

3.1 Emissions Control Changes

Over the thirtythree year life of the Holden Stromberg, the worlds views on the environment changed substantially. This lead to considerable change in the carburetor. Whilst the changes are most notable in the BX Stromberg, some changes preceeded that model. The information below aims to paint a picture of the changes in community expectations, along with Holden's response.

The standard Stromberg carburettor is a simple device – you put liquid petrol and air in one end, and it delivers a fuel/air mix in the right quality and quantity out the other end to suit the engine's needs. From the late 1960's, the Stromberg (and the manifold below it) were modified to burn things other than simple petrol and air (like crankcase vapours) in order to reduce emissions. Over time, the number of connections to the simple Strommie became complex. Whilst many a Stromberg has been "blocked off" or "disconnected", the information below should give some background to the intent of these myriad connections. The information is not intended to cover all the pollution control changes made, only those that affect the Stromberg carburettor operation. For example, changes to distributor vacuum advance controls will not be covered, nor will the changes made to the Gemini Nikki carburettors.

In Australia, the introduction of pollution control devices was done progressively by the Australian Transport Advisory Council imposing progressively tighter emission control requirements embedded into the "Australian Design Rules", or ADRs. The timing and impact of the ADRs on the Holden Stromberg will be discussed, bearing in mind that in some cases Holden had installed the required equipment some years before the ADR requirement came into effect. The ADRs that apply to the Stromberg carburettor are:

ADR	Implementation Date	Affects
ADR26	January 1972	Exhaust carbon monoxide emission at warm idle
ADR27	January 1974	Exhaust carbon monoxide and hydrocarbons emitted (in addition to carbon monoxide at idle) during warm engine dyno test cycle
ADR27A	July 1976	Exhaust gas carbon monoxide, hydrocarbons and oxides of nitrogen emitted during an extended dyno test cycle, and fuel system evaporative emissions.

Note that the latter ADRs do not apply to the Stromberg carburettor - ADR27B applies to vehicles built after the 1st of January 1982 (early in the VH Commodore run – Varajets on the sixes and Quadrajets on the eights), ADR27C from the 1st of January 1983 (midway through the VH Commodore run), ADR36 applies from January/February 1986 (last of the VK Commodores), ADR40 applies from the 1st of January 1988 (late in the VL Commodore run with EFI on the sixes and Rochester Quadrajets on the eights), and ADR79 applies to vehicles built from November 2016 (when we will be atomic-powered driving rocket cars).

3.1.1 Positive Crankcase Ventilation (PCV)

The original Holden grey motor was fitted with a form of crankcase ventilation known as road-draught. The intent of this system was to aid the removal of fumes and water vapour, stopping them condensing into the crankcase oil and diluting the oil or causing corrosion. In the grey motor system, air enters the rocker cover through an air intake (often called a breather, or oil filler cap) located on the rocker cover. The air intake has a gauze inside that traps coarse dirt (the gauze is supposed to be cleaned out with some kero and reoiled every 5,000 miles). The (relatively) clean air passes down from the rocker cover to the side plate area. The side plate has an extractor (often called a walking stick) that vents the air below the engine. As the vehicle moves, the air blowing under the car (the "road draught") causes the walking stick to suck out the air from the side plate, together with any crankcase or rocker cover fumes. A baffle in the sideplate stops too much oil mist being drawn out. Note that the road-draught system only works when the vehicle is in motion. Road-draught ventilation was installed on all grey motors, and continued on into the red motors installed in EH, HD and HR Holdens.

With the advent of the 1967 HB Torana, the road-draught system was made obsolete by the use of positive crankcase ventilation (PCV), albeit through a Zenith carburettor. The later 1968 HK Holden was the first Holden Stromberg to get fed PCV fumes. Looking at the Australian legal requirement for PCV, it appears that as early as July 1970 there was draft regulation prohibiting the escape of crankcase gases to the atmosphere on all vehicles built after July 1st, 1970. This is likely to have been the First Edition Australian Design Rules (ADRs). The First Edition ADRs appeared only in draft form. The Second Edition ADRs, which adopted many of the Society of Automotive Engineers (SAE) recommended practices for test procedures and performance (and therefore were similar to United States requirements) came into effect in 1969 and were implemented through state and territory legislation. The Third Edition ADRs in the late 1980s, administered by the Commonwealth and aiming to harmonise with international standards. It appears that the draft crankcase requirements did not make it into the Second Edition ADRs. In fact, it appears that the only requirement for PCV is that detailed in the Third Edition ADR79:

5.3.3.2. When tested in accordance with Annex 6, the engine's crankcase ventilation system shall not permit the emission of any of the crankcase gases into the atmosphere.

Translating the above means that at idle the pressure in the crankcase must be no higher than atmospheric pressure. ADR79 applies only to vehicles produced on or after 1st November 2016. The only state that legislates the need for PCV is Victoria (via the Motor Car (Air Pollution) Regulations 1967, under the Motor Car Act) which requires that every new petrol driven motor car registered after July 1, 1970 be fitted with equipment to recycle crankcase vent gases. There are however a number of states that require PCV's to be fitted to modified vehicles. For example:

- Victoria, via the Modified Vehicle Guidelines 2006 Technical Guidelines for Air and Noise Emission Requirements for Modified In-service Vehicles,
- South Australia's government website indicates PCV is required on modified vehicles if manufactured on or after 1 January 1972, mistakenly quoting ADR26 (<https://www.sa.gov.au/topics/transport-travel-and-motoring/motoring/vehicles-and-registration/vehicle-standards-and-modifications/engine-and-exhaust-modifications>)
- The NCOP ADR checklist (Second Edition ADR Compliance – NCOP Checklist LO1-2) indicates a requirement for sealed crankcase, mistakenly to comply with ADR26

Need to check this... look at Road Transport (Vehicle Registration) Regulation 2007 for NSW

