HY-PRO

CATALOG **4.0**

FLUID CONTAMINATION SOLUTIONS

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HY-PRO

Our Story

At Hy-Pro, our mission is to make our customers as efficient as possible. From improving the reliability of hydraulic and lube oil assets through our filter elements and filtration equipment to stopping equipment failures and downtime to reducing the environmental impact from the use and disposal of industrial fluids, it is our goal to eliminate industrial fluid contamination and all difficulties related to it.

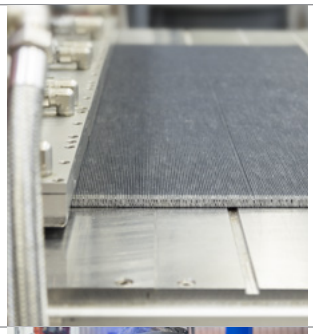
Innovation drives the growth of Hy-Pro to offer our customers an ever-increasing arsenal to combat fluid contamination. Our state of the art manufacturing facilities are home to the most inventive and streamlined design and build processes in the industry which allow us to create tailored solutions to the problems facing our customers. We thrive on continually improving and identifying new and refined ways to enhance the customer experience. By providing oil sampling and analysis, training on best practices, unmatched customer service, unrivaled equipment and the world's most comprehensive critical filter element interchange, we strive to offer the most complete and effective fluid contamination solutions.

Since our founding in 1986, Hy-Pro has grown to provide our products and services across the world. Our expert field tech reps provide vital on-site training, troubleshooting and strategies to solve industries' toughest contamination challenges across 6 continents. Through working with our expansive distribution network, we are able to deliver fast, reliable service on a local level, ensuring the relationships we make along the way are always cared for and our appreciation for them expressed. Those relationships, along with our nonstop desire for progress, allow us to improve the lives of our customers across the world.

Aaron Hoeg
Operations Manager

What we're about

Advanced Media Technology



Innovative media development and DFE rated filter elements are the core of Hy-Pro's products, delivering lower operating ISO Codes for reliable plant operation. Optimized vacuum dehydration, coalesce and nitrogen membrane water removal technologies eliminate critical system water related failures. Ion Charge Bonding (ICB) treatment of specified lube and hydraulic oils addresses fluid contamination on a molecular level to prevent servo valve failures and extend fluid life. Dedicated smart off-line filtration systems condition extremely high viscosity oils that were previously considered not filterable. And that's just scratching the surface of what Hy-Pro can do.

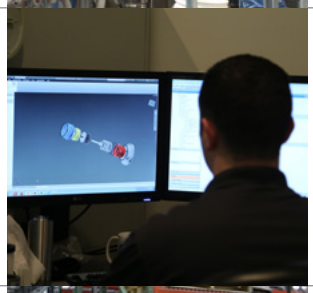
The Highest Quality

Engineered, manufactured and tested in our state of the art facilities across the US, our contamination solutions are built to be rugged, dependable, and easy to use. From the highest quality materials and components, we deliver the best filtration equipment anywhere in the world. The same quality goes into Hy-Pro filter elements, eliminating any contamination challenge imaginable to provide our customers with the incredible results and peace of mind they deserve.

Unmatched Expertise

Work with Hy-Pro and you're working shoulder-to-shoulder with the industry experts to implement contamination control and prevention in all things industrial fluid. But it doesn't stop there. From customized strategies and long term solutions to on-site service, support and training, our expert Field Technical Reps are involved from before implementation begins to long after the life of the filter element to ensure our customers are provided the best solutions for their specific contamination problems.

Flexible Design & Manufacturing



Whether you're selecting the perfect options from our standard product lines or need a completely custom, one of a kind solution, we listen to your needs and collaborate with you to deliver a specific contamination solution to fit your exact application.

Rapid Response

The flexibility in our manufacturing processes along with our extensive inventory of ready-to-ship filter elements allow us to respond to any situation with incredible speed. For standard delivery, you'll receive your elements in days, not weeks. And in some cases like the event of any emergency or upset situation, we're even able to deliver your exact filter element in hours to maximize your uptime and keep your plant running efficiently.

Eliminate Waste & Protect the Environment

Through contamination control and molecular treatment, Hy-Pro extends the useful life of critical hydraulic and lube oils to improve reliability and bottom line profitability. Preventing premature fluid replacement reduces environmental impact, which is a responsibility that falls on everyone. With our products and efforts in fluid management, we continue to bring conservation of natural resources and reduction of industrial waste to the forefront.

Understanding ISO Codes

The ISO Cleanliness Code (per ISO4406-1999) is used to quantify particulate contamination levels per milliliter of fluid at 3 sizes - $4\mu_{[C]}$, $6\mu_{[C]}$, and $14\mu_{[C]}$. It is expressed in 3 numbers (example 19/17/14) where each number represents a contaminant level code for the correlating particle size. The code includes all particles of the specified size and larger.

It is important to note that each time a code increases, the quantity range of particles is doubling. Inversely, as a code decreases by one the contaminant level is cut in half.

ISO Code Example:

13/10/6

$4\mu_{[C]}$ Channel	$6\mu_{[C]}$ Channel	$14\mu_{[C]}$ Channel

ISO 4406:1999 Code Chart

ISO Code	Particles per Milliliter (PPM)	
	Lower Limit	Upper Limit
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	0.64	1.3
6	**0.32**	**0.64**

Sample Values Before Filtration

Particle Size	PPM	ISO 4406 Code Range	ISO Code
$4\mu_{[C]}$	**151773**	**80,000-160,000**	**24**
$4.6\mu_{[C]}$	87210		
$6\mu_{[C]}$	**38363**	**20,000-40,000**	**22**
$10\mu_{[C]}$	8229		
$14\mu_{[C]}$	**3339**	**2,500-5,000**	**19**
$21\mu_{[C]}$	1048		
$38\mu_{[C]}$	112		
$68\mu_{[C]}$	2		

Sample Values After Filtration

Particle Size	PPM	ISO 4406 Code Range	ISO Code
$4\mu_{[C]}$	**69**	**40-80**	**13**
$4.6\mu_{[C]}$	35		
$6\mu_{[C]}$	**7**	**5-10**	**10**
$10\mu_{[C]}$	5		
$14\mu_{[C]}$	**0.4**	**0.32-0.64**	**6**
$21\mu_{[C]}$	0.1		
$38\mu_{[C]}$	0.0		
$68\mu_{[C]}$	0.0		

Fluid Cleanliness Code Comparisons

ISO/DIS 4406 BS 5540/4 Codes	NAS 1638	SAE 749	Defence Standard 05/42	
			Table A	Table B
25/23/17			100,000	
24/22/15			21,000	
23/21/18	12			
23/21/14			15,000	
22/20/17	11			
22/20/13			6,300	
21/19/16	10			
21/19/13			4,400	6,300F
20/18/15	9	6		
20/18/13				4400F
20/18/12			2,000	
19/17/14	8	5		
19/17/11			1,300	2,000F
18/16/13	7			
18/16/11				1,300F
18/16/10			800	
17/15/12	6	3		
17/15/10				800F
17/15/09			400	
16/14/11	5	2		
16/14/09				400F
15/13/10	4	1		
14/12/09	3	0		
13/11/08	2			

ISO Code Limits

Hydraulic component and bearing manufacturers set ISO fluid cleanliness code limits that are the maximum tolerance for fluid contamination under which predictable performance and life can be maintained. These limits often become fluid cleanliness targets at the mill or plant level. Using the upper limit as a target means that you are operating on the absolute edge with no room for error. But there is a better way.

Our mission is to make our customers as efficient as possible. To do this we recommend and help implement operating ISO Codes that are well below OEM upper limits. Our focus is not to hit a valve manufacturer's ISO Code limit but to help our customer reduce servo valve replacements from 220 in one year to 6 in the next by implementing lower operating ISO Codes and drastically reducing component wear/failure. And since that customer could prove that their oil was cleaner than required by spec, those 6 servos in year 2 were replaced under warranty by the manufacturer. Lower operating ISO Codes can extend component life by triple, quadruple and beyond, resulting in huge reliability, profitability and efficiency gains.

How clean is my fluid?

Identifying proper sampling ports and locations, taking accurate samples and correctly interpreting results are critical to success. That's why our training and support are based on knowing and understanding the importance of fluid cleanliness and sampling. Hy-Pro is on the front line with on-line particle counters, expertise and strategies to achieve lower operating ISO Codes.

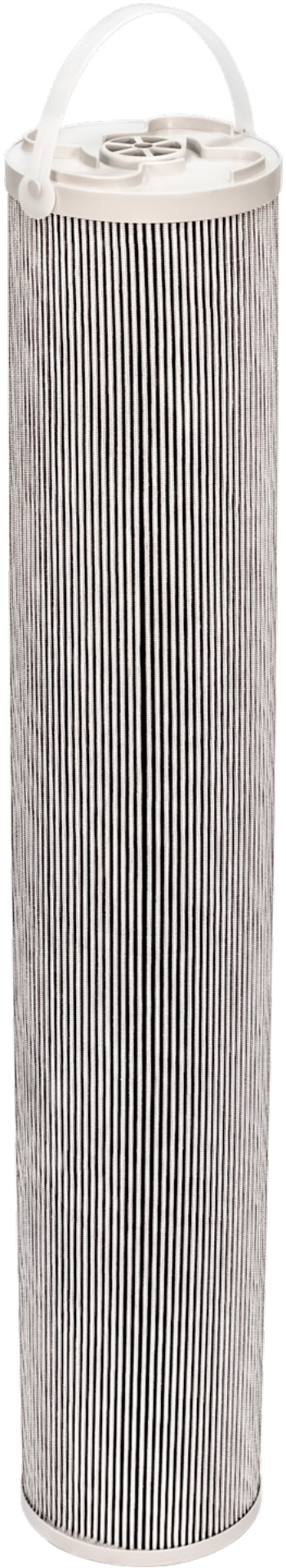
Setting operating ISO Codes.

The table on the following page represents Hy-Pro's recommendations for operating ISO Code by component and pressure. These are lower than typical industry standard target ISO Codes and are based on our experience of extending component life and reliability. Other considerations in setting a lower operating ISO Codes include:

- Component criticality (turbine hydraulic controls)
- Safety (amusement park hydraulics)
- Excessive shock or vibration (mining excavator)
- High frequency duty cycle (high speed stamping press)

Total System Cleanliness

Upgrading to Hy-Pro DFE rated filter elements, Hy-Dry breathers and adding off-line contamination solutions where needed are a small expense compared to the cost of contamination related component repair and replacement, premature fluid replacement, increased maintenance demands and, worst of all, downtime. By taking these small steps and becoming proactive in preventing contamination, you're setting yourself and your plant up with the best possible chance for success.



Recommended* Upper Limit ISO Cleanliness Codes per Component by Pressure Rating

	Pressure <2000 psi (138 bar)		Pressure 2000-3000 psi (138-207 bar)		Pressure >3000 psi (207 bar)	
	Industry Standard	Hy-Pro Recommended	Industry Standard	Hy-Pro Recommended	Industry Standard	Hy-Pro Recommended
Pumps						
Fixed gear	20/18/15	**≤ 17/15/12**	19/17/15	**≤ 16/14/11**	-	**-**
Fixed piston	19/17/14	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**
Fixed vane	20/18/15	**≤ 17/15/12**	19/17/14	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**
Variable piston	18/16/13	**≤ 16/14/11**	17/15/13	**≤ 15/13/10**	16/14/12	**≤ 15/13/10**
Variable vane	18/16/13	**≤ 16/14/11**	17/15/12	**≤ 15/13/10**	-	**-**
Valves						
Cartridge	18/16/13	**≤ 16/14/11**	17/15/12	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**
Check valve	20/18/15	**≤ 17/15/12**	20/18/15	**≤ 17/15/12**	19/17/14	**≤ 16/14/11**
Directional (solenoid)	20/18/15	**≤ 17/15/12**	19/17/14	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**
Flow control	19/17/14	**≤ 17/15/12**	18/16/13	**≤ 16/14/11**	18/16/13	**≤ 16/14/11**
Pressure control (modulating)	19/17/14	**≤ 17/15/12**	18/16/13	**≤ 16/14/11**	17/15/12	**≤ 15/13/10**
Proportional cartridge valve	17/15/12	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**	16/14/11	**≤ 14/12/9**
Proportional directional	17/15/12	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**	16/14/11	**≤ 14/12/9**
Proportional flow control	17/15/12	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**	16/14/11	**≤ 14/12/9**
Proportional pressure control	17/15/12	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**	16/14/11	**≤ 14/12/9**
Servo valve	16/14/11	**≤ 14/12/9**	16/14/11	**≤ 14/12/9**	15/13/10	**≤ 13/11/8**
Bearings						
Ball bearing	15/13/10	**≤ 15/13/10**	-	-	-	-
Gearbox (industrial)	17/16/13	**≤ 15/13/10**	-	-	-	-
Journal bearing (high speed)	17/15/12	**≤ 15/13/10**	-	-	-	-
Journal bearing (low speed)	17/15/12	**≤ 15/13/10**	-	-	-	-
Roller bearing	16/14/11	**≤ 15/13/10**	-	-	-	-
Actuators						
Cylinders	17/15/12	**≤ 16/14/11**	16/14/11	**≤ 15/13/10**	15/13/10	**≤ 15/13/10**
Vane motors	20/18/15	**≤ 17/15/12**	19/17/14	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**
Axial piston motors	19/17/14	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**	17/15/12	**≤ 15/13/10**
Gear motors	20/18/14	**≤ 17/15/12**	19/17/13	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**
Radial piston motors	20/18/15	**≤ 17/15/12**	19/17/14	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**
Other						
Test stands	15/13/10	**≤ 15/13/10**	15/13/10	**≤ 15/13/10**	15/13/10	**≤ 15/13/10**
Hydrostatic transmissions	17/15/13	**≤ 16/14/11**	16/14/11	**≤ 15/13/10**	16/14/11	**≤ 15/13/10**
High pressure fuel injector or common fuel rail	18/16/13	**≤ 16/14/11**	18/16/13	**≤ 15/13/10**	18/16/13	**≤ 15/13/10**

*Depending upon system volume and severity of operating conditions a combination of filters with varying degrees of filtration efficiency might be required (I.e. pressure, return, and off-line filters) to achieve and maintain the desired fluid cleanliness.

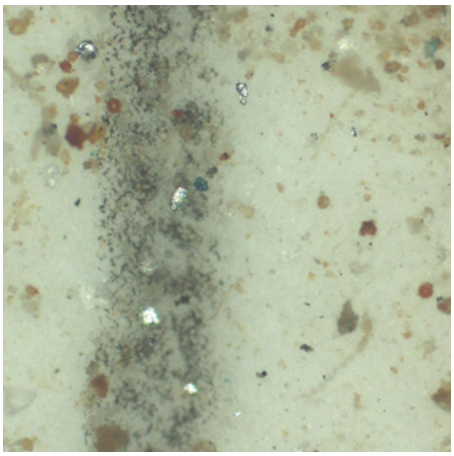
Bearing & Component Life Extension

Improving fluid cleanliness means reduced downtime, more reliable equipment, longer fluid life, and fewer maintenance hours. In addition, it also means reduced component replacement and repair expenses.

By improving the cleanliness of your fluid by only a few ISO Codes, you can directly increase the lifespan of your components and equipment. The tables on the following page demonstrate the life extension for both roller contact bearings and hydraulic components given a reduction in ISO Codes.

How clean is your *new* oil?

As it turns out, new oil can be one of the worst sources of particulate and water contamination.



The picture above was taken from a patch test at 10x magnification on a new oil sample direct from the manufacturer and shows the level of contamination present in seemingly clean oil.

A good upper limit for new oil cleanliness is 16/14/11. However, a commonly seen ISO Code for new oil reaches an ISO Code of 25/22/19, which is not only not suitable for hydraulic or lubrication systems but can actually be a major cause of degradation and premature component failure.

Hy-Pro will help you develop a plan to achieve and maintain target fluid cleanliness. Arm yourself with the support, training, tools and practices to operate more efficiently, maximize uptime and save money.

Hydraulic Component Life Extension

Current ISO Code	New ISO Code	New ISO Code	New ISO Code	New ISO Code
	2 x Life	3 x Life	4 x Life	5 x Life
28/26/23	25/23/21	25/22/19	23/21/18	22/20/17
27/25/22	25/23/19	23/21/18	22/20/17	21/19/16
26/24/21	23/21/18	22/20/17	21/19/16	21/19/15
25/23/20	22/20/17	21/19/16	20/18/15	19/17/14
24/22/19	21/19/16	20/18/15	19/17/14	18/16/13
23/21/18	20/18/15	19/17/14	18/16/13	17/15/12
22/20/17	19/17/14	18/16/13	17/15/12	16/14/11
21/19/16	18/16/13	17/15/12	16/14/11	15/13/10
20/18/15	17/15/12	16/14/11	15/13/10	14/12/9
19/17/14	16/14/11	15/13/10	14/12/9	13/11/8
18/16/13	15/13/10	14/12/9	13/11/8	–
17/15/12	14/12/9	13/11/8	–	–
16/14/11	13/11/8	–	–	–
15/13/10	13/11/8	–	–	–
14/12/9	13/11/8	–	–	–

Roller Contact Bearing Life Extension

Current ISO Code	New ISO Code	New ISO Code	New ISO Code	New ISO Code
	2 x Life	3 x Life	4 x Life	5 x Life
28/26/23	25/23/19	22/20/17	20/18/15	19/17/14
27/25/22	23/21/18	21/19/16	19/17/14	18/16/13
26/24/21	22/20/17	20/18/15	18/16/13	17/15/12
25/23/20	21/19/16	19/17/14	17/15/12	16/14/11
24/22/19	20/18/15	18/16/13	16/14/11	15/13/10
23/21/18	19/17/14	17/15/12	15/13/10	14/12/9
22/20/17	18/16/13	16/14/11	14/12/9	13/11/8
21/19/16	17/15/12	15/13/10	13/11/8	–
20/18/15	16/14/11	14/12/9	–	–
19/17/14	15/13/10	13/11/8	–	–
18/16/13	14/12/9	–	–	–
17/15/12	13/11/8	–	–	–
16/14/11	13/11/8	–	–	–
15/13/10	13/11/8	–	–	–
14/12/9	13/11/8	–	–	–

Fluid Life Extension

Our mission is to make our customers as efficient as possible, and we achieve that with the highest quality filtration products and total system cleanliness strategies to maximize uptime, productivity and prevent costly fluid contamination related failures. Been there. Done that. Going to do it again tomorrow. But that's not the only way we make our customers efficient. Extending the useful life of in-service fluids pays big dividends in reliability, saves money on premature fluid replacement costs, and reduces the environmental impact of industry by reducing the amount of fluids used and discarded. Enhancing reliability, saving money, and protecting the environment are not only good business, they're our responsibility. To help reduce oil usage, let's first understand why fluids are condemned and prematurely replaced.

Changing on time.

Routine oil changes based on operating hours for in service oil are common for large diesel engines, gearboxes, and mobile equipment hydraulics to name a few. For instance, one of our customers operating in the drilling industry opted for a dedicated off-line contamination solution that addressed particulate and water contamination plus a routine oil analysis instead of their normal 45 day oil change, extending their useful oil life to over a year. By implementing filtration and pro-actively monitoring their fluid, they were able to save millions of dollars per year on oil costs alone.

In a large diesel engine application, lube oil was changed every 500 hours based on OEM requirements to change once the Total Base Number had dropped to 50% of new. By installing the right off-line Hy-Pro solution, TBN was maintained in the acceptable range well beyond 2000 hours of engine operation. In this case, incorporating proper filtration enabled the customer to quadruple engine oil life, saving big money on oil. And since the units were remotely located, their savings were compounded with the reduction in maintenance and man hours.

An operator of large haul trucks now uses Hy-Pro filter carts with a particle monitor in lieu of dumping hydraulic drive oil during routine service. The systems are operating cleaner than ever and the oil is only changed after oil analysis indicates a viscosity loss or additive depletion.

Cleaning oil saves you from changing it.

Coal pulverizer gearbox oil is often filtered with a wire mesh strainer, and the oil is usually changed once it's so dirty you can't see through it. The trouble is the gearbox is on a crash course with a premature rebuild even if the oil is changed annually. The FSW (pictured below), combined with a Hy-Dry breather, maintains gearbox fluid cleanliness, avoiding a rebuild. Properly located sample ports on the FSW allow for accurate oil sampling and analysis. In hydraulic and lube systems dirt makes more dirt, but if we keep fluids clean, they can be changed based on oil condition. Commit to control gearbox contamination with Hy-Pro and greatly extend the life of in service gearbox oil.

Protect fluid additives and bottom line profitability.

When today's group II turbine oils are condemned, it means they have high varnish potential or the sacrificial anti-oxidant (AO) additive levels have dropped below 20% of new. SVR and FSTO turbine oil conditioning systems will remove and prevent varnish, but that's not all they do. Both systems also remove oxidation by-products on the molecular level as they are created, greatly reducing the consumption of AO additives. And by maintaining high levels of your AO additives, Hy-Pro can double or even triple your turbine oil useful life.

Fluid Life Extension

Demulsibility is life or death for oil.

And when it's gone, so is the oil. But what is demulsibility? It's the ability of the oil and water to naturally separate, and it is usually a function of the purity of the oil's base stock. Steel mill lube oils are exposed to high levels of particulate and water contamination. Wire mesh strainers are usually used for filtration, allowing ISO Codes to rise above acceptable limits. For water control, mills rely on the oil's natural demulsibility characteristic to shed water which they decant from the reservoir daily. Eventually, the stress of excessive particulate contamination and continuous operation at or above water saturation point causes the oil to lose its demulsibility. Antiquated centrifuges don't cut it. You need a total Morgoil solution, precisely what Hy-Pro's VUD delivers. The VUD offers high efficiency particulate removal and removal of free, emulsified and dissolved water that stays ahead of ingression. That means healthy oil, no decanting, less oil down the drain, and longer Morgoil useful life.

Group II turbine lube oil demulsibility can be compromised by oxidation by-products and acids. These polar forms of contamination occur during oxidation and form bonds with water which prevent the natural separation of oil and water. SVR and FSTO remove acids and oxidation by-products and have been proven to restore the demulsibility of turbine oil. Before you dump your turbine oil, let us test it. We might just be able to raise the dead to save your oil and your budget.

No need for EHC bleed and feed.

Steam turbines and high temp hydraulic applications run on phosphate ester fire resistant fluids which are difficult to maintain. Phosphate ester has little to no additives, but it attracts water. When exposed to water, hydrolysis creates aggressive acids. Fullers earth and Selexsorb filters are used to remove acids but they also add dissolved metal ions to the oil, causing servo valve deposits, slow response time and unit trips. Before that, the contamination causes resistivity to drop and the ISO Codes to rise even further. Then the fluid supplier will recommend a partial bleed and feed or a total flush followed by complete fluid replacement. Sounds like a complicated situation with an expensive solution that won't solve the problem. Don't buy more fluid or flush!

FSAPE is Hy-Pro's total solution for phosphate ester fluid maintenance that not only prevents deposits but excels at removing water and acid, lowering ISO Codes, removing dissolved metals and, yes, can even restore resistivity to keep all of your key fluid metrics in the green.

Don't settle for maintenance mediocrity and premature fluid replacement. Treat your fluids like an important system component and see the financial and environmental impact you can have.

Fluid Analysis Reference Guide

Industrial Oil Viscosities - ISO 3448

ISO 3448 established common viscosity classifications for industrial lubricants that are widely accepted and used across the globe. Each of your oils fall under a specific category of ISO VG classification which you can obtain from the manufacturer and are often listed on test reports you will receive from fluid sample analyses.

The table below outlines the viscosity measurements per ISO 3448 along with common minimum and optimum viscosities for various systems you'll likely find operating in your facility.

On the following page are contaminants found on fluid analysis test reports listed according to their chemical symbol (often how they'll be listed on the reports) and the various sources from which they are known to occur.

Viscosity Range

ISO 3448 Viscosity Class	Kinematic Viscosity Mid-point cSt @ 40°C	Kinematic Viscosity Minimum cSt @ 40°C	Kinematic Viscosity Maximum cSt @ 40°C
ISO VG 32	32	28.8	35.2
ISO VG 46	46	41.4	50.6
ISO VG 68	68	61.2	74.8
ISO VG 100	100	90	110
ISO VG 150	150	135	165
ISO VG 220	220	198	242
ISO VG 320	320	288	352
ISO VG 460	460	414	506
ISO VG 680	680	612	748

Minimum Viscosities

Application	Viscosity cSt @ 40°C
Gearbox Reducers	33
Gear Pumps	30
Spherical Roller Bearings	21
Other Roller Bearings	13
Hydraulic Systems	13
Plain Bearings	13
To Support Dynamic Load	4

Optimum Viscosities (at Operating Temp)

Application	Viscosity cSt @ 40°C
Hydraulic Systems	25
Plain Bearings	30
Spur & Helical Gears	40
Hypoid Gears	60
Worm Gears	75

Oil Analysis Test Categories

Xx Name — Wear Metals | Xx Name — Additives | Xx Name — Contaminants

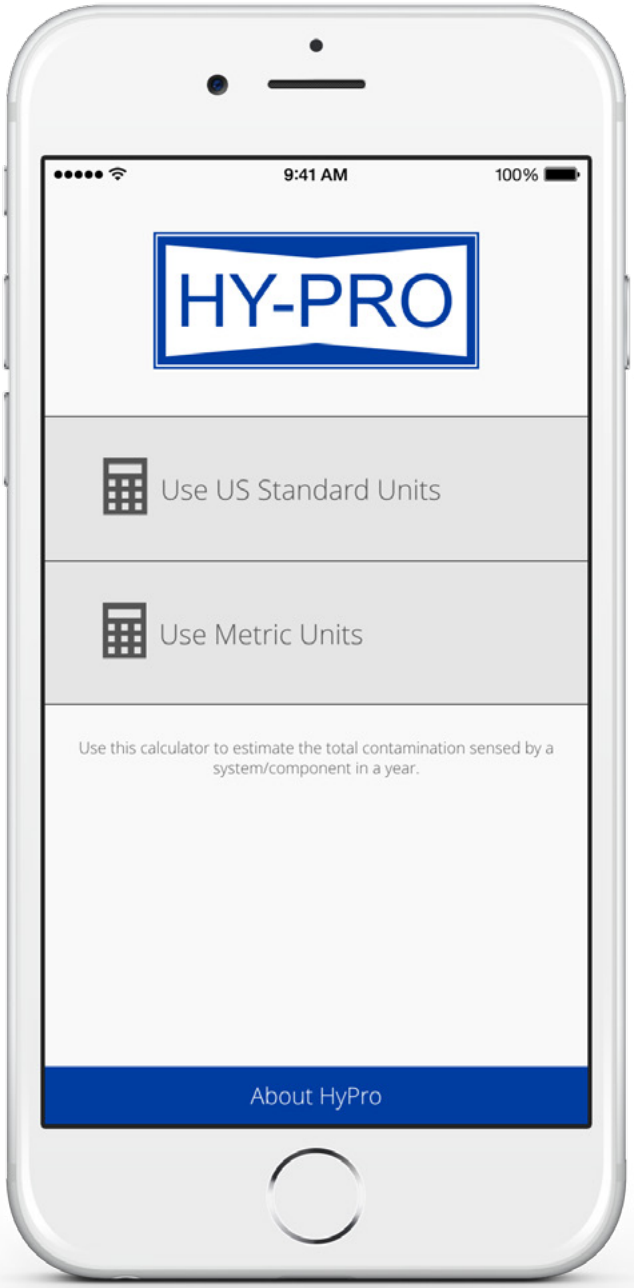
	Wear Metals	Additives	Contaminants
Al Aluminum	Bearings Blocks Blowers Bushings Clutches Cylinders Housings Pistons Pump Bearings Motor Housings Rotors Thrust Bearings Thrust Washers		Alumina Bauxite Catalyst Coal Fly Ash Foundry Dust Granite Grease Thickener Paint Road Dust
Sb Antimony	Alloy Steel		Ceramic Products Paint
Ba Barium	Fuel Additive Grease Thickener Oil Additive: Detergent		
Be Beryllium	Alloy Steel		
B Boron		Coolant Inhibitor Oil Additive: Anti Wear	Oil Additive: Ext Pressure Oil Additive: Detergent
Cd Cadmium	Journal Bearings Plating		
Ca Calcium		Cement Dust Fuller's Earth Grease Thickener Gypsum Hard Water Lignite	Hard Rock Dust Oil Additive: Detergent Oil Additive: Rust Inhibitor Road Dust Rubber Salt Water Slag
Cr Chromium	Exhaust Valves Sleeve Liners Low Alloy Steel Oil Coolers Rings Rods		Roller Bearings Stainless Steel Taper Bearings Water Treatment Paint
Cu Copper	Babbitt Bearings (Underlay) Bearing Cage Brass Bronze Cam Bushings Clutches Governors Guides Oil Coolers		Oil Pumps Pump Piston & Thrust Plate Steering Disc Valve Train Bushings Wear Plates Wrist Pin Bushings Oil Additive: Anti Wear Paint
Fe Iron	Bearings Blocks Brake Pads Cam Shaft Cast Iron Crankshafts Cylinders Discs Gears Housings		Hydraulic Pump Vanes Gears Pistons Liners Oil Pump Power Take Off (PTO) Rings Screws Shafts

Predictor Source of Spectrometry Metals

Wear Metals | Contaminants & Abrasives

	Wear Metals	Contaminants & Abrasives
Pb Lead	Babbitt Journal Bearing (Overlay) Bronze Alloy Solder Balancing Weights	Gasoline Additives Paint Road Dust
Mg Magnesium	Turbine Metallurgy	Hard Water Oil Additive: Detergent Road Dust Sea Water Fuller's Earth
Mo Molybdenum	Alloy Steel Ring	Oil Additive: Ext Pressure Grease
Ni Nickel	Hardened Steels Stainless Steel Plating	
P Phosphorous		Oil Additive: Anti Wear Oil Additive: Ext Pressure
K Potassium	Coolant Inhibitor Fly Ash Fuel Element	Granite Paper Dust Road Dust
Si Silicon	Alloy Steel Asbestos Cement Dust Fly Ash Road Dust Glass	Granite Grease Limestone Oil Additive: Antifoam Synthetic Lubricant Sealant
Ag Silver	Bearing (Overlay) Needle Bearings	Oil Cooler (Solder) Wrist Pin Bushings
Na Sodium	Activated Alumina Coolant Inhibitor Dirt Fly Ash	Grease Oil Additives Paper Mill Dust Road Salt
Sn Tin	Bearing Cage Babbitt Bearing Flashing	Piston Overlay Solder
Ti Titanium	Gas Turbine Bearings Turbine Blades	Paint
V Vanadium	Turbine Blades Valves	Bunker Oil
Zn Zinc	Brass Plating	Cathodic Protection Galvanizing Grease Oil Additive: Anti Wear

Filtration Contamination Tool



Available on the App Store and on Google Play™

Calculate the amount of contamination that passes through your hydraulic components and bearings annually with the Hy-Pro Filtration Contamination Tool.

Just enter current and target ISO Fluid Cleanliness Codes, flow rate and daily operating hours to understand the impact of dirty vs. clean oil. Raise awareness, improve reliability, and save money by minimizing component repair and replacement costs while extending useful fluid life. Put Hy-Pro on your lube team and let us help you set a target and implement strategies to achieve and maintain your fluid cleanliness goals.

Download on the App Store

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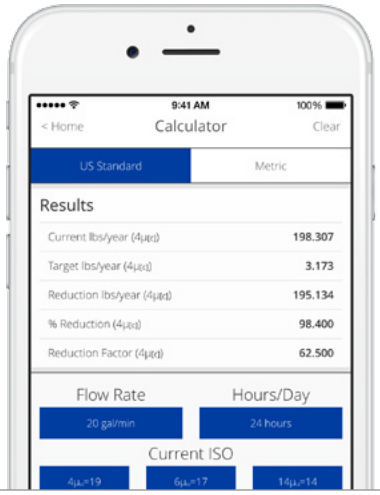
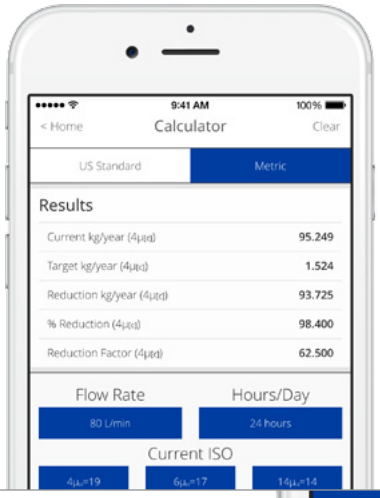
ISO Codes, decoded.

While ISO Cleanliness Codes provide a way to gauge the level of system cleanliness, they can be difficult to interpret. The Hy-Pro Filtration Contamination Tool is an app designed to decode the mystery and provide you with a real-world figure you can actually understand.



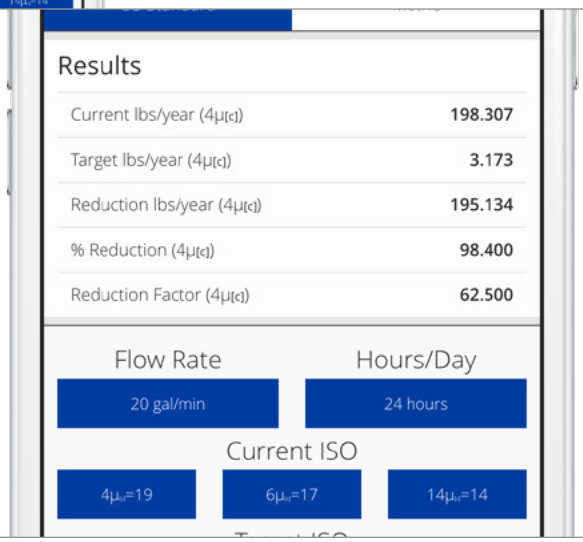


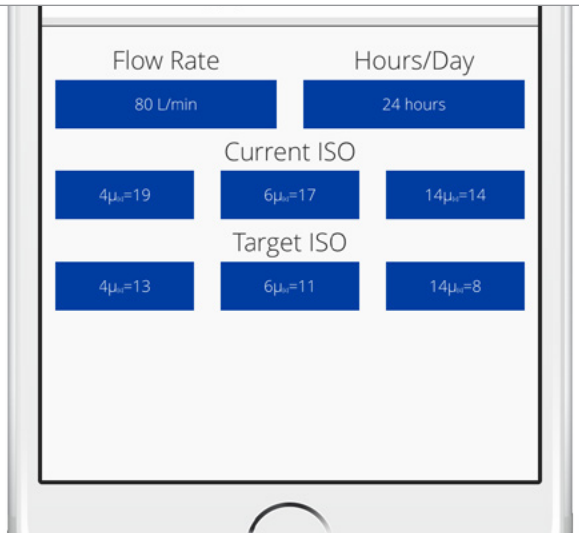
Everywhere you are.

Download the Hy-Pro Filtration App to quickly calculate the effect on your system of lowering ISO Codes. And with effortless conversion between US Standard and Metric, you'll be amazed at the results of hitting target ISO Codes no matter where you are.

Driven by results.

Do you know how much abrasive dirt you are pumping through sensitive bearings, valves and injectors in a year? The Hy-Pro Filtration Contamination Tool will tell you just how much and deliver several calculations to understand the effects of lowering your ISO Codes, in clear cut and easily understood figures.





Make a difference.

The knowledge to make a difference by lowering ISO Codes is at your fingertips. Set the inputs for your system specs to see how much contamination is removed by hitting a target ISO Code.

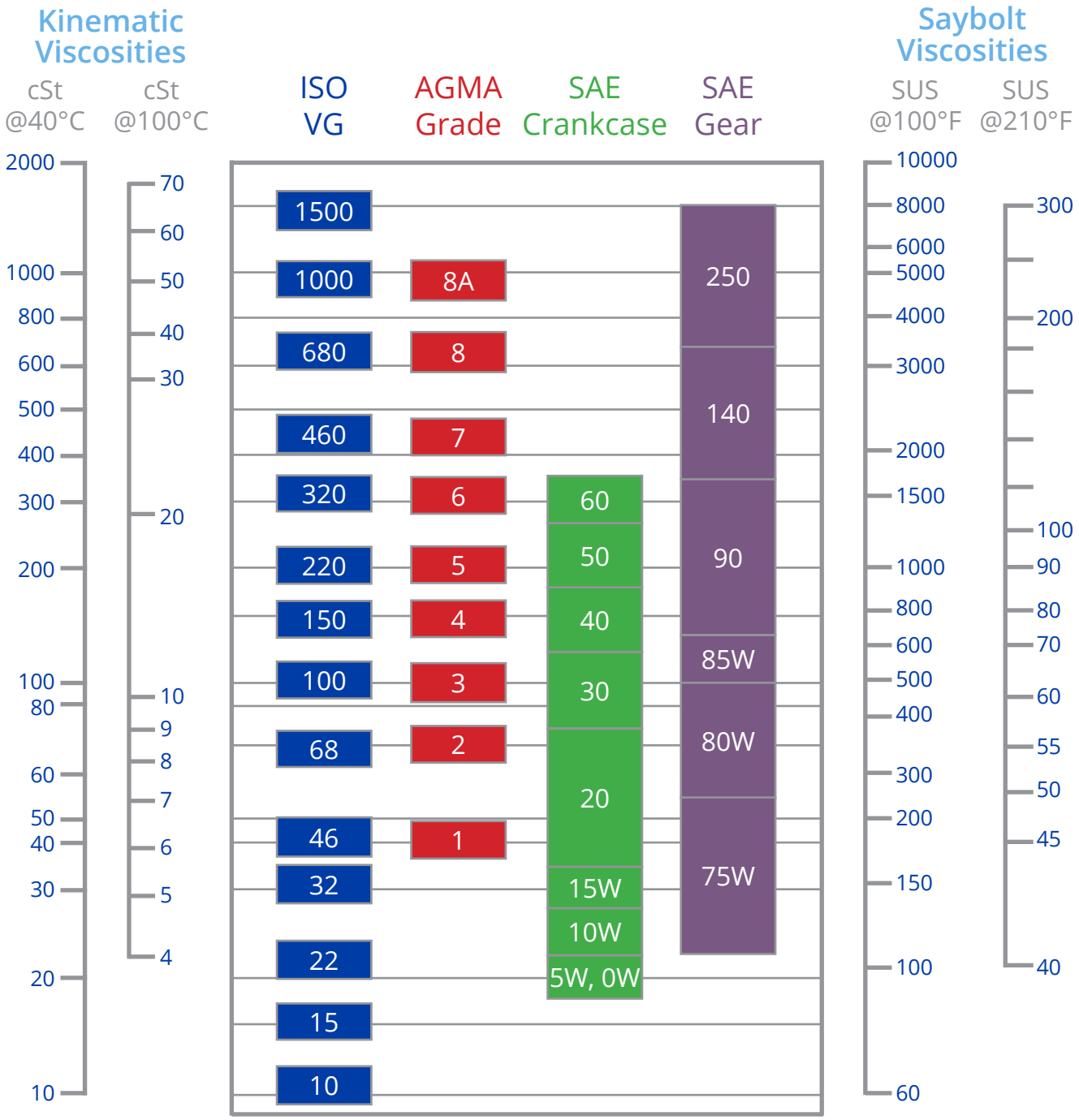
hyprofiltration.com/app

HY-PRO

Viscosity Reference Chart

Viscosity Scale Chart

The chart below provides a quick reference for converting between the four major measures of viscosity. To determine equivalents, draw a horizontal line straight across the page at your known viscosity. All other columns that intersect the line represent equivalents.



Viscosity Reference Table

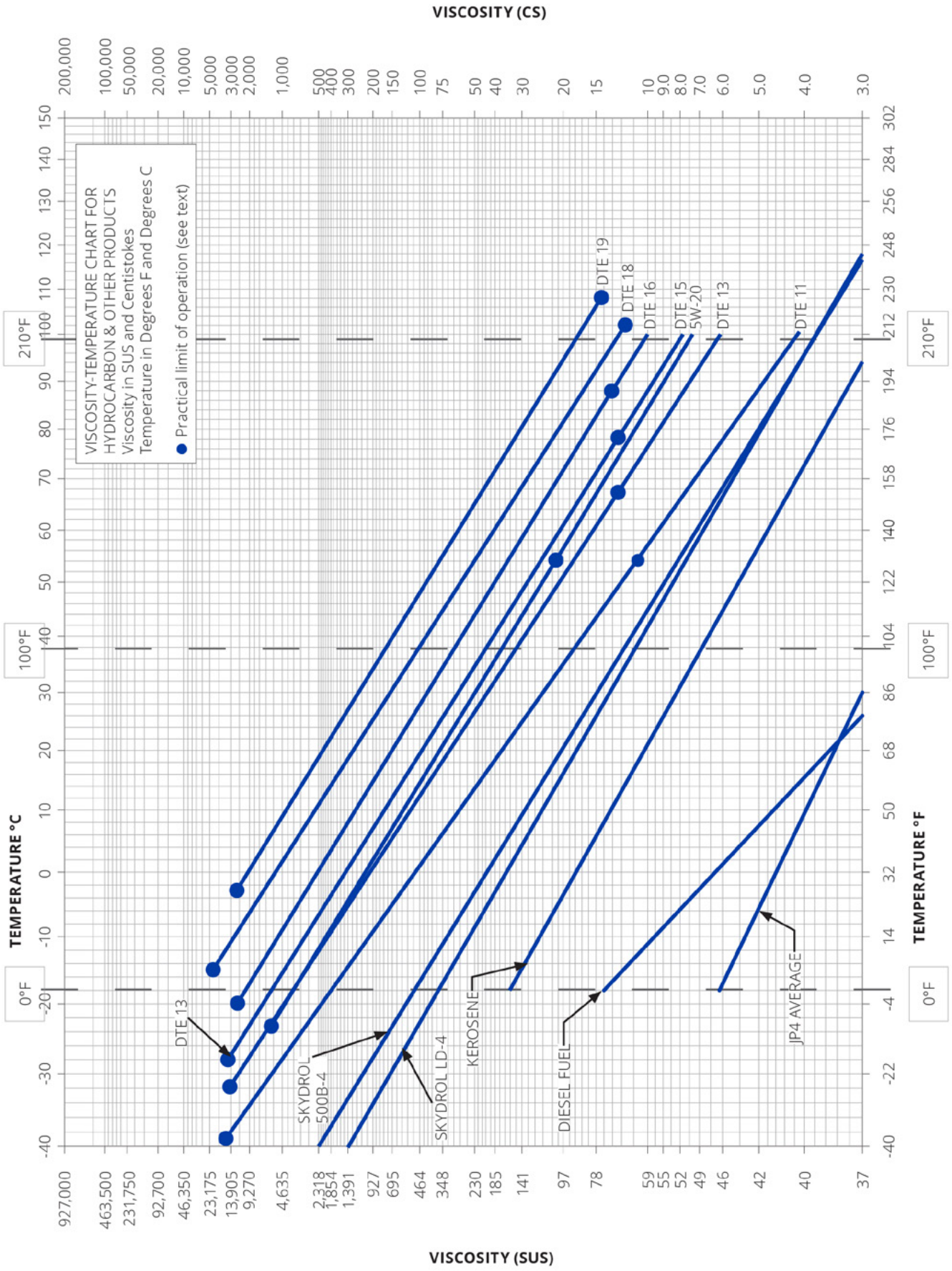
ISO/Temperature Reference

The table below gives viscosity values in cSt for known ISO VG fluids at specified temperatures using the Kinematic midpoint of each classification according to ISO 3448. Values given below are an approximation subject to variation ±10% from the midpoint value used in the calculations and are intended to be used as a reference. For exact value ranges, contact your fluid manufacturer.

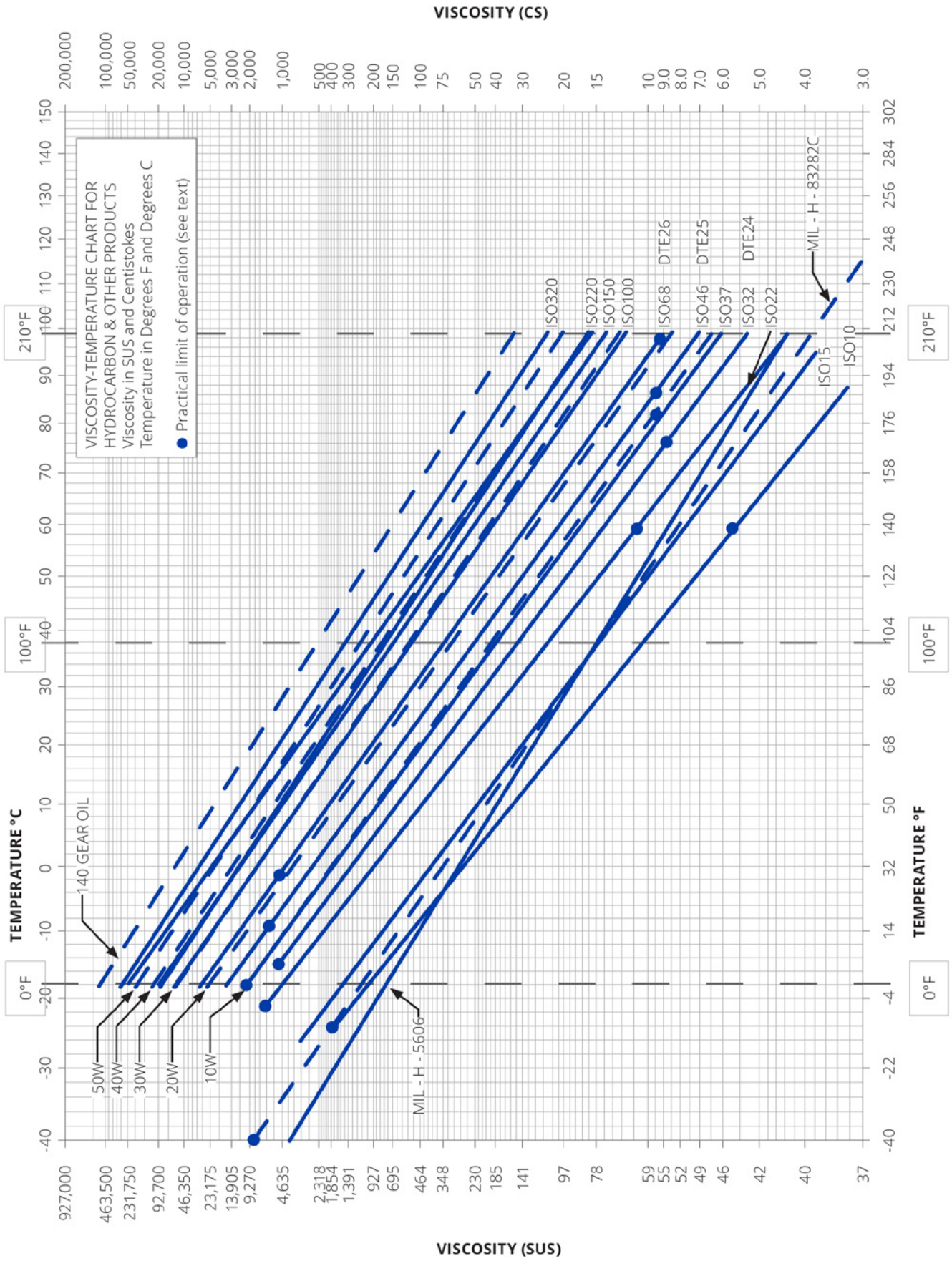
To determine viscosity, locate your fluid ISO VG across the top, locate your target/specified temperature in the two left hand columns, and the cell in which the respective column and row intersect is the approximate viscosity value.

Temp °F	Temp °C	ISO 22	ISO 32	ISO 46	ISO 68	ISO 100	ISO 150	ISO 220	ISO 320	ISO 460	ISO 680	ISO 1000	ISO 1500
14	**-10**	314.8	610.2	1129.7	2284.5	4492.7	9276.7	18565.4	36300.1	69774.7	141088.3	283473	593291
23	**-5**	217.6	405	724	1400.8	2645.9	5225.3	10012.8	18789.7	34686.9	67151.4	129188.1	258112
32	**0**	154.9	277.7	480.7	893.1	1625.3	3080.7	5672.1	10248.5	18228.2	33901.4	62664.6	119962.4
41	**5**	113.2	196.2	329.5	589.8	1037.1	1892.9	3359	5860.8	10072.2	18052.2	32160.4	59188.2
50	**10**	84.8	142.3	232.5	402.1	685	1207.3	2070.8	3498.3	5824.5	10088.3	17370.7	30827.6
59	**15**	64.8	105.7	168.4	282.2	466.8	796.5	1324.1	2171	3510	5890.3	9827.9	16865
68	**20**	50.6	80.3	124.9	203.3	327.2	542	875.1	1395.7	2196.1	3579	5799.8	9647.9
77	**25**	40.2	62.2	94.7	150	235.4	379.2	596.1	926.6	1421.7	2254.9	3556.7	5748.4
86	**30**	32.4	49.1	73.2	113	173.3	272.2	417.3	633.4	949.5	1468.4	2258.8	3554.4
95	**35**	26.5	39.3	57.5	86.9	130.4	199.9	299.6	444.8	652.4	985.6	1481.1	2273.5
104	**40**	22	32	46	68	100	150	220	320	460	680	1000	1500
113	**45**	18.5	26.4	37.3	54.1	78.1	114.7	165	235.4	332.2	481.2	693.5	1018.1
122	**50**	15.7	22	30.7	43.7	62	89.3	126.1	176.8	245.1	348.4	492.8	709.2
131	**55**	13.4	18.6	25.5	35.8	49.9	70.7	98.1	135.3	184.5	257.7	358.2	506
140	**60**	11.6	15.9	21.5	29.6	40.7	56.8	77.5	105.3	141.5	194.4	265.8	369
149	**65**	10.1	13.7	18.3	24.8	33.7	46.2	62.2	83.3	110.3	149.3	201	274.6
158	**70**	8.9	11.9	15.7	21	28.2	38.1	50.6	66.8	87.3	116.5	154.7	208.1
167	**75**	7.9	10.4	13.6	18	23.8	31.8	41.6	54.3	70.2	92.4	121	160.5
176	**80**	7	9.2	11.9	15.5	20.3	26.8	34.7	44.7	57.1	74.2	96	125.7
185	**85**	6.3	8.1	10.5	13.5	17.5	22.8	29.2	37.2	47	60.4	77.3	99.9
194	**90**	5.7	7.3	9.3	11.9	15.2	19.6	24.8	31.3	39.2	49.8	63	80.5
203	**95**	5.2	6.5	8.3	10.5	13.3	17	21.3	26.6	33	41.5	51.9	65.7
212	**100**	4.7	5.9	7.4	9.3	11.7	14.8	18.4	22.8	28	34.9	43.3	54.2
221	**105**	4.3	5.4	6.7	8.3	10.4	13	16	19.7	24	29.6	36.5	45.2
230	**110**	3.9	4.9	6	7.5	9.3	11.5	14.1	17.2	20.7	25.4	31	38.1
239	**115**	3.6	4.5	5.5	6.8	8.3	10.2	12.4	15	18.1	21.9	26.6	32.4
248	**120**	3.4	4.1	5	6.1	7.5	9.2	11.1	13.3	15.8	19.1	22.9	27.7
257	**125**	3.1	3.8	4.6	5.6	6.8	8.3	9.9	11.8	14	16.7	20	24
266	**130**	2.9	3.5	4.3	5.1	6.2	7.5	8.9	10.5	12.4	14.8	17.5	20.9
275	**135**	2.7	3.3	3.9	4.7	5.6	6.8	8	9.5	11.1	13.1	15.4	18.3
284	**140**	2.6	3	3.6	4.3	5.2	6.2	7.3	8.5	9.9	11.7	13.7	16.1
293	**145**	2.4	2.8	3.4	4	4.8	5.7	6.6	7.7	9	10.5	12.2	14.3
302	**150**	2.3	2.7	3.2	3.7	4.4	5.2	6.1	7.1	8.1	9.5	11	12.8

Viscosity Reference Charts



Viscosity Reference Charts



Filter Assembly Sizing

Filter Assembly Sizing Guidelines

Effective filter sizing requires consideration of flow rate, viscosity (operating and cold start), fluid type and degree of filtration. When properly sized, bypass during cold start can be avoided/minimized and optimum element efficiency and life achieved. The filter assembly differential pressure values provided for sizing differ for each media code, and assume 32 cSt (150 SUS) viscosity and 0.86 fluid specific gravity. Use the following steps to calculate clean element assembly pressure drop.

Calculate ΔP coefficient for actual viscosity

Using Saybolt Universal Seconds (SUS)

$$\text{ΔP Coefficient} = \frac{\text{Actual Operating Viscosity}^{1}\text{ (SUS)}}{150} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

Using Centistokes (cSt)

$$\text{ΔP Coefficient} = \frac{\text{Actual Operating Viscosity}^{1}\text{ (cSt)}}{32} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

Calculate actual clean filter assembly ΔP at both operating and cold start viscosity

$$\text{Actual Assembly Clean ΔP} = \text{Flow Rate} \times \text{ΔP Coefficient (from calculation above)} \times \text{Assembly ΔP Factor (from sizing table)}$$

Sizing recommendations to optimize performance and permit future flexibility

- To avoid or minimize bypass during cold start the actual assembly clean ΔP calculation should be repeated for start-up conditions if cold starts are frequent.
- Actual assembly clean ΔP should not exceed 10% of bypass ΔP gauge/indicator set point at normal operating viscosity.
- If suitable assembly size is approaching the upper limit of the recommended flow rate at the desired degree of filtration consider increasing the assembly to the next larger size if a finer degree of filtration might be preferred in the future. This practice allows the future flexibility to enhance fluid cleanliness without compromising clean ΔP or filter element life.
- Once a suitable filter assembly size is determined consider increasing the assembly to the next larger size to optimize filter element life and avoid bypass during cold start.
- When using water glycol or other specified synthetics we recommend increasing the filter assembly by 1~2 sizes.

Assembly Sizing Example

Sizing Example:

Replacing existing paper machine lube oil duplex with DLFM4 (4x4) duplex with HP107 series elements. The details of the system are listed below along with a breakdown of the steps to calculate the Actual Assembly Clean ΔP.

Oil:	PM220 (ISO VG 220)	**Operating Temp:**	125°F
Specific Gravity:	0.86	**Flow Rate:**	150 gpm
Assembly:	DLFM4 (4x4)	**Element:**	HP107L36-6MB
Assembly ΔP Factor[2]:	0.0084 psid/gpm	**Actual Viscosity[1]:**	120 cSt @ 125°F

Calculate ΔP coefficient for actual viscosity

Using Centistokes (cSt)

$$\text{ΔP Coefficient} = \frac{\text{Actual Operating Viscosity}^{1}\text{ (cSt)}}{32} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

$$\text{ΔP Coefficient} = \frac{120}{32} \times \frac{0.86}{0.86}$$

$$\text{ΔP Coefficient} = 3.75$$

Calculate actual clean filter assembly ΔP at both operating and cold start viscosity

$$\text{Actual Assembly Clean ΔP} = \text{Flow Rate} \times \text{ΔP Coefficient} \times \text{Assembly ΔP Factor (from sizing table)}^{1}$$

$$\text{Actual Assembly Clean ΔP} = 150\text{ gpm} \times 3.75 \times 0.0084\text{ psid/gpm}$$

$$\text{Actual Assembly Clean ΔP} = 4.7\text{ psid}$$

[1]Actual viscosity conversion information available on page 22.
[2]Assembly clean element ΔP factor can be found on the respective individual assembly data sheets.

Assembly Sizing Example

Sizing Example:

Installing an MF3 housing with 16" length code, 50 psid integral bypass and 12M media. The details of the system are listed below along with a breakdown of the steps to calculate the Actual Assembly Clean ΔP.

Oil:	AW32 (ISO VG 32)	**Operating Temp:**	110˚F / 50˚F cold start
Specific Gravity:	0.86	**Flow Rate:**	22 gpm
Assembly:	MF3 L16	**Element:**	HP60L16-12MB
Assembly ΔP Factor[2]:	0.134 psid/gpm	**Actual Viscosity[1]:**	25 cSt @ 110°F 140 cSt @ 50°F Cold Start

Calculate ΔP coefficient for actual viscosity

Using Centistokes (cSt)

$$\text{ΔP Coefficient} = \frac{\text{Actual Operating Viscosity}^{1}\text{ (cSt)}}{32} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

@ Operating Temperature

$$\text{ΔP Coefficient} = \frac{25}{32} \times \frac{0.86}{0.86}$$

$$\text{ΔP Coefficient} = 0.78$$

Cold Start

$$\text{ΔP Coefficient} = \frac{140}{32} \times \frac{0.86}{0.86}$$

$$\text{ΔP Coefficient} = 4.375$$

Calculate actual clean filter assembly ΔP at both operating and cold start viscosity

@ Operating Temperature

$$\text{Actual Assembly Clean ΔP} = \text{Flow Rate} \times \text{ΔP Coefficient} \times \text{Assembly ΔP Factor (from sizing table)}^{1}$$

$$\text{Actual Assembly Clean ΔP} = 22\text{ gpm} \times 0.78 \times 0.134\text{ psid/gpm}$$

$$\text{Actual Assembly Clean ΔP} = 2.29\text{ psid}$$

Cold Start

$$\text{Actual Assembly Clean ΔP} = 22\text{ gpm} \times 4.375 \times 0.134$$

$$\text{Actual Assembly Clean ΔP} = 12.9\text{ psid}$$

[1]Actual viscosity conversion information available on page 22.
[2]Assembly clean element ΔP factor can be found on the respective individual assembly data sheets.

Assembly Sizing Example

Sizing Example:

Fitting an FSL2 off-line filtration system to a gearbox using ISO VG 460 gear lubricant. The details of the system are listed below along with a breakdown of the steps to calculate the Actual Assembly Clean ΔP.

Oil:	Gear lube 460 (ISO VG 460)	**Operating Temp:**	48˚C / 16˚C cold start
Specific Gravity:	0.90	**Flow Rate:**	19 lpm
Assembly:	FSL5 (use LF18" 3M assembly)	**Element:**	HP107L18-3MB
Assembly ΔP Factor[2]:	0.0007 bard/lpm	**Actual Viscosity[1]:**	280 cSt @ 48°C 2500 cSt @ 16°C Cold Start

Calculate ΔP coefficient for actual viscosity

Using Centistokes (cSt)

$$\text{ΔP Coefficient} = \frac{\text{Actual Operating Viscosity}^{1}\text{ (cSt)}}{32} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

@ Operating Temperature

$$\text{ΔP Coefficient} = \frac{280}{32} \times \frac{0.90}{0.86}$$

$$\text{ΔP Coefficient} = 8.75$$

Cold Start

$$\text{ΔP Coefficient} = \frac{2500}{32} \times \frac{0.90}{0.86}$$

$$\text{ΔP Coefficient} = 81.79$$

Calculate actual clean filter assembly ΔP at both operating and cold start viscosity

@ Operating Temperature

$$\text{Actual Assembly Clean ΔP} = \text{Flow Rate} \times \text{ΔP Coefficient} \times \text{Assembly ΔP Factor (from sizing table)}^{1}$$

$$\text{Actual Assembly Clean ΔP} = 19\text{ lpm} \times 8.75 \times 0.0007\text{ bard/lpm}$$

$$\text{Actual Assembly Clean ΔP} = 0.116\text{ bard}$$

Cold Start

$$\text{Actual Assembly Clean ΔP} = 19\text{ lpm} \times 81.79 \times 0.0007\text{ bard/lpm}$$

$$\text{Actual Assembly Clean ΔP} = 1.08\text{ bard}$$

[1]Actual viscosity conversion information available on page 22.
[2]Assembly clean element ΔP factor can be found on the respective individual assembly data sheets.

DFE

Dynamic Filter Efficiency

HY-PRO

hyprofiltration.com/DFE

What is DFE?

DFE matches filter testing with real-life conditions

All hydraulic and lube systems have a critical contamination tolerance level that is often defined by, but not limited to, the most sensitive system component such as servo valves or high speed journal bearings. Defining the ISO fluid cleanliness code upper limit is a function of component sensitivity, safety, system criticality and ultimately getting the most out of hydraulic and lube assets.

Filters remove the particulate contamination that enters a system or is generated by the system as it operates. All filters are subjected to some form of system dynamics: hydraulic filters encounter frequent and rapid changes in flow rate when valves shift, cylinders unload and pump output changes; lube filters experience dynamic conditions during start up and shut down. Filters validated only to current ISO testing standards don't perform as expected when subjected to the demands of real world dynamic operating systems.

A filter is not a black hole. Two key characteristics of filter performance are capture efficiency and retention efficiency. Capture efficiency can be thought of simply as how effectively a filter captures particles while retention efficiency is a measure of how effectively that filter retains the particles it has captured. A filter is not a black hole, and its performance must not be based solely on how efficiently it captures particles. If not properly designed and applied, a filter can become one of the most damaging sources of contamination in a system if it releases previously captured particles when challenged with dynamic conditions.

The Dynamic Filter Efficiency Test (DFE) is the evolution of standard hydraulic and lube filter performance testing. DFE goes further than current industry standards to quantify capture and retention efficiency in real time by inducing dynamic duty cycles, measuring real- time performance during dynamic changes and the filters ability to retain particles. DFE testing is the method for predicting worst case fluid cleanliness along with average fluid cleanliness. The DFE test method was pioneered in 1998 during a joint effort between Scientific Services Inc (SSI) and Hy-Pro Filtration.

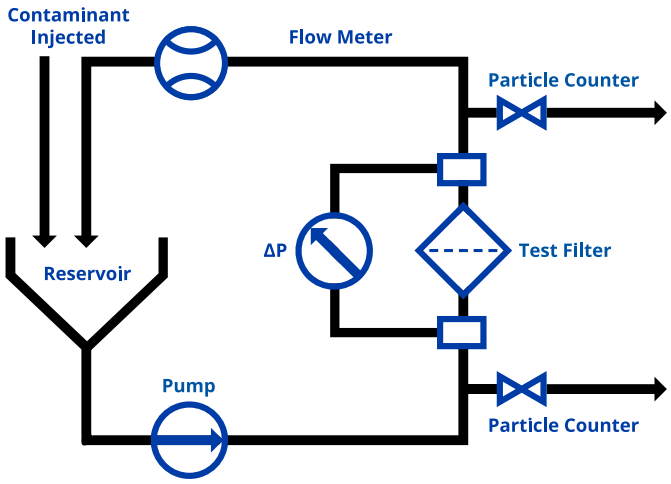
Dynamic Filter Efficiency

Current Filter Performance Testing Methods

To understand the need for DFE it is important to understand how filters are currently tested and validated. Manufacturers use the industry standard ISO16889 multi-pass test to rate filter efficiency and dirt holding capacity of filter elements under ideal lab conditions.

Figure 1 depicts the test circuit where hydraulic fluid is circulated at a constant flow rate in a closed loop system with on-line particle counters before and after the test filter. Contaminated fluid is added to the system at a constant rate. Small amounts of fluid are removed before and after the filter for particle counting to calculate the filter efficiency (capture). The capture efficiency is expressed as the Filtration Ratio (Beta) which is the relationship between the number of particles greater than and equal to a specified size ($X\mu_{[c]}$) counted before and after the filter. In real world terms this test is the equivalent of testing a filter in an off-line kidney loop rather than replicating an actual hydraulic or lube system. It's basically a filter cart test.

Figure 1: ISO16889 Multi-Pass Test



Filtration Ratio (Beta) per ISO16889:

$$\beta x_{[c]} = \frac{\text{quantity particles} \geq X\mu_{[c]} \text{ upstream of filter}}{\text{quantity particles} \geq X\mu_{[c]} \text{ downstream of filter}}$$

Example: $\beta 7_{[c]} = 600/4 = 150$
Filtration Ratio (Beta): $\beta 7_{[c]} = 150$

In the example, 600 particles greater than or equal to $7\mu_{[c]}$ were counted upstream of the filter and 4 were counted downstream. This Filtration Ratio is expressed as "Beta $7_{[c]}$ = 150". The $_{[c]}$ is referred to as "sub c". The sub c is used to differentiate between multi-pass tests run per the current ISO16889 multi-pass test with new particle counter calibration per ISO11171 from ISO4572. Filtration Ratio expressed or written without the "sub c" refers to the antiquated ISO4572 multi-pass test superseded by ISO16889. The efficiency may also be expressed as a percentage by converting the Filtration Ratio:

$$\text{Efficiency of } \beta X_{[C]} = \frac{(\beta\text{-}1)}{\beta} \times 100$$

Example: Efficiency % of $\beta 7_{[c]}$=150 = (150-1)/150 x 100
Efficiency %: 99.33%

Using our Beta Ratio found in the first example, we can calculate that the test filter is 99.33% efficient at capturing particles $7\mu_{[c]}$ and larger.

Dynamic Filter Efficiency

The DFE Multi-Pass Testing Method

DFE multi-pass enhances the industry standard by inducing dynamic conditions (duty cycle) and measuring the effects of the duty cycle in real time instead of looking at normalized numbers over a time weighted average. DFE also quantifies retention efficiency in real time in order to identify a filter's ability to properly retain previously captured contaminant and the degree to which it unloads captured contaminant back into the system. For an easy comparison, think of it as a sneeze that releases a rush of contamination to levels that are well above the upper limit of fluid cleanliness then fades as the flow rate normalizes.

In the DFE test, flow rate is truly dynamic in that rapid changes can be made while maintaining full system flow through the test filter. The raw data is continuously collected and organized so filter efficiency can be reported for variable flow conditions including time weighted averages and isolated moments to reveal true filter performance during hydraulic stress conditions – exactly when you need the filter to perform at its best.

At the end of the initial test when the filter element is loaded with contaminant, it is subjected to a restart test in which the flow goes from zero to max flow in milliseconds, replicating a hydraulic or lube system restart. Through rapid particle counting with precise control, this dynamic flow change allows Hy-Pro to analyze the amount of particles released and understand both the capture and retention efficiencies of each and every filter tested.

The DFE Testing Method

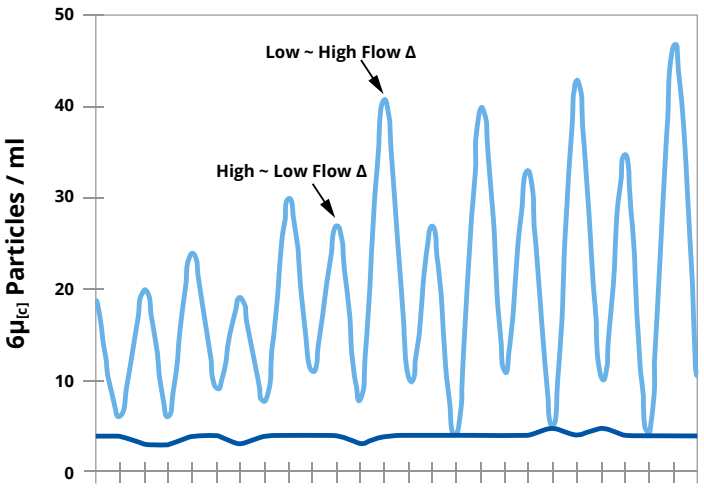
Quantifying Contaminant Capture and Retention

Figure 2 compares the performance of two identical high efficiency glass media filter elements, one tested to ISO16889 multi-pass and the other to the DFE multi-pass method. The graph expresses the actual number of particles $6\mu_{[c]}$ and larger counted downstream of the filter element from several data points during the tests.

Filter A2 was tested at a constant flow rate and maintained a steady efficiency throughout the test. Filter A1 was cycled between max rated flow rate and half of rated flow with a duty cycle consistent with that of a hydraulic system. The downstream counts for Filter A1 varied and were highest during changes from low flow to high flow. The peaks represent counts taken during flow change and the valleys represent counts taken after each flow change. The alternating high peaks represent counts taken during changes from low flow to high flow. As the amount of contaminant captured by Filter A1 increased, the downstream counts increased most dramatically during the flow changes from low to high. Filter element A1, not properly designed to retain previously captured contaminant during dynamic system conditions, can become a dangerous source of contamination as it captures and then releases concentrated clouds of contaminated fluid.

Figure 3 shows the particle counter raw data (top-upstream, bottom-downstream) for Element A1 before a change from low flow to high flow and Figure 4 shows the particle counter data for Element A1 during a change from low flow to high flow. The downstream particle count trace during the change reveals a much higher quantity of smaller particles and larger particles that did not pass the element before the dynamic system condition. This phenomenon can best be described as "contaminant unloading". As the filter element captures more dirt, greater amounts may be released back into the system that it is installed to protect when the element is subjected to a dynamic flow condition and change in differential pressure across the element. Unloading may also occur when the flow rate changes from high flow to low flow, represented by the alternating smaller peaks in Figure 3. The filter element typically recovers shortly after the dynamic condition, but highly contaminated clouds of fluid from contaminant unloading can cause severe component damage and unreliable system performance.

Figure 2: Particle Counts Downstream of Filter $6\mu_{[c]}$



Filter Element	A1	A2
Element Rating	$\beta 7_{[c]} > 1000$	$\beta 7_{[c]} > 1000$
High Flow (lpm)	112	112
Low Flow (lpm)	56	-
Contaminant Injection Rate	3 mg/l	3 mg/l

Figure 3: Element A1 Before Flow Change

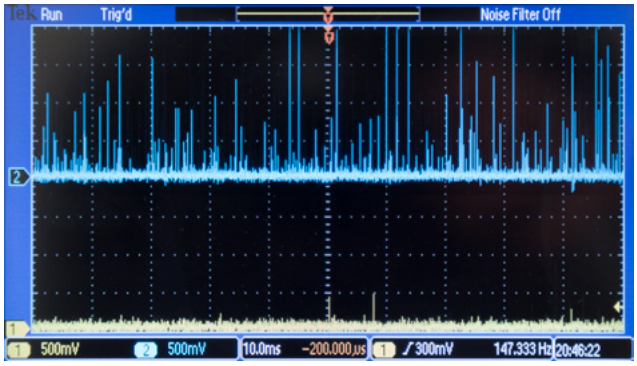
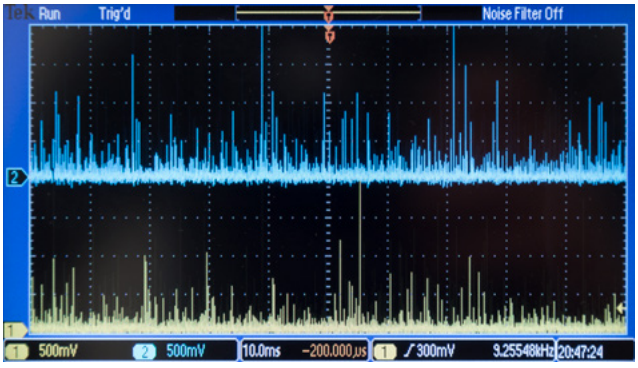


Figure 4 : Element A1 During Flow Change



The DFE Testing Method

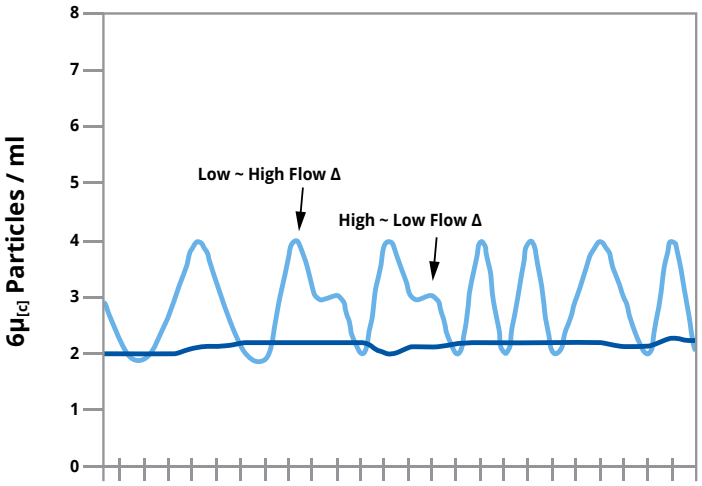
Quantifying Contaminant Capture and Retention

Figure 5 compares the performance of two identical Hy-Pro filter elements designed and developed per the DFE multi-pass test method. All Hy-Pro elements that utilize the G8 or higher media carry the Hy-Pro DFE rating.

