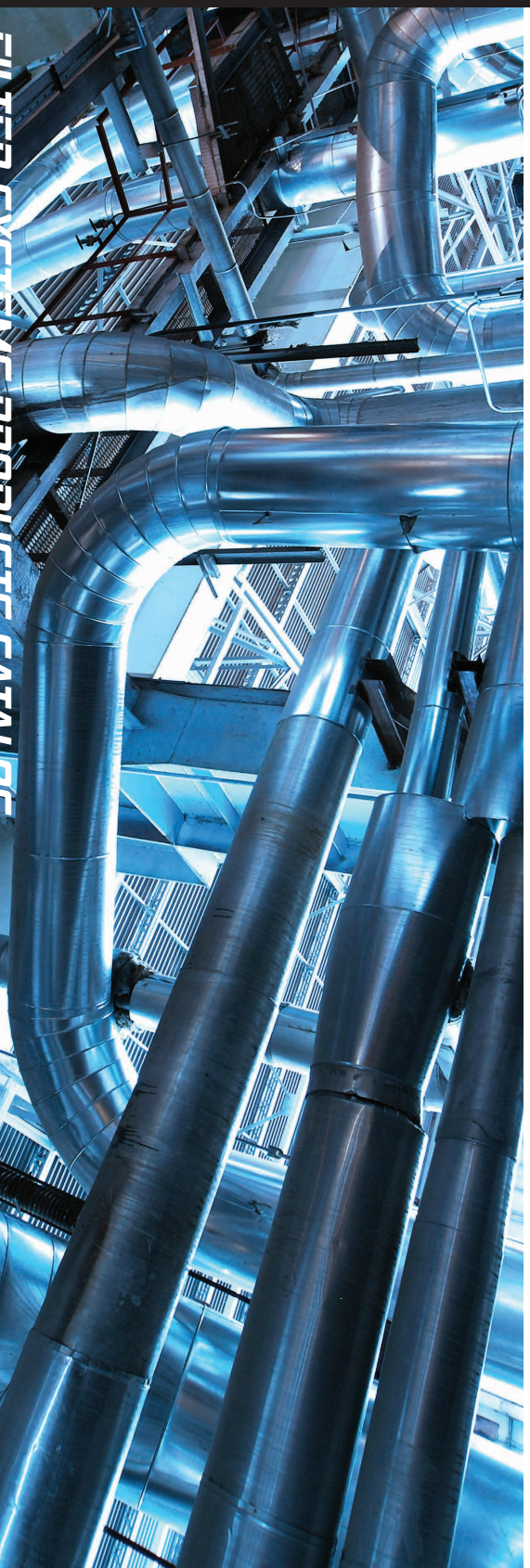
Schroeder INDUSTRIES
Advanced Fluid Conditioning Solutions®

Products Catalog

FILTER SYSTEMS



Filter Systems

Vision Mission Value Quality Statement:

Vision:

We design solutions for industry and for the success of our customers by:

- Optimizing the use of technology with applications
- Using an efficient, timely customized process to fill specific customer needs
- Increasing capacity and streamlining operations.
- Preserving our reputation for reliability
- Expanding globally to support our customers and stay current with new technologies
- Leveraging and sharing our knowledge to meet challenges openly
- Nurturing a creative, cooperative culture committed to the individual and to providing the best solutions for the customers

Leetsdale Facility

Mission Statement:

Partnerships

Innovating products, processes and services to improve performance and efficiency in our industry.

Schroeder Industries Core | Shared Values:

Honesty

Day-to-Day Behaviors:

- Tell the truth at all times, in all matters
- Have open lines of communication and share timely, accurate and thorough information with internal and external customers
- Do not steal and respect each other's and the Company's property

Teamwork

Day-to-Day Behaviors:

- Work as a team
- Cooperate within and between departments
- Coach and mentor; listen and share knowledge, experience and ideas
- Treat others with respect and consideration in all circumstances
- Invest in the development and growth of all team members
- Keep our work areas safe and clean

Leadership

Day-to-Day Behaviors:

- Recognize that we are empowered to act as leaders and participate in the decision making process
- Take responsibility for and have pride in our work
- Set goals and celebrate the efforts and accomplishments of our teammates
- Value our greater community and take leadership roles in our neighborhoods and for the environment

Ingenuity | Innovation

Day-to-Day Behaviors:

- Value innovative thinking and the generation and implementation of new ideas to solve customer (internal & external) problems
- Be flexible and adapt to new ideas and different ways of doing things
- Utilize available resources for new designs and innovations

Quality Policy:

Continuous improvement in our business to ensure a quality product, shipped on time, without compromise.

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It is important that the user analyze all aspects of the specific application and review the current product information in the current catalog. Due to the variety of operating conditions and applications for these products, the user is solely responsible for making the final product selection and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, design, availability and pricing are subject to change at any time without notice.

Schroeder
INDUSTRIES
Advanced Fluid Conditioning Solutions®

Contents at a Glance: Introduction

Product Guide by Part Number

Section 1: Diagnostic Products

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Overview of Schroeder's Approach to Advanced Fluid Conditioning Solutions®

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. Schroeder recommends a three step approach to controlling contamination in any system:

Assess the Fluid System's Health

Assess the fluid system's health

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

AMFS

Recommend and implement Advanced Fluid Conditioning Solutions®

Recommend and implement Advanced Fluid Conditioning Solutions®

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

X-Skids

Monitor, Maintain, and Extend the Service Life

Monitor, maintain, and extend the service life

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

Fluid Care Center: Multi-Pass Test Stand

Overview of Schroeder's Approach to Advanced Fluid Conditioning Solutions®

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.

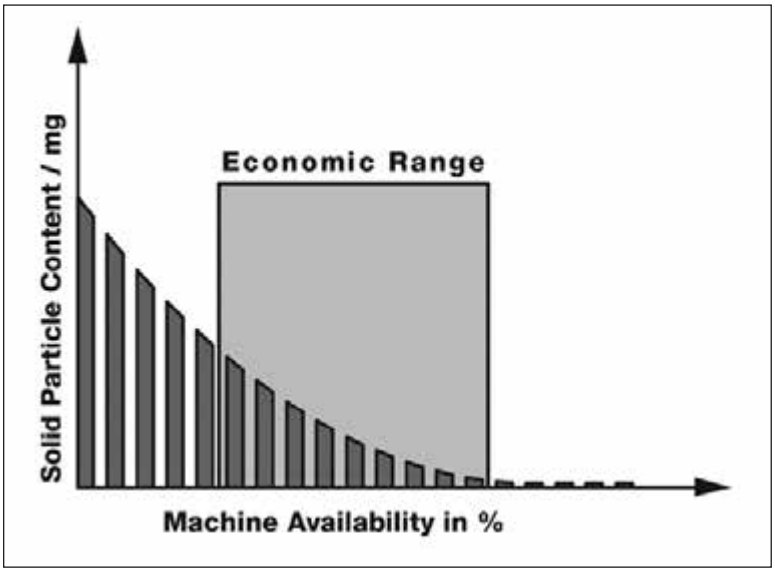


Figure 1. Savings Optimization

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 =** $\frac{[a \times b \times (100-c) \times d]}{100}$
Downtime costs due to:		
Mechanical/electrical failures (65%)	$780,000	**f (e x .65)**
Hydraulic failures (35%) of which:	$420,000	**g (e x .35)**
70% is due to the fluid	$294,000	**h (g x .70)**
30% is caused by other faults	$126,000	**i (g x .30)**
Total	$264,600	**j (h x .90)**

Schroeder Fluid Service can return 90% of the fluid related downtime costs

Overview of Schroeder's Approach to Advanced Fluid Conditioning Solutions®

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 Figure 2 to see the actual ranges.

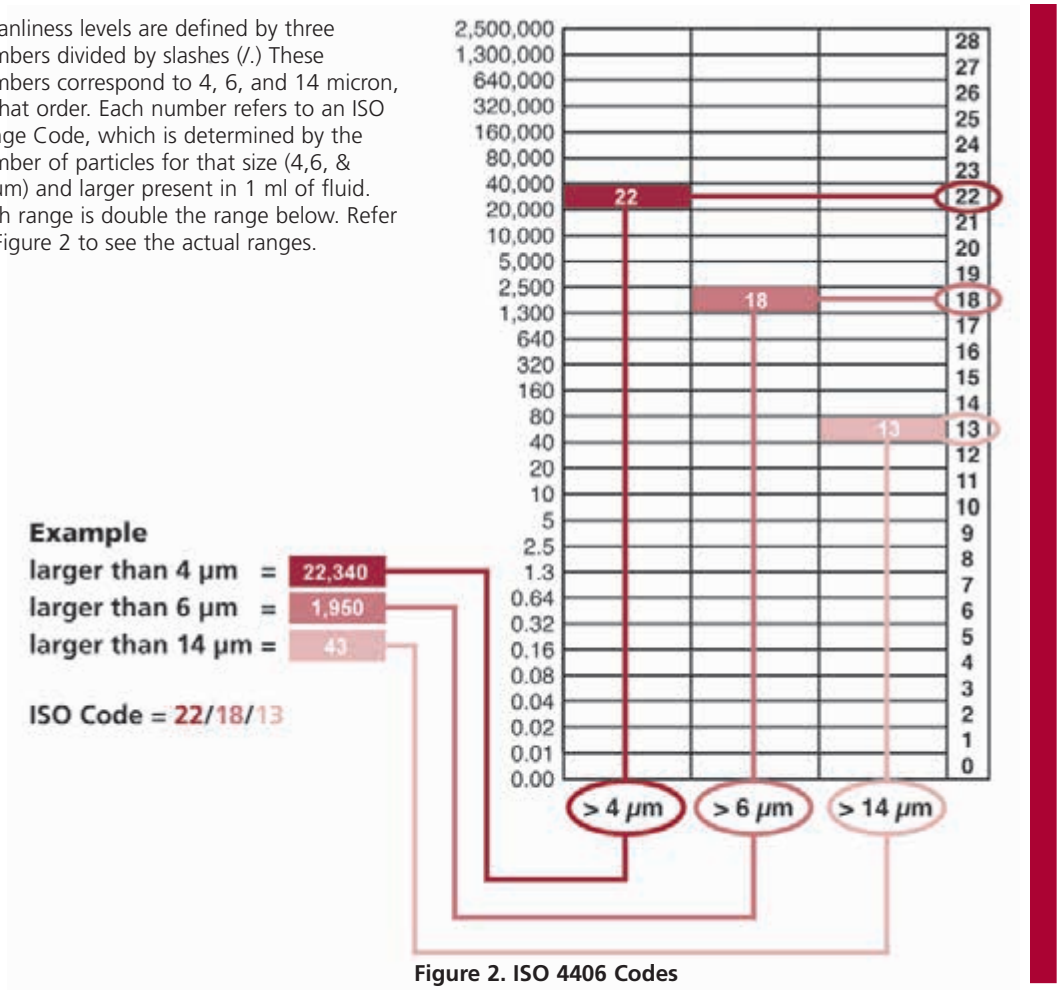


Figure 2. ISO 4406 Codes

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. Schroeder 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 pre-cleaning 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

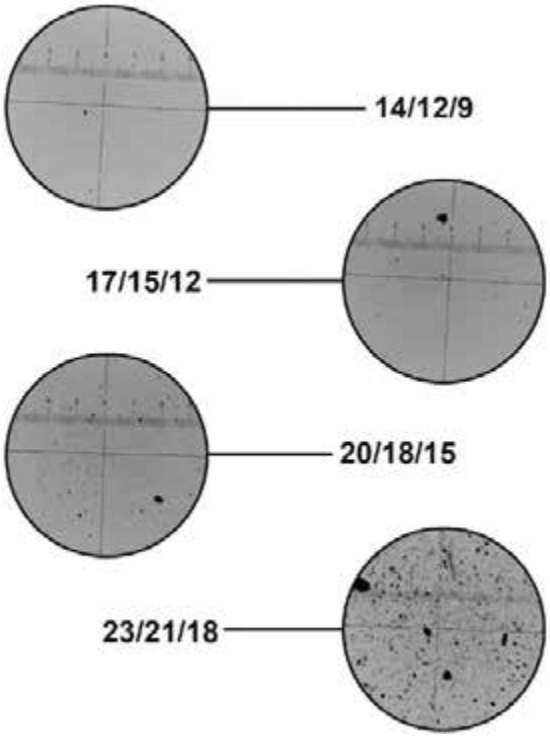


Figure 3. Microscopic Particulate Comparison

Overview of Schroeder's Approach to Advanced Fluid Conditioning Solutions®

1. Starting at the left hand column, select the most sensitive component used in the system.
2. Move 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[1])		Very High Pressure 3000 psi and over (high pressure with severe conditions[1])	
	ISO Target Levels	Micron Ratings	ISO Target Levels	Micron Ratings	ISO Target Levels	Micron Ratings
Pumps						
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	N/A	N/A
Variable Piston	18/16/13	5	17/15/12	3	16/14/11	3
Valves						
Check Valve	20/18/15	20	20/18/5	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[2]
Servo Valve	16/14/11	3[2]	16/14/11	3[2]	15/13/10	3[2]
Actuators						
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[2]	15/13/10	3[2]
Test Stands	15/13/10	3	15/13/10	3[2]	15/13/10	3[2]
Bearings						
Journal Bearings	17/15/12	3	N/A	N/A	N/A	N/A
Industrial Gearboxes	17/15/12	3	N/A	N/A	N/A	N/A
Ball Bearings	15/13/10	3[2]	N/A	N/A	N/A	N/A
Roller Bearings	16/14/11	3[2]	N/A	N/A	N/A	N/A

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.

Fluid Contamination Management Basics

Fluid Contamination Types

Various types of contamination occur in fluid power systems: gaseous (e.g. air), liquid (e.g. water) and solid contaminants. An overview of the various contamination types is shown in the following diagram (Figure 4).

Solid contamination is subdivided into three groups: extremely hard, hard and soft particles (see Figure 4). Extremely hard particles can cause substantial damage in fluid power systems if they are not removed as quickly as possible. Preventive measures can reduce the ingress of contaminants in systems.

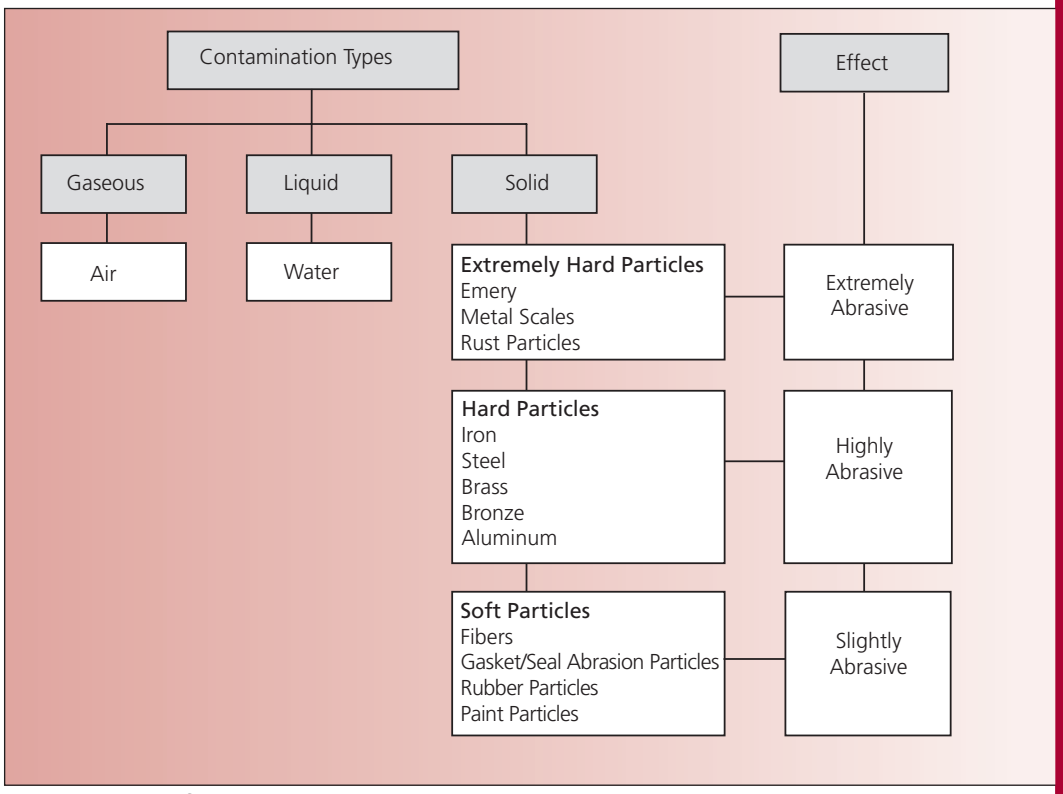


Figure 4. Types of Contamination

Hard particles are frequently listed separately in specifications. Maximum values are specified for the longest dimension these hard particles may have, e.g. largest abrasive particle: max. 200 µm or 200 x 90 µm or number of particles > 200 µm.

Not only do the hardness of contamination particles play a role but also their number and size distribution do as well.

The particle size distribution in new systems is different from that of systems that have been in operation for a number of hours. In new systems, there is an accumulation of coarse contaminants up to several millimeters long, which are then increasingly reduced in size in the course of operation or eliminated by filtration. After several hours of operation most particles are so small that they are no longer visible to the naked eye.

When commissioning fluid power systems there is additional particulate contamination by virtue of abrasive wear in which rough edges are worn away through running-in. Contamination management can't prevent this ingress of contaminants; however, if basic contamination is lower, there is less abrasion during system startup.

Definition of Fluid Contamination Management and the Technical Cleanliness Process

Definitions

Fluid Power System
A power transmission system that uses fluids to transmit power

Basic Contamination
Quantity of contamination present subsequent to assembly

Ingress Contamination
Particulate ingressed during operation of a fluid power system

Initial Damage | "Start-Up"
Damage to component surfaces caused during function testing/commissioning/assembly of systems

Fluid Contamination Monitoring
Analysis of a fluid power system measures ingressed particulate levels

Online Measurement (Real Time Monitoring)
Measurement process which the sample to be analyzed is process fed to a measurement device directly from the system

Offline Measurement
Measurement process in which the sample is taken from the process system and analyzed elsewhere, e.g. taking an oil sample and sending it in to a laboratory

Contamination Management and Technical Cleanliness
Monitoring and optimization of cleanliness, from component design to the component assembly, to the assembly and operation of the system

Technical Cleanliness

As Figure 5 shows, the level of contamination without using the Technical Cleanliness Process is higher throughout system operation as compared to a system in which the Technical Cleanliness Process is employed, the result being that more initial damage may be caused to surfaces.

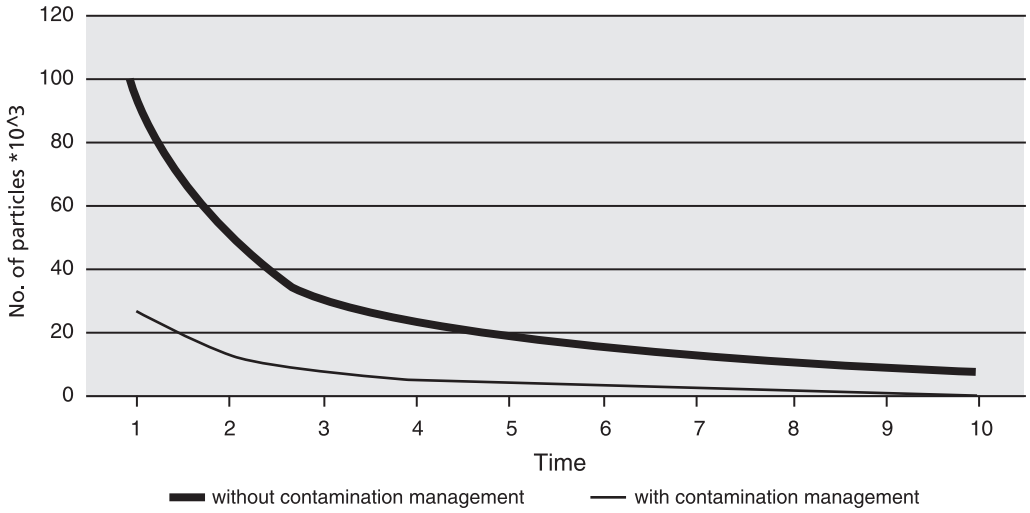


Figure 5. Cleaning of a Fluid Power System With and Without Contamination Management

Microscope images show typical particle samples, containing fine particles, as they occur in fluid power systems. (Figure 6)

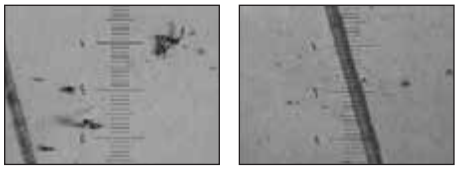


Figure 6. Typical Particle Samples

An average healthy human eye can see items down to approximately 40 µm in size. Particle analyses are conducted using a microscope or particle counters in fluid power systems employing the light extinction principle. (Figure 7)

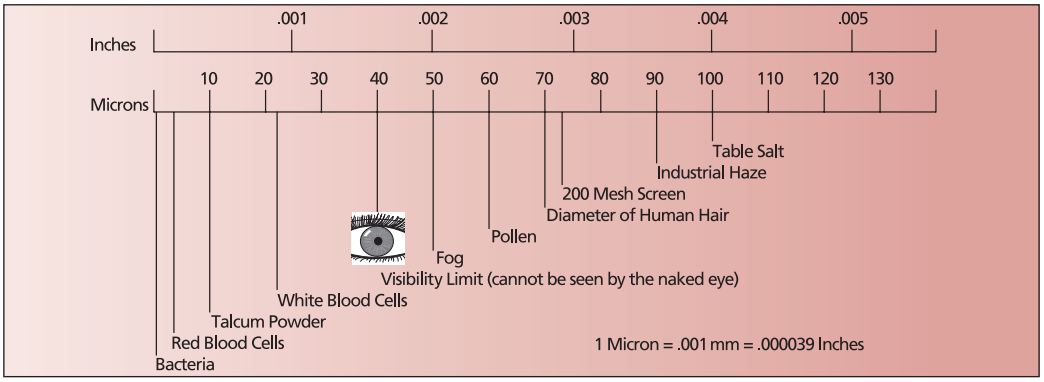


Figure 7. Sizes of Known Particles in Inches and Microns

Particulate contaminants circulating in fluid power systems cause surface degradation through general mechanical wear (abrasion, erosion, and surface fatigue).

This wear causes increasing numbers of particles to be formed, the result being that wear increases if the "chain reaction of wear" is not properly contained (by reducing contamination).

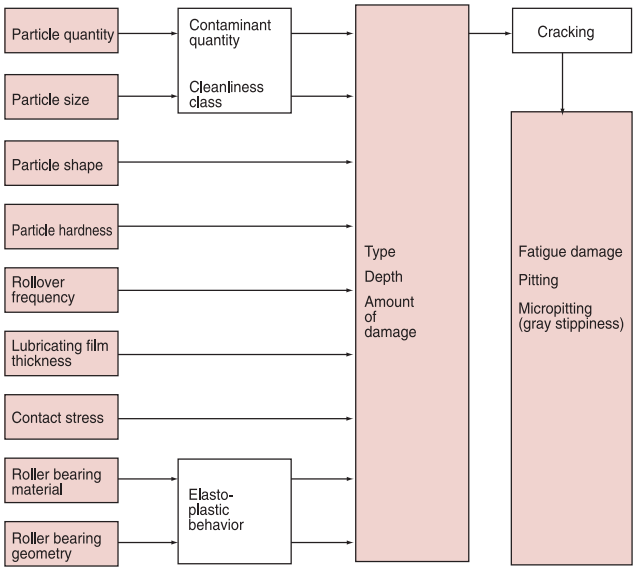


Figure 8. Factors Affecting Roller Bearing Life

Gaps grow larger, leakage oil flows increase in size, and operating efficiency (e.g. of pumps) decreases. Metering edges are worn away, thus resulting in control inaccuracies. In some cases, blockage of control ducts or nozzle bores occurs.

The chain reaction of wear during the everyday operation of hydraulic systems has to be interrupted by properly designed and dimensioned filter systems. However, the measure of security afforded the user is deceptive as highly damaging contaminants seep in during component and system assembly and system installation. This ingress of contaminants not only can cause preliminary damage to system components but also premature failure as well.

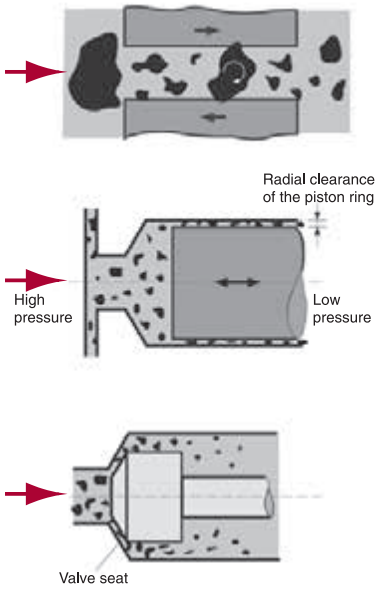


Figure 9. Examples of Wear to Movable Surfaces

Generally speaking, integrated system filtration concepts are not designed to adequately deal with large quantities of dirt as incurred with these operations:

- Component machining
- Commissioning
- System assembly
- System repair work
- System filling

A study conducted by the University of Hanover describes the factors impacting the fatigue life of roller bearings as follows: *"The quantity of contamination in the lubricant is described by the particle quantity and size. Combining this with particle hardness and geometry results in the type and extent of damage to raceways, with the extent also being affected by the elasto-plastic behavior of the material. The amount of damage is determined by the quantity of particles in the lubrication gap and the rollover frequency. Continued rollover leads to cracking, which in the form of fatigue damage (pitting) leads to roller bearing damage (bearing failure)."*

In practice ball bearings with their punctiform contact are shown in most cases to be less sensitive to particulate contamination than roller bearings with their linear contact. Friction bearings with their larger lubrication gaps are the least sensitive to particulate contamination.

Technical Cleanliness and Contamination Management Basics

Figure 10 provides an overview of the most common gap sizes illustrated in Figure 11. Comprehensive studies of particle distributions on components and in hydraulic systems have shown that at the beginning of a system's life, i.e. during assembly and commissioning, the particles are larger than during subsequent operation.

These large particles – up to several millimeters in size – can cause spontaneous outages, valve blockages, substantial preliminary damage to pumps, and destruction of seals and gaskets followed by leakage.

Active contamination management enables this rate of damage to be reduced and subsequent costs accordingly cut, i.e.:

- Costs caused by production stops
- Costs caused by delays in commissioning systems
- Warranty costs
- Reworking costs
- Costs incurred by longer testing periods since a flushing cycle is required to remove integral contamination

Contamination management counters the situation as follows: In new systems the individual components are brought to a uniform cleanliness level, the filling fluid is kept at a defined cleanliness level, as is the fluid during system operation.

Component	Typical Critical Clearance (µm)
1. Gear Pump (J1, J2)	0.5 - 5
2. Vane-cell Pump (J1)	0.5 - 5
3. Piston Pump (J2)	0.5 - 1
4. Control Valve (J1)	5 - 25
5. Servo Valve (J1)	5 - 8

Figure 10. Common Gap Sizes

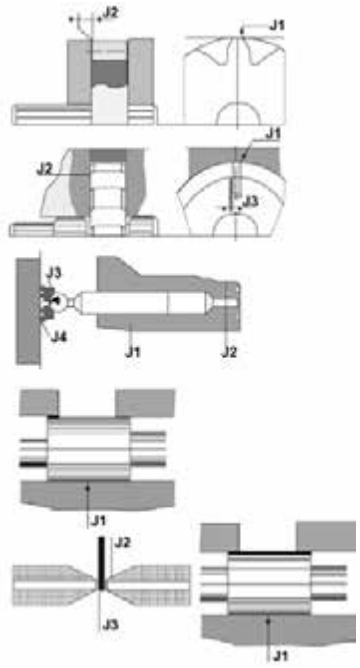


Figure 11. Common Gaps Illustrated

Figure 12. Destroyed raceway of a ball bearing caused by particulate contamination

Figure 13. Contaminate embedded in the surface of a friction bearing

Classification of Particulate Contamination in Fluids and Parts Cleanliness Measurement Using Gravimetric Analysis

The objective of the procedures described below is to enable a reproducible classification of particulate contaminants in fluids.

Currently there are four procedures for classifying particulate contaminants in fluids: ISO 4405, ISO 4406:1999, NAS 1638, SAE AS 4059(D) (see chart below)

Standard	ISO 4405	ISO 4406:1999	NAS 1638	SAE AS 4059(D)
Application	Highly contaminated media, e.g. washing media, machining fluids	Hydraulic fluids Lubrication oils	Hydraulic fluids Lubrication oils	Hydraulic fluids Lubrication oils
Parameters	(mg/liters of fluid)	Number of particles > 4 µm(c) > 6 µm(c) > 14 µm(c)	Number of particles 5 - 15 µm 5 - 25 µm 25 - 50 µm 50 - 100 µm > 100 µm	Number of particles > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c) > 38 µm(c) > 70 µm(c)
Analysis Methods	In this lab method, a known volume of the fluid undergoing analysis is filtered through a prepared membrane,which is then weighed	1. *Manual evaluation:* The fluid undergoing analysis is filtered through a prepared membrane and the cleanliness class (contamination rating) estimated or counted by hand using a microscope. 2. *Automated particle counting:* The fluid undergoing analysis is conducted through a particle counter, which tallies the particle fractions.		
Remarks	Very time-consuming method	1. *Manual evaluation:* Very time-consuming, not very exact. 2. *Automated particle counting:* Result available almost immediately.		

Gravimetric Analysis Methods

This international standard describes the gravimetric method for determining the particulate contamination of hydraulic fluids.

Basic Principle

A known volume of fluid is filtered through one or two filter disks using vacuum action and the weight differential of the filter disks (upstream and downstream of filtration) measured. The second membrane is used for evaluating accuracy.

In order to determine the gravimetric contamination of the fluid, a representative sample has to be taken from the system. ISO 4405 describes the cleaning procedure for the equipment being used. It also describes the preparatory procedures for the analysis membranes.

The membranes are flushed with isopropanol prior to use, dried in a drying oven until they achieve a constant weight, and then cooled in a defined dry environment. It is important that cooling takes place in a defined dry environment, otherwise the membrane absorbs moisture from the surroundings, thus skewing the final result.

Afterwards the membrane is weighed and this value recorded as m(T).

The membranes are then fixed in the membrane retainer and the fluid undergoing analysis is filtered. This is followed by flushing off the contaminant on the membrane using filtered solvent to completely remove the contaminant. When analyzing oil-laden fluids it is important that the remaining oil is completely flushed off the membrane.

This is followed by drying the membrane, cooling, and weighing it (as described above). The measured value is now recorded as m(E).

Gravimetric contamination is calculated as follows: M(G) = m(E) – m(T)

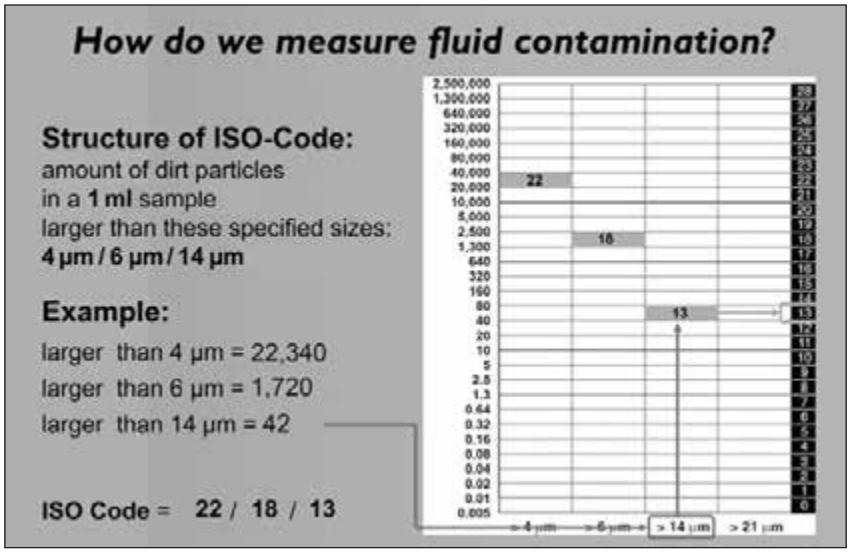
ISO 4405
"Hydraulic Fluid Power – Fluid Contamination – Determining Particulate Contamination Employing Gravimetric Analysis Methods"

ISO 4406 Particle Counting in Fluid Systems

ISO 4406:1999

In ISO 4406, particle counts are determined cumulatively, i.e. > 4 µm(c), > 6 µm(c) and > 14 µm(c) (manually by filtering the fluid through an analysis membrane or automatically using particle counters) and allocated to measurement references.

The goal of allocating particle counts to references is to facilitate the assessment of fluid cleanliness ratings.



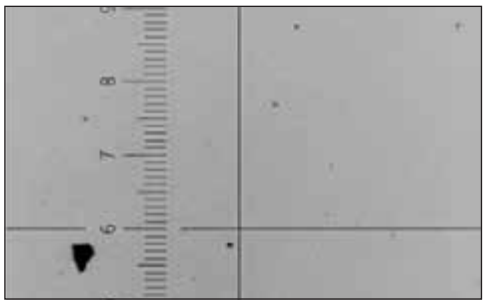


Figure 14. Microscopic Examination of an Oil Sample Magnification 100x (ISO 18/15/11)

Note: increasing the measurement reference by 1 causes the particle count to double.

Example: ISO class 18 / 15 / 11 says that the following are found in 1 ml of analyzed sample:

1,300 - 2,500 particles	> 4 µm(c)
160 - 320 particles	> 6 µm(c)
10 - 20 particles	>14 µm(c)

Recommended Cleanliness Levels (ISO Codes) for Fluid Power Components

Components	Cleanliness Levels (ISO Code) 4 µ(c)/6 µ(c)/14 µ(c)
Gear Pump	19/17/14
Piston Pump/Motor	18/16/13
Vane Pump	19/17/14
Directional Control Valve	19/17/14
Proportional Control Valve	18/16/13
Servo Valve	16/14/11

The above is based on data shown in various hydraulic component manufacturers' catalogs. Contact Schroeder for recommendations for your specific system needs.

Allocation of Particle Counts to Cleanliness Classes

No. of Particles/ml		Cleanliness Class
Over	Up to	
1,300,000	2,500,000	> 28
640,000	1,300,000	> 27
320,000	640,000	> 26
160,000	320,000	> 25
80,000	160,000	> 24
40,000	80,000	> 23
20,000	40,000	> 22
10,000	20,000	> 21
5,000	10,000	> 20
2,500	5,000	> 19
1,300	**2,500**	> 18
640	1,300	> 17
320	640	> 16
160	**320**	> 15
80	160	> 14
40	80	> 13
20	40	> 12
10	**20**	> 11
5	10	> 10
2.5	5	> 9
1.3	2.5	> 8

NAS 1638 Particle Counting in Fluid Systems

Like ISO 4406, NAS 1638 describes particle concentrations in liquids. The analysis methods can be applied in the same manner as ISO 4406:1987.

In contrast to ISO 4406, certain particle ranges are counted in NAS 1638 and attributed to measurement references.

The following table shows the cleanliness classes in relation to the particle concentration analyzed.

Cleanliness Class	Particle Size (µm)				
	5-15	15-25	25-50	50-100	>100
	No. of Particles in 100 ml Sample				
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1,000	178	32	6	1
3	2,000	356	63	11	2
4	4,000	712	126	22	4
5	8,000	1,425	253	45	8
6	16,000	1,850	506	90	16
7	32,000	5,700	1,012	180	32
8	64,000	11,600	2,025	360	64
9	128,000	22,800	4,050	720	128
10	**256,000**	**45,600**	**8,100**	**1,440**	**256**
11	512,000	91,200	16,200	2,880	512
12	1,024, 000	182,400	32,400	5,760	1,024

Increasing the class by 1 causes the particle count to double on average.

The particle counts of class 10 are bold-faced in the above table.

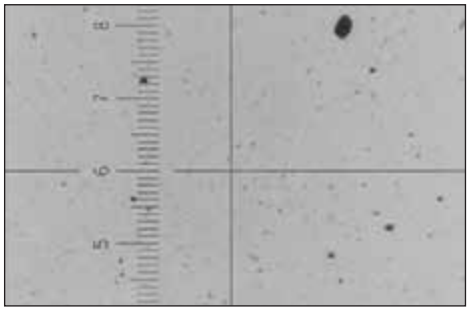


Figure 15. Microscopic Examination of an Oil Sample Magnification 100x (NAS 10)

SAE AS 4059(D) Particle Counting in Fluid Systems

SAE AS 4059(D)

Like ISO 4406 and NAS 1638, SAE AS 4059(D) describes particle concentrations in liquids. The analysis methods can be applied in the same manner as ISO 4406:1999 and NAS 1638.

The SAE cleanliness classes are based on particle size, number and distribution. The particle size determined depends on the measurement process and calibration; consequently the particle sizes are labeled with letters (A - F).

The SAE cleanliness classes can be represented as follows:

1. Absolute particle count larger than a defined particle size
   Example: **Cleanliness class according to AS 4059:6**
   The maximum permissible particle count in the individual size ranges is shown in the table in boldface.
   Cleanliness class according to AS 4059:6 B
   Size B particles may not exceed the maximum number indicated for class 6.
   6 B = max. 19,500 particles of a size of 5 µm or 6 µm (c)

2. Specifying a cleanliness class for each particle size
   Example: **Cleanliness class according to AS 4059: 7 B / 6 C / 5 D**
   Size B (5 µm or 6 µm(c)): 38,900 particles / 100 ml
   Size C (15 µm or 14 µm(c)): 3,460 particles / 100 ml
   Size D (25 µm or 21 µm(c)): 306 particles / 100 ml

3. Specifying the highest cleanliness class measured
   Example: **Cleanliness class according to AS 4059:6 B – F**
   The 6 B – F specification requires a particle count in size ranges B – F. The respective particle concentration of cleanliness class 6 may not be exceeded in any of these ranges.

Maximum Particle Concentration* (particles / 100 ml)

Size ISO 4402 Calibration or Visual Counting	> 1 µm	> 5 µm	> 15 µm	> 25 µm	> 50 µm	> 100 µm
Size ISO 11171, Calibration or Electron Microscope**	> 4 $\mu m_{(c)}$	> 6 $\mu m_{(c)}$	> 14 $\mu m_{(c)}$	> 21 $\mu m_{(c)}$	> 38 $\mu m_{(c)}$	> 70 $\mu m_{(c)}$
Size Coding	A	B	C	D	E	F
000	195	76	14	3	1	0
00	390	152	27	5	1	0
0	780	304	54	10	2	0
1	1,560	609	109	20	4	1
2	3,120	1,220	217	39	7	1
3	6,250	2,430	432	76	13	2
4	12,500	4,860	864	152	26	4
5	25,000	9,730	1,730	306	53	8
6	**50,000**	**19,500**	**3,460**	**612**	**106**	**16**
7	100,000	38,900	6,920	1,220	212	32
8	200,000	77,900	13,900	2,450	424	64
9	400,000	156,000	27,700	4,900	848	128
10	800,000	311,000	55,400	9,800	1,700	256
11	1,600,000	623,000	111,000	19,600	3,390	1,020
12	3,200,000	1,250,000	222,000	39,200	6,780	

Table shows the cleanliness classes in relation to the particle concentration determined.
*Particle sizes measured according to the longest dimension.
**Particle sizes determined according to the diameter of the projected area-equivalent circle.

Fluid Condition Field Analysis Tools

Procedure in Evaluating Fluid Samples

According to ISO 4406:1999, NAS 1638 and SAE AS 4059(D)

A representative sample is taken of the fluid and analyzed as follows:

1. Manual procedure according to ISO 4407 (Hydraulic fluid power – Fluid contamination – Determination of particulate contamination by the counting method using a microscope).

ISO 4407 contains a description of a microscopic counting method for membranes. 100 ml of the sample undergoing analysis is filtered through an analysis membrane featuring an average pore size of < 1 µm and square markings.

The standard also describes the cleaning procedure and maximum particle count of the negative control.

After the analysis membranes are dried, 10, 20 or 50 squares are counted depending on the size of the particles, followed by adding the values and extrapolating to the membrane diameter. See figure 16.

The manual count of the particles is done in the "old" levels of > 5 µm and > 15 µm since the longest dimension of a particle is counted in ISO 4407 yet the diameter of the area-equivalent circle is counted in the "new" ISO 4406:1999. As described above, the reference values obtained for this count correspond to the reference values of the "new" evaluation.

This counting method can only be used for very clean samples. Generally speaking, the cleanliness classes are estimated on the basis of reference photographs or the samples are automatically counted.

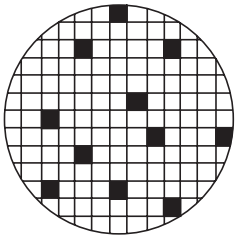


Figure 16.

2. Automated particle counting

Below follows a description of how common particle counters employing the light extinction principle function.

Figure 17 shows a simplified rendering of the measurement principle employed in the light extinction principle.

The light source transmits the light (monochromatic light for the most part) onto an optical sensor, which emits a specific electrical signal.

A shadow is created on the photodiode if a particle (black) comes between the light source and the photodetector. This shadow causes the electric signal emitted by the sensor to change. This change can be used to determine the size of the shadow cast by this particle and thus the particle size.

This procedure enables the cleanliness classes according to ISO 4406:1987, ISO 4406:1999, NAS 1638 and SAE AS 4059(D) to be accurately determined.

The "noise" involved in this measurement principle is extraneous liquids and gases which cause the light beam to be interrupted and thus be counted as particles.

The particle counter should be calibrated according to ISO 11943 (for ISO 4406:1999).

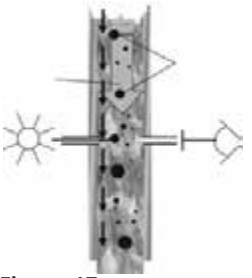


Figure 17.

Figure 18. Schroeder Industries offers seven products (see Figure 18) that include particle monitoring services: TPM TestMate® Particle Counter, TIM TestMate® In-Line Counter, TCM TestMate® Contamination Monitor, TMU TestMate® Monitoring Unit, CTU TestMate® Contamination Test Unit, the FS Filtration Station® and Asset Management Filtration System®. Product information for all of these is included in this catalog.

Determining the Residual Dirt Quantity of Components and Technical Cleanliness

Determining the residual dirt quantities present on components can be done by employing quantitative and qualitative factors.

Quantitative:
- mg/component
- mg/surface unit (oil-wetted surface)
- mg/kg component weight no. of particles > x µm/component
- no. of particles > x µm/surface unit (oil-wetted surface)

Qualitative:
- Length of largest particle (subdivision into hard/soft)

Components with easily accessible surfaces are components in which only the outer surface is of interest for the most part when performing residual dirt analyses. *There are exceptions e.g. transmission and pump housings, as the internal surface is of interest. These components belong to group 1 and their surfaces are not easily accessible in most cases.*

Components in which the inner surfaces are examined or *pre-assembled assemblies* belong to group 2.

There are two methods that can be used to determine the residual dirt of group 1 components.

Ultrasonic Method

The ultrasound method involves submitting the components to an ultrasonic bath, exposing them for a defined period of time at a defined ultrasonic setting and bath temperature. The particulate contamination is loosened by the exposure and then flushed off the component using a suitable liquid.

The particle dispersion in the flushing liquid obtained in this manner is analyzed according to specified evaluation methods.

The ultrasonic energy setting and the duration of exposure have to be indicated in reporting the result. The ultrasonic procedure is particularly suitable for small components in which all surfaces have to be examined. *Cast components and elastomers should not be subjected to ultrasonic washing if possible. A risk is posed here by the carbon inclusions in the cast piece being dissolved, thus skewing the results.* These effects have to be evaluated prior to performing an ultrasonic analysis.

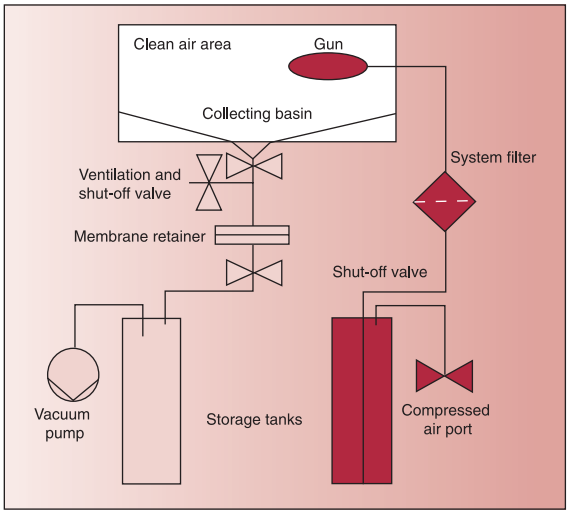


Figure 19

Flushing Method

Components with easily accessible surfaces or components in which only surface parts have to be examined are analyzed using the flushing method. This method involves flushing the surface undergoing analysis in a defined clean environment using an analysis fluid, which also has a defined cleanliness. A "negative control" or basic contamination control is performed prior to analysis in which all the surfaces of the environment, e.g. the collecting basin, are flushed and the value obtained reported as the basic contamination of the analysis equipment. The flushing fluid is then analyzed using the specified evaluation methods.

The darker areas in Figure 19 are the flushing areas; those to the left and lighter are the designated analysis area. In reality these two circuits are configured using suitable valves in such a manner that switchover can be done between the two storage tanks. The figure represents a simplified circuit diagram. The analysis fluid is subjected to a pressure of *approximately 58 – 87 psi (4 – 6 bar)* and conveyed through the system filter and the spray gun into the analysis chamber. The system filter ensures that the analysis fluid sprayed on the surface being examined has a defined cleanliness. The particle-loaded fluid *collects in the collecting basin* and is filtered through the analysis membrane via vacuum action. The membrane is then evaluated according to the analysis methods described on the following pages.

Shaking Method

The shaking method is very rarely used, as it is very difficult to reproduce manually. However, results are reproducible when automatic shakers such as those used in chemical laboratories are employed. The analyzed components are components subject to wear whose inner surfaces are to be analyzed (e.g. pipes, tanks). The important thing is that the particles are flushed out of the inside of the components after being shaken.

The table on the following page shows a comparison of the various methods for analyzing components and assemblies.

Testing Methods Comparison

Method Comparison

	Flushing Method	Ultrasonic Method
How Performed	Components are flushed with the analysis fluid in a defined clean environment.	Components are exposed to an ultrasonic bath and are then flushed with the analysis fluid.
Applications	Components in which only surface parts have to be examined and components in which ultrasound may damage the surfaces. Components with a simple design and with easily accessible surfaces.	Small components and components in which all surfaces are to be analyzed (the component size depends on the ultrasonic bath).
Pros	Analysis can be performed quickly	Reproducibility
Cons	Reproducibility Standards are not yet available (currently in preparation)	Analysis takes a long time The energy acts on the surface undergoing analysis The surface has to be flushed No valid standards

Evaluation Methods

Evaluating particle-laden flushing fluids can be done according to various criteria. Gravimetric analysis is useful for heavily contaminated components, whereas particle counts in various size ranges are useful for very clean components.

The following table provides an overview of the individual evaluation methods.

	Manual Methods		Automated Methods	
	Gravimetric method [mg/m²]	Counting of particles on the analysis membrane [no. of particles > x µm/m²]*	Counting of particles on the analysis membrane [no. of particles > x µm/m²]*	Counting of particles on the analysis membrane [no. of particles > x µm/m²]*
	The particle-laden fluid is filtered through a prepared analysis membrane			The particles on the particle-laden fluid are counted using an automatic particle counter
How Performed	The analysis membrane is weighed before and after analysis and the gravimetry computed on the basis of the difference between the measured values	The number of particles in the individual size ranges are estimated or counted < 100 µm estimated > 100 µm counted	The analysis membrane is placed under a microscope and evaluated using a software tool. This software records the light-dark contrasts on the membrane and interrupts them as particles.	
Applications	Samples exhibiting contamination >10 mg	Samples featuring high a content of coarse contamination. Often combined with gravimetric evaluation.	Samples featuring a low contamination content < 5 mg	Preferred for very clean components. When high dirt content is involved, the sample has to be diluted in order to perform counting.
Standard	ISO 4405	ISO 4407		ISO 11500
Advantages	Material types can also be analyzed. An overview can be quickly obtained of the largest particles. Air and extraneous liquids do not pose a problem (as long as no deposits form on the membrane). Can be used for large particle quantities			Analysis can be performed quickly, can be integrated in process chain as on-line method, detection of small quantities of particles possible, measurement range selectable (2-400µm). Accurate measurement method
Disadvantages	Takes a long time (min. 1 h) Lab Method	Takes a long time No. of particles <100 µm estimated Lab Method	Depending on the analysis accuracy this method can take a very long time. Light particles are not interrupted. Light-Dark contrast is manually selected in cases. The diameter of the area-equivalent circle is measured (=> result is not identical to visual appearance)	The sample has to be prepared (e.g. the sample might have to be diluted). Generally speaking, this is a statistical method providing for sufficient accuracy.
Application	Lab Method Used as a control for indirect measurement techniques (e.g. off-line process control in test stations)		Lab Method	On-line process control in manufacturing and assembly. Can also be used in labs

Evaluation Methods

The following table provides an overview of applications of the analysis and evaluation methods.

Evaluation		Gravimetry		Particle Counting		
Analysis Method		Flushing	Ultrasonic Method	Flushing	Ultrasonic Method	Function Testing
Simple Components	easy-to-access surfaces; gears	U	U	U	U	NU
Components	internal surfaces pipes, tanks	U	NU	U	NU	CU*
Complex Components	components featuring various bore holes or ducts; control plates	CU*	NU	CU*	NU	U
Simple Systems	surface is to be analyzed immersed sensors	U	U	U	U	NU
Systems	internal surfaces rails of common rail systems	CU*	NU	CU*	NU	U
Complex Systems	valves, pumps	CU*	NU	CU*	NU	U

* Must be ensured that the particles dislodged from the component can be flushed away.

U = Usable
CU = Conditionally usable
NU = Not usable

Patch Test Kit

Schroeder's EPK Patch Test Kit (shown to the right) provides the tools needed to pull contaminated fluid through a patch and compare the resulting patch under a microscope to representative photos of various contamination levels to determine the fluid's ISO level.

Advanced Technology

The Asset Management Filtration Station® (AMFS) is a complete fluid management system designed to manage fluid cleanliness, so that the greatest return of that asset is achieved. The AMFS 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.

Contamination Monitoring

The reliability of hydraulic systems can be impacted heavily by particulate contamination during the running-in phase. The risk of outages during the first minutes or hours of operation is particularly high as the foreign particles introduced or created during the assembly process are still relatively large and can thus cause sudden outages. During continued operation, these large particles are ground into smaller ones, the result being that damage can be caused to the surfaces of system components during this crushing process. The consequences are leakage, degraded output and efficiency, or a shortening of the component's service life. In many cases, microfiltering is used to quickly clean the system fluid during commissioning.

This is where contamination monitoring is key in the manufacture and assembly of these systems. By implementing contamination management 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. *For more information, refer to page 31.*

Below follows a description of the goal, design and performance of a process audit.