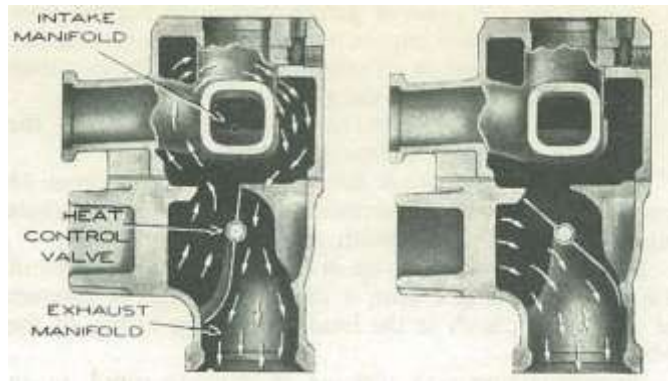
In the PCV system, filtered air is drawn from the air cleaner and into the rocker cover. It mixes with the crankcase gases before flowing back out the other end of the rocker cover. This flow of air is made possible by manifold vacuum sucking on the rocker cover. The gases sucked out are then burnt in the normal combustion process. In the hose that leads from the rocker cover back to the manifold, a spring loaded control valve (the PCV valve) is fitted. With the engine off the plunger in the PCV valve is closed by the spring. When the engine is idling, manifold vacuum is high and the plunger is sucked fully open against the spring pressure. With the plunger in this position, the PCV valve will only allow only a minimum flow of air through the system. During acceleration or under load, the vacuum acting on the plunger decreases and the spring forces the plunger to back off. This allows a greater flow of air through the system. Should a backfire occur, the PCV valve is forced closed preventing ignition of the crankcase gases.

The PCV system is not connected to the carburettor, but instead is connected to the inlet manifold. However, the PCV system does affect carburettor operation in that provides a source of unmeasured air to the engine and can also provide a source of water vapour and oil fume. A poorly performing PVC system can readily mimic a carburettor fault. The following troubleshooting information is provided to assist in distinguishing between a PCV and carburettor fault:

Condition	Cause	Corrective Action
Rough, slow idle. Stalling. Oil in air cleaner. Sump gasket sucked in.	PCV valve blocked or stuck in closed position.	Remove and clean PCV valve. Replace defective PCV valve
	PCV air inlet in air cleaner blocked.	Clean or replace breather.
	Oil separator in air cleaner blocked	Clean oil separator
	Blocked or kinked hoses	Remove and clean hoses. Replace defective hoses.
Rough, fast idle. Stalling.	PCV valve stuck in intermediate position.	Remove and clean PCV valve. Replace defective PCV valve
	PCV valve disconnected or leaking.	Install valve correctly.
Excessive sludge in sump/oil filter or rapid oil dilution	Crankcase is not being vented.	Check for above defects in PCV system.

3.1.2 Air Preheat System

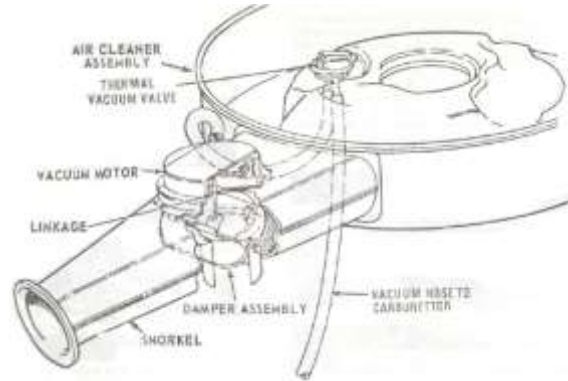
Right from the very first Holden, GMH recognised the need for air preheating. A cold inlet manifold quickly condenses the incoming fuel out of the air/fuel mixture. The liquid fuel pools on the manifold floor, and slugs into the cylinders. This gives very poor mixture control – incredibly lean one minute, and very rich the next. This makes starting the vehicle (and maintain a decent idle) difficult. For the grey motor, the intake and exhaust manifolds are separate units joined together (i.e. the exhaust manifold bolts to the inlet manifold). This allows the hot



exhaust gases to be directed into a heat jacket (often called a “hot box”) cast on the intake manifold. Whilst the hot exhaust gas does not mix with the inlet charge, it’s heat passes through the hotbox wall, preheating the air/fuel mixture. The amount of heat supplied is regulated by means of a valve in the exhaust manifold. The valve is controlled by a bi-metal thermostat spring wound around the valve shaft. When the engine is cold, the valve is held in the closed position by the thermostat. Hot exhaust gases strike the valve and are deflected upward into the hot box on the intake manifold, then pass downward to the exhaust pipe. As the engine warms up, heat radiated from the exhaust manifold as well as by the increasing air temperature under the hood, causes the thermostat to lose its spring tension and allow the valve to move towards the open position. This reduces the amount of exhaust gas deflected into the hot box and consequently reducing the amount of heat to the intake manifold. The exhaust manifold valve is offset or longer on the lower side of the shaft. This allows exhaust gas pressure to force the valve open when the engine is accelerated or operated with wide open throttle, thus reducing the heat to the intake manifold. The valve is prevented from violent fluttering by a counterweight on the shaft. Hotbox air preheating continued through from the grey motor to the red motor, though by the HR model Holden changed to using water jackets around the intake manifold (heated by radiator water) rather than exhaust heat.

