

CJV-35/U Underwater Ventilating System



CJV-35/U 10328 in the "test tank" at the Willys plant. The driver is wearing a dive suit without the helmet.

The test tank was actually just a low road within the plant that was dammed up to hold water.

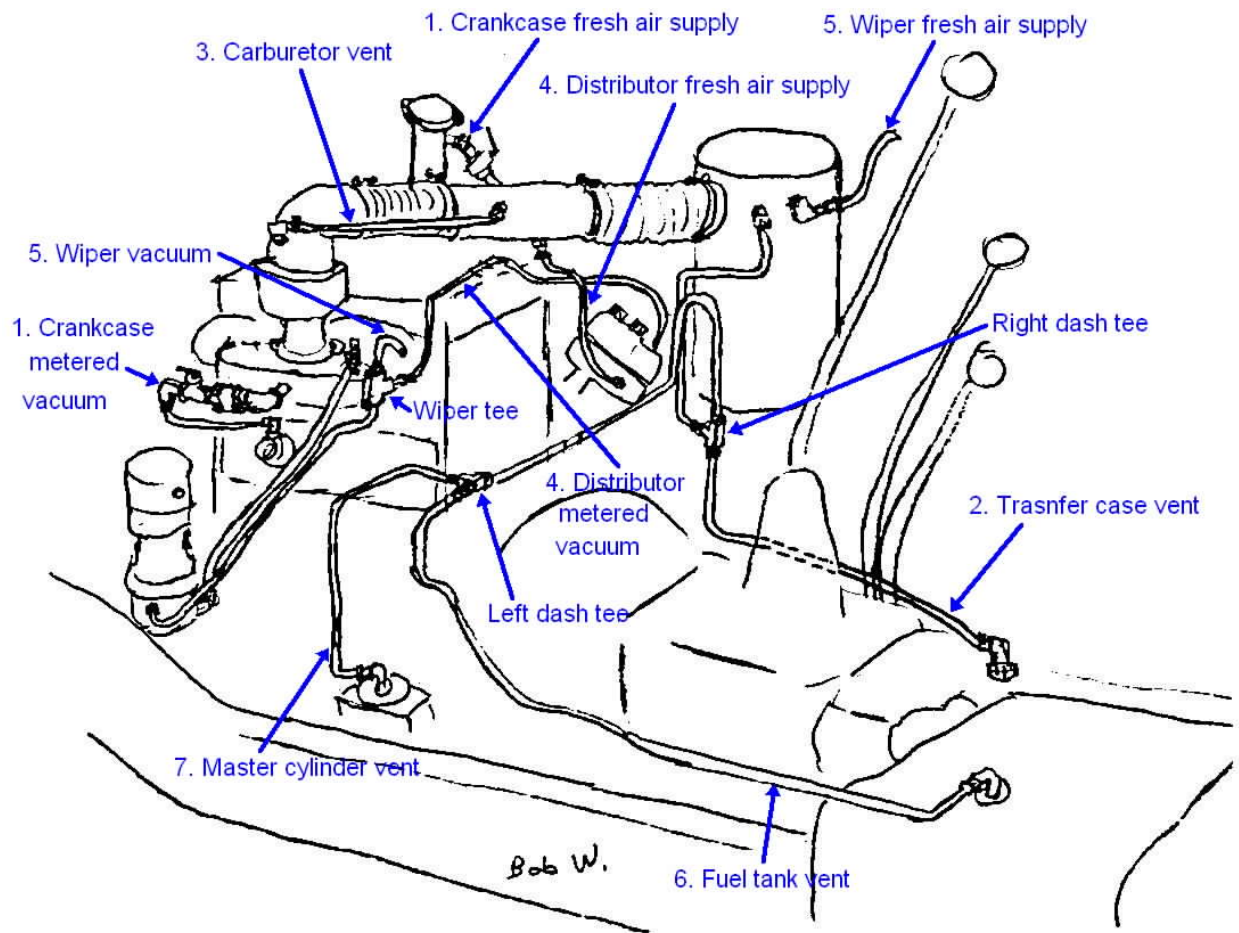
Thanks to Bill Norris for the photo.