Contamination monitoring extends to checking the cleanliness status of all manufacturing and assembly processes considered relevant in this connection. Proper preparation and informing all those involved are key in contamination monitoring.

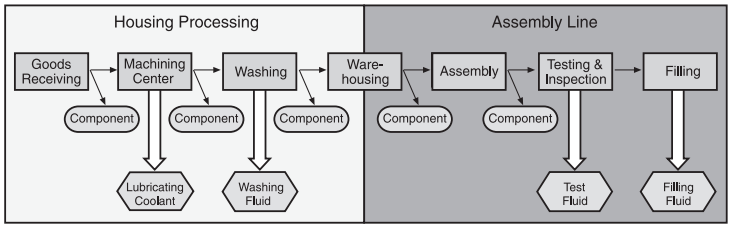


Figure 20. Schematic Excerpt of a Manufacturing Line

Planning and Design

First, the objective of contamination monitoring is specified, e.g.

- Determining the current situation
- Checking fluctuations between batches
- Checking washing processes
- Comparing the target with the actual situation
- Determining the sampling point

During the planning and design phase, the sampling points for components and taking liquid samples are determined using a production plan or operation sheet. The employees to be involved in contamination monitoring are informed of the objectives and procedures.

NOTE:

Manufacturing has to continue in the same manner, meaning that no additional cleanliness levels, etc. are to be integrated. The purpose of contamination monitoring is not to check the quality produced by the employees but rather determining the causes and sources of contamination.

Figure 20 above shows the manufacturing processes and the corresponding sampling points. However, in actuality sampling is more comprehensive, i.e. the description includes the number of the Minimess fittings at which sampling is done, for example.

How Sampling is Done

A representative sampling is taken of the fluids and components; the samples are stored so as to prevent any further contamination. Special sampling bottles are used for the fluid samples; the components are stored in defined clean packaging.

The analysis is performed in accordance with the methods specified on page 18 and the findings recorded.

Inspection of the Manufacturing and Assembly Line

Properly trained or experienced individuals while inspecting the manufacturing and assembly line can detect some sources of contamination. That is why such an inspection is conducted during the audit. The findings made during inspection are then compared with the results on hand.

Analyzing the Data

Results

The contamination monitoring results describe the condition at the time the sampling is done. The findings might look like this:

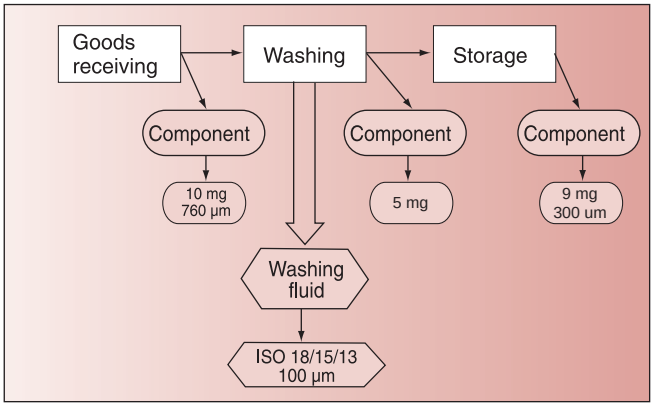
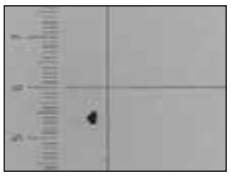


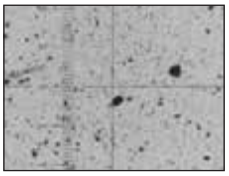
Figure 21. Housing Processing



Micro-photograph analysis membrane

Particulate contamination of a component prior to storage

Figure 22.



Micro-photograph analysis membrane

Particulate contamination of a component *after* being in storage for 2 weeks

Figure 23.

This chart shows an excerpt of the housing manufacturing process. The component samples are taken upstream and downstream of the washing station. The findings show that the washing station performs well and that it is well positioned. Subsequent storage is not being done properly as the particulate contamination is almost double.

Drafting a Cleanliness Specification

By applying a cleanliness specification to components and the system it can be ensured that as-supplied quality is constant.

The following should be kept in mind when drafting a cleanliness specification:

- State of the art
- Benchmarking – what do others do?
- Inclusion of previous experience – if available
- Defining and implementing contamination management as an "official project"
- Inclusion of all hierarchy levels
- Accurate documentation of how the specification was developed
- Developing clear-cut definitions

Next, it has to be determined which components in the system are the most sensitive. Frequently, it is not possible to achieve the same level of cleanliness throughout the system during assembly.

If suitable, filtration takes place upstream of the sensitive components. An area of low-contamination-sensitive components can be defined upstream of this filtration and an area of highly contamination-sensitive components downstream of the filter.

These individual components or system areas should be subdivided into sensitivity areas.

Category	Designation	Description
A	Low particle-sensitivity	For the most part low-pressure systems with large gap tolerances
B	Particle-sensitive	Low-pressure systems with small gap tolerances
C	High particle sensitivity	High-pressure systems with small gap tolerances and with exacting demands made of safety and security systems

A maximum particulate contamination value is specified for each of these cleanliness categories.

A car motor illustrates this subdivision below:

Category	Motor Area
A	Air / Coolant water circuit
B	Low-pressure oil circuit
C	Diesel direct injection / High-pressure oil circuit

In addition, the fluid cleanliness ratings of the individual system and process fluids are defined.

Analyzing the Data

Establishing Cleanliness Specifications

The following parameters are defined in the cleanliness specifications for the components:

1. Goal of the cleanliness specification
2. Applicability (system designation)
3. Extent of inspection and testing; inspection and testing cycles
4. Sampling
5. Analysis method
6. Evaluation method
7. Accuracy
8. Analysis fluids to be used
9. Documentation
10. Limit values

This specification has to be made for each individual system; consequently a few things are discussed which have to be borne in mind.

Work instructions concerning sampling, analysis and evaluation methods should be described in detail so as to ensure that sampling is always done in a uniform manner. In addition, the analysis results depend on the analysis fluid and method, particularly when it comes to component analysis. Documentation should be done using forms so that all the results are readily accessible.

Contamination Management			
System	Power Steering	Analysis date	Jan. 31, 2001
Component analysis			
Component	Rack	Sampling point	After washing 1
Part No.	Xx1235	Sample taken by	Joe Smith
Batch size	1	Sampling date	Jan. 30, 2001
Analysis method	Ultrasonic	Lot designation	01-2001
Analysis fluid	COLD-02	Analysis fluid vol.	1,500 ml
Negative value	.02 mg	Membrane filter rating	7 µm
Evaluation method			
In-line particle counting	Automated particle counting of the analysis fluid	Automated particle counting of the membrane	Manual particle counting
			x
	x		
Gravimetry	8	mg/component	
Largest abrasive particle	350	µm	
	No. of particles / component		
	> 50 µm	> 100 µm	> 200 µm
Actual value	100	10	3
Limit			0
System Fluid			
System	Washing 1		
Sampling point	Flushing bath		
Sample taken by	Joe Smith		
Sampling date	Jan. 30, 2001		
Measurement method			
In-line particle counting	Automated particle counting of the analysis fluid	Automated particle counting of the membrane	Manual particle counting
			x
ISO 4406	22/20/18	NAS 1638	
Largest abrasive particle	300 µm		
Signature:		Date:	

Example of a form for entering findings

Example of a Cleanliness Specification

1. Goal of the cleanliness specification
The goal in implementing this cleanliness specification is to achieve a constant level of cleanliness for system X.

2. Applicability (system designation)
This specification applies to system X including its series A, B, and C. It extends to all components whether sourced or manufactured in house. It also specifies the system fluids of system X with regard to their cleanliness.

3. Extent of inspection & testing; inspection & testing cycles
5 samples a month of each component are to be taken and analyzed. If the supplier parts achieve a constant cleanliness value after 6 months, the sampling cycle can be extended to every 2 or 3 months. An analysis of the entire (assembled) system is to be done at least once a week prior to delivery. Checking of the fluid cleanliness should be done on a continuous basis.

4. Sampling
Sampling of components is to be done at receiving and is to be representative. Samples should be packed in a dust-tight manner and sent into the laboratory. The fluid samples are to be taken at the sampling points indicated in the inspection and testing plan.

Analyzing the Data

Example of a Cleanliness Specification *continued*

5. Analysis method
The flushing method should be used for component analysis. The surfaces of the component are flushed in a clean environment using x ml of the test fluid (XY) which has a cleanliness of xx, under a pressure of z psi as specified by the inspection and testing plan. The flushed-off particulate contamination is collected on an analysis membrane and subjected to gravimetric analysis. Representative samples are taken of the system fluids at the specified sampling points. All testing parameters are specified; the duration of testing, what is tested, the pressures, and speeds. When conducting static inspection and testing make sure that a flushing effect is present so that the cleanliness of these components can be determined, (the static pressure test has to be followed by a dynamic flushing process in order to analyze the actual quantity of particles which is flushed out of the component.)

6. Evaluation method
In the component analyses the analysis membrane is dried until it achieves a constant weight, and then cooled in a defined dry environment and weighed. This procedure is repeated subsequent to filtration. The weight differential indicates the "gravimetric contamination" of the component. This is followed by visually examining the analysis membranes through a microscope and measuring the longest particles. Evaluation of the fluid samples is done in accordance with ISO 4405, ISO 4407, ISO 4406:1999 or NAS 1638.

7. Accuracy
The analysis equipment has to be brought to a residual dirt content of 0.2 mg prior to conducting the analysis so that the measurements taken of the component samples are sufficiently accurate. This is determined by performing a negative control, i.e. flushing the equipment without testing. When the result of the analysis drops below 0.5 mg, the batch size is to be increased and thus a mean value of the results computed.

8. Analysis fluids to be used
The following analysis fluid should be used for the component analyses: ABC-XX, with a cleanliness class of 14 / 12 / 9 and no particles > 40 µm.

9. Documentation
The documentation of the results is done using a result sheet.

10. Limit values
The components are subdivided into 3 cleanliness classes:

Category	Designation	Description
A	Low particle-sensitivity	For the most part low-pressure systems with large gap tolerances
B	Particle-sensitive	Low-pressure systems with small gap tolerances
C	High particle sensitivity	High-pressure systems with small gap tolerances and exacting demands

The following cleanliness specifications apply to each of these classes (fictitious example).

Category	Gravimetry	Particle Sizes
A	20 mg / component	Max. 4 particles > 500 µm Max. size: 400 µm No fiber bundles
B	10 mg / component	Max. 4 particles > 400 µm Max. size: 800 µm Fibers up to 4 mm
C	5 mg / component	Max. 4 particles > 200 µm Max. size: 1,000 µm Fibers up to 2 mm

The transmission components are subdivided into the individual categories.
Group A: crankcase sump.
Group B: intermediate housing, transmission housing, coupling flange
Group C: valve plate, valve housing, centering plate

Fluid samples:
At the end of the test run, the transmission fluid may not fall short a cleanliness rating of 17 / 15 / 13 (c) according to ISO 4406:1999. The system is to be operated using a cleanliness rating of 18 / 16 / 14 (c) according to ISO 4406:1999.

11. Procedure to be followed in the event that the specification is not adhered to
The supplier components are to be returned to the supplier in the event that the specification is not adhered to. If this procedure results in production delays, the components will be cleaned and analyzed by us at the supplier's expense.

Sources of Contamination in the Manufacturing and Assembly of Hydraulic Systems

Particulate contamination can enter a fluid power system in various ways. The main sources of ingression are shown in the following diagram. Some of these sources of contamination can be eliminated in a simple, cost-effective manner.

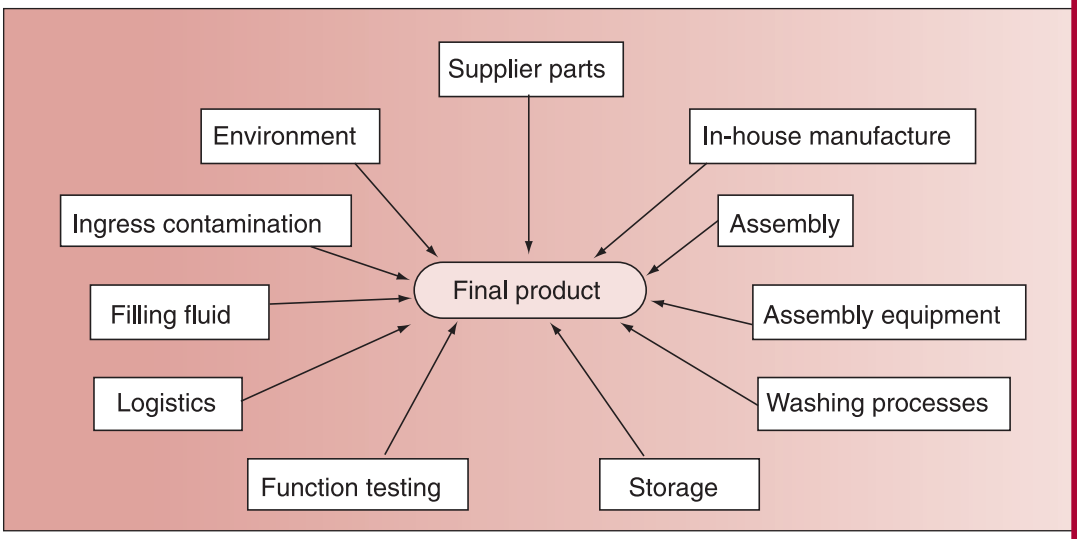


Figure 24. Sources of Contamination in the Manufacturing of Hydraulic Systems

Preventing the Ingression of Contamination in the Manufacturing and Assembly of Hydraulic Systems

The ingression of contamination in the manufacturing and assembly of hydraulic systems can be eliminated in a cost-effective manner in various process steps.

Storage and Logistics

When storing and transporting the components and systems care has to be exercised to make sure that they are properly sealed shut or well packed. Transportation and storage packing has to be in keeping with the cleanliness status of the individual components.

Assembly of Systems and Subassemblies

The assembly of these systems is to be done in accordance with system requirements. This means that the assembly and mechanical fabrication areas have to be separated if necessary in order to prevent the ingress of contamination. The assembly stations have to be kept clean to a defined cleanliness and those working in these areas have to wear special, lint-free clothing. The assembly equipment has to be properly cleaned so as to prevent the ingress of dirt here, too.

Raising the Awareness of Employees

In order to achieve the objective of "defined cleanliness of components and systems" it is important that employees at all levels be involved in this process. Frequently, a considerable savings potential is contained in the employees' wealth of ideas and experience — particularly those working at assembly lines and in fabrication.

Experience has shown that when employees are able to identify with the objective being striven for, they are more able to help in implementing it quickly and effectively.

Environment — Air Cleanliness

In some cases it will be necessary to set up a clean room for the final assembly of very contamination-sensitive systems, e.g. fuel systems, brakes shock absorbers, etc. This has to be decided on a case-by-case basis. However, in many cases performing the measures described here suffices.

Removal of Particulate Contamination from Hydraulic Systems
(Practical Experience and Components)

Generally speaking, particulate contamination is removed from a hydraulic system via filtration. Various types of filters are used depending on the amount and type of contamination.

Belt filter systems or bag filters are used when large quantities of contaminants are involved. These filters have the job of removing the major portion of contaminants from the system. These filter types are also used for pre-filtration purposes.

In most cases, these coarse filters do their job of *"removing a lot of dirt from the system"* very well. However, microfiltering also has to be done if a constant defined high level of cleanliness of the system fluid is to be ensured.

Whereas microfiltration ensures quality, the job of coarse filtration is to control the quantity of contamination.

Removal of Particulate Contamination

Cleaning System

Individual components are freed of clinging contamination in cleaning systems (particles, remainder of machining or corrosion protection fluids, etc.). Cleaning can be done by employing various mechanical methods (e.g. spraying, flooding, ultrasonic methods) using various cleaning fluids (aqueous solutions or organic solvents). The temperature and duration of cleaning also have a decisive effect on the cleaning effect. These factors have to be carefully matched and optimally tuned in order for a favorable cleaning effect to be achieved in an economical amount of time.

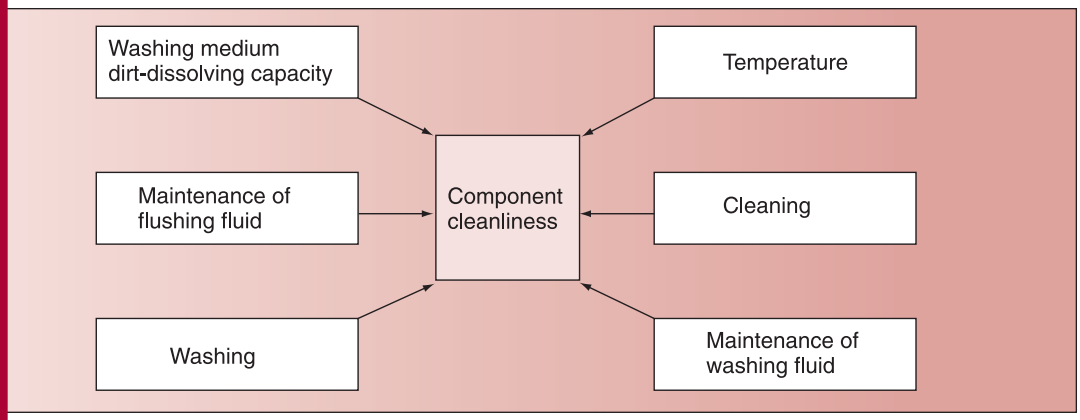


Figure 25. Cleaning Techniques

Various studies of washing processes have shown that some of these for the most part cost-intensive processes aren't worthy of the name. Some people refer to washing processes as "particle distribution processes". This "property" was detected in examinations of components sampled upstream and downstream of a washing process.

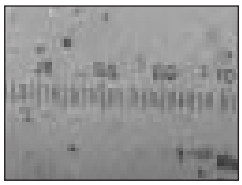


Figure 26. Micro-photograph Analysis Membrane: Pipe has been washed and sawed

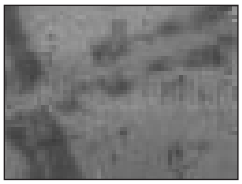


Figure 27. Micro-photograph Analysis Membrane: After sawing and washing, the pipe is bent and flushed

There are two possible responses in a case like this:

1. Discontinue the washing process when component cleanliness becomes worse after washing than before.

Advantage: temporary cost savings

The best alternative:

2. Optimize the process. The following should particularly be borne in mind when optimizing washing processes: cleanliness of the washing, flushing and corrosion protection fluid, mechanical aspects, suitability of the washing process for the components undergoing washing and filtration of the washing and flushing fluid.

When purchasing washing systems, make sure to specify the component cleanliness to be achieved and the maximum contamination load of the washing fluid in terms of *mg/l* or a cleanliness class.

Washing systems used to be subdivided into micro and micronic washing. This was a very imprecise definition of the cleaning performance to be achieved. Nowadays the permissible residual dirt quantity of the cleaned components is defined.

Specifying these residual dirt quantities is done as follows: mg/component, mg/kg component, mg/surface units or particle concentrations in various size ranges. In addition, the maximum sizes of the particles are defined which can be on the washed component, e.g. max. 3 particles > 200 µm, no particles > 400 µm.

These values cannot be achieved unless the factors indicated above are matched and fine-tuned. The following factors additionally have to be borne in mind: environmental protection and labor safety, local situation relating to space and power available, and the target throughput rate.

The cleanliness of the washing and flushing fluids also has a decisive impact on the cleaning performance of the washing machine. However, we are concerned here only with the maintenance of the washing and flushing fluids.

Removal of Particulate Contamination

Cleaning System *continued*

Cleaning Method	Solid Contamination	Liquid, Non-Dissolved Contamination (emulsion)	Liquid, Dissolved Contamination (emulsion)
Filtration			
Belt-type Filter	X		
Bag/Backflush Filter	X		
Micronic Filter (tube/disk filters)	X		
Ultrafiltration	X	X	
Distillation	X	X (for high boiling point differences)	X
Separator	X	X (density difference)	
Oil Separator		X	
Coalescer		X	

The type and composition of the cleaning medium is to be taken into account in selecting the fluid maintenance options indicated above. When using ultrafiltration, it has to be known that separating out the cleaning substances cannot be avoided in certain cases. In addition, ultrafiltration can only be used for pre-cleaned washing media since the performance of the separating membranes is degraded when they are loaded with particulate contamination.

Using Filtration as Fluid Maintenance for Separating out Particulate Contamination

Bag and backflush filters in various microfilter ratings are the standard equipment used in the maintenance of the fluid of washing systems. Although these filters are suitable for removing large quantities of contamination from a system, they are not suitable in most cases for maintaining defined cleanliness classes. Owing to their design, they do not offer much resistance, (the counterpressure built up across the filter is very low), below 15 psi for the most part. That is why this filter type is frequently used in the full flow when feeding cleaning fluid into the washing or flushing chamber. The filter housings are equipped with pressure gauges for monitoring the proper functioning of the filter.

Bag filters pose the risk that overloading can cause the bag to be destroyed and large contaminant quantities released. That is why it is advisable to additionally define minimum change intervals and to regularly monitor the cleanliness of the washing fluid in addition to the standard parameters like pH value or microbial count.

Residual dirt values of cleaned components are increasingly being defined and specified as an acceptance criterion for the cleaning system. It is of paramount importance that constant adherence be maintained to these values. It is also imperative that the quality of the cleaning fluid be maintained at a high, constant level.

This can be achieved by use of the targeted microfilters, featuring a constant and absolute separation rate. In most applications, tube filters or disk filters are used. The advantage of these filter types as compared to standard hydraulic filter elements is their high contaminant retention rate owing to their depth effect.

The high contaminant separation rate offered by these filter types removes a high amount of contamination from the washing fluid. This causes the filters to become quickly exhausted and blocked. A sufficiently long service life coupled with high washing fluid cleanliness can be achieved by combining filters for removing the main portion of contaminants from the system with absolute microfilters.

Example: At a leading automotive supplier, the camshafts were to be cleaned to a defined cleanliness of 9 mg / component. Point of departure:

Technical Specifications of the Washing Machine Present on Site	
Tank Volume:	21 gal. (80 l)
Pump Delivery Rate:	66 gpm (250 l/min) (centrifugal pump)
Washing Agent:	Ardox 6478 – Chemetall Group
Concentration:	2.3 – 3%
Bath Temperature:	ca. 122°F (50°C)
Filtration:	Backflush filter downstream of pump, 50 µm filter rating

Process Data	
Bath Change Frequency:	1 time/week
Throughput:	3,000 - 4,000
Wash Cycle:	15 s/component

Challenge: Clogging of the tank, Quality no longer sufficient after 2-3 days, Fluctuation in the contamination content of the components upstream of the line: 30 – 50 mg. Cleaning costs could not be allowed to increase, although quality still had to be improved.

Removal of Particulate Contamination

Goal of Optimizing the Cleaning Line

- Achieve a residual contaminant value of a maximum of 9 mg/camshaft
- Cleanliness of washing fluid of < 30 mg/liter
- Extend the service life of washing fluid, i.e. save costs associated with changing the fluid
- Prevent clogging of the tank, e.g. save cleaning time
- For process reliability reasons, a low-maintenance cleaning system was added to the result which enabled the camshafts to be cleaned to a residual contaminant content of 9 mg/component, this to be done cost-effectively

Result of Optimization

The service life of the cleaning fluid was extended from 1 week to 8 weeks. There was no more clogging of the tank. Changing the bath fluid was done on account of the increased chloride content, not on account of contamination.

The residual contaminant values of max. 9 mg/camshaft and max. 30 mg/liter of bath fluid (when using a 5µm membrane for analysis) were achieved and maintained at this level.

By optimizing the fluid maintenance of this washing line, an improvement in quality was achieved at no added cost and without comprising process reliability.

This example shows that prior to any such optimization or in new facilities the cleanliness of the components upstream of the system, throughput, technical details, targets have to be known and defined, for only in this way can the success of such an endeavor be ensured.

Economic Efficiency Analysis

	Investment ($)	Recurring Costs ($)	Savings/Year ($)
Off-line Filtration	**5,000.00**		
Filtration Costs		**7,500.00**	
Extension of the Service Life of the Bath			**10,000.00**
Lower Reworking Costs			These costs can't be quoted.
Down Time of the Washing Machine for Cleaning			These costs can't be quoted.

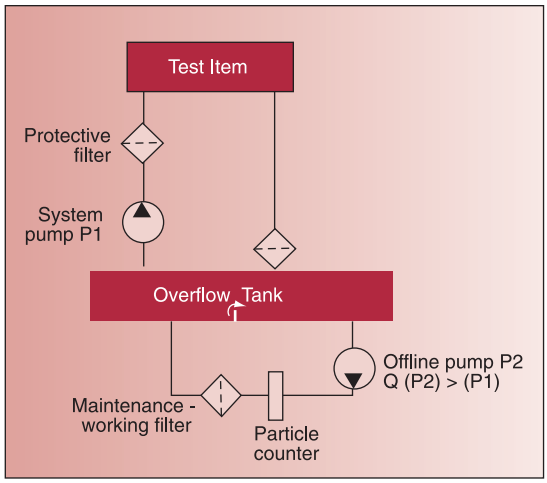


Figure 28. Schematic illustrates the basic setup of most test stands

Most systems come into contact with the hydraulic fluid during initial system filling or function testing. This process affords the manufacturer a substantial opportunity to impact the final cleanliness of the entire system. By using suitable filtration of the filling and test fluids, system cleanliness can be quickly optimized upon delivery or commissioning.

The cleanliness of the final product can be controlled via function testing in the same way as by a washing machine. Some companies have the following motto: ***"The test stand is our last washing machine."***

This statement might be true, however it is an expensive approach in practice. Yet when performing process reliability measures for supplying systems with a defined cleanliness, this is the first approach.

On a function test stand not only function testing is performed but the components and systems are run in as well. A frequent side effect of this is the flushing effect of the system undergoing testing. By employing targeted fluid maintenance and cleanliness monitoring, this flushing effect can be used to ensure that systems possess a defined, constant cleanliness status upon delivery.

Cleanliness monitoring provides information on the process stability of the upstream fabrication and cleaning steps. Frequently, continuous monitoring of test fluid cleanliness results in the cleanliness of the entire system as supplied being documented. This approach is used in mobile hydraulics, turbines or paper machinery upon delivery or during commissioning in order to demonstrate to the final customer that his system is being supplied with the specified cleanliness.

Example: The following study illustrates the cleaning process of a pump during commissioning:

The cleanliness of the test fluid upstream of the test item is maintained at a cleanliness rating of 16 / 14 / 11 (c). After 5 minutes of testing the pump speed is briefly increased to the maximum speed. The test run is concluded after 10 minutes.

In this case, the dirt content of the test item amounted to 1 *mg/kg* component weight upon the conclusion of the test run.

As the schematic below shows, the particle concentration continuously drops during the first 4 minutes of the test run. The particle concentration jumps when the pumps are turned up to full speed after 5 minutes. The next 5 minutes are again used for cleaning the system. Now the following can be asked: "How clean are the valves that leave this test stand?"

The flushing procedure can be monitored by occasionally disassembling the valves in a defined clean environment and evaluating the dirt content of the individual components.

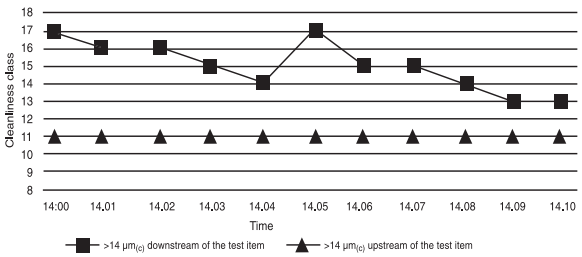


Figure 29. Pump commissioning Particle Count

Preventing Contamination

Figure 30. Valve Test Stand with 5 µm Filtration

Figure 31. Cleanliness Class Achieved by the Test Fluid: NAS 3

Storage, Logistics and Ambient Conditions

Unfortunately, improper component storage is not uncommon. Seals and gaskets which arrive at the assembly line clean and packed in bags are unpacked and filled into containers which are dirty for the most part as this involves less work and effort.

In most cases, these factors are not taken into consideration and substantial savings potential that could be easily utilized through improved packaging and storage is overlooked.

Supplier Parts and Components Manufactured In-house

Suitable cleanliness specifications for internally produced and sourced parts enable the ingress of contamination into systems to be minimized right from the beginning.

Commissioning Flushing

Commissioning flushing is most frequently chosen for large systems in order to minimize wear during commissioning.

The filtration of the flushing stand has to be designed so that during subsequent analysis the contaminants flushed out of the system undergoing testing are removed and other measurements aren't skewed. As an alternative, cleanliness can be measured and recorded upstream and downstream of the test item during the entire measurement sequence.

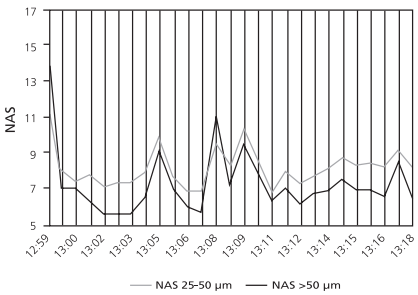
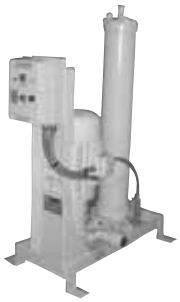


Figure 32. Examination of the Hydraulic System of a Mobile Crane

In a mobile crane application, a specified sampling point was located directly downstream of the pump and an online particle counter connected.

The crane jib was extended after 6, 8 and 10 minutes. The graph clearly shows that every time a new area was brought on line contaminant sediments were flushed out.

When a system's characteristic curve/behavior is known, cleanliness testing can be performed at the end of function testing and, thus, system cleanliness described subsequent to commissioning. This method enables process control to be implemented quickly and reliably during series testing/commissioning. The cleaning curve plotted over time is an indication of the ingress of contaminants during assembly.



X-Series Flushing Skid

Why Contamination Control is Important

Economic Efficiency Analysis

- The core aspects of contamination management are a cost analysis and efficiency review. The following costs are considered in the cost analysis:
- Warranty and non-warranty courtesy work
- Energy costs (e.g. cooling and reheating of washing machines during fluid changes)
- Test stand costs (test item time)
- Costs of the tools and dies of machine tools (increased wear due to high particle concentrations)
- Fluid costs (washing machines, test stations, machine tools)
- Labor costs (reworking, cleaning of washing machines, machine tools, etc.)
- Filter costs

	One-Time Investment	Recurring Costs / Year
Function Test Stands (5)	6,500 x 5 = 32,500	7,500 x 5 = 35,000
Storage Conditions	2,500	
Coverings for the Pallets		
Washing Machine for Cleaning the Pallets	50,000	25,000
Machining Process		2,000 x 7 = 14,000
Manpower/Cleaning	750 x 7 = 5,250	
Filtration	1,250 x 7 = 8,750	
Consulting Expenses	10,000	1,750
Total	109,000	75,750

The economic efficiency analysis (above) describes the success of contamination management as illustrated by a manufacturing line in the automotive industry with an output of 3,000 systems/day. Manufacturing is done 260 days/year (3,000 x 260 = 780,000 systems/year). A contamination review showed that the cleanliness of the function test stand fluid, the intermediate storage conditions and a machining process had to be optimized.

The next step involved forwarding the cleanliness specifications to the suppliers, who received orientation training and are periodically monitored.

The results of optimization:

- Less tool wear in surface machining
- Longer service life of the machining fluid
- Enhanced effectiveness of the downstream washing processes as less dirt had to be removed thanks to optimized storage and machining
- Longer intervals between changing the washing and flushing fluids, consequently "Saturday shifts" could be dispensed with
- Fewer outages at the test stand, i.e. the system is checked up to 3 times when performance deviations occur. These "idle cycles" were reduced by 90%, thus resulting in increased productivity.
- Drop in warranty and non-warranty courtesy work by 50% as the main reason for the outages turned out to be particulate contamination, which resulted in leakage and imprecise control in the system.
- Shortening of the test stand time.

Unfortunately we were not permitted to publish the detailed data behind these savings. Following from an economic efficiency analysis conducted by the customer in-house, savings of **$0.60** per system were achieved.

Cost Savings Per Year	780,000 systems x $0.60 = $468,000
Amortization of One-Time Investment Over 3-Years (109,000 / 3-Years)	$36,333
Recurring Costs Per Year	$75,750
Total Savings Per Year (for first 3-years)	**$355,917**

This economic efficiency analysis also includes the expenses associated with contamination management (seminars, consulting fees, analysis costs).

Contamination Management in Practice

In the previous pages we discussed the impacts of particulate contamination on the service life and reliability of hydraulic systems, how the cleanliness of fluids on components can be specified, and how contamination monitoring is performed. Deploying contamination management results in the following tasks for all participants in the production process:

Suppliers: Ensuring the defined as-supplied condition of products. Selecting the packaging of products to be supplied so that no additional contamination occurs during transportation and storage.

System vendors and manufacturers: Careful transportation, handling, storage and unpacking of products. Keep products clean after they are unpacked or after seals/plugs have been removed. Assemble/install the components in a suitably clean environment.

The following example shows how these individual parts can be combined in contamination management.

Description of the Point of Departure

System X has been successfully manufactured and marketed for years. During the past few years, System X has been developed further and a new generation, System Y was created. Y features improved performance properties, is more compact than X, and operates at higher system pressures than X. The result is that System Y is somewhat more sensitive to particulate contamination.

This is reflected in increased performance deviations during function testing. This deviation no longer occurs when Y is passed through the test stand a second or third time. An investigation of the matter has shown that this unwanted behavior is the result of coarse particulate contamination.

The goal of contamination management is now to improve the degree of cleanliness so that this undesirable behavior no longer occurs on the test stand and the associated costs of warranty and non-warranty courtesy work are reduced.

Step 1: Analysis of the Test Fluid

The cleanliness of the test fluid is determined. The analyses show that the test fluid cleanliness upstream of the test item amounts to a cleanliness rating of 22 / 20 / 18 according to ISO 4406, the largest metallic particles are 400 µm in size, and the largest fibers measure 3,000 µm.

Step 2: Optimizing the Function Test Stand

By additionally integrating bypass microfiltration, which maintains test fluid cleanliness at 15 / 13 / 10, 95% of the performance deviations can be prevented. This also results in a drop in warranty and non-warranty courtesy work.

Step 3: Lowering the Filter Costs at the Test Stands

By performing a contamination monitoring audit, it might be determined a large amount of particulate contamination is being transported into the system by the manufacturing processes and sourced components. This particulate contamination has to be removed from the system at the function test stand, which functions here as the last washing operation. This results in costs that could otherwise be avoided.

A concept is developed in which the washing, machining processes, and intermediate storage are optimized.

A cleanliness specification along with a test plan for system fluids is drafted. This specification is forwarded to external as well as internal suppliers and the components supplied with a defined, constant cleanliness.

Step 4: Integrating Particle Counting in Quality Assurance

A particle sensor is integrated in the function test stand for the purpose of continuous quality control of the as-supplied quality of System Y. A limit is defined for the maximum contamination of the test fluid in the return line. Intervention can be done immediately if this value is exceeded, thus ensuring that no contaminated systems leave the factory. Random sampling is done to check the supplier quality and non-conformant components returned to suppliers or washed in-house at the supplier's expense.

Step 5: Economic Efficiency Analysis

Contamination management started off with analyzing the costs associated with warranty and non-warranty courtesy work as the result of increased malfunction at the test stands. These costs are reanalyzed after optimization and compared. The savings achieved through optimization are briefly described in Economic Efficiency Analysis. The cost savings in that case amounted to *ca. e 355,917/year* (close to half a million dollars). This optimization process lasted *ca. 2 years*.

Step 6: Documentation and New Projects

The contamination management findings are collected in a database and used in the development of new systems. The defined maximum residual dirt content becomes standard in new systems in the same way that dimensions, surface grades and tolerances have been. This residual dirt content is primarily in reference to the specification that applies to System Y.

The specification is adapted in keeping with the experience gained with the prototypes. Cleanliness and cleaning costs are primarily determined by the design of new systems.

Section 1:

DIAGNOSTIC PRODUCTS

TCM TestMate® Series

As Shown: Standard TCM (TCM-D-H-A) includes: Unit, FluMoS Software, Operation Manual and Calibration Certificate

Features and Benefits

- Measures Particles in Four Sizes: >4, >6, >14 and >21 microns
- In-line or Manifold Mounting
- ISO or SAE codes can be output in 4-20 mA analog signal
- Compatible with Standard Mineral Fluids & Phosphate Esters
- Display and Keypad can be rotated (up to 270°)
- Inlet and Outlet Ports are Interchangeable (bidirectional) (without manifold only)
- Recommended recalibration: Only every 2 years.

Description

Schroeder's TestMate® Contamination Monitor (TCM) is the latest generation of particle monitors that continuously measure solid contamination in hydraulic fluid. Enclosed in a 4-inch diameter case, the TCM utilizes an optical sensor and measures particles in four sizes: >4, >6, >14 and >21 microns. Measurement results can be output as a contamination code according to ISO 4406:1999 or SAE AS 4059(D).

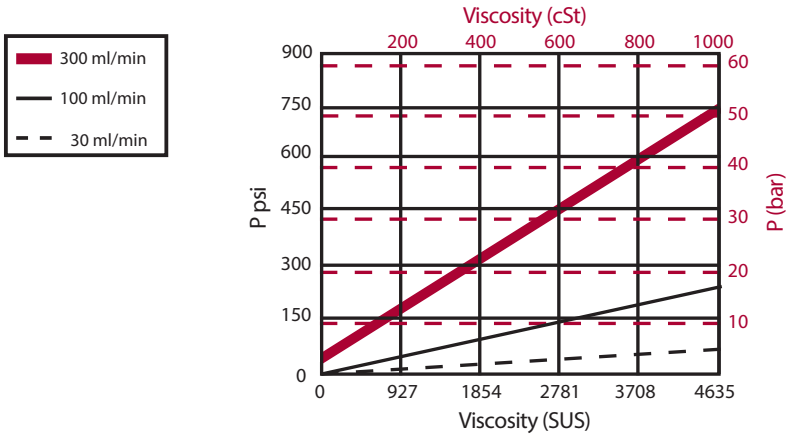
The TCM is designed for connection to hydraulic and lubrication lines with pressures up to 5075 psi (350 bar) and viscosities up to 4635 SUS (1000 cSt). The unit requires that a small flow of oil (between 30 mL/min and 500 mL/min) is diverted for measurement purposes.

The TCM provides the user with a smaller, tougher, and more versatile stationary sensor. It provides instantaneous readings and is able to self-diagnose continuously with error indication via the status LED. The attractive cost-to-performance ratio makes it especially applicable for OEM applications. Online, real-time condition monitoring allows you to have total predictive maintenance.

Market Applications

- Construction Equipment
- Agricultural Machinery
- Test Benches
- Industrial Hydraulic Systems
- Combination with Filter Unit
- Power Units
- Any hydraulic system that requires on-line monitoring
- Mobile and Stationary Mining Equipment

Pressure Requirement



NOTES:

No Water-Glycols

Mobile 424 will not work with unit

Tolerance is +- 1/2 ISO Code

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; SAE AS 4059(D)
Self-Diagnosis:	Continuously with error indication via status LED
Inlet/Outlet:	5075 psi (350 bar) max
Connections:	Inlet: ISO 228 G1/4 Threaded Outlet: ISO 228 G1/4 Threaded
Sensor Flow Rate:	30 to 500 mL/min
Permissible Viscosity Range:	0 to 4635 SUS (1 to 1,000 cSt)
Fluid Temperature Range:	32°F to 185°F (0°C to +85°C)
Power Supply Voltage:	9 to 36 VDC residual ripple <10%
Power Consumption:	3 Watt max
Electrical Outputs:	4 to 20mA Analog; 2 to 10 V Analog (option) RS485
Electrical Specifications:	4 to 20 mA Analog output (max burden 330Ω); 2 to 10 V output (min. load resistor 820Ω) Limit switching output (Power MOSFET): max current 1.5A
Ambient Temperature Range:	-22°F to 176°F (-30°C to +80°C)
Storage Temperature Range:	-40°F to 176°F (-40°C to +80°C)
Relative Humidity:	95%, non-condensing max
Seal Material:	Mineral Oil: Viton® Phosphate Ester: EPR
Electrical Safety Class:	III (low voltage protection)
IP Class:	IP67
Weight:	2.9 lbs (1.3 kg)
Mounting Position:	Recommended vertical installation with direction of flow south to north through TCM or manifold block

NOTES:

All Models feature an analog electrical output. Additionally, an electronic switching output can be configured to alert the operator about rising falling contamination levels.

Viton® is a registered trademark of DuPoint Dow Elastomers.

TCM TestMate® Series

Flow Conditioning Manifold with Water Sensor
Description: TCM-FC-W
P/N 7623774
Description: TCM-FC-WD
P/N 7632012

Features
- Manifold has pressure compensated flow control and orifices for flow conditioning
- Customer only needs to supply power (9-36 VDC) and pressure 100 psi or greater
- Allows installation in only minutes
- Compensates for varying pressures, flow rate, and viscosities
- Manifold has water sensor TWS-C installed for measurement of percent water saturation

What's Included
TCM-D-H-A-M (4-20mA only), manifold, TCM-C-3M, 2 pcs. 4mm 1620 microflex hose (p/n SM4-1620-035), TWS-C or TWS-D, TWS Power & Communication cable and 2 test points (p/n SP1620UN716VM) for installation into hydraulic system

Flow Conditioning Manifold
Description: TCM-FC
P/N 7623773

Features
- Manifold will have pressure compensated flow control and orifices for flow conditioning.
- Allows installation in only minutes
- Compensates for varying pressures, flow rate, and viscosities
- Customer to supply power (9-36 VDC) and pressure 100 psi or greater

What's Included
TCM-D-H-A-M (4-20mA only), manifold, TCM-C-3M, 2 pcs. 4 mm 1620 Microflex hose (p/n SM4-1620-035) and 2 test points (p/n SP1620UN716VM) for installation into hydraulic system, FluMoS software
Please see page 37 for drawing and dimensions.

Communication Kit
Description: TCM-RS485/USB
P/N 7632013

Features
- Enables the user to transfer data from TCM to PC
- Enables user to change TCM settings
- Enables user to have real time monitoring & data storage

What's Included
Converter box, 115 VAC to 24 VDC adapter, USB driver, FluMoS software, communication & power cables, case

Power and Communication Cable
Description: TCM-C-3M
P/N 7632009

Features
- Cable includes leads for power & communication

What's Included
9.8 ft. (3 m) length cable with M12x8 pin electrical connector on one end and flying leads on the other

Power Adapter
(without cable)
Description: TCM-PS
P/N 7619524

What's Included
115 VAC to 24 VDC power adapter

Features
- Allows user to connect TCM to standard wall outlet

Description: TCM-PS-C-3M
P/N 7600801

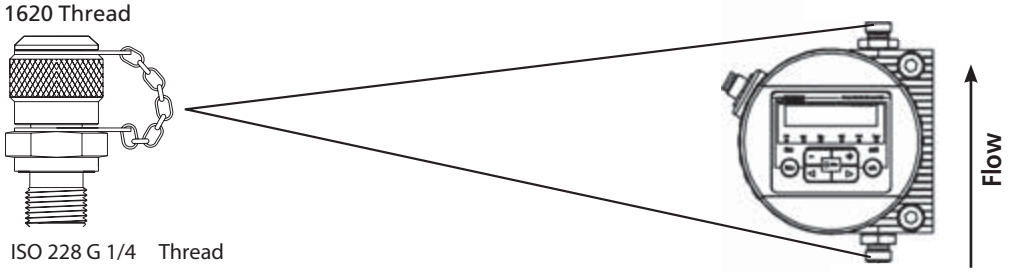
What's Included
TCM-PS and TCM-C-3M in a pre-assembled package

Schroeder Check

TestPoint Options for TCM

G Thread	Sealing System	Description	Part Number
1/4" BSPP	WD Seal Viton	SP1620G14WDM	7622704

1620 Thread

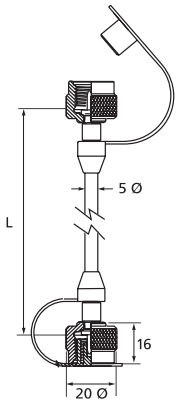


ISO 228 G 1/4 Thread

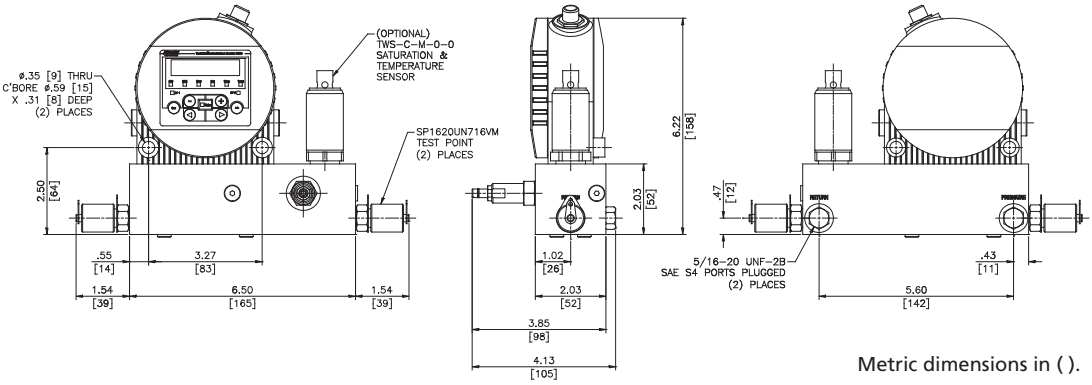
NOTES:
In-line version of TCM. In-line version cannot be mounted on manifolds

Microflex Hose

Options for TCM



Length inches (mm)	ΔP (max) psi (bar)	Description	Part Number
6 (152)	6,500 (450)	SM4-1620-006	7612174
35 (889)	6,500 (450)	SM4-1620-035	7612175



Metric dimensions in ( ).

NOTES:

TCM shown with optional manifold

TCM-FC, TCM-FC-W and TCM-FC-WD use the same manifold.

TCM-FC will include a plugged port for future installation of a water sensor, if desired

How to Build a Valid Model Number for a Schroeder TCM:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
TCM					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
TCM	D	H	A	M		= TCMDHAM

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
Model	**Display**	**Fluid**	**Output**	**Mounting Options**
TCM	D = Display	H = Hydraulic Fluids (Viton Seals)	A = 4-20 mA	Omit = Std in-line
	X = no	E = Phosphate Esters (EPR seals)	V = 2 to 10 V	M = Manifold Porting

BOX 6

Indicator Code
Omit = ISO 4406:1990 or SAE AS 4059(D)
N = ISO 4406:1987 NAS 1638 ISO 4406:1999 SAE AS 4059(D)

Model Number Selection

NOTES:

Power supply sold separately. Refer to page 36 for options and part numbers

Manually Controlled Fluid Sampling System

HY-TRAX®

Patent pending

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.
- Viton® seals.
- Fluid viscosities up to 350 cSt.
- Flow control valve providing optimal pressure for accurate sensor readings.

What's Included

- TestMate® Contamination Monitor (TCM)
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment.
- Specially designed fitting for mating to pump/motor.
- Viton® seals.
- Plugged water sensor port (G3/8)
- VSD (Variable Speed Drive) Motor Power Supply and Control Cable
- Water Sensor (TWS-D) Power Supply and Signal Cable (only supplied with optional water sensor (TWS-D))
- Contamination Monitor (TCM) output signal, USB-B Female Port for use with Windows-Based Computer and FluMoS Software, located on Control Enclosure
- Contamination Monitor (TCM), output signal, M12x1, 8 pole, Male Port, located on Control Enclosure, for use with PLC or RS485 Communication, analog or digital, 4 - 20 mA is standard, 2 to 10 V is optional
- Flow control valve
- VSD (Variable Speed Drive) pump/motor
- Manual rheostat pump controller
- IP 40 enclosure
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)
- 24 VDC Power Supply (NC3MP Female Connector)
- Optional 115 VAC Power Supply with Cord
- Contamination Monitor (TCM) Power and Signal Cable
- Water Sensor (TWS-D) M12x1, 5 pole Signal Output Connection, Male Port, located on Control Enclosure
- Contamination monitor (TCM) power connection, female M12x1, 8 pole located on control enclosure
- Water sensor (TWS-D) power connection, M12x1, 5 pole Female located on control enclosure

Applications

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

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:	Viton®
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:	1622 SUS (350 cSt)
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; 2 to 10 V analog (option for contamination monitor (TCM)) RS485 for communication with FluMoS Software
Electrical Specifications:	4 - 20 mA analog output (max burden 330 Ω) 2 to 10 V output (min load resistor 82 Ω) Limit switching output (Power MOSFET): max current 1.5A
TestMate® Contamination Monitor (TCM) Signal Output Connections Located on Control Enclosure:	USB-B Female Port for use with Windows-based computer and FluMoS Software M12x1, 8 pole, Male Port, Analog or Digital, for use with PLC or RS485 Communication, (4 - 20 mA is standard). 2 to 10 V is optional, must specify when ordering TestMate® Contamination Monitor (TCM)
Water Sensor (TWS-D) Signal Output Connection Located on Control Enclosure:	Water sensor (TWS-D) M12x1, 5 pole Signal Output 5 pole Male Port, located on Control Enclosure
Electrical Safety Class:	III (low voltage protection)
Enclosure Ratings:	IP 40 enclosure

Weight and Dimensions

Communications Module Control TestMate® Sensor	Fluid Sampling System Manifold w/ TCM & VSD Pump/Motor	HY-TRAX® Manual Control Module	Fluid Sampling Manifold w/ Communications Module & VSD Pump/ Motor
	10 lbs. (4.5 kg)	5 lbs. (2.5 kg)	15 lbs. (6.8 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)	

HY Manually Controlled Fluid Sampling System HY-TRAX®

HY-TRAX® Fluid Sampling System Manifold with Manual Controller and VSD Pump/ Motor

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 invariable conditions.
- Designed to be used with Schroeder Industries TestMate® contamination monitor (TCM) and optional water sensor.
- 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 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 Htz.
- Rugged design for field use.
- Viton® seals.
- Fluid viscosities up to 350 cSt.
- Flow control valve providing optimal pressure for accurate sensor readings.
- Manual rheostat control adjusts VSD (Variable Speed Drive) pump speed to adjust for variances in fluid viscosities.

