Motorcycle
Electronic Cruise Control
Instruction Manual ©

Vacuum test procedures for
MCS 020 and MCS 574 vacuum actuators
(vacuum throttle servo)

MotorCycle Cruise Controls

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This manual shows the tools and tests to diagnose vacuum faults with the cruise control vacuum actuator system.

Simple tests to test integrity of the vacuum hose and the check valve, no special tools required.

NOTE: - This is for cruise control vacuum systems that do NOT have a vacuum reservoir (most installations) and also there are notes for the differences with a reservoir (Kawasaki Z1400GTR Concours, Suzuki Burgman 650, Triumph Tiger 800 and a few others).

Disconnect the vacuum hose from the vacuum actuator. NOTE: - do not disconnect the hose at the check valve/s, there MUST be a significant length of hose from the check valve/s to the end of the hose.

Start the engine and 'listen' to the end of the hose, you should hear regular pulsing noise at the end of the hose as the engine is running and 'sucking' air with each inlet stroke from the cylinders. **Note: - This will be more subdued on bikes with a vacuum reservoir, but should still be there.**

Partially close off the end of the hose with your thumb or finger, you should be able to feel the pulses when you nearly seal the end of the hose.

Seal the end completely, you should feel steady vacuum on your thumb (after a few seconds on bikes with a reservoir), but this will not be easy to feel due to the small size of the hose. If you allow a slight leak, you should feel a slight inrush of air and start to feel pulses again.

With the engine running, seal off the end of the hose completely.

After a few seconds (30 seconds with a reservoir), stop the engine.

Wait 5 seconds, then release the end of the hose. You should hear an in-rush of air into the hose caused by stored vacuum in the hose. This will be very short, but MUST happen (much stronger with a reservoir). Try this several times (run engine, block off hose, stop engine, wait 5 seconds, release hose and check for slight inrush of air) to see if the result is consistent. On bikes with a reservoir, the stored vacuum should be 'strong' even if the engine is off for several minutes.

Repeat this process, but wait longer (15~20 seconds) before releasing the end of the hose. Ideally, the result should be the same, but if there is no or less inrush of air, this indicates that the hose or check valve has a slight leak, which is not a major issue, but ideally the hose should 'store' vacuum for a minute or so, in practise if it holds vacuum for more than a few seconds, it will work OK. Ideally in both cases, the vacuum should be 'held' for at least several minutes (1/2 hour or more with a reservoir) after the engine is turned off.

If the hose holds vacuum for more than a few seconds (a couple of minutes with a reservoir) after the engine is stopped, and you can hear and feel air flowing into the hose with the engine running, this indicates that the vacuum hose and check valve are both in good order and working correctly.

More advanced tests requiring special tools.

Tools required.

- Typically 1 to 2 metres (3~6 feet) of 4mm (5/32") hose. Vacuum hose is ideal, but clear plastic windscreen washer fluid hose or similar will also work well as long as it is not too soft. If it is too soft it may collapse and block off under high vacuum conditions.

- One 'T' connector to suit 4mm hose.

These components can usually be purchased from automotive spare parts stores. The plastic hose can often be bought from hardware stores too, and some hardware stores may also have suitable 'T' connectors, possibly from 'drip' irrigation systems. These parts may not survive for very long when exposed to fuel vapours, but should last long enough for testing purposes.

- A vacuum gauge.

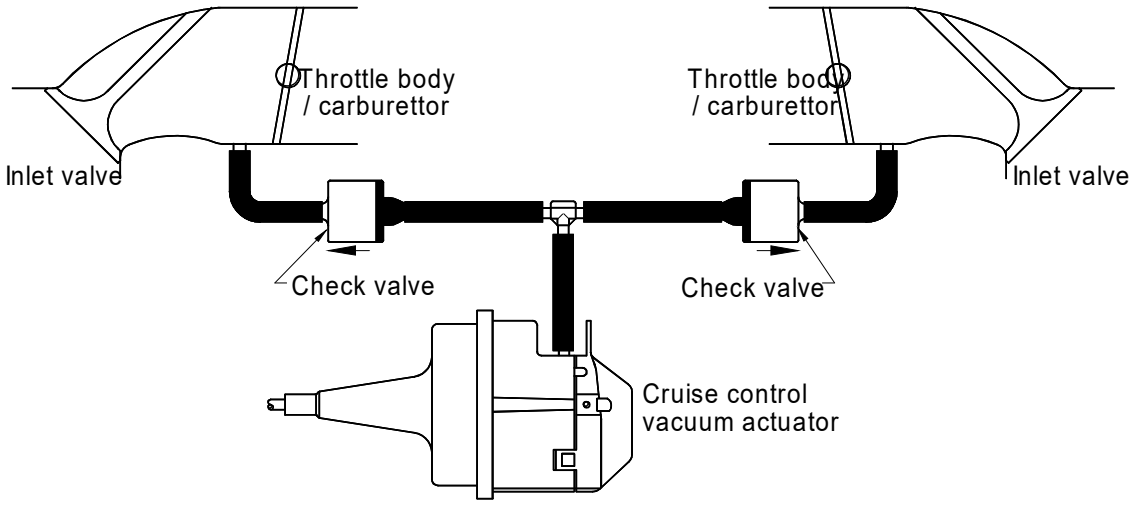
A suitable vacuum gauge can be purchased for a few dollars from most automotive spares or accessory stores or possibly from Wal-Mart or K-Mart or similar stores. We use a standard 2" (50mm) automotive vacuum gauge that is designed to fit in the dash of a car. It does NOT need to be very accurate, you are simply looking for a gauge that indicates vacuum levels, high, medium or low and that will show fluctuations in the vacuum.

