

Are your windscreen washers partial to vacuum?

The Inside Story

General

The windscreen washer, as original fitted to the ZA and ZB Midgets are termed vacuum windscreen washers. This name is derived from the fact that the energy used to direct twin streams of water onto the windscreen is drawn or powered from the partial vacuum that exists at the inlet of the car's engine. To digress – the inlet manifold duets air/fuel mixture into the engine. The speed at which the air/fuel mixture is sucked into the engine by the engine's operation causes the pressure at the inlet manifold to be less than (or lower than) the surrounding (or normal) atmospheric pressure – hence; partial vacuum.

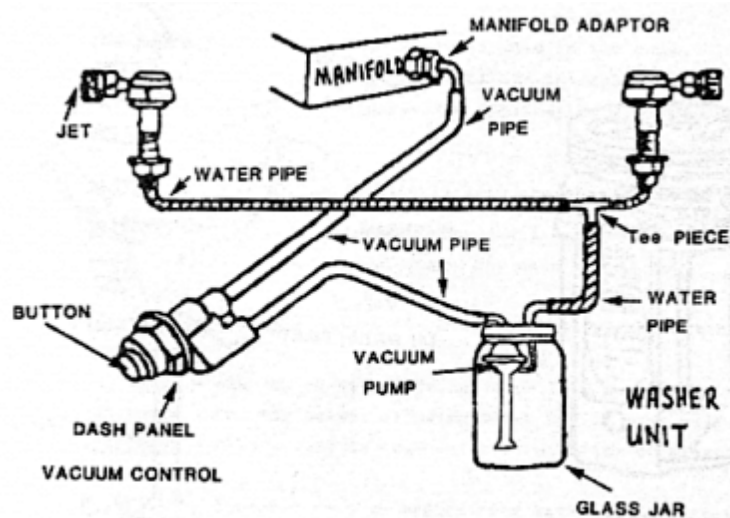


Fig.3 WINDSCREEN WASHER SYSTEM

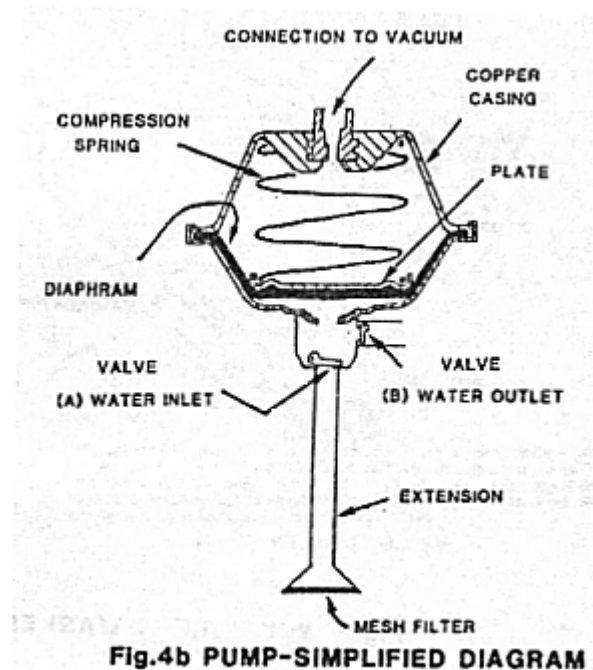
Vacuum Components

At the manifold the vacuum is accessed with an adaptor and extended via the vacuum control to the pump of the washer unit. Whenever the dash instrument panel vacuum control button is pressed in it activates the above mentioned components which are connected together by special tubing that will not collapse (flatten) by the suction created by the vacuum.

Washer Fluid (water) Components

Vacuum applied to the pump causes water to be sucked from the glass jar into the internals of the pump. On removal of the vacuum the water in the pump is forced to both jets and driven through a small opening to become a stream of water striking the windscreen. All the above mentioned components are connected together by tubing that can tolerate the internal pressure created by the pump.

