

# 6 • Crankcase Ventilation

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## Clearing the Air with Crankcase Ventilation

Due to the growing importance of safeguarding our global environment, efficient crankcase ventilation filtration systems are increasingly critical to diesel engine Original Equipment Manufacturers (OEMs). Future worldwide diesel engine emission regulations will require OEMs to continue to reduce total particulate emissions. Current emission regulations in some regions and market segments cover total engine emissions, which include both tailpipe and crankcase. Since crankcase emissions can contribute up to 25% of total emissions, control of this air pollution source is critical to the protection of the earth's environment.

## Blow-by: An Increasingly Significant Environmental Impact

A significant contributor to environmental degradation is engine crankcase blow-by. During diesel engine operation, blow-by is generated by the leakage of combustion gases past piston rings. The blow-by is typically laden with oil droplets which can be divided into two classes based on particle size:

1. Drip (visible drips or puddles of oil)
2. Aerosol (sub-micron oil drops that create the oily "smoke" seen at the crankcase vent)

During engine operation, the concentrations of oil droplets between 3 and 20  $\mu\text{m}$  tends to be low. As a percentage of total mass, most of the oil is present either as large drips or as aerosol particles smaller than 3  $\mu\text{m}$ . The major challenge for crankcase ventilation filtration is the removal of aerosol particles. A considerable portion of aerosol particles are in the 0.2 to 0.3  $\mu\text{m}$  size range, the size of maximum penetration or are in the size range of 0.2 to 3.0  $\mu\text{m}$ . This size range creates a significant challenge for all but the most advanced crankcase ventilation filtration products such as the coalescing technology provided by Cummins Filtration®.

Without adequate and effective filtration, significant amounts of aerosol may be present in blow-by. Crankcase gases must be particularly well cleaned in order to minimize turbocharger and intercooler deposits and fouling, as well as to reduce particulate loading on the exhaust aftertreatment system.

There are two basic ways of venting crankcase emissions, either into the atmosphere – Open Crankcase Ventilation (OCV) – or routing the crankcase gases back into the engine air intake system – Closed Crankcase Ventilation (CCV). Cummins Filtration offers both OCV and CCV approaches to manage crankcase blow-by on diesel engines.

## Leading the Way with the Right Technologies

Cummins Filtration has emerged with twelve US patents on or related to CV filtration, plus some related ancillary patents. Our CV patents cover coalescers, impactors and Electrostatic Droplet Collector (EDC) devices. The company also holds a patent on a rotating coalescer design and eight patents based on coalescer technology, alone or in combination with an impactor. A number of patent applications covering other CV technologies are awaiting approval.

Depending on customer requirements, our CV products may be used alone, with performance enhancing features, or in combination with other technologies to achieve desired levels of performance. Today, they are used on nearly every major make of on-highway and industrial diesel and natural gas engine in North America and Europe.

Cummins Filtration Crankcase Ventilation systems are innovative products which are specifically designed to provide the type of performance the marketplace and the environment requires.

Product features include:

- Superior aerosol filtration, 98+% efficiency
- No service required for the impactor
- Easy service access
- Easy installation
- Durability
- Integrated electronic sensor
- Easy and versatile engine and/or equipment integration
- Easy access to service the coalescing filter elements

# Introduction

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Product benefits include:

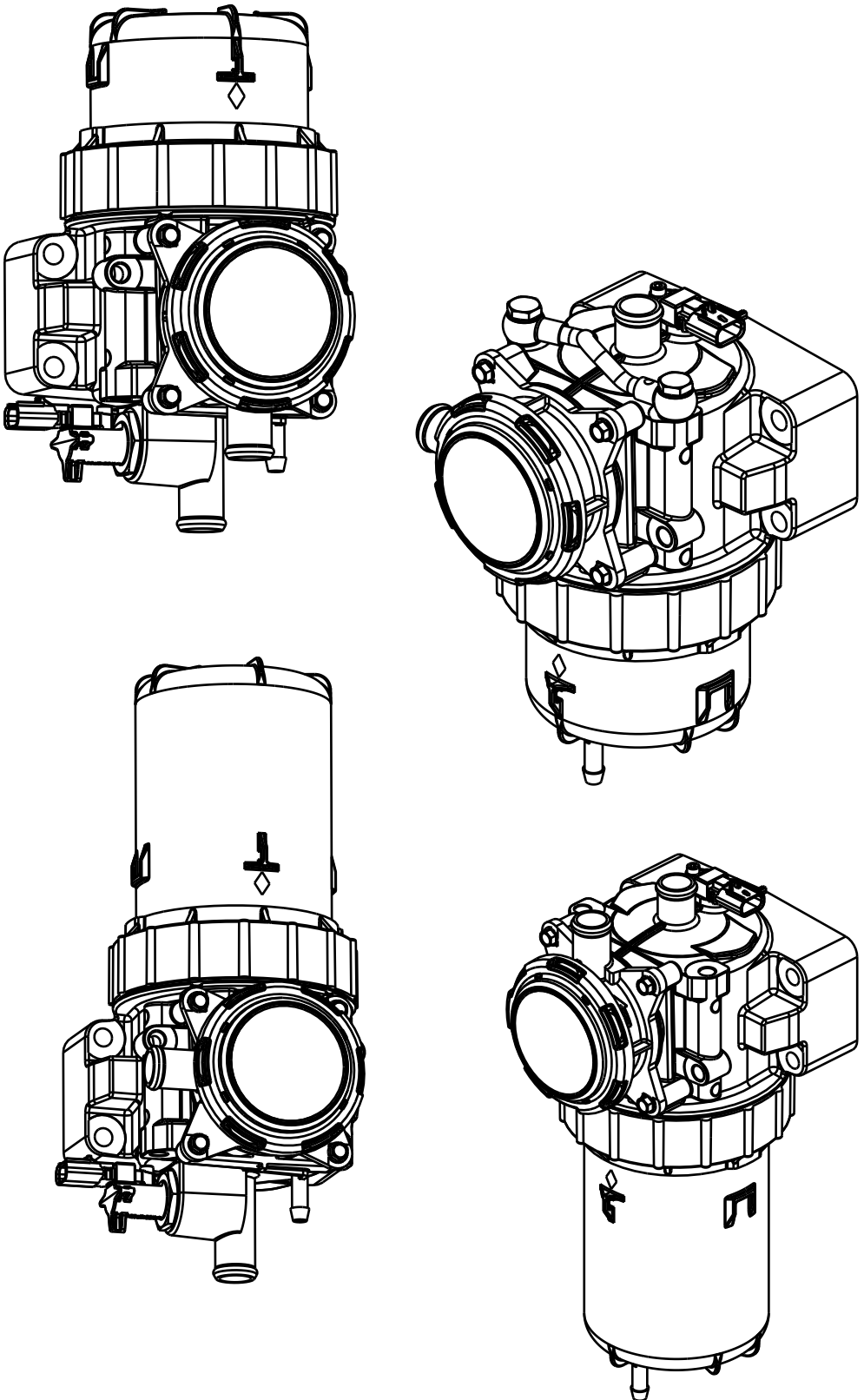
- Reduced engine oil consumption
- Reduced engine maintenance due to residual oil drip build-up
- Increased uptime
- Quick and easy service
- Reduced environmental impact and waste
- Flexibility as most of our products can be applied in either OCV or CCV mode

Optional features include:

- Crankcase ventilation heat for cold ambient conditions
- Heater options for cold ambient conditions (on select products)
- Oil drain check valves
- Crankcase Depression Regulation (CDR) valves
- Filter Minder® visual restriction gauge
- Crankcase pressure sensor

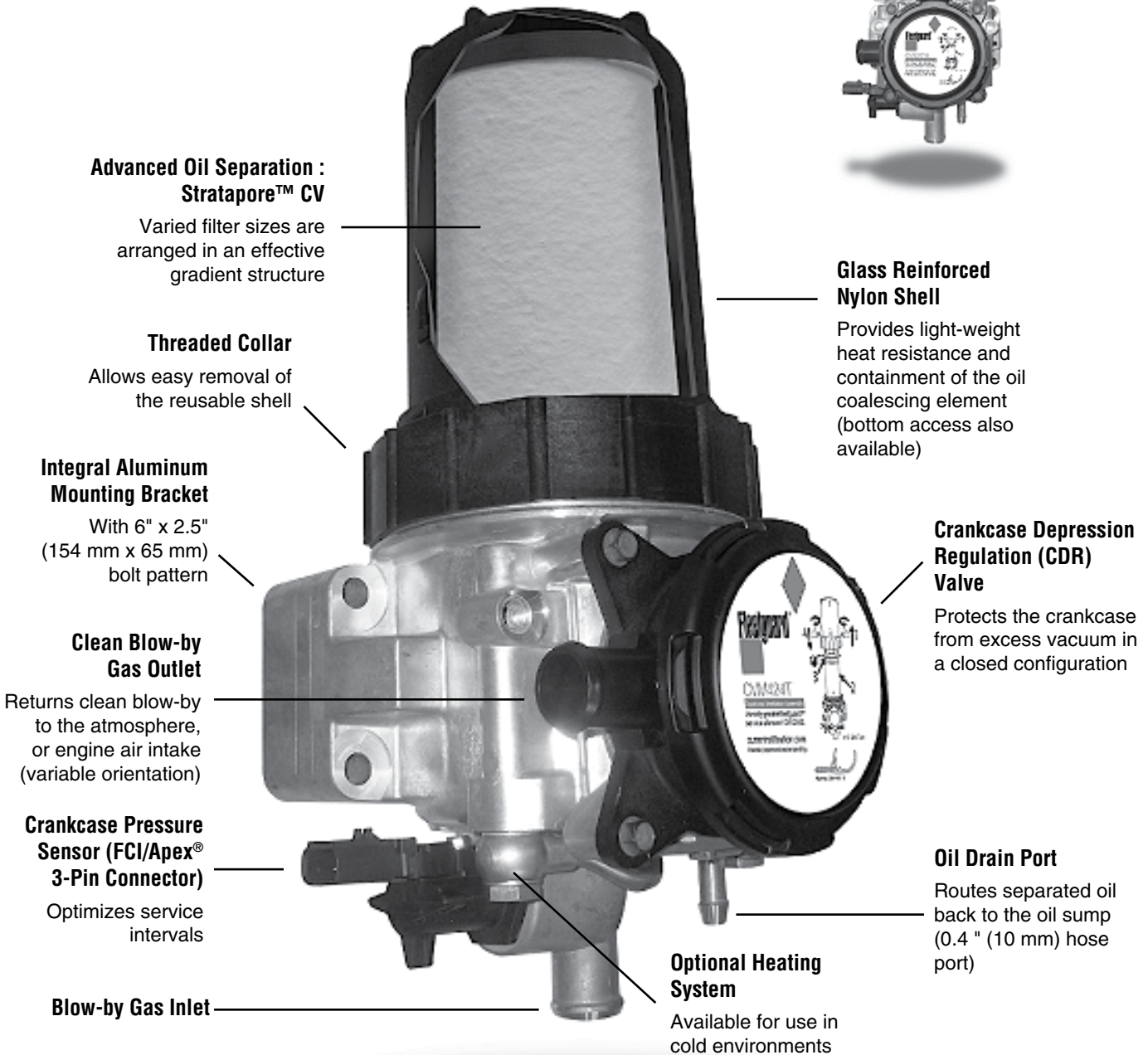
Fleetguard® crankcase ventilation systems are capable of vastly reducing the amount of contaminants either vented to the atmosphere or circulated back into the air intake for a wide variety of today's diesel engines, keeping the turbocharger and heat exchangers clean and performing well. To maintain a vehicle's optimal performance, and in order to operate under warranty, it is important that installation recommendations be met. If there are any questions, a Technical Assistance Specialist should be called. A list of the worldwide Customer Assistance Centers may be found on the back of this document. For further information, please visit [cumminsfiltration.com](http://cumminsfiltration.com).

