

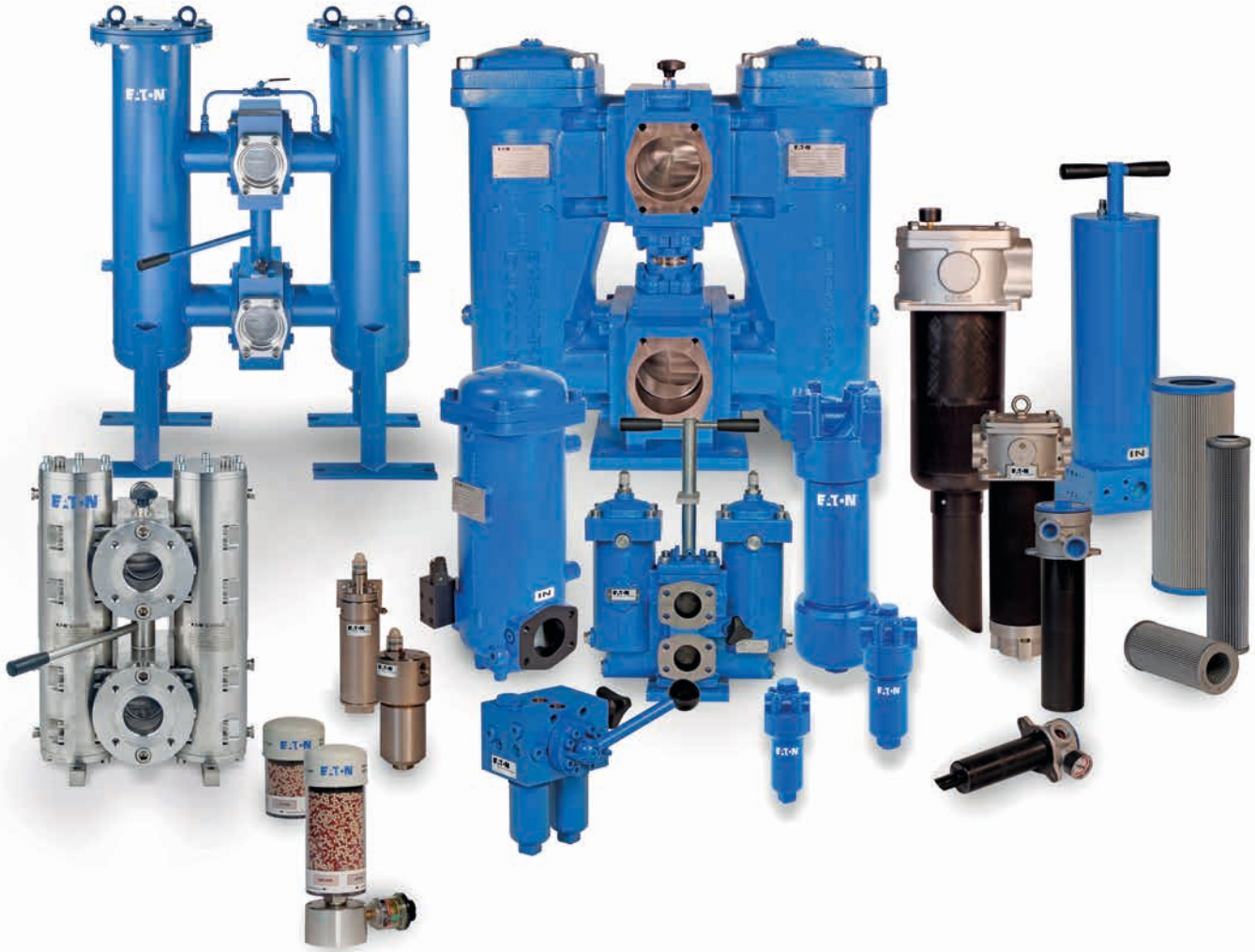
Filtration Products

Hydraulic and lubrication oil filters



EATON

Powering Business Worldwide



Eaton combines sales, engineering, manufacturing, customer service, and technical sales support into one focused business objective: Provide customers with optimum filtration solutions.