Washer Unit



The glass jar shown in figure 4a is held firmly in its own bracket which in turn is mounted on the left hand inner wing of the engine bay (viewed from front of car). Attached to the removable screw top metal lid of the washer bottle are the pump, brass connections and copper casing and vacuum connection (steel), water outlet connection (nylon) and pivoted (sheet metal) filler cap.

Functions:

Washer Jar: Provides storage for spray solution

Pump: Sucks water from the washer jar and pumps this quantity of solution under pressure to nylon outlet connection.

Water Outlet: Directs pumped water to washer jets.

The heart of the windshield washer system is the pump. Figure 4b shows a simplified view of its internals. Operation of the pump requires the application of a vacuum (partial).

Basic functions of the individual pump components are:

Diaphragm: Flexible material. Provides a seal between vacuum and water sections of pump. The main job is to draw water into the pump properly.

Compression spring: Drives diaphragm back to rest position (as shown)

,A' valve: One way valve, allowing water INTO pump only.

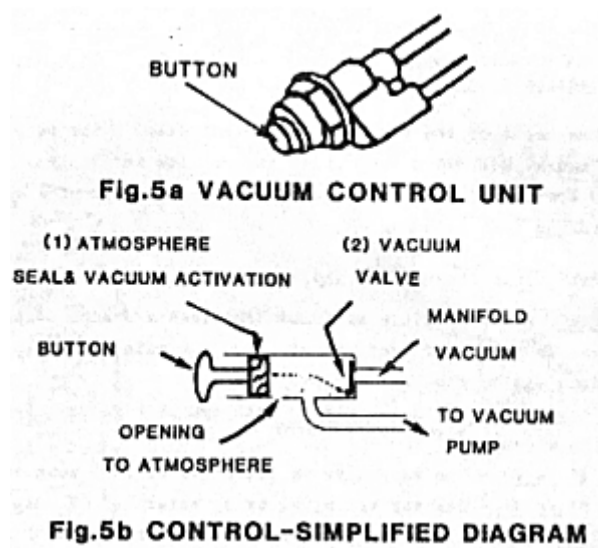
,B' valve: One way valve, allowing water OUT OF pump only.

Extension: Allows pump to draw water from bottom of glass jar.

Filter: Excludes foreign bodies from water to be pumped

Plate: Diaphragm support and compression spring locating point.

Vacuum control



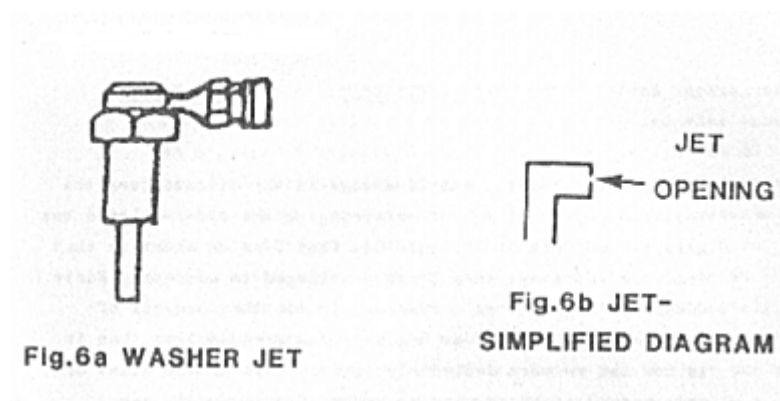
Exposed only as a button on the dashboard. Figure 5a shows the external shape of the vacuum control unit. A simplified diagram is provided in figure 5b in an attempt to indicate more clearly its operation and basic construction.

The main points to note are the button and attached atmosphere seal, vacuum valve activation linkage (dotted lines), vacuum valve, opening to atmosphere and vacuum and pump connection pipes.

Functions:

- Button Seals atmosphere opening (1) and causes valve (2) to open via the activation linkage.
- Seal (1) Excludes atmospheric pressure from windshield washer system when closed.
- Valve (2) When activated, allows the vacuum from the manifold to be applied to the windshield washer system.

