Temp Sending Unit and Gauge

http://forums.corvetteforum.com/c1-and-c2-corvettes/2189912-temp-sending-unit-problem.html
11-24-2008, 01:47 AM #**14**

ddsjoseph (Thread starter)

Temp sending unit problem?

I have a 65 coupe, with 327, 350 hp. The temp gauge always goes up to max at 240* after 1/2 hour of driving, no matter what the ambient temp. So I changed the radiator to a 3 row high efficiency copper/brass and even added an external cooling fan. Then I changed the temp sending unit 3 times. I finally used an infrared temp gun to check the temp at the sending unit, and it showed 210* instead of 240. I am not sure if it is the temp gauge inside the car that is inaccurate or the sending unit. Also, if it is the fault of the gauge, then would it be better to add a variable temp. sender resistor or just change the temp gauge inside.

buns

Do you really have an overheating problem, or just a gauge that is reading high? I would first try a different sending unit. Look at the chart below. The "typical" sender values are supposedly from the original G.M. specs. Look at the specs of the AC DELCO #G1852. My test shows they match at 200 degrees.
I don't know why Wells chose 220 degrees as a reference temperature. Once water in an open container starts boiling at 212 degrees, it won't get any hotter.

TEMPERATURE SENDER RESISTANCE CHART

"TYPICAL" SENDER FROM BARRY K'S WEBSITE

TEMP	OHMS
75	569
80	539
90	477
100	410
110	355
120	300
130	240
140	187
150	171
160	150
170	134
180	123
190	112
200	94
210	83.5
211	83

MY ORIGINAL AC DELCO

TEMP	OHMS
70	620
80	580
90	575
100	515
110	440
120	390
130	340
140	295
150	250
160	215
170	185
180	160
190	140
200	120
210	105
212	96

WELLS # TU5

TEMP	OHMS
100	440 TO 295
220	88 TO 72

THESE MEASUREMENTS ARE FROM THEIR WEBSITE. NOBODY IN MY NECK OF THE WOODS SELLS WELLS.

STANDARD MOTOR PRODUCTS # TS6

TEMP	OHMS
70	615
80	612
90	540
100	455
110	380
120	325
130	285
140	240
150	205
160	175
170	155
180	135
190	115
200	102
210	86
212	83

