M38 Underwater Ventilating System

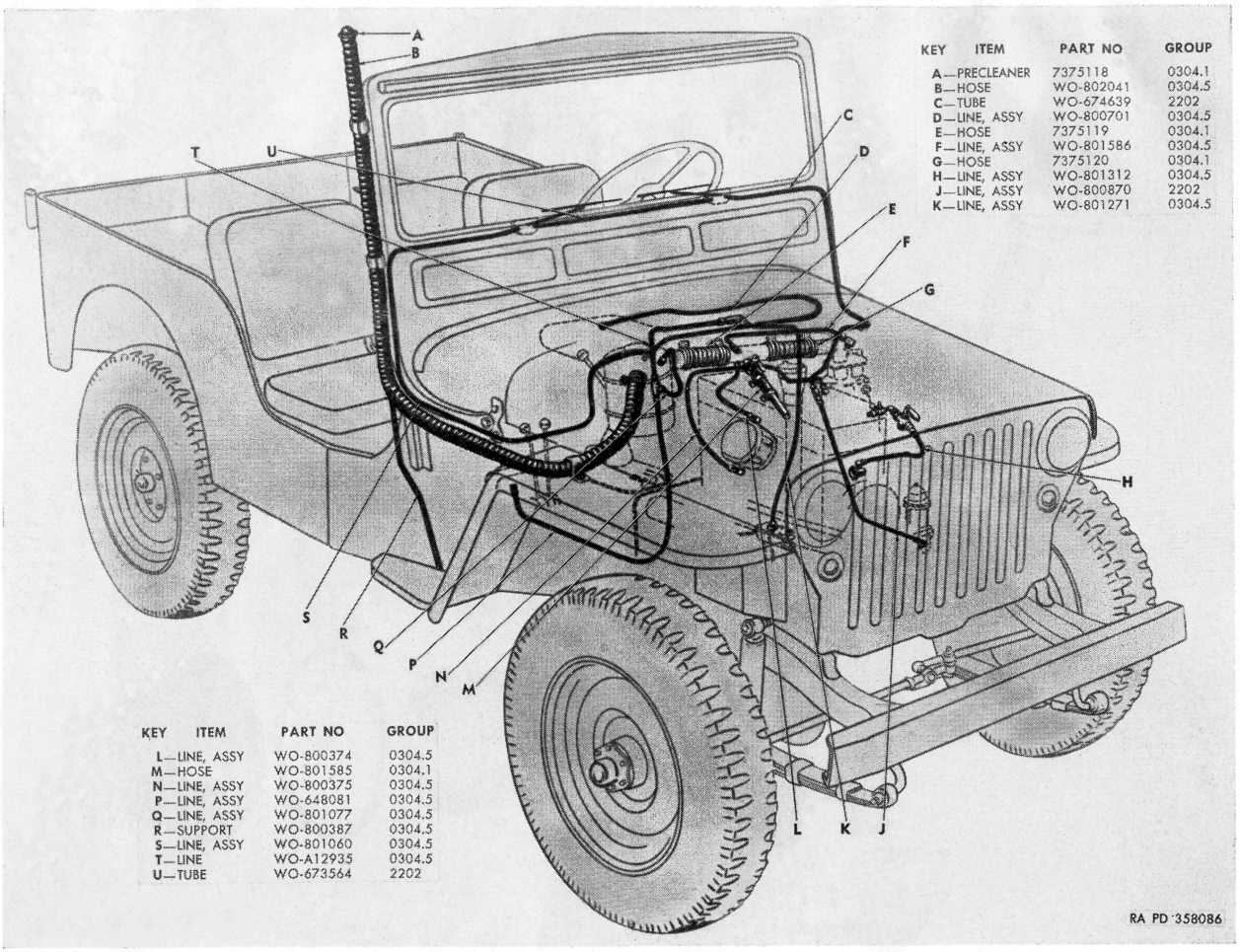


Figure 03–4. Ventilating system.

