

# SmartFilter Series

Intelligent Filtration and Maintenance Systems for Fuel Oil



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Maintenance Systems for Fuel Oil • Page 2

# SIMPLEX®



## Overview

- Filtration, maintenance system for fuel oil in bulk, long-term storage
- For permanent, on-site installation, indoor or outdoor
- Comprehensive system: pump, filter and water removal elements, controller
- Fully automated
- 5-50 GPM
- 2 micron final filtration
- 5 PPM water removal
- Single or multiple tank

## Description

The Simplex SmartFilter Series comprises a standard, engineered-design family of fuel oil filtration, conditioning and maintenance systems. These systems are intended for use with fuel oil held in bulk, long-term storage, including underground and aboveground main supply tanks, large generator sub-base tanks and large day tanks. Typical tank capacities are in excess of 5000 gallons, with 10,000-20,000 gallon or larger tanks being common. The SmartFilter system provides typical

8-hour filtration rates to cycle 25%- 33% of tank capacity on a weekly basis. Principal uses of the SmartFilter are with fuel tanks dedicated to diesel or turbine engine generator sets or with oil-fired boiler or process heat systems.

The SmartFilter Series is especially relevant and timely when considering the stringent fuel quality requirements of modern industrial engines where fuel quality impacts engine performance, reliability and emissions. Many studies have indicated poor fuel quality as a major cause of dispatch failure of standby power systems. Fuel in long-term storage is subject to degradation from bacteria, fungi, yeast, mold and algae. Ironically, fuel oil is a favorable medium for the growth of these microorganisms. Given water and a source of oxygen, microbes "feed" on the constituents of fuel, namely carbon, nitrogen, phosphorous, sulfur and other trace minerals. Persistent water contamination of fuel oil will allow for the proliferation of these microbes. Not only is the chemical makeup of the fuel being attacked, these microbes deposit contaminants which can clog engine filters, or worse, injectors. Unscheduled downtime is the result.

Where does this water originate? Uncertain quality of fuel deliveries is one source. However, simple atmospheric condensation and the resultant accumulation of water in a vented tank certainly represents the source of long-term and persistent water in fuel.

Particulate contamination is a significant source of fuel oil degradation as well and can occur in long-term storage due to tank corrosion or from contaminants accumulating over the course of many deliveries.

Keep in mind a simple fact. There are 8760 hours in a year. A typical standby generator set may run less than 300 hours a year. During the remaining 8500 hours of engine "quiet-time", microbes and corrosion continue their work of degrading fuel. The SmartFilter attacks and corrects these sources of fuel degradation. The SmartFilter thus becomes a critical element in the chain of reliability of standby power systems.

The SmartFilter combines several elements to form a comprehensive, integrated, automated system:

- Multi-stage, progressive particulate filtration and water removal
- Integrated, high-performance pump
- Flow control and monitoring devices
- Digital, user-programmable controller

The SmartFilter uses a progressive filtration and conditioning regime:

1. Coarse straining through 100 mesh washable screens
2. Pre-filtration through 10 micron disposable media filter
3. Final filtration through 2 micron disposable media filter
4. Water coalescing to 5 PPM
5. Water separation and collection

Fuel circulation and transfer is accomplished via an on-board, high-performance, cast-iron, positive-displacement gear pump direct-driven via an industrial, heavy-duty motor. The pump combines high vacuum prime maintenance with linear flow versus pressure performance. An integral pressure relief valve is included. Drive motors are NEMA class industrial type, conservatively applied and include ball-bearings, class H insulation and continuous duty ratings.

The SmartFilter system includes shutoff ball valves, check valves, flow switches, pressure and differential pressure gauges, and differential pressure sensors across each filtration element. Single or multi-tank valving is available.

Intelligent automation and operator interface is the hallmark of the Simplex SmartFilter. Each SmartFilter is packaged with a Simplex designed and manufactured digital controller. This UL508 listed and labeled industrial control panel features PLC-based digital control and touch-panel operator interface. The controller provides full automatic operation of the system and is operator field programmable to set filtration cycle duration, time of day, day of week operation. Manual override capability is included. The controller monitors flow, differential pressure across each filtration element and water level in the separator collection vessel. Filtration cycle and filter element maintenance history logs are provided. Operational alarms and alarm logs are likewise generated. The controller is MODBUS or Ethernet network compatible for integration with remote Building Automation Systems or generator control switchgear. The controller is expandable for multi-tank operation and valve control.