The CJV-35/U Underwater Ventilation System is very similar to the M-38 system. Some of this information is taken from the [M-38 Ventilation System Article](#) since many of the components are the same.

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Operation

A supply of fresh air at atmospheric pressure is provided to the air filter by the intake snorkel on the passenger side near the windshield frame. The exhaust exits via the extension pipe at the rear of the vehicle. The underwater ventilating system can be broken down into seven distinct systems. I have numbered the systems to help identify them. Systems 4 and 5 share the same vacuum supply (at the wiper tee). Systems 2, 6 & 7 join at the dash tees and terminate at the air filter.



1. Engine crankcase venting

6. Fuel tank venting

2. Drivetrain

7. Master cylinder venting

3. Carburetor venting

4. Distributor venting

5. Windshield wiper venting

1. Engine crankcase venting

Ventilation of internal combustion engines is necessary to prevent harmful condensation, 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 CJV-35/U was built, engines were usually vented directly to the atmosphere through suitable openings or vents. The CJV-35/U engine was a standard 4 cylinder jeep engine with the added components to make it waterproof, or watertight, which also makes it airtight. Therefore, the method used to ventilate the engine is different than most engines of the time period. It has the same system utilized by 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 crossover 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 drawn into the engine intake manifold and continues on into the cylinders, burned, and then exhausted 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 crankcase regardless of the engine speed. Prior to entering deep water, the vehicle operator closes the two vent control valves by pulling out the fording control cable on the dash. Closing the vent valves renders the entire engine ventilating system inoperative. This does not include the vent systems of the carburetor, wipers, master cylinder, fuel tank and the distributor, which are vented independently. When the vent control valves are closed, with the engine running, the unrelieved pressure within the engine builds up to approximately 2-psi. Internal engine pressure will rarely go higher than 2-psi. 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.

2. Drive train venting

The gear boxes would normally be vented to the atmosphere to eliminate internal pressure or vacuum from forming as they heat and cool with use. On the CJV-35/U the transmission and transfer case are internally connected by passageways and vent to the air filter. The transfer case has a tube that extends to the air filter by way of the right dash tee fitting on the passenger side of the firewall. The axle housings do not have a connection to the underwater venting system. This seems odd since they are similar to the other gearboxes. Axle breathers are located on both differential covers. A few illustrations, from the service manuals, show vent tubes from the rear axle and transfer case going inside the right frame rail. These vent tubes do not actually appear on the V-35 nor are there any parts listed for them.

3. 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 tube that connects the top of the carburetor to the air intake pipe.

4. Distributor

The distributor needs to have a supply of fresh air to eliminate moisture due to condensation and to remove oxides, which develop in all equipment where an electric spark is formed. The front edge of the distributor cap is connected to the air crossover pipe by a metal tube. This tube supplies clean air to the distributor. The lowest point of the distributor is connected by a metal tube to a special elbow fitting in the vacuum wiper supply Tee. The special elbow has a .043" restriction to limit the amount of vacuum in the distributor to a predetermined value. It should be noted that since the wiper supply line is directly connected to the intake manifold it creates a vacuum leak to the carburetor. The .043 restriction controls the vacuum leak and keeps the engine idle quality acceptable. Later in M-38 production, the restriction was made smaller, to .040".

5. Windshield wiper venting

The vacuum supply to operate the windshield wiper 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 wiper needs to have a fresh air source to avoid ingestion of water. This fresh air comes through the tube on the right side of the windshield frame which is connected to the air filter housing.