Although the contaminant unloading effect is still evident, the unloading is insignificant as filter element Hy-Pro 1, tested per DFE, performed true to its ISO16889 multi-pass rating of $\beta 7_{[c]} > 1000$ even during dynamic flow conditions.

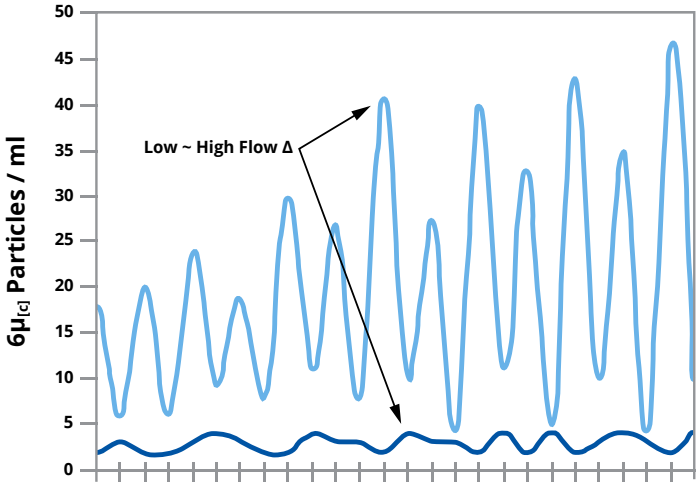
Figure 6 compares the performance of filter Element A1 and Hy-Pro 1 (DFE rated). Both elements demonstrated excellent particle capture performance during the ISO16889 and DFE testing. The DFE rated Hy-Pro element yielded much more stable particle counts downstream of the element and more consistent efficiency during the dynamic flow conditions. Improving particle retention results in more predictable fluid cleanliness levels and a system that can continually operate below the ISO cleanliness code limit.

Figure 5: Particle Counts Downstream of Filter $6\mu_{[c]}$



Filter Element	Hy-Pro 1	Hy-Pro 2
Element Rating	$\beta 7_{[c]} > 1000$	$\beta 7_{[c]} > 1000$
High Flow (lpm)	112	112
Low Flow (lpm)	56	-
Contaminant Injection Rate	3 mg/l	3 mg/l

Figure 6: Particle Counts Downstream of Filter $6\mu_{[c]}$



Filter Element	Element 1	Hy-Pro 1
Element Rating	$\beta 7_{[c]} > 1000$	$\beta 7_{[c]} > 1000$
High Flow (lpm)	112	112
Low Flow (lpm)	56	56
Contaminant Injection Rate	3 mg/l	3 mg/l

The DFE Testing Method

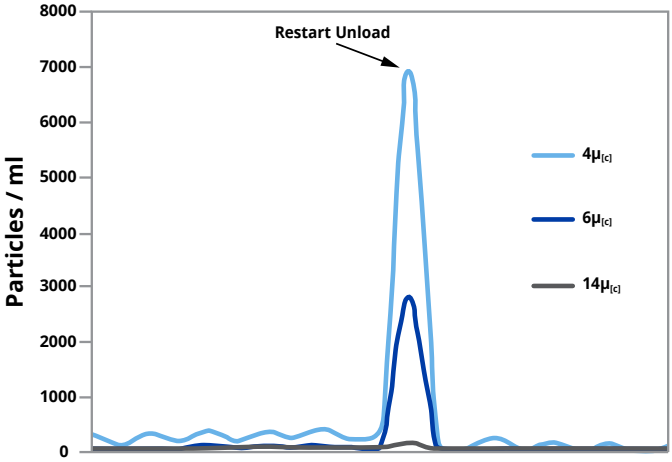
DFE Multi-Pass: Cold Start Contamination Retention

Once the element has captured enough contaminant to reach approximately 90% of the terminal ΔP (dirty filter indicator setting), the main flow goes to zero and the injection system is turned off for a short dwell period. Then main flow goes to maximum element rated flow accompanied by real time particle count to measure retention efficiency of the contaminant loaded element. The dynamic duty cycle is repeated to further monitor the retention efficiency of the filter element after a restart.

Figure 7 shows the performance of an element that was subjected to the DFE restart test. During the restart, particle counts after the filter increased by a factor of 20 on the $6\mu_{[c]}$ channel, and the ISO Codes increased by 4 codes on the $4\mu_{[c]}$ and $6\mu_{[c]}$ channels. During the restart test, there is no contaminant being injected so any particles measured were released by the element or were already in the test loop. The temporary high contamination load in the fluid can pass through the sensitive components or bearings that the filter is charged with protecting if it can't retain the dirt.

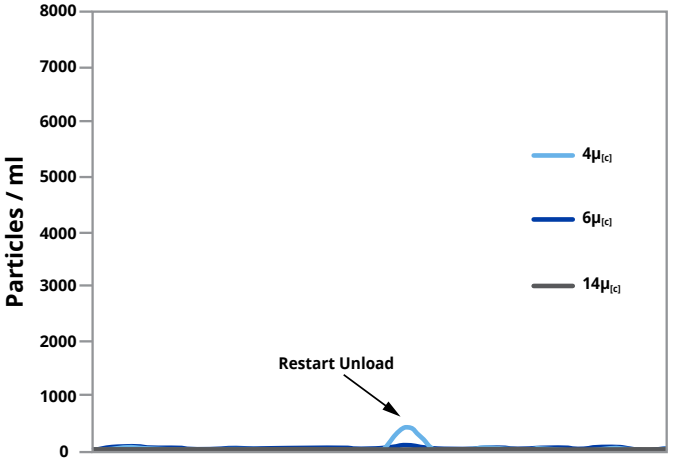
Figure 8 shows the performance of a Hy-Pro element. The unloading is evident in the DFE rated Hy-Pro element, but the effect is greatly reduced. The competitor element A3 (Figure 7) unloaded 84 times more particles $6\mu_{[c]}$ and larger than Hy-Pro, and 14 times more particles $4\mu_{[c]}$ and larger. The DFE rated Hy-Pro element had much higher retention efficiency than the filter designed and validated only to ISO16889 multi-pass.

Figure 7: Particle Counts Downstream of Filter



Downstream Element A3	Before Restart	During Restart
$4\mu_{[c]}$ particles/ml	429	6973
$6\mu_{[c]}$ particles/ml	136	2802
$14\mu_{[c]}$ particles/ml	25	139
ISO Code per ISO4406:1999	16/14/12	20/18/14

Figure 8: Particle Counts Downstream of Filter



Downstream Element Hy-Pro 3	Before Restart	During Restart
$4\mu_{[c]}$ particles/ml	93	489
$6\mu_{[c]}$ particles/ml	5	33
$14\mu_{[c]}$ particles/ml	0	0
ISO Code per ISO4406:1999	14/9/0	16/12/0

The DFE Testing Method

DFE and ISO 16889 Multi-Pass Test Results Comparison

Figure 9 shows the performance of like elements produced by three different manufacturers that were tested to ISO 16889. The results were expressed as a time weighted beta ratio. Element B had a better capture efficiency than the Hy-Pro element in the constant flow test environment of ISO 16889. All of the elements tested were true to their Beta Ratio of $\beta 7_{[c]} > 1000$.

Figure 10 shows the time weighted performance of the like elements tested to DFE multi-pass to illustrate the performance differences between DFE and ISO16889.

In Figure 11 the particle counts taken during flow change have been isolated to measure efficiency during dynamic flow. Since the DFE test has shown that filter element performance is at its worst during flow changes, isolating those sequences can help predict performance in dynamic conditions, and it is with this graph that we see how overall filter performance changes.

Element B had a beta ratio in excess of $\beta 7_{[c]} > 2000$ when tested to ISO16889 (Figure 9). However, Figure 11 shows the average beta ratio of Element B during variable flow to be $\beta 7_{[c]} > 500$. The Hy-Pro element beta ratio was in excess of $\beta 7_{[c]} > 10{,}000$, true to rating even in the dynamic test. The Hy-Pro performance in Figure 11 illustrates why Hy-Pro is committed to the DFE test method for design and development. DFE is Hy-Pro's competitive advantage.

Relying solely on ISO16889 to predict how filter elements will perform in a dynamic system is like taking a boat into rough seas that has never been in the water. The current industry standard test for hydraulic and lube filter performance (ISO 16889) is a good tool for predicting performance of off-line filters and circulating systems, but it does not accurately represent the stress of a hydraulic circuit with dynamic flow conditions or a lube system cold start. Without DFE testing, it is difficult to truly predict actual filter performance in a dynamic system.

Figure 9: ISO 16889 Multi-Pass

Time Weighted Beta Ratio Comparison for $\beta 7\mu_{[c]}>1000$ Filter Element

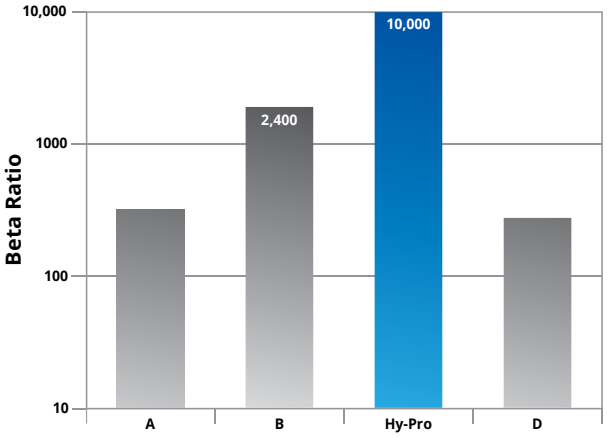


Figure 10: DFE Multi-Pass

Time Weighted Beta Ratio Comparison for $\beta 7\mu_{[c]}>1000$ Filter Element

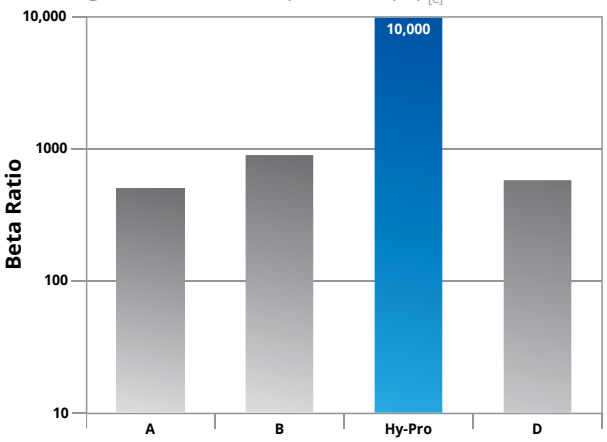
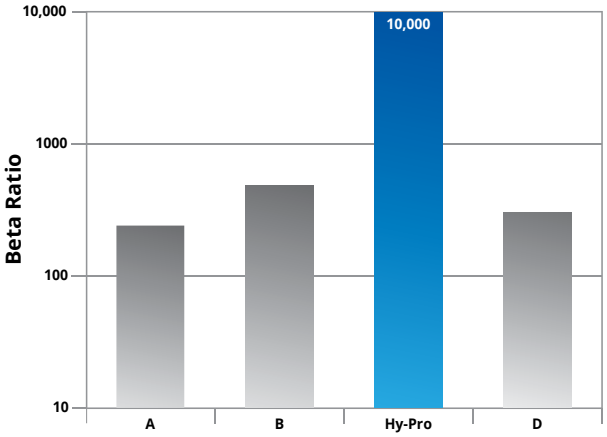


Figure 11: Real Time Flow Change

Beta Ratio Comparison per DFE Multi-Pass for $\beta 7\mu_{[c]}>1000$ Filter Element



Upgrading from Cellulose to Glass

First, understand media efficiencies.

When a filter element is rated at a particular micron size, it is said to remove particles of that particular size and larger from the fluids it is filtering. However, filter elements of different media with the same micron rating can have substantially different filtration efficiency. Filter efficiency is calculated by taking the ratio of particles upstream of (before) the filter to particles downstream of (after) the filter. The higher the ratio, the more efficient the filter and the less particles it allows to pass. There are two distinct ratings of filter efficiency, classified as nominal and absolute.

Nominal Efficiency

Nominal ratings refer to a degree of filtration at a particular micron by weight of solid particles. Filters rated as nominal (we're looking at you cellulose) have no maximum pore size, meaning while they may remove some 10 micron particles, they can still allow larger particles such as 200 micron to pass through and devastate components in the system.

Absolute Efficiency

Absolute ratings, such as most glass media filter elements are classified under, derive their value from the largest size particle which can pass through the pores of the media. Along with much greater efficiencies, glass elements have superior fluid compatibility versus cellulose with hydraulic fluids, synthetics, solvents, and high water based fluids.

Cellulose vs Glass Elements

Organic cellulose fibers can be unpredictable in size and effective useful life, while inorganic glass fibers are much more uniform in diameter and much smaller than cellulose fibers as seen in the images to the right (Figures 2 and 3).

The illustrated elements on the following page provide a visual representation of the efficiencies of both a cellulose and glass element at their respective efficiency ratings.

The cellulose element would typically achieve a code no better than 22/20/17. Runaway contamination levels at $4\mu_{[c]}$ and $6\mu_{[c]}$ are very common when cellulose media is applied in which a high population of fine particles exponentially generate more particles in a chain reaction of internally generated contaminants. The illustrated glass element would typically deliver an ISO Fluid Cleanliness Code of 18/15/8 to 15/13/9 or better depending upon the system conditions and ingression rate.

Upgrading to Hy-Pro G8 Dualglass

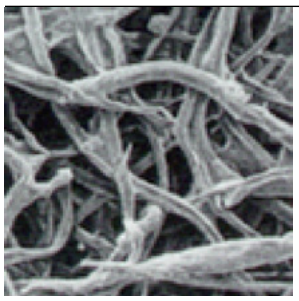
When upgrading to an absolute efficiency glass media element, the system cleanliness must be stabilized. During this clean-up period the glass element halts the runaway contamination as the ISO cleanliness codes are brought into the target cleanliness range. As the glass element removes years of accumulated fine particles, the element life might be temporarily short.

Once the system is clean the glass element can last up to 4~5 times longer than the cellulose element that was upgraded as shown in Figure 4.

Figure 1: Filter Efficiency Equation

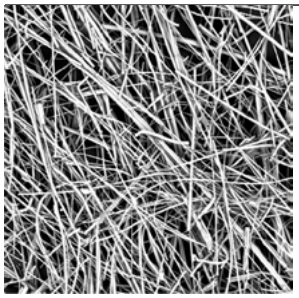
$$\beta x_{[c]} = \frac{\text{quantity particles} \geq X\mu_{[c]} \text{ upstream of filter}}{\text{quantity particles} \geq X\mu_{[c]} \text{ downstream of filter}}$$

Figure 2: Cellulose Filter Media



Cellulose fibers at 400x magnification

Figure 3: Glass Filter Media



Glass fibers at 400x magnification

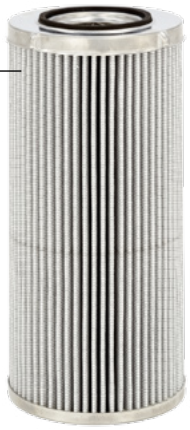
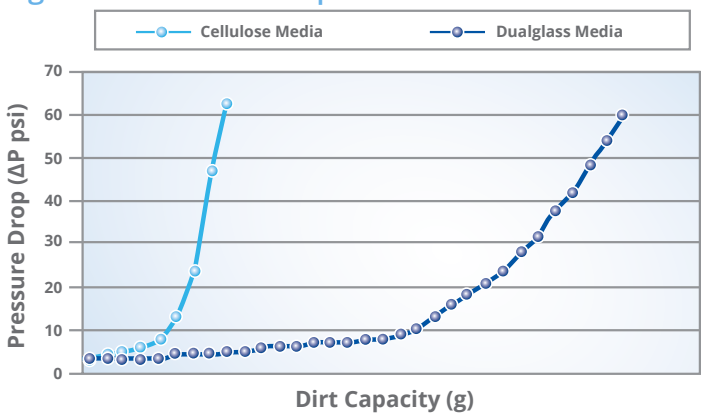


Figure 4: Element Lifespan



HY-PRO

Cellulose: $\beta 10\mu_{[C]} = 2$

$= \frac{\text{50,000 Particles In}}{\text{25,000 Particles Out}}$

Dirt in

50,000 particles $10\mu_{[c]}$ or larger

Dirt out

25,000 particles $10\mu_{[c]}$ or larger

50%
efficiency

Glass: $\beta 10\mu_{[C]} = 1000$

$= \frac{\text{50,000 Particles In}}{\text{50 Particles Out}}$

Dirt in

50,000 particles $10\mu_{[c]}$ or larger

Dirt out

50 particles $10\mu_{[c]}$ or larger

99.9%
efficiency

HY-PRO

Lube Design

Low ΔP Optimized Glass Filter Media

A modified DFE rated glass media option for high flow lube systems with low ΔP alarm (1 bard, ~15 psid). Also ideal for undersized hydraulic filter assemblies or upgrading from wire mesh to high efficiency glass media.

HY-PRO

hyprofiltration.com/LubeDesign

Lube Applications

High speed bearing lube oil systems in paper mills typically use higher viscosity ISO220 and ISO320 oils. A high clean element ΔP (i.e. 0.5 bard / 7psid) relative to a low ΔP indicator alarm setting (i.e. 1.25 bard / 18 psid) leads to reduced filter element loading and short element life. This type of condition can occur when changing to heavier oil or upgrading filter element efficiency in search of lower operating ISO Codes. Hy-Pro H and L media codes are designed specifically to optimize element life while maintaining filter efficiencies in these types of applications.

The perfect media for your application.

Hy-Pro DFE Rated *M media code is the Hy-Pro standard and is ideal for 99.99% of all hydraulic, lube and diesel applications. Contact Hy-Pro for selection and part numbers for H and L low ΔP modified media options.

Original	Hy-Pro Glass Media	Hy-Pro Lube Media
HC8314FCP39H	HP8314L39-3MB	HP8314L39-3LB

Dynafuzz

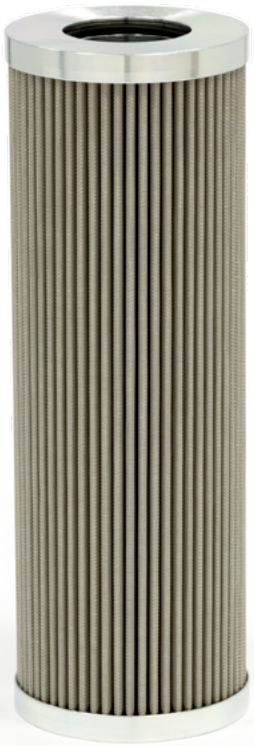
Stainless Fiber Media

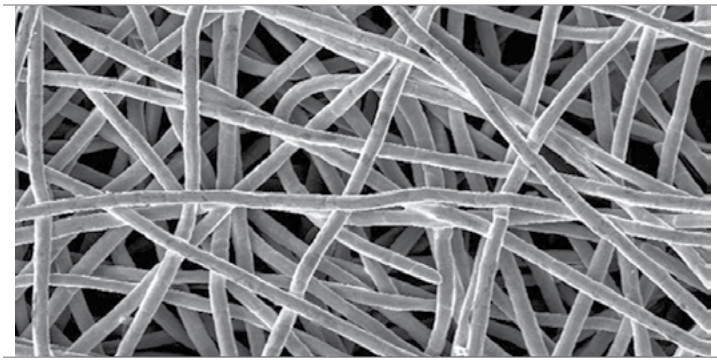
Filter Elements for Power Generation and other fire resistant fluid applications.

Dynafuzz is ideal for long term exposure to aggressive fluids such as phosphate ester, Skydrol, Deionized water, and high temperature applications where traditional glass media binders can degrade leading to media migration.

HY-PRO

hyprofiltration.com/Dynafuzz





Advanced media solutions.

EHC systems using phosphate ester fluids (FRFs) develop aggressive acids when exposed to water. The acid attacks glass fiber media binders of critical pump discharge and last chance servo pilot filters. Lower filter efficiency, media migration and fiber shedding into the servo screens can result causing servo valve malfunction. Dynafuzz media is DFE rated to provide the same low operating ISO Codes and contaminant retention you expect with the fluid compatibility you need.

Dynafuzz options:

Dynafuzz media is available for all Hy-Pro high collapse filter elements that are found in turbine EHC, primary metal, and other hydraulic control applications where fire resistant fluids are used. For the most critical installations (nuclear power), optional 100% bubble point integrity testing and validation is available. Part number modifier example, contact Hy-Pro for specifications and pricing:

Original	Hy-Pro Glass Media	Hy-Pro Dynafuzz Media
HC9401FDP13ZYGE	HP41L13-2MV	HP41L13-3SFV

Intuitive Upgrade

The PFQ290218V Westinghouse EHC upgrade features a 3SF Dynafuzz media element ($\beta 5_{[c]} > 1000$) in place of a 10 micron glass media element. The bowl extension with top loading element service minimizes mess and accepts a double length element allowing the use of higher efficiency media and extended element life.

NSD

Non-Spark Discharge Filter Elements

Hy-Pro NSD element and media technology is optimized to prevent spark discharge and minimize potential energy in bearing lubrication and hydraulic control systems.

NSD elements prevent oil degradation caused by thermal events associated with element spark discharge to extend fluid life and prevent anti-oxidant additive depletion.

HY-PRO

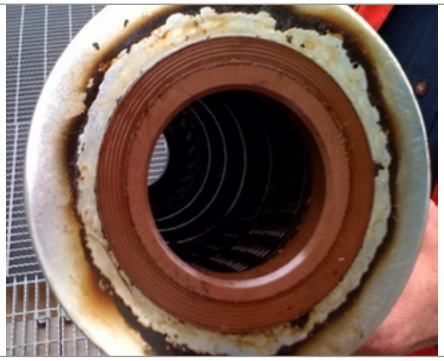
hyprofiltration.com/NSD

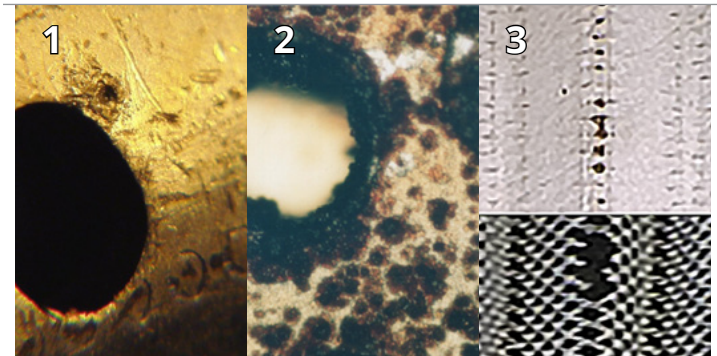
Cleaner fluid without sparking.

For some, the answer to preventing element sparking and high potential energy is to use coarse strainer type filters (Stat-Free) in the main bearing lube filter duplex. Although this may prevent sparking it renders the main bearing lube filter assembly useless in preventing catastrophic bearing failure due to contamination. Independent lab analysis proves that even Hy-Pro high efficiency 3 micron absolute ($\beta 5_{[c]} > 1000$) NSD elements are resistant to spark discharge.

Prevent varnish; promote efficiency.

With Hy-Pro NSD elements, any reduction in thermal sparking events and tribo-electric effect will have a positive impact by decelerating anti-oxidant additive depletion and extending useful fluid life. Field test data has shown that Hy-Pro NSD elements may even reduce or stabilize varnish potential values by preventing further degradation from sparking and collecting some insoluble oxidation by-products.





Eliminate damage caused by sparking.

As fluid passes through the typical tortuous filter media fiber matrix, turbulence increases which results in thermal events as the fluid layers shear, creating static accumulation on elements that can lead to high voltage spark discharge from media to support tube. Photos 1 and 2 show evidence of sparking on the filter element support tube (pitting and burning), and photo 3 shows filter media and support mesh from a lube filter element with spark discharge burn damage.

Water Removal

G8 Dualglass Media with Water Removal

Media code "A" specifies G8 Dualglass media co-pleated with water removal scrim to produce a filter that can remove water while maintaining $\beta x_{[C]}$=1000 efficiency down to 1µ/2.5$\mu_{[C]}$. Available for all Spin-On and cartridge style filter elements.

HY-PRO

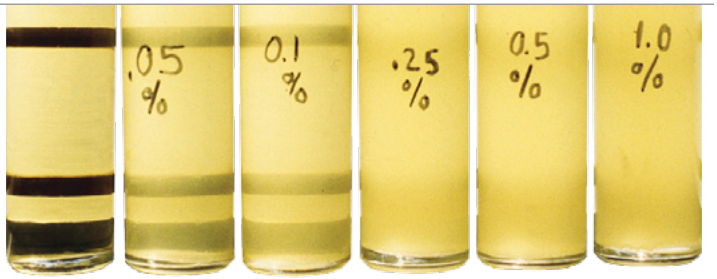
hyprofiltration.com/WaterRemoval

Dual purpose contamination removal

Hy-Pro filter elements with water removal media combine the best of particulate and water removal and can bring high water counts down and prevent any of the gel particles from being released back into the system, all while maintaining our $\beta x_{[c]}$ = 1000 particulate removal efficiency you've already come to love. Water removal is available with any of our glass media selections from 1µ to 40µ.

Remove water: protect your system.

Emulsified water, very small droplets of water dispersed through oil, will often cause oil to appear cloudy or milky along with increasing its viscosity. Hy-Pro Water Removal filter elements pull free and emulsified water from your industrial oils to leave them clean and dry and ensure your system is operating to its peak efficiency.



Hy-Pro Element	Water Capacity
HP75L8-*AB	24 oz 0.7 liters
HP107L36-*AB	177 oz 5.2 liters
HP8314L39-*AB	182 oz 5.4 liters
HP60L8-*AB	12 oz 0.4 liters

Water Capacity by Series

Water PPM ~ Ounce Conversion

Moisture (PPM) x Fluid Volume (Gal) x 0.0001279 = oz of Water

Example:

2,500 ppm x 5,000 gal reservoir x 0.0001279 = 1598.75 oz water

Turbo-TOC* Upgrades

Hy-Pro Filter Element Upgrades for Kaydon Turbo-TOC* Conditioning Skid Element Sets

Complete filter element sets including pre-filter, coalesce, separator and post-filter polishing elements.

HY-PRO

hyprofiltration.com/TurboToc

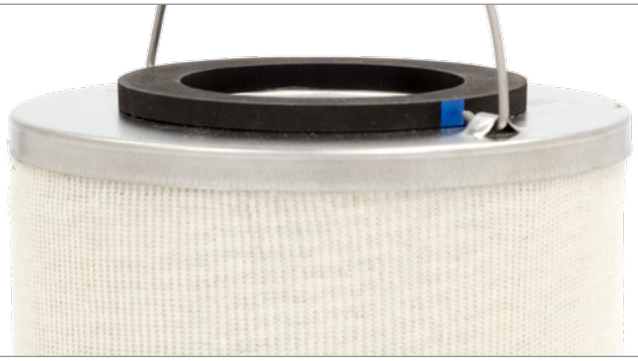
*Turbo-TOC is a registered trademark of Kaydon Corporation.

Elements that go beyond industry standard.

DFE rated elements perform true to rating even under demanding variable flow and vibration conditions. Today's industrial and mobile hydraulic circuits require elements that deliver specified cleanliness under all circumstances. Wire mesh supports the media to ensure against cyclical flow fatigue, temperature, and chemical resistance failures possible in filters with synthetic support mesh.

Water Phase 1: Coalesce.

Stage 1 in removing the free and emulsified water is to coalesce the water into larger droplets until large enough to drop out of the oil. The Hy-Pro HPQK2G coalesce utilizes all synthetic media and non-woven materials providing great compatibility even over long term exposure to water.



Water Phase 2: Separator + Final Polishing.

The HPQK3P-3M upgrade is a dual functioning element providing the final stage of water separation with a final pass of particulate removal. The TEFLON® coated screen works with the coalesce element to act as a water barrier while the water droplets grow before being collected. The final conditioning is Hy-Pro 3M media rated $\beta 5_{[c]} > 1000$, it's a total solution.

Element Interchange & Upgrade

Kaydon Model No.	Kaydon Part No.	Hy-Pro Direct Interchange	Description	Hy-Pro Upgrade	Description
K1000	A910201	HP102L36-6MB	Glass media pre-filter $\beta7_{[C]} > 1000$	HP101L36-3MB	High capacity glass media pre-filter $\beta5_{[C]} > 1000$
K1100 (replaced K1000)	A910201, A910266	HP101L36-6MB	High capacity glass media pre-filter $\beta7_{[C]} > 1000$	HP101L36-3MB	High capacity glass media pre-filter $\beta5_{[C]} > 1000$
K2000	A910202	HPQK2	Coalesce element cellulose media	HPQK2G	Coalesce element synthetic media
K2100 (replaced K2000)	A910202, A920267	HPQK2G	Coalesce element synthetic media	-	-
K3000	A910203, A910303	HPQK3	Separator element cellulose media	HPQK3P-3M	Separator layer + $\beta5_{[C]} >$ 1000 glass media polishing
K3100 (replaced K3000)	A910203, A910268	HPQK3P-3M	Separator layer + $\beta5_{[C]} >$ 1000 glass media polishing	-	-
K4000	A910204	HP102L36-3MB	High capacity glass media post-filter $\beta5_{[C]} > 1000$	HP101L36-3MB	High capacity glass media post-filter $\beta5_{[C]} > 1000$
K4100 (replaced K4000)	A910204, A910269	HP101L36-3MB	High capacity glass media post-filter $\beta5_{[C]} > 1000$	HP101L36-1MB	High capacity glass media post-filter $\beta2.5_{[C]} > 1000$

Optimize Your Turbo-TOC* performance with Hy-Pro Elements

Achieve lowest turbine lube oil reservoir ISO fluid cleanliness results and maximize element life by upgrading to Hy-Pro HP101L36-3MB series for pre-filter and HP101L36-1MB post-filter.

For optimum water removal efficiency and fluid compatibility use HPQK2G coalesce element and HPQK3P-3M separator/ polisher elements (all synthetic media, non-cellulosic).

To reduce element change out costs on skids with pre-filter and post-filter housings install HP101L36-3MB in pre-filter with HPQK2G coalesce and HPQK3P-3M separator / polisher elements in the coalesce vessel (extends coalesce element life).

Upgrade to HPQK2G and HPQK3P-3M synthetic media elements and achieve > 95% single pass water removal efficiency.

Tested to ISO Quality Standards

ISO 2941	Collapse and burst resistance
ISO 2942	Fabrication and Integrity test
ISO 2943	Material compatibility with fluids
ISO 3724	Flow fatigue characteristics
ISO 3968	Pressure drop vs. flow rate
ISO 16889	Multi-pass performance testing

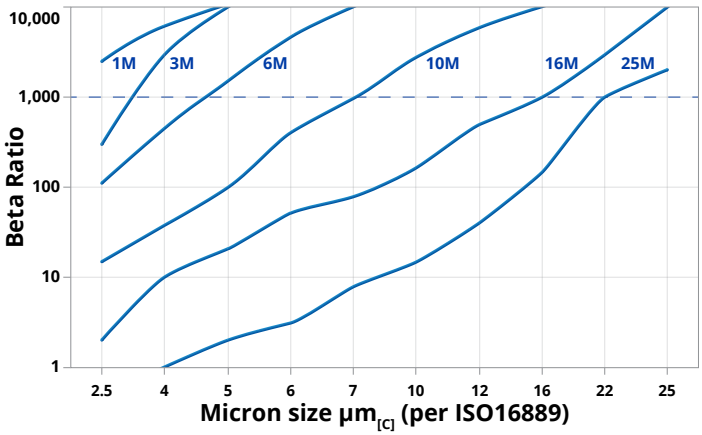
Fluid Compatibility

Petroleum based fluids, water glycols, polyol esters, phosphate esters, HWBF. Contact Hy-Pro for seal selection assistance.

Media

G8 media pleat pack features our latest generation of graded density glass media that delivers required cleanliness while optimizing dirt capacity.

Glass Media Filtration Efficiency (Beta Ratio) vs Micron Size



HY-PRO

*Turbo-TOC is a registered trademark of Kaydon Corporation.

Off-line Filtration

Types, Uses & Contamination Prevention

Our mission is to make our customers as efficient as possible, and we achieve that with the highest quality filtration products and total system cleanliness strategies to maximize uptime, productivity and prevent costly fluid contamination related failures. We often achieve that by simply upgrading our customers to Hy-Pro DFE rated filter elements and Hy-Dry breathers. But too many systems have insufficient filtration, or worse yet no filtration, creating the need for a range of off-line particulate filtration solutions.

An Off-line system (aka kidney loop) is connected to the reservoir of a hydraulic, lube or storage system that operates independently of the operation of that system meaning that it can be stopped for an element change without interrupting operations. It allows the flexibility to use ultra-high efficiency media to remove particulate and insolubles to reach low ISO Codes that might otherwise be unattainable. Conditioning off-line extends the life of critical on-board pump discharge, servo pilot and return line filters that can only be changed when the system is not running. Maintaining cleanliness in the reservoir protects critical pump inlet, eliminating the need for suction strainers that can cause pump cavitation.

Dedicated

A properly sized off-line filtration system can turn over the entire volume of a reservoir several times a day (we recommend 8 turns), maintaining ISO fluid cleanliness codes well below the upper limit. Whether you're using low viscosity hydraulic or high viscosity lube oil, implementing dedicated off-line filtration will yield longer bearing and hydraulic component life and longer useful fluid life. When dealing with high viscosity gearbox and rolling mill lubricants, it's most effective to filter off-line so that the flow rate and filter can be sized for optimal pressure drop and element life without sacrificing efficiency. That means you can pump thick fluid through an oversized filter at a low flow rate and get it super clean, even when it's cold outside. And when the filter element has removed kilograms of dirt you don't have to stop your operation to change it; just turn off the kidney loop, change elements, and get right back to filtering your fluids. With a dedicated system, you know that your fluids are always clean and your system is always protected.

Mobile

Portable filtration systems are a valuable tool in the battle against contamination and are ideal for fluid transfer and in field service work. The Hy-Pro range of portable filtration systems includes compact units for small gearboxes, filter carts optimized for hydraulic applications and units with generously sized filters for high viscosity or highly contaminated fluids commonly found in fluid reclamation. Staged filtration, two filters in series, allows for combined water removal and particulate filtration in one pass to get you on to the next job more quickly. Hy-Pro mobile filtration systems are designed for industrial, outdoor use with high quality components including cast iron gear pumps and non-shredding wheels that get your filtration exactly where you need it.

Integrated versatility

Implementing off-line filtration is the best way to ensure your hydraulic and lube oils are clean and your systems are operating efficiently. Whereas applications that consume fluids (diesel, etc) must filter fluids in a single pass, off-line filter systems for hydraulic and lube oils allow for recirculating the reservoir to remove more dirt with every pass. A dedicated off-line system has the added benefit of being used as a 3-way valve to top off the reservoir, turning your filter system into a fluid transfer solution that removes any dirt from oil that is added and prevents contamination from ever entering your system.

Off-line Systems

More than just filtration.

With a Hy-Pro dedicated filtration system, fluid contamination related failures and premature fluid replacement are a thing of the past. Every off-line solution includes sample ports before and after filters, providing accurate reservoir condition and filter performance validation. Some great options include on-board particle monitors, cooling for hot gearboxes, ultra high viscosity, dragline-optimized skids, automatic isolation valves, hazardous environment, custom enclosures and more. As with all Hy-Pro systems, your off-line system can be completely customized to provide the best solution for your application.

CFU

Compact Filter Unit

Bigger isn't always better. The Compact Filter Unit provides you with the best filtration at a size you can take anywhere. Tried and true, the CFU is the ultimate filtration system in power and mobility. And with easy to change Spin-On elements or heavy duty MF3s, you can rest easy knowing your filtration will always exceed your expectations.

HY-PRO

hyprofiltration.com/CFU

Small size, huge results.

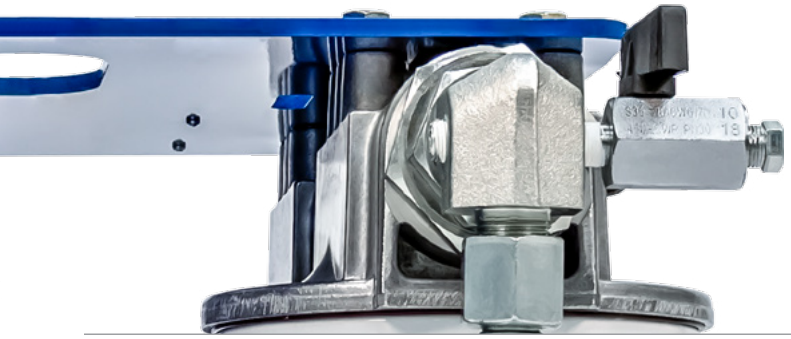
Designed specifically for limited space operations, the CFU maximizes power in a minimal package. Use the ergonomic handle to hoist the CFU to provide filtration directly within turbine nacelles or filter straight from the barrel to take out contaminants before they can ever reach your equipment.

The first stage of success.

Staged filtration allows a range of media selections for particulate and water removal to deliver ISO Codes right on target. Choose from six element configurations to get the perfect CFU for your toughest contamination problems.

Media matters.

DFE rated filter elements stay true to efficiency ratings and ensure the highest level of particulate capture and retention capabilities. And with media options down to $\beta 2.5_{[C]} \geq 1000$ you can be sure contamination stays exactly where you want it: out of your fluid.



Redefines standard filtration.

Knowledge of your system is the ultimate tool in the fight against contamination. With upstream and downstream sample ports located on every machine, the standard CFUs are anything but standard.

Different by design.

Built from lightweight aluminum and engineered for portability, the CFU is perfectly designed to filter new fluids during transfer and top-off bulk oil before use. For fluids already in service, use the CFU to flush them through the high efficiency elements for unparalleled levels of fluid cleanliness.

Completely customizable.

Every CFU can be specifically tailored to the job at hand so you get the perfect solution to suit your needs. With a variety of flow rates and power options, even the ability to color coordinate each CFU to your existing safety standards, the possibilities are endless for what you can do with the CFU.

CFU Specifications

Dimensions[1]

Height	Length	Width	Weight
21" (54 cm)	21" (54 cm)	12" (31 cm)	47 lbs (21 kg)

Connections

Inlet	Outlet	Hoses
¾" male JIC with 37° flare	½" male JIC with 37° flare	¾" x 8 ft (2.4 m) suction female JIC or BSPP swivel ½" x 8 ft (2.4 m) discharge female JIC or BSPP swivel

Operating Temperature

Fluid Temperature	Ambient Temperature
30°F to 225°F (0°C to 105°C)	-4°F to 104°F (-20C to 40C)

ΔP Indicator Trigger

22 psi (1.5 bar). Consult factory for other options.

Filter Assembly Bypass

25 psid (1.7 bard). Consult factory for other options.

Materials of Construction

Frame	Filter Assembly	Hoses	Wands	Element Bypass Valve
Powder coated aluminum	Aluminum head	Reinforced synthetic	Stainless steel	Nylon

Electric Motor

TEFC, 56C frame
½ hp, 1450-1750 RPM

Electric Connection

15' (4.6 m) cord included installed on machine.[2]

Pump

Positive displacement gear pump with relief valve. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.

Pneumatic Option Air Consumption

~15 cfm @ 60 psi[3]

Media Description

M	A	W
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Model	Filter Element Part Number	Example
CFUD	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8–12MB
CFUH	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8–3ME-WS
CFUL	HP409L9 – [Media Selection Code] [Seal Code]	HP409L9–40WV
CFUM	HP60L8 – [Media Selection Code] [Seal Code]	HP60L8–16MB
CFUN	HP60L8 – [Media Selection Code] [Seal Code]	HP60L8–6AV
CFUS	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8–25MV

Viscosity

Max viscosity rated for 200 cSt.[4]

Fluid Compatibility

Petroleum and mineral based fluids (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Hazardous Environment Options

Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord will be included.

Filter Sizing Guidelines

See pages for selected options filter sizing guidelines:
MF3: 190
S75-76: 182
S409: 186

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Selecting pneumatic power option removes electric cord.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
[4]When sized and installed appropriately. Contact factory for applications above 200 cSt for sizing requirements.

CFU Part Number Builder

CFU [ ] [ ] [ ] [ ] - [ ] - [ ] [ ] [ ]

Model | Flow Rate | Power Options | Hose Connection | Special Options | Media 1 | Media 2 | Seal

Model

Filter Assemblies

D	1 x S75D Spin-On filter assembly
H[1]	1 x S75 Spin-On filter assembly
L	2 x S409 Spin-On filter assemblies
M[1]	1 x MF3 cartridge housing
N	2 x MF3 cartridge housings
S	2 x S75 Spin-On filter assemblies

Filter Elements

2 x HP75L8-*** filter elements in parallel flow
1 x HP75L8-*** filter element
2 x HP409L9-*** filter elements in series flow
1 x HP60L8-*** filter element
2 x HP60L8-*** filter elements in series flow
2 x HP75L8-*** filter elements in series flow

Flow Rate[2]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
5	5 gpm (18.9 lpm)

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P

Pneumatic

00 Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__[3] Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Hose Connection

G	Female BSPP swivel hose ends, no wands
S	Female JIC swivel hose ends, no wands
W	Female JIC swivel hose ends, with wands

Special Options

B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
G[3]	Spill retention pan with fork guides (industrial coated steel)
J	Add pressure gauge between pump & filter assembly
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O[3]	On-board PM-1 particle monitor & clean oil indicator light
P9[4]	Phosphate ester fluid compatibility modification
S9[5]	Skydrol fluid compatibility modification
Z	On site start-up training

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12M[6]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12A[6]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS[7]	EPR seals + stainless steel support mesh

[1]When selected, omit Media 2 option from part number builder.
[2]Nominal flow rates at 60 Hz motor speeds.
[3]Significant size/weight increase when selected. Contact factory for specifications.
[4]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[6]When Model "L" selected, use 10M or 10A for respective media code in place of 12M or 12A.
[7]Only available in 3M media for HP75L8 series elements.

FPL

Dedicated Off-line Filter Panel

A dedicated contamination solution for bulk oil handling, fluid transfer and reservoir or gearbox conditioning.

Enhance cleanliness by adding the FPL to an existing hydraulic system and extend the life of in-line filters.

HY-PRO

hyprofiltration.com/FPL

Ready when you are.

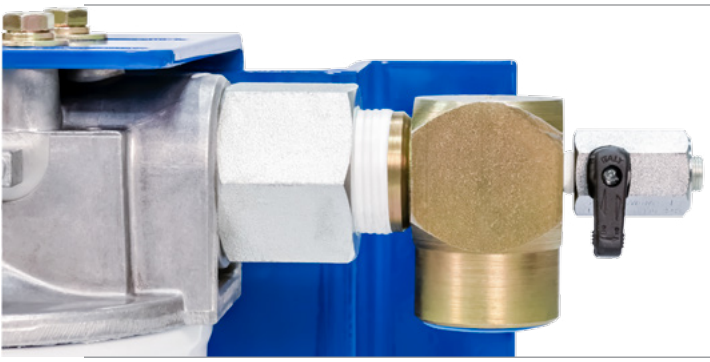
From the pump to the seals, every FPL arrives fully assembled and ready for installation so you can get straight to cleaning your fluids and improving the efficiency of your equipment.

The first stage of success.

Staged filtration allows a range of media selections for particulate and water removal to deliver ISO Codes right on target. Choose between dual MF3 cartridge or up to four Spin-On elements to tackle the most viscous fluids and achieve unimaginably low ISO Codes in a single pass.

Media matters.

DFE rated filter elements stay true to efficiency ratings and ensure the highest level of particulate capture and retention capabilities. And with media options down to $\beta 2.5_{[C]} \geq 1000$, you can be sure contamination stays exactly where you want it: out of your system.



Setting the new standard.

Sample ports in the right locations arm you with access to consistently accurate system conditions which is why every FPL comes standard with upstream and downstream sample ports in their proper positions.

Engineered for industrial use.

Precision engineered and built from heavy gauge steel, the FPL is designed to be a powerhouse addition to your equipment. To top it off, the cast iron gear pump with internal relief gives you the durability you want with the safety you need.

From concept to creation.

Whether for plastic injection molding hydraulics with varnish issues or a wind turbine gearbox with small size restrictions, the FPL can be custom designed and built to meet the exact needs to solve your contamination problems.

FPL Specifications

Dimensions[1]	**Height** 22" (58 cm)	**Length** 42" (107 cm)	**Depth** 12" (31 cm)	**Weight** 138 lbs (63 kg)
Connections	**Inlet with 3-way valve** 1" FNPT		**Outlet** 1" FNPT	
Operating Temperature	**Fluid Temperature** 30°F to 225°F (0°C to 105°C)		**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
ΔP Indicator Trigger	**Standard MF3 Assemblies** 22 psi (1.5 bar)	**Special Options D1 + S1 (S75/D)** 22 psi (1.5 bar)	**Special Option D2 (DFN)** 32 psid (2.2 bard)	**Special Option P1 (PFH)** 73 psid (5 bard)
Filter Assembly Bypass	**Standard MF3 Assemblies** 25 psid (1.7 bard)	**Special Options D1 + S1 (S75/D)** 25 psid (1.7 bard)	**Special Option D2 (DFN)** 50 psid (3.4 bard)	**Special Option P1 (PFH)** 102 psid (7 bard)
Materials of Construction	**Frame** Carbon steel with industrial coating			
Electric Motor	TEFC, 56-145 frame 1 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)[2]			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[3]			
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**A** G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**W** Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)	

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Model	Filter Element Part Number	Example
Standard FPL (2x MF3 13" bowls)	HP60L13 – [Media Selection Code] [Seal Code]	HP60L13-12MV
Special Option D1	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8-25MB
Special Option D2	HP39NL15 – [Media Selection Code] [Seal Code]	HP39NL15-10AB
Special Option P1	HP419L13 – [Media Selection Code] [Seal Code]	HP419NL13-10MV
Special Option S1	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8-3AB

Viscosity	2-5000 cSt[4]
Fluid Compatibility	Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord will be included.

Filter Sizing Guidelines

See pages for selected options filter sizing guidelines:
MF3 (Standard): 190
S75-76: 182
PFH: 203
DFN: 218

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump life and/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
[4]When sized and installed appropriately. Contact factory for applications above 800 cSt for sizing requirements.

FPL Part Number Builder

FPL [ ] [ ] - [ ] - [ ] [ ] [ ]

Flow Rate | Power Options | Special Options | Media 1 | Media 2 | Seal

Flow Rate[1]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__ Add X prefix to power option listed above. Not available with (00) Pneumatic Option

Special Options

B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D1[2]	2 x S75DL8 filter assemblies in series
D2[2,3]	1 x DFN39NL15 duplex filter assembly
D3	True differential pressure gauge, visual green to red
E	100 mesh cast iron basket strainer
J	Add pressure gauge between pump & filter assembly
K	HP75L8-149W Spin-On suction strainer
L2	Liquid cooled heat exchanger
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O	On-board PM-1 particle monitor & clean oil indicator light
P1[2,3]	1 x PFH419NL13 filter assembly
P9[4]	Phosphate ester fluid compatibility modification
S1[2]	2 x S75L8 Spin-On filter assemblies in series
S9[5]	Skydrol fluid compatibility modification
U	CUL and/or CSA marked starter enclosure for Canada
Y	VFD variable speed motor frequency control
Z	On site start-up training

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
12M[6]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
12A[6]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS[7]	EPR seals + stainless steel support mesh

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Replaces standard MF3 housings.
[3]When selected, omit Media 2 option from part number builder.
[4]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[6]When Special Options "D2" or "P1" selected, use 10M or 10A for respective media code in place of 12M or 12A.
[7]Only available in 3M media for HP75L8 series elements.

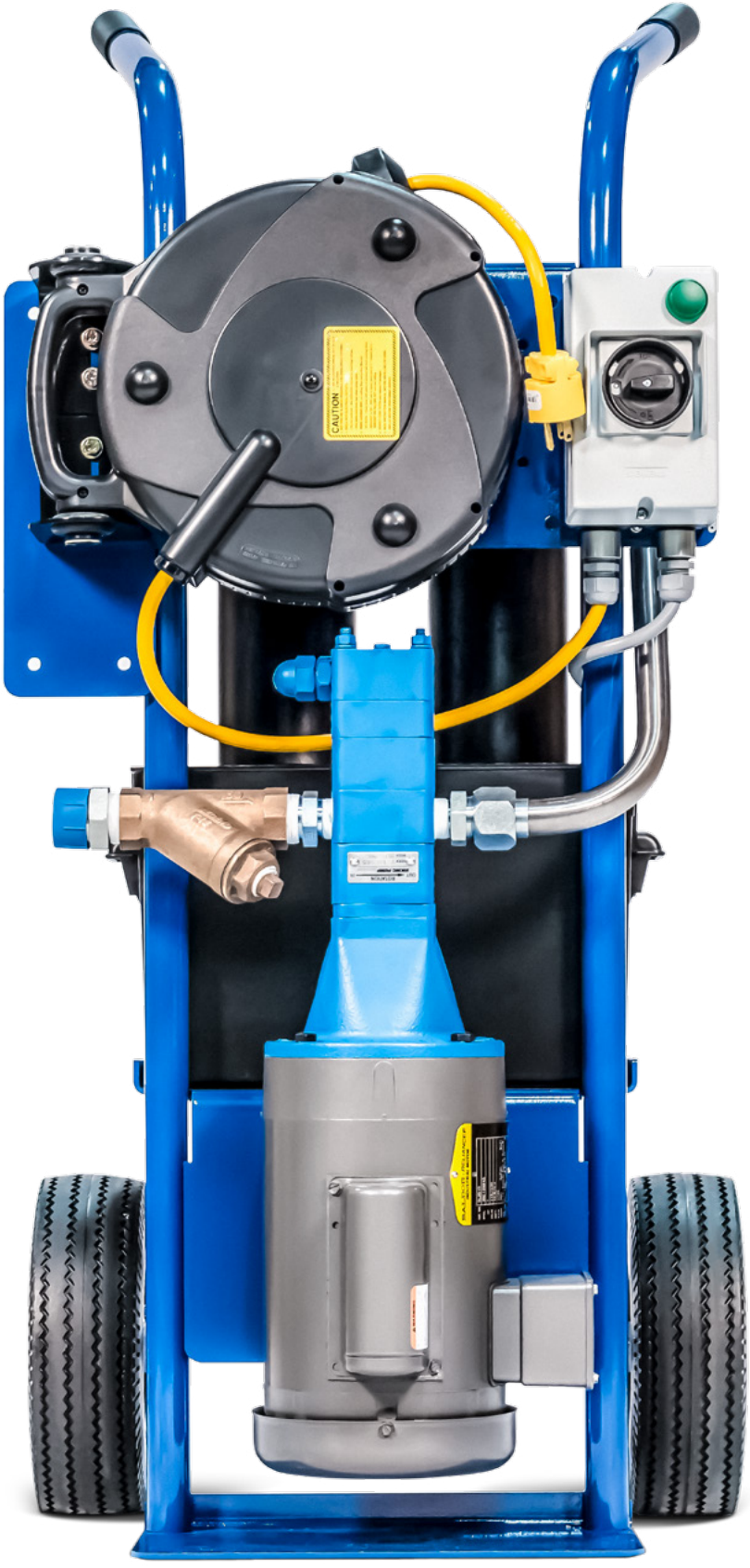
FC
Filter Cart

A fully self-contained mobile solution for bulk oil handling, fluid transfer and reservoir or gearbox conditioning.

Ideal for lower viscosity hydraulic oil, lube oil and diesel fuel.

HY-PRO

hyprofiltration.com/FC



Engineered for industrial use.

Rugged construction and attention to the smallest of details come together remarkably so that nothing holds you or your equipment back. The easy to maneuver hand-truck style design with never-flat pneumatic tires and cast iron gear pump with internal relief mean you get powerful filtration exactly when and where you need it.

Set the stage for your success.

Staged filtration allows a range of media selections for particulate and water removal to deliver ISO Codes right on target. Choose between dual MF3 cartridge (standard) or up to four Spin-On elements to tackle the most viscous fluids and achieve unimaginably low ISO Codes in a single pass.

Media matters.

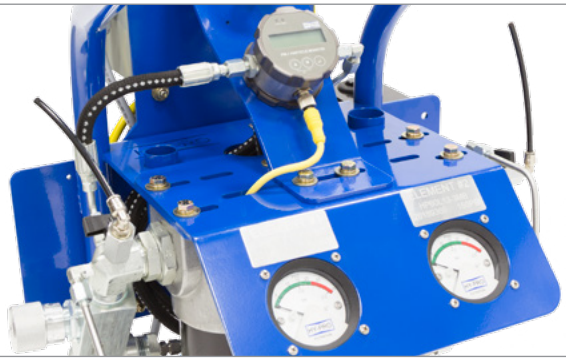
DFE rated filter elements stay true to efficiency ratings and ensure the highest level of particulate capture and retention capabilities. And with media options down to $\beta 2.5_{[C]} \geq 1000$, you can be sure contamination stays exactly where you want it: out of your systems.

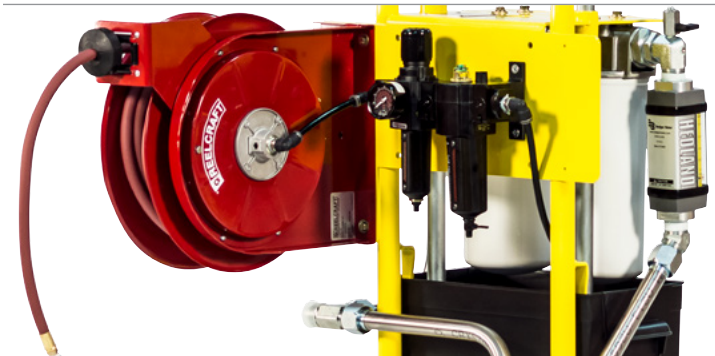
Your standard Filter Cart, reimagined.

Sample ports in the right locations arm you with access to consistently accurate system conditions which is why every FC comes standard with up- and downstream sample ports in their proper positions. And with the 35’ (11m) retractable cord reel or 35’ air hose for pneumatic models, it’s easy to see why the standard FC isn’t so standard after all.

With options to make your job easier.

With the optional filter bypass line, cold starts, gearbox pump-outs, and even element change outs become easier than ever. Add the optional PM-1 particle monitor for real time cleanliness data and know exactly how your filtration is performing without the need for a bottle.





Completely customizable.

The FC comes in a variety of flow rates and with electric options that range from 120 to 575 V ac, single or three phase. Or choose the pneumatic and explosion proof models to take your filtration into hazardous zones like you never thought possible. Even color coordinate each FC to your existing safety standards. With thousands of combinations to choose from, the possibilities are endless for what you can do with the FC.

FC Specifications

Dimensions[1]

Height	Width	Depth	Weight
45" (114 cm)	20" (50 cm)	23" (58 cm)	125 lbs (57 kg)

Connections

Inlet
FC05-FC5: 1" male JIC (37° flare)
FC10: 1.25" male JIC (37° flare)
FC20: 1.5" male JIC (37° flare)

Outlet
FC05-FC10 1" male JIC (37° flare)
FC20: 1.25" male JIC (37° flare)

Hoses

FC05-FC5:	1" x 10 ft (2.4 m)
FC10:	1.25" x 10 ft (2.4 m) suction 1" x 10 ft (2.4 m) discharge
FC20-FC30:	1.5" x 10 ft (2.4 m) suction 1.25" x 10 ft (2.4 m) discharge

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 104°F
(-20C to 40C)

ΔP Indicator Trigger

22 psi (1.5 bar). Consult factory for other options.

Filter Assembly Bypass

25 psid (1.7 bard). Consult factory for other options.

Materials of Construction

Frame	Filter Assembly	Hoses	Wands	Element Bypass Valve
Industrial coated steel	Aluminum head & canister	Reinforced synthetic	Stainless Steel	Nylon

Electric Motor

TEFC, 56-215 frame
0.5-3 hp, 1450-1750 RPM

Motor Starter

MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.

Electric Connection

Voltages 230 V ac and under, single phase: 35' (11 m) retractable cord reel included. NEMA 5-15 plug installed on Power Option 12.
Voltages over 230 V ac: 35' (11 m) power cord included.

Pump

Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.

Pump Bypass

Full bypass at 150 psi (10 bar)[2]

Pneumatic Option Air Consumption

~40 cfm @ 80 psi[3]
35' (11 m) retractable air hose included when pneumatic option selected (replaces electric cord reel).

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[c]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Model	Filter Element Part Number	Example
Standard FC (2x MF3 13" bowls)	HP60L13 – [Media Selection Code] [Seal Code]	HP60L13-12MV
Special Option D1	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8-25MB
Special Option S1	HP75L8 – [Media Selection Code] [Seal Code]	HP75L8-3AB

Viscosity

2-5000 cSt[4]

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Hazardous Environment Options

Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord will be included.

Filter Sizing Guidelines

See pages for selected options filter sizing guidelines:
MF3 (Standard): 190
S75-76: 182

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump lifeand/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
[4]When sized and installed appropriately. Contact factory for applications above 800 cSt for sizing requirements.

FC Part Number Builder

FC [ ] [ ] [ ] - [ ] - [ ] [ ] [ ]

Flow Rate | Power Options | Hose Connection | Special Options | Media 1 | Media 2 | Seal

Flow Rate[1]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
20[2]	20 gpm (75.7 lpm)

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option

Hose Connection

G	Female BSPP swivel hose ends, no wands
S	Female JIC swivel hose ends, no wands
W	Female JIC swivel hose ends, with wands

Special Options

B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D1[3]	2 x S75DL8 filter assemblies in series
D3	True differential pressure gauge, visual green to red
E	100 mesh cast iron basket strainer
H1	10' (3 m) return line hose extension
H2	20' (6 m) return line hose extension
J	Add pressure gauge between pump & filter assembly
K	HP75L8-149W Spin-On suction strainer
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O	On-board PM-1 particle monitor & clean oil indicator light
P9[4]	Phosphate ester fluid compatibility modification
S1[3]	2 x S75 Spin-On filter assemblies in series
S9[5]	Skydrol fluid compatibility modification
U	CUL and/or CSA marked starter enclosure for Canada
Z	On site start-up training

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12A	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS[6]	EPR seals + stainless steel support mesh

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Contact factory for sizing assistance on all viscosities.
[3]Replaces standard MF3 housings.
[4]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[6]Only available in 3M media for HP75L8 series elements.

FSL

High Viscosity Filtration Systems

A dedicated contamination solution for bulk oil handling and fluid transfer. Designed to excel in filtering particulate from heavily contaminated oil, the FSL keeps gearbox lubricant clean and equipment running efficiently.

Ideal for high viscosity gearbox or lube applications and highly contaminated fuel applications.

HY-PRO

hyprofiltration.com/FSL

Filtration starts with the filter.

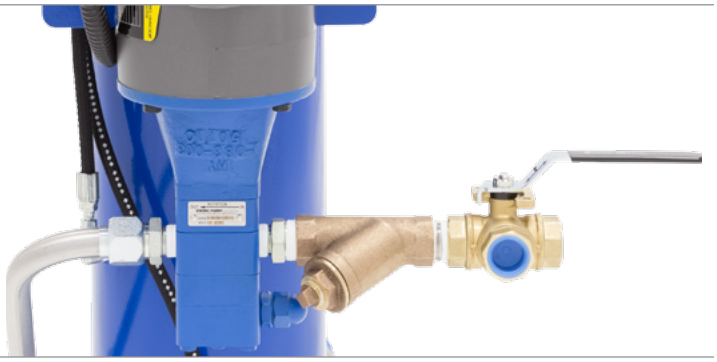
The oversized coreless filter element in every FSL delivers lower ISO Codes over a long element lifespan to ensure low disposal impact, simultaneously reducing your environmental footprint and your bottom line. To top it off, select elements come standard with an integral zero-leak bypass so with every filter change you get a new bypass along with peace of mind.

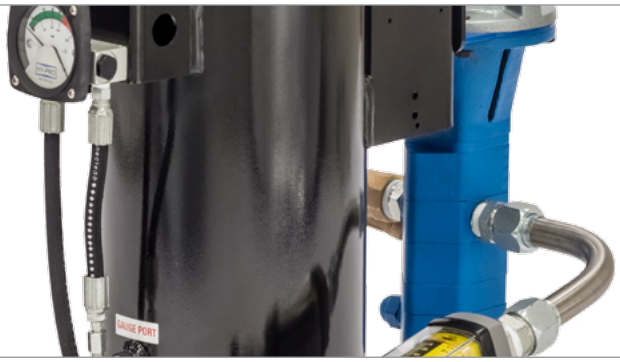
Weather any condition.

From cold weather to cold starts, the FSL is engineered to easily handle almost any job. Designed to combine incredible capacity and low maintenance, the oversized housing with secure swivel bolts allow for effortless element changes with all the parts kept right where they need to be.

Cleaner fluid + greater reliability.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities so your equipment operates unimpeded by contamination. And with the cast iron gear pump with internal relief, you get the durability you want with the safety you need, all conveniently in one square foot of floor space.





Options to make your job easier.

By selecting the optional filter bypass line, cold starts and element change-outs become easier than ever. Choose the pneumatic powered model or explosion proof option to match your application and even add the optional PM-1 particle monitor for real time cleanliness data without the need for a bottle.

Setting the new standard.

Every FSL comes standard with sample ports in the right locations to arm you with access to consistently accurate system conditions. And with true differential pressure gages, you'll know exactly how well your filtration is performing.

Completely customizable.

Every FSL can be tailored to meet any application and even to fit your existing safety standards. With the power to filter fluids greater than ISO VG 1500, contamination doesn't stand a chance.

FSL Specifications

Dimensions[1]	**Height** 50" (127 cm)	**Width** 22" (56 cm)	**Depth** 28" (71 cm)	**Weight** 222 lbs (101 kg)
Connections	**Inlet with 3-way valve** FSL05-FSL10: 1" FNPT FSL20-FSL30: 1.5" FNPT		**Outlet** FSL05-FSL10: 1" FNPT FSL20-FSL30: 1.25" FNPT	
Operating Temperature	**Fluid Temperature** 30°F to 225°F (0°C to 105°C)		**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
Materials of Construction	**Vessel** Carbon steel with industrial coating			
Electric Motor	TEFC, 56-215 frame 0.5-3 hp, 1450-1750 RPM, see Appendix for amp ratings.			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)[2]			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[3]			
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**A** G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**W** Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)	

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Element Type Code	Filter Element Part Number	Example
5	HP105L[Length Code] – [Media Selection Code][Seal Code]	HP105L36–6AB
6	HP106L[Length Code] – [Media Selection Code][Seal Code]	HP106L18–10MV
7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–VTM710V
8X	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–25WV
82	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB
85	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–16ME–WS

Viscosity	2-5000 cSt[4]
Fluid Compatibility	Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord or cord reel will be included.
Filter Sizing Guidelines	See page 170 for LF filter sizing guidelines

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump life and/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
[4]When sized and installed appropriately. Contact factory for applications above 800 cSt for sizing requirements.

FSL Part Number Builder

FSL [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Flow Rate | Element Type | Element Length | Indicator | Power Options | Special Options | Media | Seal

Flow Rate[1]

05	0.5 gpm (1.7 lpm)	**10**	10 gpm (37.9 lpm)
1	1 gpm (3.7 lpm)	**20**	20 gpm (75.7 lpm)
2	2 gpm (7.5 lpm)	**30**	30 gpm (114 lpm)
5	5 gpm (18.9 lpm)		

Element Type

5	HP105 – no bypass	**8X**	HP8314 – no bypass
6	HP106 – 25 psid (1.7 bard) integral element bypass	**82**	HP8314 – 25 psid (1.7 bard) integral housing bypass
7	HP107 – 50 psid (3.4 bard) integral element bypass	**85**	HP8314 – 50 psid (3.4 bard) integral housing bypass

Element Length

18[2]	L18 single length filter housing and coreless element	**16**[2]	L16 single length filter housing and coreless element
36[2]	L36 single length filter housing and coreless element	**39**[2]	L39 single length filter housing and coreless element

ΔP Indicator

D	22 psid visual gauge + electric switch	**H**	65 psid visual gauge + electric switch
E	22 psid visual gauge	**J**	65 psid visual gauge (elements 5 or 8X only)
F	45 psid visual gauge + electric switch	**P**	2 pressure gages (industrial liquid filled)
G	45 psid visual gauge		

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A	Air cooled heat exchanger (consult factory)	**N**	PM-1 ready (plumbing only)
B	Complete filter bypass line	**O**	On-board PM-1 particle monitor & clean oil indicator light
C	CE marked for machinery safety directive 2006/42/EC	**P9**[3]	Phosphate ester fluid compatibility modification
D	High filter ΔP auto shutdown	**R**	Spill retention pan with wheels (industrial coated steel)
E	100 mesh cast iron basket strainer	**S**[4]	All wetted components 304 or higher stainless steel
F	Filter element ΔP gauge with tattle tale follower needle	**S9**[5]	Skydrol fluid compatibility modification
G	Spill retention pan with fork guides (industrial coated steel)	**U**	CUL and/or CSA marked starter enclosure for Canada
J	Add pressure gauge between pump & filter assembly	**V**	Lifting eye kit
K	HP75L8-149W Spin-On suction strainer	**W**	Automatic air bleed valve
L	High filter element ΔP indicator light	**Y**	VFD variable speed motor frequency control
M	Total system flow meter (120 cSt max)	**Z**	On site start-up training

Media Selection

G8 Dualglass

05M	$\beta 0.9_{[C]} \geq 1000, \beta 1 \geq 200$
1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M[6]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A[6]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

VTM

VTM710[7]	$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Compatibility will be based on Element Type selection. For elements HP105, HP106, and HP107, use Length code 18 or 36. Length codes 16 and 39 only compatible with HP8314 element.
[3]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[4]With exception to cast iron gear pump.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[6]For elements HP8314, use 12M or 12A for respective media code in place of 10M or 10A.
[7]Only available on HP107 series elements. Flow rate should not exceed 16 gpm (60 lpm) for HP107L36-VTM710* elements and 8 gpm (30 lpm) for HP107L18-VTM710* elements.

FSLD

High Viscosity Dual Filter Skids

A dedicated contamination solution for off-line conditioning and bulk oil handling. Dual housings allow flexibility in using staged element ratings to achieve remarkably clean fluids and hit target ISO Codes in fewer passes, all while extending filter element and oil life.

Ideal for conditioning reclaimed fluids or fluids with high dirt load.

HY-PRO

hyprofiltration.com/FSLD

Dynamic duo.

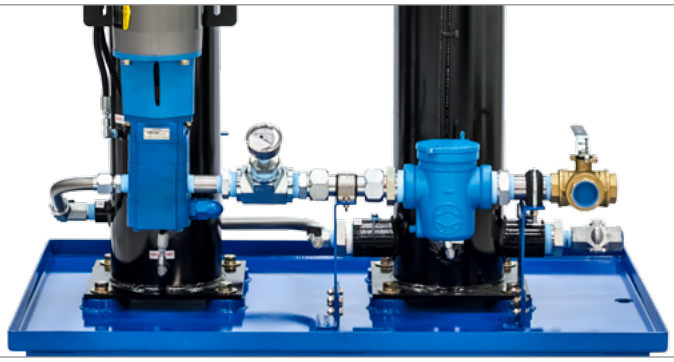
Combine a number of media options in the dual FSL filter housings to maximize single pass efficiency and achieve lower ISO Codes even faster than you thought possible.

Filtration starts with the filter(s).

The FSLD's dual oversized coreless filter elements deliver lower ISO Codes over a long element lifespan to ensure low disposal impact, simultaneously reducing your environmental footprint and your bottom line. To top it off, select elements come standard with an integral zero-leak bypass, giving you time back from unnecessary gearbox rebuilds and letting you focus on what really matters.

Engineered for Industrial use.

Rugged construction and attention to the smallest of details come together remarkably so that nothing holds you or your equipment back. The standard spill retention pan and cast iron pump with internal relief mean you get the power and durability you want with the safety you have to have.

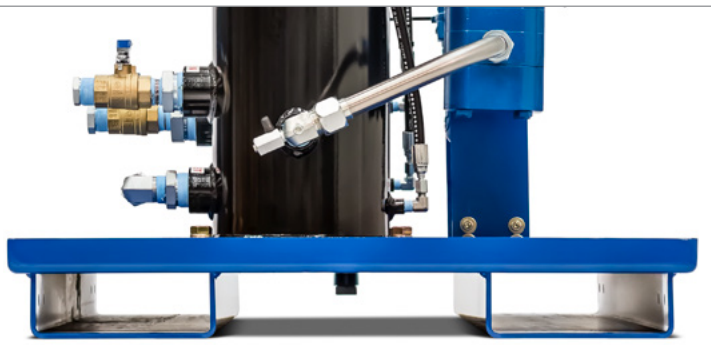


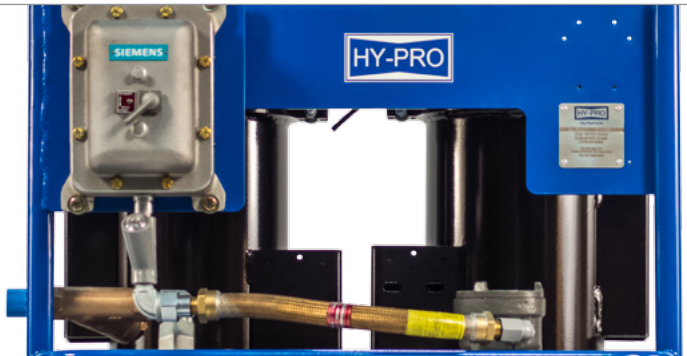
Make your filtration count.

With the optional filter bypass line, cold starts and element change outs become easier than ever. Add to that the PM-1 Particle Monitor for real time cleanliness data and watch your ISO Codes drop like you'd never believe.

Setting the new standard.

Every FSLD comes standard with sample ports in the proper locations to arm you with access to consistently accurate system conditions. And with true differential pressure gages, you'll always know exactly how well your filtration is performing.





Completely customizable.

Every FSLD can be tailored specifically to your application whether you're dealing with high viscosities, cold weather, or temperature sensitive components so you get the perfect solution to your contamination problems.