Eaton is a leader in manufacturing high quality hydraulic and lubrication systems, filter media, condition monitoring, and hydraulic and lubrication accessories.

Eaton currently offers a selection of more than 4,000 different filter elements, including corresponding filter housings for mobile and stationary applications.

The importance of cleanliness

Contamination is any solid or liquid substance that is not part of a hydraulic system's working fluid. There are three principal means through which contamination can occur in a typical hydraulic system: it can be incorporated during system assembly, generated during system operation, or ingested by the system during operation. Having a reliable way to manage contamination is vital to your operation.

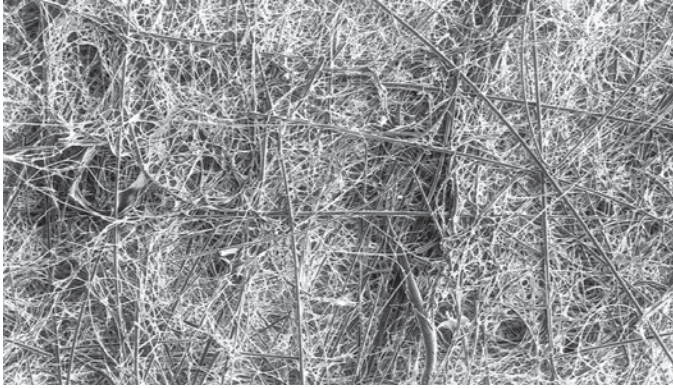
- Provides maximum efficient productivity
- Reduces equipment downtime
- Minimizes safety hazards and prevents contamination-related failure
- Increases the life of system components, improves operating profitability and decreases maintenance costs

Eaton services

In addition to world-proven hydraulic and lubrication filter systems, Eaton provides a full range of services to help you maximize the potential of your operation.

- State-of-the-art testing lab facilities
- Equipment rentals
- Calibration services: certifications, software updates, test runs
- Field service: inspections, start-up, repair, replacement, and maintenance
- Extensive network of sales and service representatives
- Worldwide technical support
- Product specialists dedicated to providing application engineering

Filter media

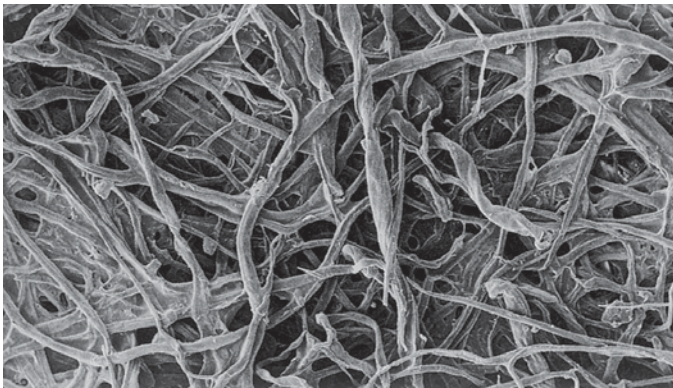


Glass fiber fleece

Glass fiber fleece (VG)

Features:

- Depth filtration
- High dirt holding capacity
- Compatible with mineral oils, emulsions and for most synthetic hydraulic fluids and lubrication oils
- Filter fineness, acc. filtration quotient $\beta_{x(c)} \geq 200$: 4 μ m, 5 μ m, 6 μ m, 10 μ m, 20 μ m
- Special filter element design for lubrication applications available (10 API and 25 API)