6. Fuel tank vent

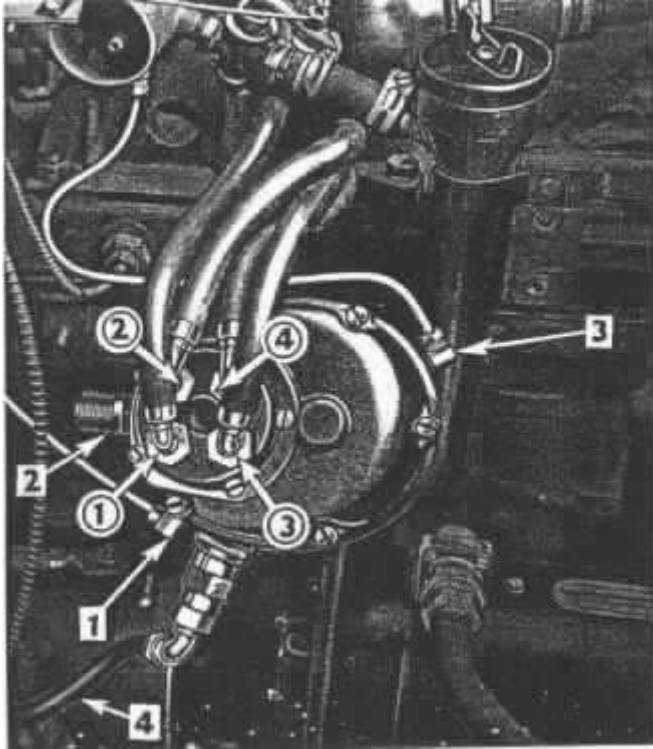
The fuel tank is vented by a tube that runs from the top of the fuel tank to the left dash tee fitting on the driver's side of the firewall. Another tube crosses the firewall to the right dash tee. From there a tube continues to the air cleaner. Although other tubes in the ventilation system are steel the fuel tank vent tube, from the tank to the left dash tee, is special thick walled copper tubing.

7. Master cylinder vent

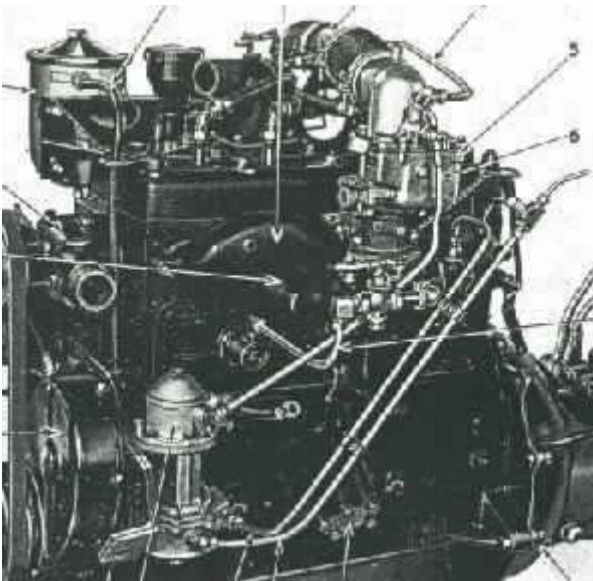
The brake master cylinder is vented through a tube that extends up between the foot pedals to the left dash tee, mounted on the driver's side of the firewall. Since the fuel tank vent is also connected to the left dash tee it is possible that gasoline could contaminate the brake system. With a full tank of fuel expansion could force gasoline up the vent tube to the left dash tee where it would drain into the master cylinder. This potential problem was eliminated in the next generation of underwater ventilation systems. The M-38 fuel tank vent ran directly to the air filter housing.

Parts

Using the Parts Catalog and an existing vehicle I attempted to locate every part associated with the ventilation system. Click on the images for a larger view with descriptions and part numbers. A database of all ventilation system components is found below the images.



Distributor, engine ventilation, right side of engine



Vacuum tubes, engine ventilator, left side of engine



Carburetor vent, engine ventilator, left side of engine



Intake and exhaust snorkels



Dash tees and tubes, firewall right side (passenger), air filter removed



Dash tees and tubes, firewall left side (driver's)