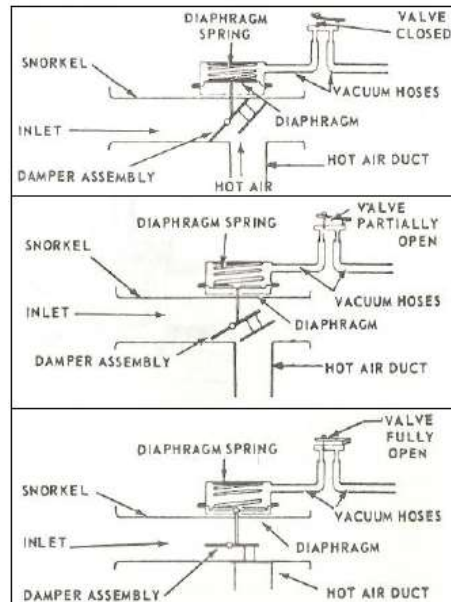
Whilst air pre-heat is a good thing for improving cold vehicle operation, it is also part of the solution to solving cold vehicle emissions. Approximately one third of a vehicle’s CO and unburnt fuel can be emitted

in the first two minutes of operation from a cold start. Starting with the LH Torana WW Strombergs, Holden Stromberg carburetors were fitted with a new air preheat system, reverting back to exhaust heat. Holden retained this system through to the final Stromberg carburetors fitted to 1979 VB Commodores. During cold starts air entering the engine is drawn across a heat stove located on the exhaust manifold. A thermostatically controlled valve in the air cleaner prevents cold air from entering through the air cleaner snorkel until the under-bonnet environment warms to approximately 30° - 40°C. This permits good driveability with a leaner carburettor air/fuel mixture which helps reduce exhaust emissions.



The air cleaner assembly includes a temperature sensor, a vacuum motor, a control damper assembly and connecting vacuum hoses as per the image to the right above. The vacuum motor, controlled by the

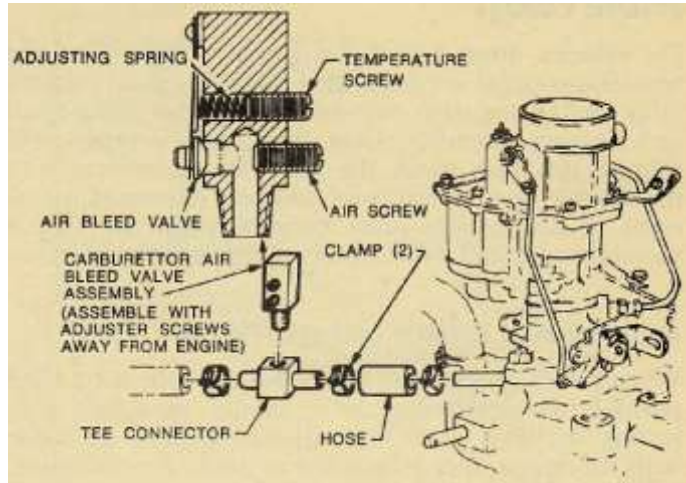
temperature sensor, operates the damper to control the air flow providing either preheated air from the heat stove or unheated air from under the snorkel. When the temperature of the air entering the air cleaner is 30°C or below, the temperature sensor is fully closed, directing engine vacuum to the vacuum motor which in turn closes the damper assembly to outside air. This is shown in the uppermost image to the right. With the damper closed engine intake air flows between the exhaust manifold and a stove surrounding the manifold where it is preheated. Preheated air then flows up through the hot air duct and into the air cleaner and into the engine. As the temperature inside the air cleaner rises, the sensor valve begins to open, as is shown in the middle image to the right. This allows the vacuum motor diaphragm spring to open the damper partially, allowing some unheated air to mix with the preheated air. After the engine warms up and the temperature in the cleaner rises above 40°C, the sensor valve opens wide, reducing the vacuum until it will no longer hold the damper assembly closed. Diaphragm spring pressure then opens the damper completely allowing only unheated air to enter the carburettor. This is shown in the lower image to the right. However, under all full throttle conditions there is little vacuum. The diaphragm spring pressure opens the damper allowing passage of cool air from the snorkel for maximum performance. Similarly, during "engine off" there is no vacuum and the damper is opened blocking the hot air duct.



On V8 engines (including those fitted with the WW Stromberg carburettor), a butterfly type exhaust heat valve is mounted between the right hand exhaust manifold and exhaust pipe... similar to the old grey motor heat valve. When cold, a thermostat spring closes the valve diverting exhaust gas through the manifold until the spring warms up and opens the valve. The inlet manifold has an exhaust cross-over passage running across under the floor of the carburettor risers. The heat valve shuts off the right hand side exhaust pipe, diverting gas across the manifold and left hand cylinder head into the left hand exhaust manifold. On cars fitted with twin exhaust and no exhaust cross-over, only the left hand exhaust pipe will blow steam until the engine warms up and lets both sides flow. To minimise high metal temperature in the inlet manifold, the right hand manifold gasket has been restricted on the exhaust cross-over. To further restrict the exhaust gas cross-over on later HZ and LX models a restricted gasket is fitted to the left hand side as well. The manifold warm up rate is only slightly compromised through this restriction. The inlet manifold gaskets are also blanked on the back water holes to cut down water corrosion of the inlet manifold. The HX and later six-cylinder engines also returned to the use of exhaust manifold heat valves similar to the grey motors.

3.1.3 Introduction of the Hot Idle Compensator

The HQ Holden marked the introduction of the engine hot idle compensator. This was fitted to models with air conditioning, and recognises that the air conditioning system places additional load on the engine. The extra load heats up the air in the engine bay. If the car is moving, the hot air is soon blown away by the incoming fresh air. However, if the car is stationary (idling), there is much less air movement in the engine bay. The engine bay temperature starts to rise, and the air becomes less dense. Additionally, the heat can cause more fuel to evaporate from the float bowl,



adding fuel to the carburettor throat. The combination of low density air and extra fuel can cause the engine to run an overly rich idle. To fix the overly rich idle, the hot air compensation valve was fitted into the hose between the carburettor and PCV valve. When idling for long periods with the air conditioning on, the engine bay temperature rises. This causes the hot air compensation valve bi-metal strip to expand outwards, opening the valve. Air is sucked in through the open valve, joining the normal PCV flow into the manifold. The additional air weakens the mixture, allowing proper idling. When under bonnet temperatures decrease, the compensator valve closes and idle operation returns to normal. The hot air compensation valve is adjustable – the temperature screw allows the valve to be set to open at the desired under bonnet temperature, whilst the air screw allows the amount of air injected to be controlled to give a satisfactory idle.