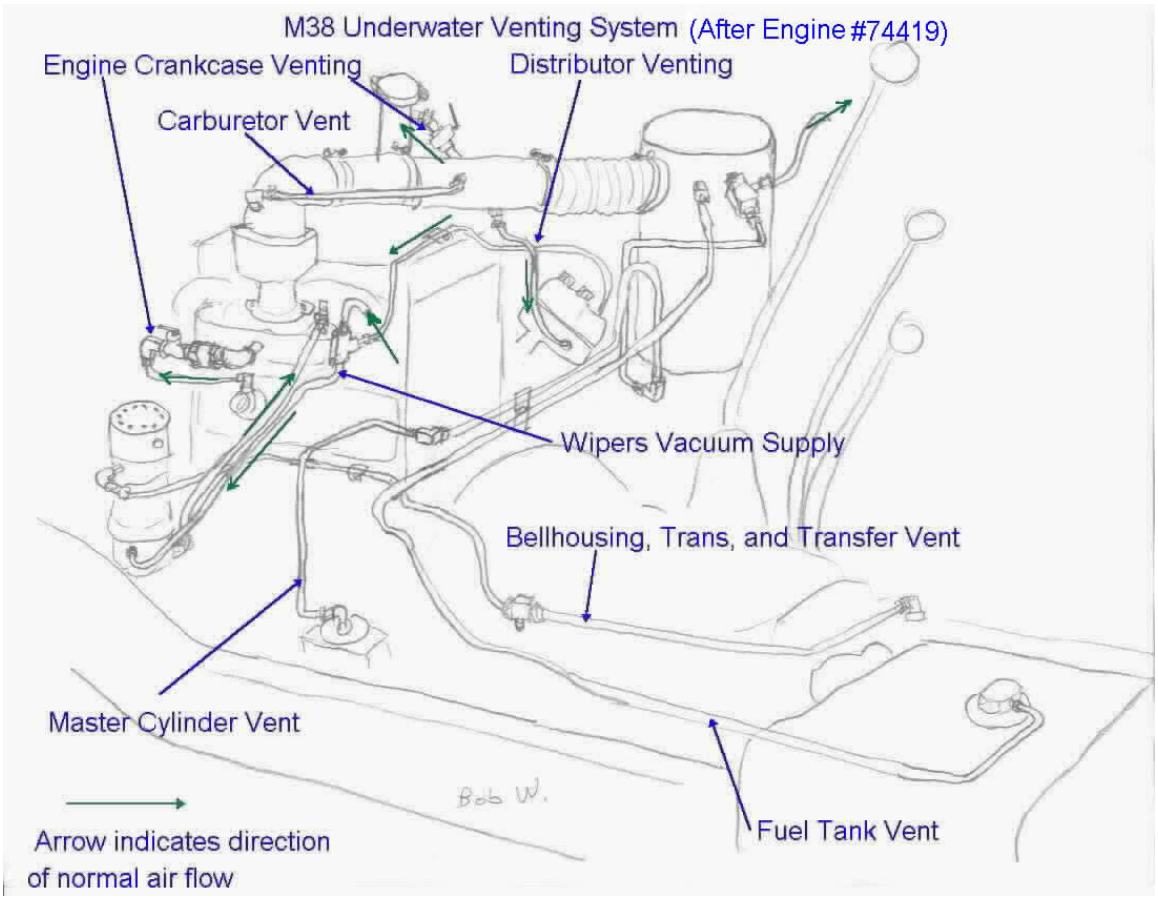
Bob Westerman

Military contracts for the production of the M38 had several special functional requirements that included a deep water fording system. This fording system required that normal drive train components that vented directly to the atmosphere (for normal vehicles of the day) be redirected into a closed system similar to modern vehicles. The redirected ventilation systems included the engine crankcase, distributor, transmission, transfer case, carburetor, air cleaner, windshield wiper system (vacuum motors), brake system, and fuel system. Initially, on the prototype vehicles produced, the axles were included in the vent system with their own vent lines. This was later replaced to one-way vent valves on each axle cover for the production vehicles.

The M38s came from the factory with the underwater ventilating system installed. During the two-model years production of the M38, a few changes were made to the underwater ventilating system.

Up to **Engine** serial number 74419, the bell housing was not sealed. The transmission and transfer cases were vented to the air filter. I will refer to this as the **Early** system.
M38s after **Engine** serial number 74419 had a sealed bell housing. The bell housing, transmission, and transfer case were pressurized while fording. I will refer to this as the **Late** system. The change likely occurred in late April or early May 1952, possibly at the same time the M38A1 production started.
The combination of the underwater ventilating system and the installation of 801080 Deep Water Fording Kit enabled the M38 to drive through water up to 74" deep. The Deep Water Fording Kit contained an extended intake hose, extended exhaust pipe, and the necessary brackets to install them.
Due to repairs and modifications made by owners, it is often difficult to find intact examples of the original underwater ventilating system. To further complicate matters, the M38 service and parts manuals seem to contain a few errors and omissions. Each part and part number using service manuals, parts manuals and an actual vehicle, MC61956, is outlined later in the chapter. Since the M38 and M38A1 are very similar, the M38A1 manuals are helpful. This information was obtained from ORD 9 SNL-G740, ORD 9 SNL-G758, and TM9-1804A.