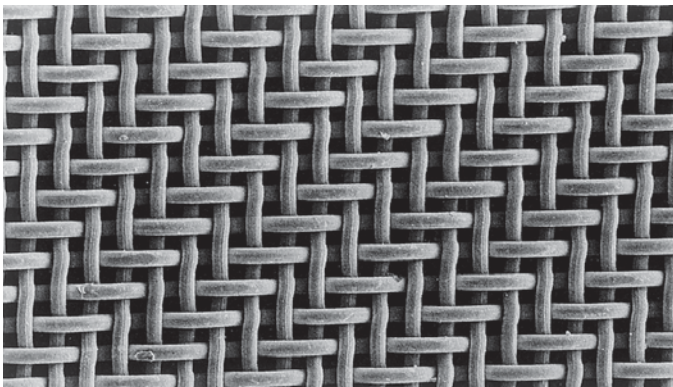


Paper

Paper (P)

Features:

- Depth filtration
- Consists of resin-reinforced cellulose fibers
- High burst strength
- Available in 10 μ m



Stainless steel wire mesh

Stainless steel wire mesh (G)

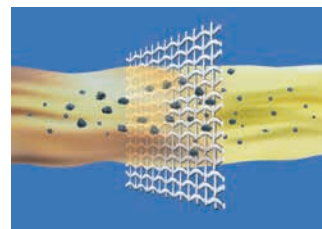
Single or multilayer, pleated construction made with stainless steel wire mesh in different weaves, depending on retention ratings.

Features:

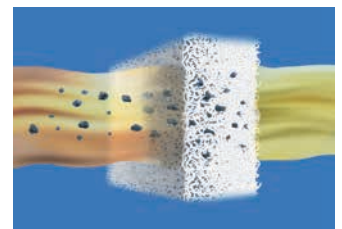
- Surface filtration
- Best resistance in all hydraulic and lubrication fluids
- Partially cleanable
- Available in 25 μ m, 40 μ m and 80 μ m (other micron ratings on request)



Surface filtration (mesh)



Depth filtration (microglass)





Return-line filters

Series TEF, DTEF, TEFB, TRW

Application: Mounted on top or in the reservoir with the outlet port returning to the reservoir

Operating pressure: Up to 145 psi (10 bar)

Flow rates: Up to 1,902 gpm (7,200 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: Lightweight and easy to change, minimizes chance of oil spillage during element change and the resulting environmental concern

Return-line filters with suction connection

Series TRS, TNRS

Application: Tank-mounted return-line filters with suction connection for mobile hydraulic applications having a minimum of two independent hydraulic circuits

Operating pressure: 145 psi (10 bar)

Flow rate: Up to 119 gpm (450 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: Tank-top-mounted, in-line filters supply clean suction flow and prevent cavitation; custom designs available



Stainless steel pressure filters

Series EH, EHP, EHPF

Application: Mounted in pressure lines

Operating pressure: Up to 6,090 psi (420 bar)

Series EHD, EDU, EDA¹

Application: Mount in suction, pressure, or return lines. The filter flow path can be switched to either of the two chambers

Operating pressure: Up to 4,568 psi (315 bar)

Benefits: For continuous filtration without system shutdown, the duplex design is equipped with a three-way changeover valve. This makes it possible for the user to divert the flow to the second filter for servicing or changing



¹ Designed according to ASME VIII Div. 1, U-Stamp option available

Duplex pressure filters

Series MDD, HDD

Application: For continuous operation. Mount in suction, pressure or return lines

Operating pressure: Up to 4,567 psi (315 bar)

Flow rates: MDD up to 26.4 gpm (100 l/min),
HDD up to 356 gpm (1,350 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: For continuous filtration without system shutdown, the duplex design is equipped with a three-way changeover valve. This makes it possible for the user to divert the flow to the second filter for servicing or changing



Series DU, DUV, DSF

Application: For continuous operation. Mount in suction, pressure or return lines

Operating pressure:

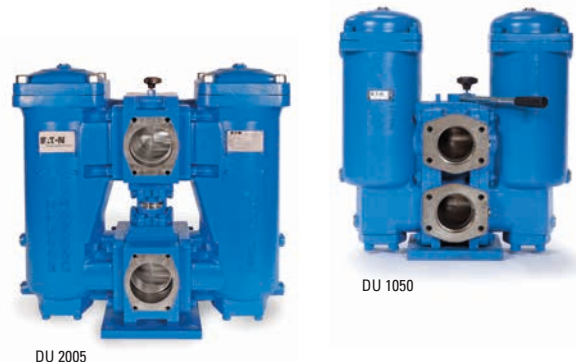
- **DU, DUV** - 464 psi (32 bar)
- **DSF** - 363 psi (25 bar)

Flow rates: DU up to 1,056 gpm (4,000 l/min),
DUV (vertical inlet/outlet) up to 528 gpm (2,000 l/min),
DSF (inline) up to 87 gpm (330 l/min)

Filtration materials: Paper, micros or stainless steel wire mesh

Benefits: For continuous filtration without system shutdown, a rotary slide or ball valve is internally mounted. This makes it possible to switch from one filter to the other for servicing or changing filter while in the "off" position

Designed according to AD2000 with an option to provide ASME equivalent material and supporting calculations



Series DWF

Application: For continuous operation. Mount in suction, pressure or return lines

Operating pressures: 232 psi (16 bar)

Flow rates: Up to 1,585 gpm (6,000 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: For continuous filtration without system shutdown, the duplex design is equipped with a three-way changeover valve. This makes it possible for the user to divert the flow to the second filter for servicing or changing

Designed according to ASME VIII Div. 1, U-Stamp option available



Series DA

Application: For continuous operation. Mount in suction, pressure or return lines

Operating pressure: 580 psi (40 bar)

Flow rates: Up to 264 gpm (1,000 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: For continuous filtration without system shutdown, the duplex design is equipped with a three-way changeover valve. This makes it possible for the user to divert the flow to the second filter for servicing or changing

Designed according to ASME VIII Div. 1, U-Stamp option available



Pressure filters PN < 1,450 psi (100 bar)

Series LF

Application: Mounted in suction, pressure and return lines

Operating pressure: 464 psi (32 bar)

Flow rate: Up to 1,057 gpm (4,000 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: LF-series filters have side inlets and bottom outlets on the same level



Pressure filters PN > 1,450 psi (100 bar)

Series ML, MNL, MF, MFO, MLO

Application: Mounted in pressure lines; threaded design

Operating pressure: Up to 2,320 psi (160 bar)

Flow rate: Up to 119 gpm (450 l/min)

Filtration materials: Microglass or stainless steel wire mesh

Benefits: Economical, lightweight filter used for low to medium pressure applications. Filter requires minimal clearance during element change, saving valuable space



Pressure filters PN > 1,450 psi (100 bar)

Series HP3

Application: High pressure filters

Operating pressure: Up to 6,000 psi (420 bar)

Flow rates: Up to 357 gpm (1,350 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: In-line or flange mounting; various port and Δp indicator options. Possible to accommodate very high flow rates with a single housing



Manifold mounted pressure filters PN > 1,450 psi (100 bar)

Series HPF, HPP

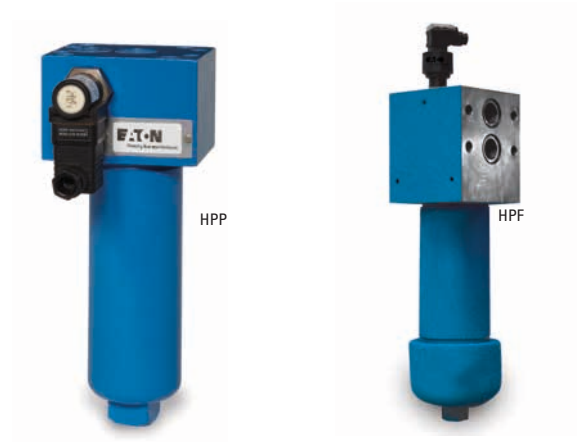
Application: Flange or manifold mounted in pressure lines