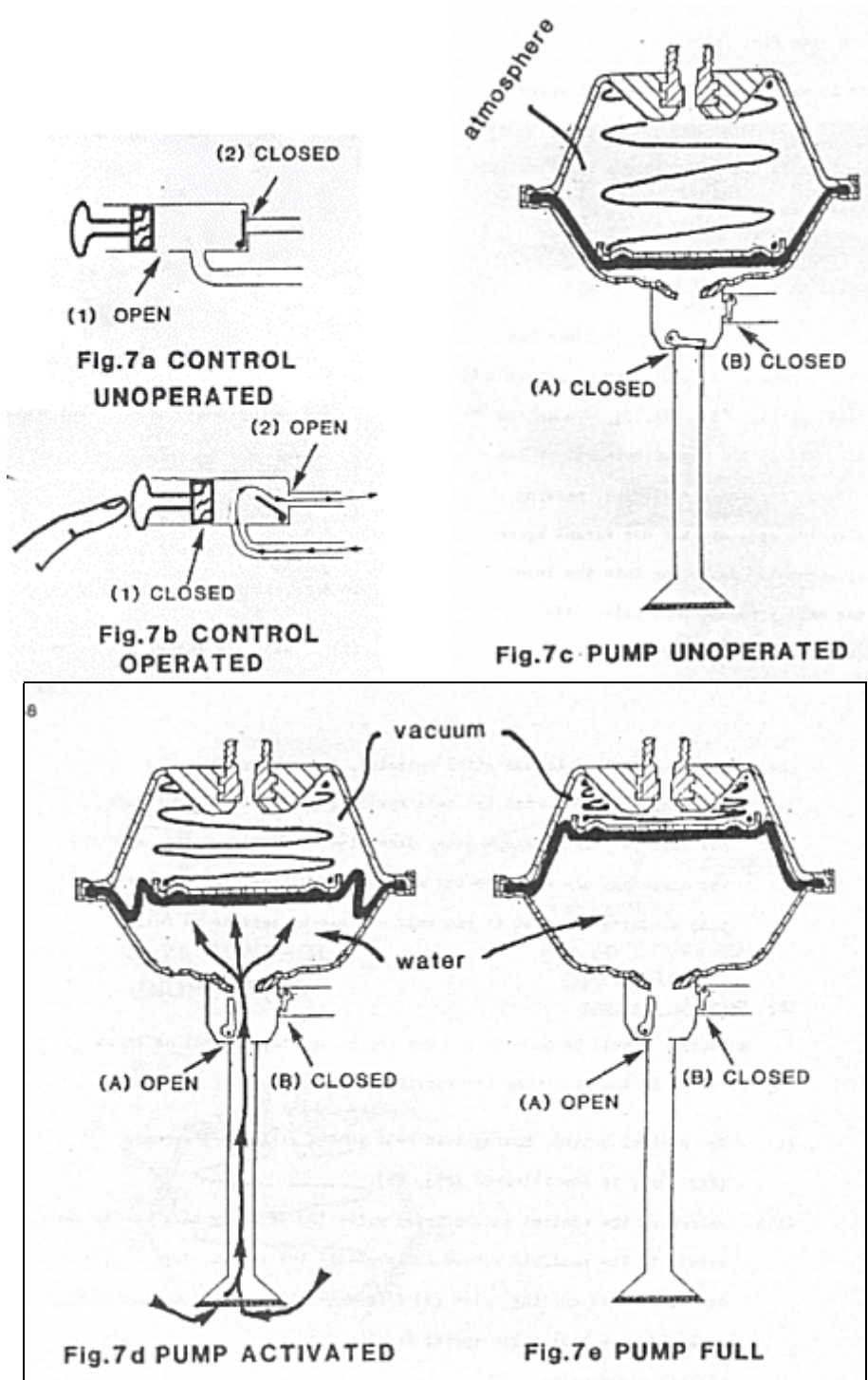
Washer jets



Two jets (fig. 6a) are provided to direct water onto the windscreen. Note the fine opening the washer is forced to pass through.