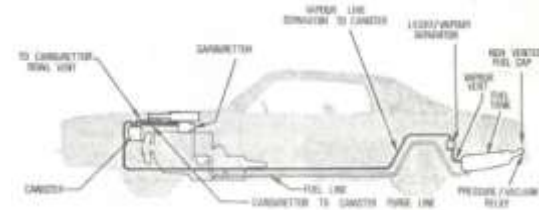
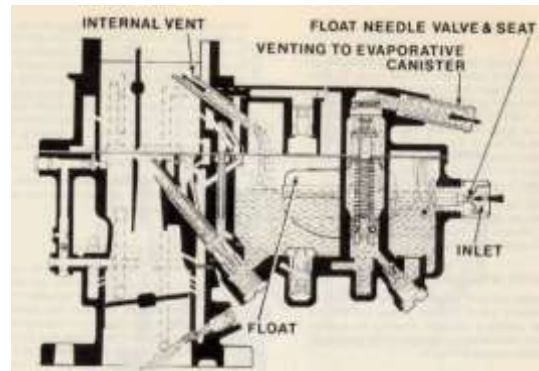
Whilst I have seen no literature to this effect, it is possible that the hot idle compensator was introduced by Holden in response to ADR26. ADR26 limits the carbon monoxide content of exhaust gas at warm-engine idle to 4.5% by volume for passenger cars manufactured after January 1st, 1972. This is part way through the HQ Holden and LC Torana runs. As far as I can tell, the HQ Holden was the only Stromberg carburettor that was subject to the hot idle compensator (though it was used, in a different format, in other carburettors including the Gemini Niki carburettors). It is mentioned in the HQ Service Manual though in no other Stromberg-fed Holden Service Manual. It is also mentioned in the HQ parts catalogue, but not in the respective HX, LH, VC or VK parts books.

3.1.4 Introduction of the BXUV-3 Carburettor

In 1973, Holden introduced the BXUV-3 carburettor to both the HQ Holden and LJ Torana (towards the end of the run of both vehicles). The BXUV-3 carburettor continued through the HJ Holden and LX and LX Toranas, becoming Holden's workhorse until the introduction of the BX carburettor in 1976. Whilst I have seen no literature to this effect, it is possible that the mid-run changes made to both HQ Holden and LJ Torana carburettors in 1973 were introduced by Holden in response to ADR27. ADR27 requires new passenger cars built after January 1974 to pass a warm-engine dyno test cycle (including idling, acceleration, cruise and deceleration). The test sets exhaust limits on the total carbon monoxide and hydrocarbons emitted (dependant on vehicle weight) in addition to the 4.5%CO at idle requirement of ADR26. ADR27 should not be confused with the later ADR27A, which also imposed evaporative limits (i.e. ADR27 is an exhaust limiting requirement, just like ADR26). As the HQ and LJ carried over from 1973 through 1974, ADR27 applied to the last of the HQ Holden and LJ Torana runs.

3.1.5 Evaporative Emission Control

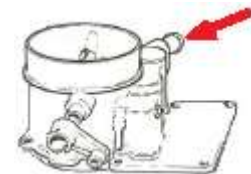
With the advent of the HJ Holden, evaporative emission controls were added to the Stromberg (both the B-model and the WW). Evaporative emission controls are used to minimize the emission of fuel vapours from the fuel system that normally escape to the atmosphere from the carburettor fuel bowl and fuel tank. In early Stromberg carburettors (FX-EJ) the fuel bowl vents to the carburettor throat, and from there via the air filter to atmosphere. In later models (EH-HQ) the fuel bowl vents directly to atmosphere via the idle vent valve. From the HJ Holden, the float bowl vent is connected to the evaporative emission control system. Similarly, prior to the HJ Holden the Holden fuel tanks vent to atmosphere. From the HJ Holden, the fuel tank utilises a sealed cap (fitted with a valve to allow both pressure and vacuum relief). All up, this means that the HJ has a sealed fuel system, with no venting to atmosphere.



In the evaporative emission control system, the fuel tank has vent lines which lead to a liquid vapour separator mounted just ahead of the fuel tank. The liquid vapour separator allows vapour to pass through, but returns any carried over liquid fuel back to the tank. Commercial vehicles have a domed fuel tank which acts as a liquid/vapour separator. After having any liquid fuel removed (by the liquid vapour separator) the fuel tank vapours pass to a vapour storage canister. The canister is mounted in the engine bay, and filled with activated charcoal.

When the engine is not running the fuel tank will breathe out fuel vapours due to natural evaporation, or when the fuel tank is refilled at a service station. The fuel tank vapours get adsorbed on the activated charcoal. When the engine is running the stored fuel vapours from the canister are drawn into the engine via the carburettor and is burnt. This is referred to as purging the canister. To control the process of purging the canister, a connection is made between the carburettor (above the throttle valve) and the carbon canister (to a purge valve). The purge valve is fitted with a diaphragm, which is acted on by the vacuum from the carburettor. At idle, there is not much vacuum above the carburettor throttle plate. This low vacuum does not open the canister purge valve very much, and there is very little purging of vapours from the canister to the carburettor. At part throttle, there is a much larger vacuum above the throttle valve. This larger vacuum opens the canister purge valve, allowing much higher purging of the canister. In 1976 the charcoal canister was simplified. The diaphragm-driven purge control valve was removed, with the purge rate being controlled by an orifice in the carburettor.

To make the carburettor connection, the airhorn assembly was modified. The idle vent valve assembly (which was introduced from the EH Holden) was removed, and replaced by a vacuum nipple – see the red arrow in the diagram to the right.