As is typical of Simplex Products, including Simplex Day Tanks, Packaged Pump Sets and Tank Filling Systems, options are plentiful and flexible, including:

- Water retention tank
- Automatic water drain to retention tank
- Fuel additive tank and injection pump, with full automation
- Multi-tank filtration
- Multi-tank crossfeed
- Outdoor and stainless-steel construction
- Hazardous environment, explosion-proof construction
- Marine or severe duty construction

The Simplex SmartFilter is today's answer to pressing fuel quality concerns: a standard, factory-packaged filtration system of robust, user-friendly design utilizing the best filtration and water removal technology, design-built to your exacting project requirements.



**50 GPM SmartFilter**



**30 GPM Skid-Mount SmartFilter**

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# SIMPLEX®



50 GPM SmartFilter

## Sizing a Filtration System

Most fuel contaminants will settle from still fuel resulting in a stratification of fuel with contaminants concentrated in the lower strata. Therefore, it is necessary to circulate and filter the lower 25-33% of the tank contents. When the SmartFilter is properly installed, fuel will be drawn from the bottom of the tank and returned with minimal disturbance of the settled strata resulting in good filtration performance and removal of contaminants and water.

It is recommended to size the SmartFilter to circulate and filter 25-33% of the tank capacity in a nominal 8-hour run period, once each week. Hence, for a 20,000 gallon tank:

- 25% of 20,000g = 5000g to circulate and filter in an 8-hour period
- 5000g/8 hours = 625 GPH or 10.4 GPM
- Use the Simplex SF-10 SmartFilter
- For the same tank filtering 33%, or 6600 gallons, run the SF-10 for 11 hours or specify the SF-20 and run for 5 hours

Of course, there is no absolute rule and if it is desired to filter greater than 33%, or even 100% of the tank, simply specify a larger SmartFilter or run the filtration system longer. These are continuous duty devices. The only limit to run time is filter condition, which is constantly monitored by the SmartFilter controller.

## Standard Models

MODEL	GPM <sup>1</sup>	GPH <sup>1</sup>	TANK SIZE <sup>2</sup> GALLONS	25% CYCLE TIME – HRS	33% CYCLE TIME – HRS	HP <sup>1</sup>	VOLTAGE	PIPE SIZE IN. NPT
SF10	10	600	12,000-20,000	5-8.3	6.6-11	0.75	115/230-1-60V, 11.0/5.5A 230/460-3-60V, 2.8/1.4A	2.0
SF15	15	900	16,000-22,000	4.4-6.1	5.9-8.1	1.0	115/230-1-60V, 13.4/6.7A 230/460-3-60V, 3.6/1.8A	2.0
SF20	20	1200	20,000-30,000	4.2-6.25	5.5-8.3	1.5	115/230-1-60V, 18.0/9.0A 230/460-3-60V, 4.8/2.4A	2.0
SF30	30	1800	28,000-40,000	3.9-5.6	5.2-7.4	2.0	230-1-60V, 10.5A 230/460-3-60V, 5.8/2.9A	2.0
SF40	40	2400	38,000-55,000	4.0-5.7	5.3-7.6	3.0	230-1-60V, 17.5A 230/460-3-60V, 8.4/4.2A	2.0
SF50	50	3000	50,000-75,000	4.2-6.25	5.6-8.3	3.0	230-1-60V, 17.5A 230/460-3-60V, 8.4/4.2A	2.0

<sup>1</sup>GPM/HP @ 32SSU, 50PSI

<sup>2</sup>Single Tank Capacity In Multiple Aggregate Capacity

## How to Order

Specify:

- Model
- Voltage
- Options

## Options

SF-010: Water holding tank, 10 gallon, with float switch, integration to controller, vent, drain hand pump, shutoff valves. Manual drain of separator canister.  
 Note: hazardous waste

SF-015: Automatic drain of separator canister to holding tank. Includes integration with controller, electric valves, water differential level sensors, alarms.

SF-030: Injection tank and pump for automatic or manual injection of fuel additives. 5-gallon.

SF-040: Magnetic fuel conditioner

SF-100: Multi-tank controller operation and valving. Multi-tank crossfeed capability.