Operating pressure: 2,320 psi (160 bar), 4,568 psi (315 bar)

Flow rates: Up to 357 gpm (1,350 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: Simplified mounting saves valuable space and provides filtration directly at the point needed. Prevents contaminants from passing downstream during element changes



Manifold mounted pressure filters, PN > 1,450 psi (100 bar)

Series HPZ

Application: Manifold mounted in pressure lines

Operating pressure: Up to 4,568 psi (315 bar)

Flow rates: Up to 24 gpm (90 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: Simplified mounting saves valuable space and provides filtration directly at the point needed. Prevents contaminants from passing downstream during element changes



Tank mounted suction filters

Series AS, TS, TSW

Application: Mounted to the side of the reservoir below oil levels. It is positioned vertically in the TS Series or horizontally in the TSW Series. The suction side faces the reservoir; a check valve prevents oil from draining from the reservoir during servicing

Flow rate: Up to 185 gpm (700 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Benefits: Suction filters can be serviced from the outside of the reservoir with no additional check valve needed



Off-line filters

Series NF

Application: Off-line filter for fine filtration of hydraulic and lubrication circuits; supplements the main filter

Operating pressure: 232 psi (16 bar)

Flow rate: Up to 264 gpm (1,000 l/min)

Filtration materials: Paper, microglass or stainless steel wire mesh

Water absorption elements are also available

Benefits: Offers a large filtration area in a compact size allowing for high dirt-holding capacity even with small grades of filter fineness. Filter element can be changed quickly and without tools



Gearbox 2-stage Pressure Filter

Series TWF

Application: For use with wind turbine gearbox lubrication systems

Operating pressure: 363 psi (25 bar)

Flow rates: Up to 85 gpm (320 l/min)

Benefits: Lightweight and corrosion resistant aluminum construction. The unique element design couples a stainless steel wire mesh filter with a high-performance glass fiber fleece filter. This design ensures continuous filtered oil to the gearbox during cold start by-pass conditions.



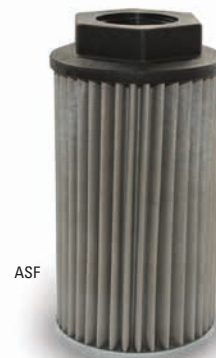
Suction strainers

Series SS

Application: Filters coarse particles to prevent pump damage

Operating temperature: -20 to 210°F (-28 to 100°C)

Flow rates: Up to 100 gpm (380 l/min)



Tank breathers

Series NBF, EBF, TBF, BFD, BF-WP

Application: Assures that no contamination reaches the tank through air exchange or water condensation in the reservoir

Flow rates: Up to 925 gpm (3,500 l/min)

Filtration materials:

- **NBF, BF-WP** - Paper, microglass
- **EBF, TBF** - Paper
- **BFD** - Silica gel, microglass

Benefits: Protects system from airborne debris and/or moisture



Clogging indicators

Series AE, AOR/AOC, OP-OE, OE (Ex), E6, E-O, VS5

Application: Wide range of clogging indicators for hydraulic and lubrication systems

Types: Optical, electrical, optical-electrical, electronic. Available variations include: block and threaded design, versions with explosion-proof, reset function and control function

