

**HYDAC** INTERNATIONAL

## **Filter Systems**

Fluid Condition Monitoring & Control





# Components, Systems and Service. All from one Company.

Our fluid engineering solutions are defined by the scope and complexity of our customers' requirements.

Our products range from individually designed components in the fields of fluid engineering, hydraulics and electronics right up to complete systems for specific functions.

All components and systems are conceived and designed in-house. Experienced industrial and product specialists develop innovative products and efficient solutions for high-quality, cost-effective production. Throughout the globe, our production facilities share one common goal: quality. We take great pride in both our products and solutions.

## Industries and Applications



<b>Overview</b> Introduction - <b>A2</b> , Cost Savings Calculations - <b>A3</b> , ISO Cleanliness Levels - <b>A4</b>	<b>A</b>
<b>Contamination Monitors</b> CS1000 - <b>B2</b> , HYTRAX-M - <b>B6</b> , HYTRAX-T - <b>B8</b> , CS2000 - <b>B12</b> , CSM1000 - <b>B14</b> , CSM2000 - <b>B16</b> , CSM-C - <b>B18</b> , FCU1000 - <b>B20</b> , FCU2000 - <b>B22</b> , MCS1000 - <b>B26</b> , AS1000 - <b>B28</b> , AS3000 - <b>B30</b> , SMU1200 - <b>B32</b> , FMS - <b>B34</b> , CTU1000 - <b>B36</b> , CTM-SC - <b>B38</b> , CTM-EB - <b>B40</b> , MM - <b>B44</b> , FAS - <b>B45</b> , FASH - <b>B46</b>	<b>B</b>
<b>Diagnostics</b> HMG3010 - <b>C2</b>	<b>C</b>
<b>Offline Filtration Systems</b> OF7 - <b>D2</b> , OFCD-BC - <b>D4</b> , OFCS/D - <b>D6</b> , OFCD-MV - <b>D8</b> , OFCD-HV - <b>D10</b> , OFS - <b>D12</b> , OFS-AM - <b>D14</b> , OF5HS/D - <b>D16</b> , OF5HD-HV - <b>D18</b> , OFAS/D - <b>D20</b> , LSN - <b>D22</b> , OFX - <b>D24</b> , OLF Compact - <b>D28</b> , OLF - <b>D32</b> , OLFP 1/3/6 - <b>D36</b> , NxTM TriMicron Element - <b>D40</b> , IXU1/4 - <b>D42</b> , MAFH-A - <b>D46</b> , MAFH-E - <b>D50</b> , FAM5 - <b>D52</b> , FAMH - <b>D56</b> , HTB - <b>D60</b>	<b>D</b>
<b>Replacement Elements</b> Pressure Elements - <b>E2</b> , Dimicron® Elements, Cartridge Elements, Spin-on Elements, Aquamicon® Elements, Betamicon®/Aquamicon® Elements, Betterfit® Interchange Elements - <b>E4</b>	<b>E</b>
<b>Bulk Diesel Filtration</b> Overview - <b>F2</b> , ICF - <b>F6</b> , QCF - <b>F10</b> , BDS - <b>F12</b> , BDS2 - <b>F14</b> , BDF1/2 - <b>F16</b> , BDFC - <b>F20</b> , BDC - <b>F22</b>	<b>F</b>
<b>Reference Materials</b> Viscosity Charts - <b>G2</b>	<b>G</b>



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**NOTE**

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# OVERVIEW

## Introduction

Contamination and degraded fluid quality cause inefficient operation, component wear, and eventually failures in all hydraulic and lubrication systems. The products in this catalog are the tools that are needed to prevent such occurrences. HYDAC recommends a three step approach to controlling contamination in any system:

### Assess

Start by gathering complete information on the system. This includes:

- a list of the most critical components
- the manufacturer's recommended ISO class for each component
- the type of oil being used
- flow rate & operating pressure
- fluid temperature & ambient temperature
- system's operational characteristics
- details on all current filters in the system
- solid contamination levels (*ISO class*)
- water content levels
- details on all current filters in the system

### Recommend & Implement

Next, specify your recommendations for upgrading the current filtration, and adding the appropriate supplementary filtration:

- pressure filters
- return line filters
- manifold cartridge/circuit protector filters
- element micron rating
- reservoir breathers or filler breathers
- strainer baskets
- addition of offline filtration loop
- use of portable filters for filling/temporary offline loops
- sufficient water removal protection
- proper fluid monitoring devices

### Monitor & Maintain

Finally, use reliable methods for continuous monitoring of the fluid conditions including:

- solid contamination
- water content
- additive depletion
- element clogging
- periodic detailed analysis of actual fluid samples
- portable filters for correcting unacceptable levels



An OLCFM-15 on a plastic injection machine.



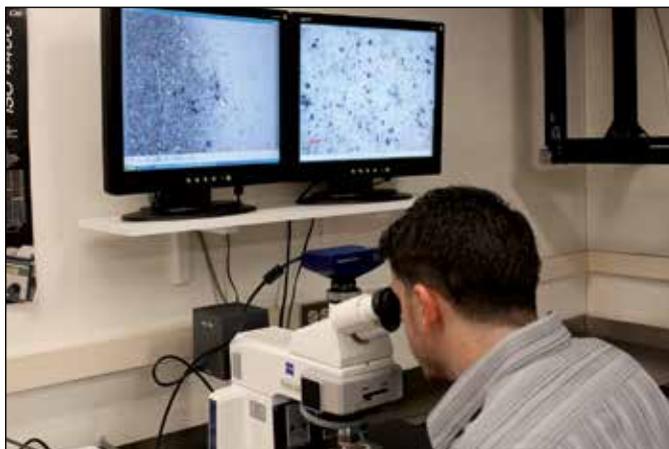
An OLF-60 on a test stand.



OFS Filtration Station with HPU.



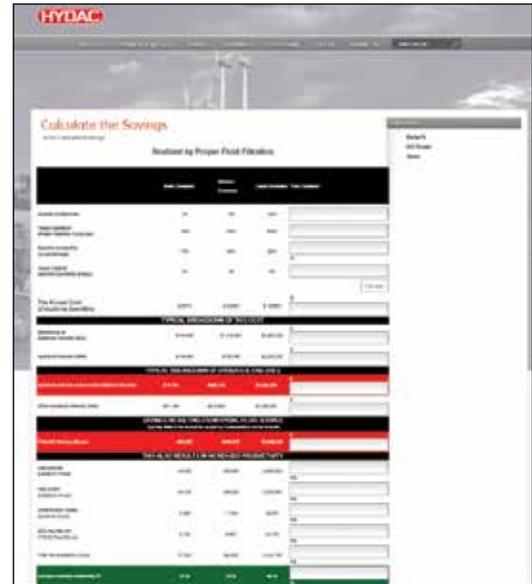
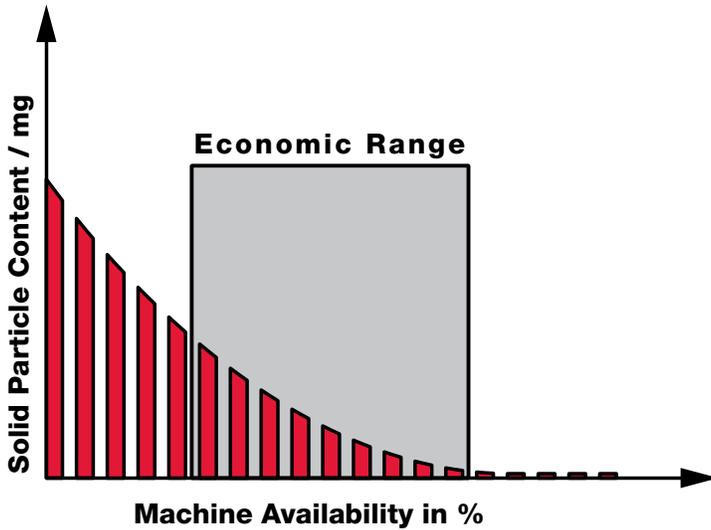
OLF Compact on a mining truck.



Microscope with camera attached to a monitor

# Savings Realized by Proper Contamination Control

The money invested in contamination control can easily be justified when the resulting machine availability increases significantly. The graph below illustrates that there is a range in which this investment really pays off.



Try our automated savings calculator at:  
[www.HYDACusa.com](http://www.HYDACusa.com)

## Savings Calculation Example

This example demonstrates how to calculate the potential savings that will be realized by implementing a proper fluid service program.

	Example	Your Data
Number of Machines	50	a _____
Operating Hours per year	5,000	b _____
Current Availability	92%	c _____
Downtime Costs per hour	\$60	d _____
Total Downtime Costs	\$1,200,000	e _____ $(a \times b \times \frac{100 - c}{100} \times d)$
<b>Downtime costs due to:</b>		
- mechanical/electrical failures (65%)	\$780,000	f _____ $(e \times .65)$
- hydraulic failures (35%) of which:	\$420,000	g _____ $(e \times .35)$
- 70% is due to the fluid	\$294,000	h _____ $(g \times .70)$
- 30% is caused by other faults	\$126,000	i _____ $(g \times .30)$
<b>HYDAC Fluid Service can return 90% of the fluid related downtime costs</b>	<b>\$264,600</b>	j _____ $(h \times .90)$

# OVERVIEW

## ISO 4406 Code

Cleanliness levels are defined by three numbers divided by slashes (/). These numbers correspond to 4, 6, and 14 micron, in that order. Each number refers to an ISO Range Code, which is determined by the number of particles for that size (4, 6, & 14µm) and larger present in 1 ml of fluid. Each range is double the range below. Refer to the chart below to see the actual ranges.

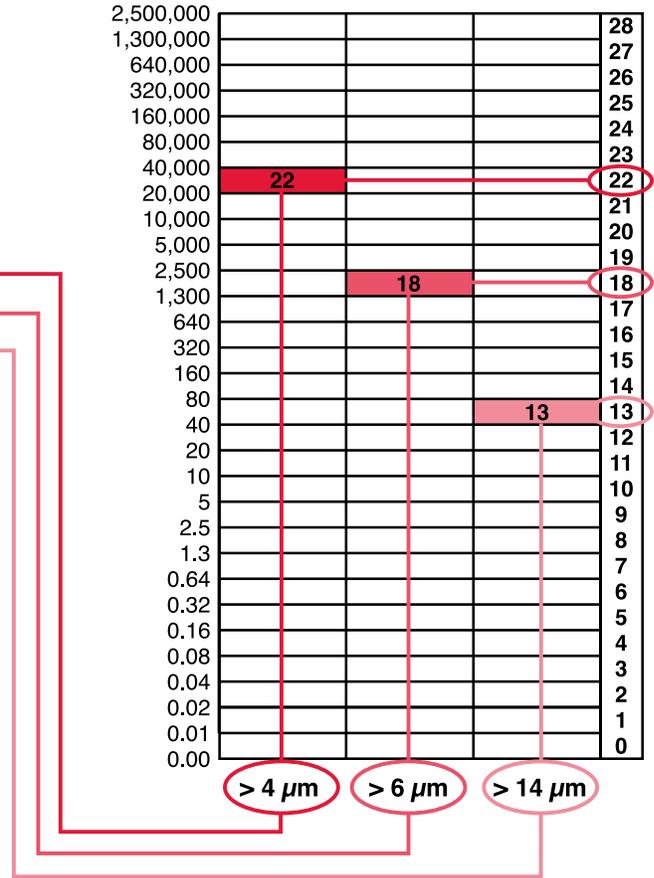
### Example:

larger than 4µm = 22,340

larger than 6µm = 1,950

larger than 14µm = 43

ISO Code = 22 / 18 / 13



### Achieving the appropriate cleanliness level in a system

The only way to achieve and maintain the appropriate cleanliness level in a hydraulic or lubrication system, is to implement a comprehensive filtration program. HYDAC offers all of the products that are needed to do just that! - They include:

#### Solid Contamination

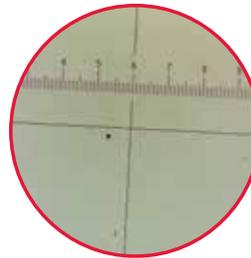
- pressure filters
- return line filters
- offline filtration loops
- oil transfer units for precleaning of new oil
- portable and online contamination monitors
- reservoir breathers and filler/breathers

#### Water Content

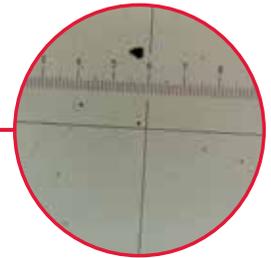
- water content sensors
- reservoir breathers with silica gel desiccant
- vacuum dehydration water removal units
- water removal elements

#### Fluid Analysis

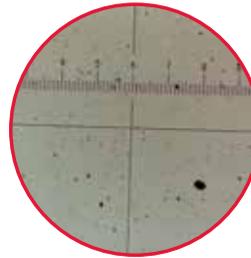
- bottle sampling kits
- complete analysis kits



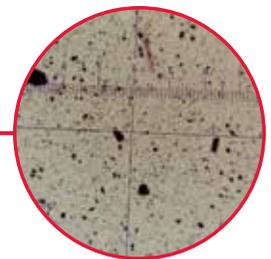
14/12/9



17/15/12



20/18/15



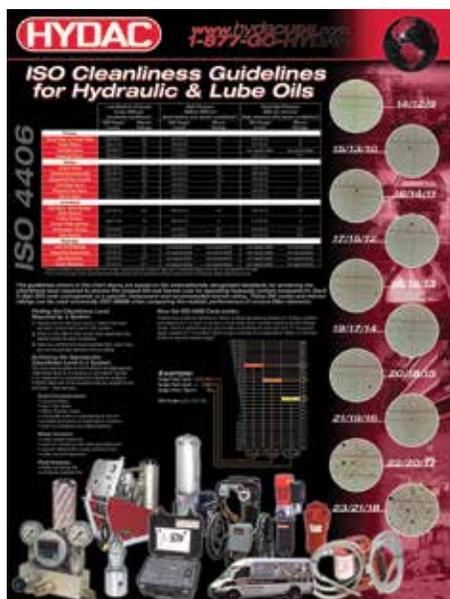
23/21/18

### Finding the cleanliness level required by a system

1. Starting at the left hand column, select the most sensitive component used in the system.
2. Move to the right to the column that describes the system pressure and conditions.
3. Here you will find the recommended ISO class level, and recommended element micron rating.

	Low/Medium Pressure Under 2000 psi (moderate conditions)		High Pressure 2000 to 2999 psi (low/medium with severe conditions <sup>1</sup> )		Very High Pressure 3000 psi and over (high pressure with severe conditions <sup>1</sup> )	
	ISO Target Levels	Micron Ratings	ISO Target Levels	Micron Ratings	ISO Target Levels	Micron Ratings
<b>Pumps</b>						
Fixed Gear or Fixed Vane	20/18/15	20	19/17/14	10	18/16/13	5
Fixed Piston	19/17/14	10	18/16/13	5	17/15/12	3
Variable Vane	18/16/13	5	17/15/12	3	not applicable	not applicable
Variable Piston	18/16/13	5	17/15/12	3	16/14/11	3 <sup>2</sup>
<b>Valves</b>						
Check Valve	20/18/15	20	20/18/15	20	19/17/14	10
Directional (solenoid)	20/18/15	20	19/17/14	10	18/16/13	5
Standard Flow Control	20/18/15	20	19/17/14	10	18/16/13	5
Cartridge Valve	19/17/14	10	18/16/13	5	17/15/12	3
Proportional Valve	17/15/12	3	17/15/12	3	16/14/11	3 <sup>2</sup>
Servo Valve	16/14/11	3 <sup>2</sup>	16/14/11	3 <sup>2</sup>	15/13/10	3 <sup>2</sup>
<b>Actuators</b>						
Cylinders, Vane Motors, Gear Motors	20/18/15	20	19/17/14	10	18/16/13	5
Piston Motors, Swash Plate Motors	19/17/14	10	18/16/13	5	17/15/12	3
Hydrostatic Drives	16/15/12	3	16/14/11	3 <sup>2</sup>	15/13/10	3 <sup>2</sup>
Test Stands	15/13/10	3 <sup>2</sup>	15/13/10	3 <sup>2</sup>	15/13/10	3 <sup>2</sup>
<b>Bearings</b>						
Journal Bearings	17/15/12	3	not applicable	not applicable	not applicable	not applicable
Industrial Gearboxes	17/15/12	3	not applicable	not applicable	not applicable	not applicable
Ball Bearings	15/13/10	3 <sup>2</sup>	not applicable	not applicable	not applicable	not applicable
Roller Bearings	16/14/11	3 <sup>2</sup>	not applicable	not applicable	not applicable	not applicable

1. Severe conditions may include high flow surges, pressure spikes, frequent cold starts, extremely heavy duty use, or the presence of water
2. Two or more system filters of the recommended rating may be required to achieve and maintain the desired Target Cleanliness Level.



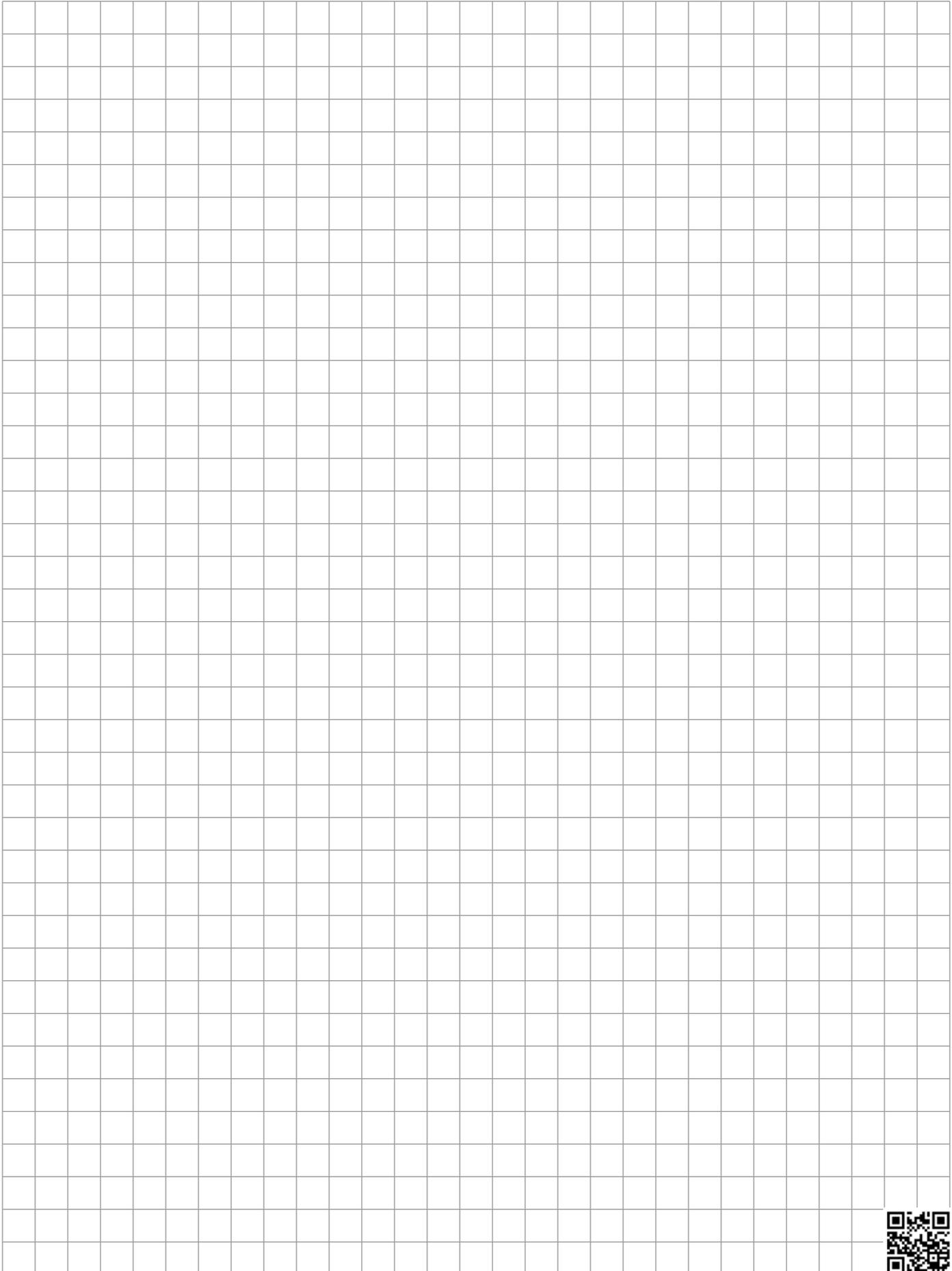
**FREE Poster!**

The information on these two pages is also available on our **ISO Cleanliness Guidelines** poster. Visit our web site to request your FREE copy.

[www.HYDACusa.com/poster](http://www.HYDACusa.com/poster)

# OVERVIEW

## Notes



## **B** Contamination Management

Contamination management pertains to the analysis and optimization of processes with regard to the cleanliness of components, systems and the purity of the fluids used. Our fluid condition monitoring products include both in-line and offline sensors to measure contamination and/or water saturation levels of the hydraulic system. By implementing fluid condition monitors a major portion of particulate contamination introduced during manufacture and assembly can be removed. The result is cost savings by virtue of smaller performance deviations on test stands caused by the sudden clogging of particles in sensitive system components plus lower costs associated with warranty and non-warranty courtesy work.

# CONTAMINATION MONITORS

## CS 1000 Series

### Contamination Sensor

CS 1000 with Block Kit



CS 1000 without display



CS 1000 with display

## Description

The CS 1000 Contamination Sensor is the latest HYDAC development for continuous measurement of solid contamination of fluids.

Using the latest technology and materials, the CS 1000 is a reliable measuring instrument that is permanently mounted on your mobile or industrial equipment.

The attractive cost-to-performance ratio makes it especially interesting for OEM applications. Online, real-time condition monitoring allows you to have total predictive maintenance.

## Applications

### Monitoring system on vehicles such as

- Construction equipment
- Agricultural machinery
- Mobile and stationary equipment

### Industrial hydraulic systems

- Integration into power unit monitoring systems
- Hydraulic test stands

### Combination with filter unit

## Features

- Version with or without display
- Display with pivot-function
- Display with 6-digit ISO Code (*optional*)
- Measurement of solid particle contamination in hydraulic and lubricating fluids
- Compact and rugged design
- Type of protection IP67
- Max. pressure 4350 psi (300 bar)
- Max. viscosity 4635 SUS
- Voltage supply 9 - 36VDC
- Data output 4 - 20mA or 2 to 10 V

## Technical Specifications

Self-diagnosis	Continuously with error indication via status LED
Measuring range	Display up to class ISO 7/6/5 to 28/27/26 Calibration within the range ISO 13/11/10 to 23/21/18
Contamination code	ISO 4406 : 1999 SAE AS 4059 (D)
Operation pressure	5075 psi (350 bar) max (sensor only) 3500 psi (through manifold block)
Connectors (on CS1xxx unit)	
Inlet	Thread G 1/4, ISO 228
Outlet	Thread G 1/4, ISO 228
Sensor flow rate	30 - 500 ml/min
Permissible viscosity range	15 - 4635 SUS (1 - 1000 cSt)
Fluid temperature range	32° to 185°F (0° to 85°C)
Power supply voltage	9 - 36 VDC, residual ripple < 10%
Power consumption	3 Watt maximum
Electrical specification	
4 to 20 mA output:	Max. 330 Ω
0 to 10 V output:	Min. 820 Ω Max. current 1.5 A
Electrical outputs	
Analog Interfaces	4 to 20 mA (max 330 Ω) 2 to 10 V (min 820 Ω)
Limit Switching Output	Passive, n-switching power MOSFET, max current 1.5A
RS485	2 conductor cable
Ambient temperature range	-22° to 176°F (-30° to 80°C)
Relative Humidity	max. 95%, non-condensing
Seal Material	
Hydraulic/Mineral Oil	Fluoro-elastomer (FPM)
Phosphate Ester	Ethylene Propylene (EPDM)
Electrical safety class	III ( <i>low voltage protection</i> )
IP class	IP67
Weight	2.9 lbs. (1.3 kg)
Mounting Position	Recommended vertical with direction of flow south to north

We do not guarantee the accuracy or completeness of this information. The information is based on average working condition. For exceptional operating conditions please contact our technical department. All details are subject to technical changes.

## Model Code

		<b>CS</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>-</b>	<b>A</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>0</b>	<b>/</b>	<b>-</b>	<b>000</b>
<b>Series</b>	CS	=	Contamination Sensor																
<b>Resolution</b>	1	=	4 Particle Size Channels																
<b>Indicator Code</b>	2	=	ISO 4406 : 1999; SAE AS 4059 (D) >4 µm(c) >6 µm(c) >14 µm(c) >21 µm(c)																
	3	=	ISO 4406 : 1987; NAS 1638 >2 µm >5 µm >15 µm >25 µm ISO 4406 : 1999; SAE AS 4059 (D) >4 µm(c) >6 µm(c) >14 µm(c) >21 µm(c)																
<b>Options</b>	1	=	without Display																
	2	=	with Display (270° rotation of display)																
<b>Fluids</b>	0	=	Hydraulic/Mineral oil																
	1	=	Phosphate Esters																
<b>Analog Interfaces</b>	A	=	4 to 20 mA																
	B	=	2 to 10 V																
<b>Switching Output</b>	0	=	Limit Switching Output																
<b>Digital Interfaces</b>	0	=	RS485																
<b>Electrical Connection</b>	0	=	Plug M12x1, 8-pole (connection cable not included)																
<b>Mounting</b>	0	=	Inline version (vertical flow mounting is recommended)																
	1	=	Flanged version																
<b>Modification Number</b>	000	=	standard																
	K	=	CS Block Kit without AS1000 Sensor (requires Mounting Option 1)																
	KAS	=	CS Block Kit with AS1000 Sensor (requires Mounting Option 1)																
	KASD	=	CS Block Kit with AS3008 Sensor (requires Mounting Option 1)																

### Scope Of Delivery

- Contamination sensor
- Operation and Instruction manual
- Calibration Certificate
- CD with FluMoS Light software and manuals

### Accessories

- Connection cable 6.5 ft. with M12x1 connector, screened 8-pole: Part Number 03281220
- Connection cable 16.4 ft. with M12x1 connector, screened 8-pole: Part Number 02702459
- Connection cable 9.8 ft. with M12x1 connector, 8-pole: Part Number 02091414
- CSI-D-5 Contamination Sensor Interface: Part Number 03249563
- Power Supply-CS1XXX-PS1: Part Number 03376530

*Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## CS 1000 Block Kit

Includes: CS / AS Sensor Connection Cables, 2 Test Points, 2 Microflex hoses, FluMoS Light software

The Contamination Sensor Block KIT (CS 1000 Block KIT) combines two condition monitoring products, the CS 1000 series (Contamination Sensor) and the AS 1000 series (Aqua Sensor) into one plug and play unit. It serves as an on-line measurement of solid contamination and water in hydraulic and lube systems.

Note: Flow control is necessary when utilizing the CS 1000 sensor. Flow must be maintained through the sensor module to ensure accurate readings. Utilization of the CS Block Kit is required to maintain Sensor flow rate range as described in the Technical Specifications (at the left).

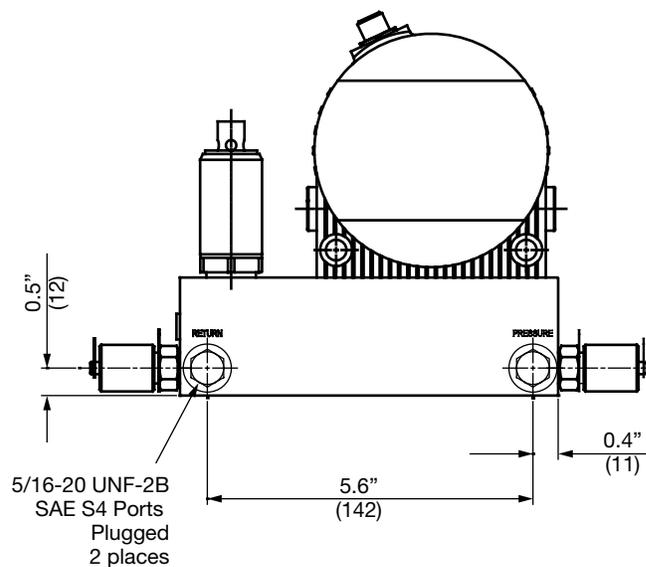
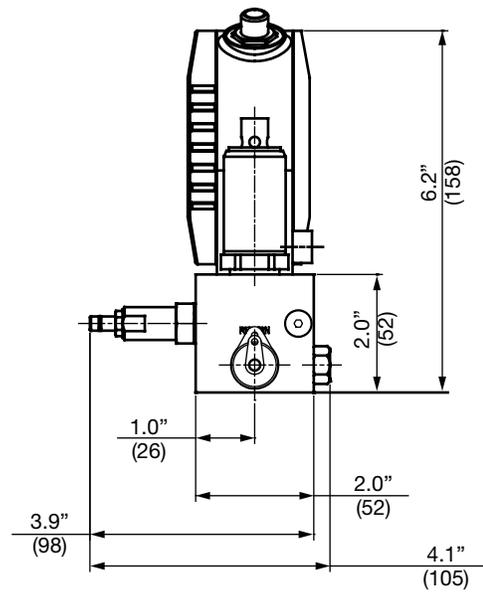
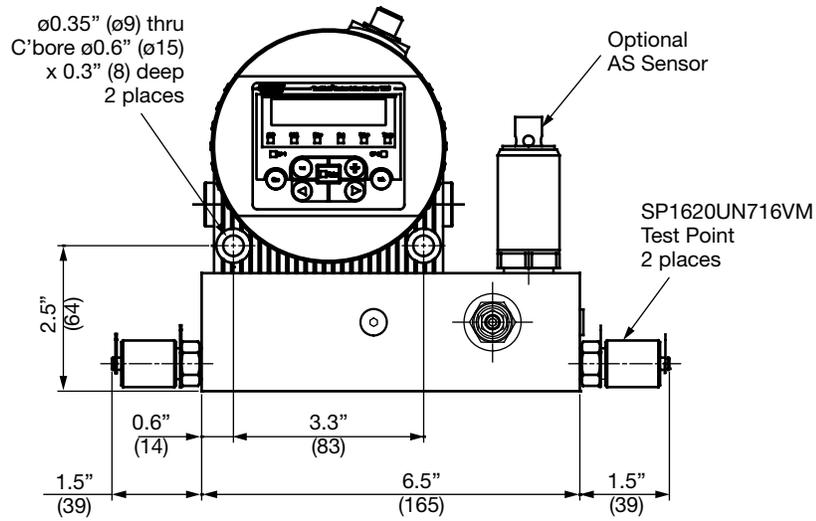
## Quick Order Guide

Model Code	Part Number	Description
CS1220-A-0-0-0-0 /-000	03236362	4-20mA display model
CS1210-A-0-0-0-0 /-000	03240458	4-20mA non-display model
CS1220-A-0-0-0-1 / K	02087348	4-20mA display model and CS Block Kit without AS Sensor
CS1220-A-0-0-0-1 / KAS	02086855	4-20mA display model and CS Block Kit with AS Sensor

# CONTAMINATION MONITORS

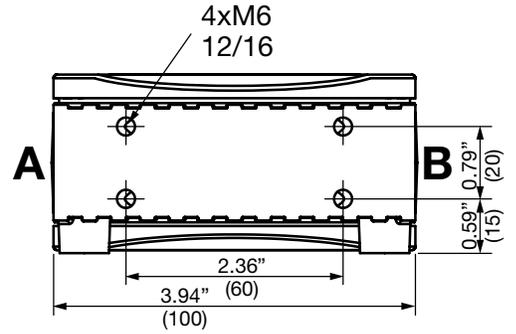
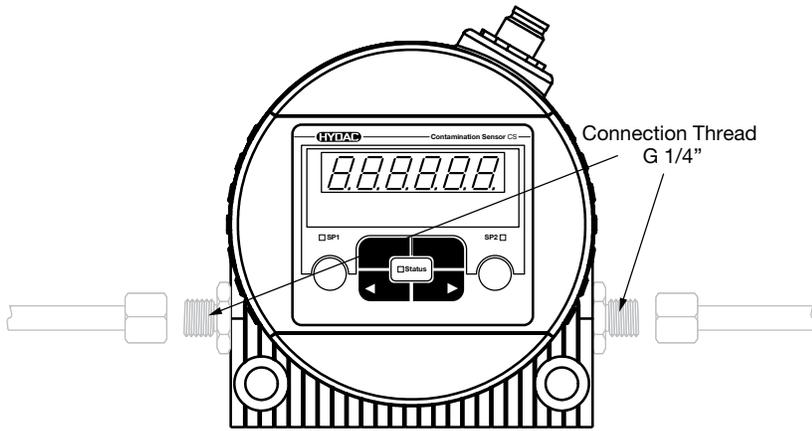
## Dimensions

### CS 1000 with Block Kit

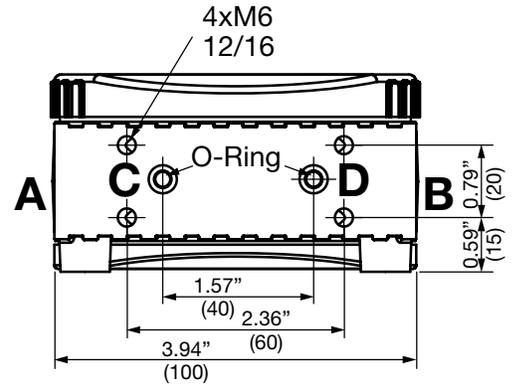
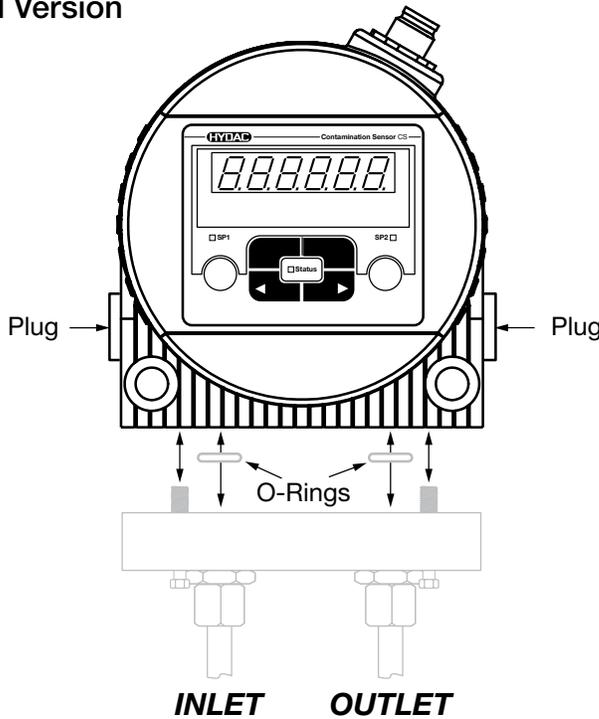


Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

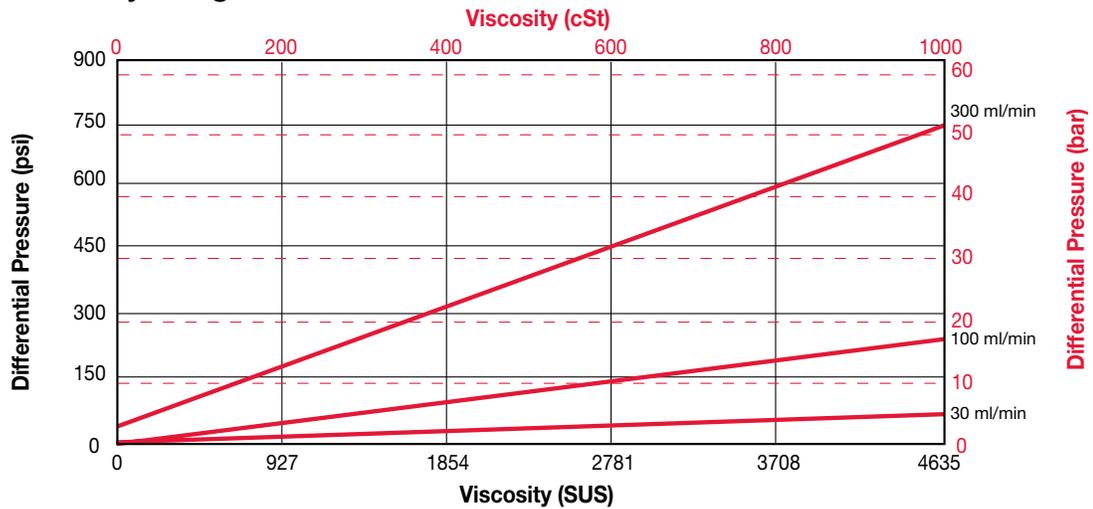
## Hydraulic Connections Inline Version



## Flanged Version



## Pressure - Viscosity Range



# LOW PRESSURE FILTERS

## HY Series

### HY-TRAX® – Manually Controlled Fluid Sampling System



#### Features and Benefits

- Provides Local Visibility to the Fluid Condition of Critical Systems.
- Integrated micro VSD, (Variable Speed Drive), pump/motor provides optimal flow for accurate sensor readings in variable conditions.
- The HY-TRAX® Manually Controlled Fluid Sampling System allows a user to retrieve ISO cleanliness levels from a reservoir tank or a low-pressure line (<50 psi max).
- The compact design allows for installations with tight space constraints.
- The Manual rheostat VSD pump controller is housed in a compact IP 40 enclosure and allows the user to adjust the pump flow for optimal sensor readings.
- Optional AC adapter allows the unit to operate on 115 VAC 60 Hz. 24 VDC is standard.
- Rugged design for field use.
- Fluorocarbon elastomer (FKM) seals.
- Fluid viscosities up to 350 cSt.
- Flow control valve providing optimal pressure for accurate sensor readings.

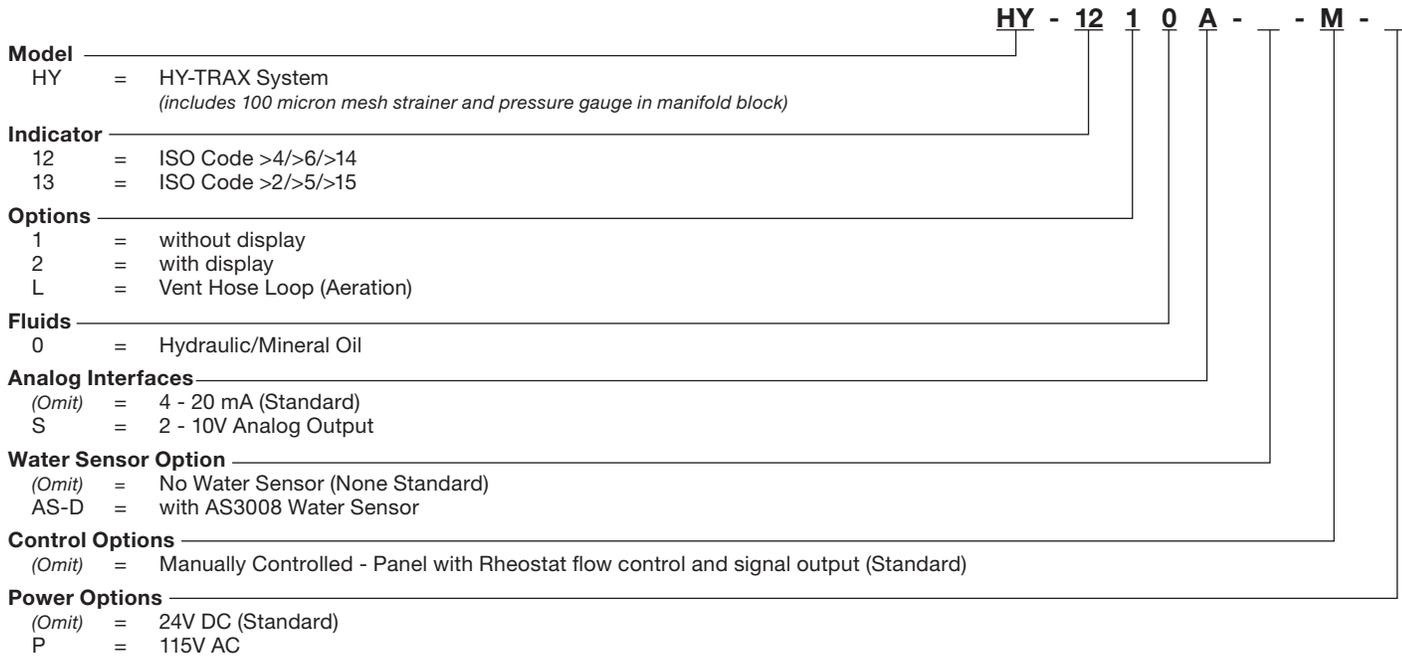
#### Applications

- Mobile Equipment Technology
- Surface Mining
- Construction
- Monitoring of Oil Cleanliness in Storage Tanks
- Fleet Services
- Rail

#### Technical Specifications

Measuring Range	Display ISO ranges between 25/24/23 and 9/8/7 Calibration within the range ISO 13/11/10 to 23/21/18	
Contamination Output Code	Standard: ISO 4406:1999 or SAE AS 4059(D) Optional: ISO 4406:1987; NAS 1638 and ISO 4406:1999	
Self-Diagnosis	Continuously with error indication via status LED	
Pressure Rating	50 psi (3.4 bar) max	
Fluid Inlet/Outlet	SAE ORB, Size 4	
Seal Material	Fluorocarbon elastomer (FKM)	
Pump Speed	500-5000 RPM (adjustable)	
Optimal Sampling Pump Flow Rate	0.008-0.079 GPM (30-300 mL/min)	
Fluid Temp. Range	32°F to 185°F (0°C to +85°C)	
Ambient Temp. Range	-22°F to 176°F (-30°C to 80°)	
Max Viscosity	350 cSt (1622 SUS)	
Pump Type	Gear Pump	
Power Supply Voltage	24 VDC +/- 10%, Residual Ripple <10%	
Max Power/Current Consumption	100 Watt/ 4 amp	
Electric Output	4-20 mA analog output; 0-10 V analog (option for contamination monitor (CS1000)) RS485 for communication with FluMoS Software	
Electrical Specifications	4 - 20 mA analog output (max burden 330 Ω) 0 to 10v output (min load resistor 82 Ω) Limit switching output (Power MOSFET): max current 1.5A	
CS1000 Contamination Monitor Signal Output Connections Located on Control Enclosure	USB-B Female Port for use with Windows-based computer and FluMoS Software M12 8 pole, Male Port, Analog or Digital, for use with PLC or RS485 Communication, (4 - 20 mA is standard). 0 - 10 V is optional, must specify when ordering CS1000 Contamination Monitor	
Water Sensor (AS1008) Signal Output Connection Located on Control Enclosure:	Water sensor (AS1008) M12-5 pole Signal Output 5 pole Male Port, located on Control Enclosure	
Electrical Safety Class	III (low voltage protection)	
Enclosure Ratings	IP 40 enclosure	
<b>Weight and Dimensions</b>		
Communications Module Control with CS1000 Sensor	Fluid Sampling System Manifold w/ CS1000 & VSD Pump/Motor	HY-TRAX® Manual Control Module
	10 lbs. (4.5 kg)	5 lbs. (2.5 kg)
	10.3" x 6.8" x 4.3" (262 x 173 x 109 mm)	9.3" x 5.7" X 2.6" (236 X 145 x 65 mm)

## Model Code



## What's Included

- CS1000 Series Contamination Sensor
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment.
- Specially designed fitting for mating to pump/motor.
- Fluorocarbon elastomer (FKM) seals.
- Plugged water sensor port (G3/8)
- VSD (Variable Speed Drive) Motor Power Supply and Control Cable
- Water Sensor (AS3008) Power Supply and Signal Cable (only supplied with optional water sensor (AS3008))
- Contamination Monitor (CS1000) output signal, USB-B Female Port for use with Windows-Based Computer and FluMoS Software, located on Control Enclosure
- Contamination Monitor (CS1000), output signal, M12 8 pole, Male Port, located on Control Enclosure, for use with PLC or RS485 Communication, analog or digital, 4 - 20 mA is standard, 0 -10 V is optional
- Flow control valve
- VSD (Variable Speed Drive) pump/motor
- Manual rheostat pump controller
- IP 40 enclosure
- Side or Front Inlet/Outlet Porting (SAE Size 04 ORB)
- 24 VDC Power Supply (NC3MP Female Connector)
- Optional 115 VAC Power Supply with Cord
- Contamination Monitor (CS1000) Power and Signal Cable
- Water Sensor (AS3008) M12 5 pole Signal Output Connection, Male Port, located on Control Enclosure
- Contamination monitor (CS1000) power connection, female M12 8 pole located on control enclosure
- Water sensor (AS3008) power connection, M12 5 pole Female located on control enclosure

# CONTAMINATION MONITORS

## HY Series

### HY-TRAX® – Telematics Communications Module with Remote Controlled Sampling System



#### Features and Benefits

- Provides Remote Visibility to the Fluid Condition of Critical Systems.
- Integrated micro VSD, (Variable Speed Drive), pump/motor provides optimal flow for accurate sensor readings in variable conditions.
- This HY-TRAX® Remote Oil Contamination Sensor Package allows remote access via the Internet and smart devices to fluid particle counts, temperature, and percent water saturation levels (optional) displayed on a customizable dashboard. The fluid sampling system collects data and the communications module transmits this data via GSM cellular at scheduled intervals. Users can receive alerts via email when a fluid's ISO contamination code or water saturation level (optional) reaches user defined critical levels. The unit can sample fluid directly from a fluid reservoir or low pressure line (<50 psi).
- The Communications Module automatically controls fluid flow to compensate for viscosity changes due to temperature or fluid type. All data is transmitted through a secure VPN and archived in a protected database in the cloud to allow real-time and historical analysis.
- The HY-TRAX® Communications Module will provide maintenance managers with the visibility and vital information necessary to pro-actively schedule preventative maintenance on local and remote equipment. Maintenance decisions can now be based on accurate and real-time data.
- The communications module components are mounted and housed in a rugged IP 40 enclosure.
- Fluid sampling system standard with Fluorocarbon elastomer (FKM) seals.
- Fluid viscosities up to 350 cSt.
- 50 psi (max.) working pressure.
- Flow control valve providing optimal pressure for accurate sensor readings.
- VSD, (Variable Speed Drive), pump/motor providing optimal flow for accurate sensor readings.

#### Applications

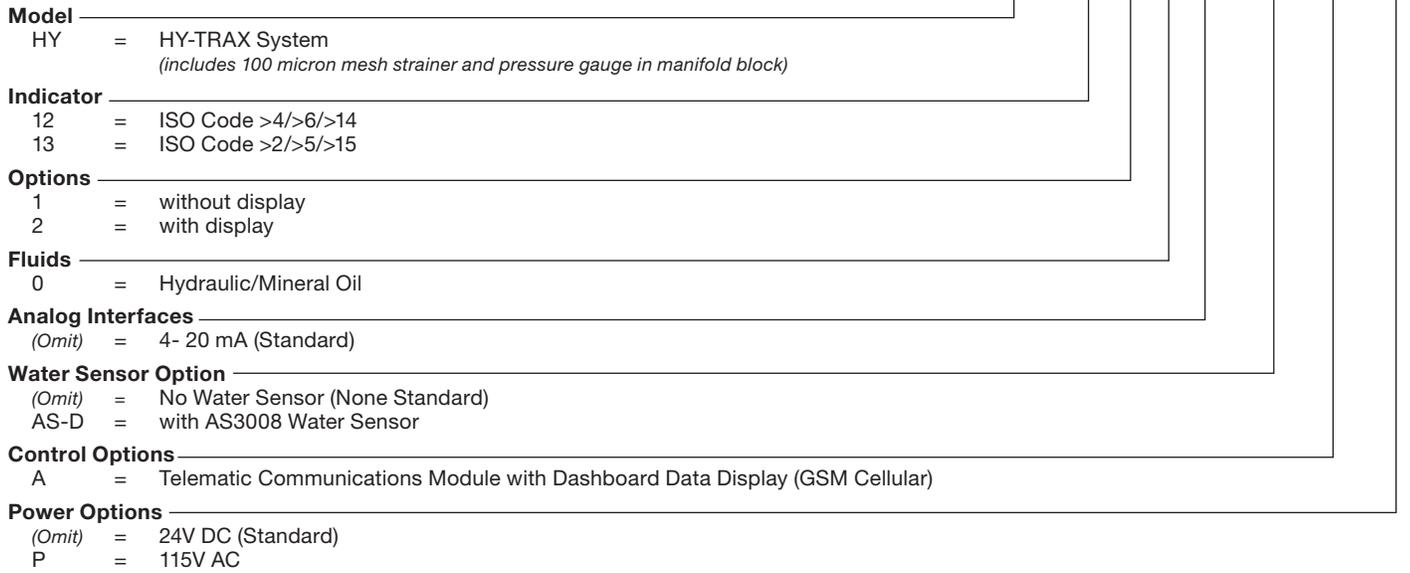
- Mobile Equipment Technology
- Surface Mining
- Construction
- Monitoring of Oil Cleanliness in Storage Tanks
- Fleet Services
- Rail

#### Technical Specifications

Measuring Range	Display ISO ranges between 25/24/23 and 9/8/7 Calibration within the range ISO 13/11/10 to 23/21/18	
Contamination Output Code	Standard: ISO 4406:1999 or SAE AS 4059(D) Optional: ISO4406:1987; NAS 1638 and ISO 4406:1999	
Self-Diagnosis	Continuously with error indication via status LED	
Pressure Rating	50 psi (3.4 bar) max	
Fluid Inlet/Outlet	SAE ORB, Size 4	
Seal Material	Fluorocarbon elastomer (FKM)	
Pump Speed	500-5000 RPM (adjustable)	
Optimal Sampling Pump Flow Rate	0.008-0.079 GPM (30-300 mL/min)	
Fluid Temperature Range	32°F to 185°F (0°C to +85°C)	
Ambient Temperature Range	-22°F to 176°F (-30°C to 80°)	
Max Viscosity	up to 350 cSt (1622 SUS)	
Pump Type	Gear Pump	
Power Supply	24 volts DC	
Power Consumption	4A	
Communications Module Signal Output	GSM cellular Communication to monitoring website	
Electrical Safety Class	III (low voltage protection), IP 40 enclosure	
Cellular Communications	AT&T Quad Band GSM (850, 900, 1800, 1900 MHz)	
<b>Weight and Dimensions</b>		
Communications Module Control Sensor	HY-TRAX® Communications Module	Fluid Sampling Manifold w/ Communications Module & VSD Pump/Motor
	10 lbs. (4.5 kg)	20 lbs. (9.1 kg)
	14.7" x 11.3" x 5.25" (374 x 287 x 133 mm)	

## Model Code

**HY - 12 1 0 A - - T -**

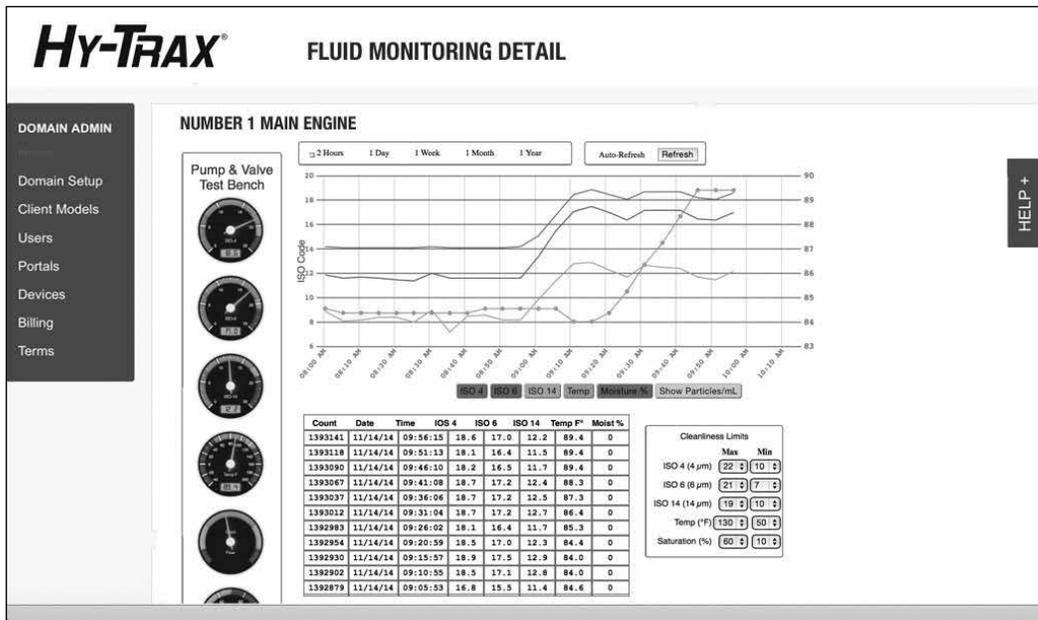


## What's Included

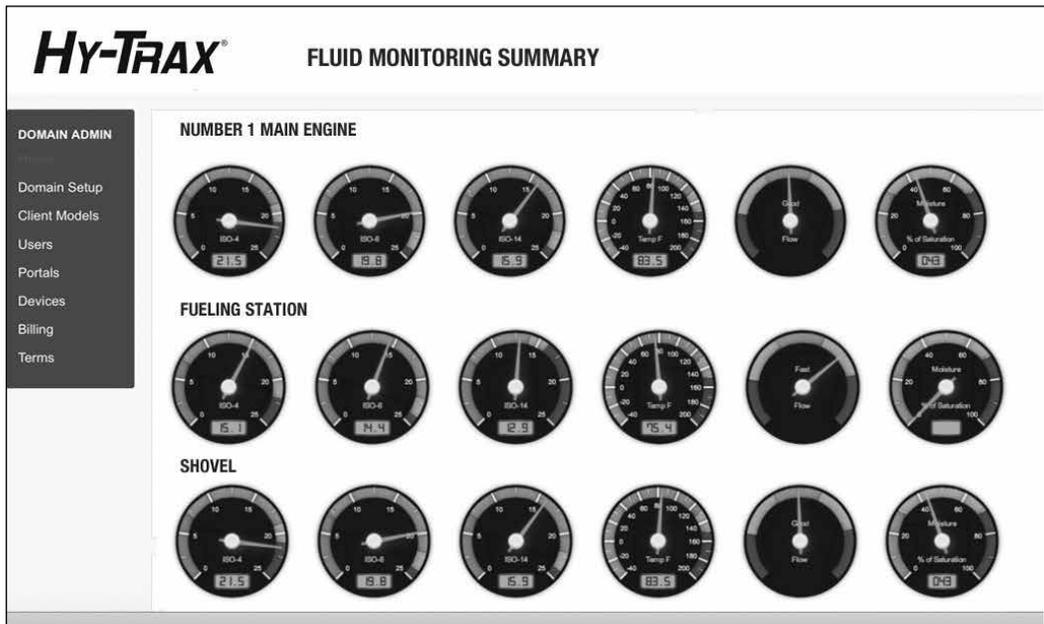
- CS1000 Series Contamination Sensor
- Flow Control Valve
- GSM cellular communications
- VSD pump/motor
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment
- CS1000 Series Contamination Sensor (CS1000) Communications/Power Cable
- Specially designed fitting for mating to pump/motor
- Plugged water sensor port (G3/8)
- IP 40 enclosure
- Water sensor (optional)
- 24 volts DC standard with optional 115 VAC Power Supply
- Optional Water Sensor (AS3008) Communication/Power Cable
- Side or Front Inlet/Outlet Porting (SAE Size 04 ORB)

# CONTAMINATION MONITORS

## Example of HY-TRAX® Communications Modules Dashboard Contamination Chart



## Example of HY-TRAX® Communications Modules Dashboard Gauge Panel

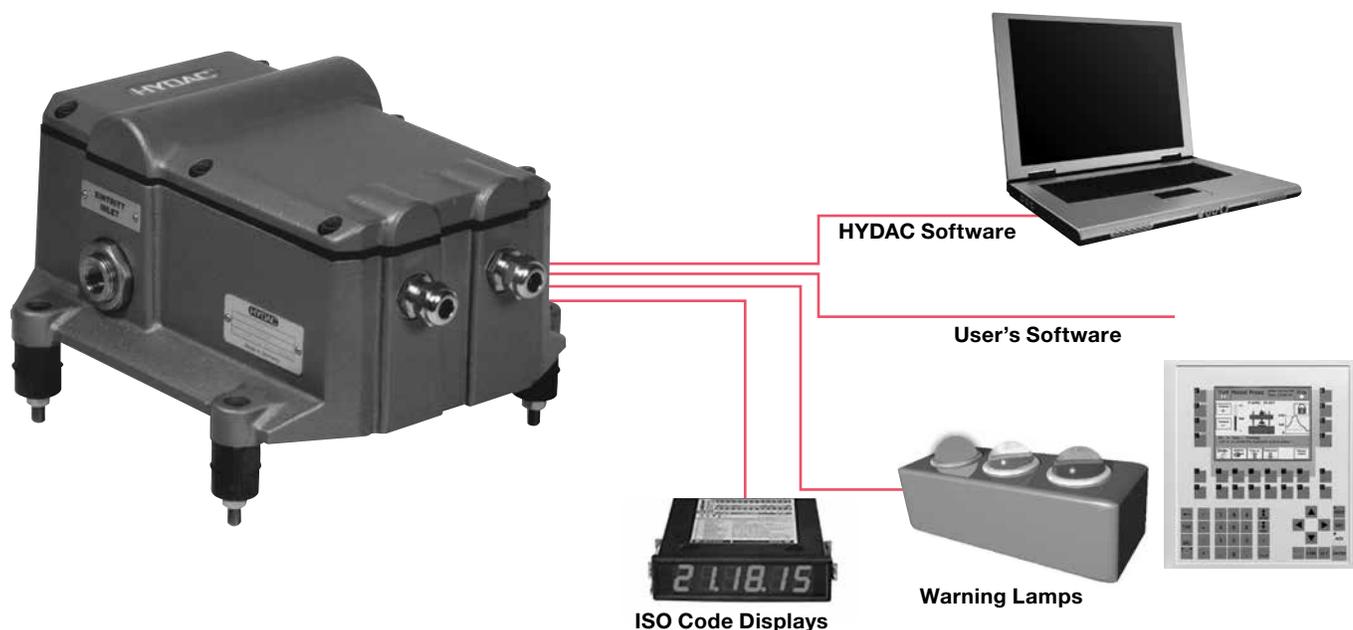




# CONTAMINATION MONITORS

## CS 2000 Series

### Contamination Sensors



### Description

The CS Contamination Sensor is a solid contamination sensor for detecting and monitoring solid contamination in hydraulic, lube and fuel oil. The CS Sensor continuously monitors the condition of the fluid and transmits the information to a variety of devices in real-time!

The data can be transmitted in various formats, allowing the user to display contamination levels, program alarms and/or warnings, activate or de-activate auxiliary filtration loops, or examine via HYDAC software.

The Sensor technology used is the same as that in our portable FCU series contamination monitors and has been proven as a successful means of detecting solid contamination particles.

The HYDAC sensor concept provides a distinct durability advantage. The CS Sensor is not sensitive to vibration, optical system contamination, pressure pulsations, fluid color, turbidity, or continuous high fluid temperatures.

### Applications

This unit can be applied to any hydraulic system in which contamination monitoring is critical. It is designed for permanent installation in the system. Common applications of the CS Sensor include:

- Lube-oil systems
- Paper mills
- Power generation plants
- Steel mills
- Flushing Process Control
- Fuel oil systems

### Technical Specifications

Self-diagnosis	Continuous with error indication via relays and serial interface
Measuring range (calibrated)	ISO 13/11/10 ... 23/21/18. Sensor calibrated within this range. Displays from ISO class 12/10/09 up to ISO 25/23/21.
Operating pressure Inlet Outlet	Max. 580 psi (40 bar); depending on the model Max. 145 psi (10 bar); rated to 5076 psi (350 bar)
Connections Inlet Outlet	Thread G 1/4, ISO 228 Thread G 1/4, ISO 228
Measurement flow rate	10 - 200 ml/min
Total flow rate	10 - 800 ml/min (depending on psi)
Fluid temperature range	32° to 158°F (0° to 70°C)
Power supply voltage	24 VDC, ± 25%
Power consumption	25 Watt maximum
Electrical data	- Output for Contamination Sensor Display - 3 relay outputs: - 1 x "ready" relay - 2 x "limit" relays - PLC output - Additional electrical output (see model code)
Ambient temperature range	32° to 131°F (0° to 55°C)
Storage temperature range	-8° to 185°F (-20° to 85°C)
Relative Humidity	max. 90%, non-condensing
Electrical safety class	III (safety extra-low voltage)
IP class	IP65
Weight	8.8 lbs. (4 kg)

### Data Output To

- PC - via HYDAC software (included)
- Programmable logic controllers (PLC)
- Warning lamps via relays
- Local ISO class display (customer supplied)
- 4 to 20mA or DIN-Messbus or Ethernet

## Model Code

**CS 21 3 0 - 1 - U / - 1 - 2**

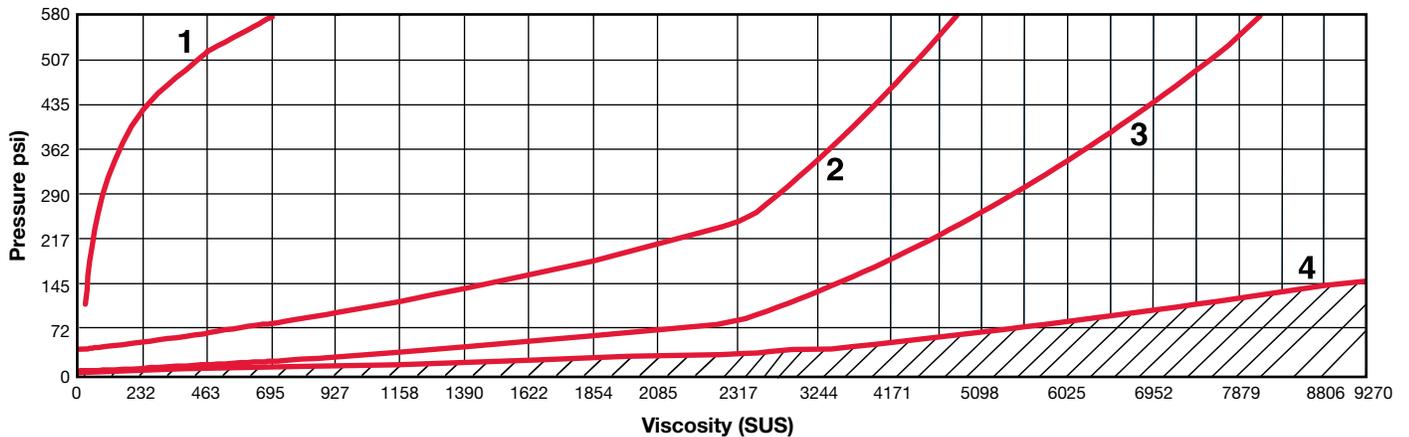
- Series**  
CS = Contamination Sensor
- Model**  
21 = 3 digit ISO 4406 Code (>2/>5/>15)  
22 = 3 digit ISO 4406 Code (>4/>6/>14)
- Enclosure**  
3 = Stationary
- Fluids**  
0 = Standard mineral fluids and mineral based synthetics  
1 = Phosphate esters (e.g. Skydrol, Hyjet)
- Modification Number**  
1 = Standard
- Supply Voltage**  
U = 24 VDC
- Pressure Range**  
1, 2, 3, 4 - See Pressure / Viscosity Range chart

- Output**  
0 = RS232 (DIN-66348 protocol) (enables easy communication with Hydac FluMoS Software)  
1 = 4 - 20 mA  
2 = RS485 (DIN-66348 protocol)  
5 = Ethernet

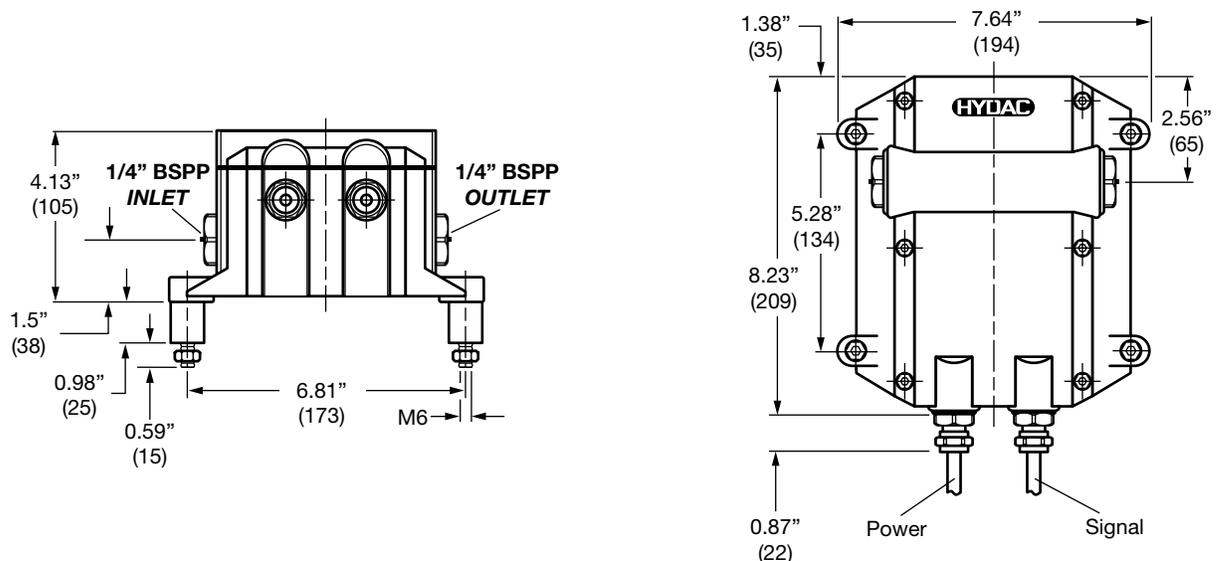
\* For pressures above 560 psi - Reduce the pressure to between 280 and 560 psi. Please contact HYDAC for details.

*Model Codes containing RED are non-standard items - Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## Pressure / Viscosity Range



## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## CSM 1000 Series

### Contamination Sensor Module



### Description

The Contamination Sensor Module CSM 1000 is an online condition monitoring system for detecting particle contamination in hydraulic and lubrication fluids containing a high proportion of air bubbles. Air bubble suppression is used to dissolve the air bubbles so that they are not detected as particles. Moreover, it is the ideal solution for analyzing the particle content of fluids, independently of the rest of the hydraulic system. As an option other condition monitoring sensors such as the HYDAC AquaSensor can be incorporated.