## Standard System Includes

- Outdoor, weatherproof, pad-mountable enclosure, also suitable for indoor installation. 2-inch NPT. See Dimensional Drawings
- On-board, integrated digital controller, UL508. See Controller Section
- Inlet, outlet ball-type shutoff valves
- Check valve
- Pressure/vacuum gauges
- Pressure transducers, flow switches, water detector. See Controller Section
- Circulation pump, GPM and HP as per Model Section
- Filtration elements:
  - Strainer, 100 mesh
  - Pre-filter, 10 micron
  - Final filter, 2 micron
  - Water coalescer
  - Water separator, 5 PPM

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**FILTER QUALITY**
SYSTEM STATUS

RUN TIME SINCE LAST FUEL DELIVERY

83.65 HOURS

RUN TIME SINCE PREFILTER SERVICE

156.73 HOURS

RUN TIME SINCE COALESCER SERVICE

25.87 HOURS

PREFILTER PRESS.

COALESCER PRESS.

**STATUS**
NEW FUEL DELIVERY

SYNCHRONIZING VALVES

ALARMS

FUEL QUALITY HISTORY
PROGRAM FILTER CYCLE
FILTER QUALITY SUMMARY
SET TIME AND DATE

GO TO TOP
PAGE UP
PAGE DOWN
SYSTEM STATUS

SERVICE PREFILTER	11:14 11/14/07
FUEL ADDED TO TANK 2	00550 GAL 11/14/07
SERVICE COALESCER	05:10 11/12/07
FUEL ADDED TO TANK 1	00631 GAL 11/02/07
DRAIN COALESCER	21:57 10/21/07

PROGRAM				SYSTEM STATUS
DAY	START TIME	CYCLE LENGTH	TANK	
TUESDAY	07:15	006:30	1	
SATURDAY	03:00	024:00	2	
WEDNESDAY	07:15	008:00	2	
FRIDAY	03:00	024:00	1	
CYCLE OFF	00:00	000:00	1	
CYCLE OFF	00:00	000:00	1	ACCEPT
CYCLE OFF	00:00	000:00	1	
CYCLE OFF	00:00	000:00	1	

## Controller

The Simplex SmartFilter includes a UL508 Listed, NEMA enclosed, digital controller with the following features:

1. PLC-based digital controller
  - a. MODBUS, ETHERNET communications
2. Touch-panel operator interface
3. Time of day, day of week, interval programmable timing
4. Analog-to-digital inputs for:
  - a. Pressure differential across strainer
  - b. Pressure differential across pre-filter
  - c. Pressure differential across coalescor
5. Point-sensing inputs for:
  - a. Flow
  - b. Leak sensing
  - c. Coalescer water detection
6. Display of the following data:
  - a. Pressure differentials as above
  - b. Filtration history
  - c. No flow alarm
  - d. Leak alarm
  - e. Water in coalescer alarm
  - f. Service strainer alarm
  - g. Service pre-filter alarm
  - h. Service coaleser alarm
7. User programmable
  - a. Filtration cycle, as above
  - b. Delivery history
  - c. Fuel quality history
8. User I/O to touch-panel
  - a. System HOA switch
  - b. Alarm reset pushbutton
  - c. Programming entry keypad
  - d. Alarm programming screen
9. Control devices
  - a. Pump motor starter
  - b. Control power fuses
  - c. Terminal blocks

## ENGINEER'S SPECIFICATION

### Fuel Oil Filtration and Conditioning System

#### 1.0 General description and requirements

1.1 Provide a standard, factory packaged design fuel oil filtration and conditioning system to maintain quality of fuel held in extended storage. The filtration system shall include all specified and necessary components required to effect the specified function and comply with applicable codes, rules and regulations.

1.1.2 The filtration system shall be the standard product of a single manufacturer and be in serial production. Custom, job-fabricated products shall not be acceptable.

1.1.3 The filtration system shall be network compatible with other elements of the fuel supply system and network compatible with the building automation system where applicable.

1.1.4 The filtration system shall consist of the following principle elements, which are described in detail in subsequent paragraphs:

1.1.4.1 Full steel enclosure with containment for indoor or outdoor installation

1.1.4.2 Three-stage filtration and water removal elements

1.1.4.3 Transfer pump

1.1.4.4 Valves and sensors

1.1.4.5 Controller

#### 1.2 Submittals

1.2.1 Comprehensive drawings, descriptive and data shall include:

1.2.1.1 Detailed dimensional drawings

1.2.1.2 Field pipe fitting details

1.2.1.3 Field electrical connection details

1.2.1.4 Filtration and water removal performance data

1.2.1.5 Details of installation clearance, ventilation requirements

1.2.1.6 Warnings, cautions and installation limitations

1.2.1.7 Detailed description of operation

1.2.1.8 One-line piping and electrical drawings

#### 1.3 Spare parts

1.3.1 Include the following field service spare parts

1.3.1.1 Three (3) each particulate filter

1.3.1.2 One (1) each water coalescing elements and gaskets

1.3.1.3 One (1) set replacement fuses

#### 1.4 General specifications

1.4.1 Three-stage filtration

1.4.1.1 Inlet strainer: 100 mesh

1.4.1.2 Pre-filter: 10 micron

1.4.1.3 Final filter: 2 micron

1.4.1.4 Water separation: 5 PPM

1.4.2 Pump performance

1.4.2.1 (Choose one: 600, 900, 1200, 1800, 2400, 3000) gallons-per-hour at 50psi, 32SSU

