Fluid Contamination Under Control . . .

DFE Rated Filter Element Upgrades

Upgrade existing hydraulic and lube filter elements to Hy-Pro G7 Dualglass for cleaner fluid and improved reliability. Hy-Pro Elements are validated to achieve $\beta x_{[c]} > 1000$ beta ratios. Establish a Total Cleanliness program with Hy-Pro element upgrades to achieve and maintain improved fluid cleanliness and optimize hydraulic and lubrication assets

Element Upgrades For:

Pall	Hydac	Parker
Schroeder	MP Filtri	Internormen
Donaldson	Vickers	Eppensteiner
General Elec	Hilco	Kaydon
Indufil	PTI	Taisei Kogyo
Stauff	Western	Purolator
Porous Media	Finn	Fairey Arlon
Cuno	Baldwin	Fleetguard
Norman	Vokes	Yamashin

. . . And More!

High Pressure Filters

In-Tank Return Filters

Off-line Filter Units

High Flow Filter Assemblies & Duplexes

HY-PRO FILTRATION

www.filterelement.com

. . . with innovative filtration products, support and solutions

Water and Entrained Gas Contamination Solutions

75% of all hydraulic component failures are caused by surface degradation which is related to fluid contamination. The effects of water in oil systems can drastically reduce lube performance and reliability. Bearing life and critical component life is greatly reduced by water levels above and within the saturation point. Continuous or periodic high water levels can 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

V10 Vac-U-Dry

Hy-Pro Vac-U-Dry Vacuum Dehydrators remove water below 20 ppm (0.002%) with greater efficiency than centrifuge or air stripping technology. Intuitive design is more effective and operator friendly.

Before . . .

. . . After

Hy-Pro Turbine Oil and Diesel Coalesce Skids

Maintain turbine lube oil water levels below 150 ppm and remove gross free and entrained water rapidly when high water ingress from seal or heat exchanger leaks occur. High efficiency particulate filtration controls fluid cleanliness below target ISO codes.

Remove water from diesel fuels in a single pass or re-circulating configuration. Solutions include complete skids with control panel and pump to filtration only skids that can be installed in-line on existing delivery or re-circulating systems. high efficiency particulate filtration improves fuel cleanliness and protects injectors.

Mobile Filtration Systems - Filter Carts

The FCL series filter carts are ideal for both hydraulic and lube fluids (low and high viscosity). Media options for fine particulate ($\beta 5_{[c]} > 1000$) & water removal capability. Flow rates 18 ~ 82 Lpm, 5 ~ 22 gpm as standards.

Higher flow and flexible design allow Hy-Pro to customize a solution for any application.

Optional particle monitor.
Oil sampling ports standard.

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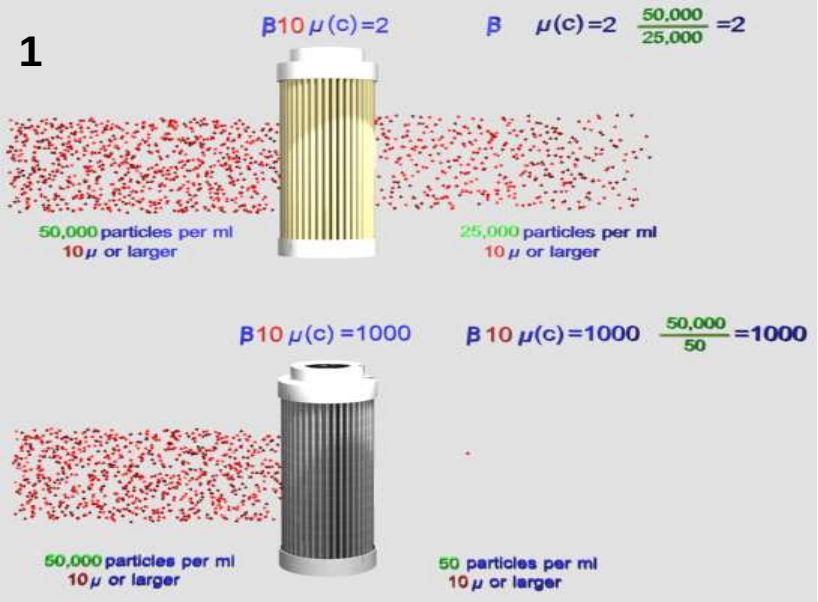
Evolution of Media: Hy-Pro G7 Dualglass Upgrade from Cellulose Media

