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Subject: Mishimoto Baffled Oil Catch Can

Objectives

Design a high-end oil/air separator that is universal and can be installed in most vehicles. Design must function exceptionally well and still look aesthetically pleasing

Background

Catch cans are usually simple devices that capture oil molecules from the PCV port in a designated container and allow cleaned air to return to the engine. The positive crankcase valve (PCV) allows the positive pressure from the crankcase caused by "blow-by" to evacuate the engine before harm occurs. The PCV system is critical to ensuring long life to the engine. The action of a PCV system can be achieved in many different ways.

The Science Behind a Catch Can

The basic theory of catching the oil from the air is a simple one. When the gas enters the catch can the volume is dramatically increased, causing reduced pressure of the gas. This decrease in pressure slows down the velocity of the gas and allows the gas inside the can to condense on the interior surfaces. The more surface area the gas can contact, the greater the effectiveness in separating the liquid from the gas. A good analogy is the steam from a hot shower that condenses on the mirror and the other cooler surfaces of the bathroom. This example demonstrates the same principles that apply to the function of a catch can. It is also worth noting that mounting the can in an isolated and cooler position in the engine bay will improve the efficiency of the catch can. Most companies use two main approaches for catch can design. The basic design is a simple can with hoses attached. The more advanced designs include internal baffling, which provides more surface area for the oil to condense. Both of these approaches work.

Mishimoto's Design Approach

Our engineers looked at current catch can designs of other companies to see the different approaches for increasing the surface area inside the can. Some companies use wire mesh, holes drilled in plates, steel wool, multiple tubes, and others. They also wanted to explore how other industries achieve separation of liquid and air. They found that the air equipment

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Mishimoto Baffled Oil Catch Can

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tools use in-line water/air separators to eliminate water from the lines. The approach is similar to the automotive industry, except that bronze filters are used to help ensure that all the air has time to condense before exiting the water/air separator. Engineering decided to use this type of system for the prototype and subsequent testing.

The Design Phase

Mishimoto engineers wanted to apply as many of these techniques as possible to ensure design of the best catch can that could be brought to market. The design criteria are listed below.

1. Maximize the time the PCV gas spends inside of the can.
2. Create a large change in volume.
3. Incorporate a micro-sized filter.
4. Include internal surface area for the gas to condense.

1) The CAD screenshots below show specially designed slopes or ramps that were created to direct airflow swirling down the entire length of the can before getting sucked back into the intake.



2) Air enters via a small-diameter hose into a large billet can.

3) The design includes a washable 40 micron filter that will ensure 100% of the air entering the engine has been filtered to that level. (Note: 40 microns is roughly the diameter of a human hair.)

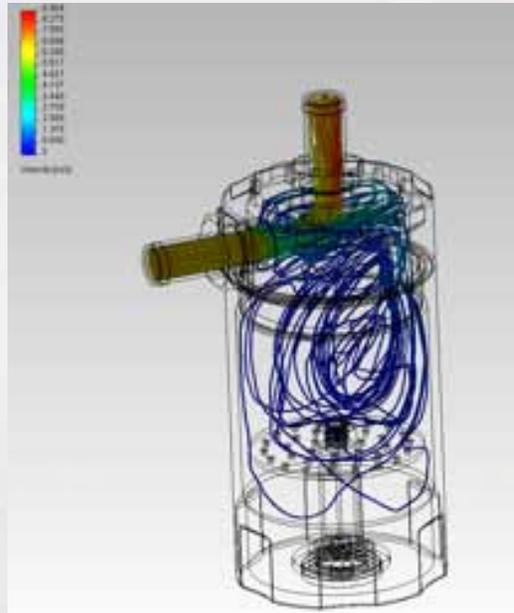
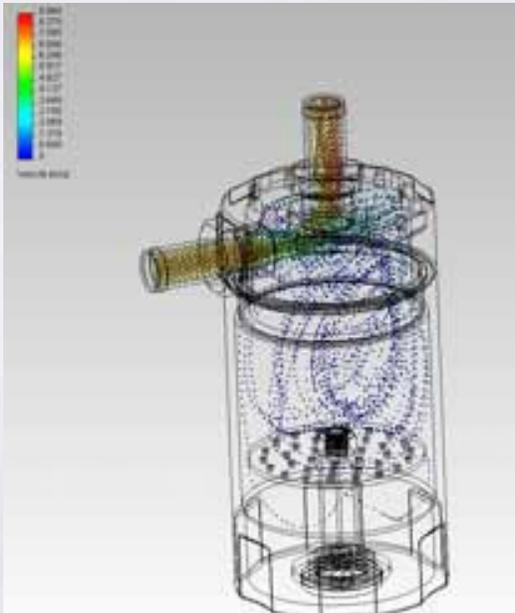
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4) An aluminum disk with small holes in it is also included. The disk serves two purposes: to allow more surface area for the oil to condense, and to act as a baffle and protect the filter from being splashed with accumulated oil on the bottom of the can. The section view of the catch can shown to the right reveals see all the internal features.