FSLD Specifications

Dimensions[1]

Height	Length	Width	Weight
55" (139 cm)	48" (121 cm)	32" (81 cm)	484 lbs (219 kg)

Connections

Inlet with 3-Way Valve
FSLD05-FSLD10: 1" FNPT
FSLD20-FSLD30: 1.5" FNPT

Outlet
FSLD05-FSLD10: 1" FNPT
FSLD20-FSLD30: 1.25" FNPT

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 104°F
(-20C to 40C)

Materials of Construction

Housings
Carbon steel with industrial coating

Tray
Carbon steel with industrial coating

Electric Motor

TEFC, 56-215 frame
1-5 hp, 1450-1750 RPM

Motor Starter

MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.

Pump

Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.

Pump Bypass

Full bypass at 150 psi (10 bar)[2]

Pneumatic Option Air Consumption

~40 cfm @ 80 psi[3]

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

VTM
$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Element Type Code	Filter Element Part Number	Example
5	HP105L[Length Code] – [Media Selection Code][Seal Code]	HP105L36–6AB
6	HP106L[Length Code] – [Media Selection Code][Seal Code]	HP106L18–10MV
7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–VTM710V
8X	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–25WV
82	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB
85	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–16ME–WS

Viscosity

2-5000 cSt[4]

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Hazardous Environment Options

Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord or cord reel will be included.

Filter Sizing Guidelines

See page 170 for LF filter sizing guidelines.

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump life and/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
[4]When sized and installed appropriately. Contact factory for applications above 800 cSt for sizing requirements.

FSLD Part Number Builder

FSLD [ ] [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ] [ ]

Flow Rate | Flow Type | Element Type | Element Length | Indicator | Power Options | Special Options | Media 1 | Media 2 | Seal

Flow Rate[1]

05	0.5 gpm (1.7 lpm)	**10**	10 gpm (37.9 lpm)
1	1 gpm (3.7 lpm)	**20**	20 gpm (75.7 lpm)
2	2 gpm (7.5 lpm)	**30**	30 gpm (114 lpm)
5	5 gpm (18.9 lpm)		

Flow Type

D[2]	Duplex
P[2]	Parallel
S	Series

Element Type

5	HP105 – no bypass	**8X**	HP8314 – no bypass
6	HP106 – 25 psid (1.7 bard) integral element bypass	**82**	HP8314 – 25 psid (1.7 bard) integral housing bypass
7	HP107 – 50 psid (3.4 bard) integral element bypass	**85**	HP8314 – 50 psid (3.4 bard) integral housing bypass

Element Length

18[3]	L18 single length filter housing and coreless element	**16**[3]	L16 single length filter housing and coreless element
36[3]	L36 single length filter housing and coreless element	**39**[3]	L39 single length filter housing and coreless element

ΔP Indicator

D	22 psid visual gages + electric switches	**H**	65 psid visual gages + electric switches
E	22 psid visual gages	**J**	65 psid visual gages (elements 5 or 8X only)
F	45 psid visual gages + electric switches	**P**	2 pressure gages (industrial liquid filled)
G	45 psid visual gages	**X**	None (ports plugged)

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12[4]	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11[4]	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__ Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A	Air cooled heat exchanger (consult factory)	**O**	On-board PM-1 particle monitor & clean oil indicator light
B	Complete filter bypass line	**P9**[5]	Phosphate ester fluid compatibility modification
C	CE marked for machinery safety directive 2006/42/EC	**R**	Spill retention pan with wheels (industrial coated steel)
D	High filter ΔP auto shutdown	**S**[6]	All wetted components 304 or higher stainless steel
E	100 mesh cast iron basket strainer	**S9**[7]	Skydrol fluid compatibility modification
F	Filter element ΔP gauge with tattle tale follower needle	**U**	CUL and/or CSA marked starter enclosure for Canada
J	Add pressure gauge between pump & filter assembly	**V**	Lifting eye kit
K	HP75L8-149W Spin-On suction strainer	**W**	Automatic air bleed valve
L	High filter element ΔP indicator light	**Y**	VFD variable speed motor frequency control
M	Total system flow meter (120 cSt max)	**Z**	On site start-up training
N	PM-1 ready (plumbing only)		

Media Selection

G8 Dualglass

05M	$\beta 0.9_{[C]} \geq 1000$, $\beta 1 \geq 200$
1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M[8]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10A[8]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

VTM

VTM710[9] $\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Bag filter

BAG[10] #2 size bag housing 25µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Nominal flow rates at 60 Hz motor speeds.
[2]When selected, omit Media 2 option from part number builder. Element chosen will be supplied for both filter housings.
[3]Compatibility will be based on Element Type selection. For elements HP105, HP106, and HP107, use Length code 36. Length code 39 only compatible with HP8314.
[4]High amp draw on 10 GPM models. Estimated FLA 18. See Appendix for details.
[5]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[6]With exception to cast iron gear pump.
[7]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[8]For elements HP8314, use 12M or 12A for respective media code in place of 10M or 10A.
[9]Only available on HP107 series elements. Flow rate should not exceed 16 gpm (60 lpm) for HP107L36-VTM710* elements and 8 gpm (30 lpm) for HP107L18-VTM710* elements.
[10]Available in series 1 housing only. Replaces Element Type in series 1 housing.

FSW

Wall Mounted Filtration Systems

A compact, dedicated off-line contamination solution ideal for small reservoirs, gearboxes and diesel engine crankcase conditioning. Element media options for every application including particulate removal, water absorption, varnish and acid removal.

Compact and compatible, the FSW is the perfect off-line filtration system for removing contamination from your systems and making sure they remain in peak operating condition.

HY-PRO

hyprofiltration.com/FSW

User friendly on a whole new scale.

With everything you need together in one tiny little package, FSW service and operation couldn't be easier. From the top loading housing to sample ports, the FSW is built to match powerful filtration with your convenience. And with the no-tools-required swing bolt enclosure, worrying about lost parts during service becomes a thing of the past.

Elements that go beyond industry standard.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities so your equipment operates unimpeded by contamination. With media options down to $\beta 0.9_{[C]} > 1000$ + water absorption and integral element bypass valves, you get the perfect element for your application, every time.

ICB Advanced Resin Technologies.

ICB canisters treat your oil on a molecular level removing acids, soluble oxidation by-products (varnish), dissolved metals, and extending useful fluid life by protecting AO additives or improving FRF resistivity. Let us help you pick the right ICB media for your turbine & compressor lube oil varnish challenges or to help you achieve trouble free phosphate ester maintenance.

AW oils, say goodbye to varnish.

FSW fitted with VTM media removes insoluble varnish and water while delivering incredibly low ISO Codes. Ideal for plastic injection molding and steel mill hydraulics with sensitive servo controls that fall victim to high temperature related insoluble varnish issues.

Dedicated to your success.

The FSW provides dedicated off-line filtration to help you stay in control of total system cleanliness and prolong the life of your critical components. And with standard sample ports in their proper positions, you'll be able to see just how good it can be running your equipment with clean oil.

Small size, huge results.

FSW provides world class filtration in all the tight spaces where you need it most with a compact wall mount arrangement. Combine FSW with a second LFW modular housing for multiple filtration passes, or to combine ICB and particulate removal technologies in series for the perfect comprehensive filtration system.

FSW Specifications

Dimensions[1]	**Height** 22" (56 cm)	**Width** 22" (56 cm)	**Depth** 13" (33 cm)	**Weight** 138 lbs (63 kg)
Mounting & Clearance	Contact factory for detailed system and mounting dimensions.			
Connections	**Inlet** ¾" male JIC 37° flare		**Outlet** ¾" male JIC 37° flare	
Operating Temperature	**Dualglass, Stainless wire mesh, VTM** 30°F to 225°F (0°C to 105°C)	**ICB** 86°F to 176°F (30°C to 80°C)	**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
Materials of Construction	**Vessel** Carbon steel with industrial coating			
Electric Motor	TEFC, 56 frame ½-1 hp, 1450-1750 RPM			
Motor Starter	Motor starter with overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)			
Pneumatic Option Air Consumption	~15 cfm @ 60 psi[2]			
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**A** G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**W** Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)	
	VTM $\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media	**ICB** Ion charge bonding resin media for molecular removal of acids, varnish deposits, soluble oxidation by-products and dissolved metal ions. Contact factory for fluid specification.		

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Element Type Code	Filter Element Part Number	Example
4	ICB – 601946 – [ICB Media Selection Code]	ICB-601946-J
6	HP106L10 – [Media Selection Code] [Seal Code]	HP106L10-10AB
7	HP107L10 – [Media Selection Code] [Seal Code]	HP107L10-3MV

Viscosity	10-5000 cSt[3]
Fluid Compatibility	Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord or cord reel will be included.
Filter Sizing Guidelines	See page 174 for LFW filter sizing guidelines.

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Air consumption values are estimated maximums and will vary with regulator setting.
[3]When sized and installed appropriately. Contact factory for applications above 800 cSt for sizing requirements.

FSW Part Number Builder

FSW [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Flow Rate | Element Type | Element Length | Indicator | Power Options | Special Options | Media | Seal

Flow Rate[1]

02	0.2 gpm (0.75 lpm)
05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
5	5 gpm (18.9 lpm)

Element Type

4[2]	ICB-601946
6	HP106 coreless element, 25 psid (1.7 bard) integral element bypass
7	HP107 coreless element, 50 psid (3.4 bard) integral element bypass

Element Length

10	L10 single length filter housing and element

ΔP Indicator

D	22 psid visual gauge + electric switch
E	22 psid visual gauge
F	45 psid visual gauge + electric switch
G	45 psid visual gauge
P[3]	2 pressure gages (industrial liquid filled)

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option

Special Options

B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
F	Filter element ΔP gauge with tattle tale follower needle
J	Add pressure gauge between pump & filter assembly
N	PM-1 ready (plumbing only)
O	On-board PM-1 particle monitor & clean oil indicator light
P9[4]	Phosphate ester fluid compatibility modification
S2	51" (130 cm) Mounting stand – ships fully assembled
S9[5]	Skydrol fluid compatibility modification
U	CUL and/or CSA marked starter enclosure for Canada
V	Lifting eye kit
W	Automatic air bleed valve
Y	VFD variable speed motor frequency control
Z	On site start-up training

Media Selection

G8 Dualglass

05M	$\beta 0.9_{[C]} \geq 1000, \beta 1 \geq 200$
1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

1A	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

VTM

VTM710[6]	$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

ICB – max reservoir size

ICBA[7]	Phosphate ester – 150 gal (567 liters)
ICBJ[7]	Jet lube aeroderivative – 100 gal (376 liters)
ICBT[7]	Specified fluids – 600 gal (2271 liters)
ICBV[7]	Mineral based R&O turbine/compressor lube oil – 400 gal (1514 liters)

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Compatible only with Flow Rate "02" and ICB Media Selection.
[3]Required when selected with ICB media from Element Type.
[4]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[6]Only available on HP107 series elements. Flow rate should not exceed 4 gpm (15 lpm) for HP107L10-VTM710* elements.
[7]Compatible only with Flow Rate "02" and Element Type "4"

FCL

High Viscosity Filter Cart

A self contained solution for high viscosity bulk oil handling, fluid transfer and reservoir or gearbox conditioning.

Ideal for higher viscosity lube oil and highly contaminated fuel and hydraulic oil.

HY-PRO

hyprofiltration.com/FCL

Built in versatility.

From cold weather to cold starts, the FCL is engineered to easily handle almost any job you can throw at it. Rugged construction including the heavy duty, oversized filter housing and cast iron gear pump with internal relief all come together so that you can be sure the FCL will tackle your application with ease.

Filtration starts with the filter.

The oversized coreless filter element in every FCL delivers lower ISO Codes over a long element lifespan to ensure low disposal impact, simultaneously reducing your environmental footprint and your bottom line. To top it off, select elements come standard with an integral zero-leak bypass so with every filter change you get a new bypass along with peace of mind.

Unmatched on the move.

Non-shredding wheels, optional off-road, heavy duty tires, and easy to maneuver cart design with ergonomic handle mean you get powerful filtration exactly when and where you need it.

Setting the new standard.

Sampling is no longer an option, it's a necessity. That's why every FCL comes standard with upstream and downstream sample ports located in the proper positions for best practice oil sampling. You'll get consistently accurate readings and a first hand view at just how well your FCL is working.

With options to make your job easier.

Use the FCL to pump out your gearbox or to ease cold starts and get your system up to temperature faster with the optional complete filter bypass line. Add on the PM-1 Particle Monitor to see real time ISO Codes of your fluid and you'll be amazed to watch how effective your FCL will be.

Completely customizable.

Tailor your FCL specifically to your application with options including pneumatic or explosion proof models, CE and CUL marks, and stainless steel construction for safety and compatibility with your existing systems. And if you're nice, we'll even let you trick it out with a custom paint job.

FCL Specifications

Dimensions[1]

Height	Width	Depth	Weight
57" (144 cm)	30" (77 cm)	30" (77 cm)	351 lbs (159 kg)

Connections

Inlet
FCL05-FCL5: 1" male JIC (37° flare)
FCL10: 1.25" male JIC (37° flare)
FCL20-FCL30: 1.5" male JIC (37° flare)

Outlet
FCL05-FCL10: 1" male JIC (37° flare)
FCL20-FCL30: 1.25" male JIC (37° flare)

Hoses
FCL05-FCL5: 1" x 10 ft (2.4 m)
FCL10: 1.25" x 10 ft (2.4 m) suction
1" x 10 ft (2.4 m) discharge
FCL20-FCL30: 1.5" x 10 ft (2.4 m) suction
1.25" x 10 ft (2.4 m) discharge

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 104°F
(-20C to 40C)

Materials of Construction

Housing
Carbon steel with industrial coating

Hoses
Reinforced synthetic

Wands
Stainless steel

Electric Motor

TEFC, 56-215 frame
0.5-3 hp, 1450-1750 RPM, see Appendix for amp ratings.

Motor Starter

MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.

Electric Connection

Voltages 230 V ac and under, single phase: 35' (11 m) retractable cord reel included. NEMA 5-15 plug installed on Power Option 12.
Voltages over 230 V ac: 35' (11 m) loose cord included.

Pump

Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.

Pump Bypass

Full bypass at 150 psi (10 bar)[2]

Pneumatic Option Air Consumption

~40 cfm @ 80 psi[3]
35' (11 m) retractable air hose included when pneumatic option selected. Replaces 35' (11m) electric cord reel.

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[c]} \geq 2$ ($\beta x \geq 2$)

VTM
$\beta 0.9_{[c]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Element Type Code	Filter Element Part Number	Example
5	HP105L[Length Code] – [Media Selection Code][Seal Code]	HP105L36–6AB
6	HP106L[Length Code] – [Media Selection Code][Seal Code]	HP106L18–10MV
7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–VTM710V
8X	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–25WV
82	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB
85	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–16ME–WS

Viscosity

2-5000 cSt[4]

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Hazardous Environment Options

Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord or cord reel will be included.

Filter Sizing Guidelines

See page 170 for LF filter sizing guidelines

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump life and/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
[4]When sized and installed appropriately. Contact factory for applications above 800 cSt for sizing requirements.

FCL Part Number Builder

FCL [ ] [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Flow Rate | Element Type | Element Length | Indicator | Power Options | Hose Connection | Special Options | Media | Seal

Flow Rate[1]

05	0.5 gpm (1.7 lpm)	**10**	10 gpm (37.9 lpm)
1	1 gpm (3.7 lpm)	**20**	20 gpm (75.7 lpm)
2	2 gpm (7.5 lpm)	**30**	30 gpm (114 lpm)
5	5 gpm (18.9 lpm)		

Element Type

5	HP105 – no bypass	**8X**	HP8314 – no bypass
6	HP106 – 25 psid (1.7 bard) integral element bypass	**82**	HP8314 – 25 psid (1.7 bard) integral housing bypass
7	HP107 – 50 psid (3.4 bard) integral element bypass	**85**	HP8314 – 50 psid (3.4 bard) integral housing bypass

Element Length

18[2]	L18 single length filter housing and coreless element	**16**[2]	L16 single length filter housing and coreless element
36[2]	L36 single length filter housing and coreless element	**39**[2]	L39 single length filter housing and coreless element

ΔP Indicator

D	22 psid visual gauge + electric switch	**H**	65 psid visual gauge + electric switch
E	22 psid visual gauge	**J**	65 psid visual gauge (elements 5 or 8* only)
F	45 psid visual gauge + electric switch	**P**	2 pressure gages (industrial liquid filled)
G	45 psid visual gauge		

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Hose Connection

G	Female BSPP swivel hose ends, no wands
S	Female JIC swivel hose ends, no wands
W	Female JIC swivel hose ends, with wands

Special Options

B	Complete filter bypass line	**N**	PM-1 ready (plumbing only)
C	CE marked for machinery safety directive 2006/42/EC	**O**	On-board PM-1 particle monitor & clean oil indicator light
D	High filter ΔP auto shutdown	**P9**[3]	Phosphate ester fluid compatibility modification
E	100 mesh cast iron basket strainer	**R**	Spill retention pan with wheels (industrial coated steel)
F	Filter element ΔP gauge with tattle tale follower needle	**S**[4]	All wetted components 304 or higher stainless steel
G	Spill retention pan with fork guides (industrial coated steel)	**S9**[5]	Skydrol fluid compatibility modification
H1	10' (3 m) return line hose extension	**T**[6]	Foam filled off-road tires for rugged environment
H2	20' (6 m) return line hose extension	**U**	CUL and/or CSA marked starter enclosure for Canada
J	Add pressure gauge between pump & filter assembly	**W**	Automatic air bleed valve
K	HP75L8-149W Spin-On suction strainer	**Y**	VFD variable speed motor frequency control
L	High filter element ΔP indicator light	**Z**	On site start-up training
M	Total system flow meter (120 cSt max)		

Media Selection

G8 Dualglass

05M	$\beta 0.9_{[C]} \geq 1000$, $\beta 1 \geq 200$
1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M[7]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10A[7]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

VTM

VTM710[8]	$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Compatibility will be based on Element Type selection. For elements HP105, HP106, and HP107, use Length code 18 or 36. Length codes 16 and 39 only compatible with HP8314.
[3]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[4]With exception to cast iron gear pump.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[6]When selected, front casters of unit will be replaced with stationary feet.
[7]For elements HP8314, use 12M or 12A for respective media code in place of 10M or 10A.
[8]Only available on HP107 series elements. Flow rate should not exceed 16 gpm (60 lpm) for HP107L36-VTM710* elements and 8 gpm (30 lpm) for HP107L18-VTM710* elements.

HS
Heater Skids

Designed to achieve target ISO Codes and safely heat hydraulic and lube oils, the HS is a fully self-contained heating and filtration solution ideal for service applications, mass fluid transfers, and preheating systems before they come online.

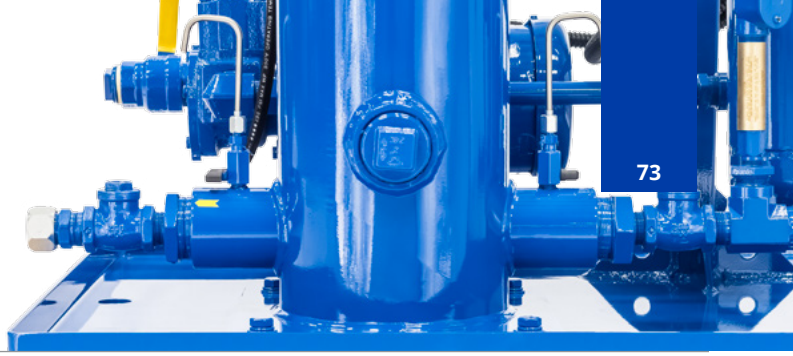
Completely customizable for hydraulic fluids and high viscosity lubrication oils up to ISO VG 680.

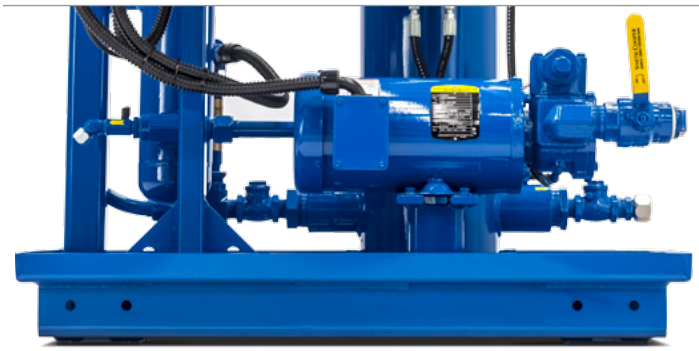
HY-PRO

hyprofiltration.com/HS

More than your standard heater skid.

Whether you're performing a high velocity flush or preheating your system before it comes online, knowing your fluids are clean is the first step in extending your system and components' lifespans. HS heater skids come standard with properly positioned sample ports both up and downstream of the filter so you get consistently accurate readings and the knowledge that your system is operating as efficiently as possible.





Rock solid from the ground up.

Standard carbon steel spill retention pans with fork guides provide a sturdy base to contain everything you need together in a single package. Add the 6" caster option for increased mobility or even select options for CE or CUL markings to meet required safety standards.

You can't beat the heat.

With no direct contact with the heating element, your fluid will safely and quickly get up to temperature without the risk of burning. The programmable temperature control and integral no-flow switch prevent oil damage and allow you to heat your fluids at your own pace. And what's more: all this comes standard on every HS.

Take control of your systems.

Smart relay enabled controls make the HS series heater skids easy to operate with just the push of a button. Take it one step further and select the optional PLC touch screen and make accessing real time data as easy as using that smartphone of yours.

Filtration starts with the filter.

Within the housing on every HS is a powerful tool to help you get the most of your system and protect your critical components from particulate erosion. Media options down to $\beta 2.5_{[c]} \geq 1000$ on the oversized filter element deliver lower ISO Codes over longer periods of time, letting you clean your new or in use oil to ensure long gear and bearing life.

Fits like a glove.

Designed and built specifically to meet your system's needs, HS heater skids can be completely customized so you get the powerful heating and filtration you need for that mass fluid transfer along with all the options you want to make the job easier than ever.

HS Specifications

Dimensions

Consult factory with model number for dimensions and connection sizes.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 104°F
(-20C to 40C)

Materials of Construction

Housing	Tray	Plumbing	Heater
Carbon steel with industrial coating	Carbon steel with industrial coating	Carbon steel with industrial coating	Aluminum low watt density fin tube

Electric Motor

TEFC with overload protection

Pump

Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar).

Pump Relief Setting

85 psi (5.86 bar)

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your equipment part number:

Element Type Code	Filter Element Part Number	Example
LF7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–25MV
LF8	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB

Fluid Compatibility

Petroleum and mineral based fluids (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Filter Sizing Guidelines

See page 170 for LF filter sizing guidelines

HS Part Number Builder

HS [ ] - [ ] [ ] [ ] [ ] - [ ] - [ ]

Flow Rate | Power Option | Element Type | Media Selection | Seals | Heat Capacity | Special Options

Flow Rate[1]

3	3 gpm (11.4 lpm)
5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
15	15 gpm (56.8 lpm)
20	20 gpm (75.7 lpm)
30	30 gpm (114 lpm)
45	45 gpm (170 lpm)
60	60 gpm (225 lpm)

Power Options

60 Hz

E3	230 V ac, 1P[2]
23	230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz

E2	220 V ac, 1P[2]
22	220 V ac, 3P
38	380 V ac, 3P
41	415 V ac, 3P

Element Type

LF7	LF housing with HP107L36 filter coreless element with integral element 50 psid (3.4 bard) bypass
LF8	LF housing with HP8314L39 filter coreless element with integral post 50 psid (3.4 bard) bypass
X	No filter housing

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M[3]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Heat Capacity

4	1 x 4.5 kw heater
9	1 x 9 kw heater
12	1 x 12 kw heater
24	2 x 12 kw heaters
36	3 x 12 kw heaters
48	4 x 12 kw heaters
64	4 x 16 kw heaters

Special Options

6	6" (15 cm) casters
B	Basket strainer
C	CE marked for machinery safety directive 2006/42/EC
D	High filter element ΔP indicator light
J	Individual heater selector switch
M	Discharge line visual flow meter
O	On-board PM-1 particle monitor
P9[4]	Phosphate ester fluid compatibility modification
S	304 stainless steel filter vessels
S9[5]	Skydrol fluid compatibility modification
T	Hose kit (suction/return hoses & wands)
U	50' (13 m) electrical cord (no plug)
V	Inlet control valve N/C solenoid
Y	VFD variable speed motor frequency control

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Option only available when coupled with 4 kw heater option and 3 or 5 gpm max flow rate unit.
[3]For elements HP8314, use 12M for media code in place of 10M.
[4]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[5]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.

Diesel Contamination

Types, Removal & Prevention

There are three main types of contamination related to Diesel fuels which can be introduced at any and all stages of the supply chain. To protect your systems and components, these contaminants must be removed prior to introduction into your system or you risk exposing your fuel injectors, fuel pumps, and every part of your system to catastrophic wear and premature failure.

When today's high pressure combustion engines fail, contamination is typically to blame. Hard particles, water and microbial growth are the primary contamination culprits that must be removed from diesel fuel to prevent fuel injector and pump failure and achieve trouble free operation.

Dirt & Particulate

Ultra fine particles at higher pressures in today's diesel engines can be a major source of fuel injector and pump failures, component wear, and loss of efficiency across entire systems. When particles get jammed inside a metal surface, it cuts a groove as it passes in a process known as scoring. Scoring can be a source of internally generated contamination and cause ISO Codes to increase, leading to the further degradation of system components.

Water

While all diesels contain water to some degree, it is crucial to prevent free water from reaching modern fuel systems as recommended by manufacturers and to prevent both direct and indirect damage caused by water. Water contamination in USLD diesel fuels leads to accelerated microbial growth (more on that below) and contributes to combustion engine failure and fuel efficiency loss. It can also cause the formation of rust, component corrosion and abrasion, etching, cavitation, and can even freeze in cold temperatures.

Microbial

With free water present in diesel fuels, microbial organisms can flourish to form slimes and sludge (soft solids) that clog fuel delivery systems and filters. If microbial growth is prevalent enough, it can even lead to high acidity which corrodes fuel systems and storage tanks, further exacerbating fuel degradation and increasing the likelihood of fuel oxidation. By removing water from diesel fuels, you alter the environment to discourage microbial growths and keep your system operating at peak efficiencies.

Diesel Contamination Solutions

Prioritize Diesel Filtration

The first priority when it comes to fuel filtration is to remove the dirt. Expose your engine to dirty fuel and you risk your on-board particulate filter and fuel/water separators becoming clogged, giving you equipment alarms, damage, failures, and a massive headache. All that productivity you've had the last quarter? Kiss that goodbye.

The most effective and efficient way to clean up diesel is to filter remove particulate with high efficiency media filter elements then come in after to remove the water. With effective particulate contamination upstream, coalesce technology, which is featured in all of the systems listed below, removes all free and emulsified water down to saturation point in a single pass. Lucky for you, our diesel systems combine unmatched particulate filtration and water removal into one system to let you focus on the job at hand and leave worrying about contamination behind.

Whereas hydraulic and lube systems are able to constantly recirc fluids using off-line kidney loops, diesel fuel applications consume fluids – meaning the best option is to condition the fuel is in transit to and from storage tanks, day tanks, service trucks, or as it is dispensed from a service truck or to a fuel rail. Those transition points are the optimal time in which contamination can enter diesel fuels. Ideally, implementing filtration at each step of the way and preventing possible sources of ingression will help rid your fuels of contamination and leave your equipment running to at the highest efficiencies.

COD
Diesel Conditioning Systems

78 CODs offer complete diesel conditioning to remove particulate, water, and bacterial contamination from your diesel. Available in both off-line (kidney loop) and on-line (CODX) systems, CODs utilize high capacity DFE rated filter elements to remove particulate with incredible efficiency upstream of the Coalesce housing, giving you clean, dry fuels and protecting your injectors. Standard models can be sized up to 600 gpm (2271 lpm) to work with diesel powered turbines or down to as few as 5 gpm (19 lpm) for the smallest of diesel reservoirs.

FSLCOD
Compact Diesel Conditioning Systems

82 A smaller and more compact alternative to full size COD systems, FSLCODs utilize a condensed design perfect for marine and any applications requiring size restrictions.

FCLCOD
Diesel Conditioning Filter Cart

86 For those applications requiring filtration on the go, FCLCOD Diesel Conditioning Filter Carts provide the same unmatched filtration capabilities as the COD and FSLCOD in a mobile platform perfect for facilities and tank farms with multiple diesel storage sites.

CSD
Diesel Coalescing In-Line Filter Assembly

90 Ideal for construction fueling depots, tank farms and common fuel rail applications with particulate filtration already in place, CSD Diesel Coalescing systems provide in-line single pass water removal efficiency down to 50 ppm. Matched to your existing system flow, CSDs give you incredible flexibility for installation and allow you to filter the fuels that pass through.

COD

Diesel Conditioning Systems

Remove water and particulate to extend fuel injector life and increase combustion engine fuel efficiency.

Ideal for large mining and construction fueling depots, diesel fueled turbines, backup generators, and smaller day tank dispensing or on-board fueling truck applications. With options for adding non-powered units to existing fuel dispensing lines, there's a perfect COD for all of your diesel applications.

HY-PRO

hyprofiltration.com/COD

Filtration starts with the filter(s).

COD combines high efficiency single pass particulate and water removal to ensure that your fuel is always in spec, eliminating wear related injector failures. Achieve cleanliness below the 18/16/13 ISO Code limit required by engine manufacturers with $\beta 5_{[c]} > 1000$ media elements and extend the life of on-board fuel filters that plug and cause replacement downtime that can shut down your entire mining group.

Redefining standard filtration.

For high pressure injectors, water is one of the worst forms of contamination. The solution for your water contamination lies in COD's 100% synthetic coalesce/separator elements that remove all free and emulsified water down to 50 ppm. Your fuel rail and high pressure injectors will be protected and running more efficiently than ever.

Increase fuel efficiency, lower emissions.

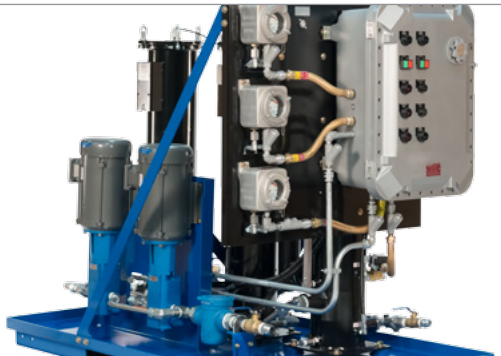
Cleaner fuel runs more efficiently and with lower emissions, yielding better injector performance and life and can even lead to lower fuel usage – which translates to bottom line profitability and a drastically lower environmental footprint. Monitor your fuel's condition with properly positioned sample ports before the pre-filter and after the coalesce stage and always know how your filtration is performing.

Take control of your systems.

Smart relay and auto water drain make COD a 24/7 unattended, easy-to-operate solution that functions as an in-line contamination barrier for every drop of fuel that goes into your engines. Optional PLC touchscreen enables custom programming so your COD can purify backup fuel tanks on your schedule and even data log ISO Codes and saturation levels so you know your fuel is clean and reliable when you're on and off the clock.

Integrated results.

For fuel delivery systems already in place, the CODX non-powered skids are the perfect addition for seamless integration and contain all the contamination removal technology of powered COD units. Ideal for fueling depots, bulk fuel deliveries, upgrading common fuel rails, on-board engine and marine applications.



Built to exceed your expectations.

Flexible dimension and process arrangement are available with every COD so you get the perfect contamination solution for your fuel delivery system. Even choose from explosion proof models and color coordinate to fit perfectly with your existing safety standards for the ultimate system in diesel conditioning.

COD Specifications

Model	COD5-10-30	COD60-100	COD200	COD300-400	COD500-600
Height[1]	72" (183 cm)	80" (203 cm)	90" (229 cm)	90" (229 cm)	90" (229 cm)
Length[1]	48" (122 cm)	72" (183 cm)	84" (213 cm)	84" (213 cm)	96" (244 cm)
Width[1]	42" (107 cm)	36" (92 cm)	48" (122 cm)	60" (152 cm)	60" (152 cm)
Weight[1]	1200 lbs (454 kg)	2000 lbs (907 kg)	2400 lbs (1089 kg)	3500 lbs (1588 kg)	4200 lbs (1905 kg)
Inlet[2]	COD5-10: 1" (2.5 cm) COD30: 1½" (3.8 cm)	2" (5.1 cm)	3" (7.6 cm)	4" (10.2 cm)	5" (12.7 cm) 6" (15.2 cm)
Outlet[2]	COD5-10: 1" (2.5 cm) COD30: 1½" (3.8 cm)	1½" (3.8 cm) 2" (5.1 cm)	3" (7.6 cm)	4" (10.2 cm)	5" (12.7 cm) 6" (15.2 cm)
Motor Size	1-5 hp	7.5-10 hp	20 hp	30 hp	40 hp
Pre-Filter Elements	1	1	3	4	4
Coalesce Elements	1 x HP538L38-CSV[3]	2 x HP731L39-CB	3 x HP731L39-CB	6 x HP731L39-CB	8 x HP731L39-CB
Separator/ Polish Elements	(combination element)	1 x HP582L30-S25MB	2 x HP582L30-S25MB	3 x HP582L30-S25MB	5 x HP582L30-S25MB

Operating Temperature	**Fluid Temperature** 30°F to 225°F (0°C to 105°C)	**Ambient Temperature** 40°F to 104°F (4°C to 40°C)	
Materials of Construction	**Housings** Carbon steel with industrial coating	**Frame** Carbon steel with industrial coating	**Tray** Carbon steel with industrial coating
Electric Motor	TEFC motors with overload protection		
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.		
Pump Relief	85-100 psi adjustable		
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)	**Coalesce** 100% synthetic fiber media	**Separator** TEFLON® coated screen (water barrier)
Fluid Compatibility	Petroleum based fuels, #2 Diesel (standard) and jet fuel. For other fuel options contact factory.		
Hazardous Environment Options	Select special option X for explosion proof unit. Consult factory for exact standards requirements such as Class, Division, and Zone.		

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Female pipe port.
[3]HP538L38-CSV element combines coalesce and separator element functions into a single element.
TEFLON® is a registered trademark of DuPont.

COD Part Number Builder

COD [ ] [ ] - [ ] - [ ]

Flow Rate | Power Options | Seal | Special Options

Flow Rate[1]

5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
30	30 gpm (114 lpm)
60	60 gpm (225 lpm)
100	100 gpm (379 lpm)
200	200 gpm (757 lpm)
300	300 gpm (1135 lpm)
400	400 gpm (1514 lpm)
500	500 gpm (1892 lpm)
600	600 gpm (2271 lpm)

Power Options

60 Hz

12	120 V ac, 1P
E2	230 V ac, 1P
46	460 V ac, 3P
57	575 V ac, 3P

50 Hz

E1	120 V ac, 1P
E3	230 V ac, 1P
32	320 V ac, 3P
38	380 V ac, 3P
41	415 V ac, 3P
52	525 V ac, 3P

Non-Powered

X[2]	Non-powered COD: No pump-motor combination or electrical controls.

Seals

B	Nitrile (Buna)
V	Fluorocarbon

Special Options

8	8” (20 cm) solid wheel upgrade
A[3]	Auto water drain (manual drain included)
B[4]	Adjustable coalesce vessel bypass loop
C	CE marked for machinery safety directive 2006/42/EC
H	Manual reset hour meter (in addition to non-reset meter)
K	Sight flow indicator (wheel type)
L	Lifting eye kit
M	Water discharge totalizing meter
O	On-board PM-1 particle monitor & clean oil indicator light
P	PLC touch screen control (does not include VFD)
Q[5]	Maintenance spares and repair kit
T[3]	Hose kit (suction & return hoses + wands)
U	50’ (15 m) electrical cord with no plug
X	Explosion proof - must specify standards required
Y	VFD variable speed motor frequency control
Z[3]	On site start-up training

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Suitable for adding to existing fuel delivery system with existing pressure and flow. Auto water drain option is mechanical.
[3]Recommended option.
[4]Standard option.
[5]Includes fuses, common relay, panel bulb, replacement element set for coalesce chamber & particulate housing.

FSLCOD

Marine and Industrial Diesel Filtration Systems

Remove water and particulate to extend fuel injector life and increase combustion engine fuel efficiency.

Ideal for permanent installation on-board sea vessels and diesel applications requiring compact size restrictions.

HY-PRO

hyprofiltration.com/FSLCOD

Remove contaminants, protect equipment.

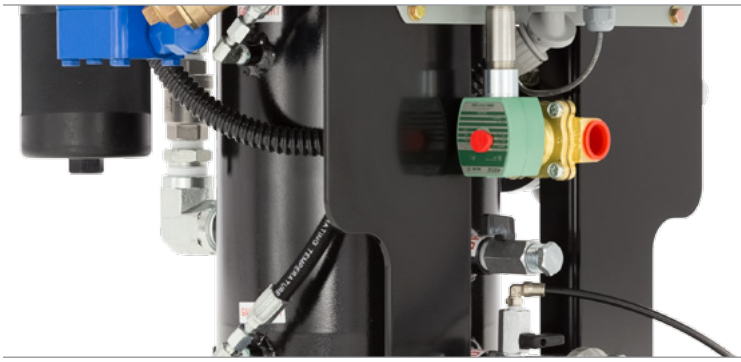
FSLCOD combines high efficiency single pass particulate and water removal to ensure that your fuel is always in spec, eliminating premature injector failures and downtime.

Elements that go beyond industry standard.

With DFE rated particulate filters and 100% synthetic coalesce/ separator elements that remove all free and emulsified water down to 50 ppm, your fuel rail and high pressure injectors will be protected and running more efficiently than ever.

Small has never been bigger.

Coming in at only 1 ft^2 (30 cm^2) of floor space and 34" (86 cm) tall, the FSLCOD is engineered to provide maximum efficiency in minimal space.



Smarter filtration.

Designed for 24/7 unattended operation, FSLCODs with auto water drain technologies, available electrically or mechanically powered, provide you with the safety and security to know your diesel is clean and dry even when you're off the clock.

Increase fuel efficiency, lower emissions.

Cleaner fuel runs more efficiently and with lower emissions, yielding better injector performance and life and leading to lower fuel usage, translating to bottom line profitability and a drastically lower environmental footprint. Monitor your fuels' condition with properly positioned sample ports before the pre-filter and after the coalesce stage and always know how your filtration is performing.

No detail overlooked.

From the cast iron gear pump with internal relief to the space saving design, every component of the FSLCOD is designed to provide you with the highest quality filtration and integrate seamlessly into your systems. So whether you've got a single vessel or an entire fleet, you can rest assured that your diesel is clean and dry.

FSLCOD Specifications

Dimensions[1]	**Height** 34" (86 cm)	**Width** 30" (76 cm)	**Depth** 25" (64 cm)	**Weight** 285 lbs (129 kg)
Connections	**Inlet** FSLCOD5-10: 1" male JIC (37° flare) FSLCOD20: 1¼" male JIC (37° flare)		**Outlet** 1" male JIC (37° flare)	
Element Configuration	**Pre-filter** HP60L13-3MV		**Main Filter** FSLCOD5-10: HP538L18-CSV FSLCOD20: HP538L38-CSV	
Seals	Fluorocarbon			
Operating Temperature	**Fluid Temperature** 30°F to 225°F (0°C to 105°C)		**Ambient Temperature** 40°F to 104°F (4°C to 40°C)	
Materials of Construction	**Housings** Carbon steel with industrial coating			
Electric Motor	TEFC, 56-184 frame 0.5-2 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)[2]			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[3]			
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)	**Coalesce** 100% synthetic fiber media	**Separator** TEFLON® coated screen (water barrier)	
Fluid Compatibility	Petroleum based fuels, #2 Diesel (standard). For other fuel options contact factory.			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord or cord reel will be included.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump life and/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
TEFLON® is a registered trademark of DuPont

FSLCOD Part Number Builder

FSLCOD [Flow Rate] [Indicator] [Power Options] - [Special Options]

Flow Rate[1]

5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
20[2]	20 gpm (75.7 lpm)

ΔP Indicator[3]

D	22 psid visual gauge + electric switch
E	22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__ Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A1[4]	Electrically powered automatic water drain
B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D	High filter ΔP auto shutdown
E	100 mesh cast iron basket strainer
F	Filter element ΔP gauge with tattle tale follower needle
G	Spill retention pan with fork guides (industrial coated steel)
J	Add pressure gauge between pump & filter assembly
K	HP75L8-149W Spin-On suction strainer
L	High filter element ΔP indicator light
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O[5]	On-board PM-1 particle monitor & clean oil indicator light
S[6]	All wetted components 303 or higher stainless steel
U	CUL and/or CSA marked starter enclosure for Canada
W	Automatic air bleed valve
Z	On site start-up training

[1]Nominal flow rates at 60 Hz motor speeds.
[2]20 gpm machine utilizes 36" vessel.
[3]Coalesce filter only. Particulate filter housing is equipped with pop-up differential indicator.
[4]Requires Electric Power Option.
[5]PM-1 will not function properly in the presence of free or emulsified water at or above saturation point. If selected, PM-1 is installed downstream of the filtration.
[6]With exception to cast iron gear pump.

FCLCOD

Diesel Conditioning Filter Cart

Remove water and particulate to extend fuel injector life and increase combustion engine fuel efficiency.

Ideal for service oriented stand by diesel tanks and marine applications.

HY-PRO

hyprofiltration.com/FCLCOD

Take control of your systems.

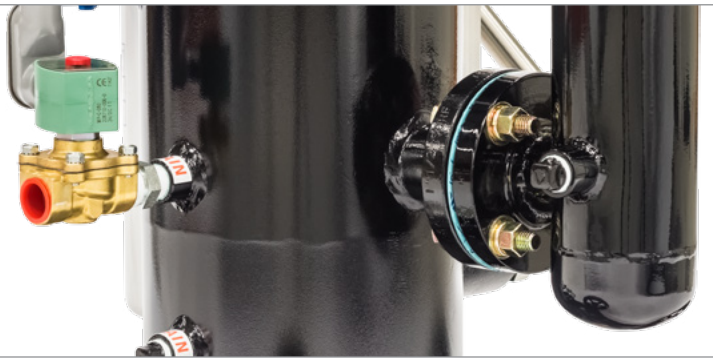
FCLCOD filter carts are constructed to be powerful, dependable, and easy to use. Whether you've got multiple diesel reservoirs or simply need your filtration on the move, conditioning your fuels has never been easier. Add automatic water drain and your FCLCOD becomes a powerhouse that does the work for you.

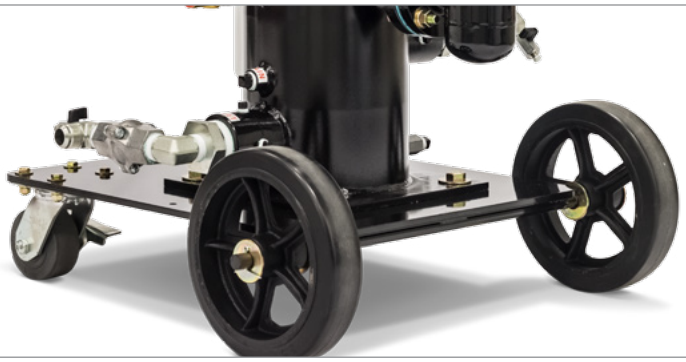
Filtration starts with the filter(s).

FCLCOD combines high efficiency single pass particulate and water removal to ensure that your fuel is always in spec, eliminating premature injector failures and downtime. With DFE rated particulate filters and 100% synthetic coalesce/ separator elements that remove all free and emulsified water down to 50 ppm, your fuel rail and high pressure injectors will be protected and running more efficiently than ever.

Never stops working.

Designed for 24/7 unattended operation, FCLCODs with auto water drain technologies, available electrically or mechanically powered, provide you with the safety and security to know your diesel is clean and dry even when you're off the clock.





Unmatched on the move.

Non-shredding wheels, optional off-road heavy duty tires and easy to maneuver cart design with ergonomic handle mean you get powerful filtration exactly when and where you need it.

Increase fuel efficiency, lower emissions.

Cleaner fuel runs more efficiently and with lower emissions, yielding better injector performance and life and can even lead to lower fuel usage which translates to bottom line profitability and a drastically lower environmental footprint. Monitor your fuel's condition with properly positioned sample ports before the pre-filter and after the coalesce stage and always know how your filtration is performing.

Completely customizable.

Flexible dimension and process arrangement are available with every FCLCOD so you get the perfect contamination solution for your fuel delivery system. Even choose from explosion proof models and color coordinate to fit perfectly with your existing safety standards for the ultimate mobile system in diesel conditioning.

FCLCOD Specifications

Dimensions[1]	**Height** 62" (158 cm)	**Width** 30.5"	**Depth** 29" (74 cm)	**Weight** 379 lbs (172 kg)
Connections	**Inlet** FCLCOD5-FCLCOD10: 1" male JIC (37° flare) FCLCOD20: 1¼" male JIC (37° flare)	**Outlet** FCLCOD5-FCLCOD10: 1" male JIC (37° flare) FCLCOD20: 1¼" male JIC (37° flare)	**Hoses** FCLCOD5-FCLCOD10: 1" x 10 ft (2.4 m) FCLCOD20: 1¼" x 10 ft (2.4 m)	
Element Configuration	**Pre-filter** HP75L8-3MV	**Main Filter** HP538L38-CSV		
Seals	Fluorocarbon			
Operating Temperature	**Fluid Temperature** 30°F to 225°F (0°C to 105°C)	**Ambient Temperature** 40°F to 104°F (4°C to 40°C)		
Materials of Construction	**Housings** Carbon steel with industrial coating	**Hoses** Reinforced synthetic	**Wands** Stainless steel	
Electric Motor	TEFC, 56-145 frame 0.5-2 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Electric Connection	Voltages 230 V ac and under, single phase: 35' (11 m) retractable cord reel included. NEMA 5-15 plug installed on Power Option 12. Voltages over 230 V ac: 35' (11 m) loose cord included.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)[2]			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[3] 35' (11 m) retractable air hose included when pneumatic option selected. Replaces 35' (11m) electric cord reel.			
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)	**Coalesce** 100% synthetic fiber media	**Separator** TEFLON® coated screen (water barrier)	
Fluid Compatibility	Petroleum based fuels, #2 Diesel (standard). For other fuel options contact factory.			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Explosion Proof option (X--) selected, no electrical cord or cord reel will be included.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]10 GPM pump is rated for intermittent duty only at pressures above 100 psi. Continual operation with dual clogged filters resulting in operating pressures over 100 psi will reduce pump life and/or cause premature pump failure.
[3]Air consumption values are estimated maximums and will vary with regulator setting.
TEFLON® is a registered trademark of DuPont.

FCLCOD Part Number Builder

FCLCOD [ ] [ ] [ ] [ ] - [ ]

Flow Rate | Indicator | Power Options | Hose Connection | Special Options

Flow Rate[1]

5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
20	20 gpm (75.7 lpm)

ΔP Indicator[2]

D	22 psid visual gauge + electric switch
E	22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Hose Connection

G	Female BSPP swivel hose ends, no wands
S	Female JIC swivel hose ends, no wands
W	Female JIC swivel hose ends, with wands

Special Options

A1	Electrically powered automatic water drain
B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D	High filter ΔP auto shutdown
E	100 mesh cast iron basket strainer
F	Filter element ΔP gauge with tattle tale follower needle
G	Spill retention pan with fork guides (industrial coated steel)
H1	10' (3 m) return line hose extension
H2	20' (6 m) return line hose extension
J	Add pressure gauge between pump & filter assembly
K	HP75L8-149W Spin-On suction strainer
L	High filter element ΔP indicator light
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O[3]	On-board PM-1 particle monitor & clean oil indicator light
R	Spill retention pan with wheels (industrial coated steel)
S[4]	All wetted components 303 or higher stainless steel
T	Foam filled off-road tires for rugged environment
U	CUL and/or CSA marked starter enclosure for Canada
W	Automatic air bleed valve
Z	On site start-up training

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Coalesce filter only. Particulate filter housing is equipped with sliding differential indicator.
[3]PM-1 will not function properly in the presence of free or emulsified water at or above saturation point. If selected, PM-1 is installed downstream of the filtration.
[4]With exception to cast iron gear pump.

CSD

Diesel Coalesce Non-Powered Filtration System

Remove water to extend fuel injector life and increase combustion fuel efficiency. The CSD is designed for direct integration into fuel delivery systems with pump flow and pressure already in place for easy, streamlined water removal through your existing system. Using high efficiency coalesce and separating media, the CSD will keep diesel free from water contamination down to 50 ppm in a single pass.

Ideal for construction fueling depots, tank farms and common fuel rail applications.

HY-PRO

hyprofiltration.com/CSD

Protect your uptime.

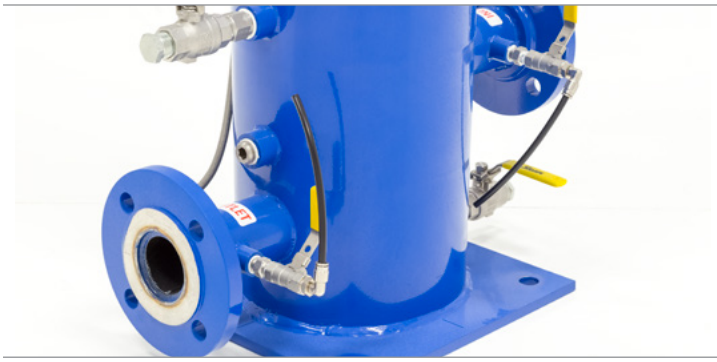
By removing water from your diesel systems, you're providing the best environment for your equipment to operate efficiently and helping to prevent breakdowns and damage, saving you time and effort. CSD systems rapidly remove water down to saturation point, protecting your systems and letting you focus on the job at hand.

Media matters.

Cellulose media is known to break down under high water content, resulting in media migration and loss of coalescence efficiency. CSD's 100% synthetic coalesce and separator elements contain no cellulose and feature a pleated synthetic configuration to maximize surface area and ensure your fuel rail and high pressure injectors will be protected and running more efficiently than ever.

Don't quit your day job.

Designed for 24/7 unattended operation, CSDs with auto water drain technologies, available mechanically or electrically powered, provide you with the safety and security to know your diesel is clean and dry so you can forget worrying about your filtration and focus on the job at hand.



Setting the new standard.

Sampling and preventative maintenance are no longer optional, they're a necessity. Knowing your diesel is clean is the first step in prolonging the life of your fuel injectors and critical components. CSD series housings come standard with easy-to-access sample ports in their proper positions so you can always know you're putting clean, dry diesel into your systems.

Combined filtration, double the power.

A properly sized Hy-Pro CSD plus Hy-Pro high efficiency particulate filtration will deliver diesel fuel cleanliness codes of 15/13/10 and better while maintaining water levels at 50 ppm. Pair your CSD with an LF housing in-line on your system and rest assured knowing your fuel injectors are protected.

Integrated results.

Installing CSDs in-line on your current system means you get powerful filtration exactly where you need it – directly upstream of your critical components. With standard models ranging up to 600 gpm, your diesel will be dry and components protected whether you're on a small diesel tank farm or a massive diesel fired turbine.

CSD Specifications

Model	CSD30	CSD120	CSD200	CSD400	CSD600
Max Flow Rate	30 gpm (114 lpm)	120 gpm (454 lpm)	200 gpm (757 lpm)	400 gpm (1514 lpm)	600 gpm (2271 lpm)
Weight[1]	164 lbs (74 kg)	319 lbs (177 kg)	546 lbs (248 kg)	1097 lbs (498 kg)	1155 lbs (524 kg)
Height[1]	62" (158 cm)	74" (188 cm)	82" (209 cm)	82" (209 cm)	82" (209 cm)
Width[1]	22" (56 cm)	32" (82 cm)	36" (92 cm)	48" (122 cm)	48" (122 cm)
Length[1]	22" (56 cm)	27" (69 cm)	32" (82 cm)	40" (102 cm)	40" (102 cm)
Coalesce Elements	1 x HP538L38-CSV[2]	2 x HP731L39-CB	3 x HP731L39-CB	6 x HP731L39-CB	8 x HP731L39-CB
Separator/ Polish Elements	(combination element)	1 x HP582L30-S25MB	2 x HP582L30-S25MB	3 x HP582L30-S25MB	5 x HP582L30-S25MB

Materials of Construction

Housing
Industrial coated steel

Tray
Industrial coated steel

Hoses
Reinforced synthetic

Media Description

Coalesce
100% synthetic fiber media

Separator
TEFLON® coated screen (water barrier)

Fluid Compatibility

Petroleum based fuels, #2 Diesel (standard). For other fuel options contact factory.

[1]Weights and dimensions are approximations taken from base model and will vary according to options chosen.
[2]HP538L38-CSV element combines coalesce and separator element functions into a single element.
TEFLON® is a registered trademark of DuPont.

CSD Part Number Builder

CSD [ ] [ ] - [ ] - [ ]

Flow Rate | Port Connection | Seals | Special Options

Flow Rate[1]

30	30 gpm (114 lpm)
120	120 gpm (454 lpm)
200	200 gpm (757 lpm)
400	400 gpm (1514 lpm)
600	600 gpm (2271 lpm)

Port Connections

	Connection Type	CSD Series Availability
B2	2" BSPP	30-120
C2	2" SAE Code 61 flange	30-120
C3	3" SAE Code 61 flange	30-120
D2	DN50 DIN flange	30-120
D3	DN65 DIN flange	30-120
D4	DN100 DIN flange	200-400
D5	DN125 DIN flange	200-400
D6	DN150 DIN flange	200-400
D8	DN200 DIN flange	200-600
D10	DN250 DIN flange	200-600
F2	2" ANSI flange	30-120
F3	3" ANSI flange	30-120
F4	4" ANSI flange	200-400
F6	6" ANSI flange	200-600
F8	8" ANSI flange	200-600
F10	10" ANSI flange	200-600
F12	12" ANSI flange	200-600
N2	2" NPT	30-120

Seals

B	Nitrile (Buna)[1]
V	Fluorocarbon

Special Options

AX	Auto water drain - mechanical (no electrical)[2]
AE	Auto water drain - electrically operated solenoid valve (120 V ac, 1P, 60Hz[3])
AE1	Auto water drain - electrically operated solenoid valve (110 V ac, 1P, 50Hz[3])
AE2	Auto water drain - electrically operated solenoid valve (230 V ac, 1P, 60Hz[3])
AE3	Auto water drain - electrically operated solenoid valve (220 V ac, 1P, 50Hz[3])
B	Auto air bleed valve[4]
M	Water discharge totalizing meter
T	Optional drip tray + fork life guides

[1]Not suitable for bio diesel.
[2]Suitable for adding to existing fuel delivery system with existing pressure and flow. Auto water drain option is mechanical.
[3]Requires power supply.
[4]Recommended options.

What is Varnish?

Varnish formation

Lubricant varnish is defined per ASTM D02.C01 WK27308 as a thin, hard, lustrous, oil-insoluble deposit, composed primarily of organic residue, and most readily definable by color intensity. It is not easily removed by wiping with a clean, dry, soft, lint-free wiping material and is resistant to saturated (light hydrocarbon) solvents. Its color may vary, but it usually appears in gray, brown, or amber hues. Varnish begins its life as a soluble degradation product before converting to an insoluble particulate form. The process responsible for the deposition of particulate varnish is reversible.

Lubricant solvency

Under normal operating conditions, turbine lubricants are subjected to oxidation, which produces polar molecules, the varnish precursors, from lubricant mineral-oil base stocks. These polar species represent the starting point of the varnish life cycle. As a result, lubricants in service are a complex combination of base stocks, additives, and contaminants.

A lubricant's solvency is defined as its ability to dissolve these distinct components. Everything in the oil has a finite solubility which is affected by numerous variables (molecular polarity, contaminant levels, temperature, etc). When the solubility of a molecule is low, the lubricant cannot dissolve those components which then release from the fluid to form deposits. However, when the solubility of a molecule is high, the lubricant will have a high capacity to dissolve it, avoiding the formation of varnish deposits.

Contaminant levels

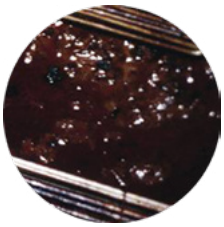
As the oil degrades and oxidation products accumulate, the solvency of the fluid decreases accordingly. Beyond the saturation point, the fluid can no longer dissolve additional varnish precursors formed by continuing oxidation and varnish will begin to precipitate from the solution.

Temperature

Oil temperature directly affects the solubilities of all the species dissolved within it. As temperature decreases, so too does the solubility of varnish and its precursors. Because metals are more polar than the lubricant's base stock, the precipitated polar varnishes prefer to adhere to the metal and form potentially damaging deposits. When the level of varnish precursors in a lubricant is at (or near) the fluid's saturation point, varnishing in cooler regions is very likely to occur.

Types of varnish

The images below depict four different formations of varnish as they can appear in different types and locations throughout a lube system. While this list is not comprehensive, the types listed below are among the most commonly seen.



Varnish can be soft and gooey (Sludge)

Varnish can be hard and brittle (Lacquer)

Varnish on reservoir ceiling (Stalactites)

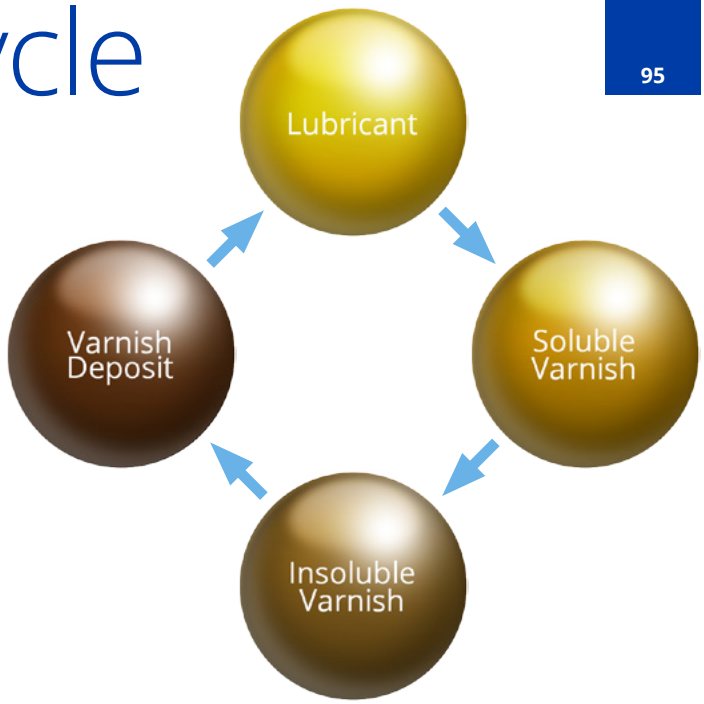
Varnish deposits on reservoir floor (Plated)

Testing for varnish

Varnishing can cause costly turbine downtime. An easy solution to combat this is to determine the lubricant's potential for varnish formation. Two of the most widely adopted techniques are QSA® (quantitative spectrophotometric analysis) and the standardized MPC (membrane patch colorimetry, ASTM 7843).

Both methods can produce results which vary significantly depending upon the length of time during which the oil sample was "aged." Indeed, longer sample aging periods produce higher MPC values, suggesting that degradation of lubricants continues in the sample bottle. For this reason, the ASTM MPC method suggests all samples be incubated at room temperature for 72 hours after being heated to 140°F (60°C) for 24 hours. This well-defined and standardized aging time has provided inter-laboratory consistency and improved testing repeatability.

The Varnish Cycle



It all starts with oxidation.

Oxidation is an unavoidable chemical reaction between the lubricant base stock and oxygen present in the air surrounding it. Oxidation increases as the operating temperature rises, but the by-products remain dissolved.

When oil moves from hotter regions within the system to cooler ones, the fluid temperature decreases and these precursors begin a physical change to precipitate from solution in the form of soft particulates.

Once formed, varnish particles agglomerate and form deposits which preferentially coat metal surfaces within the reservoir and on components like valves. These deposits are often the cause of unit trips and fail-to-start conditions.

In most cases, however, once varnish deposits form, they can be reabsorbed into the fluid and broken down if the solvency of the lubricant increases.

The table below breaks down the stages in the process of varnish formation along with the approximate fluid color corresponding to each stage.

Oxidation	**Oxidation** is the root cause of the problem. It creates free radicals resulting in acids, alcohols, esters and lactones. Anti-oxidant (A0) additives are designed to neutralize the products of oxidation. As oxidation occurs, the phenol and amine additives are depleted. The products of oxidation become the building blocks of varnish.
Polymerization	**Polymerization** occurs as the by-products of oxidation and additive reactions combine to create longer chain molecules with higher molecular weight. These molecules have lower solubility and are polarized. The rate of molecular polymerization is a function of temperature (as a catalyst) and the concentration of oxidation by-products (free radicals).
Solvency	**Solvency** describes fluid's capacity to hold the varnish producing molecules in solution (dissolved). Solubility is directly affected by temperature. As more oxidation by-products are generated, the fluid approaches its solubility saturation point beyond which no additional polymerized molecules can be held in solution.
Precipitation	**Precipitation** occurs once the solubility threshold (saturation point) has been crossed or if there is a drop in temperature which reduces the solubility of the fluid. As additional oxidation by-products (free radicals) are generated, they become insoluble and precipitate out and are free to form varnish deposits.
Agglomeration	**Agglomeration** begins as insoluble sub-micron soft particles (~0.08 micron) that have precipitated out of solution bond to form large particles (1.0 micron). These agglomerated soft particles remain insoluble, remain polarized, and maintain a higher molecular weight than the fluid itself.
Varnish Formation	**Varnish forms** as the polarized oxidation by-products come out of solution, agglomerate and collect on metal surfaces. The surfaces where varnish typically forms include cool zones, low flow and low clearance areas. Why? This is where solubility diminishes, precipitation starts and agglomeration goes on undisturbed. Deposit formation also occurs locally in the reservoir and on components where hot spots in the fluid or sparking lead to varnish, such as on reservoir walls and filter elements.

Typical Fluid Condition

Strategies to Combat Varnishing

There are two main types of varnish removal systems: those based upon the removal of suspended (insoluble) particles and those based upon the removal of soluble varnish and its precursors.

Anti-oxidant packages, generally consisting of phenols and amines, are usually added to the lubricant as a built-in varnish mitigation strategy. Anti-oxidants limit the rate of oxidative degradation and, therefore, delay varnishing. But these AO packages fail in that they cannot prevent it indefinitely. Although both phenols and amines have anti-oxidant activity on their own, they function more efficiently in concert with one another. While the specific identities and amounts of the anti-oxidants employed varies with different lubricant formulations, the mechanism by which they enhance fluid lifetime remains the same. AO levels deplete continuously which means the fluid needs to be replaced once all AO additives have been consumed.

Insoluble Varnish Removal

Charge agglomeration, electrostatic oil cleaning, or combinations of these techniques are advanced forms of particulate removal. These techniques remove fine particulates that are suspended within the fluid including insoluble varnish particles. However, these technologies are only helpful once the insoluble particles form. Soluble varnish and soluble varnish precursors are able to return to the turbine and become varnish deposits as seen on the components to the right.

Soluble Varnish Removal

Soluble Varnish Removal (SVR™) systems use specialized Ion Charge Bonding (ICB™) resins that contain billions of polar sites capable of adsorbing soluble varnish and its precursors. This adsorption relies on a preferential molecular interaction between the polar varnish molecules and the polar sites present within the resin. Just as insoluble by-products prefer metal surfaces to being suspended in the fluid, soluble by-products prefer ICB resin than to remain dissolved within the fluid.

Conventional ion-exchange resins function by exchanging one chemical for another. ICB resins are engineered to adsorb the entire contaminant without returning any others to the fluid. A key benefit of the ICB adsorption principle is that harmful oxidation products can be removed at any operating temperature, meaning that SVR systems can be used continuously. The continuous removal of soluble varnish and its precursors ensures that degradation products do not accumulate in the lubricant, eliminating the risk of varnish formation during normal turbine shut down cycles. Moreover, the continuous removal of soluble varnish produces a lubricant with extremely high solvency.

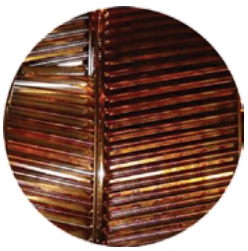
Since the physical changes that resulted in the formation of insoluble varnish particles and deposits are reversible, the high solvency of the SVR treated lubricant forces insoluble varnish already present on turbine surfaces back into the soluble varnish form where they can be adsorbed and removed. With all the remaining oxidation by-products removed, the varnish formation cycle is completely stopped.

Varnish particles and deposits are created from reversible physical changes that begin with soluble oxidation products and end with insoluble deposits. For these changes to be reversible, the chemistry of the deposits has to be similar to the chemistry of the lubricant from which the deposits originated. Normally, once fluid solvency has been increased (by removing soluble varnish at normal operating temperature), deposits will simply dissolve back into the fluid and be removed.

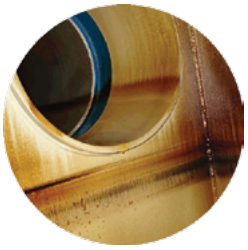
Varnish deposits on filter element (GE Frame 6B)

IGV valves and fuel control valves are typically the first problem components

Varnish on load gear (Frame 6)



Lube oil reservoir coated (Varnish Deposits)



Filter element cross section (Lacquer Varnish Deposits, Support Tube)

Varnish & Acid Scavenging Systems

SVR
Soluble Varnish Removal Systems

Ideal for large frame turbines where mineral based lube oil and specified synthetics are used. Prevent unit trip and fail-to-start conditions where a common reservoir is used for lube and hydraulic control circuits. ICB media technology treats oil on a molecular level, reversing the chemical process of varnish deposit formation, improving servo valve response time, protecting lube oil anti-oxidant additive packages, removing acids to improve oxidative stability, and improving oil demulsibility. High efficiency post filter removes particles to deliver low ISO Codes while extending the life of main bearing lube, pump discharge and servo pilot filters.

FSTO
Turbine Oil Varnish Removal Systems

A total solution for varnish deposit removal and prevention in mineral based and specified synthetic compressor and small frame turbine lube oil applications subject to varnish deposits in bearings, heat exchangers and control valves. ICB media technology treats lube oil on a molecular level, reversing the chemical process of varnish deposit formation, improving servo valve response time, protecting lube oil anti-oxidant additive package, removing acids to improve oxidative stability, and improving oil demulsibility. VTM post-filter media removes insoluble (suspended) oxidation by-products, water, and hard contamination to achieve incredibly low ISO Codes and clean lube oil.

FSAPE
Phosphate Ester Varnish Removal Systems

A dedicated solution for phosphate ester based fluids on turbine control, steel mill hydraulics and other high heat applications. ICB media removes acids formed in phosphate ester (hydrolysis) and dissolved metals leeched into the fluid from Fuller's earth, D-earth and Selexsorb acid remediation technologies which lead to gels, deposits and poor air release in FRFs. ICB also restores fluid resistivity and removes gels and deposits in control valves to improve servo valve response time. VTM mechanical filter element media reduces ISO Codes and extends pump discharge, servo pilot and last chance filter element life. $TMRN_2$ manages water to 300 ppm and prevents contamination from air ingression. Use FSAPE to avoid unit trip, expensive premature fluid replacement, flushes or bleed and feed routines.

FSJL
Aeroderivative Jet Lube Varnish Removal Systems

Aeroderivative turbines suffer from contamination related variable geometry failures, bearing deposits and premature fluid replacement, all of which can be caused by varnish. ICB media technology removes acids, molecular by-products, and varnish deposits that form during jet lube fluid degradation. $TMRN_2$ manages water to 300 ppm and prevents contamination from air ingression. VTM mechanical filter element media reduces ISO Codes and extends pump discharge, servo pilot and last chance filter element life. FSL is a total fluid management solution for aeroderivative turbine jet lube applications.

ECR
Electrostatic Contamination Removal Systems

The primary application for the ECR is the removal of sub-micron carbon particles that form as a result of micro dieseling in turbine EHC (electrohydraulic control) systems using phosphate ester based fluids. The presence of sub-micron carbon particles is evident by a general darkening of the fluid from its original amber color or by black patch color when patch weight analysis is performed. ISO fluid cleanliness codes might show very clean fluid when sub-micron carbon is present as it is below the threshold particle counting per ISO 11171. Sub-micron carbon can lead to deposits, low resistivity and poor air release properties. ECR is the most effective way to remove the sub-micron carbon particles.

ICB
Ionic Charged Bonding Filter Elements

Ionic Charged Bonding (ICB) media is used to treat a range of fluids at the molecular level by removing contaminant molecules that form as a by-product of oxidation and fluid degradation. The heavy weight molecules to be removed are polar oxides, acids and other free radicals that result in deposit formation (varnish) and are detrimental to fluid performance. ICB media is designed to selectively remove the contaminant without removing fluid additives. The use of ICB results in fluids that perform better, last longer and yield trouble-free operation for those who are responsible for maintaining them. We apply fluid specific ICB media that remove acids, dissolved metals and varnish while improving important fluid characteristics such as solubility, resistivity and demulsibility.

VTM
Particulate, Water, and Oxidation By-product Removal Media

VTM media configuration is a combination of technologies that mechanically removes insoluble (suspended) oxidation by-products that form varnish deposits in additized AW hydraulic oils and EP gear lubricants. VTM adsorbs water and some polar molecules while removing particulate contamination to $\beta 0.9_{[C]} > 1000$. Ideal for high heat hydraulic and gearbox lube applications such as plastic injection molding, wind turbine, or coal mill applications. VTM is available in FSW, FSL, and FCL dedicated and portable off-line systems and is used in tandem with ICB media on FSTO, FSA, FSJL, and SVR solutions.

SVR™

Soluble Varnish Removal

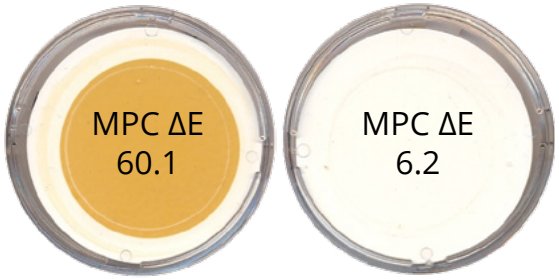
A complete recovery and maintenance solution for mineral-oil based turbine lubricants. SVR targets and removes the dissolved varnish pre-cursors which are the cause of varnish. By removing these waste oxidation by-products, you restore the oils original solvency properties which forces any solid varnish deposits to be dissolved back into the oil where they are removed permanently.

HY-PRO EPT

hyprofiltration.com/SVR

Stop varnish related fail-to-starts and unit trips.

SVR attacks the source of the problem on a molecular level, removing the oxidation by-products that form varnish deposits. SVR reverses the chemical process of varnish deposit formation by restoring oil health removing varnish throughout the system and in critical components so your servo valves operate more efficiently than ever.



Advanced media technologies.

Ion Charge Bonding (ICB) removes soluble oxidation by-products and restores demulsibility during normal turbine operation without damaging additive chemistry. With the most advanced media, SVR has 4x more capacity than competing varnish removal systems.

Remove acid.

Acid in turbine oil is by-product of oxidation, a leading pre-cursor to varnish formation. SVR removes acid improving oxidative stability, slowing oxidation rate and dramatically reducing a source of varnish production.

Attack the problem, not the symptoms.

Turbine oil is condemned when anti-oxidant (AO) additive levels deplete to 20% of new. A dedicated SVR performs in parallel with AO additives to slow depletion to drastically extend the life of your oil. On top of being the ultimate varnish deposit recovery system, SVR restores and protects oil health and actively prevents new varnish from forming. Once varnish is under control the benefit of longer oil life can be fully realized.