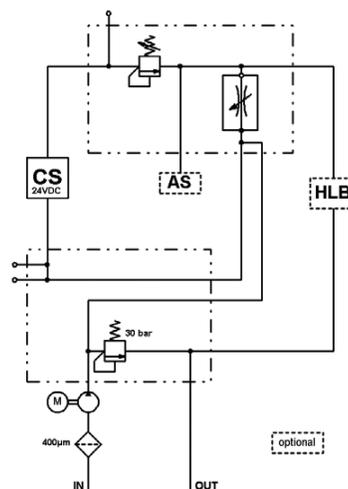
### Applications

- Lubrication oil system in paper, steel and energy sectors
- For condition-based, pro-active maintenance
- Monitoring of component cleanliness on test rigs
- Monitoring of oil cleanliness in oil reservoirs

### Advantages

- Cost-effective, self-contained solution
- Numerous data interfaces provide communication via WLAN, intranet or internet
- Online monitoring of the oil cleanliness with alarm function to indicate:
  - ingress of and increase in contamination
  - increase in contamination as components start to wear when there are filtration problems
- Verification of cleanliness on test rigs
- Verification of changes in the oil cleanliness as a result of inadequate servicing.

### Hydraulic Schematic



### Technical Specifications

Pump type	Gear pump
Operation pressure	
$P_{in}$ (INLET)	-0.4 to 0.5 bar (standard pump) -0.4 to 120 bar (pump, pressure inlet stable)
$P_{out}$ (OUTLET)	5 bar
$P_{out}$ (leakage line)	0.5 bar (pump, pressure inlet stable)
Permissible outlet pressure	5 bar max
Connections	INLET: Thread G 1/4, ISO 228 OUTLET: Thread G 1/4, ISO 228
Total flow rate	approx. 100 ml/min (standard pump) approx. 180 ml/min (pump, pressure inlet stable)
Permissible operating viscosity range	10 to 3000 cSt
Permissible viscosity range for measuring	10 to 1000 cSt
Permissible Fluid temperature range	32° to 158°F (0° to 70°C)
Permissible fluids	Hydraulic and lubrication fluids based on mineral oil
Power consumption (motor pump group)	0.18 kW @ 50 Hz 0.21 kW @ 60 Hz
Ambient temperature range	32 to 131°F (0° to 55°C)
Storage temperature range	-4 to 185°F (-20 to 85°C)
Relative humidity	max. 90%, not condensing
IP class	IP55
Weight	approx. 40 lbs (18 kg)
<b>Contamination Sensor</b>	
Self-diagnosis	continuously with error indication via status LED
Measuring range	MIN / MAX Display of class ISO 9/8/7 (MIN) to class ISO 25/24/23 (MAX) Calibrated within the range ISO 13/11/10 to ISO 23/21/18.
Power supply voltage	9 to 36 VDC, residual ripple <10%
Power consumption	3 Watt max
Electrical outputs	- Analog output 4 to 20 mA or 0 to 10 V - RS485 Interface - Switching output

## Model Code

**CSM 1 2 2 0 - 1 - 1 - W/N/X60/O60 -**

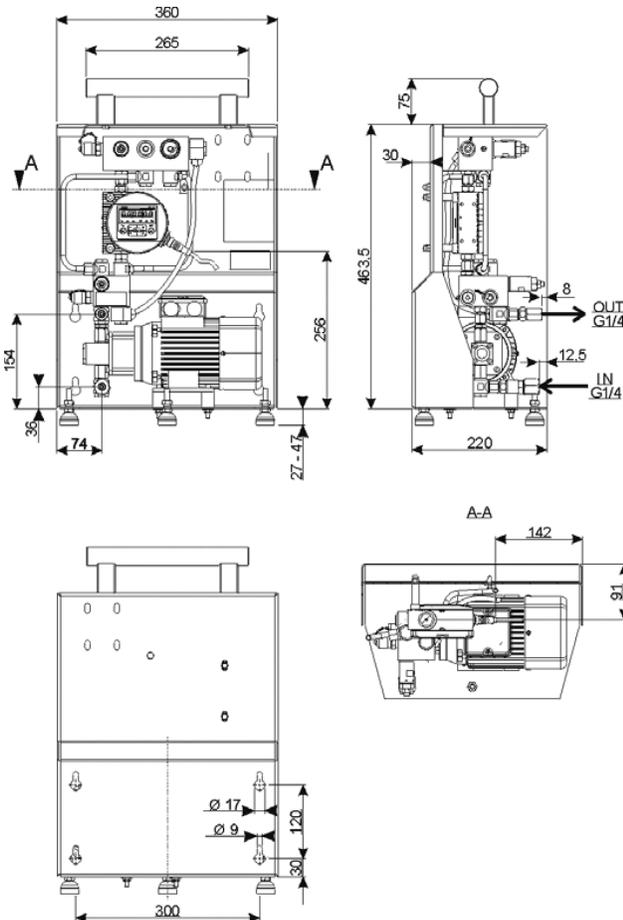
<b>Series</b>	CSM = Contamination Sensor Module
<b>Resolution Contamination Sensor</b>	1 = 4 particle size channels
<b>Contamination Codes</b>	2 = ISO 4406:1999; SAE AS 4059 (D) / > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c)
	3 = ISO 4406:1987; NAS 1638 / > 2 µm > 5 µm > 15 µm > 25 µm ISO 4406:1999; SAE AS 4059 (D) / > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c) reversible
<b>Options</b>	1 = without display 2 = with display (display rotation of 270°)
<b>Fluids</b>	0 = based on mineral oil
<b>Hydraulic Version</b>	1 = Standard pump 2 = Pump, pressure inlet stable, with oil leakage pipe
<b>Electrical Output Contamination Sensor</b>	1 = 4 to 20 mA analogue output 2 = 0 to 10 V analogue output
<b>Supply Voltage Motor Pump Unit</b>	W/N/X60/O60 = 230 V, 50 Hz, 3Ph/ 265 V, 60 Hz, 3Ph, delta connection 400 V, 50 Hz, 3Ph/ 460 V, 60 Hz, 3Ph, star connection N/AB/N60/AB60 = 400 V, 50 Hz, 3Ph/ 400 V, 60 Hz, 3Ph, delta connection 690 V, 50 Hz, 3Ph/ 690 V, 60 Hz, 3Ph, star connection
<b>Supplementary Details</b>	AS = with AquaSensor AS 1000 Series

### Items Supplied:

- CSM
- Operating and Maintenance Instructions
- CD with FluMoS software and manuals
- Calibration Certificate Contamination Sensor

*Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## Dimensions



Dimensions are millimeters and for general information only, all critical dimensions should be verified by requesting a certified print.

## Accessories for

CS 1000	Part No.
Contamination Sensor Interface CSI-D-5	03249563
Connector with 2 m cable, screened, 8-pole, M12x1	03281220
Connector with 5 m cable, screened, 8-pole, M12x1	02702459
Extension cable 5 m, socket 8-pole, M12x1 / plug 8-pole, M12x1	03281240
Connector with screw clamp, screened, 8-pole, M12x1	03281243
AS 1000	Part No.
ZBE 08 Right-angled connector, 5 pole, M12x1	06006786
ZBE 08S-02 Right-angled connector, with 2 m cable, screened, 5 pole, M12x1	06019455
ZBE 08S-05 Right-angled connector with 5 m cable, screened, 5 pole, M12x1	06019456
ZBE 08S-10 Right-angled connector with 10 m cable, screened, 5 pole, M12x1	06023102

# CONTAMINATION MONITORS

## CSM 2000 Series

### Contamination Sensor Module



### Description

The Contamination Sensor Module CSM 2000 is an online condition monitoring system for detecting particle contamination in hydraulic and lubrication fluids containing a high proportion of air bubbles. Air bubble suppression is used to dissolve the air bubbles so that they are not detected as particles. Moreover, it is the ideal solution for analyzing the particle content of fluids, independently of the rest of the hydraulic system. As an option, other condition monitoring sensors such as the HYDAC AquaSensor can be incorporated.

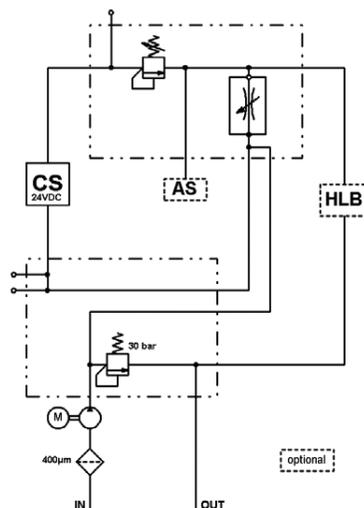
### Applications

- Lubrication oil system in paper, steel and energy sectors
- For condition-based, pro-active maintenance
- Monitoring of component cleanliness on test rigs
- Monitoring of oil cleanliness in oil reservoirs

### Advantages

- Cost-effective, self-contained solution
- Numerous data interfaces provide communication via WLAN, intranet or internet
- Online monitoring of the oil cleanliness with alarm function to indicate:
  - ingress of and increase in contamination
  - increase in contamination as components start to wear when there are filtration problems
- Verification of cleanliness on test rigs
- Verification of changes in the oil cleanliness as a result of inadequate servicing.

### Hydraulic Schematic



### Technical Specifications

Pump type	Gear pump
Operation pressure	
$P_{in}$ (INLET)	-0.4 to 0.5 bar (standard pump) -0.4 to 120 bar (pump, pressure inlet stable)
$P_{out}$ (OUTLET)	5 bar
$P_{out}$ (leakage line)	0.5 bar (pump, pressure inlet stable)
Permissible outlet pressure	5 bar max
Connections	INLET: Thread G 1/4, ISO 228 OUTLET: Thread G 1/4, ISO 228
Total flow rate	approx. 100 ml/min (standard pump) approx. 180 ml/min (pump, pressure inlet stable)
Permissible operating viscosity range	10 to 3000 cSt
Permissible viscosity range for measuring	10 to 1000 cSt
Permissible Fluid temperature range	32° to 158°F (0° to 70°C)
Permissible fluids	Hydraulic and lubrication fluids based on mineral oil
Power consumption (motor pump group)	0.18 kW @ 50 Hz 0.21 kW @ 60 Hz
Ambient temperature range	32 to 131°F (0° to 55°C)
Storage temperature range	-4 to 185°F (-20 to 85°C)
Relative humidity	max. 90%, not condensing
IP class	IP55
Weight	approx. 40 lbs (18 kg)
<b>Contamination Sensor</b>	
Self-diagnosis	continuously with error indication via status LED
Measuring range	MIN / MAX Display of class ISO 9/8/7 (MIN) to class ISO 25/24/23 (MAX) Calibrated within the range ISO 13/11/10 to ISO 23/21/18.
Power supply voltage	9 to 36 VDC, residual ripple <10%
Power consumption	3 Watt max
Electrical outputs	- Analog output 4 to 20 mA or 0 to 10 V - RS485 Interface - Switching output

## Model Code

**CSM 2 2 3 0 - 1 - 1 - W/N/X60/O60 -**

### Series

CSM = Contamination Sensor Module

### Resolution Contamination Sensor

2 = 4 particle size channels

### Contamination Codes

2 = ISO 4406:1999; SAE AS 4059 (D) / > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c)

3 = ISO 4406:1987; NAS 1638 / > 2 µm > 5 µm > 15 µm > 25 µm  
 ISO 4406:1999; SAE AS 4059 (D) / > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c) rev.

### Contamination Sensor

3 = Standard

### Fluids

0 = based on mineral oil

### Hydraulic Version

1 = Standard pump (up to 0.5 bar)

2 = Pump with increased inlet pressure, with leakage line

### Electrical Output Contamination Sensor

0 = RS232 (DIN-66348 protocol)

1 = Analog output (4-20mA)

2 = RS485 (DIN-66348 protocol)

5 = Ethernet (IEEE 802.3 TCP/IP)

### Supply Voltage Motor Pump Unit

W/N/X60/O60 = 230 V, 50 Hz, 3Ph/ 265 V, 60 Hz, 3Ph, delta connection

400 V, 50 Hz, 3Ph/ 460 V, 60 Hz, 3Ph, star connection

N/AB/N60/AB60 = 400 V, 50 Hz, 3Ph/ 400 V, 60 Hz, 3Ph, delta connection

690 V, 50 Hz, 3Ph/ 690 V, 60 Hz, 3Ph, star connection

### Options

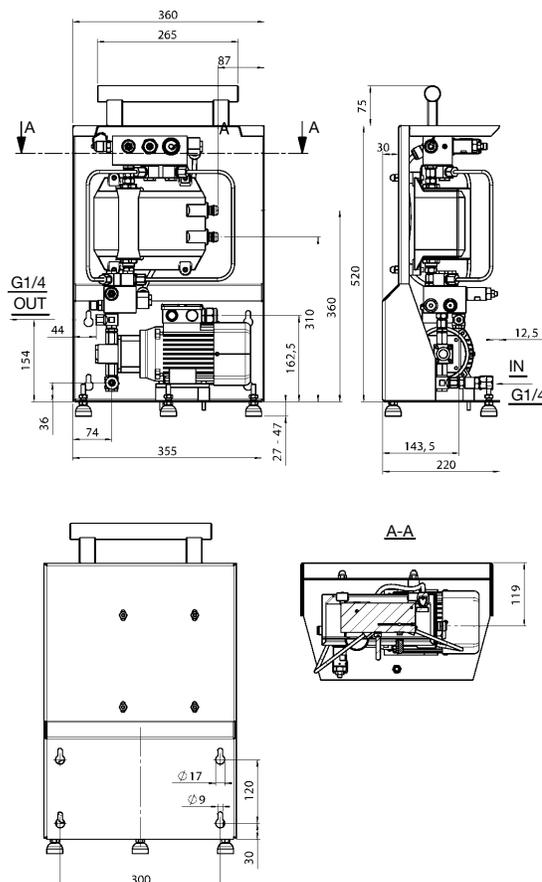
AS = with AquaSensor AS 1000 Series

### Items Supplied:

- CSM
- Operating and Maintenance Instructions
- CD with FluMoS Software and manuals
- Calibration Certificate Contamination Sensor

*Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## Dimensions



## Accessories for:

CS 2000	Part No.
Contamination Sensor Display CSD-1-U	03078272
Connector with 2 m cable, screened, 8-pole, M12x1	03281220
Connector with 5 m cable, screened, 8-pole, M12x1	02702459
Extension cable 5 m, socket 8-pole, M12x1 / plug 8-pole, M12x1	03281240
Connector with screw clamp, screened, 8-pole, M12x1	03281243
AS 1000	Part No.
ZBE 08 Right-angled connector, 5 pole, M12x1	06006786
ZBE 08S-02 Right-angled connector, with 2 m cable, screened, 5 pole, M12x1	06019455
ZBE 08S-05 Right-angled connector with 5 m cable, screened, 5 pole, M12x1	06019456
ZBE 08S-10 Right-angled connector with 10 m cable, screened, 5 pole, M12x1	06023102

Dimensions are millimeters and for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## CSM-C Series

### Contamination Sensor Module Comfort Series



### Description

The CSM Comfort Contamination Sensor Module is the plug-and-work solution for permanently monitoring fluid status by measuring solid particle contamination and water saturation.

Designed for 24/7 operation, the CSM-C can be used for all hydraulic and lubrication applications. With its own integrated power supply and multi-voltage input, the CSM-C can be used in any hydraulic conditions.

The CSM-C must be placed directly on the measuring site; it can be easily connected to the customer controller (PLC) through its integrated analog output.

The SMU 1200 Sensor Monitoring Unit is designed to be used as a remote control and display accessory with reliable data storage that integrates perfectly into the housing on the CSM-C; it can also be conveniently positioned in the customer's field of view using a 10-meter connecting cable.

### Applications

- Hydraulic and lubricating fluids
- Continuous 24/7 operation

### Advantages

- Accessory to FCU 1000
- Continuous measurement in lubricating fluids
- Housing for use near the measuring site
- Convenient display using SMU 1200

### Technical Specifications

General Specifications		
Measured variables	Contamination	ISO 4406, SAE AS 4059, NAS 1638
	Water content	Level of saturation
	Temperature	°F (°C)
Measurement ranges	Contamination	ISO 9/8/7 - ISO 25/24/23
	Water content	0 to 100 %
	Temperature	-25 to 100 °C
Calibration accuracy	Contamination	± ½ ISO-Code in calibrated range of ISO 13/11/10 - ISO 23/21/18
	Water content	± max. 2% (Full scale)
	Temperature	± max. 2% (Full scale)
Display/remote control/data storage	SMU 1200 Series Sensor Monitoring Unit sold separately.	
Ambient temp. range	32 to 131°F (0 to 55 °C)	
Storage temp. range	-4 to 185°F (-20 to 85 °C)	
Relative humidity	Max. 90%, non-condensing	
Weight when empty	≈ 25 kg	
Protection class	IP 54	
Hydraulic Specifications		
Operating mode	Pressurized operation up to 80 bar primary pressure	
Nominal operating mode	Continuous operation S1 (24/7)	
Operating pressure	P <sub>IN</sub> (INLET)	-0.4 - 80 bar
	P <sub>OUT</sub> (OUTLET)	80 bar
	P <sub>OUT</sub> (LEAKAGE)	0.5 bar
Total flow rate	≈ 180 ml/min	
Permitted operating viscosity range	10 - 3000 cSt	
Permitted measurement viscosity range	10 - 1000 cSt	
Permitted temperature range of fluid	32 to 185°F (0 to 85 °C)	
Seal material	FPM	
Ports	INLET	G1/4 as per ISO 228
	OUTLET	G1/4 as per ISO 228
	LEAKAGE	G1/4 as per ISO 228
Suction strainer	400 µm, metal mesh filter	
Suction height	max. 0.5 m	
Electrical Specifications		
Connection voltages	380 V, 50 Hz, 3 Ph (-10%/+10%)	
	400 V, 50 Hz, 3 Ph (-15%/+10%)	
	415 V, 50 Hz, 3 Ph (-10%/+6%)*	
	440 V, 60 Hz, 3 Ph (-10%/+10%)	
	460 V, 60 Hz, 3 Ph (-15%/+10%)	
*As per DIN EN 60204 connection voltage must be ±10% of nominal voltage.		
Connection, male	Supply-side	3 Ph + PE, CEE as per IEC309
	Device-side	Harting Han4A
Power supply	Connection cable 10 m with main switch, device protection and phase sequence check	
Power consumption	< 200 Watt	

## Model Code

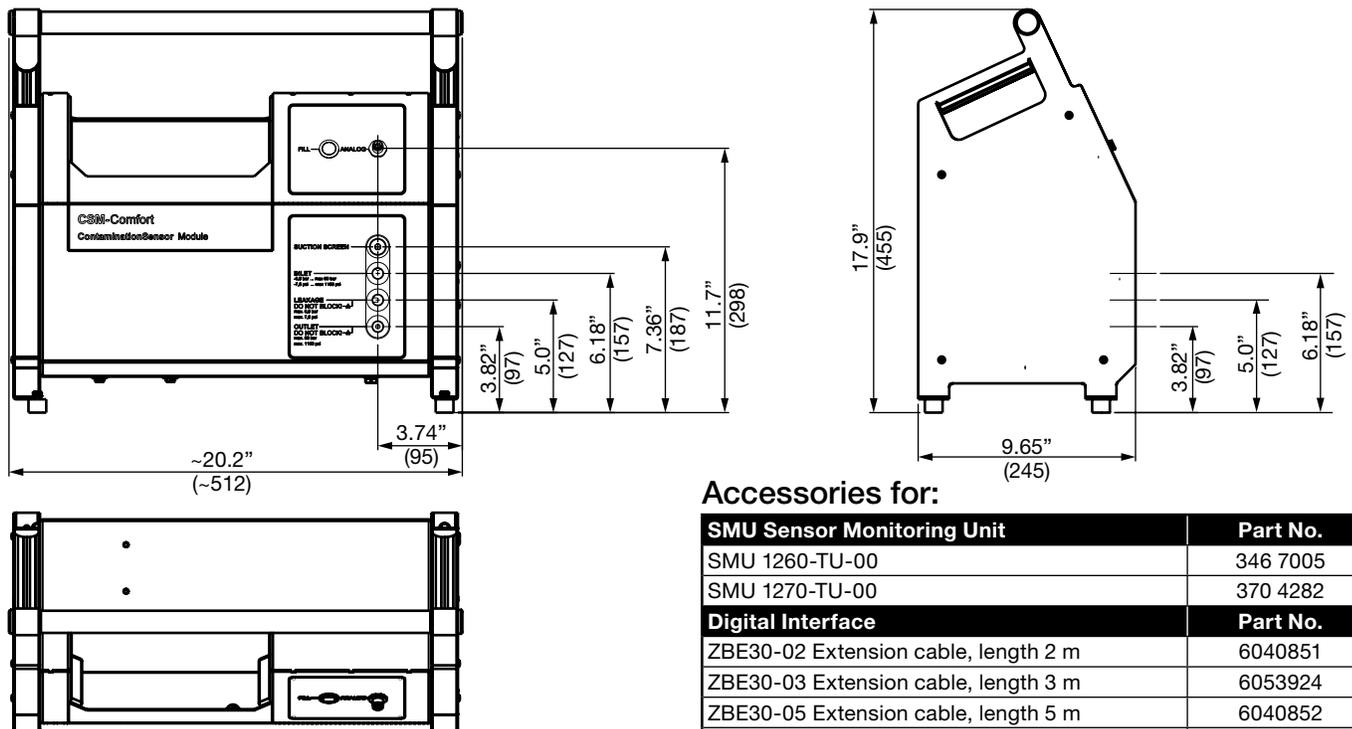
CSM-C 1 3 2 0 - N060 - AS - 0

- Type** \_\_\_\_\_  
CSM-C = Contamination Sensor Module - Comfort
- Series** \_\_\_\_\_  
1 = 4 particle channels
- Solid matter contamination coding** \_\_\_\_\_  
3 = ISO4406:1987; NAS1638 2-5 µm, 5-15 µm, 15-25 µm, >25 µm switchable to ISO4406:1999; SAE AS4059 (D) > 4 µm(C), > 6 µm(C), > 14 µm(C), > 21 µm(C)
- Housing** \_\_\_\_\_  
2 = for stationary use
- Media** \_\_\_\_\_  
0 = mineral and synthetic oils compatible with FPM seals
- Nominal voltage** \_\_\_\_\_  
N060 = 400 V, 50 Hz, 3 Ph/460 V, 60 Hz, 3 Ph (-15%/+10%)
- Integrated sensor** \_\_\_\_\_  
AS = Aqua Sensor - AS 1000 series
- Power supply adapter** \_\_\_\_\_  
0 = standard

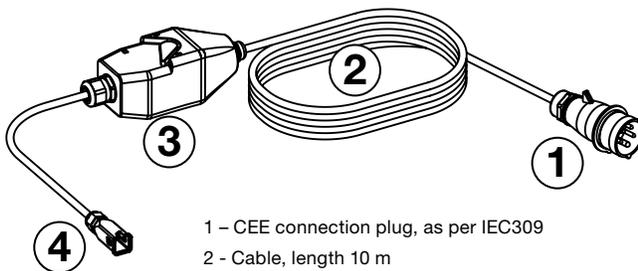
### Items Supplied:

- CSM-C
- Operating and maintenance instructions
- Power supply
- Calibration certificate

## Dimensions



## Power Supply



- 1 - CEE connection plug, as per IEC309  
2 - Cable, length 10 m  
3 - Main switch with device protection and phase sequence check  
4 - Connection plug to the CSM-C (Harting Han4A)

## Accessories for:

SMU Sensor Monitoring Unit	Part No.
SMU 1260-TU-00	346 7005
SMU 1270-TU-00	370 4282
Digital Interface	Part No.
ZBE30-02 Extension cable, length 2 m	6040851
ZBE30-03 Extension cable, length 3 m	6053924
ZBE30-05 Extension cable, length 5 m	6040852
ZBE30S-10 Extension cable, length 10 m	3729098
Software	Part No.
FluMoS Professional (Fluid Monitoring Software)	3141522
FluMoT (Fluid Monitoring Toolkit)	3355177
Analog Interface	Part No.
ZBE48S-02 Connection cable, length 2 m	6072261
ZBE48S-05 Connection cable, length 5 m	6070712
ZBE48S-10 Connection cable, length 10 m	6072262
Hydraulic	Part No.
INLET pressure hose with threaded connection for measurement coupling type 1620, length 2m	635820
INLET threaded coupling	629477
OUTLET/LEAKAGE return hose, open end, length 2m	92649
OUTLET/LEAKAGE threaded coupling	633244

Dimensions are millimeters and for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## FCU 1000 Series

Fluid Control Units - Portable Models



### Description

The Fluid Control Unit FCU 1000 series combines the advantages of the portable contamination measurement units FCU 2000 series with the measurement technology of the Contamination Sensor CS 1000. The FCU 1000 is a portable service unit and is designed for temporary measurement of solid particle contamination in hydraulic systems. The integrated pump and the hoses which are contained in the scope of delivery of the FCU 1000 series.

- control circuits
- pressure circuits
- fluid sampling from pressureless reservoirs

### Important Instructions / Restrictions

- Designed for hydraulic oils (*viscosity range 10 to 350 cSt*)
- Designed for temporary operation up to max. 30 minutes, followed by a rest period of 10 minutes (*no continuous operation*)
- Operating pressure: -0.5 to 45 bar, with pressure adaptor: 15 to 345 bar
- Not designed as a Bottle Sampler (*minimal volume of 300 ml is required for a bottle sample analysis*)
- Measurement recording with HMG 3010 is not possible (*the HMG 3010 cannot process the data from both FCU 1000 sensors simultaneously*)

### Applications

- Hydraulic systems
- Service for mobile hydraulics
- Maintenance

### Features

- Two contamination calibrations in one instrument (reversible)
  - ISO 4406:1987; NAS 1638
  - ISO 4406:1999; SAE AS 4059 (D)
- Saturation and temperature measurement through the built-in AquaSensor 1000
- Integrated pump for measurement in pressureless reservoirs
- Operation with 24 VDC network adaptor included in scope of delivery
- Interfaces: 5-pole plug, Bluetooth, USB data port

### Technical Specifications

General Data	
Self-diagnosis	continuously with error indication via status LED and display
Display	LED, 6 / 4 / 4 digits, in 17 segment format
Measured Value	ISO code/ SAE Class / NAS Class / Saturation level / Temperature
Measuring Range	Display from ISO code 9/8/7 (MIN) to ISO code 25/24/23 (MAX) Calibrated within the range ISO 13/11/10 to 23/21/18 Saturation level 0 to 100% / Temperature -13° to 212°F (-25 to 100°C)
Accuracy	+/-1/2 ISO class in the calibrated range / ≤ ± 2 % Full scale max.
Seal Material	FPM
Ambient Temperature Range	32 to 113°F (0 to 45°C)
Storage Temperature Range	-40 to 176°F (-40 to 80°C)
IP class	IP 50 in operation IP67 closed
Weight	approx. 29 lbs (13 kg)
Hydraulic Data	
Operating Pressure	<b>in:</b> -0.5 to 45 bar / -7.25 to 650 psi <b>with Adaptor for Pressure Lines</b> <b>out:</b> 0 to 0.5 bar / 0 to 7.5 psi <b>in:</b> 15 to 345 bar / 217 to 5000 psi <b>out:</b> 0 to 0.5 bar / 0 to 7.5 psi
Pressure max.	345 bar / 5000 psi
Measurement Flow Rate	30 to 300 ml/min ( <i>viscosity dependant</i> )
Maximal Suction Height	1 m
Permissible Viscosity Range with Adaptor for pressure lines	10 to 350 cSt (46 to 1622 SUS)
Fluid Temperature Range	32 to 158°F (0 to 70°C)
Electrical Data	
Power Supply Voltage	24 V DC ±20%, residual ripple < 10%
Max. Power / Current Consumption	100 Watt / 4 A
Interface	Plug connection, 5-pole, male, M12x1 ( <i>only for HYDAC Sensor Interface -HSI</i> )

We do not guarantee the accuracy or completeness of this information. The information is based on average working conditions. For exceptional operating conditions please contact our technical department. All details are subject to technical changes.

## Model Code

**FCU 1 3 1 0 - 4 - U - AS - 1**

<b>Series</b>	FCU = Fluid Control Unit								
<b>Model</b>	1 = 1000 Series, 4 particle size channels								
<b>Contamination Code</b>	2 = ISO 4406 : 1999, SAE AS 4059 (D) > 4 µm(c), >6 µm(c) and >14 µm(c)								
	3 = ISO 4406:1987; NAS 1638 / 2-5 µm, 5-15 µm, 15-25 µm, > 25 µm								
	ISO 4406:1999; SAE AS 4059 (D) / > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c)							reversible between	
<b>Housing</b>	1 = for portable use (plastic case with appending bag for hoses and cables)								
<b>Fluids</b>	0 = Mineral Oil, Synthetic Esters/PAO, Quintolubric, Cosmolubric (Consult factory for other fluid types.)								
<b>Options</b>	4 = with Integrated Pump								
<b>Supply Voltage</b>	U = 24 V DC								
<b>Integrated Sensor</b>	Z = Without AS (only available with FCU1210 option)								
	AS = AquaSensor (AS 1000 series)								
<b>Power Supply Adapter</b>	1 = 100 to 240 V AC / 50/60 Hz / 1 Phase, (Europe, USA/Canada, UK, Australia, Japan)								

*Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

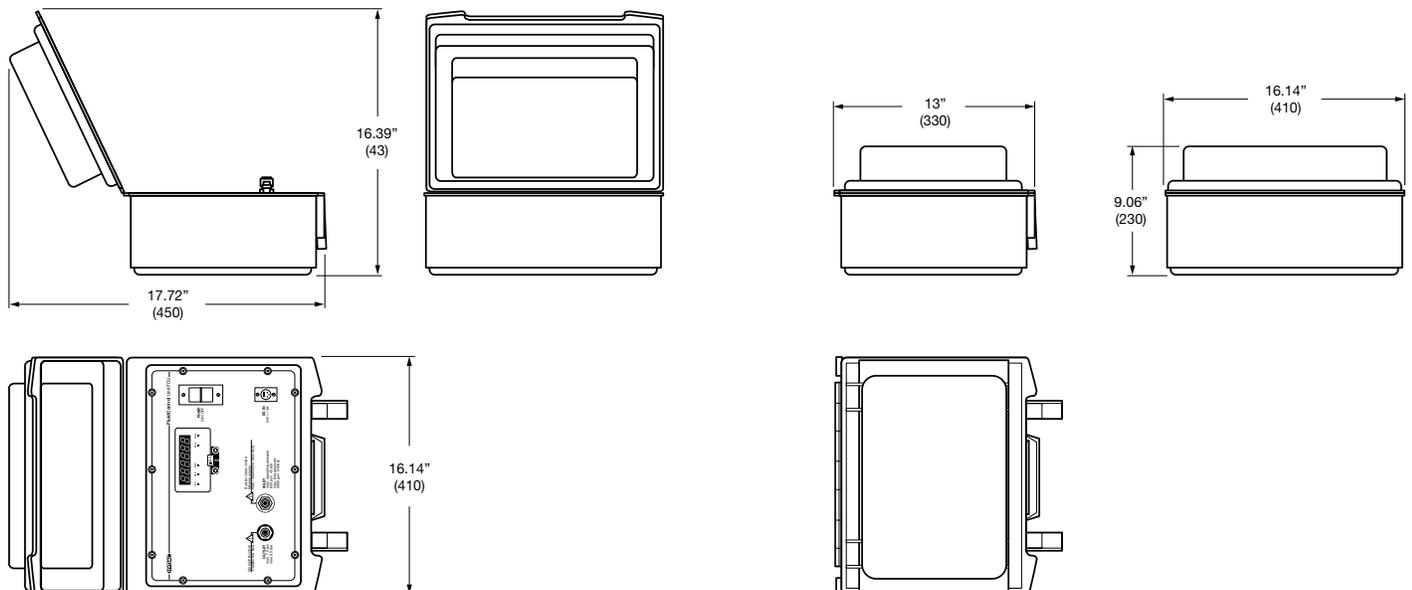
## Scope of Delivery

- Fluid Control Unit FCU 1000
- Power supply AC adaptor with connecting cables to supply voltage for Europe, USA/Canada, UK, Australia, Japan
- Adaptor for pressure lines
- INLET pressure hose with screw connection for Test Point 1620, black, length = 2 m
- INLET suction hose, open end, clear, length = 0.3 m
- OUTLET return hose, open end, clear, length = 1 m
- Operating and Maintenance Instructions / Calibration certificate
- USB Memory Stick
- CD with FluMoS Light Software and manuals

## Accessories

- Battery pack - P/N 03504605
- Cable with universal plug (for cigarette lighter or socket from supply system on board), L = 10 m - P/N 03306236
- Field Verification Start-up Kit - P/N 3443253
- Field Verification Refill Kit - P/N 3443249

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## FCU 2000 Series

Fluid Control Units



FCU 2000-1



FCU 2000-4

### Description

The FCU 2000 Series Fluid Control Unit is the second generation of diagnostic equipment for measuring and controlling contamination in hydraulic and lubrication systems. These Units are portable, which makes them ideal for use on multiple machines in a plant, or in-the-field use. The rugged construction incorporates a folding handle which also serves as a prop stand for optimal viewing.

### Online Measurement

A key advantage of the FCU is that it allows the user to measure changes in contamination instantaneously as they occur. The unit continuously detects solid particles and displays the results in cleanliness classes according to ISO 4406 (1992 or 1999), SAE AS 4059 or NAS 1638 standards.

### Tank Extraction

The FCU 2000-4 model is equipped with a specific suction inlet and an integrated pump for reservoir, in addition to the standard online measurement capability.

### Comprehensive Reporting

Measurements are automatically stored in memory and can be used to print tabular and graphic reports in a wide variety of formats. Although extensive functions for data recording and documentation are available, clear built-in menus make it easy for a user to develop highly informative reports with minimal training.

### PC Capability

For many applications, the built-in printer will produce the necessary reports. In addition, data can be transmitted to a PC via an RS232C interface, providing the user with flexibility in analysis with the supplied FluMoS light software package, or with standard packages like MS-EXCEL.

### Contamination Control

By means of control software, the user can program the FCU to activate an auxiliary filtration unit through built-in relays when contamination reaches a specified maximum level. This makes it possible to control system cleanliness reliably and automatically.

The FCU also can be programmed to de-activate an off-line unit when contamination reaches a preset target level, an especially useful feature in flushing operations.

### Applications

The versatility and simplicity of the FCU 2000 Series is advantageous in various applications:

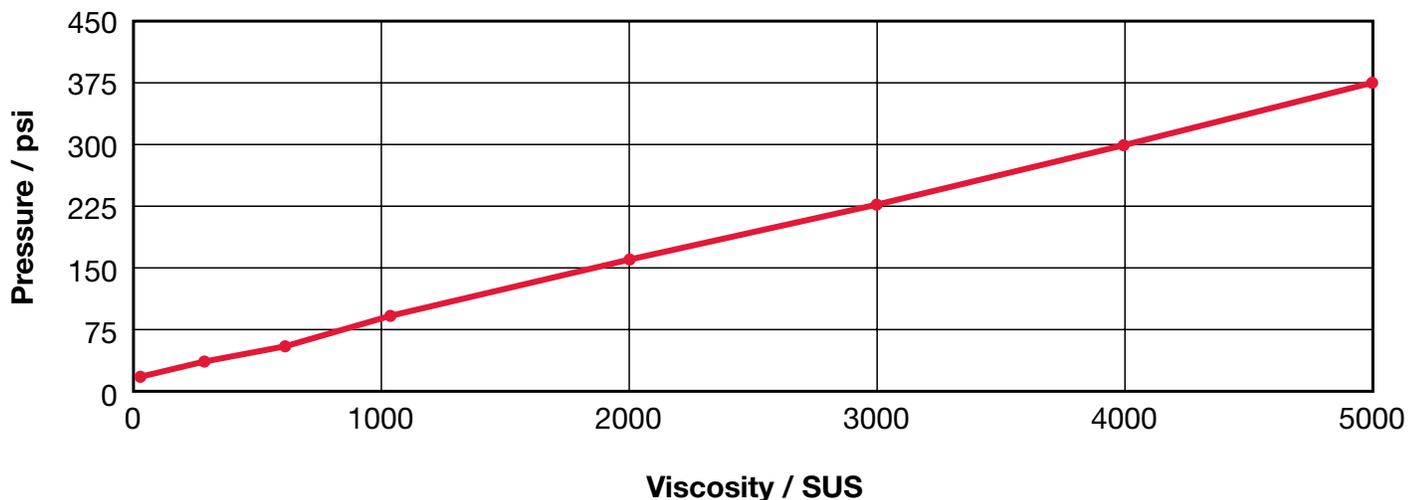
- Preventive Maintenance
- Field Service
- System Production and Testing
- Fluid Cleanliness Documentation
- Flushing Process Control

## Technical Specifications

	FCU 2100	FCU 2200
Particle size channels	2µm / 5µm / 15µm / 25µm	4µm <sub>(c)</sub> / 6µm <sub>(c)</sub> / 14µm <sub>(c)</sub> / 21µm <sub>(c)</sub>
Measurement Range	NAS 2 to 12 ISO 13/11/10 to 23/21/18	SAE 2 to 12 ISO 13/11/10 to 23/21/18
Indication Range	NAS 2 to 15 ISO 12/10/9 to 25/23/21	SAE 2 to 15 ISO 12/10/9 to 25/23/21
Accuracy	± 1/2 class (ISO, NAS, SAE)	
Calibration	ISO 4402	ISO 11943
Recalibration	Recommended every 2 years	
Log Memory	Can accommodate up to 3000 measured values / 100 Test Headers	
Inlet Operating Pressure	45 to 5000 psi	
Outlet Flow Rate	800 ml/min max	
Outlet Operating Pressure	max 45 psi back pressure	
Measurement Flow Rate	50 - 150 ml/min	
Permissible Viscosity Range	1 to 1000 cSt ( <i>inlet port, see graph below</i> ) / 1 to 150 cSt ( <i>suction port, continuous operation</i> ) / 150 to 350 cSt ( <i>suction port, brief operation, 10 min.</i> )	
Fluid Temperature Range	32° to 160°F	
Supply Voltage	24 V DC, ± 25% or 110 V AC with supplied adapter	
Wattage	25 W max	100 W max
Battery Powered Operating Duration	Measurement without pump or pump supplied externally: up to 6 hours	
Serial Port	RS 232 with 15-pin Sub D plug	
Ambient Temperature Range	0° to 130° F	
Storage Temperature Range	-4° to 185° F	
Relative Humidity	max 90%, non-condensing	
Protection Type	IP40	
Weight	approx. 30 lbs (13.6 kg)	

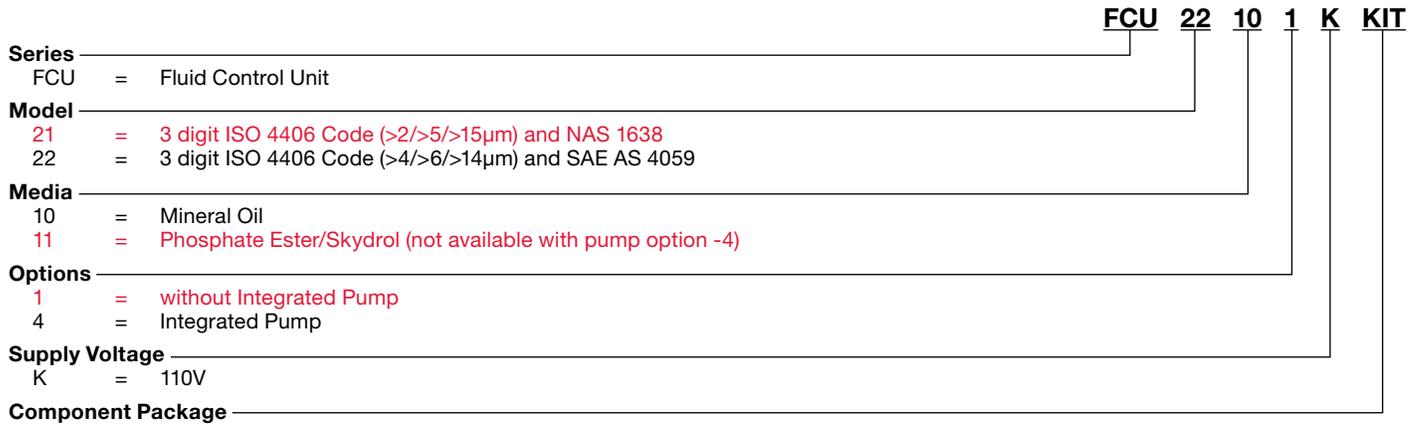
The minimum inlet pressure required to achieve a flow rate of 100 ml/min for a given viscosity can be found by referring to the graphic below. The required inlet pressure increases with increasing clogging of the filter element.

**Pressure Required at the FCU High-Pressured Port  
(inlet) for a Flow Rate of 100 ml/min  
(Flow regulator opened, new filter element)**



# CONTAMINATION MONITORS

## Model Code



- Minimess Adapter to SAE-6
- One Inlet and One Outlet Hose
- FluMoS Light Software Package (CD supplied with Unit – Also available for download from [www.hydac.com](http://www.hydac.com))
- PC Cable
- Power Adapter
- Instruction Manuals
- Shipping Case

- Additionally for FCU 2xxx-4:
- Second power adapter
  - Suction hose 6mm bore (1m length)
  - Suction hose 6mm bore (0.2m length)

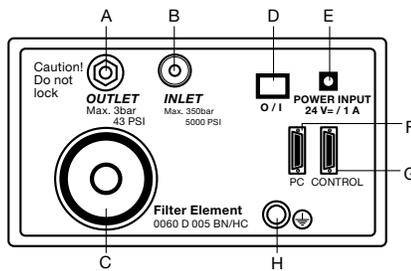
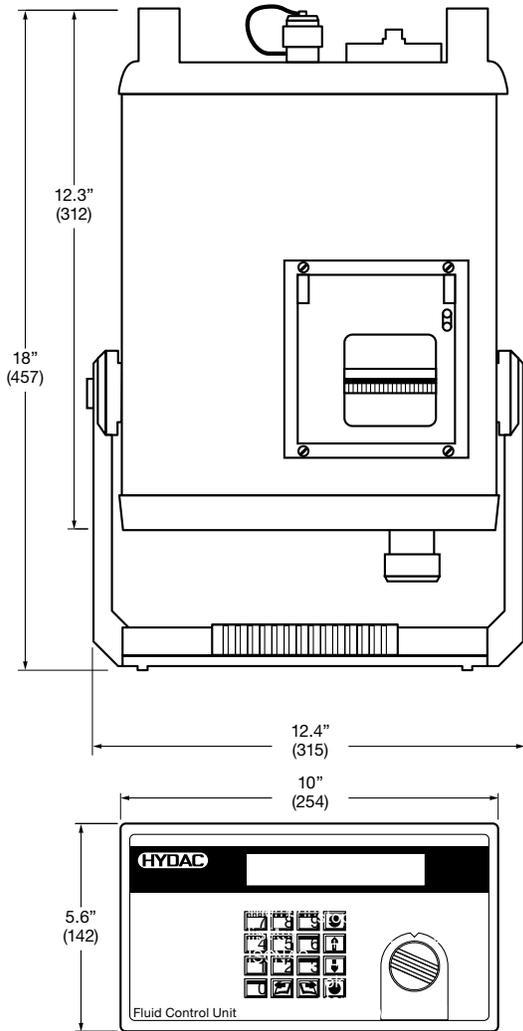
*Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## FCU Accessories

FCU Accessories	Part Number
Aluminum Transport Case for FCU-1 Series	00349153
Aluminum Transport Case for FCU-4 Series	03040814
Printer Paper (5 rolls)	00349155
Printer Ink Ribbon	00349156
Line Adapter 110V	03090803
High Pressure Hose (2 meters / 6.5 feet)	00349150
Return Hose (2 meters / 6.5 feet)	00349151

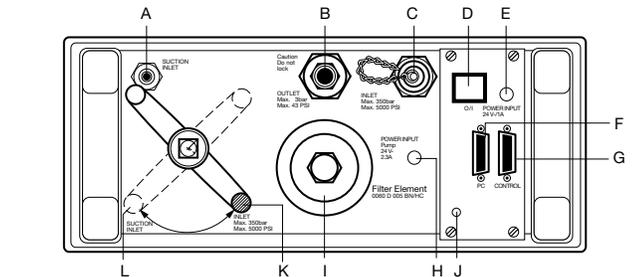
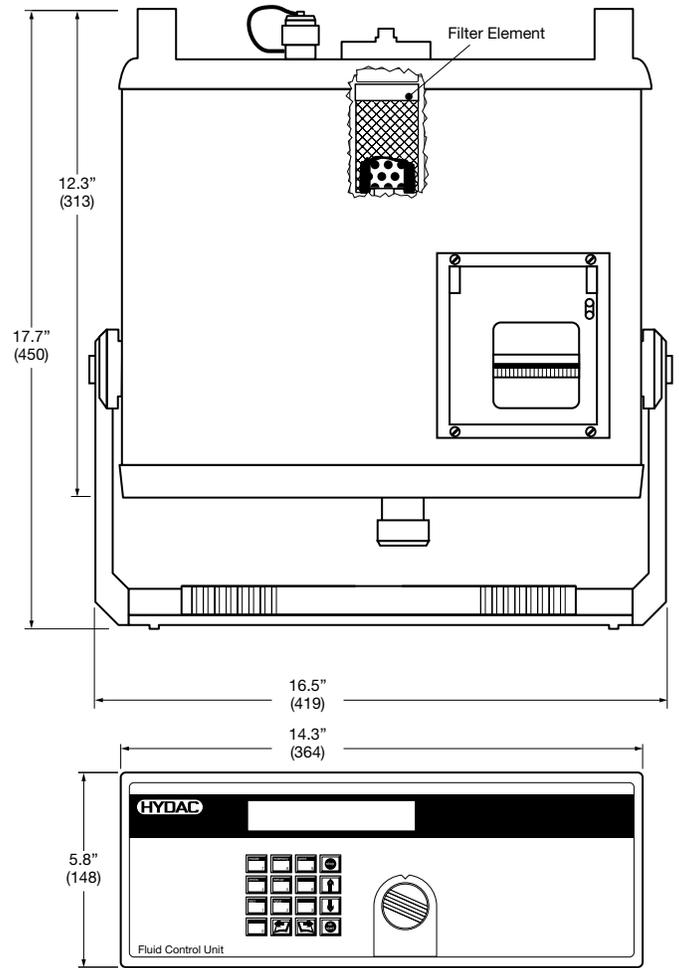
TestPoints available in HYDAC Hydraulic Accessories catalog PN#02080105

## Dimensions FCU 2000-1



- A** = Outlet (return flow to tank)
- B** = Inlet (high pressure port)
- C** = Filter Cover
- D** = On/Off Switch
- E** = Power Supply Connection (main)
- F** = PC Connector (serial port)
- G** = Control Connector
- H** = Case Ground

## FCU 2000-4



- A** = Suction Inlet (suction port)
- B** = Outlet (return flow to tank)
- C** = Inlet (high pressure port)
- D** = On/Off Switch
- E** = Power Supply Connection (main)
- F** = PC Connector (serial port)
- G** = Control Connector
- H** = Power Supply Connection (pump)
- I** = Filter Cover
- J** = Case Ground
- K** = Ball Valve (for INLET/high pressure port)
- L** = Ball Valve (for SUCTION INLET/suction port)

Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## MCS Series

### Metallic Contamination Sensor



### Description

The Metallic Contamination Sensor MCS 1000 detects metallic solid particle contamination in lubrication fluid. The particles are determined according to the inductive measurement process, in which a coil system is the key element of the sensor. Metallic particles (ferromagnetic Fe and nonferromagnetic nFe) in the > 200 µm size range are detected.

The MCS 1000 continuously monitors the status of the system and gives information on imminent gear unit damage. This makes the sensor a reliable instrument for status-oriented maintenance.

### Features

- Early detection of imminent gear unit damage
- Prevention of expensive plant downtime
- Optimal supplement to optical sensors
- Measurement of metallic particles (ferromagnetic and non-ferromagnetic) > 70 µm
- Measurement result is not affected by air bubbles or liquid contamination in the liquid

### Applications

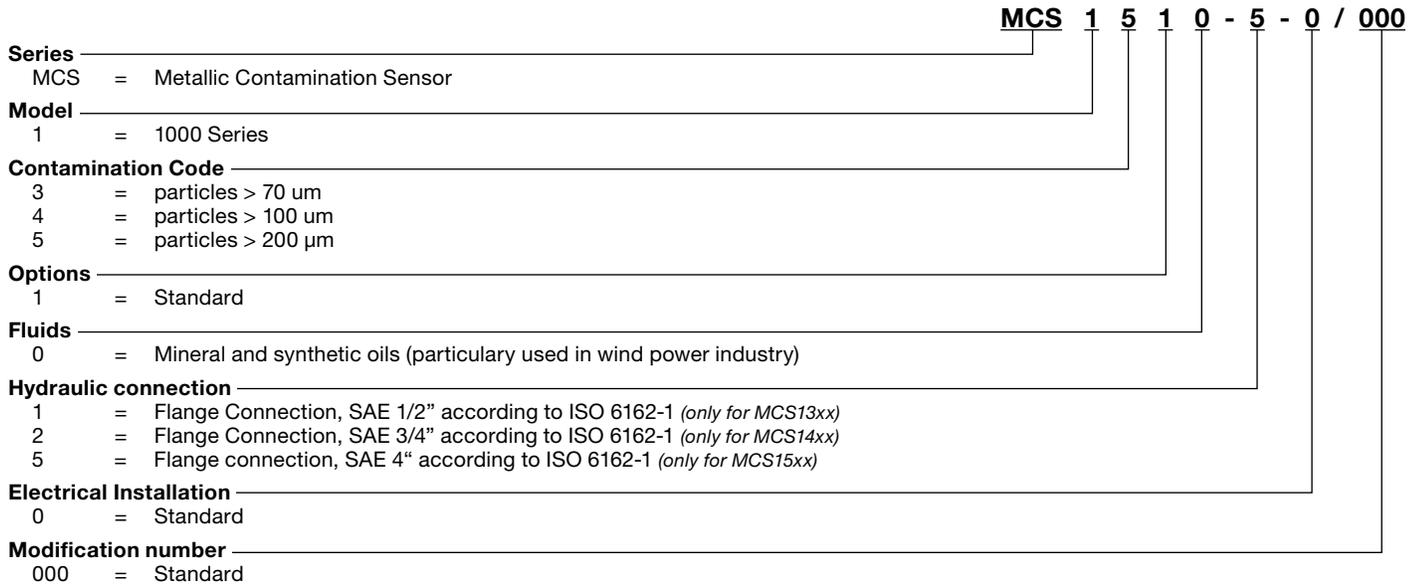
- Wind Turbines
- Marine Thrusters
- Industrial Gear Boxes
- Mobile Drive Systems
- Lubrication Systems
- Flushing Systems
- Test Stands

### Technical Specifications

General Data		
Ambient temperature	-40 ... +70°C	
Diameter sensor cross-section	MCS1310 = 1/4" (6.35mm) MCS1410 = 1/2" (12.7mm) MCS1510 = 1" (25.4 mm)	
Protection class to DIN 40050	IP 67	
Weight	approx. 8 lbs (3.5 kg)	
Dimensions (L x W x H)	83 x 162 x 140 mm	
Vibration	10 - 58 Hz 58 - 500 Hz	0.75 mm (amplitude) 10 g (acceleration)
Shock	40 g	
Hydraulic Data		
Flow rate	10 ... 200 l/min	
Operating pressure	20 bar max.	
Fluid temperature range	-40 ... +85°C	
Inlet / Outlet	Flange connection, SAE 4" according to ISO 6162-1	
External Electrical Data		
Supply voltage	9 ... 36 V DC, residual ripple < 10%	
Power consumption	5 W max.	
Internal Electrical Data		
2 Configurable switching outputs ( <i>n-switching Power MOSFET, normally-open</i> )	1 x Ferromagnetic particles (Fe) 1 x Non-ferromagnetic particles (nFe) or 1 x Ferromagnetic particles (Fe) + Non-ferromagnetic (nFe) 1 x Status signal	
Alarm relays capacity	1.5 A max.	
RS485 interface	2 wire, half duplex	
HSI interface	1 wire, half duplex	
Detection limits		
Ferromagnetic (Fe) particles	MCS1510 = > 200 µm MCS1410 = > 100 µm MCS1310 = > 70 µm (particle with volume equivalent to that of a sphere with given Ø)	
Non-Ferromagnetic (nFe) particles	MCS1510 = > 550 µm MCS1410 = > 300 µm MCS1310 = > 200 µm (particle with volume equivalent to that of a sphere with given Ø)	

We do not guarantee the accuracy or completeness of this information. The information is based on average working conditions. For exceptional operating conditions please contact our technical department. All details are subject to technical changes.

## Model Code



## Scope of Delivery

- MCS 1000
- O-ring (47.22x3.53 NBR 70 Shore)
- O-ring (110.72x3.53 NBR 70 Shore)
- Operating and maintenance instructions

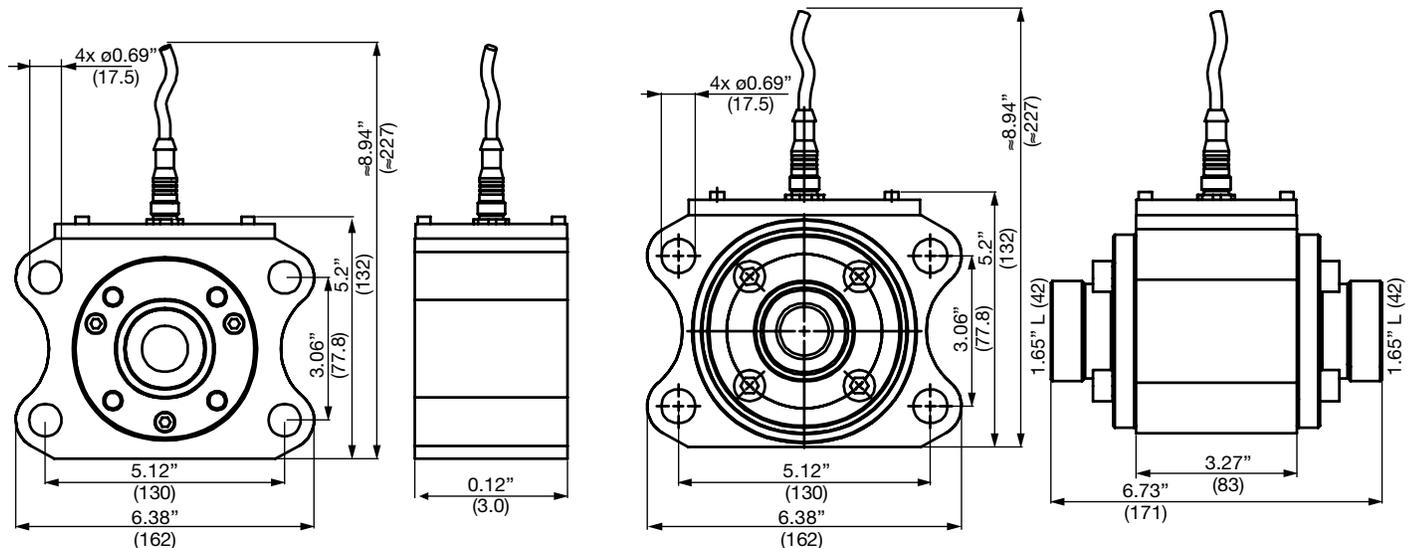
## Accessories

- SAE 4" Flange adaptor set for pipe or hose connection, 42L according ISO 8431-1 Consisting of: 2x Flange adaptors, 2x O-rings, 8x Cylinder screws, 8x Washers, 8x Spring washers, P/N: 3435426
- Flange adaptor plate, SAE 4" – SAE 1½", P/N: 3442518
- Socket plug (female) with 2 m line, shielded, 8-pole, M12x1, P/N: 3281220
- Socket plug (female) with 5 m line, shielded, 8-pole, M12x1, P/N: 02702459
- Extension cable 5 m, Socket plug (female) 8-pole, M12x1 / Socket plug (male) 8-pole M12x1, P/N: 3281240
- Socket plug with screw clamp, 8-pole, M12x1, P/N: 3281243

## Dimensions

Flange connection, SAE 4" according to ISO 6162-1

MCS with accessory flange adaptor set (optional)



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## AS 1000 Series

### Aqua Sensor



### Description

The Aqua Sensor AS 1000 is a fluid sensor for detecting water in oil, especially designed as OEM sensor for fluid condition monitoring.

The sensor measures the water content relative to the saturation concentration (saturation point) and outputs the degree of saturation (saturation level) in the range of 0 to 100% as a 4 - 20 mA signal. A reading of 0% would indicate fluid that is free of water, while a reading of 100% would indicate a fluid that is saturated with water.

The AS 1000 can be used to simultaneously determine the temperature of the oil and output it as a 4 to 20 mA signal as well.

In so doing, the AS 1000 enables hydraulic and lubrication fluids to be monitored accurately, continuously and on-line.

### Water in Oil

It is almost certain that there is water present in hydraulic and lubrication systems. These systems should be operated without the presence of free or emulsified water. The most common sources of water entering a system are ambient humidity, "splash" from process water, and new oil. Water contamination will accelerate the aging process of the oil resulting in oil oxidization, additive depletion, reduced lubrication, corrosion and damaged components. Most of these costly problems can be avoided by monitoring the water content of the operating fluids.

Sometimes the water content is difficult to determine, but with the HYDAC Aqua Sensor, determining the amount of water is easy! The most practical method for monitoring water content in oil is as a percent of the saturation level. Different oils are capable of dissolving varying amounts of water, therefore they have varying water saturation curves. The curve (below) is an example of the typical relationship of water saturation level versus fluid temperature in hydraulic and lubrication oils. By looking at the example graph it can be seen that this fluid is capable of holding more water, or has a higher saturation level, as the temperature increases.

### Applications

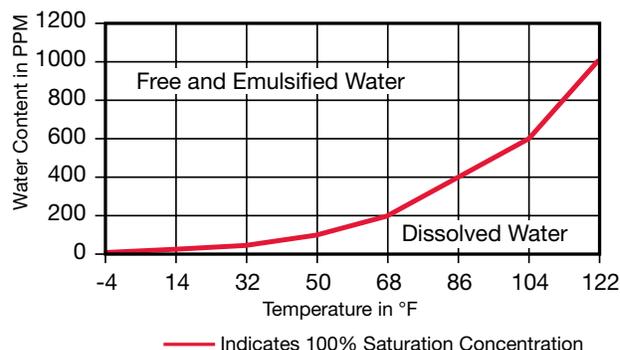
- Hydraulic systems that are sensitive to water
- Gear boxes
- Molding machines
- Turbines
- Transferrers

### Technical Specifications

Input Data	
Measuring range ( <i>temperature</i> )	-13° to 212°F (-25° to 100°C)
Measuring range ( <i>saturation level</i> )	0 to 100%
Operating pressure	max. 725 psi (50 bar)
Burst pressure	> 9000 psi (630 bar)
Parts in contact with fluid	Stainless steel, FPM seal, ceramic with evaporated metal
Output Data - Humidity Measurement	
Output level ( <i>saturation level</i> )	4 to 20 mA
Calibrated accuracy	≤ ± 2% FS max.
Accuracy in media measurements	≤ ± 3% FS typ.
Pressure dependent	+ 0.02% FS / bar
Output Data - Temperature Measurement	
Output signal ( <i>temperature</i> )	4 to 20 mA
Accuracy	≤ ± 2% FS max.
Nominal temperature range ( <i>measuring saturation level</i> )	32° to 194°F (0° to 90°C)
Ambient temperature range	-40° to 212°F (-40° to 100°C)
Viscosity range	32 to 23175 SUS (1 to 5000 cSt)
Flow velocity	< 16 ft/sec
Permissible fluids	Fluids based on mineral oil and synthetic and natural esters
CE mark	EN 50081-1, EN 50081-2, EN 50082-1, EN 61000-6-2
Type of Protection acc. DIN 40050	IP67
Other Data	
Supply voltage	12 to 32 V DC
Residual ripple	≤ 5%
Thread connection	G 3/8 BSPP male thread
Torque rating	approx. 18 ft/lbs
Electrical connection Pin 1: +Ub Pin 2: Signal saturation level Pin 3: 0V / GND Pin 4: Signal temperature Pin 5: not connected	M12x1.5 pole (DIN VDE 0627)
Reverse polarity protection of the supply voltage, excess voltage, override and short circuit protection	Standard
Weight	approx. 5 oz (145 g)

Note: FS (Full Scale) = relative to the full measuring range

Example of a Hydraulic Oil Saturation Curve



## Model Code

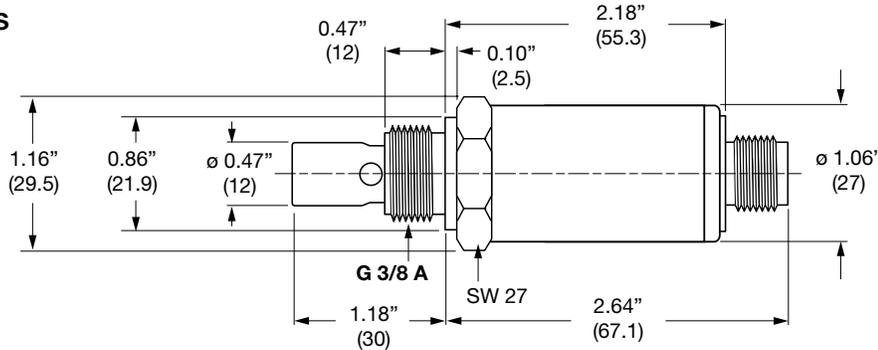
**AS 1 0 0 8 - C - 000**

- Series** AS = Aqua Sensor
- Measuring Range** 1 = Saturation level 0 to 100%; Temperature -13° to 212°F (-25° to 100°C)
- Fluids** 0 = Mineral oils  
1 = Phosphate esters (HFD-R)
- Mechanical Connection** 0 = G 3/8A DIN 3852
- Electrical Connection** 8 = Plug M12x1, 5-pole (connector not included)
- Signal Technology** C = Saturation level 4 to 20 mA (0 to 100%), Temperature 4 to 20 mA (-25° to 100°C)
- Modification Number** 000 = Standard

### Items supplied

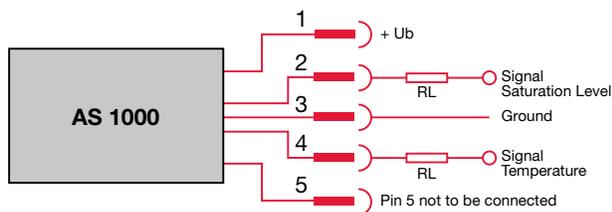
- Aqua Sensor
- Operation Manual

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

## Circuit Connection

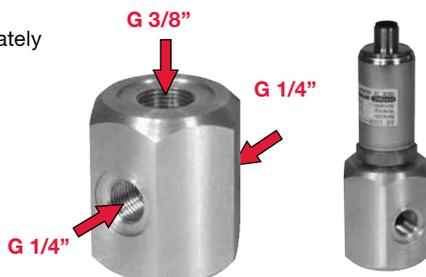


### Color Codes for connectors with cables:

- 1 = brown
- 2 = white
- 3 = blue
- 4 = black
- 5 = gray

## AS 1000 G1/4 Housing Block Adapter

Part #03182134  
Purchase separately



## Accessories

**ZBE 08 Connector**  
5 Pole M12x1 90°

**ZBE 08 connector only (IP65)**  
Part #06006786

**ZBE 08-02-4 with 2 meter cable (IP67)**  
Part #06006792

**ZBE 08-05-4 with 5 meter cable (IP67)**  
Part #06006791

**HDA 5500-0-0-AC-000 Display**  
Part #00908861

**HDA 5500-0-0-DC-000 Display**  
Part #00908862

**HDA 5500-1-0-DC-000 Display**  
Part #00908868

**HDA 5500-1-1-AC-000 Display**  
Part #00908869

**HDA 5500-1-1-DC-000 Display**  
Part #00908870



# CONTAMINATION MONITORS

## AS 3000 Series

### Aqua Sensor



### Description

The Aqua Sensor AS 3000 is the further development of the proven AS 1000 series for the online detection of water in oils, particularly as a sensor for condition monitoring.

It records the water saturation and the temperature of the operating fluid. The display allows you to view the current measured values or to adjust the parameter settings.

The measured values are output as a 4 to 20 mA signal and are the basis for two parameterizable switching outputs. The AS 3000 thus enables hydraulic and lubricating oils to be monitored accurately, continuously and online.

