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

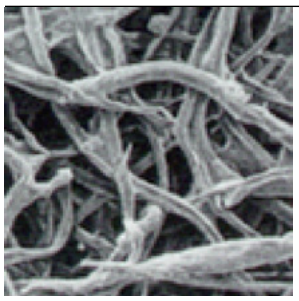
When upgrading to an absolute efficiency glass media element, the system cleanliness must be stabilized. During this clean-up period the glass element halts the runaway contamination as the ISO cleanliness codes are brought into the target cleanliness range. As the glass element removes years of accumulated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

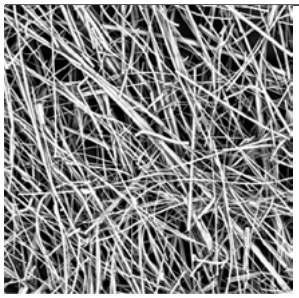
$$\beta x_{[c]} = \frac{\text{quantity particles} \geq X\mu_{[c]} \text{ upstream of filter}}{\text{quantity particles} \geq X\mu_{[c]} \text{ downstream of filter}}$$

Figure 2: Cellulose Filter Media



Cellulose fibers at 400x magnification

Figure 3: Glass Filter Media



Glass fibers at 400x magnification

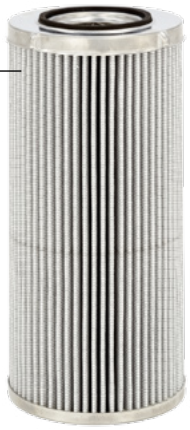
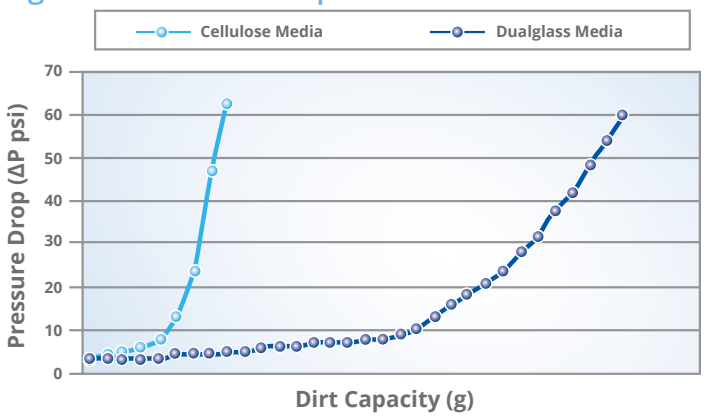


Figure 4: Element Lifespan



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

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

Dirt in

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

Dirt out

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

50%
efficiency

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

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

Dirt in

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

Dirt out

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

99.9%
efficiency

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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.

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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.

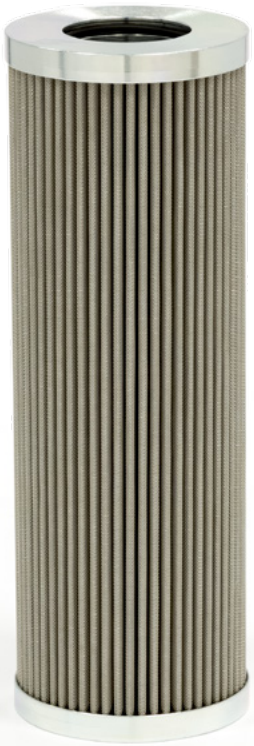
Original	Hy-Pro Glass Media	Hy-Pro Lube Media
HC8314FCP39H	HP8314L39-3MB	HP8314L39-3LB

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.



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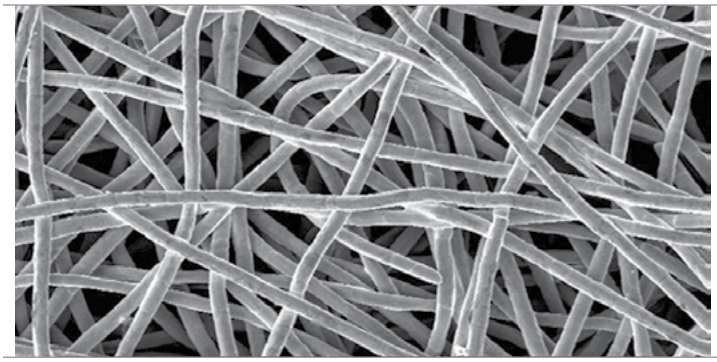

Advanced media solutions.

