MERCEDES-BENZ: A/C DIAGNOSTICS & EVAPORATOR REPLACEMENT

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ImportCar
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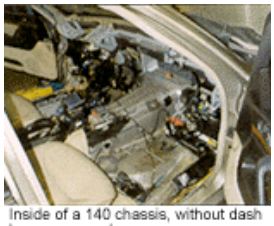
Soon it will be summer and we are already doing air conditioning work in northern Florida. We did our first 124 chassis evaporator of the season this week. By the end of this month, our gross will increase by 30 percent, mostly on the seasonal increase in air conditioning work.

I must have worked on Mercedes-Benz automobiles for 15 years before I ever replaced an evaporator. Through the 1970s, we pulled many an evaporator out of 107 and 116 chassis models to repair a poorly designed interior drainage system. The early models had little flappers on two interior tubes that carried the condensation to a lower tray that had the external drains. Originally, we were to open the case and snip the flapper from the end of the rubber tube. Later, Mercedes-Benz came out with instructions and parts for the addition of two more external drains. The 114/115 chassis cars were equipped with heater motors that couldn't be removed without the removal of the evaporator case. The need for a heater blower now "totals" those cars.


Inside of a 140 chassis, without dash brace removed.

Metallurgical changes were made in the mid-'80s, probably to save weight. Copper/brass were replaced with aluminum. Now 10-15 years later, evaporators are probably the #2 refrigeration problem, behind compressors. Number two in occurrence, but a big #1 in cost. Many manufacturers made provisions for easy removal of their evaporators, foreseeing replacement during the car's life. My experience with Mercedes-Benz says that they buried it because it would never need to be changed and then something went wrong. Two of its finest lines of the last 20 years, the 124 and 140 chassis, now come with footnotes about their cost of ownership due to air conditioning costs. We will probably do 10-15 of the 12-hour 124 model evaporator replacements this summer, and two or three of the 22-hour 140 chassis evaporator jobs.

There really isn't any theory to be discussed about evaporators, and "R & R" instructions are contained in all the data systems. However, there are a few pointers worth noting. I found one recently from the iATN archives. According to James Houwen, it is possible to crack the windshield if the car is lifted with the dash brace removed. I'm glad that I didn't figure out that one.

Dennis Warden (from the technician site www.lmvind.com) also points this out in his tips that are included in the sidebar. Also reference the photo on that shows the inside of a 140 chassis with the evaporator assembly removed. It is clear from the photo that my technician didn't remove the dash brace. It is still a good warning, as its removal could be necessary in some instances.

I can tell from experience both how easy and expensive it is to chip the center console wood on a 140 chassis model ($675). I have also noticed that the $1,140 dash of the early models has been replaced by a $3,820 version on '95 and up models. Be careful and remember the risk factor when estimating.

When doing the evaporator on 124 models, we always include all the vacuum mode actuators. They have a 10-15 year life and some are almost as hard to replace as the evaporator. The part numbers are: 124 800 00 75, 124 800 02 75, 124 800 03 75, 124 800 04 75 and 124 800 11 75. When replacing the unit on the early 140 models, there is an additional spacer/baffle, p/n 140 831 08 36, that must be added as the later-model evaporator has been reduced in size.

Warden points out that before removing the evaporator (see accompanying sidebar, point #3), the system should be diagnosed to make sure all problems are solved during this labor-intensive job.

A/C DIAGNOSTICS

Since we are inside the car, I would like to address the great diagnostic capabilities available with the modern pushbutton controller. Three different forms of diagnostic information can be gathered here. I find the "actual value" function most helpful. Diagnostic trouble codes are also available, along with the ability to activate the individual door positions (individual flap tests) within the dash. All of these functions, actual values, fault codes

and mode activation, can be done from the various buttons on the pushbutton assembly.

I really like the actual values, as one can drive the car and watch the activity of important functions that include evaporator temperature, engine temperature, blower control voltage, etc. See **Chart 1** for the list of actual values for the 210 chassis E320. Other chassis are similar, but this chart is given as an example.