### Applications

- Mobile hydraulics
- Hydraulics and lubrication systems in industry

### Advantages

- 4 digit digital display, can be aligned in two axes
- User-friendly due to key programming
- Individual configuration
- Reliable on account of its compact, rugged design
- Economical sensor
- No calibration necessary for different oil types
- Pressure-resistant, even with pulsations
- Early detection of water problems thus preventing faults and unnecessary interruption to operations

### Technical Specifications

Input Data	
Measuring range ( <i>temperature</i> )	-13° to 212°F (-25° to 100°C)
Measuring range ( <i>saturation level</i> )	0 to 100%
Operating pressure	-7.25 to 725 psi (-0.5 to 50 bar)
Burst pressure	9136 psi (≤ 630 bar)
Flow velocity	max. 5 m/s
Parts in contact with fluid	Connection part: Stainless steel / ceramic with evaporated metal Seal: FKM or EPDM
Output Data - Humidity Measurement	
Output level ( <i>saturation level</i> )	4 to 20 mA
Calibrated accuracy	≤ ± 2% FS max.
Accuracy in media measurements	≤ ± 3% FS typ.
Pressure dependent	+ 0.02% FS / bar
Output Data - Switching Outputs	
Version ( <i>parameterizable</i> )	PNP transistor outputs Closer or opener Default settings: opener
Allocation ( <i>parameterizable</i> )	Saturation level or temperature Default: saturation level Alarm 80% (SP 2), warning 60% (SP 1), Activation temp: 86° F / 30° C
Switch current	max. 1.2 A per output
Switch cycles	> 100 million
Output Data - Ambient Conditions	
Nominal temperature range ( <i>measuring saturation level</i> )	32° to 176°F (0° to 80°C)
Storage temperature range	-40° to 80°F (-40° to 176°C)
Fluid temperature range	-40° to 80°F (-40° to 176°C)
Viscosity range	32 to 23175 SUS (1 to 5000 cSt)
Permissible fluids	Fluids based on mineral oil and synthetic and natural esters
CE mark	EN 61000-6-1/2/3/4
Type of Protection acc. DIN 40050	IP67
Other Data	
Supply voltage	18 to 35 V DC
Residual ripple	≤ 5%
Thread connection	G 3/8 BSPP male thread
Torque rating	approx. 18 ft/lbs
Electrical connection	M12x1.5 pole (DIN VDE 0627)
Display	4-digit, LED, 7 segment, red, height of digits 7 mm
Weight	approx. 3.88 oz (110 g)

Note: FS (Full Scale) = relative to the full measuring range

## Model Code

AS 3 0 0 8 - 5 - 000

### Series

AS = Aqua Sensor

### Measuring Range

3 = 3000 Series

### Fluids

0 = Mineral oils

1 = Phosphate esters (HFD-R)

### Mechanical Connection

0 = G 3/8A DIN 3852

### Electrical Connection

8 = Plug M12x1, 5-pole (connector not included)

### Signal Technology

5 = 2 switch outputs / 1 analog output

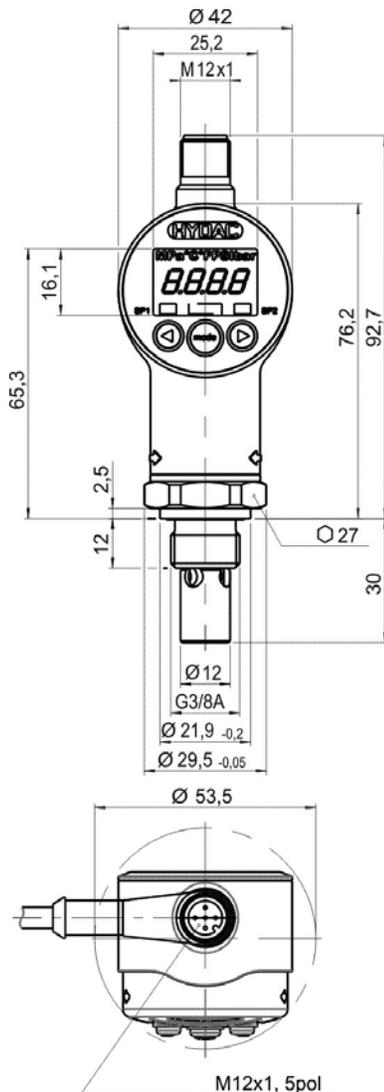
### Modification Number

000 = Standard

### Items supplied

- Aqua Sensor
- Operation Manual

## Dimensions



## Accessories

### ZBE 08 Connector

Female connector, bent, shielded, 5 Pole, M12x1  
Part #6006786

### ZBE 08S-02

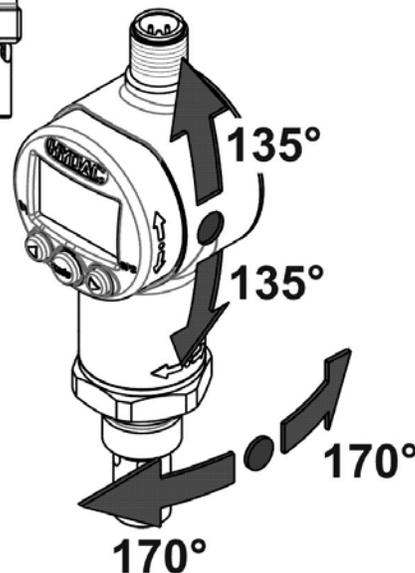
Female connector, bent, with 2m lead, shielded,  
5 pole, M12x1  
Part #6019455

### ZBE 08S-05

Female connector, bent, with 5m lead, shielded,  
5 pole, M12x1  
Part #6019456

### ZBE 47S-05

Female connector, straight, with 5m lead, shielded,  
5 pole, M12x1  
Part #3484562



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## SMU 1200 Series

### Sensor Monitoring Unit



### Description

The Sensor Monitoring Unit SMU1200 is a display unit for HYDAC fluid sensors and is designed to display and store measured data. The following combinations of fluid sensors can be connected directly:

- Contamination Sensor CS1000 & Aqua Sensor AS1000
- Metallic Contamination Sensor MCS1000 & Aqua Sensor AS1000

### Advantages

- Simple installation parallel to the customer system (*HYDAC Sensor Interface HSI for SMU1200, transfer of the sensor's own analog and switching outputs*).
- Simple installation using the magnetic holder or DIN rails.
- High protection rating IP67. Installation in a switch cabinet is not necessary.
- Plug & Work unit including the 5m connection cable required for direct connection of the sensors (*sensor connections via M12x1 male connectors, no programming necessary*).
- The measured data is displayed on the large display.
- Simple keypad operation.
- Data is stored in the SMU with a date and time stamp.
- Measured values can be read from the standard USB memory stick supplied via the USB master port.
- Simple data processing and data evaluation using MS-Excel or HYDAC FluidMonitoring Software FluMoS (*'light version' available as freeware at [www.hydac.com](http://www.hydac.com)*).
- Program restarts independently once voltage is restored; no loss of measured data.

### Technical Specifications

Mounting position	Optional
Self-diagnostics	Continuously with error indication on display
Display	LED, 6/4/4-digit, each with 17 segments
Rough handling (to IEC/EN 60068-2-31)	Drop height 50 mm
Ambient temperature	0 °C to +55 °C
Storage temperature range	-40 °C to 80 °C
Relative humidity	Maximum 95%, non-condensing
Weight	≈ 1 kg
<b>Electrical Data</b>	
Supply voltage	12 to 24 V DC (±10%) The SMU must not be used with vehicle supply systems without load dump protection of maximum 30 V DC.
Residual ripple	≤ 5%
Power consumption	15 Watt, 1.25 A max.
Accuracy of the real-time clock	± 5 s/day / ± 0.5 h/year
Clock buffer	≈ 20 years
Protection rating	III (safety extra-low voltage)
Protection class	IP 67

## Model Code

SMU 1 2 6 0 - TU - 00 / 000

<b>Type</b>	SMU = Sensor Monitoring Unit														
<b>Series</b>	1 = 1000 Series														
<b>Data input</b>	2 = Digital														
<b>Interface</b>	6 = HSI + USB Master														
<b>Application</b>	0 = Standard														
<b>Supply voltage</b>	TU = 12 to 24 V DC														
<b>Sensor combination</b>	<table border="0"> <tr> <td></td> <td>A</td> <td>B</td> </tr> <tr> <td>00</td> <td>= CS1000</td> <td>AS1000</td> </tr> <tr> <td>10</td> <td>= MCS1000</td> <td>AS1000</td> </tr> </table>							A	B	00	= CS1000	AS1000	10	= MCS1000	AS1000
	A	B													
00	= CS1000	AS1000													
10	= MCS1000	AS1000													
<b>Customer modification number</b>	000 = Customer modification number														

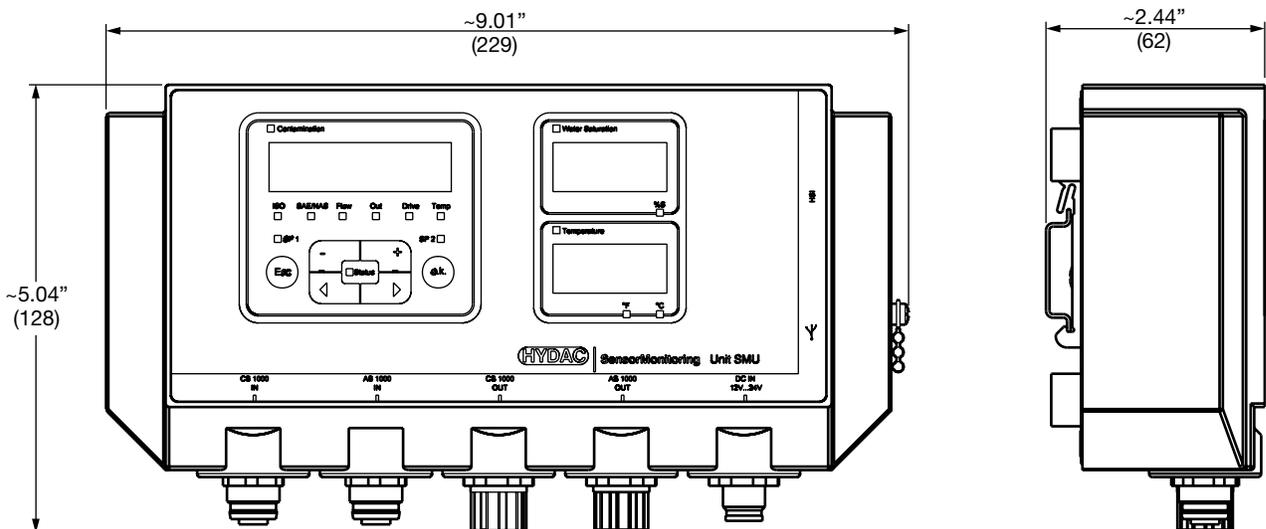
### Items supplied

- 1 SMU 1200 series
- 1 USB memory stick
- 1 connection cable 5 pole with flying leads for power supply, L = 5m
- 2 connection cables appropriate to the sensor combination, L = 5m
- 1 FluMoS light CD
- 1 User manual
- 1 DIN rail, L = 20 cm

## Accessories

Power supply PS5,  
100-240 V AC / 50-60 Hz / 1.1 A -> 24 V DC / 1000 mA,  
Cable length = 1.8 m, PN: 3399939

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## FMS Series

### Fluid Monitoring System



#### Description

The Fluid Monitoring System FMS combines HYDAC's Condition Monitoring Products Contamination Sensor CS1000 and Aqua Sensor AS1000 and the Sensor Monitoring Unit in one system.

The FMS is used as a robust and stationary system for online measurement of solid particle contamination and water content in hydraulic and lubricant fluids (e.g. for the detection of leakages).

The SMU shows the cleanliness class and the fluid temperature as well as the relative humidity. These values are passed on via the signal output for further processing.

The FMS features all of the requisite connectors / adapters, enabling it to be easily connected to existing hydraulic circuits.

Depending on the version, the FMS is suitable for bypass flow and pressure circuits:

FMS-FMM-O... = 6 – 15 bar

FMS-FMM-P... = 15 – 300 bar

#### Advantages

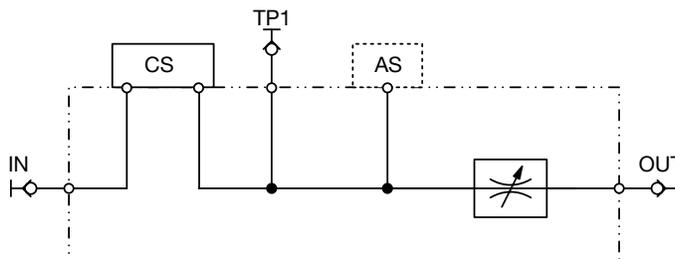
- Cost-effective solution
- Early warning of critical machine states
- Continuous fluid monitoring
- Condition-based maintenance planning

#### Caution!

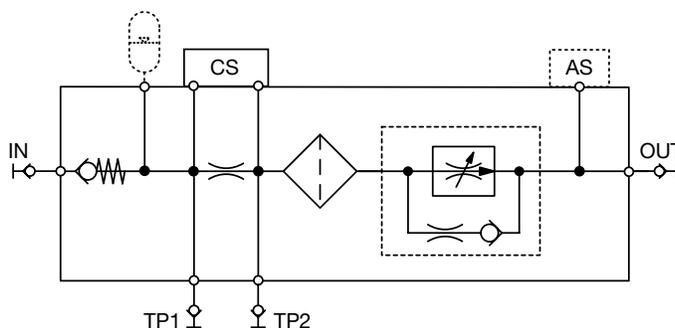
The FMS is only to be used with mineral oils or mineral oil-based raffinates.

#### Hydraulic Schematic

##### FMS-FMM-O



##### FMS-FMM-P



#### Technical Specifications

FMS-FMM-O...	
Operating pressure	6 to 15 bar / 87 to 217 psi
Minimal differential pressure	1 bar, recommended $\geq 3$ bar
Connectors (IN / OUT)	Test point type 1604 or thread G 1/4 according ISO 228
Sealing material	FPM
Permissible viscosity range	1 to 350 mm <sup>2</sup> /s
Fluid temperature range	0° to 85° C / 32° to 185° F
Ambient temperature range	-30° to 80° C / -22° to 176° F
Storage temperature range	-40° to 80° C / -40° to 176° F
Weight	~13 kg
FMS-FMM-P...	
Operating pressure without accumulator	15 to 300 bar / 217 to 4350 psi
Operating pressure with accumulator	15 to 250 bar / 217 to 3625 psi
Differential pressure	> 15 bar
Connectors (IN / OUT)	Test point type 1604 / thread G1/4 according ISO 228
Sealing material	FPM
Permissible viscosity range	1 to 1000 mm <sup>2</sup> /s
Fluid temperature range	0° to 85° C / 32° to 185° F
Ambient temperature range	-30° to 80° C / -22° to 176° F
Storage temperature range	-40° to 80° C / -40° to 176° F
Weight	~20 kg

## Model Code

**FMS - FMM-P - CS - AS - SMU12 - 01 / - 000**

### Type

FMS = Fluid Monitoring System

### Hydraulic application

FMM-O = Offline, bypass flow circulation < 15 bar

FMM-P = Pressure Line, (pressure circuit > 15 bar)

### ContaminationSensor

CS = CS 1000 \*

Z(CS) = Prepared for CS 1000

### AquaSensor

AS = AS 1000

Z(AS) = Prepared for AS 1000

### SensorMonitoring Unit

SMU12 = SMU 1200

### Sensor combination

01 = FMM-O-M-0-CS1310-A-AS-0-0-0-000 SMU1260-TU-00/-000

02 = FMM-P-L-0-CS1310-A-AS-0-1-0-000 SMU1260-TU-00/-000

### Customer modification number

000 = Customer modification number

\*Type defined in sensor combination number

### Items supplied

- 1 FluidMonitoring System FMS
- 1 Power supply connection cable, L = 5m

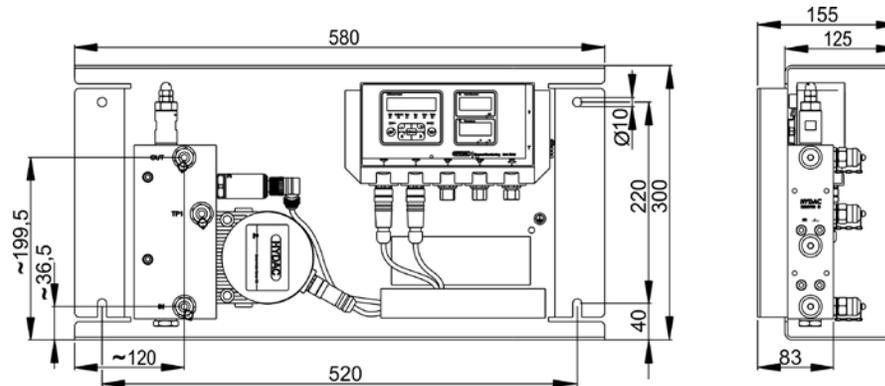
Technical Documentation, consists of:

- 1 Installation and Maintenance Instructions FMS
- 1 Operating and Maintenance Instructions SMU 1200
- 1 Operating and Maintenance Instructions AS 1000
- 1 Calibration certificate of the CS1000

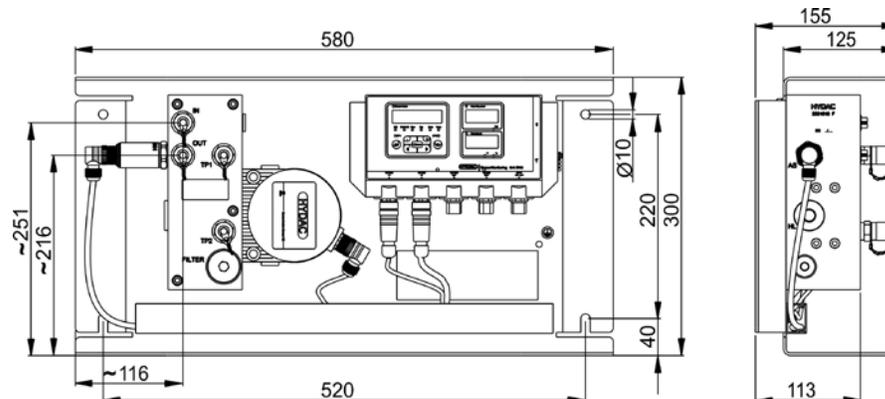
Upon receiving the FMS check it for any damage in transit. Do not put the FMS into operation unless it is in perfect condition. Report any damages in transit to the transport company or the responsible agent immediately. Do not put the unit into operation.

## Dimensions

### FMS-FMM-O



### FMS-FMM-P



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## CTU 1000 Series

Contamination Test Unit



### Description

The HYDAC Cleanliness Test Unit CTU 1000 is designed to determine the technical cleanliness especially present on minor contaminated components.

The CTU 1000 was developed due to increased demand for system cleanliness and for monitoring and optimizing the cleanliness, of smaller components during production, storage and system assembly.

By determining the type, size and quantity of the contamination, quality standards can be checked and documented and the necessary steps towards optimization can be taken.

### Applications

- Automotive suppliers
- Gear box builders
- Engine builders
- Suppliers of hydraulic and lubrication components

### Benefits to You

- Cost reduction through lower production failure rates
- Identification and elimination of weak process steps
- Optimization of both internal and external handling processes
- Establishing of cleanliness standards both internal and external
- Documentation of component cleanliness
- Survey of fluid cleanliness and filtration concepts

### Technical Specifications

Overall dimensions (height x width x length)	CTU10xx = 1800mm x 985mm x 835mm CTU12xx = 1800mm x 910mm x 1140mm
Weight	CTU10xx approx. 595 lbs (270 kg) approx. 640 lbs (290 kg) (with ultrasonic) CTU12xx approx. 685 lbs (310 kg)
Type	Mobile (mounted on castors)
Power Consumption	600 W (800 W with ultrasonic)
Ambient Temperature	59° to 82°F (15° to 28°C)
<b>Cleanroom Module</b>	
Material of cleanroom	polished stainless steel
Filling with analysis fluid	via analysis cabinet
Control	PC controlled with user-friendly software, rinse options and rinsing volume programmable
<b>Reservoir and Filtration Module</b>	
Membrane holder	for Ø 47 to 50 mm filter membranes
Vacuum strainer	for quicker filtration of the analysis fluid
Diffuser	Distribution of analysis fluid on the membrane
Operating pressure	-12 to 87 psi (-0.8 to 6 bar)
Analysis fluid reservoir	2x 20 l (1x reservoir, 1x suction reservoir)
Reservoir change-over	automatic
Filtration of analysis fluid	Fine filtration according ISO 4406 min. ISO 12/9
Filter size, filtration rating	2x LF BN/HC 60, 3 µm (1xx0 series) 2x MRF-1-E/1, 1µm (1xx1 series)
Integrated drip tray	25 liter with drainage
<b>Services to be provided by operator*</b>	
Compressed air	Air Filtered (min. 5µm) and dry compressed air, max. 6 bar Air flow rate: 60 l/min, Supply connection: DN 7.2
Power Supply	according to order

\*not supplied

The information in this catalog relates to the operating conditions and applications described. For applications or operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

## Model Code

CTU 1 0 3 0 - K - Z - Z

### Series

CTU = Contamination Test Unit

### Model

1 = Analysis cabinet (clean room)

### Installation Size

0 = Dimensions analysis cabinet: 300mm x 768mm x 365mm (effective height x width x length)

2 = Dimensions analysis cabinet: 460mm x 768mm x 650mm (effective height x width x length)

### Analysis

3 = Version 2011 with ConTes software, 1µm filtration and automatic pressure control

4 = Version 2014 with interior air extractor for clean box, quick coupling valves, compression door lock, ball valve (2/3 way) in front of membrane holder and for CTU12xx series - swivel arm for monitor

### Analysis Fluid

0 = Solvent A III Class (Flashpoint > 60°C, lower explosion limit > 0.6 Vol.%)

1 = Water with surfactants, admissible pH-range 6 to 10, no deionized / demineralized water

### Supply Voltage

K = 120 V AC / 60Hz / 1 Phase USA / CDN

M = 230 V AC / 50Hz / 1 Phase Europe

N = 240 V AC / 50Hz / 1 Phase UK

### Extraction Process

Z = Rinsing (medium pressure)

U = Rinsing (medium pressure) plus ultrasonic

### Supplementary Details

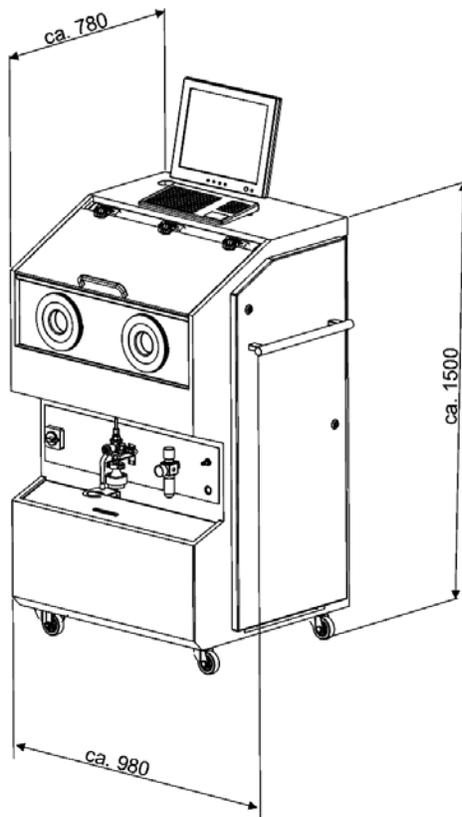
Z = standard

R = external rinsing connections Ø 6mm, between the hand holes

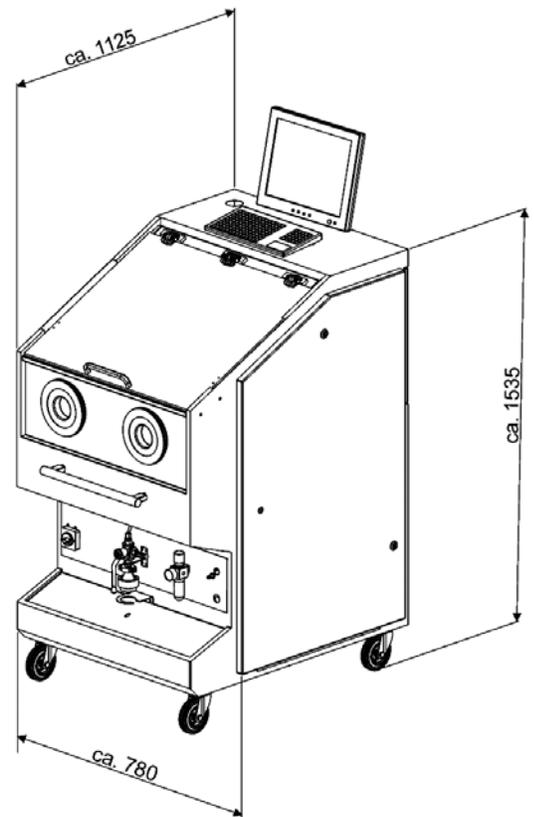
Note: Analyzing Fluid not supplied with unit - G60 Analyzing Fluid, 30L; PN 03205511

## Dimensions

### CTU10XX



### CTU12XX



Dimensions are millimeters and for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## CTM-SC Series

Contamination Test Module – Supply & Control



### Description

The Contamination Test Module CTM is a modular system designed to analyze the technical cleanliness of components. Solid contamination is washed off the surface of the component, samples are taken from the fluid and are subsequently analyzed using membranes.

The Contamination Test Module CTM-SC is the central module of the CTM series. It serves as the fluid supply and the control of the entire extraction processes and contains the graphical user interface.

### Applications

- Automotive and supplier industry
- Gear and engine builders
- Mobile hydraulics
- Production of hydraulic / lubrication system components
- Aircraft industry

### Benefits to You

- Reduction in costs as a result of fewer production failures
- Identification and elimination of weak process steps
- Reduction in start-up breakdowns
- Optimization of internal and external processes
- Documentation of the technical cleanliness of components

### Special Features

- Analysis fluid can be pulsed if required
- Adjustment of compressed air
- Filling and drainage connection
- Control and monitoring of CTM-E modules
- Automatic pressure setting using software
- User-programmable extraction procedure

### Technical Specifications

Overall dimensions <i>(height x width x length)</i>	1.8m x 0.9m x 0.8m
Housing material	S235JR powder-coated
Coupling connection	CPC coupling
Ambient Temperature	59° to 82°F (15° to 28°C)
Weight	≈ 551 lbs (250 kg) <i>(empty)</i>
Reservoir, test fluid	2 x 5.3 gal (20 l) <i>(1 x reservoir, 1 x collection tank)</i>
Reservoir switch-over	Automatic
Filtration of analysis fluid	Fine filtration to ISO4406 min. 12/9
Filter size	2x MRF-1-E/1, 1 µm
Drip tray, integral	6.6 gal (25 l) with drain
Compressed air supply	Nipple DN 7.2
Compressed air supply <i>(provided by customer)</i>	Maximum 87 psi (6 bar), Air flow rate: 15.9 gpm (60 lpm) Dry and pre-filtered to 5 µm
<b>Electrical Data</b>	
Supply voltage	according to order
Power consumption	600 Watt; 800 Watt with ultrasound
Protection class to DIN 40050	IP 54

The information in this catalog relates to the operating conditions and applications described. For applications or operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

## Model Code

CTM SC 100 0 - M

### Series

CTM = Contamination Test Module

### Model

SC = Supply and control

### Series

100 = Standard

### Analysis Fluid

0 = Solvent A III Class (*Flashpoint > 60°C, lower explosion limit > 0.6 Vol.%*)

1 = Water with surfactants, admissible pH-range 6 to 10, no deionized / demineralized water

### Supply Voltage

K = 120 V AC / 60Hz / 1 Phase USA / CDN

M = 230 V AC / 50Hz / 1 Phase Europe

N = 240 V AC / 50Hz / 1 Phase UK

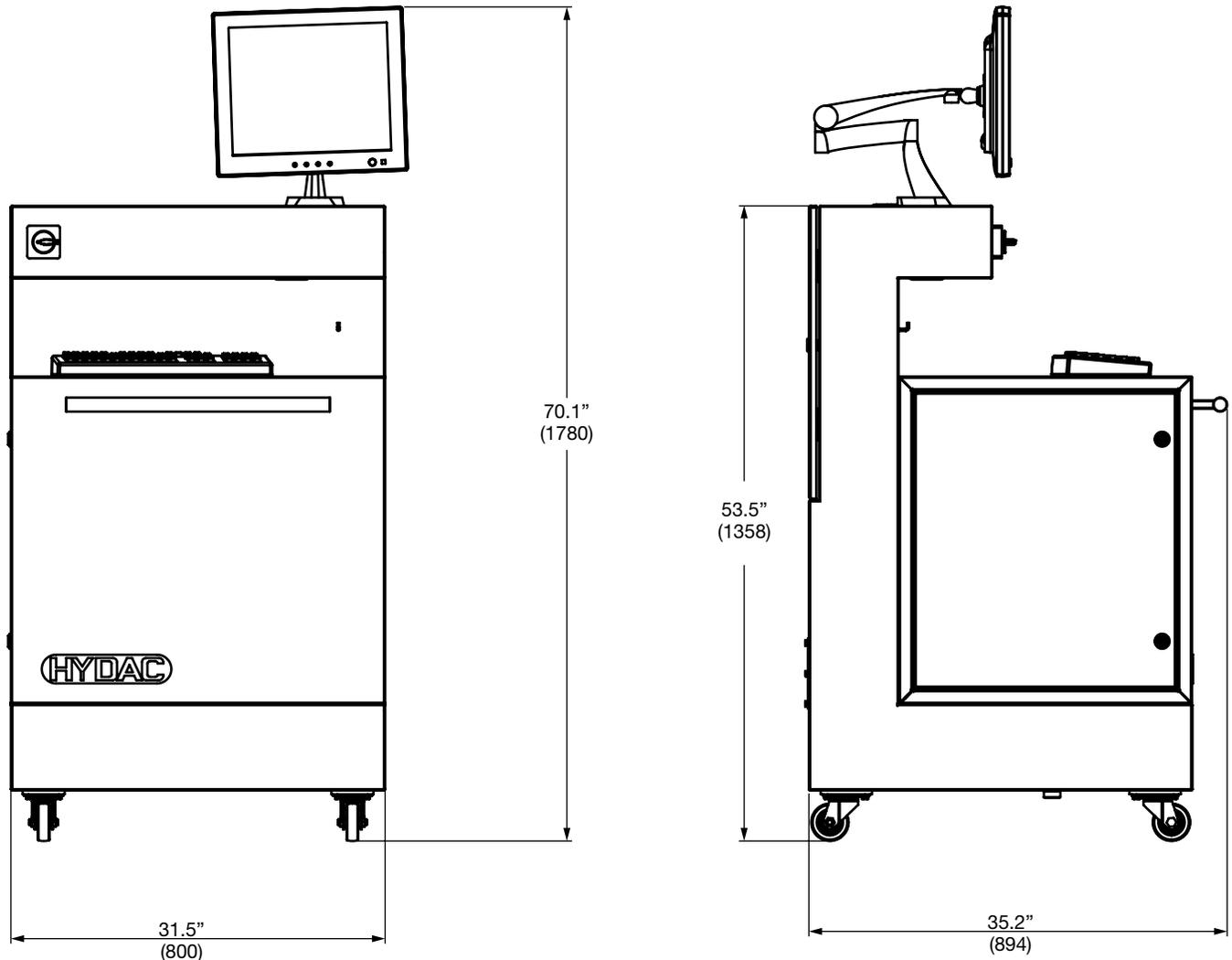
O = 240 V AC / 50Hz / 1 Phase Australia

P = 100 V AC / 50Hz / 1 Phase Japan

### Items supplied

- CTM-SC
  - incl. monitor and monitor bracket
  - PC with Windows operating system
  - PLC
  - Keyboard with touchpad
  - Foot switch
  - CTM-SC Software
- Operating and maintenance instructions

## Dimensions



Dimensions are inches (mm) and for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## CTM-EB Series

Contamination Test Module – Extraction Box



### Description

The Contamination Test Module CTM is a module system designed to analyze the technical cleanliness of components. Particle contamination is removed from the surface of the component, samples are taken from the washing fluid and are subsequently analyzed using membranes.

The extraction module CTM-EB is designed for spray extraction in conjunction with the CTM-SC.

### Applications

- Automotive and supplier industry
- Transmission and engine builders
- Mobile hydraulics
- Manufacture of hydraulic and lubrication system components
- Aircraft Industry

### Advantages

- Reduction in costs as a result of fewer production failures
- Identification and elimination of weak process steps
- Reduction in start-up breakdowns
- Optimization of internal and external processes
- Documentation of the technical cleanliness of components

### Technical Specifications

Overall dimensions (height x width x length)	EB1200: min. 1.50 ... max. 1.75 x 1.20 x 0.90 m EB1400: min. 1.50 ... max. 1.75 x 1.85 x 0.90 m EB1600: min. 1.55 ... max. 1.80 x 1.10 x 0.90 m EB2000: min. 1.70 ... max. 1.95 x 1.40 x 1.10 m
Housing material	S235JR powder-coated
Ambient Temperature	59° to 82°F (15° to 28°C)
Working height adjustment	electrical
Weight when empty	CTM-EB 12xx: ~200 kg CTM-EB 14xx: ~240 kg CTM-EB 16xx: ~220 kg CTM-EB 18xx: ~220 kg CTM-EB 20xx: ~260 kg CTM-EB 46xx: ~280 kg
Coupling connection	CPC Coupling
Filtration of analysis fluid	Fine filtration to ISO4406 min. ISO 12/9
Filter size	3x MRF1-E/1, 1 µm
<b>Extraction Cabinet (clean box)</b>	
Material of Clean Box	Polished stainless steel 1.4301
Maximum load capacity	EB1200: 69 lb (31.5 kg)* EB1210: 220 lb (100 kg) EB1400: 220 lb (100 kg)* EB1410: 331 lb (150 kg) EB1600: 220 lb (100 kg)* EB1610: 331 lb (150 kg) EB1800: 331 lb (150 kg)* EB1810: 331 lb (150 kg) EB2000: 220 lb (100 kg)* EB2010: 331 lb (150 kg) EB4600: 364 lb (165 kg)* EB4610: 331 lb (150 kg) <i>*for evenly distributed load, no point load</i>
Opening of cover	electrical
Membrane holder	For ø1.85" (ø47 mm) filter membranes
<b>Electrical Data</b>	
Supply voltage	according to order
Power consumption	400 Watt
Protection class to DIN 40050	IP 54

The information in this catalog relates to the operating conditions and applications described. For applications or operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

## Model Code

CTM EB 12 0 0 - M - Z - Z / -

### Series

CTM = Contamination Test Module

### Model

EB = Extraction Box

### Dimensions of analysis cabinet (average height x width x depth)

12 = 18.5" (470 mm) x 30.3" (770 mm) x 25.6" (650 mm)  
 14 = 15.7" (400 mm) x 55.1" (1400 mm) x 15.7" (400 mm)  
 16 = 28.0" (710 mm) x 27.6" (700 mm) x 24.4" (620 mm)  
 20 = 33.9" (860 mm) x 35.4" (900 mm) x 35.4" (900 mm)  
 46 = 22.4" (570 mm) x 69.7" (1770 mm) x 25.6" (650 mm)

### Execution of load

0 = standard  
 1 = heavy

### Analysis Fluid

0 = Solvent A III Class (Flashpoint > 60°C, lower explosion limit > 0.6 Vol.%)  
 1 = Water with surfactants, admissible pH-range 6 to 10, no deionized / demineralized water

### Supply Voltage

K = 120 V AC / 60Hz / 1 Phase USA / CDN  
 M = 230 V AC / 50Hz / 1 Phase Europe  
 N = 240 V AC / 50Hz / 1 Phase UK  
 O = 240 V AC / 50Hz / 1 Phase Australia  
 P = 100 V AC / 50Hz / 1 Phase Japan

### Extraction method

Z = spray, medium pressure

### Supplementary details

Z = standard

### Modifications

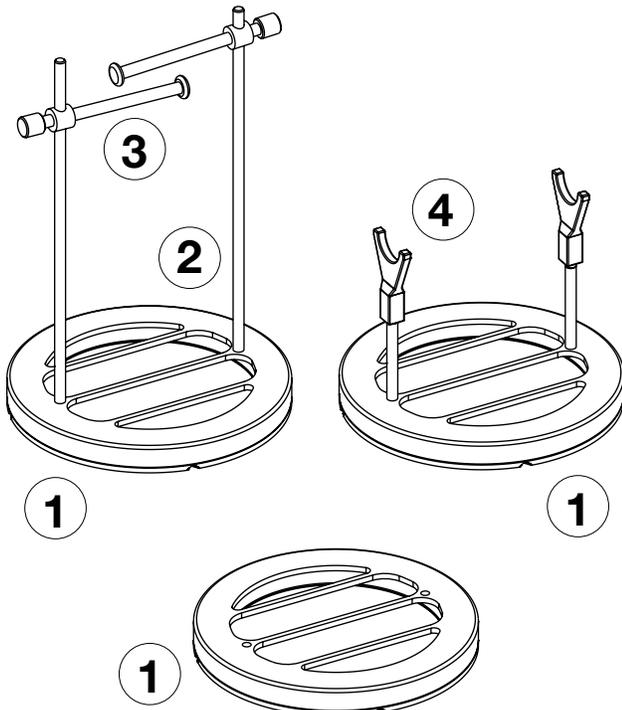
- = without modifications

### Items supplied

- CTM-EB
- Operating and maintenance instructions

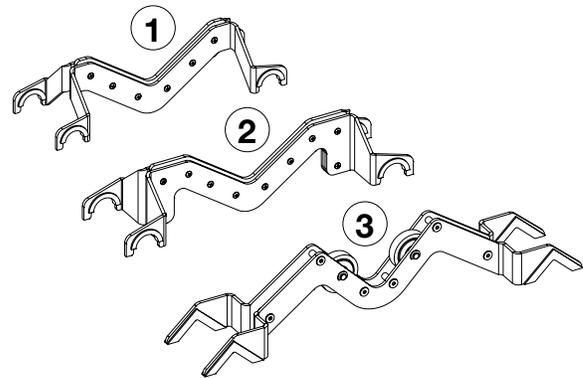
## Accessory - CTM-EB Disk

- 1200 = Part. No. 3439102
- 2000 = Part. No. 3422445



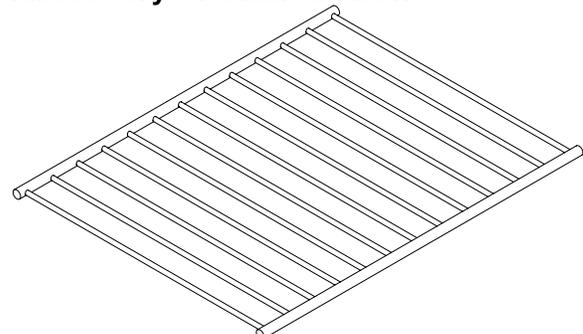
Item	Designation
1	Disk
2	Guide rod (available in different lengths)
3	Clamping rod (available in different lengths)
-	Y-shaped Bracket

## Accessory - Angled Bracket



Item	Designation
1	Angled bracket – light duty
2	Angled bracket – medium duty
3	Angled bracket – heavy duty

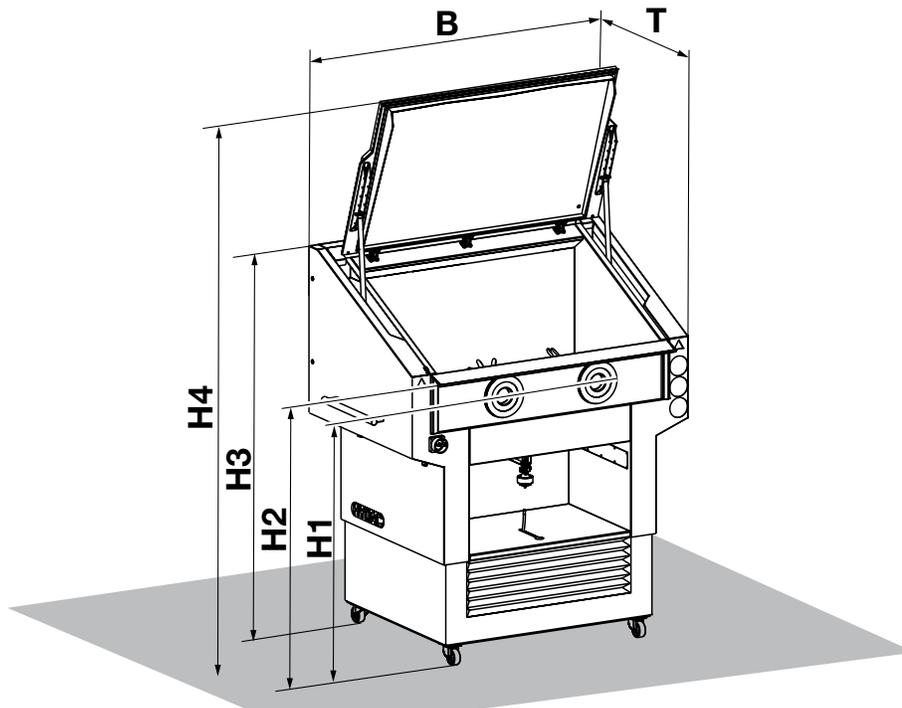
## Accessory - Polished Rack



Supplied with the CTM-EB 1200.

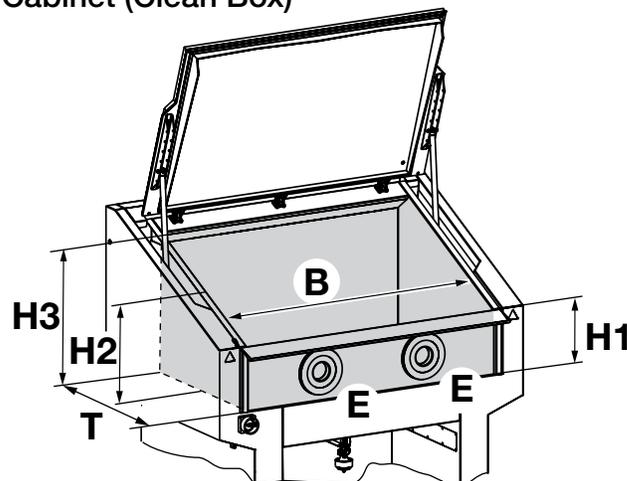
# CONTAMINATION MONITORS

Dimensions  
CTM-EB overall



CTM-EB	B	T	H1	H2	H3	H4
12xx	43.7" (1110)	36.2" (920)	38.8" to 48.6" (985 to 1235)	47.0" to 54.9" (1195 to 1395)	59.5" to 69.3" (1510 to 1760)	84.6" to 94.5" (2150 to 2400)
14xx	72.0" (1830)	36.2" (920)	37.6" to 47.4" (955 to 1205)	45.0" to 54.9" (1145 to 1395)	59.5" to 69.3" (1510 to 1760)	70.9" to 80.7" (1800 to 2050)
16xx	43.7" (1110)	36.2" (920)	40.2" to 50.0" (1020 to 1270)	50.0" to 59.8" (1270 to 1520)	61.4" to 71.3" (1560 to 1810)	84.6" to 94.5" (2150 to 2400)
18xx	64.2" (1630)	42.1" (1070)	40.2" to 50.0" (1020 to 1270)	45.3" to 55.1" (1150 to 1400)	62.6" to 72.4" (1590 to 1840)	93.5" to 103.3" (2375 to 2625)
20xx	55.1" (1400)	45.3" (1150)	39.4" to 52.8" (1000 to 1340)	48.6" to 58.5" (1235 to 1485)	42.5" to 76.0" (1080 to 1930)	96.5" to 106.3" (2450 to 2700)
46xx	90.6" (2300)	36.2" (920)	39.0" to 48.8" (990 to 1240)	46.5" to 56.3" (1180 to 1430)	59.0" to 69.0" (1500 to 1750)	86.6" to 96.5" (2200 to 2450)

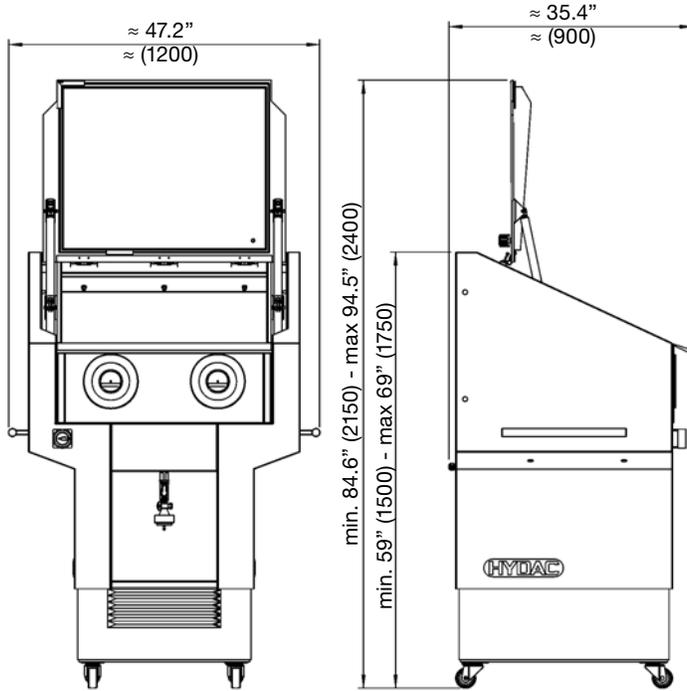
## Dimensions of Extraction Cabinet (Clean Box)



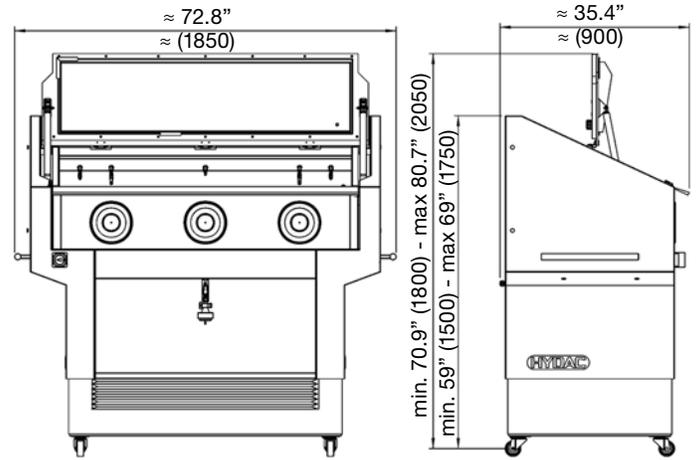
CTM-EB	B	T	H1	H2	H3	E
12xx	30.3" (770)	25.6" (650)	11.0" (280)	18.5" (470)	21.5" (545)	2 x ø7.1" (ø180)
14xx	55.1" (1400)	15.7" (400)	11.0" (280)	15.7" (400)	17.1" (435)	3 x ø7.1" (ø180)
16xx	26.4" (670)	24.4" (620)	23.4" (595)	27.6" (700)	30.1" (765)	2 x ø9.0" (ø230)
18xx	47.2" (1200)	30.7" (780)	10.6" (270)	17.7" (450)	23.8" (605)	2 x ø7.1" (ø180)
20xx	35.4" (900)	35.2" (895)	26.8" (680)	31.5" (800)	37.8" (960)	2 x ø9.0" (ø230)
46xx	69.7" (1770)	25.6" (650)	14.2" (360)	22.4" (570)	24.2" (615)	4 x ø9.0" (ø230)

Dimensions are inches (mm) and for general information only, all critical dimensions should be verified by requesting a certified print.

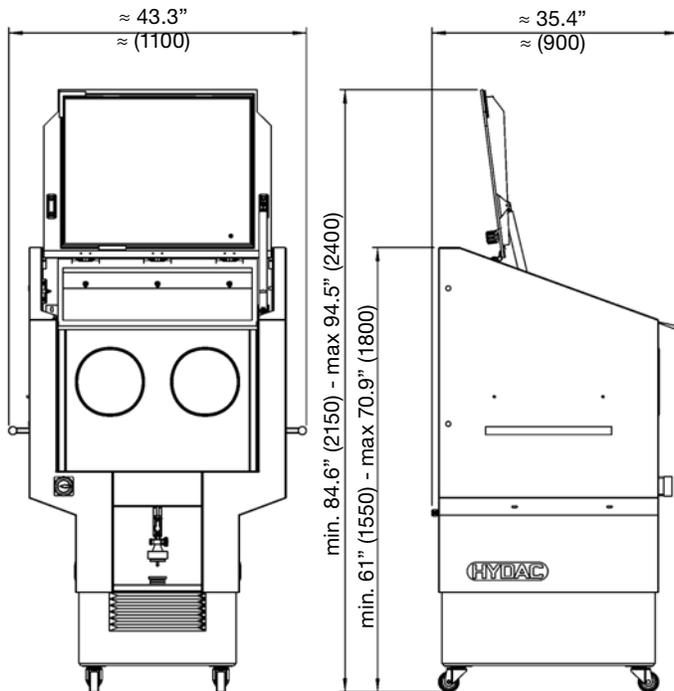
## Dimensions CTM-EB 1200



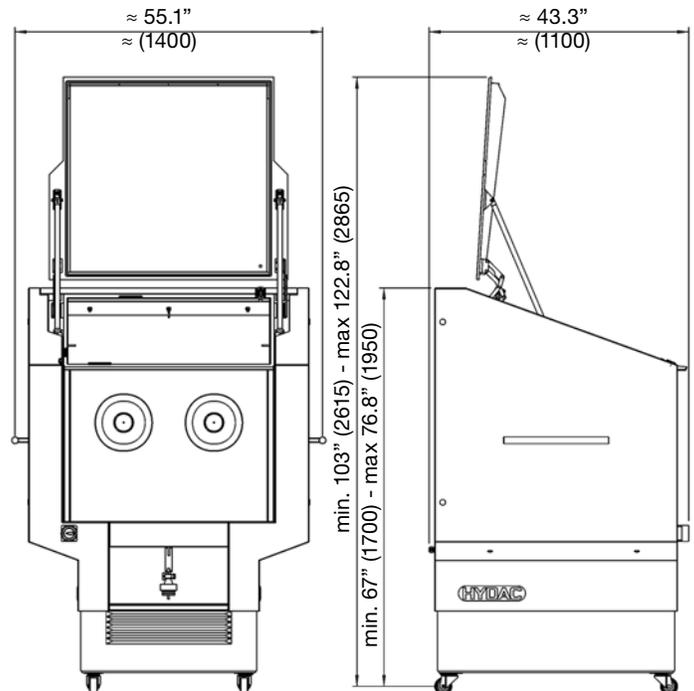
## CTM-EB 1400



## CTM-EB 1600



## CTM-EB 2000



Dimensions are inches (mm) and for general information only, all critical dimensions should be verified by requesting a certified print.

# CONTAMINATION MONITORS

## MM Series

### Measuring Microscopes



#### Description

This microscope is designed specifically to be used for measuring contamination particles in oil samples on filter membranes. All models include coarse and fine focusing adjustments, as well as both X and Y directional slide table adjustments to make focusing and positioning the subject simple, even at maximum magnification.

There is a rotating lens holder with 3 achromatic objective lenses with magnifications of 4x, 10x, and 20x. The micrometer eyepiece provides an additional 10x magnification resulting in 40x, 100x, and 200x magnifications. The measuring scale on the eyepiece has a scale division of 1 mm in 100 parts, allowing measurement of particles at all three magnifications.

These units come with an integrated plug-in light source that provides sufficient illumination, even at maximum magnification.

The optional CCD digital camera attaches to the eyepiece and transfers images to a PC via a USB connection, making it easy to capture and transmit images from the microscope.

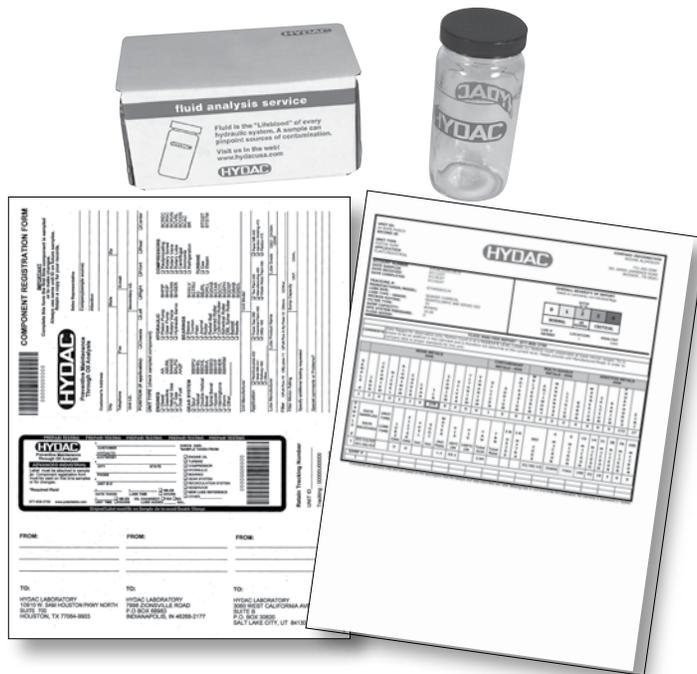
#### Ordering Information

MM-S5-P	Standard eyepiece 110 V 60 Hz powered light source
MM-S5-P-U	Standard eyepiece 110 V 60 Hz powered light source CCD camera with LPT-1 port for connection to laptop or PC
MM-KKE-P-C-U	Triocular eyepiece 110 V 60 Hz external cold light illumination CCD camera with LPT-1 port for connection to laptop or PC

#### Technical Specifications

MM-S5-P, MM-S5-P-U, & MM-KKE-P-C-U	
Huygens Eyepiece	10 x M
Achromatic Lens	4x, 10x, 20x
Magnification	40x, 100x, 200x
Supply Voltage	110 V 60 Hz
MM-S5-P-U & MM-KKE-P-C-U (only)	
Image Digitization	CCD-Camera
Video System	PAL color system
Resolution	horiz. 460 lines, vert. 400 lines
Image Processing	Video capture unit
PC interface	LPT 1 port
System Requirements	min. Pentium 100 Mhz., Windows 95

## FAS Series Fluid Analysis Service



Additional Oil Analysis Tests are available; contact factory for information

### Premium Oil Sample Testing

**Test Kit part number: 02702060** (includes a box of 10 sample bottle kits)

Oil sample analysis for standard mineral hydraulic and lube oil includes the following tests:

- Spectrometals by ICP (24 Metals including Wear, Contaminant, Additive & Multi-Source) – D5185
- Viscosity @ 40C (ASTM D445)
- Water % by Crackle (Karl Fischer if Crackle is Positive)
- Total Acid Number – TAN (ASTM D664)
- Particle Count (as per ISO4406:1999 - 3 digit ISO code 4, 6, 14)

**Test Kit part number: 02095151** (includes a box of 10 sample bottle kits), the same as the above analysis as well as a photomicrograph

### Water Glycol Sample Testing:

**Test Kit part number: 02702057** (includes a box of 10 sample bottle kits)

This kit includes specific analysis parameters for the water to oil ratio of the Glycol. Karl Fischer Water is done and pH is tested instead of TAN. If the water concentration is tested out of specification to the identified lubricant, the lab will give the current concentration level and then make a recommendation for the acceptable water concentration percentage range for the stated lubricant. The tests included are as follows:

- Spectrometals (24 Metals by ICP including Wear, Contaminant, Additive & Multi-Source) – D5185
- Viscosity @ 40C – ASTM D445
- Water by Karl Fischer in PPM – ASTM D1744
- pH (If a Standard Mineral Oil is Identified, then TAN is done)
- ISO Particle Count (as per ISO4406:1999 - 3 digit ISO code 4, 6, 14)

### Oil Analysis Reports:

Each Fluid Analysis Kit contains:

- Clean Sample Bottle
- Component Registration Form (CRF)
- Packaging for mailing sample
- Prepaid Fluid Analysis Service

Choice of three ISO 17025 A2LA accredited laboratories to send the samples. Addresses are included on the Component Registration Form

- All locations are within 48 hours ground transit from nearly anywhere in the continental United States
- Results returned within 24-48 hours after lab receipt of the test samples
- Fast email or fax notification of high severity results

A Component Registration Form (CRF) is included with each sample bottle kit, but it only needs to be filled-out the first time each piece of equipment is sampled or to make changes. After the initial sample, the CRF information is stored under the Unit ID #.

Sample results will be e-mailed to the e-mail address supplied on the CRF. Additionally, a Username and Password will be emailed to each report recipient who provides an e-mail address on the Component Registration Form (CRF). This feature allows multiple users to view the reports simultaneously. The Username and Password provides the recipient with access to [www.oilreports.com](http://www.oilreports.com) where a personal internet account has been set-up. From this site, the full sample report with the capability of graphing and trending analysis is available online as well as the complete testing history is securely stored.

### HYDAC Canada Fluid Analysis Services *(Canada Customers Only)*

#### Contamination Analysis

Test Kit Part Number: 02552392 (single); 02552390 (pack of 10)

This kit identifies contamination before it hampers production and shortens component life and includes:

- Particle Count
- Water Content
- Viscosity
- Patch Test/Photo

#### Total Conditioning Analysis Kit

Test Kit Part Number: 02552393 (single); 02552391 (pack of 10)

Includes all the above tests PLUS it determines: additive; wear metal; contaminant and oxidation levels. Tests included in this kit are:

- Particle Count
- Water Content
- Total Acid Number
- Viscosity
- Patch Test/Photo
- Spectrographic Analysis

#### Water Glycol Analysis Kit

Test Kit Part Number: 02550327

This kit is designed exclusively for water glycol systems. Contamination, water content and viscosity are monitored. Tests included:

- Water Content
- Viscosity
- Patch Test/Photo
- Estimated ISO 4406 cleanliness code

# CONTAMINATION MONITORS

## FASH Series

### Fluid Analysis Sets



### Features and Benefits

- Compatible with hydraulic and lube oils
- Provides results on site in a matter of minutes
- Determines solid contamination levels in hydraulic systems
- Includes all necessary equipment in a single lightweight case

### Applications

- Perform quick on-site determination of contamination levels of solid particulate
- Supplement on-site laboratories
- Use as a tool to demonstrate need for improved filtration

### Applicable standards

- ISO 4405 / 4406 / 4407
- Gravimetric methods for determining the amount of contamination in hydraulic fluids.

### Description

The Fluid Analysis Set from HYDAC provides the necessary tools to determine levels of solid particulate contamination present in a particular fluid sample. Using the vacuum pump contained in the kit, the fluid sample is drawn through a membrane patch. The residual dirt left on the patch is viewed under a microscope and compared to photos of known contamination levels in the HYDAC Contamination Handbook (*included*) for a visual assessment.

### Ordering Information

Part Number: 02086847

### Items Included in the Kit

Quantity	Description
1	Molded Carry Case
1	Microscope 100x
1	Vampire Pump
1	Funnel
1	Forceps
1	Rubber Tubing Hose-1/4"
5	Plastic Petri Dish
5	38mm Sample Bottles 4 oz
1	Pen Light for Microscope
100	(0.8) & (5.0) Millipore Patches
5	Solvent Filters
5	Syringes 30ml

### Replacement Parts

Description	Part Number
Molded Carry Case	02701962
Microscope 100x	02701951
Vampire Pump	02701961
Funnel	02701960
Rubber Tubing Hose-1/4"	02701958
Forceps	02701953
Plastic Petri Dish	02701955
38mm Sample Bottles 4 oz	02701959
0.8 Millipore Patches	02701952
5.0 Millipore Patches	02701997
Solvent Filters	02701957
Syringes 30ml	02701956

# C Diagnostic Monitoring

These units are designed for data capturing simple measurements (*pressure, temperature, and flow rate*) in hydraulic and pneumatic systems. Typical applications extend primarily to maintenance and servicing, troubleshooting and test stands, as well as, quality inspections.

## HMG 3010 Series

Portable Data Recorder & Diagnostic System



### Description

The HMG 3010 data recorder is a portable unit for simple measurement and data capturing tasks involving hydraulic and pneumatic systems. Applications extend primarily to maintenance and servicing, troubleshooting and test stands, as well as, quality inspections.

The HMG 3010 can concurrently evaluate signals from up to 10 sensors. The unit features 5 input jacks for connecting the sensors; if necessary this number can be doubled using a Y adapter for measurement operations involving more than 5 sensors. HYDAC offers matching HSI sensors (HSI = HYDAC Sensor Interface) for pressure, temperature and flow rate which are automatically recognized by the HMG 3010. Standard HYDAC's and other sensors without HSI can also be used.

### Features

- Simple, user-friendly operation
- Practical, robust design
- Large, full-graphics color display
- Quick and independent basic setting of the instrument through the use of automatic sensor recognition
- Up to 10 sensors can be connected simultaneously
- Up to 32 measurement channels can be displayed at a time
- Measuring rates up to 0.1 ms
- Extended voltage measurement -10 to +10 V and 0 to 50 V
- Can be connected to a CAN bus
- Very large data memory for archiving measurement curves
- Various measurement modes:  
Normal measuring  
Fast curve recording  
Long term measuring
- 4 independent triggers, can be logically linked
- PC connection  
- USB  
- RS 232
- Convenient visualization, archiving and data processing using the HMGWIN 3000 and CMWIN software supplied

### Technical Specifications

Measuring inputs	4 input sockets (channels A-H) for connecting up to 8 analog sensors or up to 4 SMART sensors 1 input socket with 2 digital inputs (channel I-J) and one voltage input of -10 V to + 10 V (shown on channel H) Sensors are connected using standard M12x1 connectors (5 pole)
Channel A, B, E, F, G (Accuracy)	HSI ( $\leq \pm 0.1$ % FS max.) 4 to 20 mA ( $\leq \pm 0.1$ % FS max.) 0 to 20 mA ( $\leq \pm 0.1$ % FS max.) 0 to 4.5 V ( $\leq \pm 0.1$ % FS max.) 0 to 5 V ( $\leq \pm 0.2$ % FS max.) 0 to 10 V ( $\leq \pm 0.1$ % FS max.) 0.5 to 4.5 V ( $\leq \pm 0.1$ % FS max.) 0.5 to 5.5 V ( $\leq \pm 0.1$ % FS max.) 1 to 5 V ( $\leq \pm 0.2$ % FS max.) 1 to 6 V ( $\leq \pm 0.2$ % FS max.)
Channel C and D (Accuracy)	HSI ( $\leq \pm 0.1$ % FS max.) 4 to 20 mA ( $\leq \pm 0.1$ % FS max.) 0 to 20 mA ( $\leq \pm 0.1$ % FS max.) 0 to 4.5 V ( $\leq \pm 0.1$ % FS max.) 0 to 5 V ( $\leq \pm 1.0$ % FS max.) 0 to 10 V ( $\leq \pm 0.5$ % FS max.) 0 to 50 V ( $\leq \pm 0.1$ % FS max.) 0.5 to 4.5 V ( $\leq \pm 0.1$ % FS max.) 0.5 to 5.5 V ( $\leq \pm 1.0$ % FS max.) 1 to 5 V ( $\leq \pm 1.0$ % FS max.) 1 to 6 V ( $\leq \pm 0.5$ % FS max.)
Channel H (Accuracy)	HSI ( $\leq \pm 0.1$ % FS max.) 4 to 20 mA ( $\leq \pm 0.1$ % FS max.) 0 to 20 mA ( $\leq \pm 0.1$ % FS max.) 0 to 4.5 V ( $\leq \pm 0.1$ % FS max.) 0 to 5 V ( $\leq \pm 0.2$ % FS max.) 0 to 10 V ( $\leq \pm 0.1$ % FS max.) 0.5 to 4.5 V ( $\leq \pm 0.1$ % FS max.) 0.5 to 5.5 V ( $\leq \pm 0.1$ % FS max.) 1 to 5 V ( $\leq \pm 0.2$ % FS max.) 1 to 6 V ( $\leq \pm 0.2$ % FS max.) -10 to +10 V ( $\leq \pm 0.5$ % FS max.)
Channel I and J (Accuracy)	Frequency range: 1 to 30 000 Hz ( $\pm 0.1$ % FS max.) Switch / switch-back threshold: 2 V / 1 V max. input voltage: 50 V
Differential channels	A - B C - D Differential channel for flow rate measurement orifice (shown on channel B)
Measuring rate (dependent on the number of active channels)	0.1 ms, max. 2 analog input channels 0.2 ms, max. 4 analog input channels 0.5 ms, all 10 input channels 1.0 ms, for SMART sensors
Resolution	12 bit
Memory	At least 100 measurement curves, each with up to 500,000 measured values
Display	3.5" color display, 7 segment display
Interfaces	1 USB, 1 serial port
CE Mark	EN 61000-1/2/3/4
Safety	EN 61010
Safety type	IP40
Environmental conditions	Operating temperature: 32 to 122 °F (0 to 50 °C) Storage temperature: -4 to 140 °F (- 20 to 60 °C) Rel. humidity: 0 to 70 %
Weight	2.4 lb (1100)

## Model Code

**HMG 3010 - 000 - US**

## Operating Manual & Documents

US = English

## Connections

**A-E, B-F, C-G & D-H** 4 sensor input sockets each with two measurement channels (channel A-D or E-H) to connect up to 8\* analog sensors or up to 4 SMART sensors, e.g. for pressure, temperature or flow rate sensors

\*The four input sockets can be doubled, if required, by plugging in Y adapters (ZBE 38)

**D / H** **For connection to CAN-bus:**

For connection to CAN-bus, use connection adapter ZBE 3010 (see Point 6.5)

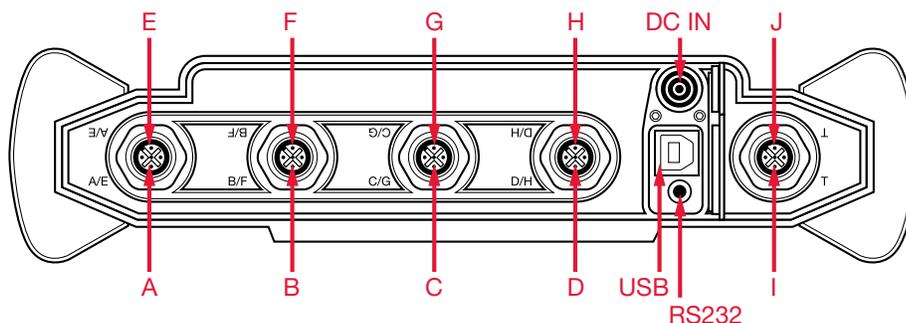
Caution! When connecting to CAN-bus, a Y-adapter cannot be used on this input socket.

**I / J** 1 input socket for: 2 digital signals, e.g. for frequency or speed measurements (channel I, J)

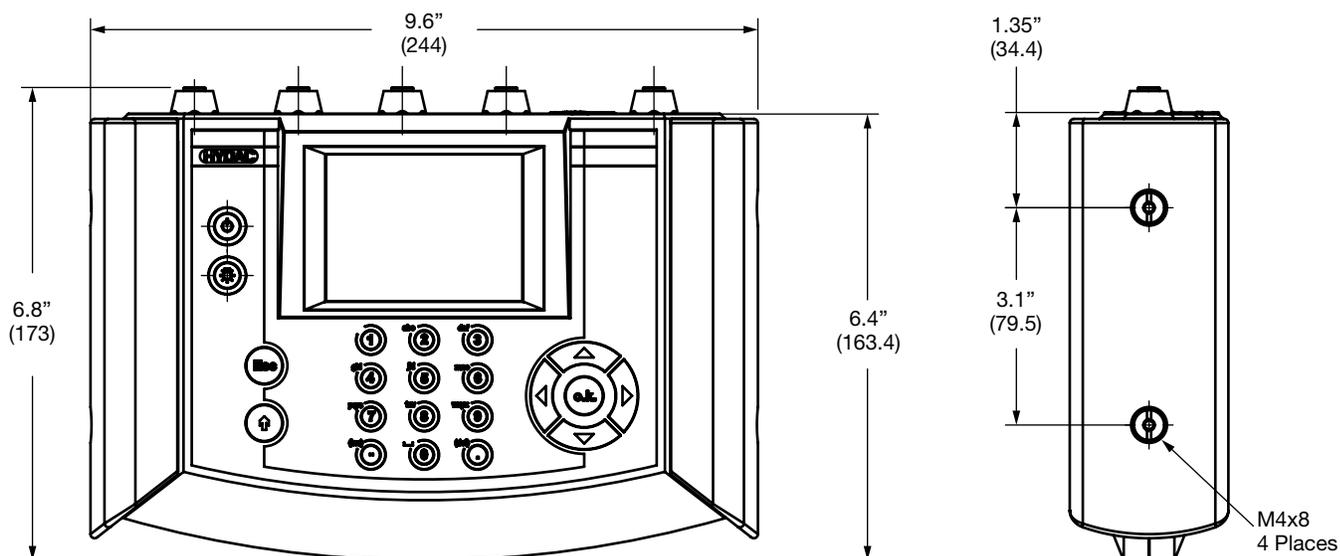
**DC IN** Female jack for power supply

**USB** 1 USB connector for PC communication

**RS232** 1 serial interface for PC communication



## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

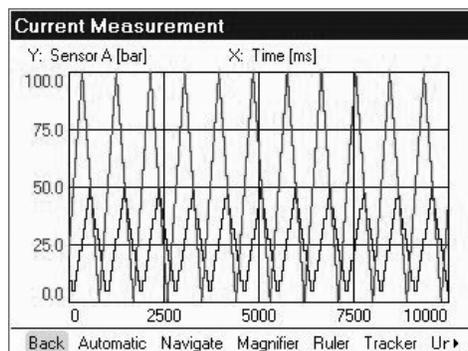
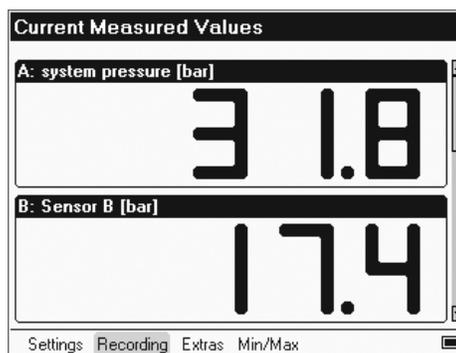
## Function

- Clear and graphical selection menus guide the operator simply to all the instrument functions available. A navigation pad on the keypad ensures rapid operation.
- The HMG 3010 can monitor signals from up to ten sensors simultaneously. For this there are 5 robust standard input sockets. By using Y adapters the number of inputs can be doubled individually to make a total of between 6 and 10.
- Up to 8 sensors can be connected to 4 of these input sockets:
  - 8 sensors (e.g., for pressure, temperature, and flow rate) with special digital HSI interface (HYDAC Sensor Interface); the basic device settings (measured variable, measurement range, and unit) are made automatically.
  - 8 standard analog sensors with current and voltage signals
  - 4 Condition Monitoring sensors\*) (SMART sensors); again, the basic device settings are made automatically.
- Frequency measurements, counter functions, or triggers for data logging can be implemented via the fifth input socket with 2 digital inputs.
- For extended voltage measurement, the HMG 3010 offers the possibility of recording signals of 0 .. 50 V on two inputs and a signal of -10 .. +10 V on one input (e.g. proportional valve control).
- The connection to a CAN bus in conjunction with the CAN adapter ZBE 3010 makes it possible to record CAN messages (e.g., motor speed, motor oil pressure) in combination with measurement data from the hydraulic system.
- HYDAC CAN bus sensors connected directly to the CAN adapter can be parameterized using the HMG 3010 (node ID and baud rate)
- All input channels can operate simultaneously at a measurement rate of 0.5 ms (1.0 ms for SMART sensors). To record highly dynamic processes, 2 analog inputs are capable of recording measured values of 0.1 ms.
- The most impressive function of the HMG 3010 is its ability to record dynamic processes "online", i.e., in real-time, as a measurement curve and render them as graphs in the field.

