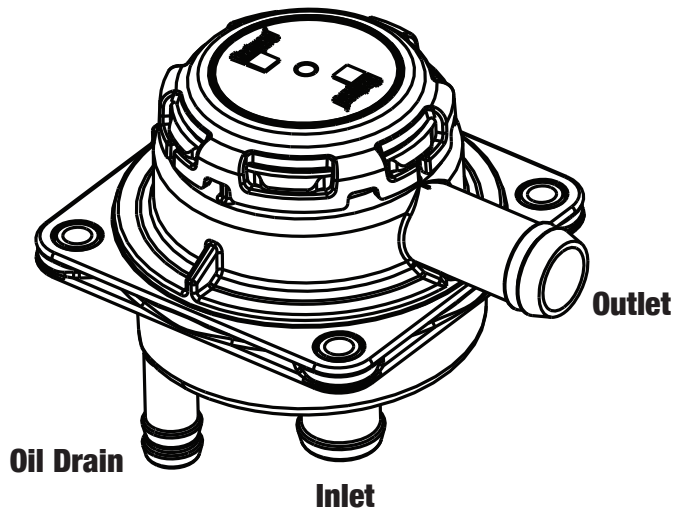




# Crankcase Ventilation Filter CV51020 Installation Instructions



## Required Tools

- M6 bolts and matching nuts for mounting (X4)
- 53/64" (21.2 mm) internal diameter (ID) hose for inlet - meet or exceed 20R3
- 7/8" (22 mm) ID hose for outlet – meet or exceed 20R3 standards
- 9/16" (14.5 mm) ID hose for oil drain - meet or exceed 30R7 standards
- Mounting Bracket
- Hose clamps for inlet, outlet and oil drain tubing
- Oil drain check valve (Cummins 5267080 recommended)
- Insulation tape for hoses and pipes (Cummins 2878268 Recommended)

## Recommended Tooling

- Hose cutter
- Ratchet and socket set
- Torque wrench

**Note:** Depending on the application, other components and tools might be required to install this Cummins Filtration Crankcase Ventilation (CV) filter.

**⚠ CAUTION:** These instructions are intended for use by professional mechanics who are trained in the proper use of power and hand tools, using appropriate safety precautions (including eye protection).

**Specification Table**

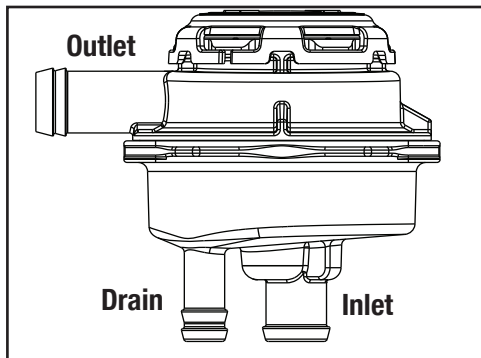
Specification	CV51020
Height Overall	4.22" (107.2 mm)
Depth Overall	5" (127 mm)
Width Max	3.92" (100 mm)
Rated Flow Rate	4.24 ft <sup>3</sup> /min (120 L/min)
Pressure Drop at Rated Flow	16.9" H <sub>2</sub> O (4.2 kPa)

Ensure that all requirements are met before starting the installation. This will ensure optimal performance from the CV filter and safe operation.

**Configuration and Location:**

- The CV Components must be located at least 6 inches (150 mm) away from any major heat source, ensuring the housing is not exposed to temperatures higher than 257°F (125°C).
- The CV components must be located such that they are not subject to significant vibration from other engine components.

**⚠ Warning:** The CV filter housing must never exceed 45° from vertical during operation to ensure proper oil drainage into the engine.



**Figure 1:** CV Unit Preferred Orientation: Oil Drain Port Pointing Down

- This product is equipped with a Crankcase Depression Regulator (CDR) valve.
- Blow-by gas inlet and outlet plumbing must not have sharp bends or dips to prevent pooling liquid that could freeze or increase pressure drop.
- The CV unit and the parts must not be installed in a location exposed to direct cooling airflow.

**⚠ WARNING:** Select a location that minimizes the required lengths of all hoses. Excessively long hoses could lead to freezing. Contact Cummins Filtration for further guidance.

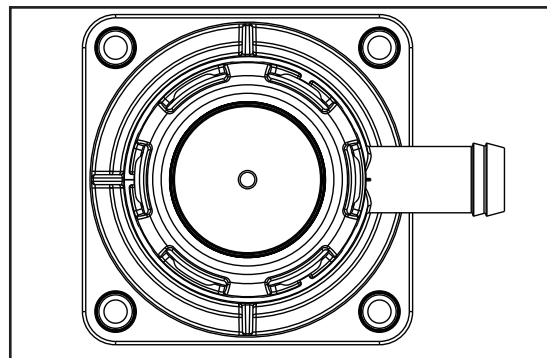
- Pick a location that minimizes the hose lengths for the inlet and outlet plumbing. Ensure that they don't exceed the estimated lengths below.

