

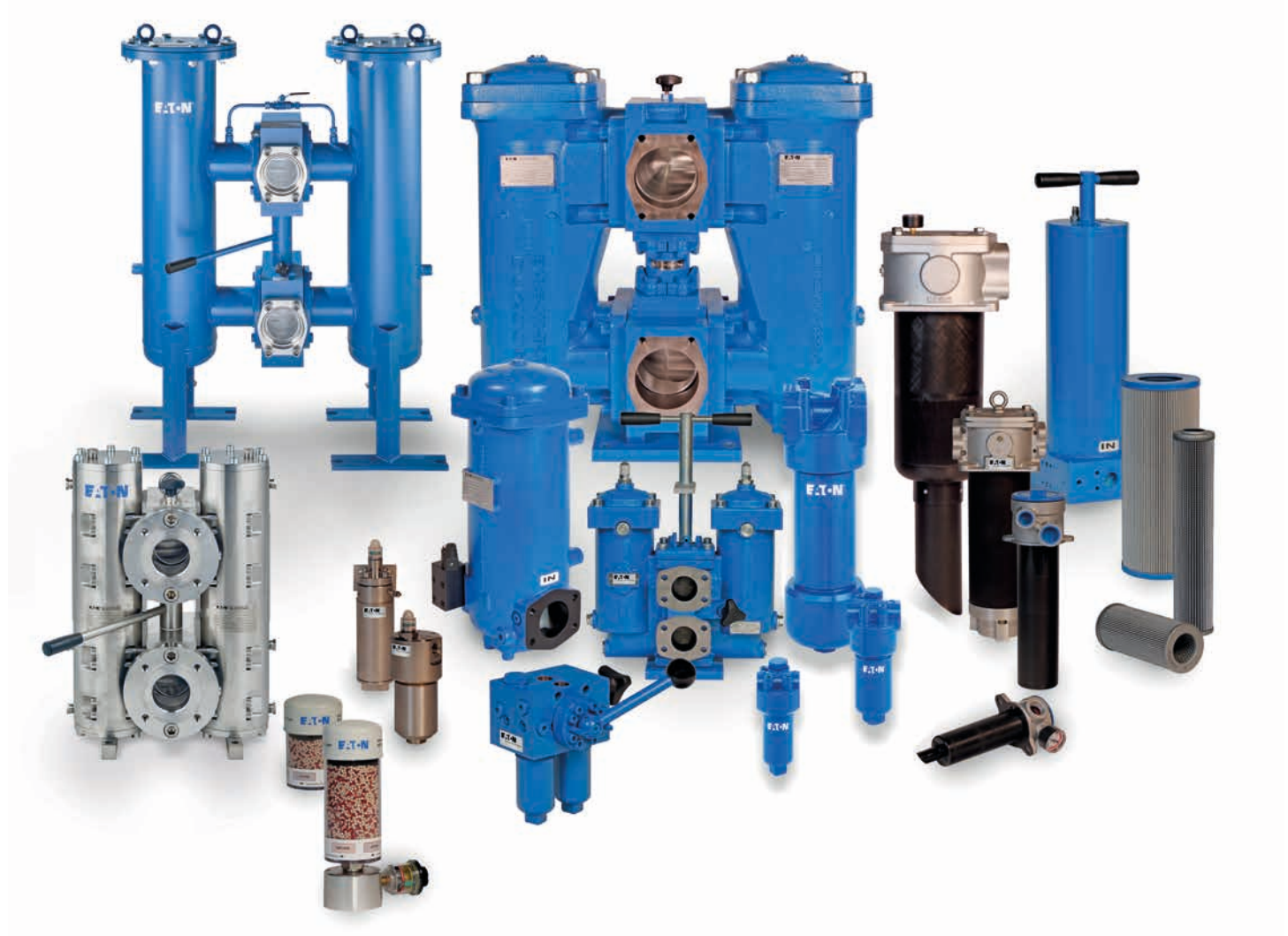
**Filtration** Products

# 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

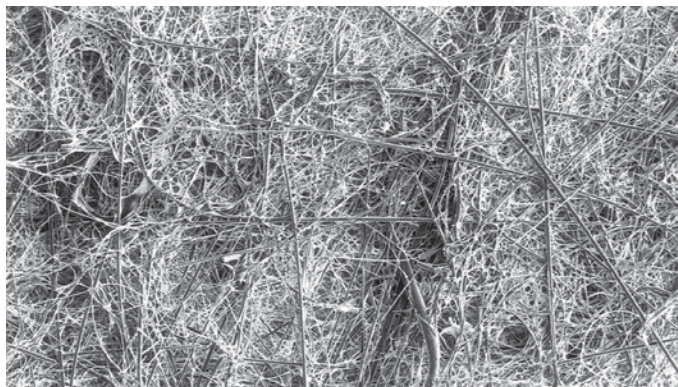
### Eaton services

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

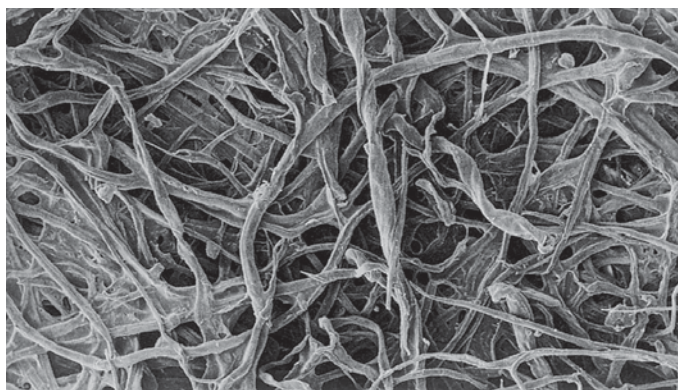


Glas fiber fleece

### Glas 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 $\mu\text{m}$ , 5 $\mu\text{m}$ , 6 $\mu\text{m}$ , 10 $\mu\text{m}$ , 20 $\mu\text{m}$
- Special filter element design for lubrication applications available (10 API and 25 API)

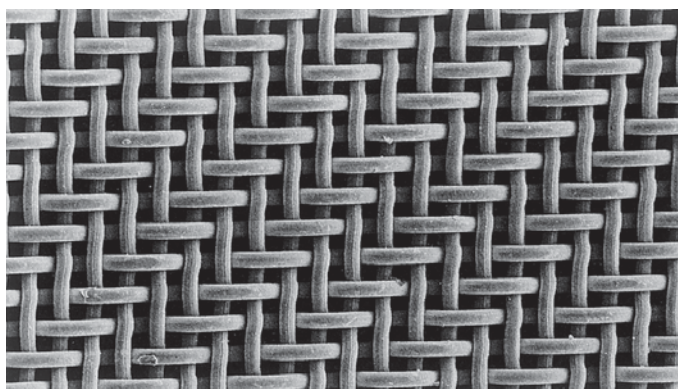


Paper

### Paper (P)

#### Features:

- Depth filtration
- Consists of resin-reinforced cellulose fibers
- High burst strength
- Available in 10  $\mu\text{m}$



Stainless steel wire mesh

### Stainless steel wire mesh (G)

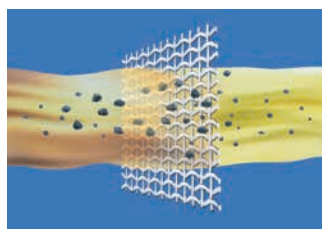
Single or multilayer, pleated construction made with stainless steel wire mesh in different weaves, depending on retention ratings.

#### Features:

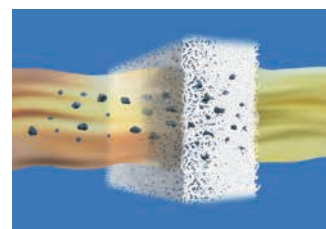
- Surface filtration
- Best resistance in all hydraulic and lubrication fluids
- Partially cleanable
- Available in 25  $\mu\text{m}$ , 40  $\mu\text{m}$  and 80  $\mu\text{m}$  (other micron ratings on request)



