
# "Crankcase Ventilation"

By Tony Cripps

## 1. Introduction

Basically there are four types of crankcase ventilation systems BMC cars of the 1960s. As we all know, the seal of the piston rings is not perfect, and during compression and combustion strokes, there is blowby from the combustion chamber into the crankcase. It is thought that some 80% of this blowby is unburnt fuel, the remainder being products of combustion – a large part of which is water. If these gases and water vapour were to remain in the crankcase, they would form sludge with the oil which is of course undesirable, not to mention the presence of corrosive compounds. The engine ventilation system is supposed to circulate a continuous stream of fresh air through the crankcase so as to remove the blowby gases before they have time to do any damage. The key point here are the words "continuous stream of fresh air" – it is well to remember them.

## 1. Draft Tube

The first and simplest method of crankcase ventilation (used by many cars of the early '60s) was to have a vented oil filler cap and what is called a "draft tube" (or draught tube if you prefer) which was connected to the crankcase and pointed downwards into the under-car air stream so that passage of the car would create a suction effect thus drawing fresh air though the cap, through the crankcase, and out the tube. Effective, but hardly environmentally friendly.

## 2. Rocker Cover

The next method (such as that found on a Morris 850 or early Morris Mini Deluxe and Morris Cooper S) is similar in operation but the air goes the other way. The oil cap is sealed. A rubber hose 2A634 joins the rocker cover to the air cleaner intake, and there is a metal tube in the engine side plate. This tube has all the appearance of being crimped off, but in fact, there is a very small slot 0.010"-0.015" in the end of the crimp.

Air is drawn through the crimped end, through the crankcase, and out the rocker cover into the air cleaner. This also works quite well, but is unregulated – so that much the same amount of ventilation occurs at idle as compared to full throttle, the only difference being the slightly greater depression in the air cleaner outer ring area.

It is almost certain that the slot in the crimped end is blocked with paint and it is a worthwhile check to make sure that it is clear. Equally important is that there is an air-tight connection at each end of the rocker cover breather hose since suction through the air cleaner is the means by which air is drawn through the crankcase. If there is a leak, or no pipe at all, then there will be little or no crankcase cross-ventilation.

Note: If you have an original rocker cover breather hose then chances are that the inside if cracked and crumbling due to the presence of oil over time. The outer fabric covering can be peeled back and a new rubber hose inserted so as to preserve an original appearance.

**Fig. 1** Rocker cover breather hose

The oil cap is plastic, (steel on very early cars) short neck, and non-vented. The rubber ring seal should be checked and replaced if necessary.

## 3. PCV Valve

The third type of system is one which involves the PCV diaphragm valve which can be found on some model Mini, Austin 1800 and MGB. The operation is quite complicated.

The breather valve essentially allows a controlled passage of a mixture of air and blowby gases to enter the inlet manifold. The flow rate of gas allowed to pass is determined by the height of the piston which is in turn connected to the rubber diaphragm. The underside of the diaphragm is connected to the crankcase volume for reasons which are explained below.

There are several versions of this breather valve. The original 13H1753 contained non-serviced items. In 1968, a new valve 13H3609 was introduced which allowed the components to be serviced. 13H5191 specified for YDO6 and also introduced at some unknown point for B series engines is a direct replacement and has a slightly different taper on the plunger inside and a different plunger guide.

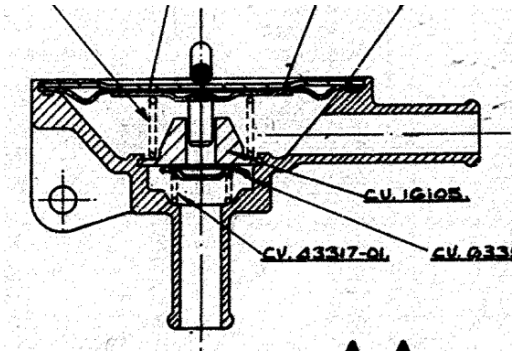


**Fig. 2** 13H3609

With the engine off, the breather valve is fully open by virtue of the light spring under the diaphragm and the lack of crankcase depression. Consequently, there is a relatively large passage from the crankcase to the inlet manifold. When the engine starts, manifold vacuum acts on the crankcase volume via the fully-open valve. The amount of crankcase depression is limited by the small hole in the oil filler cap which acts as a restrictor – allowing a depression to form, but not too much. This depression in the crankcase pulls the breather valve diaphragm down thus lowering the piston and the flow of gas through the valve is lessened – enough to handle blowby at idle. It is a self-regulating effect.

When at high engine load, such as large throttle opening, there is more blowby present and so it is desired that there be more flowrate of gas through the valve to process it through to the inlet manifold. The crankcase may even be under positive pressure. The breather diaphragm senses the loss of depression and rises, so opening the valve and allowing an increased flow rate through it. Again, it is a self-regulating system.