The procedures for reading Actual Values go like this: Turn on the ignition, press the "AUTO" button, set the temperature on each side to 72°F (this can be done quickly by pressing both the red and blue arrows at the same time), then press the "REST" button for five seconds or until the left-side display says "1."

The right-side display will then display the in-car temperature. Pressing the "AUTO" on one side makes the positions change up or down (for example, 1, 2, 3, etc). Pressing the opposite "AUTO" button runs the functions in the other direction (for example, 3, 2, 1). The test can be ended at any time by tapping the "REST" button.

Figure 1 shows the Actual Value screen. It is value #5, which is evaporator temperature. The right-side value of 06 is the temperature in Celsius.

Figure 1: Actual value test.

I first ran across these tests while trying to solve a C230 problem whereby its compressor would shut off within one minute of starting. There were some fault codes involved with communication between the fan control module and the pushbutton module. I came across the actual value test while trying to make some sense of the code. I tried the actual values without the engine running. The evaporator temperature showed 155 degrees. When I discovered that the dealer had two of the sensors in stock, I had a good idea that the problem had been found.

The new sensor gave me realistic values and the problem was fixed. That model has a variable displacement compressor and it was interesting to watch the evaporator temperature while on a road test. It dropped rapidly, then slowed and finally just stopped at 42 degrees. (It was probably 95 degrees outside at the time). This feature has many values, as the list of data is comprehensive — engine temperature, engine speed, vehicle speed, battery voltage — to name a few.

Chart 3: Diagnostic Trouble Code (DTC) Memory For 1997 E320 Models

B1226	In-car temperature sensor (B10/4)	B1417	Duovalve (Y21y1), left
B1227	Outside temperature indicator temp sensor (B14)	B1418	Duovalve (Y21y2), right
B1228	Heater core temperature (B10/1)	B1419	Electromagnetic clutch (A9k1)
B1229	Heater core temperature (B10/1)	B1420	Idle speed increase
B1230	Evaporator temperature sensor (B10/6)	B1421	Pulse module (N65)
B1231	ECT sensor (B11/4)	B1422	Series interface (K1) connection to instrument cluster (A1)
B1232	Refrigerant pressure sensor (B12)	B1423	Switchover valve block (Y11)
B1233	Refrigerant temperature sensor (B12/1)	B1424	Activated charcoal filter actuator (A32m2) open
B1234	Sun sensor (B32)	B1425	Activated charcoal filter actuator (A32m2) closed
B1235	Emissions sensor (B31)	B1432	Non-USA DTC
B1241	Refrigerant fill	B1459	Series interface (K2) connection to instrument cluster (A1)
B1416	Coolant circulation pump (M13)	B1462	Wide open throttle (WOT) position signal: diesel engines

The procedures for pulling Fault Codes go like this (See Chart 3): Turn on the ignition, and set the left temperature to "HI" and the right temperature to "LO." Then, simultaneously press buttons "Rest" and "EC" for five or more seconds. All of this must be done within 20 seconds. The "Recirculate" button will flash its LED. The screen will then go blank, and the first code can be brought up by pressing the right "AUTO" button.

Subsequent codes are retrieved by additional application of the right "AUTO" button. Figure 2 shows code B1234. Note that the code starts with "E" for error. Also note that the B1234 code appears as Eb1 234 on the screen.

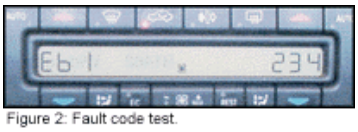


Figure 2: Fault code test.

The Individual Flap Tests are run by idling the engine, pressing the left and right "AUTO" buttons, setting temperatures to 72°, manually opening the fascia vents, and simultaneously pressing the "Rest" and "Recirculate" buttons for more than five seconds. The first step: Left display "0" and right display "LO" should appear. Pressing the left "AUTO" button changes the steps. Pressing the right "AUTO" button varies the two modes "HI" and "LO" for each step.

The functions that are checked are described in **Chart 2** and can be verified by the actual air flow changes enacted. Figure 3 shows the third step (DTC) with "2" indicated on the left side and the "HI" mode indicated on the right.