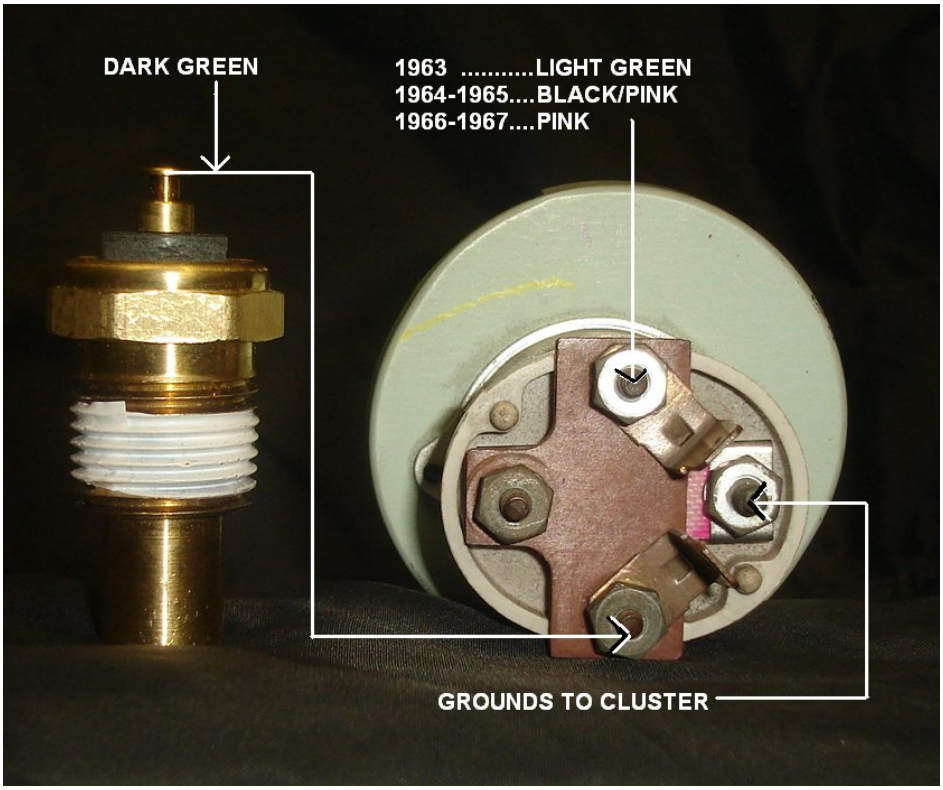
NEW AC DELCO # G1852

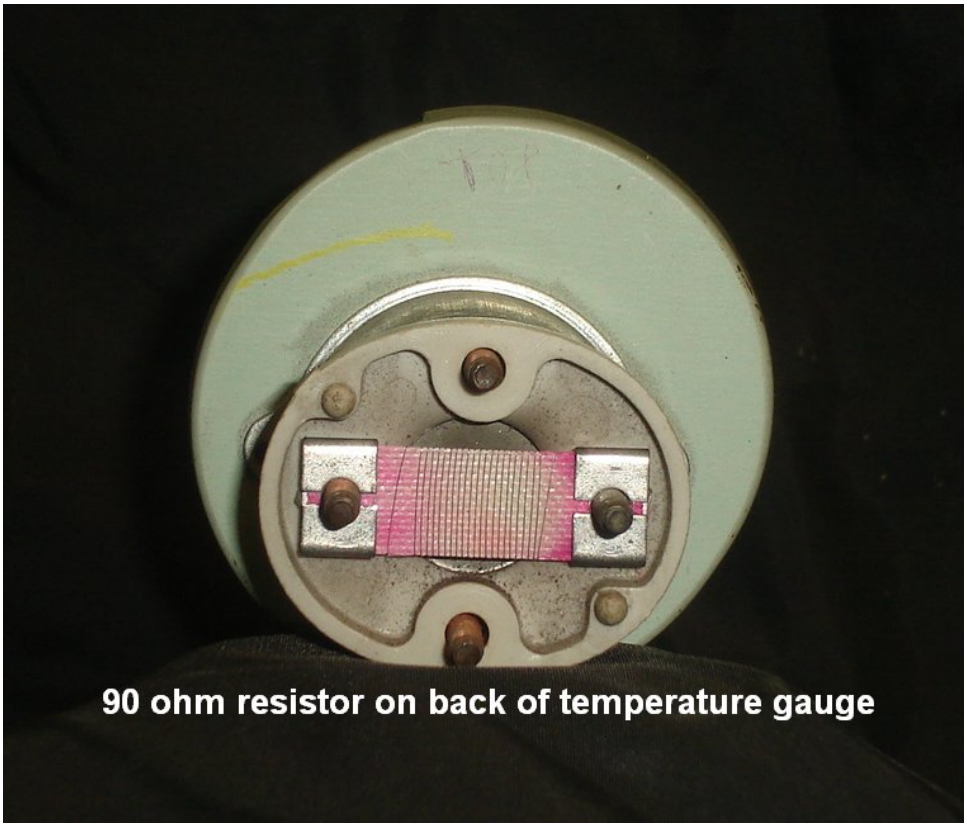
TEMP	OHMS
70	610
80	555
90	480
100	410
110	340
120	295
130	260
140	220
150	195
160	165
170	145
180	125
190	110
200	95
210	84
212	80