**Table 1: Maximum Hose Lengths for Inlet and Outlet Hoses for Reference Engine Sizes**

Engine Size (L)	Inlet	Outlet
3.3	31.5 in (800 mm)	25.6 in (650 mm)
4.5	39.4 in (1000 mm)	31.1 in (790 mm)
6.7	72 in (1829 mm)	80 in (2032 mm)

**Note:** Interpolate for desired engine size if not listed. Contact Cummins Filtration for further guidance on applications on bigger engines.

**Note:** If a mounting bracket is needed to secure the CV unit in place, refer to the technical drawings for the mounting hole dimensions and geometry.



**Figure 2:** Top view of CV Unit, showing mounting holes

- If a bracket is needed, ensure it is mounted on an independent structure, such as the engine bay panels, frame, or fenders.
- Ensure that the installed brackets and bolts are not at risk of touching moving parts within the engine while not blocking access to other serviceable parts in the engine compartment.
- Oil drain plumbing must have a continuous downward slope without sharp bends or low points to prevent oil or water from clogging and freezing in low ambient temperatures.

- It is required to use a check valve (Cummins 5267080) in the oil drain to prevent oil or aerosol from flowing back to the CV unit through the oil drain.
- Calculate the required oil drain height and determine whether a check valve is necessary.

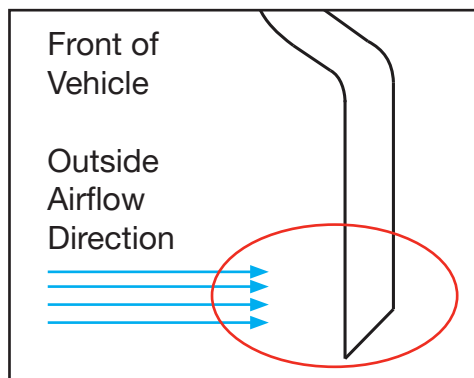
**Note: Read the Oil Drain Height sections at the end of this manual before continuing with the installation.**

### Other Considerations

- It is highly recommended that all tubing is insulated to prevent freezing, especially if engine is operating in cold weather conditions.
- Additional tooling such as T-style connecting couplers, hose barbs and welding equipment could be necessary depending on the application. Read the steps and inspect the engine components involved ensuring all the necessary tooling is available for the installation.

### For an Open Crankcase Ventilation (OCV) Configuration

- Ensure that the venting location of the outlet is on the rear of the vehicle (or the bottom rear of the engine compartment) and pointing vertically downward (see Figure 3).
- Ensure that the outlet to the atmosphere is cut at an angle as shown below to prevent freezing at the outlet. Ensure the open area faces the back of the vehicle to prevent backwards airflow.

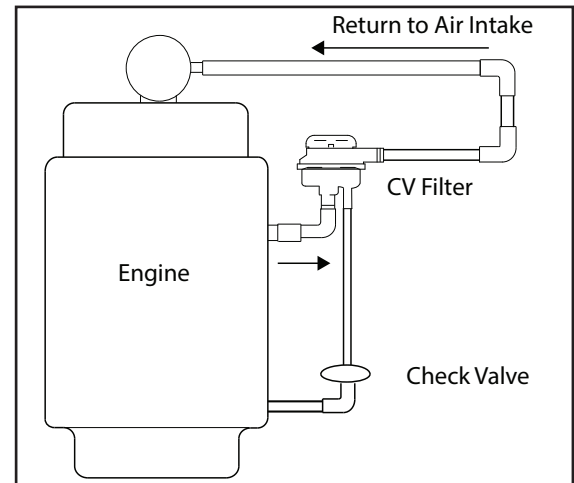


**Figure 3:** Outlet Vent for Open Configuration

**⚠ Warning:** Ensure that the venting location is not close to the Air Intake, to reduce the chance of the blowby going into the air intake.

### Typical Installation

The recommended installation procedures to set the unit and connect it to the engine system are provided below for a closed configuration. If an open configuration is selected, follow the guidelines on the outlet and vent location.



**Figure 4:** Diagram of a CCV system assembly - Arrows show flow direction.

1. Once the location of the CV filter is selected, use appropriate bolts and brackets (if necessary) to tightly secure the CV filter into its position on the engine.
2. Tighten the bolts securely to ensure the CV unit remains in place.