This page contains a description of the operation of the underwater ventilating system. Page 2 contains parts information for the underwater ventilating system.



Late style Underwater Ventilation System

The underwater ventilating system can be broken down into seven separate systems. I have numbered the systems to help identify them. System 1 and 2 are normally independent. On the late style only, Systems 1 and 2 are connected during fording
operations. Systems 4 and 5 share the same vacuum supply (the wiper Tee).

1. Engine crankcase venting

2. Transmission and transfer case (also the bell housing on late style systems)

3. Carburetor venting

4. Distributor venting

5. Windshield wiper venting

6. Fuel tank venting

7. Master cylinder venting

Engine crankcase venting

Ventilation of internal combustion engines is necessary to prevent harmful condensation of water, to relieve internal pressures set up by the action of rapidly moving hot parts, and to rid the crankcase section of volatile vapors. When the M38 was built, engines were usually vented directly to the atmosphere through suitable openings or vents. Because of the military waterproof requirements, the method used to ventilate the engine is different than that of most engines of the time period. The M38 uses the system that is on most modern automobiles, the PCV (positive crankcase ventilation) system.
A PCV system is a closed system within the normal engine intake air and exhaust systems. During normal operation with the engine running, the vacuum created in the engine intake manifold draws fresh air into the ventilating system through the upper crankcase vent control valve on the air intake pipe assembly. The flow of air enters the oil filler pipe. The air then passes downward into the crankcase.

The contaminated crankcase air leaves the cylinder block at the side valve cover through the series of parts that include the lower crankcase vent control valve and the metering valve (PCV valve). The air is then sucked into the engine intake manifold. From the intake manifold, the air is drawn into the cylinders, burned, and then exits into the engine exhaust system.

During normal operation, the two vent control valves are open and play no part in the ventilating system. The metering valve (PCV valve), however, operates to automatically control the amount of vacuum developed within the engine regardless of the engine speed. Prior to entering deep water, the vehicle operator installs the 1/4 inch pipe plug in the drain opening in the bell housing (on the late venting system with sealed bell housing) and closes the two vent control valves by