Principle of operation

Filling the pump

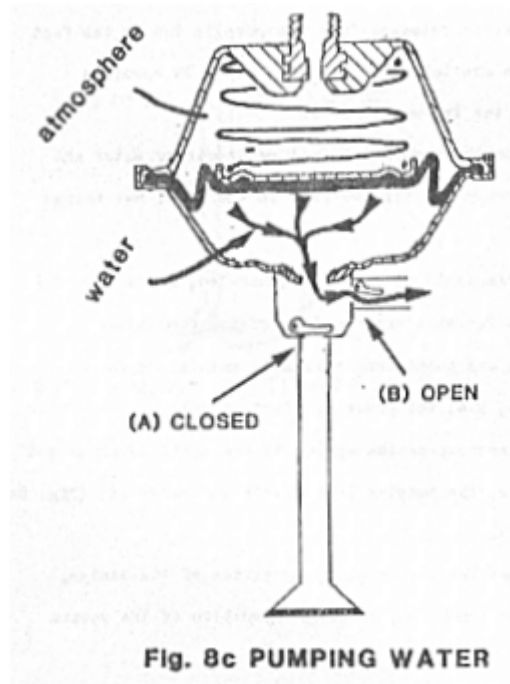
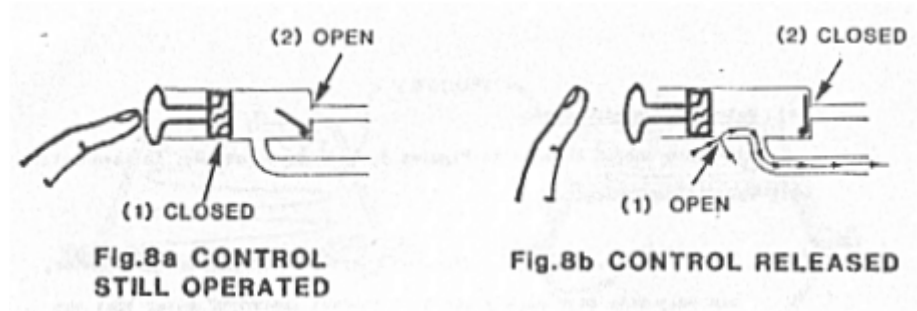


Reference should be made to Fig. 4b and 5b, as well as those given in the following description.

1. With the washer system in the unoperated state, the control (Fig. 7a) and pump (Fig. 7c) are in the condition as shown.
2. By pressing the vacuum control button in and holding it in, the following actions are initiated (see Fig. 7b):
 - Normal atmospheric pressure is excluded, (1) closed and valve 2 is driven open
 - Vacuum available at the manifold is now extended via the open (2) valve and vacuum pipes to the pump
 - The extended vacuum begins to extract or lower the atmospheric pressure that presently exists in the body of the pump
3. As the vacuum, applied to the pump, begins to remove or lower the pressure inside the pump, the diaphragm is sucked upwards against the tension in the compression (coil) spring. See Fig. 7d. In unison with this action, the suction caused by the upward movement of the diaphragm forces water to be drawn from the storage jar, passing through the filter, up the extension and into the now vacant space caused by the diaphragm's displacement. In moving into the lower part of the pump, the water has easily pushed past valve (A).

Valve (A) is designed to pivot out of the way for water moving upwards. Conversely, valve (B) is driven more firmly against its seal by the suction, preventing air or water being drawn from the jet plumbing.
4. With the control button still opened, the vacuum draws the diaphragm upwards until the coil spring is completely compressed. See Fig. 7e. Water stops being drawn into the body of the pump once the diaphragm has moved to the maximum upward position. Now the pump contains the most it can hold and can be said to be full.

