

Crankcase Ventilation Filters

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If you have a late-model, major-brand, marine diesel engine, chances are that it came equipped with a crankcase ventilation filter system. Caterpillar, Cummins, Detroit, John Deere, and some other makers install vent filters as standard equipment on some or all of their marine engine models. Other manufacturers offer them as a factory or dealer option, and there are good reasons for taking that option if offered, or for retrofitting your current engine if it isn't so equipped.

All piston engines leak some combustion gases past piston rings. These gases pressurize the crankcase and pick up engine oil mist as they leave via the crankcase vent. The volume of this "blow-by" increases as the piston rings and cylinder liners wear, and at typical overhaul intervals blow-by is double that of a new engine. In trucks these gases could escape into the environment, where they would contribute to air pollution but have little effect on the vehicle itself. In a boat's engine room or compartment vented crankcase gases would quickly coat all engine room surfaces with an oily film, making for a dirty workplace, collecting dust and grit, and potentially damaging any genset or other electrical components in the engine room.

Few engines are made any more that vent into the engine room. It is still com-

mon, however, to see a hose running straight from the crankcase vent to the engine air intake. On older, naturally aspirated engines the result is minor, possibly slightly dirtier combustion and earlier fouling of injectors. On turbocharged engines the dirty, oily mist can coat impeller blades, foul aftercoolers, and significantly shorten engine life. A source in the industry says that single-weight oils tend to pass directly into the combustion chamber, whereas multi-grade oils, which are specified for some modern turbocharged engines, contain a butyl viscosity enhancer, which is more likely to stick to turbo components.

Thus, it is important that blow-by be filtered to remove oil and soot before releasing it into the atmosphere or the air induction system of the engine. The element in a crankcase vent filter coalesces the hot oil mist into liquid and traps it in a sump. Most units are designed so that the trapped oil is returned directly to the crankcase. Some hold the oil, to be drained and either discarded or poured back into the engine.

Some vent filters are plumbed as "open systems" whereby the filtered gases are released into the atmosphere. More common now is the "closed system" design that reintroduces the gases into the induction system after crankcase vapor filtration.

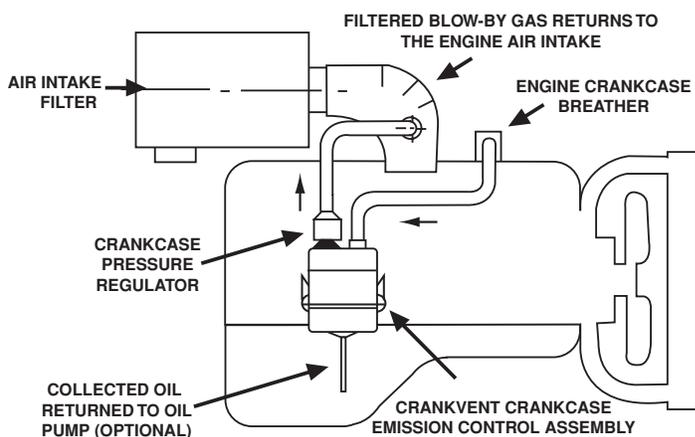
Crankcase Vacuum Stops "Oil Slobber"

A well-engineered crankcase vent filter system can do more than just clear the air. Plumbed to the blower, turbo, or intake manifold, a closed vent filter system creates a slight vacuum or negative pressure in the crankcase. The happy result is that less engine oil is forced past the rings into the combustion chambers, and crankcase gaskets don't leak when the engine is running, which eliminates a source of oil in the bilge. A pressure regulator ensures that fluctuating vacuum from the turbo doesn't impose excessive vacuum on the crankcase.

Detroit Diesel two-cycle engines (53, 71, and 92 series) have air box drains (affectionately known as "slobber tubes") that leak oil when the engine is idling. Attachments can be added to crankcase vent filter systems that collect oil from the air box drains, eliminating another source of oil headed for the bilge.

Several companies make crankcase vent filters but two dominate the marine market. Airsep, manufactured by Walker Engineering, has long been regarded as the standard of the industry. Airseps have been factory-installed on marine engines built by Detroit Diesel since 1989, Caterpillar since 1992, and Cummins and Deutz since 1994, and have been factory options on Luggers since the early 1990s. Walker makes literally dozens of Airsep models for different applications, and a potential purchaser is advised to study carefully the options before making a choice. Their newly released CCE (closed crankcase evacuation) System is an improved version of the venerable Airsep.

Most Airseps bolt directly to the engine air intake, and in addition to the connecting hoses and coalescing unit, also include a separate vacuum regulator, air filter, and turbo silencer. A separate air box drain kit is available for two-stroke diesels. Some Airseps are designed for remote mount. Airsep offers a "plenum" or mounting bracket to attach their unit directly to the airbox of the 6-71 and similar engines. The direct mount makes a neat installation



A crankcase ventilation filter should be made below the valve cover but above the oil pan.

where space allows, but where space is limited, especially on some in-line engines with the air intake on the side of the block, a filter unit mounted directly to it may obstruct access to that side, so a remotely mounted unit is the logical choice.