Glass media has superior fluid compatibility versus cellulose with hydraulic fluids, synthetics, solvents, and high water based fluids. Glass media also has a significant filtration efficiency advantage over cellulose, and is classified as "absolute" where cellulose media efficiency is classified as "nominal".



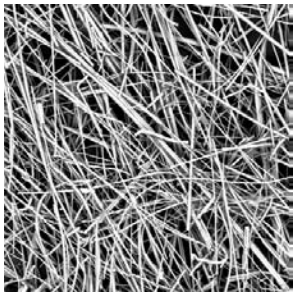
Elements of different media with the same "micron rating" can have substantially different filtration efficiency. Figure 1 provides a visual representation of the difference between absolute and nominal filter efficiency.

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. The cellulose element would typically achieve a code no better than 22/20/17.

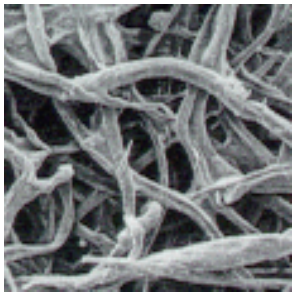
Runaway contamination levels at $4\mu_{[c]}$ and $6\mu_{[c]}$ are very common when cellulose media is applied where a high population of fine particles exponentially generate more particles in a chain reaction of internally generated contaminate.

Inorganic glass fibers are much more uniform in diameter and are smaller than cellulose fibers. Organic cellulose fibers can be unpredictable in size and effective useful life. Smaller fiber size means more fibers and more void volume space to capture and retain contaminate.

Glass Fiber



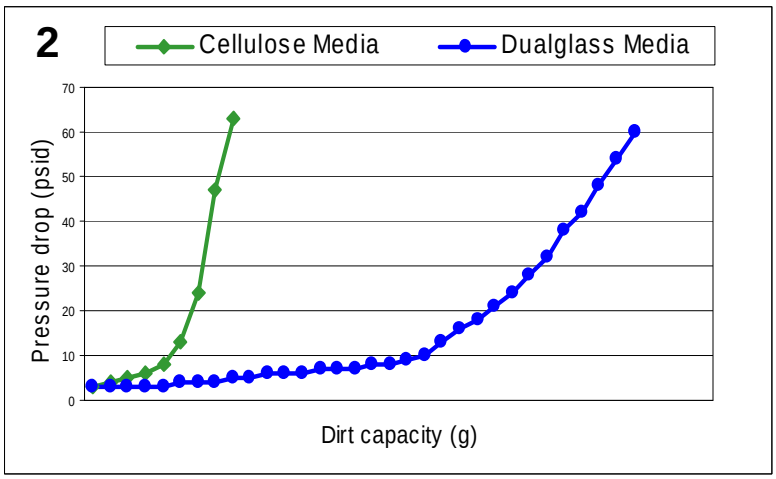
Cellulose



Upgrading to Hy-Pro G7 Dualglass

Glass media has much better dirt holding capacity than cellulose. 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 2.



Cleaner Fluid . . . Longer Component & Fluid Life . . . More Uptime!

Roller Contact Bearing

Current ISO Code	Target ISO Code	Target ISO Code	Target ISO Code	Target ISO Code
	2 x Life	3 x Life	4 x Life	5 x Life
28/26/23	25/22/19	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	19/17/14	17/15/12
25/23/20	21/19/16	19/17/14	17/15/12	16/14/11
25/22/19	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	15/13/10	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	-	-	-

Laboratory and field tests prove time and again that Hy-Pro filters consistently deliver lower ISO fluid cleanliness codes.

Improving fluid cleanliness means reduced downtime, more reliable equipment, longer fluid life, fewer maintenance hours, and reduces costly component replacement or repair expenses.