Master cylinder



Air filter connections, rear view

Parts List

WO part #	Description	Quan	Group	Fitting type	System	Notes
A-6919	BODY, ventilator	1	0107-N		1	on side cover
A-6885	ELBOW, 5/16" inverted flared tube (WH-100-43405)	1	0107-N		1	Ventilation tube to control valve
384549	ELBOW, 5/16" inverted flared tube (GM-137422)	1	0107-N		1	Ventilator to vent tube
52805	ELBOW, 1/4-90*, inverted flared tube (GM-144112)	1	0107-N	1/4 street el	1	Control valve to vent valve
GM 144592	NIPPLE, 1/4 x 1-3/8" (Steel) (Interchangeable with GM-115144)	1	0107-N	1/4 pipe	1	Control valve to vent valve
GM 115144	NIPPLE, 1/4 x 1-3/8" (Brass) (Interchangeable with GM-144592)	1	0107-N		1	Control valve to vent valve
A-17842	PIN, swivel, ventilator valve	1	0107-N		1	part of 648083?
53890	*SCREW, rd. hd., No. 6-32 x 3/16	1	0107-N		1	
53843	*WASHER, plain, 1/4	1	0107-N		1	
53891	*PIN, cotter, 1/16 x 7/16	1	0107-N		1	
648126	TUBE, crankcase ventilation, assembly	1	0107-N		1	
A-17841	VALVE, control, crankcase ventilation	1	0107-N		1	part of 648083?
648083	VALVE, control, crankcase ventilation, assembly	1	0107-N		1	
A-6895	VALVE, ventilator, assembly (AC-1543018)	1	0107-N		1	pcv valve
647551	FLANGE, pipe	1	0300	1/8 pipe	6	fuel tank vent fitting, top of tank
53892	ELBOW, inverted flared tube, 5/16	1	0301		3	carb to vent tube fitting
384569	ELBOW, 3/16, inverted flared tube	1	0301-C	90* 1/4 tube x 1/8 pipe	5	air filter to wiper vent tube
643892	HOSE, air cleaner tube to oil filler tube	1	0301-C		1	ok
800780	HOSE, flexible, 2-1/8x5-1/2	1	0301-C		intake	air filter to crossover
801051	HOSE, flexible, 2-5/16x5-1/2	1	0301-C		intake	crossover to carb
649373	TUBE, assembly	1	0301-C	1/4 steel	5	air filter to wiper vent hose
117504	TUBE, vent, timer to intake manifold, assy	1	0301-C		4	ok
800566	TUBE, w/bracket and valve, assy	1	0301-C		intake	air crossover pipe with control valve
A-17161	BRACKET, air intake pipe (Up to Serial No. . .)	1	0301-D		intake	requires 2 spacers 800860, using up early inventory?
54059	*BOLT, hex. hd., 5/16x24 x 1" (Up to Serial No..)	2	0301-D		intake	
52626	*NUT, hex., 5/16-24	2	0301-D		intake	

Parts List

WO part #	Description	Quan	Group	Fitting type	System	Notes
GM 446363	*WASHER, plain, 5/16" (Up to Serial No..)	2	0301-D		intake	
52558	*WASHER, lock, 5/16	2	0301-D		intake	
A-17844	BRACKET, clamp, valve control conduit	1	0301-D		1	To crankcase ventilation valve, mounted on PCV valve
A-17845	BRACKET, support, dual control	1	0301-D		1	To hood hinge bolt
800893	BRACKET, air intake pipe (After Serial No..)	1	0301-D		intake	no spacers required
53068	*BOLT, hex. hd., 5/16x24 x3/4" (After Serial No..)	2	0301-D		intake	Air intake bracket to RF fender
52626	*NUT, hex.,5/16-24	2	0301-D		intake	Air intake bracket to RF fender
53735	*WASHER, plain, 5/16" (After Serial No..)	2	0301-D		intake	Air intake bracket to RF fender
52558	*WASHER, lock, 5/16	2	0301-D		intake	Air intake bracket to RF fender
11386	CLAMP, (Bowden Wire) dual valve control	2	0301-D		1	on each cable bracket
53889	*SCREW, rd. hd., No. 10-24 x 1-1/4	1	0301-D		1	Dual control Bowden Wire to support bracket and clamp
52237	*SCREW, rd. hd., No. 10-24 x1/2	1	0301-D		1	Dual control Bowden Wire to support bracket and clamp
53888	*NUT, sq., No. 10-24	4	0301-D		1	Dual control Bowden Wire to support bracket and clamp
800890	CLAMP, flexible pipe to support tube	4	0301-D		intake	
635097	CLAMP, hose, 2-9/32" I. D. (USL-461389)	1	0301-D		intake	Air intake hose to air cleaner
800830	CLAMP, support, air intake flexible hose	1	0301-D		intake	
A-5449	CLIP, 5/16	2	0301-D		6,7	
52868	*SCREW, rd. hd., No. 10-24 x 3/4	2	0301-D		6,7	Tee to tee vent tube assembly to dash
52651	*NUT, hex., No. 10-24	2	0301-D		6,7	Tee to tee vent tube assembly to dash
53762	*WASHER, plain, No.10	2	0301-D		6,7	Tee to tee vent tube assembly to dash
53381	*WASHER, lock, No. 10	2	0301-D		6,7	Tee to tee vent tube assembly to dash
A-5449	CLIP, 5/16"	1	0301-D		7	Mounted to oil gage tube clip screw
A-5449	CLIP, 5/16", ventilation tube to dash	1	0301-D		6	
52868	*SCREW, rd. hd., No. 10-24 x 3/4	1	0301-D		6	