**Recommended Torques:** 10 N·m (7.4 ft-lb) (could vary depending on application)

3. Determine the minimal amount of hose lengths needed to connect the current engine blowby outlet location to the CV filter inlet.
4. Cut the hoses to the required lengths and attach them to the appropriate segments. Insulate the hose using insulating tape. Use hose clamps of the same size as the hoses on both ends to secure them and tighten each clamp.

### Outlet (open configuration)

5. Determine a location within the vehicle/engine compartment where the outlet air would be vented to the atmosphere. (Avoid using steel or metal pipes or tubing to route blowby, as it increases the freezing risk to our systems.)

**Note: Ensure that the fumes exiting the CV unit are not vented inside of the engine compartment.**

6. Insulate the hose using insulating tape. Attach the hose to the CV outlet using hose clamps. Route the hose to the selected vent location.

**Note: Ensure that outlet hose is not in contact with hot engine parts.**

### Oil Drain Return

**Note: Consider sections "Requirements for Proper Oil Drain Height Setup," "Understanding Drain Height Calculations," and "Procedure for Oil Drain Height Calculations," prior to selecting a drain and mounting location.**

7. Determine the location for the oil drain return. Locations to consider are unused engine block low pressure ports, dip-stick holes, or welding an adapter to the oil fill neck. Ensure the port or adapter is positioned upward and within 45° of vertical to ensure appropriate draining. The bottom rear of the vehicle, away from the air intake.

**Note: Keep the drain location in the lower section of the engine near the oil pan and below the full oil level mark, refer to the Oil Drain sections for more information.**

8. Determine the routing and length of the tubing needed to connect the oil drain from the CV filter to the port of the oil sump.

**Note: To connect the check valve, ensure that additional space and tooling is accounted for the install, as well as making sure that oil can flow from the CV unit to the oil sump but not in the opposite direction.**

9. Insulate the oil drain hose and attach each end to the CV oil drain port and the check valve respectively, using hoses (30R7 standards or other oil-suitable plumbing, avoiding metal tubes). Place hose clamps of the same diameter on the hoses at both ends. Tighten and secure.

### Outlet (closed configuration)

10. Locate the port on the air intake piping. If there's an extra port, then remove the plug and install an adapter to connect to the CV outlet. If no extra port exists, use either a 'T' connecting coupler, or weld a tube adapter, of equal size, onto a metal section of the air intake piping. Make sure all debris is clean and the welds are leak free.
11. Determine the hose routing and length needed to connect the unit outlet to the air intake piping. Cut the hose to the appropriate length to connect the two and use hose clamps to secure the connections.
12. Inspect the system to ensure that there is no room for oil leaks or oil escaping from the intended blow-by path.

### Post-installation Checks

- Make sure that all bolts, fasteners and clamps are tight.
- Make sure that the entire length drain line is above the oil sump port (or check valve if incorporated).
- Make sure the CV unit is placed in the right orientation with respect to the flow direction.
- Start the engine allowing it to idle, and warm up.
- Check for leaks in all hose connections and tighten clamps as needed.
- Check for leaks in the intake piping.
- Check for leaks in the crankcase vent and oil drain locations.
- Turn the engine off.
- Repair all vent leaks, if found, during checks.

### Service Instructions

This CV unit doesn't require any maintenance or service along its lifetime given that the engine is running with no issues.

**⚠ WARNING: Replace the unit if any physical damage is present.**

### Requirements for Proper Oil Drain Height Setup

- Oil drain plumbing must have a continuous downward slope without sharp bends, dips, or low points to prevent oil or water from clogging and freezing in low ambient temperatures.
- It is required to use a check valve in the oil drain to prevent oil or aerosol from flowing back to the CV unit through the oil drain.

### Understanding Drain Height Calculations

- Know the worn engine blow-by rate (if not available from manufacturer, estimate using rated horsepower ÷ 40 = worn cfm).
- Know the pressure drops for each element at the engine’s worn blow-by rates (usually available on pressure drop vs. blow-by curves provided by the manufacturer).
- It is recommended that the estimation is done assuming a worn engine since the pressure drop (and resulting oil drain height required) will be higher at worn condition. This ensures that the selected configuration for the CV will not cause oil carryover problems.
- Use a check valve to ensure oil or aerosol do not flow back to the CV filter. To further prevent potential issues.