What's Included

- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment.
- Specially designed fitting for mating to pump/motor.
- Viton® seals.
- Plugged water sensor port (G3/8)
- VSD (Variable Speed Drive) Motor Power Supply and Control Cable
- Flow control valve
- VSD (Variable Speed Drive) pump/motor
- Manual rheostat pump controller
- IP 40 enclosure
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)
- 24 VDC Power Supply (NC3MP Female Connector)
- Optional 115 VAC Power Supply with Cord
- Water Sensor (TWS-D) M12x1, 5 pole Signal Output Connection, Male Port, located on control enclosure
- TestMate® Contamination monitor (TCM) power connection, female M12x1, 8 pole located on control enclosure
- Water sensor (TWS-D) power connection, M12x1, 5 pole Female located on control enclosure

HY-TRAX® Manually Controlled Fluid Sampling System

HY

How to Build a Valid Model Number for a Schroeder HY-TRAX® Manually Controlled Fluid Sampling System:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
HY								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
HY		H		M					= HYHM

BOX 1

Model
HY

BOX 2

TestMate® Contamination Monitor (TCM)
Omit = TCM w/ display
ND = TCM w/ no display
NT = Manifold supplied w/ no TCM, Customer will supply TCM (manifold mount version needed)

BOX 3

Fluid Type
H = For use w/ Hydraulic & Diesel Fuel only*

BOX 4

TestMate® Contamination Monitor (TCM) Signal Output
Omit = 4-20 mA
S = 2 to 10 V analog output

BOX 5

TestMate® Contamination Monitor (TCM) Output Options
M = ISO 4406/SAE 4049
N = ISO 4406/NAS 1638

BOX 6

Water Sensor (TWS) Option
Omit = None
TWS-D = Water sensor w/ display

BOX 7

Manually Controlled Sampling System
Omit = Panel with Rheostat flow control, power and signal output for HY-TRAX® sampling system

BOX 8

Power Options
Omit = 24 VDC
P = 115 VAC

BOX 9

Air Suppression Loop
Omit = None
L = Looped hose and fitting

***Note: Off-road diesel contains dye. High concentrations of dye may interfere with particle count results. Please contact factory to review application.**

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

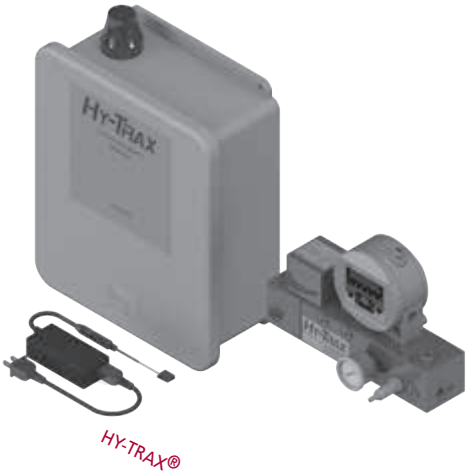
NOTES:
All HY-TRAX® manifolds come with a pressure gauge and intake strainer

Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX®

Patent pending

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 Viton® 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.

What's Included

- TestMate® Contamination monitor (TCM)
- Flow Control Valve
- GSM cellular communications
- VSD pump/motor
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment
- TestMate® Contamination Monitor (TCM) 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 (TWS-D) Communication/Power Cable
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)

Applications

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

Telematic Communications Module with Remote Controlled Sampling System

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:	Viton®
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:	1622 SUS (350 cSt)
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)

Weight and Dimensions

Communications Module Control TestMate® Sensor	Fluid Sampling System Manifold w/ TCM & VSD Pump/Motor	HY-TRAX® Communications Module	Fluid Sampling Manifold w/ Communications Module & VSD Pump/ Motor
	10 lbs. (4.5 kg)	10 lbs. (4.5 kg)	20 lbs. (9.1 kg)
	10.4" x 6.8" x 4.3" (264 x 173 x 109 mm)	14.7" x 11.3" x 5.25" (374 x 287 x 133 mm)	

Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX®

HY-TRAX® Fluid Sampling System Manifold with Contamination Sensor and VSD Pump/ Motor

Features and Benefits

- Integrated micro VFC, (Variable Speed Drive), pump/ motor provides optimal flow for accurate sensor readings in variable conditions
- Rugged design for field use
- Fluid viscosities up to 350 cSt
- 50 psi (max.) working pressure
- Flow control valve providing optimal pressure for accurate sensor readings
- Designed to be used with Schroeder Industries' communications module and optional water sensor

What's Included

- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment.
- Specially designed fitting for mating to pump/motor.
- Viton® seals.
- Plugged water sensor port (G3/8)
- Flow control valve
- Contamination Monitor
- Micro VSD pump/motor
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)

HY-TRAX® Fluid Sampling Manifold with Communications Module and VSD Pump/Motor

For Customers who have a TestMate® Contamination Monitor (TCM) (TCM must be 4-20 mA output)

What's Included

- Flow Control Valve
- GSM cellular communications
- VSD pump/motor
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment
- Specially designed fitting for mating to pump/motor
- IP 40 enclosure
- Plugged water sensor port (G3/8)
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)

HY-TRAX® Telematics Communications Module only operates with TCM's operating on Firmware 3.0 and 4-20 mA outputs. Older firmware versions will not communicate proper flow rate to the telematics module. Contact factory for more details.

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.
- Designed to be used with Schroeder Industries contamination monitor (TCM - manifold mount version only) and optional water sensor.
- 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 or on demand. 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 (<50psi).
- 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 weatherproof IP 40 enclosure.
- Fluid sampling system standard with Viton® 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.

HY-TRAX® Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX® Communications Module Only.
Order part # HY-COMMMOD

What's Included

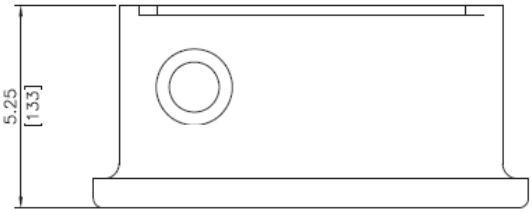
- GSM cellular communications
- IP 40 enclosure
- VSD, (Variable Speed Drive), Motor Controller
- 115 VAC Power Supply

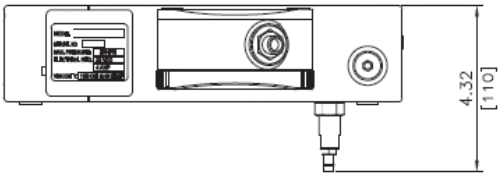
Features and Benefits

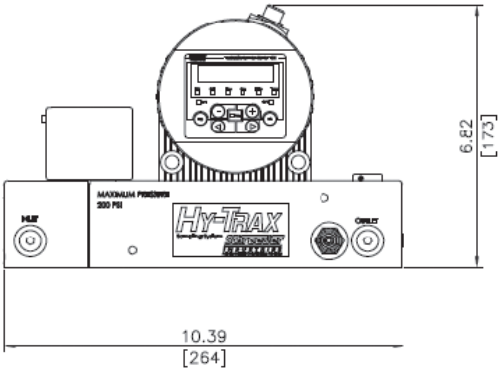
- Provides remote visibility to the fluid condition of critical systems.
- The HY-TRAX® Remote Oil Contamination Communications Module allows remote access via the Internet and smart devices to fluid particle counts, temperature and percent water saturation levels (optional) displayed on a customizable dashboard. The Communications Module collects and transmits data via GSM cellular at scheduled intervals. Users can receive alerts via email or text when the fluid's ISO contamination code or water saturation level (optional) reaches user defined critical levels.
- 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.

HY-TRAX® Communications Module

HY-TRAX® Telematics Communications Module can be utilized on existing TCM installations when the sensor receives adequate pressure (>120 psi) and flow (30-150 mL/min) from the hydraulic system. The TCM must have 4-20 mA outputs and Firmware version 3.0.



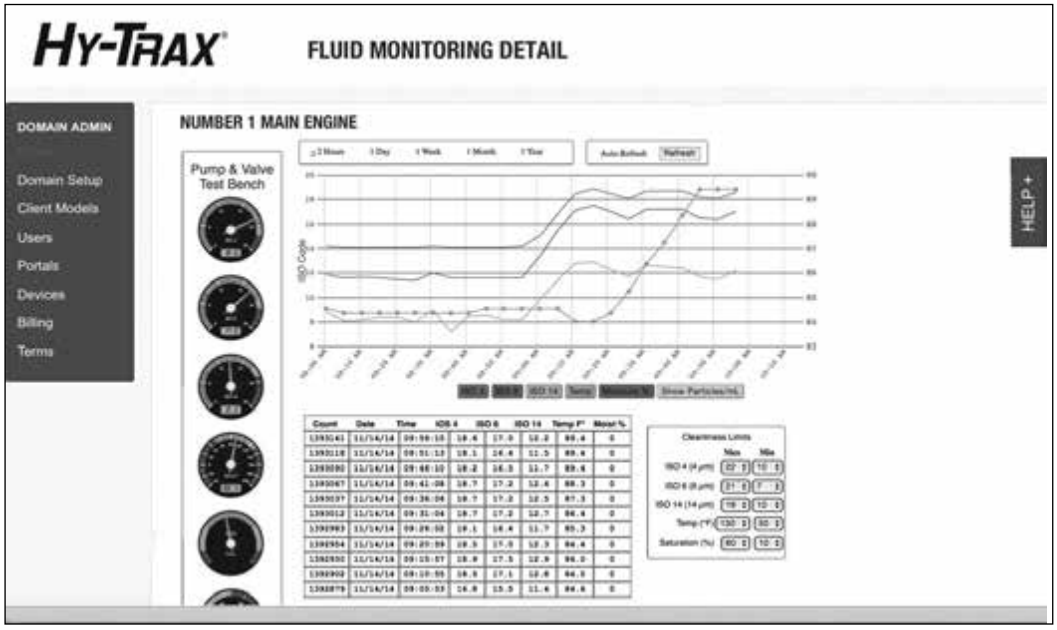




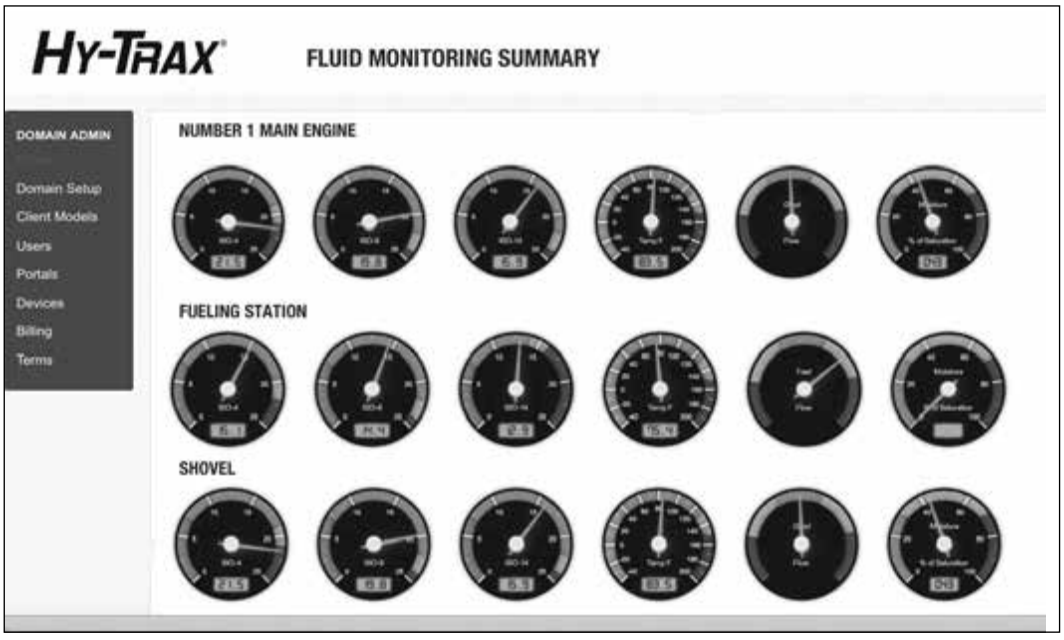
Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX®

Example of HY-TRAX® Communications Modules Dashboard Contamination Chart



Example of HY-TRAX® Communications Modules Dashboard Gauge Panel



Telematic Communications Module with Remote Controlled Sampling System

How to Build a Valid Model Number for a Schroeder HY-TRAX® Telematic Communications Module with Remote Controlled Fluid Sampling System:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
HY								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
HY		H		M		A			= HYHMA

BOX 1

Model
HY

BOX 2

TestMate® Contamination Monitor (TCM)
Omit = TCM w/ display
ND = TCM w/ no display
NT = Manifold supplied w/ no TCM, Customer will supply TCM; TCM must be 4-20 mA output only

BOX 3

Fluid Type
H = For use w/ Hydraulic & Diesel Fuel only*

BOX 4

TestMate® Contamination Monitor (TCM) Signal Output
Omit = 4-20 mA
NOTE: For customers with existing TCMs w/ a 2 to 10 V analog output please see HY-TRAX® Manually Controlled Sampling System

BOX 5

TestMate® Contamination Monitor (TCM) Output Options
M = ISO 4406/SAE 4049
N = ISO 4406/NAS 1638

BOX 6

Water Sensor (TWS) Option
Omit = None
TWS-D = Water sensor w/ display

BOX 7

Communications Module w/ Remote Controlled Fluid Sampling System
A = Telematic Communications Module w/ Dashboard Data Display (GSM Cellular)
NOTE: For customers with existing TCMs w/ a 2 to 10 V analog output please see HY-TRAX® Manually Controlled Sampling System

BOX 8

Communications Module Power Options
Omit = 24 VDC
P = 115 VAC

BOX 9

Air Suppression Loop
Omit = None
L = Looped hose and fitting

***Note: Off-road diesel contains dye. High concentrations of dye may interfere with particle count results. Please contact factory to review application.**

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

HY-TRAX® Telematics Communications Module only operates with TCM's operating on Firmware V03.00. Older firmware versions will not communicate proper flow rate to the telematics module. Contact factory for additional information.

NOTES:
All HY-TRAX® manifolds come with a pressure gauge and intake strainer

RBSA Reservoir Breather Fluid Sampling Adapter

Reservoir Breather Sampling Adapter

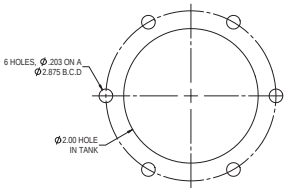
Features and Benefits

- Drop-in reservoir breather retrofit for fluid sampling provides clean easy access to the reservoir through the existing breather part
- Provides easy fluid quality sampling solution for HY-TRAX® and TMU suction and return ports
- Hytrax adapter kit includes #6 & #4 JIC adapters with 6' connection hoses included
- TMU adapter includes 1620 testpoint and 3' connection hose to TMU
- 24" SS drop tubes can be cut to length
- Standard 6 bolt breather pattern
- Anodized 6061 aluminum breather
- ¾" NPT for breather element

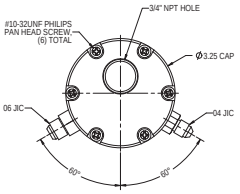
Market Applications

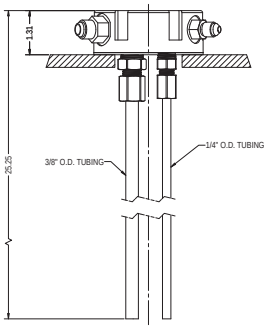
- All applications with a hydraulic reservoir utilizing a 6-bolt mounting connection

Mounting Requirement



MOUNTING REQUIREMENT



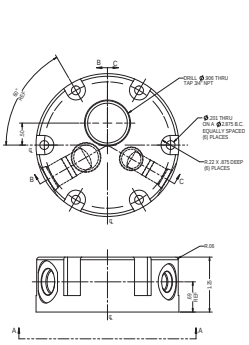


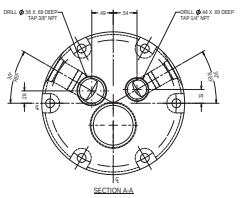
Specifications

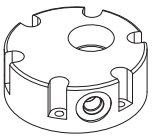
Reservoir Mounting Pattern:	Fits standard 6-bolt
Supply Port Thread Size:	9/16-18 UN
Return Port Thread Size:	7/16-20 UN
Breather Port Thread Size:	¾" NPT
Fittings:	Option 1: Includes #4 & #6 JIC fittings. Optional #6 & #4 JIC fittings and 6' supply/return hoses. Option 2: Includes 1620 test point and TMU connection hose.
Return Tubes:	Supplied with ⅜" and ¼" return tubes. Tubes are 24" long and can be shortened if necessary. Housing constructed 6061 anodized aluminum.

Reservoir Breather Fluid Sampling Adapter RBSA

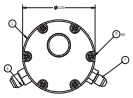
Application Example

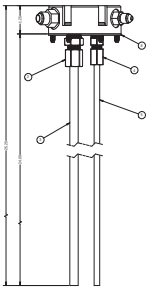


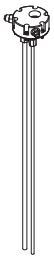




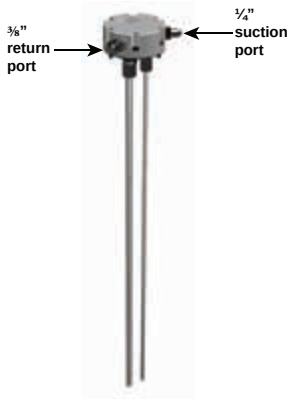
Parts List Drawing

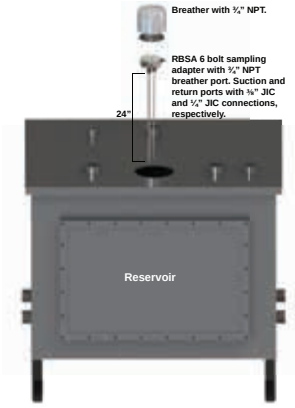


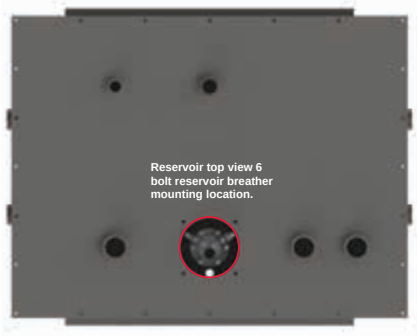




Reservoir Mounting Views







Model Number Selection

How to Build a Valid Model Number for a Schroeder Reservoir Breather Fluid Sampling Adapter RBSA:

BOX 1	BOX 2
RBSA	–

Example: *NOTE: Box 2 can have multiple options.*

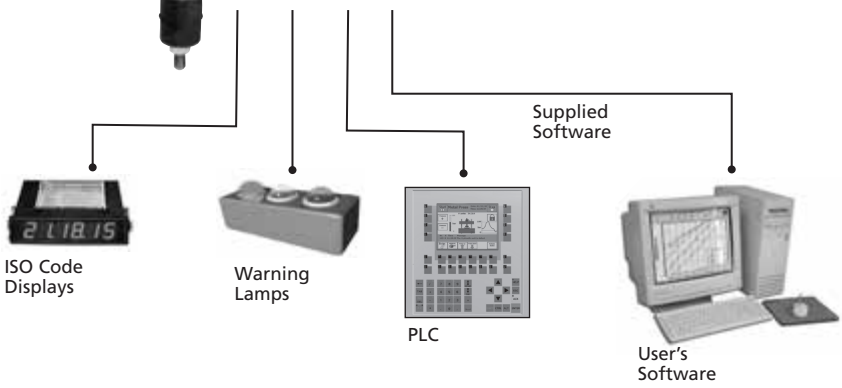
BOX 1	BOX 2	
RBSA	– 1	**= RBSA-1**

BOX 1	BOX 2
Model	**Options**
RBSA	1 = HY-TRAX® adapter fitting #6 & #4 JIC fittings and 6' supply/return hoses 2 = TMU adapter (suction hose included)

TIM TestMate® In-Line Counter

Features and Benefits

- Compatible with hydraulic fluids, lube oils, and fuels
- Data can be transmitted to various output devices to perform specific functions, such as illuminate a warning light, sound an alarm, activate an auxiliary filtration system, or even shut down equipment
- The robust sensor utilized in the TIM is not susceptible to dark fluids, pressure spikes, vibrations, or high temperatures, and is identical to that used in the TPM
- Small size makes installation unobtrusive

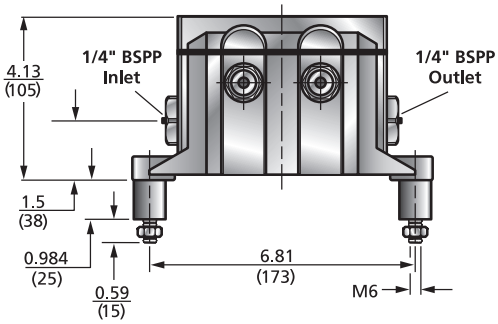


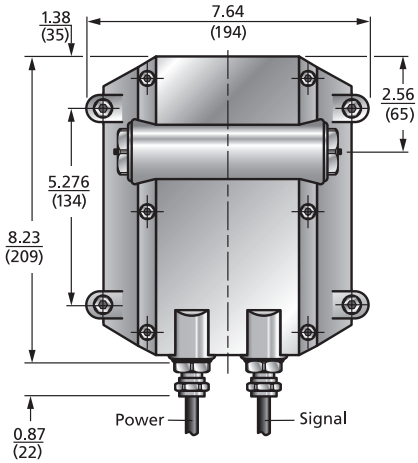
Description

The TIM from Schroeder is an in-line contamination counter capable of transmitting information regarding fluid cleanliness in various formats to a wide variety of devices in real time. Software is included to transmit data to a PC. Alternative user-supplied output devices include PLCs, individual display units, and warning lights via trigger points. This unit is intended for critical systems where continuous contamination monitoring is a must.

Applications

- Paper and steel mills
- Power generation plants
- Lube oil systems
- Gear boxes





Metric dimensions in ( ).

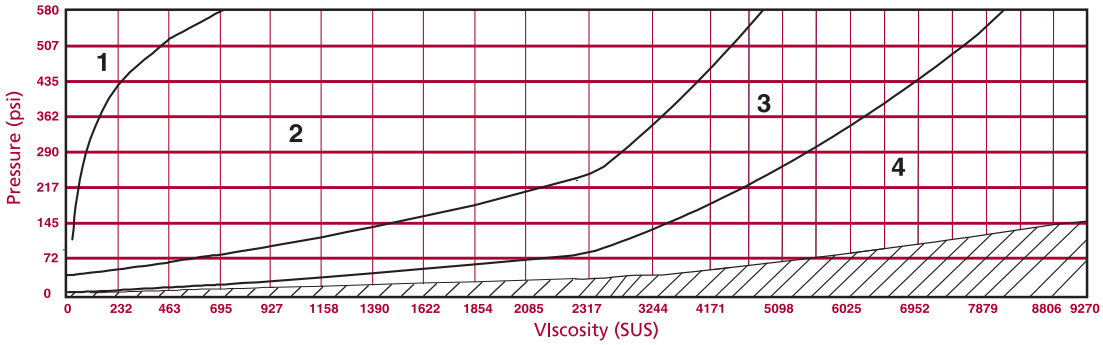
TestMate® In-Line Counter TIM

Specifications

Particle Size Channels:	4 µm(c) / 6 µm(c) / 14 µm(c)
Measurement Range:	ISO 13/11/10 to 23/21/18 (SAE 2 to 12)
Indication Range:	ISO 12/10/9 to 25/23/21 (SAE 2 to 15)
Accuracy:	±1/2 class (ISO, SAE)
Calibration:	ISO 11943
Recalibration:	1 to 2 years, dependent on customer's quality policy
*Max Operating Pressure (outlet):	145 psi (10 bar)
*Max Operating Pressure (inlet):	580 psi (40 bar)
*Max Surge Pressure:	5070 psi (350 bar)
Connections:	Inlet: Thread G 1/4, ISO 228 Outlet: Thread G 1/4 ISO 228
Measurement Flow Rate:	10 to 200 mL/min
Total Flow Rate:	10 to 800 mL/min (pressure dependent)
Fluid Temperature Range:	32°F to 158°F (0°C to 70°C)
Power Supply:	24 VDC ±25%
Power Consumption:	25 Watt max
Electrical Output:	3 relay outputs: 1 x state of readiness; 2 x limit PLC output Additional electrical output (see model code)
Ambient Temperature Range:	32°F to 131°F (0°C to 55°C)
Storage Temperature Range:	-4°F to 185°F (-20°C to 85°C)
Relative Humidity:	90%, non-condensing max
Electrical Safety Class:	III (low voltage protection)
IP Class (Protection Type):	IP65
Weight:	8.8 lb (4 kg)

*At pressures beyond maximum operating pressure specified above, the sensor will not measure properly. However, the unit can handle pressure spikes up to 5070 psi without incurring damage to the sensor.

Pressure/ Viscosity Range



Model Number Selection

How to Build a Valid Model Number for a Schroeder TIM:

BOX 1	BOX 2	BOX 3	BOX 4
TIM			

Example: *NOTE: One option per box*

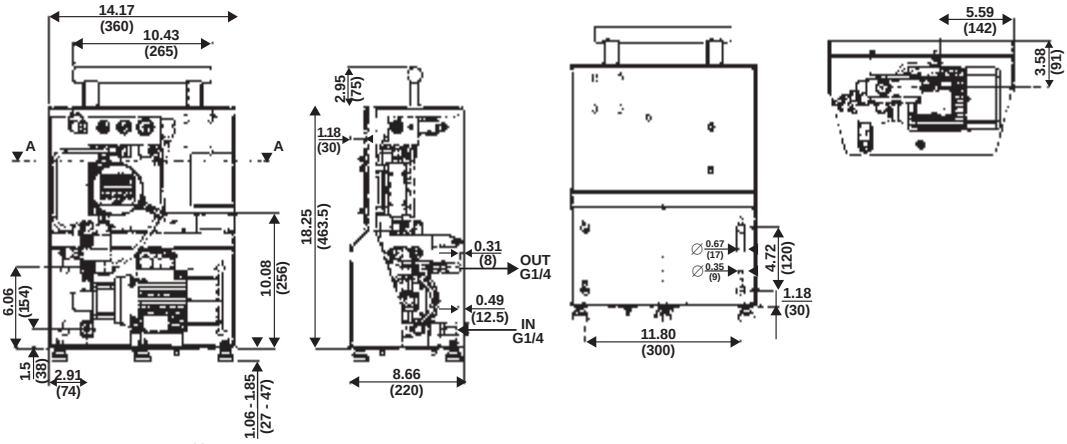
BOX 1	BOX 2	BOX 3	BOX 4	
TIM	H	2	1	**= TIMH21**

BOX 1	BOX 2	BOX 3	BOX 4
Model	**Fluid Type**	**Pressure/ Viscosity Range**	**Output**
TIM	H = Hydraulic Oil	1	1 = 4-20mA
	E = Phosphate Ester	2	3 = RS-485 (enables communication with software)
		3	4 = PLC Output
		4	5 = Ethernet

TSU TestMate® Sensor Unit

Description

The Contamination Sensor Module (TSU) 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 TestMate® Water Sensor (TWS) can be incorporated.



Metric dimensions in ( ).

TSU Installation in Systems

Basically there are three different possibilities for connecting the TSU to hydraulic and lubrication systems. Select the measuring point according to the type of information the customer requires from the system.

1. Measuring from tank
   Indicates the overall condition of the oil. Inlet and outlet of the TSU are connected to the tank near the suction of the main pump.

2. Measuring from the pressure line before the filter
   This is the normal location for taking bottle samples. By using the TSU the amount of bottle sampling can be reduced and information on the oil condition is therefore available immediately. This test point is used mostly in lube systems.

3. Measuring from pressure line after the filter
   This test point is used in roll hydraulics and the reason for measuring oil after the filter is to ensure that clean oil is always available to the sensitive proportional valves and to other machine parts. Mainly used in roll hydraulics and particularly if customers have had problems with the proportional valves.

Important! The pressure should be reduced using a separate valve before the oil goes into the TSU.

Applications

- Lubrication systems in paper, steel and energy sectors
- Preventive, pro-active preparation of service/intervals
- Monitoring of component cleanliness on test benches
- Monitoring of oil cleanliness in storage tanks

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TestMate® Sensor Unit TSU

Specifications

Pump Type:		Gear pump
Operation Pressure: P_{in} *(INLET)*: P_{out} *(OUTLET)*: P_{out} (leakage line):		-5.8 - 7.3 psi (-0.4 to 0.5 bar) (standard pump) -5.8 - 1,740 psi (-0.4 to 120 bar) (pump, pressure inlet stable) 73 psi (5 bar) 7.3 psi (0.5 bar) (pump, pressure inlet stable)
Permissible Outlet Pressure:		73 psi (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 Visc. Range for Measuring:		10 to 1000 cSt
Permissible Fluid Temp. Range:		32°F to 158°F (0°C 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°F to 131°F (0°C to 55°C)
Storage Temperature Range:		-4°F to 185°F (-20°C to 85°C)
Relative Humidity:		max. 90%, not condensing
IP Class:		IP55
Weight:		approx. 40 lbs. (18 kg)
Contamination Sensor:	Self-diagnosis:	continuously with error indication via status LED
	Measuring Range:	MIN/MAX Display from class ISO 9/8/7 (MIN) up 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 W max.
Electrical Outputs:		Analog output 4 to 20 mA or 0 to 10 V RS485 interface or switching output

Model Number Selection

How to Build a Valid Model Number for a Schroeder TSU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
TSU							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
TSU	1	D	S	1	A	1		**= TSU1DS1A1**

BOX 1 — Model

TSU

BOX 2 — Contamination Code

1 = ISO 4406:1999; SAE AS 4059(D)
2 = ISO 4406:1987; NAS 1638

BOX 3 — Display

D = Display
N = No Display

BOX 4 — Fluid

S = Standard (Hydraulic or lubricating fluids)

BOX 5 — Pump

1 = Standard gear pump
2 = Pump, increased inlet pressure with oil leakage pipe
4 = Pump, increased inlet pressure, no oil leakage line, magnetic drive

BOX 6 — Output

A = 4-20 mA analog
B = 0-10 V analog

BOX 7 — Electrical Supply

1 = 230 V, 50 Hz, 3 Ph/265 V, 60 Hz, 3 Ph, delta/460 V, 60 Hz, 3 Ph star
2 = 400 V, 50 Hz, 3 Ph/400 V, 60 Hz, 3 Ph, delta
3 = 120V, 60 Hz, 1 Ph

BOX 8 — Water Sensor

Omit = None
W = Water Sensor

What's Included

- TSU
- Operating and maintenance instructions
- CD with FluMoS software and manuals
- Calibration certificate contamination sensor

SCHROEDER INDUSTRIES 53

TMU TestMate® Monitoring Unit

Features and Benefits

- 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 TestMate® Water Sensor (TWS)
- Integrated pump for measurement in pressureless reservoirs
- Operation with 24 VDC network adaptor included in scope of delivery
- Data storage capabilities
- Interfaces: 5-pole plug, Bluetooth, USB data port

Description

The TestMate® Monitoring Unit TMU series combines the advantages of the portable contamination measurement units with the measurement technology of the Testmate® Contamination Monitor (TCM) and TWS (Testmate® Water Sensor).

The TMU is a portable service unit and is designed for measurement of solid particle contamination and water saturation in hydraulic systems. It is designed for temporary operation up to a maximum of 30 minutes followed by a rest period of 10 minutes and is not intended for continuous operation.

The TMU will measure contamination levels on mineral based hydraulic oils compatible with Viton® seals. The TMU is not compatible with water glycol fluids.

The integrated pump and the hoses with test point connections, which are included with the TMU, allow operation on pressureless reservoirs, control circuits, and high pressure circuits.

Applications

- Hydraulic systems
- Service for mobile hydraulics
- Maintenance

TestMate® Monitoring Unit TMU

Specifications

General Data:	Self-Diagnosis:	Continuously with error indication via status LED and display
	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°F to 212°F (–25°C to 100°C)
	Accuracy:	± 1/2 ISO class in the calibrated range / ± 2 % Full scale max.
	Material of Sealings:	FPM Viton seals
	Ambient Temperature Range:	32°F to 113°F (0°C to 45°C)
	Storage Temperature Range:	-40°F to 176°F (-40°C to +80°C)
	Dimensions (cover closed):	9.06" H x 16.14" L x 13"D
	IP Class:	IP50 in operation IP67 closed
	Weight:	Approx. 29 lbs (13 kg)
Hydraulic Data:	Operating Pressure:	IN: -7.25 to 650 psi (-0.5 to 45 bar) OUT: 0 to 7.5 psi (0 to 0.5 bar)
	with Adapter for Pressure Lines:	IN: 217 to 5000 psi (15 to 345 bar) OUT: 0 to 7.5 psi (0 to 0.5 bar)
	Pressure Max.:	5000 psi (345 bar) (using included high pressure adapter)
	Maximum Suction Height:	39 in (1 m)
	Permissible Viscosity Range:	46 to 1622 SUS (10 to 350 cSt)
	Fluid Temperature Range:	32°F to 158°F (0°C to +70°C)
Electrical Data:	Power Supply Voltage:	24 VDC ± 20%, residual ripple < 10%
	Max. Power / Current Consumption:	100 Watt / 4 A
	Interface:	Plug connection, 5-pole, male, M12x1 and USB

How to Build a Valid Model Number for a Schroeder TMU:

BOX 1	BOX 2	BOX 3	BOX 4
TMU			

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	
TMU	1	AS	K	**= TMU1ASK**

BOX 1	BOX 2	BOX 3	BOX 4
Model	**Contamination Code**	**Water Sensor**	**Power Supply Adapter**
TMU	1 = Reversible between: 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)	AS = TestMate® Water Sensor	K = 100-240 VAC/ 50/60 Hz/1 Phase (Europe, USA/ Canada, UK, Australia, Japan)

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.

Items supplied with TMU-1-AS-K include:

- TestMate® Monitoring Unit
- Power supply AC adapter with connecting cables to supply voltage for Europe, USA/Canada, UK, Australia, & Japan
- Adapter for pressure lines
- Inlet pressure hose with screw connection for 1620 test point, length = 2 meters (approx. 79 inches) in length
- Inlet suction hose, clear, open end, length = 0.3 meters (approx. 12 inches) in length
- Outlet return hose, open end, clear, length 1 meter (approx. 39 inches) in length
- Operation Manual & Calibration Certificate FluMoS Software
- USB Flash Drive

Accessories:

- Battery Pack (approx. 5 hours of use) Part No. 3504605
- Field Verification Startup Kit - Part No. 03443253
- Field Verification Kit (fluid only) - Part No. 03443249

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

FCU 1000 FluidControl Unit Series

Features and Benefits

- Suitable for hydraulic fluids up to 350 mm²/s
- Suitable for Diesel fuels (suction mode only) according to DIN EN 590 and ASTM D975 4-D
- Cleanliness classes to ISO and SAE or NAS
- Integrated data interfaces (wireless and cable) for direct connection to Schroeder's Fluid Monitoring Software (FluMoS)
- USB interface for data storage

Description

The FluidControl Unit FCU 1000 is a portable service unit, designed for the temporary measurement of solid particle contamination, water saturation and fluid temperature in hydraulic systems as well as Diesel fuels.

The integrated pump and the hoses contained in the FCU 1000 series scope of delivery allow operation in control circuits (oil hydraulics only), pressure circuits (oil hydraulics only) and pressureless reservoirs (oil hydraulics and Diesel fuels).

All measurement data are stored with time stamp in files (measurement value file) and folders (measurement points) in the internal data memory of the FCU 1000 unit.

The measured values can be transmitted to a PC or mobile devices and analyzed using Schroeder's own Fluid Monitoring Software (FluMoS).

Applications

- Hydraulic systems
- Diesel storage, diesel transfer and diesel filling applications, e.g. mines, refineries, ports of transshipment, emergency power systems (emergency power units), mobile machines, etc.
- Service
- Maintenance

Specifications

			FCU 1210	FCU 1315
General Data:	Self-Diagnosis:	Continuously with error indication via status LED and display	x	x
	Measured Value:	to ISO 4406, SAE AS 4059(D)	x	x
		NAS 1638	-	x
		Water saturation in %	-	x
		Temperature	-	x
	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	x	x
		Saturation level 0 to 100 % /	-	x
		Temperature -13°F to 212°F (–25°C to 100°C)	-	x
	Accuracy:	± 1/2 ISO class in the calibrated range	x	x
		Water saturation: ± maximal 2% (full scale)	-	x
		Temperature: ± maximal 2% (full scale)	-	x
	Material of Sealings:	FPM Viton seals	x	x
	Ambient Temperature Range:	32°F to 113°F (0°C to 45°C)	x	x
	Storage Temperature Range:	-40°F to 176°F (-40°C to +80°C)	x	x
	Dimensions (cover closed):	(FCU 1315) 9.06" H x 16.14" L x 13"D	-	x
		(FCU 1210) 11.81" H x 13.39" L x 8.66" D	x	-
	IP Class:	IP50 in operation IP67 closed	x	x
	Weight:	(FCU 1315) Approx. 29 lbs (13 kg)	-	x
		(FCU 1210) Approx. 20 lbs (9 kg)	x	-

Specifications

		FCU 1210	FCU 1315
Hydraulic Data: Operating Pressure with Hydraulic Fluids:	IN: -7.25 to 650 psi (-0.5 to 45 bar) OUT: 0 to 7.5 psi (0 to 0.5 bar)	x	x
with Adapter for Pressure Lines:	IN: 217 to 5000 psi (15 to 345 bar) OUT: 0 to 7.5 psi (0 to 0.5 bar)	x	x
with Diesel according to DIN EN 590 / ASTM D975 4-D:	IN: 0 psi (0 bar) OUT: 0 psi (0 bar)	-	x
Pressure Max.:	5000 psi (345 bar) (using included high pressure adapter)	x	x
Maximum Suction Height:	19.69 in (0.5 m)	x	x
Permissible Viscosity Range:	33 to 1622 SUS (1.5 to 350 cSt)	x	x
Fluid Temperature Range:	32°F to 158°F (0°C to +70°C)	x	x
Electrical Data: Power Supply Voltage:	24 VDC ± 20%, residual ripple < 10%	x	x
Max. Power / Current Consumption:	100 Watt / 4 A	x	x
Interfaces:	USB (A) for memory stick and 5 pole, M12x1, pin	-	x
	Bluetooth 1.2, Class 3 (only Sensor Interface - HSI)	-	x

Model Number Selection

How to Build a Valid Model Number for a Schroeder FCU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
FCU	1				–	–	–	–

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
FCU	1	3	1	5	– 4	– U	– AS	– 1	**= FCU 1315-4-U-AS-1**

BOX 1 – Model

FCU

BOX 2 – Series

1 = 1000 series, 4 particle size channels

BOX 3 – 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 / 2-5 µm, 5-15 µm, 15-25 µm, > 25 µm
can be switched to ISO 4406:1999; SAE AS 4059(D) / > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c)

BOX 4 – Housing

1 = Plastic case with attached pocket for hoses and cables

BOX 5 – Media

0 = Hydraulic and Lube fluids based on mineral oils

5 = Same as option 0, but including Diesel according to DIN EN 590 / ASTM D975 4-D

BOX 6 – Options

4 = with integrated pump

BOX 7 – Supply Voltage

U = 24 V DC

BOX 8 – Integral Sensor

AS = TestMate® Water Sensor (FCU 1315 only)

Z = Omit (FCU 1210; no TWS or USB port included)

BOX 9 – Power Supply Adapter

1 = 100 ... 240 V AC / 50/60 Hz / 1 Phase / 5000 mA (Europe, USA/Canada, UK, Austrailia, Japan)

TPM TestMate® Particle Counter

Features and Benefits

- Measures and counts solid contaminants in hydraulic and lubrication oil
- Completely portable for in-plant and field use
- Provides in-line counts for continuous measurement
- Built-in printer provides results of particle count for archive
- Unit can be programmed to activate a relay when the contamination level reaches target value
- Data can be analyzed using Schroeder software or MS-Excel software for single incidence or for trending

Description

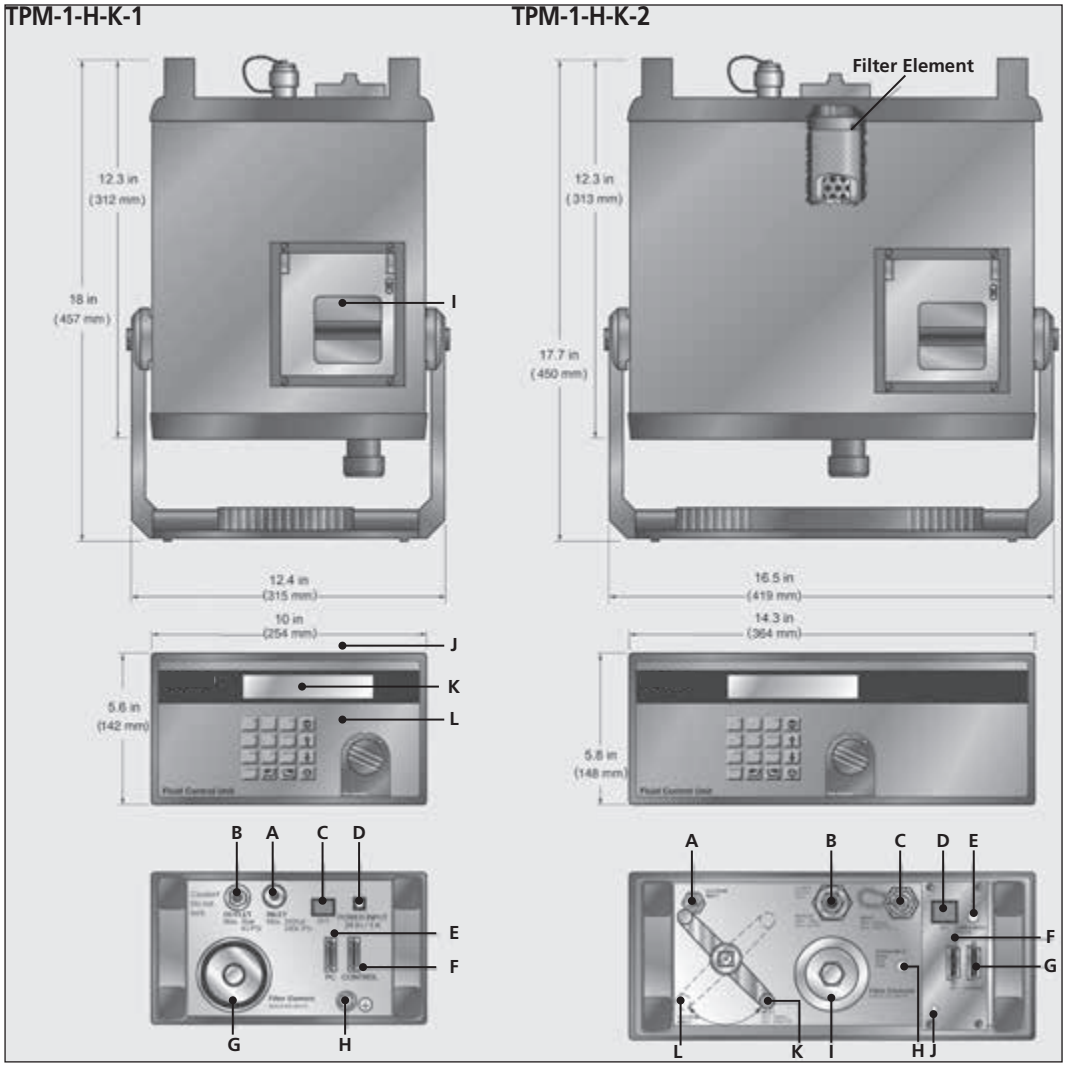
The TPM is a portable particle counter with an optional integrated pump that can be used in-line to measure contamination levels of hydraulic fluid. Particles are measured at the 4, 6, 14 and 21 micron sizes, with results available in ISO 4406:1999 and SAE AS 4059(D), as well as several other options. Various programming options are available, including the ability to activate or deactivate system functions when contamination reaches a user-specified level. It is equipped with a built-in printer to provide instant documentation and an RS-232 serial port for data transfer. A custom software package is also included for trend analysis on a PC. The unit's robust packaging includes a folding handle which doubles as a stand to provide optimal viewing.

Applications

- Preventive maintenance
- Troubleshooting
- Roll off cleanliness of mobile and industrial equipment
- Proof of clean fluid delivery
- Flushing of existing equipment

Specifications

Particle Size Channels:	4 µm(c) / 6 µm(c) / 14 µm(c) / 21 µm(c)
Measurement Range:	ISO 13/11/10 to 23/21/18 (SAE 2 to 12)
Indication Range:	ISO 12/10/9 to 25/23/21 (SAE 2 to 15)
Accuracy:	±1/2 class (ISO, SAE)
Calibration:	ISO 11943
Recalibration:	1 to 2 years, dependent on customer's quality policy
Log Memory:	Internal memory can accommodate up to 3000 measured values / 100 Test Headers
Inlet Operating Pressure:	45 to 5000 psi (3.1 to 344.8 bar)
Outlet Flow Rate:	800 mL/min max
Outlet Operating Pressure:	45 psi (3.1 bar) backpressure max
Measurement Flow Rate:	50 to 150 mL/min
Permissible Viscosity Range:	31 to 4544 SUS (1 to 1000 cSt) (inlet port, see graph below) 31 to 682 SUS (1 to 150 cSt) (suction port, continuous operation) 682 to 1590 SUS (150 to 350 cSt) (suction port, brief operation, 10 min.)
Fluid Temperature Range:	32°F to 160°F (0°C to 70°C)
Power Supply:	24 VDC, ±25% or 110 VAC with supplied adapter
Power Consumption:	75 Watt max
Battery Powered Operating Duration:	5 hours
Serial Port:	RS-232 with 15-pin Sub D plug
Ambient Temperature Range:	32°F to 130°F (0°C to 55°C)
Storage Temperature Range:	-4°F to 185°F (-20°C to 85°C)
Relative Humidity:	90%, non-condensing max
IP Class (Protection Type):	IP40
Weight:	30 lbs (13.6 kg)



Metric dimensions in ( ).

TPM-1-H-K-1

- A = High Pressure Port
- B = Outlet
- C = On/Off Switch
- D = Power Input 24 Volt
- E = Serial Port for PC Connector
- F = Control Port
- G = Cover for Filter
- H = Suction Port
- I = Dot-Matrix Printer
- J = LCD
- K = Keypad
- L = Flow Control Valve

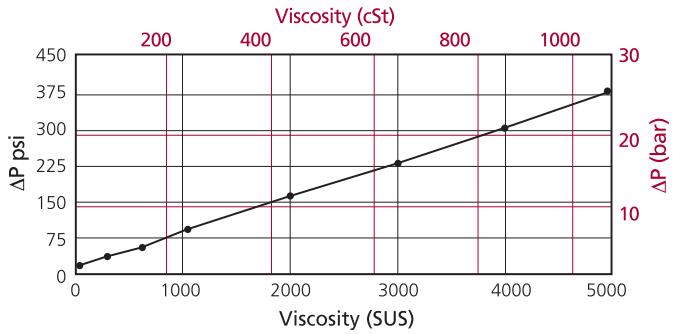
TPM-1-H-K-2

- 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)

TPM TestMate® Particle Counter

Pressure Requirement

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



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 graph at the right. The required inlet pressure increases with increasing clogging of the filter element.

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

How to Build a Valid Model Number for a Schroeder TPM:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
TPM					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
TPM	1	H	K	1		**= TPM1HK1**

BOX 1

Model
TPM

BOX 2

Contamination Code
1 = ISO 4406: NAS 1638
2 = ISO 4406; SAE AS 4059

BOX 3

Fluid
H = Hydraulic
E = Phosphate Ester/Skydrol (not available with integrated pump option)

BOX 4

Power Supply Adapter
K = 100-240 VAC/50/60 Hz/1 Phase (Europe, USA/Canada, UK, Australia, Japan)

BOX 5

Options
1 = Without integrated pump
2 = With integrated pump

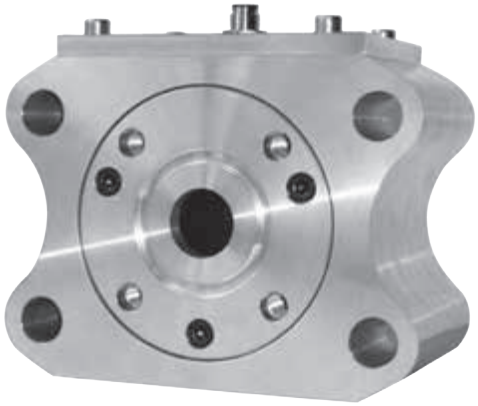
BOX 6

Accessories
Omit = None
Kit = USA power adapter; Inlet and Outlet hoses; Software package; PC cable; 5 rolls printer paper and carrying case

Spare Parts

	MODEL CODE
Transport Case	part number: 7607782
TPM-P Includes TestMate® Particle Counter for Phosphate Ester/Skydrol (TPM), accessory kit (adapter, inlet & outlet hose, software package, PC cable, and carrying case). Note unit does not come with a pump.	
	SPARE PARTS
Printer Paper (5 rolls)	00349155
Printer Ink Ribbon	00349156
Line Adapter 110 V	03090803
Inlet Suction Hose 9" (.25 m)	03036098
High Pressure Hose 6.5' (2 m)	00349150
Return Hose 6.5' (2 m)	00349151

Metallic Contamination Sensor Series TMS



Features and Benefits

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

2.6-53 gpm
10-200 l/min
290 psi
20 bar

Description

The TestMate® Metallic Sensor TMS 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 > 70 µm size range are detected.

The TMS 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.