Our gauge (very well used as you can see from scratches) has the usual Poor, Fair, Good and Excellent zones marked, as well as graduations and numbers in centimetres of Mercury (cm/Hg). Many gauges will be graduated in inches of Mercury (in/Hg). The tabulation below shows the approximate conversions.

in/Hg		cm/Hg	
4	~	10	Poor
8	~	20	Fair
12	~	30	Good
16	~	40	Good
20	~	50	Excellent
24	~	60	Excellent
28	~	70	Excellent

Connecting the vacuum gauge.

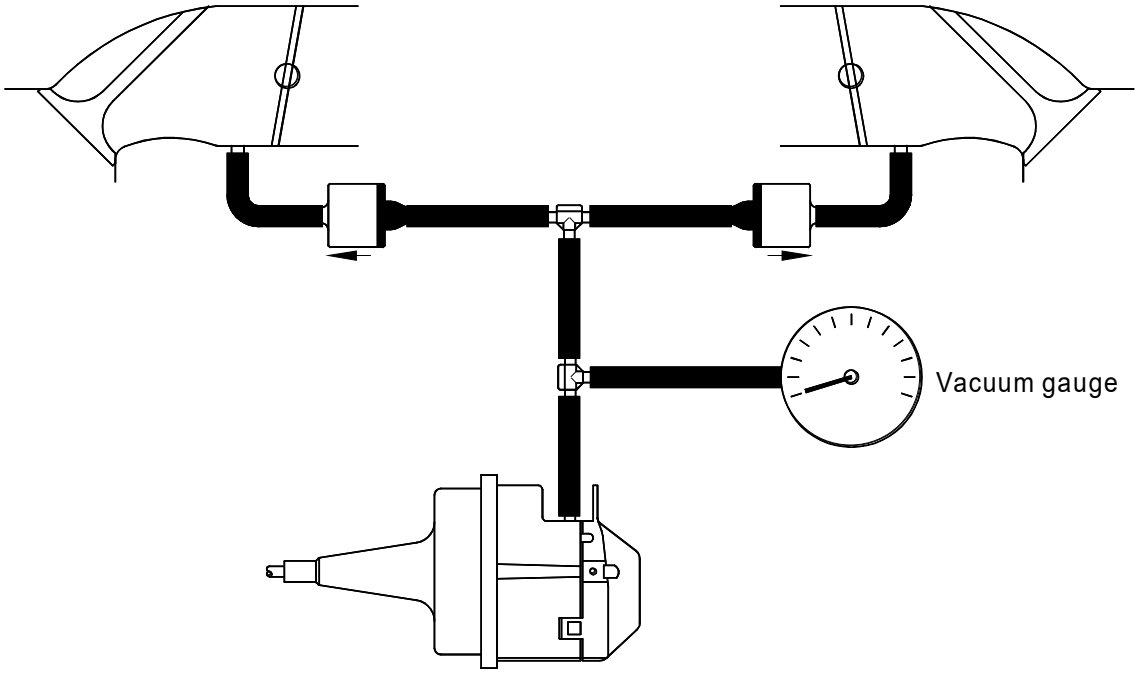
This diagram shows a typical connection for the cruise control vacuum hose. Sometimes only one cylinder is connected, instead of the two shown here, and sometimes a vacuum reservoir is fitted as well.



Insert the ‘T’ piece into the vacuum hose to the actuator, AFTER the small vacuum check valve/s. In most cases, probably the easiest point to do this is at the actuator. Disconnect the hose from the actuator and insert the hose and ‘T’ piece for the vacuum gauge.

An alternate arrangement is to disconnect at either the existing ‘T’ OR at a check valve. Just make sure that the gauge is connected between the check valve/s and the actuator, NOT between the check valve and the engine.

The check valve/s may not be readily visible, as they are usually located fairly close to the engine, at the engine inlet manifold/s. Sometimes the check valve may be connected to an existing hose to the bikes fuel tap or other vacuum operated device.



On bikes fitted with a vacuum reservoir, if the reservoir only has ONE hose to it, the connection of the vacuum gauge is the as shown above.

If the vacuum reservoir has TWO hoses (one in from the engine, and one out to the actuatr), the vacuum gauge must be connected between the reservoir and the vacuum actuator.

Mount the vacuum gauge somewhere you can see it easily while riding the bike. We usually tape it to the handlebars using duct tape.

Interpreting the vacuum readings.

Stationary tests.

While observing the vacuum gauge, start the engine.