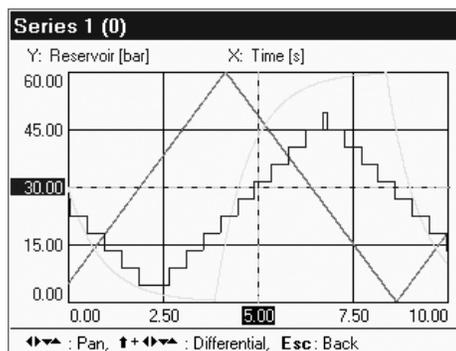
Load Stored Settings			
Name	Number	Saved	Time
plant 1	2	18.06.07	13:12:00
plant 1	1	18.06.07	13:11:57
setting system	1	18.06.07	13:11:46
setting pressure	1	18.06.07	13:11:36
setting 1	2	18.06.07	13:11:26
setting 1	1	18.06.07	13:11:23

Load Cancel

- Measured values, curves, or texts are visualized on a full-graphics color display in different selectable formats and display forms.



- Numerous useful and easy-to-use auxiliary functions are available, e.g., zoom, ruler tool, creating differential value graphs, and individual scaling, particularly for use when analyzing the recorded measurement curves.



- The data memory for recording curves or logs can hold up to 500,000 measured values. At least 100 such full length data records can be stored in an additional archive memory.
- For specific, event-driven curves or logs, the HMG 3010 has four independent triggers, which can be linked together logically.
- It is also possible to determine differential values between different input signals from sensors. Particularly when measuring flow rate by means of differential pressure measurement across a measuring orifice, the accuracy can be significantly improved by using a stored calibration curve. To generate such calibration curves, the HMG 3010 has an easy-to-use recording function.
- User-specific instrument settings can be stored and re-loaded at any time as required. This means that repeat measurements can be carried out on a machine again and again using the same instrument settings.

- The HMG 3010 communicates with a PC via the built-in USB port or RS 232 port.

## HMGWIN 3000

The HYDAC PC software HMGWIN 3000 is also supplied with the instrument. This software is a convenient and simple package for analyzing and archiving curves and logs which have been recorded using the HMG 3010, or for exporting the data for integration into other PC programs, if required. In addition it is also possible to operate the HMG 3010 directly from the computer. Basic settings can be made, and measurements can be started online and displayed directly on the PC screen in real-time as measurement curves progress.

## CMWIN

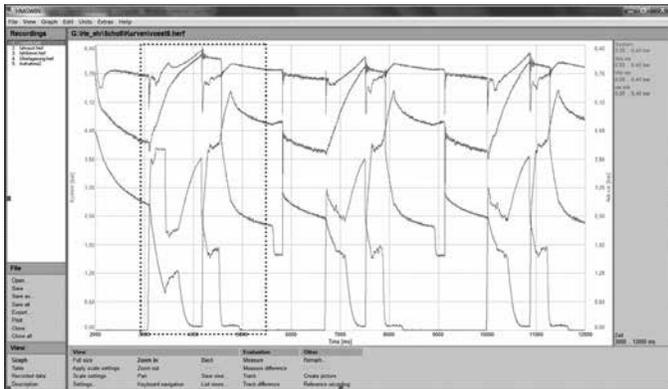
The HYDAC software CMWIN is also supplied with the instrument. This software enables you to communicate directly with SMART sensors\* connected to the HMG 3010 from your PC.

Both programs can be run on PCs with Windows Vista / XP / 2000 and Windows 7 operating systems.

\*SMART sensors (Condition Monitoring Sensors) are a generation of sensors from HYDAC which can provide a variety of different measured values.

Some examples of the numerous useful additional functions:

- Transfer and archiving of measurements recorded using the HMG 3010.
- Display of the measurements in graph form or as a table.



### Zoom function:

- Using the mouse, a frame is drawn around an interesting section of a measurement curve, which is then enlarged and displayed.

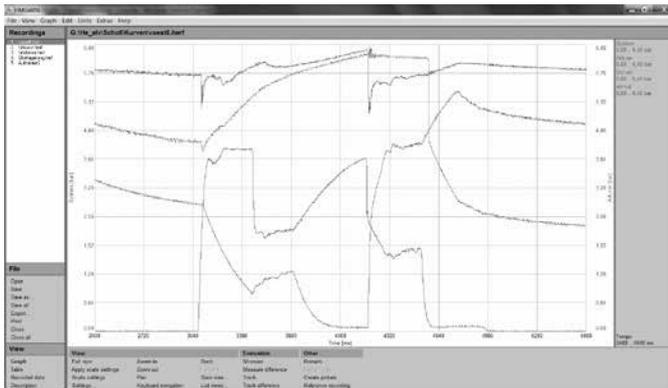
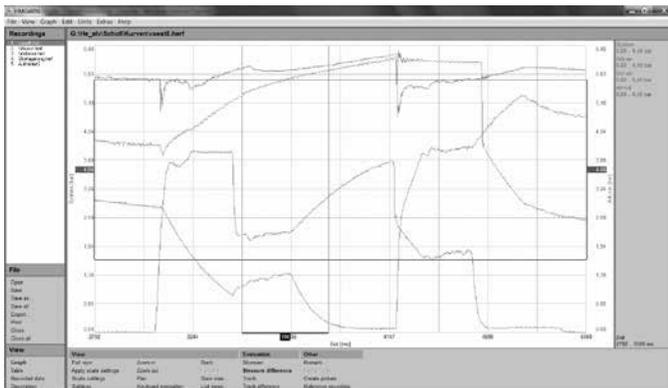
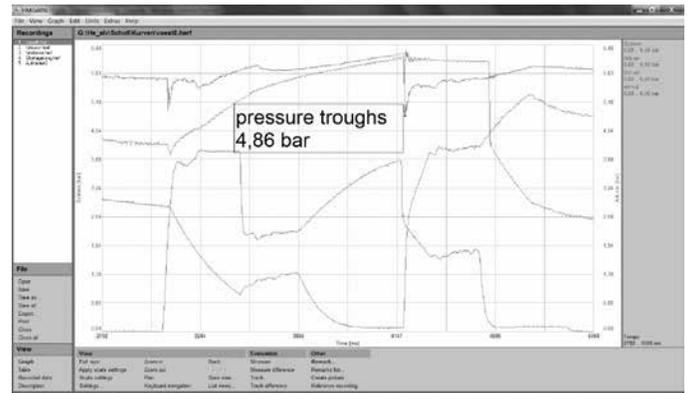


Fig.: Zoomed section of measurement curve

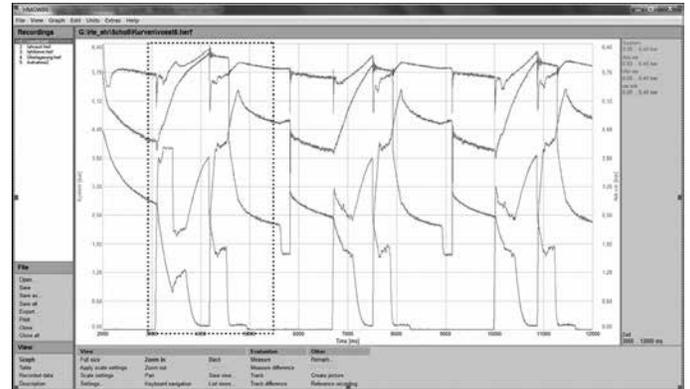
- **Accurate measurement** of the curves using the ruler tool (time values, amplitude values, and differentials)



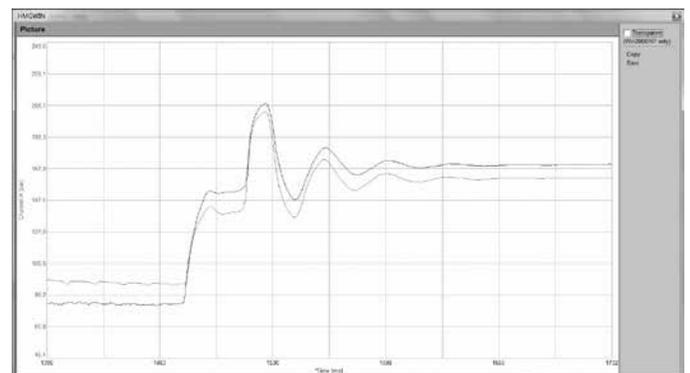
- Individual comments and measurement information can be added to the graph



- **Overlay of curves**, for example to document the wear of a machine (new condition/current condition)



- Using mathematical operations (calculation functions, filter functions) new curves can be added.
- **Snap-shot function:** comparable to the function of a digital camera, a picture can be taken immediately of any graph and saved as a jpg file.
- A **professional measurement report** can be produced at the click of a mouse: HMGWIN 3000 has an automatic layout function. Starting with a table of contents, all recorded data, descriptions, and graphics and/or tables are combined into a professional report and saved as a pdf file.
- **Online function:** Start, record, and display measurements in real-time (similar to the function of an oscilloscope).



- Change of axis assignment of the recorded measurement parameters in graph mode (e.g. to produce a p-Q graph)

# DIAGNOSTICS

## Diagnostic Unit

Model Code	Description	Part No.
HMG 3010-000-US	Includes: HMG 3010-000 with Manual Battery Set & Charging Unit HMGWIN & CMWIN software w/ USB cable	922938

## Pressure Transducer with HSI

(HYDAC Sensor Interface)

Model Code	Description	Part No.
HDA 4748-H-0009-000	-14.5 to 130.5 psi (-1 to 9 bar)	00909429
HDA 4748-H-0016-000	0 to 230 psi (0 to 16 bar)	00909425
HDA 4748-H-0060-000	0 to 870 psi (0 to 60 bar)	00909554
HDA 4748-H-0100-000	0 to 1450 psi (0 to 100 bar)	00909426
HDA 4748-H-0250-000	0 to 3625 psi (0 to 250 bar)	00909337
HDA 4748-H-0400-000	0 to 5800 psi (0 to 400 bar)	00909427
HDA 4748-H-0600-000	0 to 8700 psi (0 to 600 bar)	00909428
HDA 4778-H-0135-000	-14.5 to 135.5 psi (-1 to 9.34 bar)	00920755
HDA 4778-H-0150-000	0 to 150 psi (0 to 10 bar)	00920663
HDA 4778-H-1500-000	0 to 1500 psi (0 to 103 bar)	00920757
HDA 4778-H-3000-000	0 to 3000 psi (0 to 207 bar)	00920756
HDA 4778-H-6000-000	0 to 6000 psi (0 to 413 bar)	00920664
HDA 4778-H-9000-000	0 to 9000 psi (0 to 621 bar)	00920665

## Accessories

Model Code	Description	Part No.
USB Cable	Connection to PC	6040585
ZBE 30-02	cable for M12x1 - 6'	6040851
ZBE 30-05	cable for M12x1 - 15'	6040852
ZBE 34	M12x1 / Binder adapter	3236597
ZBE 35	M12x1 / Hirschmann adapter	3236601
ZBE 36	AS 1000 (Aqua Sensor) Adapter	909737
ZBE 38	M12 Y-adapter (doubles the inputs)	3224436
Hydraulic Adaptor Set (2 pieces each)	Adapter hose DN 2 / 1620/1620, 400mm and 1000 mm, pressure gauge connectors 1620 / G1/4, adapter 1615/1620, bulkhead couplings 1620/1620	903083
UVM 3000	Universal connection module for HMG 3010	909752
Bag	with carry strap	909795
Power Supply	DC Charging unit for HMG 3010	6054296
ZBE 31	Car Charger for HMG 3010	909739
Pelican Case	for HMG 3010 and accessories	2702730
Aluminum Case	for HMG 3010 and accessories	6042959

## Flow Sensor with HSI (HYDAC Sensor Interface)

Model Code	Description - g/min (l/min)	Part No.
<b>Aluminum</b>		
EVS 3108-H-0020-000	0.26 to 5.28 (1.2 to 20)	00909405
EVS 3108-H-0060-000	1.59 to 15.9 (6 to 60)	00909293
EVS 3108-H-0300-000	3.96 to 79.3 (15 to 300)	00909404
EVS 3108-H-0600-000	10.6 to 159 (40 to 600)	00909403
<b>Stainless Steel</b>		
EVS 3118-H-0020-000	0.26 to 5.28 (1.2 to 20)	00909409
EVS 3118-H-0060-000	1.59 to 15.9 (6 to 60)	00909406
EVS 3118-H-0300-000	3.96 to 79.3 (15 to 300)	00909408
EVS 3118-H-0600-000	10.6 to 159 (40 to 600)	00909407

## Temperature Transducer with HSI

(HYDAC Sensor Interface)

Model Code	Description	Part No.
ETS 4148-H-006-000	-13° to 212°F (-25° to 100°C)	923398
ETS 4578-H-000	-13° to 212°F (-25° to 100°C)	920662

## Additional Sensors

Model Code	Description	Part No.
HDS 1000-002	RPM Sensor (plug M12x1) 2M Includes HDS 1000 Reflector Set (part no. 00904812)	00909436
HDS 1000 Reflector Set	Reflective foil set 25 pieces	00904812
SSH 1000	Sensor simulator for 2 HSI (ideal for training purposes)	00909414

HYDAC HSI sensors are part of a new plug and play, self-identifying sensor line. HSI sensors must be used with the HMG 500 and facilitate easy use with the HMG 3010. The HMG 3010 is capable of reading standard sensors as well as competitive models.

## CAN adapter



- CAN adapter, required for CAN bus operation (ordered separately). ZBE 3010 CAN adapter for HMG 3010 Part no. 921238
- Additional accessories, such as electrical and mechanical connection adapters, power supplies, etc. can be found in the "Accessories - Service devices" catalog section

## **D** Offline Filtration Systems

Today's hydraulic filter systems have seen a shift from reactionary to preventative, and even predictive maintenance. Total system contamination management begins with our Fluid Conditioning Products. These are hydraulic oil filter systems for removing contaminants and water from various types of hydraulic fluids. Our offline hydraulic oil filter systems include both mobile filtration carts with and without contamination monitoring units, stationary filtration systems from 1.3 gallon flow rates to customizable kidney loop systems up to 140 GPM. Our dewatering units, both vacuum dehydration and mass transfer systems offered and can remove both free and dissolved water from fluids for any reservoir size at various flow rates.

# OFFLINE FILTRATION SYSTEMS

## OF7 Series

Hand Held Portable Filter



### Description

A low noise vane pump is directly flanged to the electrical motor and fixed to an aluminum housing with a foot bracket. The suction line has a cleanable wire screen strainer for pump protection. An AC motor is standard, DC optional.

### Features

The OF7 is ideal for maintaining construction and agricultural machinery, off-highway vehicles and trucks. It is equally useful for servicing a wide variety of industrial equipment.

The standard OF7 incorporates a highly efficient Betamicon® spin-on filter element with a 10 µm absolute rating. Elements with other ratings are available. Other features of the unit include:

- Relief valve in housing.
- Static pressure gauge clogging indicator.
- Element easily replaced with strap wrench.

The OF7S90 high viscosity unit features a motor with higher power, a size 180 spin-on element as well as a special frame adapted to the larger component sizes.

### Applications

The portable OF7 filtration unit is a compact filter/pump device used for transferring and filtering hydraulic fluids. It can be used for:

- Removing water from oil
- Changing oil in hydraulic systems.
- Filling hydraulic systems with filtered oil.
- Off-line filtration of hydraulic systems with inadequate filtering capacity.
- Flushing of small hydraulic systems

### Multi-Pass Filtration Efficiency Ratings for Betamicon® Elements (to ISO 4572)

- Beta Ratios for differential pressures above the indicator trip pressure are shown to demonstrate particle removal at high differential pressures.
- Beta Ratios for many competitive elements drastically deteriorate at high differential pressure.

### Betamicon® BN Beta Ratio Data

Betamicon Media	Absolute Rating	Terminal ΔP Across Filter Element
03 BN	$\beta_3 \geq 200$	43 psi
05 BN	$\beta_5 \geq 200$	43 psi
10 BN	$\beta_{10} \geq 200$	43 psi
20 BN	$\beta_{20} \geq 200$	43 psi

### Technical Specifications

Recommended Fluid	Petroleum based oils. (Contact HYDAC for other applications.)
Nominal Flow OF7S10 OF7S90 OF7CM	4gpm / 15 l/min 4gpm / 15 l/min 2.5 gpm / 10 l/min
Maximum Oil Temperature	180°F / 80°C
Viscosity Range OF7S10 OF7S90 OF7CM	20-1600 SUS / 5-350 cSt 70-4600 SUS / 15-1000cSt 20-900 SUS / 5-200cSt
Max. Operating Pressure	50 psi / 3.5 bar
Weight	27.5 lb / 12.5 kg
Electrical Motor	110 VAC (0.25 HP / 0.18 KW) or 24 VDC (0.27HP / 0.20KW)

## Model Code

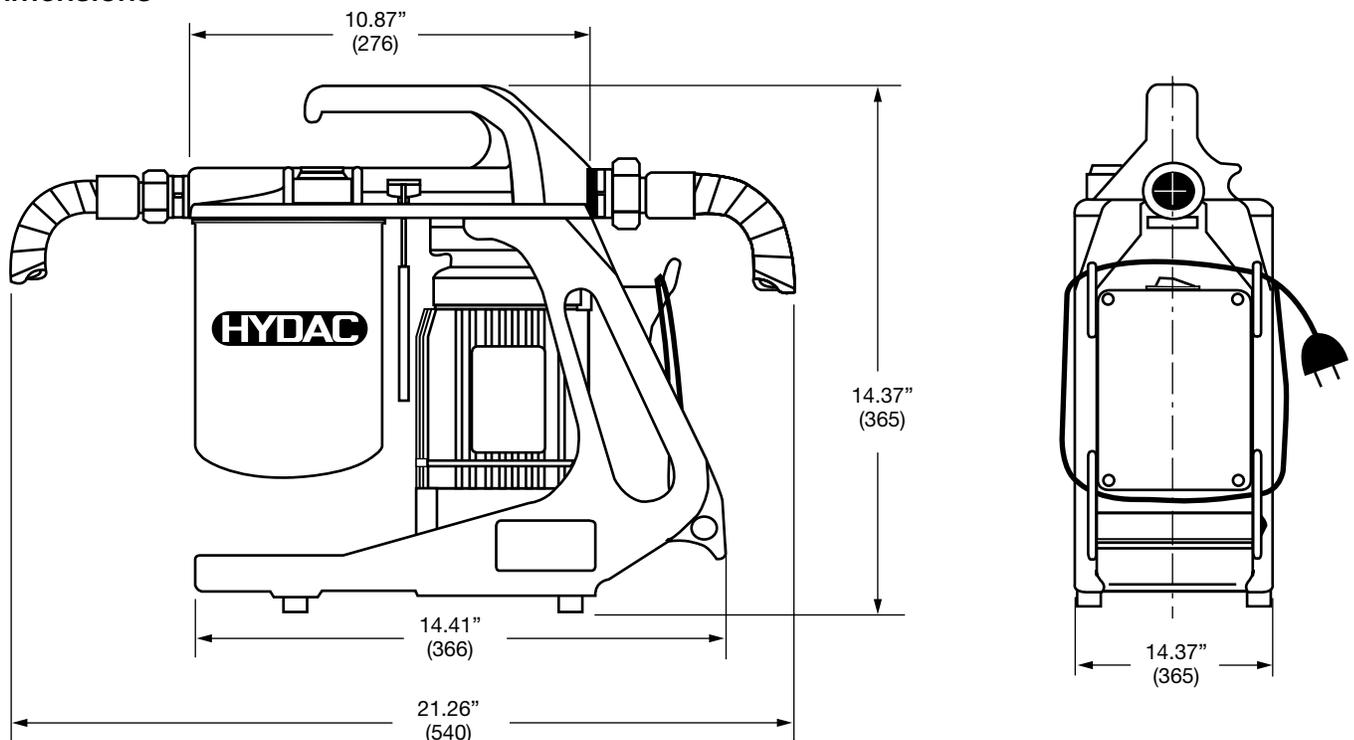
**OF7 S 10 P 1 K 1 B 10 E -**

<b>Series</b>	OF7 = Hand Held Portable Filter	
<b>Type</b>	S = standard	CM = Standard with fluid condition monitoring
<b>Code</b>	10 = standard 90 = High Viscosity Option (only for OF7S type)	
<b>Seals</b>	P = Nitrile (NBR) (standard)	
<b>Pump</b>	1 = Vane Pump (standard) 2 = Pump for OF7S90 and OF7CM options	
<b>Electric Motor Voltage</b>	K = 110 VAC, 60 Hz (standard) AE60 = 120V / 60Hz / single phase (OF7S90 option only) M = 220V / 60Hz / single phase N = 440V / 60Hz / 3 phase U = 24 VDC D = pneumatic motor	
<b>Spin-on Filter Element Size</b>	1 = Size 0160 2 = Size 0180 (OF7S90 option only)	
<b>Filter Element Material</b>	B = Betamicon® Low Collapse	P = Paper      A = Water Removal
<b>Filtration Rating (microns)</b>	03 } BN - Absolute Filtration 05 } 10 } 20 } 10 } P - Nominal Filtration 10 } W - Water Removal	
<b>Type of Clogging Indicator</b>	E = Pressure Gauge	
<b>Options</b>	C1 = with Contamination Sensor (only for OF7CM unit)	

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.*

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## OFCD-BC Series

### Compact Dual Stage Filtration System Basic Cart



### Description

The HYDAC Basic Cart Mobile Filter System is a compact, self-contained, “light-duty” filtration system equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly, conveniently and economically. It is perfect for cleaning up existing systems as well as for pre-filtering new fluids, since new fluids often have contamination levels significantly higher than that recommended for most hydraulic systems.

The filtration system’s compact, lightweight design with replaceable element cartridge and reusable bowl, minimizes landfill waste. Element service is easily accomplished through the top-ported filter housings. The OFCD-BC includes a drip pan to help catch any oil before it falls to the ground. The dual filter assembly allows for water and particulate removal or staged particulate contamination removal.

### Features

- Compact size, easily transported
- Top-ported filter provides easy element service
- Bar-type Dirt Alarm® indicates when filter elements require a change
- Hoses and connection tubes included
- Drip pan catches oil before it falls to the ground

### Applications

- Supplementing continuous filtration by system filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from storage tanks and drums to system reservoirs

### Technical Specifications

Flow Rating:	10 gpm (37.9- L/min) max
Maximum Viscosity:	1000 SUS (216 cSt)
Hose Pressure Rating:	30 psig (2.0 bar) @ 150°F (65.6°C) Full vacuum @ 150°F (65.6°C)
Fluid Temperature:	25°F to 150°F (-4°C to 65°C)
Bypass Valve Setting:	Cracking: 25 psi (1.7 bar)
Material:	Element Case: Aluminum
Seal Material:	Buna N
Compatibility:	All petroleum based hydraulic fluid. Contact factory for use with other fluids
Motor:	115 VAC Single phase 1 hp
Weight:	102 lbs. (46.3 kg)

### Replacement Elements

Model Code	Part No.
ELEMENT OFCDBC 003	02099361
ELEMENT OFCDBC 005	02099362
ELEMENT OFCDBC 010	02099363
ELEMENT OFCDBC 020	02099364
ELEMENT OFCDBC AM	02099365

## Model Code

**OFCD-BC - 1 - 09 MX10 - MX05 - B - 10**

### Series

OFCD-BC = Compact Dual Stage Filter System Basic Cart

### Number of Elements

1 = One 9" element per housing

### Element Length

09 = One 9" element supplied per housing

### Element Size (BN only - AM has no rating) (microns)

MX03, MX05, MX10, MX25 = Betamicon® Absolute Filtration Rating ( $\beta_x(c) \geq 1000$ )

MXAM\* = Aquamicon® Water Removal

### Element Size (BN only - AM has no rating) (microns)

MX03, MX05, MX10, MX25 = Betamicon® Absolute Filtration Rating ( $\beta_x(c) \geq 1000$ )

MXAM\* = Aquamicon® Water Removal

### Seals

B = Buna

### Pump

10 = 10 gpm

### Voltage

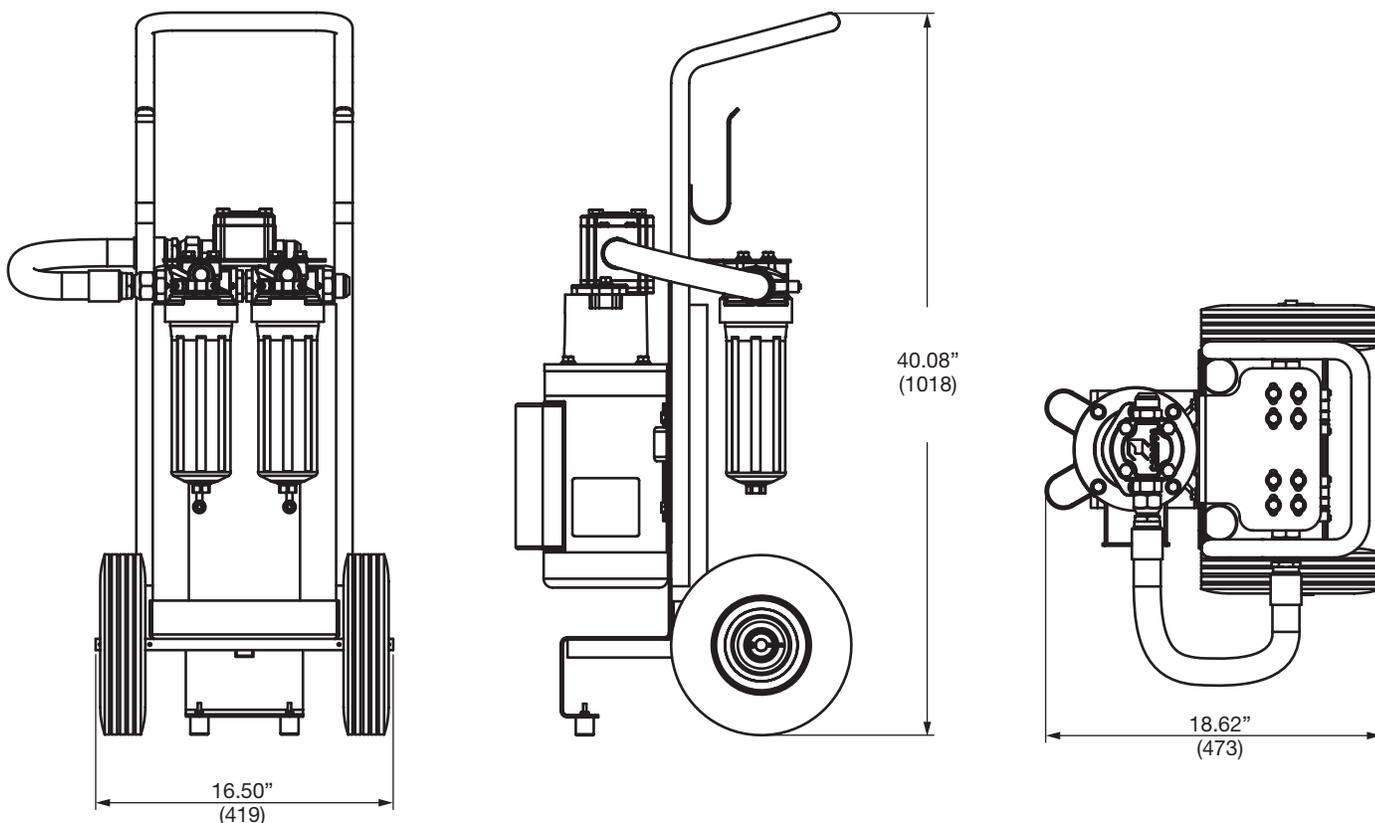
(Omit) = 115 VAC 60 Hz

A = 230 VAC 60 Hz

B = 230 VAC 50 Hz (flow rate reduced to 8gpm; no plug supplied)

\*Aquamicon media should be in the first filter housing followed by the BN media in the second housing.

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

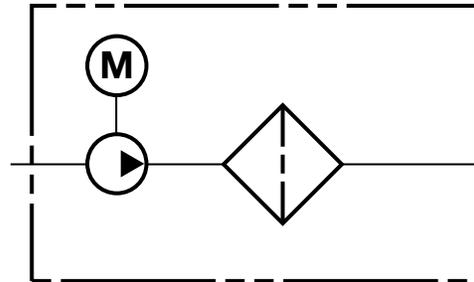
# OFFLINE FILTRATION SYSTEMS

## OFCS & OFCD Series

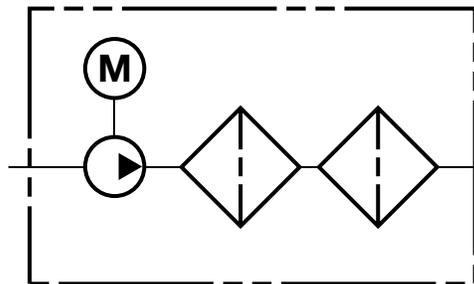
Single & Dual Stage Filtration Systems



### Hydraulic Schematics OFCS Series



### OFCD Series



### Description

The OFCS and OFCD Series are compact, self-contained filtration system equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly, conveniently and economically. It is perfect for cleaning up existing systems as well as for prefiltering new fluids, since new fluids often have contamination levels significantly higher than that recommended for most hydraulic systems.

The most attractive feature of the new OFCS and OFCD Series is the significant reduction in noise, being reduced from 91 decibels to 72 decibels at full load. Additional improvements include a modular base that eliminates hoses and fittings between components, a drip pan, and easier element servicing.

The OFCS single filtration unit can remove either water or particulate contamination. The OFCD dual filtration unit can be used to remove both water and particulate contamination, or for staged particulate contaminant removal.

### Features

- Modular base eliminates hoses between components and minimizes leakage
- Base-ported filter provides easy element service from the top cap
- Cleans up oil faster – 7 gpm and 14 gpm models available
- Ten-foot hose and extension tubes included  
Viton® available (1" dia. for 7 gpm; 1.25" dia. for 14 gpm)
- Drip pan catches oil before it falls to the ground
- Integral suction strainer protects pump
- Off-line stationary system available

### Applications

- Supplementing continuous filtration by system filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from storage tanks and drums to system reservoirs

### Technical Specifications

Flow Rating	7 gpm max or 14 gpm max	
Maximum Viscosity	1000 SUS (216 cSt) Higher viscosity version available.	
Hose Pressure Rating	30 psig (2.0 bar) @ 150°F (65.6°C) Full vacuum @ 150°F (65.6°C)	
Maximum Operating Temperature	-20° to 150°F (-29° to 65°C)	
Bypass Valve Setting	Cracking: 30 psi (2 bar)	
Material	Manifold and cap: Cast aluminum Element case: Steel	
Compatibility	All petroleum based hydraulic fluid. Contact factory for use with other fluids.	
Motor	115 V AC Single phase 3/4 hp (7 gpm) or 1-1/2 hp (14 gpm)	
Weight - lbs (kg)	OFCS	OFCD
7 gpm	190 (86)	220 (100)
14 gpm	197 (89)	227 (103)

## Model Code

**OFCD - 27 - BN 10 - BN 10 - B - 14 - A - G2187**

### Series

- OFCS = Single Filter System
- OFCD = Dual Filter System

### Pneumatic Option

- (omit) = Electric motor (standard)
- P** = **Pneumatic motor only**

### Element Length

- 1-09 = One 9" Element Supplied
- 2-09 = Two 9" Elements Supplied (must be same micron rating)
- 3-09 = Three 9" Elements Supplied (must be same micron rating)
- 18 = One 18" Element Supplied
- 27 = One 27" Elements supplied

### Filter Media

- BN = Betamicron® Low Collapse
- AM\* = Aquamicron® Water Removal
- G = Betamicron GeoSeal®

### Filtration Rating (BN only - AM has no rating) (microns)

- 3 } Betamicron® (BN/HC)
- 5 } Absolute Filtration Rating
- 10 } ( $\beta_{x(c)} \geq 1000$ )
- 20 }

### Filter Media (OFCD only)

- BN = Betamicron® Low Collapse
- AM\* = Aquamicron® Water Removal
- G = Betamicron GeoSeal®

### Filtration Rating (BN only - AM has no rating) (microns) (OFCD only)

- 3 } Betamicron® (BN/HC)
- 5 } Absolute Filtration Rating
- 10 } ( $\beta_{x(c)} \geq 1000$ )
- 20 }

### Seals

- B = Buna N
- V = FPM

### Pump Size

- 07 = 7 gpm
- 14 = 14 gpm

### Voltage

- (omit) = 115 VAC 60HZ
- A = 230 VAC 60HZ
- B = 460 VAC 60HZ/3PH
- C = 230 VAC 50HZ

### Options (High Viscosity Options Available)

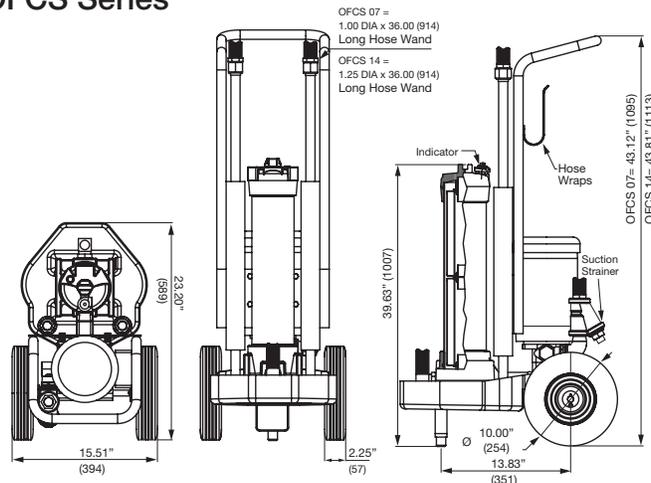
- G2185 = for 14 gpm unit; up to 2500 SUS fluids; flow reduced to ~10 gpm
- G2187 = for 7 gpm unit; up to 2500 SUS fluids; flow reduced to ~3 gpm
- PC = Hytrax Contamination Monitoring Unit (will work with G2185 option for oils up to 2500SUS)

\*Aquamicron media should be in the first filter housing followed by the BN media in the second housing.

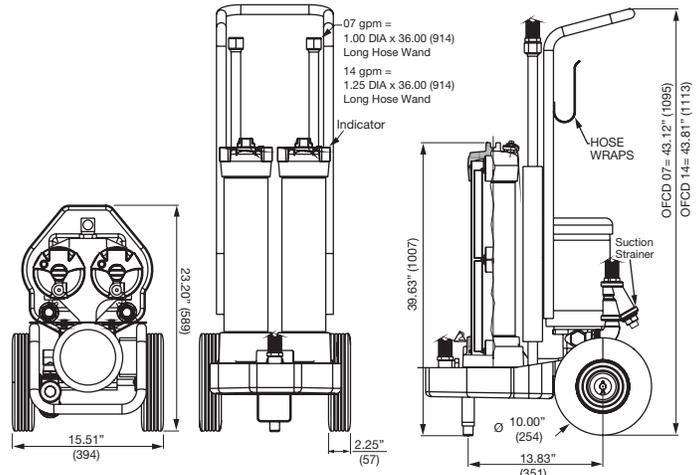
For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items - Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## Dimensions OFCS Series



## OFCD Series



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

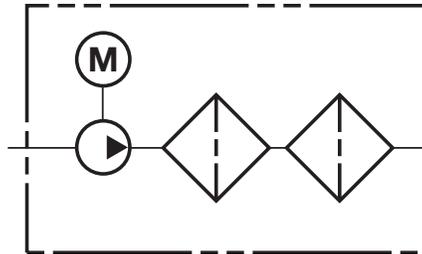
# OFFLINE FILTRATION SYSTEMS

## OFCD-MV Series

Compact Dual Stage Filtration System up to 5,000 SUS



### Hydraulic Schematic



### Description

HYDAC's newest addition to the portable filtration carts offers the user the ability to filter up to 5,000 SUS fluids.

The OFCD-MV is a compact, self-contained filtration system equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly, conveniently and economically. It is perfect for cleaning up existing systems as well as for prefiltering new fluids, since new fluids often have contamination levels significantly higher than that recommended for most hydraulic systems.

The OFCD-MV dual filtration unit can be used to remove both water and particulate contamination or for staged particulate contamination removal.

### Features

- Ability to filter fluids having a viscosity up to 5,000 SUS
- Top-ported filter provides easy element service
- Ten-foot hose and extension tubes included
- 18-inch housing is standard

### Applications

- Supplementing continuous filtration by the system's filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from storage tanks and drums to system reservoirs

### Technical Specifications

Flow Rating	up to 10 gpm
Maximum Viscosity	up to 5,000 SUS
Hose Pressure Rating	30 psig (2.0 bar) @ 150°F (65°C) Full vacuum @ 150°F (65°C)
Maximum Operating Temperature	-20° to 150°F (-29° to 65°C)
Bypass Valve Setting	Cracking: 30 psi (2 bar)
Material	Manifold and Cap: Cast Aluminum Element case: Steel
Compatibility	All petroleum based hydraulic fluid. Contact factory for use with other fluids
Motor	1.0HP 110VAC/60HZ TEFC (6gpm) 1.5HP 110VAC/60HZ (10gpm)

## Model Code

**OFCD - 18 - G 10 - G 10 - V - 6**

### Series

OFCD = Dual Filter System

### Element Length

18 = One 18" element supplied per housing  
 27 = One 27" elements supplied per housing

### Filter Media

G = Betamicon GeoSeal®  
 GAM\* = Aquamicon® Water Removal

### Filtration Rating (G only - GAM has no rating) (microns)

3 } Betamicon® (BN/HC)  
 5 } Absolute Filtration Rating  
 10 } ( $\beta_{x(c)} \geq 1000$ )  
 20 }

### Filter Media

G = Betamicon GeoSeal®  
 GAM\* = Aquamicon® Water Removal

### Filtration Rating (G only - GAM has no rating) (microns)

3 } Betamicon® (BN/HC)  
 5 } Absolute Filtration Rating  
 10 } ( $\beta_{x(c)} \geq 1000$ )  
 20 }

### Seals

V = FPM

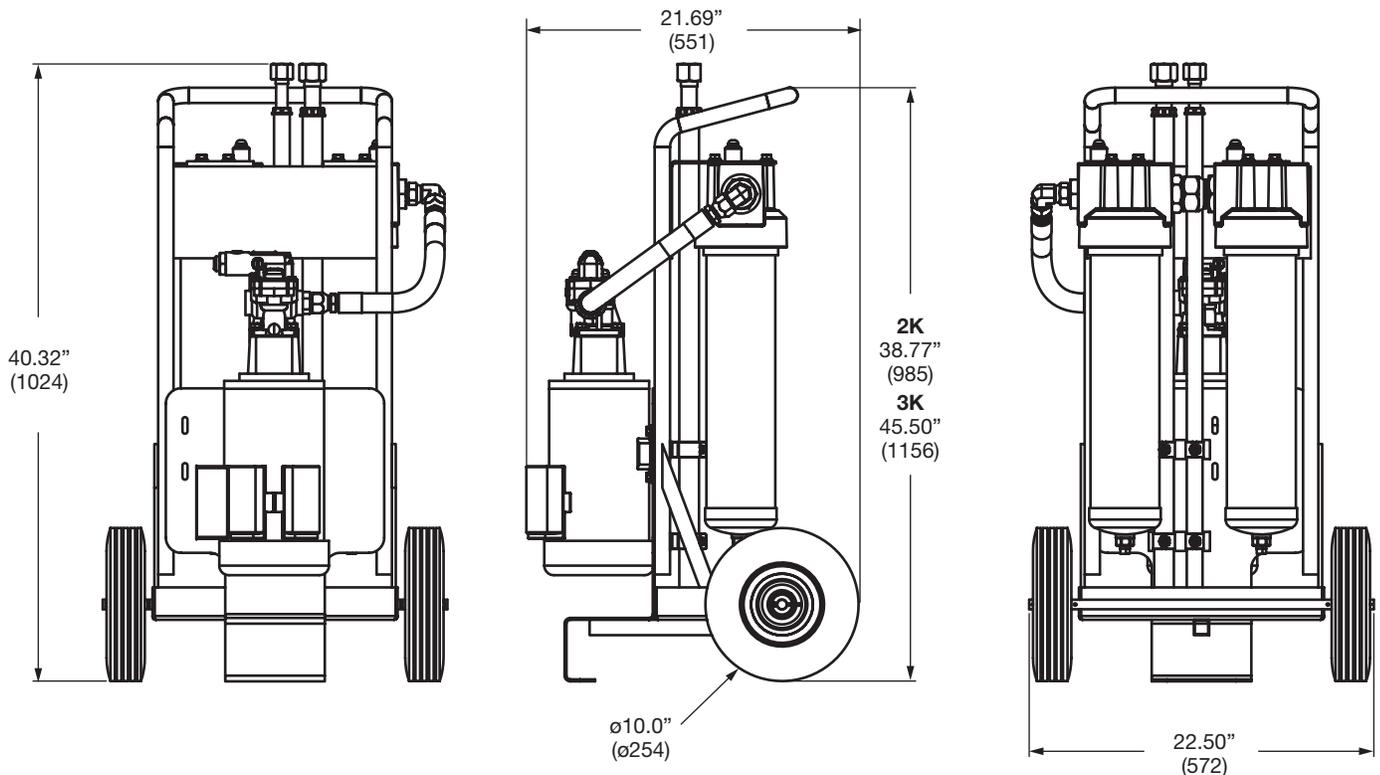
### Pump Size (gpm)

6 = 6 gpm  
 10 = 10 gpm

\*Aquamicon media should be in the first filter housing followed by the Betamicon media in the second housing. For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## Dimensions



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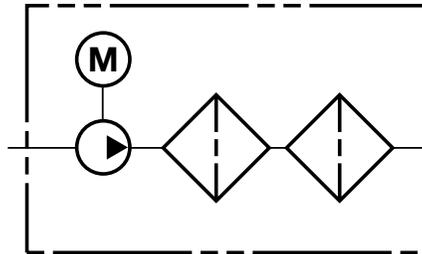
# OFFLINE FILTRATION SYSTEMS

## OFCD-HV Series

Compact Dual Stage Filtration System for High Viscosity



Hydraulic Schematic



### Description

A portable filtration cart that offers the user the ability to filter high viscosity fluids.

The OFCD-HV is a compact, self-contained filtration system equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly, conveniently and economically. It is perfect for cleaning up existing systems as well as for prefiltering new fluids, since new fluids often have contamination levels significantly higher than that recommended for most hydraulic systems.

The OFCD-HV dual filtration unit can be used to remove both water and particulate contamination or for staged particulate contamination removal. Additional features include a modular base that eliminates hoses and fittings between components, a drip pan and easier element servicing.

### Features

- An integrated lifting eye option for lifting the OFCD-HV
- Ability to filter fluids having a viscosity up to 15,000 SUS
- Base-ported filter provides easy element service from the top cap
- Ten-foot hose and extension tubes included
- Dip pan catches oil before it falls to the ground

### Applications

- Cleaning high viscosity fluids used in Wind applications
- Supplementing continuous filtration by the system's filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from storage tanks and drums to system reservoirs

### Technical Specifications

Flow Rating	Maximum 3 gpm
Maximum Viscosity	15,000 SUS
Hose Pressure Rating	30 psig (2.0 bar) @ 150°F (65°C) Full vacuum @ 150°F (65°C)
Maximum Operating Temperature	-20° to 150°F (-29° to 65°C)
Bypass Valve Setting	Cracking: 40 psi (2.8 bar)
Material	Manifold and Cap: Cast Aluminum Element case: Steel
Compatibility	All petroleum based hydraulic fluid. Contact factory for use with other fluids
Motor	115V AC Single phase, 1.5 HP

## Model Code

**OFCD - 27 - BN 10 - BN 10 - B - G2502**

### Series

OFCD = Dual Filter System

### Element Length

18 = One 18" element supplied per housing  
 27 = One 27" elements supplied per housing

### Filter Media

BN = Betamicon® Low Collapse  
 AM\* = Aquamicon® Water Removal

### Filtration Rating (BN only - AM has no rating) (microns)

3 } Betamicon® (BN/HC)  
 5 } Absolute Filtration Rating  
 10 } ( $\beta_{x(c)} \geq 1000$ )  
 20 }

### Filter Media

BN = Betamicon® Low Collapse  
 AM\* = Aquamicon® Water Removal

### Filtration Rating (BN only - AM has no rating) (microns)

3 } Betamicon® (BN/HC)  
 5 } Absolute Filtration Rating  
 10 } ( $\beta_{x(c)} \geq 1000$ )  
 20 }

### Seals

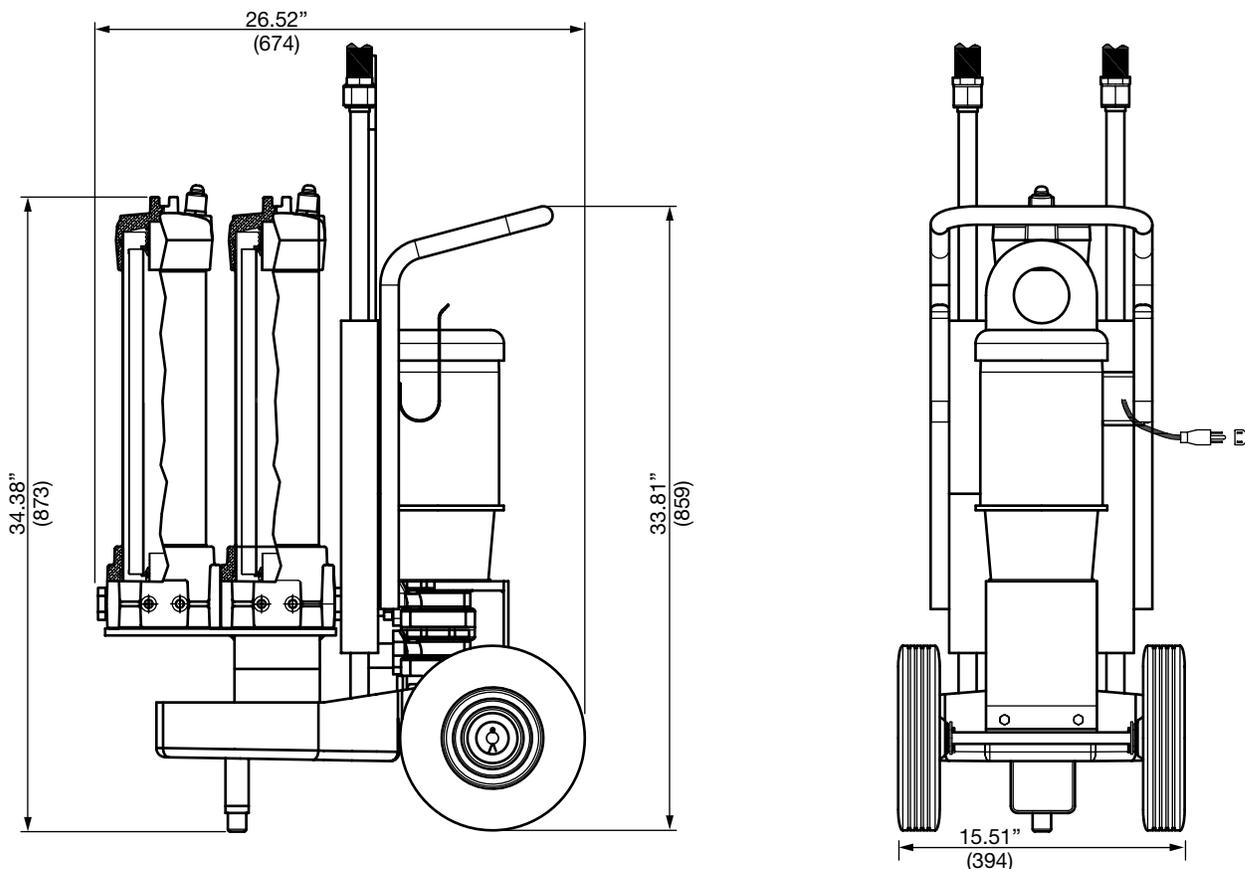
B = Buna N  
 V = FPM

### Options

G2502 = for fluids up to 15,000 SUS at 3 gpm  
 G2538 = for fluids up to 15,000 SUS at 3 gpm, integrated, balanced lifting eye

\*Aquamicon media should be in the first filter housing followed by the BN media in the second housing.  
 For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## OFS Series

### Filtration Station



### Description

The HYDAC Filtration System (OFS) is capable of flushing, filtering, and monitoring ISO cleanliness with user-defined, automatic features. **The OFS is designed to transfer fluid through two filters in series for staged particulate or water/particulate removal.** Both filters are top-loading and include element indicators in the cap. A particle monitor reads samples from the pump discharge and displays ISO contamination codes on the control panel. The monitor allows the user to input the desired ISO cleanliness codes for the fluid. In auto mode, the system will run until the cleanliness codes are reached. Upon reaching the codes, the pump will stop and the cycle complete light will come on. When in manual mode, the system will run continuously and display the ISO codes. A water sensor is included for providing the water saturation of the fluid, both displayed on the control panel.

### Features

- Real time monitoring of ISO cleanliness classes
- Automatic shutdown when user defined ISO codes are reached
- USB port allows the ISO code data to be downloaded for further processing and/or printing
- 30 mesh suction strainer and 230 micron filter and included to protect the particle monitor from clogging
- The AS1000 allows real-time water saturation and temperature values of the fluid to be displayed
- Bypass valve so cart can be used as a transfer cart
- Single lift point
- Plastic removable drip pan

### Applications

- **In-Plant Service** – Filter to desired cleanliness levels and extend component life
- **Mobile Dealer Networks** – Aid in certified re-builds, service maintenance contracts and total maintenance & repair programs
- **Original Equipment Manufacturer** – Filter to required roll-off cleanliness levels
- **Lubricant Reclamation/Recycling** – Clean oil to extend oil life and reduce hazardous waste

### Technical Specifications

Flow Rating	9 gpm (AC option); 3-8 gpm (DC option)
Motor	1 1/2 HP, 115/220VAC motor (AC option) 1 HP, 90 V DC variable speed (DC option)
Viscosity	1000 SUS (230cSt)
Operating Temperature	-20° F to 150° F (-29° C to 65° C)
Bypass Valve Setting	Cracking: 30 psi (2 bar) x 2
Compatibility	All petroleum based hydraulic fluid. (Contact factory for use with other fluids.)
Element Change Clearance	18" or 27" (depending on model configuration)
Weight	245 lbs (112 kg)

## Model Code

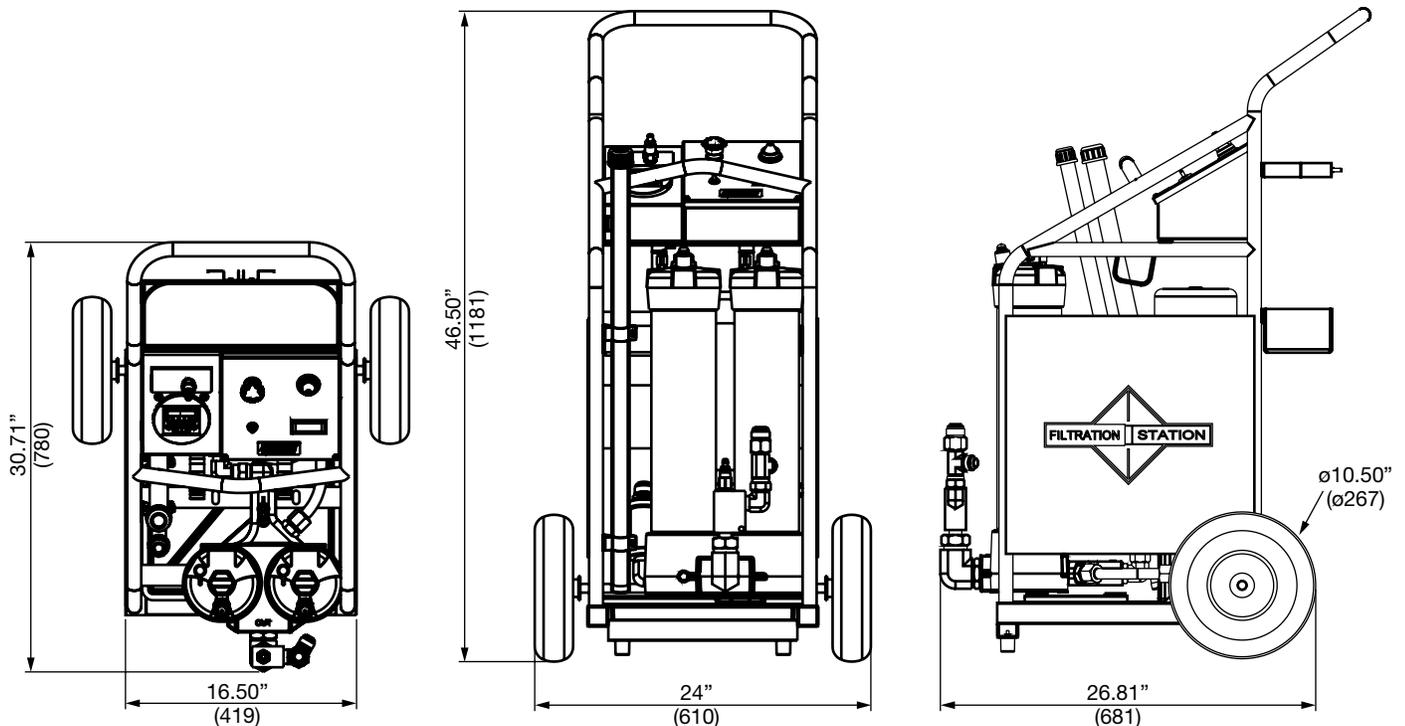
OFS - A - 1 - 27 - BN - 10 - BN - 01 - V - 9 - W

<b>Series</b>	OFS	=	Filtration Station
<b>Voltage</b>	A	=	120VAC 60 Hz
	B	=	220 VAC 60 Hz
	C	=	220 VAC 50 Hz
	<i>(A plug is not provided for these options.)</i>		
<b>Number of Elements</b>	<i>(18" and 27" housings only)</i>		
	1	=	Element length must be either 18" or 27"
	2	=	Two 9" elements per 18" housing
	3	=	Three 9" elements per 27" housing
<b>Element Length</b>	<i>(18" and 27" housings only)</i>		
	09	=	Two 9" elements per 18" housing Three 9" elements per 27" housing
	18	=	One 18" element per 18" housing
	27	=	One 27" element per 27" housing
<b>Element Media</b>	BN	=	Betamicon®
	AM*	=	Aquamicon®
<b>Filtration Rating</b>	<i>(BN only - AM has no rating) (microns)</i>		
	01, 03, 05, 10, 25		
<b>Element Media</b>	BN	=	Betamicon®
	AM*	=	Aquamicon®
<b>Filtration Rating</b>	<i>(BN only - AM has no rating) (microns)</i>		
	01, 03, 05, 10, 25		
<b>Seals</b>	V	=	Fluoroelastomer (FPM)
	B	=	Buna N
<b>Pump Size</b>	<i>(gpm)</i>		
	9	=	Gear Pump, 9 gpm
	DC	=	Variable Drive, 3 to 8 gpm
<b>Options</b>	W	=	AS1000 Water Sensor <i>(standard on all units)</i>

\*Aquamicon media should be in the first filter housing followed by the BN media in the second housing.  
For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items - Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability*

## Dimensions



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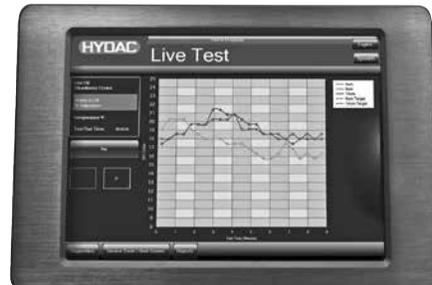
# OFFLINE FILTRATION SYSTEMS

## OFS-AM Series

Filtration Station for Asset Management



### Asset Management



- Real Time data displays cleanliness and water saturation
- Selectable ISO target levels
- Only 3 entry fields needed to start the system and record data

### Description

The Offline Filtration Station for Asset Management (OFS-AM) is a complete fluid management system designed to manage fluid cleanliness, so that the greatest return of that asset is achieved. The OFS-AM is an all-in one system that monitors your fluid condition, filters out contaminants and tracks all the necessary data needed for trend analysis and record keeping by asset number or name. The on-board ruggedized PC records the ISO code and water saturation level, provides a graphical display of the data in real time and shuts down when the selected cleanliness level is reached. Each asset file created automatically is separately labeled and summarized to quickly inform maintenance on the condition of the fluid, and each run of the fluid is logged by date and time, providing a complete history of the equipment's fluid.

### Features

- Complete tracking of hydraulic fluid conditions by equipment name
- Provides automatic record-keeping, trending and analysis of the fluid
- Ideal for managing multiple equipment assets
- Automatically shuts down when the selected ISO cleanliness is reached
- Dual staged filters for both water and/or particulate contamination removal
- Bypass valve allows cart to be used as a transfer cart

### Applications

- **In-Plant Service** – Filter to desired cleanliness levels and extend component life
- **Mobile Dealer Networks** – Aid in certified re-builds, service maintenance contracts and total maintenance & repair programs

### Technical Specifications

Flow Rating	5 gpm (19 L/min)
Motor	1.5 HP - 15 FLA at 120 volts AC
Viscosity	up to 1000 SUS (216 cSt)
Operating Temp.	-20°F to 150°F (-29°C to 65°C)
Bypass Valve Setting	Cracking: 30 psi (2 bar) x 2
Compatibility	All petroleum based hydraulic fluid compatible with Viton®
Weight	200 lbs (kg) approx.
Dimensions	26.6" x 25.25" x 50.0"(675 x 641 x 1270 mm)

## Model Code

**OFS-AM - 1 - 18 G10 - G05**

### Series

OFS-AM = Filtration Station for Asset Management

### Number of Elements

1 = Element length must be either 18" or 27"

### Element Length

18 = One 18" element supplied per housing  
27 = One 27" element supplied per housing

### Element Size (BN only - AM has no rating) (microns)

G03, G05, G10 = Betamicon® Absolute Filtration Rating ( $\beta_{x(c)} \geq 1000$ )

GAM\* = Aquamicon® Water Removal

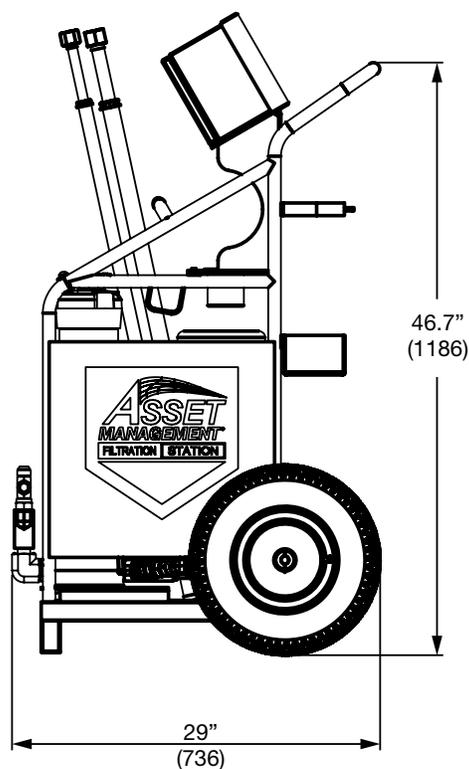
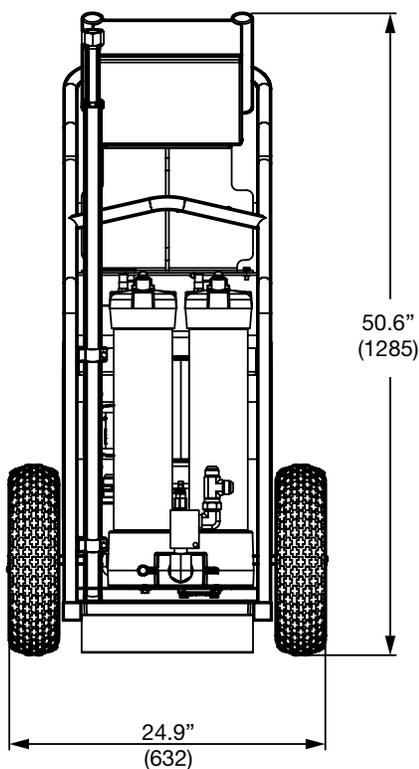
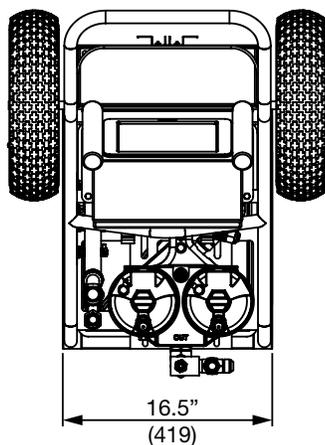
### Element Size (BN only - AM has no rating) (microns)

G03, G05, G10 = Betamicon® Absolute Filtration Rating ( $\beta_{x(c)} \geq 1000$ )

GAM\* = Aquamicon® Water Removal

\*Aquamicon media should be in the first filter housing followed by the BN media in the second housing.  
For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## OF5HS & OF5HD Series

Single & Dual Stage Kidney Loop Systems



OF5HD



OF5HS

### Description

HYDAC's off-line Kidney Loop System is a stationary version of the Mobile Filtration System. It is a compact, self-contained filtration system equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly, conveniently and economically. This off-line system can be used to supplement in-line filters when adequate turnover cannot be achieved in the system. It is also ideal for water removal. Like the Mobile Filtration System, the new OF5H Series operates at a surprisingly low noise level. Its modular base eliminates hoses and fittings between components. The OF5HS single filtration unit can remove either water or particulate contamination. The OF5HD dual filtration unit can be used to remove both water and particulate contamination, or for staged particulate contaminant removal.

### Features

- Modular base eliminates connections between components and minimizes leakage
- Base-ported filter provides easy element service from the top cap
- Single, double and triple bowl length option allows the flexibility of additional dirt-holding capacity
- Visual Dirt Alarm® indicates when filter element needs to be changed
- Two 7/16 – 20 UNF sampling port included on all models

### Applications

- Supplementing in-line filtration by system filters when adequate turnover cannot be attained
- Large volume systems requiring multiple filters in different locations
- Cleaning up a hydraulic system following component replacement
- Ideal location for water removal

### Technical Specifications

Flow Rating	7 gpm max or 14 gpm max
Maximum Viscosity	1000 SUS (216 cSt) Higher viscosity version available.
Maximum Operating Temperature	-20° to 150°F (-29° to 65°C)
Bypass Valve Setting	Cracking: 30 psi (2 bar)
Material	Manifold and cap: Cast aluminum Element case: Steel
Compatibility	All petroleum based hydraulic fluid. Contact factory for use with other fluids.
Motor	115 V AC Single phase 3/4 hp (7 gpm) or 1-1/2 hp (14 gpm)
Weight	OF5HS-1: 101 lb (45.9 kg) OF5HS-2: 112 lb (50.9 kg) OF5HS-3: 123 lb (55.9 kg) OF5HD-1: 117 lb (53.2 kg) OF5HD-2: 139 lb (63.2 kg) OF5HD-3: 161 lb (73.2 kg)

## Model Code

OF5HD - 27 - BN 10 - BN 10 - B - 14 -

### Series

- OF5HS = Single Filter System
- OF5HD = Dual Filter System

### Element Length

- 1-09 = One 9" Element Supplied
- 2-09 = Two 9" Elements Supplied (*must be same micron rating*)
- 3-09 = Three 9" Elements Supplied (*must be same micron rating*)
- 18 = One 18" Element Supplied
- 27 = One 27" Element supplied

### Element Media

- BN = Betamicon®
- AM\* = Aquamicon®
- G = Betamicon GeoSeal®

### Filtration Rating (BN only - AM has no rating) (microns)

3, 5, 10, 25

### Element Media (OF5HD only)

- BN = Betamicon®
- AM\* = Aquamicon®
- G = Betamicon GeoSeal®

### Filtration Rating (BN only - AM has no rating) (microns)

3, 5, 10, 25

### Seals

- B = Buna N
- V = FPM

### Pump Size

- 07 = 7 gpm
- 14 = 14 gpm

### Options (High Viscosity Options Available)

- G2185 = for 14 gpm unit; up to 2500 SUS fluids; flow reduced to ~10 gpm
- G2187 = for 7 gpm unit; up to 2500 SUS fluids; flow reduced to ~3 gpm

NOTE: Contact factory if EPR seals are required.

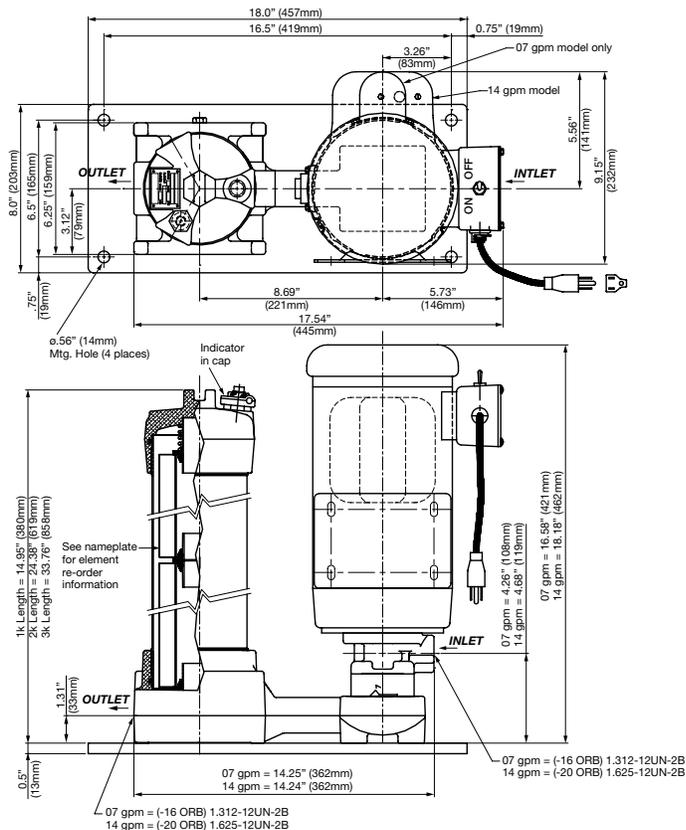
\*Aquamicon media should be in the first filter housing followed by the BN media in the second housing.