Applications

- Gear boxes for wind energy
- Paper machine bearings

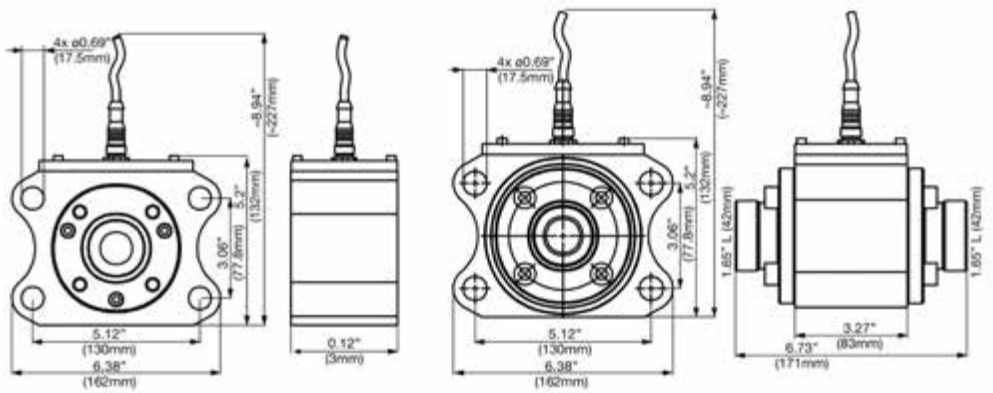
Comparison

Technical Details	TMS-1	TMS-2	TMS-3
Flow Rate	2.6... 52.8 gpm (10... 200 l/min)	0.5... 10.6 gpm (2... 40 l/min)	0.1... 2.1 gpm (0.4... 8 l/min)
Diameter sensor cross-section	1" (25.4 mm)	1/2" (12.7 mm)	1/4" (6.3 mm)
Ferromagnetic (Fe) particles	> 200 µm	> 100 µm	> 70 µm
	Particle with volume equivalent to that of a sphere with given Ø		
Non-ferromagnetic (nFe) particles	> 550 µm	> 300 µm	> 200 µm
	Particle with volume equivalent to that of a sphere with given Ø		
Particle Rate	>25/s	>25/s	>25/s

TMS-1

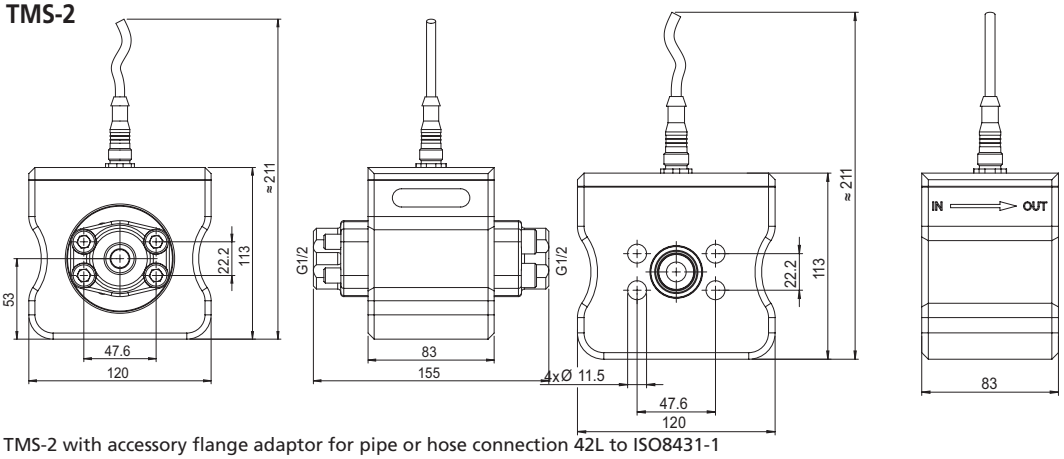
Flange connection, SAE 4" according to ISO 6162-1

TMS with accessory flange adaptor set *(optional)*



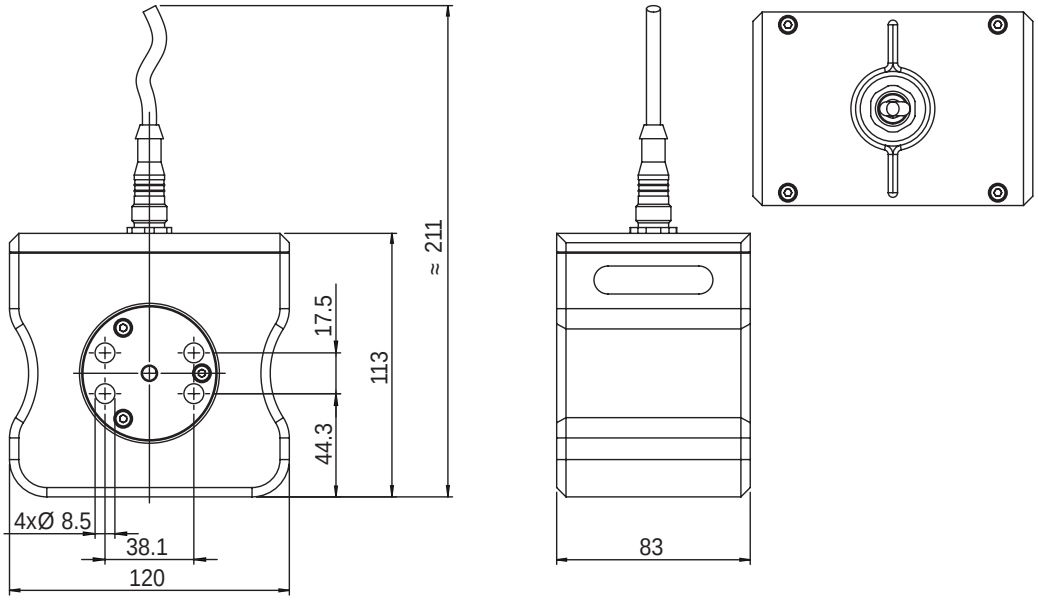
Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.

TMS-2



TMS-2 with accessory flange adaptor for pipe or hose connection 42L to ISO8431-1

TMS-3



TMS-1 Flange connection, SAE ½" to ISO 6162-1

Metric dimensions in ( ).

Metallic Contamination Sensor Series TMS

Specifications

General Data:	Ambient Temperature:	-40°F to 158°F (-40°C to +70°C)
	Diameter Sensor Cross-section:	up to 1" (25.4 mm)
	Protection Class to DIN 40050:	IP 67
	Weight:	approx. 8 lbs. (3.5 kg)
	Dimensions (L x W x H):	3.27" x 6.38" x 5.5" (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:	2.6 to 53 gpm (10 to 200 l/min)
	Operating Pressure:	290 psi (20 bar)
	Fluid Temperature Range:	-40°F to 185°F (-40°C to +85°C)
	Inlet/Outlet:	Flange connection, SAE 4" according to ISO 6162-1
External Electrical Data:	Supply Voltage:	9 - 36 VDC, residual ripple < 10%
	Power Consumption:	5 W max.
Internal Electrical Data:	2 Configurable: Switching: Outputs: *(n-switching Power MOSFET, normally-open):*	1 x Ferromagnetic particles (Fe) 1 x Non-ferromagnetic particles (nFe) OR 1 x Ferromagnetic particles (Fe) + Non-ferromagnetic particles (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:	Particle Count:	>25/s

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 Number Selection

How to Build a Valid Model Number for a Schroeder TMS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
TMS					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
TMS	1	1	S	F	1	**= TMS11SF1**

BOX 1 — Model

TMS

BOX 2 — Particle Size

1 = Particles > 200 µm
2 = Particles > 100 µm
3 = Particles > 70 µm

BOX 3 — Output Options

1 = Standard Switching Outputs/HSI
2 = Modbus/RS485
7 = TCP/Ethernet

BOX 4 — Fluid

S = Standard (Hydraulic or lubricating fluids)

BOX 5 — Hydraulic Connection

F = Flange, 4" SAE (TMS-1 only)
G = Flange, 3/4" SAE (TMS-2 only)
H = Flange, 1/2"SAE (TMS-3 only)

BOX 6 — Electrical Connection

1 = 9-36 V DC

What's Included

- TMS
- O-ring (47.22 x 3.53 NBR 70 Shore)
- O-ring (110.72 x 3.53 NBR 70 Shore)
- Operating and maintenance instructions

Available 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
- Flange adaptor plate, SAE 4" - SAE 1-1/2"
- Socket plug (female) with 3 m line, shielded, M12x1, 8 pole (Description: TCM-C-3M; P/N 7632009)
- Socket plug with screw clamp, M12x1, 8 pole

TWS TestMate® Water Sensor


TWS-C


TWS-D

Features and Benefits

- Compatible with hydraulic, lube oils and synthetic and natural esters
- Measures and displays saturation and temperature continuously in real-time
- Displays water saturation level in percentage (0% indicates oil is dry; 100% indicates oil is saturated)
- Data can be monitored to PC, PLC, etc.
- No calibration necessary for different oils
- Individual configuration (TWS-D only)
- Measured in saturation percentage, not ppm. This is preferable since it takes into account temperature and viscosity variations (see desired saturation level below)

Description

The TWS sensors are online saturation and temperature sensors for the monitoring of hydraulic and lubrication fluids accurately and continuously. They measure 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 to 20 mA signal. A reading of 0% would indicate the absence of water, while a reading of 100% would indicate that a fluid is free water. The TWS-D has a 4-digit, digital display that shows real-time, measured values and allows for parameter adjustments. It may also be rotated/aligned on two axes.

The special capacitance sensor used in the TWS absorbs water molecules from the fluid and changes its capacitance value that is directly related to the saturation level in the fluid. An integrated thermoelement on the sensor measures the temperature of the fluid in the range of -13°F to 212°F (-25°C to 100°C) and outputs it as a 4 to 20 mA signal.

Market Applications

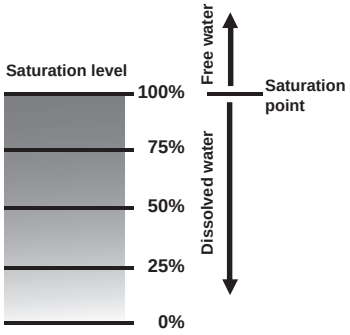
- Hydraulic systems that are sensitive to water in oil
- Gear boxes
- Injection molding machines
- Turbines
- Transformers
- Mobile Hydraulics
- OEM's

Desired Saturation Level

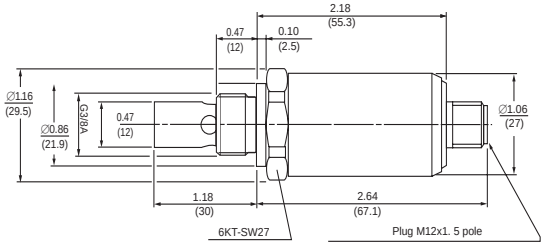
Since the effects of free and emulsified water is more harmful than those of dissolved water, water levels should remain well below the saturation point. However, even water in solution can cause damage and therefore every reasonable effort should be made to keep saturation levels as low as possible. There is no such thing as too little water. As a guideline, we recommend maintaining saturation levels below 30% in all equipment.

The TWS sensors are individually calibrated on computer-controlled test rigs and subjected to a final test and will operate perfectly when used according to the specifications. No further calibration is necessary.

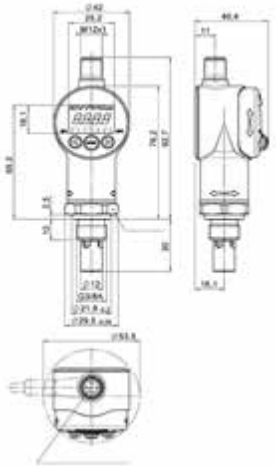
If you have any questions regarding technical details or the suitability of the TWS sensors for your application, please contact our sales/ technical department.



TWS-C



TWS-D



Metric dimensions in ( ).

TestMate® Water Sensor TWS

Specifications

Input Data	Measuring Range:	0 to 100% Saturation; -13°F to 212°F (25°C to 100°C)	
	Operating Pressure:	-7.25 to 725 psi max (-0.5 to 50 bar)	
	Burst Pressure:	9135 psi (630 bar) max	
	Parts in Contact with Media:	Connection Point: Stainless Steel/Ceramic with vacuum-metalized metal Seal: Viton = Mineral Oils/Esters, EPDM = Skydrol	
Output Data	*Humidity Measurement:*		
	Output Signal (saturation level):	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 (temperature):	4 to 20 mA	
	Accuracy:	± 2% FS max	
Ambient Conditions	Nominal Temperature Range (saturation level measuring):	**TWS-C** 32°F to 194°F (0°C to 90°C)	**TWS-D** 32°F to 176°F (0°C to 80°C)
	Ambient Temperature Range:	-40°F to 212°F (-40°C to 100°C)	-40°F to 176°F (-40°C to 80°C)
	Viscosity Range:	32 to 23,175 SUS (1 to 5000 cSt)	
	Flow Velocity:	< 16 ft/s	Maximum 16 ft/s
	Media Tolerance:	Mineral oil-based fluids, natural and synthetic esters	
	CE Mark:	EN 50081-1, EN 50081-2, EN 50082-1, EN 61000-6-1-1/2/3/4	
	Type of Protection acc. DIN 40050:	IP 67	
Other Data	Supply Voltage:	12 to 32 VDC	18 to 35 VDC
	Residual Ripple Supply Voltage:	≤5%	
	Mechanical Connection:	G3/8A DIN 3852	
	Torque Rating:	18.5 ft-lbs	
	Electrical Connection:	M12x1, 5 pole (DIN VDE 0627)	
	Pin 1:	+Ub	Supply voltage: 18-35 VDC
	Pin 2:	Signal saturation level	Analog output
	Pin 3:	0V / GND	GND
	Pin 4:	Signal temperature	SP1 (alarm)
	Pin 5:	HSI Interface: 1 wire, half duplex	SP2 (warning)

FS (Full Scale) relative to the full measuring range

How to Build a Valid Model Number for a Schroeder TWS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
TWS				

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	
TWS	C	M	0	0	**= TWSCM00**

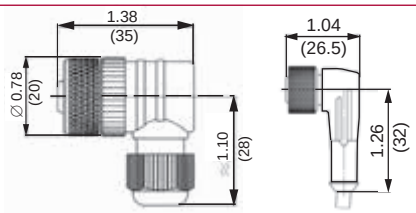
BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
Model	**Sensor Types**	**Type of Medium**	**Signal Technology**	**Signal Technology**
TWS	C = No Display	M = Mineral Oil	0 = Saturation Level	0 = Temperature
	D = Digital Display	E = Phosphate Esters		

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

Accessories

Part Number	Description	Color Code
6006791	(5 pole) with 5m cable	Pin 1: Brown
7608409	(5 pole) with 5m screened cable	Pin 2: White
6023102	(5 pole) with 10m screened cable	Pin 3: Blue
		Pin 4: Black
		Pin 5: Grey



SMU Sensor Monitoring Unit

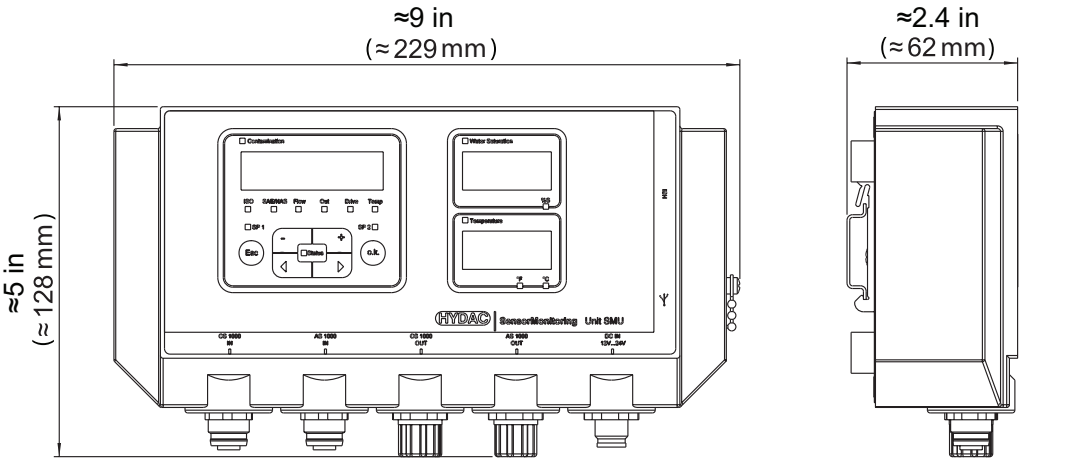
Features and Benefits

- Simple installation parallel to the customer system (Sensor Interface for SMU1200, transfer of the sensor's own analog and switching outputs) using the magnetic holder or top hat rails.
- High protection class 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).
- Simple keypad operation.

Description

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

- Contamination Sensor TCM and water sensor TWS-C
- Metallic Contamination Sensor TMS and water sensor TWS-C



Metric dimensions in ( ).

Sensor Monitoring Unit SMU

Specifications

Ambient Temperature:		32°F to 131°F (0°C to +55°C)
Self diagnostics:		Continuously with error indication on display
Display:		LED, 6/4/4-digit, each with 17 segments
Topple (according to IEC/EN 60068-2-31):		Drop height 1 in.
Storage temperature range:		-40°F to 176°F (-40 °C to +80°C)
Relative humidity:		Maximum 95%, non-condensing
Weight:		2 lbs.
Electrical data:	Supply voltage:	12 ... 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
USB Master port:		USB Type A
HSI:		1-wire half duplex
Ethernet interface:		10 Base-T / 100 Base-Tx

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 Number Selection

How to Build a Valid Model Number for a Schroeder SMU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
SMU						

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
SMU	1	2	6	0	TU	1	**= SMU1260TU1**

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
Model	**Model**	**Data Input**	**Interface**	**Application**
SMU	1 = 1000 Series	2 = Digital	6 = HSI + USB Master	0 = Standard

BOX 6	BOX 7
Supply Voltage	**Data Input**
TU = 12 to 24V DC	1 = TCM & TWS-C 2 = TMS & TWS-C

What's Included

- 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 for the sensor combination, L = 5m
- 1 FluMoS Light CD
- 1 Operating manual
- DIN rail, 7.5" long.

Available Accessories

- Power supply PS5, 100-240 V AC / 50-60 Hz / 1.1 A 24 V DC / 1000 mA, Cable length = 1.8 m, Part no.: 3399939

CTU TestMate® Contamination Test Unit

Features and Benefits

- 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

Description

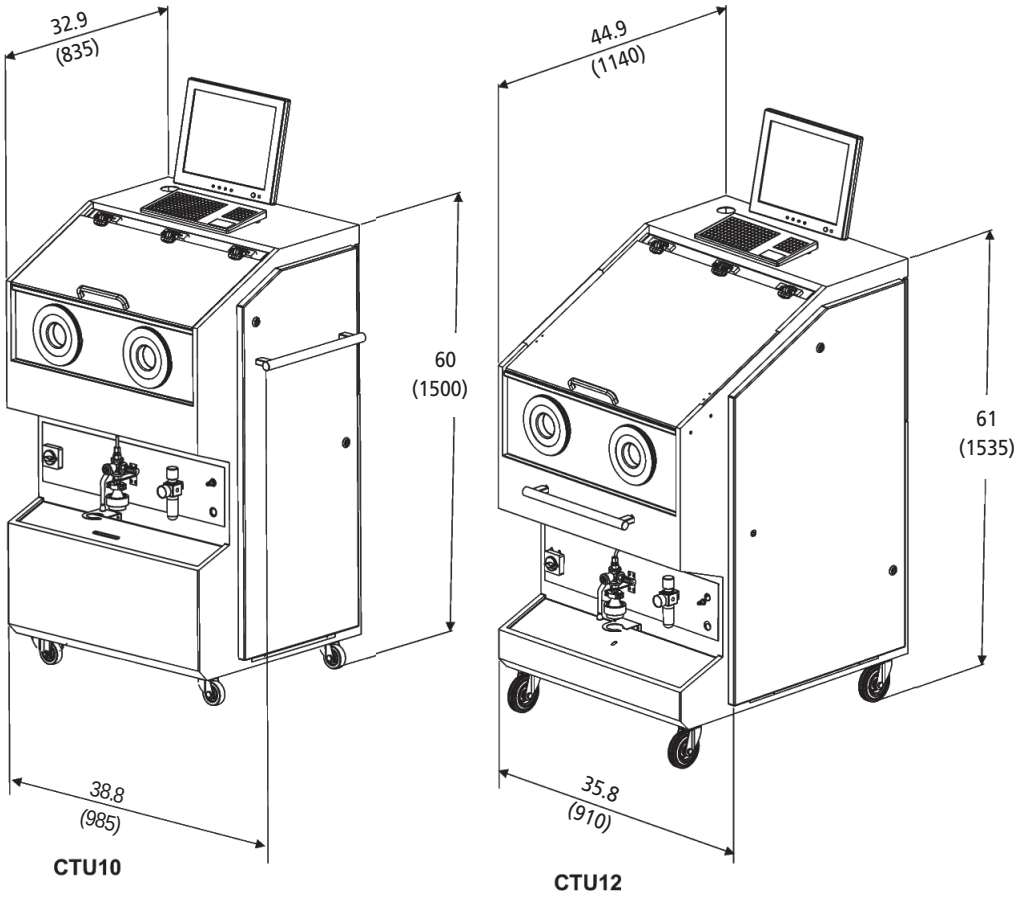
The Cleanliness Test Unit (CTU 1000) is designed to determine the technical cleanliness especially present on minor contaminated components.

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



Metric dimensions in ( ).

TestMate® Contamination Test Unit CTU

Specifications

	Overall Dimensions (H x W x L):	CTU10 71 in x 39 in x 35 in (1800 mm x 985 mm x 835 mm) CTU12 71 in x 36 in x 45 in (1800 mm x 910 mm x 1140 mm)
	Weight:	CTU10 = 595 lb (270 kg) 639 lb (290 kg) with ultrasonic CTU12 = 683 lb (310 kg)
	Mounting:	Mobile (mounted on casters)
	Power Consumption:	600 W (800 W with ultrasonic)
	Ambient Temperature:	59°F to 82°F (15°C to 28°C)
Cleanroom module	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
Reservoir and filtration module	Membrane Holder:	47 mm to 50 mm filter membranes
	Vacuum Strainer:	For quicker filtration of the analysis fluid
	Diffuser:	Distribution of analysis fluid on the membrane
	Operating Pressure:	11.6 to 87 psi (0.8 to 6 bar)
	Analysis Fluid Reservoir:	2x 5.3 gal (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 Clogging Indicator:	14.5 psi (1 bar) pressure setting
	Filter Size, Filtration Rating:	2x LF BN/HC 60, 3 µm (1xx0 series); 2x MRF-1-E/1, 1 µm (1xx1 series)
	Integrated Drip Tray:	6.6 gal (25 litre) with drainage
Services to be provided by operator*	Compressed Air:	Filtered (min. 5 µm) and dry compressed air, max. 87 psi (6 bar) Air flow rate: 2.12 cfm, Supply connection: DN 7.2
*Not supplied	Power Supply:	According to order

Model Number Selection

How to Build a Valid Model Number for a Schroeder CTU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
CTU							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
CTU	1	2	4	1	K	Z	Z	**= CTU1241KZZ**

BOX 1 – Model

CTU

BOX 2 – Series

1 = Analysis Room

BOX 3 – Installation Size - Dimensions Analysis Room

0 = 11.8 x 30.2 x 14.4 in (300 x 768 x 365 mm)

2 = 18.1 x 30.2 x 25.6 in (460 x 768 x 650 mm)

BOX 4 – Analysis

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

4 = Version 2015 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

BOX 5 – Analysis Fluid

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

1 = Water with tenside, lower admissible ph-range 6-10, no deionized/ demineralized water

BOX 6 – Supply Voltage

K = 120 VAC/60Hz/1 Phase

M = 230 VAC/50Hz/1 Phase

BOX 7 – Extraction Process

Z = Rinsing (medium pressure)

U = Rinsing (medium pressure) additionally ultrasonic

BOX 8 – Supplementary Details

Z = Series

R = External rinsing connection (6 mm), between hand holes

Scope of Delivery: CTU1000 15" TFT Monitor; Keyboard with Touch Pad; Foot Switch Accessories: Contact Factory

This information 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.

EPK EasyTest Series

Features and Benefits

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

Description

The Patch Test Kit from Schroeder provides the necessary tools to determine levels of both water and solid particulate contamination present in a particular fluid sample. The kit is named for the patch method used to visually assess the amount of solid contaminants. 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 Schroeder Contamination Handbook (included) for a visual assessment. The handbook also provides photos of various contaminants for use in identifying the type of particulate and its possible source(s).

The water sensing device included in this kit is an aluminum mixing vessel with a small LCD display and microprocessor built into the lid – the same one featured in our EWC (EasyTest Water Contamination Sampler) kit. When the two reagents supplied in the kit (one liquid and one powder) are mixed with the sample fluid in the cell, the resulting chemical reaction causes an increase in pressure within the vessel. This change in pressure is converted into water content and displayed on the screen in terms of parts per million (ppm) or % by volume.

Applications

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

Kit as supplied includes:

Quantity	Description
1	Mixing chamber
2	Reagent A (solvent), 500 ml bottle
1	Reagent B, 50 packets
3	Syringe, 5 ml
1	Syringe, 10 ml
1	Syringe, 30 ml
1	Disposable rubber gloves, bag containing 50 pairs
1	Scissors
1	Tweezers
50	Membrane patches, 0.8 µm, 25 mm diameter
50	Plastic covered slides
1	Microscope, 100x, with flashlight
1	Vacuum pump with folding stand
1	Receptacle bottle, threads onto vacuum pump
1	Plastic funnel
3	Plastic sample bottle, 4 oz
1	Case with foam insert
1	Contamination handbook
1	Instruction manual

Please note: Kit contents subject to change at the discretion of the manufacturer.

Consumables

Part Number	Description
7626480	Plastic sample bottle
7630319	Membrane patches, 0.8 µm, 25 mm diameter, qty. 50
7630320	Plastic covered slides, slides, qty. 50
7626477	Replacement parts pack, includes: 2 Reagent A (solvent), 500 ml bottle 1 Reagent B, 50 packets 3 Syringe, 5 ml 1 Disposable rubber gloves, bag containing 50 pairs 1 Scissors 1 Tweezers

Model Number Selection

How to Build a Valid Model Number for a Schroeder EPK-K:

BOX 1
EPK-K

Example: *NOTE: One option per box*

BOX 1
EPK-K **= EPK-K**

BOX 1

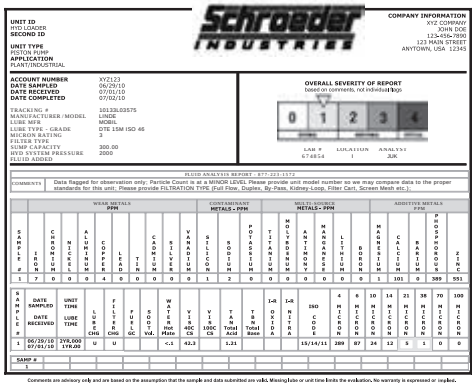
Model
EPK-K No Options

OR

Model
EPK-S Patch Test Kit without water measurement capability

Trouble Check Plus Fluid Analysis

Description



THF Sample Report Form

Schroeder's Trouble Check Plus is an easy to use fluid analysis service that can be utilized as part of any predictive maintenance program.

Schroeder offers two types of sample kits: one for hydraulic fluid (Description: THF P/N: 7624310) and one for water glycol (Description: TWG P/N: 7624741). Refer to the next section for tests performed for each of these kits. Upon receipt of order for any of these part numbers, a sample kit containing a clean sample bottle, blank form, and mailing container is shipped to the customer. After the sample has been taken, the customer simply completes the form and encloses it along with the sample in the mailing container provided. Kits are packaged and sold in lots of 10.

For each sample submitted, a lab report will be generated and forwarded directly to the user via e-mail or postal mail (per the user's request). Schroeder will maintain an electronic copy of all results for a two year period. It is strongly recommended that a MSDS (Material Safety Data Sheet) and a base line (unused) fluid sample be submitted with the initial sample to be analyzed. In addition to serving as a baseline for comparison to subsequent results, the sample of new oil will be used to determine warning limits for viscosity and TAN (total acid number).

Oil sample reports can be tracked online at: http://www.trackmysample.com/

Customers can create their own personal login and password to view all of their reports in one easy to use interface at: http://eoilreports.com/

Information gained by using this service can help identify potential problems in a hydraulic system at minimal cost to the user. Fluid analysis can provide answers to important questions such as these:

- Do I have the right filtration system in place for efficient contamination control?
- Is the fluid in my system experiencing changes that could negatively impact component life or system performance?

Part Numbers and Tests Performed

	Total Conditioning Analysis Kit (Description: THF P/N: 7624310)	Water Glycol Kit (Description: TWG P/N: 7624741)
Particle Count	✓	Patch Test
ISO 4406 Cleanliness Code	✓	Estimated
Water Content	✓	
Viscosity	✓	✓
TAN	✓	✓
Spectrographic Analysis	✓	

Explanation of Results

Particle Count and ISO Codes

Particle contamination is responsible for most of the wear in hydraulic systems. The level of contamination is determined automatically by a laser particle counter. The results are shown as the cumulative counts per milliliter of fluid according to ISO 4406:1999. (For water glycol fluids the patch test photo is used to estimate the ISO code). The current sample ISO code is displayed with the target ISO code. The target is based on the cleanliness level required for the most sensitive component in the system. An increase of 1 ISO digit is considered a caution limit and an increase of two ISO digits is critical. When the target ISO code is exceeded, improvement of the system filtration, elimination of the source of ingression or installation of auxiliary off-line filtration is required.

Water Content

High water content in oil encourages oxidation, corrosion and cavitation. The Karl Fischer Method in accordance with ASTM D 6304-04a determines the water content, which is displayed in percent (% or ppm). (Water glycol fluids normally have upper and lower limits that are set to manufacturer's specifications). Graphing results are available on-line. In general, water contents of up to 500 ppm are typically not critical for the operation of hydraulic and lubrication systems. When the water content exceeds approximately 500 ppm, the system should be protected against water penetration and measures should be introduced to extract water from the oil.

Viscosity

Maintaining the correct viscosity is important for achieving long component service life. Viscosity is reported in centistokes (cSt) @ 40° and 100°C as per ASTM D 445-04. Typically the limits are based on new oil data. Caution limits are calculated at ±10% new oil viscosity and critical limits at ±15% new oil viscosity. (Water glycol fluids can have limits set similarly but the water content should also be monitored as changes in it also affect the viscosity. The manufacturer should be consulted). Trending graphs are available on-line for all reported results. When large changes in viscosity are detected a partial drain of the affected oil and adding fresh fluid may correct the problem. However in some instances a complete oil change may be required.

Trouble Check Plus Fluid Analysis

Total Acid Number (TAN) *not applicable to Description: THF P/N: 7624310

Oxidation is the primary mechanism of oil degradation. The TAN measures the corrosive acidic by-products of oxidation. TAN results are reported in mg/g KOH (Potassium Hydroxide). Since all hydraulic fluids have some inherent acidic properties any increases in TAN must be compared to the new oil value as a baseline. Typically caution limits are set at +0.6 new oil value and critical limits are set at +1.0 new oil value. Certain application specific fluids may require limits set to manufacturer specifications. The results are graphed along with the limits to clearly show when oil oxidation has increased above acceptable levels. When the TAN has increased above the critical level, the oil should be changed immediately to prevent damage from occurring to your equipment.

Spectrographic Analysis *not applicable to Description: TWG P/N: 7624741

Additive, wear metal and contaminant levels are displayed in parts-per-million (ppm). The oil sample is analyzed for eighteen different elements. The results are also graphically displayed for easy detection of increasing or decreasing levels. The manufacturer blends additives into the oil in different forms and quantities. The additive package varies with the oil type. Wear metals indicate wear on particular components of an individual unit. These metals will indicate a wear problem on the microscopic level (< 8 microns) before the problem can be detected by conventional means. The existence of a wear problem is determined by absolute values of metals, and more importantly, by a relative increase or trend in one or more metals. Contaminants can be an indicator of internal or external contamination. The source and amount can be determined by a comparison with new oil data. Below is a list of additive types, wear metal and contaminant sources.

Additives	Function
Magnesium (Mg)	Dispersant / Detergent
Calcium (Ca)	Dispersant / Detergent
Barium (Ba)	Dispersant / Detergent
Zinc (Zn)	Anti-Wear
Molybdenum (Mo)	Anti-Wear
Phosphorous (P)	Anti-Wear
Wear Metals	**Typical Source**
Titanium (Ti)	Turbine Components, Bearings, Platings
Chromium (Cr)	Rings, Roller/Taper, Bearings, Rods, Platings
Iron (Fe)	Cylinders, Gears, Rings, Crankshafts, Liners, Bearings, Housings, Rust
Nickel (Ni)	Valves, Shafts, Gears, Rings, Turbine Components
Copper (Cu)	Bearings, Bushings, Bronze, Thrust-Washers, Friction Plates, Oil Cooler
Silver (Ag)	Bearings, Bushings, Platings
Aluminum (Al)	Pistons, Bearings, Pumps, Blowers, Rotors, Thrust-Washers, Dirt
Lead (Pb)	Bearing Overlays, Grease, Paint, Possible Additive in Gear Oils
Tin (Sn)	Bearings, Bushings, Piston Platings, Solder, Coolers
Vanadium	
Cadmium	
Contaminants	**Typical Source**
Sodium (Na)	Coolant, Sea Water, Dirt, Possible Additive
Boron (B)	Coolant, Sea Water, Possible Additive
Silicon (Si)	Dirt, Possible Additive (Anti-Foam)
Potassium (K)	

Status and Recommendations

Corrective actions are recommended when applicable. The status of the sample is rated in three categories:

- Normal - System is operating within the parameters established by baseline data & prior samples.
  - System requires no immediate action.
- Abnormal - System is operating outside of caution limits in one or more areas.
  - System requires scheduled maintenance.
- Critical - System is operating outside of critical limits in one or more areas.
  - System requires immediate attention.

Model Code	
Description: THF P/N: 7624310	Total Conditioning Analysis Kit
Description: TWG P/N: 7624741	Water Glycol Kit

Explanation of Results

Model Number Selection

NOTES:

Sample kits sold in case lots of 10 pieces. No samples will be processed without completed paperwork supplied with kits.

HMG 2500 TestMate® Series

Features and Benefits

- Simple and user-friendly operation
- Large, full color graphics display
- Quick and independent basic setting by use of automatic sensor recognition
- HMG 2500 can only be used with Schroeder HSI and Schroeder SMART sensors
- Up to 4 sensors and 32 measurement channels can be connected simultaneously
- Sampling rates up to 0.1 ms
- Very large data memory for archiving measurement curves
- Various measurement modes: Normal measuring, Fast curve recording, Long-term measurement
- 2 independent triggers, can be linked logically
- Simple sensor connection with M12x1 push-pull connector
- PC connection: USB and RS 232
- Convenient visualization, archiving and data processing using the HMGWIN software supplied

Description

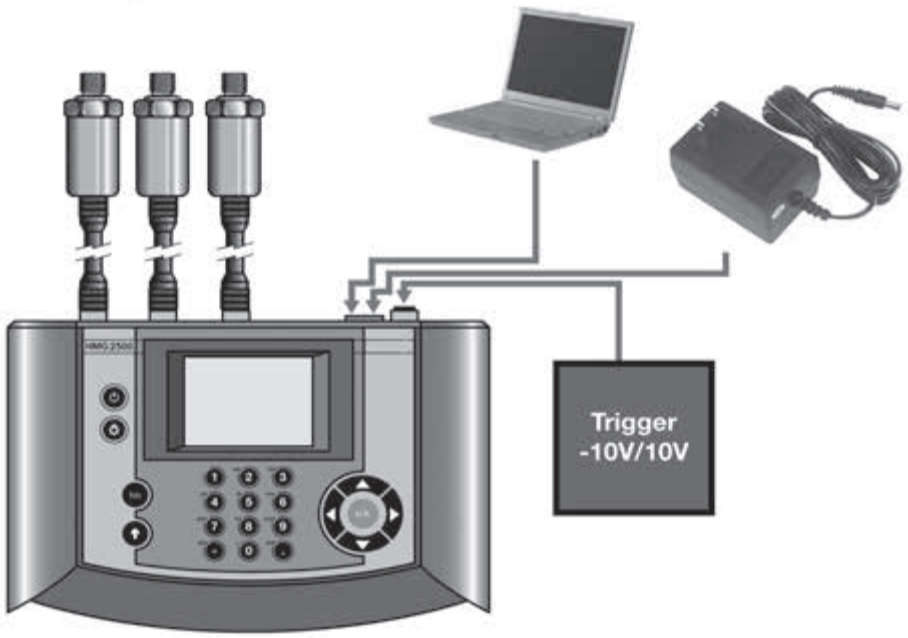
Automated setting procedures, a simple, self-explanatory operator guide and many comprehensive functions ensure the operator is able to carry out a wide range of measurement tasks within a very short time. This makes the HMG 2500 an ideal companion for employees in maintenance, commissioning and service.

The device is designed primarily to record pressure, temperature and flow rate values, which are the standard variables in hydraulics and pneumatics. For this purpose, special sensors are available. The HMG 2500 recognizes the measured variable, measuring range and the unit of these sensors and automatically carries out the basic device settings accordingly.

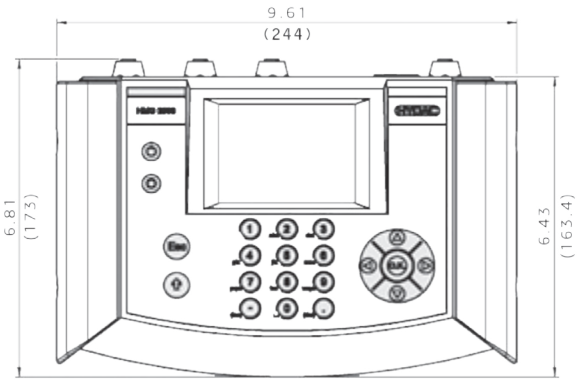
In addition to this, the HMG 2500 has a digital input, e.g. for frequency or speed measurement, as well as a virtual measurement channel for the measurement of difference or performance.

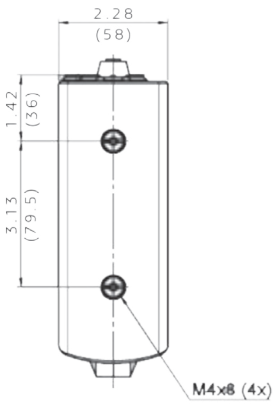
Due to the wide range of functions and its simple handling, the HMG 2500 is just as appropriate for users who take measurements only occasionally as it is for professionals for whom measuring and documentation are routine.

The HMG 2500 is designed to accept future upgrades of the device software.

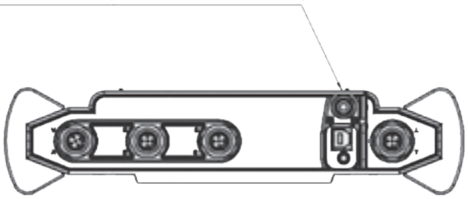


Dimensions



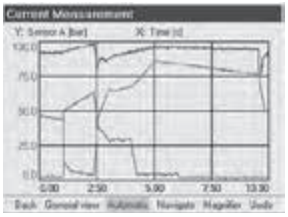


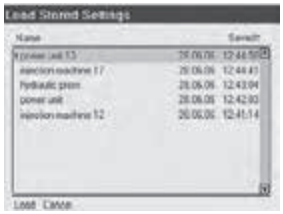
Shown with protective cover open



Function

- Clear and graphical selection menus guide the operator intuitively to all the device functions available. A navigation pad on the keypad ensures rapid operation
- The HMG 2500 can monitor signals from up to 4 **sensors simultaneously**.
- The following sensors can be connected to 3 of these input sockets:
  - 3 analogue sensors (e.g. for pressure, temperature and flow rate) with the special digital HSI interface (Sensor Interface); this means the basic device settings (measured variable, measuring range and unit of measurement) are undertaken automatically
  - 3 analogue sensors (e.g. for pressure, temperature and flow rate) with the special digital HSI interface (Sensor Interface); *reference HSI information above*
- Frequency measurements, counter functions or triggers for data logging can be implemented via the fourth input socket with one digital input
- Additionally, the HMG 2500 has a virtual measurement channel which enables a differential measurement or a performance measurement by means of the sensors connected to the measurement channels "A" & "B"
- All input channels can operate simultaneously at a **sampling rate** of 0.5 ms (1.0 ms for SMART sensors). For the recording of highly dynamic processes, a sampling rate of 0.1 ms can be achieved
- The most impressive function of the HMG 2500 is without doubt its ability to record dynamic processes as a **measurement curve** "online", i.e. in real-time, and to render them as graphs in the field
- The **data memory** for recording curves or logs can hold up to 500,000 measured values per recording. Over 100 of such data recordings in full length can be stored in an additional archiving memory
- For specific, **event-driven curves or logs**, the HMG 2500 has two independent triggers, which can be linked together logically
- User-specific device 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 device settings
- Measured values, curves or texts are visualized on a **full color graphics display** in different selectable formats and display forms
- Numerous useful and easy-to-use **auxiliary functions** are available, e.g. zoom, ruler tool, differential value graph creation and individual scaling, which are particularly for use when analyzing the recorded measurement curves





Software

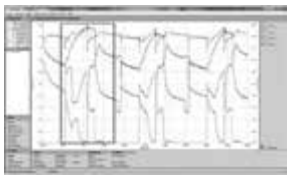
The HMG 2500 communicates with a computer via a USB or RS 232 port. Schroeder offers HMGWIN 2500, the matching software for the HMG 2500, for convenient post-processing, rendering, and evaluation of measurements on a pc. It also enables the HMG 2500 to be operated directly from a computer in real time.

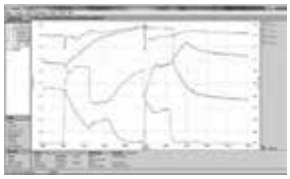
The HMG 2500 is equipped with specially developed software providing for fast data collection and processing. A measurement curve can comprise up to 500,000 measured values. The HMG 2500's measured value memory is capable of storing at least 100 of these curves.

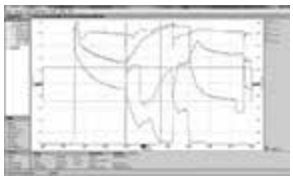
The Schroeder software, CMWIN, is also supplied that allows direct communication with SMART (HSI) sensors connected to the HMG 2500 from your PC.

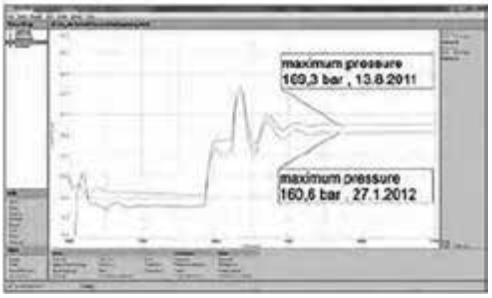
Some examples of the numerous useful additional functions:

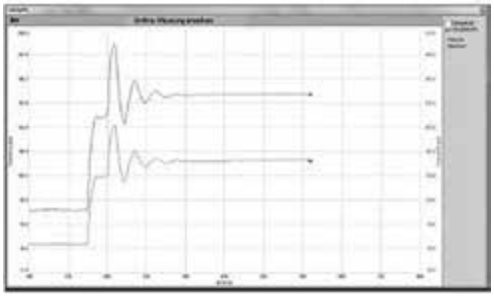
- Transfer and archiving of measurements recorded using the HMG 2500
- Display of the measurements in graph form or as a table
- **Zoom function:** Using the mouse, a frame is drawn around an interesting section of a measurement curve, which is then enlarged and displayed
- **Accurate measurement** of 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 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 (HMGWIN only): Starting, recording, and online display of measurements (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)











Technical Data

Analog Inputs	
Input signals	HSI analogue sensors
3 channels M12x1 Ultra-Lock flange sockets (5-pin) channel A to channel C	HSI SMART sensors
Accuracy	≤ ± 0.1% FS
Digital Input	
1 channel via M12x1 Ultra-Lock flange socket Channel D	Digital status (high/low) Frequency (0.01 to 30,000 Hz)
Calculated channel	
Quantity	1 channel via virtual channel E
Sampling rate (dependent on number of active channels)	0.1 ms, max. 1 input channel 0.2 ms, max. 2 input channels 0.5 ms, all 3 input channels 1.0 ms, for SMART sensors
Resolution	12 bit
Memory	Min. 100 measurement curves, each with 500,000 measured values
Display	3.5" color display 7-segment display
Interfaces	1 USB, 1 serial interface RS 232
CE mark	EN 61000-6-1 / 2 / 3 / 4
Safety	EN 61010
IP class	IP 40
Ambient conditions	
Operating temperature	32°F to 122°F (0°C to 50°C)
Storage temperature	-4°F to 140°F (-20°C to 60°C)
Relative humidity	70%, non-condensing max
Weight	approx. 2.43 lb (1.1 kg)

Order Details

Model Code

Description: HMG 2500 - 000 - US
P/N 7634365

Operating manual and documentation

US = English

Scope of delivery

- HMG 2500
- Power supply for 90 to 230 V AC
- Operating Instructions
- Data carrier with USB drivers. HMGWIN software
- USB connector cable

Accessories

- Additional accessories, such as electrical and mechanical connection adapters, power adapters, etc. can be found in the "Accessories for HMG Series" catalog pages.

HMG 4000 TestMate® Series

Features and Benefits

- Large, full graphics color display 5.7" touch screen
- Capable of recording up to 38 sensors at once, 8 analog, 2 digital sensors and 28 HSCI sensors via CAN bus
- Up to 100 measurement channels can be depicted simultaneously
- High-speed measuring rate, up to 8 sensors at 0.1 ms at a time
- Rapid and automatic basic setting of the device by means of automatic sensor detection
- Analog inputs 0.. 20 mA, 4 .. 20 mA Voltage 0 .. 50V, -10 .. 10 V
- PT 100/1000 input
- Connection to a CAN bus system (also J1939)
- Simple and user-friendly operation, intuitive menu
- Very large data memory for archiving measurement curves enables the storage of 500 measurements with up to 8 Million measured values
- Various measurement modes: Measuring, Fast curve recording, Long term measurements
- Recording of dynamic processes "online" in real time
- Event-driven measurements with several triggering options
- PC interface via USB
- USB Host connection for USB memory sticks
- Convenient visualization, archiving and data processing using the HMGWIN software

Description

The HMG 4000 hand–held measuring unit is a portable measuring and data logging device. It was mainly developed for all values measured in relation with hydraulic systems, such as pressure, temperature, flow rate and position. Moreover, it provides a very high flexibility, even when it comes to evaluating other measuring values. The main applications are servicing, maintenance or test rigs.

The HMG 4000 has a very easy-to-operate user interface due to its large 5.7" touchscreen. The operator can access all of the unit's functions and settings by means of clearly presented selection menus.

The HMG 4000 can record the signals of up to 38 sensors at once. For this purpose, Schroeder Industries offer special sensors, which are automatically detected by the HMG 4000 and whose parameters such as measurement values, measuring ranges and measuring units can be set.

On the one hand, there are the HSI Sensors (Sensor Interface) for the measurement of pressure, temperature and flow rate, for the connection of which there are 8 analog input channels. Furthermore, there is the option of connecting Schroeder SMART sensors to these inputs. SMART senors can display several different measured variables at a time.

Up to 28 special HCSI-Sensors (CAN Sensor Interface) can be connected additionally via the CAN bus Port, also supporting automatic sensor detection.

HMG 4000 can optionally be connected to an existing CAN network. This enables the recording of measured data transmitted via CAN bus (e.g. motor speed, motor pressure) in combination with the measured data from the hydraulic system.

The device also offers measurement inputs for standard sensors with current and voltage signals. The HMG 4000 rounds off the application, providing two additional digital inputs (e.g. for frequency or rpm measurements).

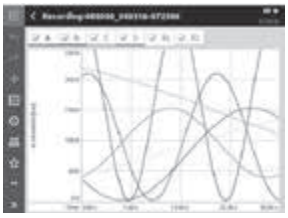
The most impressing feature of the HMG 4000 is its ability to record the dynamic processes of a machine in the form of a measurement curve and render them as a graph — and, moreover, online and in real-time.

Schroeder software HMGWIN which is specific to the HMG 4000, is supplied for convenient postprocessing, rendering and evaluation of measurements on your computer.

Function

- Clear and graphical selection menus intuitively guide the operator to all the device functions available and ensure fast implementation.
- HMG 4000 can detect the signals of up to **38 sensors simultaneously**. 11 Push-pull M12x1 input sockets are available as sensor interfaces. Apart from the push-pull sensor connection cable, M12x1 standard cables can also be used.
- The following sensors can be connected to 8 of these input sockets:
  - 8 analogue sensors (e.g. for pressure, temperature and flow rate) with the special digital HSI interface (Sensor Interface); this means the basic device settings (measured variable, measuring range and unit of measurement) are performed automatically.
  - 8 standard analog sensors with current and voltage signals
  - 8 condition monitoring sensors (SMART sensors), the basic device settings are also performed automatically.

- The blue input socket provides 2 digital inputs, i.e. for 1 or 2 speed sensors (2nd speed sensor connection via Y adapter). Frequency measurements, counting functions or triggers can as well be implemented for data recording.
- Different **CAN bus** functions can be utilized via the red input socket.
  - Connection of up to 28 HCSI sensors (CAN Sensor Interface) by setting up a CAN bus with HCSI sensors and the relevant connection accessories, also with automatic parameterization.
  - Connecting to a CAN bus, you have the option of evaluating up to 28 CAN messages
  - Configuration of **CAN Sensors**, the parameterization is performed by means of EDS files, which can be stored and administrated in the HMG 4000



- The yellow input socket serves as the interface for pressure, temperature or level switches with **I/OLink** as well as for the programming device HPG P1. These devices can be parameterized by means of the HMG 4000.
- The most impressive function of the HMG 4000 is its ability to record dynamic processes “online”, i.e. in real-time, as a **measurement curve** and to render them as graphs. During the recording process of a measuring curve, you can zoom in the curve sections of interest using gestures on the touchscreen.

- For the purpose of recording highly dynamic processes, all 8 analog input channels can be operated simultaneously at a **measuring rate** of 0.1 ms.
- The **data memory** for the recording of curves or logs can memorize up to 8 million measured values. At least 500 of such data recordings in full length can be stored in an additional archiving memory.
- For the targeted **event-driven curve or log recording**, the HMG 4000 has two independent triggers which can be linked together logically. In addition, there is a “start/stop” condition, by means of which a measurement can be initiated or finished.

- 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 device settings.
- 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, differential value graph creation and individual scaling, which are particularly for use when analyzing the recorded measurement curves.
- The communication between the HMG 4000 and a PC is performed via the built-in USB port.
- A HMG 4000 connected to your PC is recognized and depicted as a directory by the PC. You can conveniently move measured data to your PC. Optionally, data transfers can be carried out via a file manager by means of a USB memory stick.

Software

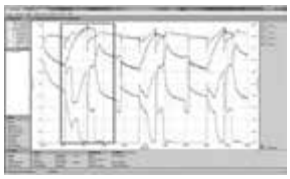
The PC software HMGWIN is also supplied with the device. This software is a convenient and simple package for analyzing and archiving curves and logs which have been recorded using the HMG 4000, or for exporting the data for integration into other PC programs if required. In addition it is also possible to operate the HMG 4000 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.

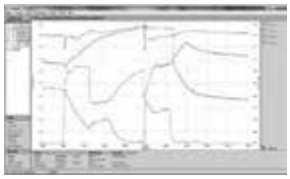
HMGWIN can be run on PCs with Windows 7, Windows 8.1 as well as Windows 10 operating systems.

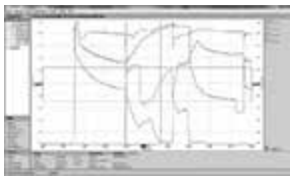
*) SMART sensors (Condition Monitoring Sensors) are a generation of sensors which can provide a variety of different measurement variables.