Work with the experts.

With SVR, you'll work alongside industry experts and receive comprehensive oil analysis and results interpretation to provide the best solution to extend your fluid life and make varnish vanish, for good.

Endless applications.

In addition to a range of options including the PM-1 Particle Monitor, explosion proof models, a range of power options, even stainless steel vessels, SVR can be completely customized to provide the perfect solution for your application.

Elements that go beyond industry standard.

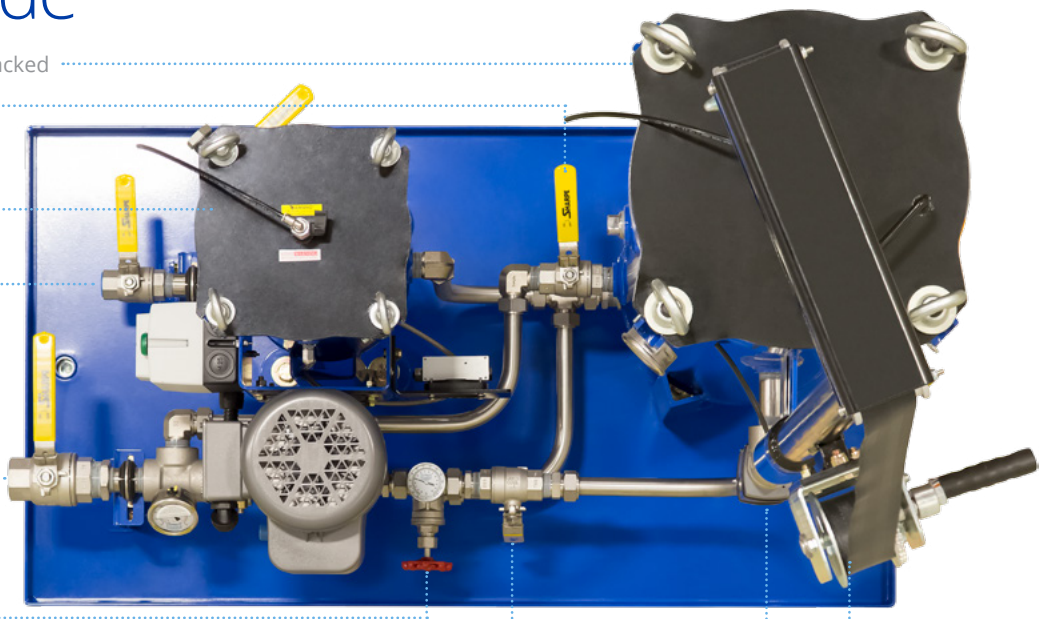
ICB Advanced Resin Technology.

Turbine oil varnish deposits form when oil becomes saturated with oxidation by-products from fluid breakdown. ICB goes where other technologies can't to remove polar oxides on a molecular level. When varnish deposits are affecting servo valve response time, that means the oil is saturated. SVR addresses this by removing dissolved oxidation by-products and restoring the oil's solubility. The restored oil dissolves deposits back into solution which can then be removed by the SVR. The process repeats during recovery until the entire system and the oil are varnish free. That's when you see a white patch. Once the varnish is gone, SVR continues to work by removing by-products as they form to prevent future deposits. ICB also slows anti-oxidant additive depletion to boost oil life. ICB is the only technology that treats the dissolved varnish during normal turbine operation to prevent varnish from forming.

HP107 for ISO Code Management.

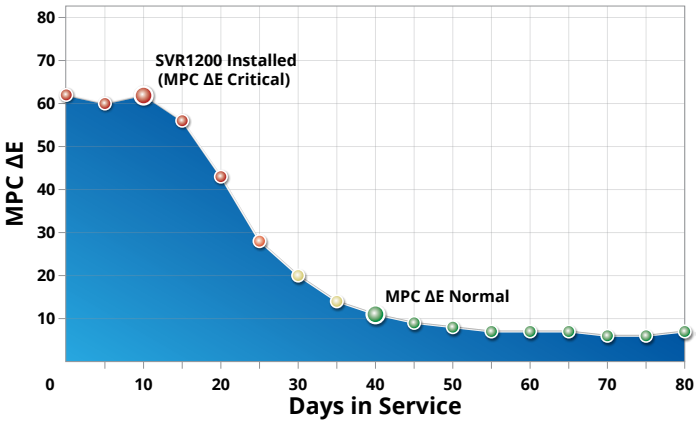
DFE rated advanced media technologies provide the highest level of particulate capture and retention so your equipment operates unimpeded by contamination. The coreless filter element in every SVR delivers remarkably low ISO Codes, taking the dirt load off of critical system lube and hydraulic control filter elements (IGV, pump discharge). In addition to particulate control, the HP107 with VTM media also removes the insoluble oxidation by-products that are suspended in the oil, working hand-in-hand with the ICB media to rapidly reduce varnish potential and restore the health of your oil. The element is oversized to perform over a long element lifespan and to ensure low environmental and bottom line impact. To top it off, the HP107 element comes standard with an integral zero leak bypass so with every filter change, you get a new bypass along with peace of mind.

SVR Quick Guide

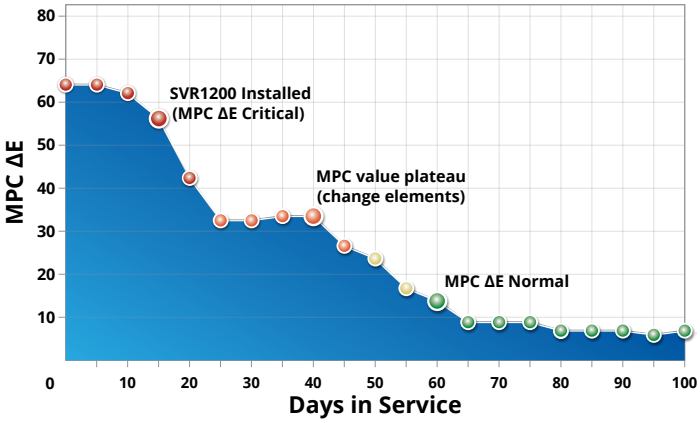


The Proven Varnish Solution

Varnish Potential (MPC) Trend After SVR Installation



Varnish Potential (MPC) Trend After SVR Installation



MPC ΔE Condition Scale

Normal	Monitor	Abnormal	Critical
<15	16-25	26-35	>36

Figure 1 depicts SVR1200 on a 7FA gas turbine with critically high varnish potential (MPC ΔE) experiencing slow servo valve response time and sticking. SVR had an immediate impact on the 6,200 gallon / 24,000 liter lube reservoir. Within 45 days MPC values were reduced to condition normal.

Starting RULER was 5 meaning only 5% AO remained in the oil, below condemning level. By installing SVR before a fluid change, all varnish deposits were removed before the oil change which allowed new oil to be added to a clean reservoir. If not for the deposit removal, AO in the new oil could have immediately depleted to as low as 65%.

Figure 2 is the restoration of a combustion turbine with heavy varnish deposits where MPC varnish potential dropped to 35 after SVR installation. 40 days into service, the ICB elements were changed as they were fully loaded with oxidation by-product. Once changed, MPC dropped to single digits. In the case of a heavily varnished turbine, 2 to 3 sets of ICB elements might be required to achieve condition normal. Once MPC drops to single digits, the ICB elements would normally be replaced annually to maintain the lubricant in optimal condition.

Note: Graph lines have been smoothed to demonstrate long term performance and MPC values will fluctuate as varnish is drawn from the system back into solution and subsequently removed from the system by the SVR

VTK Varnish Test Kits

Colorimetric analysis per ASTM D02.C0.01 WK13070 is used to determine varnish potential in turbine lube oil. A mixture of the sample oil and petroleum ether is used to make the soluble by-products available for collection on a patch. The patch is analyzed with a spectrometer measuring ΔE reported as the MPC ΔE value. See page 236 for more details.

SVR Specifications

Dimensions[1]	**Height** 58" (147 cm) 98" (249 cm) with crane	**Length**[2] 48" (122 cm)	**Width**[2] 26" (66 cm)	**Weight** 700 lbs (318 kg)
Connections	**Inlet** 1.5" FNPT with locking ball valve		**Outlet** 1" FNPT with locking ball valve	
Max Reservoir Size	**SVR1200 + SVR1200X** 8,000 gal (30,000 liter) reservoir		**SVR2400** Max 16,000 gal (60,000 liter) reservoir	
Element Configuration	**Particulate filter** SVR1200: HP107L18-VTM710V SVR2400: HP107L18-VTM710V SVR1200X: no particulate filter included		**Main Filter** SVR1200: ICB600524-V x 2 SVR2400: ICB600524-V x 4 SVR1200X: ICB600524-V x 2	
Seals	Fluorocarbon + silicone			
Operating Temperature	**Fluid Temperature** 86°F to 176°F (30°C to 80°C)		**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
Materials of Construction	**Housings** Carbon steel with industrial coating ASME U Code optional	**Tray** Carbon steel with industrial coating	**Fittings** Swagelok® stainless	
Electric Motor	TEFC, 56-145 frame 1-1.5 hp, 1150-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 90 psi (6.2 bar)			
Total System Flow[3]	**SVR1200** 7-11 gpm	**SVR2400** 14-16 gpm		
ICB Canister Flow Rates[4]	**SVR1200 + SVR1200X** 5 gpm (18.9 lpm) max	**SVR2400** 10 gpm (37.9 lpm) max		
Pneumatic Option Air Consumption[5]	~40 cfm @ 80 psi			
Media Description	**VTM** $\beta 0.9_{[C]}$ = 1000 particulate, insoluble oxidation by-product and water removal media		**ICB** Ion charge bonding resin media for molecular removal of acids, varnish deposits, soluble oxidation by-products and dissolved metal ions from mineral based turbine oil.	
Fluid Compatibility	Petroleum and mineral based fluids only (standard). For phosphate ester and other specified synthetic fluids, see FSA (page 108) or contact factory.			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Spill retention pan standard size. Contact factory for custom pan sizing.
[3]Controlled via flow control valve + flow meter (included standard).
[4]Maximum system flow dependent on and will vary with motor selection.
[5]Air consumption values are estimated maximums and will vary with regulator setting.

SVR Part Number Builder

SVR [ ] [ ] [ ] [ ] - [ ]

Model | Turbine Type | Indicator | Power Options | Special Options

Model

Particulate Filter	ICB	Recommended Reservoir Size
1200 HP107L18-VTM710V	ICB600524-V x 2	Max 8,000 gal (30,000 liter) reservoir
2400 HP107L18-VTM710V	ICB600524-V x 4	Max 16,000 gal (60,000 liter) reservoir
1200X none (omit ΔP indicator and power options)	ICB600524-V x 2	Max 8,000 gal (30,000 liter) reservoir

Turbine Type

CT Combustion turbine - mineral based oil
ST Steam turbine - mineral based oil

ΔP Indicator[1]

D 22 psid visual gauge + electric switch
E 22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1150-1750 RPM

12 120 V ac, 1P
22 208-230 V ac, 1P
23 208-230 V ac, 3P
46 460-480 V ac, 3P
57 575 V ac, 3P

50 Hz, 1450 RPM

11 110 V ac, 1P
21 220 V ac, 1P
40 380-440 V ac, 3P
52 525 V ac, 3P

Pneumatic

00 Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__ Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A Air cooled heat exchanger (consult factory)
C CE marked for machinery safety directive 2006/42/EC
D High filter ΔP auto shutdown
E 100 mesh cast iron basket strainer
F Filter element ΔP gauge with tattle tale follower needle
H Automatic high temp shut down (160°F, 71°C)
L High filter element ΔP indicator light (particulate filter only)
M Total system flow meter (120 cSt max)
N PM-1 ready (plumbing only)
O On-board PM-1 particle monitor & clean oil indicator light
S All wetted components 304 or higher stainless steel[2]
U CUL and/or CSA marked starter enclosure for Canada
U1 U Code (ASME U code certified) + CRN
V Lifting eye kit
W Automatic air bleed valve (includes one per vessel)
Y VFD variable speed motor frequency control
Z On site start-up training

[1]Particulate filter only. ICB housing is equipped with 0-100 psi static pressure gauge. Industrial, liquid filled.
[2]With exception to cast iron gear pump.

FSTO

Turbine Oil Varnish Removal Systems

FSTO is the complete oil conditioning solution for turbine and compressor lube oil. FSTO treats both soluble and insoluble forms of oxidation by-products to remove and prevent varnish deposits and deliver guaranteed results.

Utilizing ICB technology, FSTO removes the soluble varnish feedstock, acids and protects the anti-oxidant additive package while VTM high efficiency post filter removes insoluble by-products and will deliver unimaginably low ISO cleanliness codes so you can use your clean, in-service oil longer than ever before.

HY-PRO EPT

hyprofiltration.com/FSTO

Sized just right.

Not every job calls for a Goliath sized solution. When it comes to small turbine lube oil and compressor reservoirs with contamination problems, the FSTO is sized just right. Sizing and flow rate options mean you get the perfect solution tailored specifically to your systems.

Reverse varnish formation.

Even before MPC values climb, trending acid number can be a leading indicator of trouble ahead. By removing oxidation by-products, FSTO restores the solubility of your oil which in turn chemically removes varnish deposits in your system. The continuous process goes even further by removing the acids from your system on a molecular level, meaning you're free and clear of varnish and its underlying causes.

Continuous varnish control.

Combined VTM and ICB technologies continuously remove soluble and insoluble oxidation by-products so that your turbines operate uninhibited by varnish. With the added benefits of increasing the lifespan of AO packages, implementing the FSTO to your filtration regime will make unit trips and unplanned downtime a thing of the past.

ISO Codes: right on target.

The same ultra-high efficiency particulate filter which removes insoluble oxidation by-products doubles up to deliver incredibly low ISO Codes and take the pressure off your on-board bearing lube, pump discharge, and servo filters, giving you an extension on the lifespans of both your oil and your critical components.

Extend your oil life.

FSTO prevents AO additive depletion, removes acids which negatively affect oxidative stability, and can even improve oil demulsibility to greatly extend the useful life of your oil. Every FSTO comes standard with sample ports in the right locations to arm you with access to consistently accurate and best practice samples.

A league of its own.

ICB is used on over 400 turbine and compressor packages achieving over 40 million hours of operating experience. No other product in the market can match track record or experience level. ROI in a Frame 7ea Gas Turbine has been calculated at $170,000 per year on a $8000 average annual investment on lubricant maintenance.

FSTO Specifications

Dimensions[1]	**Height** 72" (183 cm)	**Length**[2] 47.5" (121 cm)	**Width**[2] 31.5" (80 cm)	**Weight** 585 lbs (265 kg)
Connections	**Inlet** 1" FNPT with ball valve		**Outlet** 1" FNPT with ball valve	
Max Reservoir Size	**FSTO05** 600 gal (2,271 liters)	**FSTO1** 1,200 gal (4,542 liters)	**FSTO2** 2,500 gal (9463 liters)	**FSTO4** 5,000 gal (18,927 liters)
Element Configuration	**Pre-filter** HP107L18-VTM710V		**ICB** FSTO05: ICB600504-V FSTO1: ICB600504-V x 2 FSTO2: ICB600524 -V FSTO4: ICB600524-V x 2	
Seals	Fluorocarbon + silicone			
Operating Temperature	**Fluid Temperature** 86°F to 176°F (30°C to 80°C)		**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
Materials of Construction	**Housings** Carbon steel with industrial coating		**Tray** Carbon steel with industrial coating	
Electric Motor	TEFC, 56-145 frame 0.5 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[3]			
Media Description	**VTM** $\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media.		**ICB** Ion charge bonding resin media for molecular removal of acids, varnish deposits, soluble oxidation by-products and dissolved metal ions from mineral based turbine oil.	
Fluid Compatibility	Petroleum and mineral based fluids only (standard). For phosphate ester and other specified synthetic fluids, see FSA (page 108) or contact factory.			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Spill retention pan standard size. Consult factory for custom pan sizing.
[3]Air consumption values are estimated maximums and will vary with regulator setting.

FSTO Part Number Builder

FSTO [ ] [ ] [ ] - [ ]

Flow Rate | Indicator | Power Options | Special Options

Flow Rate[1]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
4	4 gpm (15.1 lpm)

ΔP Indicator[2]

D	22 psid visual gauge + electric switch
E	22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group D per NEC 501 – Ready for outdoor use

X__ Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A	Air cooled heat exchanger (consult factory)
B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D	High filter ΔP auto shutdown
E	100 mesh cast iron basket strainer
F	Filter element ΔP gauge with tattle tale follower needle
H	Automatic high temp shut down (160°F, 71°C)
L	High filter element ΔP indicator light
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O	On-board PM-1 particle monitor & clean oil indicator light
S	All wetted components 304 or higher stainless steel3
U	CUL and/or CSA marked starter enclosure for Canada
V	Lifting eye kit
W	Automatic air bleed valve
Z	On site start-up training

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Particulate filter only. ICB housing is equipped with 0-100 psi static pressure gauge. Industrial, liquid filled.

FSA

Phosphate Ester Conditioning Systems

A complete solution for trouble-free EHC operation using phosphate ester fluids. Avoid premature fluid replacement, bleed and feed, and eliminate expensive flushes. FSAPE is the new standard for maintenance of water, acid, ISO Code, resistivity, and removal of gels and deposits that cause servo valve failure.

Ideal for steam turbine EHC fire resistant fluid maintenance.

HY-PRO EPT **hyprofiltration**.com/FSA

Resolve servo valve issues.

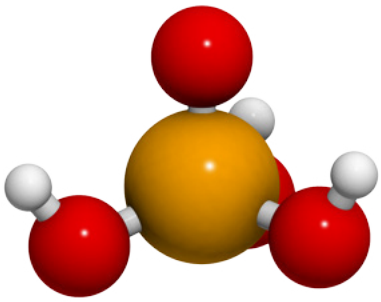
FSA skids featuring ICB™ technology will maintain ideal fluid chemistry and cleanliness. Systems will reduce elevated Acid Number and water, increase resistivity and eliminate the cause of fluid gelling and servo valve sticking.

Clean, dry, healthy oil.

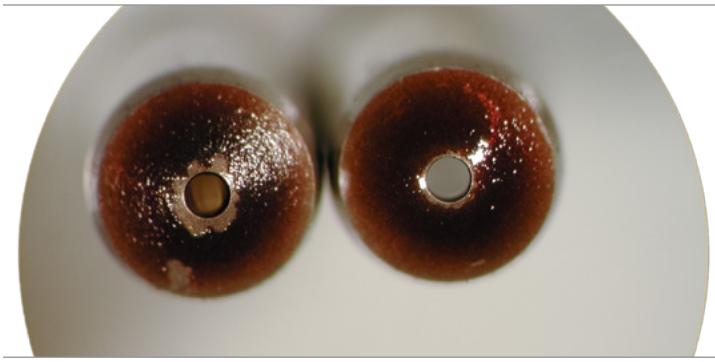
Water and phosphate ester together form strong acid which leads to premature fluid replacement. Integrated TMRN$_2$™ Headspace Dehydrators continuously introduce nitrogen through the headspace to simultaneously remove water, O2, CO, H and other high temperature breakdown gases. Maintaining low water levels and eliminating reservoir contact with O2 will proactively manage the rate of fluid breakdown and minimize acid production.

Minimize acid. Maximize efficiency.

High acid number (AN) in phosphate ester means premature fluid replacement if left unmanaged. Since acid production is autocatalytic, the acid in your system will generate more acid until your fluid becomes unusable. ICB technology can reduce AN to as low as 0.03 with 4-8x the capacity of other acid removal filters.



H_3PO_4
Phosphoric Acid

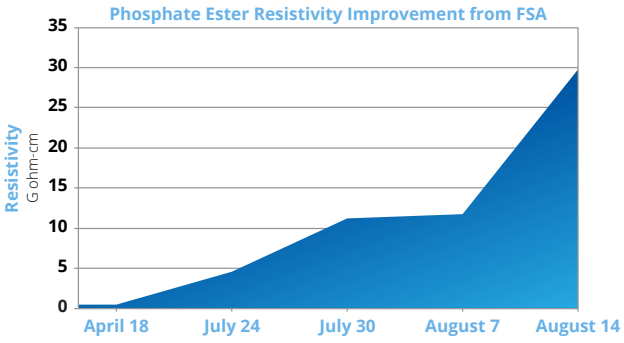


Remove what others left behind.

Dissolved metal ions in phosphate ester form gels and deposits that accumulate on servo valve nozzles & flappers, resulting in slow servo valve response time, unit trips, and reduced fluid resistivity. ICB removes all dissolved metal, reverses gel and deposit formation, prevents unit trip and restores servo valve response time.

Extend your oil life, don't flush it.

Low resistivity in phosphate ester leads to electro-kinetic corrosion between dissimilar metal surfaces and is one of the condemning factors of phosphate ester. In addition to removing acids and dissolved metals, ICB has been shown to significantly increase fluid resistivity to prevent premature fluid replacement, expensive bleed-and-feed routines and unnecessary chemical flushes.



Comprehensive EHC protection.

In addition to FSA we offer these important companion products that eliminate common weak points in EHC fluid maintenance. Dynafuzz stainless steel filters to eliminate the common issues of high pressure filter fiber migration and static discharge, ECR to restore fluid color and to reduce patch weight, and VTM to upgrade existing low pressure filters.

FSA Specifications

Dimensions[1]	**Height** 58" (147 cm)	**Length**[2] 47.5" (121 cm)	**Width**[2] 31.5" (80 cm)	**Weight** 571 lbs (259 kg)
Connections	**Inlet** 1" FNPT with locking ball valve		**Outlet** 1" FNPT with locking ball valve	
Max Reservoir Size	**FSA05** 200 gal (750 liters)	**FSA1** 400 gal (1,500 liters)	**FSA2** 800 gal (3,000 liters)	**FSA4** 1,600 gal (6,050 liters)
Element Configuration	**Particulate filter** HP107L18-VTM710V		**ICB** FSA05: ICB600504-A FSA1: ICB 600504-A x 2 FSA2: ICB600524-A FSA4: ICB600524-A x 2	
Seals	Fluorocarbon + silicone			
Operating Temperature	**Fluid Temperature** 86°F to 176°F (30°C to 80°C)		**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
Materials of Construction	**Housings** Carbon steel with industrial coating		**Tray** Carbon steel with industrial coating	
Electric Motor	TEFC, 56-145 frame 0.5 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[3]			
TMR-N_2 Air Consumption	**FSA05** < 1.2 SCFM	**FSA1** < 1.2 SCFM	**FSA2** < 2.0 SCFM	**FSA4** < 3.6 SCFM
Media Description	**VTM** $\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media.		**ICB** Ion charge bonding resin media for molecular removal of acids, gels and deposits, oxidation by-products and dissolved metal ions from phosphate ester and other synthetic fluids.	
Fluid Compatibility	EHC Fire resistant hydraulic fluids (phosphate ester). For polyol ester and other specified synthetics contact factory.			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Spill retention pan standard size. Consult factory for custom pan sizing.
[3]Air consumption values are estimated maximums and will vary with regulator setting.

FSA Part Number Builder

FSA [ ] [ ] [ ] [ ] - [ ]

Fluid Type | Flow Rate | Indicator | Power Options | Special Options

Fluid Type

PE	Phosphate Ester (not compatible with Skydrol)[1]

Flow Rate[2]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
4	4 gpm (15.1 lpm)

ΔP Indicator[3]

D	22 psid visual gauge + electric switch
E	22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A	Air cooled heat exchanger (consult factory)
C	CE marked for machinery safety directive 2006/42/EC
D	High filter ΔP auto shutdown
E	100 mesh cast iron basket strainer
F	Filter element ΔP gauge with tattle tale follower needle
H	Automatic high temp shut down (160°F, 71°C)
L	High filter element ΔP indicator light
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O	On-board PM-1 particle monitor & clean oil indicator light
S	All wetted components 304 or higher stainless steel[4]
T3	Remove $TMRN_2$ reservoir headspace dehydrator
U	CUL and/or CSA marked starter enclosure for Canada
V	Lifting eye kit
W	Automatic air bleed valve
Z	On site start-up training

[1]Consult factory for additional fluid type information.
[2]Nominal flow rate at 60 Hz motor speeds.
[3]Particulate filter only. ICB housing is equipped with 0-100 psi static pressure gauge. Industrial, liquid filled.
[4]With exception to cast iron gear pump.

FSJL

Aeroderivative Jet Lube Oil Conditioning Systems

FSJL fluid conditioning skids are a total solution for managing aeroderivative jet lube oils susceptible to high thermal oxidative stress and coke deposit formation. FSJL prevents and reduces coke deposits that lead to variable geometry failures. Extend useful fluid life by removing the catalysts for oxidation; O_2 contact, acid, oxidative coking precursors, dissolved metals, combustible gases, water, and varnish all while maintaining low ISO Codes. Specifically designed for MIL-L-23699 aeroderivative jet lube oils, the FSJL eliminates the contamination that leads to variable geometry failures.

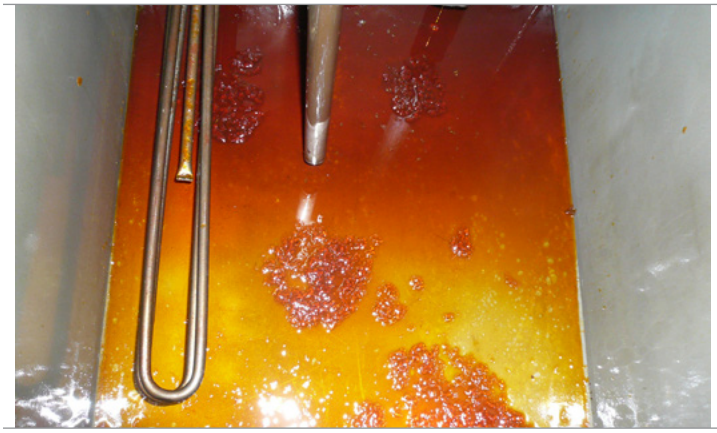
Ideal for maintenance of aeroderivative jet lube oil and hydraulic systems.

HY-PRO EPT

hyprofiltration.com/FSJL

Prevent coking deposits.

Mechanical wear, oil flow restrictions, and increased operating temperature are all caused by coking deposits, the major cause of premature failure in aeroderivative oils. ICB (Ion Charge Bonding) technology removes the oxidation by-products before they can cause additive depletion and coking deposits that form on the turbine rotor, bearings and other wetted surfaces.



Remove acids & dissolved metals.

Aeroderivative turbines often operate at elevated Acid Number (AN) values which attack metal surfaces, adding dissolved metals into the lubricant. ICB technology removes acids and metals, keeping rates of breakdown at a minimum while eliminating the feedstock that leads to coke formation.

High efficiency filtration.

The FSJL high efficiency final filter removes particles and insoluble by-products, delivering unimaginably low ISO Codes to extend the life of your mechanical components and bearings. To top it off, every HP107 filter element comes with an integral bypass valve to give you the safety and security you want with the filtration power you need.

Actively manage oxidation.

Normal lubricant reservoirs are vented to atmosphere, the key ingression pathway for water and oxygen which are two major causes of jet lube breakdown. The integrated TMR-N_2 headspace dehydrator on every FSJL actively blankets the reservoir with dry nitrogen to remove water, oxygen and combustible gases and greatly reduce the rate of oxidation and extend your fluid's useful life.

Full-time (water) extraction.

For applications that require full-time operation of reservoir headspace extraction fans, special option V1 integrates the V1 Compact Vacuum Dehydrator in place of the TMR-N_2 to provide a powerhouse water removal option that complements ICB and high efficiency on-board particulate filtration.

FSJL Specifications

Dimensions[1]	**Height** 58" (147 cm)	**Length**[2] 47.5" (121 cm)	**Width**[2] 31.5" (80 cm)	**Weight** 571 lbs (259 kg)
Connections	**Inlet** 1" FNPT with ball valve		**Outlet** 1" FNPT with ball valve	
Max Reservoir Size	**FSJL05** 150 gal (560 liters)	**FSJL1** 300 gal (1,125 liters)	**FSJL2** 800 gal (3,000 liters)	**FSJL4** 1,600 gal (6,000 liters)
Element Configuration	**Particulate filter** HP107L18-VTM710V		**ICB** FSJL05: ICB600504-J FSJL1: ICB 600504-J x 2 FSJL2: ICB600524-J FSJL4: ICB600524-J x 2	
Seals	Fluorocarbon + silicone			
Operating Temperature	**Fluid Temperature** 86°F to 176°F (30°C to 80°C)		**Ambient Temperature** -4°F to 104°F (-20C to 40C)	
Materials of Construction	**Housings** Carbon steel with industrial coating		**Tray** Carbon steel with industrial coating	
Electric Motor	TEFC, 56-145 frame 0.5 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[2]			
TMR-N_2 Option Air Consumption	**FSJL05** < 1.2 SCFM	**FSJL1** < 1.2 SCFM	**FSJL2** < 2.0 SCFM	**FSJL4** < 3.6 SCFM
Media Description	**VTM** $\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media.		**ICB** Ion charge bonding resin media for molecular removal of acids, gels and deposits, oxidation by-products and dissolved metal ions from polyol ester and other synthetic fluids.	
Fluid Compatibility	Type II, MIL-L-23699, polyol ester base stock, synthetic turbo oils and polyol esters.			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Air consumption values are estimated maximums and will vary with regulator setting.

FSJL Part Number Builder

FS [ ] [ ] [ ] [ ] - [ ]

Fluid Type | Flow Rate | Indicator | Power Options | Special Options

Fluid Type

JL	Aeroderivative jet lubricants

Flow Rate[1]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)
4	4 gpm (15.1 lpm)

ΔP Indicator[2]

D	22 psid visual gauge + electric switch
E	22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Special Options

A	Air cooled heat exchanger (consult factory)
B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D	High filter ΔP auto shutdown
E	100 mesh cast iron basket strainer
F	Filter element ΔP gauge with tattle tale follower needle
H	Automatic high temp shut down (160°F, 71°C)
L	High filter element ΔP indicator light
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O	On-board PM-1 particle monitor & clean oil indicator light
S	All wetted components 304 or higher stainless steel[3]
T2	Add $TMRN_2$ reservoir headspace dehydrator
U	CUL and/or CSA marked starter enclosure for Canada
V	Lifting eye kit
V1	Add V1 Compact Vacuum Dehydrator
W	Automatic air bleed valve
Z	On site start-up training

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Particulate filter only. ICB housing is equipped with 0-100 psi static pressure gauge. Industrial, liquid filled.
[3]With exception to cast iron gear pump.

ECR™

Electrostatic Contamination Removal

Ideal for sub-micron insoluble contamination removal in phosphate ester fluids in turbine EHC systems.

Remove fine particulates that are below the range of mechanical filters. Standard Electrostatic Oil Cleaner (EOC) systems are ineffective for phosphate ester fluid applications due to fluid conductivity restrictions. The ECR™ is designed specifically to solve this dilemma.

HY-PRO EPT hyprofiltration.com/ECR

Extend your oil life.

ECR™ improves fluid color and drastically reduces solid contamination levels. When used in conjunction with ICB™ for acid and dissolved contamination removal and TMR™-N2 for water removal, comprehensive fluid maintenance is achieved which, when maintained over time, eliminates the need for chemical flushes.

Unique restoration solution.

Pressure induced dieseling and element spark discharge generate sub-micron insoluble carbon based particles that cannot be removed by traditional particulate filtration. The ECR™ combines a high voltage electrostatic field with a proprietary collector element design to remove the sub-micron particles that are the cause of dark EHC fluid and high varnish potential values (MPC).

Comprehensive testing & support.

With typical analysis showing as little as 10% of the contamination present, specialized testing is included to document starting contamination levels and demonstrate results.

ECR™ Specifications

Model	ECR4000	ECR8000
Height	57" (145 cm)	57" (145 cm)
Width	42" (107 cm)	56" (142 cm)
Depth	27" (69 cm)	27" (69 cm)
Weight	426 lbs (193 kg)	567 lbs (257 kg)
Connections	1" MNPT	1" MNPT
Max Flow Rate	4.5 gpm (17 lpm)	9 gpm (34 lpm)
Element Quantity	1 collector element	2 collector element
Seals	Fluorocarbon	Fluorocarbon
Control Panel	Weather resistant NEMA 4 enclosure	Weather resistant NEMA 4 enclosure
High Voltage Capacity	12,000 V	12,000 V
Electric Motor	TEFC, 56-145 frame ¾ hp, 1450-1750 RPM	TEFC, 56-145 frame ¾ hp, 1450-1750 RPM
Dirt Capacity	15 lbs (6.8 kg) per element	15 lbs (6.8 kg) per element
Element Lifespan	Approximately 4,000 service hours	Approximately 4,000 service hours
Max Suction Line Pressure Loss	6 psi (0.41 bar), 12.2 Hg vacuum	6 psi (0.41 bar), 12.2 Hg vacuum
Max Water Level	<500 ppm for maximum efficiency	<500 ppm for maximum efficiency
Fluid Compatibility	Phosphate ester based fire resistant fluids.	Phosphate ester based fire resistant fluids.

ECR™ Part Number Builder

ECR [ ] [ ] - [ ]

Model | Element Type | Power Option

Model

4000	1 collector element
8000	2 collector elements

Element Type

Fluid Resistivity Value		Collector Element
omit	> 8G-OHMS/cm	COL-600990
-LR	< 8G-OHMS/cm	COL-600907

Power Options

60 Hz, 1750 RPM		50 Hz, 1450 RPM	
12	120 V ac, 1P	**11**	110 V ac, 1P
22	208-230 V ac, 1P	**21**	220 V ac, 1P
23	208-230 V ac, 3P	**40**	380-440 V ac, 3P
46	460-480 V ac, 3P	**52**	525 V ac, 3P
57	575 V ac, 3P		

ICB™

Ion Charge Bonding Acid and Varnish Removal Filters

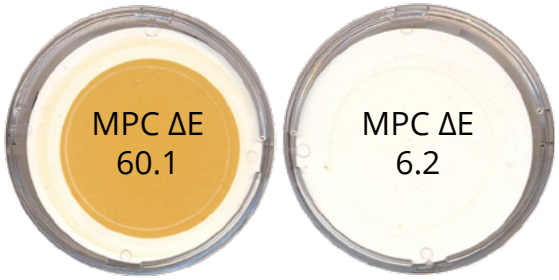
While offering best in class acid and varnish removal, ICB™ filter elements significantly reduce production losses and resolve servo-valve issues by eliminating the contamination responsible for sticking or sluggish valves. Conventional acid filters cannot remove this contamination and are also significant contributors of harmful metals and fine particulate. ICB™ filters eliminate these key issues and direct maintenance to where it matters most.

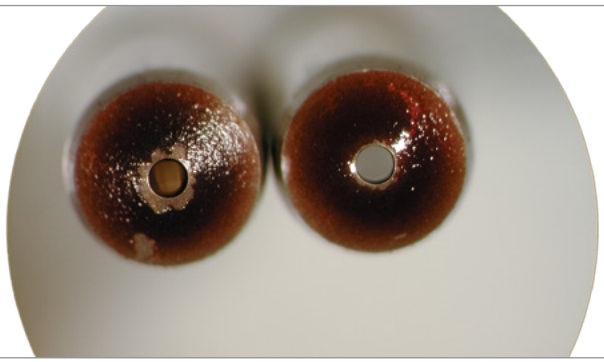
HY-PRO EPT

hyprofiltration.com/ICB

Stop varnish related fail-to-starts and unit trips.

ICB™ attacks the source of the problem on a molecular level, removing the oxidation by-products that form varnish deposits. By reversing the chemical process of varnish deposit formation, ICB™ restores oil health to remove varnish throughout the system and in critical components so your servo valves operate more efficiently than ever.



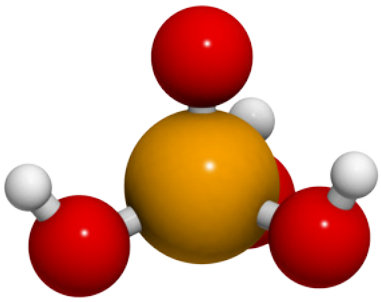


Remove what others left behind.

As dissolved metals accumulate, they act as a catalyst forming depots on servo valves and gels that can cause valve restriction and mask filter elements. ICB™ elements do not contribute metals and will remove dissolved metals from airborne ingress and element leaching to <10 ppm.

Minimize acid. Maximize efficiency.

High acid number (AN) in phosphate ester means premature fluid replacement if left un-managed. Since acid production is autocatalytic, the acid in your system will generate more acid which, left unchecked, can quickly become a serious problem. ICB™ technology removes acid to our target of AN < 0.05 with 4-8 times the capacity of alternate acid removal medias.



H_3PO_4
Phosphoric Acid

Unlike all others.

ICB™ is unlike all other ion exchange resin products. Our 20 years of operating experience and continued research has led to best in class resistivity improving capability with increases >10X having been observed. We use custom engineered resins that have been optimized for the lubricant environment.

Extend your oil life, don't flush it.

For most EHC systems, the primary operating fluid is phosphate ester. This is a very safe fluid with excellent lubricating properties that when properly maintained can provide years of trouble-free operation without the need for a flush during replacement. Unfortunately, many power plants have insufficient or incorrect maintenance which causes wide ranging issues that result in actual or high risk of production loss, and expensive flushes after the fact.

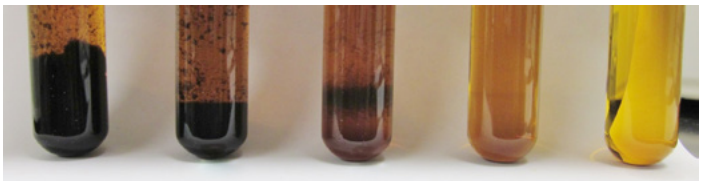
Upgrade your filtration.

ICB™ filters are drop in replacements for many OEM sizes and come in a variety of chemistries for specialized lubricant and fluid applications. When used in conjunction with Hy-Pro Dualglass media filter elements, ISO particle codes will be decreased significantly with document results.

Acid Scavenging Technology Comparison

Selexsorb	Fuller's Earth	ICB™ Ion Charge Bonding
Produces by-products that react with fluid to cause soft gel deposits	Produces hard salts and soap deposits that coat sensitive servo valves	Removes the dissolved break-down products that are responsible for servo valve failures (See Figures 1 and 2)
Can only control acids up to 0.25 mg KOH/g, leading to diminished fluid resistivity	Can only control acids up to 0.25 mg KOH/g, leading to diminished fluid resistivity	Dramatically increases fluid resistivity values which eliminates a common servo-valve failure mode referred to as electro-kinetic-wear or valve erosion
Removes acid but re-contaminates your fluid with sodium, aluminum, silicon	Removes acid but re-contaminates your fluid with magnesium, iron, calcium	Does not contribute fine particulate, or add dissolved metals that normally contribute to increased rates of oxidation
3x less capacity to remove acid than ICB	6-7x less capacity to remove acid than ICB	Highest ratio of resin volume to flow rate for higher single pass removal rate and much lower cost of ownership
Made from purified activated Alumina as a Y-Zeolite	Made from magnesium oxide and hydroxide, processed from attapulgus clay or attpulgite	Complete stainless steel construction, featuring robotic, spiral welding which provides maximum filter integrity, adding a new fail-safe in the EHC fluid conditioning system

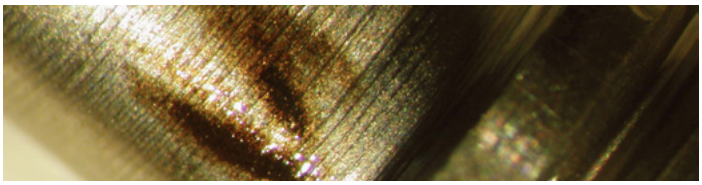
Figure 1 – Deposition Tendency Test



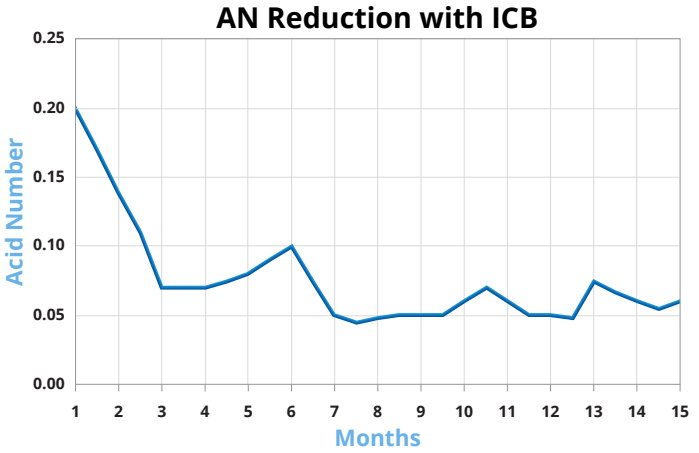
A B C D E

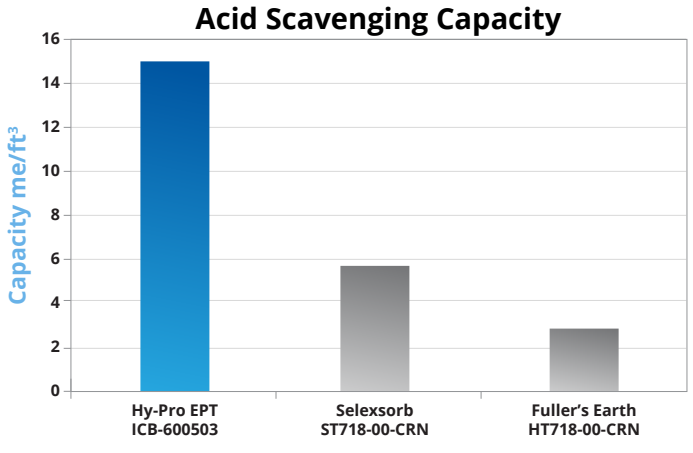
In Step 1 of the Deposition Tendency Test referred to in the EPRI EHC Fluid Maintenance Guide 2002, Page 4-39, EHC fluid is mixed with Hexane which forces out dissolved contamination into solid form. In the first three test tubes (A,B,C), EHC fluid using conventional treatment form visible solids. Servo-valve performance and reliability would be significantly impaired using EHC fluid in this condition. In the last 2 test tubes (D,E) where the EHC fluid was cleaned with ICB™, no deposition or solids of any form are observed. Servo-valve response time and reliability would be maximized operating EHC fluid in this condition.

Figure 2 – Servo Valve Spool with Contamination Deposit



Servo Valve Spool showing signs of fluid contamination deposition. The contamination responsible for these deposits is not routinely measured and in this example the servo-valve would be at abnormal risk level for failure. The Deposition Tendency test as shown in Figure 1, easily identifies if this contamination is present.





ICB™ Specifications

Dimensions

Model	Length	Outer Diameter	Inner Diameter	Dry Weight
ICB-600502	11.030 in (28.016 cm)	4.869 in (12.367 cm)	1.866 in (4.740 cm)	8.5 lbs (3.9 kg)
ICB-600503	18.000 in (45.720 cm)	6.211 in (15.776 cm)	2.250 in (5.715 cm)	13.0 lbs (5.9 kg)
ICB-600504	18.000 in (45.720 cm)	6.211 in (15.776 cm)	2.600 in (6.604 cm)	13.0 lbs (5.9 kg)
ICB-600508	32.072 in (81.463 cm)	6.202 in (15.753 cm)	1.555 in (3.950 cm)	23.0 lbs (10.4 kg)
ICB-600509	17.875 in (45.403 cm)	11.045 in (28.054 cm)	2.375 in (6.033 cm)	35.0 lbs (15.9 kg)
ICB-600510	19.010 in (48.285 cm)	11.045 in (28.054 cm)	2.375 in (6.033 cm)	37.0 lbs (16.8 kg)
ICB-600511	19.473 in (49.461 cm)	11.020 in (27.991 cm)	2.375 in (6.033 cm)	38.0 lbs (17.2 kg)
ICB-600514	20.157 in (51.199 cm)	11.045 in (28.054 cm)	2.375 in (6.033 cm)	40.0 lbs (18.1 kg)
ICB-600524	20.157 in (51.199 cm)	11.045 in (28.054 cm)	2.375 in (6.033 cm)	40.0 lbs (18.1 kg)
ICB-601349	24.563 in (62.390 cm)	10.281 in (26.114 cm)	8.919 in (22.654 cm)	35.0 lbs (15.9 kg)
ICB-601946	9.119 in (23.162 cm)	6.211 in (15.776 cm)	2.600 in (6.604 cm)	6.0 lbs (2.7 kg)

Operating Temperature

86°F to 176°F
(30°C to 80°C)

Operating Pressure

Maximum operating ΔP is <90 psid (<6.2 bard) with normal ΔP <25 psid (<1.8 bard)

Materials of Construction

Shell	Endcaps	Handle	Seals
Stainless steel	Stainless steel	Stainless steel	Silicone[1]

Media Description[2]

A	C	J	T	V
A filter for phosphate ester, fire-resistant lubricants, sold under the brand names: Fyrquel®, Fyrquel® EHC, Fyrquel® EHC Plus, Fyrquel® GT, Reolube® TurboFluid 46XC, Reolube® TurboFluid B, Anvol® 46 XC, Shell Turbo® Fluid DR 46, Mobil Pyrotec® HFD 46, and many others	C filter for polyol ester fluids including QuintoLubric®	J filter for polyol ester lubricants used in aero derivative jet engines including Mobil Jet® II	T filter for mineral oil based hydraulic fluids	V filter for mineral oil based turbine and compressor lubricants

Applications

A	C	J	T	V
Acid + Varnish Scavenging (Acid Numbers <0.5 mg KOH/g)	Aggressive Acid + Varnish Scavenging (Acid Numbers >0.5 mg KOH/g)	Acid + Varnish Scavenging	Varnish Removal	Aggressive Varnish + Moderate Acid Scavenging

Filter Sizing Guidelines

Phosphate ester and EHC applications ideally require 3-4x reservoir exchange per day for normal fluid maintenance. Mineral Oil based turbine and compressor lubricants require 1x reservoir exchange per day for normal lubricant maintenance. For fluid or lubricant restoration higher flow rates may be required. Contact Hy-Pro for application guidelines, selection and sizing assistance.

[1] ICB-600508 utilizes Fluorocarbon gasket standard.
[2] Fyrquel is a registered trademark of ICL, Reolube is a registered trademark of Chemtura, Anvol is a registered trademark of Castrol. Shell Turbo is a trademark of Shell Oil Company. Mobil Pyrotec and Mobil Jet are trademarks of Exxon Mobil Corporation. Quintolubric is a registered trademark of Quaker Chemicals.

Water Contamination

Types, Removal & Prevention

Water is one of the most common and most damaging contaminants found in lube or hydraulic systems. Continuous or periodic high water levels result in damage such as: metal etching (corrosion), abrasive wear in hydraulic components, dielectric strength loss, fluid breakdown, additive precipitation and oil oxidation, reduction in lubricating properties, and many others.

The effects of moisture in your oil systems can drastically reduce on-stream plant availability. Bearing life and critical component life can also be greatly reduced by moisture levels above and within the saturation point. What makes matters worse, the degree of contamination and type of water contamination play a pivotal role in determining the best method for removal. The three types are listed below.

Free and dissolved water in hydraulic and lube systems leads to bearing fatigue, accelerated abrasive wear, corrosion of metal surfaces, increased electrical conductivity, viscosity variance, loss of lubricity, and fluid additive breakdown. Sources include condensation, reservoir leakage, worn actuator seals, heat exchanger leakage, new oil and more.

Dissolved Water

Dissolved water is the state at which individual water molecules (not visible to the naked eye) are dispersed throughout a fluid. Dissolved water accrues below the fluid's saturation point. Fluid with only dissolved water in it will have a bright, clear appearance.

Emulsified Water

Once the dissolved water's concentration has exceeded the saturation point of the fluid, microscopic water droplets will start to form an emulsion which is suspended within the fluid. Fluid samples containing emulsified water will have a cloudy, hazy appearance.

Free Water

Free water is formed once the emulsified water has reached a concentration at which it starts a separation phase and large water droplets begin to fall out of solution. Fluid samples containing free water will have a cloudy, hazy appearance. As the sample settles, the free water will fall out to form a separated layer on the bottom of the sample.

Water Contamination Solutions

VUD
Vac-U-Dry Vacuum Dehydrators

 Vacuum dehydration removes free, emulsified and dissolved water while maintaining low operating ISO Codes with high efficiency particulate filtration. With flow rates up to 100 gpm (379 lpm) and 24x7 unattended operation capabilities, the VUD is ideal for all hydraulic and lube oil fluids up to ISO VG 680.

V1
Compact VUD Vacuum Dehydrators

 Optimized for tight spaces with a salt water edition for marine applications, V1 removes free, emulsified and dissolved water while maintaining low operating ISO Codes with high efficiency particulate filtration. Ideal for all hydraulic and lube oils up to ISO VG 680.

COT
Turbine Oil Conditioning Systems

 A total conditioner for turbine and compressor lube oils, COT rapidly removes gross free and emulsified water by coalesce liquid-liquid separation technology. Ideal for managing steam turbine water ingression during start-up or continuous cooler/steam leaks. COT maintains low operating ISO Codes with high efficiency particulate filtration. Suitable only for R&O lube oils up to ISO VG 68.

FCLCOT
Turbine Oil Conditioning Filter Carts

 A compact, portable solution for boiler feed pump and compressor lube oils, FCLCOT rapidly removes gross free and emulsified water by coalesce liquid-liquid separation technology. Suitable only for R&O lube oils up to ISO VG 68. Maintains low operating ISO Codes with high efficiency particulate filtration.

TMR-N_2
Active Headspace Dehydrator + Nitrogen Generators

 A dedicated active headspace dehydrator and nitrogen generator for hydraulic reservoir and gearbox applications. TMR-N_2 maintains water between 200-500 ppm, prevents airborne water, particulate and metal ion ingression, and removes dissolved combustible gases.

TMR-Air
Active Headspace Dehydrators

 A dedicated active headspace dehydrator for hydraulic reservoir and gearbox applications. TMR-Air maintains water between 200-500 ppm, and prevents airborne water, particulate and metal ion ingression.

VUD

Vac-U-Dry Vacuum Dehydrators

The optimized balance between heat, vacuum, process design and an easy, user friendly operating system for removal of water and particulate from hydraulic and high viscosity lubricating oils. Equipped with generously sized, high efficiency filtration, the VUD is the ultimate oil purifier.

Keeping fluids clean and dry extends component and bearing life, increases productivity, minimizes downtime and extends useful fluid life. The VUD is ideal for removal of all forms of water, including free, emulsified and dissolved water and gas from hydraulic and lubricating oils.

HY-PRO

hyprofiltration.com/VUD

Contamination is complicated. Removing it is easy.

With features including viscosity specific dispersal element designs, fin tube low watt density heaters, oversized particulate filter, adjustable recirculation line, auto phase detection and reversal, programmable thermostat, proprietary vacuum chamber level control, foam sensor and auto-drain, VUD is the ultimate contamination removal system.

Results you can see.

Clear covers on the vacuum chamber and condensate collection tanks let you see what is really happening inside the VUD. You will know when you start removing water or when you are almost below saturation point with just a glance.

Never stops working.

VUD is a workhorse designed for 24/7 unattended operation. With a dual condensate collection tank design, auto water level sensors and automatic drain valves, there is no need to stop to drain water. The oversized condenser and dual condensate collection tanks work together to keep the water out of the vacuum pump.

Integrated intelligence.

The VUD smart relay enabled control panel makes start-up and shut-down safe and operator friendly so that everything is controlled with the simple push of a button. To take it even further, the optional PLC Touch Screen provides operating controls and data right at your fingertips.

Filtration starts with the filter(s).

Particulate media options down to $\beta 2.5_{[C]} \geq 1000$ and viscosity specific dispersal elements provide you with the best filtration and water removal capabilities in the world, period.

Completely, entirely, totally, all inclusive.

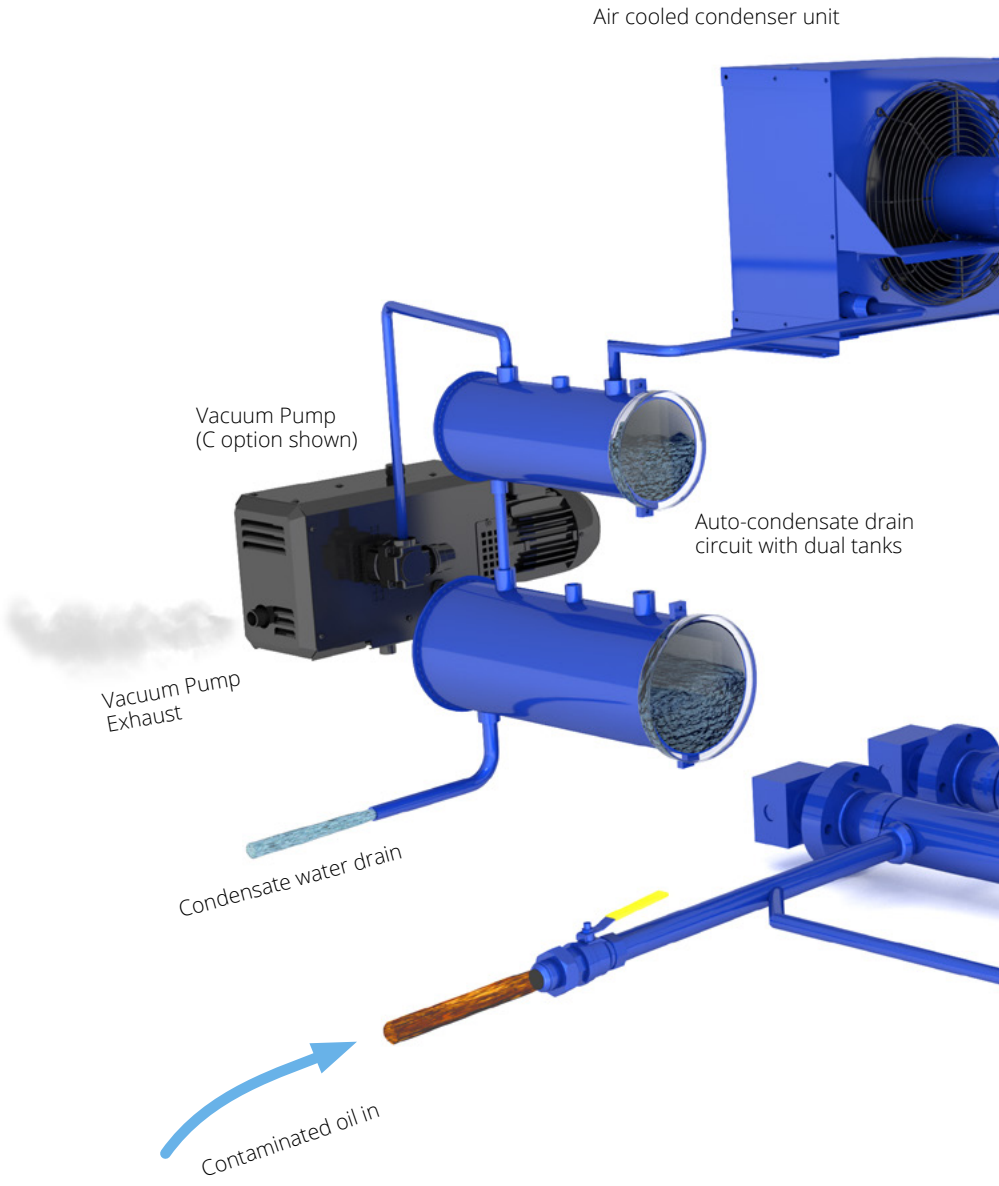
When it comes to comprehensive filtration and water removal, the buck stops here. VUD customization takes on many forms such as unique size requirements, combining VUD with other technologies such as FRF acid or turbine lube oil varnish removal, ATEX electrical standards, all to deliver the perfect oil purification system to meet your exact needs.

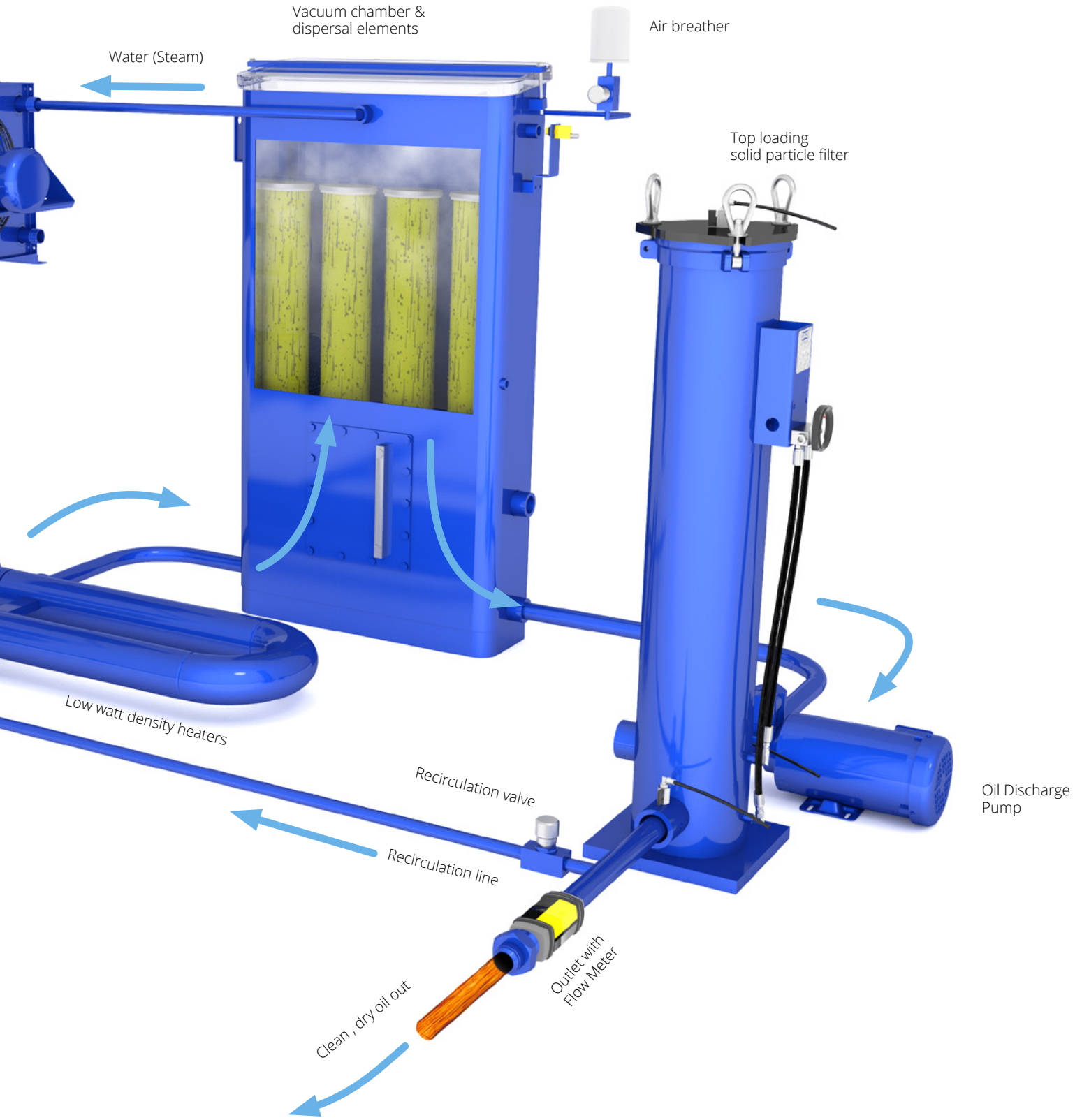
The Unmatched Purification Process

How it works

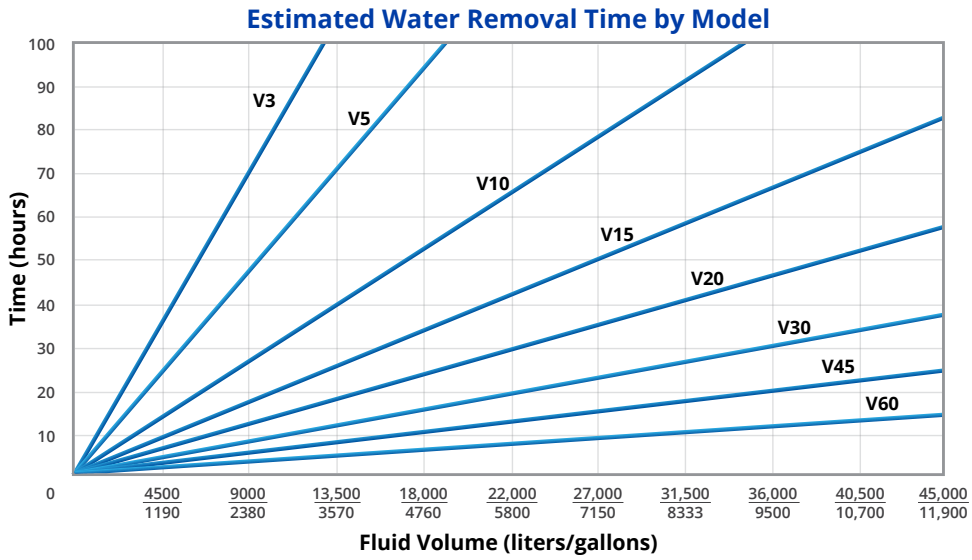
Contaminated oil is drawn into the Vac-U-Dry purifier by a high output vacuum pump. The oil passes through the low watt density heater where heated to optimum temperature for the dehydration process (150°F, 66°C). The oil enters the vacuum chamber passing through specially designed dispersal elements which create a thin film of oil that is exposed to the vacuum. The water is vaporized and then drawn into the condenser where it liquefies and drains into the condensate tank.

The dehydrated oil flows to the bottom of the vacuum chamber and is removed by the discharge pump where it is pumped through the high efficiency particulate filter assembly ($\beta x_{[c]}$ >1000) and returned to the system. The recirculating line helps the Vac-U-Dry reach optimum temperature in cold start situations and can be used to throttle machine inlet and outlet flow. From here, your oil can either be recirculated for additional temperature and contamination control or returned to your reservoir or equipment where it will operate more efficiently than ever.




Vacuum chamber &
dispersal elements
Air breather
Water (Steam)
Top loading
solid particle filter
Low watt density heaters
Recirculation valve
Oil Discharge
Pump
Recirculation line
Outlet with
Flow Meter
Clean , dry oil out

The Proven Performer



No other technology removes water faster or more safely with less chance of foaming than the Hy-Pro VUD. The graph here represents the estimated time required per model to remove water from 5000 ppm (0.5%) down to 150 ppm (0.015%) for increasing reservoir sizes.

Vacuum Pump Options

VUDs come standard with several vacuum pump options to best suit your application needs. Options C and D offer maximum portability to use your VUD in almost any location. Whether you're using your VUD to service multiple systems or for service work, you'll have unmatched filtration everywhere you need it.

C – Dry Seal (Dry Rotary Claw)

Long maintenance interval (10,000 hour synchronizing gear oil change) and great for portability. With excellent corrosion resistance to condensate exposure, this offers our lowest cost of ownership vacuum pump option.

D – Dry Seal (Lubricated Rotary Vane)

500-750 hour maintenance interval (lubricating oil and filter change), excellent for portability, compact size and low weight. The D option vacuum pump offers our lowest initial cost of ownership.

L – Liquid Ring

Ideal for dedicated VUD applications where ambient conditions are hot and humid and portability is not required. Minimum 3 gpm (11 lpm) external process water is required. Maintenance includes maintaining clean process water and balancing compound pressure gauge.

Vacuum power that doesn't suck.

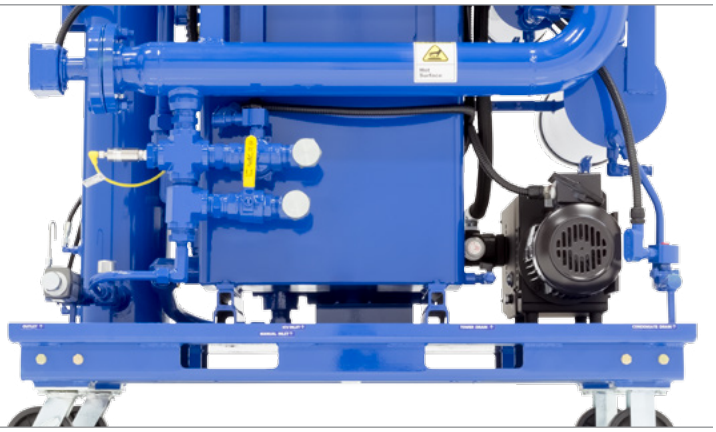
Pulled by the vacuum pump, oil passes through the heater housing and vacuum chamber dispersal elements, providing smooth flow for optimum water removal without foam. The tall vertical vacuum chamber achieves maximum oil film surface area on the dispersal elements, aided by proprietary variable flow level control, to remove water from your oil incredibly fast with unmatched consistency.

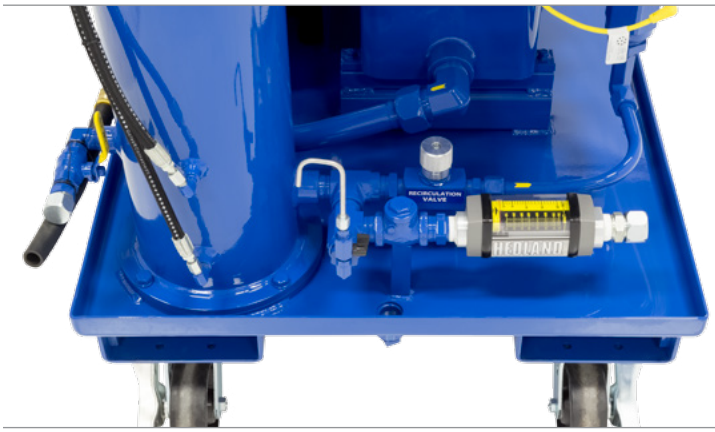
Dispersal elements.

Inside every VUD's vacuum chamber is the secret to its high efficiency water removal success. Viscosity range specific dispersal elements configured properly means faster water removal without the foaming issues that come with a one size fits all dispersal media for hydraulic and lube oils.

Take control of your system, automatically.

The Inlet Control Valve (N/C Solenoid) automatically closes when the VUD is not in operation, preventing the unit from siphoning fluid from a reservoir or flooding from a positive head inlet situation.



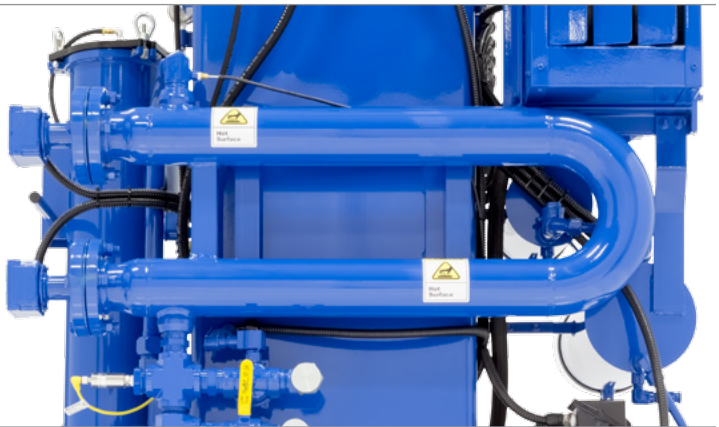


Synced to your system.

Achieve optimum VUD process temperature faster and ease start-up on high viscosity oils, especially when they're cold. Also ideal for adjusting overall VUD return flow down when using VUD on a small reservoir or gearbox. Simple and effective, the recirculation line adds incredible flexibility to fine tune the VUD to your system.

You can't beat the heat.

With no direct contact with the heating element, your turbine oil will safely and quickly get up to temperature without the risk of burning. The programmable temperature control with integral no-flow switch prevents oil damage and allows you to heat your fluids at your own pace. And what's more: all this comes standard on every VUD.



VUD Specifications

Model	V3D	V5C	V10C	V15C	V20C	V30C	V45C	V60C	V100C
Height[1]	60″ (152 cm)	75″ (191 cm)	75″ (191 cm)	75″ (191 cm)	75″ (191 cm)	89″ (226 cm)	75″ (191 cm)	89″ (226 cm)	89″ (226 cm)
Length[1]	48″ (122 cm)	56″ (142 cm)	56″ (142 cm)	56″ (142 cm)	72″ (183 cm)	84″ (213 cm)	84″ (213 cm)	96″ (244 cm)	120″ (305 cm)
Width[1]	32″ (82 cm)	32″ (82 cm)	32″ (82 cm)	32″ (82 cm)	36″ (91 cm)	40″ (102 cm)	48″ (122 cm)	60″ (153 cm)	96″ (244 cm)
Weight[1]	850 lbs (386 kg)	2000 lbs (908 kg)	2400 lbs (1089 kg)	2500 lbs (1134 kg)	2800 lbs (1270 kg)	3100 lbs (1406 kg)	3400 lbs (1542 kg)	3700 lbs (1678 kg)	4600 lbs (2087 kg)
Dispersal Element Quantity	2 x 11″ (28 cm)	2 x 22″ (56 cm)	3 x 22″ (56 cm)	3 x 22″ (56 cm)	4 x 22″ (56 cm)	4 x 36″ (91 cm)	8 x 22″ (56 cm)	8 x 36″ (91 cm)	16 x 36″ (91 cm)

Operating Temperature

Fluid Temperature
30°F to 180°F
(0°C to 82°C)

Ambient Temperature
-4°F to 104°F
(-20C to 40C)

Materials of Construction

Frame
Painted steel & 304 stainless

Filter assembly
Carbon steel

Condensate tanks
Stainless steel

Element bypass valve
Nylon

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

[1]Dimensions are approximations taken from base model and will vary according to options chosen.