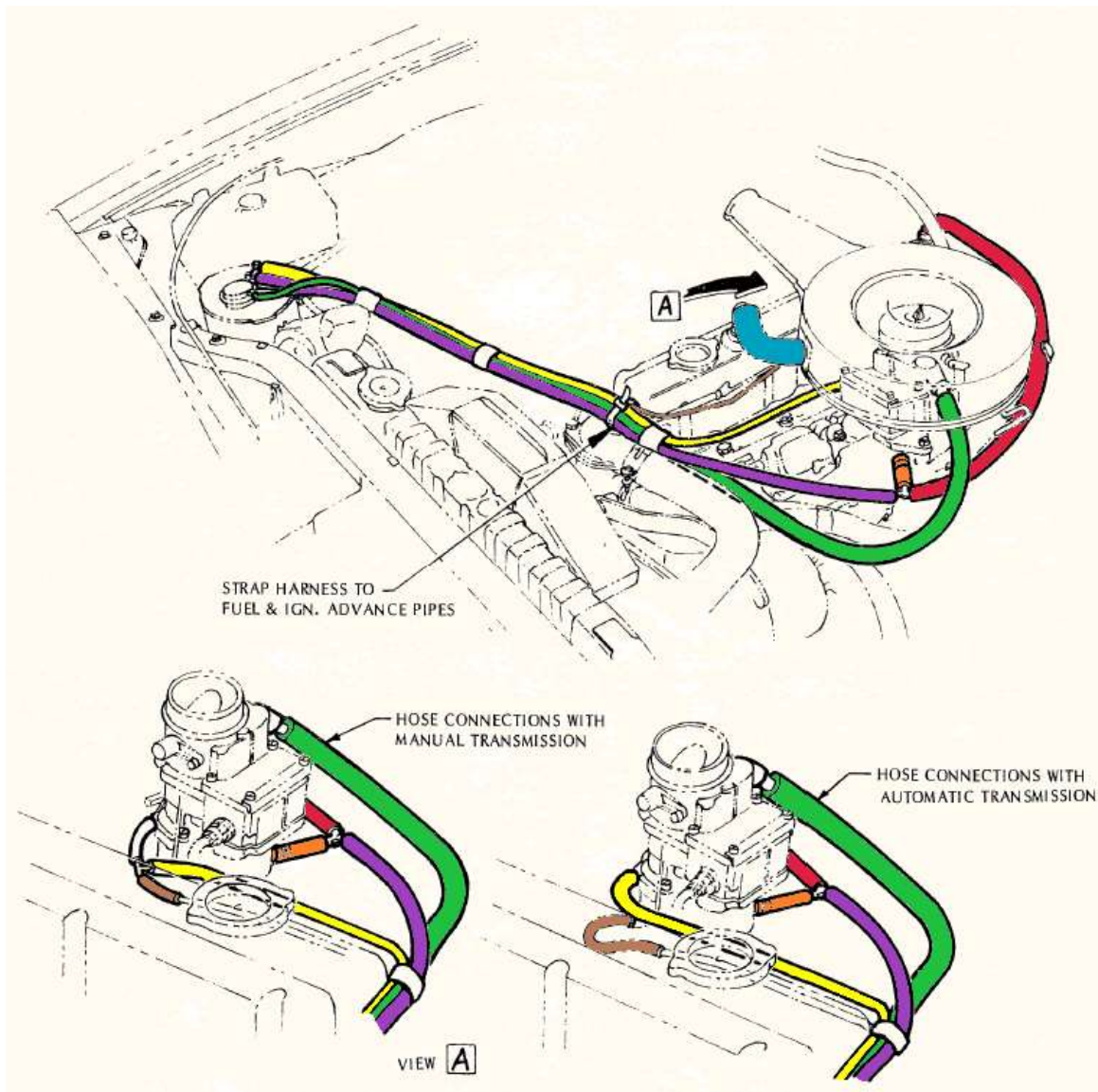
In the diagram below (for a HJ Holden), we can see the positive crankcase ventilation system:

- The blue line is filtered air passing from the air cleaner to the rocker cover/side plate/sump.

- The red line is the air and crankcase gases passing from the rocker cover/side plate/sump to the inlet manifold to be burnt (via the orange hose).

and the ventilation and the evaporative emission control systems:

- The purple line is the fuel vapours being de-adsorbed off the canister and passing to the inlet manifold to be burnt.
- The green coloured hoses are the fuel bowl vent lines, allowing fuel bowl vapour to pass to the canister for adsorption.
- The yellow coloured hoses are the vacuum control lines for the vacuum purge valve diaphragm. For manual transmission models this is taken from a tee piece connected in the distributor vacuum advance line (shown in brown). On automatic transmission models will have two vacuum outlets, the lower outlet (below the throttle valve) is connected to the distributor vacuum advance whilst the upper outlet (above the throttle valve) is connected to the vacuum purge valve on the canister.