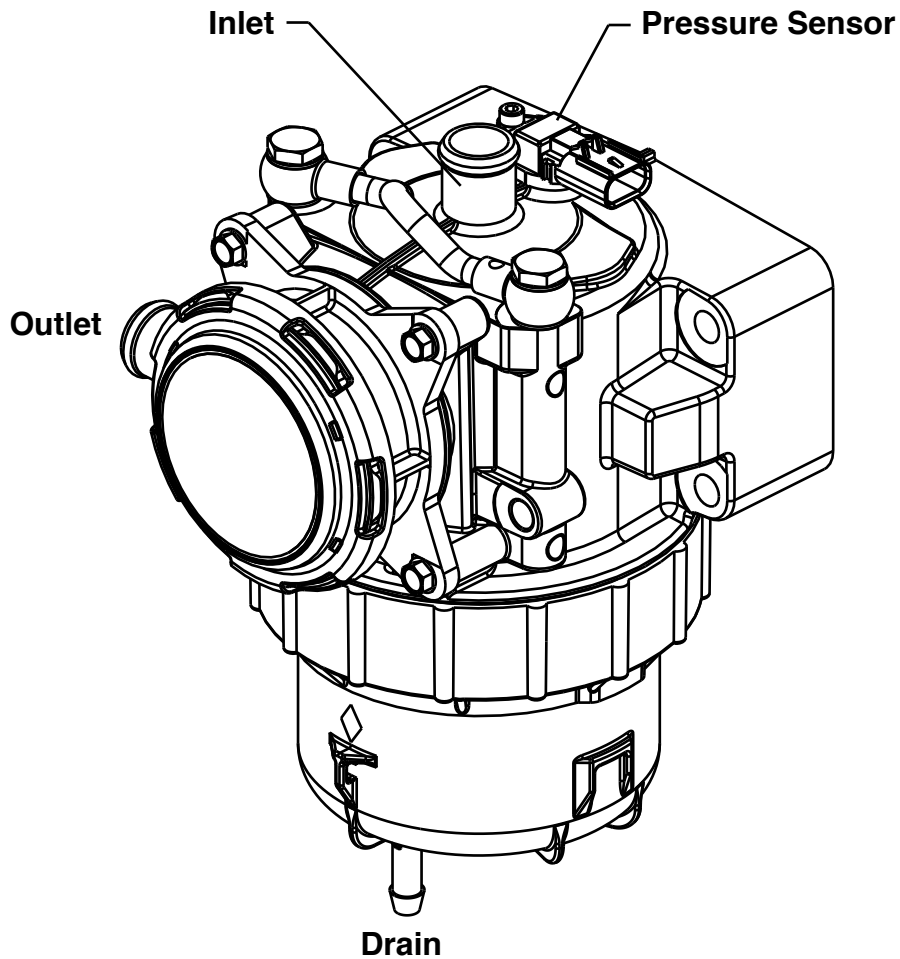
# Crankcase Ventilation Manager (CVM)



## Superior Crankcase Ventilation Management

- Highest oil and particle removal efficiency available
- High efficiency to meet emissions regulation compliance
- Long service intervals and reliability of the engine air handling components
- Maintains superior saturated oil removal efficiency for the droplet (aerosol) sizes that comprise blow-by gases





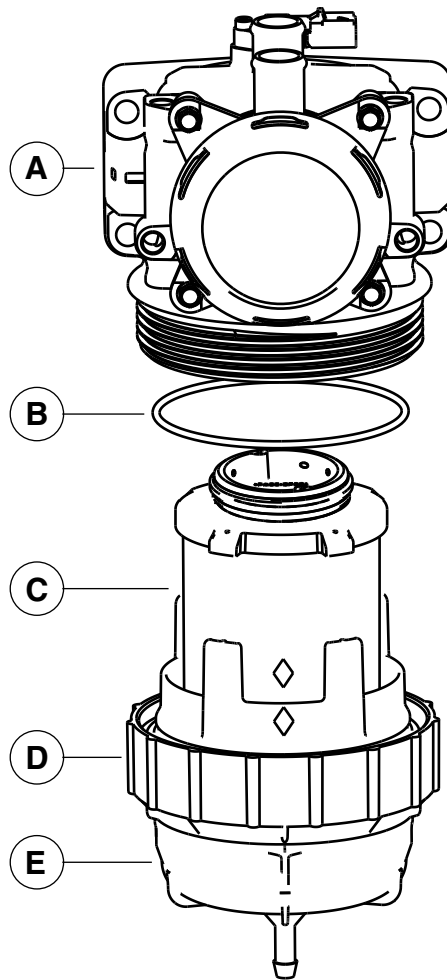
## Specifications

Specification	CVM280B
Height Overall	11.46" (290.9 mm)
Depth Overall	7.92" (201 mm)
Width Overall	6.97" (177 mm)
Nominal Flow	3.53 ft <sup>3</sup> /min (100 L/min)
Efficiency at Nominal Flow (Dry)	99.5 %
Restriction at Nominal Flow (Dry)	1.97" H <sub>2</sub> O (0.49 kPa)
Restriction at Nominal Flow (Saturated)	5.51" H <sub>2</sub> O (1.37 kPa)
Maximum Flow	9.89 ft <sup>3</sup> /min (280 L/min)
Restriction at Max Flow (Dry)	8.11" H <sub>2</sub> O (2.02 kPa)
Restriction at Max Flow (Saturated)	15.87" H <sub>2</sub> O (3.95 kPa)

## Parts List

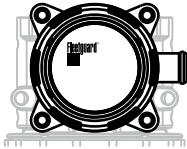
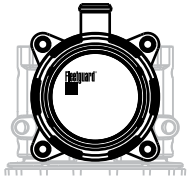
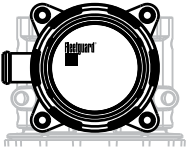
Part	No. Included	Description
A	1	Head
B	1	*O-Ring
C	1	*Element
D	1	Collar
E	1	Shell

\* Parts included in Service Kit #CV52053.

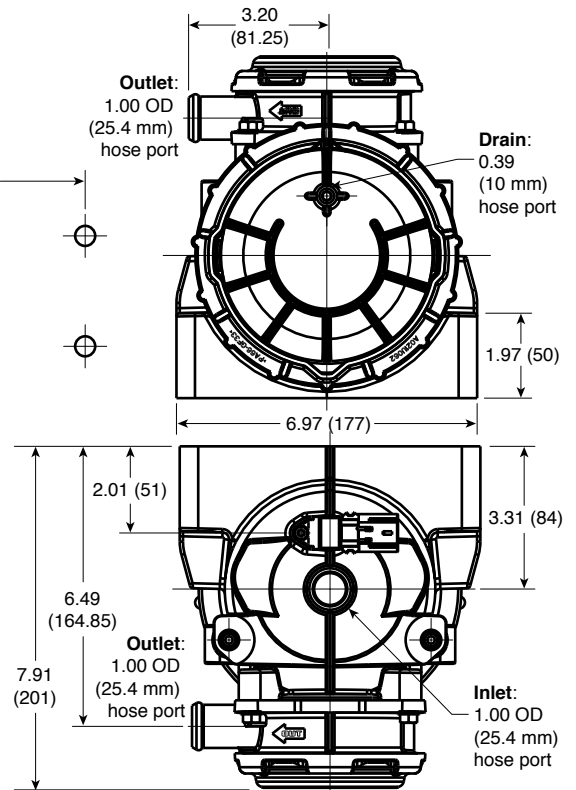
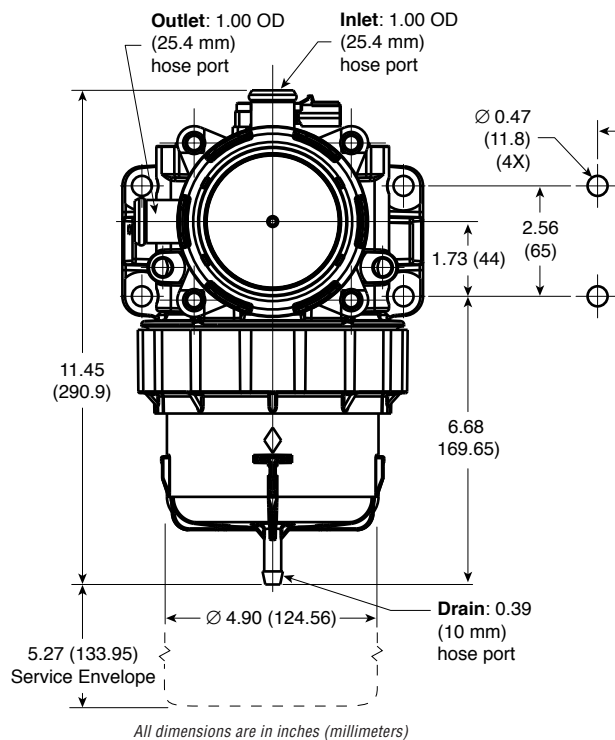




## Ordering Information

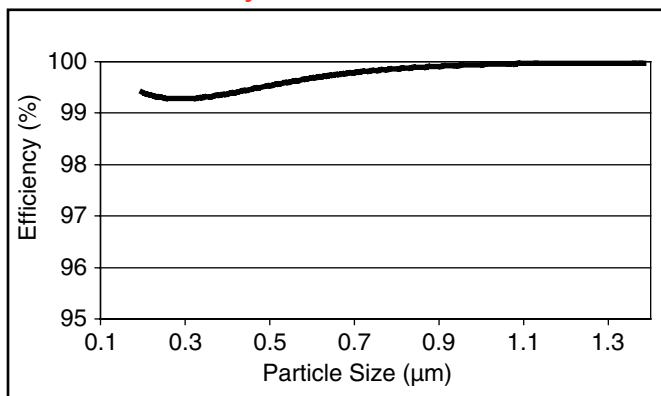
Part Number	Description	Outlet Orientations
CV52008	CVM with Outlet at 3 O'Clock	
CV52034	CVM with Outlet at 12 O'Clock	
CV52015	CVM with Outlet at 9 O'Clock (as shown below)	
CV52053	Service Kit (includes O-Ring and Element)	