Some examples of the numerous useful additional functions:

- 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
- **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 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 (HMGWIN only): Starting, recording, and online display of measurements (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)







Technical Data

Analog Inputs	
Input signals	HSI analogue sensors
8 channels M12x1 Ultra-Lock flange sockets (5 pole) channel A to channel H	HSI SMART sensors Voltage signals: i.e. 0.5 .. 4.5 V, 0 .. 10 V etc. (input ranges for 0 .. 50 V, 0 .. 10 V, 0 .. 4.5 V, -10 .. 10 V) Current signals, i.e. 4 .. 20mA, 0 .. 20mA (input range 0 .. 20 mA) 1 x PT 100 / PT 1000 (on Channel H)
Accuracy dependence of the input range	≤ ± 0.1% FS at HSI, voltage, current ≤ ± 1 % FS at PT 100 / PT 1000
Digital Inputs	
Input signals 2 channels via M12x1 Ultra-Lock flange socket (5 pole) Channel I, J	Digital status (high/low) Frequency (0.01 to 30,000 Hz) PWM duty cycle Durations (i.e. Period length)
Level	Switching threshold / switch-back threshold: 2 V/1 V Max input voltage: 50 V
Accuracy	≤ ± 0.1 %
CAN	
Input signals 28 channels M12x1 Ultra-Lock flange socket (5 pole) channel K1 to K28	HCSI sensors, CAN, J1939, CANopen PDO, CANopen SDO
Baud rate	10 kbit/s to 1 Mbit/s
Accuracy	≤ ± 0.1 %
Calculated channels	
Quantity	4 channels via virtual port L (channel L1 to channel L4)

Technical Data

Programming interface	
For O-Link devices	1 channel via M12x1 Ultra-Lock flange socket (5 pole)
Voltage supply	
Network operation	9 to 36 V DC via standard round plug 2.1 mm
Battery	Lithium-Nickel-Kobalt-Aluminum-Oxide 3.6 V; 9300 mAh
Battery charging time	approx. 5 hours
Service Life	without sensors: approx. 11 hours with 2 sensors: approx. 9 hours with 4 sensors: approx. 7 hours with 8 sensors: approx. 4 hours
Display	
Type	TFT-LCD Touchscreen
Quantity	5.7"
Resolution	VGA 640 x 480 Pixel
Backlight	10 to 100% adjustable
Interfaces	
USB Host	
Plug-in connection	USB socket, Type A, screened
USB Standard	2.0 (USB Full speed)
Transmission rate	12 Mbit/s
Voltage supply	5 V DC
Power supply	100 mA max.
Protection	short circuit protection to GND (0 V)
USB Slave	
Plug-in connection	USB socket, Type B, screened
USB Standard	2.0 (USB High speed)
Transmission rate	480 Mbit/s
Voltage supply	5 V DC
Power supply	100 mA max.
Protection	short circuit protection to GND (0 V)
Memory	
Measured value memory	16 GB for min. 500 measurements, each containing 8 Million measured values
Technical Standards	
EMC	IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8
Safety	EN 61010
IP class	IP 40
Ambient conditions	
Operating temperature	32°F to 122°F (0°C to 50°C)
Storage temperature	-4°F to 140°F (-20°C to 60°C)
Relative humidity	70%, non-condensing max
Dimensions	approx. 11.22 x 7.44 x 3.43 in (B x H x T)
Weight	approx. 4.08 lb (1.85 kg)
Housing material	Plastic (Elastollan® R 3000 - TPU-GF)

Model Code

Description: HMG 4000 - 000 - US
P/N 7634366

Scope of delivery

- HMG 4000
- Power supply for 90 to 230 V AC
- Strap

Operating manual and documentation

US = English

- Operating Instructions
- Data storage medium containing USB drivers HMGWIN and CMWIN software
- USB connector cable

Order Details

Additional accessories, such as electrical and mechanical connection adapters, power adapters, etc. can be found in the "Accessories for HMG Series" catalog pages.

Accessories for HMG Series

Available Accessories

- Pressure, temperature and flow rate transmitters with HSI sensor detection as well as CAN pressure transmitters with HCSI sensor detection, see below and next page:

Pressure Transducer with HSI
(Sensor Interface)

Model Code	Description	Part No.
HDA 4748-H-0016-000	-14.5 to 130.5 psi (-1 to 9 bar)	909429
HDA 4748-H-0016	0 to 230 psi (0 to 16 bar)	909425
HDA 4748-H-0060-000	0 to 870 psi (0 to 60 bar)	909554
HDA 4748-H-0100-000	0 to 1450 psi (0 to 100 bar)	909426
HDA 4748-H-0250-000	0 to 3625 psi (0 to 250 bar)	909337
HDA 4748-H-0400-000	0 to 5800 psi (0 to 400 bar)	909427
HDA 4748-H-0600-000	0 to 8700 psi (0 to 600 bar)	909428
HDA 4778-H-0135-000	-14.5 to 135.5 psi (-1 to 9.34 bar)	920755
HDA 4778-H-0150-000	0 to 150 psi (0 to 10 bar)	920663
HDA 4778-H-1500-000	0 to 1500 psi (0 to 103 bar)	920757
HDA 4778-H-3000-000	0 to 3000 psi (0 to 207 bar)	920756
HDA 4778-H-6000-000	0 to 6000 psi (0 to 144 bar)	920664
HDA 4778-H-9000-000	0 to 9000 psi (0 to 621 bar)	920665

HCSI Pressure Measuring Transducer (HMG 4000 only CANbus)

Model Code	Description	Part No.
HDA 4748-HC-0009-000 (-1...+9 bar)	-1 ... 9 bar	925287
HDA 4748-HC-0016-000	0 ... 16 bar	925298
HDA 4748-HC-0060-000	0 ... 60 bar	925305
HDA 4748-HC-0100-000	0 ... 100 bar	925299
HDA 4748-HC-0160-000	0 ... 160 bar	925286
HDA 4748-HC-0250-000	0 ... 250 bar	925304
HDA 4748-HC-0400-000	0 ... 400 bar	925303
HDA 4748-HC-0600-000	0 ... 600 bar	925301
HDA 4748-HC-1000-000	0…1000 bar	925300

HCSI Temperature Measuring Transducer (HMG 4000 only CANbus)

Model Code	Description	Part No.
ETS 4148-HC-006-000	-13 to +212 °F	925302

Speed Sensors

Model Code	Description	Part No.
HDS 1000-002	Rpm Sensor (plug M12x1) 2M; Includes HDA 1000 Reflector Set (part no. 904812)	909436
HDS 1000 Reflector Set	Reflective foil set 25 pieces	904812
SSH 1000 (HMG 2500 only)	Sensor simulator for 2 HSI (ideal for training purposes)	909414
HSS 210-3-050-000 (HMG 4000 only)	Rpm Sensor (in connection with ZBE 46)	923193
HSS 220-3-046-000 (HMG 4000 only)	Rpm Sensor (in connection with ZBE 46)	923195

Temperature Transducer with HSI
(Sensor Interface)

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

NOTES:

The information in this catalog relates to the operating conditions and applications described. For applications or operating conditions not described, please contact us a filtersystemsmanger@schroederindustries.com.

Subject to technical modifications

Accessories for HMG Series HMG

Sensor Cables (HMG 4000 only)

Model Code	Description	Part No.
Push-pull connection on plug-side		
ZBE 40-02	(CABLE M12X1/5P, PUSH-PULL) 2M length	6177158
ZBE 40-05	(CABLE M12X1/5P, PUSH-PULL) 5M length	6177159
ZBE 40-10	(CABLE M12X1/5P, PUSH-PULL) 10M length	6177160
Screw connection		
ZBE 30-02	(Sensor cable M12x1, 5-pin) 2M length	6040851
ZBE 30-05	(Sensor cable M12x1, 5-pin) 5M length	6040852

Flow Sensor with HSI
(Sensor Interface)

Model Code	Description	Part No.
Aluminum		
EVS 3108-H-0020-000	0.26 to 5.28 (1.2 to 20)	909405
EVS 3108-H-0060-000	1.59 to 15.9 (6 to 60)	909293
EVS 3108-H-0300-000	3.96 to 79.3 (15 to 300)	909404
EVS 3108-H-0600-000	10.6 to 159 (40 to 600)	909403
Stainless Steel		
EVS 3118-H-0020-000	0.26 to 5.28 (1.2 to 20)	909409
EVS 3118-H-0060-000	1.59 to 15.9 (6 to 60)	909406
EVS 3118-H-0300-000	3.96 to 79.3 (15 to 300)	909408
EVS 3118-H-0600-000	10.6 to 159 (40 to 600)	909407

Other Accessories

Model Code	Description	Part No.
Pelican Case	for HMG 2500 and accessories	2702730
Case for HMG 4000	Case for HMG 4000 and accessories	6179836
USB Cable (HMG 2500 only)	Connection to PC	6040585
ZBE 30-02 (HMG 2500 only)	cable for M12x1 - 6'	6040851
ZBE 30-05 (HMG 2500 only)	cable for M12x1 - 15'	6040851
ZBE 36 (HMG 2500 only)	TWS (TestMate® Water Sensor) Adapter	909737
Power Supply	DC Charging unit for HMG 2500	6054296
ZBE 31	Car charger for HMG Unit	909739
HCSI Y splitter	Y splitter for HCSI sensors	6178196
HCSI bus termination	Termination connector for HCSI Sensors	6178198
ZBE 46	Pin adapter HMG (for three-wire signals, AS, ...)	925725
ZBE 100	Adapter for TFP 100	925726
ZBE 38	Y adapter, black for jack I/J	3224436
ZBE 26	Y adapter, blue for HLB 1000	3304374
ZBE 41	Y adapter, yellow for TCM sensor	910000
UVM 3000	Universal connection module for HMG 4000 only	909752
Hydraulic Adapter set	Adapter hose DN 2 / 1620/1620, 400 mm and 1000 mm, pressure gauge connection 1620/ G1/4, adapter 1615/ 1620, bulkhead couplings 1620/ 1620	903083

ET-100-6 TestMate® Series

Features and Benefits

- Easy to use–for beginner or experienced troubleshooters
- Large meters are clearly marked with easy-to-read scales
- Scale selector switches and the load valve control knob are also large and specially designed to be easy to grip under any conditions
- All loose components are stowed in form-fitting recesses in the impact resistant plastic case that also protects the meters and circuitry
- The electronic sensor and the EasyTest fitting are the only components that see hydraulic fluid, so clean-up is limited to draining the sensor and replacing the cap on the EasyTest fitting
- The load valve allows the operator to simulate operating pressure, if required

Description

Schroeder's original TestMate® system with the patented EasyTest fitting provides the hydraulic user with a quick, convenient method to test, troubleshoot, and obtain preventive maintenance data on hydraulic systems. Flows up to 100 gpm and pressures up to 6000 psi, as well as operating temperature, are measured through an EasyTest fitting, which is permanently installed in the hydraulic system.

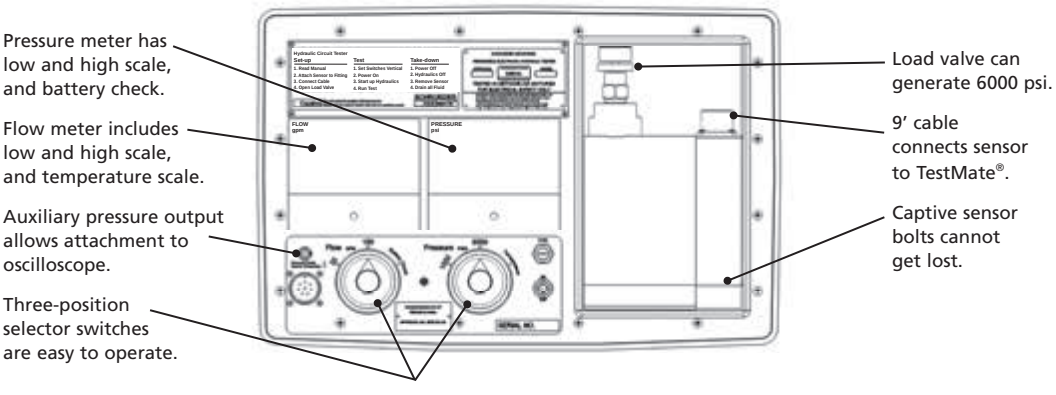
The sensor and EasyTest fittings are robust units designed to operate safely at any system pressure up to the maximum 6000 psi that the sensor load valve is capable of generating. Pressure bearing parts are thick section aluminum extrusions carefully chosen for their combination of high strength and light weight.

If the system's prime mover is kept at constant rpm, any drop in indicated flow will represent a loss of system efficiency at the point of test. During testing, system operation can be used to create the load, or the load can be simulated with the load valve in the sensor block.

The electronic circuitry produces data that accurately reflects system performance at each test point throughout the operating pressure range, making it possible to also determine pump and motor efficiency as well as valve and cylinder leakage.

Applications

- Check systems before and after rebuild
- Use as part of a preventive maintenance program
- Use to troubleshoot in instances of poor system performance or excessive machine downtime
- Use to check performance on a production line
- Install EasyTest fittings on prototypes to accurately evaluate hydraulic performance at any stage of development



NOTES:

Box 2. Required for any underground coal mining application. Unit will be furnished with the required MSHA tag.

Specifications

Flow Meter	Type:	Electronic turbine
	Low Scale Range:	0 to 20 gpm (0 to 75.7 L/min)
	Low Scale Accuracy:	±1 gpm @ 3 to 5 gpm (11-19 L/min) ±0.2 gpm @ 6 to 20 gpm (22.7-75.7 L/min)
	High Scale Range:	0 to 100 gpm (0 to 378 L/min)
	High Scale Accuracy:	±2% of full scale
	Minimum Reading:	3 gpm (11.35 L/min)
Pressure Meter	Type:	Electronic transducer
	Low Scale Range:	0 to 1000 psi (0 to 69 bar)
	Low Scale Accuracy:	±35 psi (2.41 bar)
	High Scale Range:	0 to 6000 psi (0 to 413.8 bar)
	High Scale Accuracy:	±120 psi (8.44 bar)
Auxiliary Pressure Output:		BNC connector - 2.5 mv @ 0.1mA per 1000 psi (68.96 bar), linear in the range 0 to 6000 psi (0 to 413.8 bar), independent of meter scale selection
Temperature Scale:		50°F to 250°F (10°C to 121°C)
Power Source:		8 "C" size batteries *To be furnished by customer*
Weight:		18 lbs (8 kg)
Case Dimensions:		19.87 x 13.93 x 4.68 in (50.4 x 35.4 x 11.9 cm)
EasyTest Fitting Envelope Dimensions:		4.5 x 4 x 3 in (114 x 102 x 76 mm)
EasyTest Fitting Mounting Holes:		Qty 2 - .375 to 16 UNC .75 dp.
Clearance to Install Sensor:		11 in (280 mm) min

EasyTest Fittings

Port Type and Size	Model Numbers: Station with Through Flow for In-Line Testing	Model Numbers: Station with Blocked Flow for "T" Testing	Port Type and Size	Model Numbers: Station with Through Flow for In-Line Testing	Model Numbers: Station with Blocked Flow for "T" Testing
NPTF			SAE 4-Bolt Boss[2]		
0.75	A-ET-211	A-ET-197	0.75	A-ET-219	A-ET-205
1.00	A-ET-212	A-ET-198	1.00	A-ET-220	A-ET-206
1.25	A-ET-213	A-ET-199			
1.501	A-ET-256	A-ET-312			
SAE O-Ring			BSP PL		
1.06-12	A-ET-215	A-ET-201	0.75	A-ET-222	A-ET-314
1.3125-12	A-ET-216	A-ET-202	1.00	A-ET-223	A-ET-315
1.625-12	A-ET-217	A-ET-203	1.25	A-ET-224	A-ET-316
1.875-12[1]	A-ET-258	A-ET-313			

[1]For 3000 psi only
[2]Depth of holes not per SAE specifications

Model Number Selection

How to Build a Valid Model Number for a Schroeder Original TestMate®:

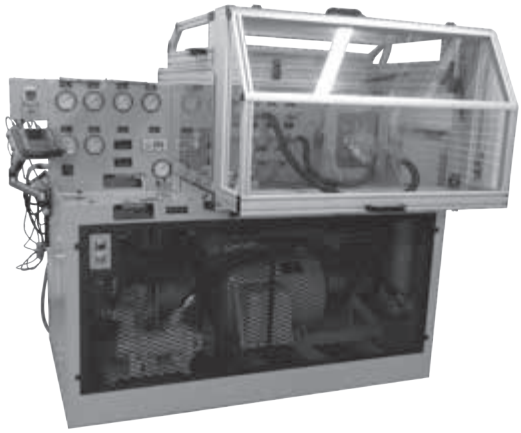
BOX 1 ET-100-6 – BOX 2 [ ]

Example: *NOTE: One option per box*

BOX 1 ET-100-6 – BOX 2 [ ] **= ET-100-6**

BOX 1	BOX 2
Model	**Option**
ET-100-6 Original TestMate®	Omit = None C = MSHA approved

HTB Hydraulic Test Bench



Features and Benefits

- 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
- Two complete operating manuals are supplied with each bench
- Kits and spare parts available for upgrades and maintenance

Description

The Schroeder Model 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 Schroeder 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 50 years by Schroeder engineers, based on the comments and requests of over 1,000 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.

Accessories

- Suction and pressure hose and fittings group (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)
- Oil cooler
- Solenoid and pilot-operated valve test group
- Spline shaft adapter kit
- Jib Crane Group
- Digital Instrumentation Package
- Water Cooled Heat Exchanger
- Filtration Group
- Safety Enclosure Group
- High Pressure Intensifier Circuit
- Bidirectional Pump Test Circuit
- HMG Digital Electronic Group
- Air Cooled Heat Exchanger
- 25 gpm Case Drain Meter
- TCM Kit

Hydraulic Test Bench HTB

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 200 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.

Specifications

	Model HTB-50	Model HTB-100	Model HTB-150
Speed Range *in either direction*	200 to 2400 rpm	200 to 2400 rpm	200 to 2400 rpm
Power Available *For testing pumps* *Expressed torque* *Expressed in horsepower*	275 ft-lbs to 1200 rpm 60 hp at 1200 rpm	458 ft-lbs to 1200 rpm *(decreasing proportionately to 2400 rpm)* 115 hp at 1200 rpm *(with constant hp to 2400 rpm)*	670 ft-lbs to 1200 rpm 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 to be used.*	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	Digital Readout from 0 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 Unit30" H x 50" L x 30" W 900 lbs (408 kg)

HTB Hydraulic Test Bench

Model Number Selection

How to Build a Valid Model Number for a Schroeder HTB:

BOX 1	BOX 2	BOX 3	BOX 4	
HTB –	–	–	–	

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	
HTB –	100 –	A –	AD –	GXXXX	**= HTB100AADGXXXX**

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
Model	**HP**	**Voltage**	**Options**	**Custom Groups**
HTB	50	A = 230V 60Hz	A = Water Cooled Heat Exchanger	Add G # for all custom parts & frame modifications.
	100	B = 460V 60Hz	B = Solenoid & Pilot Operated Valve Group	
	150	C = 575V 60Hz	C = Jib Crane Group	
		D = 380V 50H	D = Filtration Group (standard/included on all benches)	
		E = 415V 50Hz	E = Safety Enclosure Group	
		F = 380V 60Hz	F = High Pressure Intensifier Circuit	
		G = 208V 60Hz	G = Bidirectional Pump Test Circuit	
		H = 220V 50Hz	H = HMG Digital Electronic Group	
			I = Air Cooled Heat Exchanger	
			J = 25 gpm Case Drain Meter	
			K = Digital Gauges	
			L = TCM Kit	
			Splined Shaft Group*	
			Hose & Fitting Group*	
			* Not part of BOM structure, listed as separate line item on P.O.	

NOTES:

Box 4. May have multiple options.

Section 2:

FLUID CONDITIONING PRODUCTS

HFS-BC Handy Filter Systems Basic Cart

Features and Benefits

- 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
- Optional BackPack Version available for ease of transport across distances

Description

Schroeder's Handy Filter System Basic Cart 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 optional dual filter assembly allows for water and particulate removal or staged particulate contamination removal.

Applications

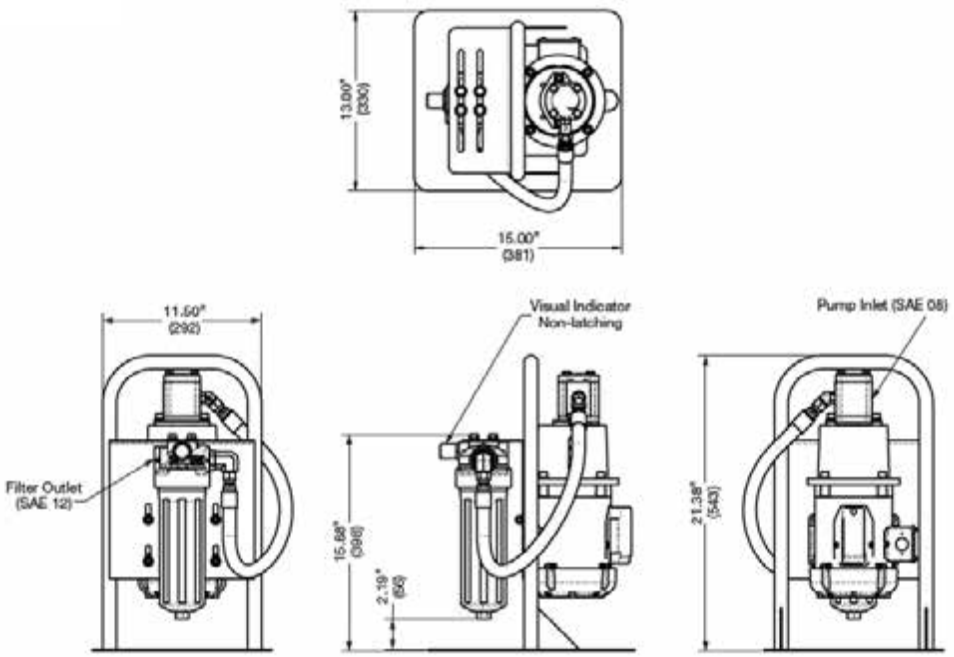
- Supplementing continuous filtration by system filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from drums to system reservoirs

Specifications

Flow Rating:	4 gpm (15.14 L/min) max
Maximum Viscosity:	1,600 SUS (350 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)
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 .25 hp
Weight:	Single housing - 40 lbs Dual housing - 44 lbs BackPack version - 39 lbs (Does not include weight of hose/wands)

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Handy Filter Systems Basic Cart



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder HFS-BC:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
HFS-BC								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
HFS-BC	A	2	09	H10	H05	B	E		**= HFS-BCA209H10H05BE**

BOX 1

Model
HFS-BC

BOX 2

Voltage
A = 120VAC / 1-Phase / 60 Hz

BOX 3

Number of Filter Housings
1 = Single
2 = Dual

BOX 4

Element Length
09

BOX 5

Element Media First Housing
H03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
H05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
H10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
H25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
GW = Water Removal

BOX 6

Element Media Second Filter (Dual Only)
Omit = Single housing and Backpack version
H03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
H05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
H10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
H25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
GW = Water Removal

BOX 7

Seal Material
B = Buna

BOX 8

Clogging Indicator
E = Standard Visual Indicator

BOX 9

Options	
BP =	BackPack Version (Single Housing Only)

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

HFS Handy Filter Systems

Features and Benefits

- Spin-on elements make element changeouts quick and easy and limit oil spillage
- All units equipped with a clogging indicator
- Suction line incorporates a wire mesh strainer to protect the pump
- Relief valve provided in housing
- Convenient carrying handle provided in framework
- Inlet and outlet wands provided

Description

As the name implies, the HFS is a hand-held filtration unit that utilizes convenient Schroeder M-size spin-on elements. It is powered by an electrical motor that drives a low noise vane pump. All components are securely fixed to an aluminum framework with integral feet for stable placement. The HFS is ideal for maintaining off-highway vehicles and a wide variety of industrial equipment.

Applications

- Transfer and filter hydraulic fluids
- Remove water from hydraulic fluids
- Provide auxiliary filtration on demand

Specifications

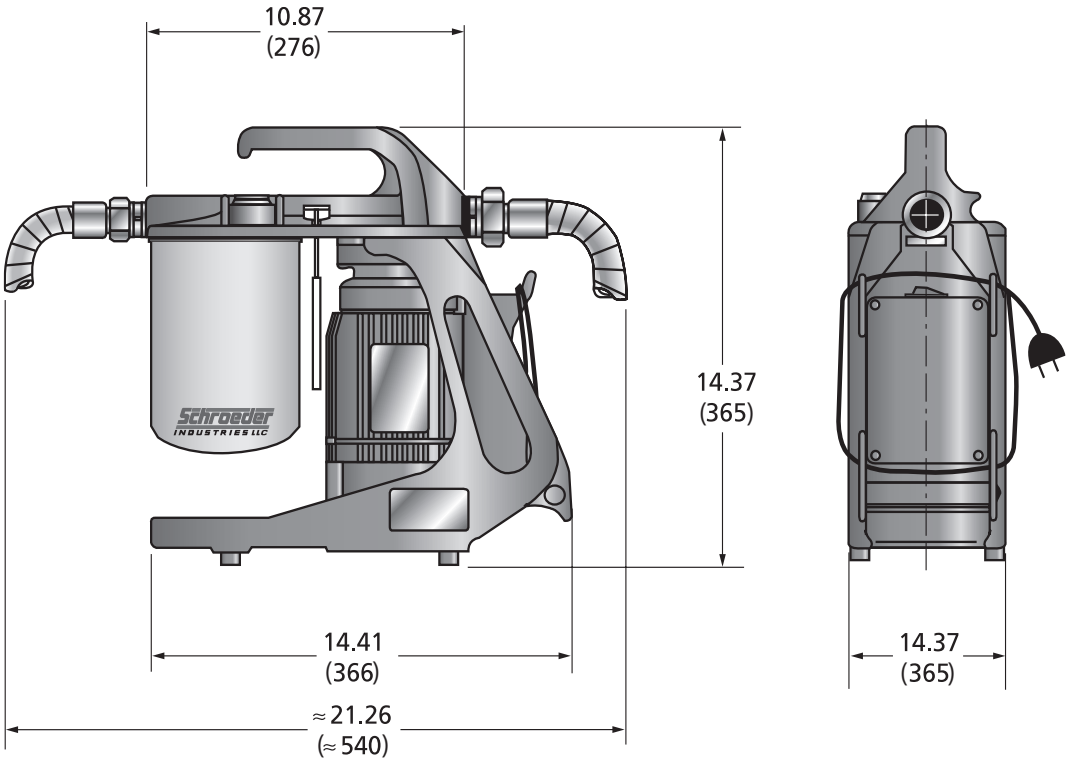
Recommended Fluid:	Petroleum based oils. Not for use with Water-Glycols.
Nominal Flow:	4 gpm (15 L/min)
Maximum Oil Temperature:	180°F (80°C)
Viscosity Range:	40 to 1,600 SUS
Maximum Operating Pressure:	50 psi (3.5 bar)
Seal Material:	Buna N
Weight:	27.5 lb (12.5 kg)
Electrical Motor:	110 VAC (0.25 hp / 0.18 kw) or 24 VDC (0.27 hp / 0.20 kw)

Element Performance Information

7" Element	Absolute Rating Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Abs. Rating wrt ISO 16889 Using APC calibrated per ISO 11171		Dirt Holding Capacity gm
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x(c) \geq 200$	$\beta_x(c) \geq 1000$	
M3	6.8	7.5	10.0	N/A	N/A	50
M10	15.5	16.2	18.0	N/A	N/A	37
MZ3	<1.0	<1.0	<2.0	4.7	5.8	105
MZ10	7.4	8.2	10.0	10.0	12.7	104

NOTES:

Not for use with Glycols.



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder HFS: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4
HFS			

Example:

BOX 1	BOX 2	BOX 3	BOX 4	
HFS	A	M10	C	**= HFSAM10C**

BOX 1

Model
HFS

BOX 2

Motor
A = 110 VAC
B = 24 VDC
C = Pneumatic

BOX 3

Element
M3
M10
MZ3
MZ10
MW

BOX 4

Contamination Monitor
C = TCM
Omit = None

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

MFDBC Mobile Filter System - Basic Cart

10 gpm max
37.9 L/min

Features and Benefits

- Compact size, easily transported
- Top-ported filter provides easy element service
- D10 Auto-Reset Indicator indicates when filter elements require a change
- Hoses and connection tubes included (10' total length)
- Drip pan catches oil before it falls to the ground
- Off-line stationary system available – see Kidney Loop System

Description

The Schroeder Mobile Filter System - Basic Cart 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 prefiltering 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, minimizing landfill waste. Element service is easily accomplished through the top-ported filter housings. The MFD-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.

Applications

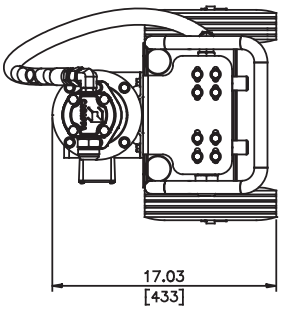
- Supplementing continuous filtration by system filters
- Cleaning up a hydraulic system following component replacement
- Filtering new fluid before it is put into service
- Transferring fluid from storage tanks and drums to system reservoirs

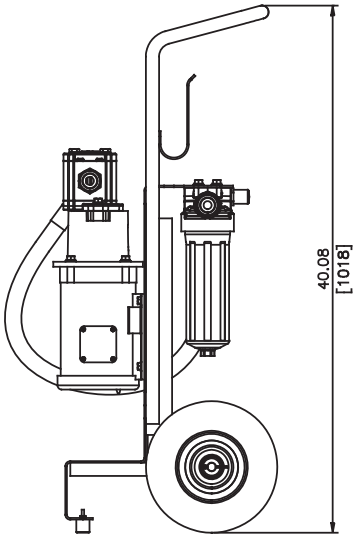
Specifications

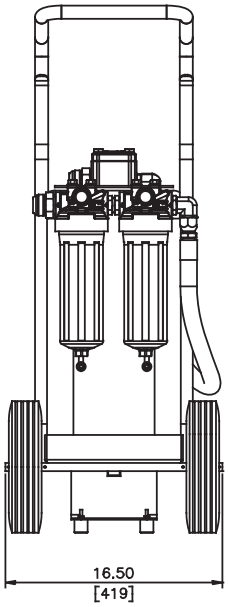
Flow Rating:	10 gpm (37.9 L/min) max
Viscosity Range:	46 - 1,000 SUS (6 - 216 cSt)
Hose Pressure Rating:	30 psig (2.0 bar) @ 150°F (65.6°C) Full vacuum @ 150°F (65.6°C)
Fluid Temperature:	25°F to 150°F (-4°C to 65°C)
Bypass Valve Setting:	Cracking: 25 psi (1.7 bar)
Material:	Element Case: Aluminum
Seal 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)

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Mobile Filter System - Basic Cart MFDBC







Metric dimensions in ( ).

How to Build a Valid Model Number for Schroeder MFDBC:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
MFDBC					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
MFDBC	1	09	H10	H05		= MFDBC109H10H05

BOX 1

Model
MFDBC

BOX 2

No. of Elements
1

BOX 3

Element Length
09

BOX 4

Element Media First Filter
H03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
H05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
H10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
H25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
GW = Water Removal

BOX 5

Element Media Second Filter
H03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
H05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
H10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
H25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
GW = Water Removal

BOX 6

Voltage
Omit = 115 V / 60 Hz
A = 220 V / 60 Hz
B = 220 V / 50 Hz

Model Number Selection

NOTES:

Box 6. If 220V, 50 Hz option selected, flow rating is reduced to ~8-gpm and will have plug cutoff.

MFS MFD Mobile Filtration Systems

U.S. Patents 6568919 7604738

7 or 14 gpm
26.5 or 53 L/min

Features and Benefits

- Modular base eliminates hoses 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
- D5 Dirt Alarm® indicates when filter element needs changed
- Cleans up oil faster – 7 gpm and 14 gpm models available
- Hoses and connection tubes included (13' total length)
- Drip pan catches oil before it falls to the ground
- Integral suction strainer protects pump
- Off-line stationary system available – see Kidney Loop System

Description

The Schroeder Mobile Filtration System 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 most attractive feature of the Mobile Filtration System 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 through the patented K9 base-ported filter housing.

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

Schroeder now offers the HY-TRAX® manual fluid sampling system as an additional option. ISO particle counts are visually displayed on the TCM. Users will now know when they have reached their desired ISO contamination levels.

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

Specifications

Flow Rating:	7 gpm (26.5 L/min) max or 14 gpm (53.0 L/min) max
Viscosity Range:	40 - 1,000 SUS (4 - 216 cSt) Higher viscosity version available. Contact factory for details.
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: 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 VAC Single phase 3/4 hp (7 gpm) or 1-1/2 hp (14 gpm)
Element Change Clearance:	8.50" (215 mm) 1K (9, 18 or 27" depending on model configuration)

Weights

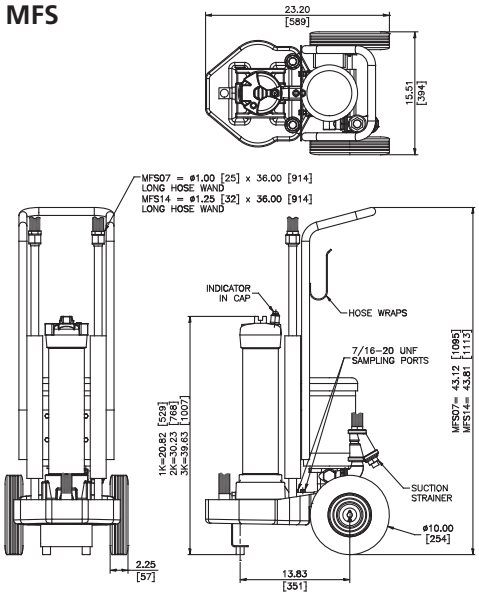
gpm	MFS-1K lb (kg)	MFS-2K lb (kg)	MFS-3K lb (kg)	MFD-1K lb (kg)	MFD-2K lb (kg)	MFD-3K lb (kg)
7	170 (77)	180 (82)	190 (86)	185 (84)	203 (92)	220 (100)
14	170 (80)	187 (85)	197 (89)	192 (87)	210 (95)	227 (103)

Mobile Filtration Systems

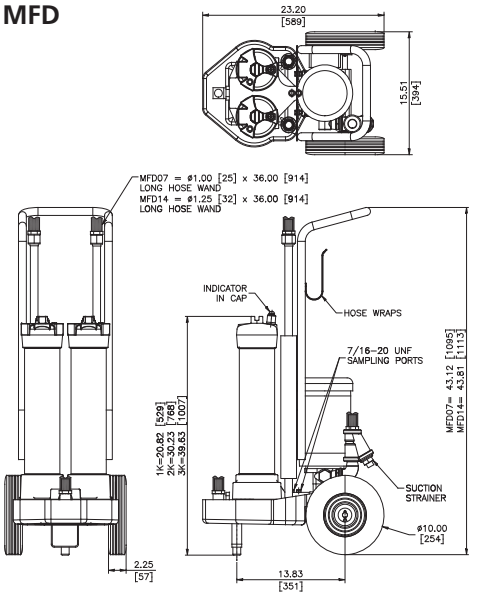
U.S. Patents 6568919 7604738

MFS MFD

MFS



MFD



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder MFS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
MFS								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
MFS	1	09	Z10		B		07		= MFS109Z10B07

BOX 1

Model
MFS
MFD

BOX 2

No. of Elements
1
2
3

BOX 3

Element Length
09
18
27

BOX 4

Element Media First Filter
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 5

Element Media Second Filter (MFD Only)
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 6

Seal Material
B = Buna
V = Viton®
H.5 = Skydrol Compatibility

BOX 7

Voltage
Omit = 115 V / 60 Hz
A = 230 V / 60 Hz
B = 460 V / 60 Hz
C = 220 V / 50 Hz

BOX 8

Pump Size(gpm)
07
14

BOX 9

Particle Counter
P = Particle Counter
Omit = Without Particle Counter

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

NOTES:

Box 2. When Box 2 is 2 or 3, Box 3 must be 09.

Box 5. If MFD is ordered, the quantity, length, and seals will be identical for both filter housings.

Box 6. H.5 seal designation may be used with 3, 5, 10, and 25µ Z (synthetic) and calls for EPR seals, stainless steel wire mesh in element(s) and Imron® epoxy coated enclosures on cart. H.5 not available with 7 gpm pump. Imron® is a registered trademark of DuPont.

Box 7. 230 & 460 Volt, 60 Hz options supplied with starters. 230 Volt, 50 Hz units will have plug cut-off from power cord and include no starters, flow ratings reduced to ~5-gpm and 11-gpm. Contact factory for high viscosity version.

Box 9. Particle counter option only available on 115VAC 60 hertz carts. Particle counter is not available with Skydrol fluids.

MFD-MV Medium Viscosity Mobile Filtration Systems

6 or 10 gpm
22.7 to 37.9 L/min

MFD-MV

Features and Benefits

- Ability to filter fluids having a viscosity up to 5,000 SUS
- Top-ported filter provides easy element service
- 7' hose and extension wands included (10' total length)
- 18" housing is standard, 27" housings are optional

Description

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

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

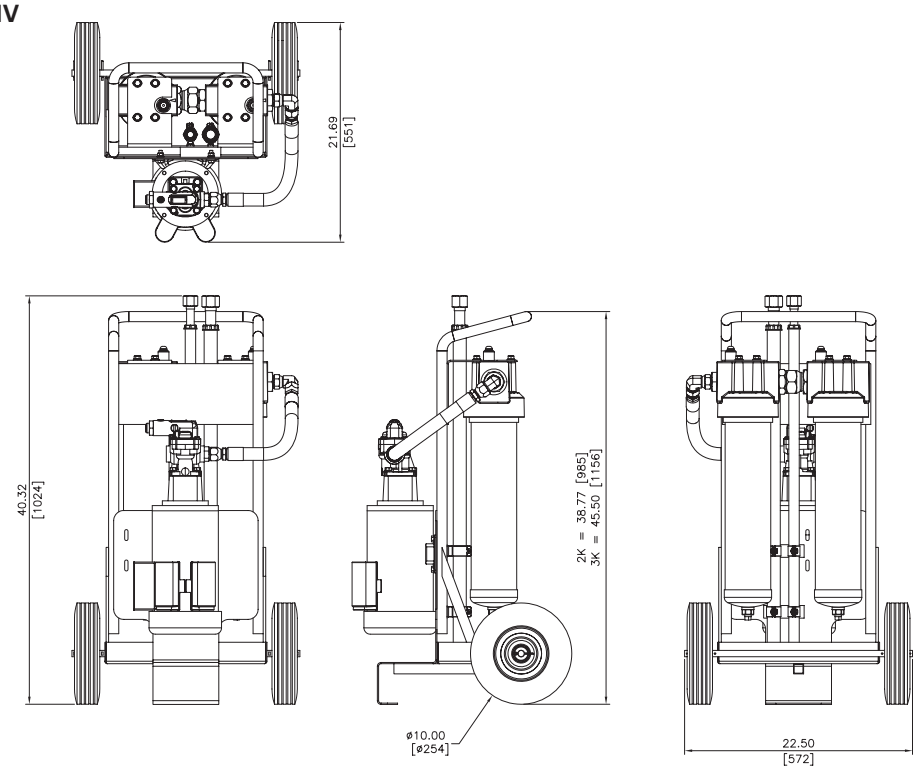
Specifications

Flow Rating:	6 or 10 gpm (22.7 or 37.9 L/min) max
Maximum Viscosity:	up to 5,000 SUS (1000 cSt)
Hose Pressure Rating:	30 psig (2.0 bar) at 150°F (65.6°C) Full vacuum at 150°F (65.6°C)
Maximum Operating Temperature:	-20°F to 150°F (-29°C 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:	1.0 hp 110 VAC/60 Hz TEFC (6 gpm) 1.5 hp 110 VAC/60 Hz TEFC (10 gpm)

Medium Viscosity Mobile Filtration Systems

MFD-MV

MFD-MV



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder MFD-MV:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
MFD-MV						

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
MFD-MV	1	18	G10	G05	V	6	**= MFD-MV118G10G05V6**

BOX 1

Model
MFD-MV

BOX 2

No. of Elements
1

BOX 3

Element Length
18
27

BOX 4

Element Media First Filter
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 5

Element Media Second Filter
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 6

Seal Material
V = Viton®

BOX 7

Pump Size(gpm)
6
10

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

NOTES:

Box 5. When MFD is ordered, the number of elements, element length, and seals will be identical for both filter housings.

MFS-HV
MFD-HV

High Viscosity Mobile Filtration Systems

U.S. Patents 6568919 7604738

3 gpm max
7.5 L/min

MFD-HV

Features and Benefits

- Ability to filter fluids having a viscosity up to 15,000 SUS
- Flow rates up to 3 gpm
- 115 V AC single phase 1 1/2 HP motor
- Dual filtration unit, available to remove both water and particulate contamination or for staged particulate contamination removal
- Modular base eliminates hoses between components and minimizes leakage
- Base-ported filter provides easy element service from the top cap
- Ten-foot hose and extension tubes included (13' total length)
- Drip pan catches oil before it falls to the ground
- 27-inch housing is standard
- Integrated lifting eye option

Description

The Schroeder Mobile Filtration System for high viscosity applications 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 prefiltering and transferring fluids. Remember, new fluid does not mean clean fluid! Most new fluids have contamination levels significantly higher than is recommended for most hydraulic systems.

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

Specifications

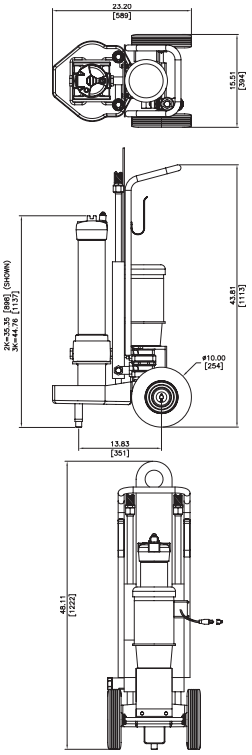
Flow Rating:	3 gpm (7.5 L/min) max
Maximum Viscosity:	15,000 SUS (3236 cSt)
Hose Pressure Rating:	30 psig (2.0 bar) @ 150°F (65.6°C) Full vacuum @ 150°F (65.6°C)
Fluid Temperature:	25°F to 150°F (-4°C to 65°C)
Bypass Valve Setting:	Cracking: 40 psi (2.8 bar)
Material:	Manifold and cap: Cast Aluminum Element case: Steel
Compatibility:	All petroleum based hydraulic fluid. Contact factory for use with other fluids.
Motor:	115 VAC Single phase 1.5 hp
Element Change Clearance:	8.50 (215 mm) 1K (9, 18 or 27" depending on model configuration)
Weight:	MFS-HV - 230 lbs (104 kg); MFD-HV - 260 lbs (118 kg)

High Viscosity Mobile Filtration Systems

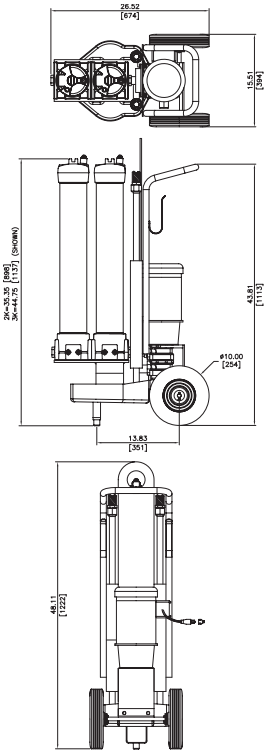
U.S. Patents 6568919 7604738

MFS-HV
MFD-HV

MFS-HV



MFD-HV



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder MFS-HV:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
MFD-HV						

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
MFD-HV	1	27	Z10	Z05	B	03	= MFD-HV127Z10Z05B03

BOX 1

Model
MFS-HV
MFD-HV

BOX 2

No. of Elements
1

BOX 3

Element Length
18
27

BOX 4

Element Media First Filter
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 5

Element Media Second Filter (MFD-HV Only)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 6

Seal Material
B = Buna
V = Viton®

BOX 7

Pump Size(gpm)
03

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

NOTES:

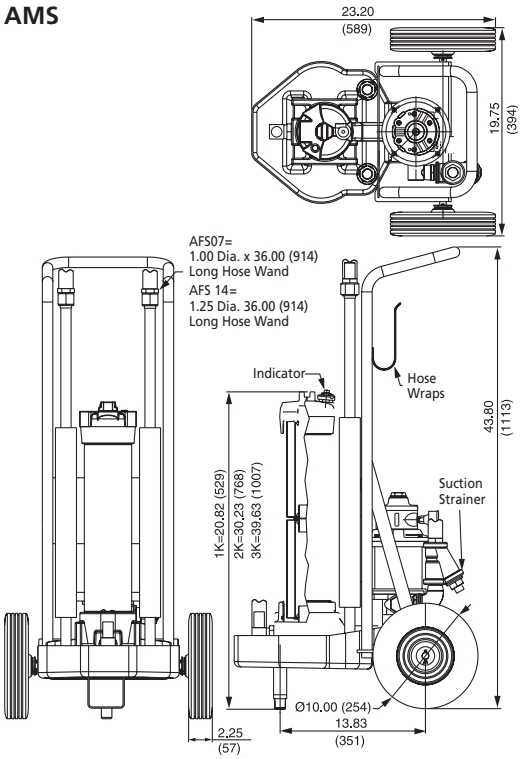
Box 5. When MFD is ordered, the number of elements, element length, and seals will be identical for both filter housings.

AMS AMD Air -Operated Mobile Filtration Systems

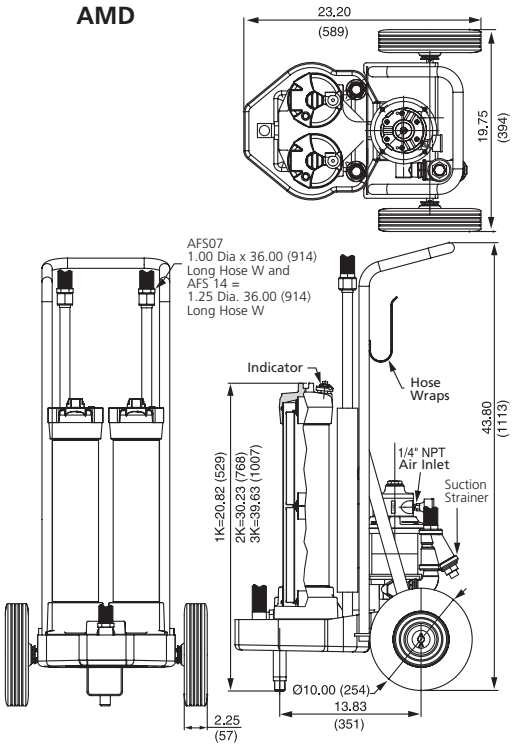
U.S. Patents 6568919 7604738

7 or 14 gpm
26.5 or 53 L/min

AMS



AMD

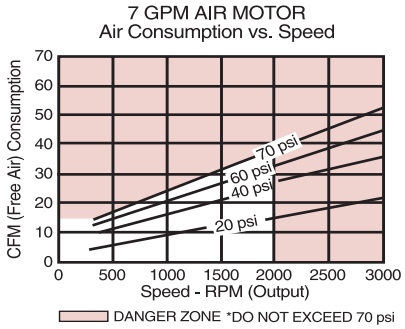


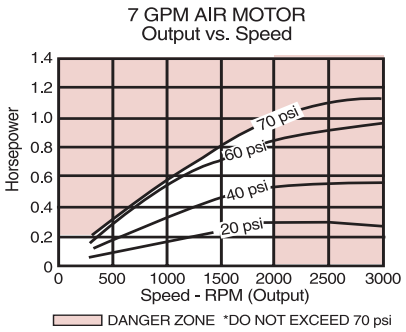
Metric dimensions in ( ).

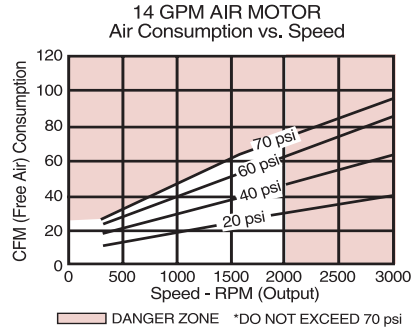
Description

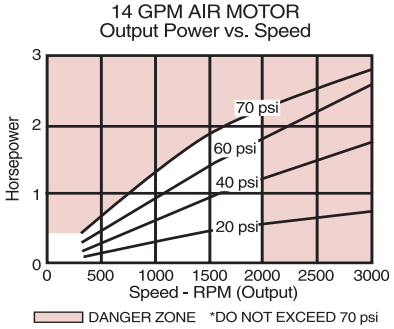
Schroeder's AMS and AMD carts feature a pneumatic motor in place of the standard electric motor. The pneumatic motor offers the same flow capability using the same components, but without the need for an electrical outlet. This provides a major advantage in the application of this unit. With no need 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 4.0 HP motor) of compressed air. Because no electricity is used, the pneumatic motor is ideal for working in hazardous environments such as mines.









NOTES:

Performance data represents a 4-Vane model with no exhaust restriction.

Air-Operated Mobile Filtration Systems

U.S. Patents 6568919 7604738

AMS
AMD

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
- Field applications on service trucks

Specifications

Flow Rating:	7 gpm (26.5 L/min) max and 14 gpm (53.0 L/min) max
Maximum Viscosity:	1,000 SUS (216 cSt) Higher viscosity version available. Contact factory for details.
Housing Pressure Rating:	250 psi (17.2 bar) max operating[1] 1,000 psi (68.9 bar) min yield
Fluid Temperature:	25°F to 150°F (-4°C to 65°C)[2]
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:	8.50" (215 mm) 1K (9, 18 or 27" depending on model configuration)

[1]For higher hose pressure applications contact factory.
[2]For higher temperature applications contact factory.

Weights

gpm	AMS-1K lb	AMS-1K (kg)	AMS-2K lb	AMS-2K (kg)	AMS-3K lb	AMS-3K (kg)	AMD-1K lb	AMD-1K (kg)	AMD-2K lb	AMD-2K (kg)	AMD-3K lb	AMD-3K (kg)
7	170	(77)	180	(82)	190	(86)	185	(84)	203	(92)	220	(100)
14	177	(80)	187	(85)	197	(89)	192	(87)	210	(95)	227	(103)

Model Number Selection

How to Build a Valid Model Number for Schroeder AMS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
AMS						

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
AMS	1	09	Z10		B	14	**= AMS109Z10B14**

BOX 1

Model
AMS
AMD

BOX 2

No. of Elements
1
2
3

BOX 3

Element Length
09
18
27

BOX 4

Element Media First Filter
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 5

Element Media Second Filter (AMD Only)
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 6

Seal Material
B = Buna

BOX 7

Pump Size(gpm)
07
14

NOTES:

Box 2 & 3. When Box 2 equals 2 or 3, Box 3 must be 09.

Box 5. When AMD is ordered, the number of elements, element length, and seal will be identical for both filter housings.

Box 7.
07 gpm - 50 CFM at 70 psi
14 gpm - 70 CFM at 70 psi

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

FS Filtration Station® Schroeder SMART TECHNOLOGY INSIDE

U.S. Patents 6979397

9 gpm or 3-8 gpm variable *34 L/min or 11-30 L/min*

Features and Benefits

- 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 are included to protect the particle monitor from clogging
- Water sensor allows real-time water saturation of the fluid to be displayed
- Bypass valve allows cart to be used as a transfer cart
- Single lift point
- Plastic removable drip pan
- Hoses and connection tubes included (13' total length)

Description

The Filtration Station® (FS) is capable of flushing, filtering, and monitoring ISO cleanliness with user-defined, automatic features. The FS is designed to transfer fluid through two (2) K9 filters in series for staged particulate or water/particulate removal. The FS is always furnished with two filter housings. 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. The included water sensor reports the water saturation of the fluid, which is displayed on the control panel.