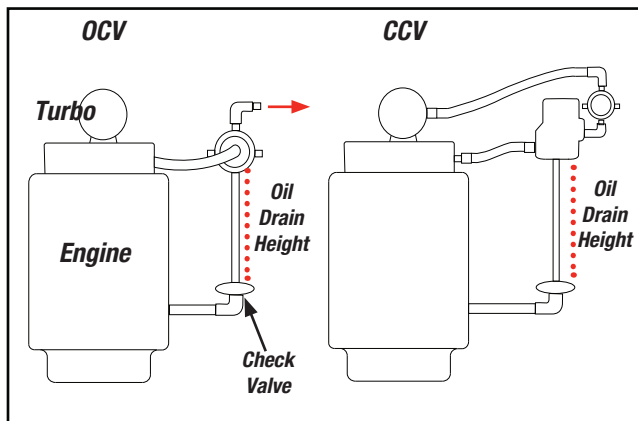


Figure 8 - Setting the Oil Drain Height

### Procedure for Oil Drain Height Calculation

To find the height in inches, first estimate the crankcase pressure. This can be done either by measuring directly or by adding up the pressure drop that each element adds. For example, if a cyclone and CV filter are integrated into the system, they will all add up to the crankcase pressure and will need the CV filter to be placed higher. Use the engine blow-by rates and the performance specifications of the CV unit to estimate the pressure added by the CV unit. As an additional step, the total pressure needs to be multiplied by a factor of 1.2 to account for the difference in density between water and oil. See table 3.

Table 3: Total pressure and drain height estimation.

<b>Crankcase Pressure</b>	+ 29 in H <sub>2</sub> O	
<b>Total Pressure</b>	2.9 in H <sub>2</sub> O	= 3.48 inch Oil Drain Height

### OCV and CCV Drain Height Calculation: Requirements and Formula

**Note:** For the following applications, please multiply the needed oil drain height obtained above by the multiples given for a safer estimate:

**On-highway** – multiply by 1.05:

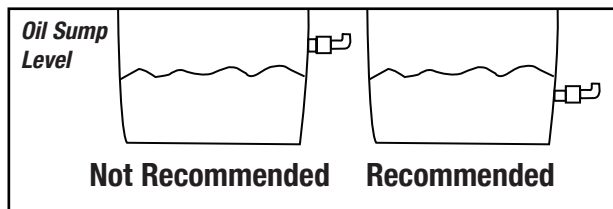
$$3.48 \times 1.05 \approx 3.7 \text{ inches.}$$

**Off-highway** – multiply by 1.45:

$$3.48 \times 1.45 \approx 5.1 \text{ inches.}$$

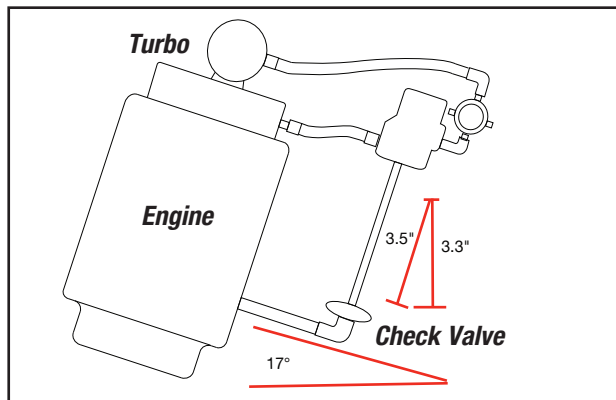
**Note:** In OCV and CCV configurations, the separated oil is usually drained back to the engine oil sump. For the oil to be drained back, this oil must be able to overcome the pressure in the crankcase. As a result, the CV unit must be placed at a certain height from the oil drain check valve. See figure 8.

**Note:** It is preferred that the port to the oil sump is placed below the oil level, as shown below in figure 9.



**Figure 9:** Oil drain port preferred location on the oil sump.

**⚠ WARNING:** Failure to place the CV unit at an appropriate height could lead to oil carryover from the CV filter.



**Figure 10 -** Effect of engine inclination on oil drain height

**Note:** It is important to consider that the vehicle might be operating at an angle (like the slope of a highway). When this happens, the vertical distance for the oil drain height is reduced, as the diagram above shows for an angle of 17°. See figure 10 above.

**Note:** The use (or lack) of a CDR does not affect the oil drain height required.

**Note:** These estimations are performed at a certain crankcase pressure for a given blow-by rate. Since these change as the engine wears out and could vary depending on the vehicle's specific application, it is advised that special attention is placed on using pressures and blow-by rates that are truly representing the engine at work.

## Sources for Pressure Drop Estimations

For CV filtration products, the pressure drop caused by each component should be obtained from each product's literature. Cummins Filtration products have data sheets for these figures. If not found, please contact Cummins Filtration (or your selected manufacturer). For any further questions or assistance, please contact Cummins Filtration at [www.cumminsfiltration.com](http://www.cumminsfiltration.com).



**Filtration**

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