VUD Part Number Builder

VUD [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] - [ ] - [ ]

Flow Rate | Vacuum Pump | Power Options | Dispersal Element | Media | Seals | Heaters | Condenser | Special Options | Multi Function Unit

Flow Rate[1]

3	3 gpm (11 lpm)
5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
15	15 gpm (56.8 lpm)
20	20 gpm (75.7 lpm)
30	30 gpm (114 lpm)
45	45 gpm (170 lpm)
60	60 gpm (225 lpm)
100	100 gpm (379 lpm)

Vacuum Pump Type

C	Dry seal (rotary claw)
D	Dry seal (lubricated rotary vane)
L	Liquid ring (external water supply required)

Power Options

60 Hz		50 Hz	
23	208-230 V ac, 3P	**38**	380 V ac, 3P
46	460-480 V ac, 3P	**41**	415 V ac, 3P
57	575 V ac, 3P	**52**	525 V ac, 3P

Dispersal Element

D	Pleated dispersal element - all synthetic media (viscosity ≤ ISO VG 220)
P	Metallic packed dispersal element - not for use in phosphate ester systems (viscosity ≥ ISO VG 460)
W	Pleated stainless steel dispersal element (ISO VG 150-320)

Media Selection

G8 Dualglass		Stainless wire mesh	
1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$	**25W**	25µ nominal
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$	**40W**	40µ nominal
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$	**74W**	74µ nominal
10M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$	**149W**	149µ nominal
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$		
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$		

Seals

V	Fluorocarbon
E[2]	EPR seals (for Skydrol use)

Heaters

9	9 kW	**48**	48 kW (4 x 12 kW)
12	12 kW	**64**	64 kW (4 x 16 kW)
24	24 kW (2 x 12 kW)	**80**	80 kW (5 x 16 kW)
36	36 kW (3 x 12 kW)	**96**	96 kW (6 x 16 kW)

Condenser

A	Air cooled
B	Air & liquid cooled
L	Liquid cooled

Special Options

8	8" solid wheel upgrade	**P**	PLC touch screen operation & data
A[3]	Auto condensate drain	**Q**[4,5]	Maintenance spares & repair kit
B	Pre-filter bag filter housing	**P9**[6]	Phosphate ester fluid compatibility modification
C	CE marked + international crating (V5-V60)	**R**[3]	Electrical phase reversal switch
D	Dirty filter indicator alarm light	**S**	Inlet line basket strainer
E	Carbon vacuum pump exhaust filter	**S9**[7]	Skydrol fluid compatibility modification
F	Vacuum chamber foaming sensor	**T**[4]	Hose kit (suction & return hoses + wands)
G	316 stainless condensate wet parts (304 standard)	**U**	50' (15 m) electrical cord without plug
H	Manual reset hour meter (in addition to std. non-reset)	**V**[4]	Inlet control valve (for positive head inlet)
J	Individual heater selector switches	**W**	Water sensor and indicator
K	Sight flow indicator (wheel type)	**X**[8]	Explosion proof - Class 1, Div 2 Group C+D
L	Lifting eye kit	**Y**	VFD variable speed motor frequency control
M	Discharge line flow meter	**Z**	On site start-up training (1 x 10 hour shift)
O	On-board PM-1 particle monitor		

Multi Function Units

omit	Standard VUD capabilities
COT	COT coalesce vessel adder + auto water drain function (sized to handle 100% of VUD flow)
ICBPE[9]	Phosphate ester acid & dissolved metal removal (contact factory for alternate fluids)
SVR1200CT[9]	Varnish removal & prevention side loop (5 gpm continuous element flow up to 8000 gal/30,000 liter reservoir)

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Contact factory for other fluid option compatibility.
[3]Standard supplied options, must be included in part number.
[4]Recommended option.
[5]Repair & spares kit includes common consumable and select critical spares such as flow switches, fuses, and tank lids.
[6]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[7]When selected, must be paired with Seal option "E." Contact factory for more information or assistance in fluid compatibility.
[8]Consult factory for other explosion proof options.
[9]Varnish and ICB add-on technologies condition a portion of maximum VUD flow. Standard SVR1200CT flow rate ≤ 5 gpm. ICB add-on will be sized to reservoir volume.

HY-PRO

V1

Compact VUD Vacuum Dehydrator

A compact and mobile dehydration and high efficiency filtration solution, the V1 prevent acidity and loss of lubrication properties caused by inefficient dehydration and high ingression.

Ideal for rapidly removing all forms of water including free, emulsified, and dissolved water and gas from hydraulic and lube oils.

HY-PRO

hyprofiltration.com/V1

V1P model shown

V1S model shown

Different by design.

The V1S is optimized for low headspace clearance for use in marine applications and with the S special option, V1S can remove the water without leaving salt behind to cause problems in thruster, steering and propulsion systems.

Size matters.

With small size comes great power. Utilizing single phase power supplies, V1 models provide the same unmatched water and particulate removal as larger VUDs on a smaller scale with the added benefit of incredible mobility. And with the ability to use single phase connections for power, you'll have clean, dry fluids anywhere and everywhere you need them.

Results you can see.

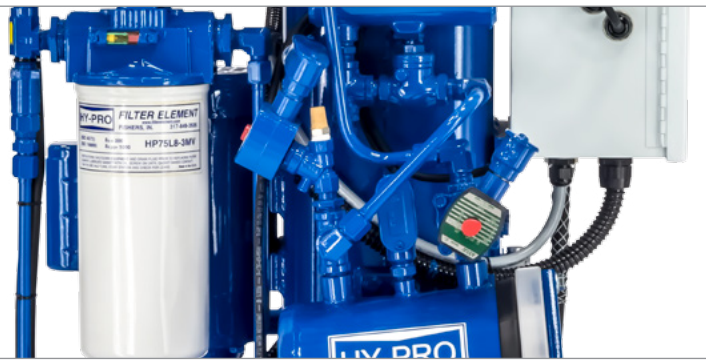
Clear covers on the vacuum chamber and condensate collection tank let you see as the V1 removes the water from your oil and collects it in the condensate tank. From there, you can say goodbye as it's drained and removed from your system, for good.

Integrated intelligence.

The V1 smart relay enabled control panel makes start-up and shut-down operator friendly and safe so that when you press the start button the automatic scripted sequence controls what comes on and when, meaning you don't need three hands to get it going.

Never stops working.

V1 is a workhorse designed for 24/7 unattended operation. With a dual condensate collection tank design, auto water level sensors and automatic acting drain valves, there is no need to stop to drain water.



Completely, entirely, totally, all inclusive.

When it comes to comprehensive filtration and water removal, the buck stops here. V1 customization takes on many forms such as unique size requirements, combining V1 with other technologies (i.e. FRF acid or turbine lube oil varnish removal), or other customer specific needs.

V1 Specifications

Model	V1P	V1S
Height[1]	50" (127 cm)	45" (114 cm)
Width[1]	28" (71 cm)	34" (86 cm)
Depth[1]	28" (71 cm)	24" (61 cm)
Weight[1]	400 lbs (181 kg)	400 lbs (181 kg)
Inlet	¾" male JIC	¾" male JIC
Outlet	½" male JIC	½" male JIC
Electric Motor	TEFC with overload protection	
Pump	Cast iron, positive displacement gear pump with internal relief.	
Vacuum Pump	Dry Rotary Vane	
Operating Temperature	**Fluid Temperature** 32°F to 180°F (0°C to 82°C)	**Ambient Temperature** -4°F to 104°F (-20C to 40C)
Materials of Construction	**Frame** Carbon steel or stainless steel	**Filter assembly** Aluminum and carbon steel
Electric Connection	50' (15 m) power cord supplied with machine.	
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**W** Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)
Fluid Compatibility	Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester or skydrol fluid compatibility select fluid compatibility from special options.	

[1]Dimensions are approximations taken from base model and will vary according to options chosen.

V1 Part Number Builder

V1 [ ] [ ] [ ] [ ] [ ] [ ] A- [ ]

Model Type | Power Option | Dispersal Element | Media | Seal | Heater | Special Options

Model

P	Hand truck style design for maximum mobility
S	Low profile design optimized for marine low headspace applications

Power Options

60 Hz

12	120 V ac, 1P
23	230 V ac, 1P

50 Hz

22	220 V ac, 1P

Disperser Element

D	Pleated disperser element - all synthetic media (viscosity ≤ ISO VG 220)
P	Metallic packed disperser element (viscosity ≥ ISO VG 460)[1]
W	Pleated stainless steel disperser element (ISO VG 150-320)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

Heater[1]

1	1 kW (power option 12 only)
2	2.5 kW (power options 22 & 23 only)
4	4.5 kW (power options 22 & 23 only)

Special Options

A	Auto-condensate drain
C	CE marked for machinery safety directive 2006/42/EC
P9[2]	Phosphate ester fluid compatibility modification
S[3]	Stainless components for salt water removal
S9[4]	Skydrol fluid compatibility modification
T	Hose kit (suction & return hoses + wands)
V[5]	Inlet control valve (for positive head inlet)

[1] Heater is dependent on power option
[2] When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[3] Only available on V1S model.
[4] When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[5] Recommended option.

COT

Turbine Oil Conditioning Skids

Remove harmful particulate and water contamination and achieve target ISO Codes faster with the COT.

Ideal for preventing unplanned downtime and premature component failures in turbine lube systems.

HY-PRO

hyprofiltration.com/COT

Size matters.

COT optimizes coalesce and separator flow density to rapidly remove gross free water ingress during steam turbine start-up or in the event of a seal leak. High single pass water removal efficiency that keeps up with ingression so your bearings don't see free or emulsified water.

Filtration starts with the filter(s).

COT combines high efficiency single pass particulate and water removal to ensure that your turbine oil is always in spec, eliminating premature component failures and downtime. With particulate media options down to $\beta 2.5_{[C]} > 1000$ and 100% synthetic coalesce/separator elements that remove all free and emulsified water down to saturation point, your turbines will be protected and running more efficiently than ever.

Setting the new standard.

Sampling and preventative maintenance are no longer optional, they're a necessity. That's why every COT comes standard with properly positioned sample ports to arm you with access to consistently accurate system conditions and letting you know exactly how well your filtration is performing.

Take control of your systems.

Smart relay and auto water drain make COT a 24/7 unattended, easy-to-operate solution that functions as an in-line contamination barrier for every drop of turbine oil that goes into your turbines. Optional PLC touchscreen enables custom programming so your COT can purify reservoirs on your schedule and even data log ISO Codes and water removal rates so you know your lube is clean and reliable when you're on and off the clock.

You can't beat the heat.

With no direct contact with the heating element, your turbine oil will safely and quickly get up to temperature without the risk of burning. The programmable temperature control with integral no-flow switch prevents oil damage and allows you to heat your fluids at your own pace. And what's more: all this comes standard on every COT.

Built to exceed your expectations.

Flexible dimension and process arrangement are available with every COT so you get the perfect contamination solution for your turbine lubrication system. Even choose from explosion proof models and color coordinate to fit perfectly with your existing safety standards for the ultimate system in turbine oil conditioning.

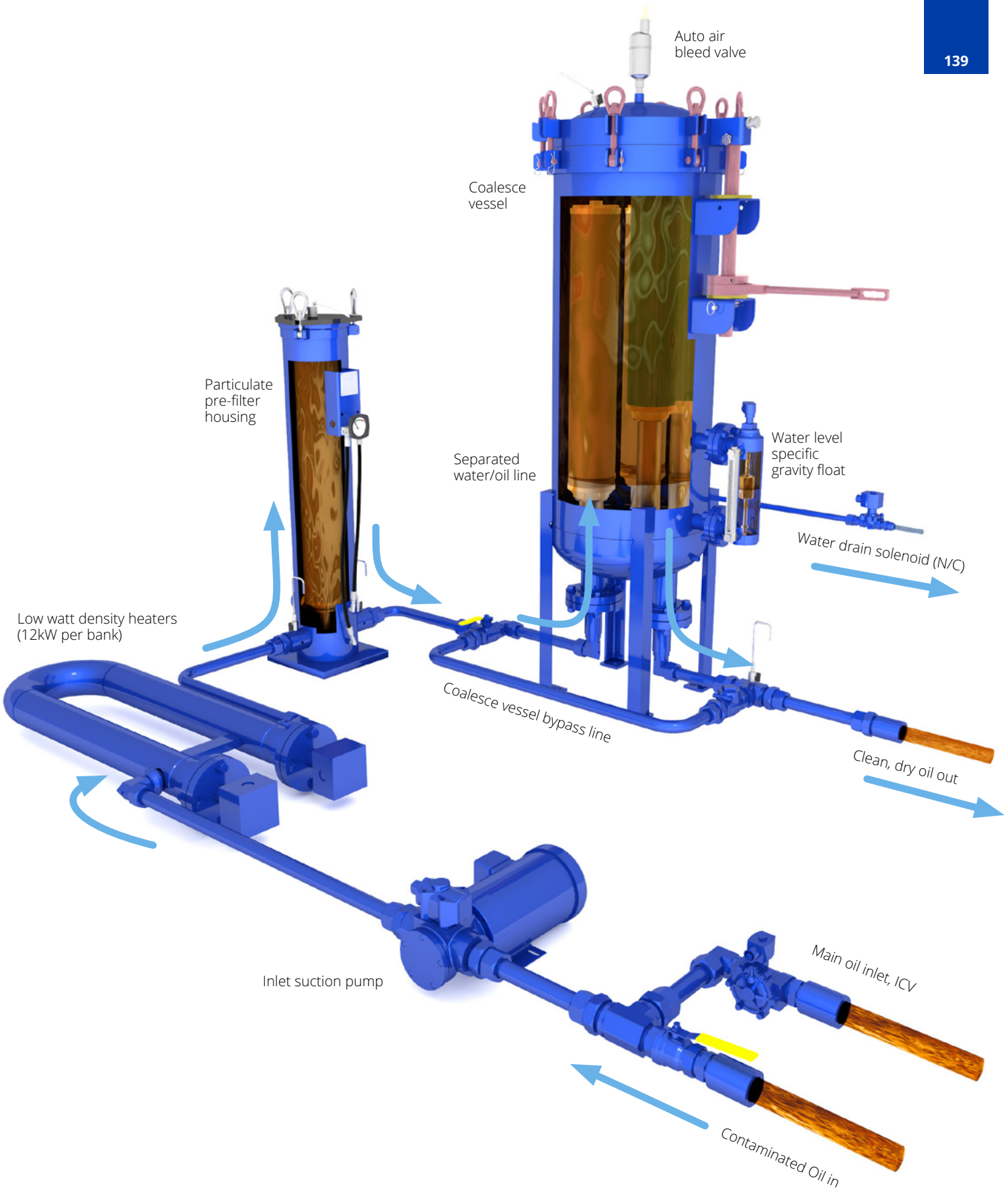
The COT Process

How it works

Oil from the system entering the COT through a positive displacement gear pump passes through low watt density heat to achieve the optimum turbine oil temperature for efficient liquid-liquid separation by coalesce, >100°F (38°C).

The first stage of oil conditioning is particulate removal by $\beta 5_{[c]}$>1000 high efficiency glass media element. Next, the oil enters the two stage coalesce vessel where the oil passes through 100% synthetic media coalesce elements. The free and emulsified water coalesces to form larger droplets that overcome the specific gravity of the oil and drop to the bottom of the vessel. Stage two in the coalesce vessel is the separator/post-filter element that functions as a water barrier for emulsified and small droplets of water that have not reached a size large enough to drop of suspension. After passing through the water barrier, the oil passes through a final stage of particulate removal filtration by $\beta 2.5_{[c]}$>1000 media to achieve even lower operating ISO Codes.

The coalesce vessel will achieve single pass water removal from 5000 ppm to <150 ppm under normal operating conditions and oil health. As water collects in the bottom of the coalesce vessel, a specific gravity float reaches a limit indicator that will open the automatic water drain valve and eject the separated water as it is removed to allow for 24/7 continuous operation. When fitted with a totalizing meter on the water drain line, quantity and timing for water removal can be established.


Auto air
bleed valve
Coalesce
vessel
Particulate
pre-filter
housing
Separated
water/oil line
Water level
specific
gravity float
Water drain solenoid (N/C)
Low watt density heaters
(12kW per bank)
Coalesce vessel bypass line
Clean, dry oil out
Inlet suction pump
Main oil inlet, ICV
Contaminated Oil in

COT Specifications

Model	COT5	COT10	COT30	COT60	COT100
Max Reservoir Size	800 gallons (3000 liters)	1600 gallons (6000 liters)	4000 gallons (15100 liters)	8000 gallons (30300 liters)	13250 gallons (50200 liters)
Height[1]	65″ (165 cm)	83″ (211 cm)	88″ (224 cm)	88″ (224 cm)	100″ (254 cm)
Length[1]	56″ (142 cm)	60″ (153 cm)	84″ (213 cm)	84″ (213 cm)	96″ (244 cm)
Width[1]	32″ (81 cm)	40″ (102 cm)	40″ (102 cm)	60″ (153 cm)	60″ (153 cm)
Weight[1]	1400 lbs (635 kg)	2000 lbs (907 kg)	2700 lbs (1225 kg)	3400 lbs (1542 kg)	4400 lbs (1996 kg)
Inlet[2]	1″ (2.5 cm)	1.5″ (4 cm)	2″ (5 cm)	3″ (7.5 cm)	3″ (7.5 cm)
Outlet[2]	1″ (2.5 cm)	1″ (2.5 cm)	1.5″ (4 cm)	2″ (5 cm)	3″ (7.5 cm)
Motor Size	1 hp	1.5 hp	5 hp	7.5 hp	10 hp
Pre-Filter Elements	1	1	1	2	3
Coalesce Elements	1 x HP538L38-CS3MV[3]	2 x HP731L39-CV	5 x HP731L39-CV	8 x HP731L39-CV	10 x HP731L39-CV
Separator/ Polish Elements	(combination element)	1 x HP582L30-S1MV	3 x HP582L30-S1MV	5 x HP582L30-S1MV	9 x HP582L30-S1MV
Seals	Fluorocarbon				
Operating Temperature	**Fluid Temperature** 32°F to 200°F (0°C to 93°C)		**Ambient Temperature** 40°F to 104°F (4°C to 40°C)		
Materials of Construction	**Housings** Carbon steel with industrial coating		**Frame** Carbon steel with industrial coating		
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)		**Coalesce/Separator** Coalesce: 100% synthetic fiber media Separator: TEFLON® coated screen (water barrier)		
Fluid Compatibility	Mineral based turbine oil, call factory for synthetic. Cannot be used with AW hydraulic oils or phosphate esters. For water removal in AW hydraulic oils and phosphate esters, see VUD (page 136).				

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Female pipe port.
[3]HP538L38CS-3MV element combines coalesce and separator element functions into a single element.
TEFLON® is a registered trademark of DuPont.

COT Part Number Builder

COT [ ] [ ] - [ ] [ ] - [ ]

Flow Rate | Power Options | Heat Capacity | Seal | Special Options

Flow Rate[1]

5	5 gpm (18.9 lpm)
10	10 gpm (37.9 lpm)
30	30 gpm (114 lpm)
60	60 gpm (225 lpm)
100	100 gpm (379 lpm)

Power Options

60 Hz, 1750 RPM

23[2]	230 V ac, 3P
46	460 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

38	380 V ac, 3P
41	415 V ac, 3P
52	525 V ac, 3P

Heat Capacity

12	12 kW
24	24 kW
36[3]	36 kW
48[3]	48 kW
64[3]	64 kW
72[3]	72 kW
84[3]	84 kW
X	No heaters

Seal

V	Fluorocarbon

Special Options

8	8” (20 cm) solid wheel upgrade
A[4]	Auto water drain (manual drain included)
B	Adjustable coalesce vessel bypass loop
C	CE marked for machinery safety directive 2006/42/EC
H	Manual reset hour meter
J[3]	Individual heater selector switches for limited amp circuits
K	Sight flow indicator
L	Lifting eye kit
M	Water discharge totalizing meter
O	On-board PM-1 particle monitor & clean oil indicator light
P	PLC touch screen control (does not include VFD)
Q[4,5]	Maintenance spares & repair kit
S	Oil sensing safety shut-off in water discharge line
T[4]	10’ (3 m) hose kit + wands (JIC female connections)
U	50’ (15 m) electrical cord (no plug supplied)
V	Inlet control valve (for positive head application)
X	Explosion proof - Class 1, Div 2, Group C+D. Consult factory for other explosion proof options.
Y	VFD variable speed motor frequency control
Z[4]	On-site startup training (1 x 10 hour shift)

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Only available with COT5.
[3]Possible high full amp load (consider special option J).
[4]Recommended option.
[5]Q option repair & spares kit includes several items such as fuses, common rely, panel bulb, and replacement element set for coalesce chamber & particulate housing.

FCLCOT

Turbine Oil Conditioning Filter Cart

A mobile solution that maintains turbine lube oil by removing water and particulate contamination that can cause corrosion, fluid breakdown, abrasive wear on components, additive precipitation, reduced lubricity, and dielectric strength loss.

Ideal for turbine lube oil, boiler feed pumps, compressors and others R&O applications.

HY-PRO

hyprofiltration.com/FCLCOT

Filtration starts with the filter(s).

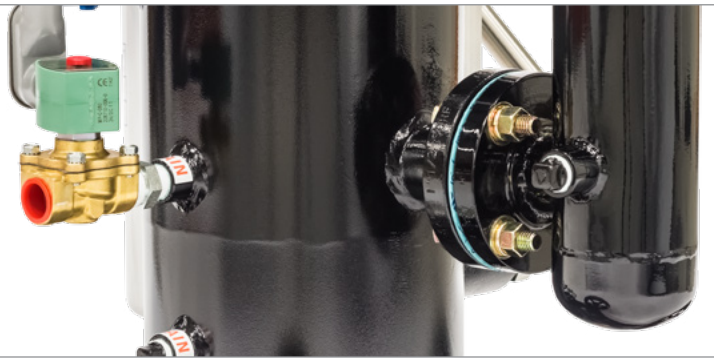
FCLCOT combines high efficiency single pass particulate and water removal to ensure that your turbine oil is always in spec, eliminating premature component failures and downtime. With particulate media options down to $\beta 2.5_{[C]} > 1000$ and 100% synthetic coalesce/separator elements that remove all free and emulsified water down to 50 ppm, your turbines will be protected and running more efficiently than ever.

Cleaner fluids: greater efficiency.

Water and particulate contamination in turbine oils can lead to decreased output efficiency, metal etching, fluid breakdown, and abrasive wear in hydraulic components among many other costly issues. With a single pass through the FCLCOT, you'll not only remove harmful contaminants but increase your uptime and promote the best environment for your turbine to operate efficiently.

Never stops working.

Designed for 24/7 unattended operation, FCLCOTs with auto water drain technologies provide you with the safety and security to know your turbine oil is clean and dry even when you're off the clock.



Unmatched on the move.

Non-shredding, never flat wheels and easy to maneuver cart design with ergonomic handle mean you get powerful filtration exactly when and where you need it.

Setting the new standard.

Sampling and preventative maintenance are no longer optional, they're a necessity. That's why every FCLCOT comes standard with properly positioned sample ports to arm you with access to consistently accurate system conditions and letting you know exactly how well your filtration is performing.

Completely customizable.

Whether you need the heavy duty off-road tires for greater mobility or add one of several inlet strainer options, each and every FCLCOT can be built specifically to suit your needs. And with options for both convenience and tailoring for specific applications, you'll be sure to get the perfect solution for all your contamination problems.

FCLCOT Specifications

Dimensions[1]	**Height** 62" (158 cm)	**Width** 30.5" (77 cm)	**Depth** 29" (74 cm)	**Weight** 379 lbs (172 kg)
Connections	**Inlet** 1" male JIC	**Outlet** 1" male JIC	**Hoses** 1" x 10 ft (2.4 m)	
Element Configuration	**Particulate filter** HP75L8-3MV	**Coalesce/Separator Filter** HP538L38-CS3MV		
Seals	Fluorocarbon			
Operating Temperature	**Fluid Temperature** 80°F to 250°F (27°C to 121°C)	**Ambient Temperature** 40°F to 104°F (4°C to 40°C)		
Materials of Construction	**Housings** Carbon steel with industrial coating	**Hoses** Reinforced synthetic	**Wands** Stainless steel	
Electric Motor	TEFC, 56-145 frame 0.5 hp, 1450-1750 RPM			
Motor Starter	MSP (motor starter/protector) in an IP65, aluminum enclosure with short circuit and overload protection.			
Electric Connection	Voltages 230 V ac and under, single phase: 35' (11 m) retractable cord reel included. Power Option 12 includes NEMA 5-15 plug. Voltages over 230 V ac: 35' (11 m) power cord included.			
Pump	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.			
Pump Bypass	Full bypass at 150 psi (10 bar)			
Pneumatic Option Air Consumption	~40 cfm @ 80 psi[2] 35' (11 m) retractable air hose included when pneumatic option selected. Replaces 35' (11m) electric cord reel.			
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)	**Coalesce/Separator** Coalesce: 100% synthetic fiber media Separator: TEFLON® coated screen (water barrier)		
Fluid Compatibility	Mineral based turbine oil, call factory for synthetic. Cannot be used with AW hydraulic oils or phosphate esters. For water removal in AW hydraulic oils and phosphate esters, see VUD (page 124).			
Hazardous Environment Options	Select pneumatic powered unit (Power Option 00) or explosion proof NEC Article 501, Class 1, Division 1, Group C+D. Call for IEC, Atex or other requirements. If Power Option X selected, no electrical cord or cord reel will be included.			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Air consumption values are estimated maximums and will vary with regulator setting.
TEFLON® is a registered trademark of DuPont.

FCLCOT Part Number Builder

FCLCOT [ ] [ ] [ ] [ ] - [ ]

Flow Rate | Indicator | Power Options | Hose Connection | Special Options

Flow Rate[1]

05	0.5 gpm (1.7 lpm)
1	1 gpm (3.7 lpm)
2	2 gpm (7.5 lpm)

ΔP Indicator[2]

D	22 psid visual gauge + electric switch
E	22 psid visual gauge

Power Options

Contact factory for options not listed

60 Hz, 1750 RPM

12	120 V ac, 1P
22	208-230 V ac, 1P
23	208-230 V ac, 3P
46	460-480 V ac, 3P
57	575 V ac, 3P

50 Hz, 1450 RPM

11	110 V ac, 1P
21	220 V ac, 1P
40	380-440 V ac, 3P
52	525 V ac, 3P

Pneumatic

00	Pneumatically driven air motor & PD pump. FRL & flow meter included.

Explosion proof - Class 1, Division 1, Group C+D per NEC 501 – Ready for outdoor use

X__	Add X prefix to power option listed above. Not available with (00) Pneumatic Option.

Hose Connection

G	Female BSPP swivel hose ends, no wands
S	Female JIC swivel hose ends, no wands
W	Female JIC swivel hose ends, with wands

Special Options

A1	Electrically powered automatic water drain
B	Complete filter bypass line
C	CE marked for machinery safety directive 2006/42/EC
D	High filter ΔP auto shutdown
E	100 mesh cast iron basket strainer
F	Filter element ΔP gauge with tattle tale follower needle
G	Spill retention pan with fork guides (industrial coated steel)
H1	10 ft (3 m) return line hose extension
H2	20 ft (6 m) return line hose extension
J	Add pressure gauge between pump & filter assembly
K	HP75L8-149W Spin-On suction strainer
L	High filter element ΔP indicator light
M	Total system flow meter (120 cSt max)
N	PM-1 ready (plumbing only)
O[3]	On-board PM-1 particle monitor & clean oil indicator light
R	Spill retention pan with wheels (industrial coated steel)
S[4]	All wetted components 304 or higher stainless steel
T	Foam filled off-road tires for rugged environment
U	CUL and/or CSA marked starter enclosure for Canada
W	Automatic air bleed valve
Z	On site start-up training

[1]Nominal flow rates at 60 Hz motor speeds.
[2]Particulate filter only. Coalesce housing is equipped with sliding differential indicator.
[3]PM-1 will not function properly in the presence of free or emulsified water at or above saturation point. If selected, PM-1 is installed downstream of the filtration.
[4]With exception to cast iron gear pump.

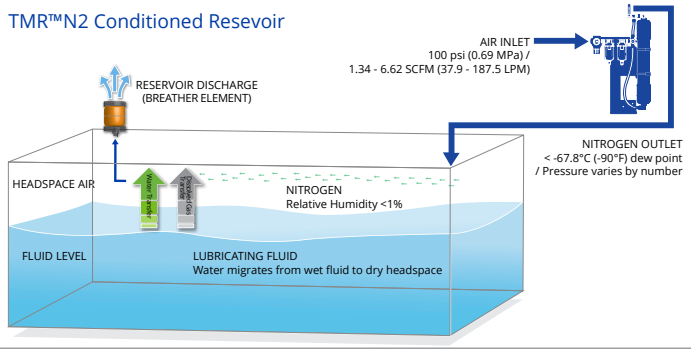
TMR™-N_2

Highly effective water removal system for atmospheric breathing lubricant reservoirs

Total Moisture Removal-Nitrogen systems (TMR™-N_2) cost effectively remove all 3 forms of water from lubricants and hydraulic fluids through mass transfer which is a highly effective, non-mechanical process. TMR™-N_2 generates a constant flow of high purity N_2 which is injected into the head space of the lubricant reservoir to remove and maintain very low water levels.

HY-PRO EPT

hyprofiltration.com/TMRN2



Control water contamination.

Produced Nitrogen is vented at low flow out the breather element, eliminating the effects atmosphere has on the fluid. TMR™-N_2 systems are regulated, intrinsically safe, and have a manually adjusted flow control valve with flow meter.

Clean, dry, healthy oil.

Dry air mass transfer extracts dissolved water from the fluid and since the nitrogen introduced by the TMR™-N_2 is an inert gas, it also removes combustible gases (i.e. CO_2, C_2H_2, CO, C_2H_4, C_2H_6, CH_4, and H_2) from the oil to reduce oxidation and fluid breakdown.

Extend your fluid life.

A properly sized TMR™-N_2 is designed to remove up to 200 ppm of water per day under normal operating conditions to minimize oxidation and fluid breakdown and extend the useful life of your oil while protecting your critical components.

TMR™-N_2 Specifications

Model	TMRN$_2$-601902	TMRN$_2$-601903	TMRN$_2$-601904	TMRN$_2$-601905[2]
Height[1]	30" (76 cm)	48" (122 cm)	48" (122 cm)	70" (178 cm)
Width[1]	20" (51 cm)	20" (51 cm)	20" (51 cm)	20" (51 cm)
Depth[1]	7" (18 cm)	7" (18 cm)	7" (18 cm)	7" (18 cm)
Weight	38 lbs (17 kg)	44 lbs (20 kg)	48 lbs (22 kg)	55 lbs (9 kg)
Inlet	¼" FNPT	¼" FNPT	¼" FNPT	¼" FNPT
Outlet	¼" FNPT	¼" FNPT	¼" FNPT	¼" FNPT
Air Consumption[3]	< 1.2 SCFM	< 2.0 SCFM	< 3.6 SCFM	< 6.0 SCFM
Headspace Volume	< 15 ft^3 (< 0.42 m^3)	< 22 ft^3 (< 0.62 m^3)	< 36 ft^3 (< 1.02 m^3)	< 100 ft^3 (< 2.8 m^3)
Fluid Operating Temperature	30°F to 225°F (0°C to 105°C)	30°F to 225°F (0°C to 105°C)	30°F to 225°F (0°C to 105°C)	30°F to 225°F (0°C to 105°C)
Materials of Construction	**Frame** Powder coated steel			

[1]Dimensions are approximations taken from base model and will vary according to options chosen.
[2]Ships in two pieces.
[3]Minimum 100 psig (6.89 barg).

TMR™-N_2 Part Number Builder

TMRN2-60190 [ ] - [ ]
Model Special Options

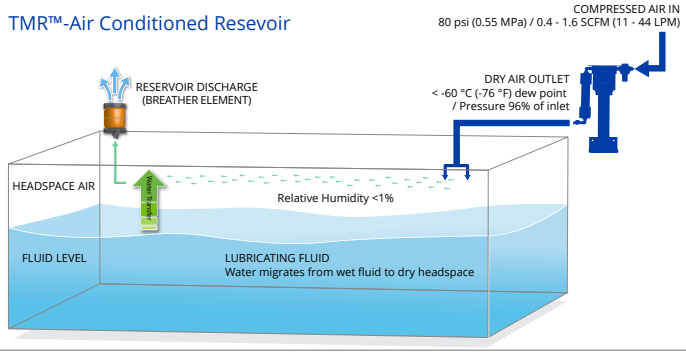
Model	**2**	TMR™-N_2 Nitrogen Generator for reservoir volume < 400 gal (1,500 liter)
	3	TMR™-N_2 Nitrogen Generator for reservoir volume < 800 gal (3,050 liter)
	4	TMR™-N_2 Nitrogen Generator for reservoir volume < 2000 gal (7,650 liter)
	5	TMR™-N_2 Nitrogen Generator for reservoir volume < 3000 gal (11,500 liter)
Special Options	**M1**	Manifold to share TMR™-N_2 with 2 reservoirs (601902 and 601903 models only)
	M2	Manifold to share TMR™-N_2 with 2 reservoirs (601904 and 601905 models only)

TMR™-Air

Total Moisture Removal Systems

TMR™-Air systems cost effectively remove all 3 forms of water from lubricants and hydraulic fluids through mass transfer which is a highly effective, non-mechanical process. Using TMR™-Air exploits the principle of chemical equilibrium in a gentle, energy efficiency method.

HY-PRO EPT hyprofiltration.com/TMR

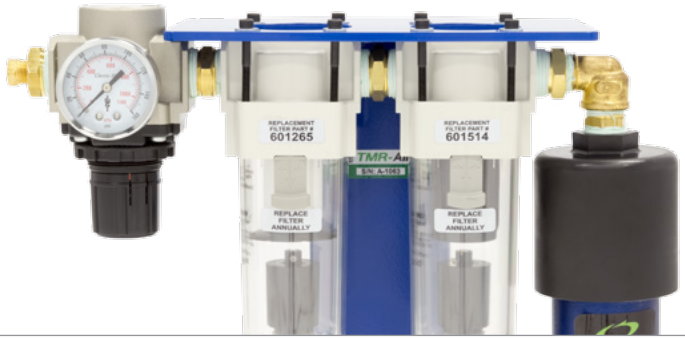


Remove water: protect your systems.

With TMR™-Air, dry air is generated at the source, providing unlimited capacity to reduce existing moisture in the reservoir and oils. The water is released from the oil to the super dry air. TMR™-Air is a maintenance solution that will maintain water at very low levels (<50 ppm total or in the ideal range between 200~300 ppm for EHC fluids), reducing the rate of lubricant break-down.

Eliminate water at its source.

Free flowing dry air is exhausted out of the breather element, reversing the typical flow configuration of reservoir air and eliminating one of the key ingression points for water and particulate contamination.



Extend your fluid life.

A properly sized TMR™-Air is designed to remove up to 100 ppm of water per day under normal operating conditions to minimize oxidation and fluid breakdown and extend the useful life of your oil while protecting your critical components.

TMR™-Air Specifications

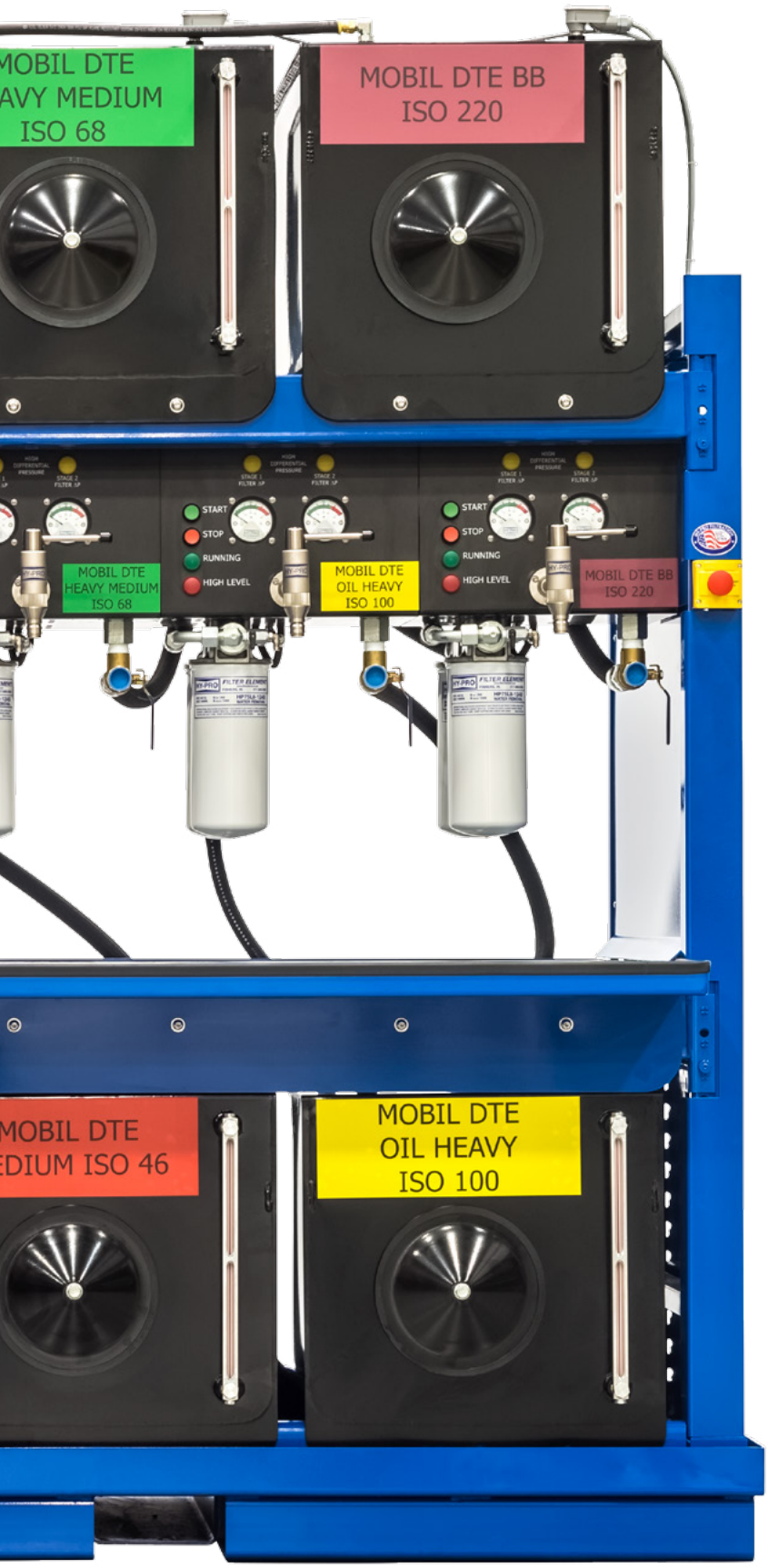
Height	24" (61 cm)
Width	14" (35 cm)
Depth	5" (13 cm)
Weight	21 lbs (10 kg)
Inlet	¼" FNPT
Outlet	¼" FNPT
Headspace Volume	< 36 ft^3 (< 1.02 m^3)
Flow Rate Manual Control with Flow Meter	0-60 SCFH (0-1680 LPH)
Preset Flow Rate	30 SCFH (840 LPH)
Air Consumption Max @ 100 psi/0.69 MPa (SCFM/LPM)	0-180 SCFH (0-5040 LPH)
Fluid Operating Temperature	30°F to 225°F (0°C to 105°C)
Materials of Construction	**Frame** Powder coated steel

TMR™-Air Part Number Builder

TMR-60090 [ ] - [ ]

Model | Special Options

Model	**4**	TMR™-Air for reservoir volume ≤ 2000 gal (7,600 liter)
Special Options	**M1**	Manifold to share TMR™-Air with 2 reservoirs



LCS

Liquid Conditioning Station

Begin filtration and contain contamination before it ever enters your plant to protect your equipment and your bottom line. Built with your convenience in mind and completely customizable for size and fluids, the LCS is a complete contamination solution for hydraulic and lube oil storage and handling.

HY-PRO

hyprofiltration.com/LCS

Everything you need. Within arms reach.

Your day at work is hard enough. That's why we've built the LCS with your convenience in mind. Everything you need, conveniently placed for maximum accessibility. From start-up to clean up, all of your daily activities come without the need for a ladder.

Say goodbye to cross contamination.

Dedicated pump, filter and plumbing for each tank maintain fluid integrity and allow multiple fluids to be filtered exclusively and simultaneously.

The best in filtration[3].

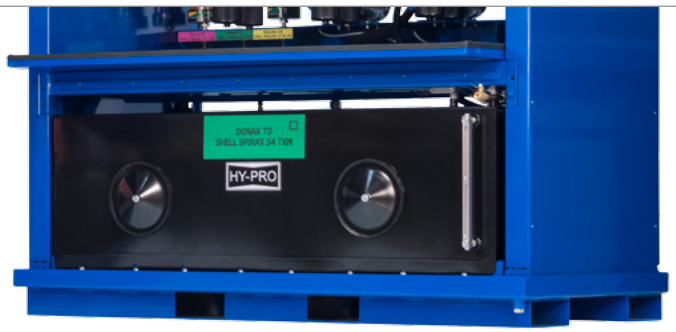
Filter fluids as they are added to and dispensed from the reservoirs. Recirculate fluids inside the reservoirs for a third level of unparalleled fluid cleanliness and unimaginably low ISO Codes. And with DFE rated media options down to $\beta 2.5_{[C]} \geq 1000$ you can be sure contamination stays exactly where you want it: out of your fluid.

Take control of your systems.

The definition of brains and brawn, the control panel on the LCS regulates all the system operations so you can filter and dispense your fluids worry-free. Tucked back and out of the way, once you're up and running you might as well forget it's even there.

Size matters.

Packed with as many reservoirs as your heart desires, the LCS is a behemoth with power that can't be denied. With space for 70 gallons of fluid in each standard reservoir, you can kiss the rows of scattered oil drums goodbye. Or if 70 gallons isn't enough for you, reservoirs can be sized up to 250 gallons so you'll have all your fluids clean, dry, and in one place.



Perfectly tailored to fit your needs.

Label designs, symbols and colors are tailored for each fluid to fit your existing safety and identification standards. To take it even further, each filtration system is set up specifically for the type and viscosity of its specific fluid, meaning you get the perfect contamination solutions for each and all of your fluids.

Minimize the mess.

Dual drip pans allow draining spent filters directly within the Workstation, eliminating oily filter transfer and subsequent oil clean-up.

Setting the new standard.

Sampling and preventative maintenance are no longer optional, they're a necessity. Knowing your fluids are clean is the first step in prolonging the life of your systems and critical components. That's why every LCS comes standard with easy-to-access sample ports in their proper positions so you can always know you're putting clean oils into your systems.

A breath of fresh air.

With built in check valves (0.1 psi, 0.007 bar) to maximize lifespans, Hy-Dry desiccant breathers on each reservoir help remove water contamination from your oils and prevent cross contamination between fluids.

Let there be light.

Integrated LED lights illuminate the Workstation for dispensing fluid, changing elements and reading gages even in poorly lit environments.

Built for industrial use.

Rated to hold 5000 pounds each, the tiered shelves and rock solid frame will handle your plant's filtration needs without breaking a sweat.

LCSX Add-on Kit

For applications with existing tanks or for building your own lube room, the LCSX Add-on Kit provides all the filtration of the LCS in a self-contained, drop-in platform perfect for as many units as you desire and expanding on your time.

LCS Specifications

Consult Factory for Part Numbers & Pricing

Model	LCS2	LCS4	LCS6
Height	96" (244 cm)	96" (244 cm)	96" (244 cm)
Width	50" (127 cm)	88" (235 cm)	112" (285 cm)
Depth	60" (152 cm)	60" (152 cm)	60" (152 cm)
Inlets	1" FNPT	1" FNPT	1" FNPT
Outlets	Open Nozzle + ¾" Male QD	Open Nozzle + ¾" Male QD	Open Nozzle + ¾" Male QD
Filter Element Configuration	S75 Spin-On, S75D Spin-On, MF3 L13 and optional 2 stage systems available		
Seals	Fluorocarbon or Nitrile (Buna)	Fluorocarbon or Nitrile (Buna)	Fluorocarbon or Nitrile (Buna)
ΔP Gages	Sliding, Pop-Up, Visual 0-25 psid (1.7 bard) available.		
Operating Pressure	150 psi (10 bar) maximum standard		
Operating Temperature	50°F to 100°F (10°C to 38°C)	50°F to 100°F (10°C to 38°C)	50°F to 100°F (10°C to 38°C)
Materials of Construction	**Reservoirs** Industrial coated steel; **Facing** Industrial coated aluminum	**Frame** Powder coated steel; **Grate** Aluminum	**Plumbing** Plated steel hydraulic fittings + stainless tubing; **Hoses** Reinforced synthetic
Reservoir Size	70 gal (265 liter), 150 gal (568 liter), 250 gal (946 liter) available standard. Contact factory for additional sizes.		
Electric	cUL listed industrial control panels. All voltages available.		
Electric Motors	TEFC, 56-184 frame 0.5-1 hp, 1200-1500 RPM	TEFC, 56-184 frame 0.5-1 hp, 1200-1500 RPM	TEFC, 56-184 frame 0.5-1 hp, 1200-1500 RPM
Motor Starter	MSP (motor starter/protector) with short circuit and overload protection.		
Pumps	Cast iron, positive displacement gear pump with internal relief. Maximum pressure on pump inlet 15 psi (1 bar). Consult factory for higher pressures.		
Pump Bypass	Full bypass at 150 psi (10 bar)[2]		
Media Description	**M** G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**A** G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	**W** Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)
Viscosity	10-5000 cSt		
Fluid Compatibility	Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.		

Custom Equipment

Application based contamination solutions tailored to meet your exact needs and exceed your expectations. Call Hy-Pro for more information.

HY-PRO

hyprofiltration.com/

Super high viscosity.

Applications such as dragline mining require oils in excess of ISO VG 680 that were previously considered unfilterable. Across the mines of Canada for more than three years, our dragline optimized filter skids have been eliminating unplanned downtime and maintenance in fluids with viscosities as high as ISO VG 1500 and temperatures down to 0°C.

Extreme temperatures.

Whether you're removing varnish from turbine oil in the deserts of the Middle East or particulate from lube oil in the frozen tundra of the Arctic Circle, Hy-Pro can integrate specialized cooling and heating with smart controls to tackle contamination in any environment. Gearboxes running too hot? Hy-Pro can design and build a dual function solution to condition the oil and maintain your ideal operating temperature.

Compact size restrictions.

Overcrowded plants and streamlined vessels require careful consideration when integrating filtration systems. Engineered for maximum efficiency in minimal space, our filtration systems are designed to excel at maximizing your efficiency no matter the application or the space requirements.

Mobile fluid handling.

Integrating fluid storage and mobility has never been easier with the ability to add reservoirs to any standard product line or a completely customized unit. Take clean fluids with you to top off reservoirs or completely replace discarded oil in as large of reservoirs as your heart desires.

Explosion proof and code certified.

Navigating the red tape of safety classifications can be a nightmare. Take the hassle out of your filtration with systems designed and built to meet the regulations of nearly any certifications required.

Color coordinated to safety standards.

While we think Hy-Pro Blue is the perfect color for our equipment, all of our units can be tailored to meet your existing safety and identification standards.

TF4

In-Tank Filter Assembly

Ideal for installation on the return line to remove contaminant ingested or generated by the system.

Max Operating Pressure: 100 psi (6.9 bar)

HY-PRO

hyprofiltration.com/TF4

Elements that go beyond industry standard.

Hy-Pro's DFE rated G8 dualglass elements are rated to assure performance even when exposed to the toughest conditions that hydraulic systems can generate. Designed to provide the best filtration and ease of use, the HP4C coreless element gives you more options for disposal, meaning you improve your environmental impact ***and*** your bottom line.

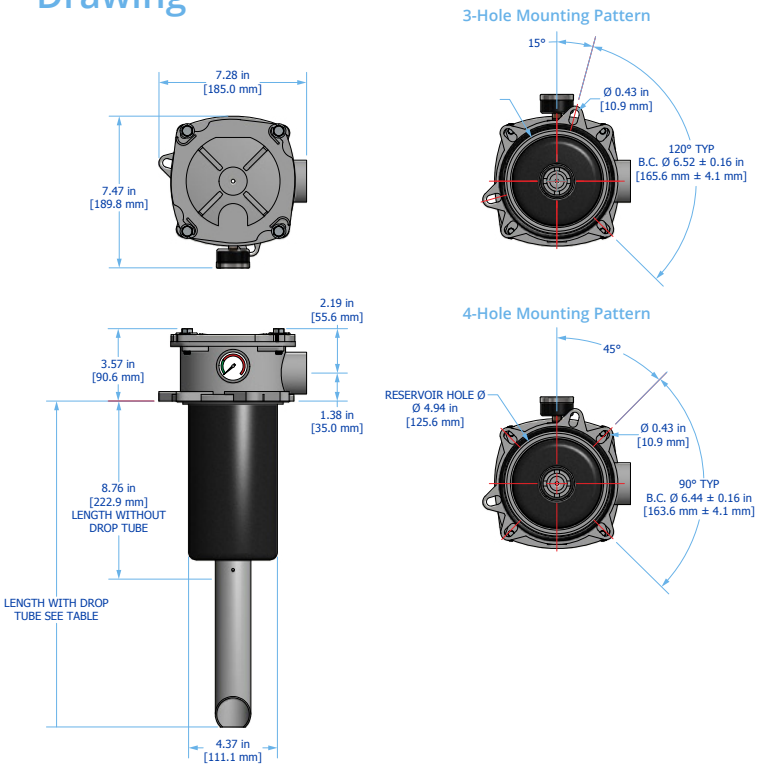
Works with your system.

Available with one or two inlet ports (180° orientation) for maximum flexibility of installation, you'll be amazed at how easily the TF4 integrates into your system. For applications requiring AIAG HF4 automotive standards compliance, the H4 special option incorporates the HPK filter element to ensure you meet compatibility requirements and exceed efficiency expectations.

Minimize the mess.

With most of the assembly inside the reservoir, the top loading housing on the TF4 provides easy and clean access when servicing or changing the element. To top it off, keyways on the twist open cover require only loosening of the bolts to access the element so lost parts during service becomes a thing of the past.

TF4 Installation Drawing



The perfect fit.

Coming in at just over 7" (185 mm) in diameter, the TF4 is the perfect compact solution for keeping your mobile equipment or power units operating at peak performance. And with mounting patterns to fit both North American and European formats, you'll get clean oil and increased efficiency no matter where you are.

Drop Tube Option	Length including Drop Tube
4" Nominal Extension	14.3" (363 mm)
6" Nominal Extension	16.3" (414 mm)
8" Nominal Extension	18.3" (465 mm)
9" Nominal Extension	19.3" (490 mm)
10" Nominal Extension	20.3" (516 mm)
12" Nominal Extension	22.3" (566 mm)

TF4 Specifications

Dimensions

See Installation Drawings on page 157 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

100 psi (6.9 bar) maximum

Pressure Switch Trigger

22 psi (1.5 bar)

Element Collapse Rating

HP4CL9
150 psid (10.3 bard)

HPKL9
290 psid (20 bard)

Integral Bypass Setting

25 psid (1.7 bard)

Materials of Construction

Head
Cast aluminum

Bowl
Polyammide

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Configuration	Filter Element Part Number	Example
Standard Filter Element	HP4CL9 – [Media Selection Code] [Seal Code]	HP4CL9–10AV
Special Option H4	HPKL9 – [Media Selection Code] [Seal Code]	HPKL9–6MB

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Units	Media 1M	3M	6M	10M	16M	25M	**W
psid/gpm	0.2370	0.2000	0.1550	0.1390	0.1360	0.1310	0.0240
bard/lpm	0.0043	0.0036	0.0028	0.0025	0.0025	0.0024	0.0004

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

TF4 Part Number Builder

TF4 [ ] [ ] [ ] - [ ] - [ ] [ ]

Connection | Bypass | Indicator | Special Options | Media | Seal

Connection

	Port Option	Max Flow Rate
B20	1.25" BSPT	40 gpm (151 lpm)[1]
N20	1.25" NPT	40 gpm (151 lpm)[1]
S20	1.25" SAE	40 gpm (151 lpm)[1]

Bypass

2	Integrated bypass - 25 psid (1.7 bard)

Pressure Indicator

DX	Electric pressure switch (DIN connection)
E	Electric switch with flying leads (3-wire connection)
G	Visual pressure gauge
X	No indicator (port plugged)

Special Options

D2[2]	Dual inlet ports, 180° orientation
H4[3]	HPK series element for automotive standards compatibility
4	4" (10 cm) nominal drop tube extension
6	6" (15 cm) nominal drop tube extension
8	8" (20 cm) nominal drop tube extension
9	9" (23 cm) nominal drop tube extension
10	10" (25 cm) nominal drop tube extension
12	12" (30 cm) nominal drop tube extension

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M[3]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A[3]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]Available with S4 port only.
[3]Replaces standard HP4C series element with HPKL9. Use 12M or 12A for respective media code in place of 10M or 10A.

TFR

In-Tank Filter Assemblies

Hy-Pro TFR in-tank filter assemblies are ideal for particulate contamination removal in hydraulic power unit return line and mobile hydraulic OEM installations.

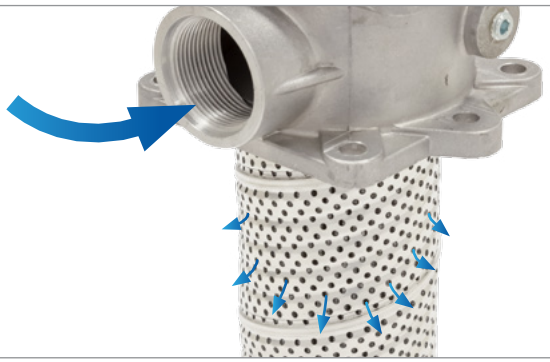
Max Operating Pressure: 150 psi (10 bar)

HY-PRO

hyprofiltration.com/TFR

Filtration starts with the filter.

Advanced DFE rated filter elements deliver lower operating ISO Codes with high efficiency particulate removal and retention efficiency. With a range of media options down to $\beta 2.5_{[c]} > 1000$ + water absorbing options, you get the perfect element for your application, every time.



Inside to out flow.

The dirtiest fluid in you system can be found before the filter element in the filter housing. Here, contaminants collect in the filter media and unless disposed of properly, can wreak havoc on your system after element service. That's why when you service the TFR element, which utilizes inside-to-outside flow, you remove all the dirt and contaminated fluid with the element.

Integral element bypass.

TFR elements include an integral, zero-leak bypass valve. Every time an element is changed a new bypass is installed eliminating bypass valve fatigue and leakage over time.

Minimize the mess.

With most of the assembly inside the reservoir, the top loading TFR housing provides easy and clean access during element service, no slippery spin-ons to handle. With the keyway cover and bolt arrangement lost parts during element service become a thing of the past.

Compact and sized for your system.

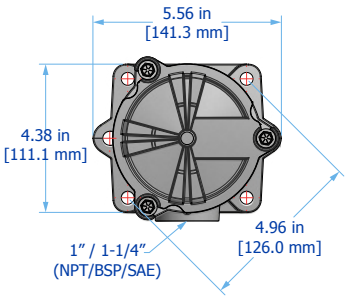
With three head sizes, multiple connection sizes, filter element lengths and diffuser options to choose from, TFR assemblies smoothly deliver clean fluids back to tank with a design that keeps things compact.

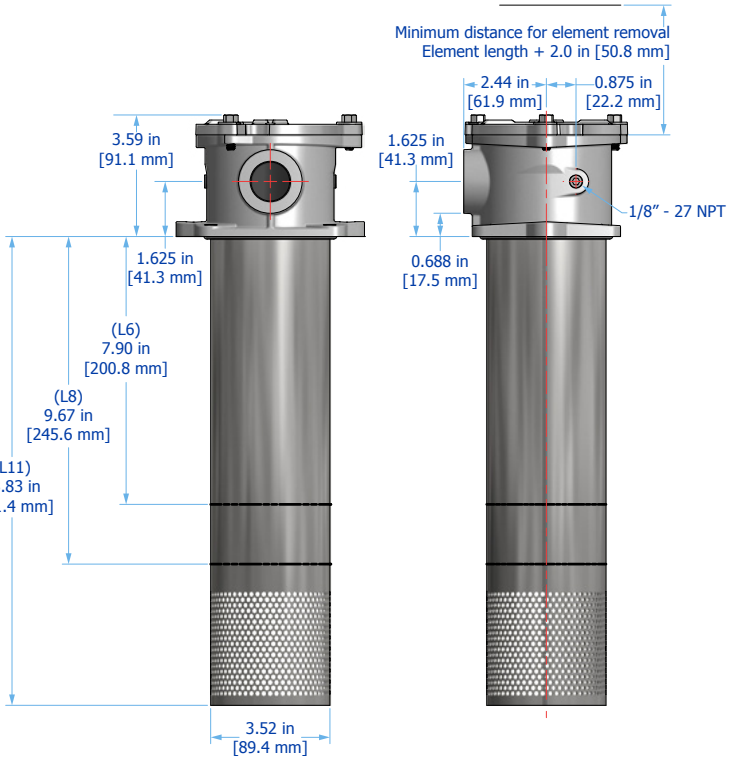
Eliminate aeration.

Smaller reservoirs with higher turnover and less settling time typically lead to aeration as fluids are churned and recirculated. The unique TFR element design minimizes turbulence and integral diffuser tube prevents aeration in compact hydraulic and high velocity return line applications by maintaining a column of fluid outside the filter element and above the fluid line to ensure your fluids are returned clean and without aeration.

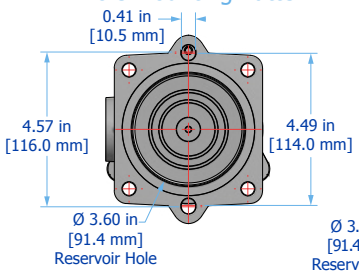
TFR Installation Drawings

TFR1 Installation Drawing

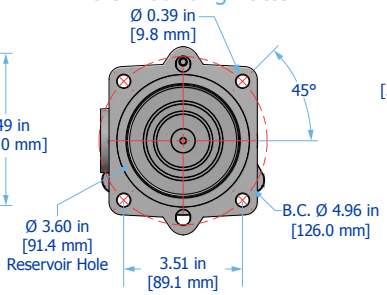




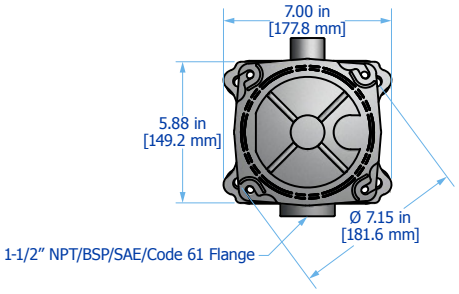
2-Hole Mounting Pattern

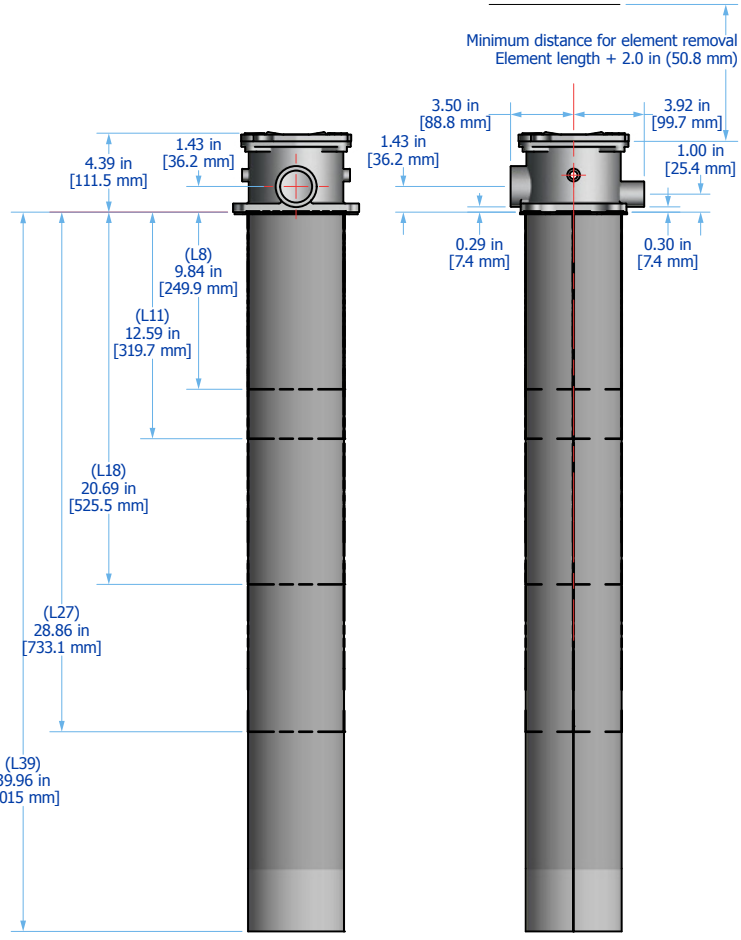


4-Hole Mounting Pattern

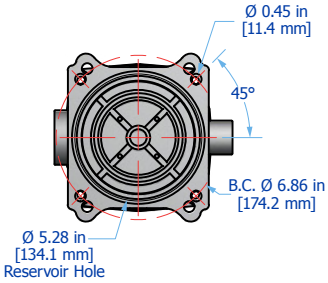


TFR2 Installation Drawing

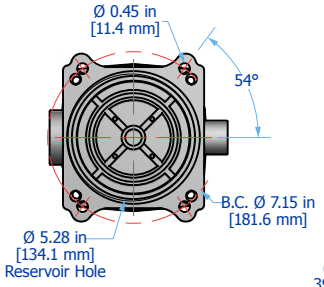




4-Hole Mounting Pattern



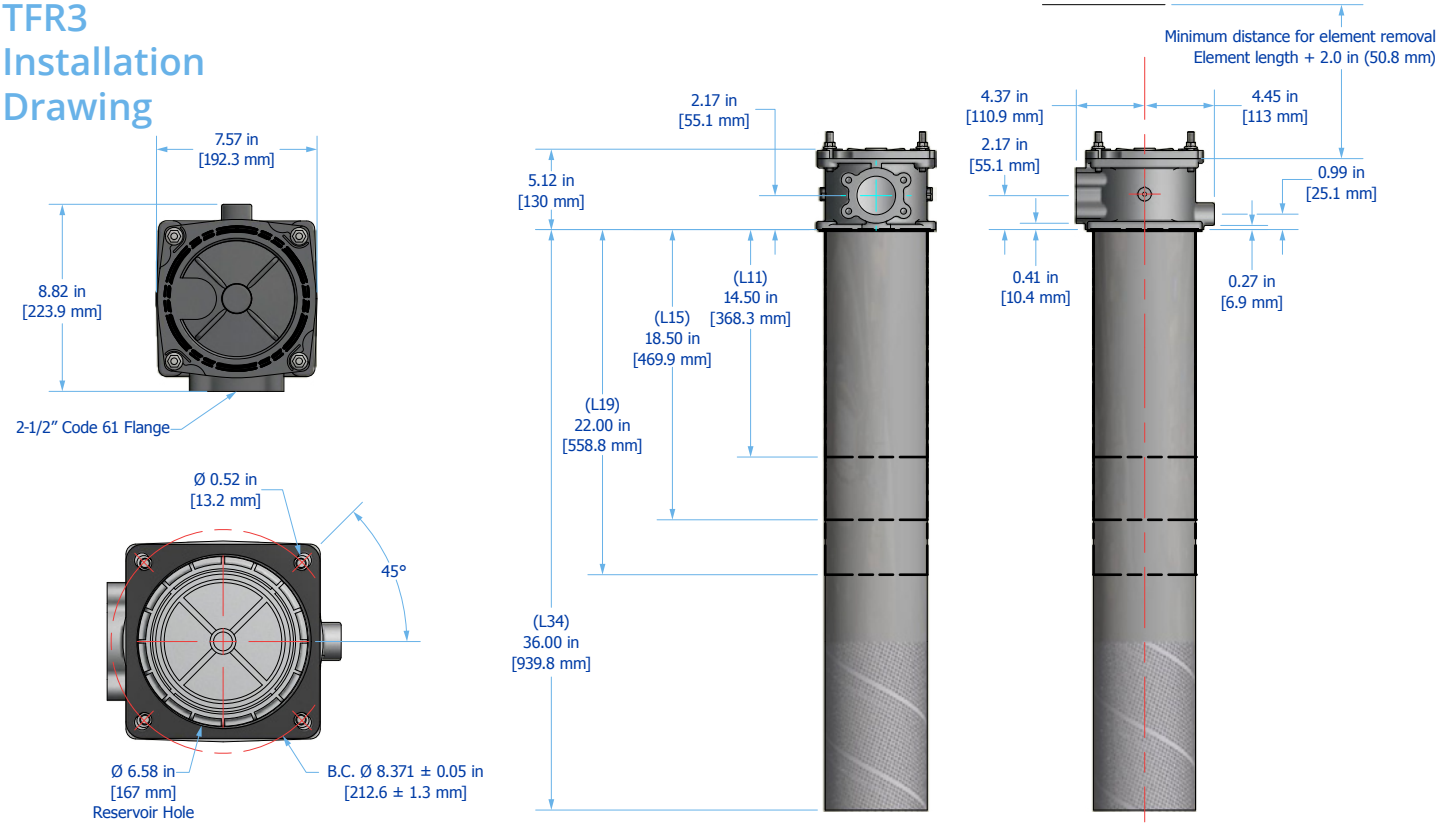
2-Hole Mounting Pattern



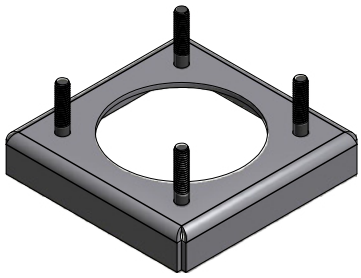
HY-PRO

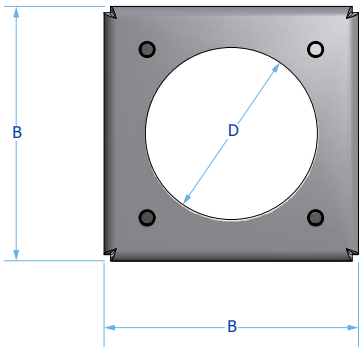
TFR Installation Drawings

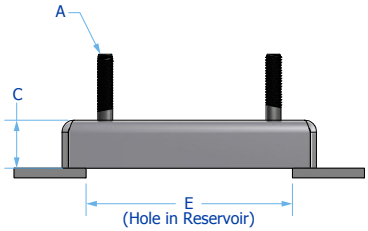
TFR3 Installation Drawing



TFR Weld Flange Installation Drawing







Series	TFR1	TFR2	TFR3
A	5/16" - 18 UNC-2A	3/8" - 16 UNC-2A	3/8" - 16 UNC-2A
B	5.33" (135.4 mm)	7.18" (18.2 mm)	21.2 (21.2 mm)
C	1.00" (25.4 mm)	1.00" (25.4 mm)	1.00" (25.4 mm)
D	3.59" (91.2 mm)	5.30" (134.6 mm)	6.67" (169.4 mm)
E	3.8-4.5" (96.5-114.3 mm)	5.5-6.25" (139.7-158.75 mm)	6.75-7.25" (171.5-184.2 mm)

TFR Specifications

Dimensions

See Installation Drawings on page 162-163 for model specific dimensions.

Operating Temperature

Fluid Temperature	Ambient Temperature
30°F to 225°F (0°C to 105°C)	-4°F to 140°F (-20C to 60C)

Operating Pressure

150 psi (10 bar) maximum

Pressure Switch Trigger

22 psi (1.5 bar)
45 psi (3.1 bar)

Visual Gauge

0-22 psi (0-1.5 bar), green to red
0-45 psi (0-3.1 bar), green to red

Element Collapse Rating

100 psid (6.9 bard)

Integral Bypass Setting

25 psid (1.7 bard) standard. For 50 psid (3.4 bard) option, select Bypass Option "3" in Assembly Part Number Builder and add "-50" to the end of Replacement Element part number.

Materials of Construction

Head	Diffuser	Element Bypass Valve
Cast aluminum	Powder coated or plated steel	Plated steel

Media Description

M	A	W
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Series Code	Bypass Code	Filter Element Part Number	Example
1	2	HPTFR1L[Element Length Code] – [Media Selection Code][Seal Code]	HPTFR1L6–6MV
	3	HPTFR1L[Element Length Code] – [Media Selection Code][Seal Code] – 50	HPTFR1L6–6MV–50
2	2	HPTFR2L[Element Length Code] – [Media Selection Code][Seal Code]	HPTFR2L27–10AB
	3	HPTFR2L[Element Length Code] – [Media Selection Code][Seal Code] – 50	HPTFR2L27–10AB–50
3	2	HPTFR3L[Element Length Code] – [Media Selection Code][Seal Code]	HPTFRL19–3ME-WS
	3	HPTFR3L[Element Length Code] – [Media Selection Code][Seal Code] – 50	HPTFRL19–3ME-WS–50

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Model	Length	Units	Media 1M	3M	6M	10M	16M	25M	**W
TFR1	L6	psid/gpm	0.5640	0.4759	0.3688	0.3308	0.3236	0.3117	0.0571
		bard/lpm	0.0103	0.0087	0.0067	0.0060	0.0059	0.0057	0.0010
	L8	psid/gpm	0.4846	0.4090	0.3170	0.2842	0.2781	0.2679	0.0491
		bard/lpm	0.0088	0.0074	0.0058	0.0052	0.0051	0.0049	0.0009
	L11	psid/gpm	0.3379	0.2852	0.2210	0.1982	0.1939	0.1868	0.0342
		bard/lpm	0.0062	0.0052	0.0040	0.0036	0.0035	0.0034	0.0006
TFR2	L8	psid/gpm	0.2370	0.2000	0.1550	0.1390	0.1360	0.1310	0.0240
		bard/lpm	0.0043	0.0036	0.0028	0.0025	0.0025	0.0024	0.0004
	L11	psid/gpm	0.1774	0.1497	0.1160	0.1041	0.1018	0.0981	0.0180
		bard/lpm	0.0032	0.0027	0.0021	0.0019	0.0019	0.0018	0.0003
	L18	psid/gpm	0.1009	0.0852	0.0660	0.0592	0.0579	0.0558	0.0102
		bard/lpm	0.0018	0.0016	0.0012	0.0011	0.0011	0.0010	0.0002
TFR3	L11	psid/gpm	0.1102	0.0930	0.0721	0.0646	0.0632	0.0609	0.0112
		bard/lpm	0.0020	0.0017	0.0013	0.0012	0.0012	0.0011	0.0002
	L15	psid/gpm	0.0834	0.0704	0.0545	0.0489	0.0479	0.0461	0.0084
		bard/lpm	0.0015	0.0013	0.0010	0.0009	0.0009	0.0008	0.0002
	L19	psid/gpm	0.0688	0.0580	0.0450	0.0403	0.0395	0.0380	0.0070
		bard/lpm	0.0013	0.0011	0.0008	0.0007	0.0007	0.0007	0.0001
	L34	psid/gpm	0.0398	0.0336	0.0260	0.0234	0.0228	0.0220	0.0040
		bard/lpm	0.0007	0.0006	0.0005	0.0004	0.0004	0.0004	0.0001

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

TFR Part Number Builder

TFR [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Series | Connection | Length | Bypass | Indicator | Special Options | Media | Seal

Series

Series

1	1.25" maximum inlet
2	1.5" maximum inlet
3	2.5" maximum inlet

Max Flow Rate

40 gpm (151 lpm)[1]
60 gpm (227 lpm)[1]
150 gpm (568 lpm)[1]

Connection

TFR1

B16	1" BSPT (tapered)
B20	1.25" BSPT (tapered)
N16	1" NPT
S16	1" SAE
S20	1.25" SAE

TFR2

B24	1.5" BSPT (tapered)
F24	1.5" Code 61 flange
N24	1.5" NPT
S24	1.5" SAE

TFR3

F40	2.5" Code 61 flange

Element Length[2]

TFR1

6	6" (15 cm) nominal
8	8" (20 cm) nominal
11	11" (28 cm) nominal

TFR2

8	8" (20 cm) nominal
11	11" (28 cm) nominal
18	18" (46 cm) nominal
27	27" (69 cm) nominal
39	39" (99 cm) nominal

TFR3

11	11" (28 cm) nominal
15	15" (38 cm) nominal
19	19" (48 cm) nominal)
34	34" (86 cm) nominal

Bypass

2[3]	Integrated bypass - 25 psid (1.7 bar)
3[4]	Integrated bypass - 50 psid (3.4 bar)

Pressure Indicator

DX	Electric pressure switch (DIN connection)
E	Electric switch with flying leads (3-wire connection)
G	Visual pressure gauge
X	No indicator (port plugged)

Special Options

R[5]	Exclude diffuser tube
W	Reservoir weld flange

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]Improper length selection could result in reservoir foaming. Consider diffuser and element length and anticipated reservoir fluid level when sizing. To protect against foaming, using longer lengths is recommended.
[3]Standard Bypass Rating. Consult Hy-Pro for alternate valve setting.
[4]When selected, add "-50" to end of replacement element part number.
[5]Excluding diffuser tube can result in reservoir foaming in high flow density applications.