Hydraulic Component

Current ISO Code	Target ISO Code	Target ISO Code	Target ISO Code	Target 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
25/22/19	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	14/12/8
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	-	-	-

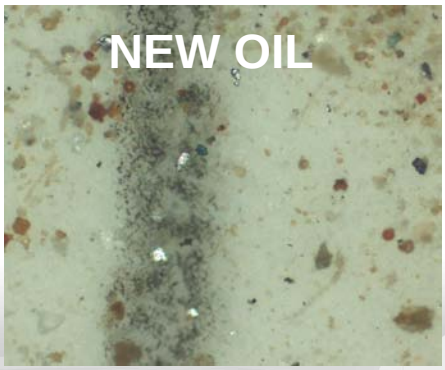
Develop a Fluid Cleanliness Target

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.

New Oil is Typically Dirty Oil . .

New oil can be one of the worst sources of particulate and water contamination.

25/22/19 is a common ISO code for new oil which is not suitable for hydraulic or lubrication systems. A good target for new oil cleanliness is 16/14/11.



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 $14\mu_{[c]}$. The ISO code is expressed in 3 numbers (example: 19/17/14). 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 and inversely as a code decreases one level the contaminant is cut in half.

ISO 4406:1999 Code Chart		
Range Code	Particles per milliliter	
	More than	Up to/including
24	80000	160000
23	40000	80000
22	20000	40000
21	10000	20000
20	5000	10000
19	2500	5000
18	1300	2500
17	640	1300
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 1 (see photo 1)

Particle Size	Particles per milliliter	ISO 4406 Code range	ISO Code
$4\mu m_{[c]}$	151773	80000~160000	24
$6\mu m_{[c]}$	38363	20000~40000	22
$10\mu m_{[c]}$	8229		
$14\mu m_{[c]}$	3339	2500~5000	19
$21\mu m_{[c]}$	1048		
$38\mu m_{[c]}$	112		

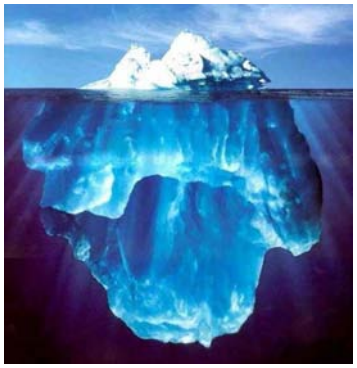
Sample 2 (see photo 2)

Particle Size	Particles per milliliter	ISO 4406 Code range	ISO Code
$4\mu m_{[c]}$	492	320 ~ 640	16
$6\mu m_{[c]}$	149	80 ~ 160	14
$10\mu m_{[c]}$	41		
$14\mu m_{[c]}$	15	10 ~ 20	11
$21\mu m_{[c]}$	5		
$38\mu m_{[c]}$	1		

Succeed with a Total System Cleanliness Approach

Developing a Total System Cleanliness approach to control contamination and care for fluids from arrival to disposal will ultimately result in more reliable plant operation and save money. Several steps to achieve Total System Cleanliness include: evaluate and survey all hydraulic and lubrication systems, establish an oil analysis program and schedule, insist on specific fluid cleanliness levels for all new fluids, establish a baseline and target fluid cleanliness for each system, filter all new fluids upon arrival and during transfer, seal all reservoirs and bulk tanks, install high quality particulate and desiccant breathers, enhance air and liquid filtration on existing systems wherever suitable, use portable or permanent off-line filtration to enhance existing filtration, improve bulk oil storage and handling during transfer, remove water and make a commitment to fluid cleanliness.

The visible cost of proper contamination control and total systems cleanliness is less than 3% of the total cost of contamination when not kept under control. Keep your head above the surface and avoid the resource and asset draining costs associated with fluid contamination issues including:



- Downtime and lost production
- Component repair/replacement
- Reduced useful fluid life
- Wasted materials and supplies ($)
- Root cause analysis meetings
- Maintenance labor costs
- Unreliable machine performance
- Wasted time and energy ($)

Hy-Pro Contamination Solutions

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