Parts List

WO part #	Description	Quan	Group	Fitting type	System	Notes
800603	CONNECTION, flexible, air tube, 74" long	1	0301-D		intake	Air intake to air cleaner
53667	CONNECTOR, 5/16, flared tube (GM-137404)	1	0301-D	straight 3/16 tube x 1/8 pipe	2,6,7	Air cleaner to air cleaner vent tube
53667	CONNECTOR, 5/16, flared tube (GM-137404)	1	0301-D	straight 3/16 tube x 1/8 pipe	7	Master cylinder to master cylinder vent tube
800921	CONTROL, dual, crankcase ventilating valve, assembly	1	0301-D		1	Air cleaner and crankcase ventilation vent valve
801085	*NUT, special	1	0301-D		1	Mounting dual control
801084	*WASHER, special	1	0301-D		1	Mounting dual control
53670	ELBOW, 3/16, inverted flared tube, 1/8 pipe	1	0301-D	90* brass	6	Fuel tank to fuel tank vent tube
53670	ELBOW, 3/16, inverted flared tube, 1/8 pipe	1	0301-D	90* brass	4	Timer to air cleaner vent tube to timer
53670	ELBOW, 3/16, inverted flared tube	1	0301-D	90* brass	2	Transfer case vent to vent tube
53892	ELBOW, 5/16" x 1/8-90*, flared, ventilating tube (GM-111284)	1	0301-D		3	?carb vent ??
A-17444	LOOM, 30" long	1	0301-D		6	on fuel vent tube inside cab
A-17445	LOOM, split, 3/16 x 1"	1	0301-D		7	Master cylinder vent tube to dash
A-17445	LOOM, 3/16" x 1", split	2	0301-D		6,7	Tee to tee vent tube assembly to dash
A-17122	NIPPLE, 1/4", pipe	1	0301-D		1	For vent valve hose connection
53668	NUT, 3/16", flared tube	12	0301-D		all	flare nuts, part of all the tubes
384526	NUT, ventilating tube (5/16" flared)	2	0301-D		3	part of tube 648126
A-17842	PIN, swivel, ventilator valve	1	0301-D		1	
53890	*SCREW, rd. hd., No. 6-32 x 3/16	1	0301-D		1	Valve shut-off control connection
53843	*WASHER, plain, 1/4	1	0301-D		1	Valve shut-off control connection
53891	*PIN, cotter, 1/16 x 7/16	1	0301-D		1	Valve shut-off control connection
648452	RING, anti-rattle, air intake tube	1	0301-D		intake	
800860	SPACER, air intake pipe bracket (Up to Serial No. .)	2	0301-D		intake	
A-17380	SPACER, flexible pipe to support tube clamp, 5/16 I. D. x 5/8" long	2	0301-D		intake	
53751	*SCREW, rd. hd., 1/4-20 x 1-	2	0301-D		intake	Air intake flexible pipe to