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

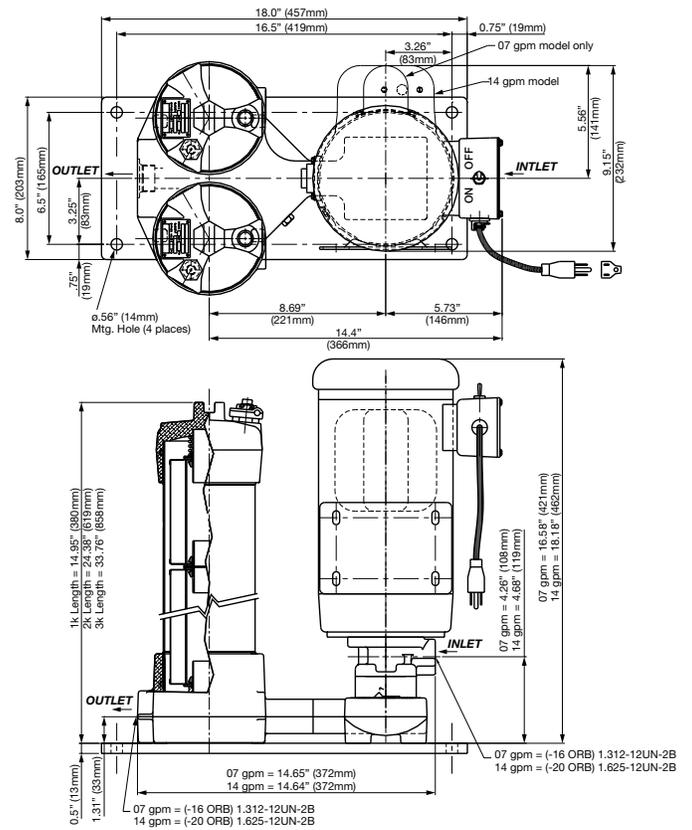
*Model Codes Containing RED are non-standard items - Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.*

## Dimensions

### OF5HS



### OF5HD



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

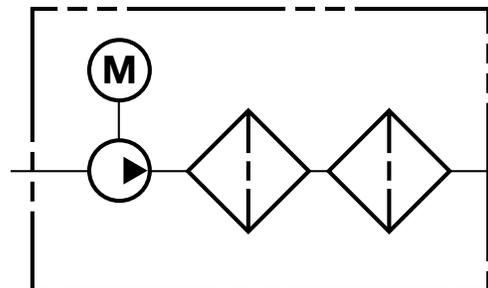
# OFFLINE FILTRATION SYSTEMS

## OF5HD-HV Framed Series

Compact Dual Stage Filtration System for High Viscosity



### Hydraulic Schematic



### Description

HYDAC's newest addition to the off-line kidney loop family offers the user the ability to filter high viscosity fluids - up to 15,000 SUS.

The OF5HD-HV is a compact, self-contained filtration system equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly, conveniently and economically. It is perfect for cleaning up existing systems as well as for prefiltering new fluids, since new fluids often have contamination levels significantly higher than that recommended for most hydraulic systems.

The OF5HD-HV dual filtration unit can be used to remove both water and particulate contamination or for staged particulate contamination removal. Additional features include a modular base that eliminates hoses and fittings between components with easy to change element design.

### Features

- Rugged, protective frame with integrated lifting eyes for lifting the filter skid via crane or hoist
- Ability to filter fluids having a viscosity up to 15,000 SUS
- Modular base eliminates hoses between components and minimizes leakage
- Base-ported filter provides easy element service from the top cap
- 18-inch housing is standard

### Applications

- Compact design in protective frame allows for easy transport up tower in Wind applications
- Supplementing continuous filtration by the system's filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from storage tanks and drums to system reservoirs

### Technical Specifications

Flow Rating	Maximum 3 gpm
Maximum Viscosity	15,000 SUS (2150 cSt)
Maximum Operating Temperature	-20° to 150°F (-29° to 65°C)
Bypass Valve Setting	Cracking: 40 psi (2.8 bar)
Material	Manifold and Cap: Cast Aluminum Element case: Steel Protective Frame: Tubular Steel
Compatibility	All petroleum based hydraulic fluid. Contact factory for use with other fluids
Motor	115V AC Single phase, 1.5 HP

## Model Code

**OF5HD - 18 - G10 - G05 - V - G2820**

### Series

OF5HD = Dual Filter System

### Element Length

18 = One 18" Element supplied per housing

### Element Size (BN only - AM has no rating) (microns)

G03, G05, G10 = Betamicon® Absolute Filtration Rating ( $\beta_{x(c)} \geq 1000$ )

GAM\* = Aquamicon® Water Removal

### Element Size (BN only - AM has no rating) (microns)

G03, G05, G10 = Betamicon® Absolute Filtration Rating ( $\beta_{x(c)} \geq 1000$ )

GAM\* = Aquamicon® Water Removal

### Seals

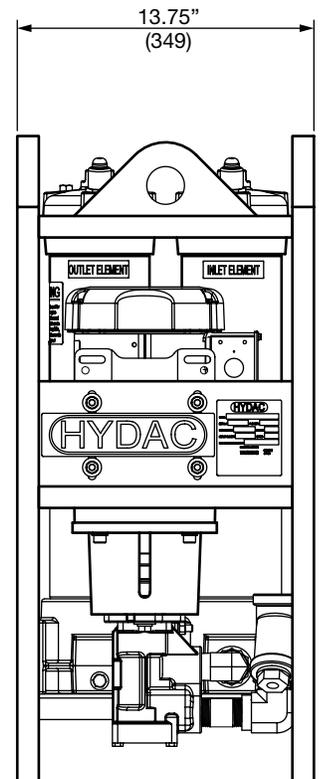
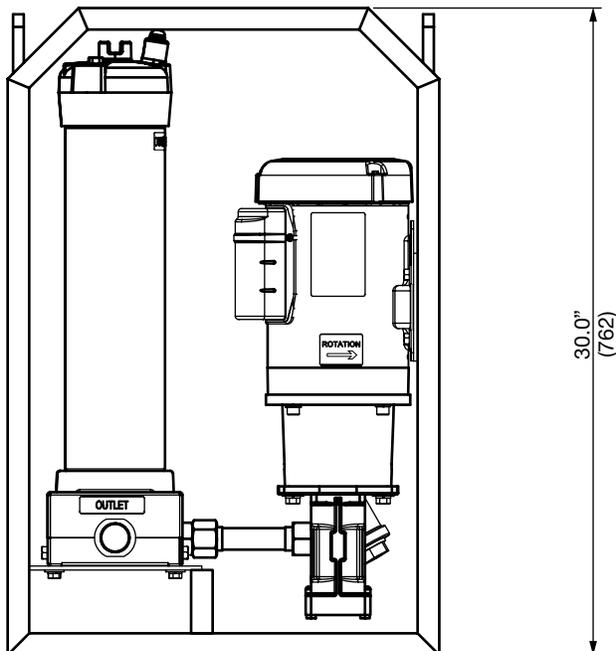
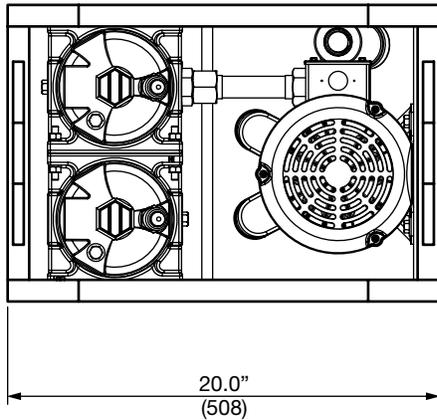
V = FPM

### Options

G2820 = High Viscosity Filter Skid with rugged protective frame

\*Aquamicon media should be in the first filter housing followed by the BN media in the second housing.  
For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## OFAS & OFAD Series

Single & Dual Stage Air-Operated Kidney Loop Systems



OFAS

### Description

HYDAC offers a kidney loop filtration system with a pneumatic motor in place of the standard electric motor. The pneumatic motor offers the same flow capability using the same components, but without the need for an electrical outlet. This provides a major advantage in the application of this unit. With no need for an electrical outlet, it is more portable than the standard electric-motored skids and carts.

Because most trucks and industrial machinery are already equipped with an air compressor, a simple connection to the 1/4" NPT port will easily power the 1.5 HP (or 4.0 HP) motor. At 70 psi, and 2000 rpm, this motor consumes less than 40 cfm (70 cfm for the 4.0HP motor) of compressed air. Because no electricity is used, the pneumatic motor is ideal for working in hazardous environments such as mines.

### Applications

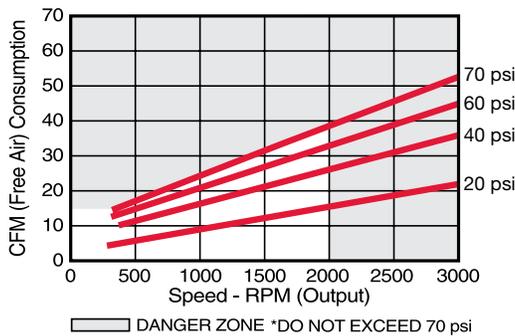
- Supplementing in-line filtration by system filters when adequate turnover cannot be attained
- Large volume systems requiring multiple filters in different locations
- Cleaning up a hydraulic system following component replacement
- Ideal location for water removal
- Field applications on service trucks

### Technical Specifications

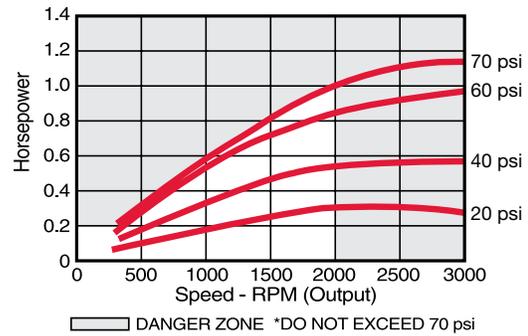
Flow Rating	7 gpm (26.5 L/min) max and 14 gpm (53.0 L/min) max
Maximum Viscosity	1000 SUS (216 cSt) Higher viscosity version available. Contact factory for details
Maximum Operating Temperature	-20° to 150°F (-29° to 65°C) For higher temperature applications contact factory.
Bypass Valve Setting	Cracking: 30 psi (2 bar)
Material	Manifold and cap: Cast aluminum Element case: Steel
Compatibility	All petroleum based hydraulic fluid. Contact factory for use with other fluids.
Element Change Clearance	9", 18" or 27" (depending on model configuration)

### Performance

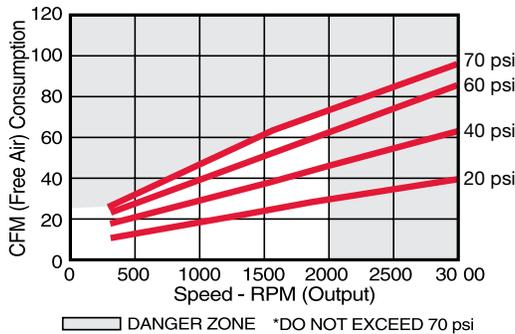
7 GPM AIR MOTOR  
Air Consumption vs. Speed



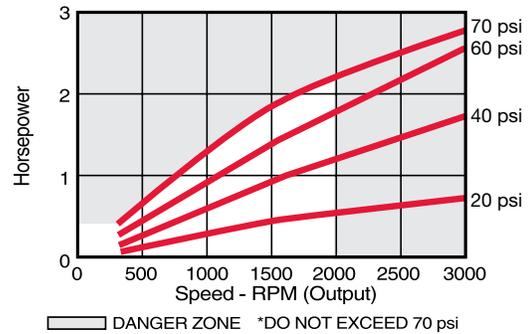
7 GPM AIR MOTOR  
Output vs. Speed



14 GPM AIR MOTOR  
Air Consumption vs. Speed



14 GPM AIR MOTOR  
Output Power vs. Speed



Note: Performance data represents a 4-vane model with no exhaust restriction.



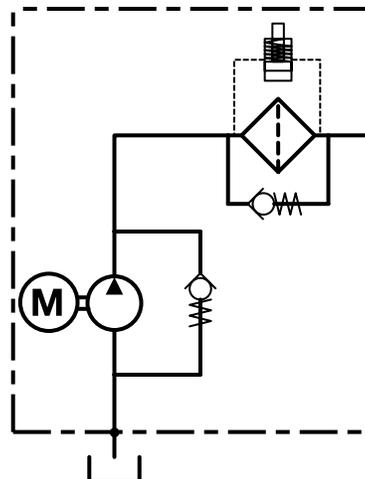
# OFFLINE FILTRATION SYSTEMS

## LSN Series

Lube Skid Kidney Loop Systems



### Hydraulic Schematic



### Description

HYDAC's new off-line filter system has been designed to be a modular system to fit most hydraulic, lubrication and fluid transfer applications as a kidney loop system. The LSN is a compact, stand-alone pump/motor/filter configuration for removing particulate contamination. This off-line system can be used to supplement in-line filters when adequate turnover cannot be achieved in the system.

### Features

- Modular hydraulic accessories
- Multiple filtration options (FLND, LPF, LF)
- Built in clogging indicator
- AC Motors available in 208V, 230V, 460V and 575V
- 50/60 HZ
- Gear pumps
- Flows available from 1.2 gpm up to 45.2 gpm
- Standard Viscosity range up to 1,000 SUS (216 cSt)
- Designed for up to 22,720 SUS (5000 cSt) viscosity (optional)
- Condition monitoring and control panels available

### Applications

- Supplemental Filtration
- Bulk Oil Storage | Transfer
- System Flushing
- In-Plant Maintenance
- Recycling
- Injection Molding Machines
- Machine Tools
- Gear Boxes
- Mobile Equipment
- Filtration of fluids for intermittently operated hydraulic systems and test stands

### Technical Specifications

Mounting Position:	Vertical
Operating Pressure	10 (145 psi) bar standard available up to 15 bar (217 psi)
Filter Bypass:	3 bar (44 psi) and 6 bar (87 psi)
Pressure Drop:	1 bar (14.5 psi)
Fluid Temperature:	8°C (46°F) to 80°C (176°F)
Ambient Temperature:	-20°C (-4°F) to 50°C (122°F)
Standard Viscosity:	250-1000 SUS (54-216 cSt)
Fluids	Gear Oil: Up to VG320 Mineral Oil: DIN 51524 Part 1 and Part 2 Water Glycol: HFC based

## Model Code

**LSN - 1 - P4L A - FLND250 10 - BM - 2**

### Series

LSN = Lube Skid System

### Size

1, 2, 3, 4

### Pump

P4L = 1.2 gpm, P5L = 1.5 gpm, P6L = 1.9 gpm, P8L = 2.4 gpm, P10L = 3.0 gpm, P12L = 3.8 gpm (Size 1)  
 P16L = 4.8 gpm, P20L = 6.0 gpm, P25L = 7.5 gpm (Size 2)  
 P32L = 9.6 gpm, P40L = 12.0 gpm, P50L = 15.0 gpm, P63L = 18.9 gpm (Size 3)  
 P80L = 24.1 gpm, P100L = 30.2 gpm, P80S = 36.1 gpm, P100S = 45.2 gpm (Size 4)

### Motor Voltage

A = 115/230V (1-phase) (Size 1 only)  
 B = 208-230/460V (3-phase)  
 C = 575V-3 (3-phase)

### Filter

FLND 250 (Size 1, 2, and 3)  
 FLND 400 (Size 2, 3, and 4)  
 LPF 160 (Size 1, 2, and 3)  
 LPF 240 (Size 2 and 3)  
 LF 660 (Size 4)

### Filtration Rating (microns)

3, 5, 10, 20

### Clogging Indicator

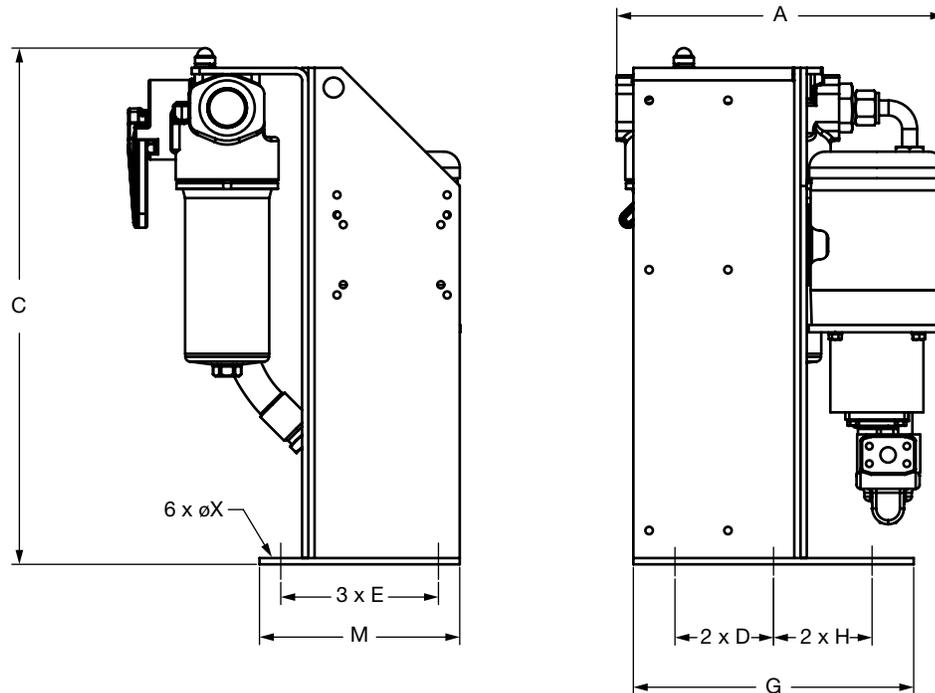
BM = visual  
 C = electric  
 D = visual and electric

### Clogging Indicator Pressure Setting

2 = 29 psi (2 bar)  
 5 = 72.5 psi (5 bar)

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

## Dimensions



Size	A Max	B Max	C Max	D	E	G	H	M	X
LSN 1	16.45 (417.83)	19.4 (492.76)	27.6 (701.04)	4.92 (124.97)	7.87 (199.9)	11.81 (299.97)	4.92 (124.97)	9.84 (249.94)	.55 (13.97)
LSN 2	20.6 (523.24)	21.5 (546.1)	28 (711.2)	6 (152.4)	10 (254)	14 (355.6)	6 (152.4)	12 (304.8)	.55 (13.97)
LSN 3	22.1 (561.34)	24.11 (612.39)	33.61 (853.69)	6.52 (165.61)	13.28 (337.31)	15 (381)	6.52 (165.61)	15.25 (387.35)	.55 (13.97)
LSN 4	24.16 (613.66)	25.77 (654.56)	39.34 (999.24)	5.93 (150.62)	13.28 (337.31)	17 (431.8)	9.07 (230.38)	15.25 (387.35)	.55 (13.97)

Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## OFX Series

### Filter Skids



Single OFX

### Description

HYDAC's new OFX Series filtration skids are compact, self-contained filtration systems equipped with high efficiency, high capacity elements capable of removing particulate contamination and/or water quickly and economically. They supplement in-line filters whenever the existing filtration is incapable of obtaining the desired ISO cleanliness level.

It is not uncommon for viscosity to be overlooked when specifying an off-line filtration unit. The results of this oversight can severely affect system efficiency and longevity, and render the filtration system useless when high viscosity fluid causes the filter to be in constant bypass. HYDAC considers maximum fluid viscosity, (at the minimum operating temperature) in conjunction with flow to properly size the pump and motor.

Standard OFX Series OFX1 – OFX6 skids include a hydraulic pump, electric motor, and either a single or dual standard capacity or high capacity housing. Many different component combinations provide the flexibility to match specific system viscosity, flow, and cleanliness requirements. Multiple housing lengths give the option of adding additional dirt holding capacity.

HYDAC's high viscosity OFX Series skids, OFX7 & OFX8, are designed to handle fluids that have a viscosity as high as 25,000 SUS. The skids have 39" long high capacity filters to efficiently clean the viscous fluids. The filters have a high dirt-holding capacity, capable of holding almost 1000 grams of dirt depending on the element. OFX7 & OFX8 Series skids include a pump, motor, high capacity filter, suction strainer, and dirt indicator. Various options can account for specific user needs.

### Features

- Protects and extends the life of expensive components
- Minimizes downtime and maintenance costs
- Designed to handle high viscosity oils up to 25,000 SUS (see Skid Selection)
- Many component combinations and variable starter options allow the flexibility to match specific user needs
- Four wheel cart option provides product portability
- Integral drip pan with drain plug prevents oil from spilling on ground
- Sample valves provided at filter base for fluid sampling
- Market leading HYDAC Betamicon® synthetic filtering media provides for quick, efficient clean up with maximum element life

### Technical Specifications

Flow Rating	Up to 82 gpm (310 L/min)
Temp. Range	0°F to 180°F (-17°C to 82°C)
Bypass Valve Setting	50 psi (3.5 bar) for skid series OFX1, OFX2, OFX3, OFX4, OFX5, OFX7 & OFX8 40 psi (2.8 bar) for skid series OFX6
Fluid Viscosity	Up to 25,000 SUS (see Skid Selection)
Compatibility	All petroleum based hydraulic fluids. Contact HYDAC for use with other fluids, including ester and skydrol
Pump	OFX1-OFX6: Continuous duty gear pump with integral 150 psi relief. Flow dependent on skid series and motor. (Refer to Pump, Motor & Weight Data table) OFX7-OFX8: Positive displacement rotary screw-pumps.
Motor	Horsepower dependent on skid series and flow. (Refer to Pump, Motor & Weight Data table)
Porting	Dependent on flow. (Refer to Porting Data table)

## Skid Selection

Series	Viscosity Range	Filter Housing(s)	Maximum Flow
OFX1	150 - 500 SUS	(1) High Capacity or Standard Capacity	82 gpm (310 lpm)
OFX2	500 - 2000 SUS	(1) High Capacity or Standard Capacity	82 gpm (310 lpm)
OFX3	2000 - 5000 SUS	(1) High Capacity or Standard Capacity	37 gpm (140 lpm)
OFX4	150 - 500 SUS	(2) High Cap. or Stand. Cap. in series	82 gpm (310 lpm)
OFX5	500 - 2000 SUS	(2) High Cap. or Stand. Cap. in series	82 gpm (310 lpm)
OFX6	2000 - 5000 SUS	(2) High Cap. or Stand. Cap. in series	37 gpm (140 lpm)
OFX7	100 - 25,000 SUS	(1) High Capacity	6 gpm (23 lpm)
OFX8	100 - 25,000 SUS	(2) High Capacity in parallel	30 gpm (114 lpm)

## Pump, Motor and Weight Data

Skid Series	Flow (gpm)	Motor (hp)	Weight (lb)*	Skid Series	Flow (gpm)	Motor (hp)	Weight (lb)*
OFX1	09	1.5	238 - 357	OFX5	09	2	301 - 442
	17	3	300 - 504		17	5	396 - 684
	37	5	329 - 577		37	10	497 - 849
	82	10	476 - 705		82	15	947 - 1054
OFX2	09	1.5	238 - 357	OFX6	09	2	267 - 650
	17	3	311 - 504		17	5	370 - 659
	37	5	348 - 577		37	10	502 - 607
	82	10	597 - 705				
OFX3	09	1.5	238 - 479	OFX7	06	2	-
	17	5	340 - 580				
	37	10	461 - 566				
OFX4	09	2	372 - 442	OFX8	30	15	-
	17	3	353 - 662				
	37	5	398 - 791				
	82	10	551 - 904				

\* Weight dependent on options chosen.

## Porting Data

Flow (gpm)	Inlet Port Sizes	Outlet Port Sizes with Standard Capacity Filters	Outlet Port Sizes with High Capacity Filters
06	1" JIC	N/A	1.625-12UN-2B SAE O-Ring Boss
09	1.625-12UN-2B SAE O-Ring Boss	1.312-12UN-2B SAE O-Ring Boss	1.625-12UN-2B SAE O-Ring Boss
17	1.875-12UN-2B SAE O-Ring Boss	1.625-12UN-2B SAE O-Ring Boss	1.625-12UN-2B SAE O-Ring Boss
30	2" JIC	N/A	1.625-12UN-2B SAE O-Ring Boss
37	2" JIC	1.875-12UN-2B SAE O-Ring Boss	1.875-12UN-2B SAE O-Ring Boss
82	2" JIC	1.875-12UN-2B SAE O-Ring Boss	2.500-12UN-2B SAE O-Ring Boss



# OFFLINE FILTRATION SYSTEMS

## Model Code

**OFX4 - 09 - H1 - BN - 3 - BN - 3 - B - N - N - B - G - N - S - C**

**Series** \_\_\_\_\_  
 OFX = Filter Skid

**Size** \_\_\_\_\_  
 1, 2, 3, 4, 5, 6, 7, 8

**Flow Rate** \_\_\_\_\_  
 06 = 6 gpm (22.7 lpm) (size 7 only)  
 09 = 9 gpm (34 lpm) (size 1-6 only)  
 17 = 17 gpm (64.3 lpm) (size 1-6 only)  
 30 = 30 gpm (113.6 lpm) (size 8 only)  
 37 = 37 gpm (140 lpm) (size 1-6 only)  
 82 = 82 gpm (310.4 lpm) (size 1, 2, 4, 5 only)

**Filter Designation** \_\_\_\_\_  
 Standard Capacity (S)  
 S1 = 9 gpm (sizes 1 - 6), 17, 37 gpm (sizes 1 & 4)  
 S2 = 9, 17 gpm (sizes 1 - 6), 37 gpm (sizes 1 & 4)  
 S3 = 9, 17, 37 gpm (sizes 1 - 6), 82 gpm (sizes 1 & 4)  
 High Capacity (H)  
 H1 = 9 gpm (sizes 3 & 6), 17 gpm (sizes 1 - 6), 37, 82 gpm (sz 1 & 4)  
 H3 = 6 gpm (size 7), 9, 17 gpm (sizes 3 & 6), 30 gpm (size 8),  
 37 gpm (sizes 1 - 6), 82 gpm (sizes 1, 2, 4, & 5)

**Filter Media** (first stage all sizes) \_\_\_\_\_  
 BN = Betamicon® AM = Aquamicon® water removal

**Filtration Rating** (micron) (first stage all sizes) \_\_\_\_\_  
 3, 5, 10, 20 (szs. 1, 2, 4, 5) ] = BN  
 5, 10, 20 (sizes 3 & 6) ]  
 10, 20 (sizes 7 & 8) ]  
 10 = AM

**Filter Media** (second stage sizes 4, 5, 6, & 8) \_\_\_\_\_  
 BN = Betamicon® AM = Aquamicon® water removal

**Filtration Rating** (micron) (second stage sizes 4, 5, 6, & 8) \_\_\_\_\_  
 3, 5, 10, 20 (sizes 4 & 5) ] = BN  
 5, 10, 20 (size 6) ]  
 10, 20 (size 8) ]  
 10 = AM

**Seals** \_\_\_\_\_  
 B = Buna (standard)  
 H = EPR  
 V = Fluroelastomer (FPM)

**Voltage** \_\_\_\_\_  
 A = 115 VAC 1.5 hp (sizes 1-3 with 9 gpm only - includes switch, 10' cord & plug)  
 N = 230 /460 VAC 3 ph (sizes 1-8)  
 E = 575 VAC 3 ph (Built to CSA standards)

**Motor** \_\_\_\_\_  
 N = TEFC W = Washdown (NEMA Design B)

**Starter Control Options\*** \_\_\_\_\_  
 N = None  
 A = 230 VAC  
 B = 460 VAC  
 C = 230 VAC (with VFD)  
 D = 460 VAC (with VFD)  
 E = 575 VAC  
 F = 575 VAC (with VFD)

**Clogging Indicator** \_\_\_\_\_  
 N = Visual pop-up in cap (standard)  
 G = Differential pressure gauge  
 M = Electric with 12 ft. 4 in. conductor wire  
 C = Differential pressure gauge with electric switch\*

**Vacuum Gauge** \_\_\_\_\_  
 N = None V = Vacuum gauge

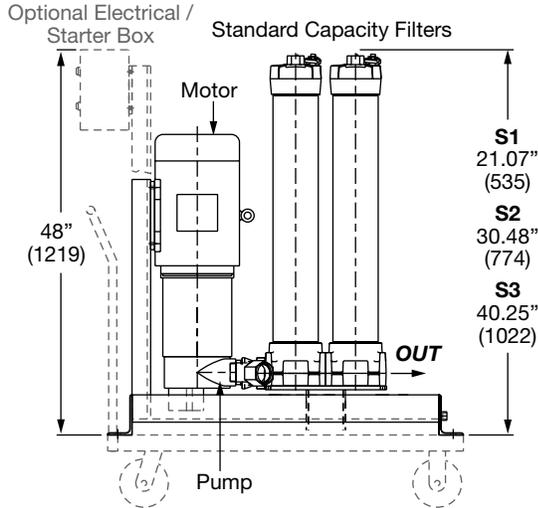
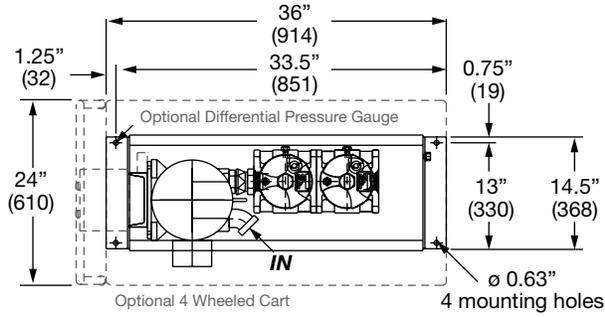
**Suction Strainer** \_\_\_\_\_  
 S = standard (all units)

**Options** \_\_\_\_\_  
 N = None  
 C = 4 wheeled cart (sizes 1-6 only)  
 B = Continuous bleed (for continuously aerated systems - includes cap vent port, valve and return line)  
 P = Particle counter (sizes 1-6 only, need to specify oil type being used)

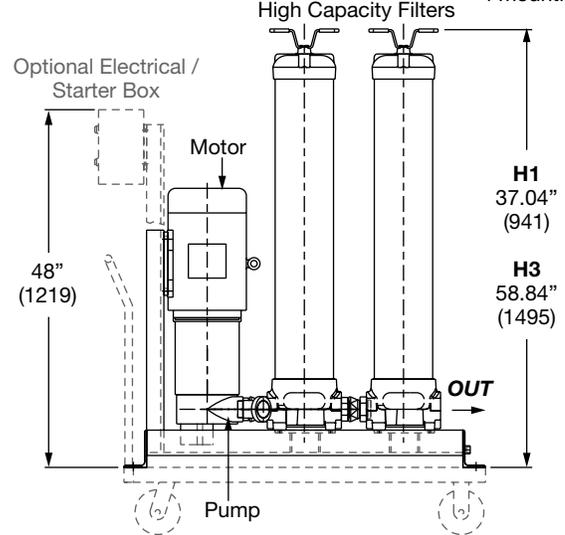
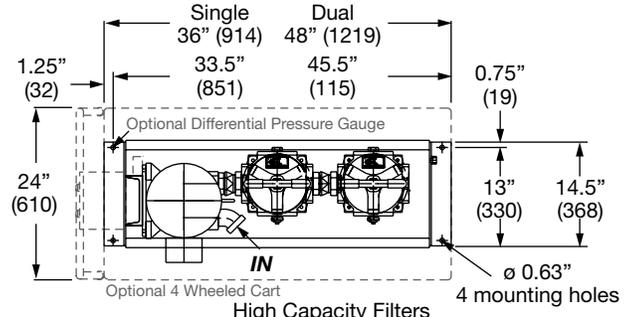
\*Motor starter control option - C-series, non-disconnect shut-off, "motor on" light, electrical indicator "change element" light, and type 4x wash down enclosure.  
 VFD control option - same as above but with enclosed variable frequency drive control and larger metal NEMA enclosure.  
 For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

## Dimensions

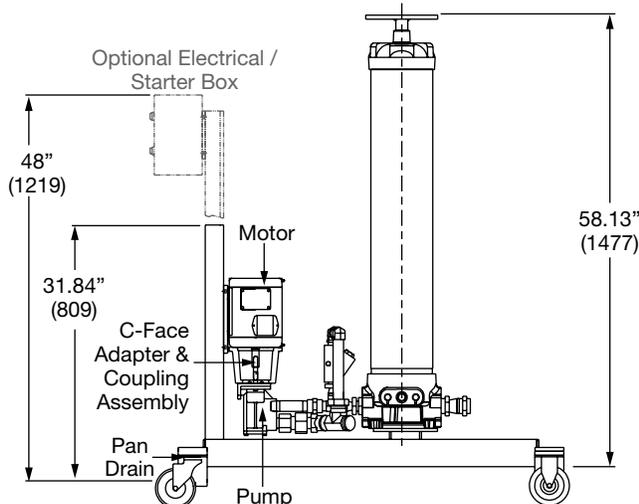
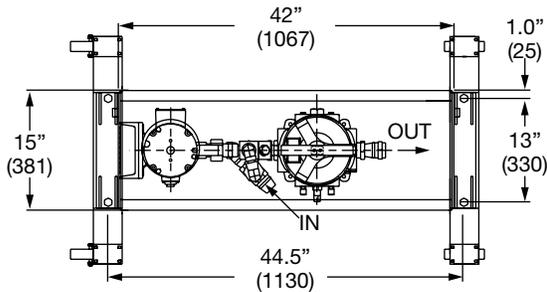
### OFX4, OFX5 & OFX6 Series (Dual Standard Capacity Filter Version)



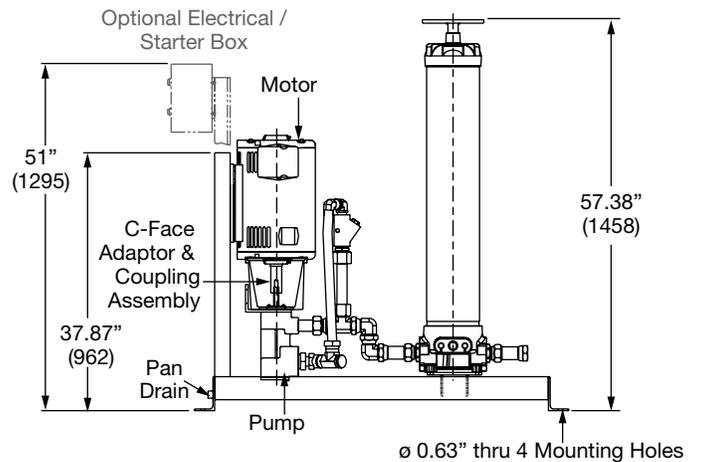
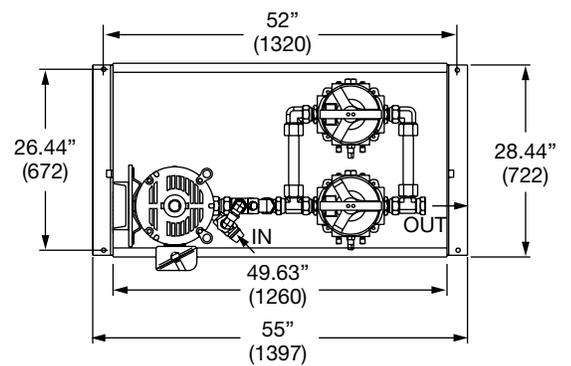
### OFX4, OFX5 & OFX6 Series (Dual High Capacity Filter Version)



### OFX7 Series - High Viscosity



### OFX8 Series - High Viscosity



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## OLF Compact Series



### Features

The OLF Compact filter is designed to be used offline to efficiently and cost effectively filter standard hydraulic oils which are highly contaminated. The OLF Compact is specifically designed to be used on hydraulic systems with a reservoir volume of up to 1000 gallons. The standard filters can be supplied as ready to install offline units complete with motor and pump units as shown or as individual filters.

### Benefits

- Lower operating costs
- Extended element service life
- Extended fluid life
- Cleaner, more efficient systems
- Incinerable elements
- Easy installation

### Applications

Typical applications include:

- Injection molding machinery
- Machine tools
- Gear boxes
- Mobile equipment
- Filtration of fluids for intermittently operated hydraulic systems and test stands

### Technical Specifications

Operating Range	
Viscosity: <i>(see pressure drop curves)</i>	to 700 SUS (OLF-5) to 3000 SUS (OLF-5/15) to 10,000 SUS (OLF-5/4)
Operating Pressure:	45 psi (3 bar) max
Suction Pressure:	11" Hg (-0.4 to 6 bar) max
Inlet Pressure <i>(Model with flow control valve):</i>	145 psi (10 bar) min / 725 psi (50 bar) max
Fluid Temperature:	32° to 175°F (0 to 80°C)
Ambient Temperature:	-4° to 104°F (-20 to 40°C)
Seals:	NBR <i>(standard)</i>
Maximum Flow Rate:	OLF-5 = 1.6 gpm OLF-5/15 = 4.9 gpm OLF-5/4 = 1.3 gpm
Fluids	Standard Mineral Oils / Water/Oil based fluids <i>(Minimum 40% Oil in Fluid)</i> <i>(Consult factory for other fluids.)</i>
Elements	
Media:	Dimicron - 2µm, 20µm / Water Removal - 2µm, 20µm
Number required:	OLF-5, 5/15, and 5/4 = 1
Dirt Holding Capacity - ΔP = 36 psi (2.5 bar)	200g ISO MTD <i>(N5DM...)</i> / 185g ISO MTD <i>(N5AM...)</i>
Water Retention - ΔP = 36 psi (2.5 bar):	Approximately 0.5 quarts (0.5 liters)
Beta Ratio:	β <sub>x</sub> > 1000 <i>(absolute value)</i>
Maximum ΔP:	45 psi (3 bar)
Connections <i>(All Female)</i>	
OLF-5 with motor/pump:	Inlet & Outlet: 3/4 - 16UNF (SAE 8) (BSPP G1/2)
OLF-5/15 & 5/4:	Inlet & Outlet: 1 5/16-12UN (SAE 16) (BSPP G1)
OLF-5 without motor/pump:	Inlet: 9/16-18UNF (SAE 6) (BSPP G3/8) Outlet: 3/4-16UNF (SAE 8) (BSPP G1/2)
Weight	OLF-5-S = 15.5 lbs. (7.0 kg) OLF-5-E = 5.5 lbs. (2.5 kg) OLF-5/15 = 24.3 lbs. (11 kg) OLF-5/4 = 24.3 lbs. (11 kg)

Housing drain standard on all units

Black = SAE connections when using supplied adapters (standard)

Red = BSPP connections if supplied adapters are not used

## Model Code

**OLF-5 - S - 120 - K - N5DM002 - E / 12 / CD**

### Series

- OLF-5 = Series 5 (1.6 gpm)
- OLF-5/15 = Series 15 (4.9 gpm)
- OLF-5/4 = Series 15 (1.3 gpm)
- OLFCM-5/15 = With Fluid Condition Monitoring

### Pump Type

- S = Vane Pump\* (standard)
- E = Flow Control Valve (series 5 only)
- TV = Toploader with Motor (available for OLF-5/15 & OLFCM-5/15 only)

### Power Consumption

- 120 = 120W for all OLF 5
- 200 = 200W for all 24VDC
- 370 = 370W for all Series 5/15 & 5/4
- Z = Without motor-pump unit (series 5 only)

### Voltage

- K = 115V single phase (series 5/15 and 5/4 only)
- L60 = 115V single phase (series 5 only)
- M = 220V single phase
- N = 440V 3 phase
- U = 24VDC
- Z = Without motor-pump unit

### Element

- N5DM002 = 2 micron
- N5DM005 = 5 micron
- N5DM010 = 10 micron
- N5DM020 = 20 micron
- N5AM002 = 2 micron with water removal
- N5AM020 = 20 micron with water removal
- M180B20 = 20 micron spin-on (series 5/4 only)

### Clogging Indicator

- E = Standard gauge (series 5 & 5/4 only)
- F = Static electrical switch VMF2F.0 (series 5 & 5/4 only)
- BM = Differential visual VM2BM.1 (series 5/15 & 5/4 only)
- C = Differential electrical VM2C.0 (series 5/15 & 5/4 only)
- D = Differential electrical/visual VM2D.0/L... (series 5/15 & 5/4 only)

### Mechanical Connections

- 12 = SAE Connections (standard)

### Supplementary Details

- L24, L48, L115, L230 = Lamp for D-type clogging indicator (LXX, XX = voltage)
- C = with ContaminationSensor CS 1310 (without display; OLFCM only)
- CD = with ContaminationSensor CS 1320 (with display; OLFCM only)
- AC = with ContaminationSensor CS 1310 and AquaSensor AS1000 (without display; OLFCM only)
- ACD = with ContaminationSensor CS 1320 and AquaSensor AS3000 (with display; OLFCM only)

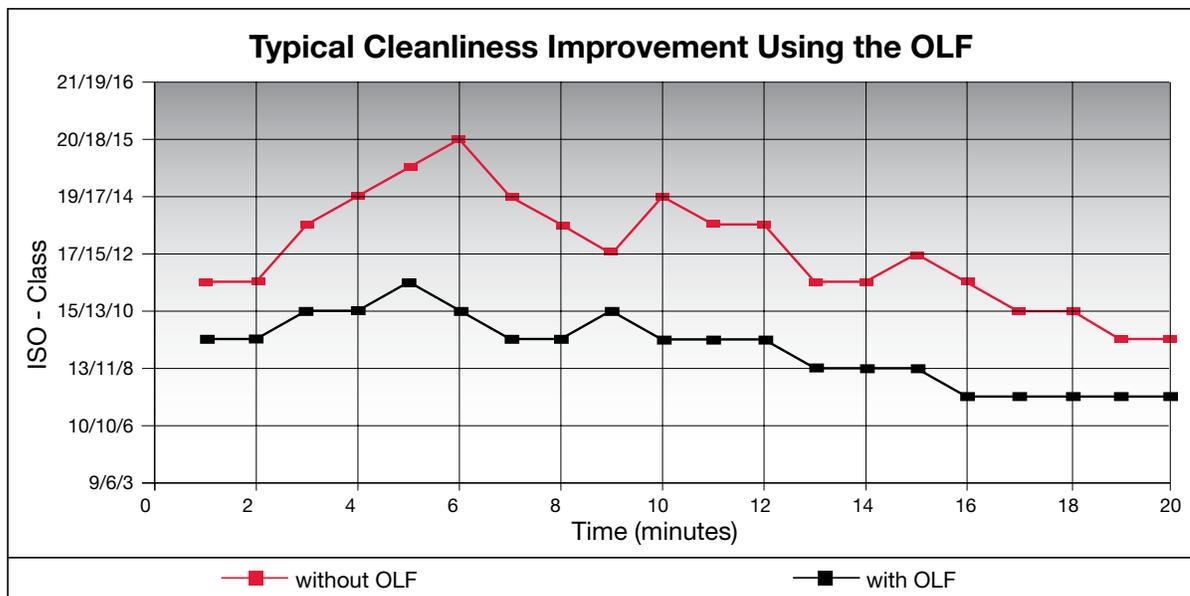
Consult Factory for special options.

Not all combinations available.

\*Choose "S" for model without motor-pump and without flow control valve.

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

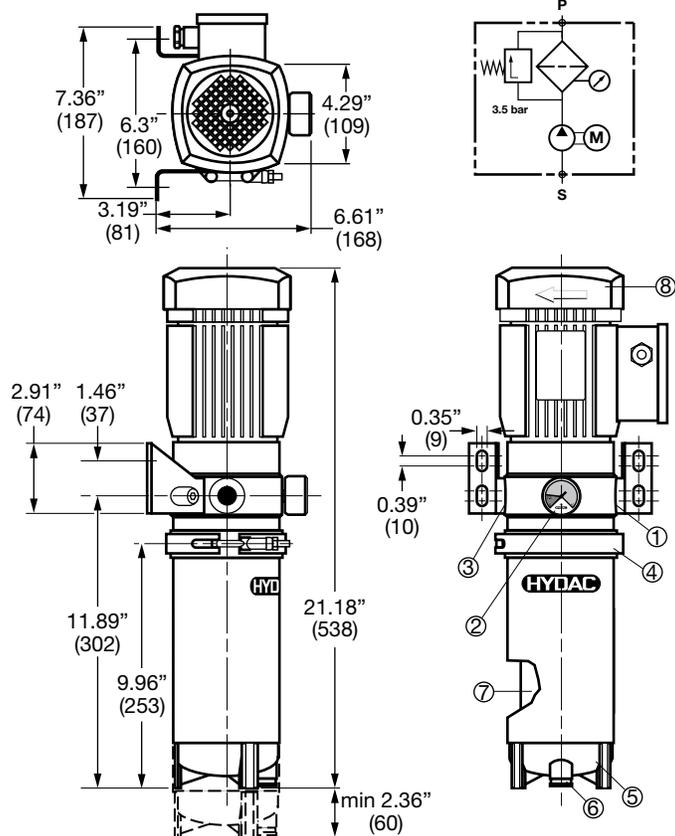
*Model Codes Containing RED are non-standard items - Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.*



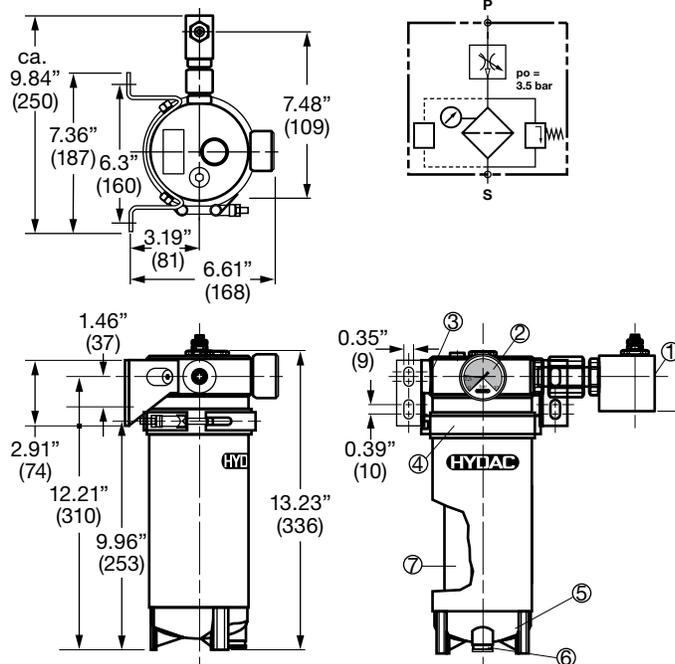
# OFFLINE FILTRATION SYSTEMS

## Dimensions

### OLF-5-S-...



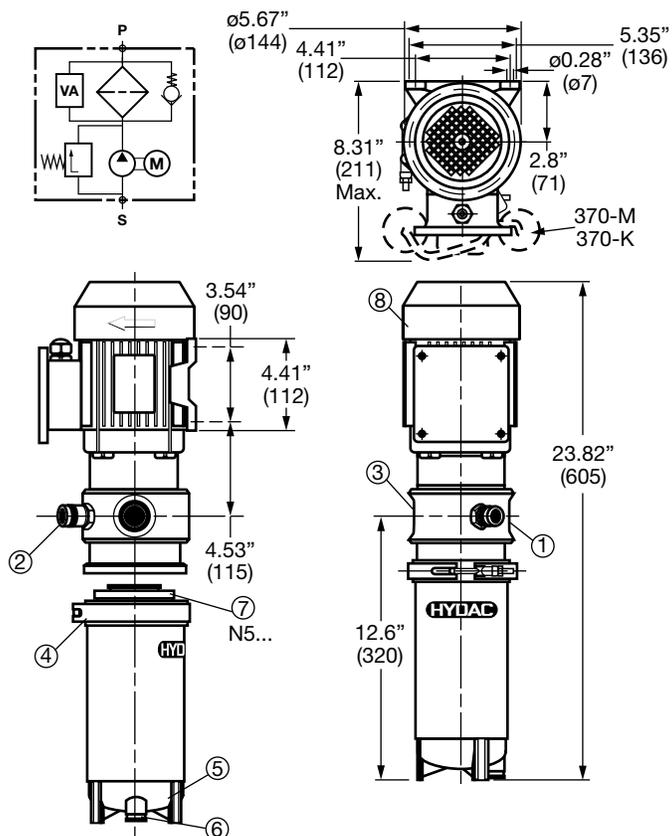
### OLF-5-E-...



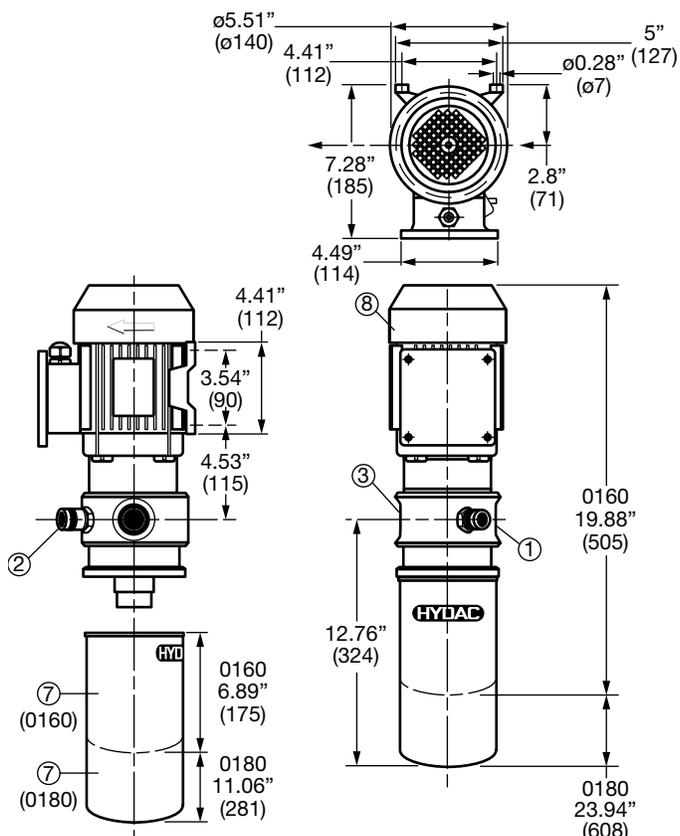
#### Key

- |                        |                    |
|------------------------|--------------------|
| 1 = Inlet              | 5 = Filter Bowl    |
| 2 = Clogging Indicator | 6 = Drain          |
| 3 = Outlet             | 7 = Filter Element |
| 4 = Clamp              | 8 = Electric Motor |

### OLF-5/4-S-... and OLF-5/15-S-...



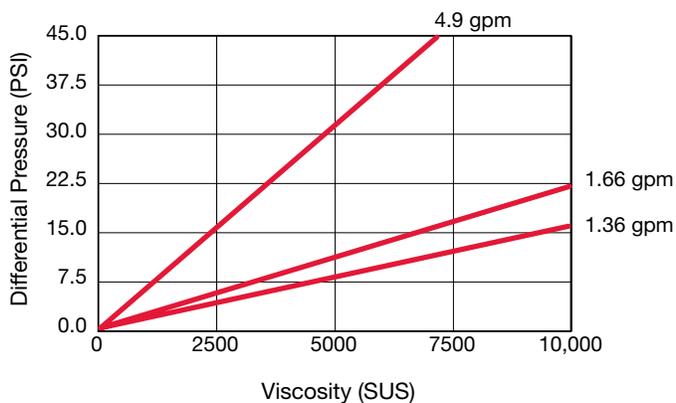
### OLF-5/4-SP-...



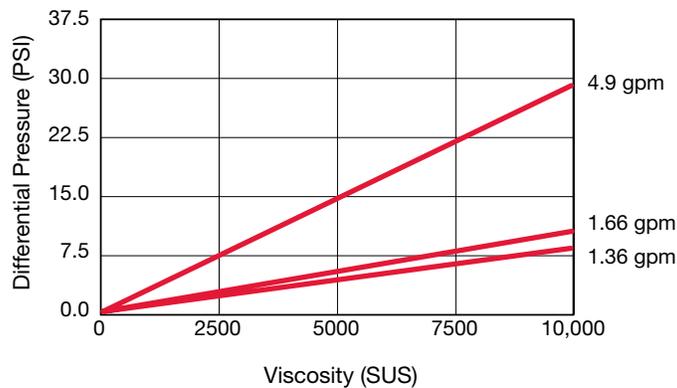
Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

## Differential Pressure

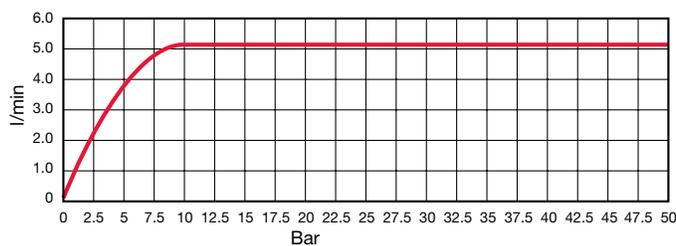
N5DM002



N5DM020

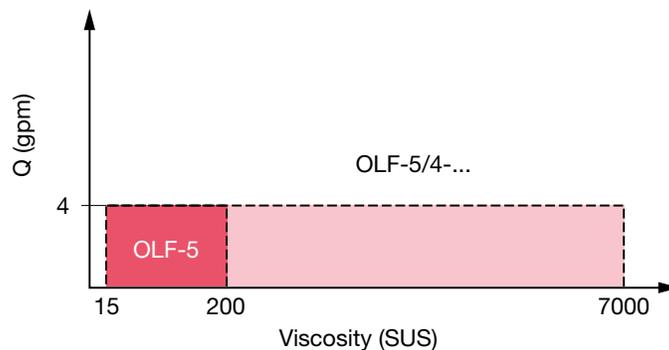


## SRV Flow Control Valve Curve



## Application

- Tank capacity to approx. 200 gallons
- Tank capacity to approx. 525 gallons



## OLF-5-TAK



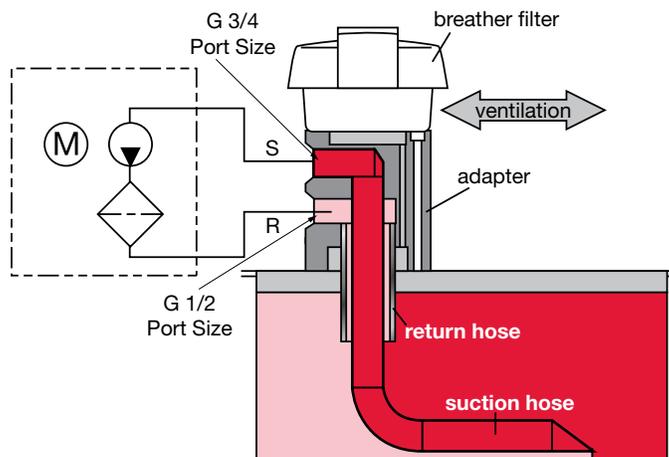
### Description

Use the OLF-5-TAK tank connection kit 2.0 to quickly mount bypass filter units on hydraulic installations. This component can be mounted on installations with ventilation filter whose connections conform to DIN 24557/T2.

### Ordering Information

**Model Code:** OLF-5-TAK

**Part No.:** 03039235



# OFFLINE FILTRATION SYSTEMS

## OLF Series



### Applications

Typical applications include:

- Filling and flushing hydraulic units
- Filtration of fluids for hydraulic systems and test stands
- Filtration of cleaning fluids for parts washing machines
- Filtration of coolants

### Dimicron® Element

The synthetic membrane (*2µm absolute*) provides a high filtration rating while the cellulose filter layer collects and holds the bulk of the dirt load. This combination results in excellent removal efficiency, even in a single pass, and extremely high dirt holding capacity.



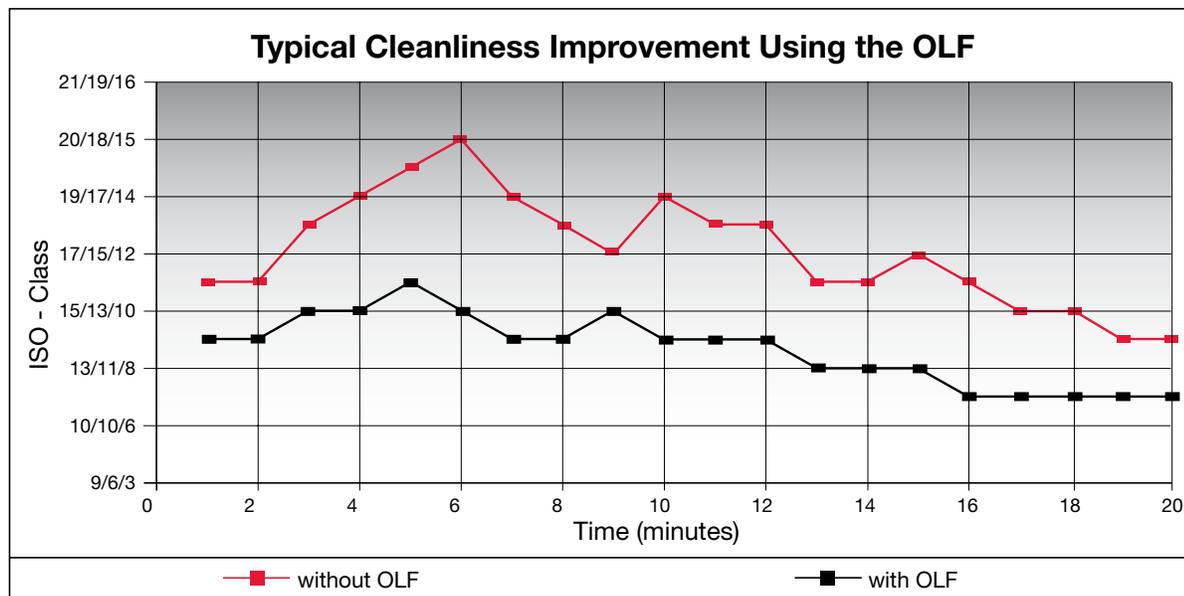
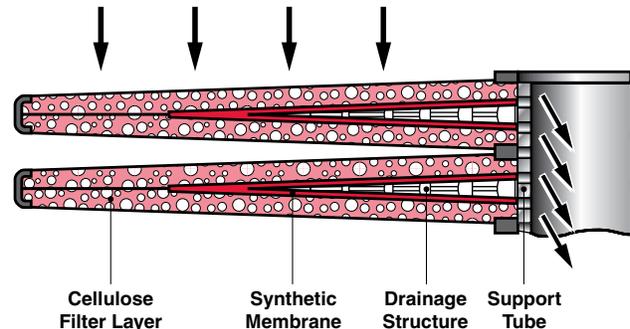
### Features and Benefits

The OLF series of filters is designed to efficiently and cost effectively filter hydraulic oils, lubricating oils, cleaning fluids and coolants which are highly contaminated. The filters can be supplied either as individual filters or as ready-to-install offline units complete with optional motor and pump units.

- Lower Operating Costs
- Extended Element Service Life
- Cleaner, more efficient systems

### Dimicron® Technology

Dimicron® technology, which incorporates membrane filtration and multi-disc construction, sets the OLF apart from conventional filters by providing it with exceptional dirt holding capacity and separation efficiency. Each filter element is able to capture and hold more than 1 pound of dirt, meaning that the OLF60, which uses four elements, will hold nearly 5 pounds of dirt. Membrane filtration provides the OLF with a separation efficiency over 99.9% for particles 2 micron and larger (B2 > 1000) even in a single pass.



## Model Code

**OLF - 15 / 15 - G - L60 - N15DM002 - E / 12**

### Series

- OLF = Stationary offline filter with integrated pressure gauge
- OLFCM = Stationary offline filter with integrated contamination monitoring sensors

### Size

15 = 1 element, 30 = 2 elements, 45 = 3 elements, 60 = 4 elements

### Pump Flow Rate *(must be less than or equal to size)*

- 15 = 5 gpm
  - 30 = 10 gpm
  - 45 = 15 gpm
  - 60 = 20 gpm
  - Z = without pump
- This code entry (15,30, 45, 60) must be less than or equal to the size entry (15,30, 45, 60)*

### Pump Type

- S = vane pump
- G = gear pump
- Z = Without motor-pump

### Motor Voltage

- L60 = 115V, Single Phase
- O60 = 460V, Three Phase
- Z = Without motor-pump

### Filter Element

- N15DM002 = Dimicron® 2 µm Absolute
- N15DM010 = Dimicron® 10µm Absolute
- N15DM020 = Dimicron® 20 µm Absolute
- N15DM030 = Dimicron® 30 µm Absolute
- Z = No filter element supplied

### Clogging Indicator

- E = Standard gauge
- BM = Differential visual VM2BM.1
- C = Differential electrical VM2C.0
- D = Differential visual/electrical

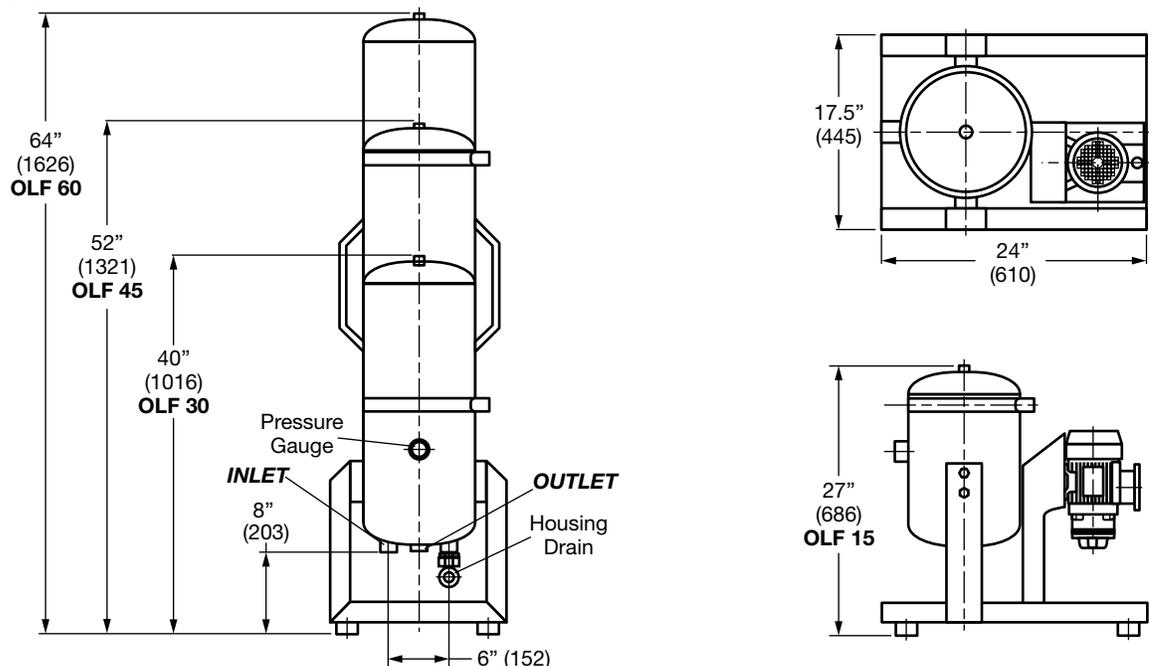
### Options

- 12 = SAE adapters *(BSPP connections are standard)*
  - V = Viton® Seals *(NBR seals are standard)*
  - MP = Integrated TestPoint for connection to FCU via Minimes Line
  - C = ContaminationSensor CS1310 (without Display)
  - CD = ContaminationSensor CS1320 (with Display)
  - CS = ContaminationSensor CS1310 (without Display) with SMU1260
  - AC = Contamination Sensor CS1310 and AS 1000 (without Display)
  - ACD = ContaminationSensor CS1320 and AS 3000 (with Display)
  - ACS = ContaminationSensor CS1310 and AS 1000 (without Display) with SMU1270
- (OLFCM option only)*

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.*

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## Technical Specifications

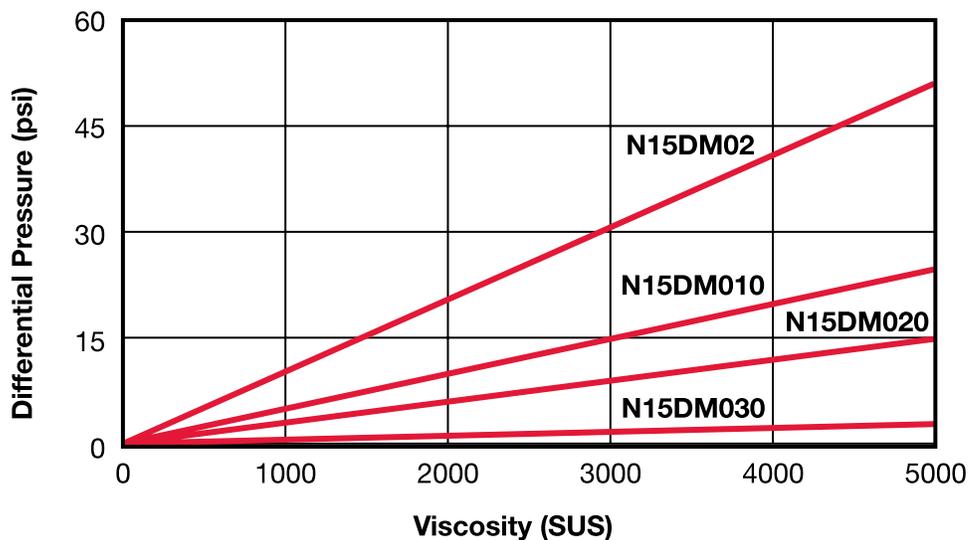
Model	OLF-15	OLF-30	OLF-45	OLF-60
Connections	Female			
Housing Inlet & Outlet	1 5/16 - 12UN (SAE 16); <b>G 1"</b> *			
Pump Inlet: Vane	1 1/16 -12UN (SAE 12); <b>G 3/4"</b>	1 5/8 -12UN (SAE 20); <b>G 1 1/4"</b>		
Pump Inlet: Gear	1 1/16 -12UN (SAE 12); <b>G 3/4"</b>	1 5/16 -12UN (SAE 16); <b>G "1"</b>	1 7/8 -12UN (SAE 24); <b>G 1 1/2"</b>	
Pump Inlet: Centrifugal	1 5/16-12UN (SAE 16); <b>G "1"</b>		1 5/8 -12UN (SAE 20); <b>G 1 1/4"</b>	
Filter Element	N15DMxxx(1x)	N15DMxxx(2x)	N15DMxxx(3x)	N15DMxxx(4x)
Contamination Retention Capacity	1.1lbs (500g)	2.2lbs (1000g)	3.3lbs (1500g)	4.4lbs (2000g)
Filter Efficiency	$\beta_x > 1000$			
Permissible $\Delta p$ Across the Element	72.5 psi			
Element Weight	6.6lbs	13.2lbs	19.8lbs	26.4lbs
Material of Filter Housing	Stainless Steel			
Capacity of Pressure Vessel	5.25 gal.	10.50 gal.	15.75 gal.	20.5 gal.
Max. Operating Pressure - Filter Housing	85 psi			
Material of Seals - Housing	NBR ( <i>standard</i> )			
Housing Weight	25lbs	33lbs	53lbs	62lbs
Fluid Temperature	15-175°F			
Motor-Pump Units	5 gpm	10 gpm	15 gpm	20 gpm
Pump Operating Pressure	65 psi			
Vane Pump Viscosity Range	75-2500 SUS			
Vane Pump Motor Capacity	370 W	570 W	1500 W	1500W
Gear Pump Viscosity Range	75-5000 SUS			
Gear Pump Motor Capacity	370 W	570 W	1500 W	1500W
Material of Seals - Pumps	NBR ( <i>standard</i> )			

Housing drain standard on all units

BLACK = SAE connections when using adapters which are supplied standard

RED = BSPP connections if supplied adapters are not used

## Differential Pressure at 3.96 gpm (15 L/min)

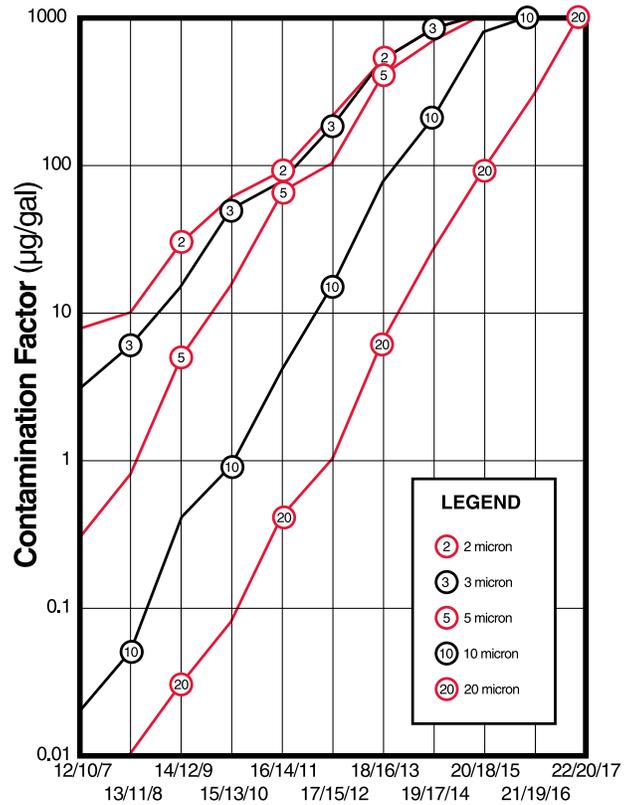


## Sizing Offline Filtration

The following calculations will help to approximate the attainable system cleanliness level when applying offline filtration.