## Mounting/Dimensions

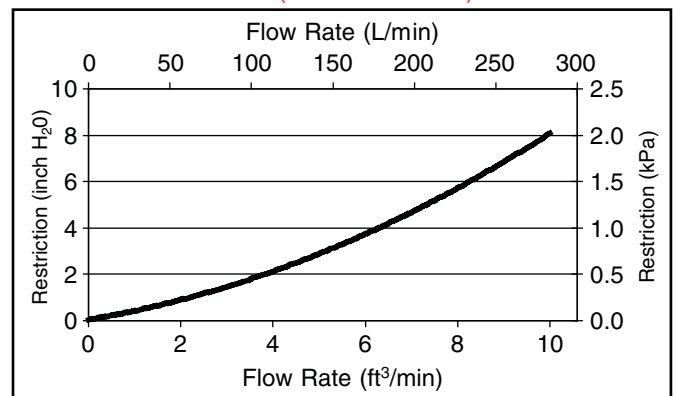


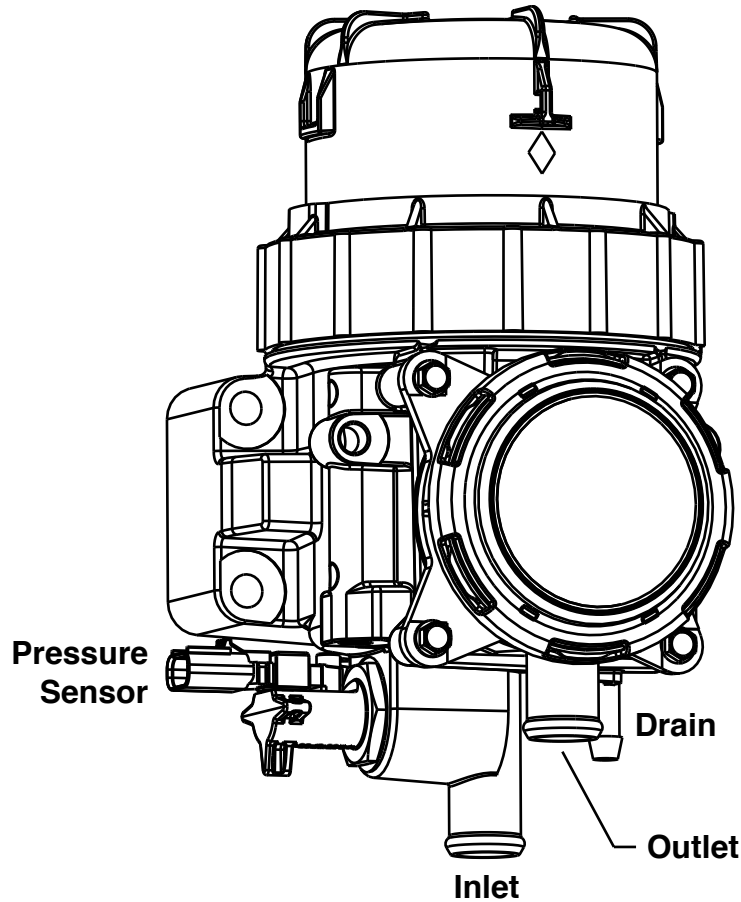
## Performance

### Fractional Efficiency



### Flow vs Restriction (Clean Element)





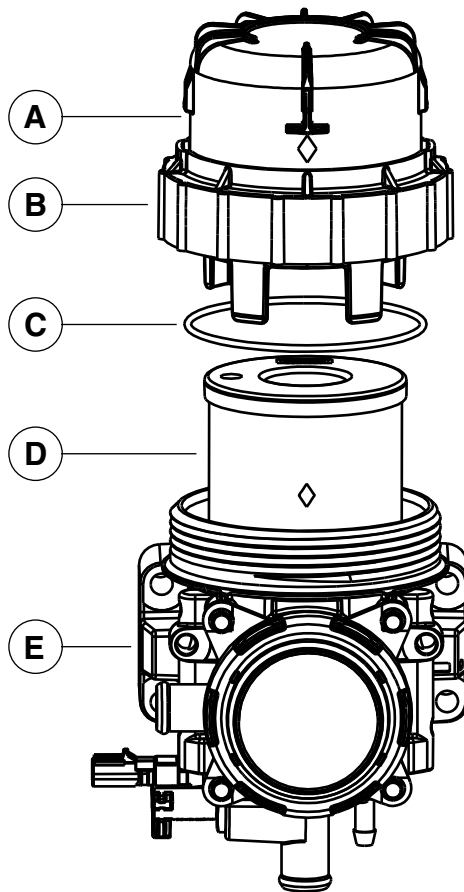
**Specifications**

Specification	CVM280T
Height Overall	11.71" (297.37 mm)
Depth Overall	7.91" (201 mm)
Width Overall	8" (203.2 mm)
Nominal Flow	3.53 ft <sup>3</sup> /min (100 L/min)
Efficiency at Nominal Flow (Dry)	99.5 %
Restriction at Nominal Flow (Dry)	1.97" H <sub>2</sub> O (0.49 kPa)
Restriction at Nominal Flow (Saturated)	5.51" H <sub>2</sub> O (1.37 kPa)
Maximum Flow	9.89 ft <sup>3</sup> /min (280 L/min)
Restriction at Max Flow (Dry)	8.11" H <sub>2</sub> O (2.02 kPa)
Restriction at Max Flow (Saturated)	15.87" H <sub>2</sub> O (3.95 kPa)

## Parts List

Part	No. Included	Description
A	1	Shell
B	1	Collar
C	1	*O-Ring
D	1	*Element
E	1	Head

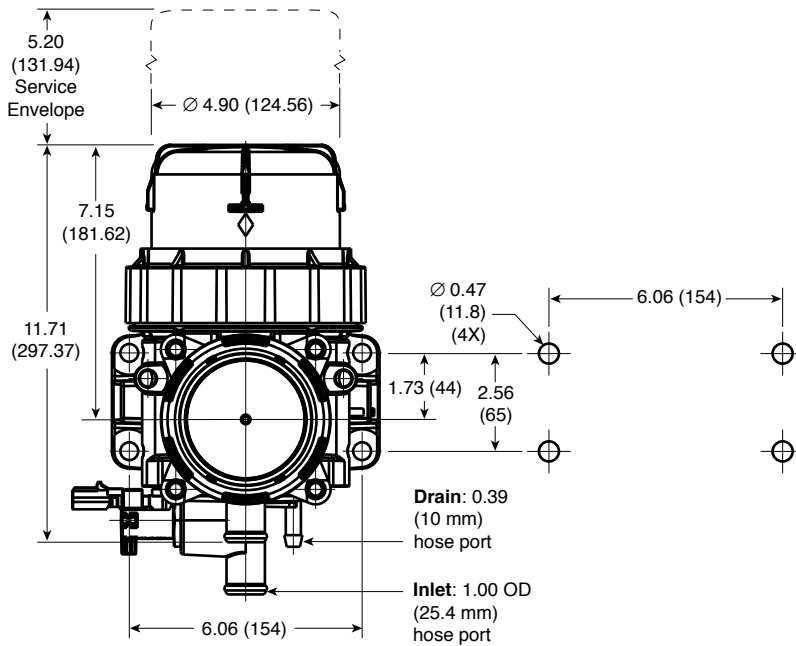
\* Parts included in Service Kit #CV52053.



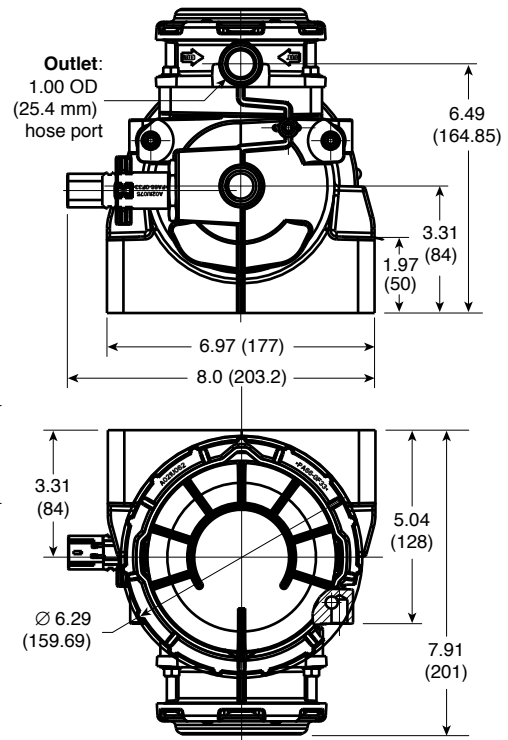
## Ordering Information

Part Number	Description	Outlet Orientations
CV52019	CVM with Outlet at 3 O'Clock	
CV52021	CVM with Outlet at 6 O'Clock (as shown below)	
CV52023	CVM with Outlet at 9 O'Clock	
CV52053	Service Kit (includes O-Ring and Element)	

## Mounting/Dimensions

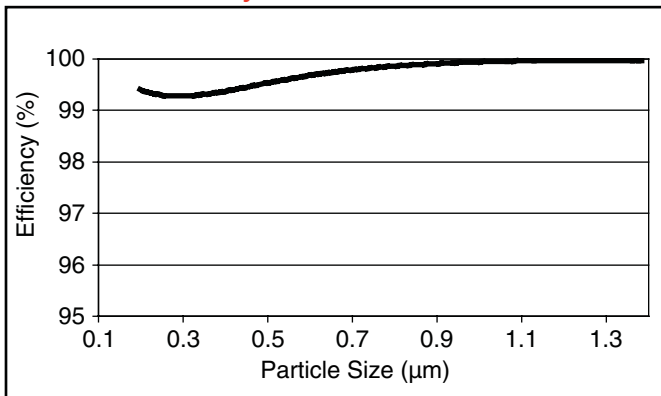


All dimensions are in inches (millimeters)