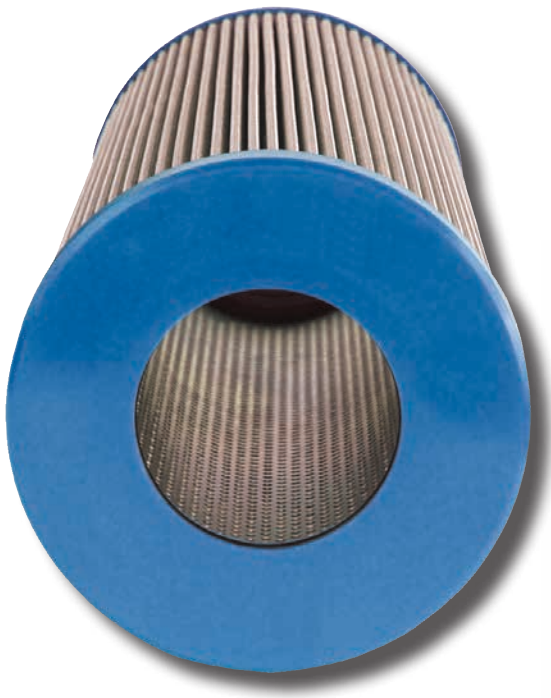
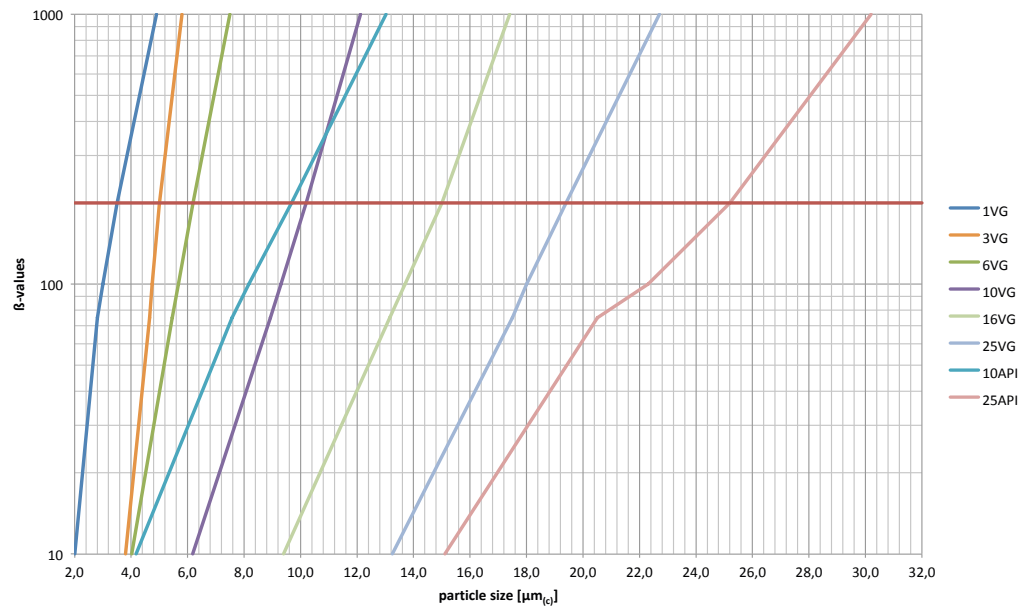
Benefits: Easy integration into automatic control systems, allows for continuous contamination control and pressure differential measuring, early identification of increased contamination, and optimal utilization of filter elements