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 require roll-off cleanliness levels
- Lubricant Reclamation/Recycling: Clean oil to extend oil life and reduce hazardous waste

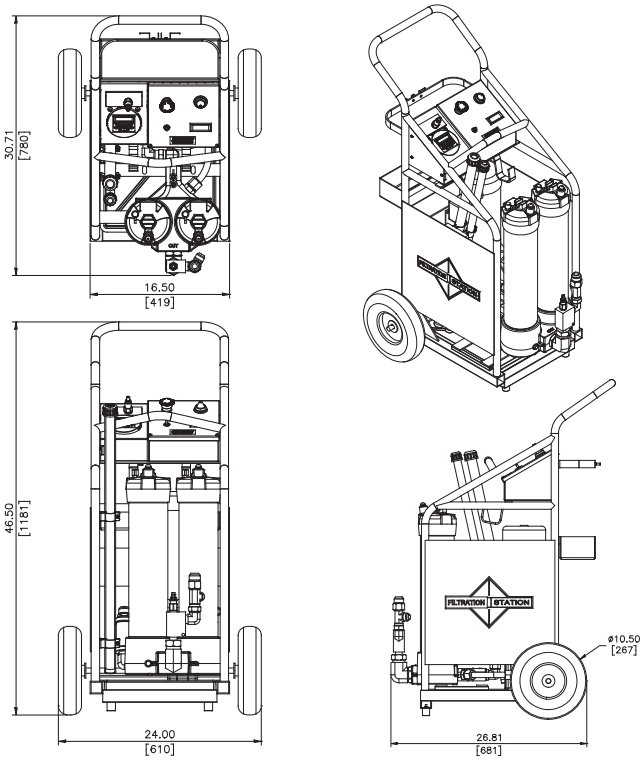
Specifications

Flow Rating:	9 gpm (34 l/min) fixed or 3-8 gpm (11-30 l/min) variable
Motor:	1.5 HP - 15 amps at 120 volts AC for fixed flow 1 HP - 10 amps at 120 volts AC for variable flow
Viscosity:	60 - 1,000 SUS (10-216 cSt)
Fluid Temperature Range:	-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:	8.50" (215 mm) 1K
Weight:	195 lbs (89 kg)
Protection Class:	IP54 (DIN 40050)

***Note: Optional front caster set PN: 7627132 includes (2) plate mount swivel casters with brake, installation hardware and mounting instructions.**

Element Performance Information

Element	Filtration Rating Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Rating wrt ISO 16889 Using APC calibrated per ISO 11171		Dirt Holding Capacity gm
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x(c) \geq 200$	$\beta_x(c) \geq 1000$	
KZ5/KKZ5	2.5	3.0	4.0	4.8	6.3	119 / 238
KZ10/KKZ10	7.4	8.2	10.0	8.0	10.0	108 / 216
KZ25/KKZ25	18.0	20.00	22.5	19.0	240.	93 / 186



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder FS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
FS								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
FS	A	1	27	Z05	Z03	B	9	W	= FSA127Z05Z03B9W

BOX 1

Model
FS

BOX 2

Voltage
A = 120 V / 60 Hz
B = 220 V / 60 Hz
C = 220 V / 50 Hz

BOX 3

No. of Elements
1
2
3

BOX 4

Element Length
09
18
27

BOX 5

Element Media First Filter
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Medi® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 6

Element Media Second Filter
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Medi® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 7

Seal Material
B = Buna
V = Viton®

BOX 8

Pump Size
9 = 9 gpm
D = DC drive, variable flow, 3-8 gpm

BOX 9

Water Sensor
W = TestMate® Water Sensor

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

NOTES:

Box 2. A plug is not provided for options B & C in Box 2 (220 V). If C is chosen, flow rate will be reduced to 7 and 6 gpm.

Box 3 & 4. Box 3 =1, Box 4 must be either 18 or 27; when Box 3 =2 or 3, Box 4 must be 09.

Box 9. The water sensor is to be used as a reference tool for hydraulic oil analysis purposes only.

AMFS Asset Management Filtration Station®

5 gpm
19 L/min

Features and Benefits

- 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 contaminated removal bypass valve allows cart to be used as a transfer cart
- Real Time data displays cleanliness and water saturation
- Selectable ISO target levels
- Only 3 entry fields needed to start the system and record data
- Hoses and connection tubes included (13' total length)

Description

The Asset Management Filtration Station® (AMFS) is a complete fluid management system designed to manage fluid cleanliness, so that the greatest return of that asset is achieved. The AMFS 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 rugged 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.

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
- Industry
- Paper Industry
- Power Generation
- Mobile Vehicles
- Steel Making

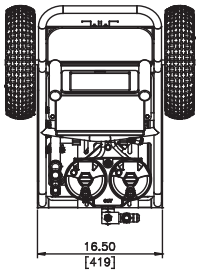
Specifications

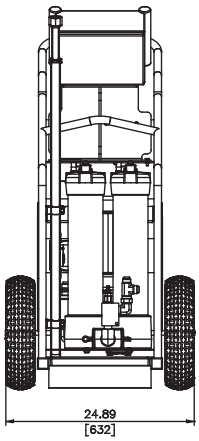
Flow Rating:	5 gpm (19 L/min)
Motor:	1.5 HP - 15 FLA at 120 volts AC
Viscosity Range:	60 - 1,000 SUS (10 - 216 cSt)
Operating Temperature:	-20°F to 150°F (-29°C to 65°C)
Bypass Valve Setting:	Cracking: 30 psi (2 bar) x 2
Compatibility:	All petroleum-based hydraulic fluid compatible with Viton®
Element Change Clearance:	17.5" KK / 26.5" 27K
Weight:	200 lbs (440 kg) *approx.*
Dimensions:	26.6" x 25.25" x 50.0" (675 x 641 x 1270 mm)

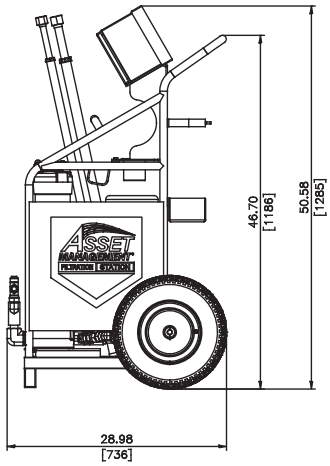
***Note: Optional front caster set PN: 7627132 includes (2) plate mount swivel casters with brake, installation hardware and mounting instructions.**

Asset Management Filtration Station®

AMFS







Metric dimensions in ( ).

Element Performance Information

GeoSeal® Element	Filtration Rating Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Rating wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x(c) \geq 200$	$\beta_x(c) \geq 1000$
KKGZ3/27KGZ3	<1.0	<1.0	<2.0	4.0	4.8
KKGZ5/27KGZ5	2.5	3.0	4.0	4.8	6.3
KKGZ10/27KGZ10	7.4	8.2	10	8.0	10.0

Dirt Holding Capacity

GeoSeal® Element	DHC (gm)	GeoSeal® Element	DHC (gm)
KKGZ3V	230	27KGZ3V	345
KKGZ5V	238	27KGZ5V	357
KKGZ10V	216	27KGZ10V	324

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

How to Build a Valid Model Number for a Schroeder AMFS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
AMFS				

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	
AMFS	1	27	G05	G03	= AMFS127G05G03

BOX 1

Model
AMFS

BOX 2

No. of Elements
1

BOX 3

Element Length
18
27

BOX 4

Element Media First Filter
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/ GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/ GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/ GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/ GeoSeal®

BOX 5

Element Media Second Filter
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/ GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/ GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/ GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/ GeoSeal®

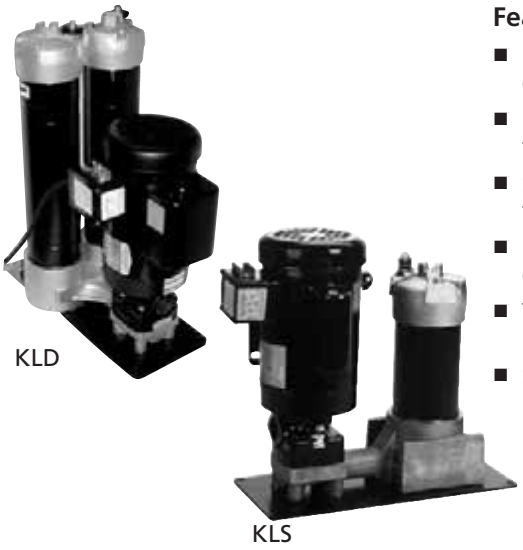
For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

KLS KLD

Kidney Loop Systems

U.S. Patents 6568919 7604738

7 or 14 gpm
26.5 or 53 L/min



KLD

KLS

Features and Benefits

- 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
- D5 Dirt Alarm® indicates when filter element needs changed
- Two 7/16 – 20 UNF sampling port included on all models (upstream)
- Suction strainers to protect pump

Description

Schroeder'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 free water removal. Like the Mobile Filtration System, the Kidney Loop System operates at a surprisingly low noise level. Its modular base eliminates hoses and fittings between components. The KLS single filtration unit can remove either water or particulate contamination. The KLD dual filtration unit can be used to remove both water and particulate contamination, or for staged particulate contaminant removal.

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

Specifications

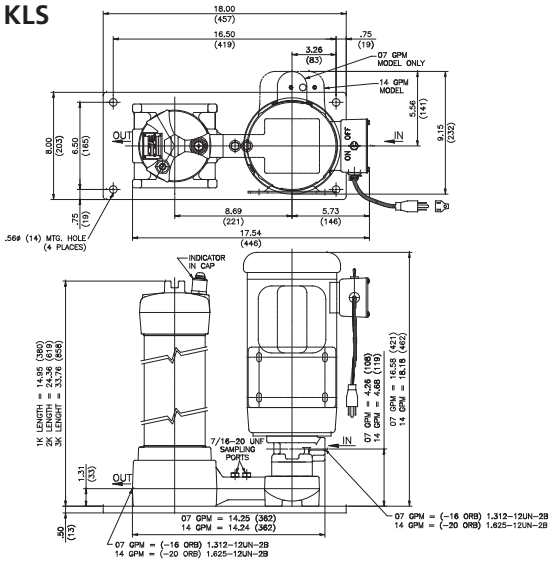
Flow Rating:	7 gpm (26.5 L/min) max and 14 gpm (53.0 L/min) max
Viscosity Range:	40 - 1,000 SUS (4 - 216 cSt) Higher viscosity version available. Contact factory for details.
Fluid Temperature:	25°F to 150°F (-4°C to 65°C)
Bypass Valve Setting:	Cracking: 30 psi (2 bar)
Material:	Manifold and cap: Cast aluminum Element case: Steel
Compatibility:	All petroleum based hydraulic fluid. Contact factory for use with other fluids.
Motor:	115 VAC single phase 3/4 hp (7 gpm) or 1-1/2 hp (14 gpm)
Weight:	**KLS-1:** 101 lb (45.9 kg) **KLS-2:** 112 lb (50.9 kg) **KLS-3:** 123 lb (55.9 kg) **KLD-1:** 117 lb (53.2 kg) **KLD-2:** 139 lb (63.2 kg) **KLD-3:** 161 lb (73.2 kg)
Element Change Clearance	8.50" (215 mm) 1K

Kidney Loop Systems

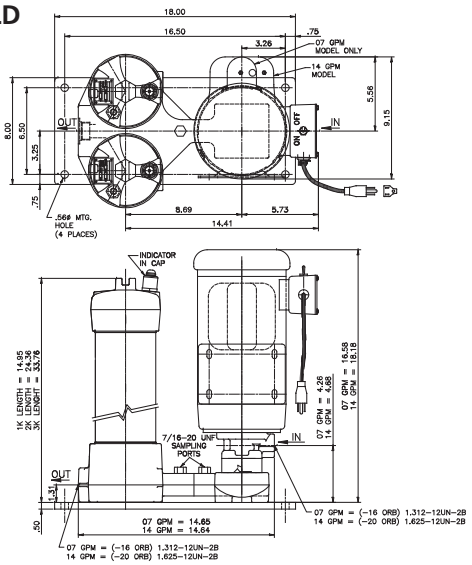
U.S. Patents 6568919 7604738

KLS KLD

KLS



KLD



Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder KLD:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
KLD							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
KLD	1	27	Z05	Z03	B		07	**= KLD127Z05Z03B07**

BOX 1

Model
KLS
KLD

BOX 2

No. of Elements
1
2
3

BOX 3

Element Length
09
18
27

BOX 4

Element Media First Filter
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 5

Element Media Second Filter (KLD only)
Z01 = 1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 = 3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 = 5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 = 10 µm Excel-ZPlus® Z-Media® (synthetic)
Z25 = 25 µm Excel-ZPlus® Z-Media® (synthetic)
EWR = Water Removal
G03 = 3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 = 25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR = Water Removal w/GeoSeal®

BOX 6

Seal Material
B = Buna
V = Viton®

BOX 7

Voltage
Omit = 115 V / 60 Hz/1-Phase
A = 230 V / 60 Hz /3-Phase
B = 460 V / 60 Hz /3-Phase
C = 220 V /50 Hz/1-Phase

BOX 8

Pump Size
07
14

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

NOTES:

Box 2 & 3 . When Box 2 equals 2 or 3, Box 3 must be 09.

Box 5 . When KLD is ordered, the number of elements, element length, and seals will be identical for both filter housings.

Box 7. Motor starter not included with options A or B. If C flow rate reduced to 5 & 12 gpm.

Contact factory if EPR seals are required. Contact factory for high viscosity version.

AKS AKD

Air-Operated Kidney Loop Systems

U.S. Patents 6568919 7604738

7 or 14 gpm
26.5 or 53 L/min

AKD

AKS

Features and Benefits

- 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
- D5 Dirt Alarm® indicates when filter element needs changed
- Two 7/16 – 20 UNF sampling port included on all models (upstream)
- Suction strainers to protect pump

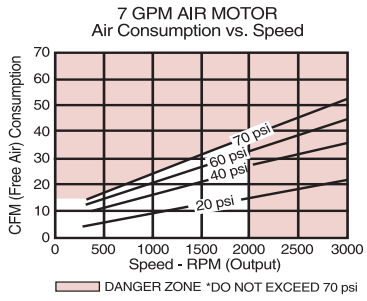
Description

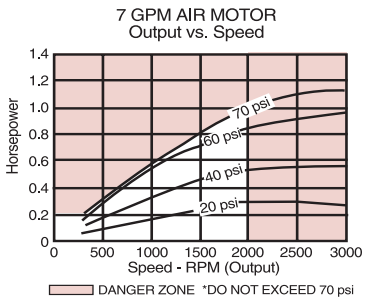
Schroeder offers a kidney loop filtration system with a pneumatic motor in place of the standard electric motor. The pneumatic motor offers the same flow capability using the same components, but without the need for an electrical outlet. This provides a major advantage in the application of this unit.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

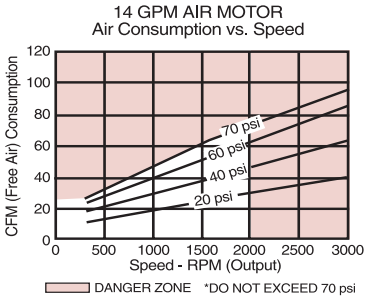
Because most trucks and industrial machinery are already equipped with an air compressor, a simple connection to the 1/4" NPT port will easily power the 1.5 HP (or 4.0 HP) motor. At 70 psi, and 2000 rpm, this motor consumes less than 40 cfm (70 cfm for the 4.0HP motor) of compressed air. Because no electricity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

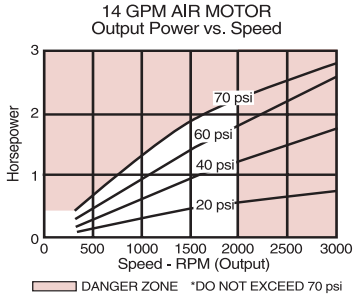
Applications

- 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









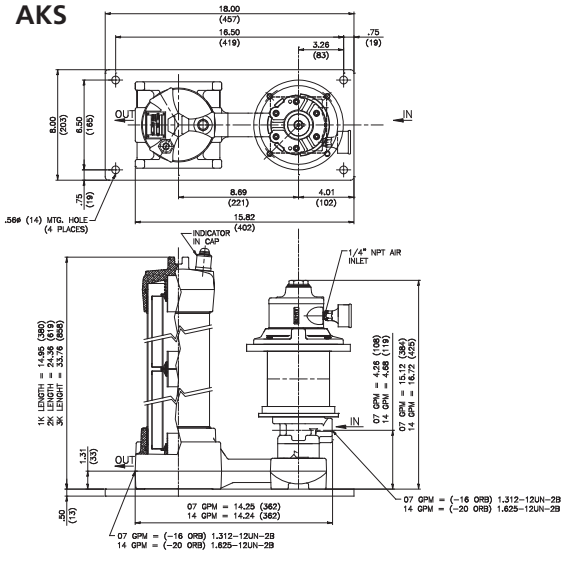
Note: Performance data represents a 4-vane model with no exhaust restriction.

Air-Operated Kidney Loop Systems

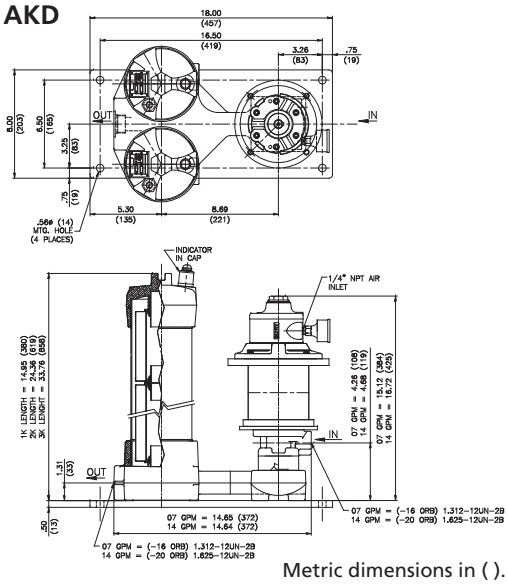
U.S. Patents 6568919 7604738

AKS AKD

AKS



AKD



Metric dimensions in ( ).

Specifications

Flow Rating:	7 gpm (26.5 L/min) max and 14 gpm (53.0 L/min) max
Maximum Viscosity:	1,000 SUS (216 cSt) Higher viscosity version available. Contact factory for details.
Fluid Temperature:	25°F to 150°F (-4°C 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:	8.50" (215 mm) 1K
Weight:	AKS1 = 86 lbs. (39 kg.) AKD1 = 98 lbs. (44 kg.) AKS2 = 98 lbs. (44 kg.) AKD2 = 120 lbs. (54 kg.) AKS3 = 108 lbs. (49 kg.) AKD3 = 142 lbs. (64 kg.)

Model Number Selection

How to Build a Valid Model Number for Schroeder AKS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
AKD						

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
AKD	1	09	Z10	Z05	B	14	**= AKD109Z10Z05B14**

BOX 1 — Model

AKS
AKD

BOX 2 — No. of Elements

1
2
3

BOX 3 — Element Length

09
18
27

BOX 4 — Element Media First Filter

Z01 =1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 =3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 =5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 =10 µm Excel-ZPlus® Z-Media®(synthetic)
Z25 =25 µm Excel-ZPlus® Z-Media®(synthetic)
EWR =Water Removal
G03 =3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 =5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 =10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 =25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR =Water Removal w/GeoSeal®

BOX 5 — Element Media Second Filter (AKD Only)

Z01 =1 µm Excel-ZPlus® Z-Media® (synthetic)
Z03 =3 µm Excel-ZPlus® Z-Media® (synthetic)
Z05 =5 µm Excel-ZPlus® Z-Media® (synthetic)
Z10 =10 µm Excel-ZPlus® Z-Media®(synthetic)
Z25 =25 µm Excel-ZPlus® Z-Media®(synthetic)
EWR =Water Removal
G03 =3 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G05 =5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 =10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G25 =25 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
GWR =Water Removal w/GeoSeal®

BOX 6 — Seal Material

B = Buna

BOX 7 — Pump Size(gpm)

07
14

NOTES:

Box 2 & 3. When Box 2 equals 2 or 3, Box 3 must be 09.

Box 5. When AKD is ordered, the number of elements, element length, and seal will be identical for both filter housings.

Box 7.
07 gpm - 50 CFM at 70 psi
14 gpm - 70 CFM at 70 psi

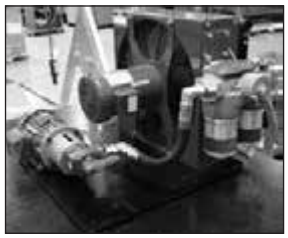
For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

LSN LSA LSW

Kidney Loop Systems

1.2 - 45.2 gpm
4.5 or 172 L/min

LSN & LSW



LSA

Features and Benefits

- Easy accessibility and reconfiguring
- Modular hydraulic accessories
- 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)
- Up to 100 HP cooling capacity
- Condition monitoring and control panels available

Description

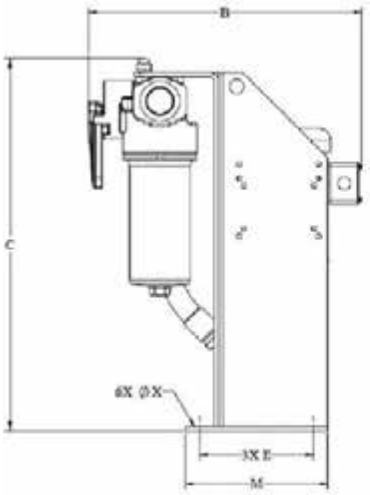
Schroeder's off-line Filter System has been designed to be a modular system to fit most hydraulic, lubrication and fluid transfer applications as a kidney loop system. The LSN is a compact, stand-alone pump/motor/filter configuration for removing particulate contamination. This off-line system can be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

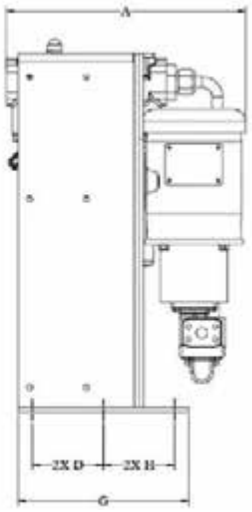
The base kidney loop system (LSN) can be equipped with AC air cooling (LSA), or plate water cooling (LSW) heat exchangers if heat removal of the fluid is required as well. Lowering the temperature of the fluid can enhance the life expectancy of the fluid and reduce the amount of oil aging occurring due to elevated heat levels.

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

LSN

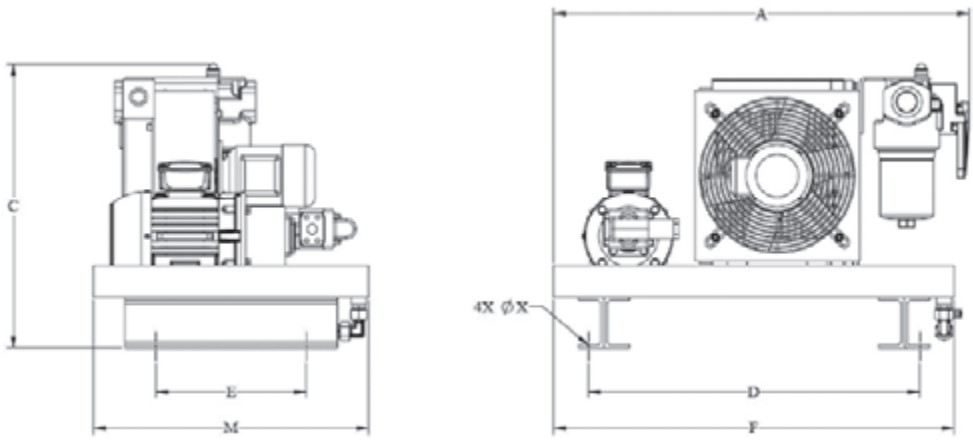




Metric dimensions in ( ).

	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)

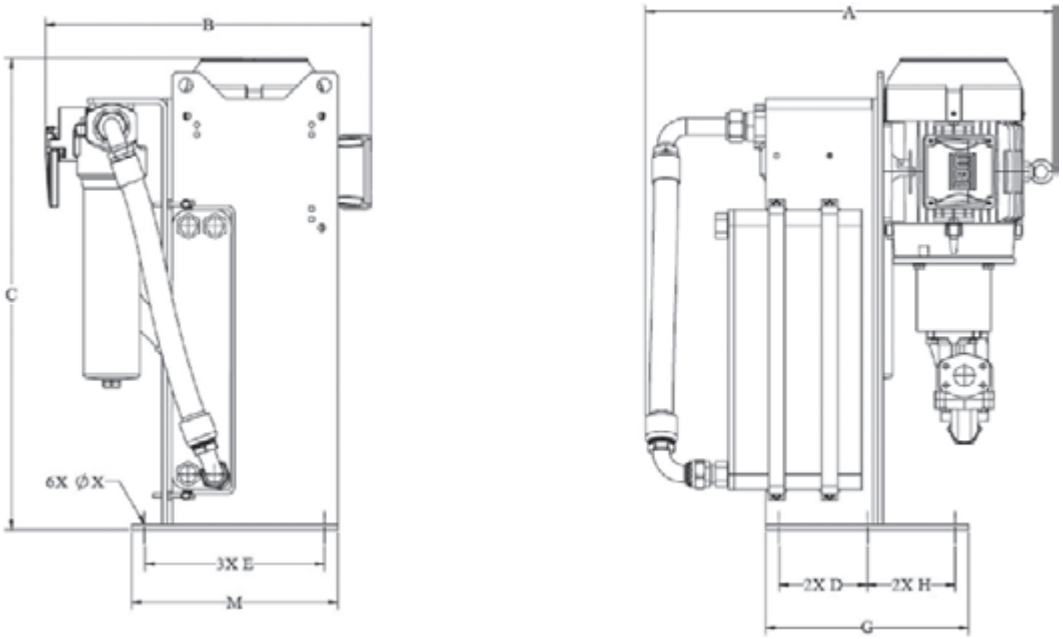
LSA



Metric dimensions in ( ).

	A Max	C Max	D	E	F Max	M Max	X
LSA 1, 2	45 (1143)	33.1 (840.74)	26.05 (661.67)	11.81 (299.97)	42.5 (1079.5)	25 (635)	0.53 (13.46)
LSA 3, 4	48 (1219)	45 (1143)	26.05 (661.67)	30 (762)	44 (1117.6)	46 (1168.4)	0.53 (13.46)

LSW



Metric dimensions in ( ).

	A Max	B Max	C Max	D	E	G	H	M	X
LSW 1	16.45 (417.83)	19.4 (492)	27.6 (701.04)	4.92 (124.97)	7.87 (199.90)	11.81 (299.97)	4.92 (124.97)	9.84 (249.94)	.55 (13.97)
LSW 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)
LSW 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)
LSW 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)

LSN LSA LSW

Kidney Loop Systems

Specifications

Flow Rating:	1.2 to 45.2 gpm
Standard Viscosity:	250-1,000 SUS (54-216 cSt) Higher Viscosity version available. Contact Factory for details
Compatibility:	All petroleum based hydraulic fluid. Contact factory for use with other fluids.
Operating Pressure:	Oil Side: 10 (145 psi) bar standard available up to 15 bar (217 psi) Water Side (LSW): 30 bar (435 psi) Filter Bypass: 2 bar (29 psi) and 5 bar (72 psi)
Pressure Drop:	1 bar (14.5 psi)
Fluid Temperatures:	Oil Side: 8° C (46° F) to 80° (176° F) Water Side: 5° C (41° F) to 60° C (140°) Ambient: -20°C (-4° F) to 50°C (122° F)
Seal Material:	Buna-N

NOTES:

Viscosity standard up to 1,000 SUS for higher viscosity contact factory

Control box and motor starter not included

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

How to Build a Valid Model Number for Schroeder LSN:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11
LSN –		–			–		–		–	

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11	
LSN –	3 –	P63L –	B –	LPF 240 –	5 –	–	BM –	5 –	–		**= LSN3P63LBLPF2405BM5**

BOX 1

Model
LSN
LSA
LSW

BOX 2

Size
1
2
3
4

BOX 3

Element Length			
Size 1	Size 2	Size 3	Size 4
P4L = 1.2 gpm (4.5 LPM)	P16L = 4.8 gpm (18.1 LPM)	P32L = 9.6 gpm (36.3 LPM)	P80L = 24.1 gpm (91.2 LPM)
P5L = 1.5 gpm (5.6 LPM)	P20L = 6.0 gpm (22.7 LPM)	P40L = 12.0 gpm (45.4 LPM)	P100L = 30.2 gpm (114.3 LPM)
P6L = 1.9 gpm (7.2 LPM)	P25L = 7.5 gpm (28.4 LPM)	P50L = 15.0 gpm (56.7 LPM)	P80S = 36.1 gpm (136.6 LPM)
P8L = 2.4 gpm (9.1 LPM)		P63L = 18.9 gpm (71.5 LPM)	P100S = 45.2 gpm (171.1 LPM)
P10L = 3.0 gpm (11.3 LPM)			
P12L = 3.8 gpm (14.3 LPM)			

BOX 4

Voltage
A = 115/230 V (1-Phase) - size 1 only
B = 208-230/460V (3-Phase)
C = 575V (3-Phase)

BOX 5

Filter
FLND 250 (for size 1, 2, 3)
FLND 400 (for size 2, 3, 4)
LPF 160 (for size 1, 2, 3)
LPF 240 (for size 2, 3)
LF 660 (for size 4)

BOX 6

Micron Rating
3
5
10
20

BOX 7

Optional Second Filter Micron Rating
3
5
10
20
Omit

BOX 8

Dirt Alarm®
BM = Visual
C = Electric
D = Visual/Electric

BOX 9

Filter Bypass Setting
2 = 30 psi (2 bar)
5 = 72 psi (5 bar)

BOX 10

Cooler Type (optional)
Contact Factory

BOX 11

Accessories
Contact Factory

NOTES:

Box 1. Cooler option LSA (air cooled) and LSW (water cooled contact factory).

Box 2 . Flow rates below 19 gpm (size 1, 2 and 3) contact factory).

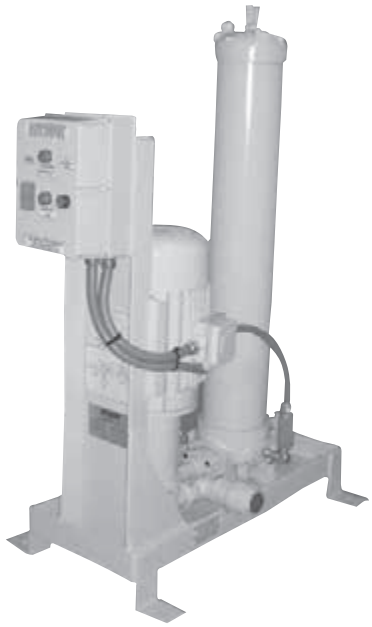
Box 4. Voltage 115/230V 1 phase for size 1 only, contact factory.

Box 7. Second filter (same as base filter selected, valid for FLND only) for staged filtration contact factory.

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Schroeder SMART TECHNOLOGY INSIDE X Series Filter Skids

X Series



Features and Benefits

- 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; next page)
- 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 protects oil from spilling on the ground
- Sample valves provided at filter base for fluid sampling
- Market leading Schroeder Excel-ZPlus® synthetic filtering media provides for quick, efficient clean up with maximum element life
- Availability of all plastic, environmentally friendly, coreless elements for QF5 housings (X1-X6 only)

Description

Schroeder's X 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. Schroeder considers maximum fluid viscosity, (at the minimum operating temperature) in conjunction with flow to properly size the pump and motor.

Standard X Series skids (X1, X2, X3 and X7) include a hydraulic pump, electric motor, and a QF5 housing. Standard X Series Skids (X4, X5, X6 and X8) include a hydraulic pump, electric motor, and dual K9 or QF5 housings. 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.

Schroeder's high viscosity X Series skids (X7 and X8) are designed to handle fluids that have a viscosity as high as 25,000 SUS. The skids have 39" long QF5 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. X7 and X8 skids include a pump, motor, QF5 filter, suction strainer, and dirt indicator. Various options can account for specific user needs.

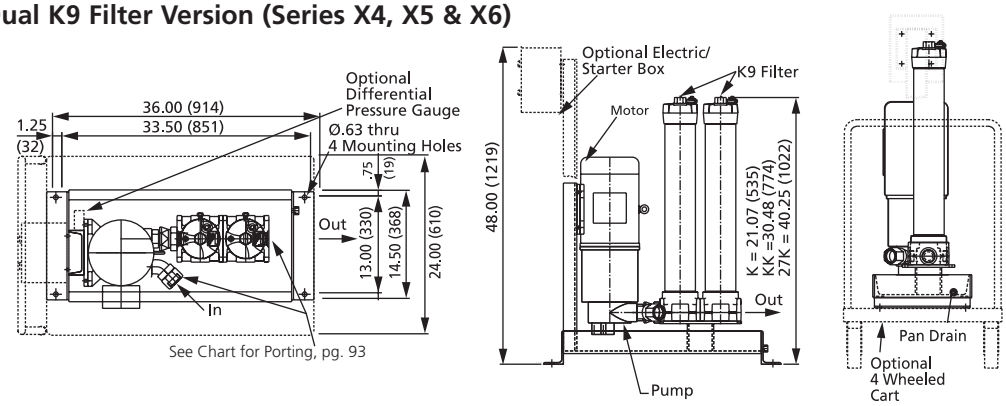
Skid Selection

Series	Viscosity Range	Filter Housing(s)	Maximum Flow
X1	150 - 500 SUS	(1) QF5	82 gpm (310 L/min)
X2	500 - 2000 SUS	(1) QF5	82 gpm (310 L/min)
X3	2000 - 5000 SUS	(1) QF5	37 gpm (140 L/min)
X4	150 - 500 SUS	(2) QF5 or K9 in series	82 gpm (310 L/min)
X5	500 - 2000 SUS	(2) QF5 or K9 in series	82 gpm (310 L/min)
X6	2000 - 5000 SUS	(2) QF5 or K9 in series	37 gpm (140 L/min)
X7	100 - 25,000 SUS	(1) QF5	6 gpm (23 L/min)
X8	100 - 25,000 SUS	(2) QF5 in parallel	30 gpm (114 L/min)

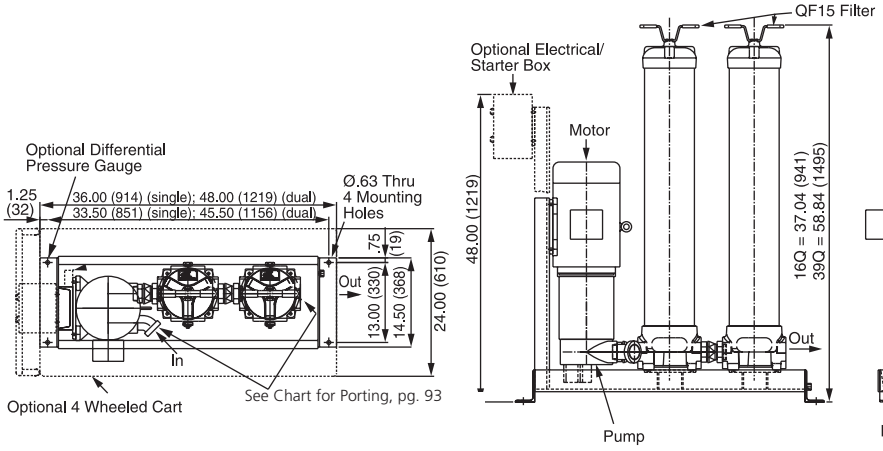
X Series Filter Skids

Schroeder SMART TECHNOLOGY INSIDE

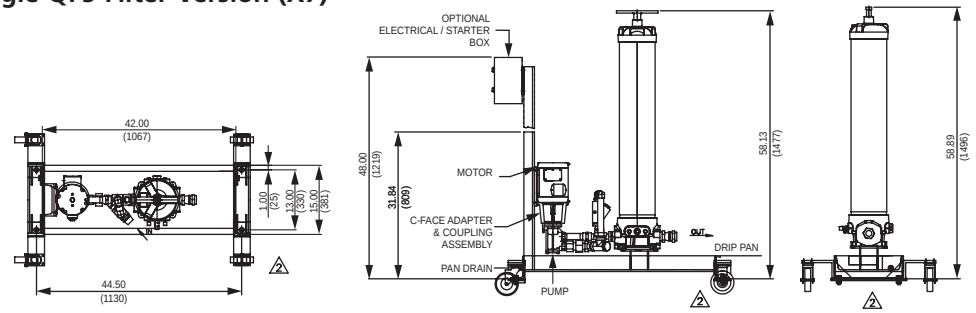
Dual K9 Filter Version (Series X4, X5 & X6)



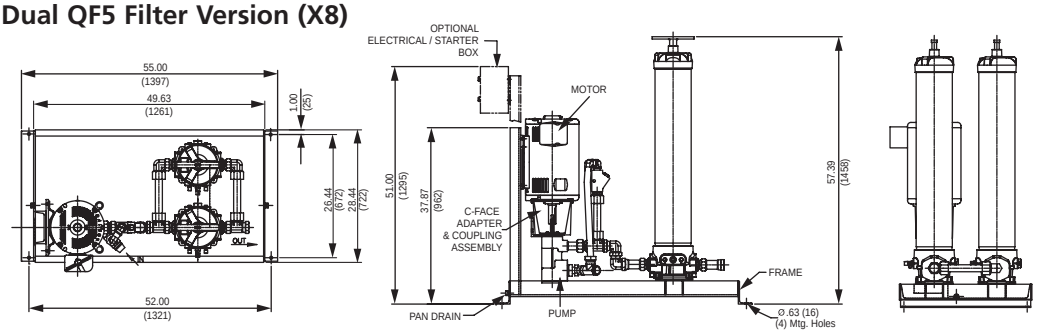
Dual QF5 Filter Version (Series X4, X5 & X6)



Single QF5 Filter Version (X7)



Dual QF5 Filter Version (X8)



Metric dimensions in ( ).

X Series Filter Skids

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 X1, X2, X3, X4, X5, X7, and X8 40 psi (2.8 bar) for skid series X6
Fluid Viscosity:	Up to 25,000 SUS (see Skid Selection; previous page)
Compatibility:	All petroleum based hydraulic fluids. Contact Schroeder for use with other fluids, including ester and skydrol.
Pump:	**X1-X6:** Continuous duty gear pump with integral 150 psi relief. Flow dependent on skid series and motor. Refer to table below. **X7-X8:** Positive displacement rotary screw pumps
Motor:	Horsepower dependent on skid series and flow. Refer to table below.
Porting:	Dependent on flow. Refer to table below.

Pump and Motor Data

Skid Series	Flow (gpm)	Motor (hp)	Skid Series	Flow (gpm)	Motor (hp)
X1	17 37 82	3 5 10	X5	17 37 82	5 10 15
X2	17 37 82	3 5 10	X6	17 37	5 10
X3	17 37	5 10	X7	06	2
X4	17 37 82	3 5 10	X8	30	15

Porting Data

Flow (gpm)	Inlet Port Sizes	Outlet Port Sizes with K9	Outlet Port Sizes with QF5 Filters
06	1" JIC	N/A	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

Weight Data

Skid Series	Flow (gpm)	Weight (lb)*	Skid Series	Flow (gpm)	Weight (lb)*
X1	17 37 82	300-504 329-577 476-705	X5	17 37 82	396-684 497-849 947-1054
X2	17 37 82	311-504 348-577 597-705	X6	17 37	370-659 502-607
X3	17 37	340-580 461-566	X7	06	Contact factory
X4	17 37 82	353-662 398-791 551-904	X8	30	Contact factory

*Weight dependent on options chosen.

X Series Filter Skids

Schroeder SMART TECHNOLOGY INSIDE

Model Number Selection

NOTES:

Box 1.
Z1 media not offered for use in 500 to 2000 SUS filtration skids. Contact factory for specific applications. (X2, X5) Z1 and Z3 media not offered for use in 2000 to 5000 SUS filtration skids. Contact factory for specific applications. (X3, X6)

Boxes 4 & 5.
Z1 media not offered for use in 500 to 2000 SUS filtration skids. Contact factory for specific applications. Z1 and Z3 media not offered for use in 2000 to 5000 SUS filtration skids. Contact factory for specific applications. All elements are singular construction (no stacked elements). QPML and QCLZ coreless elements only available in the QF5 housing. X7 skid has one filter housing, omit box 5. X8 skid has filters in parallel. Box 4 & 5 must have same micron rating.

Box 7.
115 VAC power option includes switch, 10' cord, and plug. For 1.5 hp motors only. 575 will be built to CSA standards. (E) X7 and X8 only available with 230/460 VAC 3 phase motor.

Boxes 9 and 10.
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. (Applies to M and C in Box 10).

Box 13.
Continuous bleed option – to eliminate filter air buildup in continuously aerated systems. Includes cap vent port, valve, and return line. (B) Suction strainer standard on all X Skids.

Particle Counter not available for X7 or X8.

How to Build a Valid Model Number for a Schroeder X Series Filter Skid:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11	BOX 12	BOX 13
X1												

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11	BOX 12	BOX 13	
X1	17	1Q	B		B	N	N	A	M	N	S	N	= X1171QBBNNAMNSN

BOX 1 / BOX 2 / BOX 3

Model	Flow (gpm)	K9 Filter 2K	K9 Filter 3K	QF5 Filter 16Q	QF5 Filter 39Q
X1	17			1Q	
	37			1Q	3Q
	82			1Q	3Q
X2	17			1Q	
	37				3Q
	82				3Q
X3	17			1Q	3Q
	37				3Q
X4	17	2K	3K	1Q	
	37	2K	3K	1Q	3Q
	82		3K	1Q	3Q
X5	17	2K	3K	1Q	
	37		3K		3Q
	82				3Q
X6	17	2K	3K	1Q	3Q
	37		3K		3Q
X7	06				3Q
X8	30				3Q

BOX 4 – Element Media 1st Filter

- A = 1 Micron
- B = 3 Micron
- C = 5 Micron
- D = 10 Micron
- E = 25 Micron
- F = QCLQFZ1
- G = QCLQFZ3
- H = QCLQFZ5
- J = QCLQFZ10
- L = QCLQFZ25
- M = QPMLZ1
- P = QPMLZ3
- R = QPMLZ5
- S = QPMLZ10
- T = QPMLZ25
- W = W

BOX 5 – Element Media 2nd Filter (omit for X1 thru X3 skids)

- N = NA
- A = Z1 (K or Q)
- B = Z3 (K or Q)
- C = Z5 (K or Q)
- D = Z10 (K or Q)
- E = Z25 (K or Q)

Coreless

- F = QCLQFZ1
- G = QCLQFZ3
- H = QCLQFZ5
- J = QCLQFZ10
- L = QCLQFZ25

Deeper Pleats

- M = QPMLZ1
- P = QPMLZ3
- R = QPMLZ5
- S = QPMLZ10
- T = QPMLZ25

- W = W

BOX 6 – Seal Material

- B = Buna (Standard)
- H = EPR
- V = Viton®

BOX 7 – Power

- A = 115 VAC 1.5 hp (Available only with 109, 209, and 309)
- N = 230/ 460 VAC 3 PH.
- E = 575 VA 3 PH

BOX 8 – Motor Frame

- N = TEFC
- W = Washdown (NEMA Design B)

BOX 9 – 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)
- G = 220 VAC, 50 Hz, Single Phase
- H = 200 VAC, 50 Hz, 3-Phase

BOX 10 – Dirt Alarm®

- N = Cartridge in Cap (Standard)
- G = Differential Pressure Gauge
- M = MS11 Electric Cartridge
- C = Differential Pressure Gauge with Electric Switch

BOX 11 – Vacuum Gauge

- N = None
- V = Vacuum Gauge

BOX 12 – Suction Strainer (standard)

- S = Suction Strainer

BOX 13 – Miscellaneous Options

- N = None
- C = Mobile
- B = Continuous Bleed
- P = Particle Counter

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Kidney Loop Compact Systems KLC

Features and Benefits

- Lower operating costs
- Extended element service life
- Extended fluid life
- Cleaner and more efficient systems
- Easy installation
- High dirt-holding capacity
- Requires low volume of oil

Description

Schroeder's series of Kidney Loop - Compact (KLC) filters are designed to filter highly contaminated hydraulic oils efficiently and cost effectively off-line. The KLC is designed for use on hydraulic systems with a reservoir of up to 1000 gallons and is perfect for retrofit situations when additional filtration is required. This compact filter is easy to install and ideal for gear boxes. They are supplied as ready-to-install off-line units complete with pump/motor assembly.

Applications

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

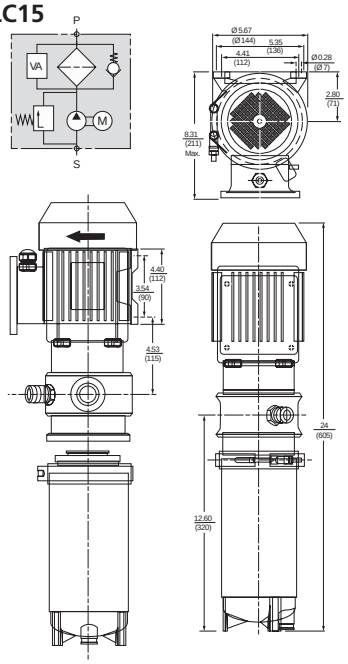
Specifications

Viscosity:	**KLC04** to 10,000 SUS **KLC05** to 700 SUS **KLC15** to 3,000 SUS
Operating Pressure:	45 psi (3 bar) max
Suction Pressure:	11" Hg (-0.4 to 6 bar) max
Fluid Temperature:	32°F to 175°F (0°C to 80°C)
Ambient Temperature:	-4°F to 104°F (-20°C to 40°C)
Seals:	Buna N
Maximum Flow Rate:	**KLC04** 1.3 gpm **KLC05** 1.6 gpm **KLC15** 4.9 gpm
Fluids:	Standard mineral oils, water/oil based fluids (min 40% oil in fluid), Consult factory for other fluids
Media:	Dimicron with or without water removal capability - (2 µm, 20 µm)
Dirt Holding Capacity:	200g ISO MTD (KLE particulate elements) / 185g ISO MTD (KLE water elements)
Water Retention:	Approximately 0.5 quarts (0.5 liters)
Beta Ratio:	ßx > 1000
Maximum ΔP:	45 psi (3 bar)
Connections with Pump/Motor:	**KLC04** 1 5/16"-12 SAE Female Straight Thread **KLC05** 3/4"-16 SAE Female Straight Thread **KLC15** 1 5/16"-12 SAE Female Straight Thread
Weight:	**KLC04** 24.3 lbs (11.0 kg) **KLC05** 15.5 lbs (7.0 kg) **KLC15** 24.3 lbs (11.0 kg)

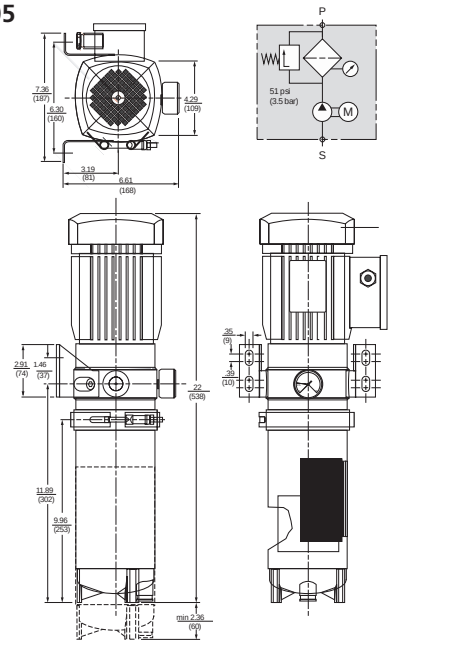
Note: SAE connections when using supplied adapters; BSPP connections when supplied adapters are not used. Housing drain standard on all models.

KLC Kidney Loop Compact Systems

KLC04 | KLC15



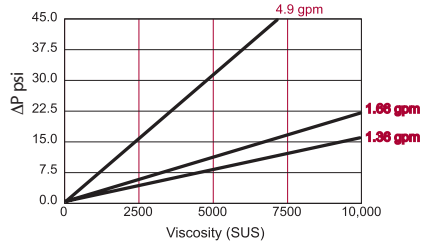
KLC05



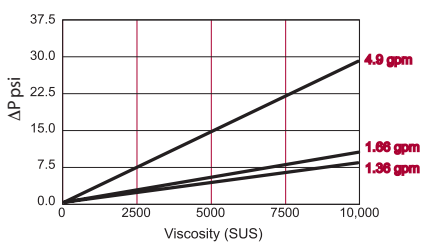
Metric dimensions in ( ).

Pressure Drop

KLE02 (2 µm element without water retention)



KLE20 (20 µm element without water retention)



Model Number Selection

How to Build a Valid Model Number for a Schroeder KLC:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
KLC04						

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
KLC04	V	3	20	VD			**= KLC04V320VD**

BOX 1

Model
KLC04
KLC05
KLC15

BOX 2

Pump Type
V = Vane Pump
F = Flow Control Valve (pump and motor not included)

BOX 3

Voltage
1 = 12VDC
2 = 24VDC
3 = 115V single phase
4 = 220V single phase
5 = 220/440V 3 phase
6 = 380V, 3 Phase, 50 Hz

BOX 4

Element
2 = 2 micron
5 = 5 micron
10 = 10 micron
20 = 20 micron
A02 = 2 micron with water removal
A20 = 20 micron with water removal

BOX 5

Indicator
F = Static Electrical Switch
VD = Differential Visual
ED = Differential Electrical
EVD = Differential Visual/Electrical
G = Standard Gauge

BOX 6

Loading Feature (KLC15 Series Only)
T = Top Loading Element

BOX 7

Options (KLC15-T Series Only)
C = TCM with no display
CD = TCM with display
AC = TCM and TWS with no display
ACD = TCM and TWS with display

NOTES:

Box 2 . F is only available for KLC05

Box 5 . G is only available with KLC05. VD, ED and EVD are only available with KLC04 and KLC15.

Box 6 . Top load option only available with KLC15 model.

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Membrane Technology Systems MTS

Single Membrane Element

Element Cross Section

Features and Benefits

- Effectively cleans hydraulic and cleaning fluids, lubricating oils, and coolants
- Provides excellent dirt removal efficiency, even in single pass filtration
- Available with pump and motor or can be utilized as an individual filter
- Included framework makes unit ready to install
- Easy to retrofit existing system
- Test points provided on all models
- Housing drain standard on all units

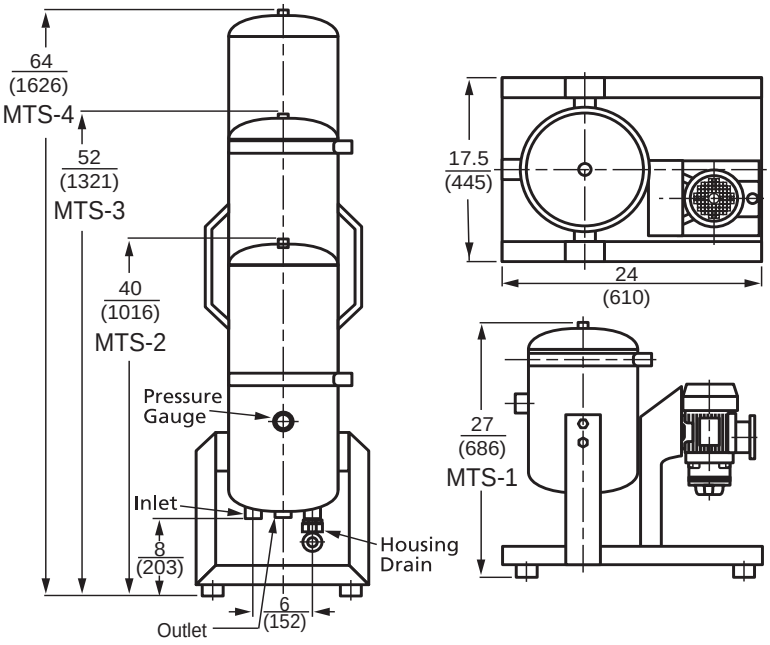
5 - 20 gpm
18.93-75.71 L/min
6.0 bar
85 psi

Description

The MTS from Schroeder is an off-line filtration system that features unique membrane elements constructed of stacked disks where dirt holding capacity is measured in pounds instead of grams, drastically reducing the amount of time required to clean up highly contaminated fluids. The abundant media surface area afforded by the stacked disk construction combined with the highly efficient membrane filtration give the MTS its very impressive dirt retention characteristics. The MTS can hold up to four filter elements and can be supplied as a stand-alone filter or with a pump and motor.