As soon as the engine starts, or even while it is cranking, the needle should start to rise.

The needle should come up to 'good' to 'excellent' (40~60cm or 16~24 inches) in jumps (at each inlet stroke of the engine) within 2 to 3 seconds or less. The needle should then stabilise and NOT MOVE at all.

If your cruise has a vacuum reservoir, it will take much longer to for the vacuum level to rise, possibly as long as 30 seconds to reach 'good', depending on the size of the reservoir.

If the needle flutters, it means that either one or both (if two are fitted) check valves are faulty OR there is an air leak somewhere between the check valve/s and the actuator.

Rev the engine a little and allow it to drop to idle. As the engine slows down to idle, the gauge should rise a little more and stay there.

Stop the engine.

The gauge should hold stable for at least 10~15 seconds and really should be stable for several minutes. If the gauge drops very slowly, that will not cause problems, but if it drops quickly (back to zero in less than 30 seconds) this will compromise the cruise control's performance. If a vacuum reservoir is fitted, the vacuum should hold fairly stable for at least 5 minutes, and ideally for longer. The source of the leak should be found and fixed. This could be faulty check valve/s, perished/split/cracked hose, broken fittings or leaking vacuum solenoid in the actuator.

It is very unusual for the vacuum solenoid to fail. The most common cause is perished hose; the second most common is faulty check valve/s.

Place the cruise control in diagnostic mode. For the older MCSU 400C cruise control computer and current MCS8000C computer (any cruise control kits with an MCS 4*** part number), press and HOLD the SET and ON-OFF buttons on the cruise control switch, then turn the ignition ON. Release the SET and ON-OFF buttons.

Start the engine.

Press the ON-OFF button and check that the indicator light on the switch comes on green with each button press. This confirms that the cruise control is in diagnostic mode.

NOTE: - Refer to your installation instructions or trouble shooting guide for other earlier cruise control models.

Observe the vacuum gauge.

Press the SET button a few times. At each button press, the needle on the gauge should drop a little, typically only 5~10 cm (2~4"), with each press, and then it should recover almost immediately. If you have a vacuum reservoir, the vacuum level will drop less, and take more time to recover. After 9~15 presses (ideally not more than 12 presses) the engine rpm should start to rise above idle. Apply the brakes to release the actuator and allow the engine to return to idle.

This confirms that the actuator is sourcing vacuum from the system, and the bike is replenishing it.

If the needle does NOT flick with each button press that indicates that the vacuum solenoid in the actuator is either sticking (most common issue), is faulty or blocked.

NOTE: - Remember to turn the ignition switch OFF to release the cruise control from diagnostic mode.

Moving (riding) tests.

WARNING: - Take great care to pay attention to traffic and road conditions while performing these tests. Do NOT allow the cruise control tests to take your attention away from riding the bike.

Ride the bike at 'normal' speeds and engage the cruise control and observe the gauge.

When the cruise control first engages, the needle will drop a lot, typically to 10~30cm (4~12 inches) and flutter wildly for the first second or so while the cruise control is applying the throttle. If a vacuum reservoir is fitted, the needle with drop, but not more than about 1/3 to ½ way, then slowly recover over the next few seconds.

As soon as the initial engage is complete, the vacuum will come back up (slower with a reservoir). On level road on most large capacity motorcycles, the vacuum should come up to around 25~40 cm (10~16 inches) at normal speeds (60~100kph or 35 to 60mph). Higher speeds or smaller engines will result in lower readings.

While the cruise control is engaged on level road, you should see the needle flicker down slightly at intervals (typically every 0.5 to 5 seconds) when the cruise control is applying a little throttle. You will not see any significant needle movement when the cruise control releases the throttle.

If you apply the brakes and disengage the cruise and allow the throttle to close, the needle will move high, typically about 50~60cm (20~24 inches). This should hold until the next time the cruise control is engaged.

If the cruise control is applying throttle to go up a hill, the vacuum will drop substantially, probably as low as 10~20 cm (4~8 inches) and will recover whenever the throttle is backed off. The cruise control actuator will work acceptably well with vacuum levels down to about 10~15 cm (4~6 inches). Vacuum levels below that will see the cruise control performance suffer significantly.

If the cruise control always seems to be applying throttle even on flat road sections (the needle regularly and repeatedly flickers down as the cruise applies throttle, every 1~3 seconds or so), this tends to indicate a leak in the actuator that is slowly releasing the throttle, and the cruise is regularly applying throttle to compensate.

If the cruise control does not engage consistently under the same conditions, sometimes it does not apply enough throttle when the SET button is first pressed, at other times it seems OK when riding on flat ground at the same speed, this indicates an intermittent leak in the actuator OR an intermittent blockage in the vacuum hose. If the vacuum readings on the gauge is consistent at each time the cruise is engaged, but the behaviour of the cruise is different, this points to an issue in the actuator. If the gauge behaves differently at each time, this points to a vacuum source variation, a partial blockage or pinched hose.

It is impossible to cover every circumstance in this manual, but this should give you a reasonable chance of determining what fault exists and then allow you to fix it.