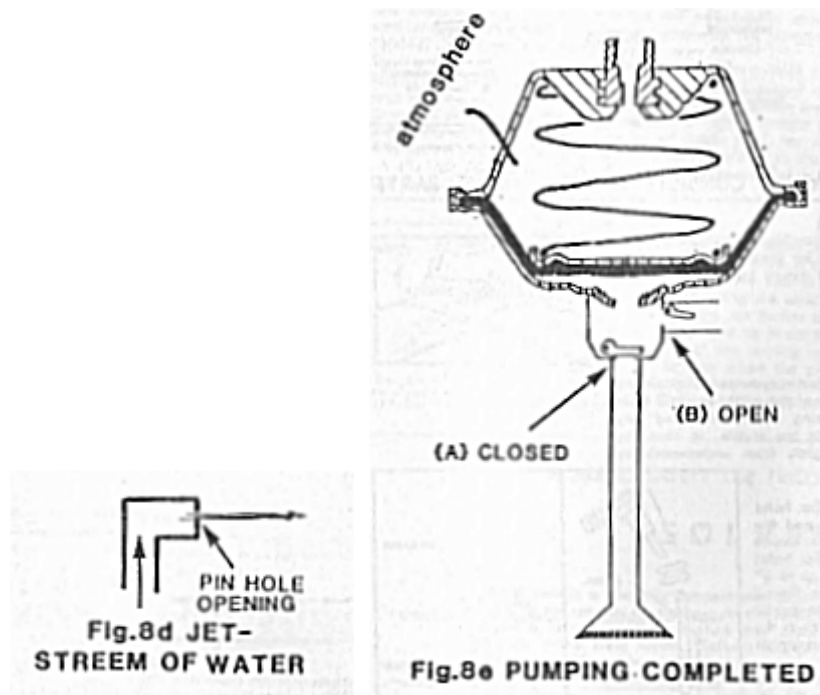
Emptying the pump



Reference should be made to Fig. 4b and 5b and 6a, as well as those given in the following description.

1. The control button, having been held in for at least 3 seconds (Fig. 8a), is now released (Fig. 8b).
2. Releasing the control button frees valve (2) to swing back across the access to the manifold vacuum and seal off the vacuum source. The vacuum side in holding valve (2) firmly closed. Button and attached seal (1) move back under spring tension (not shown), leaving the atmospheric opening clear.
3. As shown in Fig. 8b, a new path now exists to the vacuum pump. This path is for normal atmospheric pressure to travel to the pump and bring the pump cavity up to atmospheric pressure. Atmospheric pressure breaks the suction holding the diaphragm upmost and the compression spring compresses. The pump now begins its pumping action – the combined effects of the incoming atmospheric pressure and the tension in the compression (compressed) spring begin to move the diaphragm down against the water contained in the pump.
4. Pressure applied to the water closes valve (A) (Fig. 8c) and easily pivots open Valve B drives water out of its outlet pipe.

Water to the windscreen



Reference should be made to Fig. 3, 4b, 5b, 6a, and 8c in association with the following text.

1. The diaphragm, although continuously applying pressure to the water, can only move down slowly due to the small amount of water that can be pushed out of the pump.
2. The small amount of water released from the pump is due to the fact that the only outlets available are the tiny pin holes openings (Fig. 8d) in each of the two washer jets.
3. By applying a force on the pump's internal reservoir of water and driving the water through the tiny outlets in the jets, two things are accomplished:
 - Solid stream (jet) of water is generated, being powerful enough to strike the windscreen under driving conditions
 - A constant and consistent stream is maintained for as long as possible, i.e. not prone to fluctuations.
4. When the tension in the compression spring is too spent to drive out a stream from the jets, the pumping is complete and valve (B) (Fig. 8e) will swing closed (Fig. 7c).
5. It should be noted that the pump action, by virtue of it's design, cannot be stopped once commenced, although operation of the vacuum control would provide a temporary halt.