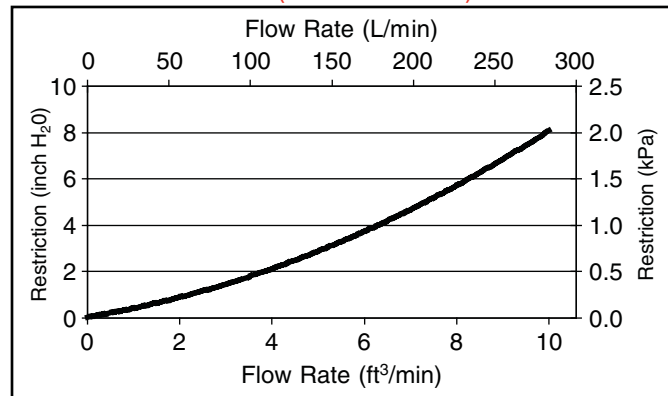


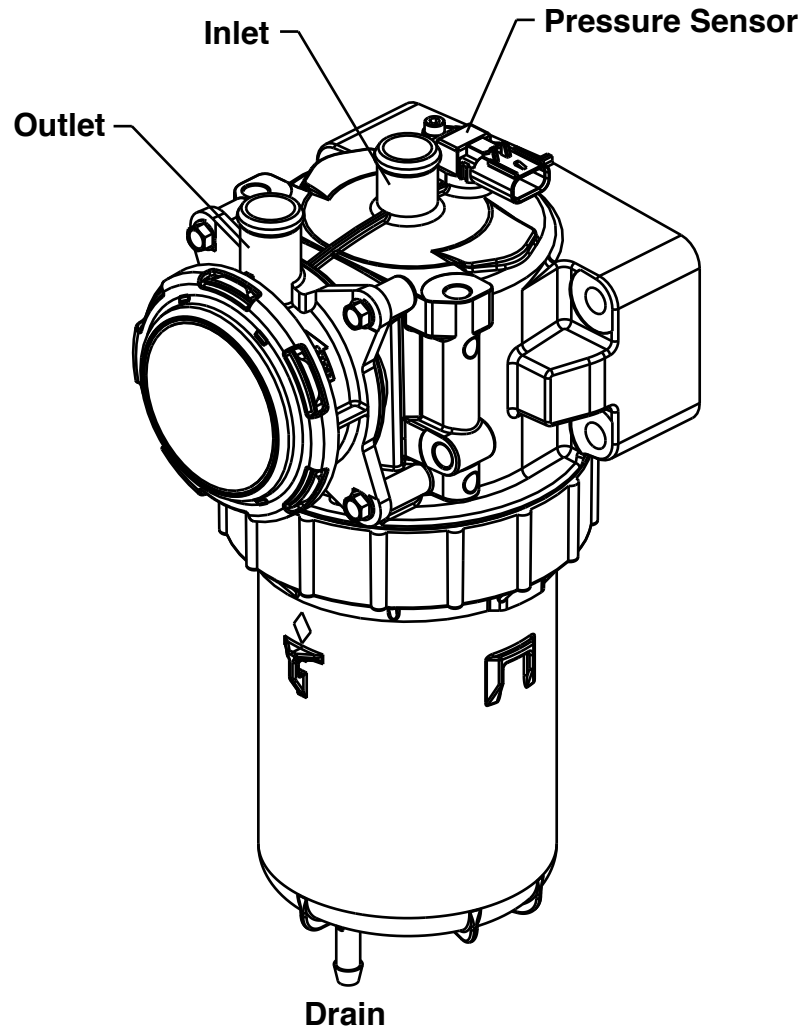
## Performance

### Fractional Efficiency



### Flow vs Restriction (Clean Element)





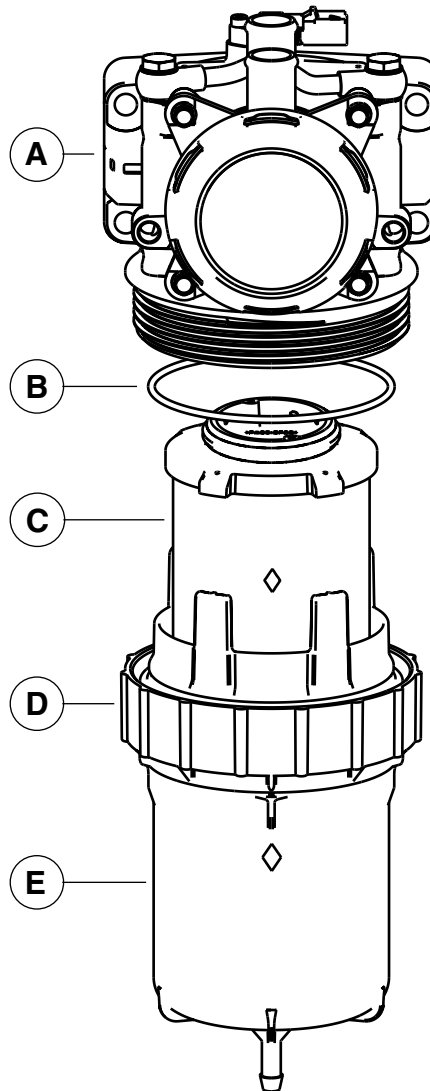
## Specifications

Specification	CVM424B
Height Overall	15.39" (391 mm)
Depth Overall	7.91" (201 mm)
Width Overall	6.97" (177 mm)
Nominal Flow	5.30 ft <sup>3</sup> /min (150 L/min)
Efficiency at Nominal Flow (Dry)	99.9 %
Restriction at Nominal Flow (Dry)	2.28" H <sub>2</sub> O (0.57 kPa)
Restriction at Nominal Flow (Saturated)	4.92" H <sub>2</sub> O (1.23 kPa)
Maximum Flow	14.97 ft <sup>3</sup> /min (424 L/min)
Restriction at Max Flow (Dry)	12.17" H <sub>2</sub> O (3.03 kPa)
Restriction at Max Flow (Saturated)	17.56" H <sub>2</sub> O (4.37 kPa)

## Parts List

Part	No. Included	Description
A	1	Shell
B	1	Collar
C	1	*O-Ring
D	1	*Element
E	1	Head

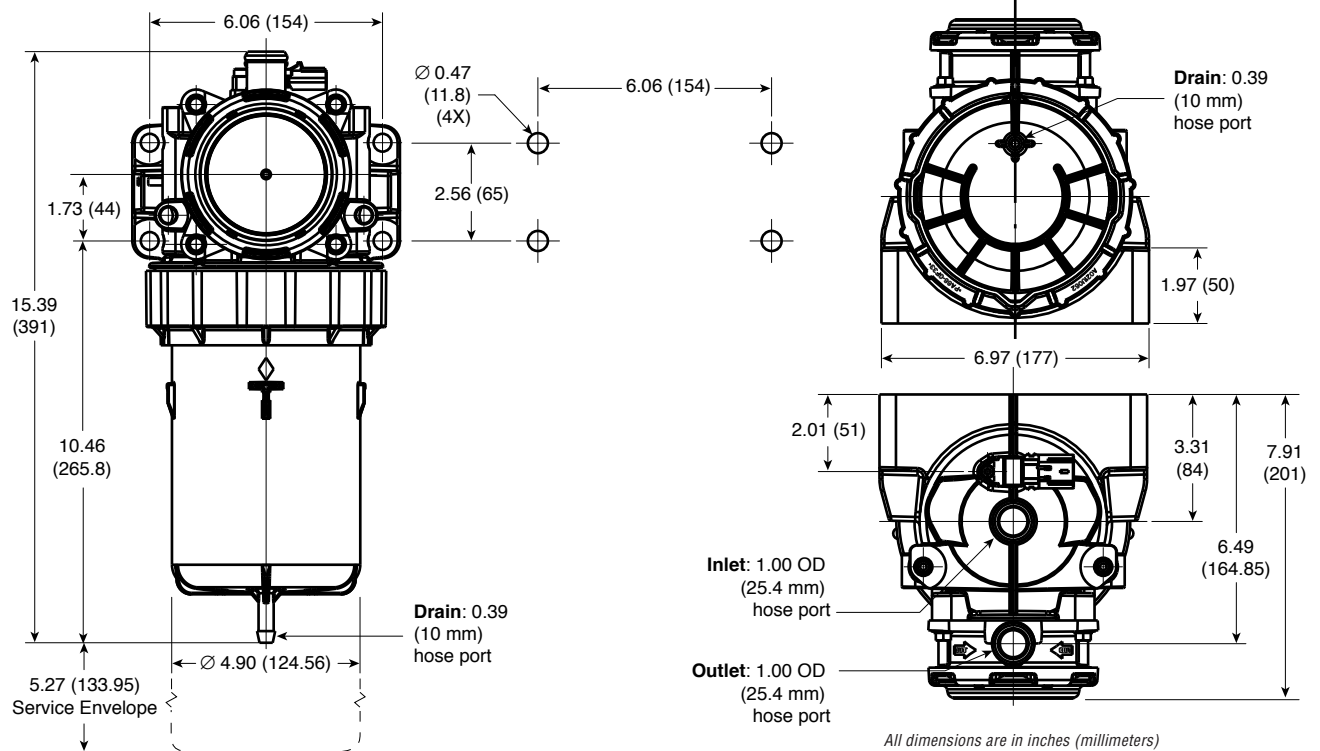
\* Parts included in Service Kit #CV52052.



## Ordering Information

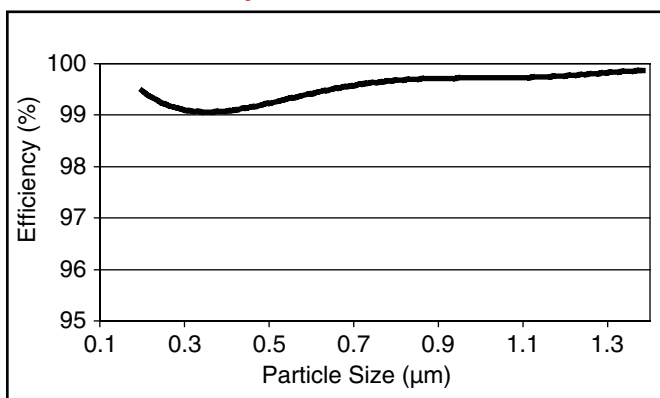
Part Number	Description	Outlet Orientations
CV52016	CVM with Outlet at 3 O'Clock	
CV52006	CVM with Outlet at 12 O'Clock (as shown below)	
CV52009	CVM with Outlet at 9 O'Clock	
CV52052	Service Kit (includes O-Ring and Element)	