Figure 3: Individual flap test.

All of these tests are so easy to run that they should be done frequently to gain familiarity with them. They definitely should be run before and after major dash surgery.

A/C Service Diagnostic & Test Procedures:
Pre Evaporator Replacement Steps

1. Before you try to diagnose an A/C complaint on a Mercedes-Benz 140 model, a complete cooling capacity test, function test and leak test are all musts.
    a. A cooling capacity test is performed by evacuating the freon and measuring the amount removed. This procedure will verify whether the system has lost freon or is low in capacity.
    b. A leak test is performed by adding 2.5 pounds of freon (2.9 with rear A/C) and running the A/C on full cold at low fan speed. A leak detector can be used in the vents or the drains under the vehicle located on each side of the transmission.
    c. A full function test should be performed by operating all of the normal functions of the pushbutton, including auto, manual and REST. Activating the pushbutton diagnostic mode and checking actual values, codes and activation of flaps will also save time and embarrassing moments if an evaporator replacement is justified. Oftentimes, a technician will not perform these checks only to replace the evaporator. And when the task is completed, he finds a leaking flap, or a defective sensor or pushbutton assembly. Now, he must approach the customer for additional repairs that could have been avoided if the above simple tests had been performed. Most technicians are paid 1.5 hours for these tests that can accurately be performed in 30 to 45 minutes.
2. Another option is to evacuate the system, install fluorescent dye, and then recharge to test for leaks. Some evaporators with larger leaks may only need a few hours of run time before the light can detect a leak, while others may take a few weeks of driving. If dye is used, a simple way to see the dye is to remove the blower motor and insert a smaller detector light in the evaporator housing through the blower area. The front of the evaporator can easily be seen this way and the dye can be easily detected. You can also insert a leak detector in the same area for verification.
3. In 1992, a longer evaporator was used. They were replaced on ‘94 models by newer, updated evaporators that have a better cooling capacity and are about six inches smaller. If an early-type evaporator is replaced with a newer, shorter-type evaporator, it is a must that you use a baffle provided by the dealer to block off the opened area that results from the use of the shorter evaporator. Failure to use a baffle will cause a difference in air cooling of more than 15°F from the left to the right side of the center A/C dash vent. The result of air bypassing the evaporator fins, this temperature difference will also reduce total cooling capacity by roughly 30 percent.
4. Once the dash and supports are removed, the vehicle should never be raised. The possibility of damaging the windshield, as a result of the chassis twisting while raising the car without the braces, is great.
5. Base modules play a very important role in the function of the compressor activation in the 140 model. One of the base module’s functions is to receive the speed signal from the compressor and match it against a mapped grid that will calculate the difference from engine speed. If the tolerance is exceeded, the base module shuts off power to the compressor until the key is recycled. If the belt were to slip due to water, the module would also shut off the compressor. When activating the A/C pushbutton, the module will activate the compressor until it receives its speed signal. If the signal is not received, the base module will quickly shut off the compressor. This provides a quick self-test procedure seeing that if the compressor comes on and then shuts off quickly when starting the system, one can assume a speed signal problem exists.
6. The evaporator temperature sensor has the most control over compressor operation. If the sensor resistance is shown as being below 2°C, the compressor is turned off. The pushbutton module is also logically programmed to show an unrealistic value, such as -40°C or +40°C if an open circuit in the sensor or a short to ground is detected.

7. The sensors with the least control are the sun and smog sensors. The sun sensor raises or lowers the speed of the blower by only a few percentages depending on the direct sunlight, while the smog sensor opens or closes the fresh air flap again depending on the carbon monoxide concentration in the air.
8. A very common problem in the 140 model equipped with a 119 V8 engine is that the harness to the compressor connector A9x1 is too short, causing the wires to break at the connector. Worn motor mounts and engine flex have been blamed for the breakage. Mercedes-Benz increased the length of the harness in models with production dates from 08/1994 to prevent this problem.

Courtesy of Dennis Warden, LMV Industries, Inc.
(www.lmvind.com – an independent website for M-B specialists).

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