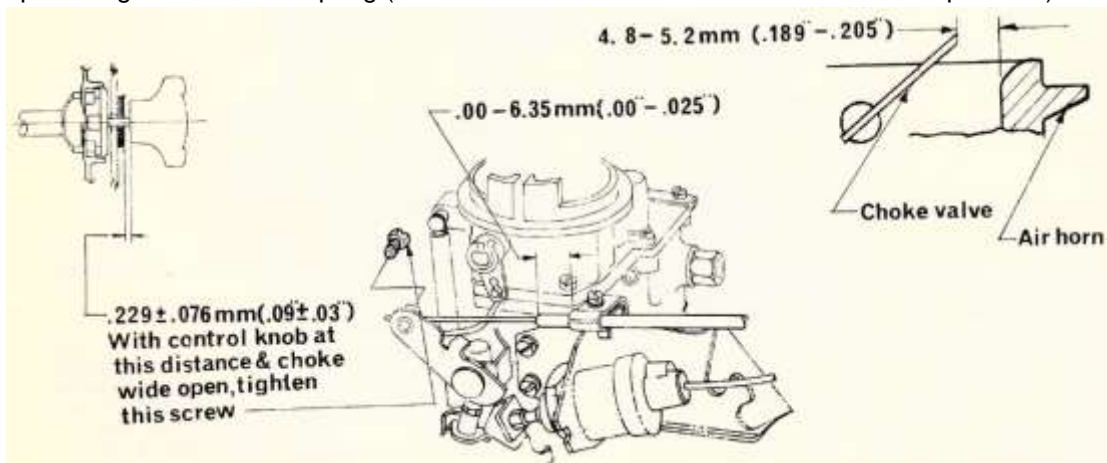


3.1.6 The 1976 ADR27A Changes

In 1976, additional changes were made to Holden's Stromberg carburettors in order to comply with the intent of Australian Design Rule 27A. ADR27A applies to vehicles built after the 1st of July 1976, and imposes a limit on carbon monoxide, hydrocarbons and oxides of nitrogen emitted during an extended test cycle. It also introduces a limit on evaporative emissions (i.e. whilst ADR26 and ADR 27 are exhaust emission targeted, ADR27A introduces emissions from fuel system vents). ADR27 also includes the need for a label in the engine bay describing tune-up specifications, and a requirement for the manufacturer to provide emission control maintenance instructions.

To reduce the risk of unintended changes to pollution controls, Holden recommended that no major service operations be carried out during the first 80,000km, with only "Minor Service Operations" permitted:

- Carburettors may have material, e.g. dirt, water, etc. cleaned from float bowl or jets, as long as any settings are not altered.
- Idle adjustment was permitted after the vehicle run-in period of 3,000km. After adjusting point gap and timing, the idle was allowed to be set with both the idle stop solenoid on, and off (see process below). Whilst adjustment of the idle speed was permitted, idle mixture was no longer a part of the normal engine tune-up process. All carburettors were pre-set for idle mixture and speed settings, and the idle mixture screw sealed by metal or plastic caps.
- The choke system was permitted to have the following (minor) adjustments.
 1. With the choke control knob clear of the stop by 2.3mm \pm 0.8mm (0.090" \pm 0.030") and the choke valve fully open and the end of the cable casing protruding up to 6.35mm (0.25") through the clamp on the carburettor, tighten the clamp screw and the screw attaching the cable to the choke lever. Note that following a "major overhaul", these dimensions were specified as 1.6-3.2 mm (0.063"-0.126") clear of the stop and 0-6mm of protrusion.
 2. Set the choke link so that the valve will close, but an opening of 4.8-5.2mm (0.189"-0.205") measured from the choke valve to the inner surface of the throat is obtained when the valve is opened against the relief spring (with the fast idle cam at the maximum fast idle position.)

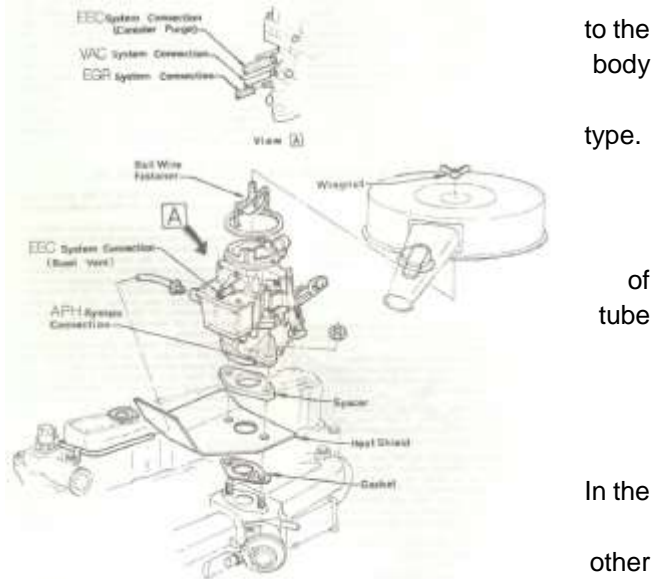


As note in the HX Holden Service notes (Group OB, July 7 1976 (HX Holden)):

The only carburettor settings and adjustments permitted during the early life of the vehicle are covered on the sticker in the engine compartment. Adjustments include slow idle, fast idle, linkage and manual choke cable.

The limitations of the above permitted tinkering meant that should a major fault develop early in a vehicles life, complete carburettor replacement was required. Accordingly, complete vehicle service manuals were not issued to cover current those models, with service supplements instead used. Additionally, compared to 1975:

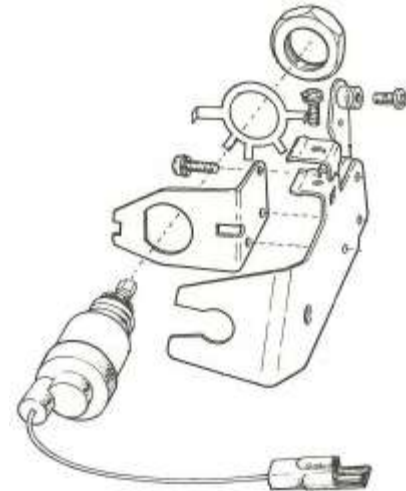
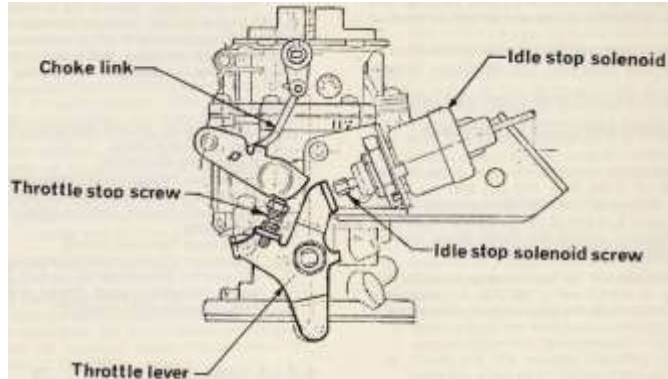
- The 1976 BX carburettor is shorter mainly due elimination of the spacer between the main and throttle body. This has changed the accelerator pump from a pull type to a push type.
- The choke plate and therefore the choke cable attachment are now at 90° to their previous position.
- The fuel bowl vent now points forward instead sideways. On the main body will be found the for the vacuum advance connection, marked "DIST". This is in the same place as on 1975 carburetors. Just above this a larger tube marked 'CAN' for the canister purge hose whilst below the distributor vacuum connection throttle body is found another tube marked 'EGR' for exhaust gas recirculation. On the side of the throttle body is a full vacuum connection for the air preheat system.
- The air horn now incorporates a ball fastening similar to that used on 4.2 ltr V8 carburetors. The carburettor will be attached to the manifold along with a heat shield and an insulator.
- The throttle body is made of aluminium.
- On the WW carburetors a thicker throttle body to accommodate passages for the EEC system.