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, EDA<sup>1</sup>

**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

<sup>1</sup> 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:**

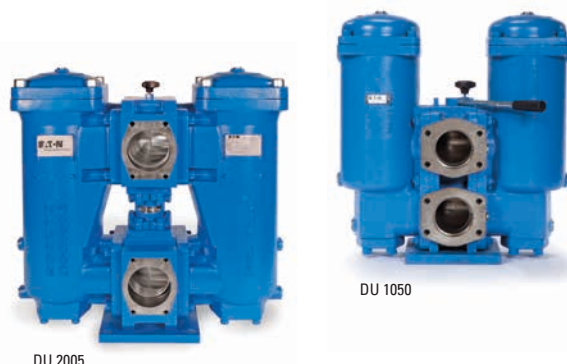
- **DU, DUV** - 464 psi (32 bar)
- **DSF** - 363 psi (25 bar)

**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, microglass 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  $\Delta p$  indicator options. Possible to accommodate very high flow rates with a single housing



HP3.30



HP3.60



HP3.600

## 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



HPP



HPF



## 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

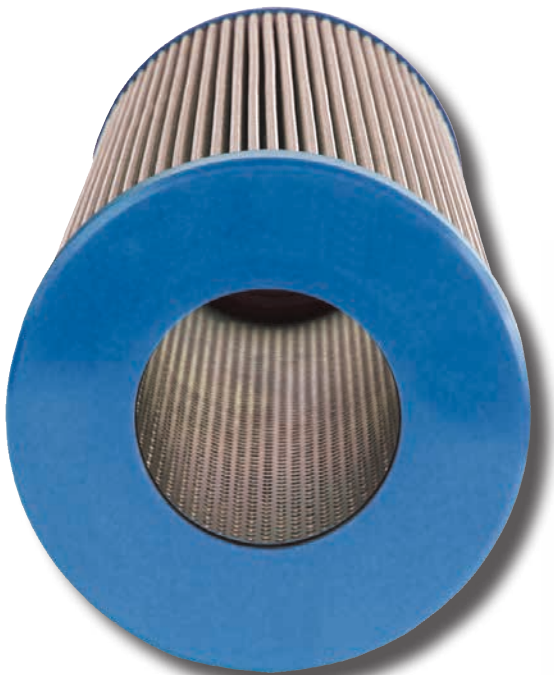
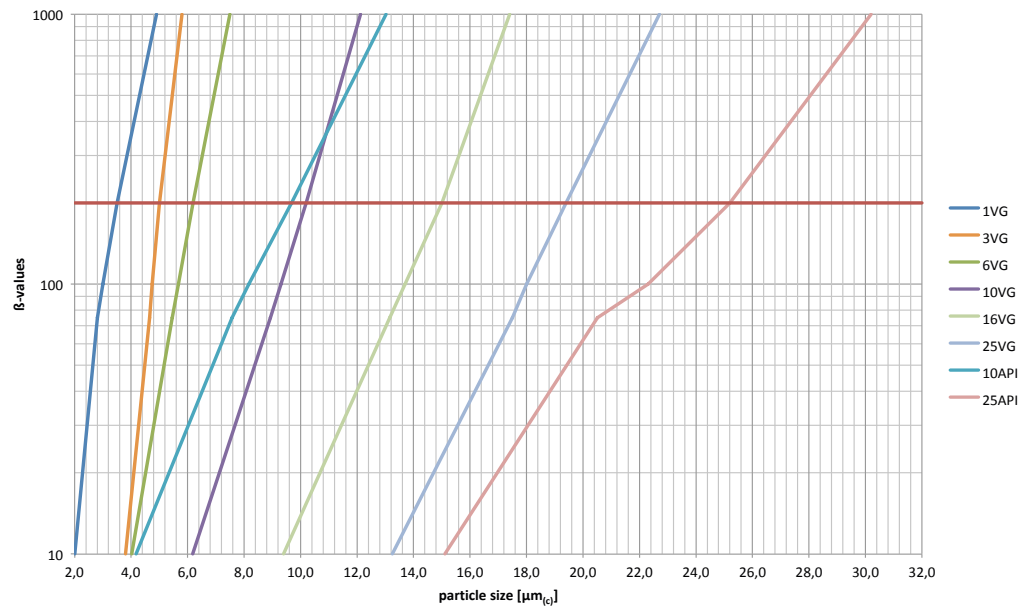
**Benefits:** Easy integration into automatic control systems, allows for continuous contamination control and pressure differential measuring, early identification of increased contamination, and optimal utilization of filter elements



# 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 %)

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

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



## 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:

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







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