Applications

- Off-line filtration for hydraulic systems and test stands
- Bypass filtration
- Flushing and filling applications
- In-line auxiliary filtration

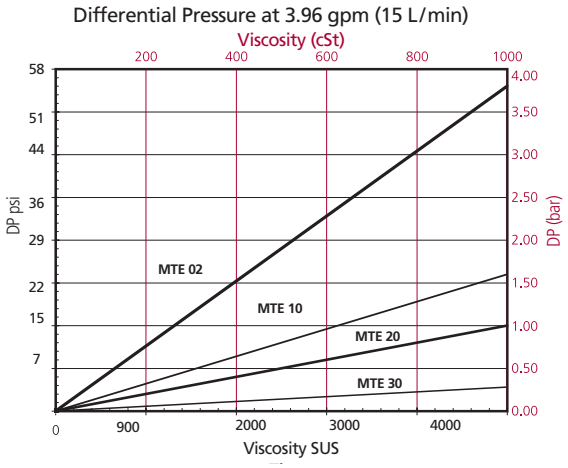


Metric dimensions in ( ).

Specifications

	MTS-1	MTS-2	MTS-3	MTS-4
Number of Elements:	1	2	3	4
Contamination Retention Capacity:	1.1 lbs (500 g)	2.2 lbs (1000 g)	3.3 lbs (1500 g)	4.4 lbs (2000 g)
Filter Efficiency:	$\beta_x > 1000$	$\beta_x > 1000$	$\beta_x > 1000$	$\beta_x > 1000$
Permissible Δp Across the Element:	72.5 psi (5.0 bar)	72.5 psi (5.0 bar)	72.5 psi (5.0 bar)	72.5 psi (5.0 bar)
Material of Filter Housing:	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Capacity of Pressure Vessel:	5.25 gal (19.87 L)	10.50 gal (39.75 L)	15.75 gal (59.62 L)	20.5 gal (77.60 L)
Max Operating Pressure Filter Housing:	85 psi (6.0 bar)	85 psi (6.0 bar)	85 psi (6.0 bar)	85 psi (6.0 bar)
Material of Seals-Housing (standard):	Buna N	Buna N	Buna N	Buna N
Fluid Temperature:	15° to 175°F (-9.44° to 79.44°C)	15° to 175°F (-9.44° to 79.44°C)	15° to 175°F (-9.44° to 79.44°C)	15° to 175°F (-9.44° to 79.44°C)
Technical Details for Motor-Pumps Units:	5 gpm (18.93 L/min)	10 gpm (37.85 L/min)	15 gpm (56.78 L/min)	20 gpm (75.71 L/min)
Operating Pressure of the Pump:	65 psi (4.48 bar)	65 psi (4.48 bar)	65 psi (4.48 bar)	65 psi (4.48 bar)
Viscosity Range with Vane Pump (SUS):	75 to 2500	75 to 2500	75 to 2500	75 to 2500
Gear Pump (SUS)	75 to 5000	75 to 5000	75 to 5000	75 to 5000
Motor Capacity (watts) Vane Pump:	370 W	570 W	1500 W	1500W
Weight Vane Pump:	17 lbs (7.71 kg)	30 lbs (13.61 kg)	43 lbs (19.50 kg)	43 lbs (19.50 kg)
Weight Element	6.6 lbs (2.99 kg)	13.2 lbs(5.99 kg)	19.8 lbs (8.98 kg)	26.4 lbs (11.97 kg)
Weight Housing:	25 lbs (11.34 kg)	33 lbs (14.97 kg)	53 lbs (24.04 kg)	62 lbs (28.12 kg)
Material of Seals in Pumps (standard):	Buna N	Buna N	Buna N	Buna N
Vane Pump Connectors:	Model MTS-1 MTS-2, 3, and 4	 1 1/16 -12UN (SAE 12) 1 5/8 -12UN (SAE 20)		
Housing Connections: (Units without motor pump groups)	1 5/16-12UN (SAE16)			

Element Pressure Drop

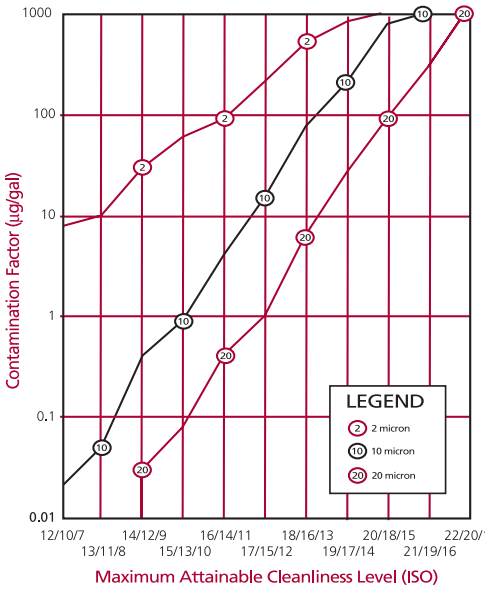


Sizing Off-line Filtration

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

Step 1: Select the approximate contamination ingression rate from the chart. 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 off-line filtration.
The contamination input selected above must be multiplied by the factor:
Main System Flow Rate / Desired Off-line 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:

$$\textbf{Contamination Factor} = \textbf{Contamination Input}\ (\mu g/gal) \times \frac{\textbf{Main System Flow Rate}\ (gpm)}{\textbf{Desired Off-line Flow Rate}\ (gpm)}$$

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 off-line filter, the attainable cleanliness level will be 2 to 3 times worse than indicated by the graph.)

Off-line Filtration Sizing Example:

Type of System: Heavy industrial press

Surroundings: Normal

Main System Flow Rate: 150 gpm

Desired Off-line Flow Rate: 20 gpm (MTS-4)

Step 1: Using this criterion select the approximate contamination ingression 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 off-line filtration.
Contamination Factor = 18 µg/gal x 150 gpm / 20 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 off-line flow rate should be increased. The approximate attainable levels for this example are as follows.**

2 µm - ISO 17/15/12

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

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

How to Build a Valid Model Number for a Schroeder MTS:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
MTS							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
MTS	2	2	G	3	02	I	S	**= MTS23G302IS**

BOX 1

Model
MTS

BOX 2

No. of Elements
1
2
3
4

BOX 3

Pump Flow Rate (must be ≤ No. of Elements)
1 = 5 gpm
2 = 10 gpm
3 = 15 gpm
4 = 20 gpm
X = No pump

BOX 4

Type of Pump
G = Gear Pump
V = Vane
X = No Pump

BOX 5

Motor
1 = 115 VAC, 60 Hz
3 = 230/460 VAC 3 PH,50/60 Hz
5 = 575 VAC 3 PH, 60 Hz
X = No Motor

BOX 6

Absolute Rating of Element Media
02 = 2 micron
05 = 5 micron
10 = 10 micron
20 = 20 micron
30 = 30 micron

BOX 7

Dirt Alarm®
I = Integrated Pressure Gauge
E = Electrical Diff Pressure Gauge

BOX 8

Options (may specify more than one)
S = SAE Adapters (BSPP connections are standard)
V = Viton® Seals

NOTES:

Box 3. See Element Selection Chart above for correlation between number of elements and flow. Other pumps available upon request.

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Offline Filtration Systems

OLF-P

Features and Benefits

- 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

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 Trimicron 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.

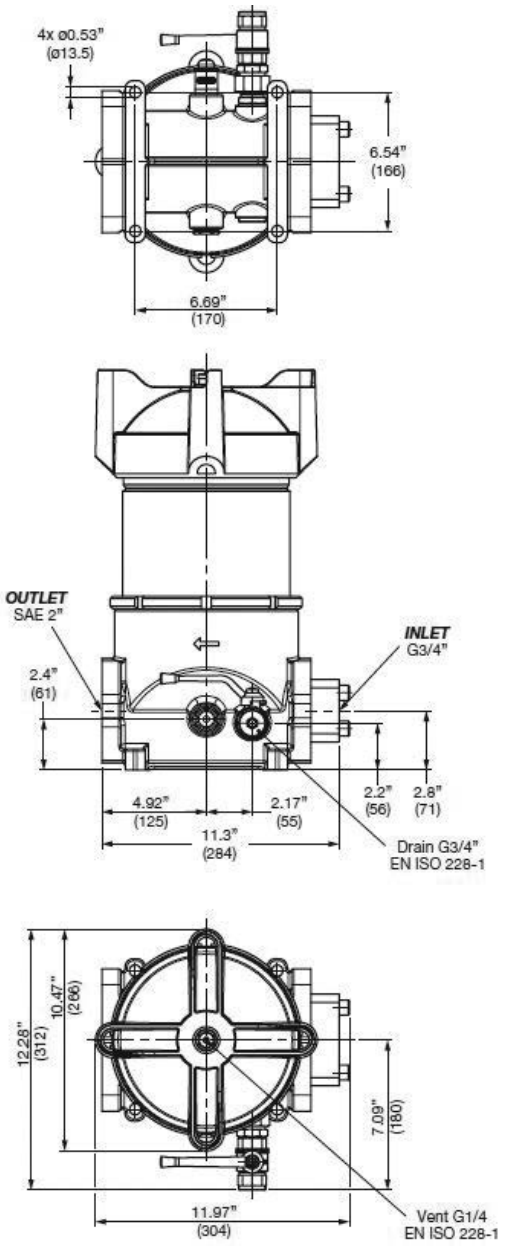
Applications

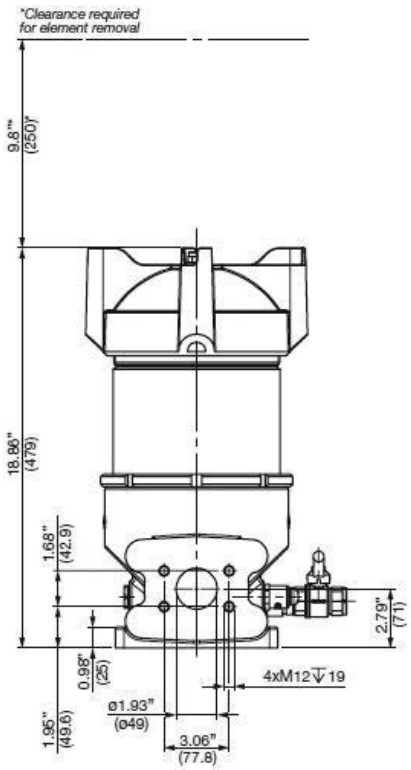
- Wind power plants
- Industrial transmission systems

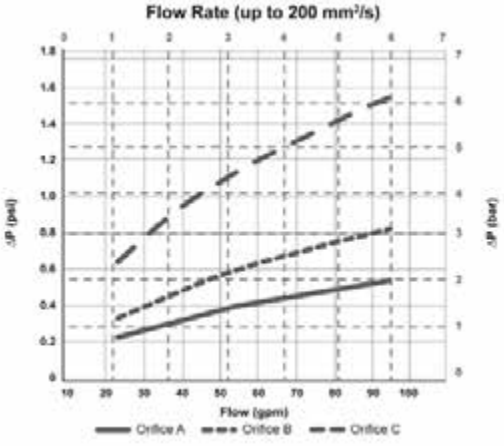
Specifications

	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 Temp.:	-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" on next page		
Filter Element:	1 x N1TMXXX	1 x N3TMXXX	2 x N3TMXXX
Weight:	Approx. 46.3 lbs (21 kg)	Approx. 82 lbs (37 kg)	Approx. 90 lbs (41 kg)

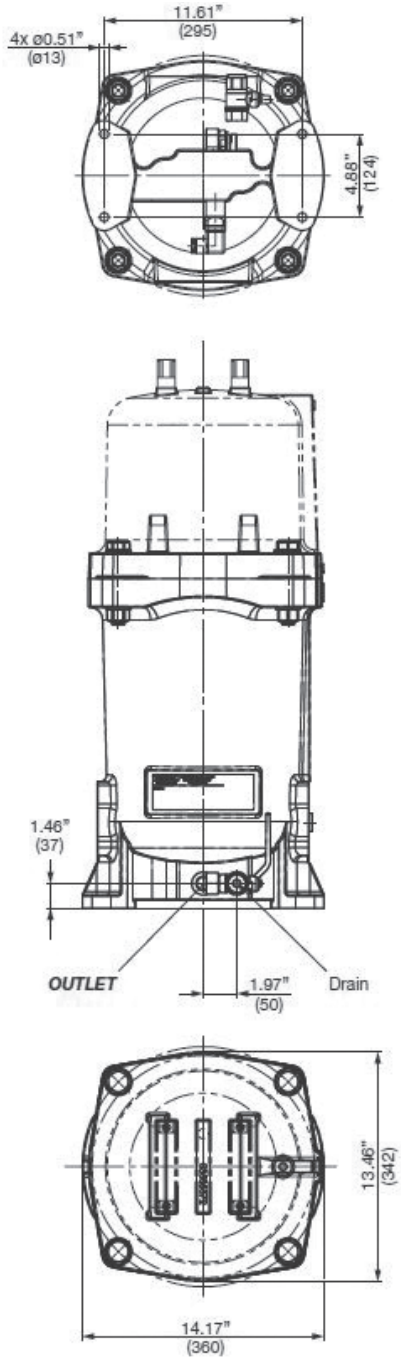
OLFP 1

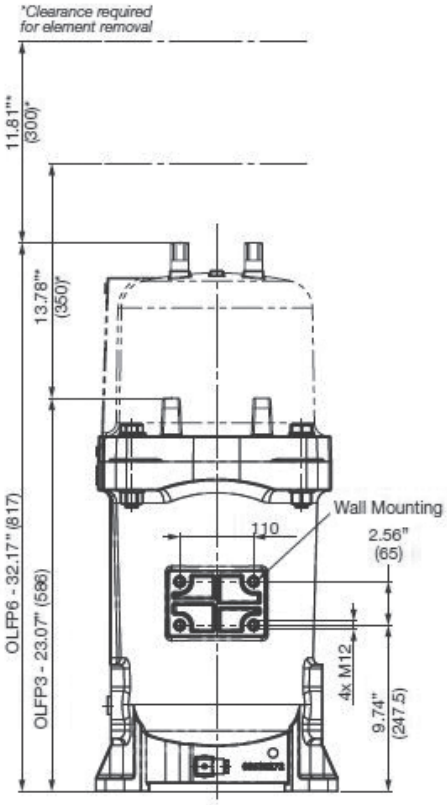

4x ø0.53"
(ø13.5)
6.54"
(166)
6.69"
(170)
OUTLET
SAE 2"
INLET
G3/4"
2.4"
(61)
4.92"
(125)
2.17"
(55)
11.3"
(284)
2.2"
(56)
2.8"
(71)
Drain G3/4"
EN ISO 228-1
12.28"
(312)
10.47"
(266)
7.09"
(180)
11.97"
(304)
Vent G1/4
EN ISO 228-1


*Clearance required
for element removal
9.8"*
(250)*
18.86"
(479)
1.68"
(42.9)
0.98"
(25)
1.95"
(49.6)
ø1.93"
(ø49)
3.06"
(77.8)
4xM12↧19
2.79"
(71)

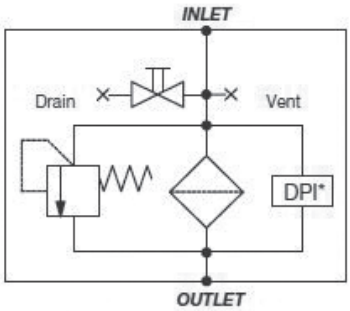

Flow Rate (up to 200 mm²/s)
ΔP (psi)
ΔP (bar)
Flow (gpm)
Orifice A
Orifice B
Orifice C

OLFP 3/6





Hydraulic Schematic



*Option: Differential pressure indicator

Replacement Elements

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

Offline Filtration Systems

Model Number Selection

How to Build a Valid Model Number for a Schroeder OLF-P:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
OLFP–		/		–	–	–	–	–

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
OLFP–	1	/ 2	– G	– M	– M	– TM	– N	E	**= OLFP-1/2-G-M-M-TM-N E**

BOX 1

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

BOX 2

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 *)

BOX 3

Flow Rate
2 = 0.53 gpm (2 L/min)
3 = 0.79 gpm (3 L/min)
6 = 1.59 gpm (6 L/min)
Z = variable (without pump)

BOX 4

Type of Pump
O = with orifice
G = gear pump
Z = without

BOX 5

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

BOX 6

Contamination Monitoring
M = TMS Metallic Sensor
A = TWS Water Sensor
Z = Omit

BOX 7

Element Type
TM = Trimicron

BOX 8

Sealing Material
N = NBR
F = FPM

BOX 9

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 = Omit

TriMicron Element Series NxTM

Features and Benefits

- Excellent filtration performance ($\beta_{5(c)} > 1000$)
- 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

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.

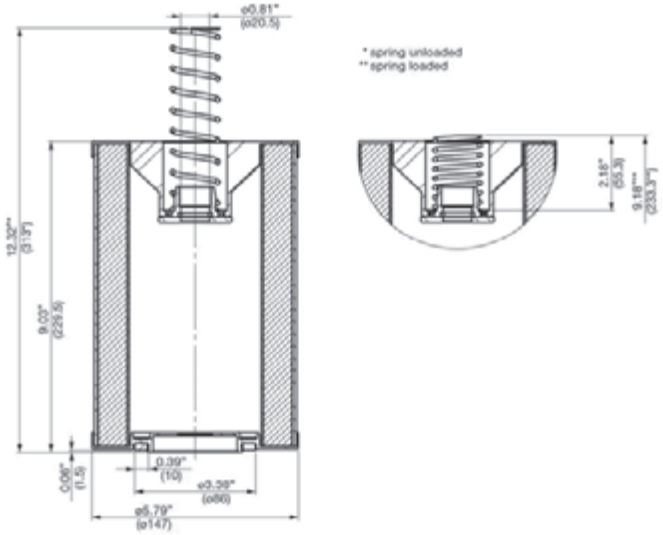
They are a combination of pleated and SpunSpray depth filter elements. The filter layers are produced using melt-blown technology (synthetic fibers).

Applications

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

Specifications

Model:	N1	N3
Contamination Retention Capacity ISOMTD at ΔP = 2.5 bar	~ 410 g	~ 410 g
Water Retention Capacity:	~ 680 ml	~ 2.1 l
Beta value $\beta_{5(c)}$ @ 2 bar	> 1,000	
Filtration Rating:	3 µm	
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)	



NxTM TriMicron Element Series

Model Number Selection

How to Build a Valid Model Number for a Schroeder NxTM TriMicron Element:

	BOX 1	BOX 2	BOX 3		BOX 4
N				/–	

Example: *NOTE: One option per box*

	BOX 1	BOX 2	BOX 3		BOX 4	
N	1	TM	003	/–	N	= **N1TM003 /- N**

BOX 1

Nominal Flow Rate	
1 =	Nominal flow rate 1 L/min
3 =	Nominal flow rate 3 L/min

BOX 2

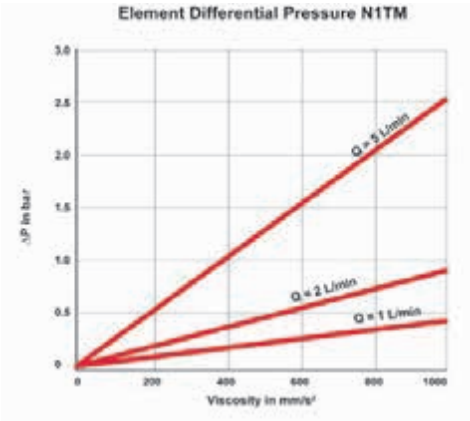
Element Type	
TM =	TriMicron

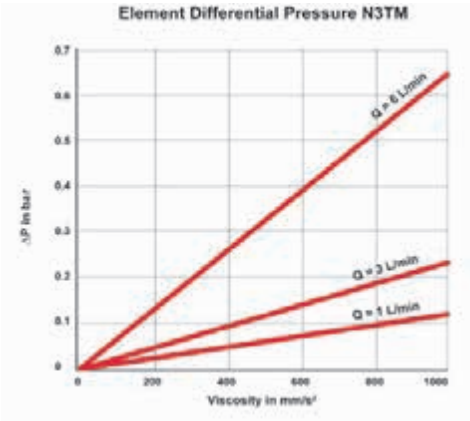
BOX 3

Filtration Rating (microns)	
003 =	3

BOX 4

Sealing Material
N = NBR
F = FPM





Ion eXchange Unit IXU

Features and Benefits

- Longer oil change intervals
- Increase in the lifetime of operating fluids and components
- Higher machine availability
- Reduction in functional problems, e.g. with servo valves
- Easy to service unit through
  – Component replacement without tools
  – Filter elements can be removed with the cover pointing "upward"
- Ideal to combine with type SVD Dewatering Units
- Available to service as complete unit, modular system for retrofitting existing bypass circuits or for OEM
- Visual Dirt Alarm® provided on all models
- Sold in North America only.

.5 -2.5 gpm
1.9-9.5 L/min

6 bar
87 psi

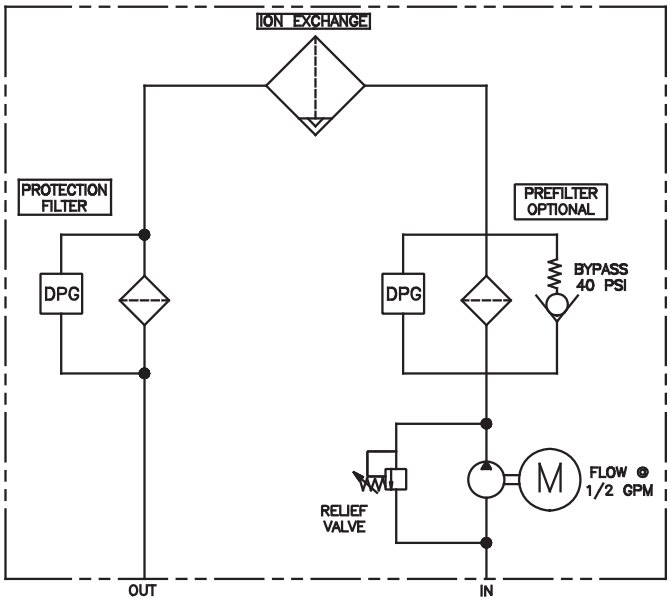
Description

This easy to service ion exchange unit of the IXU series is used for conditioning flame resistant, HFD-R-based hydraulic and lubrication fluids. They effectively remove acidic products of decomposition caused by hydrolysis and/or oxidation of the fluid. The units are applied to hydraulic and lubrication oil tanks up to approximately 5,300 gallons (20,000 L) with volumetric flow of up to approximately 2.4 gpm (9 l/min) in the bypass flow. Mobile or stationary IXU are available. The IXU uses Ion eXchange Element (IXE) filled with ion exchange resin.

Applications

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

Hydraulic Circuit

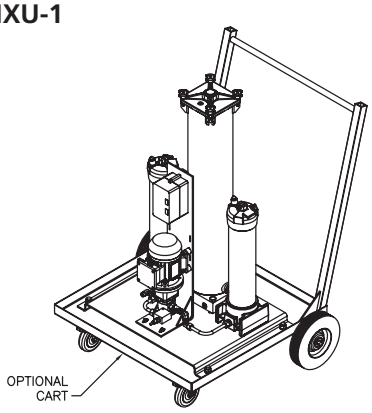


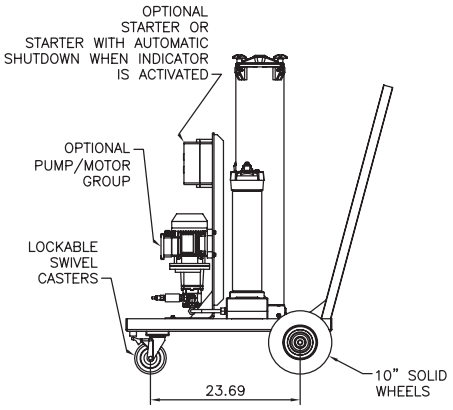
NOTES:
No connection lines included

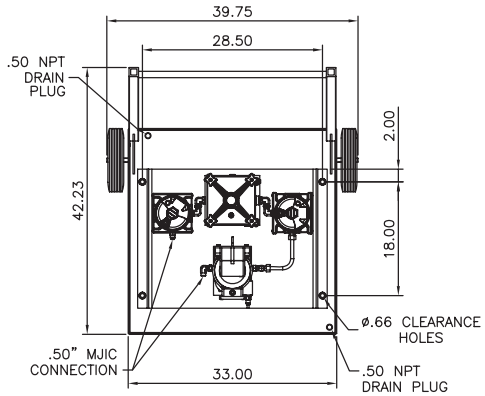
IXU Ion eXchange Unit

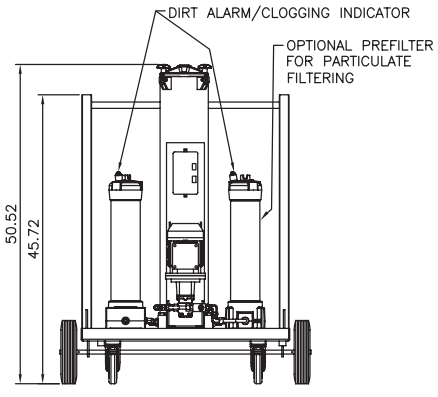
IXU-1

IXU-1



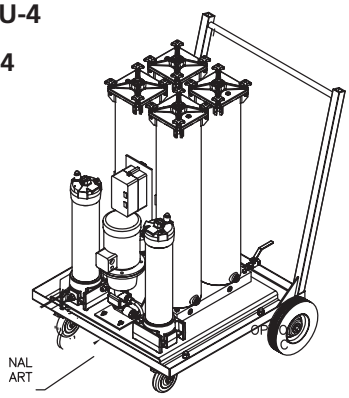


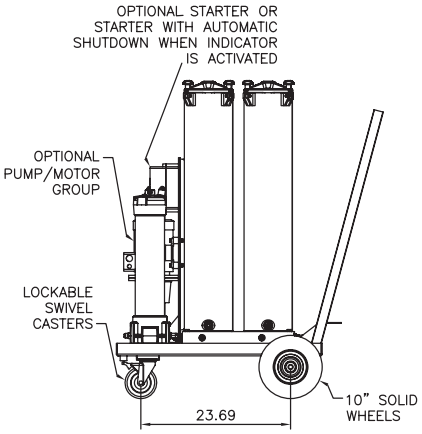


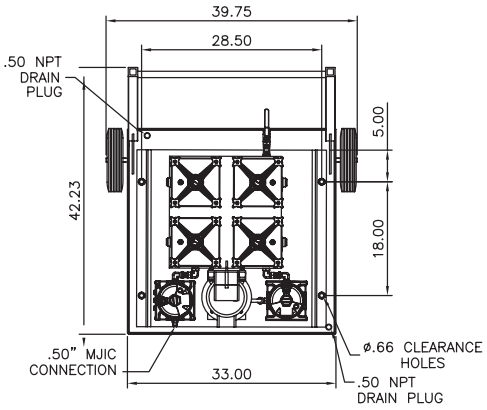


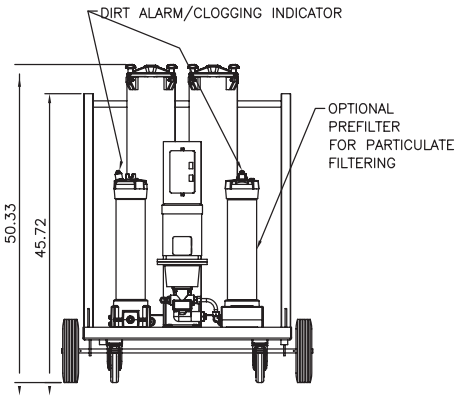
IXU-4

IXU-4









Ion eXchange Unit IXU

Specifications

Neutralization Number:	< 0.1 mg KOH/g possible
Flow Rating:	IXU-1: 0.5 gpm (1.9 l/min) IXU-4: 2.5 gpm (9.5 l/min)
Max. Operating Pressure:	87 psi (6 bar)
Suction Pressure @ Inlet:	-5.8 to 14.5 psi (-0.4 to 1 bar)
Viscosity Range:	80 to 400 SUS (15 to 80 cSt)
Fluid Compatibility:	HFD-R (Fire-Resistant / Phosphate-Based Fluids)
Operating Temperature :	32°F to 104°F (0 to 40°C) <80% = Relative humidity (non-condensing)
Hydraulic Connection:	1/2" (-8) Male JIC Inlet and Outlet
Seals:	Viton®
Pump Type:	Gear (Pump optional - see Box 4 below)
Power Consumption:	0.25 - 0.6 kW, depending on motor and voltage
Length of Electrical Cable:	30 ft. (10 m)
Noise Level:	<80 dB at 3 feet (1 m)
Storage Temperature:	32°F to 140°F (0°C to 60°C)

Model Number Selection

How to Build a Valid Model Number for a Schroeder IXU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
IXU								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
IXU	1	M	G	J	G10	C	G05	PKZ	= IXU1MGJG10CG05PKZ

BOX 1 – Model

IXU

BOX 2 – Flow Rate

1 = 0.5 gpm (1.9 l/min)
4 = 2.5 gpm (9.5 l/min)

BOX 3 – Transport

M = Mobile
S = Stationary

BOX 4 – Pump

G = Gear Pump
X = Without Pump

BOX 5 – Connection Voltage

F = 230 V / 60 Hz, 3 Phase
J = 115 V / 60 Hz, 3 Phase
K = 460 V / 60 Hz, 3 Phase
N = 575 V / 60 Hz, 3 Phase

BOX 6 – Prefilter

05 = w/ 5µm Element
10 = w/ 10µm Element
X = Without prefilter
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®

BOX 7 – Clogging Indicator

C = Differential Pressure Indicator – Electrical

BOX 8 – Post Filter

05 = w/ 5µm element
10 = w/ 10µm element
G05 = 5 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®
G10 = 10 µm Excel-ZPlus® Z-Media® (synthetic) w/GeoSeal®

BOX 9 – Accessories

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)

NOTES:

IonExchange Element is not included with unit and is to be ordered separately

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Triton-A

Triton Dehydration Station®

U.S. Patent 8491785

TRITON DEHYDRATION STATION®

1.5 gpm
5.7 L/min

Features and Benefits

- Patented mass transfer technology uses ambient air to optimize and control dewatering rates
- 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
- Compact, efficient footprint
- Remove free and dissolved water
- Highly effective in low and high humidity elements

Description

Water contamination in hydraulic systems can severely reduce the life of hydraulic systems and fluids. The Triton Dehydration Station® is designed to eliminate 100% of free and up to 90% of dissolved water from small reservoirs, barrels, and gear boxes. Using a patented mass transfer process, the Triton Dehydration Station® 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 Triton Dehydration Station® uses patent-pending 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 TestMate® Water Sensor (TWS) and displayed real-time on the control panel.

Specifications

Dimensions:	46"H x 23.25"OD
Dry Mass:	295 lbs (134 kg)
Inlet Connections:	1-1/4" MJIC (shroud version) / S16 Female (cart version)
Outlet Connections:	1/2" MJIC (shroud version) / S16 Female (cart version)
Flow Rate:	90 gallons/hour or 1.5 gpm
Inlet Pressure:	Atmospheric
Outlet Pressure:	to 40 psi (2.76 bar)
Fluid Service Temperature:	40° F to 140°F (4°C to 60°C)
Fluid Viscosity:	70- 1000 SUS (13 - 215 cSt), Explosion-proof: 500 SUS maximum
Power Supply:	110 VAC, 60 Hz, 12 amp
Attainable Water Content:	< 50 ppm
Relative Humidity Display:	Standard, 0-99% Range
Construction:	Base Frame and Vessel: Stainless Steel Seals: Viton®
Protection Class:	NEMA 2

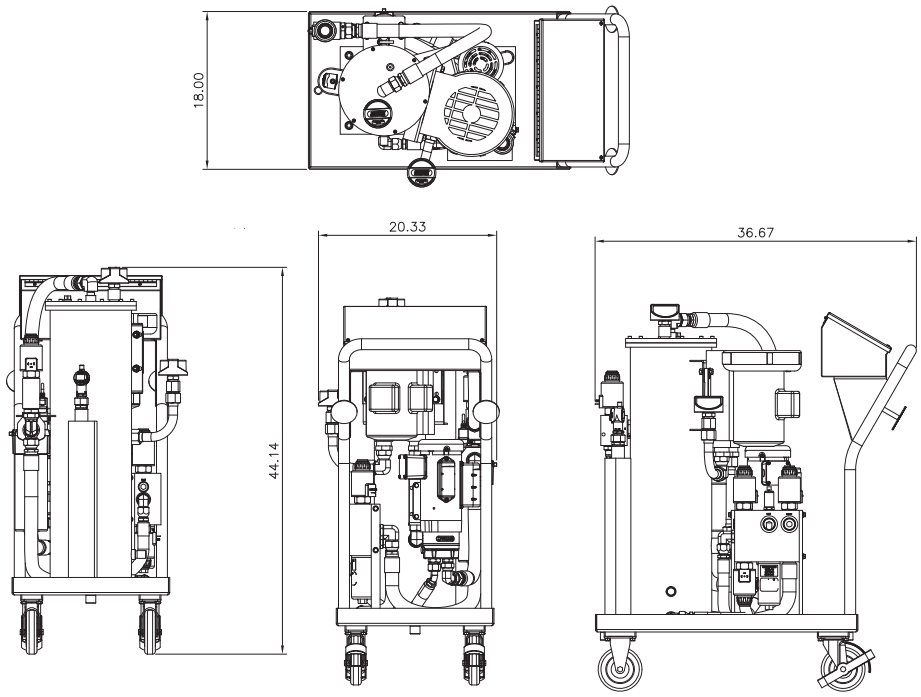
Element Performance

Media	Filter Rating	DHC (gm)
Z1	$\beta\ 4.2_{(C)} \geq 1000$	55
Z3	$\beta\ 4.8_{(C)} \geq 1000$	57
Z5	$\beta\ 6.3_{(C)} \geq 1000$	62
Z10	$\beta\ 10_{(C)} \geq 1000$	52
Z25	$\beta\ 24_{(C)} \geq 1000$	48

Triton Dehydration Station®

U.S. Patent 8491785

Triton-A



New Cart Style

Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder Triton-A:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
TDS							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
TDS	A	V	M	A	B	05	1	**= TDSAVMAB051**

BOX 1

Model
TDS

BOX 2

Flow Rate
A = 1.5 gpm Average

BOX 3

Seals
V = Viton®

BOX 4

Mobility
S = Stationary
M = Caster Base

BOX 5

Voltage
A = 110V/60 Hz/ 1 Phase
B = 220V/60 HZ/ 1 Phase
C = 220V/50 Hz/ 1 Phase

BOX 6

Air Source
B = Integral Blower
C = Compressed Air (supplied)

BOX 7

Media
01
03
05
10
25

BOX 8

Option
X = Class 1, Div 2 explosion-proof
1 = Cart Version, No Shroud
Y = Built with CSA approved components (requires CSA inspection on-site)

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Triton-E

Triton Dehydration Station®

U.S. Patent 8491785

TRITON DEHYDRATION STATION®

15 gpm
56.78 L/min

Features and Benefits

- Patent Pending mass transfer technology uses ambient air to optimize and control dewatering rates
- High Dewatering Rates and particulate removal in one system
- Simple Controls - maintenance, operation and troubleshooting instructions are available in the Human Machine Interface (HMI) Touch Screen
- Reduce fluid recycling cost
- No expensive vacuum pump to service and replace
- Compact, efficient footprint
- Remove free and dissolved water
- Highly effective in low and high humidity elements

Description

Water contamination in hydraulic systems can severely reduce the life of hydraulic systems and fluids. The Triton Dehydration Station® is designed to eliminate 100% of free and up to 90% of dissolved water. The Triton-E can handle large quantities of oil from sizeable hydraulic reservoirs, lubricating circuits, totes and large gear boxes due to the high flow rate of the unit. Using a patent pending mass transfer process, the Triton Dehydration Station 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 is designed to be extremely portable using either the integrated lifting lugs located on each corner of the cart or the optional wheeled version.

Principle of Operation

The Triton Dehydration Station® uses patent-pending 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 moist air/stream. The relative humidity of the incoming fluid is continually monitored by an integral TestMate® Water Sensor (TWS) and displayed real-time on the control panel in percent saturation.

Specifications

Dimensions:	32"W x 59"L x 70.25" H
Dry Mass:	1000 lbs (453 kg)
Inlet Connections:	1-1/2" MJIC
Outlet Connections:	1-1/4" MJIC
Flow Rate:	900 gallons/hour or 15 gpm
Inlet Pressure:	Atmospheric
Outlet Pressure:	to 125 psi (8.62 bar)
Fluid Service Temperature:	50° F to 175°F (10°C to 79°C)
Fluid Viscosity:	70-2000 SUS (13 -539 cSt), 2500 with heater
Power Supply:	380 V/3/50 Hz,10 amps 460 V/3/60 Hz, 7 amps 460 V/3/60 Hz, 22.5 amps w/heater 575 V/3/60 Hz, 5.5 amps 575 V/3/60 Hz, 18 amps w/heater
Attainable Water Content:	< 50 ppm
Relative Humidity Display:	Standard, 0-99% Range
Construction:	Base Frame: Carbon Steel Vessel: Stainless Steel Seals: Viton®
Protection Class:	NEMA 2

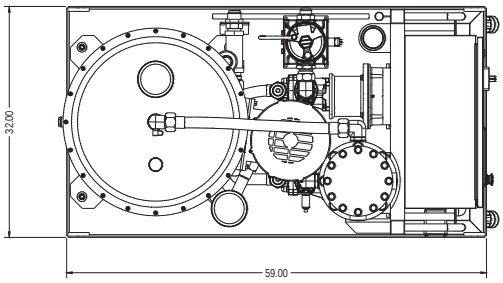
Element Performance

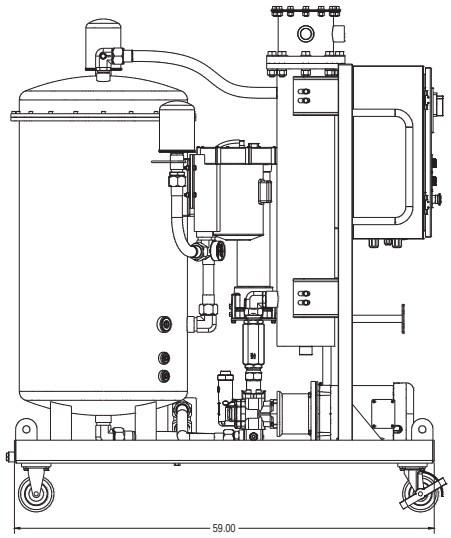
Media	Filter Rating	DHC (gm)	Media	Filter Rating	DHC (gm)
Z1	ß $4.2_{(C)}$ ≥1000	55	**Z10**	ß $10_{(C)}$ ≥1000	52
Z3	ß $4.8_{(C)}$ ≥1000	57	**Z25**	ß $24_{(C)}$ ≥1000	48
Z5	ß $6.3_{(C)}$ ≥1000	62			

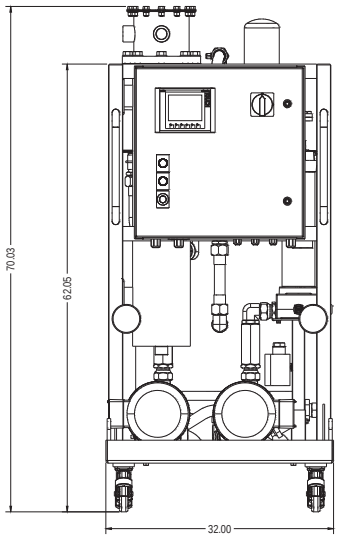
Triton Dehydration Station®

Triton-E

U.S. Patent 8491785







Metric dimensions in ( ).

How to Build a Valid Model Number for a Schroeder Triton-E:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
TDS							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
TDS	E	V	M	A	B	G05	H	**= TDSEVMABG05H**

BOX 1

Model
TDS

BOX 2

Flow Rate
E = 15 gpm Average

BOX 3

Seals
V = Viton®

BOX 4

Mobility
S = Stationary
M = Caster Base

BOX 5

Voltage
A = 460V/3/60 Hz (15 gpm)
B = 575V/3/60 Hz (15 gpm)
C = 380V/3/50 Hz (10 gpm)

BOX 6

Air Source
B = Integral Blower

BOX 7

Media
G01 = 1 µ Excel-ZPlus® Media w/ GeoSeal®
G03 = 3 µ Excel-ZPlus® Media w/ GeoSeal®
G05 = 5 µ Excel-ZPlus® Media w/ GeoSeal®
G10 = 10 µ Excel-ZPlus® Media w/ GeoSeal®
G25 = 25 µ Excel-ZPlus® Media w/ GeoSeal®

BOX 8

Option
H = 12500 W Heater (15 gpm)

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

Model Number Selection

SVD01 Vacuum Dehydrator

1.3 gpm
4.9 L/min

Features and Benefits

- Small, compact and easy to operate unit for use during service calls or emergencies
- Reliable and convenient for continuous or occasional use
- Optional integrated heater to increase the rate of water extraction, especially for colder or higher viscosity fluids
- Optional integrated water content and particulate measurement technology with continuous display of the measurements and storage of the values
- Lower residual water content, gas content and particulate contamination lead to longer oil change intervals, improve life expectancy of components, higher machine availability and reduction in the Life Cycle Cost of equipment.

Description

The Schroeder Vacuum dehydrator SVD01 serves to dewater, degas and filter hydraulic and lubricating fluids. It is ideal for fluid tank sizes of up to 500 gallons, with its flow rate of up to 1.3 gpm, under normal water ingression rates of the fluid.

It works on the principal of vacuum dewatering to extract free and dissolved water as well as free and dissolved gases. By using KLC filter technology, with its high dirt holding capacity to remove particulate contamination, the SVD01 is very cost effective.

Its compact and mobile construction makes it ideally suited for service work or for use in tight spaces. In the version for permanent installation, it provides continuous protection for applications where operating fluids require optimal and continuous care.

Design

As a rough guide, a Vacuum Dehydrator should be sized according to the tank volume of the system. Therefore, a SVD01 can be used on tank volumes up to 500 gallons under normal water ingress conditions. Generally, it must observed that the size is dependent on the application, the operating fluid condition such as starting water concentration, fluid temperature, ambient temperature, the amount of operating fluid as well as the water infiltration rate into the system. These factors greatly affect dewatering performance. It is for that reason that the specifications can only serve as a starting point.

Heater

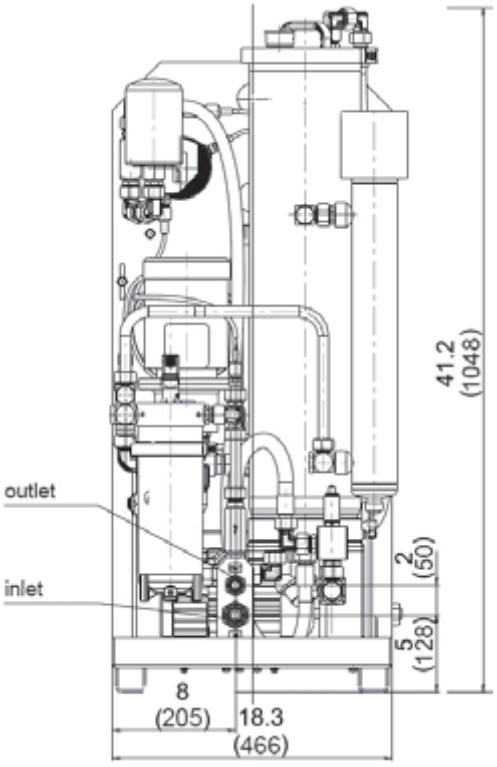
By using the optional built-in heater, the dewatering capacity can be increased in the case of high viscosity operating fluids or operating fluids at low temperatures. If the temperature of the operating fluid is raised by 18 degrees Fahrenheit then the dewatering capacity increases by up to 50%. The ideal temperature for dewatering is 120 to 140 degrees Fahrenheit. Generally, the heater option has to be chosen, and the heater has to be in operation, for operating viscosities of between 1700 and 4000 SUS.

Specifications

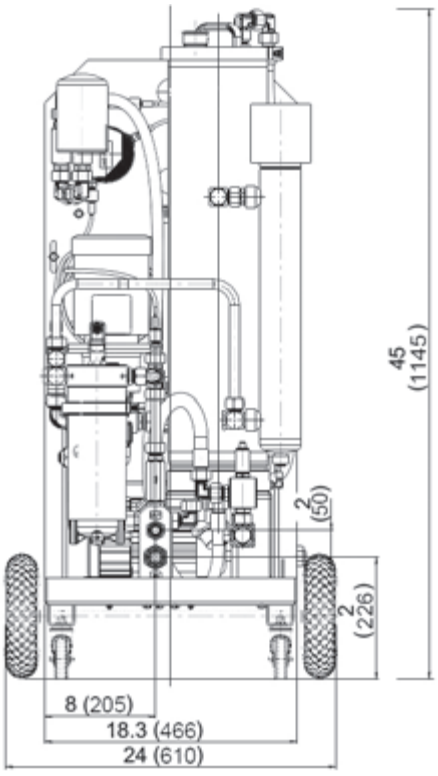
Dimensions:	44.8"H x 23.6"W x 23.2"L
Dry Mass:	265 lbs (120 kg)
Inlet Connections:	G 1½" (BSPP)
Outlet Connections:	G 1" (BSPP)
Flow Rate:	80 gallons/hour (1.3 gpm)
Inlet Pressure:	Atmospheric
Operating Pressure:	up to 65 psi (4.5 bar)
Fluid Service Temperature:	50° F to 175°F (10°C to 79°C)
Fluid Viscosity:	1000 SUS, up to 4000 SUS with optional heater
Power Supply:	230 VAC, 60 Hz, 16 AMP, optional 460 VAC, 60 Hz
Attainable Water Content:	< 100 ppm
Optional Relative Humidity Display:	Standard, 0-99% Range
Seals:	Standard NBR, Optional Viton®
Operating Fluids:	Mineral based hydraulic and lubrication fluids

Vacuum Dehydrator SVD01

SVD01 Stationary



SVD01 Mobile



Metric dimensions in ( ).

Model Number Selection

How to Build a Valid Model Number for a Schroeder SVD01:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
SVD							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
SVD	01	H	S	46	24H	05	TWS	**= SVD01HS4624H05TWS**

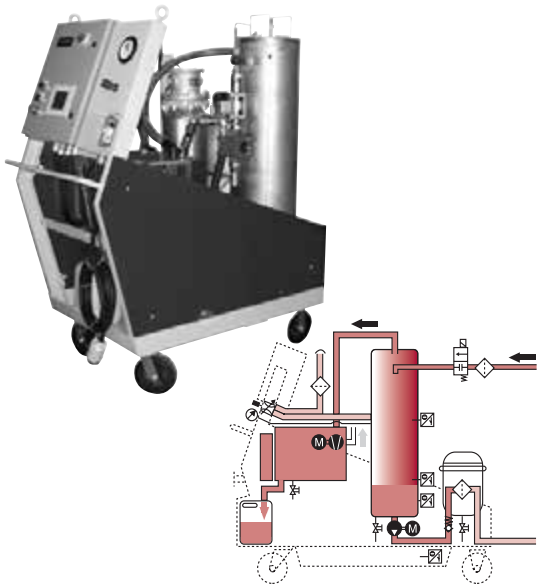
BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
Model	**Flow Rate**	**Fluid Type**	**Mobility**	**Voltage**
SVD	01 = 1.3 gpm	H = Hydraulic & Synthetic Fluid V = HDF-R, Biodegradable	S = Stationary M = Caster Base	23 = 230VAC/60 Hz/1-Phase 46 = 460VAC/60 Hz/3-Phase 235 = 230VAC/50 Hz/1-Phase

BOX 6	BOX 7	BOX 8
Power	**Media (KLC Element)**	**Option**
12X = 1200 Watts (230 Volt) 24H = 2400 Watts w/ Heater (460 Volt)	02 05 10 20	None = Omit TWS = Water Sensor w/ Display TCMTWS = Contamination and Water Sensor

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

SVD Vacuum Dehydrator

5 - 23 gpm
18.93-87.06 L/min



Features and Benefits

- Water Sensor standard on all units to show percent saturation
- Removes 100% of free and over 90% of dissolved water and as well as 100% of free and over 90% of dissolved gases
- Automatic mode with automatic shutdown based on user settings
- Four models are available to accommodate various flow rates
- Use of a vacuum pump avoids any dangerous chemically reactive by-products
- Maintenance, operating, troubleshooting instructions are in HMI (touch screen)

Description

Centrifuge and condensation methods typically only remove free water. The SVD, which uses vacuum technology, can remove both free and dissolved water from the oil, as well as dissolved gases. In addition, solid contaminants are also removed by highly efficient membrane elements. The SVD is intended to be used on large hydraulic and lubricating circuits that have a minimal 200 gallon (760 l) reservoir. Unit automatically shuts down when desired % saturation is reached.

Designed to offset the negative effects of water in hydraulic oil which include:

- Depletion of additives
- Increased acidity of oil
- Reduction in lubricity
- Accelerated aging of components

Principle of Operation

When connected to the hydraulic reservoir of a system with wet oil, the SVD unit draws the oil in its chamber. Oil slowly cascades down in the reactor chamber. Water is separated in the form of vapor and is removed by the vacuum pump. This vapor can be released to atmosphere or condensed into a separate reservoir. The purified oil is drained from the reactor chamber through a pump back to system reservoir at a continuous flow rate. This oil is now dry and free of water (within the specifications provided).