LF(M)

High Viscosity Filter Assemblies

Low pressure filter assemblies optimized for high flow hydraulic, high viscosity lube and heavily contaminated fuel applications.

Max Operating Pressure: 150 psi (10 bar)
Available options up to 1000 psi (68.9 bar)

HY-PRO

hyprofiltration.com/LF

Filtration starts with the filter.

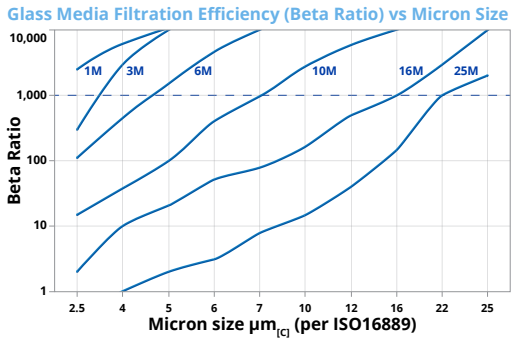
The oversized coreless filter element in every LF delivers lower ISO Codes over a long element lifespan to ensure low disposal impact, simultaneously reducing your environmental footprint and your bottom line. To top it off, select elements come standard with an integral zero-leak bypass so with every filter change you get a new bypass along with peace of mind.

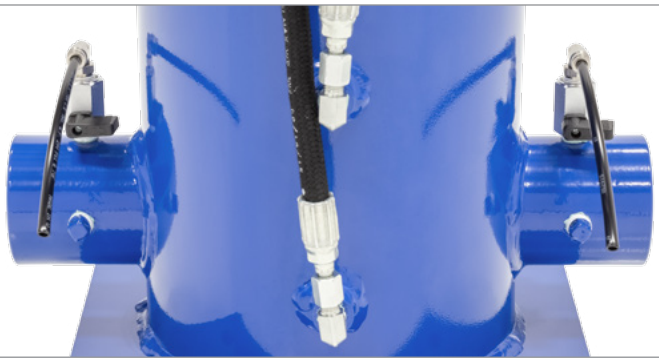
Built for industrial use.

Constructed from heavy duty carbon steel (standard) or the optional 304 or 316 stainless steel, the LF filter housings are designed to excel in even the toughest industrial conditions. Multiround units go even further to provide increased capacity whether you're operating with incredibly high viscosity oils, extreme flow rates or need extended service intervals.

Element configuration & media options.

With media options down to $\beta 0.9_{[C]} > 1000$, insoluble varnish removal and water absorbing options, you get the perfect element for your application, every time. Element configurations include Hy-Pro HP106 and HP107 coreless style elements with integral, zero-leak bypass valves. For those plants using 8314 style industry standard elements, the HP8314 offers an improved bypass valve design.



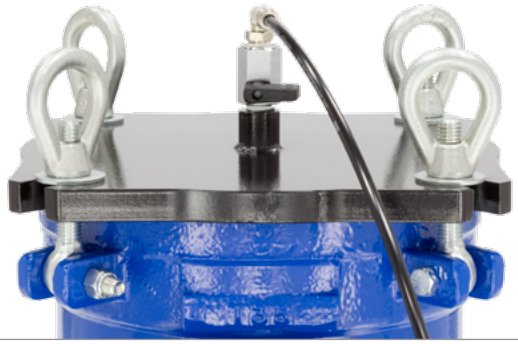


Setting the new standard.

Sampling and condition monitoring are no longer optional, they're a necessity. That's why every LF comes standard with sample ports and green to red true ΔP gages that indicate exact element condition at all times. With access to accurate system cleanliness conditions, you'll know exactly how well your filtration is performing.

Minimize the mess.

Top loading filter housings minimize the mess from element services and changes. And with the easy open swing bolt lid design, you'll be back to filtering your fluids without having to search for all those lost parts.

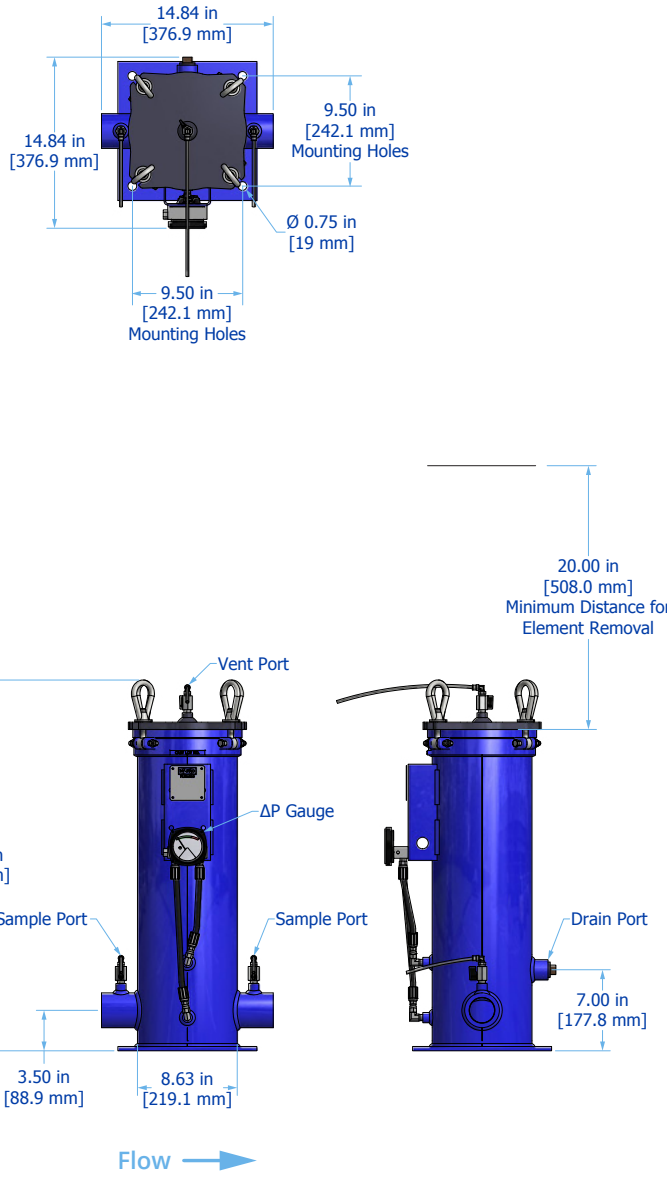


Seamlessly integrated into your systems.

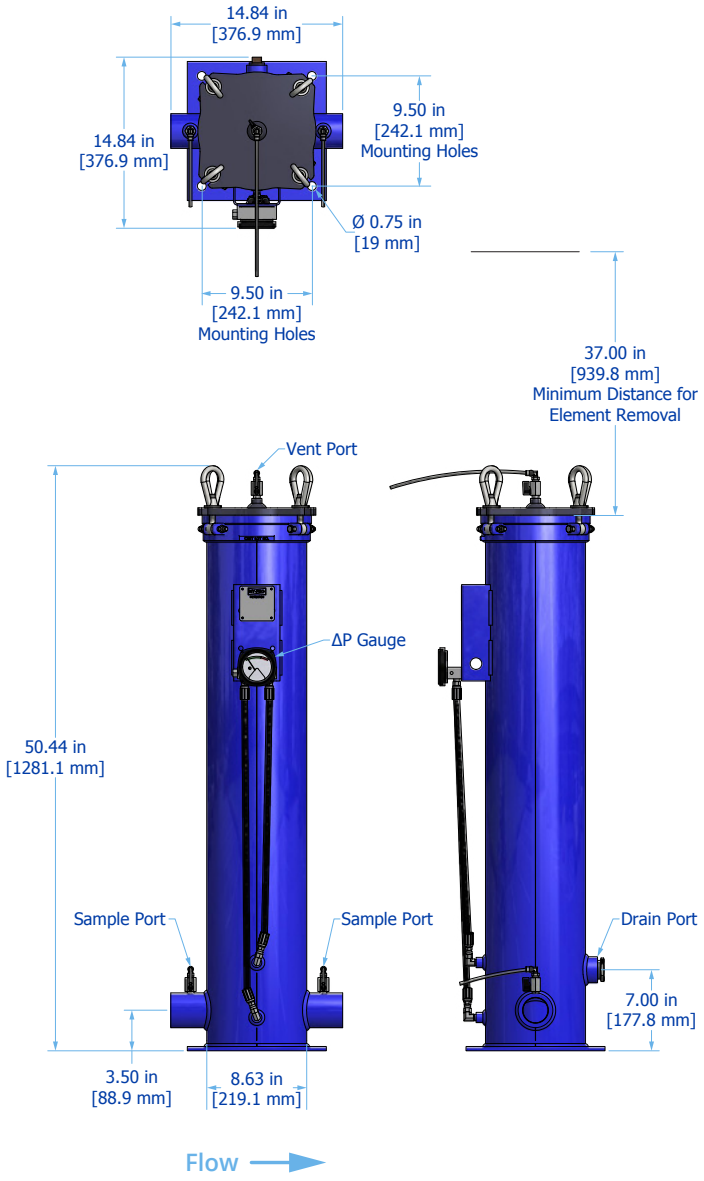
Multiple connection options and port customization provide the flexibility to integrate LF directly into existing re-circulating or auxiliary side loop and dispensing lines to improve fluid cleanliness and optimize existing assets. Get filtration exactly where you need it without extra expense of installing new plumbing and electrical.

LF Installation Drawings

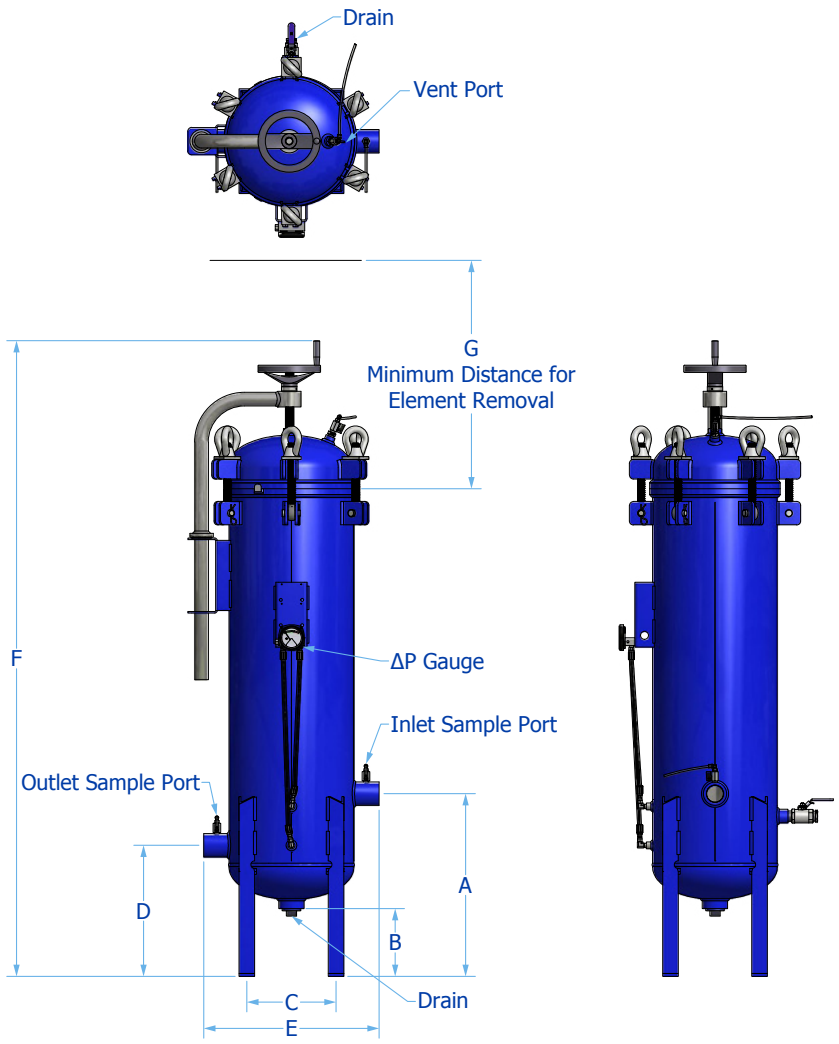
LF (L18) Installation Drawing



LF (L36) Installation Drawing



LFM Installation Drawings



Series	Number of Elements	Port Size	Vessel Diameter	A	B	C	D	E	F	G	Weight
LFM	3	2	16.0 in 40.6 cm	27.1 in 68.8 cm	13.0 in 33.0 cm	14.1 in 35.8 cm	16.8 in 42.7 cm	26.0 in 66.0 cm	78.5 in 199.4 cm	37.0 in 94.0 cm	465.0 lb 210.9 kg
		3	16.0 in 40.6 cm	27.1 in 68.8 cm	13.0 in 33.0 cm	14.1 in 35.8 cm	16.8 in 42.7 cm	26.0 in 66.0 cm	78.5 in 199.4 cm	37.0 in 94.0 cm	465.0 lb 210.9 kg
		4	16.0 in 40.6 cm	27.1 in 68.8 cm	13.0 in 33.0 cm	14.1 in 35.8 cm	16.8 in 42.7 cm	26.0 in 66.0 cm	78.5 in 199.4 cm	37.0 in 94.0 cm	65.0 lb 29.5 kg
	4	2	18.0 in 45.7 cm	29.8 in 75.7 cm	13.0 in 33.0 cm	16.1 in 40.9 cm	17.5 in 44.5 cm	26.0 in 66.0 cm	83.0 in 210.8 cm	37.0 in 94.0 cm	550.0 lb 249.5 kg
		3	18.0 in 45.7 cm	29.8 in 75.7 cm	13.0 in 33.0 cm	16.1 in 40.9 cm	17.5 in 44.5 cm	26.0 in 66.0 cm	83.0 in 210.8 cm	37.0 in 94.0 cm	550.0 lb 249.5 kg
		4	18.0 in 45.7 cm	29.8 in 75.7 cm	13.0 in 33.0 cm	16.1 in 40.9 cm	17.5 in 44.5 cm	26.0 in 66.0 cm	83.0 in 210.8 cm	37.0 in 94.0 cm	550.0 lb 249.5 kg
	9	3	24.0 in 61.0 cm	32.3 in 82.0 cm	13.0 in 33.0 cm	23.5 in 59.7 cm	23.7 in 60.2 cm	37.3 in 94.7 cm	89.0 in 226.1 cm	37.0 in 94.0 cm	645.0 lb 292.6 kg
		4	24.0 in 61.0 cm	32.3 in 82.0 cm	13.0 in 33.0 cm	23.5 in 59.7 cm	23.7 in 60.2 cm	37.3 in 94.7 cm	89.0 in 226.1 cm	37.0 in 94.0 cm	645.0 lb 292.6 kg
		6	24.0 in 61.0 cm	32.3 in 82.0 cm	13.0 in 33.0 cm	23.5 in 59.7 cm	23.7 in 60.2 cm	37.3 in 94.7 cm	89.0 in 226.1 cm	37.0 in 94.0 cm	645.0 lb 292.6 kg

[1]Dimensions are approximations taken from base model and will vary according to options chosen and customer sizing requirements.

LF(M) Specifications

Dimensions

See Installation Drawings on page 168-169 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

150 psi (10 bar) standard, see Special Options for additional pressure ratings.

Element Collapse Rating

HP105	HP106	HP107	HP8314 (All Codes)
150 psi (10.3 bar)	150 psi (10.3 bar)	150 psi (10.3 bar)	150 psi (10.3 bar)

Integral Bypass Setting

HP106 – integral element bypass	HP107 – Integral element bypass	HP8314 (Code 82) – Integral housing bypass	HP8314 (Code 83) – Integral housing bypass
25 psid (1.7 bard)	50 psid (3.4 bard)	25 psid (1.7 bard)	50 psid (3.4 bard)

Materials of Construction

Housing
Carbon steel with industrial coating
Optional 304/316 stainless steel

Media Description

M	A	W	VTM
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)	Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)	$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Element Type Code	Filter Element Part Number	Example
5	HP105L[Length Code] – [Media Selection Code][Seal Code]	HP105L36–6AB
6	HP106L[Length Code] – [Media Selection Code][Seal Code]	HP106L18–10MV
7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–VTM710V
8X	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–25WV
82	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB
85	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–16ME–WS

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Model	Length	Units	Media VTM	05M	1M	3M	6M	10M	16M	25M	**W
LF	16/18	psid/gpm	0.0628	0.0473	0.0463	0.0391	0.0303	0.0271	0.0266	0.0256	0.0046
		bard/lpm	0.0011	0.0009	0.0008	0.0007	0.0006	0.0005	0.0005	0.0005	0.0001
	36/39	psid/gpm	0.0440	0.0331	0.0324	0.0273	0.0212	0.0190	0.0186	0.0179	0.0032
		bard/lpm	0.0008	0.0006	0.0006	0.0005	0.0004	0.0003	0.0003	0.0003	0.0001
LFM3	36/39	psid/gpm	0.0122	0.0092	0.0081	0.0055	0.0051	0.0045	0.0041	0.0035	0.0029
		bard/lpm	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LFM4	36/39	psid/gpm	0.0091	0.0069	0.0067	0.0048	0.0044	0.004	0.0037	0.0032	0.0025
		bard/lpm	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00005

Model	Length	Units	Media 1A	3A	6A	10A	16A	25A
LF	16/18	psid/gpm	0.0514	0.0434	0.0336	0.0302	0.0295	0.0284
		bard/lpm	0.0009	0.0008	0.0006	0.0005	0.0005	0.0005
	36/39	psid/gpm	0.0360	0.0304	0.0235	0.0211	0.0207	0.0199
		bard/lpm	0.0007	0.0006	0.0004	0.0004	0.0004	0.0004
LFM3	36/39	psid/gpm	0.0073	0.0049	0.0046	0.0040	0.0037	0.0031
		bard/lpm	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LFM4	36/39	psid/gpm	0.0060	0.0043	0.0040	0.0036	0.0033	0.0029
		bard/lpm	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

LF(M) Part Number Builder

LF [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Series | Connection | Element Type | Element Length | ΔP Indicator | Special Options | Media | Seal

Series

Number of Elements		Max Flow Rate
omit	1 element	200 gpm (757 lpm)[1]
M3	3 elements	600 gpm (2271 lpm)[1]
M4	4 elements	800 gpm (3028 lpm)[1]
M9	9 elements	1800 gpm (6814 lpm)[1]
M14	14 elements	2800 gpm (10,600 lpm)[1]
M22	22 elements	4400 gpm (16,656 lpm)[1]
M38	38 elements	7600 gpm (28,769 lpm)[1]

Connection

A2	2" ANSI flange – 150# standard	**D8**	DN200 DIN flange – PN16 standard
A3	3" ANSI flange – 150# standard	**D10**	DN250 DIN flange – PN16 standard
A4	4" ANSI flange – 150# standard	**F2**[1]	2" Code 61 flange
A6	6" ANSI flange – 150# standard	**F3**[1]	3" Code 61 flange
A8	8" ANSI flange – 150# standard	**G2**	2" G thread (BSPP)
A10	10" ANSI flange – 150# standard	**G3**	3" G thread (BSPP)
D2	DN50 DIN flange – PN16 standard	**N2**	2" NPT
D3	DN80 DIN flange – PN16 standard	**N3**	3" NPT
D4	DN100 DIN flange – PN16 standard	**N4**	4" NPT
D6	DN150 DIN flange – PN16 standard	**S2**[2]	2" SAE threaded O-ring boss

Element Type

5	HP105 – no bypass	**8X**	HP8314 – no bypass
6	HP106 – 25 psid (1.7 bard) integral element bypass	**82**	HP8314 – 25 psid (1.7 bard) integral housing bypass
7	HP107 – 50 psid (3.4 bard) integral element bypass	**85**	HP8314 – 50 psid (3.4 bard) integral housing bypass

Element Length

18[3]	L18 single length filter housing and coreless element	**16**[3]	L16 single length filter housing and coreless element
36[3]	L36 single length filter housing and coreless element	**39**[3]	L39 single length filter housing and coreless element

ΔP Indicator

D	22 psid visual gauge + electric switch	**H**	65 psid visual gauge + electric switch
E	22 psid visual gauge	**J**	65 psid visual gauge (elements 5 or 8* only)
F	45 psid visual gauge + electric switch	**P**	2 pressure gages (industrial liquid filled)
G	45 psid visual gauge	**X**	None (ports plugged)

Special Options

omit	150 psi (10.3 bar) max operating pressure, carbon steel	**S4**[5]	1000 psi (68.9 bar) max oper. pressure, 304 stainless steel
F	Filter element ΔP gauge with tattle tale follower needle	**S9**[6]	Skydrol fluid compatibility modification
G	Spill retention pan with fork guides (industrial coated steel)	**U1**	U Code (ASME U code certified)
P9[4]	Phosphate ester fluid compatibility modification	**W**	Automatic air bleed valve
S1[5]	150 psi (10.3 bar) max oper. pressure, 304 stainless steel	**X**	250 psi (17.2 bar) max oper. pressure, carbon steel
S2[5]	250 psi (17.2 bar) max oper. pressure, 304 stainless steel	**Y**	450 psi (31.0 bar) max oper. pressure, carbon steel
S3[5]	450 psi (31.0 bar) max oper. pressure, 304 stainless steel	**Z**	1000 psi (68.9 bar) max oper. pressure, carbon steel

Media Selection

G8 Dualglass

05M	$\beta 0.9_{[C]} \geq 1000$, $\beta 1 \geq 200$
1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M[7]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

1A	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10A[7]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

VTM

VTM710[8] $\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1] Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2] Code 61 flange and SAE connection options include all other ports with SAE connections. When selected, no NPT connections are present in the assembly.
[3] Compatibility will be based on Element Type selection. For elements HP105, HP106, and HP107, use Length Code 18 or 36. Length Codes 16 and 39 only compatible with HP8314 element.
[4] When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[5] Lid closure hardware is plated carbon steel.
[6] When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[7] For elements HP8314, use 12M or 12A for respective media code in place of 10M or 10A.
[8] Only available on HP107 series elements. Max recommended flow rate 16 gpm (60 lpm) for HP107L36-VTM710* elements and 8 gpm (30 lpm) for HP107L18-VTM710* elements.

LFW

Wall Mounted Filter Assemblies

A compact, dedicated off-line contamination solution ideal for small reservoirs, gearboxes and diesel engine crankcase conditioning. Coming in at a whopping 0 ft² of floor space, the LFW is designed to get your filtration off the ground and positioned conveniently for you, whether you're polishing off that high viscosity gearbox oil or just want to add a little more protection for your critical components from heavy contaminants. And with Hy-Pro filter elements inside, the possibilities are endless for what you can do with the LFW.

Max Operating Pressure: 150 psi (10 bar)
Available options up to 250 psi (17.2 bar)

Elements that go beyond industry standard.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities so your equipment operates unimpeded by contamination. With media options down to $\beta 0.9_{[C]} > 1000$ + water absorption and integral element bypass valves, you get the perfect element for your application, every time.

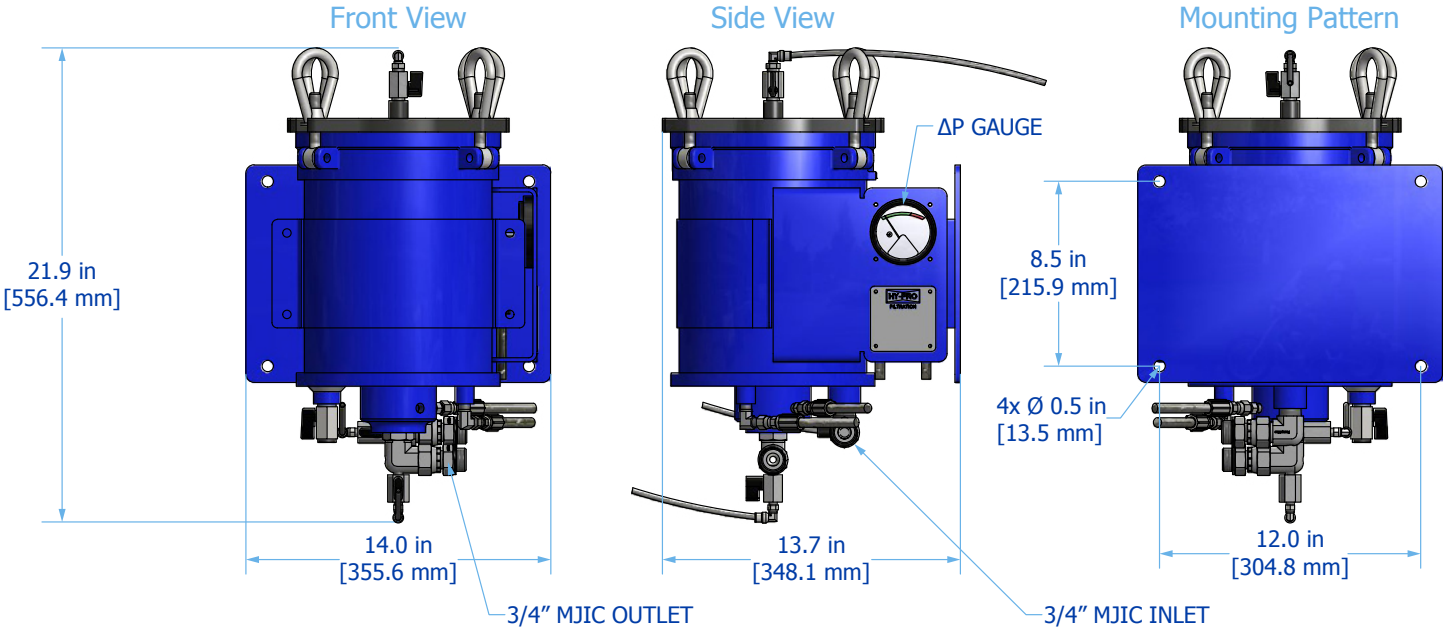
User friendly on a whole new scale.

With everything you need together in one tiny little package, LFW service and operation couldn't be easier. From the top loading housing to the sample ports, the LFW is built to match powerful filtration with your convenience. And with the easy-open swing bolt enclosure, worrying about lost parts during service becomes a thing of the past.

On board fuel filter upgrade.

New diesel engine fuel cleanliness requirements for high pressure injectors call for higher efficiency filters, rendering your existing on-board filters too small. The LFW element is sized just right and with available water absorbing media options, you'll get clean, dry fuel and the knowledge that your diesel engines are running more efficiently than ever.

LFW Installation Drawing



LFW Specifications

Dimensions

See Installation Drawings on page 173 for model specific dimensions.

Operating Pressure

150 psi (10 bar) maximum standard. For 250 psi (17.2 bar) select Special option "X."

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Materials of Construction

Vessel
Carbon steel with industrial coating

Element Bypass Valve
Nickel plated steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

VTM
$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Element Type Code	Filter Element Part Number	Example
6	HP106L10 – [Media Selection Code] [Seal Code]	HP106L10-10AB
7	HP107L10 – [Media Selection Code] [Seal Code]	HP107L10-3MV

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester (P9) or skydrol fluid (S9) compatibility select fluid compatibility from special options.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Units	Media							
	VTM	**1M**	**3M**	**6M**	**10M**	**16M**	**25M**	****W**
psid/gpm	0.1700	0.1670	0.0980	0.0600	0.0390	0.0250	0.0200	0.0160
bard/lpm	0.0031	0.0030	0.0018	0.0011	0.0007	0.0005	0.0004	0.0003

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

LFW Part Number Builder

LFW [ ] [ ] [ ] - [ ] - [ ] [ ]

Connection | Element Type | Indicator | Special Options | Media | Seal

Connection

	Port Option	Max Flow Rate
G12	¾" G thread (BSPP)	25 gpm (95 lpm)[1]
J12	¾" male JIC with 37° flare	25 gpm (95 lpm)[1]
N12	¾" FNPT	25 gpm (95 lpm)[1]

Element Type

6	HP106 coreless element, 25 psid (1.7 bard) integral element bypass
7	HP107 coreless element, 50 psid (3.4 bard) integral element bypass

ΔP Indicator

D	22 psid visual gauge + electric switch
E	22 psid visual gauge
F	45 psid visual gauge + electric switch
G	45 psid visual gauge
P	2 pressure gages (industrial liquid filled)

Special Options

F	Filter element ΔP gauge with tattle tale follower needle
P9[2]	Phosphate ester fluid compatibility modification
S2	51" (130 cm) Mounting stand – ships fully assembled
S9[3]	Skydrol fluid compatibility modification
W	Automatic air bleed valve
X	250 psi (17.2 bar) max oper. pressure

Media Selection

G8 Dualglass

05M	$\beta 0.9_{[C]} \geq 1000$, $\beta 1 \geq 200$
1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10A	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

VTM

VTM710[4]	$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[3]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[4]Only available on HP107 series elements. Max recommended flow rate 4 gpm (15 lpm) for HP107L10-VTM710* elements.

F8

Low Pressure, High Flow Filter Assembly

Ideal for high viscosity lubricating fluids, high flow hydraulic, and heavily contaminated fuel applications. Drop-in mounting interchange for common pulp and paper industry 8300/8310/8314 filter assemblies.

Max Operating Pressure: 500 psi (34.5 bar)

HY-PRO

hyprofiltration.com/F8

Filtration starts with the filter.

Advanced DFE rated filter elements deliver lower operating ISO Codes with high efficiency particulate removal and retention efficiency. With a range of media options down to $\beta 2.5_{[c]} > 1000$ + water absorbing options, you get the perfect element for your application, every time.

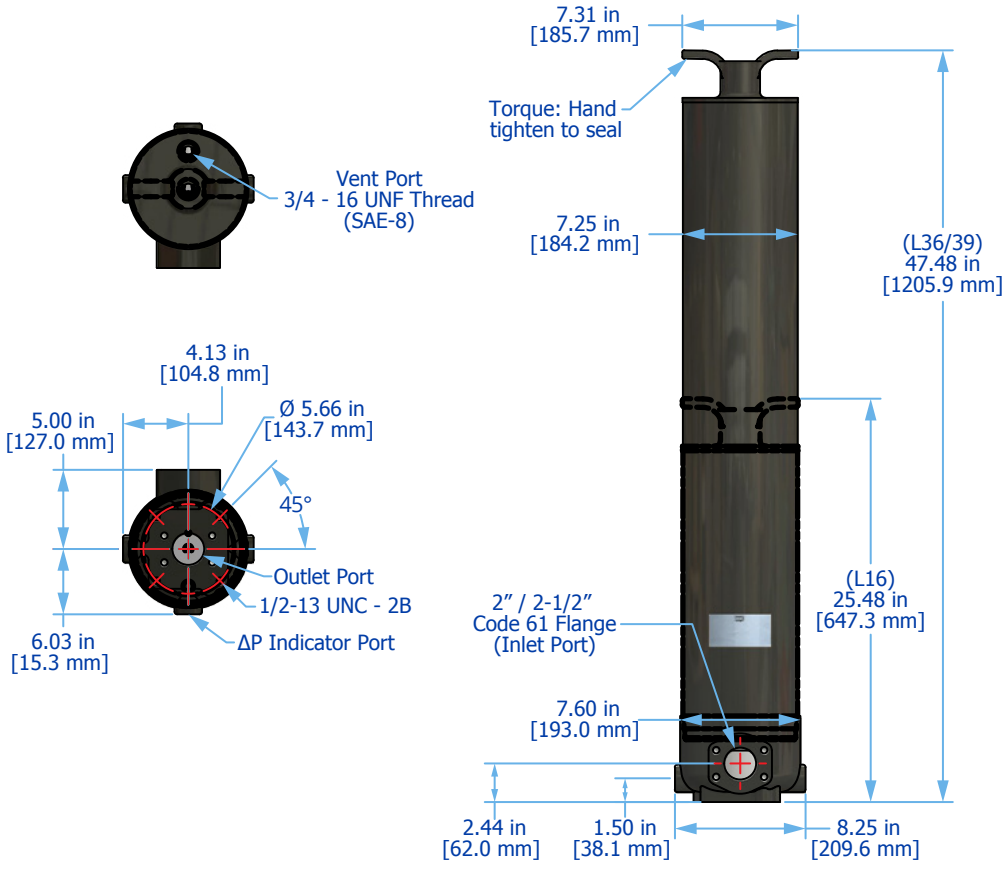
Minimize the mess.

The top loading housing on F8 filter assemblies provide easy and clean access when servicing or changing the element. Accessing the element is as simple as removing the housing cover, meaning you have no heavy bowl to lift and can get back in operation more quickly than ever.

Setting the new (industry) standard.

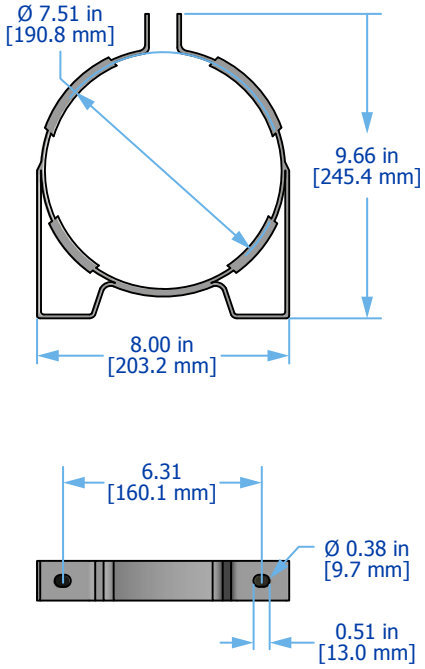
Designed as a drop-in replacement for industry standard 8300 series filter housings, only the F8 from Hy-Pro gives you the flexibility to choose from numerous DFE rated filter arrangements. Even upgrade your existing 83** series filter elements with the HP107 series to get a new integral bypass valve with every filter.

F8 Installation Drawing



F8 Mounting Bracket

(Not to scale)



HY-PRO

F8 Specifications

Dimensions

See Installation Drawings on page 177 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

500 psi (34.5 bar) max

ΔP Indicator Trigger

15 psi (1 bar): 25 psid bypass
35 psi (2.4 bar): 50 psid bypass + non bypass

Materials of Construction

Head/Lid
Cast aluminum (anodized)

Bowl
Industrial coated steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

VTM
$\beta 0.9_{[C]} \geq 1000$ particulate, insoluble oxidation by-product and water removal media

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Element Type Code	Filter Element Part Number	Example
5	HP105L[Length Code] – [Media Selection Code][Seal Code]	HP105L36–6AB
6	HP106L[Length Code] – [Media Selection Code][Seal Code]	HP106L16–10MV
7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–1MV
32	HP8310L[Length Code] – [Media Selection Code][Seal Code]	HP8310L16–25AV
35	HP8310L[Length Code] – [Media Selection Code][Seal Code]	HP8310L39–3MB
8X	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–25WV
82	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB
85	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–16ME–WS

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Length	Units	Media						
		1M	3M	6M	10M	16M	25M	**W
16	psid/gpm	0.0463	0.0391	0.0303	0.0271	0.0266	0.0256	0.0046
	bard/lpm	0.0008	0.0007	0.0006	0.0005	0.0005	0.0005	0.0001
36/39	psid/gpm	0.0324	0.0273	0.0212	0.0190	0.0186	0.0179	0.0032
	bard/lpm	0.0006	0.0005	0.0004	0.0003	0.0003	0.0003	0.0001

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

F8 Part Number Builder

F8 [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Connection | Element Type | Element Length | Indicator | Special Options | Media | Seal

Connection

	Port Option	Max Flow Rate
F32	2" Code 61 flange	300 gpm (1,136 lpm)[1]
F40	2.5" Code 61 flange	300 gpm (1,136 lpm)[1]

Element Type

5	HP105 – no bypass
6	HP106 – 25 psid (1.7 bard) integral element bypass
7	HP107 – 50 psid (3.4 bard) integral element bypass
32	HP8310 – 25 psid (1.7 bard) integral housing bypass
35	HP8310 – 50 psid (3.4 bard) integral housing bypass
8X	HP8314 – no bypass
82	HP8314 – 25 psid (1.7 bard) integral housing bypass
85	HP8314 – 50 psid (3.4 bard) integral housing bypass

Element Length

16	L16 single length filter housing and coreless element
36[2]	L36 single length filter housing and coreless element
39[2]	L39 single length filter housing and coreless element

ΔP Indicator

D	Visual with electric switch (DIN connection)
V	Visual/Mechanical
X	No indicator (port plugged)

Special Options

M1	Mounting stand for base mount applications

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M[3]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A[3]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]Compatibility will be based on Element Type selection. For elements HP105, HP106, and HP107, use Length Code 36. Length Code 39 only compatible with HP8310 and HP8314.
[3]For elements HP8310 and HP8314, use 12M or 12A for respective media code in place of 10M or 10A.

S75-76

Low Pressure Spin-On Filter Assemblies

Hy-Pro low pressure S series filters are designed for installation on the return line to remove contaminant ingested or generated by the system. Functions include off-line filtration (kidney loop or filter cart) and some suction applications.

Ideal for automotive manufacturing and assembly machine tools, mobile applications such as waste haulers and transit, filter carts and filter panels, and power unit return line/suction.

Max Operating Pressure: 200 psi (13.8 bar)

HY-PRO

hyprofiltration.com/S75

Media matters.

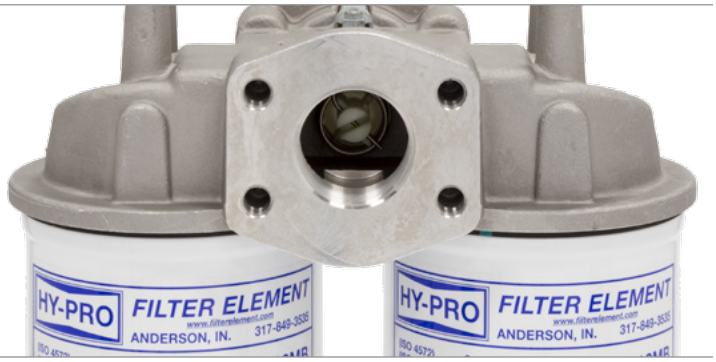
DFE rated filter elements stay true to efficiency ratings and ensure the highest level of particulate capture and retention capabilities. And with media options down to $\beta 2.5_{[C]} \geq 1000$ or $\beta 5_{[C]} \geq 1000$ + water removal, you can be sure contamination stays exactly where you want it: out of your fluid.

Multiple configurations.

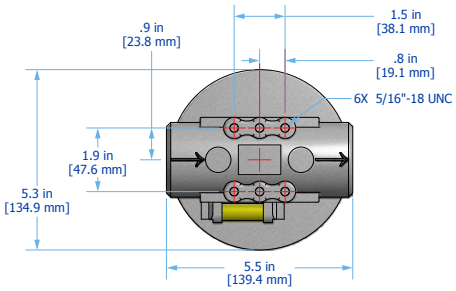
With a variety of connection types and sizes, mounting options, pressure indicators, media options and sample ports, there is a Spin-On assembly to meet the needs for almost any application.

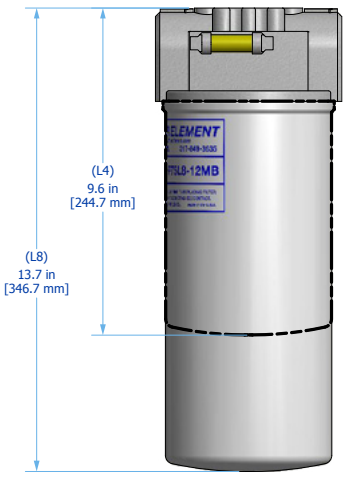
Double duty.

S75D assemblies pack double the punch using two Hy-Pro Spin-Ons in a parallel flow arrangement. Ideal for high flow or high viscosity applications, these assemblies offer unmatched filtration surface area in a compact size.

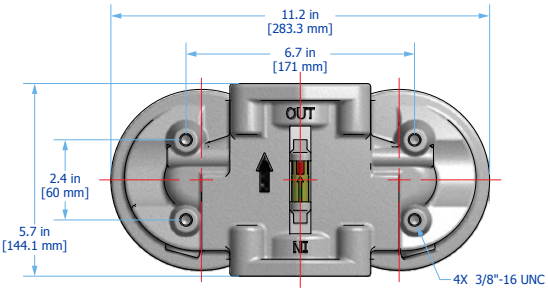


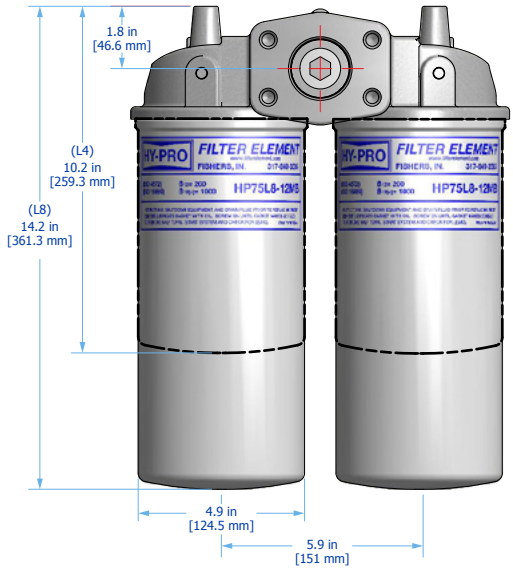
S75 Installation Drawing



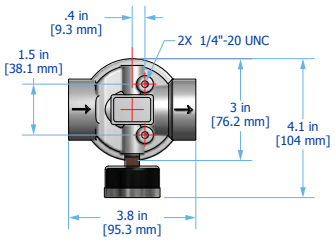


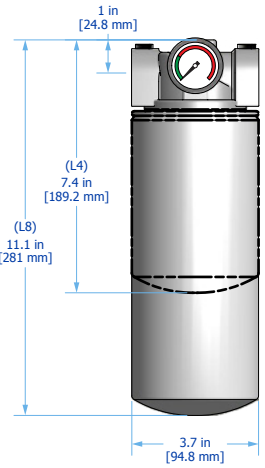
S75D Installation Drawing





S76 Installation Drawing





S75-76 Specifications

Dimensions

See Installation Drawings on page 181 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

200 psi (13.8 bar) max

ΔP Indicator Trigger

22 psi (1.5 bar) or 44 psi (3.0 bar)

Element Collapse

100 psid (6.9 bard) max

Materials of Construction

Head
Cast aluminum

Can
Stamped steel

Element Bypass Valve
Nylon

Element End Caps
Zinc or Tin coated carbon steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Series	Filter Element Part Number	Example
S75	HP75L[Length Code] – [Media Selection Code] [Seal Code]	HP75L4-25MV
S75D	HP75L[Length Code] – [Media Selection Code] [Seal Code]	HP75L8-12AB
S76	HP76L[Length Code] – [Media Selection Code] [Seal Code]	HP76L8-3MB

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Series	Length	Units	Media 1M	3M	6M	12M	16M	25M	**W
S75	L4	psid/gpm	0.332	0.280	0.217	0.195	0.190	0.183	0.033
		bard/lpm	0.006	0.005	0.004	0.004	0.003	0.003	0.001
	L8	psid/gpm	0.183	0.155	0.120	0.107	0.105	0.101	0.018
		bard/lpm	0.003	0.003	0.002	0.002	0.002	0.002	0.000
S75D	L4	psid/gpm	0.166	0.140	0.108	0.097	0.095	0.092	0.017
		bard/lpm	0.003	0.003	0.002	0.002	0.002	0.002	0.000
	L8	psid/gpm	0.092	0.077	0.060	0.054	0.053	0.051	0.009
		bard/lpm	0.002	0.001	0.001	0.001	0.001	0.001	0.000
S76	L4	psid/gpm	0.573	0.484	0.375	0.336	0.329	0.317	0.057
		bard/lpm	0.010	0.009	0.007	0.006	0.006	0.006	0.001
	L8	psid/gpm	0.310	0.261	0.203	0.182	0.178	0.171	0.031
		bard/lpm	0.006	0.005	0.004	0.003	0.003	0.003	0.001

Series	Length	Units	Media 3A	6A	12A	25A	3C	10C	25C
S75	L4	psid/gpm	0.311	0.241	0.216	0.204	0.448	0.292	0.284
		bard/lpm	0.006	0.004	0.004	0.004	0.008	0.005	0.005
	L8	psid/gpm	0.172	0.133	0.119	0.113	0.247	0.161	0.157
		bard/lpm	0.003	0.002	0.002	0.002	0.005	0.003	0.003
S75D	L4	psid/gpm	0.156	0.121	0.108	0.102	0.224	0.146	0.142
		bard/lpm	0.003	0.002	0.002	0.002	0.004	0.003	0.003
	L8	psid/gpm	0.086	0.067	0.060	0.056	0.124	0.081	0.078
		bard/lpm	0.002	0.001	0.001	0.001	0.002	0.001	0.001
S76	L4	psid/gpm	0.533	0.413	0.370	0.349	0.774	0.505	0.491
		bard/lpm	0.010	0.008	0.007	0.006	0.014	0.009	0.009
	L8	psid/gpm	0.288	0.223	0.200	0.188	0.418	0.273	0.265
		bard/lpm	0.005	0.004	0.004	0.003	0.008	0.005	0.005

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

S75-76 Part Number Builder

S [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Series | Connection | Element Length | Bypass | ΔP Indicator | Special Options | Media | Seal

Series

Series		Max Flow Rate
75	HP75 Series Filter Element, single head	50 gpm (189 lpm)[1]
75D	HP75 Series Filter Elements, double head	100 gpm (379 lpm)[1]
76	HP76 Series Filter Element, single head	30 gpm (111 lpm)[1]

Connection

S75		S75D		S76	
B20	1¼" BSP	**F32**	2" Code 61 flange	**B12**	¾" BSP
N20	1¼" NPT	**N24**	1½" NPT	**N12**	¾" NPT
S20	1¼" SAE, 1⅝" - 12	**S24**	1½" SAE, 1⅞" - 12	**N16**	1" NPT
				S8	½" SAE, ¾" - 16
				S12	¾" SAE, 1 1/16" - 12

Element Length

4	4" (10 cm) nominal length filter element
8	8" (20 cm) nominal length filter element

Bypass

02	3 psid (0.2 bard)
03	5 psid (0.3 bard)
1	15 psid (1.0 bard)
2	25 psid (1.7 bard)
3	50 psid (3.4 bard)
X	No bypass

ΔP Indicator

DX	Electrical pressure switch (DIN Connector)
E	Electrical pressure switch 3-Wire
G	Visual pressure gauge
V[2]	Visual ΔP indicator (sliding green to red)
X	No indicator (port plugged)

Special Options

S	Oil sampling port on filter head

Media Selection

G8 Dualglass		G8 Dualglass+water removal		Cellulose		Stainless wire mesh	
1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$	**3A**	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$	**3C**	$\beta 5_{[C]} \geq 5, \beta 3 \geq 5$	**25W**	25µ nominal
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$	**6A**	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$	**10C**	$\beta 12_{[C]} \geq 5, \beta 12 \geq 5$	**40W**	40µ nominal
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$	**12A**	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$	**25C**	$\beta 25_{[C]} \geq 5, \beta 25 \geq 5$	**74W**	74µ nominal
12M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$	**25A**	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$			**149W**	149µ nominal
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$						
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$						
40M	$\beta 35_{[C]} \geq 1000, \beta 40 \geq 200$						

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS[3]	EPR seals + stainless steel support mesh

[1] Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2] Only available with S75/S75D, Bypass Option "2" - 25 psid (1.7 bard).
[3] Only available with filter element HP75L8-3M

S409

Medium Pressure Spin-On Filter Assemblies

Hy-Pro medium pressure S series filters are designed for installation on the return line to remove contaminant ingested or generated by the system. Functions include off-line filtration (kidney loop or filter cart) and some suction applications.

Ideal for automotive manufacturing and assembly machine tools, mobile applications such as waste haulers and transit, filter carts and filter panels, and power unit return line/suction.

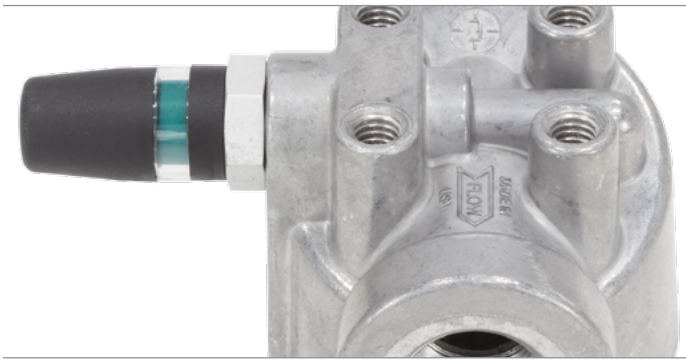
Max Operating Pressure: 500 psi (35 bar)

HY-PRO

hyprofiltration.com/S409

Media matters.

Only Hy-Pro S409 Spin-On assemblies come with DFE rated filter elements to ensure maximum particulate capture and retention. And with media options down to $\beta 2.5_{[C]} \geq 1000$, you can be sure contamination stays exactly where you want it: out of your fluid.



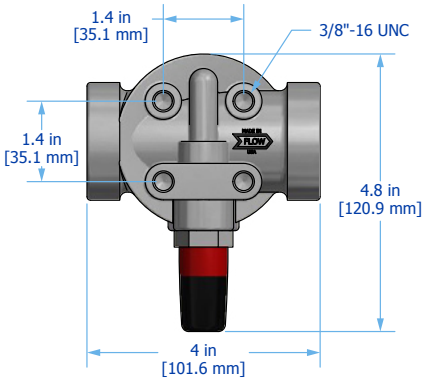
Easily configured.

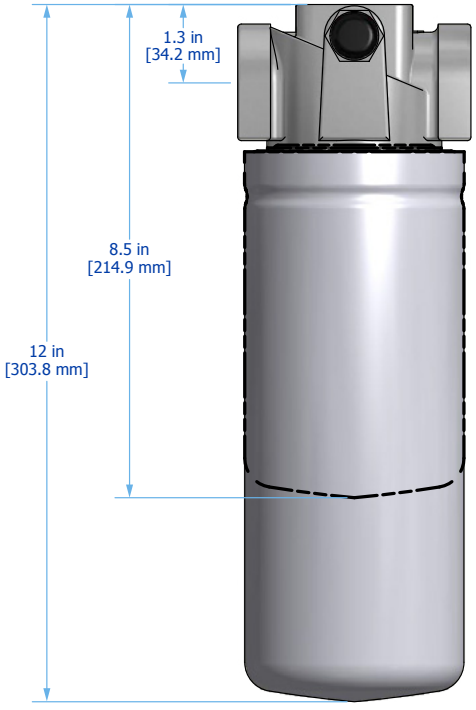
With a variety of connection types and sizes, indicator options, and included mounting provisions all in a compact package, the S409 is ready to go to work in mobile equipment, return line, hydrostatic and other applications.

Fits in all the right places.

With flow rates up to 35 gpm (132 lpm), temperature resistance to 200°F (93°C), a 2:1 safety factor, high fluid compatibility and a tight footprint, the S409 delivers the best filtration everywhere you need it. Even combine two S409 assemblies in series for incredibly low ISO Codes and water removal in a single pass.

S409 Installation Drawing





S409 Specifications

Dimensions[1]

See Installation Drawings on page 185 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

500 psi (34.5 bar) max

ΔP Indicator Trigger

22 psi (1.5 bar) or 44 psi (3.0 bar)

Element Collapse Rating

100 psid (6.9 bard) max

Materials of Construction

Head
Cast aluminum

Can
Stamped steel

Element Bypass Valve
Nylon

Element End Caps
Zinc or Tin coated carbon steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Filter Element Part Number
HP409L9 – [Media Selection Code] [Seal Code]

Example
HP409L9-10MB

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Length	Units	Media 1M	3M	6M	10M	25M	25A	**W
L9	psid/gpm	0.2961	0.2499	0.1937	0.1737	0.1699	0.1869	0.0306
	bard/lpm	0.0054	0.0046	0.0035	0.0032	0.0031	0.0034	0.0006

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

S409 Part Number Builder

S409 [ ] [ ] [ ] [ ] [ ] [ ] - [ ] [ ]

Connection | Element Length | Bypass | ΔP Indicator | ΔP Indicator Location | ΔP Indicator Setting | Media | Seal

Connection

	Port Option	Max Flow Rate
N12	3/4" NPT	25 gpm (95 lpm)[1]
N16	1" NPT	35 gpm (132 lpm)[1]
S12	3/4" SAE-12, 1 1/16" - 12	25 gpm (95 lpm)[1]
S16	1" SAE-16, 1 5/16" - 12	35 gpm (132 lpm)[1]

Element Length

9	9" (23 cm) nominal length filter element
X	No element

Bypass

2	25 psid (1.7 bard) bypass
3	50 psid (3.4 bard) bypass
X	No bypass

ΔP Indicator

C	dc electrical signal wire (no DIN or visual indication)
D	Visual with electric switch (DIN Connection)
V	Visual, Mechanical
X	No indicator (port plugged)

ΔP Indicator Location

L	Left side
R	Right side
T	Top mount
X	No indicator (port plugged)

ΔP Indicator Setting

2	ΔP 22 psi (1.5 bar) indicator setting
3	ΔP 44 psi (3.0 bar) indicator setting
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.

MF3

Medium Pressure Filter Assemblies

Ideal for mobile equipment return line applications as an alternative to spin-ons, on-board fuel and dispensing and hydrostatic charge circuits.

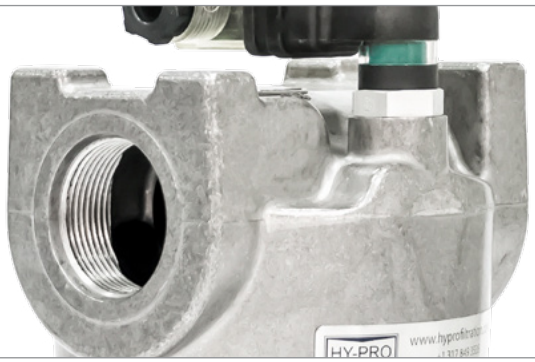
Max Operating Pressure: 1,200 psi (83 bar)

HY-PRO

hyprofiltration.com/MF3

Filtration starts with the filter.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities so your equipment operates unimpeded by contamination. With media options down to $\beta 2.5_{[C]} \geq 1000$, + water absorption, you get the perfect element for your application, every time.



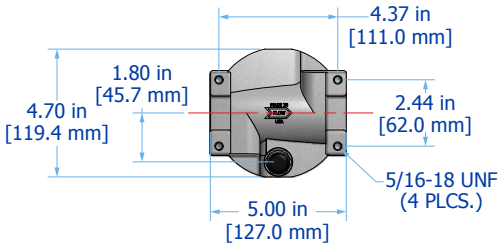
HF3 Compatible Design.

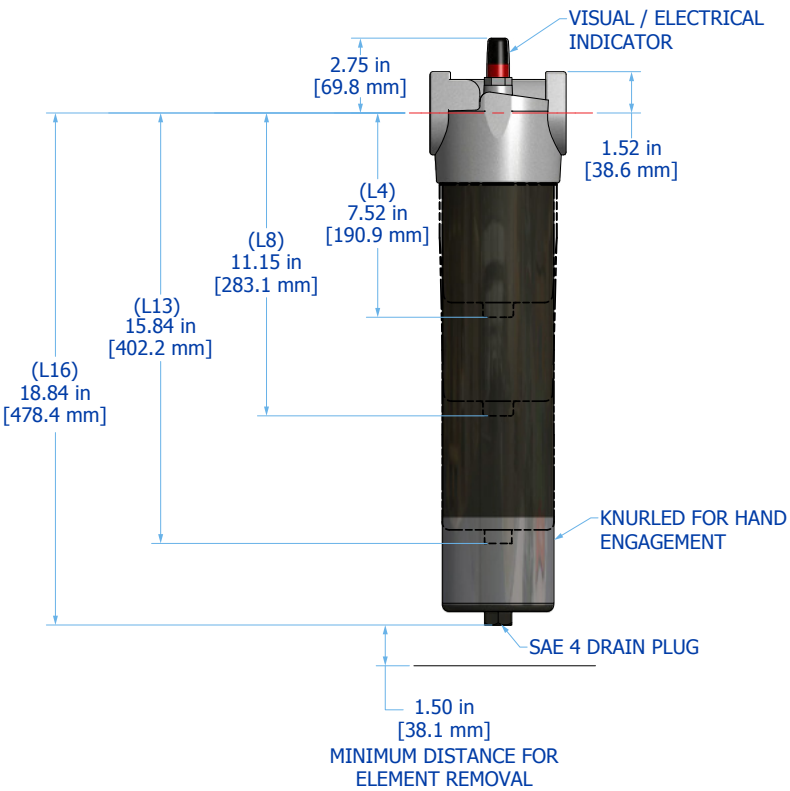
Port to port dimension, mounting pattern, and element design meet HF3 automotive specification. And with standard SAE drain ports, lightweight aluminum bowls, and knurled texture on the bowls provide ease for element servicing, you get all of the convenience you want with the compatibility you need.

Inherently versatile.

Unique internal flow paths providing a low clean pressure drop and element sizes from 4-16", the MF3 can be used in a variety of applications including Hydrostatic charge circuit for mobile equipment, CAT 5-Star service center, and return line alternative to spin-on assembles.

MF3 Installation Drawing





HY-PRO

MF3 Specifications

Dimensions

See Installation Drawings on page 189 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

1200 psi (83 bar) max

Burst Pressure

3000 psi (206.8 bar) max

ΔP Indicator Trigger

22 psid (1.52 bard) for 25 psid bypass
45 psid (3.10 bard) for 50 psid bypass and non bypass

Element Collapse Rating

290 psid (20 bard)

Materials of Construction

Head
Cast aluminum

Bowl
L4/L8: Cast aluminum
L13/L16: Anodized impact extruded aluminum

Element Bypass Valve
Nylon

Element End Caps
Zinc or Tin coated carbon steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Filter Element Part Number
HP60L[Length Code] – [Media Selection Code] [Seal Code]

Example
HP60L16-6MB

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Length	Units	Media 1M	3M	6M	12M	16M	25M	**W
L4	psid/gpm	0.459	0.357	0.268	0.186	0.171	0.149	0.027
	bard/lpm	0.008	0.007	0.005	0.003	0.003	0.003	0.000
L8	psid/gpm	0.324	0.252	0.206	0.156	0.151	0.143	0.026
	bard/lpm	0.006	0.005	0.004	0.003	0.003	0.003	0.000
L13	psid/gpm	0.237	0.200	0.155	0.139	0.136	0.131	0.024
	bard/lpm	0.004	0.004	0.003	0.003	0.002	0.002	0.000
L16	psid/gpm	0.203	0.174	0.148	0.134	0.131	0.129	0.023
	bard/lpm	0.004	0.003	0.003	0.002	0.002	0.002	0.000

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

MF3 Part Number Builder

MF3 [ ] [ ] [ ] [ ] - [ ] [ ]

Connection | Element Length | Bypass | ΔP Indicator | Media | Seal

Connection

	Port Option	Max Flow Rate
G20	1.25" G thread (BSPP)	75 gpm (284 lpm)[1]
N20	1.25" NPT	75 gpm (284 lpm)[1]
N24	1.5" NPT	100 gpm (379 lpm)[1]
S20	1.25" SAE	75 gpm (284 lpm)[1]
S24	1.5" SAE	100 gpm (379 lpm)[1]

Element Length

4	4" (10 cm) nominal length filter element and housing
8	8" (20 cm) nominal length filter element and housing
13	13" (33 cm) nominal length filter element and housing
16	16" (41 cm) nominal length filter element and housing

Bypass

1	25 psid (1.7 bard) bypass
3	50 psid (3.4 bard) bypass
X	No bypass

ΔP Indicator

D	Visual with electric switch (DIN Connection)
V	Visual/Mechanical
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12A	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS[2]	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]Only available with ΔP Indicator option "X" selected.

PF2

High Pressure In-Line Filter Assembly

Ideal for a variety of applications including mobile applications, paper and saw mills, power generation, general industrial machine tools, and automotive manufacturing. With HF2 compatible port-to-port dimension, mounting pattern, and element design to meet the automotive manufacturing standard.

Max Operating Pressure: 4000 psi (275 bar)

HY-PRO

hyprofiltration.com/PF2

Filtration starts with the filter.

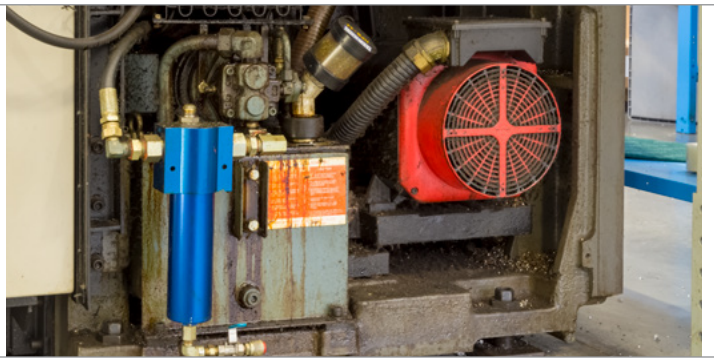
G8 Dualglass and PE glass elements are DFE rated to assure performance even when exposed to the toughest hydraulic systems and provide unmatched particulate capture and retention to remove contamination from your hydraulic and lube oils, for good.

Small size, huge results.

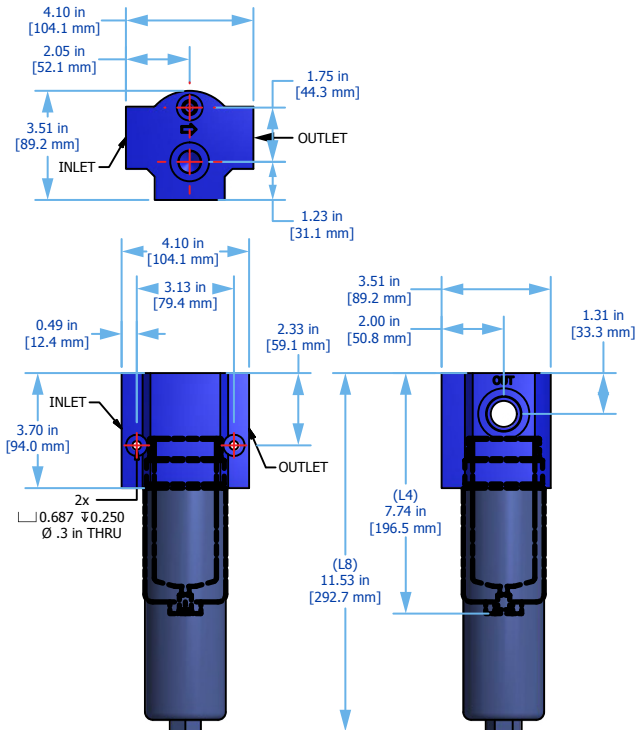
The compact size of PF2 filter assemblies make them the perfect addition directly upstream of your control valves and other sensitive components even in the tightest of spaces. And with two different mounting options to choose from, the incredible versatility of the PF2 makes it ideal for all of your high pressure filter applications.

Works under pressure.

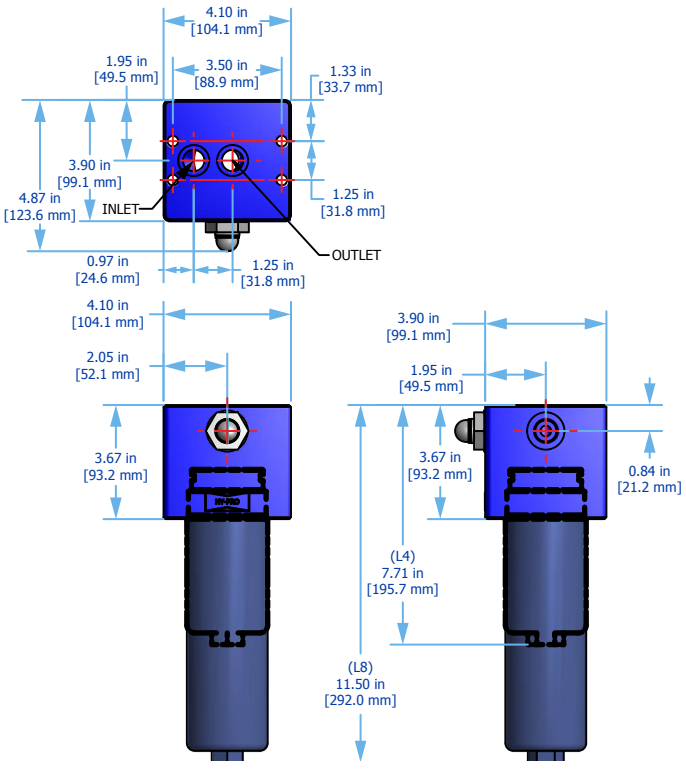
Applications for the PF2 include mobile, general industrial machine tools, paper mills, sawmills, and speed control circuits for power generation systems. So whether you're operating waste haulers, cement mixers, fire trucks, cranes, or CNC routers, you can be sure the PF2 will protect your critical components even when the pressure is on.



In-Line Mount Installation Drawing



Manifold Mount Installation Drawing



PF2 Specifications

Dimensions

See Installation Drawings on page 193 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

4000 psi (275 bar) max

Flow Fatigue Rating

2000 psi (137 bar)

Burst Pressure

12,000 psi (827 bar) max

ΔP Indicator Trigger

50 psid (3.4 bard) for bypass. 102 psid (7 bard) for non-bypass.
Thermal lockout indicator functions at or above 68°F (20°C), manual reset on visual indicators with exception to "V" option (auto reset standard).

Element Collapse Rating

Normal Collapse
290 psid (20 bard)

High Collapse
3000 psid (206 bard)

Integral Bypass Setting

60 psid (4.1 bard)

Materials of Construction

Head
Anodized aluminum
(grade T6061)

Bowl
Anodized aluminum
(grade T6061)
Bowl drain #4 SAE standard

Element Bypass Valve
Nickel plated/Stainless steel

Element End Caps
Zinc or Tin coated
carbon steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim.
$\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

SF
Dynafuzz stainless steel fiber media $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Filter Element Part Number
HP2[Collapse Rating Code]L[Length Code] – [Media Selection Code] [Seal Code]

Example
HP20L4-12MV

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Collapse	Length	Units	Media 1M	2M	3M	6M	12M	15M	16M	25M	**W
20	L4	psid/gpm	2.145	N/A	1.810	1.403	1.258	N/A	1.231	1.185	0.213
		bard/lpm	0.039	N/A	0.033	0.026	0.023	N/A	0.022	0.022	0.004
	L8	psid/gpm	1.118	N/A	0.944	0.731	0.656	N/A	0.642	0.618	0.111
		bard/lpm	0.020	N/A	0.017	0.013	0.012	N/A	0.012	0.011	0.002
21	L4	psid/gpm	2.287	1.930	N/A	1.496	N/A	1.341	1.312	1.264	0.228
		bard/lpm	0.042	0.035	N/A	0.027	N/A	0.024	0.024	0.023	0.004
	L8	psid/gpm	1.188	1.003	N/A	0.777	N/A	0.672	0.657	0.647	0.116
		bard/lpm	0.022	0.018	N/A	0.014	N/A	0.012	0.012	0.012	0.002

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

PF2 Part Number Builder

PF2 [ ] [ ] [ ] [ ] [ ] - [ ] [ ]

Connection | Collapse | Length | Bypass | Indicator | Media | Seal

Connection

	Port Option	Max Flow Rate
G12[1]	¾" G thread (BSPP)	20 gpm (76 lpm)[2]
M12	¾" Manifold top mount	20 gpm (76 lpm)[2]
S12[1]	¾" SAE	20 gpm (76 lpm)[2]

Collapse Rating

0[3]	290 psid (20 bard) normal collapse element
1	3000 psid (206 bard) high collapse element

Element Length

4	4" (10 cm) nominal length filter element and housing
8	8" (20 cm) nominal length filter element and housing

Bypass

4	60 psid (4.1 bard) bypass
X	No bypass

ΔP Indicator

DX	Electrical switch only (DIN connection)
T	Visual/mechanical with thermal lockout
V	Visual/mechanical
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
2M[4]	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
3M[5]	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
12M[5]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
15M[4]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
12A	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Dynafuzz stainless fiber

3SF	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
10SF	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Vent connection standard on G12 and S12 models - #4 SAE.
[2]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[3]When chosen, must be paired with Bypass option "4"
[4]Compatible only with High Collapse Rating option "1."
[5]Not available on High Collapse Rating option "1."

PF4

High Pressure Base Mounted Filter Assemblies

Hy-Pro PF4 pressure filters are designed for protecting sensitive components in hydraulic circuits. Install the series upstream of specific components or directly after the pressure pump to minimize risk of failure and costly system downtime.

Ideal for components that are sensitive to particulate contamination, such as the servo valve, and require clean pressurized fluid for reliable operation.

HY-PRO

hyprofiltration.com/PF4

Filtration starts with the filter.

G8 Dualglass elements are DFE rated to assure performance even when exposed to the toughest hydraulic systems and provide unmatched particulate capture and retention to protect servo valves and ensure you're operating at maximum efficiency.

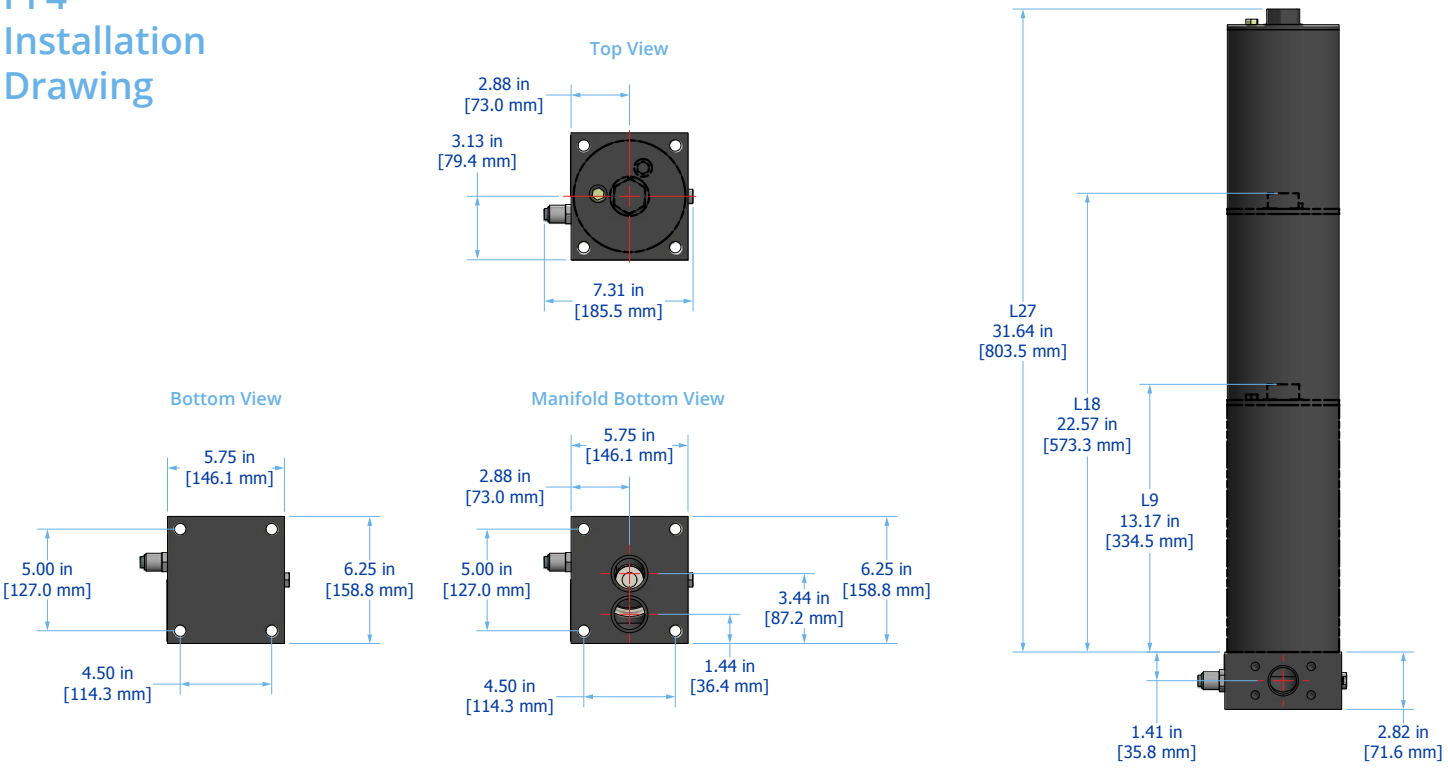
Minimize the mess.