## Mounting/Dimensions

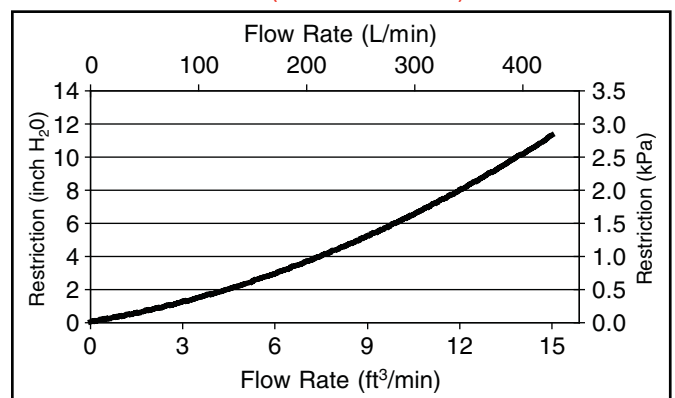


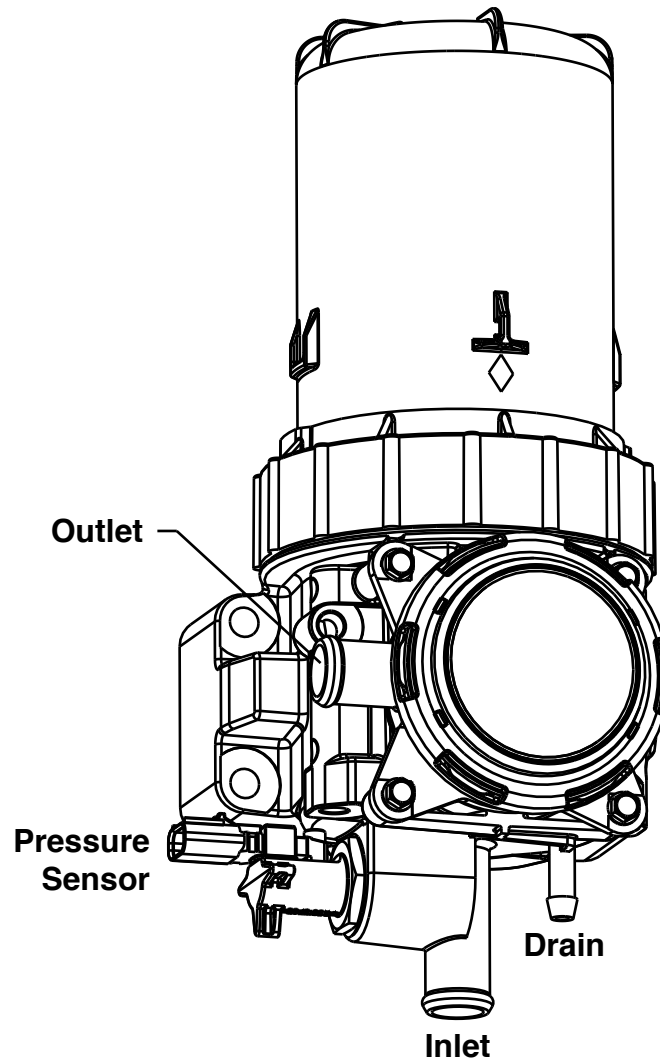
## Performance

### Fractional Efficiency



### Flow vs Restriction (Clean Element)





**Specifications**

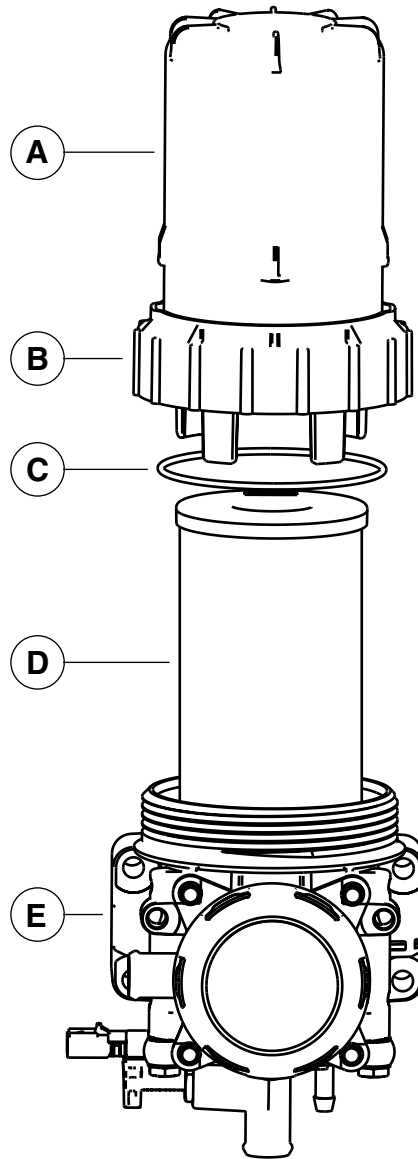
Specification	CVM424T
Height Overall	15.50" (393.47 mm)
Depth Overall	7.92" (201 mm)
Width Overall	8" (203.2 mm)
Nominal Flow	5.30 ft <sup>3</sup> /min (150 L/min)
Efficiency at Nominal Flow (Dry)	99.9 %
Restriction at Nominal Flow (Dry)	2.28" H <sub>2</sub> O (0.57 kPa)
Restriction at Nominal Flow (Saturated)	4.92" H <sub>2</sub> O (1.23 kPa)
Maximum Flow	14.97 ft <sup>3</sup> /min (424 L/min)
Restriction at Max Flow (Dry)	12.17" H <sub>2</sub> O (3.03 kPa)
Restriction at Max Flow (Saturated)	17.56" H <sub>2</sub> O (4.37 kPa)



## Parts List

Part	No. Included	Description
A	1	Shell
B	1	Collar
C	1	*O-Ring
D	1	*Element
E	1	Head

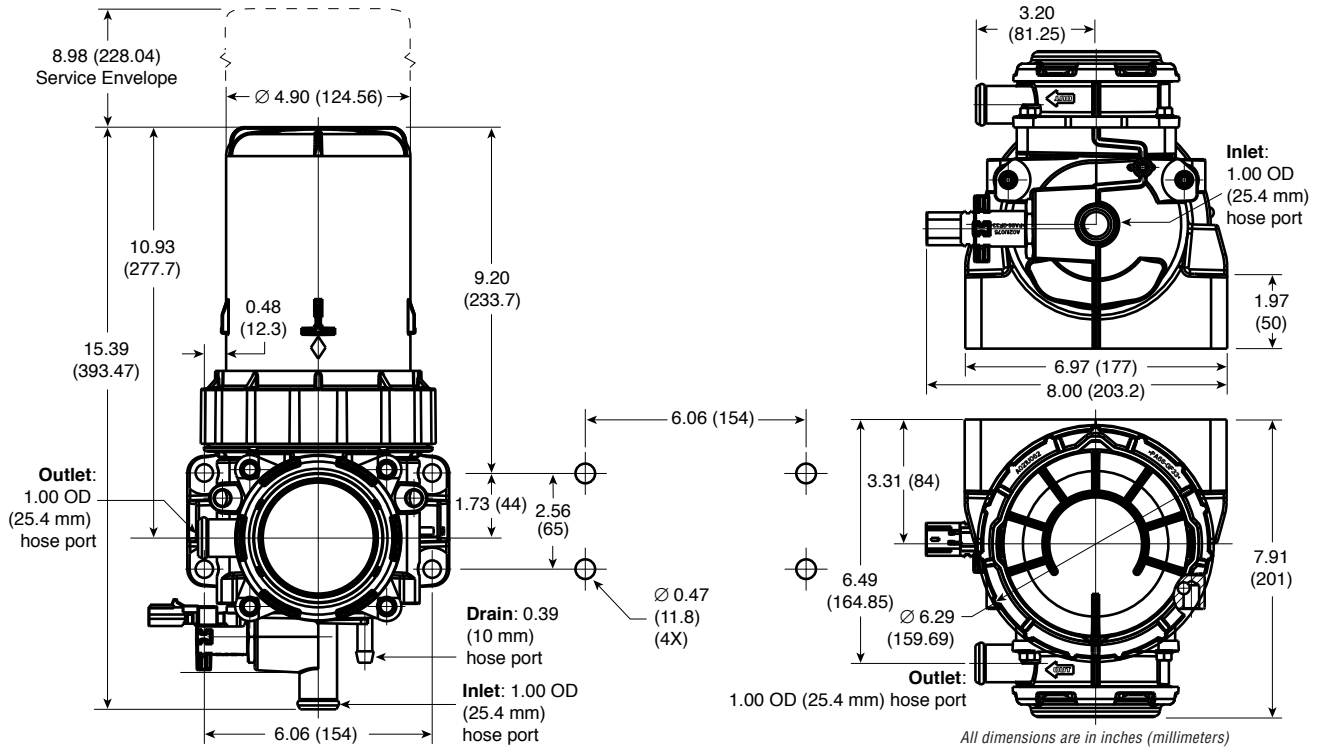
\* Parts included in Service Kit #CV52052.



## Ordering Information

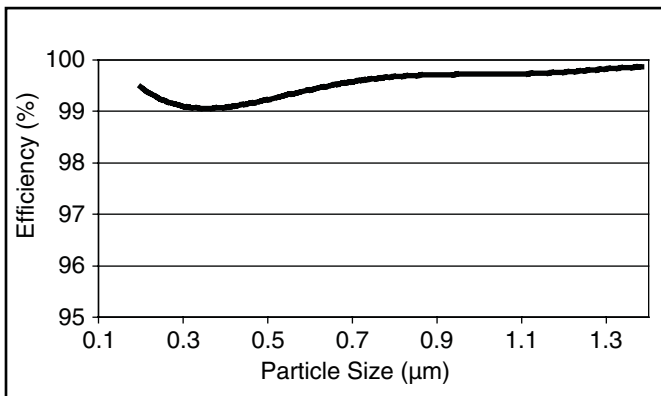
Part Number	Description	Outlet Orientations
CV52007	CVM with Outlet at 3 O'Clock	
CV52017	CVM with Outlet at 12 O'Clock	
CV52028	CVM with Outlet at 9 O'Clock (as shown below)	
CV52052	Service Kit (includes O-Ring and Element)	