Specifications

	SVD05	SVD10	SVD16	SVD23
Capacity of Pressure Vessel:	5.25 gal (20 L)	10.5 gal (40 L)	20.5 gal (78 L)	26.25 gal (100 L)
Solid Contamination to ISO 4572:	1.1 lbs (500 g)	2.2 lbs (1000 g)	3.3 lbs (1500 g)	5.5 lbs (2500 g)
Bypass Cracking Pressure:	29 psi (2 bar)	29 psi (2 bar)	29 psi (2 bar)	29 psi (2 bar)
Pump Type:	Gear pump	Gear pump	Gear pump	Gear pump
Flow Rate:	5 gpm (18.93 L/min)	10 gpm (37.85 L/min)	16 gpm (60.57 L/min)	23 gpm (87.06 L/min)
Maximum Operating Pressure:	87 psi (4.5 bar)	87 psi (4.5 bar)	87 psi (4.5 bar)	87 psi (4.5 bar)
Visc. Range without Heater SUS: (cSt):	75-1500 (15-350)	75-1500 (15-350)	75-1500 (15-350)	75-1500 (15-350)
Visc. Range with Heater SUS:	2800	2800	2800	2800
Electrical Cable Length:	25 ft (7.6 m)	25 ft (7.6 m)	25 ft (7.6 m)	25 ft (7.6 m)
Seal Material:	NBR	NBR	NBR	NBR
Weight with Heater:	1300 lbs (585 kg)	1350 lbs (608 kg)	Contact factory	Contact factory
Weight without Heater:	1105 lbs (497 kg)*	1170 lbs (527 kg)*	Contact factory	Contact factory
Fluid Temperature:	50°F to 175°F (10°C to 79°C)	50°F to 175°F (10°C to 79°C)	50°F to 175°F (10°C to 79°C)	50°F to 175°F (10°C to 79°C)
Ambient Temperature:	5°F to 105°F (-15°C to 41°C)	5°F to 105°F (-15°C to 41°C)	5°F to 105°F (-15°C to 41°C)	5°F to 105°F (-15°C to 41°C)
Attainable Water Content:	<100 ppm	<100 ppm	<100 ppm	<100 ppm

*Estimated weight

Sizing

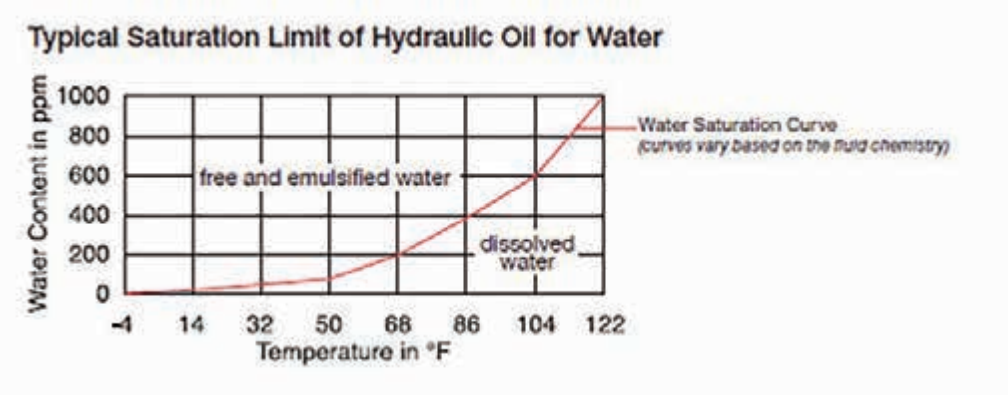
Sizing Chart
(continuous water ingression)

Tank Volume (gallons)	SVD Model
1000 to 2000	SVD05
2000 to 4000	SVD10
4000 to 7000	SVD16
7000 and up	SVD23

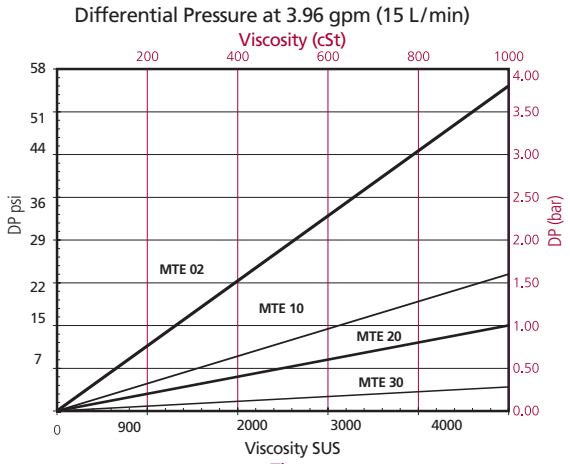
Sizing of the SVD is normally done through periodic measuring of the water content which will determine the hourly ingestion of water. If there is a continuous ingression of water (i.e. condensation) the recommended flow rate of the SVD can be determined by the system size (total gallons.) It should circulate 3 or 4 times through the SVD every day.

Factors That Affect Water Removal Rate

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

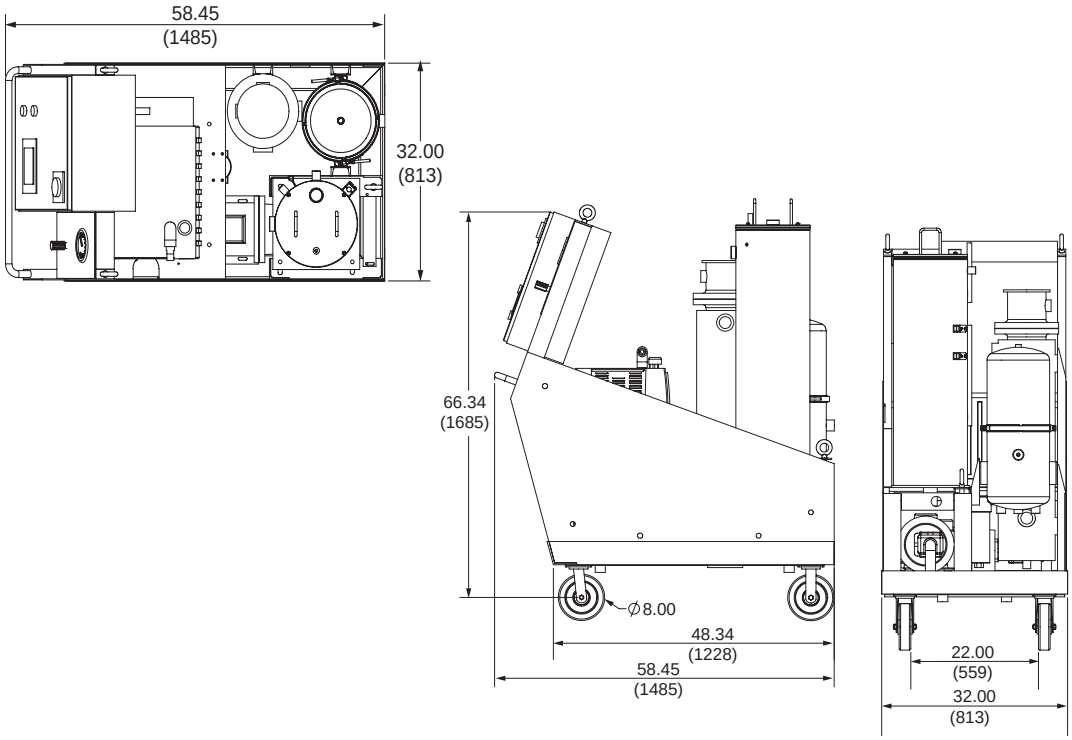


Element Pressure Drop



SVD Vacuum Dehydrator

Schroeder SMART TECHNOLOGY INSIDE



Metric dimensions in ( ).

Element Selection

Model	No. of Elements	Flow gpm (L/min)	Model	No. of Elements	Flow gpm (L/min)
SVD05	1	5 (18.93)	SVD16	3	16 (56.78)
SVD10	2	10 (37.85)	SVD23	4	23 (75.71)

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

How to Build a Valid Model Number for a Schroeder SVD:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8
SVD							

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	
SVD	10	H	M	46	19H	2	02	**= SVD10HM4619H202**

BOX 1

Model
SVD

BOX 2

Flow Rate
05 = 5 gpm
10 = 10 gpm
16 = 16 gpm
23 = 23 gpm

BOX 3

Fluid
H = Hydraulic and Synthetic Oil
T = Transformer Oil (requires heater)
B = Biodegradable Oil
F = Fire Resistant Oils (must identify fluid type with order)

BOX 4

Mobility
S = Stationary
M = Mobile

BOX 5

Voltage
23 = 230V/60 Hz/ 3 Phase
46 = 460V/60 Hz/ 3 Phase
57 = 575V/60 Hz/ 3 Phase
XX = Other

BOX 6

Power
19X = 1900 watts
27X = 2700 watts
51X = 5100 watts
09H = 8650 watts w/ heater
19H = 19200 watts w/ heater
21H = 21200 watts w/ heater
26H = 26100 watts w/ heater

BOX 7

Number of Elements
1
2
3
4

BOX 8

Media
02
05
10
20
30

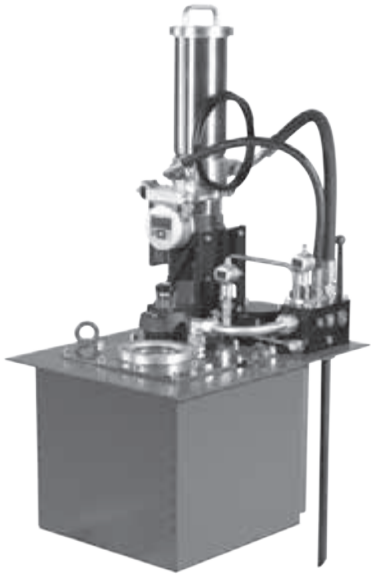
NOTES:

Box 7. See element selection chart above for correlation between number of elements and flow

For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

OXiStop OXS LID Series

OXS



Features and Benefits

- Reduced oil volume up to a factor of 10
- Oil service life is increased as a result of the reduction by up to 80% in air content and reduced dirt ingress
- Higher process speeds
- Higher efficiency
- Reduced noise and wear due to less cavitation
- Ideal for humid and dusty environments
- Reduced costs due to similar size, fewer installation costs, less oil required and easier transport
- Longer component service life, less service downtime of hydraulic system components

Description

Schroeder's OXiStop is a tank solution for hydraulic systems with an integrated, hydraulically driven degassing and dewatering unit. The integrated membrane prevents direct contact with the ambient air. This means the tank can be calculated for the differential operating volume actually required, thus reducing its size. The pump flow rate is no longer important for the tank calculation.

Very low gas and water content is achieved in the fluid. Thanks to the membrane which keeps the fluid "vacuum packed", it is also possible to install the OXiStop in extremely dusty or humid environments. The OXS LID series is installed in a custom-designed tank and contains all necessary components

The OXS LID comes in seven standard sizes, with differential operating volumes ranging from 8 to 32 gallons. Contamination Sensor option available.

The size of the OXiStop (based on required differential operating volume) can be calculated from the sum of the actual volume differences of cylinders, accumulators, hoses etc. that may be present in a system. In addition, allowances must be made for the volume required for thermal expansion in the oil and for possible continuous oil losses. This volume (except for accumulator) should be doubled as a safety margin.

Rule of thumb:

Sum of total accumulator volume + 2x sum of volume difference for cylinders, hoses, temperature expansion, etc. = OXiStop differential operating volume.

Also, it is important to check if the total oil volume in the system is required to return to the tank when maintenance work is carried out.

What's Included

- OXiStop LID according to model code
- Membrane bag holder
- Integrated membrane
- MiniOx degassing unit
- KLC5 offline filtration unit with optional TestMate® Contamination Sensor (TCM)
- TestMate® Water Sensor (TWS-D)
- HNS electronic level sensor
- Breather filter and piping for individual components
- Gasket (interface to tank)
- Operating and maintenance instructions
- Instructions for tank installation

OXS OXiStop OXS LID Series

Specifications

	OXS 30LID	OXS 45LID	OXS 70LID	OXS 150LID	OXS 250LID	OXS 325LID	OXS 500LID
Differential Operating Volume:	8 gal.	11.8 gal.	18.5 gal.	39.5 gal.	66 gal.	86 gal.	132 gal.
Typical Degassing Rate*:	up to 2.3 gallons per hour						
Max. Viscosity:	up to 1,500 SUS						
Max. Fluid Flow Rate IN/OUT:	238 gpm						
Fluid Temperature:	50°F to 175°F (10°C to +80°C)						
Ambient Temperature**:	-4°F to 104°F (-20°C to 40°C)						
Storage Temperature:	32°F to 104°F (0°C to 40°C)						
Relative Humidity:	0 - 80%, non-condensing						
Filtration Unit:	KLC05						
Filtration Unit Filter Element:	KLE02						
Contamination Retention Capacity:	36 psi (2.5 bar)						
Pump Type:	Vane Pump						
Optimal Sampling Pump Flow Rate:	1.9 gpm (7.5 L/min)						
Filtration Unit Operating Pressure:	145 psi (10 bar)						
Clogging Indicator:	Visual Differential Pressure Indicator						
Electrical Connection:	See Model Code						
Power Consumption:	370 W						
IP Rating per DIN 40050:	IP54						
Permitted Fluids**:	Mineral Based Hydraulic Fluids						
Sealing Material**:	NBR						
Membrane Material**:	PUR						
Typical Lifetime, Membrane:	≈ 6 years with 104°F - 140°F fluid temperature ≈ 2 years with 175°F fluid temperature						

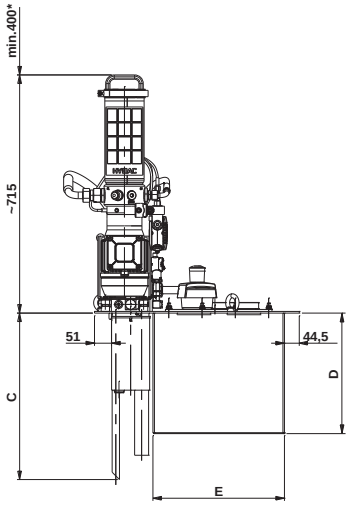
* Typical values for ISO VG 46, 40 °C when saturated with gas. The degassing rate depends on the total gas content in the oil, the oil temperature, and especially the oil viscosity. The degassing rate reduces as viscosity increases.

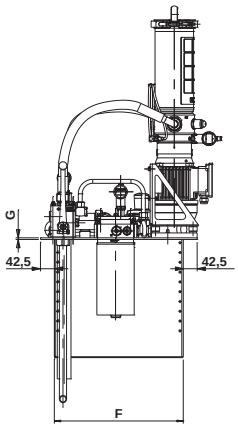
** Others on request

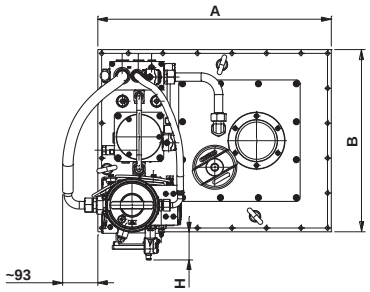
For replacement element part numbers, please see "Appendix Section - Replacement Elements" of this catalog.

OXiStop OXS LID Series

OXS

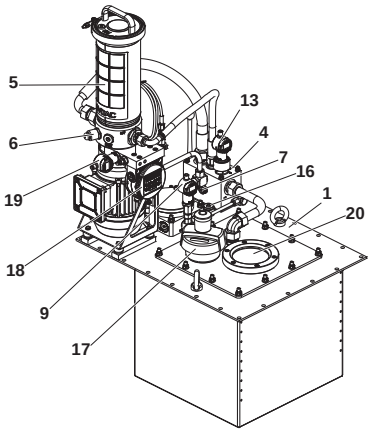


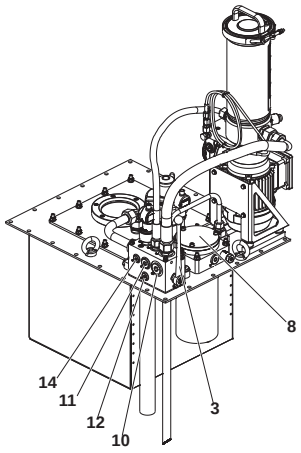




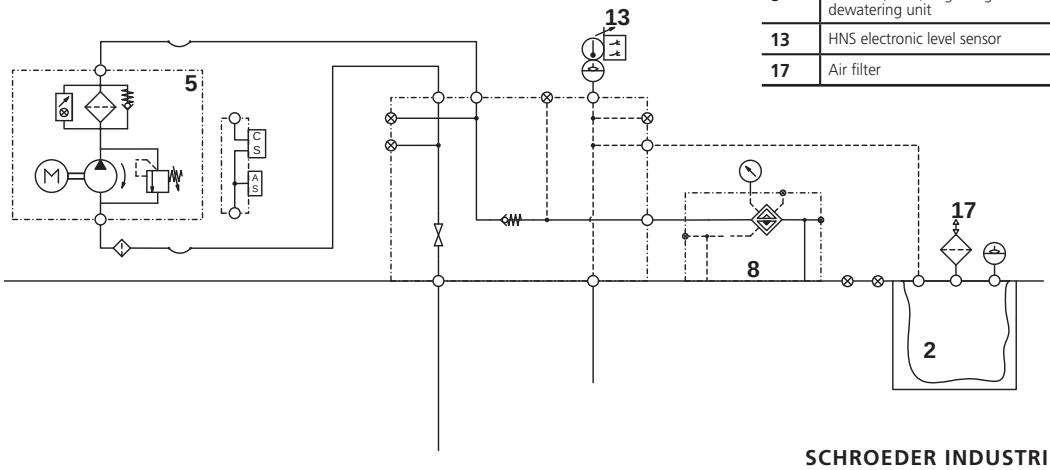
	A	B	C	D	E	F	G	H
OXS 30LID	615	480	500	362	395	395	5	74
OXS 45LID	615	480	610	472	395	395	5	74
OXS 70LID	615	480	820	682	395	395	5	74
OXS 150LID	1015	680	610	472	795	595	5	-27
OXS 250LID	1015	680	820	682	795	595	5	-27
OXS 325LID	1415	880	607	472	1195	795	8	-127
OXS 500LID	1415	880	817	682	1195	795	8	-127

Item	Component
1	OXS LID with membrane bag holder
2	Directional control valve
3	Valve and connection block
4	KLC5 filtration unit
5	Clogging indicator on KLC5
6	Check valve
7	MOX degassing unit
8	EDS electronic pressure sensor or vacuum gauge (optional)
9	Filling port
10	Drain port
11	Pressure test point
12	HNS electronic level sensor
13	Port for visual tank fluid level indicator
14	Vent
15	Air filter
16	TCM Contamination Sensor (optional)
17	TWS-D Water Sensor (optional)
18	Sight glass





Item	Component
2	Tank membrane
5	KLC5 offline filtration n
3	Valve and connection block
4	KLC5 offline filtration unit
8	MiniOX (MOX) degassing and dewatering unit
13	HNS electronic level sensor
17	Air filter



OXS OXiStop OXS LID Series

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

How to Build a Valid Model Number for a Schroeder OXiStop OXS LID Series:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
OXS								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
OXS	30LID	O	1	Z	Z	1	2	WP	**= OXS30LIDO1ZZ12WP**

BOX 1

Model
OXS

BOX 2

Size	
30LID =	Operating volume 8 gal.
45LID =	Operating volume 11.8 gal.
70LID =	Operating volume 18.5 gal.
150LID =	Operating volume 39.5 gal.
250LID =	Operating volume 66 gal.
325LID =	Operating volume 86 gal.
500LID =	Operating volume 132 gal.

BOX 3

Voltage
O = 460 V/60Hz/3-Phase
N = 400 V/50Hz/3-Phase

BOX 4

Sealing Material	
1 =	NBR seals, PUR membrane

BOX 5

Return Line Filter
Z = Omit

BOX 6

Plate Heat Exchanger + Pump Motor Group
Z = Omit

BOX 7

Vacuum Pressure Monitoring, Degassing Unit	
1 =	Pressure Gauge
2 =	Electronic Pressure Sensor (EDS)

BOX 8

Level/Temperature Monitoring	
2 =	Electronic Level Sensor with integrated temperature sensor

BOX 9

Measuring Equipment	
Z =	Omit
WP =	Water Sensor (TWS-D) + Contamination Sensor (TCM)

Section 3:

APPENDIX

Replacement Element

Used in FS Series, MFS & MFD Series, AKS & AKD Series, KLS & KLD Series and X-Skid - Standard Capacity Series

Pressure Elements

9" Elements

Model Code	P/N	Description
KW	7630767	Water Removal Element
KWV	7628759	Water Removal Element (viton)
KZ1	7630768	1 Micron Element
KZ1V	7615685	1 Micron Element (viton)
KZ3	7628664	3 Micron Element
KZ3V	7615706	3 Micron Element (viton)
KZ5	7628345	5 Micron Element
KZ5V	7628665	5 Micron Element (viton)
KZ10	7627464	10 Micron Element
KZ10V	7628662	10 Micron Element (viton)
KZ25	7628663	25 Micron Element
KZ25V	7615694	25 Micron Element (viton)

18" Elements

Model Code	P/N	Description
KKW	7628654	Water Removal Element
KKWV	7615323	Water Removal Element (viton)
KKZ1	7615325	1 Micron Element
KKZ1V	7615337	1 Micron Element (viton)
KKZ3	7628657	3 Micron Element
KKZ3V	7628760	3 Micron Element (viton)
KKZ5	7628658	5 Micron Element
KKZ5V	7615359	5 Micron Element (viton)
KKZ10	7628655	10 Micron Element
KKZ10V	7628656	10 Micron Element (viton)
KKZ25	7615339	25 Micron Element
KKZ25V	7615346	25 Micron Element (viton)

27" Elements

Model Code	P/N	Description
27KW	7629168	Water Removal Element
27KWV	7603050	Water Removal Element (viton)
27KZ1	7628576	1 Micron Element
27KZ1V	7603061	1 Micron Element (viton)
27KZ3	7628577	3 Micron Element
27KZ3V	7629172	3 Micron Element (viton)
27KZ5	7628578	5 Micron Element
27KZ5V	7603077	5 Micron Element (viton)
27KZ10	7628575	10 Micron Element
27KZ10V	7603056	10 Micron Element (viton)
27KZ25	7629170	25 Micron Element
27KZ25V	7603065	25 Micron Element (viton)

Used in MFD-BC Filter Cart and HFS-BC

9" Elements

Model Code	P/N	Description
9GW	7604551	Water Removal Element
9GZ3	7604564	3 Micron Element
9GZ5	7604569	5 Micron Element
9GZ10	7604553	10 Micron Element
9GZ25	7604559	25 Micron Element

Used in X-Skid - High Capacity Replacement Elements

16" Elements

Model Code	P/N	Description
16QPML-Z1B	Contact Factory	1 Micron Element
16QPML-Z1V	7602695	1 Micron Element (viton)
16QPML-Z3B	Contact Factory	3 Micron Element
16QPML-Z3V	7602698	3 Micron Element (viton)
16QPML-Z5B	Contact Factory	5 Micron Element
16QPML-Z5V	7602700	5 Micron Element (viton)
16QPML-Z10B	Contact Factory	10 Micron Element
16QPML-Z10V	7602692	10 Micron Element (viton)
16QPML-Z25B	Contact Factory	25 Micron Element
16QPML-Z25V	7602697	25 Micron Element (viton)

39" Elements

Model Code	P/N	Description
39QPML-Z1B	7603313	1 Micron Element
39QPML-Z1V	7603314	1 Micron Element (viton)
39QPML-Z3B	Contact Factory	3 Micron Element
39QPML-Z3V	7603320	3 Micron Element (viton)
39QPML-Z5B	Contact Factory	5 Micron Element
39QPML-Z5V	7603323	5 Micron Element (viton)
39QPML-Z10B	7632409	10 Micron Element
39QPML-Z10V	7603309	10 Micron Element (viton)
39QPML-Z25B	Contact Factory	25 Micron Element
39QPML-Z25V	7603318	25 Micron Element (viton)

Used in X-Skid - Coreless Replacement Elements

16" Elements		
Model Code	P/N	Description
16QCLQFZ1	Contact Factory	1 Micron Element
16QCLQFZ1V	Contact Factory	1 Micron Element (viton)
16QCLQFZ3	Contact Factory	3 Micron Element
16QCLQFZ3V	7628349	3 Micron Element (viton)
16QCLQFZ5	Contact Factory	5 Micron Element
16QCLQFZ5V	Contact Factory	5 Micron Element (viton)
16QCLQFZ10	Contact Factory	10 Micron Element
16QCLQFZ10V	7628348	10 Micron Element (viton)
16QCLQFZ25	Contact Factory	25 Micron Element
16QCLQFZ25V	7628475	25 Micron Element (viton)

39" Elements		
Model Code	P/N	Description
39QCLQFZ1	Contact Factory	1 Micron Element
39QCLQFZ1V	7628372	1 Micron Element (viton)
39QCLQFZ3	Contact Factory	3 Micron Element
39QCLQFZ3V	7628374	3 Micron Element (viton)
39QCLQFZ5	Contact Factory	5 Micron Element
39QCLQFZ5V	7628375	5 Micron Element (viton)
39QCLQFZ10	Contact Factory	10 Micron Element
39QCLQFZ10V	7628732	10 Micron Element (viton)
39QCLQFZ25	Contact Factory	25 Micron Element
39QCLQFZ25V	7628373	25 Micron Element (viton)

Dimicron® Elements - Used in MTS Series and SVD Series

Model Code	P/N	Description
MTE02	Contact Factory	2 Micron Element
MTE05	Contact Factory	5 Micron Element
MTE10	Contact Factory	10 Micron Element
MTE20	7617620	20 Micron Element
MTE30	7617621	30 Micron Element

*Note - Be sure to order the correct number of elements: MTS1 = 1, MTS2 = 2, MTS3 = 3, MTS4 = 4..

Handy Filter Systems Replacement Elements

Model Code	P/N	Description
M3	7616070	3 Micron Element
M10	7631073	10 Micron Element
MZ3	7627545	3 Micron Element
MZ10	7628733	10 Micron Element

AMFS Unit (and all carts/skids using 18"/27" GeoSeal®) Replacement Elements

Model Code	P/N	Description
KKWV	7615323	Water Removal Element (viton)
KKGZ3V	7615301	3 Micron Element (viton)
KKGZ5V	7615304	5 Micron Element (viton)
KKGZ10V	7630721	10 Micron Element (viton)
27KWV	7603050	Water Removal Element (viton)
27KGZ3V	Contact Factory	3 Micron Element (viton)
27KGZ5V	7603035	5 Micron Element (viton)
27KGZ10V	7603028	10 Micron Element (viton)

Dimicron Elements - Used in KLC and OxiStop

Model Code	P/N	Description
KLE02	7632742	2 Micron Element
KLE05	Contact Factory	5 Micron Element
KLE10	7632741	10 Micron Element
KLE20	7632739	20 Micron Element
KLEA02	7632743	2 Micron Element w/Water Removal
KLEA20	7632740	20 Micron Element w/Water Removal

Ion eXchange Unit Replacement Elements

Model Code	P/N	Description
IXE36-5.5	3348961	Standard Ion Exchange Resin Element
KKZ5V	7615359	5 Micron Pre/ Post Element
KKZ10V	7628656	10 Micron Pre/ Post Element

Appendix

Pressure Elements

Triton-A Unit Replacement Elements

Model Code	P/N	Description
9VZ1V	7604651	1 Micron Element
9VZ3V	7604664	3 Micron Element
9VZ5V	7604673	5 Micron Element
9VZ10V	7628743	10 Micron Element
9VZ25V	7604656	25 Micron Element
PAB3P3N.75AS	7633710	Breather (cart version)
ABF-S40	7627888	Breather (shroud version)

Triton-E Unit Replacement Elements

Model Code	P/N	Description
KKGZ1V	7604651	1 Micron Element
KKGZ3V	7604664	3 Micron Element
KKGZ5V	7604673	5 Micron Element
KKGZ10V	7628743	10 Micron Element
KKGZ25V	7604656	25 Micron Element
MBF-3-M-P20	7627888	Air Breather Element

LSN, LSA, LSW Unit Replacement

Replacement Element Part Numbers				
Size	3µ	5µ	10µ	20µ
RLD250	1307539	2201054	1305954	Contact Factory
RLD400	1313317	2201055	1304608	Contact Factory
LPF160	7620903	7620906	7620895	Contact Factory
LPF240	7620931	7631656	7620924	Contact Factory
LF660	7621004	7621008	7620996	Contact Factory

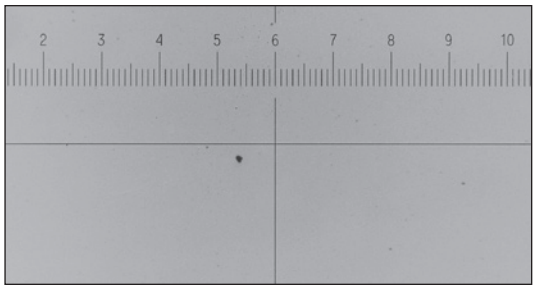
Comparison Photographs for Fluid Contamination Class

Magnification x 100
1 scale mark = 10 µm

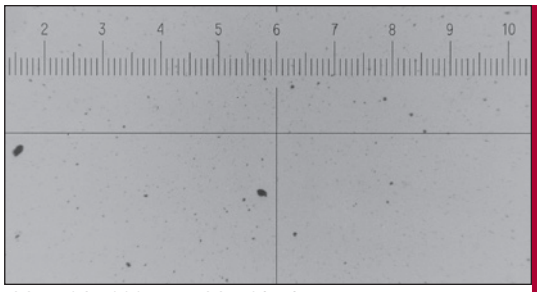
Photos are representative of:

a) 100 ml sample pulled through 0.8 µm 47mm patch or

b) 28 ml sample pulled through 0.8 µm 25 mm patch



ISO 4406:1999 ISO 14/12/9
NAS 1638 Class 3
SAE AS 4059(D) Class 4



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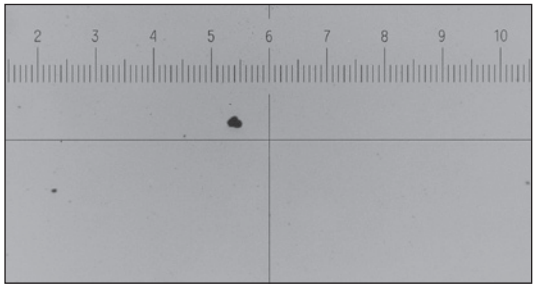

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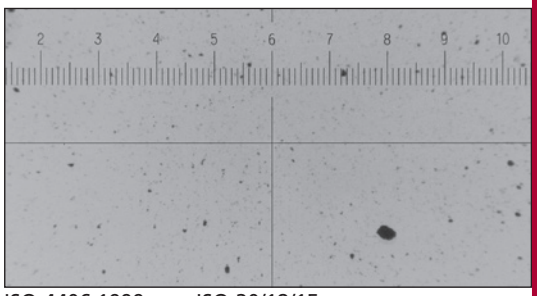

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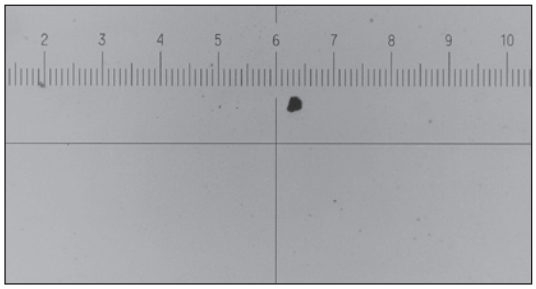

ISO 4406:1999 ISO 16/14/11
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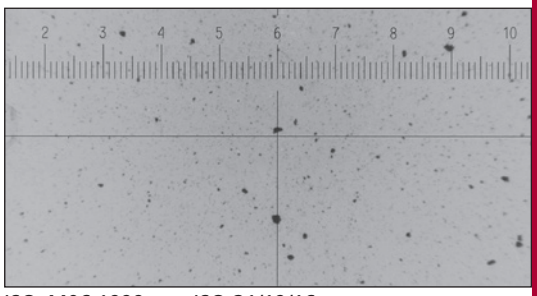
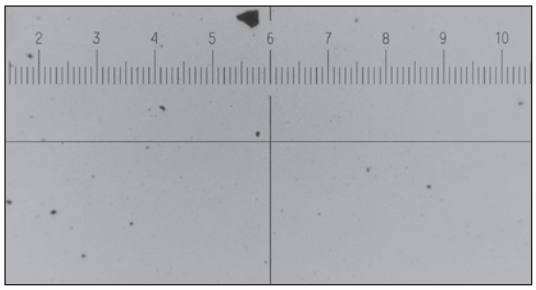
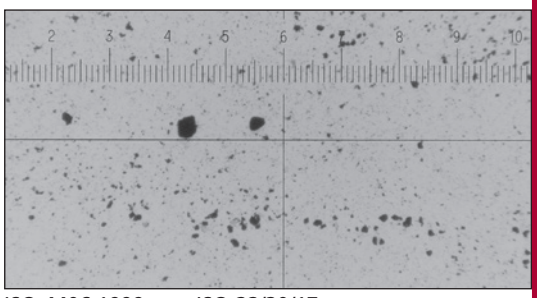
SAE AS 4059(D) Class 6



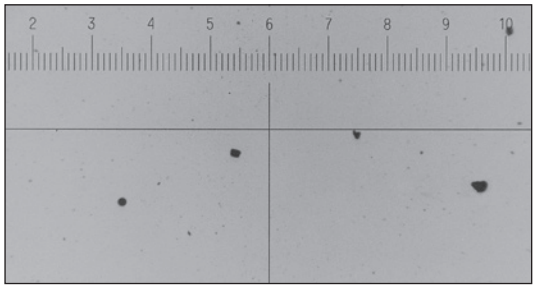
ISO 4406:1999 ISO 21/19/16
NAS 1638 Class 10
SAE AS 4059(D) Class 11



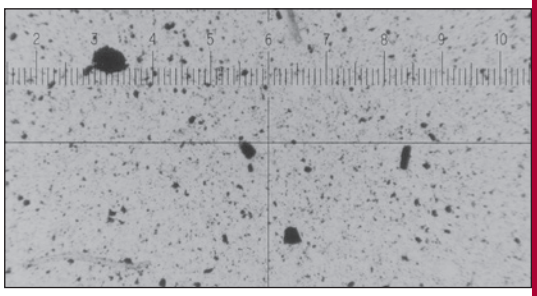
ISO 4406:1999 ISO 17/15/12
NAS 1638 Class 6
SAE AS 4059(D) Class 7



ISO 4406:1999 ISO 22/20/17
NAS 1638 Class 11
SAE AS 4059(D) Class 12



ISO 4406:1999 ISO 18/16/13
NAS 1638 Class 7
SAE AS 4059(D) Class 8



ISO 4406:1999 ISO 23/21/18
NAS 1638 Class 12
SAE AS 4059(D) Class 13

Appendix Contamination Types

Contamination Types

All photos x 48 magnification

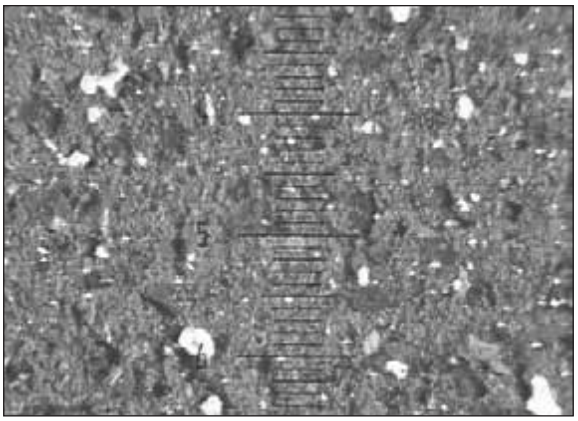
1 scale mark = 45 µm

Particle Type:

Mainly rust; white particles; additives

Effect:

- Rapid oil aging
- Breakdowns in pumps, valves
- Wear and tear

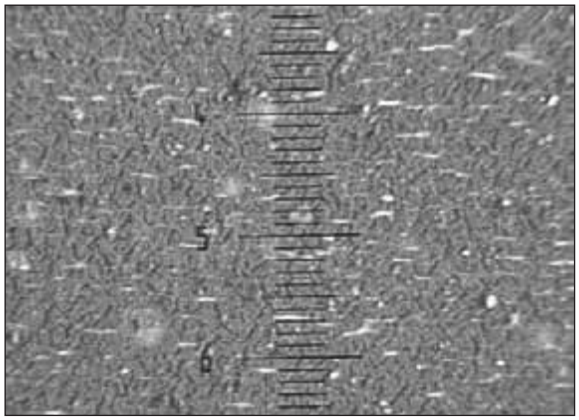


Particle Type:

Oil aging products

Effect:

- Blocking of filters
- Silting-up system

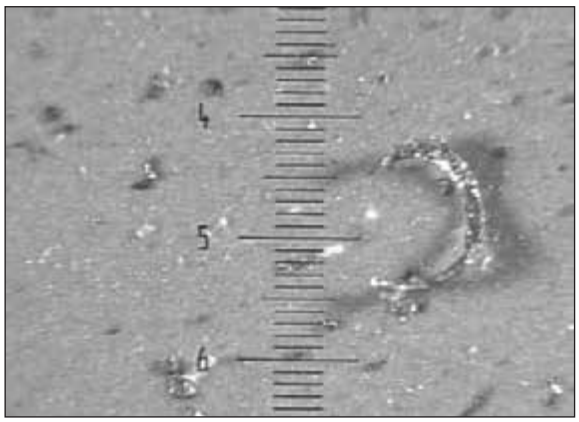


Particle Type:

Metal

Effect:

- Breakdowns in pumps, valves
- Wearing of seals
- Leakage
- Oil aging

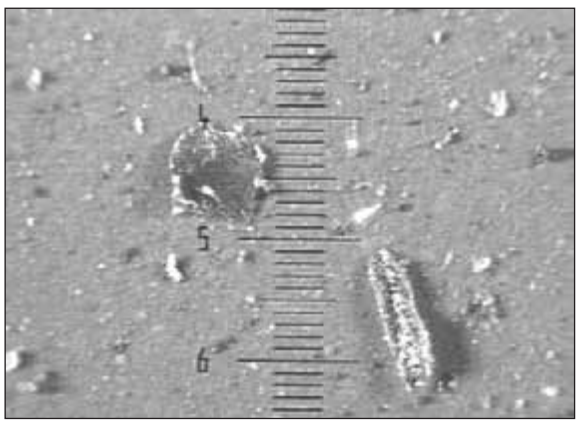


Particle Type:

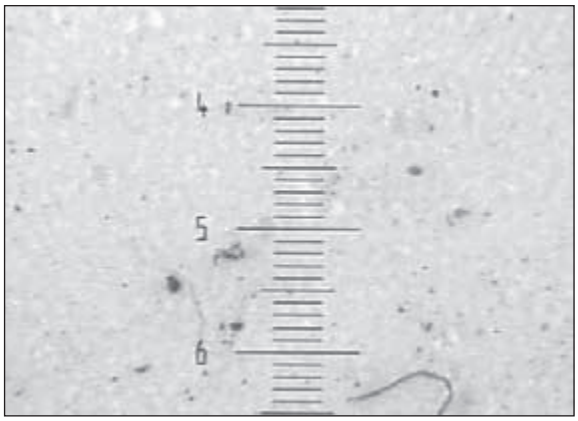
Particles in bronze, brass and copper

Effect:

- Breakdowns in pumps, valves
- Oil aging
- Leakage
- Wearing of seals



Contamination Types

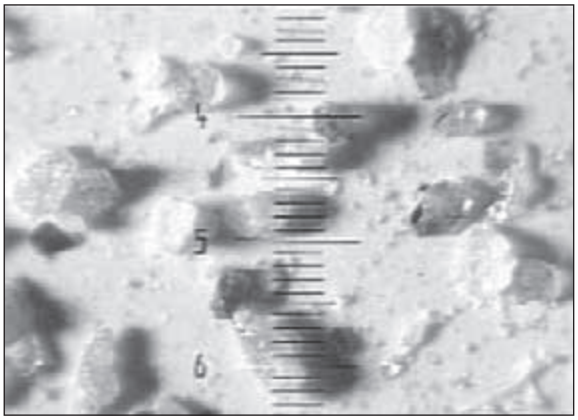


Particle Type:

Gel-type residue from filter element

Effect:

- Blocking of filter
- Silting-up

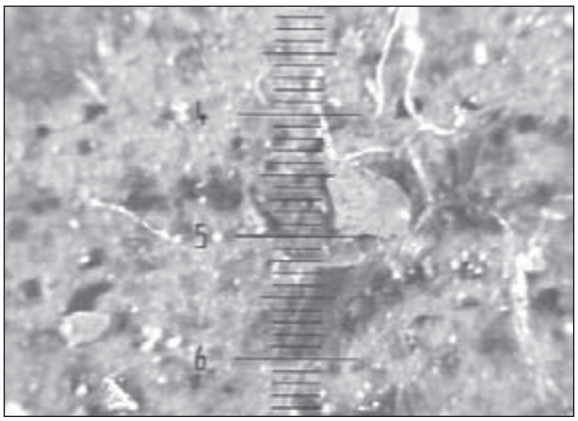


Particle Type:

Silicates due to lack of, or inadequate, air breather filter

Effect:

- Heavy wear on components
- Breakdowns in pumps, valves
- Wearing of seals

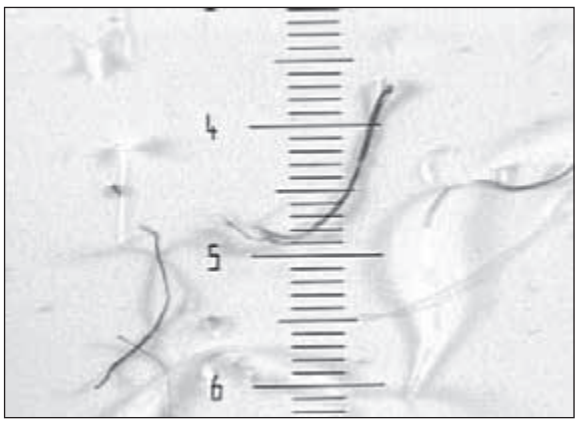


Particle Type:

Colored particles (red/brown)
Synthetic particles (blue)

Effect:

- Breakdowns in pumps, valves
- Wearing of seals



Particle Type:

Fibers due to initial contamination, open tank, cleaning cloths, etc.

Effect:

- Blocking of nozzles
- Leaking from seat valves

Contamination Types

All photos x 48 magnification

1 scale mark = 45 µm

Appendix Contamination Classification

Contamination Classification According to NAS 1638-01/1964

Extended to particle range 2 - 5 µm

NAS-Class	Number of Particles/100 ml						Amount of Contamination (ACFTD) [mg/l]
	2 - 5 µm	5 - 15 µm	15 - 25 µm	25 -50 µm	50 - 100 µm	> 100 µm	
00	625	125	22	4	1	0	—
0	1,250	250	44	8	2	0	0.01
1	2,500	500	88	16	3	1	—
2	5,000	1,000	178	32	6	1	—
3	10,000	2,000	356	63	11	2	—
4	20,000	4,000	712	126	22	4	0.1
5	40,000	8,000	1,425	253	45	8	—
6	80,000	16,000	2,850	506	90	16	0.2
7	160,000	32,000	5,700	1,012	180	32	0.5
8	320,000	64,000	11,400	2,025	360	64	1
9	640,000	128,000	22,800	4,050	720	128	3
10	1,280,000	256,000	45,600	8,100	1,440	256	5
11	2,560,000	512,000	91,200	16,200	2,880	512	7 - 10
12	5,120,000	1,024,000	182,400	32,400	5,760	1,024	20
13	—	2,048,000	364,800	64,800	11,520	2,048	40
14	—	4,096,000	729,000	129,600	23,040	4,096	80

Contamination Classification According to SAE AS 4059(D)

	ISO 4402 Calibration	>1 µm	>5 µm	>15 µm	>25 µm	>50 µm	>100 µm
	ISO 11171 Calibration	>4 $\mu m_{(c)}$	>6 $\mu m_{(c)}$	>14 $\mu m_{(c)}$	>21 $\mu m_{(c)}$	>38 $\mu m_{(c)}$	>70 $\mu m_{(c)}$
Contamination Classes	SAE Code	A	B	C	D	E	F
	000	195	76	14	3	1	0
	00	390	152	27	5	1	0
	0	780	304	54	10	2	0
	1	1,560	609	109	20	4	1
	2	3,120	1,220	217	39	7	1
	3	6,250	2,430	432	76	13	2
	4	12,500	4,860	864	152	26	4
	5	25,000	9,730	1,730	306	53	8
	6	50,000	19,500	3,460	612	106	16
	7	100,000	38,900	6,920	1,220	212	32
	8	200,000	77,900	13,900	2,450	424	64
	9	400,000	156,000	27,700	4,900	848	128
	10	800,000	311,000	55,400	9,800	1,700	256
	11	1,600,000	623,000	111,000	19,600	3,390	512
	12	3,200,000	1,250,000	222,000	39,200	6,780	1,020

Contamination Classification

Appendix

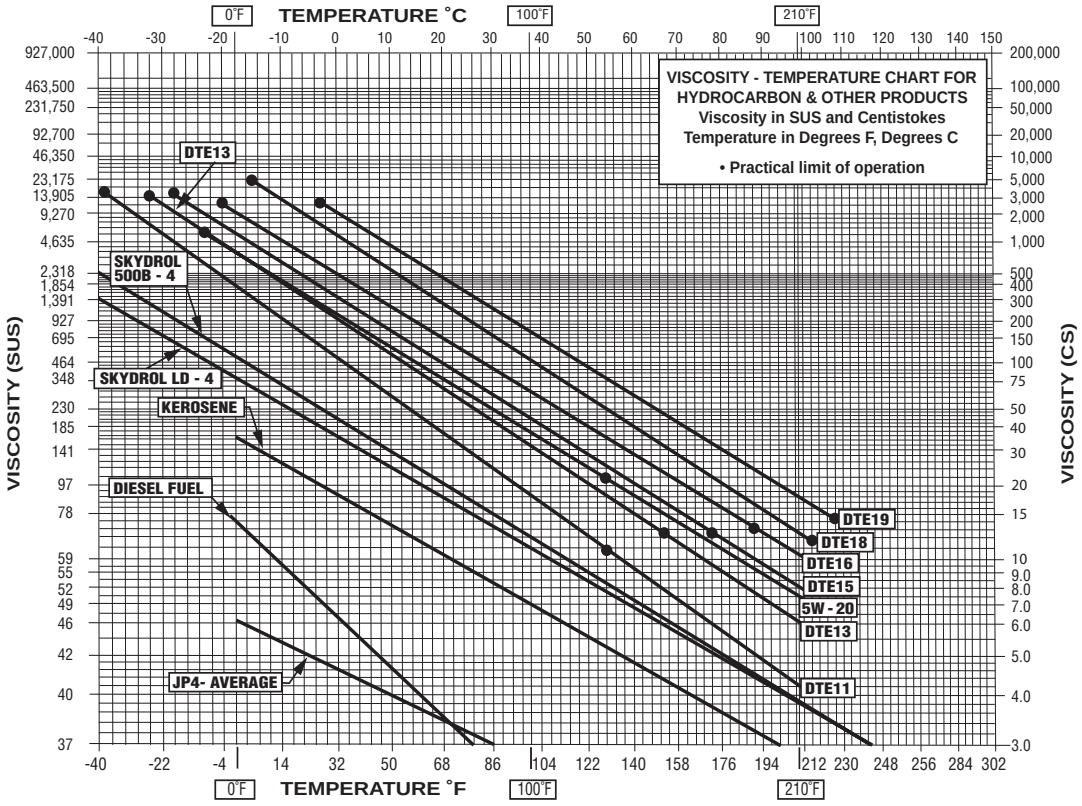
Contamination Classification in Accordance with ISO 4406:1999

ISO-Class	Number of Particles/1 ml more than	Number of Particles/1 ml up to and up including	ISO-Class	Number of Particles/1 ml more than	Number of Particles/1 ml up to and up including
0	0.00	0.01	15	160	320
1	0.01	0.02	16	320	640
2	0.02	0.04	17	640	1,300
3	0.04	0.08	18	1,300	2,500
4	0.08	0.16	19	2,500	5,000
5	0.16	0.32	20	5,000	10,000
6	0.32	0.64	21	10,000	20,000
7	0.64	1.3	22	20,000	40,000
8	1.30	2.5	23	40,000	80,000
9	2.50	5	24	80,000	160,000
10	5	10	25	160,000	320,000
11	10	20	26	320,000	640,000
12	20	40	27	640,000	1,300,000
13	40	80	28	1,300,000	2,500,000
14	80	160			

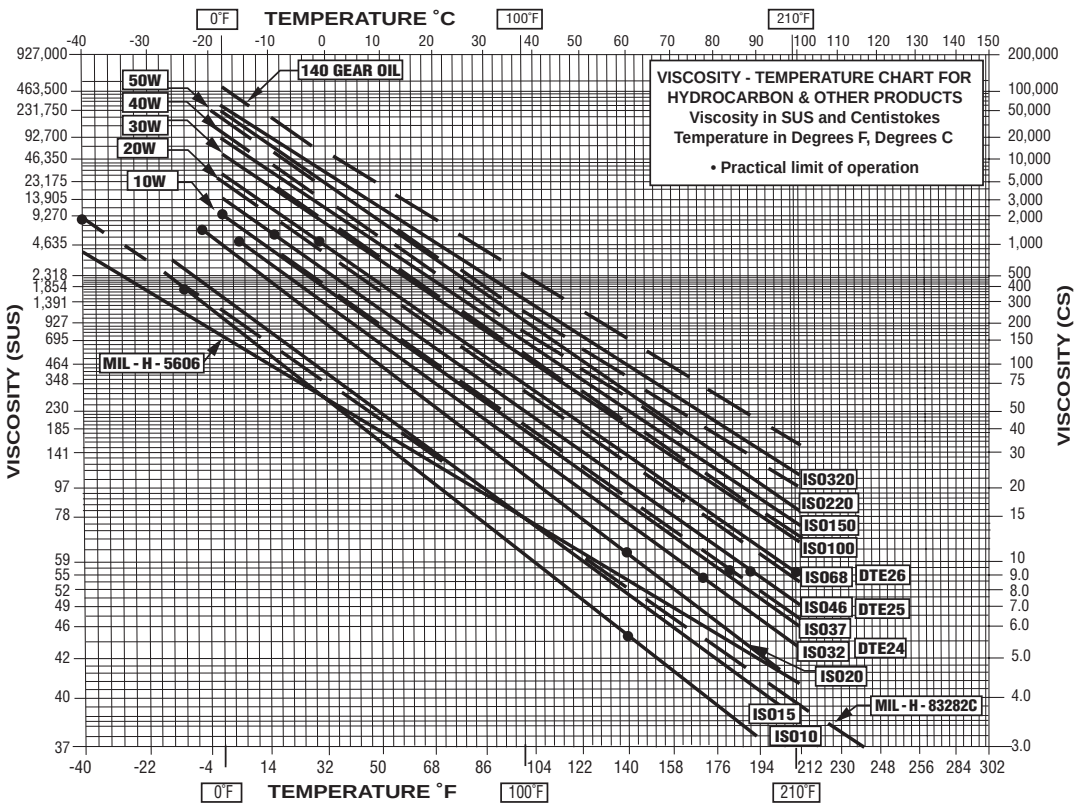
- Current ISO codes are made up of 3 numbers representing the number of particles ≥4 µ(c), ≥6 µ(c) and ≥14 µ(c). *The particle count is expressed as the number of particles per ml.*
- Reproducibility below scale number 8 is affected by the actual number of particles counted in the fluid sample. Raw counts should be more than 20 particles. If this is not possible, then refer to bullet below.
- When the raw data in one of the size ranges results in a particle count of fewer than 20 particles, the scale number for that size range shall be labeled with the symbol ≥.

EXAMPLE: A code of 14/12/≥7 signifies that there are more than 80 and up to and including 160 particles equal to or larger than 4 µ(c) per ml and more than 20 and up to and including 40 particles equal to or larger than 6 µ(c) per ml. The third part of the code, ≥7 indicates that there are more than 0.64 and up to and including 1.3 particles equal to or larger than 14 µ(c) per ml. The ≥ symbol indicates that less than 20 particles were counted, which lowers statistical confidence. Because of this lower confidence, the 14 µ(c) part of the code could actually be higher than 7, thus the presence of the ≥ symbol.

Appendix Viscosity Chart



Viscosity Chart



Notes Section:

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ISO 11171:1999 Hydraulic fluid power - Calibration of liquid automatic particle counters

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