**Step 1:** Select the approximate contamination ingress rate from the chart below. HYDAC quantitative investigations have yielded the following approximate figures.

Type of System	Contamination Ingression (µg/gal) Surroundings		
	Clean	Normal	Polluted
Closed circuit	1	3	5
Injection molding machine	3	6	9
Standard hydraulic system	6	9	12
Lubrication system	8	11	14
Mobile equipment	10	13	16
Heavy industrial press	14	18	22
Flushing test equipment	42	60	78



**Step 2:** Make the correction required for offline filtration. The contamination input selected above must be multiplied by the factor:

**Main System Flow Rate / Desired Offline Flow Rate**

**Note:** Main system flow rate must be corrected for cycle time. For example, if the flow rate is 500 gpm, but only runs for 20% of the system cycle, the main system flow rate would be 100 gpm. (500 gpm X 20%)

This yields the expression:

$$\text{Contamination Factor} = \text{Contamination Input } (\mu\text{g/gal}) \times$$

$$\frac{\text{Main System Flow Rate (gpm)}}{\text{Desired Offline Flow Rate (gpm)}}$$

Calculate the contamination factor using this expression.

**Step 3:** Determine the attainable cleanliness level. Locate the calculated contamination factor on the y-axis of the attached graph. Go to the right to find the intersection point on the curve corresponding to the desired absolute filter micron rating. Read the resulting attainable cleanliness level on the x-axis. (In case of dynamic flow through the offline filter, the attainable cleanliness level will be 2 to 3 times worse than indicated by the graph.)

## Offline Filtration Sizing Example

**Type of System:** Heavy industrial press

**Surroundings:** Normal

**Main System Flow Rate:** 150 gpm

**Desired Offline Flow Rate:** 16 gpm (OLF 60)

**Step 1:** Using this criterion select the approximate contamination ingress rate from the chart above.

This yields a contamination input of **18 µg/gal** based on a **heavy industrial press** with **normal** surroundings.

**Step 2:** Make the correction required for offline filtration.

$$\text{Contamination Factor} = 18 \mu\text{g/gal} \times 150 \text{ gpm} / 20 \text{ gpm} = 135$$

**Step 3:** Determine the approximate attainable cleanliness level for each micron rating using the attached graph. If the attainable cleanliness level is not acceptable, the desired offline flow rate should be increased. The approximate attainable levels for this example are as follows.

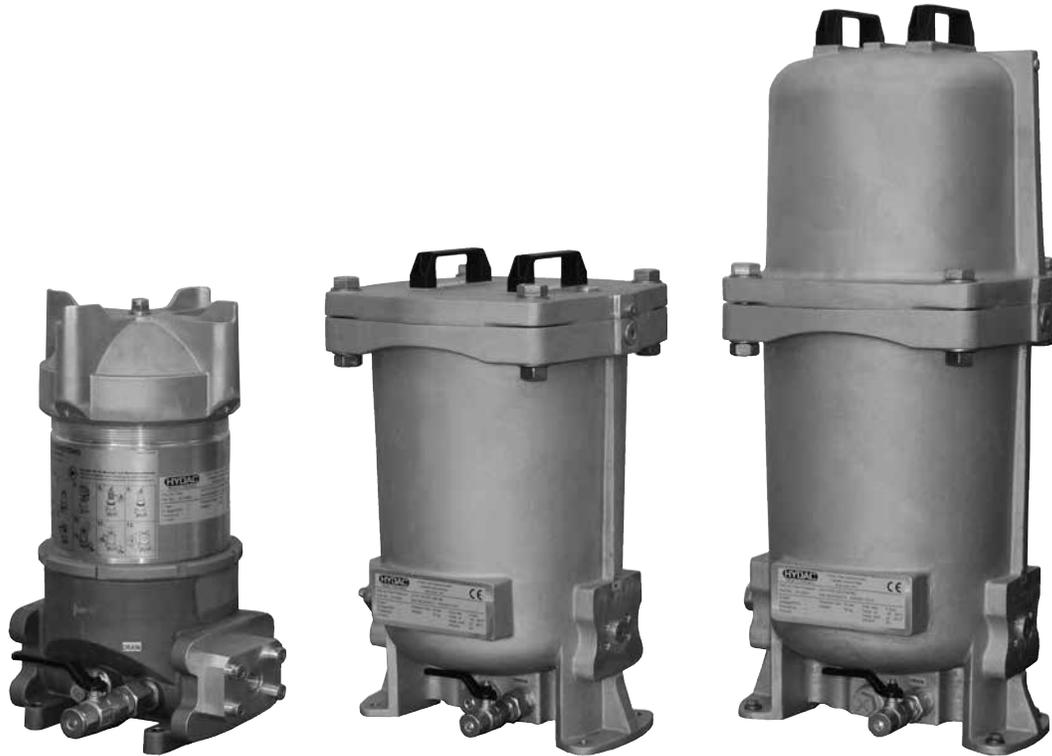
**2µm** - ISO 17/15/12

**20µm** - Between ISO 20/18/15 and ISO 21/19/16

# OFFLINE FILTRATION SYSTEMS

## OLFP 1 / 3 / 6 Series

Offline Filter Pressure



### Description

The OffLine Filter Pressure (OLFP) is a stationary offline filter and is used to remove oil aging products, water and solid particles from hydraulic and lubrication fluids.

Thanks to its compact construction, the OLFP is also ideally suited for use in even the smallest of installation spaces. The housings are pressure resistant up to 20 bar. Since the housing material is aluminium, the filters are also suitable for low-temperature applications

The flow can be taken directly from the main flow through an orifice and the orifice determines the flow rate. The offline filters can also be equipped with a motor-pump unit and an inductive particle counter, as an option.

The Trimicon series of filter elements NxTMxxx have been specially developed for the combined removal of fine particles, water and oil aging products. The most modern filter materials with reliable separation characteristics and high contamination retention capacity are used for this purpose.

### Features

- Removal of oil aging products, solid particles and water
- Improvement in component lifetime
- Greater machine availability
- Less space required due to compact construction
- Very easy maintenance
- High contamination retention capacity of the elements

### Applications

- Wind power plants
- Industrial transmission systems

### Technical Specifications

Model	OLFP 1	OLFP 3	OLFP 6
Operating Pressure	Max. 363 psi (25 bar)	Max. 290 psi (20 bar)	
Fluid Temp. Range	-22° F to 176° F (-30° C to 80° C)		
Max. Operating Viscosity	1000 cST		
Ambient Temp. Range	-22° F to 176° F (-30° C to 80° C)		
Survival Temp.	-40° F (-40° C)		
Storage Temperature	-40° F to 176° F (-40° C to 80° C)		
Head Material	Aluminum		
Bowl Material	Aluminum		
Seals	FPM/NBR		
Filter Housing Content	~2.4 gal. (~9 liters)	~7.1 gal. (~27 liters)	~11 gal. (~43 liters)
Hydraulic Port (IN/OUT)	See table "Hydraulic Connections"		
Filter Element	1 x N1TMXXX	1 x N3TMXXX	2 x N3TMXXX
Weight	~46.3 lbs (~21 kg)	~82 lbs (~37 kg)	~90 lbs (~41 kg)

## Model Code

**OLFP - 1 / 2 - G M - M - TM - N E**

### Series

- OLFP = Offline Filter - Pressure
- OLFPCM = Offline Filter - Pressure with Condition Monitoring (CM)

### Size

- 1 = Filter size 1 (1 x filter element N1TM003 \*)
- 3 = Filter size 3 (1 x filter element N3TM003 \*)
- 6 = Filter size 6 (2 x filter element N3TM003 \*)

### Nominal Flow Rate / type of orifice

- 2 = 0.53 gpm (2 l/min) - orifice A
- 3 = 0.79 gpm (3 l/min) - orifice B
- 6 = 1.59 gpm (6 l/min) - orifice C
- Z = variable (without orifice, without pump)

### Pump Unit

- O = with orifice
- G = gear pump
- Z = without

### Electric Motor

- M = 230 V / 50 HZ / 1 Ph / 0.37 kW
- N = 400 V / 50 HZ / 3 Ph / 0.37 kW
- AB = 690 V / 50 HZ / 1 Ph / 0.37 kW
- X = Other voltages
- N60, M60 = Operation at 60 HZ
- Z = Without electric motor

### Measurement Technology

- M = MCS 14xx Metallic Contamination Sensor
- A = AS 1000 Aqua Sensor
- Z = without (for basic type OLFP)

### Element Type

- TM = Trimicron

### Sealing Material

- N = NBR
- F = FPM

### Clogging Indicator

- E = Standard, back-pressure indicator
- B = Differential pressure indicator, visual (VM2BM.x)
- C = Differential pressure indicator, electrical (VM2C.x)
- D3 = Differential pressure indicator, visual/electrical (VM2D.x)
- D38 = Differential pressure indicator, visual/electrical (VL x GW.0 /-V-113)
- Z = without

\* filter element not supplied. These must be ordered separately.

### Items supplied (Preferred models, designed for 87 psi (6 bar) inlet pressure)

- OffLine Filter OLFP 1 - OffLine Filter OLFP-1/2-OZ-Z-TM-NZ Part no. 3738168
- OffLine Filter OLFP 3 - OffLine Filter OLFP-3/3-OZ-Z-TM-NZ Part no. 3712592
- OffLine Filter OLFP 6 - OffLine Filter OLFP-6/6-OZ-Z-TM-NZ Part no. 3712591

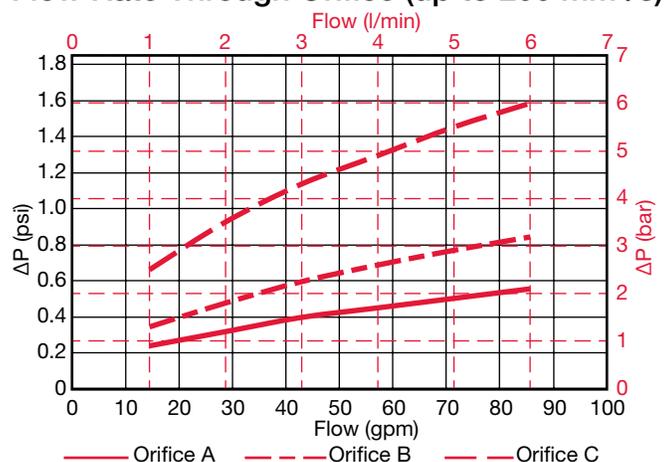
## Hydraulic Connections

Type	IN				OUT		
	SAE 2"	SAE 3/4"	G 3/4"	G 1/2"	SAE 2"	G 3/4"	G 1/2"
OLFP-1/Z-ZZ-Z-TM-NZ	•	-	-	-	•	-	-
OLFP-1/2-OZ-Z-TM-NZ	-	-	•	-	•	-	-
OLFP-3/Z-ZZ-Z-TM-NZ	-	•	-	•	-	-	•
OLFP-3/3-OZ-Z-TM-NZ	-	-	•	-	-	•	-
OLFP-6/3-GN-Z-TM-NZ	-	•	-	-	-	-	•
OLFPCM-6/3-GN-MA-TM-NZ	-	•	-	-	-	-	•

## Replacement Elements

Model Code	Micron Rating	Part No.
N1TM003	3	3284980
N3TM003	3	3566060

## Flow Rate Through Orifice (up to 200 mm<sup>2</sup>/s)

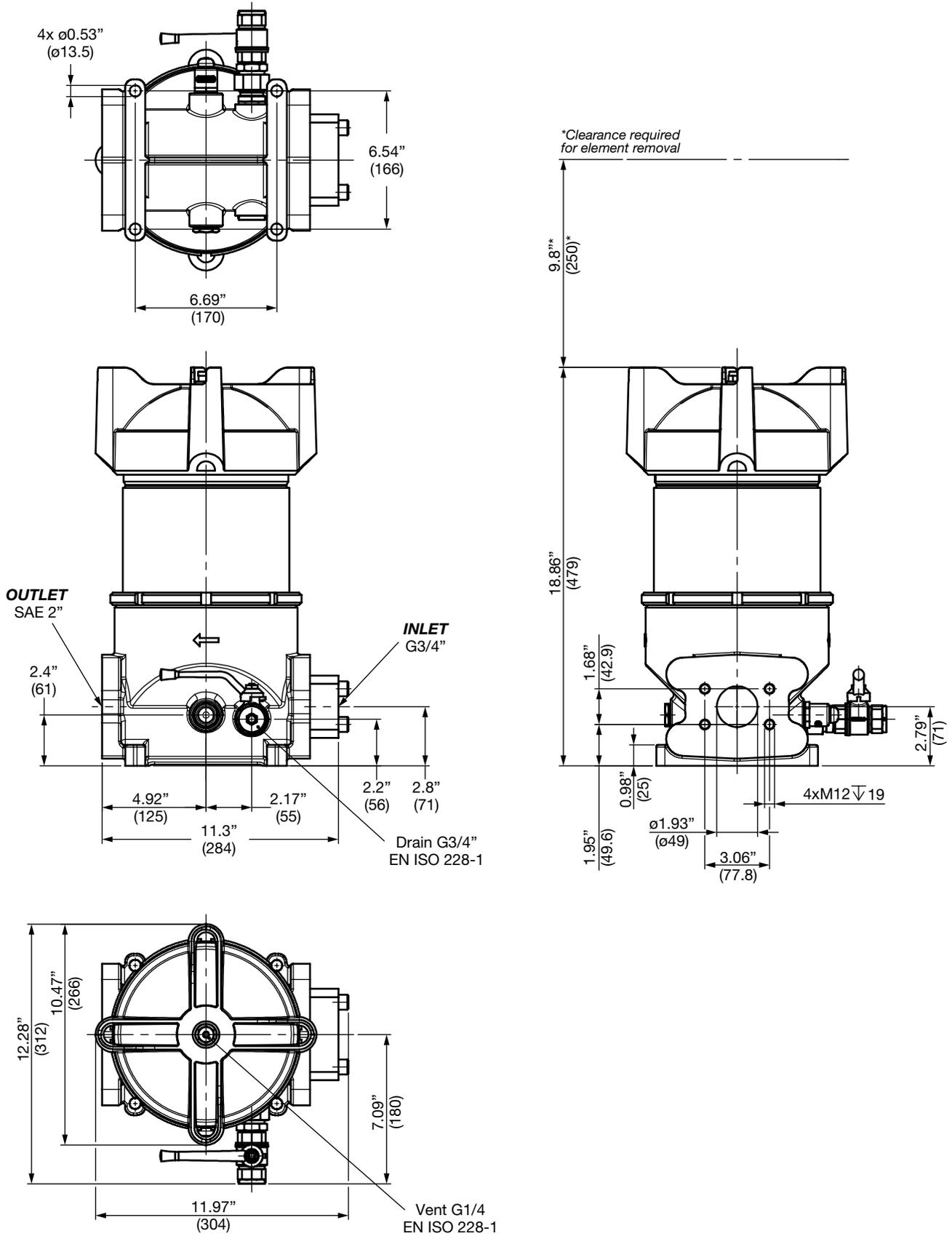


Type	Nominal Flow Rate	Orifice
OLFP x/2	2 l/min	A
OLFP x/3	3 l/min	B
OLFP x/6	6 l/min	C
OLFP x/z	variable	-

Values are valid for clean elements only.

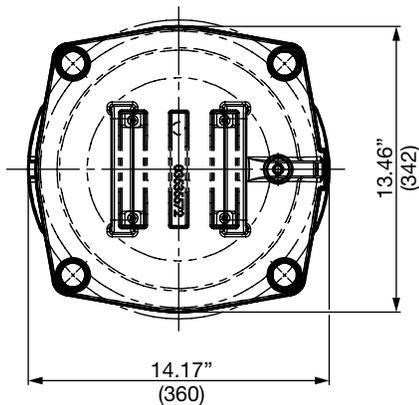
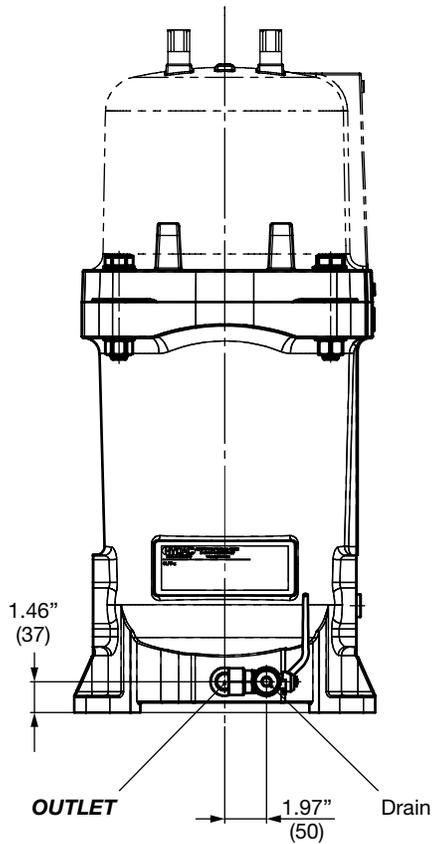
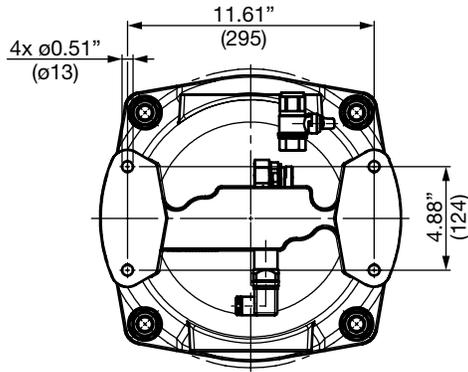
# OFFLINE FILTRATION SYSTEMS

## Dimensions OLFP 1

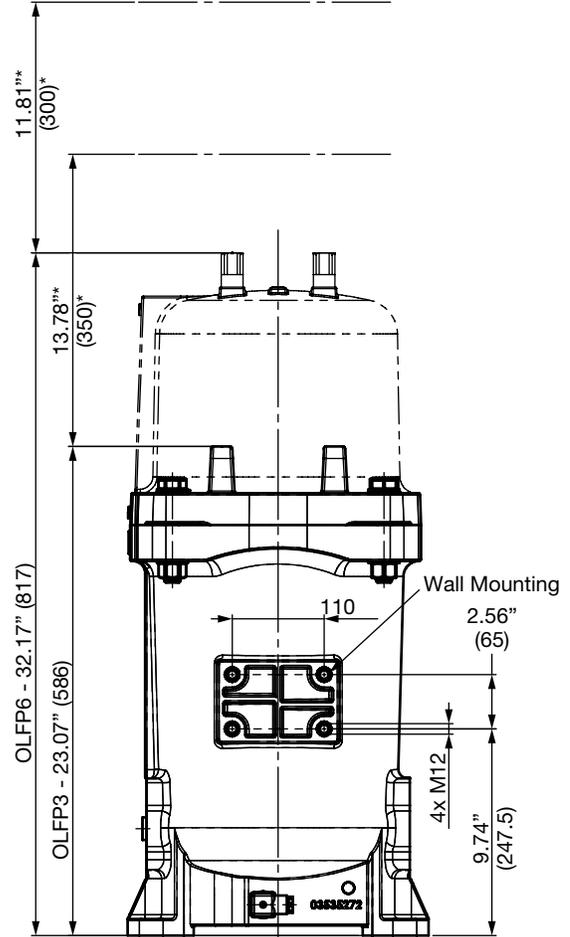


Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

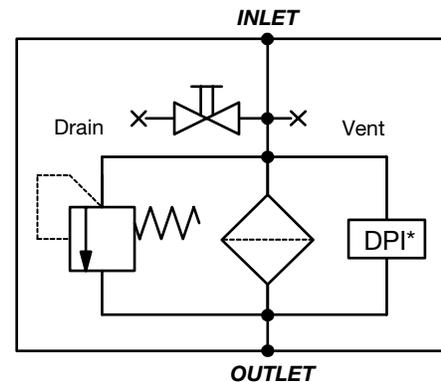
## Dimensions OLFP 3 / 6



\*Clearance required for element removal



## Hydraulic Schematic



\*Option: Differential pressure indicator

Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## NxTM TriMicron Element Series



### Description

The filter elements in the TriMicron series have been specially developed for the combined filtration of

- fine solid particle contamination,
- water and
- oil-ageing products from hydraulic and lubrication oils in the bypass flow.

They are a combination of pleated and SpunSpray depth filter elements. The filter layers are produced using melt-blown technology (synthetic fibers).

### Features

- Excellent filtration performance ( $\beta_{s(c)} > 1000$ )
- Low initial differential pressure
- High contamination retention capacity
- Fine particle contamination, water and oil aging products removed by depth filter material
- Broad range of fluid compatibility
- Simple element change

### Applications

- Offline filtration in lubrication systems (e.g. in wind turbines)
- Offline filtration in hydraulic systems
- Transmission and hydraulic test rigs

### Technical Specifications

Model	N1	N3
Contamination Retention Capacity ISOMTD at $\Delta P = 2.5$ bar	~ 410 g	~ 2500 g
Water Retention Capacity	~ 680 ml	~ 2.1 l
Beta value $\beta_{s(c)}$ @ 2 bar	> 1,000	
Filtration Rating	3 $\mu$ m	
Differential Pressure at Starting Point	< 0.1 bar	
Permitted Fluid Temperature Range	14 to 176 °F (-10 to 80 °C)	
Storage Temperature Range	41 to 104 °F (5 to 40 °C)	

## Model Code

N 1 TM 003 /- N

### Nominal Flow Rate

- 1 = Nominal flow rate 1 l/min
- 3 = Nominal flow rate 3 l/min

### Element Type

- TM = TriMicron

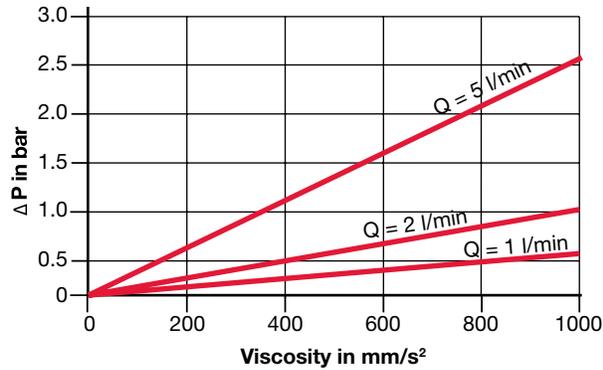
### Filtration Rating (microns)

- 003 = 3

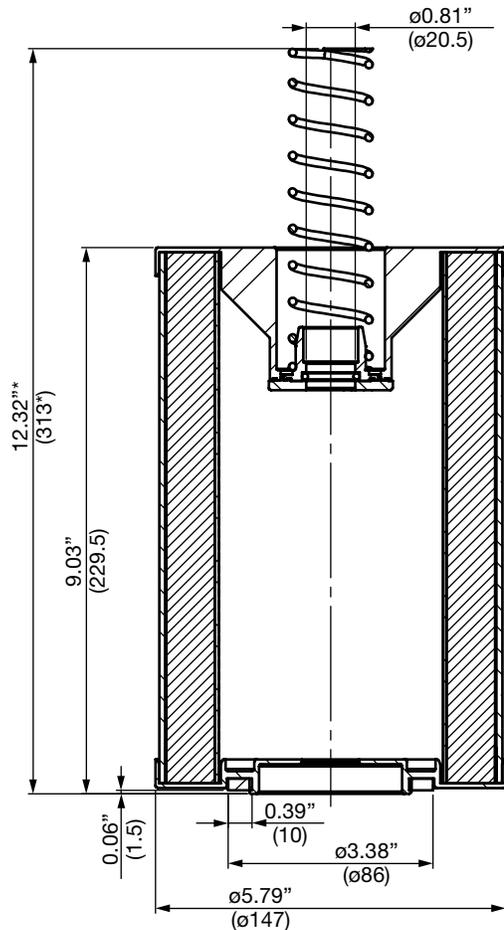
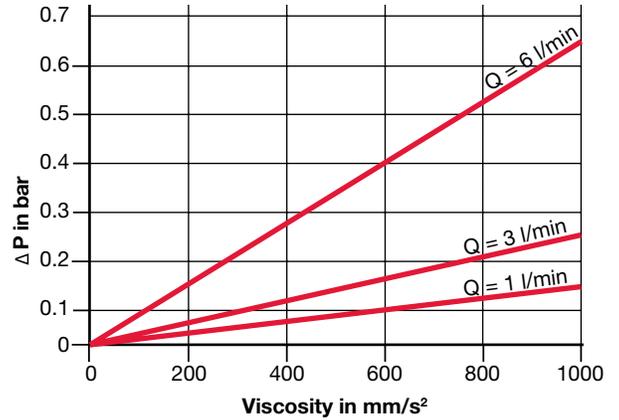
### Sealing Material

- N = NBR
- F = FPM

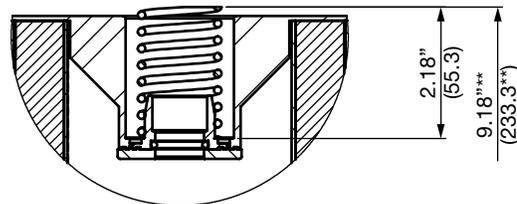
## Element Differential Pressure N1TM



## N3TM



- \* spring unloaded
- \*\* spring loaded



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

## IXU 1/4 Series

Ion eXchange Unit



### Description

The easy to service Ion eXchange Units of the IXU series are used for conditioning flame resistant, phosphate-ester-based (HFD-R) hydraulic and lubrication fluids.

They effectively remove acidic products of decomposition and dissolved metals caused by the hydrolysis and/or oxidation of the fluid.

The units are applied to hydraulic and lubrication oil tanks of up to  $\approx 20,000$  liters with a volumetric flow of  $\approx 9$  l/min in the bypass flow.

Mobile or stationary IXU are available.

The IXU uses HYDAC Ion eXchange Elements (IXE).

### Features

- Effective removal of acids and metallic salts
- No extractable metals or particles, as in the case of fuller's earth or active aluminum oxide
- Easy to service units
- Available as complete unit for service, and as a modular system for retrofitting existing bypass circuits or for OEM.

### Advantages

- Extended service life of the operating fluid
- Reduction in functional problems, e.g. with servo valves
- Greater machine and system availability.

We additionally recommend continuous dewatering, for example using a FluidAquaMobil - FAMH.

### Applications

- Power plants
- Steel industry
- Other applications with ester-base, flame resistant fluids

### Technical Specifications

Hydraulic Data	
Terminal value neutralization number	< 0.1 mg KOH / g possible
Use typically	Possible up to max. TAN 1mgKOH/gÖl
Flow rate	IXU 1 $\approx 2.2$ l/min, IXU 4 $\approx 8.9$ l/min
Fluid temperature	86 to 140 °F (30 to 60 °C)
Max. operating pressure	6 bar
Permissible suction pressure at suction inlet IN	-0.4 to 1bar
Viscosity range	15 to 80 cSt
Permissible operating fluid	HFD-R – Flame resistant, phosphate-based hydraulic fluids.
Connectors IN / OUT	½"
Pump type	Gear pump
Electrical Data	
Power supply voltage	See ordering details
Power consumption	0.25 to 0.6 kW / 16 Amps
Ambient Conditions	
Operating temperature range	32 to 104 °F (0 to 40 °C)
Storage temperature range	32 to 140 °F (0 to 60 °C)
Relative humidity	0 to 80%, non-condensing
Protection class to DIN 40050	IP 55
General Data	
Length of electrical connection cable (optional)	10 m (for option PKZ, FA1, FA2, see ordering details)
Length of suction / pressure hose (optional)	5 m
Sealing material	Fluoroelastomer FPM
Sound level at 1m	< 80 dB(A)
Weight* (empty)	IXU 1 = 155 lbs (70 kg), IXU 4 = 660 lbs (300 kg)
Fluid cleanliness required	ISO 19/17/14 (ISO 4406:1999) 9A/9B/9C (SAE AS4059) (We recommend to order the unit with prefilter to ensure the required cleanliness level or filter with 5-10 $\mu$ m absolute)

\*Weight noted is for a stationary unit.

## Model Code

**IXU - 4 - M - G - F - 05 - BM - 05 /-PKZ**

### Series

IXU = Ion eXchange Unit

### Size

1 = 1 Ion eXchange element IXE200 ≈ 0.5 gpm (2.2 l/min)  
4 = 4 Ion eXchange elements IXE200 ≈ 2.5 gpm (8.9 l/min)

### Type

M = mobile  
S = stationary

### Type of pump

G = gear pump  
Z = without

### Power supply voltage

F = 230 V, 60 Hz, 3 Ph  
J = 115 V, 60 Hz, 1 Ph  
O = 460 V, 60 Hz, 3 Ph

### Prefilter

05 = with 5µm element  
10 = with 10µm element  
X = without prefilter

### Clogging indicator

BM = differential pressure indicator – visual (VM2BM.1)  
C = differential pressure indicator – electrical (VM2C.0)

### Postfilter

05 = with 5µm element  
10 = with 10µm element

### Supplementary details

PKZ = with on-off switch and overload protective motor switch  
FA1 = with on-off switch, overload protective motor switch and cut-out when filter clogged (requires neutral wire in power supply)  
FA2 = with on-off switch, overload protective motor switch and cut-out when filter clogged (does not require neutral wire in power supply)

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.*

## Sizing

Tank Volume	Ion eXchange Unit
< 924.6 gal. (< 3,500 liters)	IXU-1
924.6 – 3,962.6 gal. (3,500 – 15,000 liters)	IXU-4
> 3,962.6 gal. (> 15,000 liters)	2x IXU-4

## Scope of delivery

- IXU with prefilter. Additional filter elements ordered separately.
- Operating manual

**Please order Ion eXchange Elements separately.**

Note: Ion eXchange Elements are not included with the IXU unit.

## Ion eXchange Element & Filter Elements

Ion eXchange Element	Part No.
IXE200	3348961
Replacement Filter Element (prefilter & protection filter)	Part No.
5.03.18D05BN/V SO103H	02077497
5.03.18D10BN/-V SO103H	2056369

One element for each filter required.

### Order examples:

**IXU- 4 -M-G-A -1-BM-Z /-PKZ** requires:

4 x IXE200 element  
2 x 5.03.18D10BN/-V SO103H (for prefilter and protection filter)

**IXU- 4 -M-G-A -Z-BM-Z /-PKZ** requires:

4 x IXE200 element  
1 x 5.03.18D10BN/-V SO103H (for protection filter only)

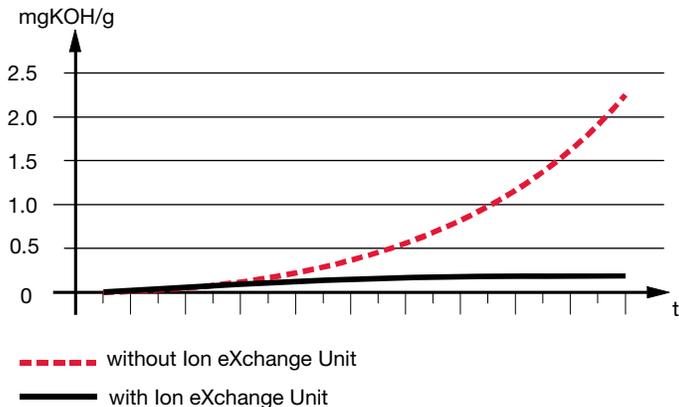
**IXU- 1 -M-G-A -1-BM-Z /-PKZ** requires:

1 x IXE200 element  
2 x 5.03.18D10BN/-V SO103H (for prefilter and protection filter)

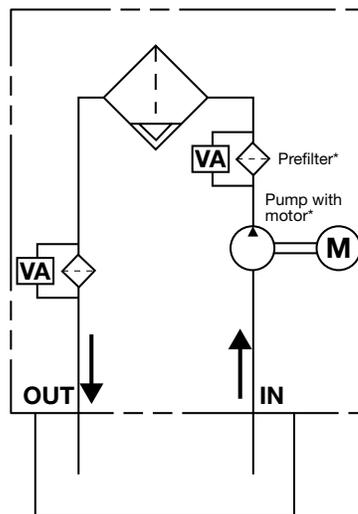
# OFFLINE FILTRATION SYSTEMS

## Performance

Example of acidification in HFD fluids with and without Ion eXchange Unit

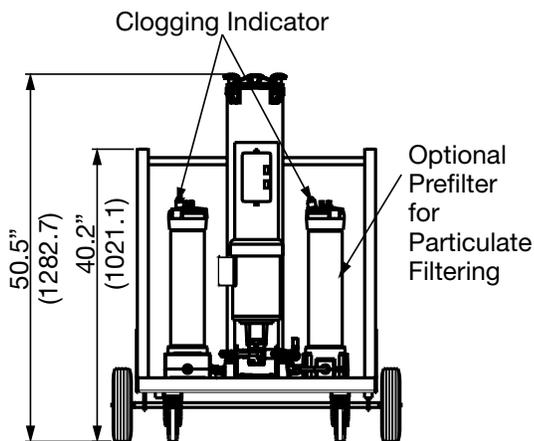
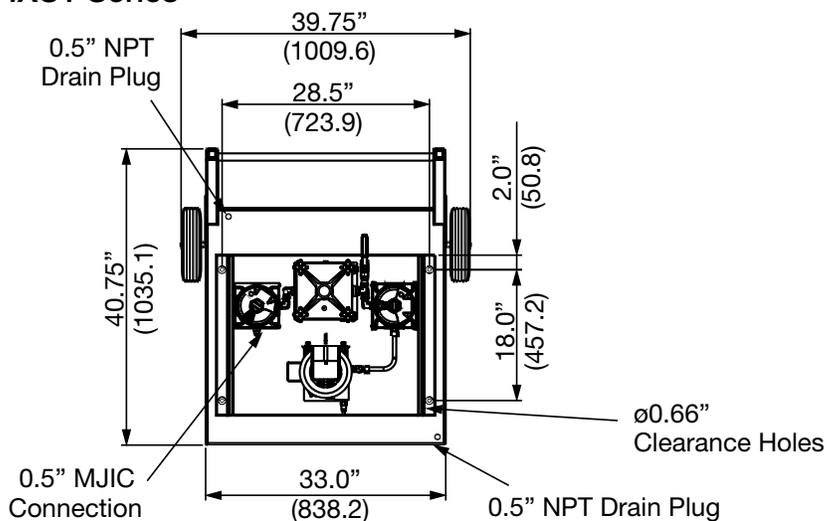


## Hydraulic Schematic

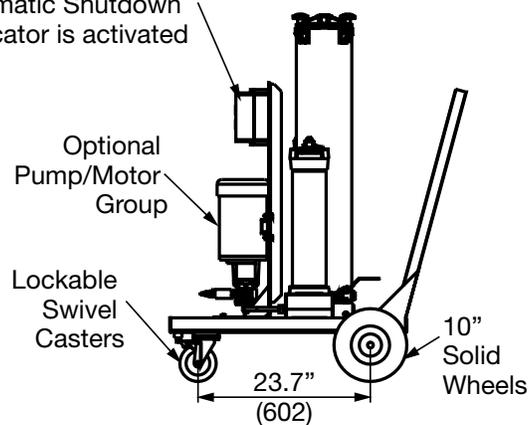


\* optional equipment, see ordering details  
VA = Clogging indicator

## Dimensions IXU1 Series

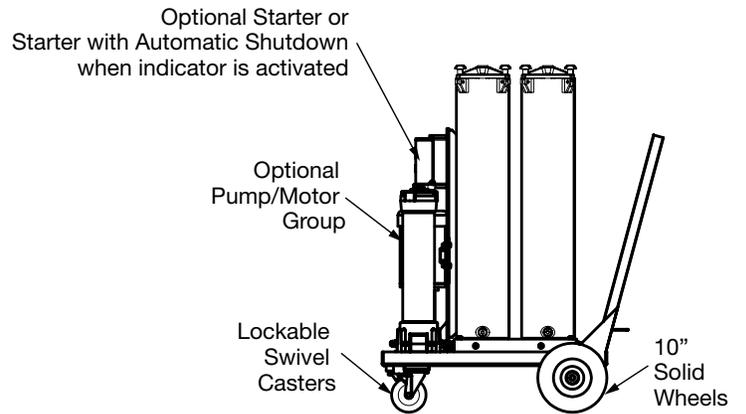
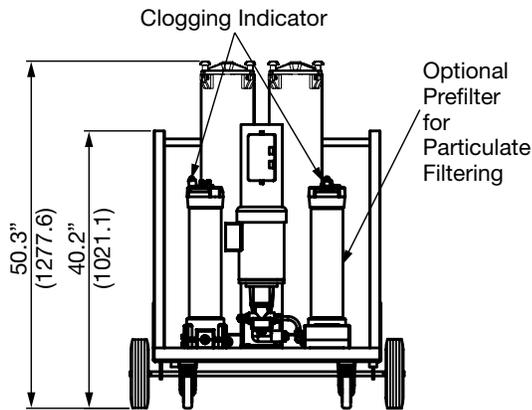
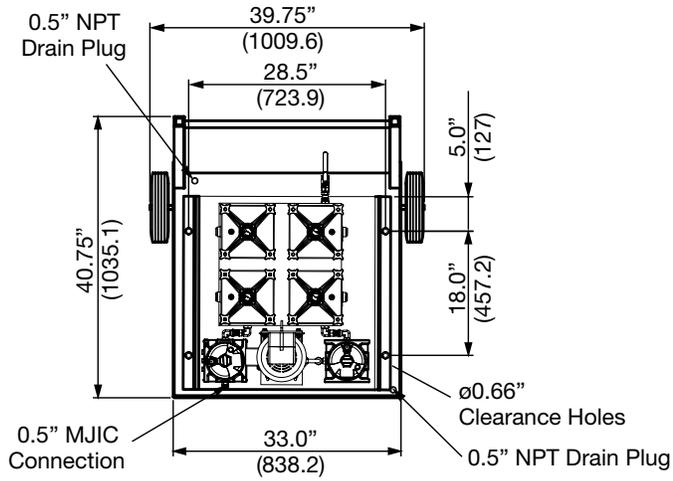


Optional Starter or Starter with Automatic Shutdown when indicator is activated



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

## Dimensions IXU4 Series



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## MAFH-A Series

### Dehydration Station



Cart



Shrouded

### Description

Water contamination in hydraulic systems can severely reduce the life of hydraulic systems and fluids. The MAFH is designed to eliminate 100% of free and up to 90% of dissolved water from small reservoirs, barrels, and gear boxes. Using a patented transfer process, the MAFH efficiently removes water and particulate contamination quickly in all environments. A proprietary design reduces aeration of free and entrained gases of returned fluid. The unit was designed to be extremely portable using either the central lifting point or the optional cart to access tight areas.

### Principle of Operation

The MAFH uses a new mass transfer dewatering technology. Ambient air is conditioned to increase its water holding capability before injecting to the reaction chamber. Fluid is equally distributed and cascaded down through reticulated media and the conditioned air stream. Water is transformed to water vapor and is expelled from the unit as a moist air stream. The relative humidity of the incoming fluid is continually monitored by an integral AS 1000 AquaSensor and displayed real-time on the control panel.

### Applications

- Steel and rolling mills
- Pulp and paper plants
- Power generation plants
- Tool machines / Plastic machines
- Hydraulic operated presses
- Oil conditioning

### Features

- High Dewatering Rates and particulate removal in one system
- Simple Controls; RUN/DRAIN modes
- Reduce fluid recycling cost
- No expensive vacuum pump to service and replace
- Patent Pending mass transfer technology uses ambient air to optimize and control dewatering rates
- Compact, efficient footprint - same diameter as a 55 gallon drum
- Remove free and dissolved water
- Highly effective in low and high humidity elements

### Technical Specifications

Type	Cart Ver. (standard)	Shrouded Ver.
Dimensions	44"h x 20.3"w x 36.7"d	46"h x ø23.25"w
Weight	295 lbs (134 kg)	295 lbs (134 kg)
Inlet Connections	1" SAE	1 1/4" inlet connection
Outlet Connections		1/2" MJIC
Flow Rate	90 gallons/hour	
Inlet Pressure	Atmospheric	
Outlet Pressure	to 40 psi	
Fluid Service Temp.	50° F to 175°F (10°C to 79°C)	
Power Supply	110 VAC, 60 Hz, 12 AMP Explosion proof version (Option X): 460 VAC, 60Hz, 3Ph	
Attainable Water Content	< 50 ppm	
Relative Humidity Display	Standard, 0-99% Range	
Materials of Construction	Vessel: Stainless steel Seals: FPM	Shroud & vessel: Stainless steel Seals: FPM
Fluid Viscosity	1000 SUS Explosion proof ver. (Option X): 500 SUS max	
Operating Fluids	Recommended for use with Hydraulic Fluids and Petroleum Based Fluids; (Consult factory for use with other fluid types)	
Max. Recommended Hose L/Dia. 15 ft. max. hose length at 1000 SUS	At 70 SUS - 10 ft/0.75 (inlet) 15ft/0.5 (outlet) At 1000 SUS - 8ft/1.0 (inlet) 10ft/0.75 (outlet)	
Max. Suction Pressure	-0.4 bar (11.97 in Hg)	

Note: Shrouded version does not have a suction strainer to protect pump - optional prefilter required for highly contaminated oil.

## Model Code

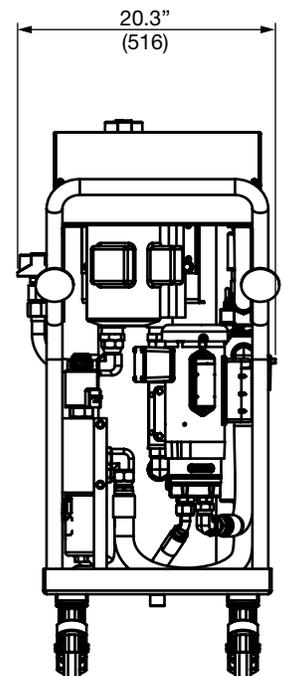
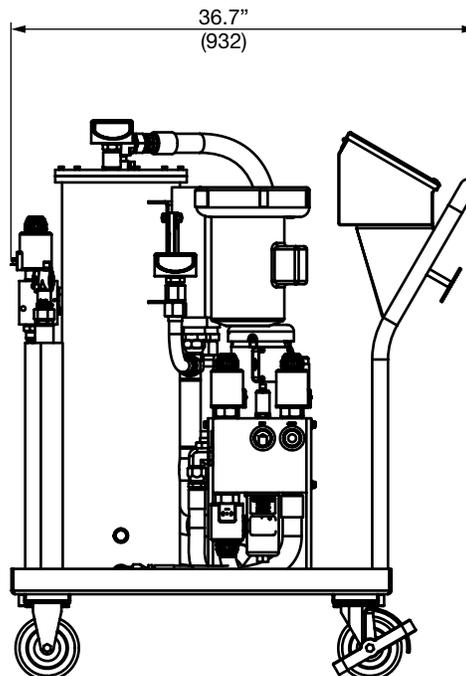
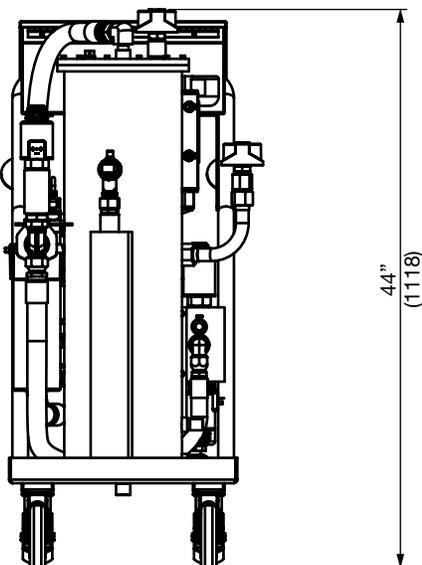
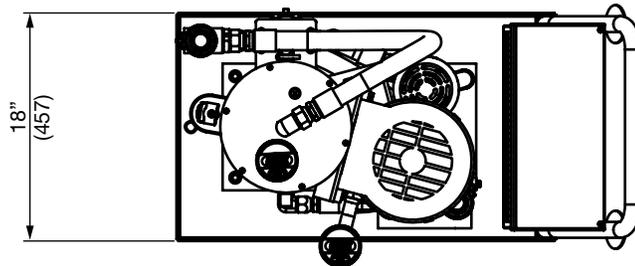
**MAFH - A - C - V - S - A - B - 01 - X**

<b>Series</b>	MAFH = Dehydration station
<b>Flow Rate</b>	A = 1.5 gpm average
<b>Type</b>	C = Cart (standard) (Omit) = Shrouded
<b>Seals</b>	V = Fluoroelastomer (FPM)
<b>Mobility</b>	S = Stationary M = Caster base
<b>Voltage</b>	A = 110V/60 Hz/1 Phase B = 220V/60 Hz /1 Phase
<b>Air Source</b>	B = Integral blower C = Compressed air (customer must supply clean, dry air)
<b>Element Size</b>	01, 03, 05, 10, 25
<b>Options</b>	X = Class 1, Div 2 explosion-proof, Supplied Voltage: 460V / 60Hz / 3Ph (contact factory if this option is required in for your application)

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

*Model Codes Containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.*

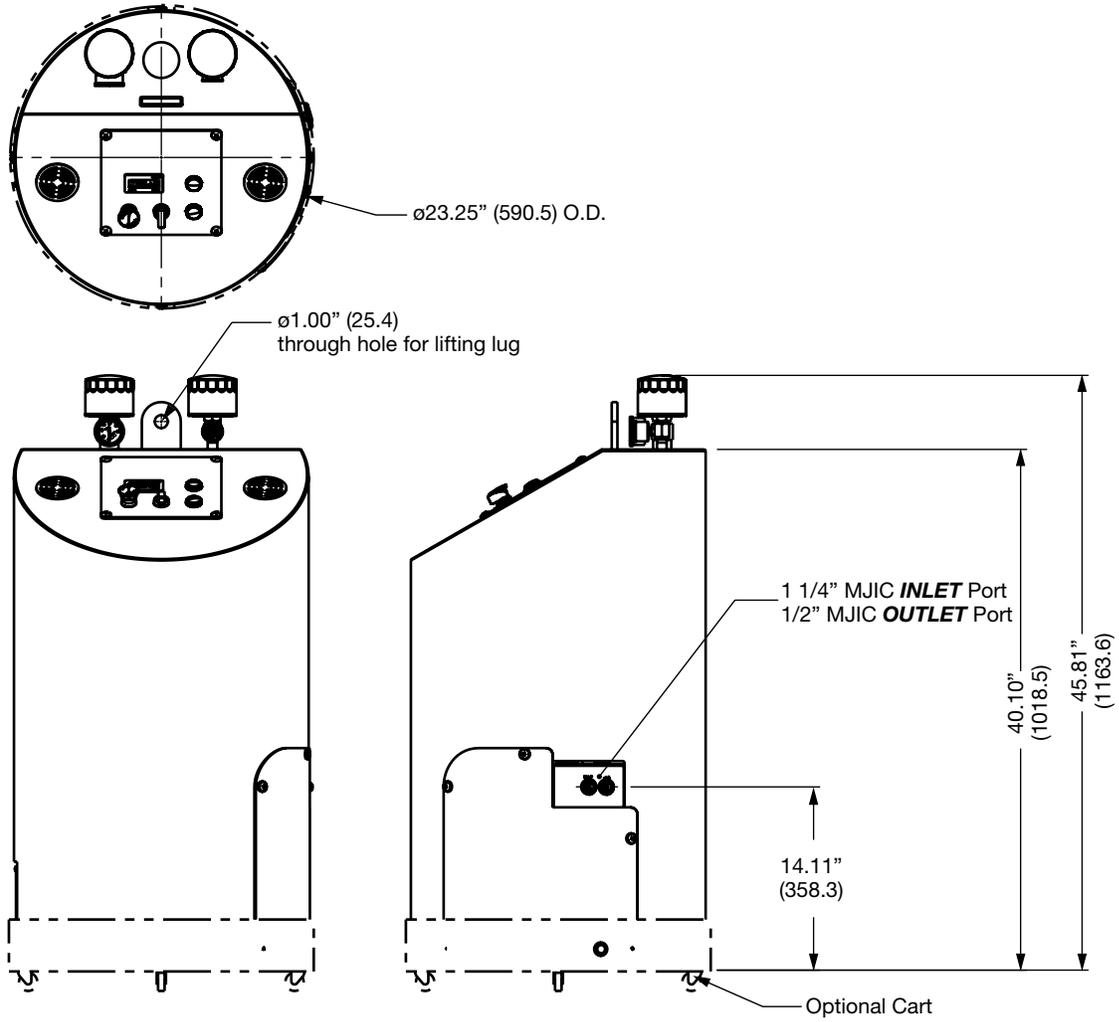
## Dimensions Cart



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# OFFLINE FILTRATION SYSTEMS

## Dimensions Shrouded



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.



# OFFLINE FILTRATION SYSTEMS

## MAFH-E Series

### Dehydration Station



#### Description

Water contamination in hydraulic systems can severely reduce the life of hydraulic systems and fluids. The MAFH-E is designed to eliminate 100% of free and up to 90% of dissolved water from reservoirs, barrels, and gear boxes. Using a patent pending transfer process, the MAFH-E efficiently removes water and particulate contamination quickly in all environments. A proprietary design reduces aeration of free and entrained gases of returned fluid. The unit was designed to be extremely portable using either the integrated lifting lugs located on each corner of the cart or the optional wheeled cart.

#### Principle of Operation

The MAFH-E uses a new mass transfer dewatering technology. Ambient air is conditioned to increase its water holding capability before injecting to the reaction chamber. Fluid is equally distributed and cascaded down through reticulated media and the conditioned air stream. Water is transformed to water vapor and is expelled from the unit as a moist air stream. The relative humidity of the incoming fluid is continually monitored by an integral AS 1000 AquaSensor and displayed real-time on the control panel.

#### Applications

- Steel and rolling mills
- Pulp and paper plants
- Power generation plants
- Tool machines / Plastic machines
- Hydraulic operated presses
- Oil conditioning

#### Features

- High Dewatering Rates and particulate removal in one system
- Simple Controls; RUN/DRAIN modes
- Reduce fluid recycling cost
- No expensive vacuum pump to service and replace
- Patent Pending mass transfer technology uses ambient air to optimize and control dewatering rates
- Remove free and dissolved water
- Highly effective in low and high humidity

#### Technical Specifications

Dimensions	32" W x 59" L x 70.25" H
Dry Mass	Without Heater: 1050lbs; With Heater: 1230lbs
Inlet Connections	1-1/2" MJIC
Outlet Connections	1-1/2" MJIC
Oil Viscosity	Min 75 SUS; Max 2500 SUS
Flow Rate	900 gallons/hour
Inlet Pressure	Atmospheric
Outlet Pressure	To 100psi (6.9 bar)
Fluid Service Temperature	50°F to 160°F (10°C to 71°C)
Power Supply	460V/3/60Hz, 7 amps 460V/3/60Hz, 22.5 amps w/Heater 575V/3/60Hz, 5.5 amps 575V/3/60Hz, 18 amps w/Heater
Attainable Water Content	<50ppm
Relative Humidity Display	Standard, 0-99% Range
Construction	Base Frame: Carbon Steel Vessel: Stainless Steel Seals: Viton
Protection Class	NEMA-2

## Model Code

**MAFH - E - V - M - A - B - G05 - H**

**Series** \_\_\_\_\_

MAFH = Dehydration Station

**Flow Rate** \_\_\_\_\_

E = 15gpm average

**Seals** \_\_\_\_\_

V = Fluoroelastomer (FPM)

**Mobility** \_\_\_\_\_

S = Stationary

M = Mobile

**Voltage** \_\_\_\_\_

A = 460V/3/60 Hz

B = 575V/3/60Hz

**Air Source** \_\_\_\_\_

B = Integral Blower

**Element Size** \_\_\_\_\_

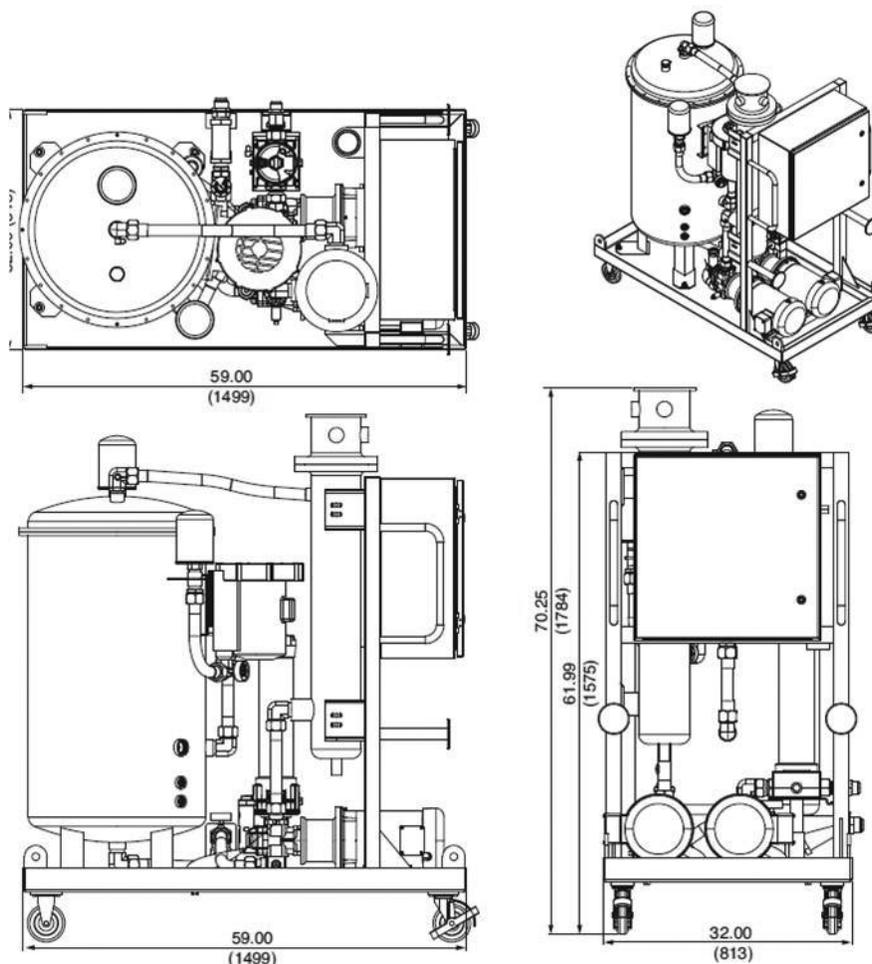
G01, G03, G05, G10, G25

**Optional Heater** \_\_\_\_\_

H = 12500W Heater

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

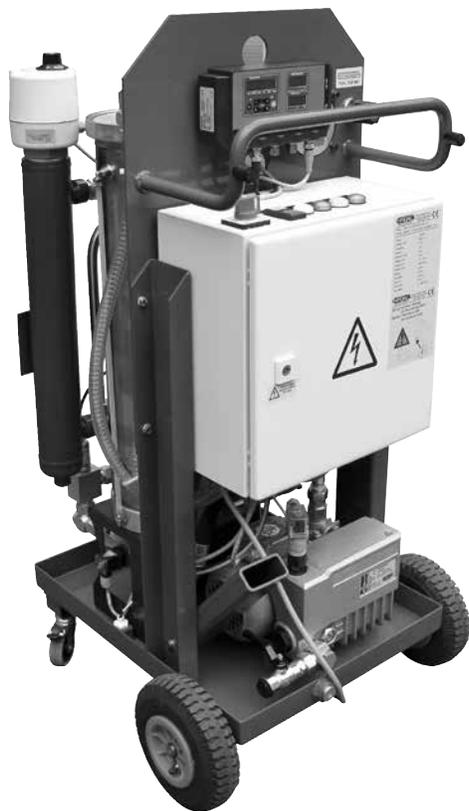
## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

## FAM5 Series

Fluid Aqua Mobile



### Description

The Fluid Aqua Mobile FAM 5 is designed for dewatering, degassing and filtering hydraulic and lubrication fluids.

It operates on the principle of vacuum dewatering to eliminate free and dissolved water as well as free and dissolved gases. By using HYDAC Dimicron filter technology which has a high contamination retention capacity and filtration efficiency, the FAM 5 is extremely cost effective.

Its compact and mobile design makes it ideally suited for service work. The version designed for permanent installation provides continuous protection for applications where operating fluids require optimal conditioning, where valuable bio-oils or fire-resistant operating fluids are used, or where water frequently gets into the system.

### Features

- Small, compact and easy-to-use unit for prompt deployment during service calls or emergencies
- Reliable and convenient for fixed and permanent use due to extensive monitoring functions
- Optional integrated heater to increase dewatering performance, especially for cold or high viscosity oils
- Optional integrated water content and particle measurement technology with continuous display of the measurements and storage of the values
- Very low residual water content, gas content and particle contamination result in longer oil change intervals, improved life expectancy of components, higher machine availability and as a result, a reduction in the Life Cycle Cost (LCC)

### Applications

- Steel and rolling mills
- Pulp and paper plants
- Power generation plants
- Tool machines / Plastic machines
- Hydraulic operated presses
- Oil conditioning

### Technical Specifications

Flow rate at 50 Hz	≈ 5 l/min
Permitted fluids**	Fluids compatible with NBR seals: <ul style="list-style-type: none"> <li>• Mineral oils to DIN 50524</li> <li>• Gear oils to DIN 51517, 51524</li> </ul> Operating fluids compatible with FPM (FKM, Viton®) seals: <ul style="list-style-type: none"> <li>• Synthetic esters (HEES) DIN 51524/2</li> <li>• Vegetable oils (HETG, HTG)</li> <li>• HFD fluids (<i>not for pure phosphate esters which require EPDM seals</i>)</li> </ul>
Sealing material	NBR or FPM (see model code "Operating fluid")
Filter size of fluid filter	OLF 5
Filter element for fluid filter (xxx = filtration rating)	N5DMxxx Filter element must be ordered separately, (see table "Filter elements for fluid filters")
Clogging indicator	Differential pressure switch with cut-off function when filter is clogged
Type of vacuum pump	Rotary vane vacuum pump
Pump type for filling & draining	Gear pump
Operating pressure	0 to 116 psi (0 to 8 bar)
Permissible pressure at suction port (without suction hose)	-2.9 to 14.5 psi (-0.2 to 1 bar)
Permissible operating viscosity range**	15 to 350 mm <sup>2</sup> /s (w/o integrated heater) 15 to 550 mm <sup>2</sup> /s (with integrated heater)
Permitted viscosity range for particle measurement	15 to 200 mm <sup>2</sup> /s - (with ACS measuring equipment)
Fluid temperature range**	50 to 176 °F (10 to 80 °C)
Ambient temperature **	32 to 104 °F (0 to 40 °C)
Storage temp. range**	32 to 104 °F (0 to 40 °C)
Relative ambient humidity**	Maximum 90%, non-condensing
Electrical power consumption (without heater) / required external fuse*	≈ 1 kW / 16 A for circuit breakers with trip characteristics type C
Heating output (optional)	Max. 2.4 kW (depending on the nominal voltage, see model code)
Protection class	IP54
Length of power cable / plug	10 m / CEE (depending on the nominal voltage, see model code)
Length of connection hoses	197" (5 m) (mobile version only)
Material of hoses	see Model Code
Hydraulic connections	see table "Connection Summary"
Weight when empty	~26.5 lb. (~120 kg)
Achievable residual water content	< 100 ppm - Hydraulic and lube oils < 50 ppm - Turbine oils (ISO VG 32/46) < 10 ppm - Transformer oils ***

\*Maximum specifications given, depends on equipment

\*\*For other fluids, viscosities or temperature ranges, please contact HYDAC

\*\*\*Units are not suitable for "Online" and "Onload" operation  
(transformer in operation and connected to grid).

## Model Code

**FAM - 5 - M - 2 - E - 05 - R - H - B - ACS - 00/-V**

### Series

FAM = Fluid Aqua Mobile

### Size

5 = ~ 1.32 gpm (~ 5 l/min)

### Operating fluid

- M = Mineral oil - NBR seals, NBR hoses, tested with mineral oil\*
- I = Insulating oil - NBR seals, NBR hoses, tested with insulating oil (e.g. Shell Diala)\* / \*\*
- X = HFD-R fluids - Fluroelastomer (FPM) seals, UPE/PE-PA hoses, tested with HFD-R fluid (e.g. Fyrquel)\*
- B = Biodegradable (ester-based) - Fluroelastomer (FPM) seals, NBR hoses, tested with biodegradable operating fluid based on esters\*

### Mechanical type

- 1 = Stationary (*with feet*)
- 2 = Mobile (*with castors and connection hoses*)

### Voltage / Frequency / Power supply

- E = 220 V/60 Hz/3Ph+PE
- M = 230 V/50 Hz/1Ph+PE
- O = 460 V/60 Hz/3Ph+PE<sup>1)</sup>
- AD = 220 V/60 Hz/1Ph+PE
- X = other voltage on request

### Filter Size of Fine Filter

05 = OLF5

### Type of Vacuum Pump

R = Rotary vane vacuum pump

### Heater

- H = Heater
- Z = Without heater (*for 200 to 359 V = 1 kW, for 360 to 690 V = 2.4 kW, heater only possible from 200 V*)

### Control Concept

B = basic

### Measuring Equipment

- Z = without
- AD = Aqua Sensor 3000, with display directly on the sensor, without control function.
- ACS = Aqua Sensor AS 1000 + Contamination Sensor CS 1000 + Sensor Monitoring Unit. Display and storage of the measurements, without control function.

### Modification Number

00 = The latest version is always supplied.

### Supplementary Details

- None = standard
- CSI = with GSM Wi-Fi module (HYDAC CSI-F-10)
- V = Fluroelastomer (FPM) seals for "M" and "I" fluids

1) Supplied without connector

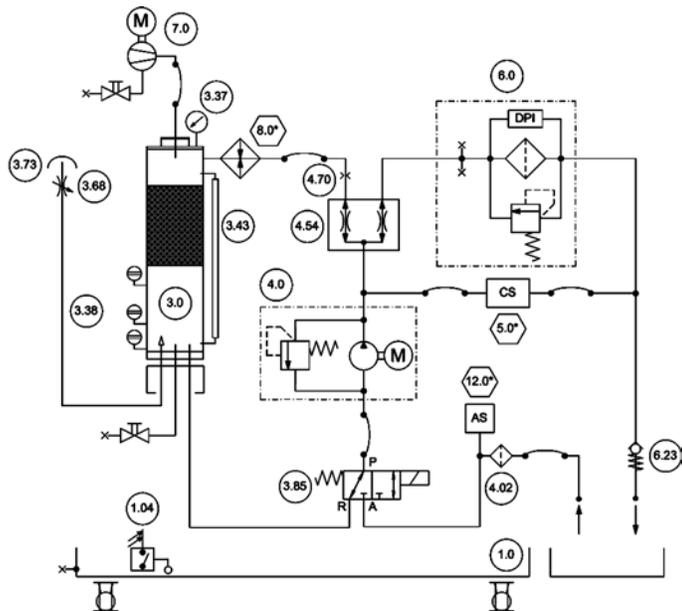
\* Residues of test fluid will remain in the unit after testing

\*\* Units not suitable for "Online" and "Onload" operation (*transformer in operation and connected to grid*)

For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

# OFFLINE FILTRATION SYSTEMS

## Hydraulic Schematic



Item	Description
1.0	Drip tray
1.04	"Drip pan full" float switch
3.0	Vacuum column
3.38	Level sensor for vacuum column
3.68	Needle valve to regulate the necessary vacuum in the vacuum column
3.73	Breather filter
3.85	3/2 directional valve
4.0	Motor pump assembly
4.02	Suction screen
4.54	Flow divider
5.0	ContaminationSensor CS1000 (optional)
6.0	Fluid filter for elimination of solid particles, with differential pressure switch for filter monitoring
7.0	Vacuum pump
8.0	Heater (optional)
12.0	AquaSensor AS 1000 / AS 3000 (optional)



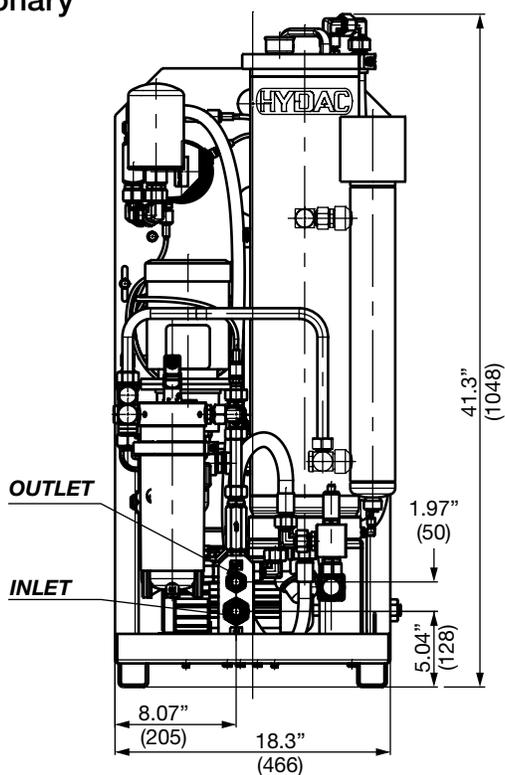
## Type of vacuum pump

The vacuum pump used is an oil lubricated rotary vane pump.