## Mounting/Dimensions

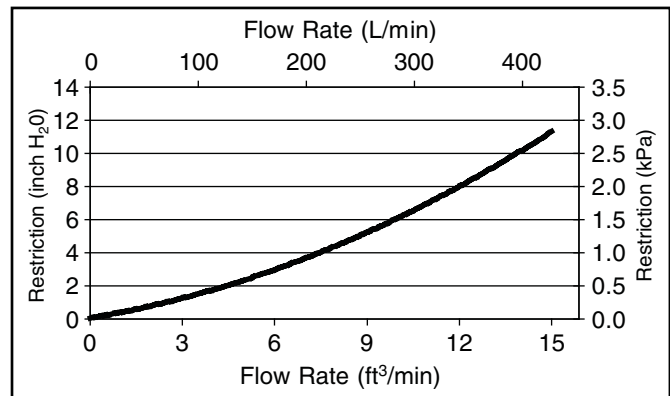


## Performance

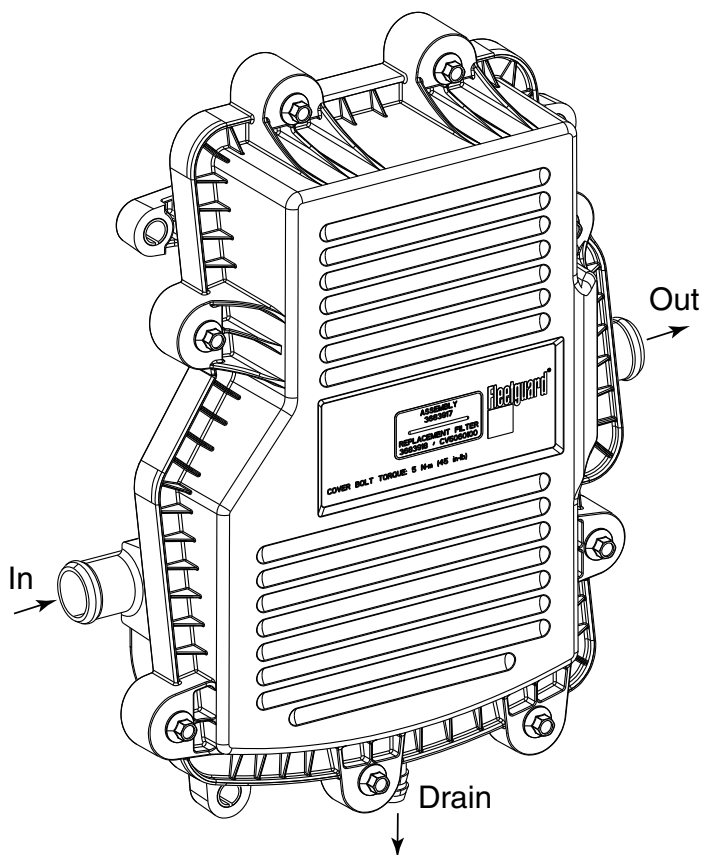
### Fractional Efficiency



### Flow vs Restriction (Clean Element)



# Crankcase Ventilation Filter



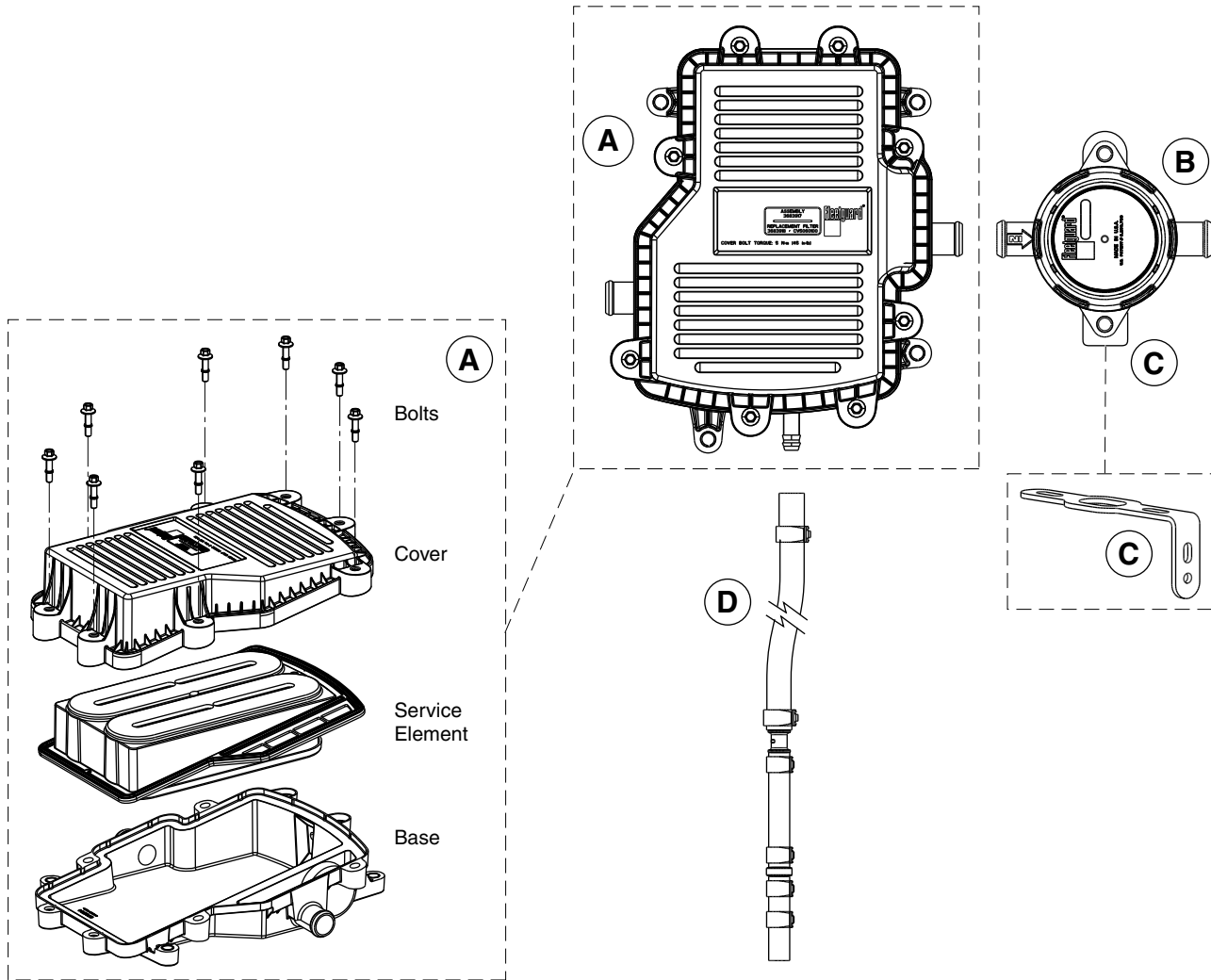
## Specifications

Specification	CV51118
Height Overall	13.7" (347.1 mm)
Depth Overall	3.4" (87.3 mm)
Width, Max	11.5" (291.0 mm)
Weight (Dry)	4.63 lbs (2.1 kg)
Nominal Flow Rate	6 ft <sup>3</sup> /min (170 L/min)
Restriction at Nominal Flow	0.3 kPa (1.2 in H <sub>2</sub> O)
Rated Flow Rate	12 ft <sup>3</sup> /min (340 L/min)

**Note:** US EPA verification pending.

## Parts List

Part	No. Included	Description
A	1	Coalescer Assembly (includes Bolts, Cover, Service Element and Base)
B	1	CDR Valve
C	1	CDR Valve Mounting Bracket
D	1	1/2" to 3/8" Drain Line with Check Valve

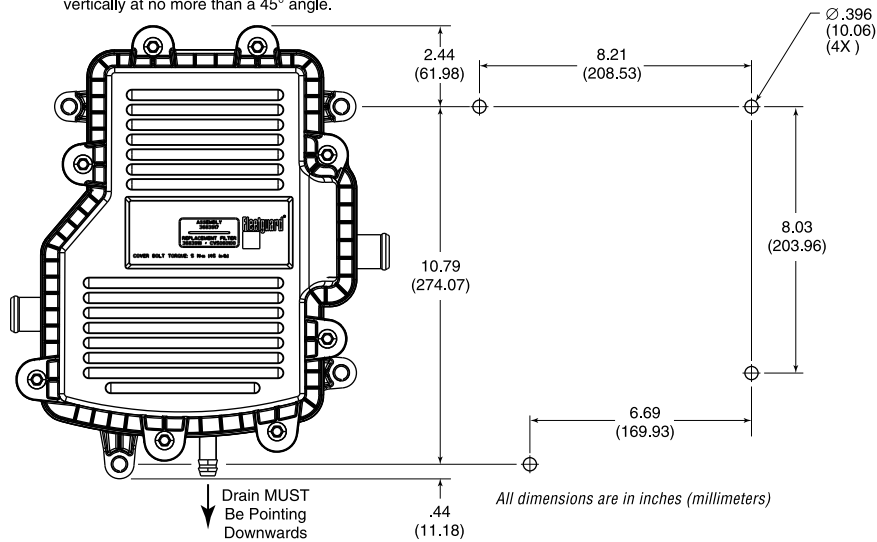


## Ordering Information

Part Number	Description
CV51118	Crankcase Ventilation Kit (includes CCV Breather, CDR Valve, CDR Mounting Bracket, and Drain Line)
CV50601	Service Element

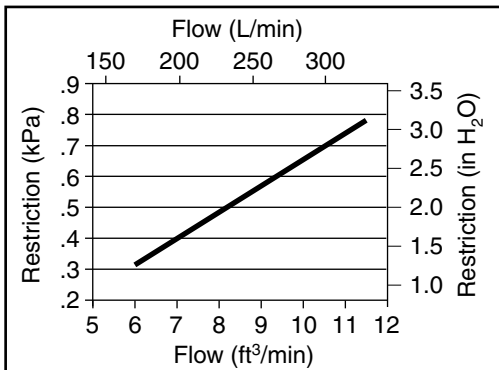
## Mounting/Dimensions

Note: Breather must be mounted vertically at no more than a 45° angle.

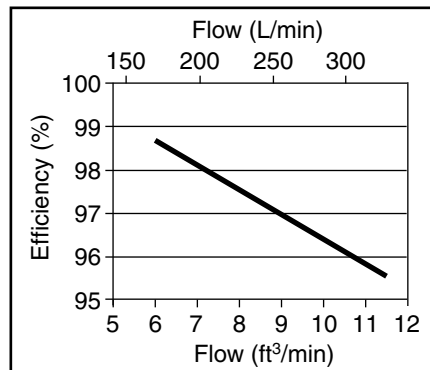


## Performance

Filter Restriction vs Flow

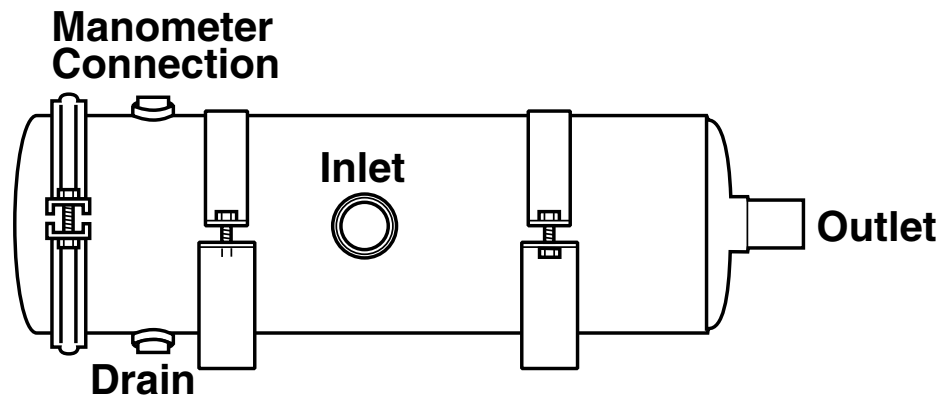


Filter Efficiency vs Flow





# Recirculators

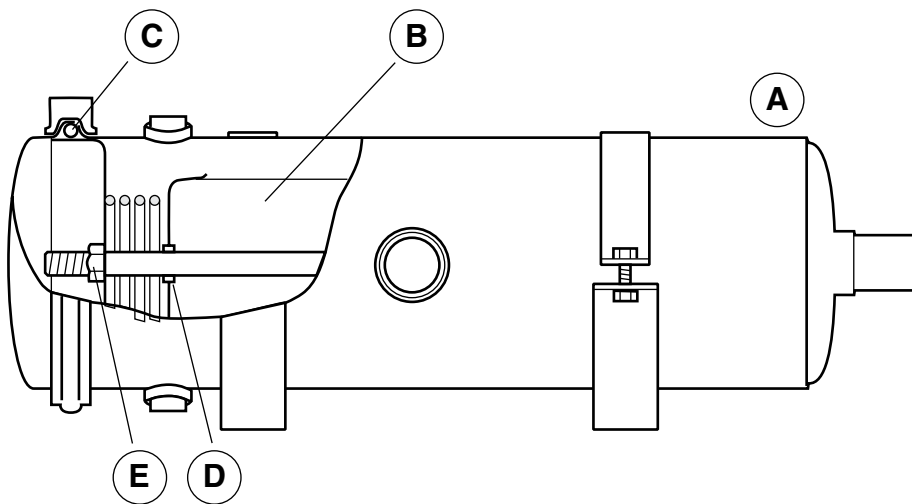


## Specifications

Specification	93194A	93192A
Diameter	8.6" (218.4 mm)	8.6" (218.4 mm)
Length	30.2" (767.1 mm)	38.1" (967.7 mm)
Inlet/Outlet Tube OD	1.75" (44.5 mm)	2.25" (57.2 mm)
Max. Crankcase Emission Flow Rate with Clean Element	15 SCFM (0.43 m <sup>3</sup> /min)	25 SCFM (0.71 m <sup>3</sup> /min)