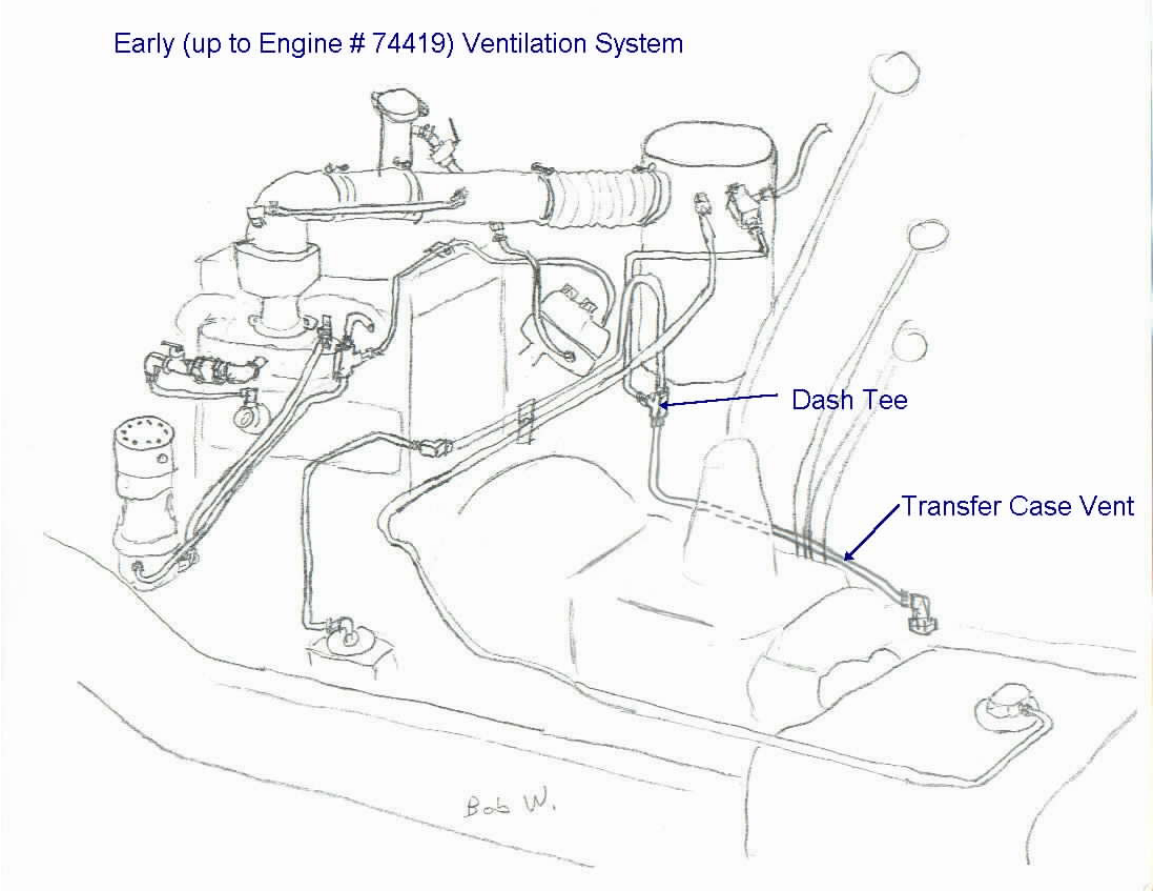
pulling the control cable on the dash. Closing the vent valves renders the entire engine ventilating system inoperative. This does not include the vent system of the carburetor, wipers, master cylinder, fuel tank and the distributor, which are vented independently of the engine. When the vent control valves are closed, with the engine running, the unrelieved pressure within the engine builds up to approximately 2-psi. Internal pressure rarely goes higher than 2-psi because, at higher pressure, leakage occurs through the crankshaft front and rear oil seals. This internal pressure offsets the external pressure of the water surrounding the engine and effectively prevents the entry of water into the engine past imperfectly sealed joints or through the front or rear oil seals.

Bell housing, transmission and transfer case venting, Early and Late style systems

These three components normally need to be vented to the atmosphere to eliminate internal pressure or vacuum from forming as they heat and cool with use.

Late system
On the late M38, the bell housing, transmission and transfer case are all connected. The transmission is connected to the transfer case by internal passageways. The transfer case has a tube from the normal vent location to a Tee fitting on the driver's side of the bell housing. This Tee also has a line that continues to a check valve on the center section of the fuel pump. During normal operation, the bell housing is connected to the atmosphere through the threaded drain hole in the bottom. This allows the bell housing, transmission and transfer case to vent to the atmosphere. For fording operations the operator installs a plug in the bell housing drain hole to seal it. During fording the engine crankcase is slightly pressurized. This pressure passes through the center of the fuel pump, unseats the special fitting check ball, and pressurizes the bell housing, transmission and transfer case. The purpose in raising the internal pressure of these units is to give them the same protection against the entry of water that is given the engine.

Early system.
Early M38s did not have a sealed bell housing. There was no bell-housing tee and there were no fuel pump center fittings. The transfer case vent line was connected to the air filter via the dash tee fitting. The bell housing and transmission were not pressurized during fording operations on the early vehicles.



Early style Underwater Ventilation System

Carburetor venting
The upper section of the carburetor must be open to atmospheric pressure to maintain a balanced condition in the carburetor. Therefore, the carburetor is vented by means of the vent line that is connected at the top of the carburetor to the air intake pipe.

Distributor
The distributor needs to have a supply of fresh air to avoid build up of water vapors inside the cap. The rear inside of the distributor is connected to the air crossover pipe by a metal line. This line supplies clean air to the distributor.

A metal line to a special fitting in the vacuum wiper supply tee connects the outside front of the distributor. The special fitting has a .040" restriction to limit the amount of vacuum in the distributor to a predetermined value regardless of the engine speed.

Windshield wiper venting
The vacuum supply to operate the windshield wipers comes from the intake manifold. To insure a constant vacuum regardless of engine speed, the vacuum booster section of the fuel pump is connected in series between the intake manifold and the wiper supply tee fitting.