The top loading housing on PF4 filter assemblies provide easy and clean access when servicing or changing the element. Accessing the element is as simple as removing the housing cover, meaning you have no heavy bowl to lift and can get back in operation quicker than ever.

HF4 Compatible Design.

The PF4 series is engineered to meet mill and plant target cleanliness codes and required ISO4406:1999 cleanliness standards to meet hydraulic component manufacturers warranties. Available with HF4 compatible port to port dimension, mounting pattern, and element design to meet the automotive manufacturing standard.

PF4 Installation Drawing



PF4 Specifications

Dimensions

See Installation Drawings on page 197 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

5,000 psi (310 bar) max

Flow Fatigue Rating

3,500 psi (238 bar)

Burst Pressure

13,500 psi (931 bar)

ΔP Indicator Trigger

35 psid (2.4 bard) bypass or 100 psid (6.9 bard) non-bypass
All indicators revert to original state when ΔP is removed (auto-reset).

Element Collapse Rating

HPK	HPK3	HPK5	HPKC
290 psid (20.0 bard)	3000 psid (206.8 bard)	5000 psid (344.7 bard)	150 psid (10.3 bard)

Integral Bypass Setting

50 psid (3.4 bard)

Materials of Construction

Head/Lid
Ductile iron

Bowl
Seamless steel tubing

Element Bypass Valve
Nylon

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[c]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[c]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Filter Element Part Number
HP[Collapse Rating Code]L[Length Code] – [Media Selection Code] [Seal Code]

Example
HPKL18–16MV

Fluid Compatibility

Petroleum and mineral based fluids (standard). For polyol ester, phosphate ester, and other specified synthetic fluids use fluorocarbon seal option or contact factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Collapse	Length	Units	Media 1M	3M	6M	12M	16M	25M	**W
PF4K**, PF4K1**, PF4KC**	L9	psid/gpm	0.2374	0.2003	0.1553	0.1392	0.1362	0.1312	0.0236
		bard/lpm	0.0043	0.0036	0.0028	0.0025	0.0025	0.0024	0.0004
	L18	psid/gpm	0.1167	0.0985	0.0764	0.0685	0.0670	0.0645	0.0116
		bard/lpm	0.0021	0.0018	0.0014	0.0012	0.0012	0.0012	0.0002
	L27	psid/gpm	0.0775	0.0654	0.0507	0.0454	0.0444	0.0428	0.0077
		bard/lpm	0.0014	0.0012	0.0009	0.0008	0.0008	0.0008	0.0001
PF4K3** (non-bypass housing)	L9	psid/gpm	0.3376	0.2849	0.2208	0.1980	0.1937	0.1866	0.0336
		bard/lpm	0.0061	0.0052	0.0040	0.0036	0.0035	0.0034	0.0006
	L18	psid/gpm	0.1651	0.1393	0.1080	0.0968	0.0947	0.0912	0.0164
		bard/lpm	0.0030	0.0025	0.0020	0.0018	0.0017	0.0017	0.0003
	L27	psid/gpm	0.1094	0.0924	0.0716	0.0642	0.0628	0.0605	0.0109
		bard/lpm	0.0020	0.0017	0.0013	0.0012	0.0011	0.0011	0.0002

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

PF4 Part Number Builder

PF4 [ ] [ ] [ ] [ ] [ ] - [ ] [ ]

Connection | Collapse | Length | Bypass | Indicator | Media | Seal

Connection

	Port Option	Max Flow Rate
C24	1.5" Code 62 flange	115 gpm (435 lpm)[1]
F24	1.5" Code 61 flange	115 gpm (435 lpm)[1]
M24	Manifold mount (see installation detail)	115 gpm (435 lpm)[1]
S24	1.5" SAE	115 gpm (435 lpm)[1]

Collapse Rating

K	290 psid (20.0 bard), HF4 element configuration
K3	3000 psid (206.8 bard), HF4 element configuration
K5	5000 psid (344.7 bard), HF4 element configuration
KC	150 psid (10.3 bard), Coreless with o-ring seals

Element Length

9	9" (23 cm) nominal length filter element and housing
18	18" (46 cm) nominal length filter element and housing
27	27" (69 cm) nominal length filter element and housing

Bypass

3	50 psid (3.4 bard) bypass
X	No bypass

ΔP Indicator

D	Visual with electric switch (DIN connection)
V	Visual/Mechanical
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
12A	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1] Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.

PFH

High Pressure In-Line Filter Assemblies

Hy-Pro's PFH pressure filters are designed to protect sensitive components in hydraulic circuits. Install the series upstream of specific components or directly after the pressure pump in smaller systems to minimize risk of failure and costly system downtime.

Ideal for use on a power unit pump discharge filter or pilot filter directly in front of valves and actuators.

Max Operating Pressure: 9137 psi (630 bar)

HY-PRO

hyprofiltration.com/PFH

Dynamic Filter Efficiency

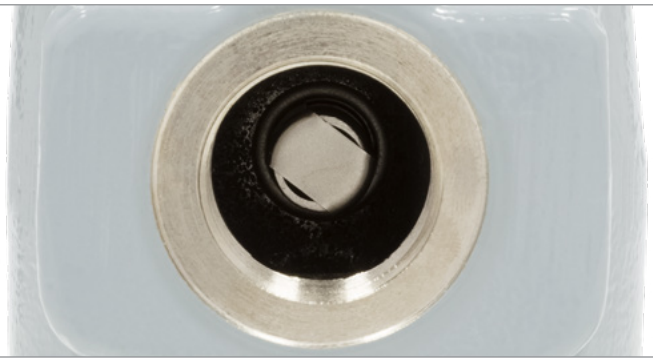
Hydraulic applications see dynamic flow changes on a regular basis. Dynamic Filter Efficiency testing takes the ISO 4409 Multi-Pass testing even further with variable flow shifts to ensure your filter elements stand up to real world conditions and maintain the highest capture and retention rates in the industry.

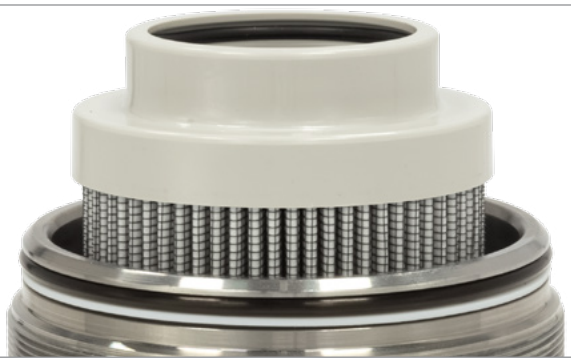
Industrial duty.

Standard mounting holes for optional brackets, stainless steel ID tags, a variety of indicator options, and standard drain ports make the PFH the ideal choice for heavy duty hydraulic filtration.

Unique applications.

With available nickel plating of internal components and coarse wire mesh media options, the PFH series is perfect for applications like drill rig mud pump and gearbox applications where water contamination wrecks traditional filtration. Even include Hy-Pro's G8 Dualglass media with Water Removal to take out dirt and water and leave your equipment operating more efficiently than ever.



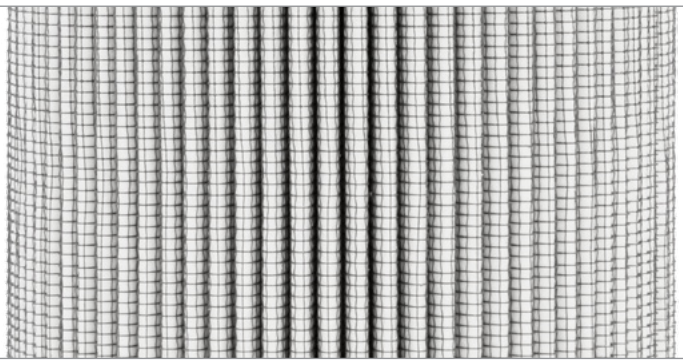


Minimize the mess.

The PFH series is available with Hy-Pro's coreless filter elements that can be readily disposed of through crushing or incineration. The circumferential o-ring bowl seal eliminates leaking and weeping. For easy cleaning and service, PFH bowls comes standard with drain plugs.

Extend the life of your element.

Unique internal flow paths provide low resistance to flow, resulting in a low housing pressure drop. Hy-Pro's advanced filter media delivers lower operating ISO Codes to eliminate internally generated contamination meaning your filter will have an incredibly long service life to protect your sensitive components better than ever.

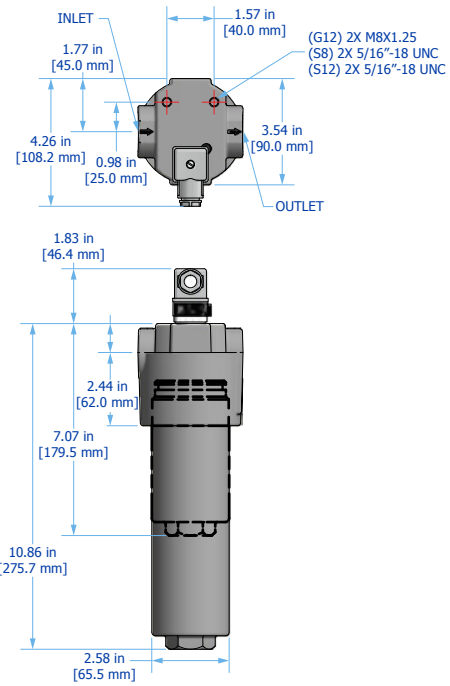


The ideal choice for hydraulics.

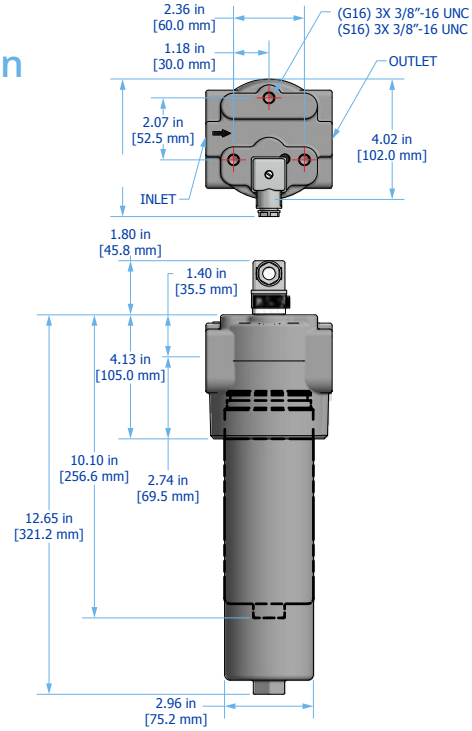
Use the PFH as the main high pressure filter(s) in a hydraulic system or upstream of sensitive components as a pilot filter to protect your valves and actuators. The PFH series are engineered to provide lower operating ISO Codes than what is required for compliance with hydraulic component manufacturers warranties.

PFH Installation Drawings

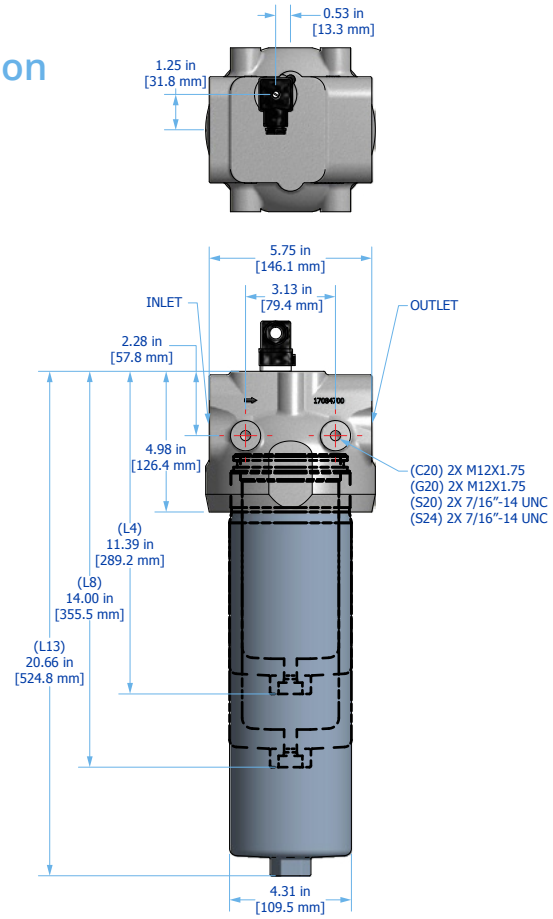
PFH131 Installation Drawing



PFH152 Installation Drawing

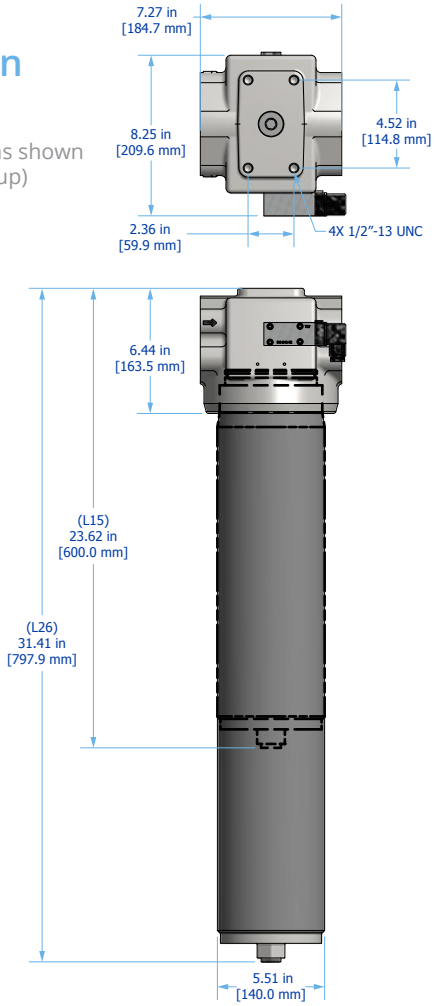


PFH419 Installation Drawing



PFH840 Installation Drawing

Can be mounted as shown or inverted (bowl-up)



PFH Sizing Guide

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Series	Length	Units	Media 1M	3M	6M	10M	16M	25M	**W
PFH131	L4	psid/gpm	2.4121	2.0355	1.5775	1.4147	1.3842	1.3333	0.2400
		bard/lpm	0.0439	0.0371	0.0287	0.0258	0.0252	0.0243	0.0044
	L8	psid/gpm	1.1674	0.9852	0.7635	0.6847	0.6699	0.6453	0.1162
		bard/lpm	0.0213	0.0179	0.0139	0.0125	0.0122	0.0118	0.0021
PFH152	L4	psid/gpm	0.9438	0.7964	0.6172	0.5535	0.5416	0.5217	0.0939
		bard/lpm	0.0172	0.0145	0.0112	0.0101	0.0099	0.0095	0.0017
	L8	psid/gpm	0.6769	0.5712	0.4427	0.3970	0.3884	0.3742	0.0673
		bard/lpm	0.0123	0.0104	0.0081	0.0072	0.0071	0.0068	0.0012
PFH419	L4	psid/gpm	0.4735	0.3996	0.3097	0.2777	0.2717	0.2617	0.0471
		bard/lpm	0.0086	0.0073	0.0056	0.0051	0.0049	0.0048	0.0009
	L8	psid/gpm	0.3415	0.2882	0.2234	0.2003	0.1960	0.1888	0.0340
		bard/lpm	0.0062	0.0052	0.0041	0.0036	0.0036	0.0034	0.0006
	L13	psid/gpm	0.2364	0.1995	0.1546	0.1387	0.1357	0.1307	0.0235
		bard/lpm	0.0043	0.0036	0.0028	0.0025	0.0025	0.0024	0.0004
PFH840	L15	psid/gpm	0.1613	0.1361	0.1055	0.0946	0.0926	0.0892	0.0160
		bard/lpm	0.0029	0.0025	0.0019	0.0017	0.0017	0.0016	0.0003
	L26	psid/gpm	0.1054	0.0889	0.0689	0.0618	0.0605	0.0582	0.0105
		bard/lpm	0.0019	0.0016	0.0013	0.0011	0.0011	0.0011	0.0002

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

PFH Specifications

Dimensions

See Installation Drawings on page 202 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

PFH131
5800 psi (400 bar)
min. 2 x 10^6 pressure cycles
Nominal pressure
according to DIN 24550

PFH152
5800 psi (400 bar)
min. 2 x 10^6 pressure cycles
Nominal pressure
according to DIN 24550

PFH419[1]
5220 psi (360 bar)
min. 2 x 10^6 pressure cycles
Nominal pressure
according to DIN 24550

PFH840
5800 psi (400 bar)
min. 2 x 10^6 pressure cycles
Nominal pressure
according to DIN 24550

Flow Fatigue Rating

PFH131
9137 (630 bar)
min. 2 x 10^4 pressure cycles
Quasi-static operating
pressure

PFH152
9137 (630 bar)
min. 2 x 10^4 pressure cycles
Quasi-static operating pressure

PFH419
9137 (630 bar)
min. 2 x 10^4 pressure cycles
Quasi-static operating
pressure

PFH840
9137 (630 bar)
min. 2 x 10^4 pressure cycles
Quasi-static operating
pressure

ΔP Indicator Trigger

73 psid (5 bard)

Element Collapse Rating

HP*N**
450 psid (31.0 bard) max

HP*H**
3000 psid (206.8 bard) max

HP*C**
250 psid (17.2 bard) max

Integral Bypass Setting

PFH131
102 psid (7 bard)

PFH152
102 psid (7 bard)

PFH419
102 psid (7 bard)

PFH840
87 psid (6.0 bard) – Integral
element bypass

Materials of Construction

Head
Cast steel

Bowl with Drain Plug
PFH131-419: Cold forged steel
PFH840: DOM tubing

Interior Coating
Phosphate

Exterior Coating
Industrial powder coating

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use the selected codes from the following page below:

Series Code	Filter Element Part Number	Example
131	HP131[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP131HL4-10MB
152	HP152[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP152NL8-16MV
419	HP419[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP419CL13-3AB
840	HP840[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP840NL15-25MB

Fluid Compatibility

Biodegradable and mineral based fluids. For high water based or specified synthetics consult factory.

[1]PFH419 C20 Connection Option rated for 6000 psi (414 bar) max operating pressure. M20 Connection Option rated for 7520 psi (518 bar) max operating pressure.

PFH Part Number Builder

PFH [ ] [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Series | Connection | Collapse | Length | Bypass | ΔP Indicator | Special Options | Media | Seal

Series

131	Nominal flow rate up to 15 gpm (57 lpm)[1]
152	Nominal flow rate up to 35 gpm (132 lpm)[1]
419	Nominal flow rate up to 95 gpm (360 lpm)[1]
840	Nominal flow rate up to 150 gpm (568 lpm)[1]

Connection

PFH131

G12	¾" G thread (BSPP)
S8	½" SAE
S12	¾" SAE

PFH152

G16	1" G thread (BSPP)
S16	1" SAE

PFH419

C20	1¼" Code 62 flange (6000 psi)
G20	1¼" G thread (BSPP)
M20	1.22" Manifold mount
S20	1¼" SAE
S24	1½" SAE

PFH840

C32	2" Code 62 flange (6000 psi)

Collapse Rating

C[2]	250 psid (17.2 bard) – Coreless element with integral bypass (includes post assembly for element support)
H	3000 psid (206.8 bard) – High collapse element with no housing bypass
N[3]	450 psid (31.2 bard) – Core-in element with housing bypass

Length

PFH131

4	4" (10 cm) nominal
8	8" (20 cm) nominal

PFH152

4	4" (10 cm) nominal
8	8" (20 cm) nominal

PFH419

4	4" (10 cm) nominal
8	8" (20 cm) nominal
13	13" (33 cm) nominal

PFH840

15	15" (38 cm) nominal
26	26" (66 cm) nominal

Bypass

7[4]	102 psid (7 bard) bypass
X[5]	No bypass

ΔP Indicator

DX	Electrical switch only (DIN connection)
L	Visual with electric switch (DIN connection) + LED indicator
V	Visual/Mechanical
X	No indicator (port plugged)

Special Options

N[6]	Nickel plated internal components for high water applications

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V[7]	Fluorocarbon
E-WS[7]	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]Available on PFH419 and PFH840 only.
[3]PFH840 includes integral element bypass and does not include a bypass in the housing.
[4]PFH840 bypass setting is 87 psid (6.0 bard).
[5]Only available when paired with "H" high collapse element.
[6]When selected, automatically adds nickel plating to filter element. For replacement elements, add"-N" to end of filter element part number. Not available on PFH840 series.
[7]Not available with PFH840 series housings.

PFHB

High Pressure Full Flow Bi-Directional Filter Assemblies

Hy-Pro's PFHB high pressure filter assemblies are designed for applications where flow direction changes and fluid must be filtered with full flow in both directions. Protect both components and clean fluid that typically does not return to the reservoir.

Ideal for steel mills, board plants, scrap yards, and concrete mixers.

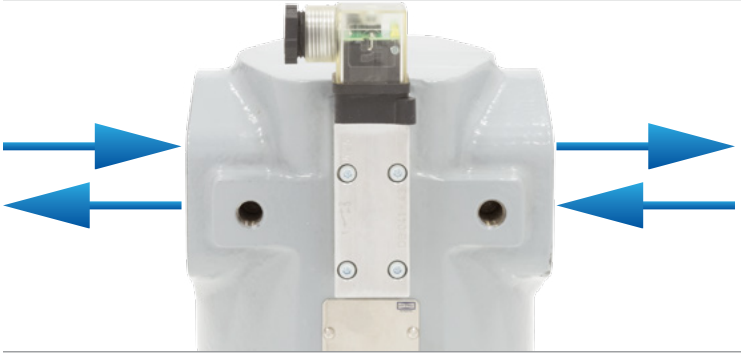
Max Operating Pressure: 7252 psi (500 bar)

HY-PRO

hyprofiltration.com/PFHB

Elements that go beyond industry standard.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities to combat the dynamic flow changes in all hydraulic applications. With media options down to $\beta 2.5_{[C]} \geq 1000$, + water absorption, you get the perfect element for your application, every time.



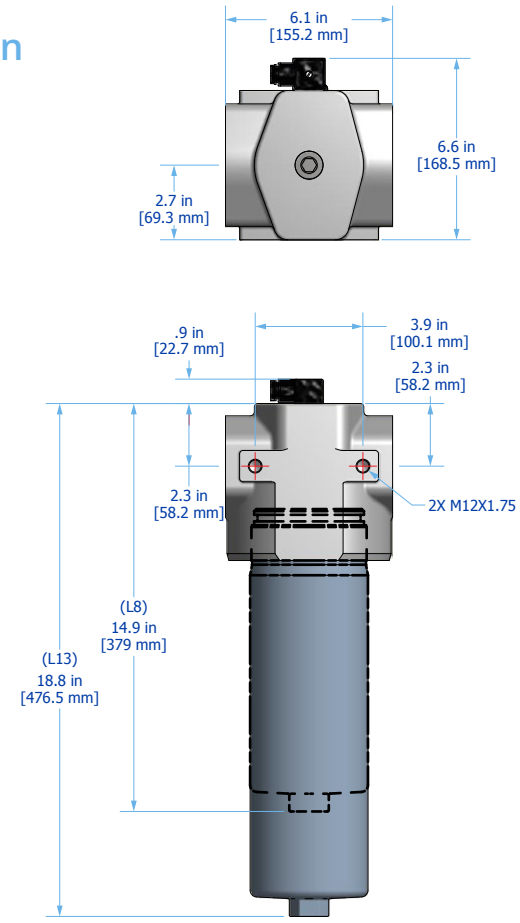
Two directions, one result.

With unique flow paths and internal check valves, PFHB assemblies allow hydraulic fluids to travel in both directions while maintaining the highest of filter efficiencies. Whether installed at the end of a remotely located cylinder or small cylinders where used fluid is not able to return to the tank for standard filtration, the PFHB captures contaminants in both flow directions where others can't.

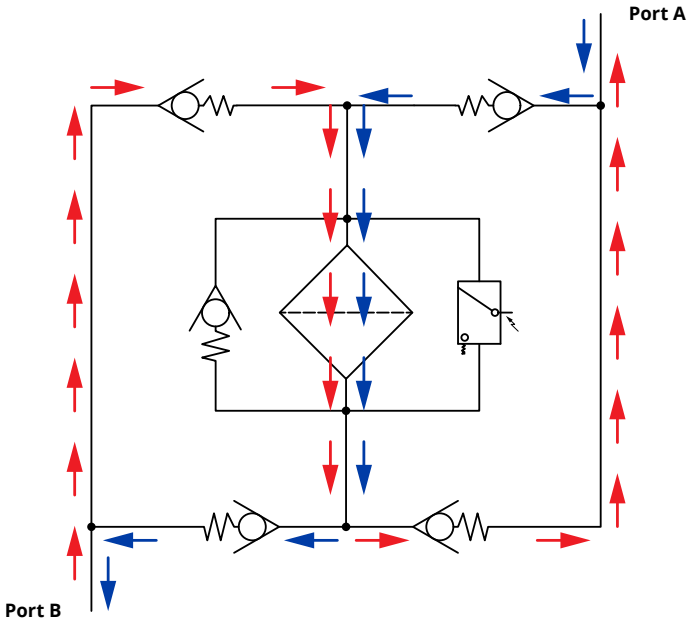
Always ready.

Perfect for use in hydrostatic loop circuits and any system where flow can change direction, the PFHB is ready for capturing particles in both directions with absolute efficiency - automatically.

PFHB Installation Drawing



Bi-Directional Schematic



HY-PRO

PFHB Specifications

Dimensions[1]

See Installation Drawing on page 207 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

7252 psi (500 bar)

ΔP Indicator Trigger

73 psid (5 bard)

Element Collapse Rating

HP419NL
450 psid (31.0 bard) max

HP419HL
3000 psid (206.8 bard) max

HP419CL
250 psid (17.2 bard) max

Materials of Construction

Head
Cast steel

Bowl[1]
Extruded steel

Interior Coating
Phosphate

Exterior Coating
Industrial powder coating

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use the selected codes from the following page below:

Filter Element Part Number
HP419[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]

Example
HP419NL13-25MB

Fluid Compatibility

Biodegradable and mineral based fluids. For high water based or specified synthetics, consult factory.

Filter Sizing[2]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[2]

Length	Units	Media 1M	3M	6M	10M	16M	25M	**W
L8	psid/gpm	0.3415	0.2882	0.2234	0.2003	0.1960	0.1888	0.0340
	bard/lpm	0.0062	0.0052	0.0041	0.0036	0.0036	0.0034	0.0006
L13	psid/gpm	0.2364	0.1995	0.1546	0.1387	0.1357	0.1307	0.0235
	bard/lpm	0.0043	0.0036	0.0028	0.0025	0.0025	0.0024	0.0004

[1]Bowl comes standard with drain plug.
[2]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

PFHB Part Number Builder

PFHB [ ] [ ] [ ] [ ] [ ] - [ ] [ ]

Connection | Collapse | Length | Bypass | Indicator | Media | Seal

Connection

	Port Option	Max Flow Rate
C20	1¼" Code 62 flange	95 gpm (360 lpm)[1]
C24	1½" Code 62 flange	95 gpm (360 lpm)[1]

Collapse

C	250 psid (17.2 bard) – Coreless element with integral bypass (includes post assembly for element support)[1]
H	3000 psid (206.8 bard) – High collapse element with no housing bypass
N	450 psid (31.2 bard) – Core-in element with housing bypass

Element Length

8	8" (20 cm) nominal length filter element and housing
13	13" (33 cm) nominal length filter element and housing

Bypass

7	102 psid (7 bard) bypass
X	No bypass

ΔP Indicator

DX	Electrical switch only (DIN connection)
L	Visual with electric switch (DIN connection) + LED indicator
V	Visual/Mechanical
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.

DLF(M)

Low Pressure High Flow Duplex Filter Assembly

Designed to maintain continuous filtration, even throughout element servicing, the DLF series filter assemblies provide two high efficiency, high capacity filter housings coupled by a user-friendly 6-way, 3 position valve that completely seals the system from the atmosphere. Use the DLF(M) to remove particulate and water from a variety of fluids and maximize your uptime.

Ideal for systems where filters must be serviced without system interruption such as hydraulic, gearbox, pulp and paper, rolling mill oil, bulk oil handling, and high flow return-line filtration.

Max Operating Pressure: 150 psi (10 bar)
Available options up to 450 psi (31 bar)

HY-PRO

hyprofiltration.com/DLF

One assembly, twice the filtration.

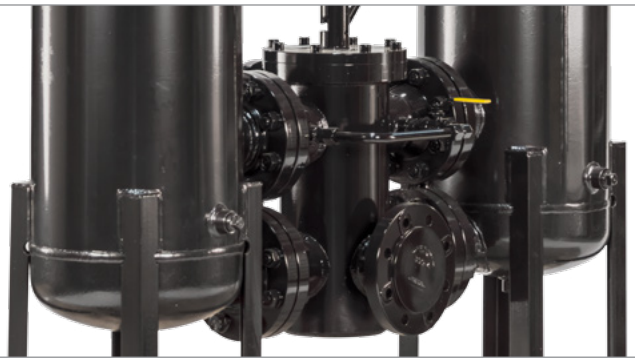
DLF assemblies combine two powerful LF housings to deliver lower ISO Codes faster than ever. With a turn of the lever, you'll introduce a new element to your fluid while simultaneously valving the used element out of service to easily change and replace, all while your system continues operating at full capacity.

Built for industrial use.

Constructed from heavy duty carbon steel (standard) or the optional 304 or 316 stainless steel, the DLF filter housings are designed to excel in even the toughest industrial conditions. Multiround units go even further to provide increased capacity whether you're operating with incredibly high viscosity oils or extreme flow rates.

Filtration starts with the filter.

The oversized coreless filter element in every DLF delivers lower ISO Codes over a long element lifespan to ensure low disposal impact, simultaneously reducing your environmental footprint and your bottom line. To top it off, select elements come standard with an integral zero-leak bypass so with every filter change you get a new bypass along with peace of mind.

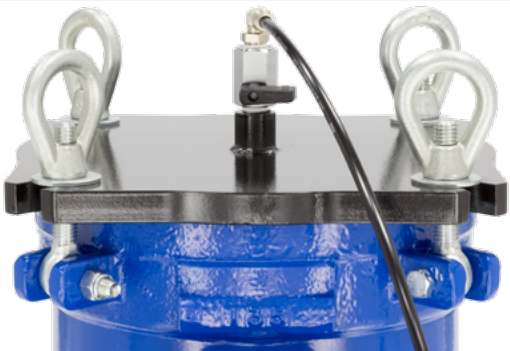


Seamlessly integrated into your systems.

Multiple connection options provide you with the ability to integrate the DLF directly in-line on your systems and get the most impact from your filtration directly where you need it.

Inherently safe.

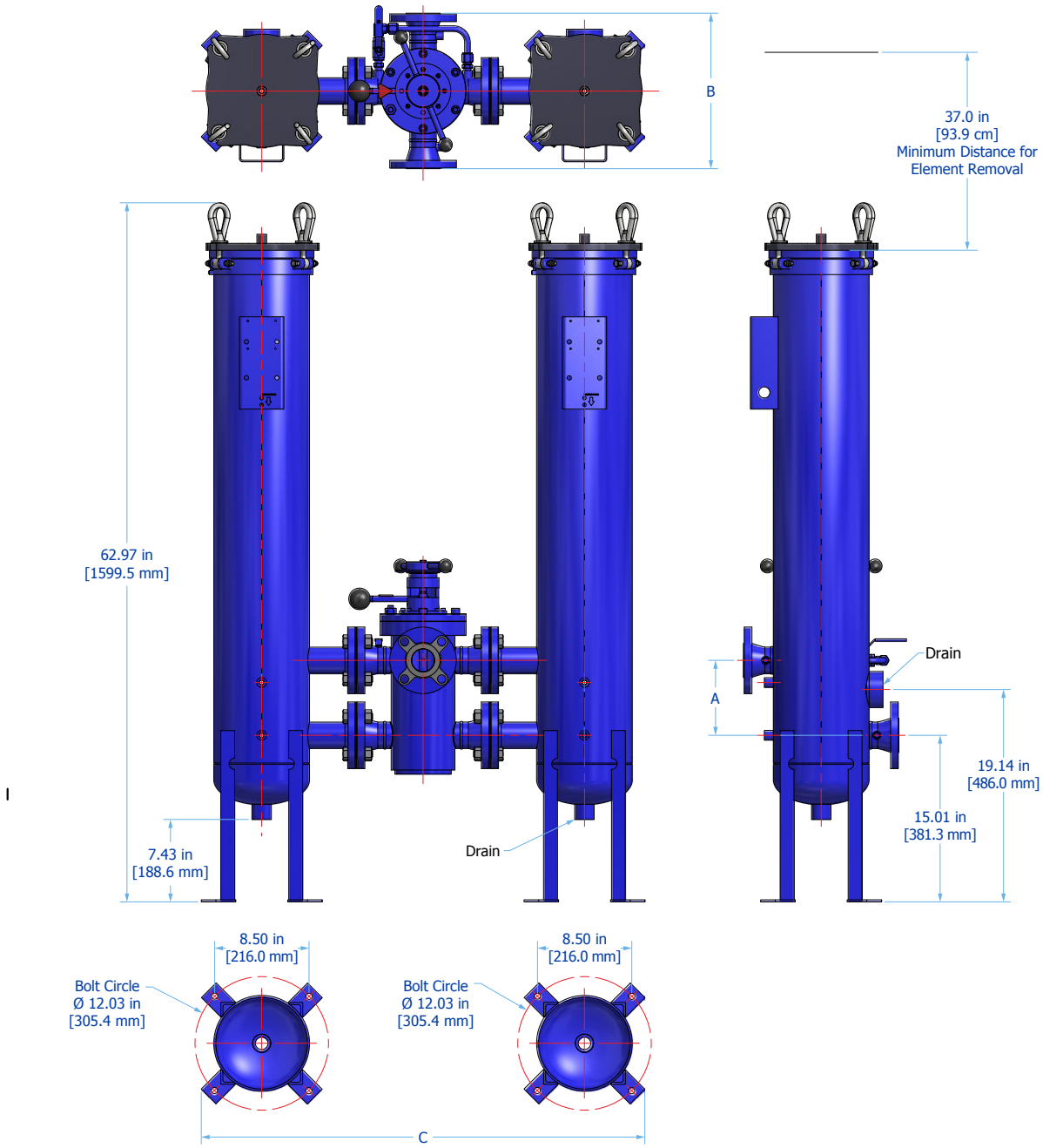
The true 6-way valve with internal pressure equalization and fill line allows for seamless transition of flow from one housing to the other. As the valve is repositioned, oil from the in-service housing is redistributed to the out-of-service housing to purge air before it can move downstream – meaning you maintain fluid levels, preserve system control and prevent cavitation of your components, all while ensuring your fluid stays remarkably clean.



Clean oil has never been easier.

Designed to combine incredible capacity and low maintenance, the oversized housing with secure swivel bolts allow for effortless element changes with all the parts kept right where they need to be. The top loading housing and post/nipple system provide incredible ease of use and make element installation and maintenance easier than ever.

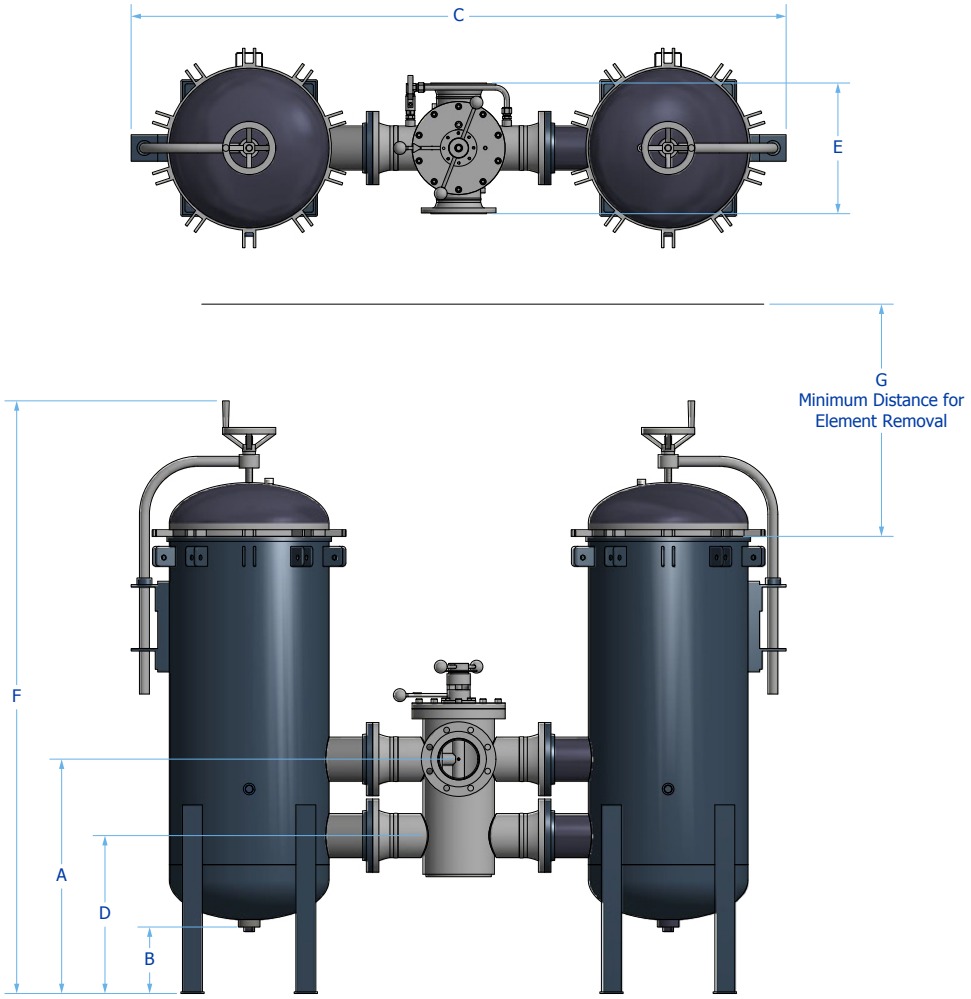
DLF Installation Drawing



Series	Port Size	Vessel Diameter	A	B	C	Weight
DLF	2	8.0 in 20.3 cm	11.7 in 29.7 cm	14.0 in 35.6 cm	41.4 in 105.2 cm	389.0 lb 176.4 kg
	3	8.0 in 20.3 cm	11.7 in 29.7 cm	14.0 in 35.6 cm	43.4 in 110.2 cm	451.0 lb 204.6 kg
	4	8.0 in 20.3 cm	15.2 in 38.6 cm	17.0 in 43.2 cm	50.7 in 128.8 cm	544.0 lb 246.8 kg

[1]Dimensions are approximations taken from base model and will vary according to options chosen and customer sizing requirements.

DLFM Installation Drawing



Series	Number of Elements	Port Size	Vessel Diameter	A	B	C	D	E	F	G	Weight
DLFM	3	2	16.0 in 40.6 cm	28.7 in 72.9 cm	13.0 in 33.0 cm	60.0 in 152.4 cm	17.0 in 43.2 cm	14.0 in 35.6 cm	78.5 in 199.4 cm	37.0 in 94.0 cm	1190.0 lb 539.8 kg
		3	16.0 in 40.6 cm	29.7 in 75.4 cm	13.0 in 33.0 cm	63.0 in 160.0 cm	17.0 in 43.2 cm	14.0 in 35.6 cm	78.5 in 199.4 cm	37.0 in 94.0 cm	1251.0 lb 567.4 kg
		4	16.0 in 40.6 cm	32.2 in 81.8 cm	13.0 in 33.0 cm	70.0 in 177.8 cm	17.0 in 43.2 cm	17.0 in 43.2 cm	78.5 in 199.4 cm	37.0 in 94.0 cm	1344.0 lb 609.6 kg
	4	2	18.0 in 45.7 cm	29.1 in 73.9 cm	13.0 in 33.0 cm	66.0 in 167.6 cm	17.5 in 44.5 cm	14.0 in 35.6 cm	83.0 in 210.8 cm	37.0 in 94.0 cm	1360.0 lb 616.9 kg
		3	18.0 in 45.7 cm	30.7 in 78.0 cm	13.0 in 33.0 cm	68.0 in 172.7 cm	17.5 in 44.5 cm	14.0 in 35.6 cm	83.0 in 210.8 cm	37.0 in 94.0 cm	1421.0 lb 644.6 kg
		4	18.0 in 45.7 cm	27.6 in 70.1 cm	13.0 in 33.0 cm	75.0 in 190.5 cm	17.5 in 44.5 cm	17.0 in 43.2 cm	83.0 in 210.8 cm	37.0 in 94.0 cm	1514.0 lb 686.7 kg
	9	3	24.0 in 61.0 cm	31.6 in 80.3 cm	13.0 in 33.0 cm	87.0 in 221.0 cm	17.5 in 44.5 cm	14.0 in 35.6 cm	89.0 in 226.1 cm	37.0 in 94.0 cm	1811.0 lb 821.5 kg
		4	24.0 in 61.0 cm	34.1 in 86.6 cm	13.0 in 33.0 cm	94.0 in 238.8 cm	17.5 in 44.5 cm	17.0 in 43.2 cm	89.0 in 226.1 cm	37.0 in 94.0 cm	1904.0 lb 863.6 kg
		6	24.0 in 61.0 cm	35.3 in 89.7 cm	13.0 in 33.0 cm	99.0 in 251.5 cm	17.5 in 44.5 cm	20.0 in 50.8 cm	89.0 in 226.1 cm	37.0 in 94.0 cm	2081.0 lb 943.9 kg

[1]Dimensions are approximations taken from base model and will vary according to options chosen and customer sizing requirements. Contact factory to request model specific drawings or for any models not listed above.

DLF(M) Specifications

Dimensions

See Installation Drawing on pages 212-213 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

150 psi (10.3 bar) standard. See special options for additional pressure ratings.

Element Collapse Rating

HP105	HP106	HP107	HP8314 (All Codes)
150 psi (10.3 bar)	150 psi (10.3 bar)	150 psi (10.3 bar)	150 psi (10.3 bar)

Integral Element Bypass Setting

HP106	HP107	HP8314 (Code 82)	HP8314 (Code 83)
25 psid (1.7 bard)	50 psid (3.4 bard)	25 psid (1.7 bard)	50 psid (3.4 bard)

Materials of Construction

Housing
Industrial coated carbon steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Element Type Code	Filter Element Part Number	Example
5	HP105L[Length Code] – [Media Selection Code][Seal Code]	HP105L36–6AB
6	HP106L[Length Code] – [Media Selection Code][Seal Code]	HP106L18–10MV
7	HP107L[Length Code] – [Media Selection Code][Seal Code]	HP107L36–25MB
8X	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–25WV
82	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L16–12MB
85	HP8314L[Length Code] – [Media Selection Code][Seal Code]	HP8314L39–16ME–WS

Fluid Compatibility

Petroleum and mineral based fluids, #2 diesel fuels (standard). For specified synthetics contact factory for compatibility with fluorocarbon seal option. For phosphate ester or skydrol fluid compatibility select fluid compatibility from special options.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Model	Length	Units	Media 1M	3M	6M	10M	16M	25M	**W
DLF	L36/L39	psid/gpm	0.0324	0.0273	0.0212	0.0190	0.0186	0.0179	0.0032
		bard/lpm	0.0009	0.0008	0.0007	0.0007	0.0007	0.0007	0.0006
DLFM3	L36/L39	psid/gpm	0.0081	0.0055	0.0051	0.0045	0.0041	0.0035	0.0029
		bard/lpm	0.00015	0.0001	0.00009	0.00008	0.00007	0.00006	0.00005
DLFM4	L36/L39	psid/gpm	0.0067	0.0048	0.0044	0.004	0.0037	0.0032	0.0025
		bard/lpm	0.00012	0.00009	0.00008	0.00007	0.00007	0.00006	0.00005
DLFM9	L36/L39	psid/gpm	0.0034	0.0025	0.0022	0.002	0.0019	0.0016	0.0013
		bard/lpm	0.00006	0.00005	0.00004	0.00004	0.00003	0.00003	0.00002

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

DLF(M) Part Number Builder

DLF [ ] [ ] [ ] [ ] [ ] - [ ] - [ ] [ ]

Series | Port Configuration | Connection | Element Type | ΔP Indicator | Special Options | Media | Seal

Series

	Number of Elements	Max Flow Rate
omit	1 element	200 gpm (757 lpm)[1]
M3	3 elements	600 gpm (2271 lpm)[1]
M4	4 elements	800 gpm (3028 lpm)[1]
M9	9 elements	1800 gpm (6814 lpm)[1]
M14	14 elements	2800 gpm (10,600 lpm)[1]
M22	22 elements	4400 gpm (16,656 lpm)[1]

Port Configuration

K	Opposite side porting (180°), same center line
O	Opposite side porting (180°), in-line (different center line)
S	Same side porting (standard)

Connections

A15	1.5" ANSI flange
A2	2" ANSI flange
A3	3" ANSI flange
A4	4" ANSI flange
A6	6" ANSI flange
A8	8" ANSI flange
D15	DN40 DIN flange
D2	DN50 DIN flange
D3	DN80 DIN flange
D4	DN100 DIN flange
D6	DN150 DIN flange
D8	DN200 DIN flange
F15	1.5" Code 61 flange
F2	2" Code 61 flange
F3	3" Code 61 flange

Element Type

5	HP105 – no bypass
6	HP106 – 25 psid (1.7 bard) integral element bypass
7	HP107 – 50 psid (3.4 bard) integral element bypass
8X	HP8314 – no bypass
82	HP8314 – 25 psid (1.7 bard) integral housing bypass
85	HP8314 – 50 psid (3.4 bard) integral housing bypass

ΔP Indicator

D	22 psid visual gauge + electric switch
E	22 psid visual gauge
F	45 psid visual gauge + electric switch
G	45 psid visual gauge
H	65 psid visual gauge + electric switch
J	65 psid visual gauge (elements 5 or 8* only)
P	2 pressure gages (industrial liquid filled)
X	None (ports plugged)

Special Options

omit	150 psi (10.3 bar) max operating pressure, carbon steel
F	Filter element ΔP gauge with tattle tale follower needle
G	Spill retention pan with fork guides (industrial coated steel)
P9[2]	Phosphate ester fluid compatibility modification
S1[3]	150 psi (10.3 bar) max oper. pressure, 304 stainless steel
S2[3]	250 psi (17.2 bar) max oper. pressure, 304 stainless steel
S3[3]	450 psi (31.0 bar) max oper. pressure, 304 stainless steel
S9[4]	Skydrol fluid compatibility modification
U1	U Code (ASME U code certified)
W	Automatic air bleed valve
X	250 psi (17.2 bar) max oper. pressure, carbon steel
Y	450 psi (31.0 bar) max oper. pressure, carbon steel

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M[5]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A[5]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon

[1]Maximum recommended flow rate based on velocity through port and internal flow path. Consult sizing guidelines or consult factory for sizing based on flow rate, viscosity, temperature, filter media selection.
[2]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[3]Lid closure hardware is plated carbon steel.
[4]When selected, must be paired with Seal option "E-WS." Contact factory for more information or assistance in fluid compatibility.
[5]For elements HP8314, use 12M or 12A for respective media code in place of 10M or 10A.

DFN

Low Pressure Duplex Filter Assembly

Designed to maintain continuous filtration, even throughout element servicing, the DFN series filter assemblies provide a compact and user-friendly 4-way, 2 position housing completely sealed from the atmosphere. Remove particulate and water from a variety of fluids including hydrogen seal, oil, turbine lube oil, bearing lube oil, and FD-ID-PA fan lube.

Ideal for systems where filters must be serviced without system interruption such as hydraulic, gearbox, wind turbine, boiler feed pump, mechanical/ electro hydraulic control, and servo systems.

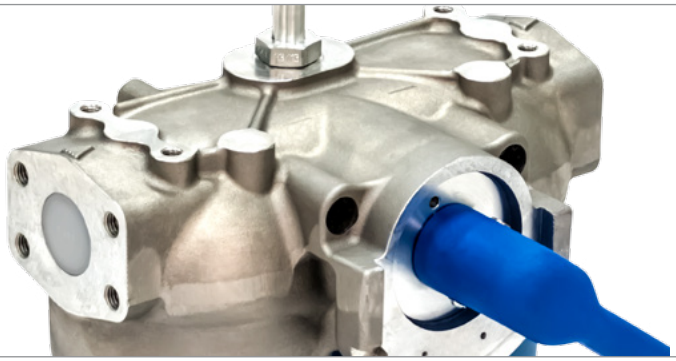
Max Operating Pressure: 888 psi (61.2 bar)

HY-PRO

hyprofiltration.com/DFN

Two positions, one result.

DFN housings provide unmatched in-line filtration with incredible ease of use. With a squeeze of the trigger and turn of the wrist, you'll introduce a new element to your fluid while simultaneously valving the used element out of service to easily change and replace, all while your system continues operating at full capacity.



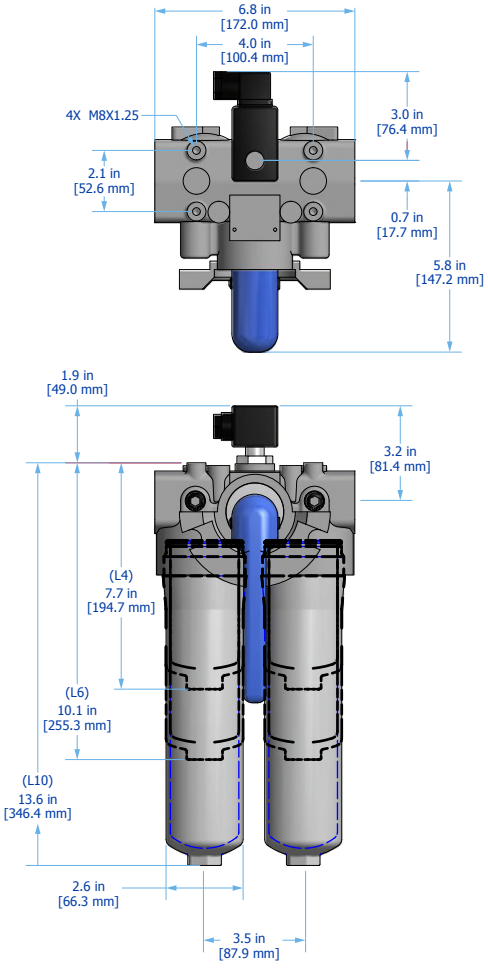
All duplexes are not created equal.

Air in any lube system can quickly cause failure and force you to take your system down for maintenance. DFN assemblies utilize internal equalization and external vent ports to automatically push oil into and purge air out from the unused housing without any added effort.

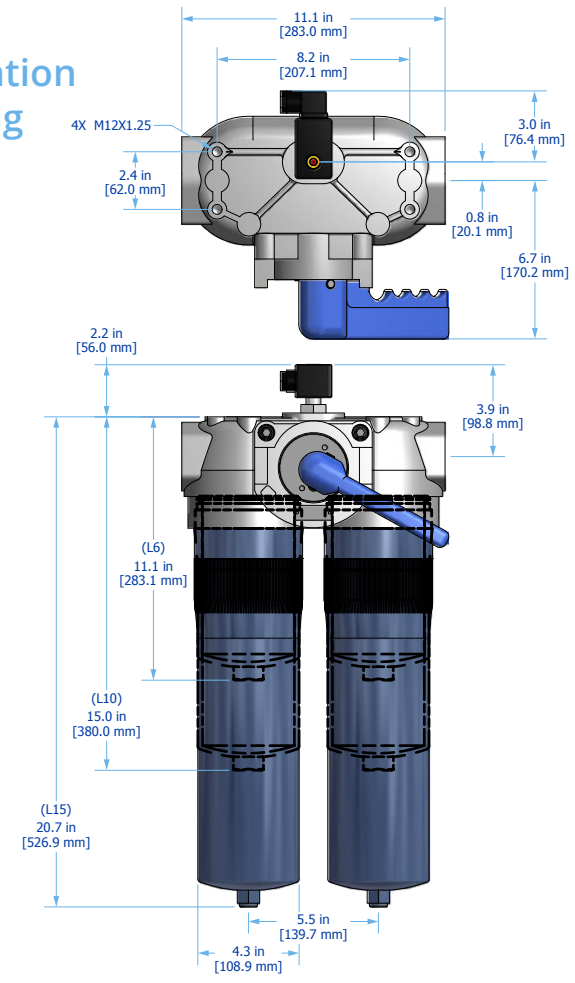
Elements that go beyond industry standard.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities so your equipment operates unimpeded by contamination. With media options down to $\beta 2.5_{[C]} \geq 1000$ + water absorption, you get the perfect element for your application, every time.

DFN19 Installation Drawing



DFN39 Installation Drawing



DFN Specifications

Dimensions

See Installation Drawing on page 217 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

DFN19
888 psi (61.2 bar) max

DFN39
350 psi (24.1 bar) max

ΔP Indicator Trigger

32 psid (2.21 bard)

Element Collapse Rating

Normal Collapse (Collapse Option N)
450 psid (31.0 bard)

High Collapse (Collapse Option H)
3000 psid (206.8 bard)

Materials of Construction

Head
Aluminum

Bowl
Aluminum

Interior Coating
Anodized

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Series Code	Filter Element Part Number	Example
19	HP19[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP19HL6-10MB
39	HP39[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP39NL6-6AV

Fluid Compatibility

Biodegradable and mineral based fluids. For high water based of specified synthetics, consult factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Model	Length	Units	Media 1M	3M	6M	10M	16M	25M	**W
DFN19N	L4	psid/gpm	3.4021	2.8710	1.9270	1.3030	0.9198	0.8860	0.4700
		bard/lpm	0.0620	0.0523	0.0351	0.0237	0.0168	0.0161	0.0086
	L6	psid/gpm	2.0986	1.7710	1.1980	1.0420	0.8658	0.8340	0.4170
		bard/lpm	0.0382	0.0323	0.0218	0.0190	0.0158	0.0152	0.0076
	L10	psid/gpm	1.4943	1.2610	1.0420	0.7820	0.6489	0.6250	0.3130
		bard/lpm	0.0272	0.0230	0.0190	0.0142	0.0118	0.0114	0.0057
DFN39N	L6	psid/gpm	0.6541	0.5520	0.4170	0.3440	0.2710	0.2610	0.1550
		bard/lpm	0.0119	0.0101	0.0076	0.0063	0.0049	0.0048	0.0028
	L10	psid/gpm	0.5190	0.4380	0.3230	0.2870	0.2429	0.2340	0.1350
		bard/lpm	0.0095	0.0080	0.0059	0.0052	0.0044	0.0043	0.0025
	L15	psid/gpm	0.4633	0.3910	0.3010	0.2660	0.2180	0.2100	0.1170
		bard/lpm	0.0084	0.0071	0.0055	0.0048	0.0040	0.0038	0.0021

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

DFN Part Number Builder

DFN [ ] [ ] [ ] [ ] [ ] [ ] - [ ] [ ]

Series | Connection | Collapse | Length | Bypass | ΔP Indicator | Media | Seal

Series

19	25 gpm (95 lpm) max flow rate[1]
39	70 gpm (265 lpm) max flow rate[1]

Connection

DFN19

F16[2]	1" Code 61 flange
G16	1" G thread (BSPP)

DFN39

F24[2]	1½" Code 61 flange
G24	1½" G thread (BSPP)

Collapse Rating

H	3000 psid (206.8 bard)
N	450 psid (31.0 bard)

Element Length

DFN19

4	4" (10 cm) nominal length filter element and housing
6	6" (15 cm) nominal length filter element and housing
10	10" (25 cm) nominal length filter element and housing

DFN39

6	6" (15 cm) nominal length filter element and housing
10	10" (25 cm) nominal length filter element and housing
15	15" (38 cm) nominal length filter element and housing

Bypass

3	Integrated bypass – 50 psid (3.4 bard)
X	No bypass

ΔP Indicator

D	Visual with electric switch (DIN connection)
V	Visual/Mechanical
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000$, $\beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000$, $\beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

G8 Dualglass + water removal

3A[3]	$\beta 5_{[C]} \geq 1000$, $\beta 3 \geq 200$
6A[3]	$\beta 7_{[C]} \geq 1000$, $\beta 6 \geq 200$
10A[3]	$\beta 12_{[C]} \geq 1000$, $\beta 12 \geq 200$
25A[3]	$\beta 22_{[C]} \geq 1000$, $\beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon

[1]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[2]Metric threads for flange connection bolts. See Appendix for exact connection sizes and specifications.
[3]Water Removal Media available only with Collapse option "N."

DFH

High Pressure Duplex Filter Assembly

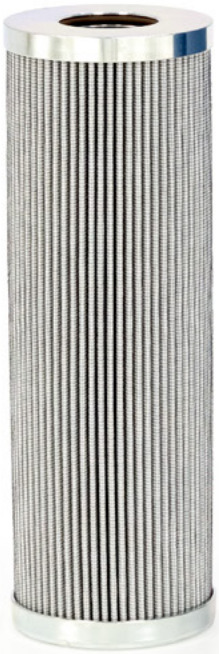
The DFH series is designed to remove particulate and water from a variety of fluids including hydrogen seal oil, turbine lube oil, bearing lube oil, and FD-ID-PA fan lube. Applicable for wind turbine, boiler feed pump, mechanical/electro hydraulic control, and fuel handling systems.

Ideal for systems where filters must be serviced while continuous operation is not interrupted such as hydraulic, gearbox, and servo systems.

Max Operating Pressure: 3600 psi (248 bar)

HY-PRO

hyprofiltration.com/DFH



Elements that go beyond industry standard.

DFE rated advanced media technologies provide the highest level of particulate capture and retention capabilities so your equipment operates unimpeded by contamination. With media options down to $\beta 2.5_{[C]} \geq 1000$, + water absorption, you get the perfect element for your application, every time.

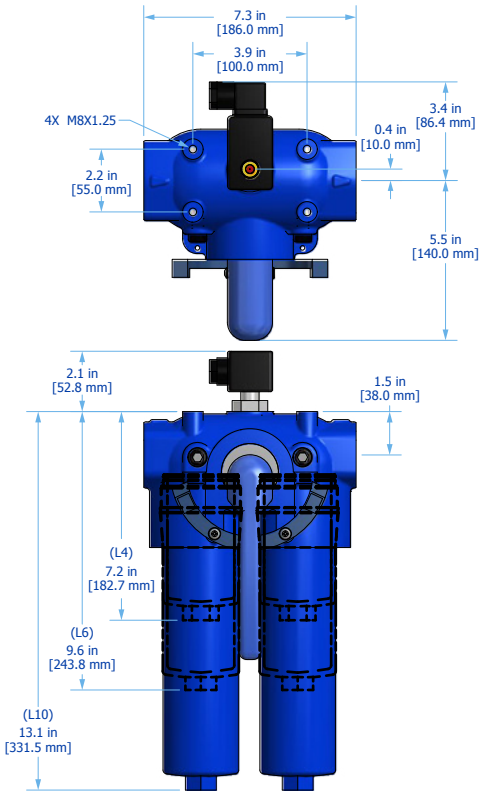
Two positions, one result.

DFH housings provide unmatched in-line filtration with incredible ease of use. With a squeeze of the trigger and turn of the wrist, you'll introduce a new element to your fluid while simultaneously valving the used element out of service to easily change and replace, all while your system continues operating at full capacity.

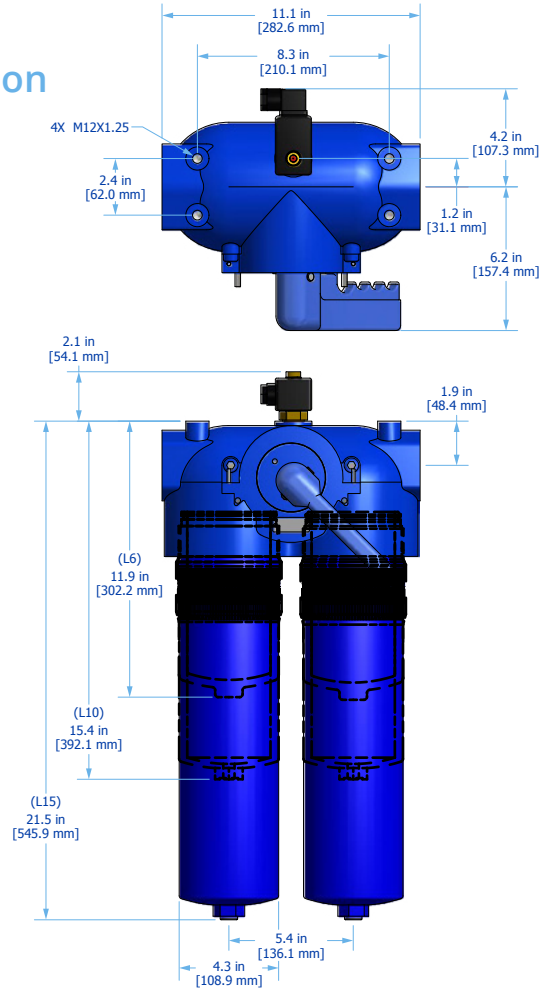
All duplexes are not created equal.

Air in any lube system can quickly cause failure and force you to take your system down for maintenance. DFN assemblies utilize internal equalization and external vent ports to automatically push oil into and purge air out from the unused housing without any added effort.

DFH19 Installation Drawing



DFH39 Installation Drawing



DFH Specifications

Dimensions

See Installation Drawing on page 221 for model specific dimensions.

Operating Temperature

Fluid Temperature
30°F to 225°F
(0°C to 105°C)

Ambient Temperature
-4°F to 140°F
(-20C to 60C)

Operating Pressure

DFH19
3600 psi (248.2 bar) max

DFH39
3000 psi (206.8 bar) max

ΔP Indicator Trigger

73 psid (5 bard)

Element Collapse Rating

450 psid (31.0 bard)

Materials of Construction

Head
Cast steel

Bowl
Cast steel

Housing Bypass Valve
Steel

Media Description

M
G8 Dualglass, our latest generation of DFE rated, high performance glass media for all hydraulic & lubrication fluids. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

A
G8 Dualglass high performance media combined with water removal scrim. $\beta x_{[C]} \geq 1000$ ($\beta x \geq 200$)

W
Stainless steel wire mesh media $\beta x_{[C]} \geq 2$ ($\beta x \geq 2$)

Replacement Elements

To determine replacement elements, use corresponding codes from your assembly part number:

Series Code	Filter Element Part Number	Example
19	HP19[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP19HL6-10MB
39	HP39[Collapse Code] L [Length Code] – [Media Selection Code][Seal Code]	HP39NL6-6AV

Fluid Compatibility

Biodegradable and mineral based fluids. For high water based of specified synthetics, consult factory.

Filter Sizing[1]

Filter assembly clean element ΔP after actual viscosity correction should not exceed 10% of filter assembly bypass setting. See page 22 for filter assembly sizing guidelines & examples. For applications with extreme cold start condition contact Hy-Pro for sizing recommendations.

ΔP Factors[1]

Model	Length	Units	Media 1M	3M	6M	10M	16M	25M	**W
DFH19	L4	psid/gpm	3.402	2.871	1.927	1.303	0.920	0.886	0.470
		bard/lpm	0.0620	0.0523	0.0351	0.0237	0.0168	0.0161	0.0086
	L6	psid/gpm	2.099	1.771	1.198	1.042	0.866	0.834	0.417
		bard/lpm	0.0382	0.0323	0.0218	0.0190	0.0158	0.0152	0.0076
	L10	psid/gpm	1.494	1.261	1.042	0.782	0.649	0.625	0.313
		bard/lpm	0.0272	0.0230	0.0190	0.0142	0.0118	0.0114	0.0057
DFH39	L6	psid/gpm	0.654	0.552	0.417	0.344	0.271	0.261	0.155
		bard/lpm	0.0119	0.0101	0.0076	0.0063	0.0049	0.0048	0.0028
	L10	psid/gpm	0.519	0.438	0.323	0.287	0.243	0.234	0.135
		bard/lpm	0.0095	0.0080	0.0059	0.0052	0.0044	0.0043	0.0025
	L15	psid/gpm	0.463	0.391	0.301	0.266	0.218	0.210	0.117
		bard/lpm	0.0084	0.0071	0.0055	0.0048	0.0040	0.0038	0.0021

[1]Max flow rates and ΔP factors assume υ = 150 SUS, 32 cSt. See filter assembly sizing guideline for viscosity conversion formula on page 22 for viscosity change.

DFH Part Number Builder

DFH [ ] [ ] [ ] [ ] [ ] [ ] - [ ] [ ]

Series | Connection | Collapse | Length | Bypass | ΔP Indicator | Media | Seal

Series

19	25 gpm (95 lpm) max flow rate[1]
39	70 gpm (265 lpm) max flow rate[1]

Connection

DFH19

F16[2]	1" Code 61 flange
G16	1" G thread (BSPP)

DFH39

F24[2]	1½" Code 61 flange
G24	1½" G thread (BSPP)

Collapse

H	3000 psid (206.8 bard)
N	450 psid (31.0 bard)

Element Length

DFH19

4	4" (10 cm) nominal length filter element and housing
6	6" (15 cm) nominal length filter element and housing
10	10" (25 cm) nominal length filter element and housing

DFH39

6	6" (15 cm) nominal length filter element and housing
10	10" (25 cm) nominal length filter element and housing
15	15" (38 cm) nominal length filter element and housing

Bypass

7	102 psid (7 bard) bypass
X	No bypass

ΔP Indicator

D	Visual with electric switch (DIN connection)
V	Visual/Mechanical
X	No indicator (port plugged)

Media Selection

G8 Dualglass

1M	$\beta 2.5_{[C]} \geq 1000, \beta 1 \geq 200$
3M	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6M	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10M	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
16M	$\beta 17_{[C]} \geq 1000, \beta 17 \geq 200$
25M	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

G8 Dualglass + water removal

3A[3]	$\beta 5_{[C]} \geq 1000, \beta 3 \geq 200$
6A[3]	$\beta 7_{[C]} \geq 1000, \beta 6 \geq 200$
10A[3]	$\beta 12_{[C]} \geq 1000, \beta 12 \geq 200$
25A[3]	$\beta 22_{[C]} \geq 1000, \beta 25 \geq 200$

Stainless wire mesh

25W	25µ nominal
40W	40µ nominal
74W	74µ nominal
149W	149µ nominal

Seals

B	Nitrile (Buna)
V	Fluorocarbon

[1]When selected, must be paired with Seal option "V." Contact factory for more information or assistance in fluid compatibility.
[2]Metric threads for flange connection bolts. See Appendix for exact connection sizes and specifications.
[3]Water Removal Media available only with Collapse option "N."

Hy-Dry

Desiccant Breathers

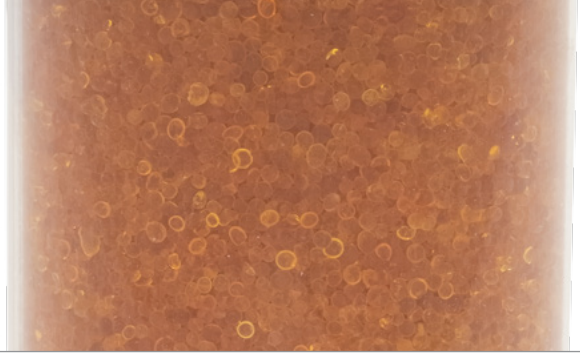
Protect your uptime, critical hydraulic & lube assets and fluid life. Hy-Dry breathers are critical in Hy-Pro's Total System Cleanliness approach as a barrier preventing airborne particles and water from entering reservoirs and gearboxes.

HY-PRO

hyprofiltration.com/Hy-Dry

A breath of fresh air.

Atmospheric moisture is a continuous threat to efficient operations of your equipment and machinery. Hy-Dry Breathers utilize high capacity silica gel to remove water from the air before it can ever enter your equipment, protecting your investment and helping prevent fluid breakdown.



Unmistakable water removal.

As Hy-Dry Breathers adsorb moisture from the air entering your system, the gold silica gel gradually changes colors to let you know it's working effectively and even give you a reminder of when it's time for replacement.

Dual contamination prevention.

Each Hy-Dry Breather is equipped with an internal 2 micron particulate filter on both ends of the silica chamber to protect your system from airborne contamination. As an added benefit, exhaust from your reservoir flushes the trapped particulate from the outer filter and back into the atmosphere, making your Hy-Dry a self-cleaning powerhouse for contamination prevention.

Keep contamination in check.

Select models of Hy-Dry breathers come with dual check valves (0.1 psi / 0.007 bar standard) to prevent outside moisture from entering and greatly extending the life of your breather.

The perfect fit for your system.

Hy-Dry Breathers come in a variety of sizes, connections, and other options designed for countless applications. Whether you're installing on a small gearbox reservoir or on-board a high vibration mobile application, there's a Hy-Dry Breather suited perfectly to fit your needs.

Total Systems Cleanliness

Used in conjunction with more robust particulate filtration, Hy-Dry Breathers are a pivotal component to achieving Total Systems Cleanliness and ensuring your equipment is protected from all forms of contamination.

HPB Disposable Cartridge Breathers

Stationary Applications

Designed for versatility, HPB Breathers provide the base for all Hy-Dry Breathers with a wide range of fluid compatibility and numerous models to fit nearly any stationary application. The high impact resistant ABS caps and clear acrylic silica chamber provide protection from industrial environments while making inspection and replacement easier than ever.