3.1.7 Idle Stop Solenoid

With the introduction of leaner mixtures for pollution control, a higher idle speed was required to maintain stable idle. In hot weather, lean mixtures and high idle speeds can lead to the engine to “run-on” or “diesel”. When the ignition is switched off with the car’s key, the engine normally stops for lack of spark. In dieseling, the hot motor still has enough energy to self-ignite the fuel despite the lack of spark (just like a diesel motor). This means that even though the key is off, the engine keeps running.

With the introduction of the BX carburettor, a 12V idle stop solenoid was introduced. This was introduced in the later 1976 LX Toranas and HX Holdens, and carried unchanged through to the final Stromberg carburettors fitted to 1979 VB Commodores. The idle stop solenoid is an electric solenoid. When de-energized (ignition off), the solenoid retracts and allows the carburettor throttle plate to almost fully close. This reduces the air supply to the engine so that it will shut down without "running on" or "dieseling". The amount of air reduction is similar to dropping the engine by around 300rpm. In the energized position, the solenoid plunger extends and acts as the idle stop for the throttle lever (similar to the way the slow idle screw did in earlier carburettors). The solenoid push rod operates over a working range of 5mm (0.197"), exerting a force of 4.08-5.9kg (9-13lb). To permit the idle stop solenoid to be set, it is necessary to open the throttle at least one half after turning the ignition to the "on" position. The solenoid is not strong enough to open the throttle itself, it merely provides a throttle stop. The idle stop solenoid is preset to give the required Idle speeds. When the engine is warm, the throttle must always be held at least one half open while cranking the engine. If this is not done, insufficient air and fuel passes through the carburettor for the engine to idle and successive stalls would be experienced.



For vehicles fitted with an idle stop solenoid, the following process is used to set the idle:

1. Adjust the dwell and timing before proceeding with the idle adjustment. Bring the engine to normal operating temperature, with the choke open, air conditioning off, parking brake set drive wheels chocked.
2. Place automatic transmission in drive (except air conditioned vehicles), whilst manual transmission vehicles and automatic transmission vehicles with air conditioning are placed in neutral.
3. Disconnect the fuel tank hose from the vapour canister. Disconnect the vacuum line from the distributor and plug the line.
4. As the vehicle is running, the idle stop solenoid is energized. Set the idle speed by means of the idle stop solenoid screw to:

Engine	Transmission	
	Automatic	Manual
2850cc and 3300cc without air conditioning	650rpm	850rpm
2850cc and 3300cc with air conditioning	900rpm	850rpm

5. Disconnect the idle stop solenoid lead to de-energize the solenoid.
6. Place the vehicle in neutral.
7. Set the idle speed by means of the throttle stop screw to approximately 550rpm. At this speed, the throttle valves should just be cracked open.
8. Reconnect (energize) the idle stop solenoid lead. Unplug and reconnect the distributor vacuum hose. Reconnect the fuel tank vent hose to the canister.

Note that this process is that specified for a “Minor Service Operation”. For a “Major Service Operation” (post 80,000km), the process was changed as follows:

1. Adjust the dwell and timing before proceeding with the idle adjustment. Bring the engine to normal operating temperature, with the choke open, air conditioning off, parking brake set drive wheels chocked.
2. Place automatic transmission in drive (except air conditioned vehicles), whilst manual transmission vehicles and automatic transmission vehicles with air conditioning are placed in neutral.
3. Disconnect the fuel tank hose from the vapour canister. Disconnect the vacuum line from the distributor and plug the line.
4. As the vehicle is running, the idle stop solenoid is energized. Set the idle speed by means of the idle stop solenoid screw to:

Engine	Transmission	
	Automatic	Manual
All engines	730rpm	950rpm

5. Turn idle mixture screw clockwise (leaner) until the fastest idle speed is achieved.
6. Repeat the last two steps above.
7. Turn the idle mixture screw clockwise (leaner) until idle speed drops to:

Engine	Transmission	
	Automatic	Manual
2850cc and 3300cc without air conditioning	650rpm	850rpm
2850cc and 3300cc with air conditioning	900rpm	850rpm

8. Adjust the idle speed by means of the idle stop solenoid screw to:

Engine	Transmission	
	Automatic	Manual
2850cc and 3300cc without air conditioning	650rpm	850rpm
2850cc and 3300cc with air conditioning	900rpm	850rpm

9. Disconnect the idle stop solenoid lead to de-energize the solenoid.
10. Place the vehicle in neutral.
11. Set the idle speed by means of the throttle stop screw to approximately 550rpm. At this speed, the throttle valves should just be cracked open.
12. Reconnect (energize) the idle stop solenoid lead. Unplug and reconnect the distributor vacuum hose. Reconnect the fuel tank vent hose to the canister.