Since the vehicle can be submerged, the wipers need to have a fresh air source to avoid ingestion of water. This fresh air comes from the tee fitting on the rear of the air filter housing.

Fuel tank vent
A line that runs from the top of the fuel tank to the tee fitting on the rear of the air filter housing vents the fuel tank. The fuel tank is equipped with a pressure relief valve that will permit pressure to build up in the tank to a maximum of 4 psi. The cap is a solid-type pressure cap designed for use only with this vehicle and should not be interchanged with the vented-type pressure cap, used with 3/4-ton trucks, which open and release excess pressure. The solid-type cap used with truck M38 has a cup about 3-1/2 inches in diameter inside of the shell, with a rivet in the center of the cup and a safety chain riveted about 1 inch off center. The cap used on the truck M38 is marked with embossed letters or decalcomania usint the word pressurized and instructions to open slowly.

Master cylinder vent
The brake master cylinder is vented through a line that extends up between the foot pedals to the left dash elbow, mounted on the firewall. Another line crosses the firewall to the right side dash elbow. From there, a line continues to the air cleaner. On the early style venting system, the "Dash Tee", was used in place of the right side elbow. The additional connection point is where the transfer case vent line was connected.

M38 Underwater Ventilation System Parts information

Part numbers that begin with WO- are Wilnumbers; numbers, all others are Ordnance part numbers.

System ID number. (my numbering system)

1. Engine crankcase venting

2. Transmission and transfer case (Also the bell housing on late style systems)

3. Carburetor venting

4. Distributor venting

5. Windshield wiper venting

6. Fuel tank venting

7. Master cylinder venting

Illustrations

Click below for illustrations, use Parts Database for part descriptions. The illustrations show the late ventilation system. Early ventilation systems will have minor differences.

Left side Crankcase venting, Vacuum supply

Left side Manifold Vacuum Tee

Air filter, right side Dash Elbow Late system

Distributor

Power plant left side, Transfer case venting Late system

Deep Water Fording Kit part numbers

Tubing and pipe thread size ID

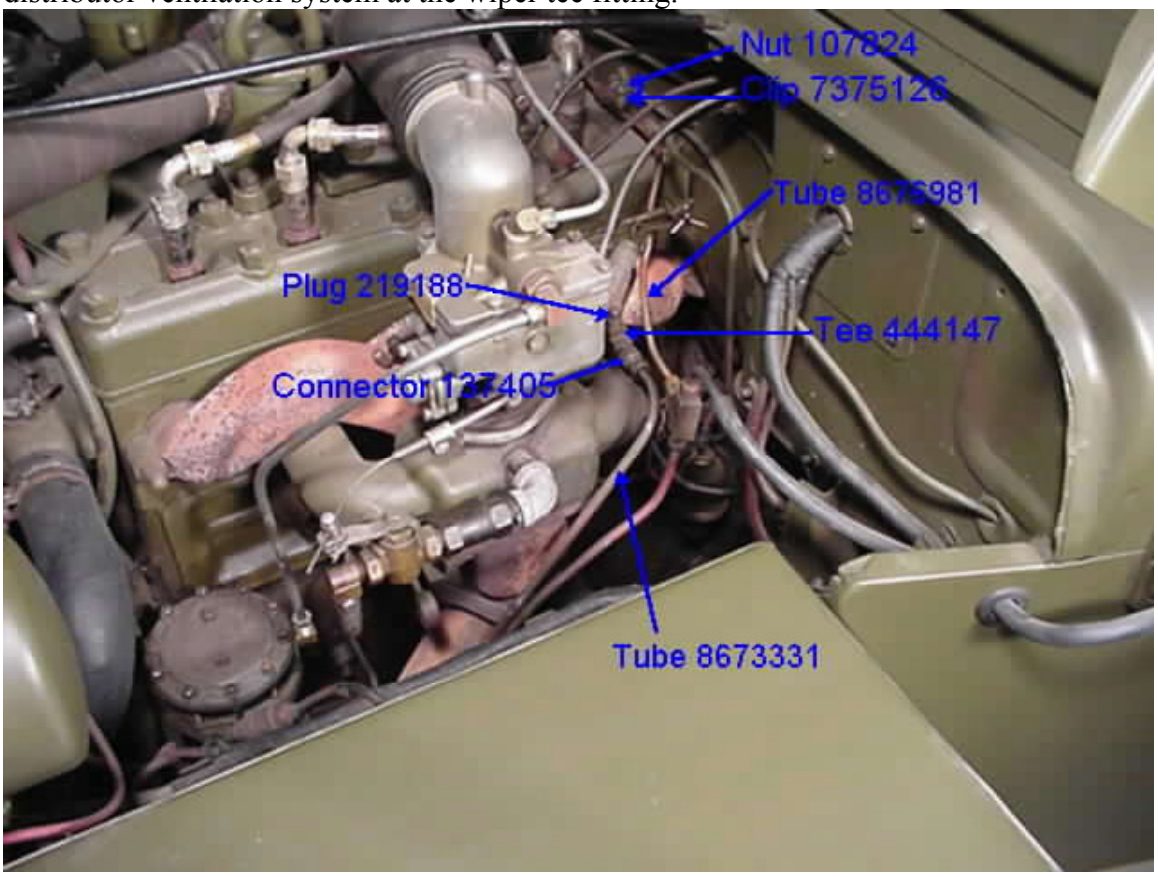
Special Fitting Description and Substitution