1.4.3 Power requirements

1.4.3.1 (Choose one: 115-1-60v, 230-1-60v, 230-3-60v, 460-3-60v)

1.4.4 Pipe size: 2-inch NPT

1.4.5 Filtration rate: 6-8 hour nominal filtration cycle once per week.

#### 1.5 Filtration system detail

1.5.1 Enclosure: Provide the filtration system factory packaged within a pad-mountable steel enclosure suitable for indoor or outdoor installation. Enclosure shall have the following attributes:

1.5.1.1 Fabricated steel, monolithic welded construction

1.5.1.2 Enclosure shall be powder-coated for use in an industrial environment

1.5.1.3 Hinged and lockable service access doors, with perimeter rain gutters

1.5.1.4 Leak containment basin integral to enclosure floor, including leak detector

1.5.1.5 Lifting eyes

1.5.1.6 Forklift channels

1.5.1.7 Bolt-down feet

#### 1.5.2 Transfer pump

1.5.2.1 Positive displacement gear pump, cast-iron construction with mechanical shaft seal and integral pressure-relief valve. High-vacuum, prime-maintenance and lift performance.

1.5.2.2 AC direct-drive motor, TEFC construction, 1800 RPM, continuous duty performance, voltage per requirement above. HP as required for 50PSI output at GPH specified

#### 1.5.3 Filtration devices

1.5.3.1 Strainer: Install a simplex basket type strainer on the suction side of the pump. 100-mesh, stainless steel screen, cleanable basket, cast-iron strainer body with NPT screw thread connection. Equipped with pressure differential switch.

1.5.3.2 Pre-filter: disposable micro-glass media, 10 micron, spin-on type. Equipped with pressure differential sensors and gauge

1.5.3.3 Final filter: disposable media, 2 micron, canister type construction. Equipped with pressure differential sensors and gauge

1.5.3.4 Water coalescer and separator: semi-permanent, canister type construction. Equipped with pressure differential sensors and gauge

### 1.5.4 Valves

1.5.4.1 Main inlet shutoff valve, 2-inch NPT, bronze, ball-type

1.5.4.2 Main outlet shutoff valve, 2-inch NPT, bronze, ball-type

1.5.4.3 Check valve

1.5.5 Controller: The system shall include a UL508 Listed, NEMA enclosed, digital controller with the following features:

1.5.5.1 PLC-based digital controller

1.5.5.2 MODBUS, ETHERNET communications

1.5.5.3 Touch-panel operator interface

1.5.5.4 Time of day, day of week, interval programmable timing

1.5.5.5 Analog-to-digital inputs for:

1.5.5.5.1 Pressure differential across strainer

1.5.5.5.2 Pressure differential across pre-filter

1.5.5.5.3 Pressure differential across coalescer

1.5.5.6 Point-sensing inputs for:

1.5.5.6.1 Flow

1.5.5.6.2 Leak sensing

1.5.5.6.3 Coalescer water detection

1.5.5.7 Display of the following data:

1.5.5.7.1 Pressure differentials as above

1.5.5.7.2 Filtration history

1.5.5.7.3 No flow alarm

1.5.5.7.4 Leak alarm

1.5.5.7.5 Water in coalescer alarm

1.5.5.7.6 Service strainer alarm

1.5.5.7.7 Service pre-filter alarm

1.5.5.7.8 Service coaleser alarm

1.5.5.8 User programmable

1.5.5.8.1 Filtration cycle, as above

1.5.5.8.2 Delivery history

1.5.5.8.3 Fuel quality history

1.5.5.9 User I/O to touch-panel

1.5.5.9.1 System HOA switch

1.5.5.9.2 Alarm reset pushbutton

1.5.5.10 Manufacturer: the filtration and conditioning system shall be a Smart Filter as manufactured by Simplex, Inc., Springfield, Illinois.