Alternatively, the idle speed can be set using a CO meter following a “Major Service Operation” as follows:

1. Place exhaust gas analyser probe in exhaust pipe.
2. Adjust the dwell and timing before proceeding with the idle adjustment. Bring the engine to normal operating temperature, with the choke open, air conditioning off, parking brake set drive wheels chocked.
3. Place automatic transmission in drive (except air conditioned vehicles), whilst manual transmission vehicles and automatic transmission vehicles with air conditioning are placed in neutral.
4. Disconnect the fuel tank hose from the vapour canister. Disconnect the vacuum line from the distributor and plug the line.
5. As the vehicle is running, the idle stop solenoid is energized. Set the idle speed by means of the idle stop solenoid screw to:

Engine	Transmission	
	Automatic	Manual
2850cc and 3300cc without air conditioning	650rpm	850rpm

2850cc and 3300cc with air conditioning

900rpm

850rpm

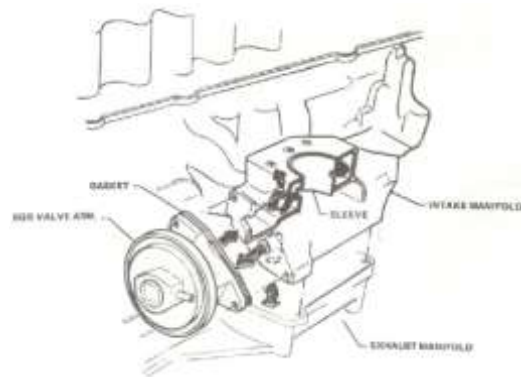
6. Adjust the idle mixture screw to give an initial idle reading of 2.0-4.0%.
7. Adjust the solenoid adjuster to obtain an idle speed of 50-100rpm higher than the values specified above.
8. Readjust the idle mixture screw to reduce the idle CO reading to 0.2-0.8%.
9. Readjust the solenoid adjuster to correct speed to required setting if necessary.
10. Recheck the idle CO reading and correct by adjusting the mixture screw if required.
11. Disconnect the idle stop solenoid lead to de-energize the solenoid.
12. Place the vehicle in neutral.
13. Set the idle speed by means of the throttle stop screw to approximately 550rpm. At this speed, the throttle valves should just be cracked open.
14. Reconnect (energize) the idle stop solenoid lead. Unplug and reconnect the distributor vacuum hose. Reconnect the fuel tank vent hose to the canister.

3.1.8 Vacuum Advance Control System (VAC)

Note that there is a connection on some Stromberg carburetors labelled VAC. Similarly to earlier Stromberg carburetors, this is a connection for the distributor vacuum advance. However, the 1976 and later Stromberg-equipped vehicles used a more complex system of vacuum advance control (the Vacuum Advance Control System, or VAC). The VAC system measured a variety of different things (for example engine temperature and gear position) to decide whether the car should run manifold or ported vacuum to the distributor advance. For all intents and purposes, the VAC system does little differently to modify the carburettor's operation, and I will not delve deeper into the VAC mysteries here.

3.1.9 Exhaust Gas Recirculation System (EGR)

The EGR system introduced into Stromberg carburetors aims to reduce the emission of Nitrogen oxides. Nitrogen oxides are mainly generated when the temperature of the gases in the combustion chamber reaches high values. This occurs during lugging modes of the engine when the engine works hard at low speeds or simply runs at high speeds under load. By mixing some (inert) exhaust gas into the intake mixture, the combustion process is retarded, the combustion temperatures are lowered and nitrogen oxide emissions are reduced. Exhaust gas recirculation is therefore not used to after-burn or re-burn exhaust gases, but to cool the combustion gases in the engine. Only a very small amount of exhaust gas is recirculated. At idle and full throttle there is no recirculation at all whilst at approximately 80km/h cruising, about 10% of the intake mixture is exhaust gas. The amount of exhaust admitted to the inlet manifold is modulated by a valve in response to engine operating conditions.



The exhaust gas recirculation system consists of an EGR valve, a vacuum signal line from the carburettor to actuate the valve, passages in the inlet manifold to duct exhaust gas from the exhaust side to the inlet side, and a thermal vacuum switch.

The EGR valve is operated by vacuum applied on one side of a diaphragm. By means of a rod, the diaphragm raises or lowers a pintle or stopper inside an orifice thereby metering the amount of exhaust gas that passes through the valve. The vacuum signal is taken from the carburettor above the throttle plate (ported vacuum). When the throttle is closed (for example at idle), there is no vacuum and the EGR valve remains closed, recycling no exhaust gas. With the throttle valve partially open (for example with at cruise or lightly accelerating) there is a partial vacuum signal to open the EGR valve. When the throttle is wide open there is little vacuum and the EGR valve is again closed so as to obtain best engine performance. Thus the EGR system only recycles exhaust gas at part throttle.

The method of metering exhaust gases from the exhaust manifold to the inlet manifold is by cast passages or tubing. When the EGR valve is open, the exhaust gas passes through the EGR valve to a location in the inlet manifold just below the carburettor mounting flange. This permits the exhaust gas to mix with the intake air-fuel mixture and be evenly distributed to all cylinders.

A thermal vacuum switch is used to assist the cold start by preventing any exhaust gas recirculation when the engine is cold. It does this by blocking the vacuum signal from the carburettor to the EGR valve. This is acceptable for emissions because when the engine is cold and the choke is on, the engine runs rich and cool and therefore produces very little nitrogen oxide emissions. The thermal vacuum switch is connected between the vacuum port in the carburettor and the EGR valve. The switch senses engine water temperature. It is normally shut and opens when the water temperature reaches approximately 38°C, which is relatively soon after the engine is started from cold. The method of operation is similar to that of a coolant thermostat. As the wax melts and expands it opens the vacuum valve portion of the switch.