Parts List

Part	No. Included	Description
A	1	Recirculator
B	1	Filter Element
C	1	Cover Gasket
D	1	Grommet
E	1	Hex Nut

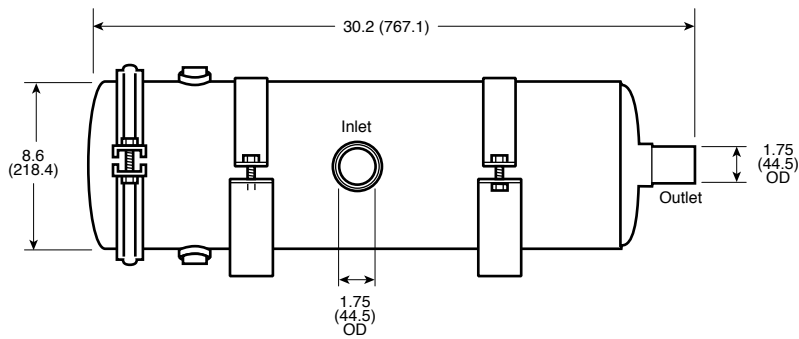




## Ordering Information

Part Number	Description
93194A	Recirculator Unit
88365A	Service Element
Q58403	Cover Gasket
Q58521	Grommet
Q53714	Hex Nut

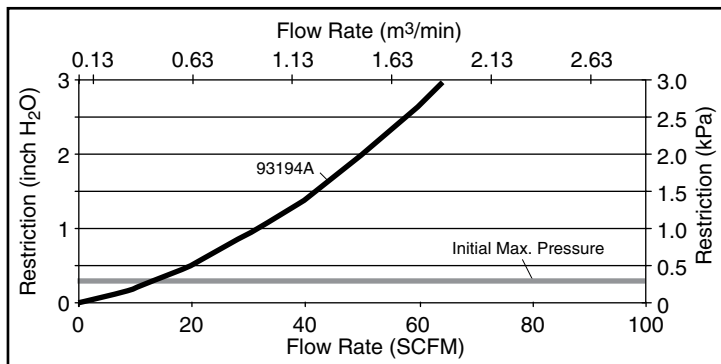
## Mounting/Dimensions



All dimensions are in inches (millimeters)

## Performance

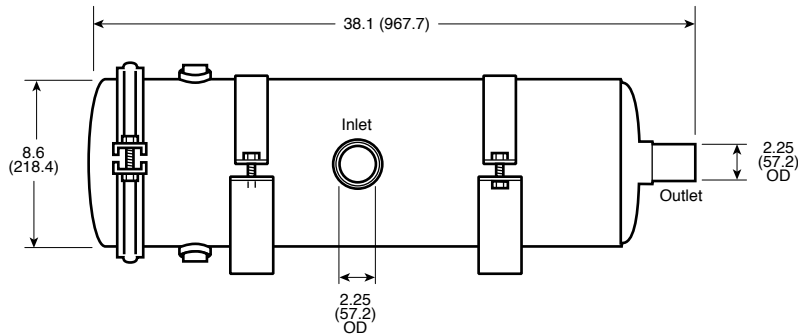
### Filter Restriction vs Flow



Ordering Information

Part Number	Description
93192A	Recirculator
88465A	Service Element
Q58403	Cover Gasket
Q58521	Grommet
Q53714	Hex Nut

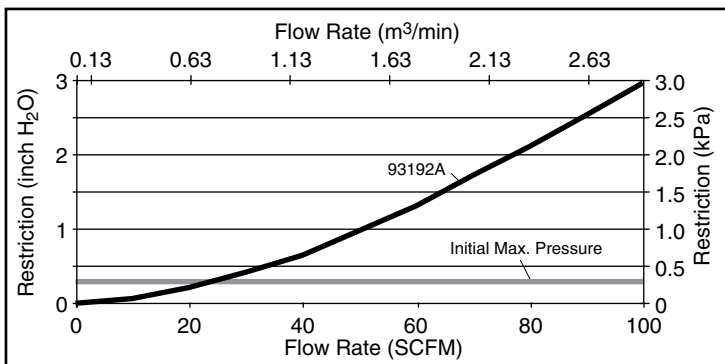
Mounting/Dimensions



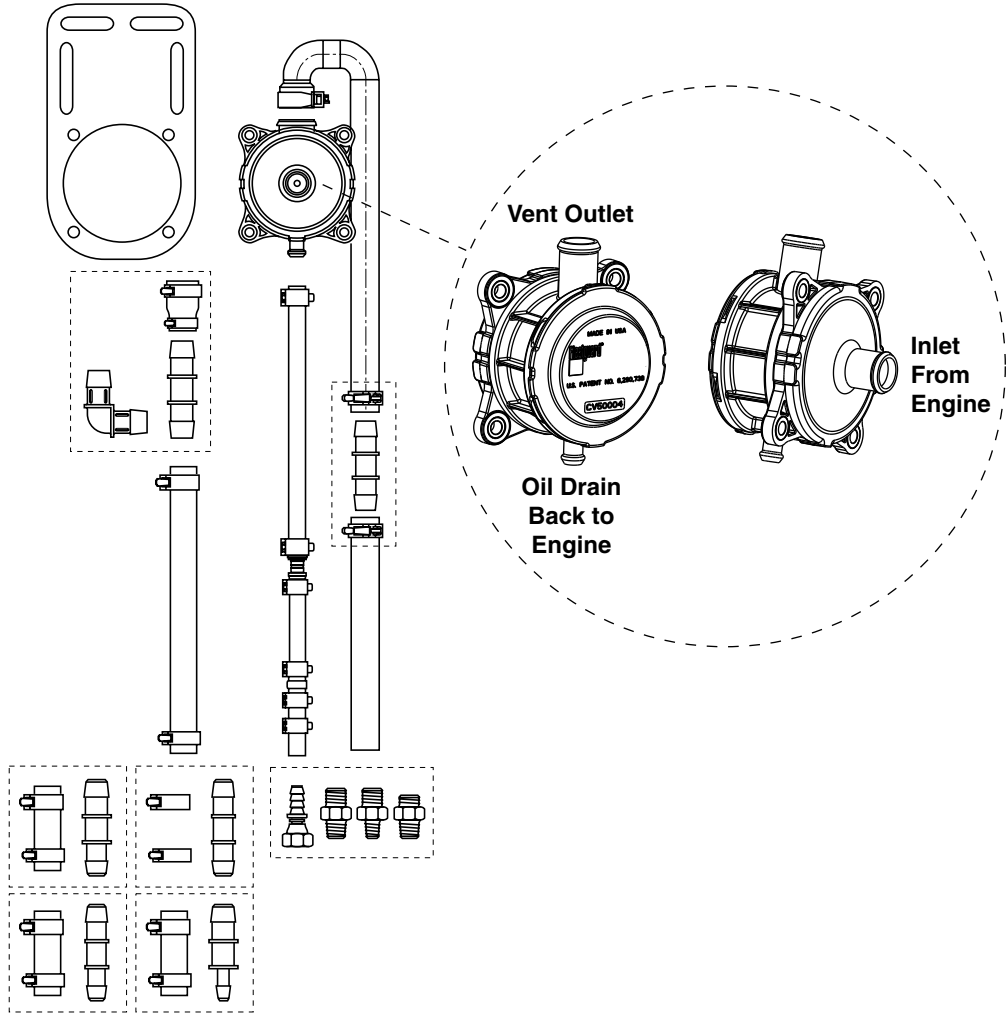
All dimensions are in inches (millimeters)

Performance

Filter Restriction vs Flow



# Crankcase Ventilation Breathers

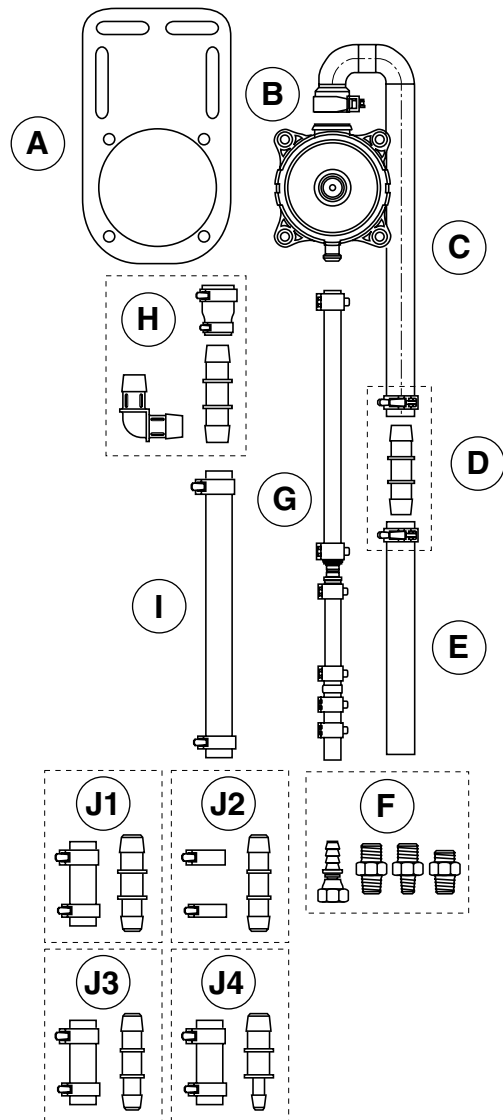


### Specifications

Specification	CV50111
Height Overall (Breather)	13.7" (150 mm)
Depth Overall (Breather)	3.4" (113.3 mm)
Weight (Dry) (Kit)	9.9 lbs (4.5 kg)
Max. Flow	6 ft <sup>3</sup> /min (169.9 L/min)
Min. Flow	3 ft <sup>3</sup> /min (85.0 L/min)
Max. Restriction	11-12 in H <sub>2</sub> O (280-305 mm H <sub>2</sub> O)