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.

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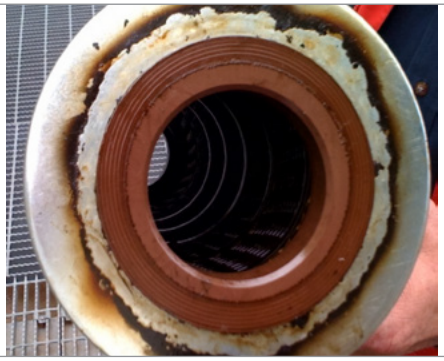
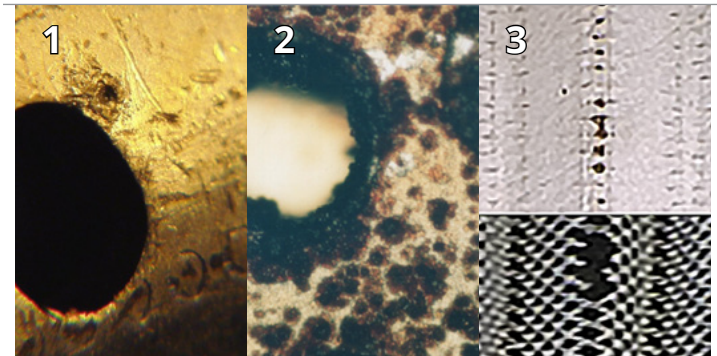
Cleaner fluid without sparking.

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.

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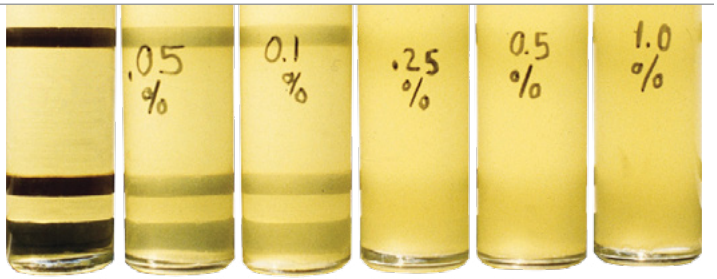
hyprofiltration.com/WaterRemoval

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.

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hyprofiltration.com/TurboToc

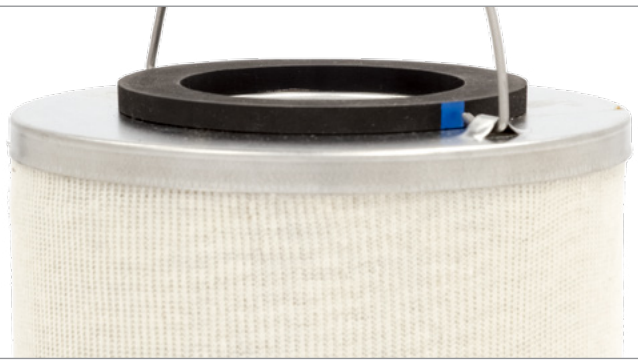
*Turbo-TOC is a registered trademark of Kaydon Corporation.

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

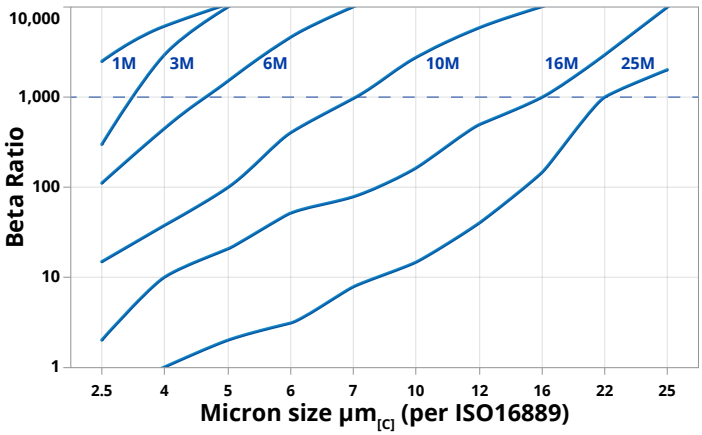
Fluid Compatibility

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



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