

Broken Temperature Gauge

The temperature gauge is a “mechanical” unit consisting of a bulb with fluid (ether) mounted in engine head, a gauge head mounted in the instrument cluster on the dash, and a tube connecting the bulb to the gauge head. The gauge head is actually a pressure sensing unit.

In operation, the coolant in the engine head heats the working fluid in the sensor bulb. As the engine gets hotter the pressure in the bulb and tubing rises. The dash head unit simply reads the pressure on a scale calibrated in degrees Fahrenheit.

A common failure mode is for corrosion to lock the bulb in the engine head. The tubing is twisted off near the bulb when bulb removal is attempted. In this case, the gauge head unit is known to be working properly, the defect is in the tubing and in the loss of fluid from the sealed system.

For a more detailed description, a number of articles about the operation of this type of temperature gauge have appeared in *Skinned Knuckles* over the years. The earliest article I have is from the March 1984 issue.

Replacement parts

Mechanical temperature gauges are still being manufactured and available in most auto parts stores. The goal of this procedure is to graft a new bulb (with fluid) and tube onto the old gauge head.

Find a gauge that has a spiral wound protective cover over the tube. There are some that use a plastic coating. While these can be made to work, they will not look correct. As of October 2004, it is possible to find a suitable donor gauge in California auto supply stores for about \$15.

The Procedure

Caution: The working fluid in the gauge is ether, a highly flammable substance. Do not have any open flame near your work area. Do not use a torch for the soldering operations.

1. Make up a sleeve from some tubing. In this case the capillary on the donor gauge had a slip fit into 1/16" inside diameter copper tubing found at the local hardware store. The capillary on the original gauge was slightly larger, so the 3/4" long sleeve was drilled out halfway through to make a slip fit for the old capillary.
2. To keep the ether from escaping we use some crushed ice and salt to create a “cold bath” for the sensing bulb.



3. And we might as well be chilling the bulb while we do all the other preparation work.



4. Trim the capillary tubing on the old gauge a couple of inches from the gauge head.
5. Make sure that the tubing has not been closed off when trimming to length.



6. We might as well do as much as we can before cutting open the donor gauge. So the next step is to “tin” the capillary on the old gauge near the cut. You don’t want to tin all the way to the cut as you don’t want to encourage solder to fill the capillary opening.
7. Now we can attach the sleeve to the tinned capillary. In this case we seated the capillary tubing to the limit that we opened up the diameter by drilling.



8. Again we want to make sure we have not closed off the capillary. A piece of stiff wire small diameter can be used to verify that the capillary is not clogged with solder.
9. Cut the protective spring on the donor gauge capillary near the point marked for the length you need (indicated by the tape).



10. In the spirit of doing as much work as possible before breaking the seal on the donor unit, we now tin the part of the capillary that will be inserted in the sleeve.



11. Almost done! Verify that the sensor bulb is still in the ice solution. Cut the capillary tubing, assure that the center is open and now solder it into the sleeve.
12. Before removing the sensor bulb from the ice solution, double, triple and quadruple check that you have a good solder joint with no voids or other possible leaks on both sides of the sleeve. When you are happy with your work it is time to check the function.



13. Immerse the sensor bulb in boiling water while observing the needle of the gauge. It should move up to the 212° F mark. While observing the dial mechanism, you might want to cycle the sensor bulb between the ice solution and boiling water a few times to verify that nothing is binding the movement. The gauge should now be restored to operation.

Calibration

If the gauge does not read 212° F in boiling water you have two options:

1. Note the error and live with it.
2. Attempt to adjust the gauge head unit.

The gauge head is a Bourdon tube connected to the indicator by a linkage. The Bourdon tube is simply a flattened tube rolled into a coil. As pressure is applied the tube slightly unwinds. When the pressure is removed, the coiled tube returns to its original position.

Adjustment is made by bringing the sensing bulb to a known temperature by placing it in boiling water (212°F) then bending the linkage that connects the Bourdon tube to the indicator. **Do not bend the Bourdon tube itself.** It is possible to adjust the gauge if its reading is less than 30° different than the actual temperature.

If you have any doubts about the adjustment operation, then don't do it. You can buy replacement sensing bulbs and tubes at any auto supply store. Getting an original gauge dash head is a lot harder.

Installation

Avoid sharp bends or kinking the tubing when installing the repaired gauge.