Model	HPB-31	HPB-34	HPB-100	HPB-101	HPB-102	HPB-103	HPB-108	HPB-154
Height	2" 5.1 cm	3.25" 8.3 cm	3.5 " 8.9 cm	5" 12.7 cm	8" 20.3 cm	8" 20.3 cm	10" 25.4 cm	5" 12.7 cm
Diameter	2" 5.1 cm	3.25" 8.3 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm
Stem Height	1.25" 3.2 cm	N/A N/A	1.25" 3.2 cm	1.25" 3.2 cm	1.25" 3.2 cm	1.25" 3.2 cm	N/A N/A	1.25" 3.2 cm
Connection	1/2" FNPT	1/2" FNPT	1" Slip Fit	1" Slip Fit	1" Slip Fit	1" MNPT	2" MNPT	1" MNPT
Silica Gel	0.08 lb 0.04 kg	0.50 lb 0.23 kg	0.80 lb 0.36 kg	1.40 lb 0.64 kg	2.70 lb 1.22 kg	2.70 lb 1.22 kg	3.50 lb 1.59 kg	1.40 lb 0.64 kg
Fluid Capacity	0.5 oz 14 ml	3.1 oz 90 ml	4.9 oz 145 ml	8.6 oz 254 ml	16.6 oz 490 ml	16.6 oz 490 ml	21.5 oz 635 ml	8.6 oz 254 ml
Airflow	5 cfm 8 m³/h	5 cfm 8 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h
Reservoir Flow	37 gpm 140 lpm	37 gpm 140 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm
Particulate Efficiency	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000

HPBC Integrated Check Valve Breathers

High Humidity & Dust Applications

Taking our HPB Disposable Breathers even further, HPBC Disposable Breathers feature integrated intake and exhaust check valves to close the system from the atmosphere until airflow is required and extend the life of the breather. The reusable top cap that houses the check valves provides incredible ease of use in replacing spent cartridges and protects new breathers from the moment you install them.

Model	HPBC-100	HPBC-101	HPBC-102	HPBC-121	HPBC-122	HPBC-503	HPBC-505
Height	6.25" 15.9 cm	7" 17.8 cm	10" 25.4 cm	7" 17.8 cm	10" 25.4 cm	7" 17.8 cm	10" 25.4 cm
Diameter	3.25" 8.3 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm	5" 12.7 cm
Stem Height	N/A N/A	1.25" 3.2 cm	1.25" 3.2 cm	1.625" 4.1 cm	1.625" 4.1 cm	1.375" 3.5 cm	1.375" 3.5 cm
Connection	1/2" FNPT	1" Slip Fit	1" Slip Fit	2" MNPT	2" MNPT	1" MNPT	1" MNPT
Check Valve In	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar
Check Valve Out	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar
Silica Gel	0.8 lb 0.36 kg	1.4 lb 0.64 kg	2.7 lb 1.22 kg	1.4 lb 0.64 kg	2.7 lb 1.22 kg	1.4 lb 0.64 kg	2.7 lb 1.22 kg
Fluid Capacity	4.91 oz 145 ml	8.6 oz 254 ml	16.56 oz 490 ml	8.6 oz 254 ml	16.56 oz 490 ml	8.6 oz 254 ml	16.56 oz 490 ml
Airflow	10 cfm 17 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h	20 cfm 34 m³/h
Reservoir Flow	75 gpm 284 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm	150 gpm 568 lpm
Replacement Cartridge	HPB-143	HPB-341	HPB-342	HPB-343	HPB-344	HPB-345	HPB-346
Particulate Efficiency	$2\mu_{[c]}$>1000	$2\mu_{[c]}$>1000	$2\mu_{[c]}$>1000	$2\mu_{[c]}$>1000	$2\mu_{[c]}$>1000	$2\mu_{[c]}$>1000	$2\mu_{[c]}$>1000

HPBCR & HPBR Extreme Duty Breathers

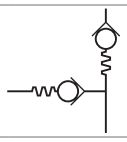
High Vibration, Dust, & Humidity Applications

Featuring a reusable metal reinforced based with male NPT threads, HPBCR and HPBR Breathers are ideal for fluid management applications that require protection from extreme conditions. HPBCR models include intake and exhaust check valves in a reusable top cap to prevent unnecessary air flow and economical replacement of the desiccant cartridges. Perfect for high vibration applications such as mobile, wind power, mining and many others.




Model	HPBCR-101	HPBCR-102	HPBR-101	HPBR-102
Height	8.5 " 21.6 cm	11.5 " 29.2 cm	6.5" 16.5 cm	9.5" 24.1 cm
Diameter	5.2 " 13 cm	5.2" 13 cm	5.2" 13 cm	5.2" 13 cm
Stem Height	1" 2.5 cm	1" 2.5 cm	1" 2.5 cm	1" 2.5 cm
Connection	1" MNPT	1" MNPT	1" MNPT	1" MNPT
Check Valve In	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar
Check Valve Out	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar	0.1 psi 0.007 bar
Silica Gel	1.4 lb 0.64 kg	2.7 lb 1.22 kg	1.4 lb 0.64 kg	2.7 lb 1.22 kg
Fluid Capacity	8.6 oz 254 ml	16.6 oz 490 ml	8.6 oz 254 ml	16.6 oz 490 ml
Airflow	25 cfm 42 m³/h	25 cfm 42 m³/h	25 cfm 42 m³/h	25 cfm 42 m³/h
Reservoir Flow	187 gpm 708 lpm	187 gpm 708 lpm	187 gpm 708 lpm	187 gpm 708 lpm
Replacement Element	HPB-351	HPB-352	HPB-301	HPB-302
Particulate Efficiency	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000	$2\mu_{[C]}$>1000

HPBA Reservoir Adapters

Model	Element Connection	Reservoir Connection	
HPBA-101	1" Slip Fit	Flange No Mounting Holes	
HPBA-102	1" Slip Fit	1" MNPT	
HPBA-103	1" Slip Fit	3/4" MNPT	
HPBA-104	1" Slip Fit	Bayonet	
HPBA-105	1" Slip Fit	1" - 12 UNF	
HPBA-106	1" Slip Fit	1.5" - 16 UNF	
HPBA-110	1" Slip Fit		
HPBA-114	1" Slip Fit	Flange 6 ANSI Mounting Holes	
HPBA-201	1" Slip Fit	1.125" - 16 UNF	
HPBA-403	3/8" MNPT	1/2" MNPT	
HPBA-G31	1" Slip Fit	G 1.25" - 11 BSPP	

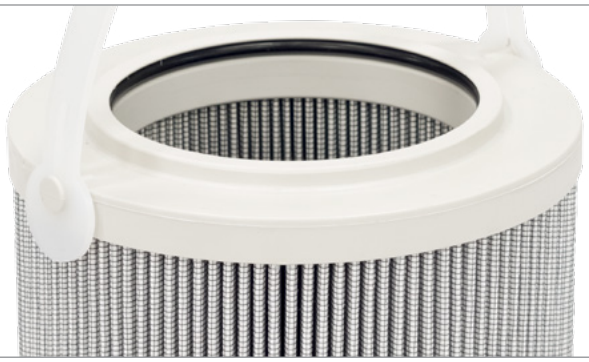
BF Breathers

High Flow Particulate Breathers

Control airborne contamination and extend the life of other filters in your system. BF Breathers go beyond ineffective filler/breather caps to protect your system with high capacity, high efficiency pleated glass media elements. Combine with Hy-Pro Filter Assemblies and Fluid Conditioning Equipment for the ultimate in Total Systems Cleanliness.

HY-PRO

hyprofiltration.com/Breathers

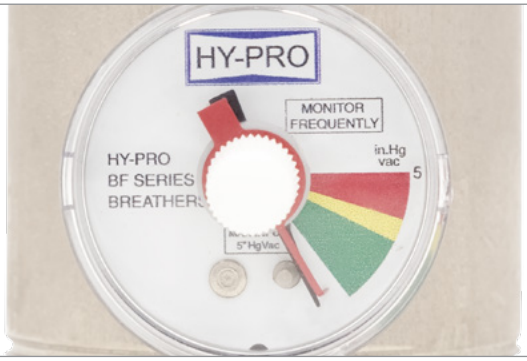


Let it breathe.

The same Hy-Pro Dualglass you trust to remove particulate from your hydraulic and lube oils pulls double duty in the BF Breathers by removing airborne contamination from incoming air as your reservoir levels change. Designed to withstand the constant flexing of hydraulic systems, Hy-Pro filter media is the hands-down best at capturing and preventing contaminants from ever entering your systems.

Tells the tale of your system.

BF Breathers are equipped with tattle-tale gages that capture the maximum vacuum level caused by rising and falling fluid levels to let you know exactly how your system is operating. And unlike those nagging kids, you'll be more than grateful for this tattle-tale.



The perfect fit.

Whether you're operating reservoirs with high cylinder return flows or large extrusion presses, BF Breathers offer the perfect fit for your system. And with numerous standard connections, you can set yours up straight from the box - no adapters required.

BF Specifications[1]

Model	BF*256	BF*2511	BF*2517	BF*36	BF*311	BF*317
Height	12.4 in 31.5 cm	18.1 in 46.0 cm	23.7 in 60.2 cm	12.4 in 31.5 cm	18.1 in 46.0 cm	23.7 in 60.2 cm
Diameter	8.9 in 22.6 cm	8.9 in 22.6 cm	8.9 in 22.6 cm	8.9 in 22.6 cm	8.9 in 22.6 cm	8.9 in 22.6 cm
Weight	21 lb 9.5 kg	22 lb 10.0 kg	28 lb 12.7 kg	25 lb 11.3 kg	26 lb 11.8 kg	32 lb 14.5 kg
Air Flow	1320 gpm 176 cfm 4997 lpm	1450 gpm 194 cfm 5489 lpm	1580 gpm 211 cfm 5981 lpm	1825 gpm 244 cfm 6908 lpm	2100 gpm 281 cfm 7949 lpm	2375 gpm 317 cfm 8990 lpm
Operating Temperature	30°F to 225°F (0°C to 105°C)					
Materials of Construction	**Tube Assembly** Plated steel		**Shell** Powder coated steel		**Element End Caps + Handle** Synthetic – incinerates @ 1100°F (593°C)	

[1]Specifications are approximations taken from base models (Connection options B**/N**) and will vary according to options chosen. Connection option A** dimensions will vary slightly. Contact Hy-Pro for exact specifications.

BF Part Number Builder

BF [ ] [ ] - [ ] [ ]

Connection Length Media Seal

Connection

A2	2" ANSI flange
A3	3" ANSI flange
B15	1.5" BSPT
B2	2" BSPT
B25	2.5" BSPT
B3	3" BSPT
N15	1.5" NPT
N2	2" NPT
N25	2.5" NPT
N3	3" NPT

Length

6	6" (15 cm) nominal length filter
11	11" (28 cm) nominal length filter
17	17" (38 cm) nominal length filter

Media Selection

G8 Dualglass

1M	0.1µ absolute
3M	0.3µ absolute
6M	0.6µ absolute
10M	1.0µ absolute
25M	2.5µ absolute

Seals

B	Nitrile (Buna)
V	Fluorocarbon
E-WS	EPR seals + stainless steel support mesh

Spin-On Breathers

G8 Dualglass Particulate Breathers + Adapters

Control solid contaminant ingression with high capacity, high efficiency pleated glass elements. Spin-On Breathers combine ease of installation and adaptability to prevent airborne contamination and extend the life of other filters in your system.

HY-PRO

hyprofiltration.com/Breathers

Contamination Prevention 101.

Fluid contamination is the root cause of most hydraulic system failures and while most systems today utilize oil filters, it is not uncommon for airborne contamination to go overlooked altogether. By preventing airborne contamination ingression, Spin-On Breathers help reduce strain on system filters to extend the life of your fluids and protect your critical components.

Plug and play.

With common threaded and bayonet style adapters and numerous media options, Spin-On Breathers are a quick way to replace ineffective filler/breather caps right out of the box.

Total Systems Cleanliness.

Combining Spin-On Breathers with other Hy-Pro Fluid Contamination Solutions will yield a clean, healthy, and reliable hydraulic or lubrication system.

Spin-On Breather Adapters

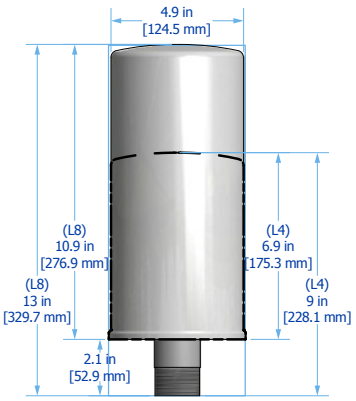




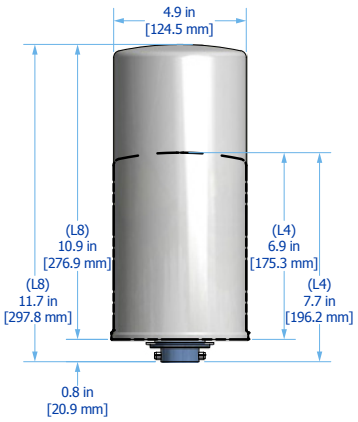
Adapter Model	ADBB-75	ADBB-76	ADTB-75	ADTB-76	ADTB-76V
Material of Construction	Aluminum	Aluminum	Plated steel	Plated steel	Plated steel
Overall Length	2.58" (65.53 mm)	2.38" (60.45 mm)	3.70" (93.98 mm)	1.75" (44.45 mm)	2.48" (62.99 mm)
Element Thread Length	0.70" (17.78 mm)	0.70" (17.78 mm)	0.50" (12.7 mm)	0.30" (7.62 mm)	0.35" (8.89 mm)
Element Connection	1½" - 16 UN (HP75 series spin-on)	1" - 12 UNF-2A (HP76 series spin-on)	1½" - 16 UN (HP75 series spin-on)	1" - 12 UNF-2A (HP76 series spin-on)	1⅛" - 16 UNF (HP76 series spin-on)
Reservoir Connection	1.87" pin length 1.40" diameter boss	1.87" pin length 1.40" diameter boss	1¼" NPT	¾" NPT	¾" NPT
Seals	Nitrile (Buna)	Nitrile (Buna)	Nitrile (Buna)	Nitrile (Buna)	Nitrile (Buna)

Spin-On Breather Installation Drawings

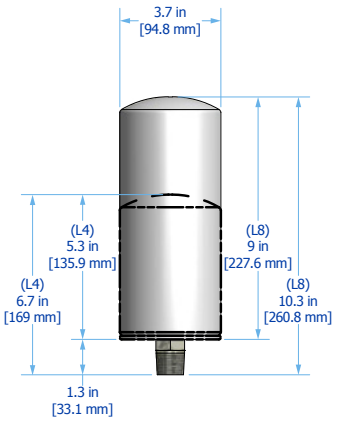
HP75L__-__ + ADTB-75



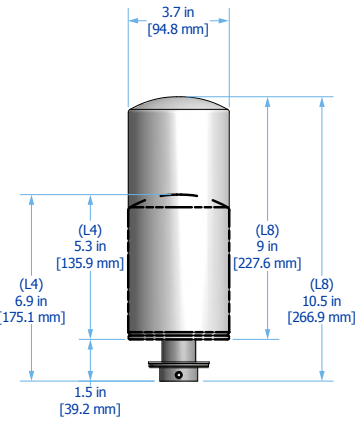
HP75L__-__ + ADBB-75



HP76L__-__ + ADTB-76



HP76L__-__ + ADBB-76



Spin-On Breather Part Number Builder

HP [ ] - [ ] **-B**

Flow Rate | Media Selection

Flow Rate

75L4 290 gpm (1097 lpm), 39 cfm (66 m³/h)
75L8 290 gpm (1097 lpm), 39 cfm (66 m³/h)
76L4 212 gpm (802 lpm), 28 cfm (47 m³/h)
76L8 212 gpm (802 lpm), 28 cfm (47 m³/h)

Media Selection

G8 Dualglass

1M 0.1µ absolute air filtration
3M 0.3µ absolute air filtration
6M 0.6µ absolute air filtration
12M 1.0µ absolute air filtration
25M 2.2µ absolute air filtration

HY-PRO

PTK1

Oil Analysis Patch Test Kit

With PTK1, oil cleanliness can be visually analyzed in the field without waiting for lab results and losing control of the analysis process. The PTK1 kit provides the opportunity to see the type, concentration, and actual size of particulate contamination inside the system.

HY-PRO

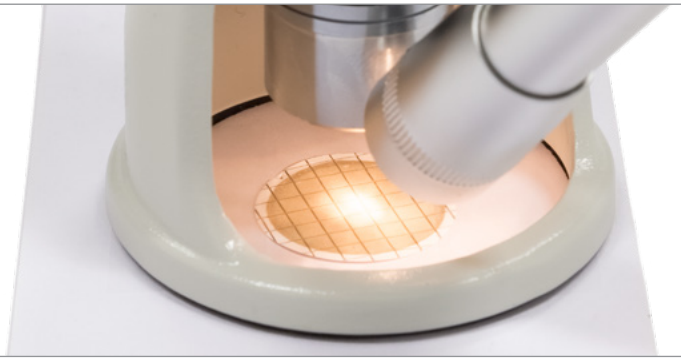
hyprofiltration.com/PTK1

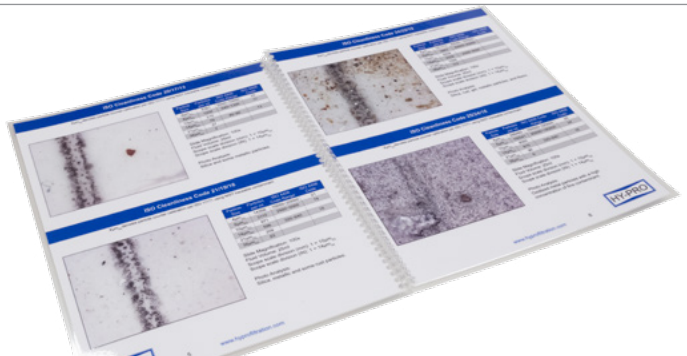
Protect your investment and your equipment.

From the sample bottles to the microscope, everything you need for running patch tests on your oil comes neatly packed away in the PTK1 case. Watertight, crushproof, and dust proof, the Pelican™ Protector Case that houses every PTK1 protects your test equipment so whether you're stowing it for flights between plants or working in the dirtiest of environments, your test equipment is safe and ready when you need it.

See the difference.

With the 100x magnification field microscope and included patch light in every PTK1, examining and monitoring the condition of your oils has never been easier.





ISO Codes have never been easier.

Included in every PTK1 is a visual correlation chart to determine approximate ISO cleanliness codes and types of contamination present in your system. Combined with using Hy-Pro filter elements, you'll be amazed as you watch contamination disappear from your fluids sample after sample.

PTK1 Specifications

Complete PTK-1 Kit includes:

100x Magnification field microscope with battery operated patch light (2 AAA batteries included)

Pelican™ 1520 – watertight, crushproof, and dust proof case

1.2µ filter test patches with patch mounting cards and adhesive covers to protect samples from ambient contamination and to preserve samples for future reference

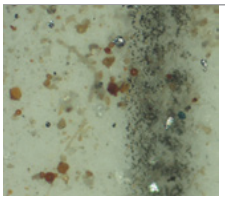
Forceps for filter patch handling

Vacuum pump to extract fluid samples from the system and process 25 ml sample through filter patch

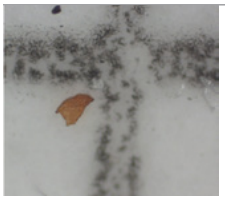
Funnel assembly with ml fill line for accuracy

Sample bottles (6)

Solvent dispenser with dispensing filters



Visual correlation chart to determine approximate ISO Cleanliness Code of patch test kit sample



Visual correlation chart to determine type of particles captured on the patch

Instruction Manual

VTK

On-Site Varnish Test Kits

Condition monitoring is critical in staying ahead of lube oil degradation issues. Varnish Test Kits from Hy-Pro provide on-site access to laboratory grade Membrane Patch Colorimetric (MPC) testing as a key piece in predicting potential varnish problems before unit trip or fail-to-start conditions occur, all according to the world recognized ASTM D7843-12 standard for the measurement of insoluble oxidation by-products.

HY-PRO

hyprofiltration.com/VTK

Unmistakably easy.

Specifically calibrated for MPC testing according to ASTM D7843-12, the Spectrophotometer in every VTK provides incredible ease of use in colorimetry testing for your fluids with results displayed right on the screen.

Bring the lab to you.

VTKs put the same equipment used in labs around the world directly at your disposal to give you access to the most accurate varnish potential testing and trending. Everything you need to properly prepare and analyze a filter patch for varnish potential comes included.

Results before your eyes.

Testing in-house provides the fastest results to understand the status of your fluid. With varnish removal filtration from Hy-Pro and VTK on-site testing, you'll be amazed as your fluids become cleaner sample after sample.

VTK Specifications

Complete Varnish Test Kit includes:

Spectrophotometer calibrated for MPC ΔE

Bench piston vacuum pump (120V AC, 1P, 60 Hz)

.45µ 47 mm membrane filter patches (100)

Glass filter funnel + filter holder top assembly

125 ml glass mixing flask (for sample oil & solvent)

Glass filter funnel flask with vacuum pump tube port

Solvent dispenser with cap, squirt nozzle, and syringe filters (3)

Forceps

Vacuum pump hose

Instruction manual including details on patch preparation, spectrophotometer operation, sample result interpretation and solutions for lube oil varnish

[1]MPC testing should be performed to specifications documented in ASTM D7843-12. For more information or to purchase a report, visit http://www.astm.org/Standards/D7843.htm

PM-1

On-Line ISO Code Particle Monitor

Get fast and accurate ISO cleanliness code readings from your hydraulic and lube oils in real time with the PM-1 Particle Monitor.

HY-PRO

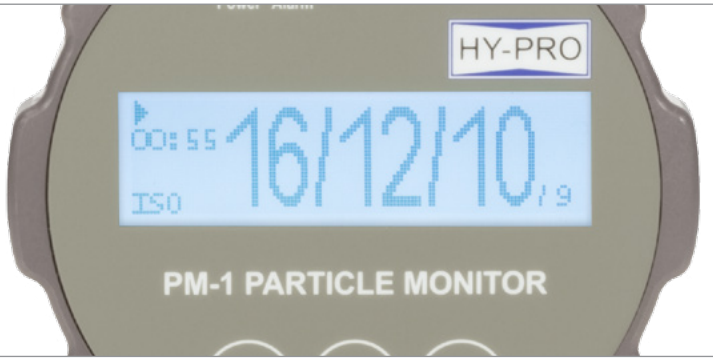
hyprofiltration.com/PM1

Eliminate the guesswork.

Dedicating PM-1 to hydraulic and lube systems can eliminate the need for bottle sampling and let's you know how clean your oil is at all times. PM-1 can be integrated into operating software for constant monitoring and can also be set up to trigger alarms if a system gets too dirty, giving you complete control of your fluids and your systems.

Unmistakably easy.

As the PM-1 analyzes your fluids, the on-screen counts update in real time to show you the ISO cleanliness codes for the 4µ, 6µ, 14µ and 21µ channels in incredible clear and easy to read figures.



Perfectly integrated.

Add the PM-1 to almost any Hy-Pro Filtration System with Special Option code "O" (where applicable) to get real time ISO Codes integrated directly on your filtration and always know exactly how clean your hydraulic and lube oils are.

PM-1 Specifications

Display	The device is calibrated to ISO 11943. It calculates and displays results according to ISO 4406:99, SAE AS 4059, NAS 1638 und GOST 17216.
Voltage	9-33 V dc
Operating Pressure	Up to 6,090 psi (420 bar) dynamic
Protection Class	IP67
Flow Rate	50-400 ml/min (required for operation)
Fluid Connection	M16 x 2.0 (Minimess®)
Electric Connection	M12 x 1 (8 Pole)
Data Memory	On-board 4MB storage capacity
Fluid Compatibility	Mineral oils, phosphate esters and specified synthetics (Skydrol by special option only). Not for use with water glycol or other water based fluids. Water levels above saturation in any fluids will cause the PM-1 to malfunction.
Temperature Range	**Oil** 14°F to 176°F (-10°C to 80°C) **Air** 14°F to 176°F (-10°C to 80°C) **Storage** -4°F to 176°F (-20°C to 80°C)
Interface	RS-232, analog output 4-20 mA configurable, digital alarm output, digital input to start and stop readings

Ordering Information

PM-1	PM-1 Particle Monitor
PM-1-PWRSUP-60[1]	PM-1 electrical power supply for portable use (120V AC, 1P, 60 Hz to 24 V dc)
PM-1-PWRSUP-50[1]	PM-1 electrical power supply for portable use (220V AC, 1P, 50 Hz to 24 V dc)
PM-1-PWRCAB	PM-1 9-33 V power cable with M-12 x 1 (8 pole) connection 15' (5 m) power cable plus 1 x 8 pole connection for PM-1
PM-1-HKIT-60	Portability kit for PM-1. Includes: Pelican™ case, sampling hoses for high pressure Minimess® & low pressure lube application adapters, outlet line flow control attachment, PM-1-PWRSUP-60 power supply (60 Hz) and PM-1-DAT data/power adapter.
PM-1-HKIT-50	Portability kit for PM-1. Includes: Pelican™ case, sampling hoses for high pressure Minimess® & low pressure lube application adapters, outlet line flow control attachment, PM-1-PWRSUP-50 power supply (50 Hz) and PM-1-DAT data/power adapter.
PM-1-BR	PM-1 back mounting bracket with rubber vibration suppression
PM-1-USB	USB adapter – RS-232 serial
PM-1-DAT[1]	15' (5 m) data cable with open ends
PM-1-FITLOW	Low pressure lube system fittings to replace standard Minimess® inlet & outlet connections.[2] Suitable for low pressure systems< 29 psi (2 bar) where achieving minimum flow index 50,000 reading (50 ml/min) is not possible.
PM-1-SC[3]	PM-1 Soft Calibration
PM-1-HC[3]	PM-1 Hard Calibration

[1]For PM-1portable counting you must purchase the PM-1-DAT AND either the PM-1-PWRSUP-60 (for 60 Hz) or the PM-1-PWRSUP-50 (50 Hz) to power the unit. The unit cannot be powered with just the PM-1-PWRSUP-60 or -50. The PM-1-DAT allows for connection to RS232 data port for data acquisition and download.
[2]Minimess® is a registered trademark of Hydrotechnik GMBH.
[3]It is recommended that the unit receives a soft calibration every 2 years of service to ensure the unit is still operating as intended. If soft calibration indicates the unit is not functioning properly, a hard calibration should be performed.

HY-PRO

OA-TO

Turbine Oil Analysis

Hy-Pro offers two levels of analysis for turbine oils to provide insight into system conditions and to help predict and prevent fluid contamination related issues.

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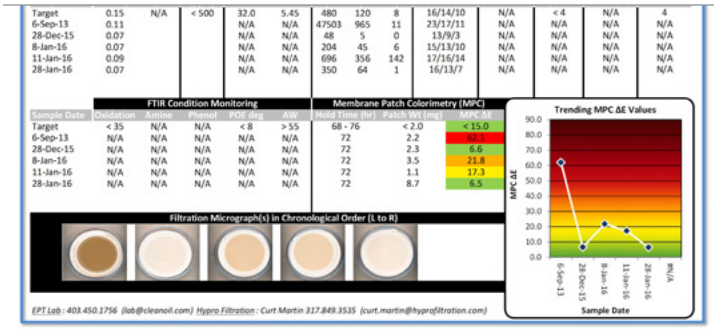


Target	0.15	N/A	< 500	32.0	5.45	480	120	8	16/14/10	N/A	< 4	N/A	4
6-Sep-13	0.11			N/A	N/A	47503	965	11	23/17/11	N/A	N/A	N/A	N/A
28-Dec-15	0.07			N/A	N/A	48	5	0	13/9/3	N/A	N/A	N/A	N/A
8-Jan-16	0.07			N/A	N/A	204	45	6	15/13/10	N/A	N/A	N/A	N/A
11-Jan-16	0.09			N/A	N/A	696	356	142	17/16/14	N/A	N/A	N/A	N/A
28-Jan-16	0.07			N/A	N/A	350	64	1	16/13/7	N/A	N/A	N/A	N/A

FTIR Condition Monitoring						Membrane Patch Colorimetry (MPC)		
Sample Date	Oxidation	Amine	Phenol	POE deg	AW	Hold Time (hr)	Patch Wt (mg)	MPC ΔE
Target	< 35	N/A	N/A	< 8	> 55	68 - 76	< 2.0	< 15.0
6-Sep-13	N/A	N/A	N/A	N/A	N/A	72	2.2	62.1
28-Dec-15	N/A	N/A	N/A	N/A	N/A	72	2.3	6.6
8-Jan-16	N/A	N/A	N/A	N/A	N/A	72	3.5	21.8
11-Jan-16	N/A	N/A	N/A	N/A	N/A	72	1.1	17.3
28-Jan-16	N/A	N/A	N/A	N/A	N/A	72	8.7	6.5

Filtration Micrograph(s) in Chronological Order (L to R)

Trending MPC ΔE Values

(PT Lab : 403.450.1756 (lab@cleanoil.com) Hypro Filtration : Curt Martin 317.849.3535 (curt.martin@hyprofiltration.com)

Comprehensive analysis

Newer generation group II based turbine oils typically have an anti-oxidant additive package made up of sacrificial amines and/or phenols that are depleted as oxidation and oil degradation occurs. The RULER (Remaining Useful Life Evaluation Routine) test compares remaining levels of anti-oxidant additive versus the levels found in new oil to give you the big picture of exactly how your oil is holding up.

MPC

ASTM developed standard (ASTM D7843-12) for quantifying the amount of oil degradation by-products in the oil that can lead to the formation of varnish deposits. We recommend monitoring MPC monthly on older fluids that may have depleted anti-oxidant levels and quarterly for new fluids.

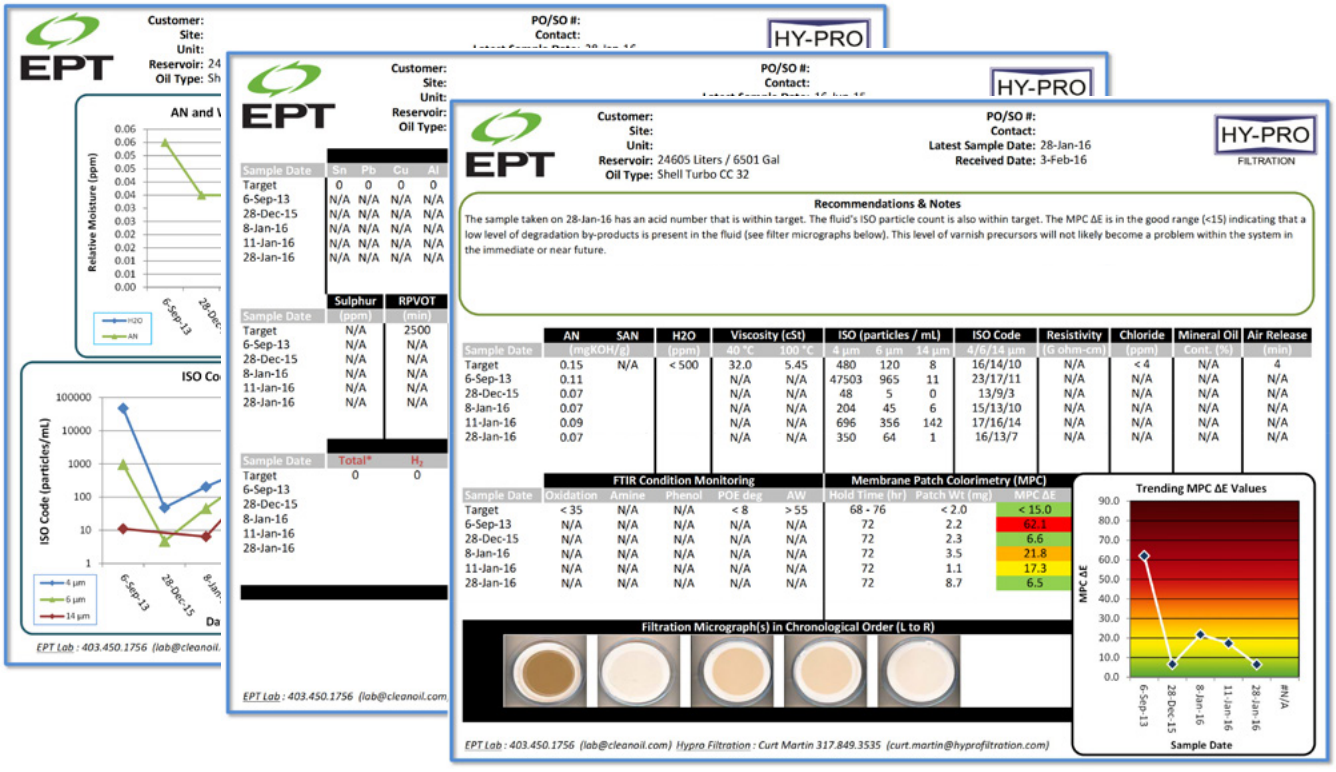
Trending

OA-TO is an invaluable tool to establish a baseline for condition based recommendations to eliminate servo valve deposits, high acid number, water, or high ISO Codes. And once a Hy-Pro contamination solution has been implemented, OA-TO trends your progress toward success and trouble free operation.

Analysis Specifications

Oil Analysis Testing	OA-MPC601311	OA-TO601368
Description	**MPC varnish potential test includes:** MPC colorimetry patch test and photo	**Full analysis package includes:** TAN Metals analysis ppm Water % Karl Fischer Viscosity at 40°C MPC varnish potential MPC patch weight ISO particle count RULER
Recommended Frequency	Monthly for varnish potential and ICB element condition monitoring	Bi-annually for overall lube oil condition monitoring
Testing Standards	MPC/Patch Weight: ASTM D7843	TAN: ASTM D664 Metals: ASTM D5185 Water: ASTM D7546 Viscosity: ASTM D445 ISO Codes: ISO 11500/4406 MPC/Patch Weight: ASTM D7843
Sample Size Required	100mL (sample bottle included)	350mL (sample bottle included)
Fluid Compatibility	Mineral oils and turbine oils	Mineral oils and turbine oils

Sample Report



OA-PE

Phosphate Ester Analysis

Maintaining phosphate ester based fluids can be complex. Hy-Pro has solutions that make it easy and the first step in achieving trouble free EHC and high temp hydraulic operations is understanding the condition of your fire resistant fluids.

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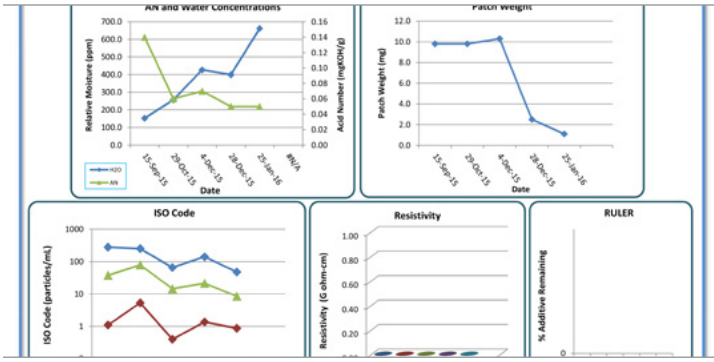
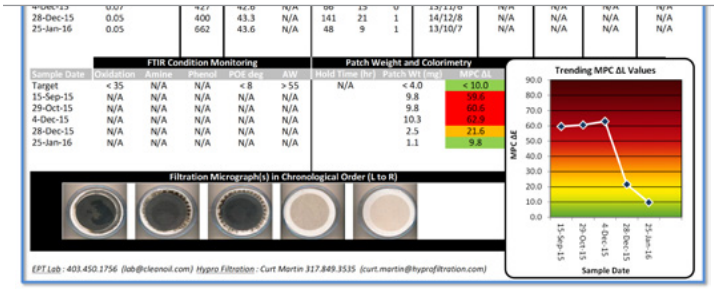


Comprehensive analysis

OA-PE is the most comprehensive phosphate ester analysis package currently available. In addition to common metrics such as AN (acid number), water and resistivity, the OA-PE also reports dissolved metals, SAN (strong acid), patch weight, ISO Code and MPC to provide the whole picture of your fluids.

Restoration focused

With phosphate ester there are no sacrificial additives and fluids are typically condemned based on contamination that could be removed. OA-PE arms you with the information you need to avoid premature fluid replacement or a bleed and feed routine and to implement a solution to restore the fluid to normal operating condition.



Trending

OA-PE is an invaluable tool to establish a baseline for condition based recommendations to eliminate servo valve deposits, electro-kinetic corrosion, high acid number, water, low resistivity or black fluid. And once a Hy-Pro contamination solution has been implemented, OA-PE trends your progress toward success and trouble free operation.

Analysis Specifications

Oil Analysis Testing

OA-PE601370

Description

Full analysis package includes:
TAN
Metals analysis ppm
Water % Karl Fischer
Viscosity at 40°C
Resistivity
ISO particle count
MPC patch weight + photo

Recommended Frequency

Monthly for varnish potential and ICB element condition monitoring

Testing Standards

TAN: ASTM D664
Metals: ASTM D5185
Water: ASTM D7546
Viscosity: ASTM D445
Resistivity: ASTM D1169
ISO Codes: ISO 11500/4406
MPC/Patch Weight: modified ASTM D7843.

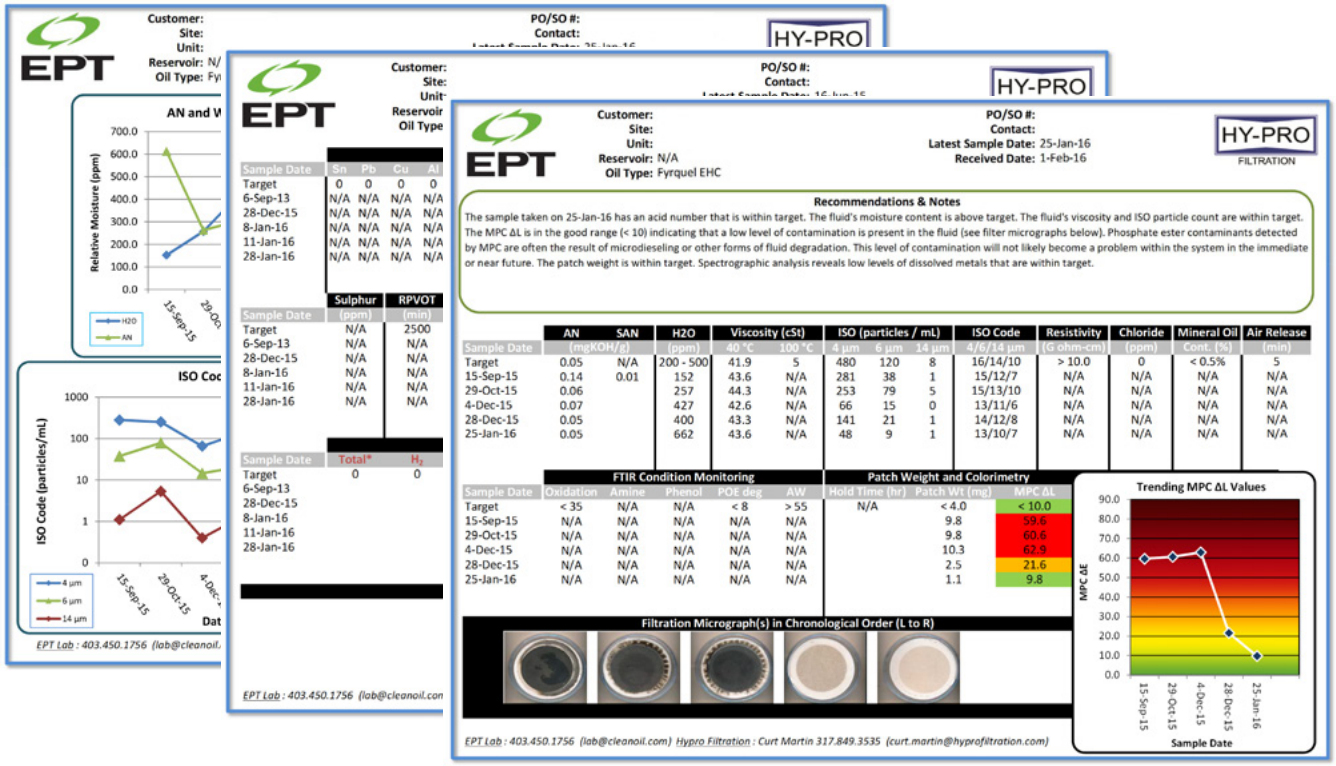
Sample Size Required

250mL (sample bottle included)

Fluid Compatibility

Phosphate esters

Sample Report



VUD Questionnaire

Name	**Phone**
Position	**Email**
Company	**Fax**
Address	

System Questions

Oil Characteristics
ISO Cleanliness
Water Content (PPM)
Water Ingress
Current Unit
Why Change?
Objective in hours (High PPM to Target PPM)

Location Questions

Temperature
Utility Services Available
General Environment (i.e. dry, wet, dust, etc)
Explosion Proof Requirement?
Unit
Plant Application (i.e. turbine, paper mill, etc)

Information & Respond

Reply Required (in days)
Customer Objectives

Filter Application Data Sheet

Name				**Company**			
Phone				**Email**			
Mobile				**Fax**			
System Description							
Critical System Components							
Filter Location (pressure, return, etc)							
Existing System Filtration (location, micron rating)							
Fluid Information	Manufacturer/Tradename:						
	ISO VG:			S.G.:			
	Viscosity cSt:			Viscosity SUS:			
	Emulsion Mix:			Water Content (PPM):			
Operating Temperature Range	From:		To:	☐ °F ☐ °C			
Cold Start Temperature	☐ °F	☐ °C	Time Interval to Operating Temp:				
Contaminant Ingression Rate & Description (coal mill, paper mill)	☐ Low		☐ Medium	☐ Severe			
Contaminant (wear metal, gel, etc)							
Maximum Clean Element ΔP			☐ PSID	☐ BARD	(Typically 15-30% indicator trip setting)		
Maximum Loaded Element ΔP			☐ PSID	☐ BARD	(dependent on bypass valve setting)		
Element Change Interval							
Target ISO Cleanliness Code (per ISO4409:1999, 4/6/14)							
System Pressure	Normal:		Maximum:		☐ PSID	☐ BARD	
Pump Flow Rate	Normal:		Maximum:		☐ GPM	☐ LPM	
Return Flow Rate	Normal:		Maximum:		☐ GPM	☐ LPM	
Seal Material	☐ Nitrile (Buna)	☐ Viton	☐ EPR	☐ Silicone	☐ Other:		
Bypass Valve	☐ None	☐ 3 psi (0.21 bar)	☐ 5 psi (0.34 bar)	☐ 15 psi (1.03 bar)	☐ 25 psi (1.72 bar)	☐ 50 psi (3.45 bar)	☐ 102 psi (7.0 bar)
Differential Pressure Indicator	☐ Visual Pop-Up	☐ Electrical	☐ Visual + Electrical	☐ ΔP Gauge	☐ ΔP Gauge + Electrical	☐ None	
Mounting Arrangement (bowl down, top loading, etc)							
Port Configuration (in-line 180°, 90°, dual inlet, etc)							
Other Requirements (duplex, reverse flow, bi-directional, etc)							
Space Restrictions (overhead)							
Quantity and Required Delivery							
Notes:							

HY-PRO

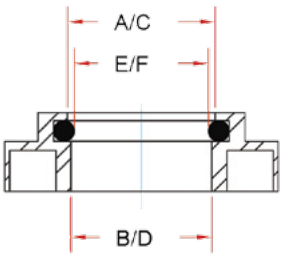
Non-Standard Filter Element Worksheet

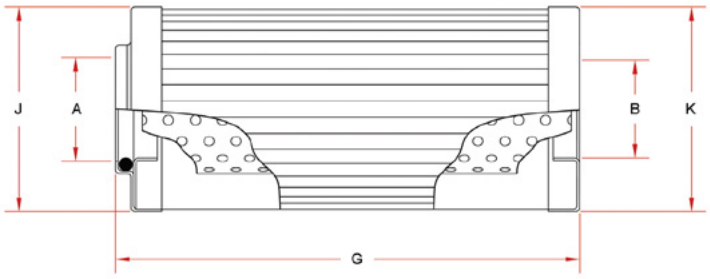
Name				
Company				
Phone				
Email				
Part Number				
Element OEM				
Element Style[1]				(i.e. 1A – Select from page next page)
Quantity Required				
End Cap Material				(plated steel, stainless steel, plastic molded, etc)
Support Tube				(no-coreless, inner only, outer only, inner + outer)
Bypass Valve	☐ Yes	☐ No		
Bypass Setting			☐ PSID	☐ BARD
Media Type				(cellulose, poly, glass, wire mesh, stainless fiber)
Media Rating				(nominal, absolute, $\beta X_{[C]}$ = ?, βX = ?)
Seal Location				(none, single end, double end)
Seal Type				(captured o-ring, male o-ring, flat gasket, grommet)
Seal Material				(Buna, Viton/fluorocarbon, EPR, silicone, neoprene)
Flow Direction	☐ In-to-out	☐ Out-to-in		
Collapse Rating			☐ PSID	☐ BARD
Fluid Type + ISO VG				

Dimensions

☐ inches ☐ cm

Dimension boxes H, I, L have been left blank for use in a sketch or other features that need to be added to the drawing. When measuring for dimensions E and F (o-ring touch-off) be sure that the o-ring is still installed and that the caliper blade makes only very light contact with the o-ring. Do not apply pressure to the o-ring. With captured o-ring seal end caps the B or D dimension will typically be smaller than the A or C dimension respectively.



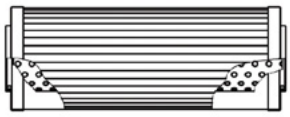
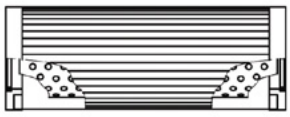
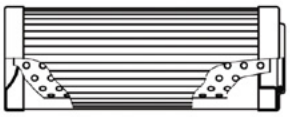
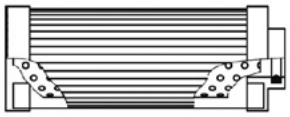
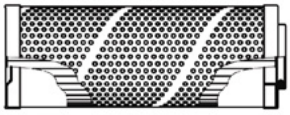
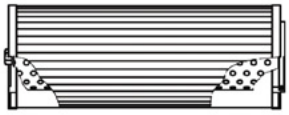
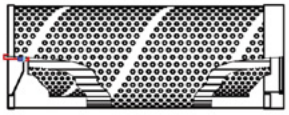
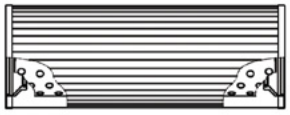
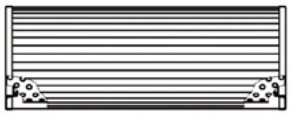
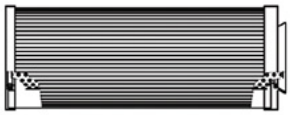
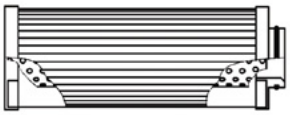
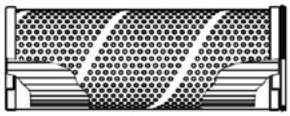
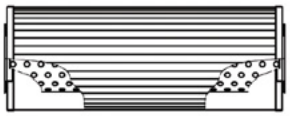
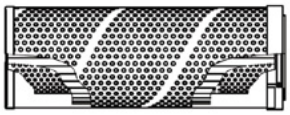
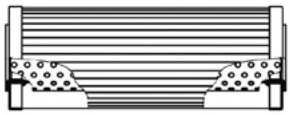
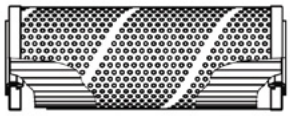
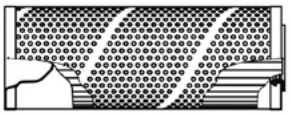
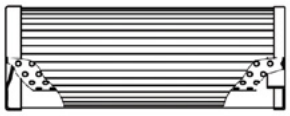
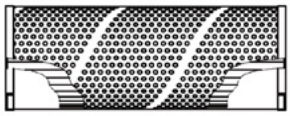
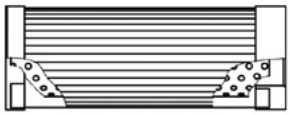
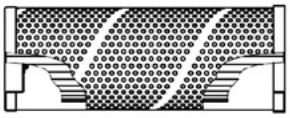
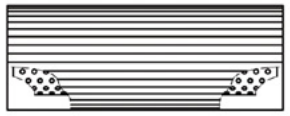
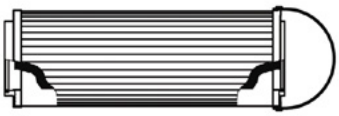
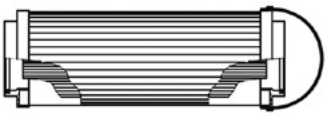
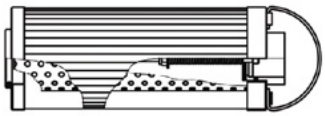
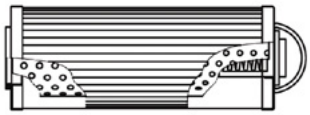
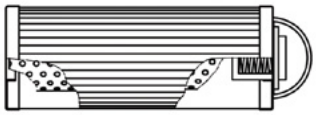
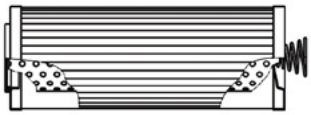
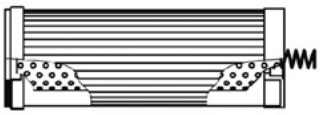
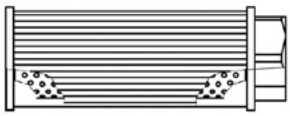
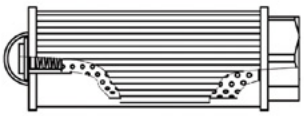


A (id1):	E (ort1):	I:
B (id1a):	F (ort2):	J (od1):
C (id2):	G (oal):	K (od2):
D (id2a):	H:	L:

[1]If your element style is not on the grid (see next page), please send a sketch and/or digital photos.

HY-PRO

Non-Standard Filter Element Worksheet

	1	2	3	4
A				
B				
C				
D				
E				
F				
G				
H				
I				

HY-PRO

Terms and Conditions

Standard Terms

Minimum Invoice $50.00 Net

F.O.B.: Anderson, Indiana Terms: Net 30

A 1½% per month (18% annual percentage rate) finance charge may be added to your account on any amount that is more than 30 days past due.

The items described in this document are hereby offered for sale at prices to be established by Hy-Pro Filtration, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Hy-Pro Filtration, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. **Terms and Conditions of Sale:** All descriptions, quotations, proposals, offers, acknowledgments and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.
2. **Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.
3. **Element Warranty:** Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 365 days from the date of shipment to Buyer. This warranty comprises the sole and entire warranty pertaining to items provided hereunder, Seller makes no other warranty, guarantee, or representation of any kind whatsoever, all other warranties, including but not limited to, merchantability and fitness for purpose, whether express, implied, or arising by operation of law, trade usage, or course of dealing are hereby disclaimed. Notwithstanding the foregoing. There are not warranties whatsoever on items built or acquired wholly or partially, to buyer's designs or specifications. Excludes manufactured equipment, see Equipment Warranty.
4. **Limitation of Remedy:** Seller's liability arising from or in any way connected with the item sold or this contract shall be limited exclusively to the repair or replacements of the items sold or refund of the purchase price paid by Buyer, at Seller's sole option. In no event shall Seller be liable for any incidental consequential or special damages of any kind, or nature whatsoever, including but not limited to lost profits arising from or in any way connected with this agreement or items sold hereunder, whether alleged to arise from breach of contract, express or implied warranty or in tort, including without limitation, negligence, failure to warn or strict liability.
5. **Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modifications or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require. Special (non-catalog) articles are not cancelable or returnable. Subject to a 20% restocking charge.
6. **Special Tooling:** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller, which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.
7. **Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.
8. **Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items, sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts of the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.
9. **Force Majeure:** Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of the Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.
10. **Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the state of Indiana. No actions arising out of the sale of the items sold hereunder of this Agreement may be brought by either party more than two (2) years after the cause of action accrues.
11. **Packaging and Shipping:** Items are provided with standard commercial packaging, labeling, painting and inspection. Prices and discounts are based on standard commercial packaging only. Hy-Pro Filtration reserves the right to make partial shipments at its discretion.
12. **Returns:** Contact Hy-Pro Filtration for a Return Goods Authorization (RGA) number. Returns will not be accepted without a complete RGA number attached to the product or shipping documents. Returned material must be in sellable condition, in original packaging and sealed. Elements may be returned within one year of date code. Returns must be received by Hy-Pro Filtration within 45 days after an authorization (RGA) number is issued. Returns are subject to a 20% restocking charge.
13. **Payment:** Shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.
14. **Indemnity for Infringement of Intellectual Property Rights:** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer bases on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If any item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party. Seller may at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it non-infringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing. Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyers sole and exclusive remedy for infringement of Intellectual Property Rights. If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

Bulletin # MKTTC2014/12

Warranty Statement

Hy-Pro Filtration manufactured equipment is warranted to be free from defective materials and workmanship for a period of one year from the date of shipment when used within the normal working parameters for which the equipment was designed. Hy-Pro Filtration assumes no responsibility for unauthorized installation of any added components, removal or repair of originally installed components or alterations or rewiring of originally supplied equipment. Any such changes without written instructions or prior approval from Hy-Pro Filtration will void all warranties. If any Hy-Pro Filtration supplied equipment does not perform as warranted, it will be repaired or replaced at Hy-Pro Filtration's discretion. If deemed defective due to improper use, installation, start-up, or maintenance, Hy-Pro Filtration reserves the right to charge the Purchaser with the full costs associated with warranty replacement. Hy-Pro Filtration will ship warranty replacements via standard ground service. If other modes are required, the customer may be liable for costs incurred. It is the customer's responsibility to properly ship, freight prepaid, all item(s) to be returned to Hy-Pro Filtration. Shipping insurance is recommended.
This warranty does not apply to parts, which through normal use require replacement during the warranty period. Hy-Pro Filtration liability under this warranty shall be limited to repair or replacement. In no event, however, will Hy-Pro Filtration be liable for any labor or consequential damages. This warranty shall not apply to any assembly or component part of the equipment which has been furnished by Purchaser.
Except for the express warranty set forth above, Hy-Pro Filtration hereby disclaims all warranties, expressed or implied, to Purchaser, including but not limited to, warranty of fitness for a particular purpose and warranty of merchantability. Hy-Pro Filtration shall not be liable for any incidental or consequential damages which might arise out of the use of this property.

Merchandise Return & Warranty Authorization Policy

Any merchandise returned to the factory for credit or warranty replacement must be accompanied by a completed Return Goods Authorization (RGA) form. To obtain an RGA number and form you must contact Customer Service at 317.849.3535. All shipments must be sent to the factory freight prepaid, unless otherwise approved. Shipping insurance is recommended. Returns must be sent to the correct factory location, Customer Service will confirm the return location.

Hy-Pro Filtration
6810 Layton Road
Anderson, IN 46011

Hy-Pro Filtration West
1704 64th Ave, Suite B
Vancouver, WA 98661

In the case of multiple item returns, all items must be tagged with possible causes of failure (if applicable). Please mark the outside of each shipping carton with the RGA number.

Return Disposition: Elements and Non-Manufactured Equipment

1. Upon request, an authorized RGA number and form will be issued to the customer.
2. Any items returned must be in unused condition, unless otherwise authorized.
3. If items are returned for a customer related error a restocking fee up to 20% will be applied.
4. If items are returned for a Hy-Pro related error a full credit will be issued.
5. Credit will not be issued on items which are no longer in specification with current design, were manufactured more than 12 months prior to the return date, or were damaged in return shipping. Hy-Pro will determine if the items are suitable for return.
6. If the return material is not received within 45 days from the date of issue, Hy-Pro will cancel the RGA and reserves the right to not accept the return, unless otherwise authorized.
7. Items returned shall be shipped to the factory freight prepaid. Shipping insurance is recommended.

Return Disposition: Manufactured Equipment

Complete Equipment Return:

1. Upon request, an authorized RGA and form will be issued to the customer.
2. The customer must return equipment to the appropriate plant indicated on the RGA.
3. If equipment is returned for a customer related error a restocking fee up to 20% will be applied.
4. If equipment is returned for a Hy-Pro related error a full credit will be issued.
5. Credit will not be issued on equipment which is no longer in specification with current design, were manufactured more than 12 months prior to the return date, or were damaged in return shipping. Hy-Pro will determine if the equipment is suitable for return.
6. If the return equipment is not received within 45 days from the date of issue, Hy-Pro will cancel the RGA and reserves the right to not accept the return, unless otherwise authorized.
7. Equipment returned shall be shipped to the factory freight prepaid. Shipping insurance is recommended.

Defective Component Return (Warranty Claims):

1. Upon request, an authorized warranty RGA claim number and form will be issued to the customer.
2. The customer must return the item(s) to the appropriate plant indicated on the RGA.
3. The customer must supply a replacement PO for warranty claim processing.
4. Hy-Pro reserves the right to refuse warranty coverage and charge all costs associated with warranty replacement if:
   a. The item(s) are deemed defective as a result of inappropriate use, installation, start-up, improper maintenance or during return shipping.
   b. The warranty claim is not received by Hy-Pro within 45 days of the date of issue, unless otherwise authorized.
5. Items returned shall be shipped to the factory freight prepaid. Shipping insurance is recommended.

Note: All correspondence must reference the RGA# to ensure proper tracking return or claim.

ATEX Recommendation for the use of fluid filter and maintenance indicators in hazardous zones according to Directive 2014/34/EU

Fluid Filters

Filters (hydraulic-, lubrication-oil-, air breather-) in fluid systems are not subjective to this directive. Fluid filters do not require a CE- marking.

For fluid filters to be used in hazardous zones, the ignition sources have to be analyzed by the operator, considering the complete installation.

During filtration of fluid and gases, electrostatic charge may occur on the filter element, the filter housing and the fluid – especially when glass fiber filter elements are used.

For use in hazardous zones, Hy-Pro Filtration recommends to use only metal filter housings and to connect the housing electrically to ground.

These filters do not possess any external ignition source.

The earthing is realized by using the clamping bolts. The maximum content of magnesium is less than 7.5%.

The size of the largest projected non-conducting areas are smaller than 100 sqcm (400 sqcm if a conducting framing is provided).

According to DIN EN 13463, the Hy-Pro fluid filters are suitable for the use in applicance group II category 2 G/D up to 120 Deg C.

The function of the electrical maintenance indicator is described below.

Maintenance Indicators

The electrical maintenance indicators provided with Hy-Pro released products are simple electrical devices according to DIN EN 60079-11, without their own voltage supply.

The electrical components consist of reed-contacts, bimetal switches, plug connections and terminal clamps.

For equipment group II, category 2 G (zone 1) and category 2 D)zone 21), these simple electrical components can be used acc. EN 60079-14 and EN241-11 in intrinsically safe circuits [EEX ib] without making and certification.

The EN 60079-12 (gas) and EN 61241-14 (dust) installation regulations have to be observed as well as the national security terms and accident prevention regulations.

The electrical utilities are attributed to category ib and temperature class T5.

If the electrical upper part is used, conventional (intrinsically safe circuit), it will not present itself as a heat source.

Usage in EX-zones is possible when the indicators are connected intrinsically safe (EX-i).

For that purpose, a switch amplifier with an intrinsically safe input is required. The switch amplifier must be installed outside the EX-zone, leaving only the intrinsically safe wires in contact with the hazardous zone.

FLA Estimated Amp Draw

FSLD

Flow Rate	HP (kW)	Power Option 11	X11	12	X12	21	X21	23	X23	40	X40	46	X46	52	X52	57	X57
0.5-2	0.5 (0.37)	7.2	6.4	7.4	6.6	3.6	3.1	1.9	1.6	0.86	0.8	0.95	0.8	0.89	1.3	0.69	1.1
5	1 (0.75)	12.4	12.4	12.8	13	6.4	6.2	3.7	3.2	1.85	1.9	1.7	1.6	1.5	1.3	1.3	1.1
10	2 (1.5)	20	23	17.6	23.2	10	11.5	8.8	11.3	3.1	3.6	3	2.9	2.5	2.4	2.3	2.2
22-32	5 (3.7)	NA	NA	NA	NA	22	23.5	23	8.4	7.6	8	6.5	4.2	5.7	5.4	5.2	5.2

CFU, FCLCOD, FCLCOT, FSLCOD

Flow Rate	HP (kW)	Power Option 11	X11	12	X12	21	X21	23	X23	40	X40	46	X46	52	X52	57	X57
0.5-5	0.5 (0.37)	7.2	6.4	7.4	6.6	3.6	3.1	1.9	1.6	0.86	0.8	0.95	0.8	0.89	1.3	0.69	1.1
10	1 (0.75)	12.4	12.4	12.8	13	6.4	6.2	3.7	3.2	1.85	1.9	1.7	1.6	1.5	1.3	1.3	1.1
20	1.5 (1.1)	16	17	15	16	8	9	5	4.4	2.3	2.8	2.3	2.2			1.8	2.2

SVR

Model	HP (kW)	Power Option 11	X11	12	X12	21	X21	23	X23	40	X40	46	X46	52	X52	57	X57
1200	1 (0.75)	12.4	12.4	13.2	13	6.4	6.2	3.7	3.6	1.6	3.3	1.7	1.8	1.3	1.3	1.1	1.1
2400	1.5 (1.1)	16	16.5	15	15.5	8	8.5	5	4.4	2.3	2.8	2.3	2.2	2	2.4	1.8	2.2

FC, FCL, FPL, FSL, FSW, FSTO, FSA, FSJL

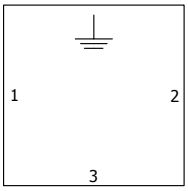
Flow Rate	HP (kW)	Power Option 11	X11	12	X12	21	X21	23	X23	40	X40	46	X46	52	X52	57	X57
0.5-4	0.5 (0.37)	7.2	6.4	7.4	6.6	3.6	3.1	1.9	1.6	0.86	0.8	0.95	0.8	0.89	1.3	0.69	1.1
5-10	1 (0.75)	12.4	12.4	12.8	13	6.4	6.2	3.7	3.2	1.85	1.9	1.7	1.6	1.5	1.3	1.3	1.1
22-32	3 (2.2)	NA	NA	NA	NA	13.2	14	8	8.4	4.4	5.2	3.8	4.2	3.2	3.5	3.1	3.3

*Equipment with on board PM-1 (O Option) may have higher power motors and higher amp draw. Contact factory.

Indicator Wiring Diagrams

PFH 131, 152, 419 "DX" INDICATORS

DIN 43650A PLUG & RECEPTACLE
WITH CABLE CLAMP

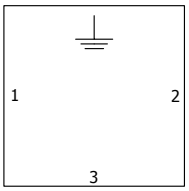


SPDT SWITCH
1 = COMMON
2 = NC
3 = NO

SWITCHING VOLTAGE: MAX. 120 V AC / 175V DC
SWITCHING CURRENT: MAX. 0.17A AC / 0.25A DC
SWITCHING POWER: MAX. 3.5 VA AC / 5W DC

PF2

DIN 43650A PLUG & RECEPTACLE
WITH CABLE CLAMP



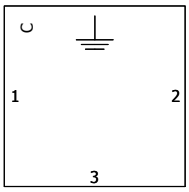
SPDT SWITCH
1 - COMMON
2 - NC
3 - NO

ALTERNATING CURRENT: 250 V AC 5 AMPS

DIRECT CURRENT
RESISTIVE VOLTAGE: 220
INDUCTIVE LOAD AMPS: 0.25
LOAD AMPS: 0.10

PF2, PFH131, PFH152, PFH419 "L" INDICATOR OPTION

DIN 43650A PLUG & RECEPTACLE
WITH CABLE CLAMP

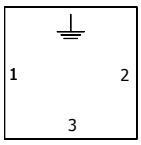


SPDT SWITCH
C - 24 V DC Common (-)
1 - 24 V DC (+)
2 - NC
3 - NO

24 V DC MAXIMUM VOLTAGE
0.25 AMP MAX
3 WATT MAX POWER

LFIND-F,D,H

For FSL, FCL, FCLCOD, FSLCOD, FSTO, FSA, FSJL,
SVR, LF, LFM, DLF, DLFM, FPL&FC "D3" OPTION



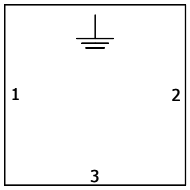
STANDARD PORT
1 - COMMON
2 - NC
3 - NO

TYPE: SPDT
OPTION: H
POWER: 60W
MAX. CURRENT: 1.0 AMPS
MAX. VOLTAGE (VAC/VDC): 240
SETTING (%F.S.): 25 TO 100

A PROTECTIVE CONDUCTOR
TERMINAL IS PROVIDED ON
THE DIN CONNECTOR

F8, PF4

DIN 43650A PLUG & RECEPTACLE
WITH CABLE CLAMP

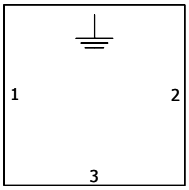


SPDT SWITCH
1 - COMMON
2 - NO
3 - NC

ELECTRICAL RATINGS
4 AMPS, INDUCTIVE
7 AMPS, RESISTIVE
2 AMPS, LAMP LOADED @ 28 V DC, 115 V AC 60 HZ
28 V DC

MF3, S409

DIN 43650A PLUG & RECEPTACLE
WITH CABLE CLAMP

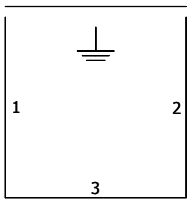


SPDT SWITCH
1 - COMMON
2 - NO
3 - NC

5A
125/250 V AC
24 V DC (RESISTIVE)
AUTOMATIC RESETTING

DFN/DFH

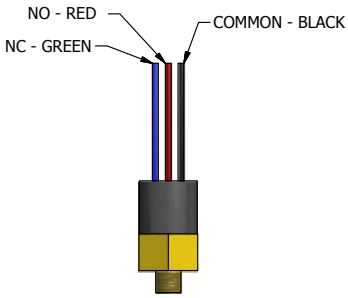
43650A PLUG & RECEPTACLE
WITH CABLE CLAMP



SPDT SWITCH
1 - NO OR NC (REVERSIBLE)
2 - NC OR NO (REVERSIBLE)
3 & ⏚ - NOT USED

1A
250 V AC / 200 V DC
70W
AUTOMATIC RESETTING

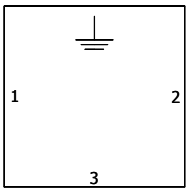
G25E / G45E



3A 125 V AC MAX
3A 40 V DC MAX

G25D / G45D

DIN 43650A PLUG & RECEPTACLE
WITH CABLE CLAMP



SPDT SWITCH
1 - COMMON
2 - NC
3 - NO

3A 125 V AC MAX
3A 40 V DC MAX
U.L. RECOGNIZED

Mounting Specifications

Assembly	Connection Option	Mounting Thread Type	Connection Flange Thread
PFH131	G12	M8 x 1.25	
	S8	5/16 – 18 UNC	
	S12	5/16 – 18 UNC	
PFH152	G16	M10 x 1.50	
	S16	3/8 – 16 UNC	
PFH419	G20	M12 x 1.75	
	C20	M12 x 1.75	1/2 – 13 UNC
	S20	7/16 – 14 UNC	
	S24	7/16 – 14 UNC	
PFH840	C32	1/2 – 13 UNC	3/4 - 10 UNC
PFHB	C20	M14 x 2.0	M12 x 1.75
	C24	M16 x 2.0	M12 x 1.75
DFH19	F16	M8 x 1.25	M8 x 1.25
	G16	M8 x 1.25	
DFH39	F24	M12 x 1.25	M12 x 1.25
	G24	M12 x 1.25	
DFN19	F16	M8 x 1.25	3/8 x 16 – UNC
	G16	M8 x 1.25	
DFN39	F24	M10 x 1.5	7/16 – 14UNC
	G24	M10 x 1.5	

Quality Statement & ISO Certification

Our Mission

At Hy-Pro, our mission is to make our customers as efficient as possible. From improving the reliability of hydraulic and lube oil assets through our filter elements and filtration equipment to stopping equipment failures and downtime to reducing the environmental impact from the use and disposal of industrial fluids, it is our goal to eliminate industrial fluid contamination and all difficulties related to it.

Hy-Pro Filtration strives to provide the highest quality filtration products and solutions, with a strong commitment to customer service, competitive pricing, and customer product support. The company continuously develops product and process improvements along with the introduction of new products.

Quality Policy

Our policy is to provide the highest quality filtration products and service to both internal and external customers.

Our commitment is to continually improve products and processes, increase the capabilities of all employees and enhance the relationships with suppliers and customers.

ISO Certification

ASR
American Systems
REGISTRAR
5281 Clyde Park Ave. SW, Suite 1
Wyoming, MI 49509 USA
www.asrworldwide.com
616-942-6273

ANAB ACCREDITED

American Systems Registrar, LLC, a provider of third-party system registration and accredited by the ANSI-ASQ National Accreditation Board attests that:

HY-PRO CORPORATION
6810 LAYTON ROAD
ANDERSON, IN 46011

with a scope of:

DESIGN AND MANUFACTURE OF FLUID FILTRATION COMPONENTS AND SYSTEMS

has established a quality management system that is in conformance with the International Quality System Standard

ISO 9001:2008

ASR Certificate Number:	1459
Date of Certification:	August 20, 2015
Date of Certification Expiration:	August 19, 2018
Revision:	
Re-Issue Date:	

President

CERTIFICATE OF REGISTRATION

Hy-Pro Interchange

The world's largest selection of critical filter elements.

With over 250,000 filter element crosses, Hy-Pro's Interchange offers the most extensive and comprehensive selection of critical hydraulic and lube oil filter elements anywhere. And it's only growing larger. Each year, we catalog thousands of filter elements in our efforts to provide our customers with the best contamination solutions, service and support possible.

Lower ISO Codes: Lower Total Cost of Ownership Hy-Pro filter elements deliver lower operating ISO Codes so you know your fluids are always clean, meaning lower total cost of ownership and reducing element consumption, downtime, repairs, and efficiency losses.

DFE Rated Filter Elements DFE is Hy-Pro's proprietary testing process which extends ISO 16889 Multi Pass testing to include real world, dynamic conditions ensures that our filter elements excel in your most demanding hydraulic and lube applications.

Upgrade Your Filtration Keeping fluids clean results in big reliability gains and upgrading to Hy-Pro filter elements is the first step to clean oil and improved efficiency.

Advanced Media Options DFE glass media maintaining efficiency to $\beta 0.7_{[c]} > 1000$, Dualglass + water removal media to remove free and emulsified water, stainless wire mesh for coarse filtration applications, and Dynafuzz stainless fiber media for EHC and aerospace applications.

Delivery in days, not weeks From a massive inventory of ready-to-ship filter elements to flexible manufacturing processes, Hy-Pro is equipped for incredibly fast response time to ensure you get your filter elements and protect your uptime.

More than just filtration Purchasing Hy-Pro filter elements means you not only get the best filters, you also get the unrivaled support, training, knowledge and expertise of the Hy-Pro team working shoulder-to-shoulder with you to eliminate fluid contamination.

Want to find out more? Get in touch.

hyprofiltration.com
info@hyprofiltration.com
+1 317 849 3535

HY-PRO

MKTLIT-CATA-090717-BC