Parts List

WO part #	Description	Quan	Group	Fitting type	System	Notes
	1/2					support tube
53741	*NUT, wing, 1/4-20	2	0301-D		intake	Air intake flexible pipe to support tube
53340	*WASHER, lock, 1/4, internal	2	0301-D		intake	Air intake flexible pipe to support tube
800778	SUPPORT, carburetor air intake tube	1	0301-D		intake	
53931	*BOLT, hex. hd., 5/16-18 x 7/8	2	0301-D		intake	Support and clamp to cowl side
52558	*WASHER, lock, 5/16	2	0301-D		intake	Support and clamp to cowl side
53671	TEE, 3/16", flared tube	1	0301-D	brass	6,7	Tee to tee vent tube, master cylinder and fuel tank vent tube. left dash tee
53671	TEE, 3/16", flared tube	1	0301-D	brass	2,6,7	Transfer case vent tube, air cleaner vent tube and tee to tee vent tube. right dash tee
A-17742	TUBE, fuel tank vent to tee, assembly	1	0301-D	3/16 copper	6	54-1/4" long
648081	TUBE, transfer case vent to tee, assembly	1	0301-D	3/16 steel	2	
800059	TUBE, vent, air cleaner to dash tee, assembly	1	0301-D	3/16 steel	2,6,7	
A-12935	TUBE, vent, assembly, 17-1/2" long	1	0301-D	3/16 steel	6,7	Tee to tee on dash
A-17866	TUBE, ventilating, carburetor, assembly	1	0301-D	5/16	3	Carburetor to housing tube
648080	TUBE, ventilation, assembly	1	0301-D	3/16 steel	4	Timer to air cleaner tube
648704	TUBE, ventilation, master cylinder to tee, assembly	1	0301-D	3/16 steel	7	23" long
A-17840	VALVE, ventilation, air cleaner tube, assembly	1	0301-D		1	
A-17082	VENT, transfer case	1	0301-D		2	pipe bushing?
384569	ELBOW, connector, 1/4 flared tube	3	0302-A	1/4 tube x 1/8 pipe	5	2 vacuum tube connectors at pump, 1 for fuel
A-1694	CLIP		0304		5	illustration p50 shows 4 clips holding vacuum tubes together
800161	TUBE, vacuum, intake manifold to pump	1	0304	1/4 tube	5	
387891	UNION, 1/4, inverted flared tube (interchangeable with GM-145474)	1	0304	1/4 tube x 1/8 pipe	5	Vacuum tube to manifold
GM-145474	UNION, 1/4, inverted flared tube (interchangeable with 387891)	1	0304		5	Vacuum tube to manifold
800911	PIPE, tail, exhaust, assembly	1	0401		exhaust	exhaust pipe snorkle
800912	CLAMP, exhaust tail pipe to	1	0401		exhaust	exhaust pipe snorkle to body

Parts List						
WO part #	Description	Quan	Group	Fitting type	System	Notes
	body, assembly					bracket
117608	ELBOW, 90*, inverted flared tube	1	0603		4	?vac tube at dist?
117609	ELBOW, 90*, flared type, .042 orifice	1	0603	90* 3/16 tube x 1/8 pipe	4	distributor vacuum restriction at wiper tee
648144	EXTENSION, windshield wiper tube, assembly	1	1811-D-1	1/4 tube	5	Tube extension to tee
GM-178910	TEE, inverted flared tube, 1/4x1/4x1/8 pipe	1	1811-D-1	1/8 street tee, 3750x2	5	Windshield wiper tube, extension and distributor vent tube. wiper tee
800162	TUBE, windshield wiper, assembly	1	1811-D-1	1/4 tube	5	Vacuum pump to tee

Special thanks to Harold West for all his help in writing this article. He has spent countless hours researching the CJV-35/U and has been incredibly generous with his time and efforts.

More information and comments are welcome,
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