Thanks to Ted Kraines, Gary Zuber, and Ben Daugherty for the use of photographs, Harold West, Gary Keating and the entire Yahoo M38, M38A1, M606 Group for their supply of information.

Questions or comments? Please e-mail Bob Westerman 52cj3a@warwick.net

Special Fittings

There are two special fittings in the M38 Underwater Ventilation System.

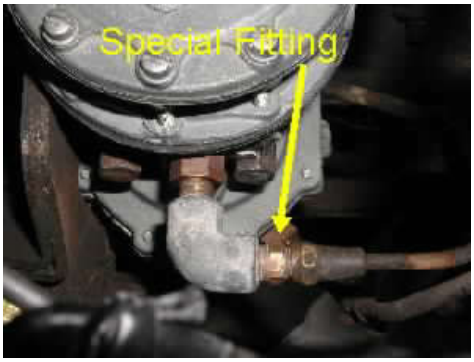
1. The first special fitting is found on all M38s. It is located in the vacuum supply of the distributor ventilation system at the wiper tee fitting.
2. 

The special fitting is Connector, 7348568, WO-802665. It is a brass inverted flare fitting; 3/16" tube, 1/8" pipe Male Connector. What makes it special is the center hole is a .040" orifice.

End view and side view of the special fitting.
The drill and needle show hole size on each end.

This fitting can be easily fabricated from a standard Male Connector (Weatherhead #202x3) by filling the center hole and drilling it out with a .040" drill bit.

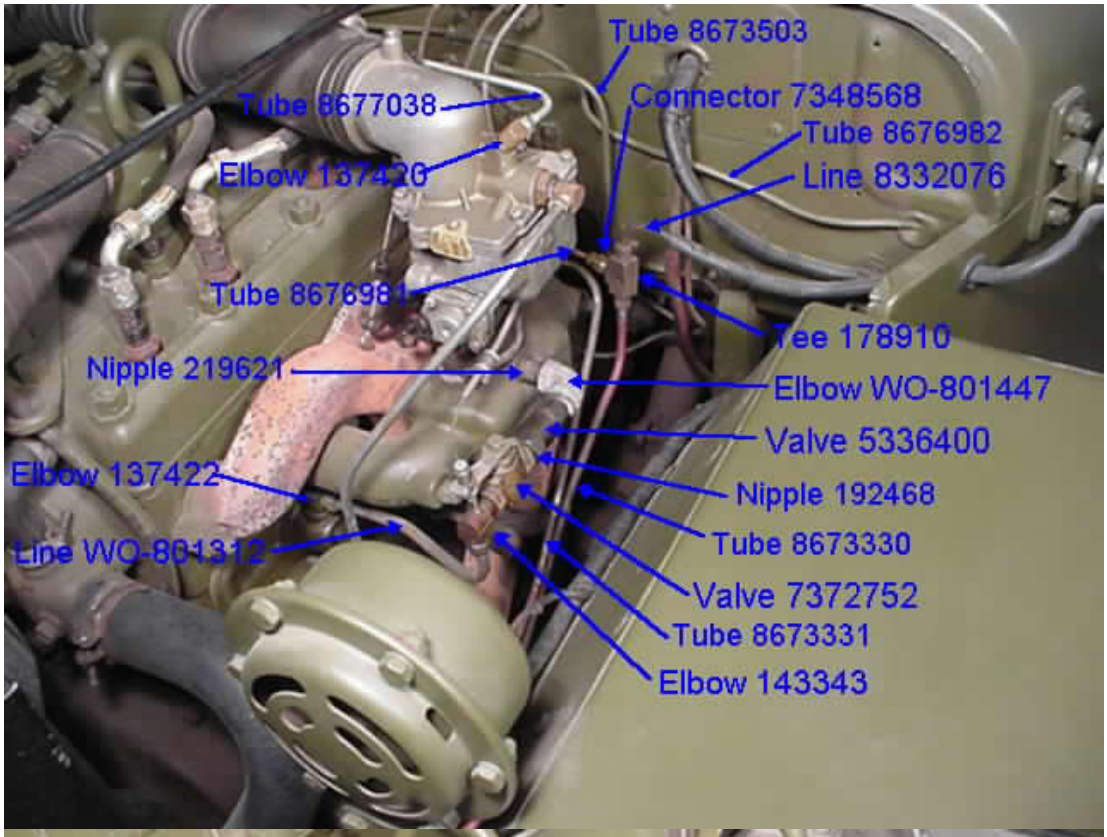
3. The next special fitting is only used after Engine #74419. This is the late style venting system. On these vehicles the bell housing is sealed, and a vent line connects the bell housing to the center section of the fuel pump. This special fitting is a ball check valve located at the elbow near the fuel pump.