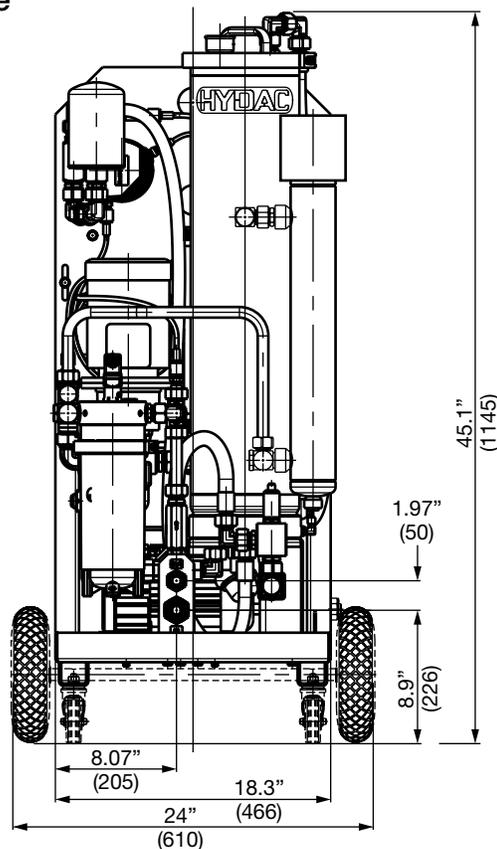
The air discharged by the vacuum pump can, in addition to water, contain constituent elements of the operating fluid concerned, as well as any gases it contained.

Therefore, please ensure that the area in which the FAM is operated is adequately ventilated.

## Dimensions Stationary



## Mobile



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

## Sizing

As a rough guide, the FluidAqua Mobil can be sized according to the tank volume of the system.

Tank Volume (gallons)	Model
< 396 (< 1,500 L)	FAM 5

In general, it must however be noted that sizing will depend on the application, the fluid, the temperature of the fluid and the ambient temperature, the fluid quantity and the water ingress into the system. These have a great effect on the dewatering efficiency. Therefore the specifications can only serve as an indication.

## Factors That Affect Water Removal Rate

	Factor (increasing/decreasing)	Dewatering Speed
Water Content	↑	↑
Fluid Temperature*	↑	↑
Detergent Additives	↑	↓
FAM Flow Rate	↑	↑

## Heater

By using the built-in heater, the dewatering capacity can be increased, particularly in the case of high viscosity fluids or fluids at low temperatures.

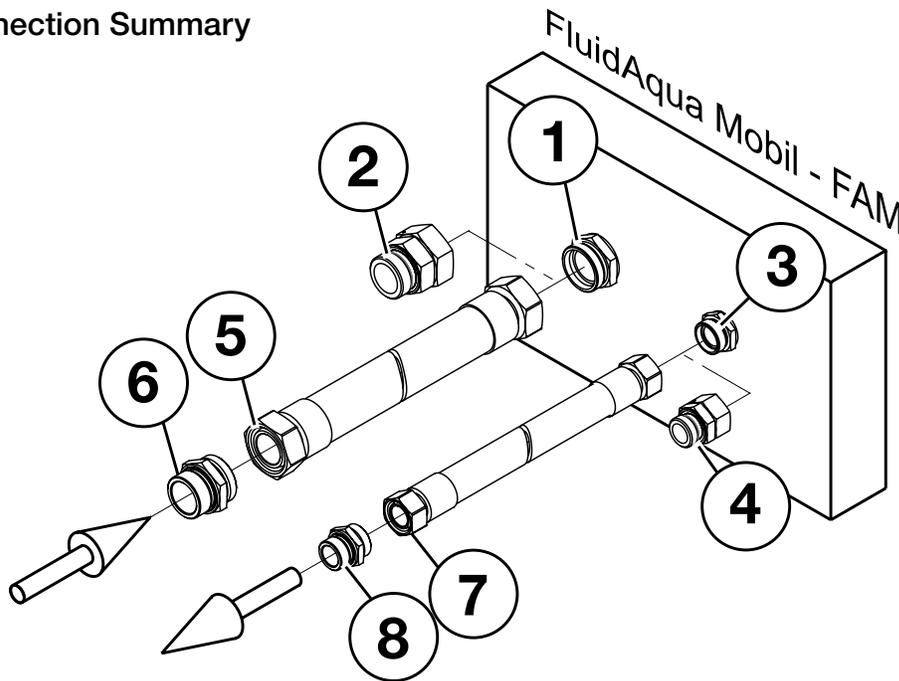
If the temperature of the fluid is raised by 50°F(10°C) then the dewatering capacity increases by up to 50 %. The ideal temperature for dewatering is ~122 to 140°F (~50 to 60°C).

Generally speaking, for operating viscosities of between 350 to 800 mm<sup>2</sup>/s the heater option must be selected and the heater must be used.

## Instrumentation

If the water and particle measuring options (*AquaSensor* and *ContaminationSensor*) are included, it is possible to display the water content relative to the saturation point (*saturation level, relative humidity*), as well as the particle contamination and temperature of the fluid. The measured data is stored in the SensorMonitoring Unit with a date and time stamp and can be easily transferred using a USB memory stick.

## Connection Summary



Item	FAM 5
1 - FAM inlet connector	28L / M36x2 (male thread)*
2 - Adapter	Adapter G1 A (male thread)**
3 - FAM outlet connector	18L / M26x1.5 (male thread)*
4 - Adapter	Adapter G ½ A (male thread)**
5 - Suction hose connection	28L / M36x2 (female thread)***
6 - Adapter	Adapter G1 A (male thread)**
7 - Pressure hose connection	18L / M26x1.5 (female thread)***
8 - Adapter	Adapter G ½ A (male thread)**

\* Connection Form D to ISO 8434-1 Series L  
(corresponds to ISO 12151, Form S, Series L)

\*\* Screw-in spigot to ISO 1179-2 (Form E)

\*\*\* Connection Form N to ISO 8434-4 Series L  
(corresponds to ISO 12151, Form SWS, Series L)

Items 1 to 4 are supplied with the stationary FAM.

Items 1 to 8 are supplied with the mobile FAM.

## Accessories

Description	Material	Part No.
Lance set for suction and return hose, consisting of: 2x lances ø0.71" (ø18 mm), length = 19.7" (0.5 m)	FPM	3685146

## Items supplied

- Fluid Aqua Mobile
- With suction and return hose (*only on mobile version*)
- 0.26 gal. (1L) vacuum pump oil for initial filling of vacuum pump
- Control cabinet key
- Technical documentation:
  - Operating and Maintenance Manual
  - Electrical wiring diagram
  - Test certificate
  - CE declaration of conformity

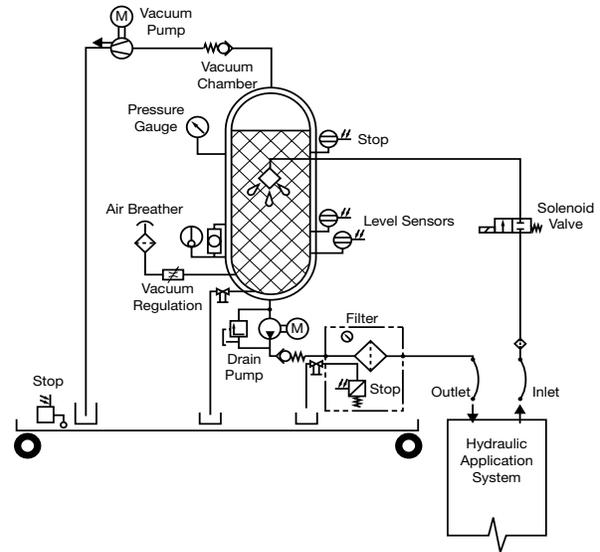
# OFFLINE FILTRATION SYSTEMS

## FAMH Series

Vacuum Dehydrator - Water & Solid Removal



### Hydraulic Schematic



### Description

The dewatering and filtration unit FAMH is a bypass unit which has been specially designed for the conditioning of lubrication and hydraulic fluids. Use of HYDAC's Dimicron® filter element technology provides a high contamination retention capacity.

The FAMH has been redesigned to include a touch screen menu for ease of diagnostics.

### Advantages

- Nema 12 Standard
- Separation of 100% free and 90% dissolved water through vacuum dehydration
- Removal of 100% free and 95% dissolved gases
- Separation of particles with high contamination retention capacity
- Easy handling and automatic supervision of the PLC controlled process
- User friendly touch screen diagnostics
- Standard aquasensor provides % water saturation
- JIC connections

### Applications

- Steel and rolling mills
- Pulp and paper plants
- Power generation plants
- Tool machines / Plastic machines
- Hydraulic operated presses
- Oil conditioning

### Options

- Nema 4 Enclosure

### HYDAC FAMH vs Other

- Water removal below saturation point
- Static flow through the filter
- Optimal particle removal efficiency
- Removed water is used to seal the vacuum pump (*Vacuum Pump type S, SW only*)
- The special vacuum pump concept avoids any dangerous chemical reaction products (*Vacuum Pump type S, SW only*)
- No corrosion within the vacuum pump
- No oil mist with standard watering / vacuum pump
- Serviceable vacuum chamber
- Low operating costs
- User friendly on screen operational and maintenance instructions

The contamination of hydraulic fluids with water can either be caused by condensation or by ingress. Variations in temperature of the hydraulic tank lead to condensation. The ingress of water can be caused by defective cooler hoses, defective seals or external leakages into the system.

In lubrication and hydraulic fluids water can occur in two different forms:

- free water (*visible*)
- dissolved water (*not visible*)

Aquamicon® elements, centrifuges and condensation methods normally only separate free water, the FAMH separates both forms of water from the oil. While dewatering the fluid, dissolved gases are also removed. Thereby the lubricating properties are improved which extends oil life, reduces component wear rates, and eliminates production losses caused by breakdowns.

## Model Code

**FAMH 30 M 2 O / 2700 030 DM 02 S A 1\***

### Series

FAMH = Fluid Aqua Mobile

### Flow Rate

15 = 5 gpm  
 30 = 10 gpm  
 50 = 16 gpm  
 70 = 23 gpm

### Operating Fluid

M = Mineral Oils (including Oils with max. viscosity as identified in Technical Data)  
 I = Transformer Oil (heater required)  
 X = Synthetic & Fire Resistant Oil (please specify exact fluid type) - FPM seals

### Type

1 = Stationary  
 2 = Mobile

### Voltage/Frequency

F = 230 V / 60 Hz / 3Ph+PE  
 O = 460 V / 60 Hz / 3Ph+PE  
 N = 575 V / 60 Hz / 3Ph+PE

### Power

without heater		with heater	
1900	= 1900 W (FAMH 15)	8650	= 8650 W (FAMH 15)
2700	= 2700 W (FAMH 30)	19200	= 19200 W (FAMH 30)
3200	= 3200 W (FAMH 50)	21200	= 21200 W (FAMH 50)
5100	= 5100 W (FAMH 70)	26100	= 26100 W (FAMH 70)

### Filter Size (microns) & Number of Elements

015 = 1 x N15DMxx (FAMH 15 only)  
 030 = 2 x N15DMxx (FAMH 15 and 30 only)  
 045 = 3 x N15DMxx (FAMH 30 and 50 only)  
 060 = 4 x N15DMxx (FAMH 50 and 70 only)  
 075 = 5 x N15DMxx (FAMH 70 only)

### Filter Material

DM = Dimicron®

### Absolute Filtration Rating (micron)

02 = 2 µm (DM)  
 10 = 10 µm (DM)  
 20 = 20 µm (DM)  
 30 = 30 µm (DM)

### Vacuum Pump Type/Size

D = Rotary vane pump  
 S = Standard watering / vacuum pump

### Measuring Equipment

A = AquaSensor (standard)

### Modification Number (latest version always supplied)

1  
 SW = Automatic Water Fill (for S type vacuum pump only)

Note: Please consult factory for NEMA4 enclosure.

Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.

**\*Sample Model Code (top of the page) is a standard version.**

**FAMH 30 M 2 O / 2700 030 DM 02 D A 1** - Standard FAMH without a heater

**FAMH 30 M 2 O / 19200 030 DM 02 D A 1** - Standard FAMH with a heater

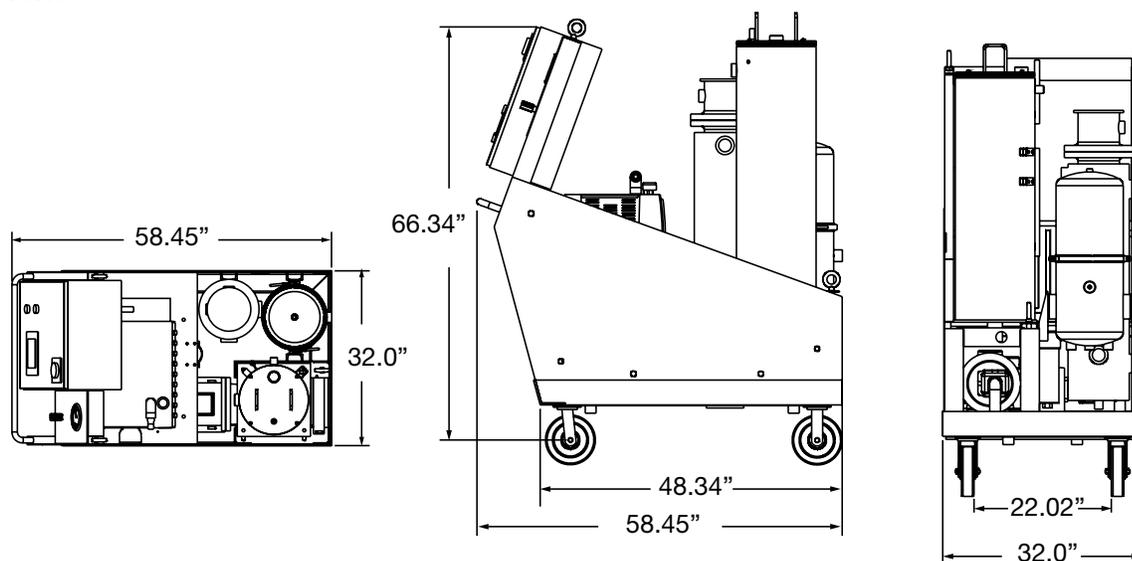
For replacement element part numbers, please see Section E - REPLACEMENT ELEMENTS of this catalog.

# OFFLINE FILTRATION SYSTEMS

## Technical Specifications

Series	FAMH 15	FAMH 30	FAMH 50	FAMH 70
Filter Size	OLF-15	OLF-30	OLF-45	OLF-70
Filter Element	N15DMxxx(1x)	N15DMxxx(2x)	N15DMxxx(3x)	N15DMxxx(5x)
Capacity of Pressure Vessel gal (liters)	5.25 (20)	10.5 (40)	20.5 (78)	26.25 (100)
Approx. Solid Contamination removal to ISO 4572 lbs (g)	1.1 (500)	2.2 (1000)	3.3 (1500)	5.5 (2500)
Electric Clogging Indicator	VM 2C.x			
Bypass Cracking Pressure psi (bar)	29 (2)			
Pump Type	Gear pump			
Flow rate gpm	5	10	16	23
Maximum Operating Pressure psi (bar)	87 (4.5)			
Viscosity Range (without ) SUS (cst)	75-2500 (15-500)			
Electrical Cable Length ft (m)	32 (10)			
Hose Length ft (m)	16 (5)			
Hose Material	NBR			
Inlet - Outlet	JIC 20 (1 1/4") - JIC 16 (1")			
Seal Material (FPM for operating fluid B, X)	NBR			
Dry Weight (lbs.)	940	970	1100	1145
Fluid Temperature	50° to 175°F			
Ambient Temperature	5° to 105°F			
Approx. Max. Free Water Removal Rate* (liters/hour)	1	1.7	2.2	2.6
Attainable water content (ppm)	< 100 ppm			
Power Requirements	60 AMP Circuit Required			

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

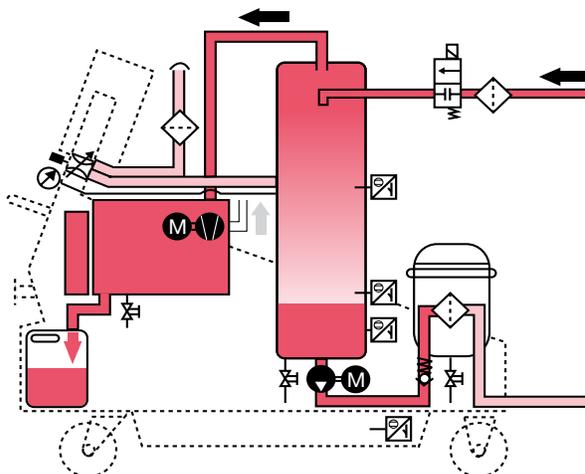
## Water Extraction Process

(for FAMH 15 - 70 without heater only)

The operating fluid is drawn from the oil reservoir by the vacuum in the reactor through the suction strainer and the shut-off valve. The oil trickles down slowly and from there is fed back into the oil reservoir by the gear pump through the filter. When Dimicron filter element technology is used the unit is especially economical.

Water is removed from the fluid in the reactor. The vacuum present has the effect of reducing the boiling point of the water.

The water vapor is released into the atmosphere or the water reservoir through the vacuum pump.



## Negative Effects of Water on Oils

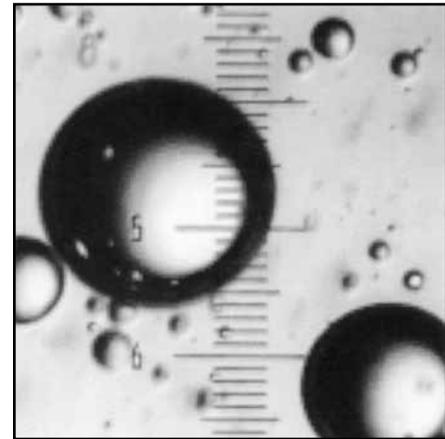
It is almost certain that there is water in a hydraulic system. The most frequent causes are: ambient humidity, splash water, and new oil. Mineral based oils show a faster aging process, if there is water in the oil. This aging process is accelerated through contamination particles by a catalytic effect. The additives are quickly used up and the lifetime of the operating fluid is much shorter than that of "dry" oil.

### Water in Mineral Oil causes

- Aging of the fluid
- Fluid deterioration
  - Reduced air separating results in: Cavitation
  - Increased foaming results in: Cavitation
  - Reduced lubrication results in: Vibration & Wear
  - Erratic operation results in: Inaccuracy
- Depletes additives
- Clogged filters
- Corrosion

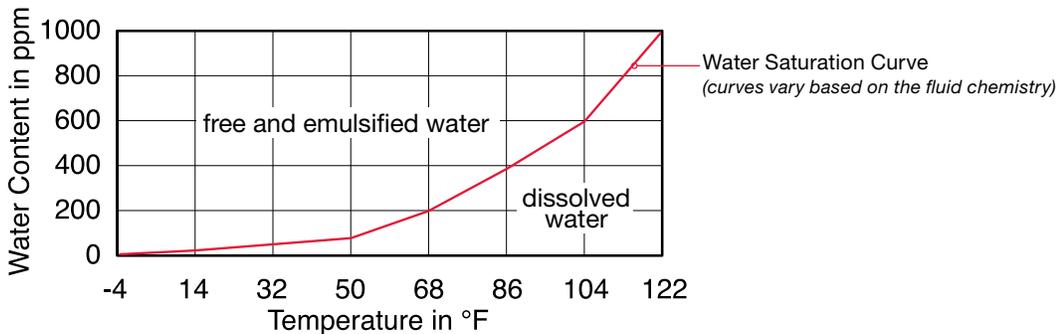
### Water in Ester Oils causes:

- Hydrolysis
- Seal deterioration
- Leakage



Tiny water droplets in hydraulics fluid  
(1 unit equals 10 micron)

### Typical Saturation Limit of Hydraulic Oil for Water



### FAMH Sizing

Sizing of the FAMH is normally done through periodic measuring of the water content which will determine the hourly ingress of water. The typical dewatering speed of the FAMH is listed in the technical data table. If there is a continuous ingress of water the recommended flow rate of the FAMH can be determined by the system size (*total gallons*). It should circulate 3 or 4 times through the FAMH every day.

### Sizing Chart Limits

(continuous water ingress)

Tank Volume (gallons)	FAMH Model
1000 to 2000	FAMH 15
2000 to 4000	FAMH 30
4000 to 7000	FAMH 50
7000 and up	FAMH 70

\*Please note that the fluid temperature should be a minimum of 20°F warmer than the ambient air temperature to enable efficient dewatering. An inline heater is available for reclaim applications. Please contact our sales/technical department.

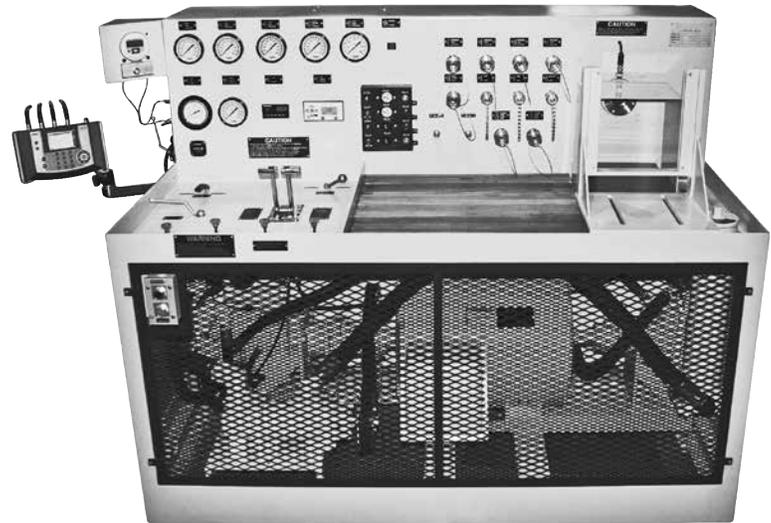
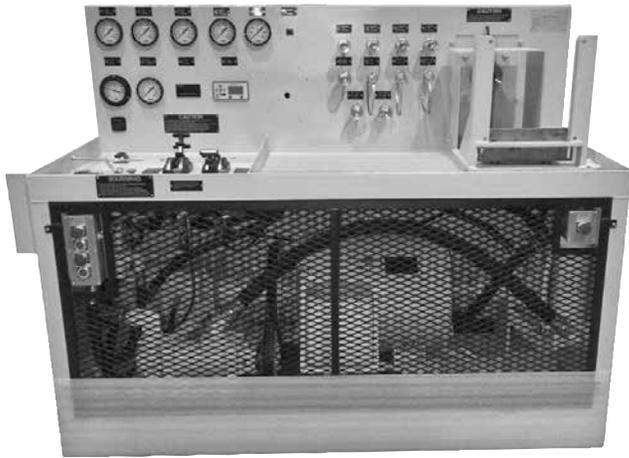
### Factors That Affect Water Removal Rate

	Factor (increasing/decreasing)	Dewatering Speed
Water Content	↑	↑
Fluid Temperature*	↑	↑
Detergent Additives		↓
Absolute Pressure in Vacuum Chamber	↓	↑
Humidity	↓	↑
FAM Flow Rate	↑	↑
Ester Oils		↘

# OFFLINE FILTRATION SYSTEMS

## HTB Series

### Hydraulic Test Bench



### Description

The HYDAC HTB hydraulic test bench is the ultimate diagnostic tool, capable of thoroughly testing a vast array of new or rebuilt components and subassemblies prior to their installation in a working system. Test bench instrumentation has been designed to make diagnosis fast and accurate, with virtually no requirement for connecting external instruments. The bench panel includes a digital flow gauge, a tachometer to measure the speed of tested pumps or motors, and a reservoir temperature gauge. Individual gauges measure pressure on the test bench main pump, the pump or motor being tested, the test bench load pump, the cylinder and valve pressure port, and the test bench super charge pump.

Every HTB includes efficient HYDAC hydraulic filters to keep the bench oil at optimum cleanliness, providing assurance that newly rebuilt components will not be subjected to harmful levels of dirt. To keep filters operating at peak efficiency, the instrument panel includes a red pilot light that signals the operator when any bench filter needs a new element.

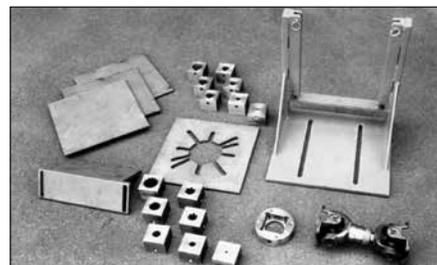
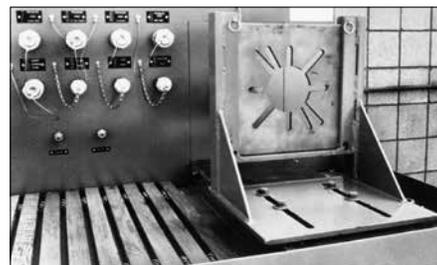
These benches have been refined for over 30 years by HYDAC engineers, based on the comments and requests of over 700 test bench owners. The versatile hydraulic circuitry present in each of the three models can shorten troubleshooting time and take the guesswork out of diagnoses. Current models are powerful, compact units that pay for themselves quickly in saved maintenance time and expenses.

### Applications

- **Pumps and motors** can be tested dynamically. Pump and motor testing is aided by the wide speed and torque ranges built into the bench and by the universal mounting bracket and mounting accessories that come with the bench. An open loop hydrostatic variable volume hydraulic system provides the power and speed control for the drive shaft. Motors can be dynamically tested, under load, for operating efficiency. Pumps can be tested for external leakage and volumetric efficiency in either direction, at speeds from 100 to 2400 rpm. The test bench can also be used to break-in pumps and motors to manufacturer's specifications before they are installed in a system.
- **Cylinder** leaks are easy to find. Double-acting cylinders may be cycled, and tested for both internal and external leakage at any point of piston travel. Scored cylinder walls and defective packing are easily detected. Single-acting cylinders are tested at maximum stroke.
- **Valve** testing time is minimized. Pressures can be set, external and internal leakage spotted, flow and pressure data can be generated and checked against operating requirements and overall valve efficiency determined. Optional electrical and pilot pressure supplies are available on the bench for testing solenoid-actuated and pilot-operated valves.

### Features

- An ingenious universal mounting bracket makes mounting pumps and motors on the bench a simple, quick operation
- Mounting plates are furnished to accommodate flange-mounted and foot-mounted pumps or motors
- Drive adapter equipment includes inserts for keyed shafts, an insert chuck and a universal drive shaft
- Quick disconnect porting on the bench provides convenient hook-up for test components
- Includes a factory-trained technician for a two-day, on-site training session
- Two complete operating manuals are supplied with each bench
- Kits and spare parts available for upgrades and maintenance

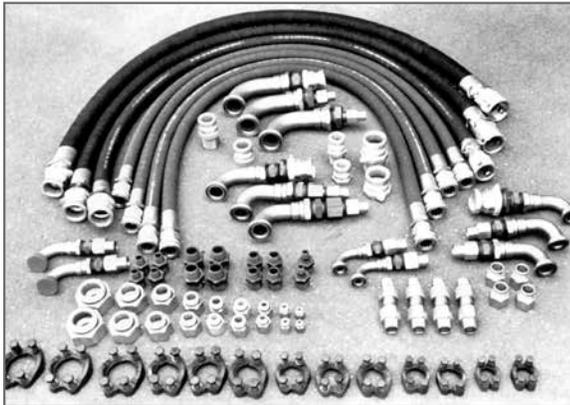


## Model Code

<b>Series</b>	<b>HTB</b>	<b>100</b>	<b>A</b>	<b>AD</b>	<b>GXXXX</b>
HTB = Hydraulic Test Bench					
<b>HP</b>					
50, 100, 150					
<b>Voltage</b>					
A = 230V 60Hz, B = 460V 60Hz, C = 575V 60Hz, D = 380V 50Hz, E = 415V 50Hz, F = 380V 60Hz					
<b>Options</b>					
A = Water Cooled Heat Exchanger	G = Closed Loop Circuit				
B = Solenoid & Pilot Operated Valve Group	H = HMG Digital Electronic Group				
C = Jib Crane Group	I = Air Cooled Heat Exchanger				
D = Filtration Group	J = 25 GPM Case Drain Meter				
E = Safety Enclosure Group	K = Digital Gauges				
F = High Pressure Intensifier Circuit	L = CS1000 Kit				
Splined Shaft Group*, Hose & Fitting Group*					
<b>Custom Groups</b>					
G = Add G# for all custom parts and frame modifications					

\*Note: Ordered as a separate line item.

Model Codes containing RED are non-standard items – Minimum quantities and longer lead times may apply - Contact HYDAC for information and availability.



### Hose and Fittings Group Option

(contains hose connection with female quick disconnects on both ends, plus a series of separate national pipe thread, straight thread, and SAE four-bolt flange adapters, ranging in size from 3/8" through 2", equipped with male quick disconnects)

Features	Model HTB-50-E	Model HTB-100-E	Model HTB-150-E
Speed Range in either direction	100 to 2400 rpm	100 to 2400 rpm	100 to 2400 rpm
Power Available for testing pumps Expressed torque	275 ft-lbs to 1200 rpm	458 ft-lbs to 1200 rpm <i>(decreasing proportionately to 2400 rpm)</i>	670 ft-lbs to 1200 rpm
Expressed in horsepower	60 hp at 1200 rpm	115 hp at 1200 rpm <i>(with constant hp to 2400 rpm)</i>	150 hp at 1200 rpm
Test Pressure	0 to 5000 psi (345 bar)	0 to 5000 psi (345 bar)	0 to 5000 psi (345 bar)
Test Motor Load Maximum in either direction	275 ft-lbs	458 ft-lbs	670 ft-lbs
Electrical Drive Motor-230/460V, 1800 rpm; 3 phase, 60 hertz (A start-stop push button is mounted on the bench; Starter(s) is/are not included. Customer must advise type of starter(s) and service voltage he will use.)	50 hp	100 hp	100 hp and 50 hp
Hydraulics			
Main Bench Pump (variable piston)	23 gpm/5000 psi (87 L/min/345 bar)	38 gpm/5000 psi (144 L/min/345 bar)	38 gpm/5000 psi (144 L/min/345 bar)
Auxiliary Main Pump (variable piston)	N/A	N/A	23 gpm/5000 psi (87 L/min/345 bar)
Supplemental Pump	20 gpm/2000 psi (76 L/min/138 bar)	20 gpm/2000 psi (76 L/min/138 bar)	20 gpm/2000 psi (76 L/min/138 bar)
Pressure and Return Ports	1" quick disconnects	1" quick disconnects	1" quick disconnects
Suction Porting	1" & 2" quick disconnects	1" & 2" quick disconnects	1" & 2" quick disconnects
Flow Gauge Scales	Three Scales: 2 to 14; 8 to 36; 24 to 100 gpm (all models)		
Reservoir Capacity	100 gallons (378 L)	100 gallons (378 L)	200 gallons (757 L)
General	Full flow 3 micron filtration maintains excellent system cleanliness level; bench includes a 30" x 30" work pan, oil level gauge, fill cap mesh strainer, digital tachometer.		
Bench Dimensions and Weight	62" H x 76" L x 43" W 4100 lbs (1860 kg)	62" H x 76" L x 43" W 4500 lbs (2041 kg)	62" H x 76" L x 55" W 6000 lbs (2722 kg) Auxiliary Power Unit 30" H x 50" L x 30" W 900 lbs (408 kg)



## **E** Replacement Elements

Each of our hydraulic filtration systems are equipped with high efficiency elements to remove solid particulates and/or water quickly and efficiently. A complete listing of the replacement elements used through-out the Filter Systems catalog can be found on the following pages.

# REPLACEMENT ELEMENTS

## Pressure Elements

Used in OFS Series, OFCS & OFCD Series, OFAS & OFAD Series, OF5HS & OFCD-HV Series, and OFX Skid - Standard Capacity Series

9 inch Elements		18 inch Elements		27 inch Elements	
Model Code	Part No.	Model Code	Part No.	Model Code	Part No.
5.03.09D03BN	02060528	5.03.18D03BN	02060430	5.03.27D03BN	02065003
5.03.09D03BN/-V	02056713	5.03.18D03BN/-V	02071680	5.03.27D03BN/-V	02082855
5.03.09D05BN	02060529	5.03.18D05BN	02060431	5.03.27D05BN	02065004
5.03.09D05BN/-V	02056714	5.03.18D05BN/-V	02056457	5.03.27D05BN/-V	02073488
5.03.09D10BN	02060530	5.03.18D10BN	02060432	5.03.27D10BN	02065005
5.03.09D10BN/-V	02056715	5.03.18D10BN/-V	02056492	5.03.27D10BN/-V	02056493
5.03.09D20BN	02060531	5.03.18D25BN	02060433	5.03.27D20BN	02065006
5.03.09D20BN/-V	02056716	5.03.18D25BN/-V	02072428	5.03.27D20BN/-V	02096052
5.03.09D10AM	02075265	5.03.18D40AM	02091879	5.03.27D40AM	02088358
5.03.09D01BN/-V	02096735	—	—	5.03.27D40AM/-V	02088359
5.03.09D01BN	02081446	—	—	5.03.27D01BN	02094531
5.03.09D10BN/AM	02075258	—	—	5.03.27D01BN/-V	02099845
5.03.09D40AM/-V	02561740	—	—	—	—
HK/HJ (connector element)	02056730	—	—	—	—

### Element Performance

Micron Rating	Filtration Rating per ISO 4572/NFPA T3.10.8.8 <i>Using automated particle counter (APC) calibrated per ISO 4402</i>			Filtration Rating wrt ISO 16889 <i>Using APC calibrated per ISO 11171</i>	
	Bx≥75	Bx≥100	Bx≥200	Bx≥200	Bx≥1000
Element					
5	2.5	3.0	4.0	4.8	6.3
10	7.4	8.2	10.0	8.0	10.0
25	18.0	20.0	22.5	19.0	24.0

### Dirt Holding Capacity

9" Element Micron Rating	DHC(gm)	18" Element Micron Rating	DHC(gm)
5	119	5	238
10	108	10	216
25	93	25	186

Used in OFCD-MV Series, OFS-AM Series, OF5HD-HV Series, MAFH-E Series

18 inch Element		27 inch Element	
Model Code	Part No.	Model Code	Part No.
5.03.18D03BN/-V-G	02094523	5.03.27D03BN/-V-G	02098195
5.03.18D05BN/-V-G	02094528	5.03.27D05BN/-V-G	02200583
5.03.18D10BN/-V-G	02094529	5.03.27D10BN/-V-G	02200584
5.03.18D25BN/-V-G	02098097	5.03.27D25BN/-V-G	02200585
5.03.18D10AM/-V-G	02097600	5.03.27D40AM/-V-G	02098194

Note: G = Betamicron GeoSeal® (r) replacement elements

### Element Performance

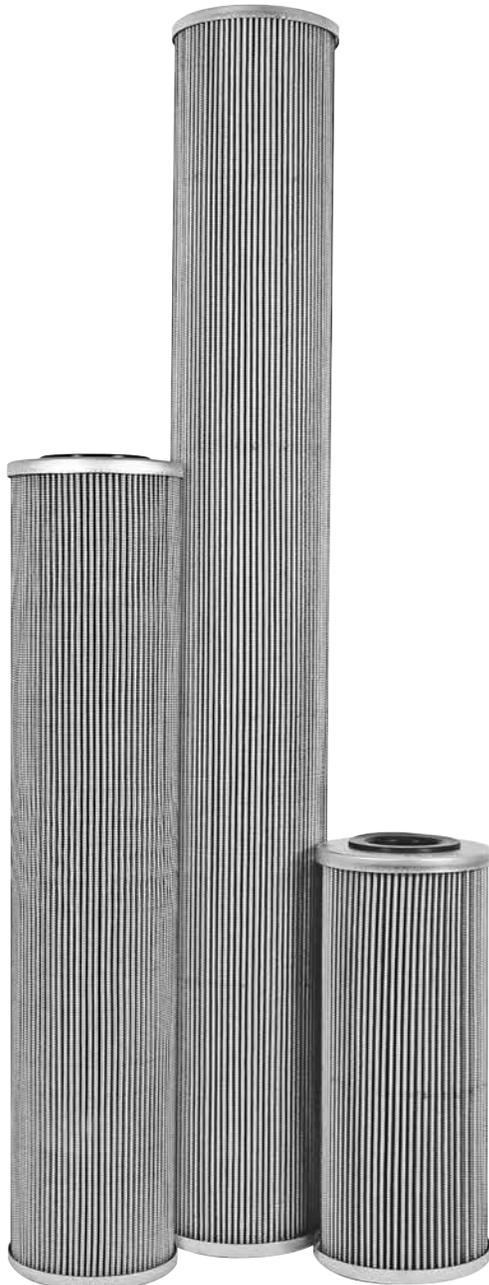
Micron Rating	Filtration Rating per ISO 4572/NFPA T3.10.8.8 <i>Using automated particle counter (APC) calibrated per ISO 4402</i>			Filtration Rating wrt ISO 16889 <i>Using APC calibrated per ISO 11171</i>	
	Bx≥75	Bx≥100	Bx≥200	Bx≥200	Bx≥1000
Element					
3	<1.0	<1.0	<2.0	4.0	4.8
5	2.5	3.0	4.0	4.8	6.3
10	7.4	8.2	10	8.0	10.0

### Dirt Holding Capacity

18" Element Micron Rating	DHC(gm)	27" Element Micron Rating	DHC(gm)
3	230	3	345
5	238	5	357
10	216	10	324

## Used in OFX Skid - High Capacity Series

16 inch Element		39 inch Element	
Model Code	Part No.	Model Code	Part No.
1.14.16D03BN	02060578	1.14.39D03BN	02060844
1.14.16D03BN/-V	02078420	1.14.39D03BN/-V	02070809
1.14.16D06BN	02060588	1.14.39D06BN	02060845
1.14.16D06BN/-V	C/F	1.14.39D06BN/-V	C/F
1.14.16D12BN	02060589	1.14.39D12BN	02060846
1.14.16D12BN/-V	C/F	1.14.39D12BN/-V	02071197
1.14.16D25BN	02060590	1.14.39D25BN	02060847
1.14.16D25BN/-V	02078423	1.14.39D25BN/-V	C/F



## Used in MAFH-A Series

Model Code	Part No.
5.12.09D10BN/-V	02561354
5.12.09B03BN/-V	02093367
5.12.09B05BN/-V	02091885
Breather Element ( <i>Shrouded</i> )	02561357
Breather Element ( <i>Cart</i> )	1296639

## Element Performance

Micron Rating	Filter Rating	DHC (gm)
1	$\beta$ 4.2(c) $\geq$ 1000	55
3	$\beta$ 4.8(c) $\geq$ 1000	57
5	$\beta$ 6.3(c) $\geq$ 1000	62
10	$\beta$ 10(c) $\geq$ 1000	52

## Used in IXU 1/4 Series

Model Code	Part No.
IXE 200	03348961
5.03.18D05BN/V SO103H	02077497
5.03.18D10BN/-V SO103H	02056369

# REPLACEMENT ELEMENTS

## Dimicron® Elements

Used in OLF Series & FAMH Series

Model Code	Micron Rating	Part No.
N15DM002	2	01251590
N15DM010	10	03115180
N15DM020	20	00349576
N15DM030	30	03048790

Be sure to order the correct number of elements:  
OLF 15 = 1, OLF 30 = 2, OLF 45 = 3, OLF 60 = 4



## Cartridge Elements

Used in FAM5 & OLF Compact Series

Model Code	Micron Rating	Media Type	Part No.
N5DM002*	2	Dimicron®	00349494
N5DM005*	5	Dimicron®	03068101
N5DM010*	10	Dimicron®	03102924
N5DM020*	20	Dimicron®	03023508
N5AM002*	2	Aquamicron®	00349677
N5AM020*	20	Aquamicron®	03040345

\*Cartridge element can not be used with OLF 5/4-SP



## Spin-on Elements

Used in OF7 Series

Micron Rating	160: Betamicron® (Part No.)	180: Betamicron® (Part No.)	Paper (Part No.)	Water Removal (Part No.)
3 µm	0160MA003BN (02059434)	0180MA003BN (02059438)	-	-
5 µm	0160MA005BN (02059435)	0180MA005BN (02059439)	-	-
10 µm	0160MA010BN (02059436)	0180MA010BN (02059440)	0160MA010P (02058116)	0160MA010A (02058771)
20 µm	0160MA020BN (02059437)	0180MA020BN (02059441)*	-	-

\*Spin-on element for OLF 5/4-SP

## Aquamicron® (AM) Elements

Aquamicron® filter elements are specially designed to separate water from mineral oils. They are only supplied in the dimensions of HYDAC return line filter elements from size 330 and larger. This means that they can be installed in all HYDAC filter housings from size 330 which are fitted with return line filter elements.

The increasing pressure loss in a filter element which is being saturated with water indicates, by means of standard clogging indicators, that it is time to change the element. When the Aquamicron® technique is employed, particle contaminants are also separated from the hydraulic medium as a by-product. This means that the Aquamicron® element doubles as a safety filter. The "filtration rating" is 40 µm absolute ( $\beta_{40} \geq 100$  to  $\Delta p = 3$  bar).

In order to guarantee the greatest efficiency, it is recommended that these elements be installed in an off-line recirculation loop configuration.

For complete details please contact your HYDAC distributor.



## Betamicron®/Aquamicron® (BN/AM) Elements

BN/AM filter elements are specifically designed to absorb water and achieve absolute filtration of solid particles from mineral oils, HFD-R oils, and rapidly biodegradable oils. A super absorber reacts with the water present in the fluid and expands to form a gel from which the water can no longer be extracted even by increasing the system pressure. These filter elements do not remove dissolved water below the saturation level of the hydraulic medium. Solid particle filtration (3 µm, 10 µm absolute) is achieved due to the Betamicron® filter construction.

For complete details please contact your HYDAC distributor.



## Betterfit® Interchange Elements

HYDAC's family of interchange elements has a new name and a new focus. The former Betafit line will now be called Betterfit, and will incorporate an exclusive outer wrap that not only improves performance, but also provides quality protection. It features a unique oval-hole design that improves flow for more efficient filtration, ensuring long system life and cost savings. This is a one-of-a-kind oval design, so you can be assured that when your element includes this outer wrap that it is a HYDAC original and not a low quality imitation.



## **F** The New World of Advanced Diesel Filtration

In the past, the cleanliness level of delivered diesel fuel was rarely questioned. Now however, the cleanliness mandates of Tier IV requirements (2 µm tolerances in 30,000 psi injection systems) dictates that close attention must be paid to these levels.

Historically, an engine with poor quality filtration would probably still run – maybe not efficiently, but it would run. The byproducts of poor filtration were black smoke and compromised horsepower. Today, Tier IV engines with poor quality fuel filtration will most likely suffer downtime due to failed injector(s), which equates to lost revenue. High quality filtration is no longer an option, but a requirement for the efficient operation of these new engines.

# BULK DIESEL FILTRATION

## Tier IV Requirements Demand a Sophisticated Approach and the Highest Quality Filtration

Newly delivered bulk diesel fuel typically has an ISO cleanliness level of ISO 22/20/18 to 21/19/17. The Tier IV compliant engine on the other hand, has injectors that require fuel with a cleanliness level below ISO 11/8/6 – which is typical of aerospace cleanliness.

The most cost effective way to consistently achieve this cleanliness level is through use of the highest quality particulate and coalescing filtration, both at the bulk tank and on the engine itself. The engine filter alone is no longer an adequate solution as there simply is not enough room in the engine to accomplish this. HYDAC has developed a series of both bulk and on-board fuel-specific products to address these new standards.

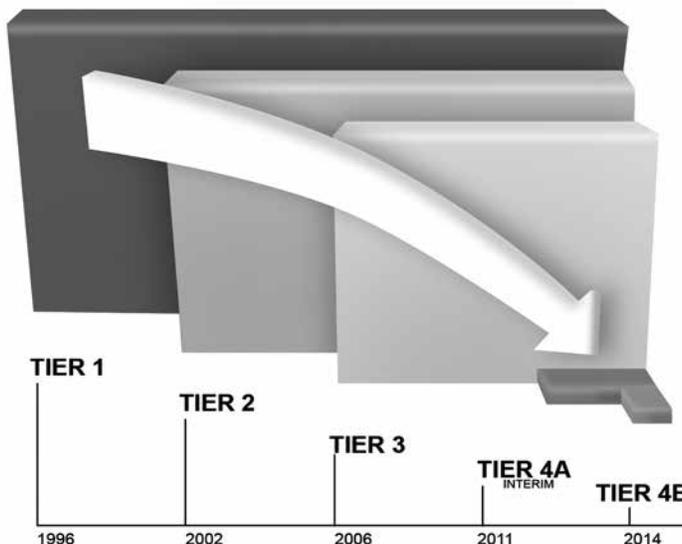
## High Pressure Common Rail Systems

This series of engines is built to very strict specifications – operating pressures in excess of 30,000 psi and injectors with nozzle tolerances of 2 – 5 microns are not uncommon. OEM injector and engine makers require that the fuel used in these engines meet tight guidelines before warranty claims are accepted. Diesel fuel cleanliness at the engines injectors must reach an ISO level of 11/8/6 and a water level of <200 ppm, both of which are harder to obtain with the surfactants for lubricity found in Ultra Low Sulfur Diesel fuel.



## Ultra Low Sulfur Diesel (ULSD)

In 2010, North America and Europe completed the requirements switch from Low Sulfur Diesel to Ultra Low Sulfur Diesel. The purpose was to reduce the sulfur content from 500 ppm to 15 ppm, reducing exhaust emissions by over 90%. To achieve this, much of the lubricity agents in Low Sulfur Diesel are removed, along with some of the original fuels built-in lubricity. The result is an ultra-clean fuel where surfactants must be added to provide the needed lubricity. Diesel engines depend on the lubricity of the fuel to keep moving parts from wearing prematurely. Lubricity additives such as lubricity enhancers and anti-wear additives have also been replaced with biodiesel blended into diesel. Ultra Low Sulfur Diesel 15 is generally hydrophobic, i.e. it does not like to hold water, and has a 25 – 100 pm water saturation point at room temperature. Unlike traditional Low Sulfur Diesel, the biodiesel additives are hydrophilic, meaning they do like to hold water. For this reason, when biodiesel is blended, the diesel fuel's saturation point can rise to 250 ppm (B2), 500 ppm (B5) or even 1600 ppm (B20). This is acceptable, but the user should understand that there is more water in the fuel and that this water can become free water when the temperature decreases – which is not good for the performance of the engine or the engine itself. This water must be eliminated, which becomes more difficult when the Inter Facial surface Tension of Diesel with surfactants and/or biodiesel blends is lower making it harder to separate the water in Ultra Low Sulfur Diesel. A coalescing filter that was >90% efficient in traditional diesel is typically now only 66% effective in removing water in the Ultra Low Sulfur fuels.



The Tier 4 Emissions Regulations established by the U.S. Environmental Protection Agency (EPA) and Canadian Environmental Protection Agency (CEPA) are getting tougher. In 1996, the first off-highway diesel emissions standard began with the implementation of Tier 1 regulations. Since then, standards have continued to be raised and will end with Tier 4B/Final in 2014.

## Biodiesel Addition to ULSD 15 as a Blend

The EPA's Renewable Fuel Standard #2 requires that renewable fuel, such as biodiesel, be blended into traditional diesel fuels. The goal is to reduce dependence on carbon-heavy fuels and reduce carbon pollution 17% below 2005 levels by 2020.

An additional challenge in this respect is the bulk tank and water from condensation in the tank, and the delivered fuel itself. Most bulk tanks are not designed to help meet the Tier IV requirements. Many reservoirs are open to their surrounding atmospheres. Almost all have some volume of free water caused by temperature changes, ingress and delivered fuel quality. In addition, poor design makes the removal of all free water nearly impossible. This free water in diesel accelerates corrosion and fuel degradation. It can also create an ideal growth environment for microbial contamination. Bacteria can grow in the water at the fuel interface and can cause the liquid fuel to breakdown. The result can be the accelerated corrosion of metals as well as plugged fuel systems and clogged filters and lines. In addition, fungus can grow on solid surfaces, like filters, and in piping.



## Previously acceptable “industry standard” filtration solutions are not adequate for Tier IV engines.

Against this backdrop, HYDAC has developed a series of bulk diesel fuel specific filter products, including desiccant breathing systems and bulk housings. We are focused on being a world leader in diesel fuel filtration.

### Past Practice

Separation of emulsified water from diesel fuel is a long standing requirement for diesel engine operation. Traditionally, this has been performed by a fuel-water separation filter mounted in the engine fuel system or as part of the bulk tanks staged filtration at the dispensing system. The most typical filtration media found in such separators is a single resin impregnated hydrophobic barrier, such as silicone treated cellulose. This media separates water in its water repellent surface. Water in the fuel is rejected and beads up on the upstream side of the barrier media. As more water is rejected, beads coalesce into large drops and drain into collection cup while the fuel passes through a port located above the sump.

Just as the processing of Ultra Low Sulfur Diesel produces side effects in diesel lubricity, the failure of existing fuel-water separators to react to the changing conditions described above is apparent. The lubricity additives in the ULSD blends containing biodiesel create conditions in which industry-standard commercial fuel-water separators failed to remove 40 – 100% of fuel-entrained water. The side effect is that now typically 40% more water is downstream of the filters that in the past worked at a 90% efficiency. Typically, there is no way for an operator to know this is happening unless the effects are drastic and observed. Unlike particle filters which generate pressure differentials prior to by-pass alerting the operator to the end of the element life, there is nothing that communicates to the operator that the fuel-water separator is not removing water. Fuel-water separators rely on an operator or auto-valve to empty water to a collection chamber when the housing is partially full. If the collection chamber does not fill up, it is not an indicator of fuel-water separator failure; rather it is an indicator of dry fuel. The result is the fuel-water separator can be passing the water continuously into the injection system without the operator’s knowledge.



### Fuel Surfactant and ULSD 15

The root cause of fuel-water separator failure in ULSD-biodiesel blends is increased fuel surfactant. Although given separate titles to address the lubricity issue, lubricity enhancers, anti-wear additives and biodiesel can all be grouped into a single molecular family: surfactants. Fuel and water are classes that normally do not dissolve into one another; if forced to coexist, they are most stable as separate layers, with the fuel layer on top of the water layer. The degree to which these layers repel is measurable as the interfacial surface tension (IFT). If mixed, an emulsion is formed, where water briefly exists as suspended drops in the fuel. Surfactants are molecules unique in that they form strong associations with both fuel and water. When surfactants are in a fuel, they associate with water, and increase fuel-water compatibility. The increased compatibility is reflected in lower IFT between the two fluids. This unique surfactant behavior allows more water to dissolve into the fuel.

Surfactants create sufficiently small water drops (because they do not want to coalesce into larger drops) that will often pass through the media without encountering it. Surfactants also stabilize the emulsion from separation so that drops that do impact the media are less likely to fall out of the fuel at the barrier media. Also, drops that impact other drops resist coalescing into the larger drops necessary for successful separation. Collectively, the result of blending additives and biodiesel into ULSD is a significant reduction of the fuel-water separation process efficiency and finally the escape of the water into the injector circuit.

At the same time, another unforeseen consequence of the mandated fuel change is a lack of correlation of the tests with actual field performance. The result, the end user is largely unaware of the alarming failure consistency of fuel dewatering systems in ULSD-biodiesel blends. This is the case because the time required for a legislative body to mandate 2% biodiesel inclusion in diesel is fleeting relative to the time needed to adapt proven standardized industry test for the new fuel. Regardless of the procedure selected, there are currently key differences between fuel surfactants/emulsifications found in the field versus the tests that are still specified to measure and rate water separator performance. Until resolved, the result is a disconcerting overestimation of a separator’s fuel water separation performance and capability as measured using standardized tests.

HYDAC is committed to delivering the solutions to allow OEM’s and users to meet today’s diesel filtration requirements. We offer a series of diesel fuel filtration products working in-line and/or in a fuel conditioning circuit with flow rates from 1.5 gpm to 1000 gpm. We offer condensation management solutions for the tank and the diagnostic tools such as particle counters and water sensors to measure the results.

### Tier 4 Fuel Quality Requirements

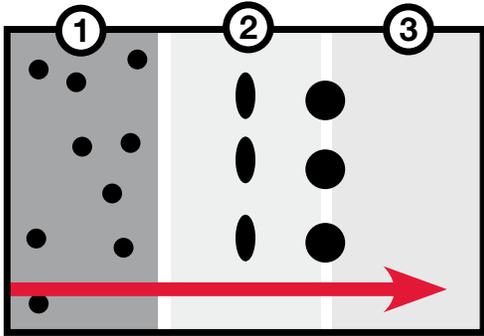
Organization	Particulate ISO 4406	Water
Bosch	11/8/6 at Injector	<200 ppm
CAT	18/16/13 at storage	200 ppm
CUMMINS	18/16/13 at storage 15/13/10 at vehicle tank 12/9/6 at injector	<200 ppm
Worldwide Fuel Charter	18/16/13	No free or emulsified, dissolved <200 ppm

Most diesel storage tank owners, maintenance staff and company buyers are not knowledgeable of these guidelines.

# BULK DIESEL FILTRATION

## Design Principles of HYDAC Particulate Removal Filters & Elements

HYDAC offers the highest quality particulate removal filtration with the best combination of dirt holding capacity, low element delta P, and the highest beta stability throughout the service life of the element. We offer contamination removal efficiencies from  $1\mu\text{m} > \text{Beta } 1000$  to as open as  $150\mu\text{m}$  metal mesh. Most importantly, when filtering diesel fuel we use these filters and elements upstream to protect and extend the life of the downstream dedicated coalescing elements. We do this because testing shows that with our patent pending materials our coalescing elements will outperform the competition averaging  $<96\%$  efficiency. HYDAC offers an entirely new level of coalescing performance, one that when used correctly has a very low cost over time.



Design features of the water coalescing filters and elements include an inside-out flow to optimize coalescing, and a five micron synthetic pre-filter pleat pack to protect the downstream components. In addition a depth tube coalesces water which either drains to the bottom or creates large droplets. Downstream, a 25 micron treated hydrophobic barrier sleeve traps droplets  $<25\mu\text{m}$ . Essentially this is three elements in one pre-filter, unlike our competitors, who typically furnish a single filter element for each function. We have tested these products per SAE J1488, and with fuel down to 12 dynes/cm IFT to replicate performance with poor fuel quality.

Contaminated fuel enters the elements as the fuel passes through a 3 or 5 micron synthetic media pleat

pack. Wet fuel then passes through the coalescing layer. Water collects and drains from the element forming large droplets. The fuel then passes through the downstream hydrophobic barrier. Water droplets are repelled by the barrier and fall to the bottom of the chamber, which is collected into the filter housing sump. Through the union of high surface area the coalescing media or tube provides the perfect balance to collect and trap both water and contaminants in a single element. This composite barrier separation media element has been developed with greater than 99% water removal capability in all but the highest surfactant ULSD or ULSD-biodiesel blends. This coalescing media provides a minimum of 95% water removal efficiencies from biodiesel blends (B5). Water exits the media in the form of drops that settle out of the flow.



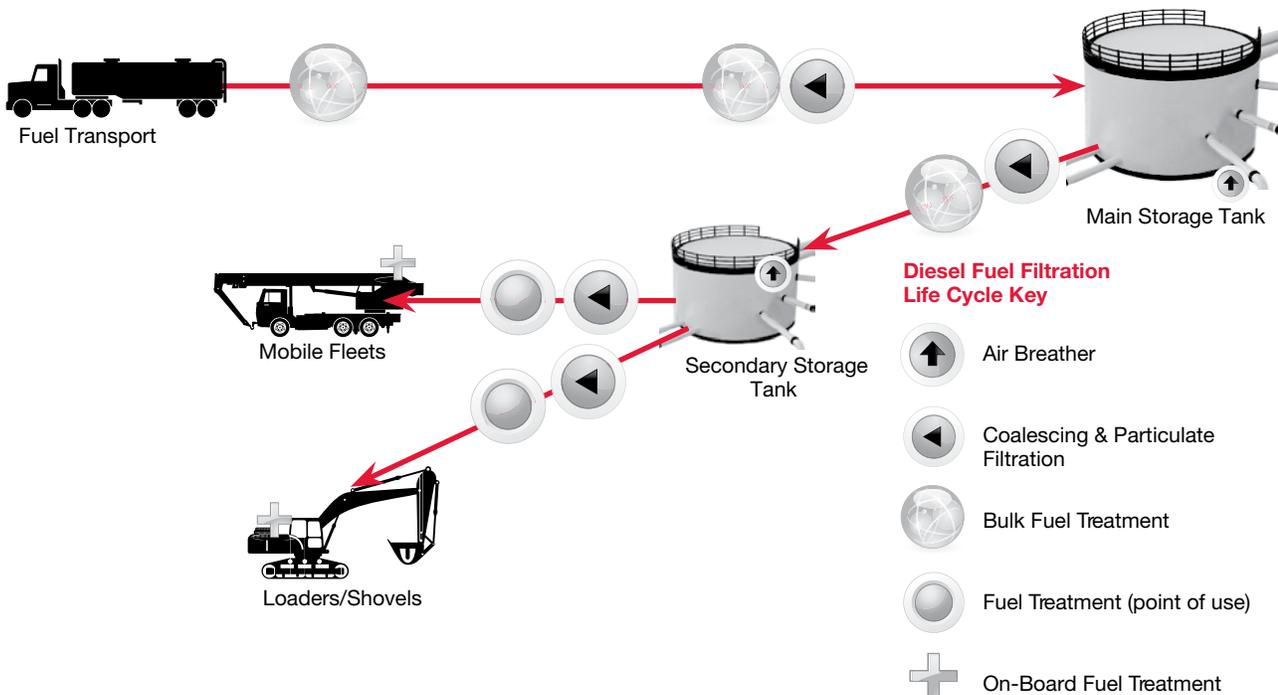
HF4RL Filter Housing  
(catalog - Filters, Hydraulic & Lube, PN 02081318)

## The Cost of Dirty Fuel

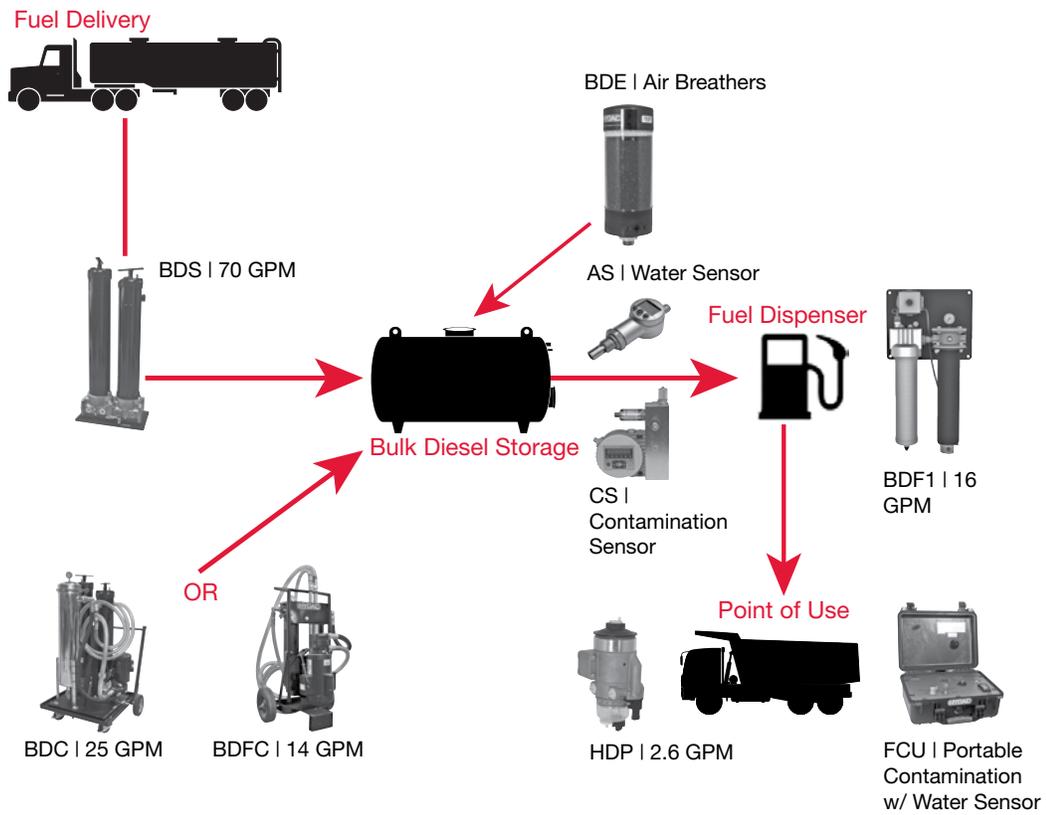
All new off-road diesel engines now must meet Tier IV requirements. Manufacturers of engines and injector systems have gone to high pressure, common rail, injection systems. The pressures can exceed 30,000 psi and might go even higher in the future. Particulates left in the fuel under the high pressure, combined with very small injector nozzle clearances as small as  $2\mu\text{m}$ , can cause premature failure of nozzles or system components.

Failures of the injection system caused by particulates and water can result in repair costs of up to \$1500 per injector. The associated costs for a failure due to parts damage, repair and down time, and loss of production could be significantly higher. A comprehensive filter strategy is required to assure proper fuel quality for trouble free engine operation.

## Comprehensive Fuel Filtration Strategy by Application



## Comprehensive Fuel Filtration Strategy by Products



HYDAC has developed many of these core diesel products into turnkey filtration solutions with integrated pump motor functions for almost every diesel application from gen sets to fleet fueling tanks to the Ag tank at a farm. All are designed to address the challenges of fuel in its environment.

# BULK DIESEL FILTRATION

## ICF Series

### In-line Bulk Fuel Coalescing Filter



#### Description

Coalescing filtration can be a highly effective method to remove water from diesel fuels. Water is typically introduced into the fuel supply by condensation. Water in a vehicle fuel system can reduce lubricity causing seizure of close tolerance parts and increased wear. Water in fuel storage tanks causes rust and promotes microbial growth. Microbial growth in fuel storage systems begins in free water at the tank bottom and can quickly migrate through the fuel. In warm weather, microbial “blooms” can quickly overwhelm and bypass fuel filters causing contamination to reach the fuel injectors. Today’s high pressure (20,000+ psi) fuel injector systems have tighter tolerances and require complete water removal to minimize wear related failures. The ICF Bulk Fuel Coalescing Filter will protect critical equipment and components.

#### Features

- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today’s ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier III and Tier IV engine components against failures caused by particulate and water transferred from bulk fuel tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today’s ULSD fluids
- Housing design allows for field upgrade of any available option
- HYDAC Stat-Free® media is standard for all coalescing elements
- Pressure bypass indicator setting at 25 psi, with bypass valve cracking at 40 psi, allows for early indication before by-pass of filter for advanced time for maintenance
- In application >32°F (0°C) complete automation is achievable with fail-safe auto-drain feature using a remote 5 gallon (18L) or 20 gallon (75L) sump with alarm and auto shutdown

#### Applications

- Fleet fill or bulk fuel transfer
- Bulk fuel unloading
- Protection for high-flow fuel injection systems
- Bulk tank kidney loop or recirculation
- Point of use fuel dispensing

#### Technical Specifications

Flow Rating	Up to 16 gpm (60 L/min) for ULSD15
Inlet / Outlet Pressure	1 1/2" NPTF (standard), SAE 16 (optional)
Max. Operating Pressure	150 psi (10 bar)
Min. Yield Pressure	450 psi (31 bar)
Rated Fatigue Pressure	90 psi (6 bar), per NFPA T2.6.1-2005
Temp. Range	-20°F to 165°F (-29°C to 74°C) (standard) AWD option = 32°F (0°C) min. temp.
Bypass Indication	25 psi (1.7 bar) (lower options available)
Bypass Setting	Cracking: 40 psi (3 bar)
Porting Head/Cap:	Aluminum (see Coating Option - Model Code)
Element Bowl:	Steel - Epoxy paint w/high-phos electroless nickel plating (standard)
Weight	15 lbs (6.8 kg) (base unit w/o options or element)
Element Change Clearance	18" (457.2mm) w/mounting bracket (access from top, remove cap) 2.5" (63.5mm) w/o mounting bracket (access from below, remove bowl)
Housing Sump	32 oz. (0.946 L)
Optional	External water sump and non-immersion heater (power 120VAC, 1 x 45W), sight glass, bracket, water in fuel sensor w or w/o remote mount light & 6 ft. lead

Note: Other electrical options, contact factory, element sold separately

## Model Code

**ICF - V - P24 - L - B - S-I - EP-A - H - AWD5 -**

**Filter Series** \_\_\_\_\_  
 ICF = In-line Coalescing Filter

**Seals** \_\_\_\_\_  
 V = FPM

**Port Configuration** \_\_\_\_\_  
 P24 = 1 1/2" NPTF (standard)  
 S16 = SAE 16 (1" port)

**Element Change Indicator** \_\_\_\_\_  
 L = in cap bar indicator

**Mounting Option** \_\_\_\_\_  
 Omit = None  
 B = Bracket

**Sump Level Indicator Option\*** \_\_\_\_\_  
 Omit = None  
 S = Sight glass  
 I = Water in fuel sensor remote w/light indicator & 6 ft. lead for use in factory supplied control panel  
 T = Water in fuel sensor w/o remote light for use in customer supplied control panel

**Coating Option\*** \_\_\_\_\_  
 EP = Epoxy painting and plating (standard)  
 A = Anodized cap & head (optional)

**Heating Option** \_\_\_\_\_  
 Omit = None  
 H = Filter Sump Heater

**Automatic Drain Option** \_\_\_\_\_  
 Omit = None  
 AWD5 = Auto water drain 5 gal. tank w/failsafe (only offered for applications above 32°F (0°C) & units ordered w/o heater)  
 AWD20 = Auto water drain 20 gal. tank w/failsafe (only offered for applications above 32°F (0°C) & units ordered w/o heater)

**Optional Sump for Manual Drain** \_\_\_\_\_  
 Omit = None  
 S5 = 5 gal. sump tank  
 S20 = 20 gal. sump tank

Note: Unless automatic drain option is specified, ICF units will come standard with manual drain.

**Coalescing element sold separately.**

\*Only Options that allow a combination.