The breather valve opening is controlled by the small *depression in the crankcase* – which is why the diaphragm is so large in diameter. In other cars, in a normal PCV system, there is a small cylindrical spring loaded valve connected directly to the inlet manifold and it is the *manifold vacuum* that controls the gas flow, not the crankcase depression.

In the BMC system, when the filler cap is removed, then as far as the breather valve is concerned, this signals “more blowby present” since the restriction offered by the breather cap is no longer there and more air enters via rocker cover and there is consequently less depression in the crankcase. The valve opens up, allowing more gas to pass into the inlet manifold – that is, more than there is supposed to be at idle.

The fuel air mixture in the inlet manifold at idle is not stochiometric. The exhaust CO concentration at idle is about 4%, where as at light cruise, it is about 1 or 2%. It is necessary to increase the mixture strength at idle because of a combination of factors mainly to do with the latent heat of vapourisation of petrol under low pressure to the relative mass to surface area in the combustion chamber.

When there is a small air leak on the manifold side of the carburetter, this upsets the balance of factors mentioned above and results in a slight rise in engine idle rpm. The same thing happens when the oil cap is removed. More gas going into the inlet manifold than intended. If there is too much of a leak, then the mixture becomes too lean and the engine stalls.

There is a one-way spring loaded valve in the bottom of the assembly that protects the crankcase against flashback in the case of a misfire.

## 4. Carburetter

The fourth type worthy of mentioning involves a connection to a port on the carburetter. The ventilated gases from the crankcase are fed into a pipe connector at the carburetter body near the main piston chamber. This connector is positioned up stream of the throttle disc and downstream of the carburetter piston. Since the velocity of the air flow through the carburettor past this port depends on the throttle opening, then the resulting depression (similar in action to the original draft tube) serves to control the amount of crankcase ventilation depending on engine load. Air is drawn in at the rocker cover.

## 5. Oil Separators

The position of the oil separator varies: Front timing cover, engine side plate, rocker cover, and flywheel housing. It is important that the correct oil separator is used depending on the type of PCV system fitted since the restrictions involved in the complete system are matched.

The oil separators in earlier systems consist of just a baffle in the engine side plate, some of which also have a wire gauze.

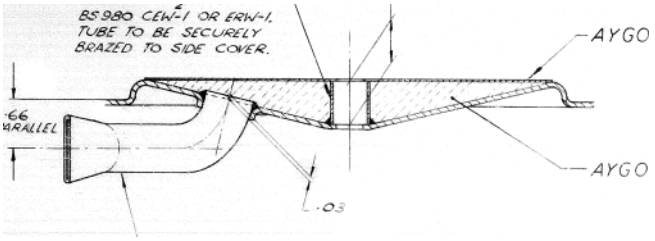


**Fig. 3** Side cover with gauze.

The rocker cover separator is packed with gauze.

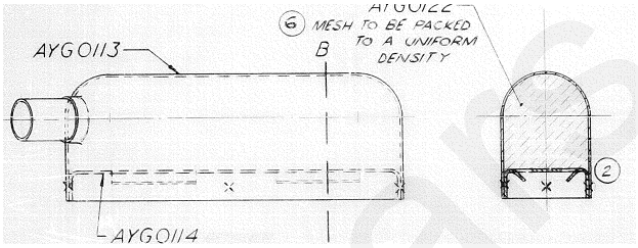


**Fig. 4** Rocker cover oil separator.

The cylindrical type of separator has baffles and gauze and one should not expect a rod to pass through from one end to the other, but there should be a fairly free flow of air through them when being tested and serviced.

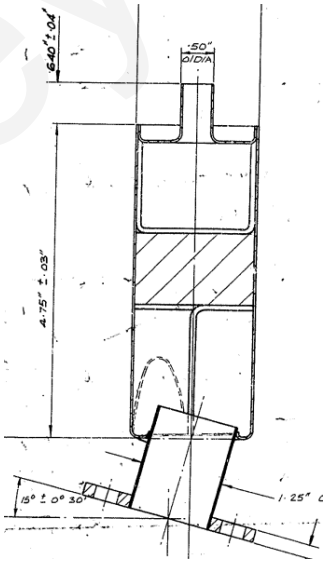


**Fig. 5** Side cover/Flywheel cover oil separator.

## 6. Home Remedies and 3rd Party Products

Perhaps the last type of ventilation that is sometimes observed are various home-designed arrangements whereby every pipe possible is fed into a tin. This totally defeats the whole purpose of actively removing blowby gases from the crankcase and should never be done.

There *are* some properly designed catch cans available which retain the circulatory nature of the ventilation system while and condensing the blowby before it re-enters the carburettor or manifold and these would appear to be satisfactory. Also, for turbo or super charged engines, some thought should be given as to how the crankcase ventilation under boost (when it is mostly needed) is to be achieved.

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