This special fitting is Connector, 7375063, WO-8000347. It is an SAE 45° Flare fitting Male Ball Check Connector 3/16" tube, 1/8" pipe.

7375063 Disassembled

During normal operation, this ball check valve is closed. If you do not use the underwater feature of the M38, a standard SAE 45° Flare fitting Male Connector 3/16” tube could replace this special fitting, 1/8" pipe (Weatherhead #48x3). Simply fill the center hole with RTV to stop the flow of air.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Tube 8677038
Tube 8676982
Elbow 137420
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Elbow WO-801447
Valve 5336400
Elbow 137422
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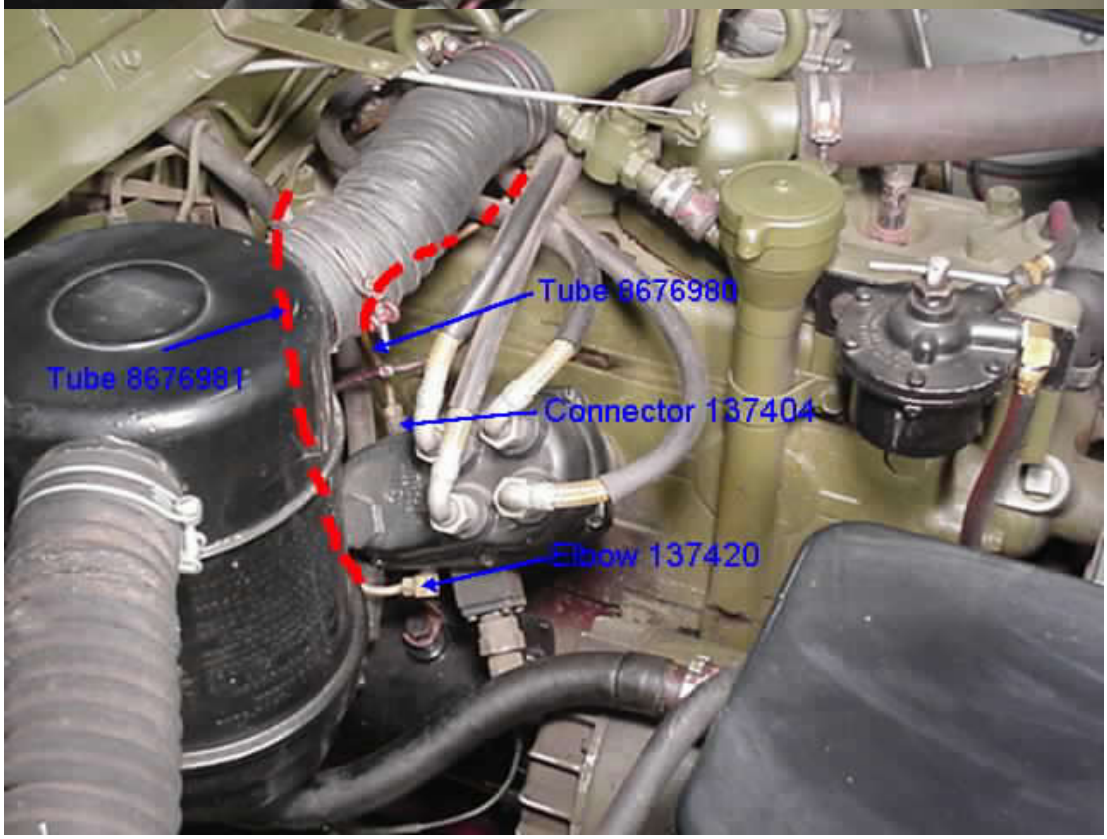
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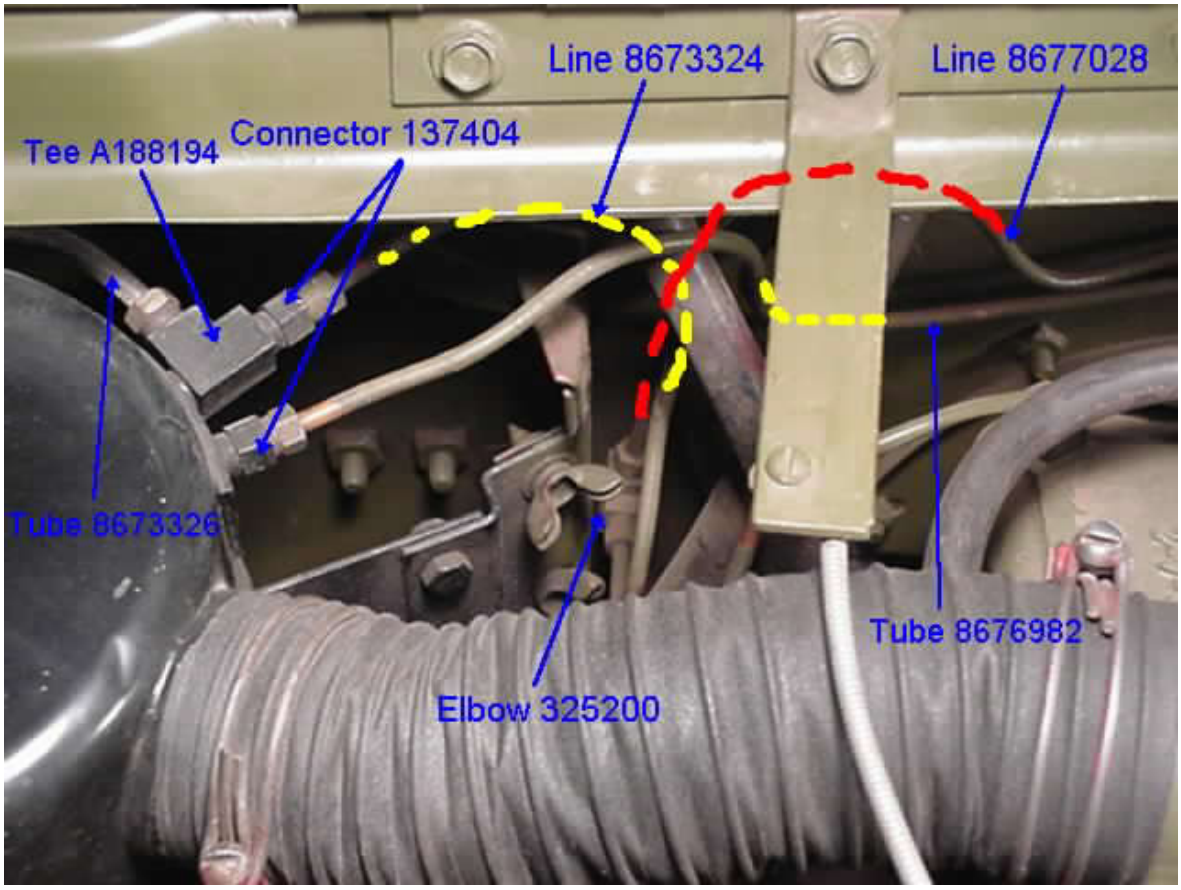
Tube 8676981
Connector 137404
Elbow 137420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