Filter efficiency data

Multi-pass performance according to ISO 16889

Filtration quotient $\beta_{x \mu m(c)}$ for filter materials



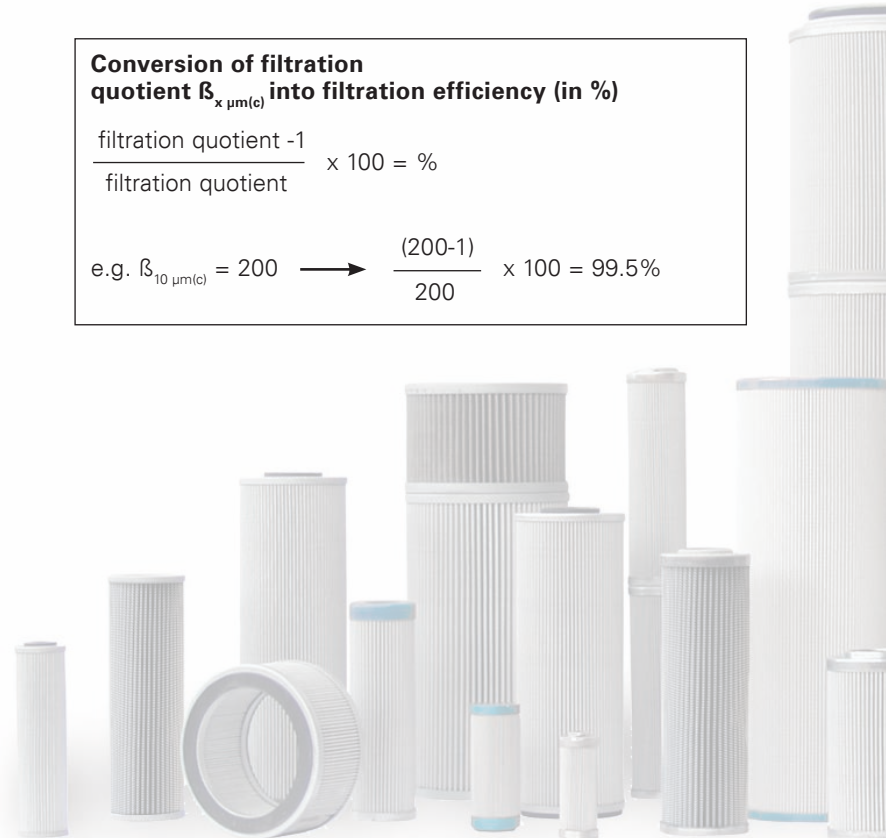
Calculation of the filtration quotient $\beta_{x \mu m(c)}$

$$\beta_{x \mu m(c)} = \frac{\text{amount of particles of the size } \geq x \mu m(c) \text{ before the filter}}{\text{amount of particles of the size } \geq x \mu m(c) \text{ after the filter}}$$

Conversion of filtration quotient $\beta_{x \mu m(c)}$ into filtration efficiency (in %)

$$\frac{\text{filtration quotient} - 1}{\text{filtration quotient}} \times 100 = \%$$

e.g. $\beta_{10 \mu m(c)} = 200 \rightarrow \frac{(200-1)}{200} \times 100 = 99.5\%$



Systems sensitivity and optimal cleanliness class

The cleanliness of the oil in a hydraulic system is determined by the micron rating of the filter element, the type of contamination, and the size and distribution of the particles in the fluid.

This table presents standard data values. To determine the quality of the oil, it should be analyzed using established procedures.

System types Application case	Required class according to ISO 4406:99	Required class according to NAS 1638	Recommended Eaton filter material
Against fine soiling and gumming up of sensitive systems	16/12/8	2–3	1 VG
	17/13/9	3–4	3 VG
Heavy-duty servo motor systems; high pressure systems with long service life	19/15/11	4–6	6 VG
Proportional valves; industrial hydraulics with high operating safety	20/16/13	7–8	10 VG
Heavy industries; low pressure systems; mobile hydraulics	23/19/15	9–11	25 VG

In addition, Eaton's wide range of filter elements enables trouble-free operation of standard fluids, but also when filtering abrasive fluids, cooling lubricants or water-based fluids and are designed to achieve cleanliness class requirements. We can perform fluid analysis capabilities on-site or in our lab to determine the best filter element for your hydraulic and lubrication system requirements.

In addition to proprietary tests developed by Eaton, filter elements are tested according to several ISO standards:

ISO 2941	Verification of collapse/burst pressure rating
ISO 2942	Verification of fabrication integrity
ISO 2943	Verification of material compatibility with fluids
ISO 3723	Method for end load test
ISO 3724	Determination of resistance to flow fatigue using particulate contaminant
ISO 3968	Evaluation of pressure drop versus flow characteristics
ISO 16889	Multi-pass method for evaluating filtration performance



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10-2023