Parts List

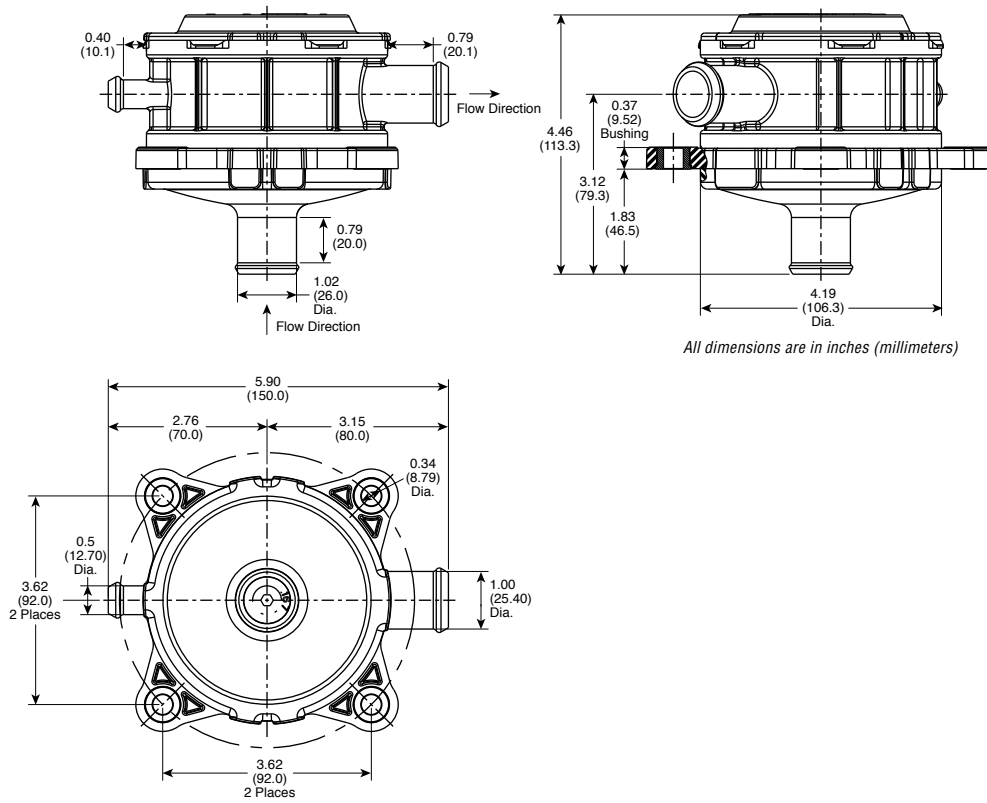
Part	No. Included	Description
A	1	Mounting Bracket
B	1	Breather Assembly and Mounting Hardware
C	1	Vent Hose
D	1	Vent Hose Connector and Clamps
E	1	Vent Hose Extender
F	1	Cylinder Block Insert Fittings and Coupler
G	1	Drain Hose Assembly
H	1	Breather Hose Connections and Clamps
I	1	Inlet Hose Assembly
J	4	Inlet Hose Connections and Clamps

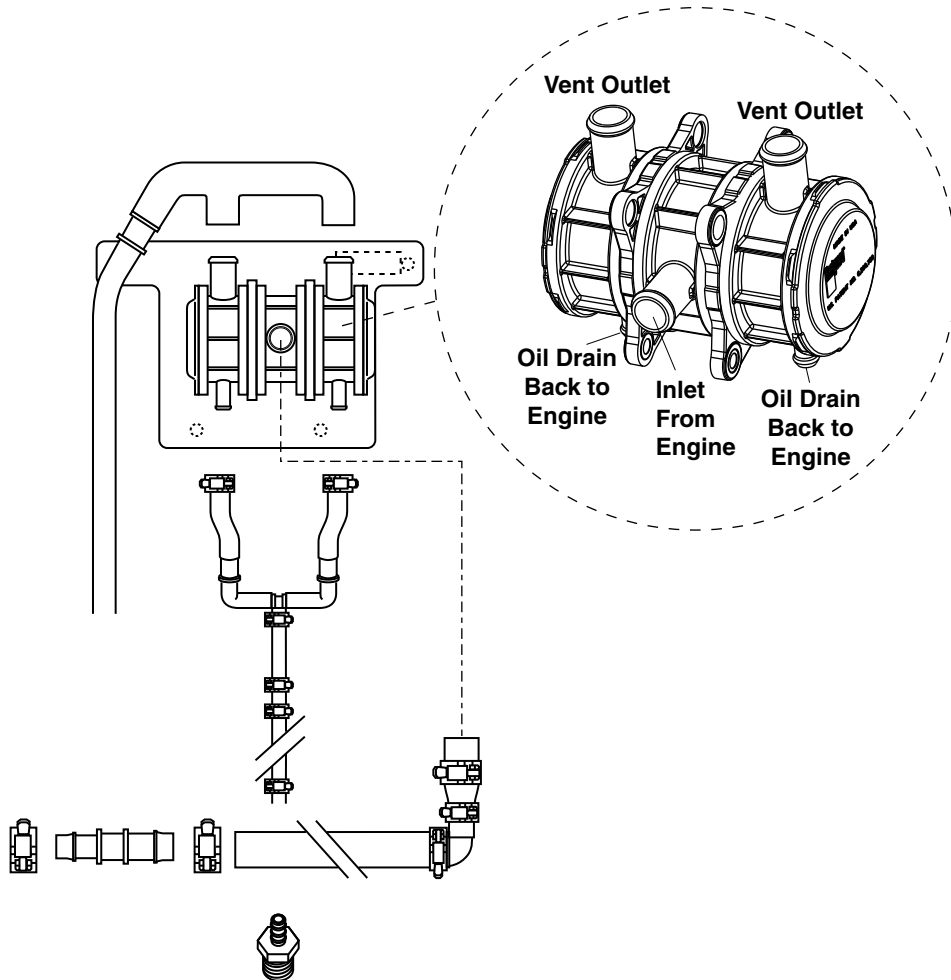


## Ordering Information

Part Number	Description
CV50111	Single Crankcase Ventilation Breather Kit (includes parts listed on previous page)

## Mounting/Dimensions



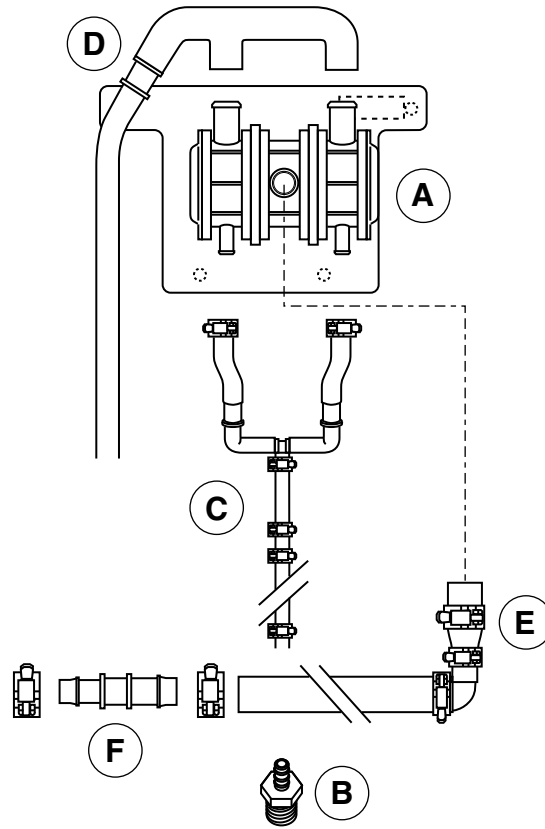


**Specifications**

Specification	CV50202
Height Overall (Breather)	13.7" (150 mm)
Depth Overall (Breather)	7.1" (181.2 mm)
Weight (Dry) (Kit)	12.1 lbs (5.5 kg)
Max. Flow	14 ft <sup>3</sup> /min (396.4 L/min)
Min. Flow	7 ft <sup>3</sup> /min (198.2 L/min)
Max. Restriction	11-12 in H <sub>2</sub> O (280-305 mm H <sub>2</sub> O)

## Parts List

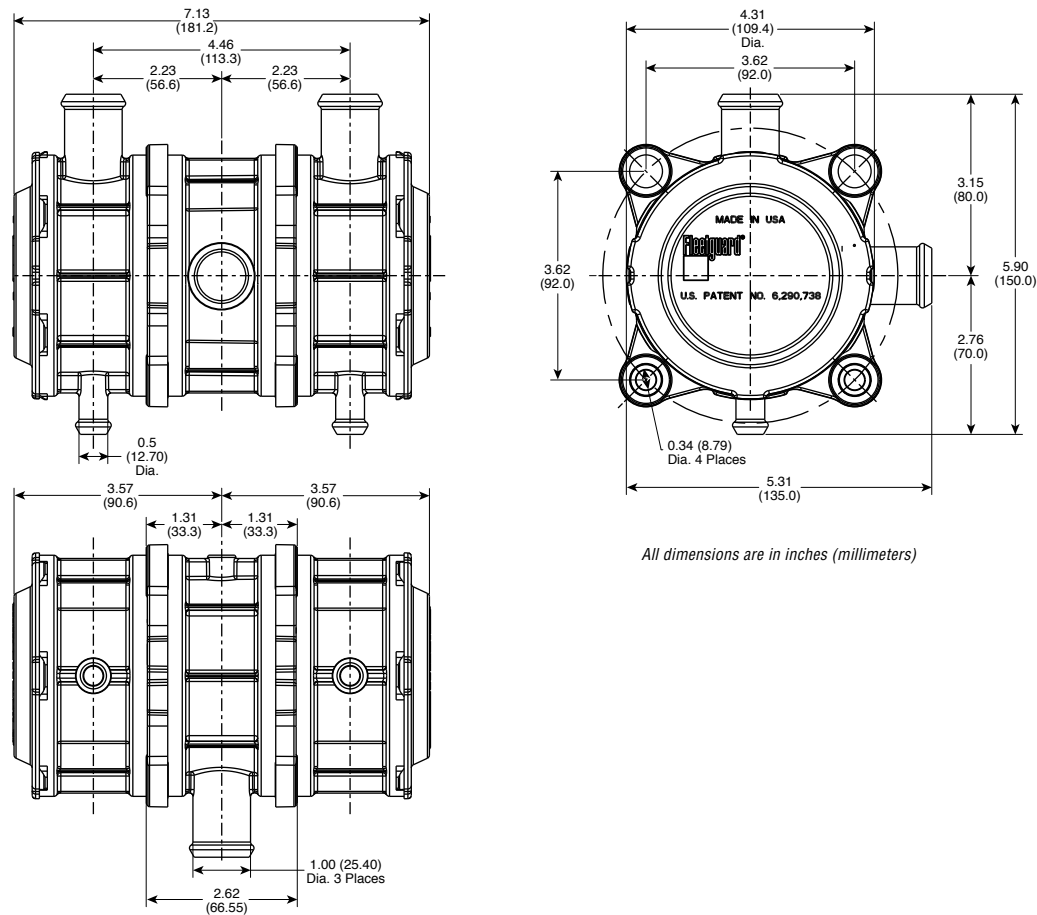
Part	No. Included	Description
A	1	Breather and Bracket Assembly
B	1	Drain Fitting
C	1	Drain Hose Assembly
D	1	Vent Hose Assembly
E	1	Breather Inlet Hose Assembly
F	1	Reducer Fitting and Clamps



## Ordering Information

Part Number	Description
CV50202	Dual Crankcase Ventilation Breather Kit (includes parts listed on previous page)

## Mounting/Dimensions



All dimensions are in inches (millimeters)