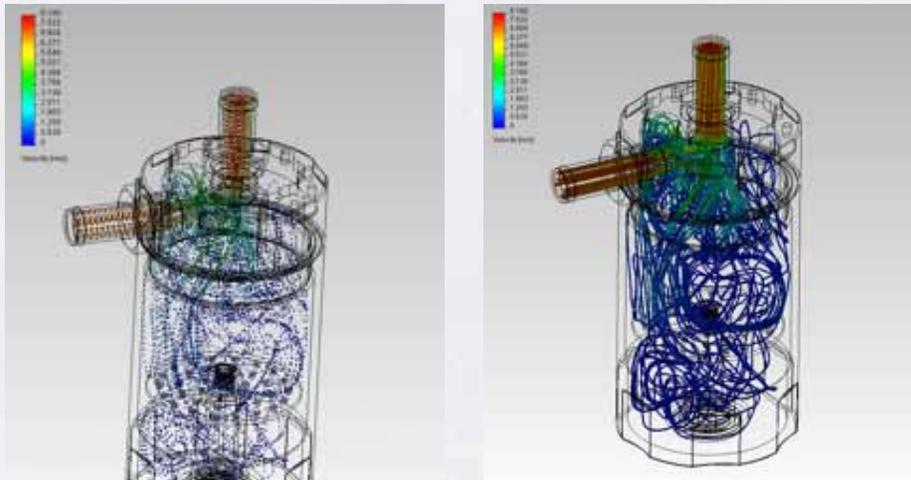
Using computational fluid dynamics (CFD) software, engineers were able to adjust the internal components of the can to maximize its efficiency. The screenshot below shows the patterns of the gas as it travels when entering the can. The first two screenshots are of a can without any specially designed internals. It is simply a can with an inlet and outlet.



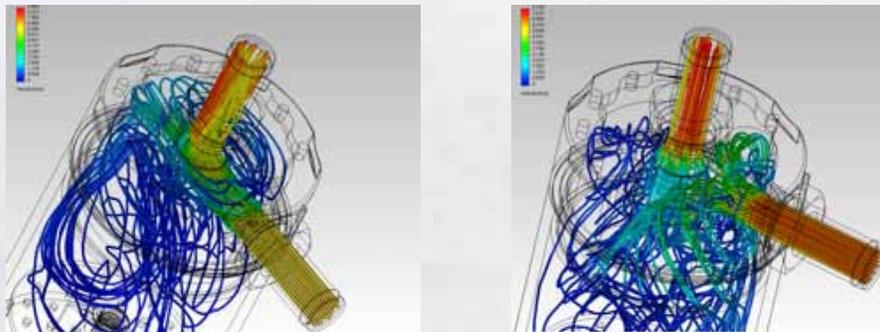
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The two screenshots below are Mishimoto's designed internals, which help direct the excess crankcase gases swirling down the can. This is important because it slows down the gas and gives it more time to condense on the interior surfaces of the can.



A more detailed view below shows what we are emphasizing here. The screenshot on the left shows a large amount of gas traveling in the can and immediately exiting. This gives the gas no chance to condense and eliminate the oil and other chemicals in the mixture. The screenshot on the right shows the gas being deflected down and in a swirling manner. This is important because the gas loses its velocity and spends more time inside the catch can, allowing more time for the gas to condense before getting sucked back into the engine.



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Aesthetics/versatility

After the design functions were finalized, the engineers worked hard at choosing material, shapes, and finishes. We tried to design it from a consumer stand-point: access to mounting points, changing different hose ports, multiple drain locations, color combinations, and making it washable/reusable. After multiple designs we ended up with one we are quite proud of. To the right is a 3-D render of what we wanted the product to look like. All these research and engineering tools help Mishimoto design products at the highest level.



Features

- 6061 billet aluminum body with sandblasted and anodized finish
- CFD-designed internal lid to maximize air travel
- Upper billet aluminum cog-designed mounting bracket (multiple mounting positions)
- Lower billet aluminum clamp-on mounting bracket (adjustable mounting positions)
- 40 micron bronze filter
- Includes two M20 push-on fittings (can use M20 AN fittings as an upgrade)
- Drain plug at bottom of can accepts M20 push-on or AN fittings
- Internal baffle
- Completely airtight and sealed with O-ring and dowdy seals for the fittings and drain plug

Maintenance Notes

Every vehicle has a different amount of PCV gas so be sure to check the can's contents. The catch can should be drained every 3000 miles or when the oil is changed, whichever comes first. If the vehicle is tracked then it should also be drained after each session. Remember to examine filter media and clean by washing with soap and water, or use brake cleaner at every oil change.

Kevin McCardle
Product Engineer, Mishimoto Automotive