Racor, a division of Parker Hannifin Corp., produces a wide range of filtration products and offers its own line of crankcase vent filter units. Racor crankcase vent filters and air filter/silencers are also standard or optional equipment on some Cat, Cummins, and John Deere marine engines. Their earlier models, the CV820 and CV1000, were designed primarily for open systems on non-turbocharged engines, although with supplemental hoses and fittings they can be installed as closed systems on the naturally aspirated (blower) two-stroke Detroit by returning the filtered vapor to the low-pressure intake side of the air filter. The newer line, called CCV, is strictly a closed-system design.

All Racor units are designed for remote mounting. For CCV installation the hose from the filter to the air intake is connected between the existing air filter (if there is one) and the turbo by means of a “tap sleeve” or a “through-hull” type of fitting.

Both Racor and Airsep incorporate a drain cock and check valve that allow coalesced oil to return to the crankcase through an auxiliary fitting in the engine block.

Engine output is the factor for determining model selection, as they are sized by blow-by volume in cubic feet per minute. Take the engine’s rated horsepower and divide by 40 to get approximate blow-by CFM. Actual blow-by volume of a new engine is less but the formula takes into account eventual ring and liner wear.

The coalescing filter unit offered by each company is relatively inexpensive, but with the addition of hoses, fittings, clamps, adapters, and air filters, a complete kit for either brand will cost between \$500 and \$1,000 in the smaller sizes (up to about 600 hp). Kits for larger horsepower engines are more, and each turbo requires its own unit.

Both brands have good reputations for reliability and effectiveness, and choice is mostly a matter of personal preference. Study the specs and installation instructions for both before making a decision. Engine room space allocation may determine the outcome.

Easy Installation, Low Maintenance

Fortunately installation is pretty straightforward and can usually be done by the owner-operator. A complete installation kit will



Racor's CCV line is a remotely mounted closed system incorporating a drain cock for coalesced oil. Photo courtesy Racor.

include some or all of the following: several feet of inlet hose, check valves, an air box drain collector, the coalescing filter unit, several feet of outlet hose, a vacuum regulator (may be integral to the filter unit), a tap sleeve or air filter connector, air filter unit, mounting brackets, and hose clamps. Both companies provide detailed installation instructions.

The first step is to select a location for the filter unit if it is not going directly onto the turbo. It must be placed where not more than five feet of hose is required to connect it to the air filter, and it should be somewhere between even with the valve cover to midway down the engine block, but not lower than the oil level in the oil pan if the plan is to let it drain back into the crankcase. Allow four inches under it to remove the bottom of the case to change the filter element.

The filter cases must be firmly attached, and hoses secured so that they don't vibrate loose, and kept away from hot spots like exhaust manifolds. Supplied hoses usually have to be cut to proper length. If a “through-hull” type of fitting is used to connect the outlet hose to the air filter housing or turbo inlet tube, the nut must be secured with a thread locking compound so that the fitting doesn't work loose and get sucked into the turbo.

Maintenance is minimal. Most units made by both companies have pop-up indicators that show when the filter is becoming clogged, but under normal use 750 hours is about the usual replacement interval. An optional electric remote indicator

is available from Racor. The engineered-fiber coalescer filters cost about \$20 and can be changed in a few minutes. The older Racors use a foam rubber filter that can actually be wrung out as long as care is used not to tear it. Recommended replacement interval for the foam filter is 500 hours.

Air Filters and Intake Silencers

Some engine makers assume that marine engines operate in a dirt- and dust-free environment, so they don't supply air filters. Detroit, for example, didn't put air filters on most of its blower-equipped two-cycles. Turbochargers are susceptible to damage from dirt so most engines equipped with them also have some kind of air filter. At the same time, air intake and blower noise or turbo whine is a major component of diesel engine noise.

It's possible to buy after-market air filters for makes or models that didn't come with them. A Parker subsidiary makes a “transitional inlet” (what Airsep calls a “plenum”) which allows an air filter to be installed on in-line two-cycles, although it increases the overall height of the engine. Users say the filters do protect the engine from contaminants in the air, but don't do a lot for overall sound reduction.

Both Racor and Airsep offer air filters and silencers compatible or integral with their crankcase filtration units. The distinctive raspberry-colored cone associated with Airsep is the air filter element, not the blow-by coalescing filter. Racor air filters are housed in black fiberglass barrels with 4-, 5-, or 6-inch outlets for attachment to popular size turbos. Air filters are sized by CFM of maximum airflow; CFM = rated horsepower × 2.0 (four stroke) or × 2.5 (two stroke).

The units are claimed to reduce intake and turbo noise by as much as 6-10 dBA.



Airsep offers units that bolt directly to the engine air intake, filtering air, coalescing oil, and reducing noise. Photo courtesy Racor.

That's minor compared to the 110-140 dBA that a running engine produces, but it could be a noticeable improvement in the living quarters after engine room insulation has lowered the ambient sound to 65-85 dBA.

Clogged air filters often are implicated in poor engine performance. To avoid problems associated with clogged air filters while minimizing element replacement costs, install a filter restriction monitor, which measures suction at the turbo or engine air intake after the air filter. Some models have a visual indicator on the air filter outlet. Others may have remote- or dash-mounted indicators that are either electric or pneumatic

Air filter elements for both makes are replaceable, and can be washed—Racor in hot, soapy water; Airsep in a special cleaning solution (never use fuels or solvents). Air filters should be cleaned annually, every 250 hours (Airsep), or when the optional filter restriction monitor indicates (Racor). Once cleaned, air filter elements should be air dried and re-oiled before being put back into service.

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