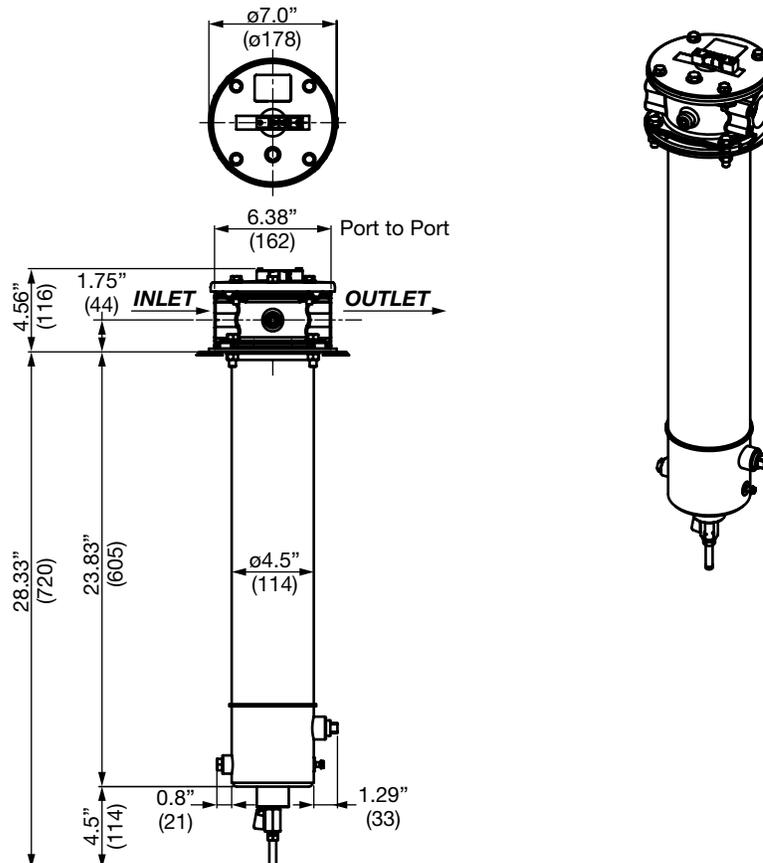
Filter sump heater option only available when ordered w/out automatic water drain (AWD5 or AWD20)

AWD fail safe is shown on next page

## Fuel Oils

- ULSD15, low and high sulfur diesels
- Biodiesel blends
- Synthetic diesel and blends
- No. 2 fuel oil & heating oil

## Dimensions



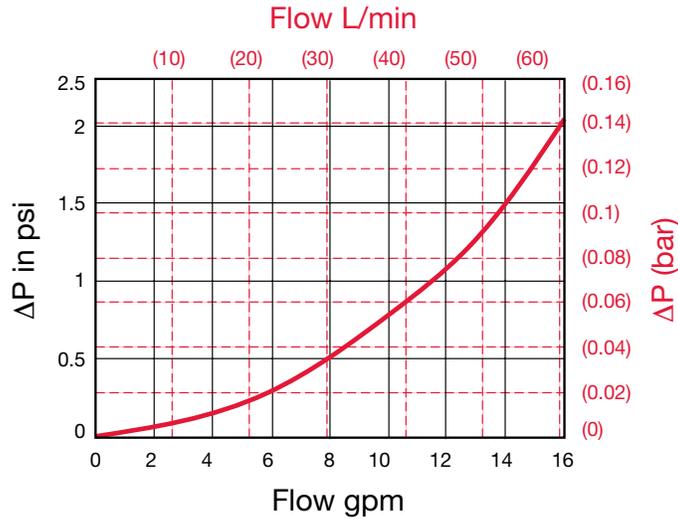
Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# BULK DIESEL FILTRATION

## Pressure Drop

$\Delta P_{\text{housing}}$

ICF  $\Delta P_{\text{housing}}$  for fluids with sp gr = 0.86



$\Delta P_{\text{element}}$

$\Delta P_{\text{element}} = \text{flow} \times \text{element } \Delta P \text{ factor} \times \text{viscosity factor}$

El.  $\Delta P$  factors @ 37 SUS (3 cSt).

C184Z3V = 0.2

C184Z5V = 0.2

If working in units of bars & L/min, divide above factor by 54.9.

Viscosity factor: Divide viscosity by 37 SUS (3 cSt).

## Element Water Coalescing Performance

Element	Max Flow	Single Pass Efficiency*
C184Z5V	16 gpm	> 99.5%*
C184Z3V		
C184Z7VE	Contact HYDAC for Economy Element Data	

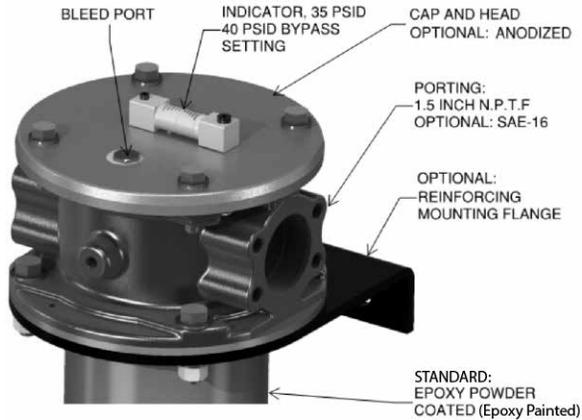
Flow Direction: Inside Out

Element Nominal Dimensions:  $\phi$  4.0" (102 mm) x 18.5" (470 mm) long

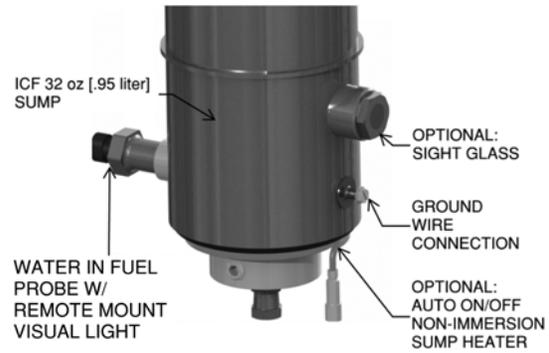
\*HYDAC Stat-Free media is standard

Note: Efficiency based on ULSD15 with 27 Dynes/CM surface tension and 0.25% (2500 PPM) water injection. Discharge water concentration of <100 PPM free and emulsified water.

## ICF Options Filter Cap Assembly

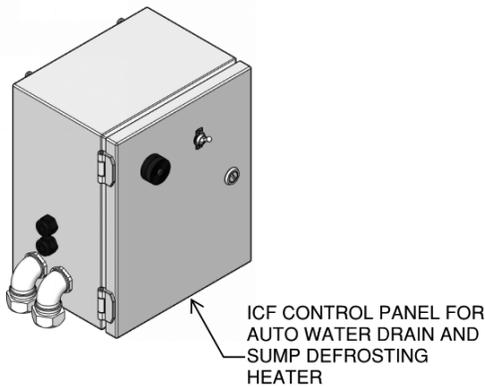


## Reservoir Available Options



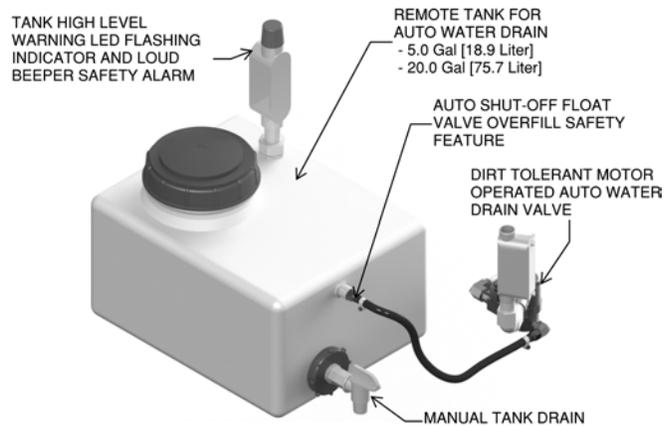
Note: Water in fuel sensor (WIF) supplied with or w/o remote mount indicator light to show full filter housing sump  
 T Option = WIF sensor only w/out filter housing sump full indication light or control panel  
 I Option = WIF sensor w/ remote mount filter housing sump full indicator light and NEMA 4X control panel supplied

## Automatic Drain w/Redundant Safety Features



Note: Filter Sump Heater Control Panel dimension: 6.5" W x 5.5" H x 6.5" D (165 W x 140 H x 165 D)  
 Automatic Water Drain Control Panel dimension: 10" W x 8" H x 12" D (254 W x 203.20 H x 304.80 D) \*For use above 32°F (0°C) only  
 Electrical cable length (Control Panel to ICF): 4 ft. (1.22m)  
 Hose length for Automatic Water Drain feature (ICF to Tank): 6 ft. (1.83m)  
 All control panels "NEMA 4X" rated

## Automatic or Manual Remote Sump



Note: Remote Tank dimension: 5 Gallon Tank, 22" W x 9.25" L x 7.125" H (558.80 W x 234.95 L x 180.97 H)  
 20 Gallon Tank: 15" W x 11" L x 31" H (381 W x 279.40 L x 787.40 H)  
 Power supply for tank high level LED light: 9 VDC (battery included)  
 Supplied w/ 9 VDC terminal for customer wiring provided.



# BULK DIESEL FILTRATION

## QCF Series

In-line Bulk Fuel Coalescing Filter



### Description

Advances in diesel engine fuel injection systems have been instrumental in complying with future emission standards. Higher pressure fuel produces a finer mist of fuel, which burns cleaner. Common rail injection systems run at higher pressures and allow more injections per combustion cycle, improving fuel economy, enhancing engine performance and reducing noise. Higher pressure fuel injector systems have tighter tolerances and require the highest efficiency, single-pass removal to minimize wear related failures.

### Features

- New fuel/water separation media technology in a three-phase element construction for high efficiency, single-pass removal of free-water in ultra-low Sulfur Diesel (ULSD) and Biodiesel fuels
- Prior generation coalescing products no longer provide high-efficiency separation in ULSD and Biofuels
- Can be upstream (suction side) or downstream (pressure side) of transfer pumps
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Can separate emulsified or finely dispersed water from fuel
- For use in single-pass fuel dispensing or multi-pass reservoir clean-up and continuous maintenance

### Applications

- Industrial
- Agricultural
- Power Generation
- Mining
- Bulk Fuel Filtration

### Technical Specifications

Flow Rating	Up to 70 gpm (265 l/min) for ULSD15
Max. Operating Pressure	100 psi (7 bar); 45 psi (3 bar) with water sight gauge
Min. Yield Pressure	400 psi (27.6 bar) without sight glass <i>(Contact factory for use with sight glass)</i>
Rated Fatigue Pressure	Contact Factory
Temperature Range	-20°F to 165°F (-29°C to 74°C) <i>(standard)</i> 32°F to 165°F (0°C to 74°C) <i>(with optional Automatic Water Drain)</i>
Bypass Setting	Cracking: 30 psi (2 bar)
Porting Base:	Anodized Aluminum
Element Case:	Nickel Coated Steel
Cap:	Nickel Coated Ductile Iron
Weight	155 lbs (77 kg)
Element Change Clearance	33.8" (858 mm)

## Model Code

**QCF - C - 5 - V - S24 - VM -**

### Filter Series

QCF = In-line Coalescing Filter

### Element Series

C = Coalescing Element

### Element Media

5 = 5 µm Syn./Coalescing

### Seals

V = FPM

### Port Configuration

S24 = SAE 24

### Clogging Indicator

VM = Visual Pop-Up w/ Manual Reset

### Options

Omit = None

AWD5\* = Auto water drain 5 gal. tank w/failsafe

AWD20\* = Auto water drain 20 gal. tank w/failsafe

H = Integrated heater to prevent water in sump from freezing

S = Sight Gauge

\*Note: Optional Automatic Water Drain (for use only above >32°F)

## Element Water Coalescing Performance

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency	Max Flow	Single Pass Efficiency
C396Z5V	70 gpm	> 99.5%	CF	> 99.5%

Flow Direction: Inside Out

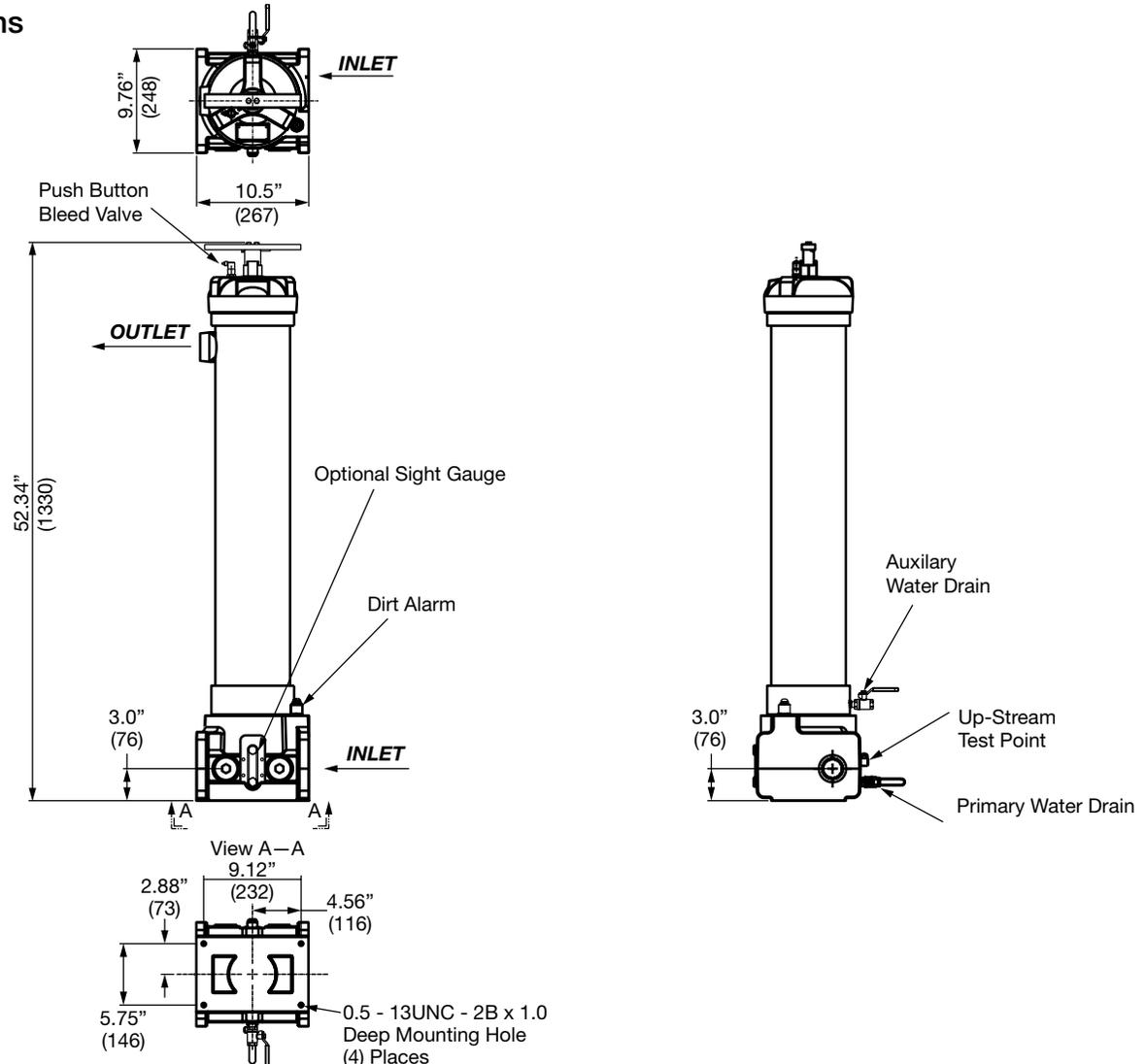
Element Nominal Dimensions: ø6.4" (ø163mm) x 39.4" (470mm) long

Note: Based on ULSD15 with 27 Byres/CM surface tension and 0.25% (2500 PPM) water injection

## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel and blends
- Synthetic diesel and blends

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# BULK DIESEL FILTRATION

## BDS Series

Bulk Diesel Skid



### Features

- Routine element change is only needed on Pre-Filter (particulate filter) which saves time and maintenance costs
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's Ultra-low Sulfur Diesel (ULSD) fluids
- Protects expensive Tier III and Tier IV engine components against failures caused by water transferred from the bulk fuels tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Complete automation is achievable with fail-safe auto-drain feature using a remote 5 gallons (18L) or 20 gallons (75L) sump with alarm and auto shutdown

### Applications

- Industrial
- Agricultural
- Power Generation
- Mining

### Technical Specifications

Flow Rating	Up to 70 gpm (265 l/min) for ULSD15
Max. Operating Pressure	100 psi (7 bar); 45 psi (3 bar) with water sight gauge
Min. Yield Pressure	400 psi (27.6 bar) without sight glass <i>(Contact factory for use with sight glass)</i>
Rated Fatigue Pressure	Contact Factory
Temperature Range	-20°F to 165°F (-29°C to 74°C) <i>(standard)</i> 32°F to 165°F (0°C to 74°C) <i>(with optional Automatic Water Drain)</i>
Bypass Setting	Cracking: 30 psi (2 bar)
Porting Base: Element Case: Cap:	Anodized Aluminum Plated Steel Plated Steel
Weight	441 lbs (200 kg)
Element Change Clearance	33.8" (858 mm)

## Model Code

**BDS - Q1 - V - VM -**

### Filter Series

BDS = Bulk Diesel Skid

### Filtration Rating (microns)

Q1 = 1 µm particulate filter element  
Q3 = 3 µm particulate filter element

### Seals

V = FPM

### Clogging Indicator

VM = Visual Pop-Up w/ Manual Reset

### Options

Omit = None

AWD5\* = Auto water drain 5 gal. tank w/failsafe

AWD20\* = Auto water drain 20 gal. tank w/failsafe

H = Integrated heater to prevent water in sump from freezing

S = Sight Gauge

\*Note: Optional Automatic Water Drain (for use only above >32°F)

## Element Particulate Performance

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_{x \geq 75}$	$\beta_{x \geq 100}$	$\beta_{x \geq 200}$	$\beta_{x(c) \geq 200}$	$\beta_{x(c) \geq 1000}$
3 µm element 1.14.39D03ECO/-V	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency	Max Flow	Single Pass Efficiency
C396Z5V	35 gpm	> 99.5%	CF	> 99.5%

Flow Direction: Inside Out

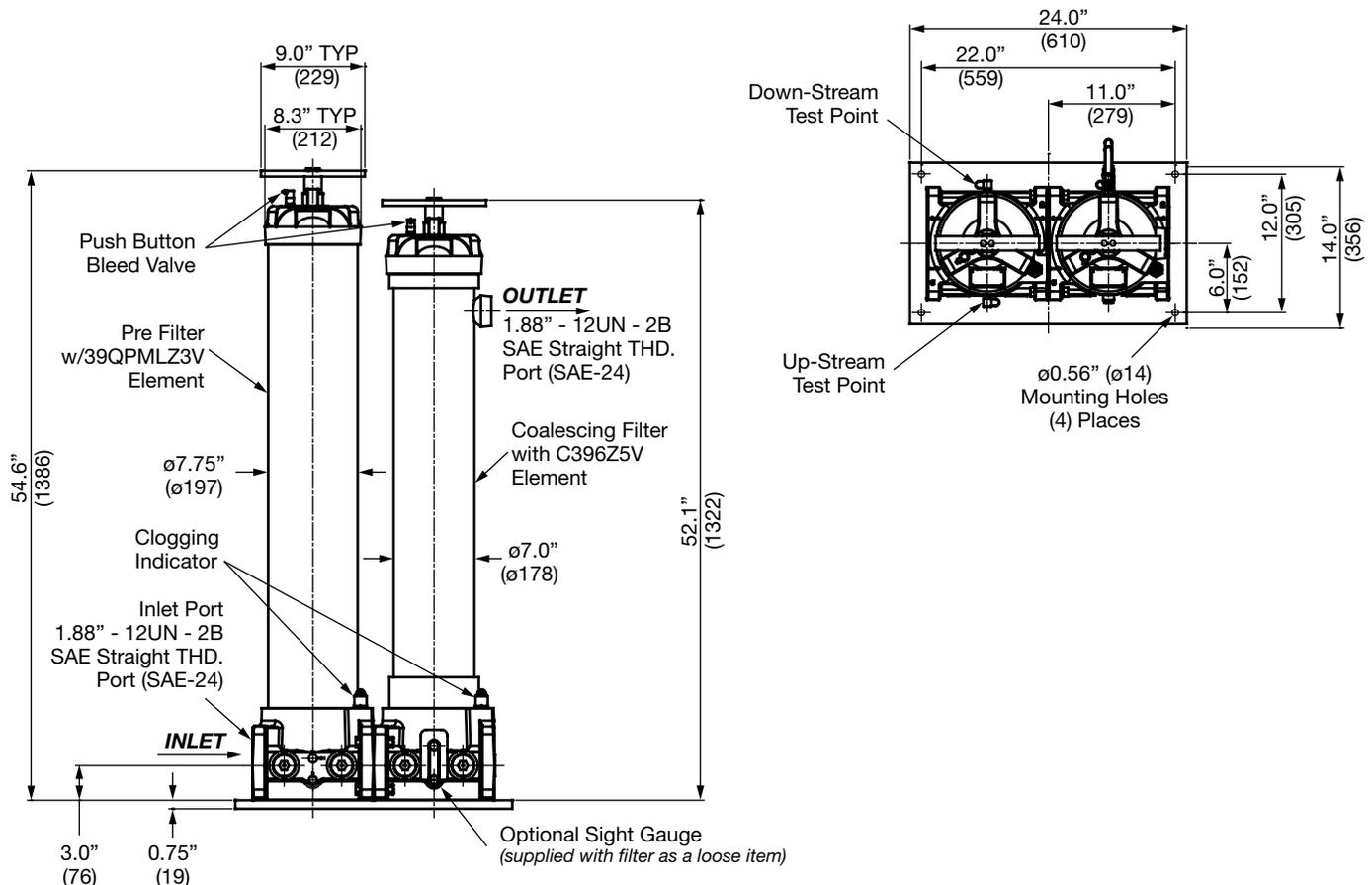
Element Nominal Dimensions:  $\phi 6.4"$  ( $\phi 163\text{mm}$ ) x 39.4" (1001mm) long

Note: Based on ULSD15 with 27 Byres/CM surface tension and 0.25% (2500 PPM) water injection

## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel and blends
- Synthetic diesel and blends

## Dimensions

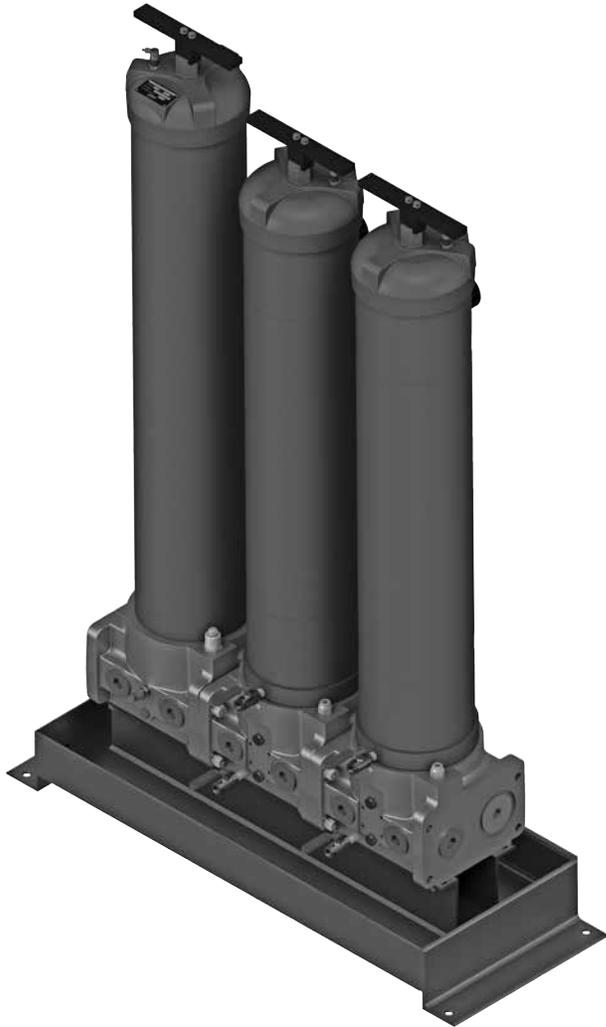


Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# BULK DIESEL FILTRATION

## BDS2 Series

Bulk Diesel Multi-Skid



### Features

- Routine element change is only needed on Pre-Filter (particulate filter) which saves time and maintenance costs
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's Ultra-low Sulfur Diesel (ULSD) fluids
- Protects expensive Tier III and Tier IV engine components against failures caused by water transferred from the bulk fuels tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Complete automation is achievable with fail-safe auto-drain feature using a remote 5 gallons (18L) or 20 gallons (75L) sump with alarm and auto shutdown

### Applications

- Industrial
- Agricultural
- Power Generation
- Mining
- Bulk Fuel Filtration

### Technical Specifications

Flow Rating	Up to 140 gpm (530 l/min) for ULSD15
Inlet/Outlet Connection	SAE 32
Drain Connection Upper	1/4" NPT Ball Valve
Drain Connection Lower	1/4" NPT Ball Valve
Max. Operating Pressure	100 psi (7 bar); 45 psi (3 bar) with water sight gauge
Min. Yield Pressure	400 psi (27.6 bar) without sight gauge <i>(Contact factory for use with sight gauge)</i>
Rated Fatigue Pressure	Contact Factory
Temperature Range	-20°F to 165°F (-29°C to 74°C) <i>(standard)</i> 32°F to 165°F (0°C to 74°C) <i>(with optional Automatic Water Drain)</i>
Bypass Setting	Particulate: 20 psi (1.37 bar) Coalescing: 30 psi (2 bar)
Porting Base: Element Case: Cap:	Anodized Aluminum Plated Steel Plated Steel
Weight	596 lbs (270 kg)
Element Change Clearance	33.8" (858 mm)

## Model Code

**BDS - 2 - Q1 - V - VM -**

### Filter Series

BDS = Bulk Diesel Skid

### Number of Coalescing Filters

2 = 140 gpm (530 l/min)

### Filtration Rating (microns)

Q1 = 1 μm

Q3 = 3 μm

### Seals

V = FPM

### Clogging Indicator

VM = Visual Pop-Up w/ Manual Reset

### Options

Omit = None

AWD5\* = Auto water drain 5 gal. tank w/failsafe

AWD20\* = Auto water drain 20 gal. tank w/failsafe

H = Integrated heater to prevent water in sump from freezing

S = Sight Gauge

\*Note: Optional Automatic Water Drain (for use only above >32°F)

## Element Particulate Performance

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_{x \geq 75}$	$\beta_{x \geq 100}$	$\beta_{x \geq 200}$	$\beta_{x(c) \geq 200}$	$\beta_{x(c) \geq 1000}$
3 μm element 1.14.39D03ECO/-V	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency	Max Flow	Single Pass Efficiency
C396Z5V	70 gpm	> 99.5%	CF	> 99.5%

## Fuel Oils

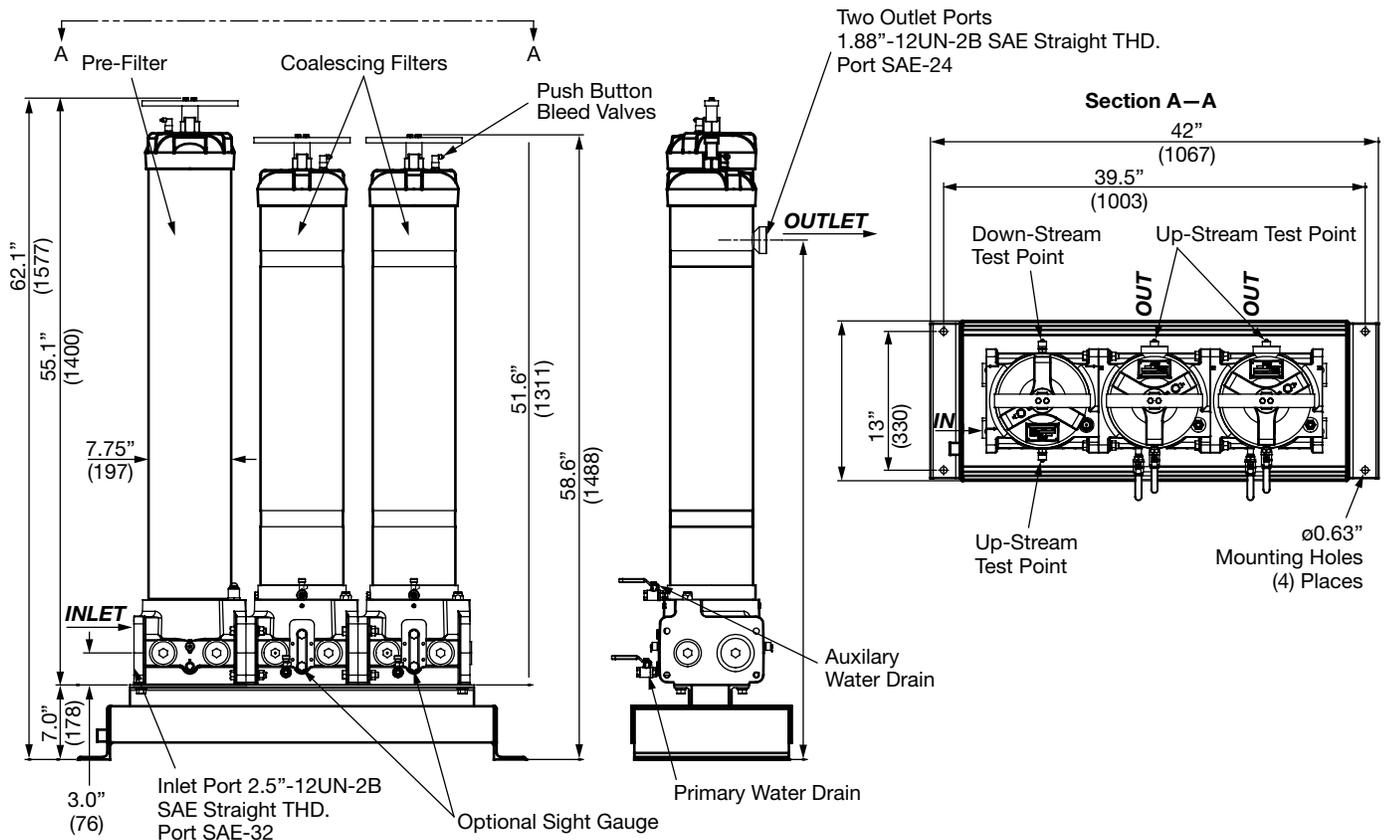
- ULSD15 and similar petroleum diesels
- Biodiesel and blends
- Synthetic diesel and blends

**Particulate Element** - Flow Direction: Outside In  
Element Nominal Dimensions: ø6.0" (ø150mm) x 37.8" (960mm) long

**Coalescing Element** - Flow Direction: Inside Out  
Element Nominal Dimensions: ø6.4" (ø163mm) x 39.4" (1001mm) long

Note: Based on ULSD15 with 27 Bynes/CM surface tension and 0.25% (2500 PPM) water injection

## Dimensions

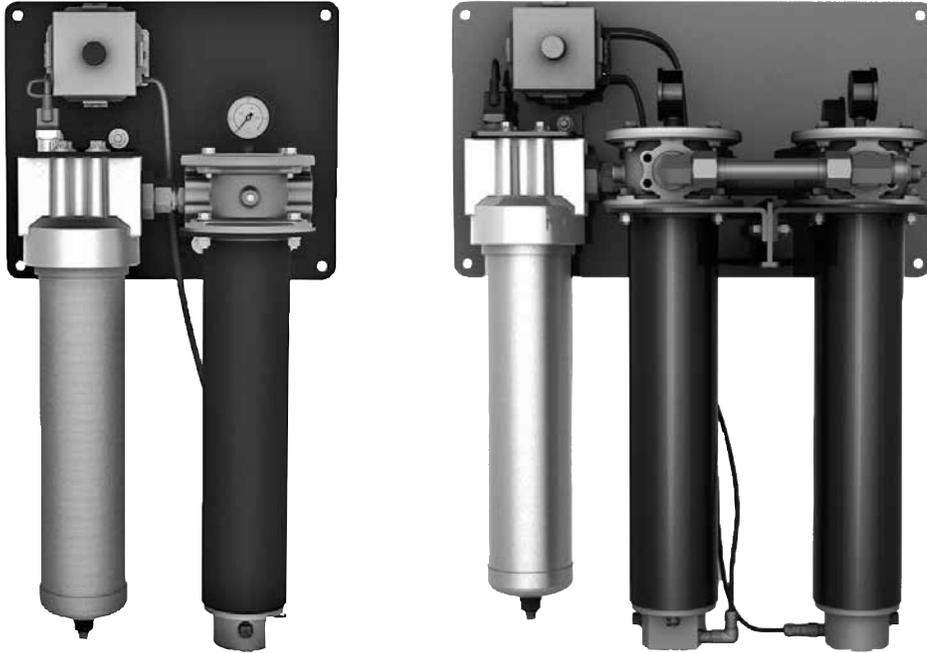


Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# BULK DIESEL FILTRATION

## BDF1 & BDF2 Series

### Bulk Diesel Filter



### Description

The BDF1 and BDF2 provide exceptional single-pass diesel filtration and continuous water removal. The BDF1 and BDF2 protect the latest in high pressure, common rail diesel injectors. Both filters combine HYDAC's fully synthetic Betamicon® media in a particulate pre-filter, with our patent-pending coalescing water removal filter, the ICF, to fully protect vital diesel engines from dirt and water. The BDF1 and BDF2 were designed expressly for customers who are looking for fluid conditioning solutions to protect their investment in Tier III and new Tier IV diesel engines. Long term savings and piece of mind come from implementing the latest fuel cleanliness standards and practices.

The BDF1, 16 gpm (61 l/min) and BDF2, 32 gpm (121 l/min), are ideal for fuel dispensing operations. The filters can be installed on the inlet or outlet of a diesel fueling dispenser or in-line, between the storage tank and the dispenser. The BDF1 is also perfect for generator sets in a single-pass or kidney loop installation. When emergency power is required, you cannot let fuel quality get in the way of reliable diesel generator operation.

### Features

- Routine element change is only needed on the particulate filter which saves time and money
- Particulate filtration at 1 or 3 microns utilizing Betamicon® media element for contamination control
- Optional electrical Clogging Indicator with integrated, amber colored, particulate element change indicator light
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's Ultra-low Sulfur Diesel (ULSD) fluids
- Protects expensive Tier III and Tier IV engine components against failures caused by water transferred from the bulk fuels tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Housing design allows for field upgrade of any available option
- Anti-static media is standard for all coalescing elements
- Complete automation is achievable with fail-safe auto-drain feature using a remote 5 gal. (18L) or 20 gal. (75L) sump with alarm and auto shutdown

### Applications

- Bulk Fuel Filtration
- Private Fleet Fuel Storage
- Emergency Generators
- Construction
- Oil and Gas
- Industrial
- Mobile Vehicles
- Marine
- Mining
- Agriculture

### Technical Specifications

Inlet / Outlet	Up to 70 gpm (265 l/min) for ULSD15	
Connection Size	1" NPT female thread	
Flow Rating	BDF1: up to 16 gpm (61 L/min) BDF2: up to 32 gpm (122 L/min)	
Max. Operating Pressure	100 psi (7 bar)	
Temperature Range	-20°F to 165°F (-29°C to 74°C) (with optional Water Sump Heater) 32°F to 165°F (0°C to 74°C) (with optional Automatic Water Drain)	
Bypass Setting	<b>Particulate Filter</b> 30 psi (2 bar)	<b>Coalescing Filter</b> 15 psi (1 bar)
Materials of Construction	Porting Head/Cap: Cast Aluminum Element Case: Steel	Porting Head/Cap: Anodized Aluminum Element Case: Nickel Coated Steel
Weight	45 lbs. (20.4 kg)	
Element Change Clearance	20" (508 mm)	
Optional Water Sump Heater	120V, 45W	
Optional Electrical Indicator	120V	

## Model Code

**BDF - 1 - V - S16 - L - VM - S-I - EP-A - H - AWD5 -**

### Filter Series

BDF = Bulk Diesel Filter

### Flow Rate

1 = 16 gpm  
2 = 32 gpm

### Seals

V = FPM

### Port Configuration

S16 = SAE 16 (1" port)

### Element Change Indicator

L = in cap bar indicator

### Clogging Indicator

VM = Visual Pop-Up w/ Manual Reset  
E = MS5 Electrical indicator with amber light in NEMA4X box

### Sump Level Indicator Option\*

Omit = None  
S = Sight glass  
I = Water in fuel probe w/light indicator

### Coating Option\*

Omit = None  
EP = Epoxy painting (standard)  
A = Anodized cap & head (optional)

### Heating Option

Omit = None  
H = Heater

### Automatic Drain Option

Omit = None  
AWD5 = Auto Water Drain 5 gal. tank w/failsafe  
AWD20 = Auto Water Drain 20 gal. tank w/failsafe

### Optional Sump for Manual Drain

Omit = None  
S5 = 5 gal. sump tank  
S20 = 20 gal. sump tank

Note: Unless automatic drain option is specified, ICF units will come standard with manual drain.

**Coalescing element sold separately.**

\*Only Options that allow a combination.

## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel and blends
- Synthetic diesel and blends

## Element Particulate Performance

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_{x \geq 75}$	$\beta_{x \geq 100}$	$\beta_{x \geq 200}$	$\beta_{x(c) \geq 200}$	$\beta_{x(c) \geq 1000}$
BN01	<1.0	<1.0	<1.0	<4.0	4.2
BN03	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency	Max Flow	Single Pass Efficiency
C184Z3V				
C184Z5V	16 gpm	> 99.5%	CF	> 99.5%

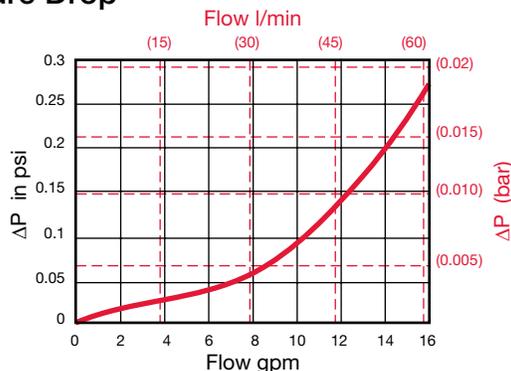
Flow Direction: Inside Out

Element Nominal Dimensions:  $\phi 6.4"$  ( $\phi 163\text{mm}$ ) x  $39.4"$  (1001mm) long

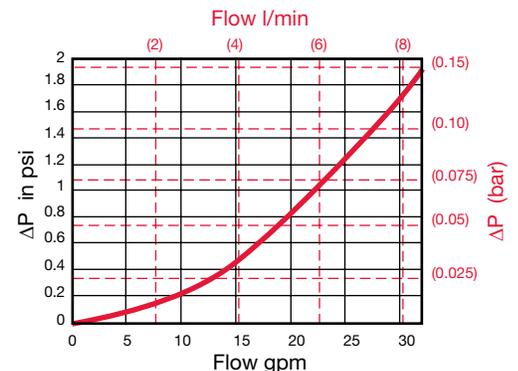
Note: Based on ULSD15 with 27 Bynes/CM surface tension and 0.25% (2500 PPM) water injection

## Pressure Drop

### BDF1

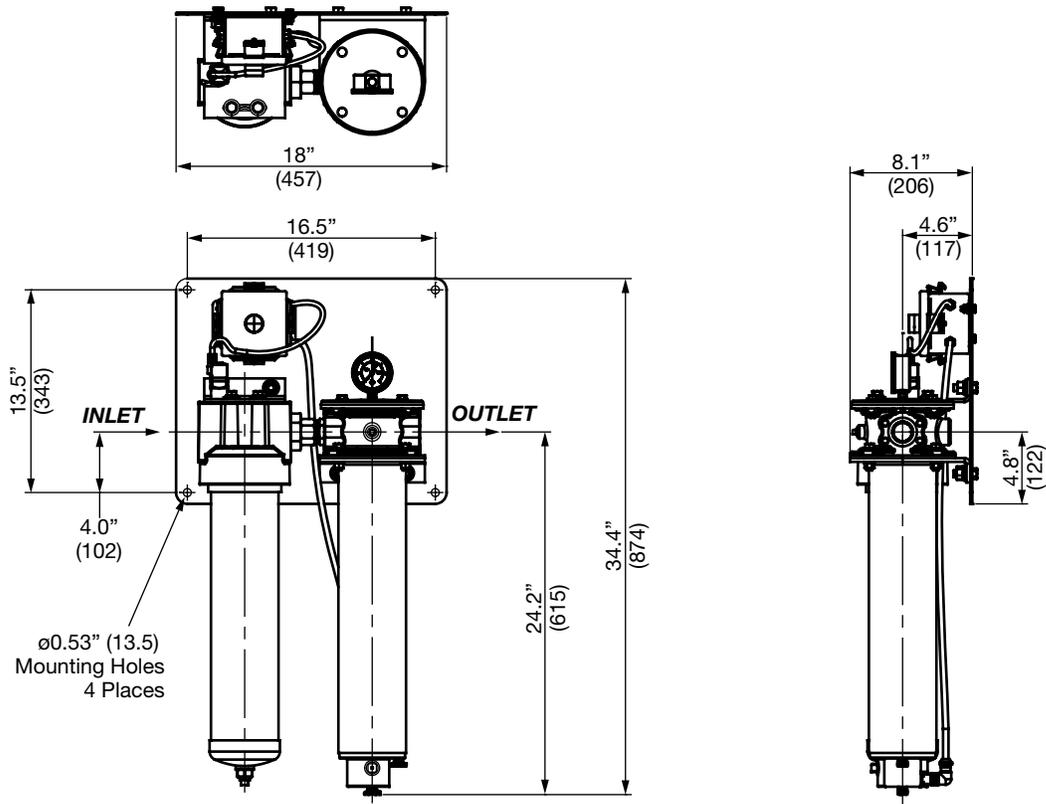


### BDF2

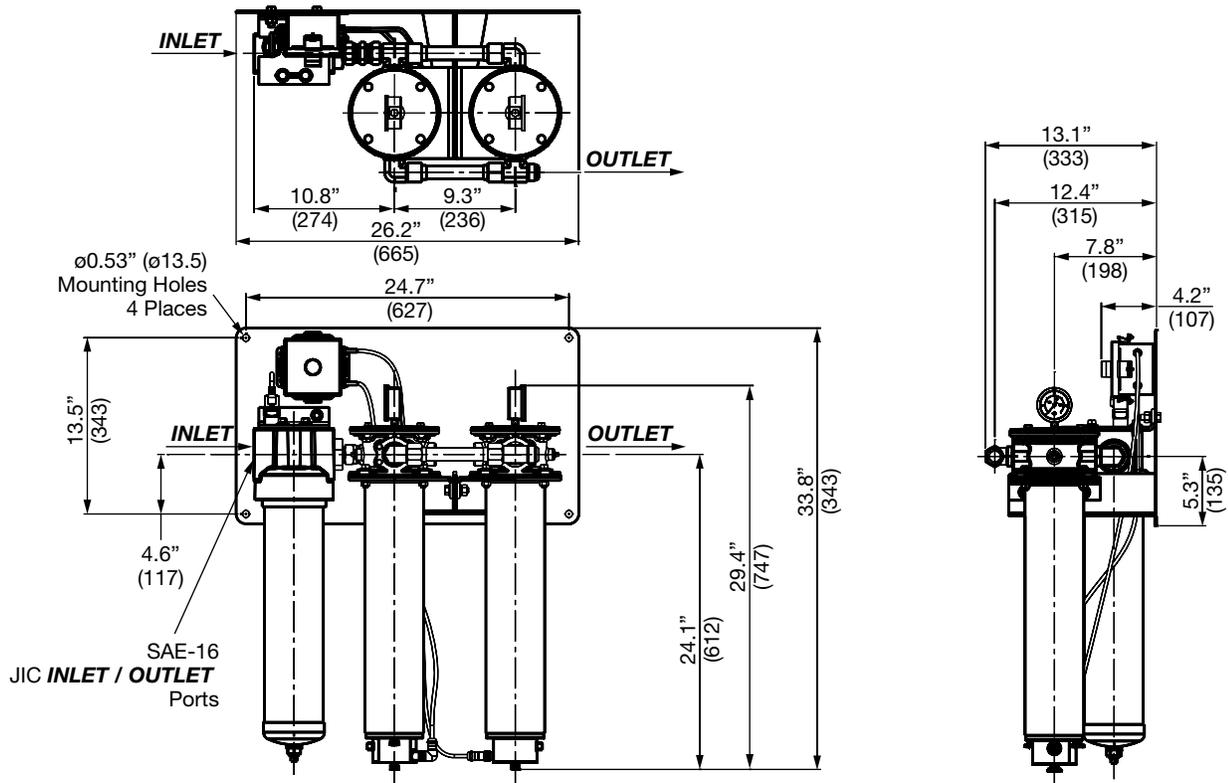


# BULK DIESEL FILTRATION

## Dimensions BDF1



## BDF2



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.



# BULK DIESEL FILTRATION

## BDFC Series

### Bulk Diesel Filter Cart



### Description

The BDFC provides exceptional single-pass diesel filtration and continuous water removal. Both filters combine HYDAC's fully synthetic Betamicon® media in a particulate pre-filter, with our patent-pending coalescing water removal filter, the ICF, to fully protect vital diesel engines from dirt and water. The BDFC is ideal for kidney loop or fuel maintenance operations.

### Features

- Routine element change only needed on KL3 particulate filter, saving time and money
- Fully synthetic, patent-pending coalescing (fuel/water separation) media requires minimal change outs
- At just 22" wide, cart will fit through standard doorways
- Pump motor is 115VAC with resettable overload and 7' power cord
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Great for kidney loop clean-up of contaminated reservoirs and single pass transfer
- Coalescing filter delivers 99.5% single pass, free and emulsified water removal efficiency to achieve outlet water concentrations below 100 ppm

### Applications

- Industrial
- Agricultural
- Construction
- Offshore
- Mining

### Technical Specifications

Flow Rating	Up to 14 gpm (53 l/min) for ULSD15 and biodiesel blends	
Fluid Temp. Range	-20°F to 165°F (-29°C to 74°C)	
Ambient Environment Temp. Range	-20°F to 104°F (-29°C to 40°C)	
Bypass Setting	<b>Particulate Filter</b> 30 psi (2 bar)	<b>Coalescing Filter</b> 15 psi (1 bar)
Materials of Construction	Porting Head/Cap: Cast Aluminum Element Case: Steel	Porting Head/Cap: Anodized Aluminum Element Case: Nickel Coated Steel
Weight	117 lbs. (53.1 kg)	
Element Change Clearance	20" (508 mm)	

## Model Code

**BDFC - BN01 - V - VM - S**

### Filter Series

BDFC = Bulk Diesel Filter Cart

### Particulate Filtration Rating (microns)

BN01 = 1 µm particulate filter element

BN03 = 3 µm particulate filter element

### Seals

V = FPM

### Clogging Indicator

VM = Visual Pop-Up w/ Manual Reset

### Options

Omit = None

S = Sight Gauge

M = Magnetic Suction Strainer

## Element Particulate Performance

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_{x \geq 75}$	$\beta_{x \geq 100}$	$\beta_{x \geq 200}$	$\beta_{x(c) \geq 200}$	$\beta_{x(c) \geq 1000}$
BN01	<1.0	<1.0	<1.0	<4.0	4.2
BN03	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency	Max Flow	Single Pass Efficiency
C184Z5V	16 gpm	> 99.5%	CF	> 99.5%

Flow Direction: Inside Out

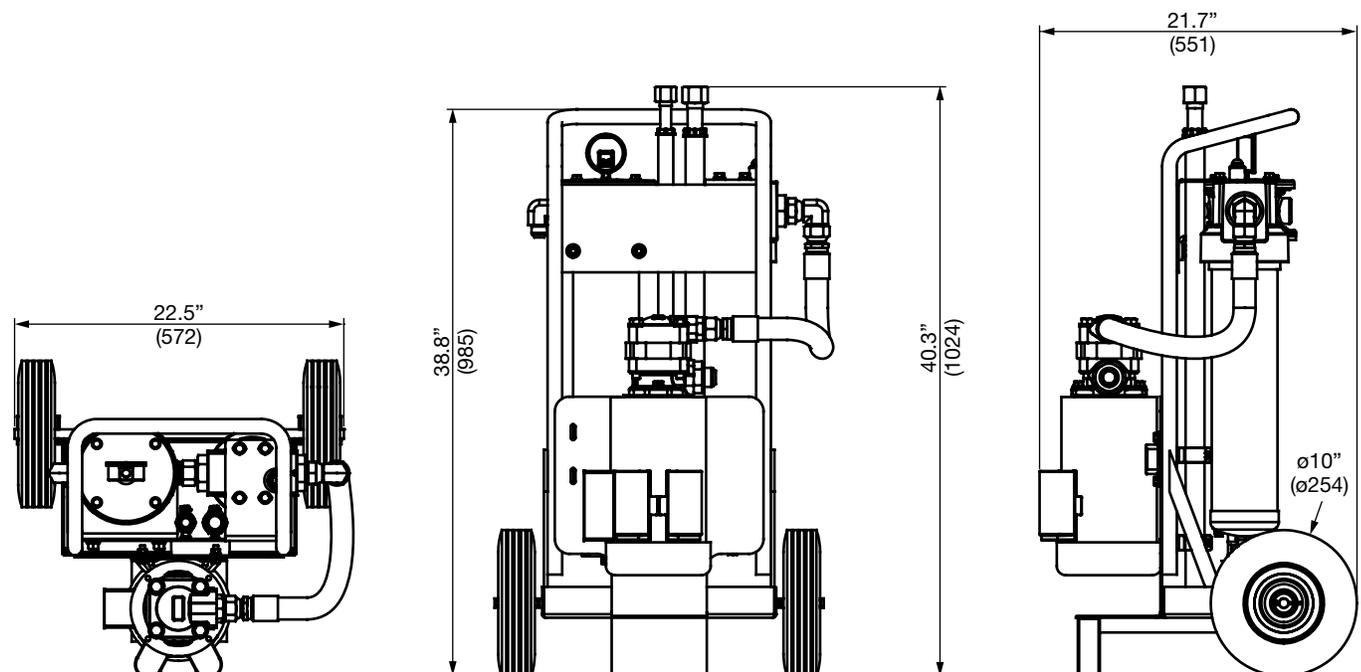
Element Nominal Dimensions:  $\phi 6.4''$  ( $\phi 163\text{mm}$ ) x  $39.4''$  (1001mm) long

Note: Based on ULSD15 with 27 Byres/CM surface tension and 0.25% (2500 PPM) water injection

## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel and blends
- Synthetic diesel and blends
- No.2 fuel oil and heating oil

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

# BULK DIESEL FILTRATION

## BDC Series

Bulk Diesel Cart



### Features

- New fuel/water separation media technology in a three-phase element construction for high efficiency, single-pass removal of free-water in Ultra-low Sulfur Diesel (ULSD) and Biodiesel fuels
- Prior generation coalescing products no longer provide high efficiency separation in ULSD and Biofuels
- Bag element pre-filter down to 5 micron, for gross removal of microbial bloom contamination and rust
- Pump motor is 120VAC with resettable overload and 7' power cord
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Great for kidney loop clean-up of contaminated reservoirs and single pass transfer
- Manual water drains and up and downstream test points
- Optional automatic water drain and/or heater; 120VAC, 60Hz power supply required

### Applications

- Industrial
- Agricultural
- Power Generation
- Mining

### Technical Specifications

Flow Rating	Up to 70 gpm (266 l/min) for ULSD15 and biodiesel blends	
Fluid Temp. Range	-20°F to 165°F (-29°C to 74°C) (standard) 32°F to 165°F (0°C to 74°C) (with optional Automatic Water Drain)	
Ambient Environment Temp. Range	-20°F to 104°F (-29°C to 40°C) 32°F to 165°F (0°C to 74°C) (with optional Automatic Water Drain)	
Bypass Setting	<b>Particulate Filter</b> 20 psi (1.37 bar)	<b>Coalescing Filter</b> 30 psi (2 bar)
Materials of Construction	Porting Base: Anodized Aluminum Element Case: Plated Steel Cap: Plated Steel	
Weight	785 lbs. (356 kg)	
Element Change Clearance	33.8" (858 mm)	

## Model Code

**BDC - Q1 - V - A - VM -**

### Filter Series

BDC = Bulk Diesel Cart

### Filtration Rating (microns)

Q1 = 1 µm particulate filter element  
Q3 = 3 µm particulate filter element

### Seals

V = FPM

### Bag Element Rating (microns)

A = 5 µm  
B = 25 µm  
C = 50 µm  
D = 100 µm

### Clogging Indicator

VM = Visual Pop-Up w/ Manual Reset

### Options

Omit = None  
AWD = Automatic Water Drain with 5 gal tank w/failsafe  
H = Integrated heater to prevent water in sump from freezing

70A = 70 gpm, 220VAC Single Phase (60 Hz)  
70B = 70 gpm, 230VAC Three Phase (60 Hz)  
70C = 70 gpm, 460VAC Three Phase (60 Hz)

\*Note: Optional Automatic Water Drain (for use only above >32°F)

## Element Particulate Performance

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_{x \geq 75}$	$\beta_{x \geq 100}$	$\beta_{x \geq 200}$	$\beta_{x(c) \geq 200}$	$\beta_{x(c) \geq 1000}$
3 µm element 1.14.39D03ECO/-V	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency	Max Flow	Single Pass Efficiency
C396Z5V	70 gpm	> 99.5%	CF	> 99.5%

## Fuel Oils

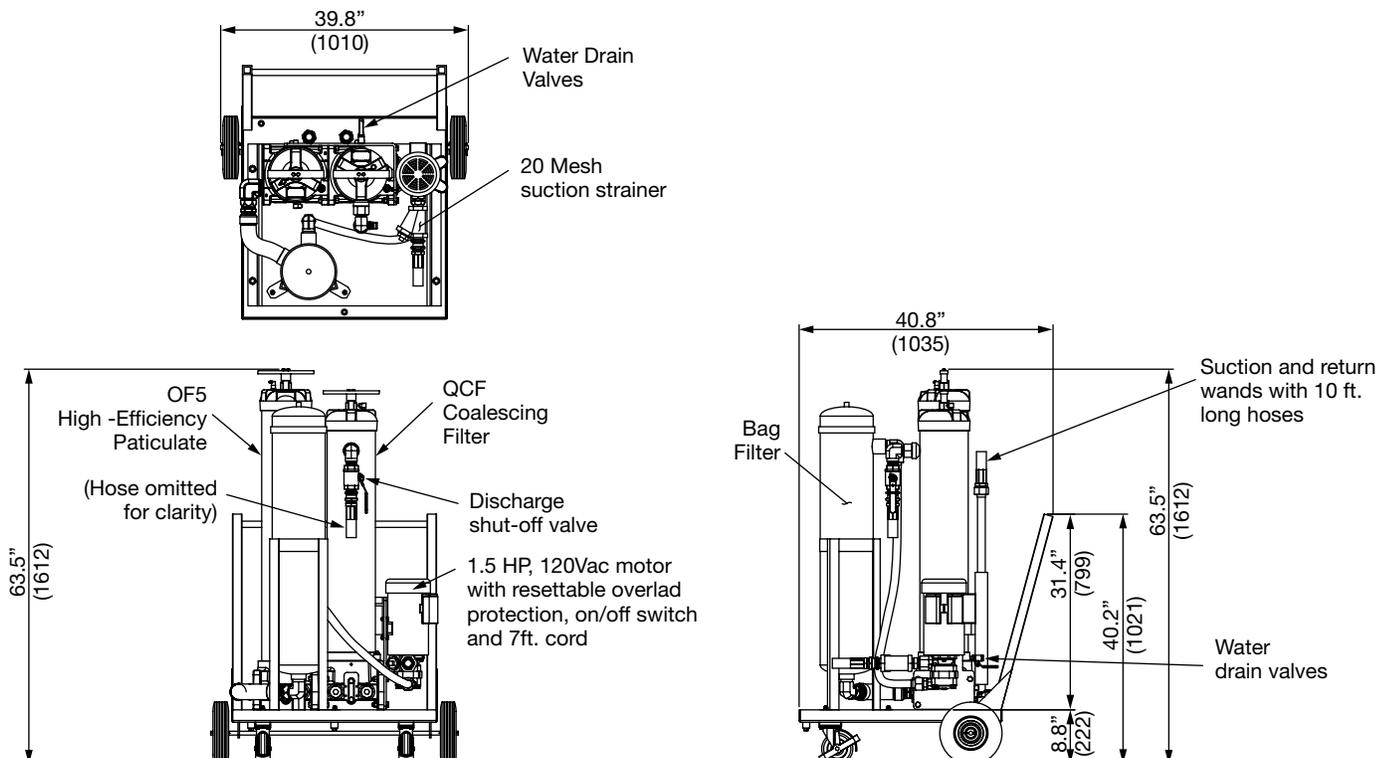
- ULSD15 and similar petroleum diesels
- Biodiesel and blends
- Synthetic diesel and blends

**Particulate Element** - Flow Direction: Outside In  
Element Nominal Dimensions: ø6.0" (ø150mm) x 37.8" (960mm) long

**Coalescing Element** - Flow Direction: Inside Out  
Element Nominal Dimensions: ø6.4" (ø163mm) x 39.4" (1001mm) long

Note: Based on ULSD15 with 27 Byres/CM surface tension and 0.25% (2500 PPM) water injection

## Dimensions



Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.



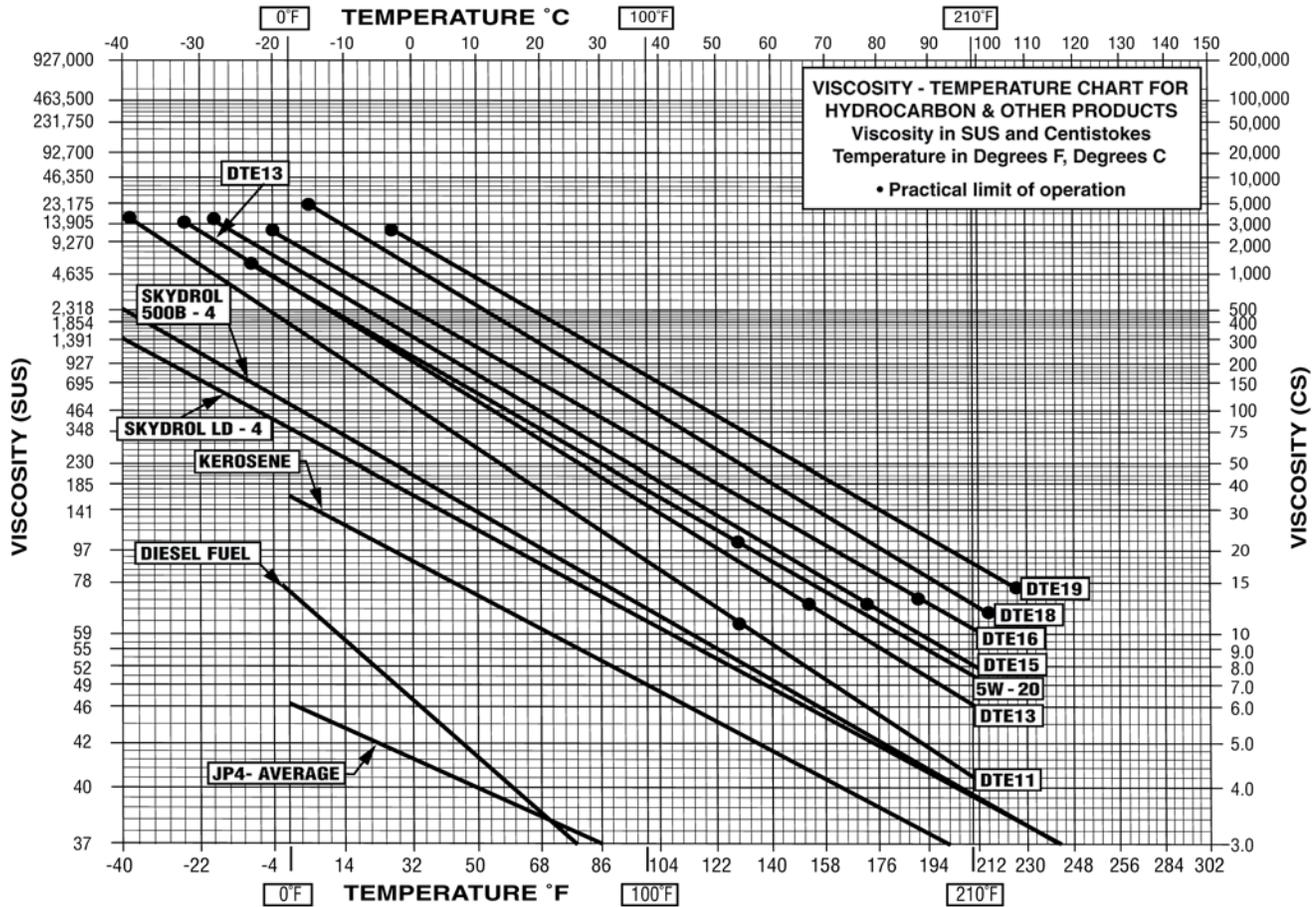
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## Reference Material

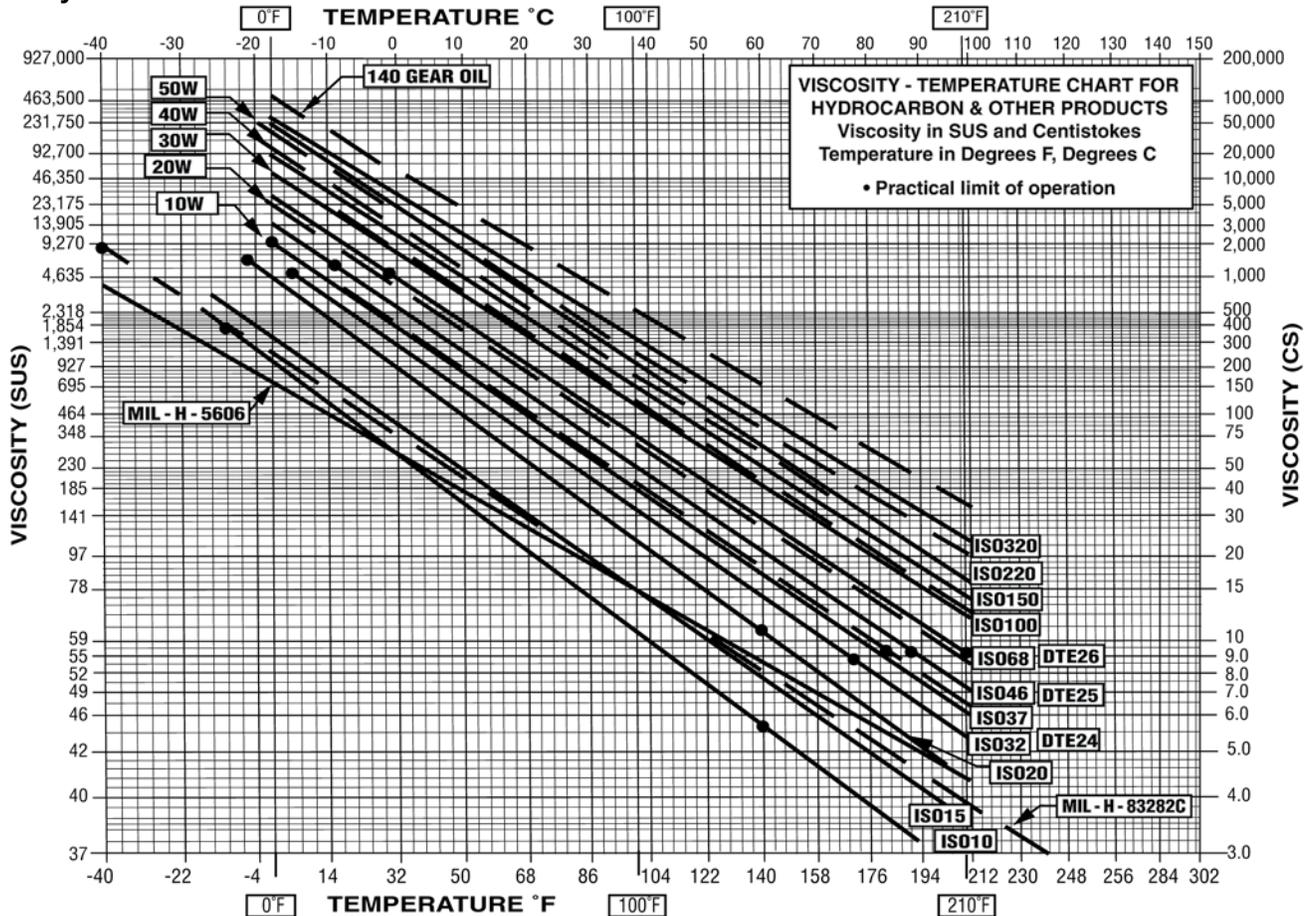
A quick reference of information and conversion charts to help guide you through this catalog.

# REFERENCE MATERIAL

## Viscosity Chart #1



## Viscosity Chart #2



# Ordering HYDAC Literature...

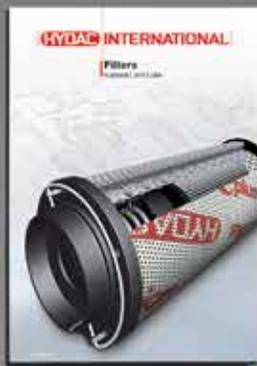
HYDAC literature is available for ordering via our website, [www.hydacusa.com](http://www.hydacusa.com) then click on the **Downloads** button to proceed with ordering printed copies *(digital versions excluded)* or email us at [HYD.catalog@hydacusa.com](mailto:HYD.catalog@hydacusa.com) using the appropriate Part Number (PN) and name. Other brochures, manuals and technical documents are also available when ordering from our website.



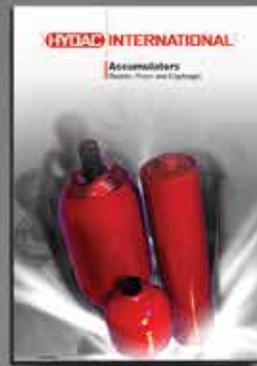
Overview Brochure  
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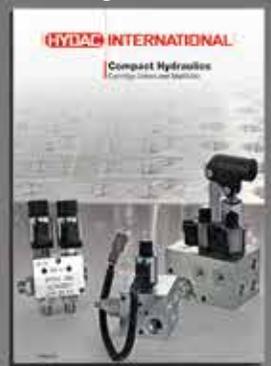
Filters Catalog  
PN02081318



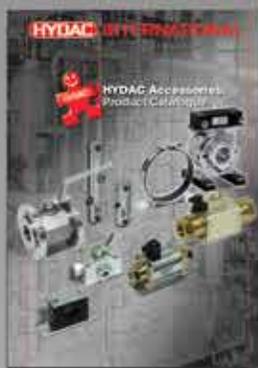
Accumulators Catalog  
PN02068195



Compact Hydraulics  
Catalog - PN02087369



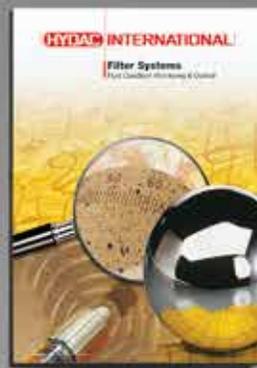
Accessories Catalog  
PN02080105



Standard Coolers  
Catalog - PN02085359



Filter Systems Catalog  
PN02075860



Electronics Catalog\*  
(online only)



Process Technology\*  
Catalog (online only)



Mobile Valves Catalog  
PN02092408



Hydraulic Cylinders  
Catalog (Release: TBD)



Control Technology\*  
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\*These catalogs are digital file versions only.

Various market and product brochures are also available for ordering.



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