NIEHOFF

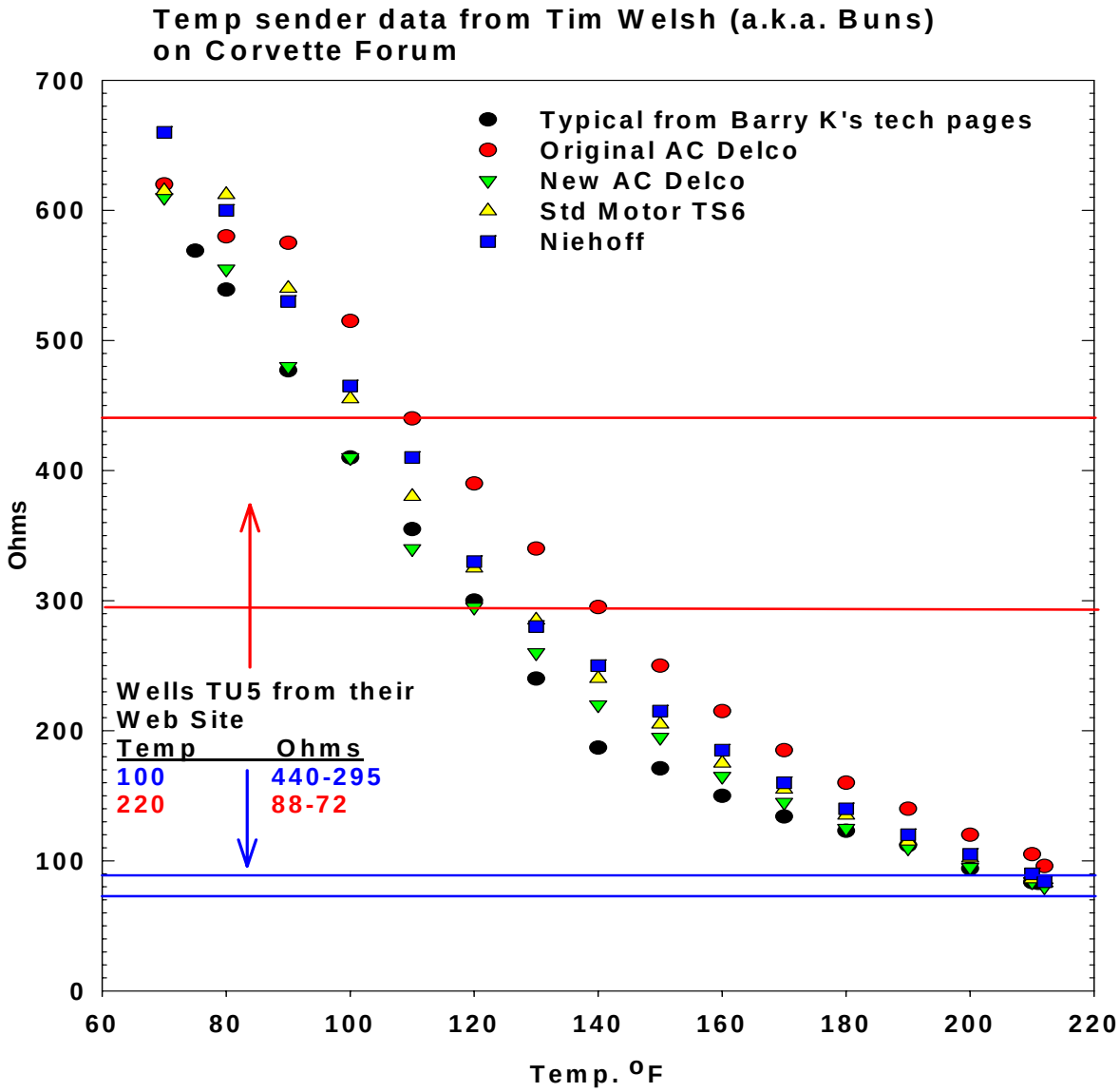
TEMP	OHMS
70	660
80	600
90	530
100	465
110	410
120	330
130	280
140	250
150	215
160	185
170	160
180	140
190	120
200	105
210	90
212	84

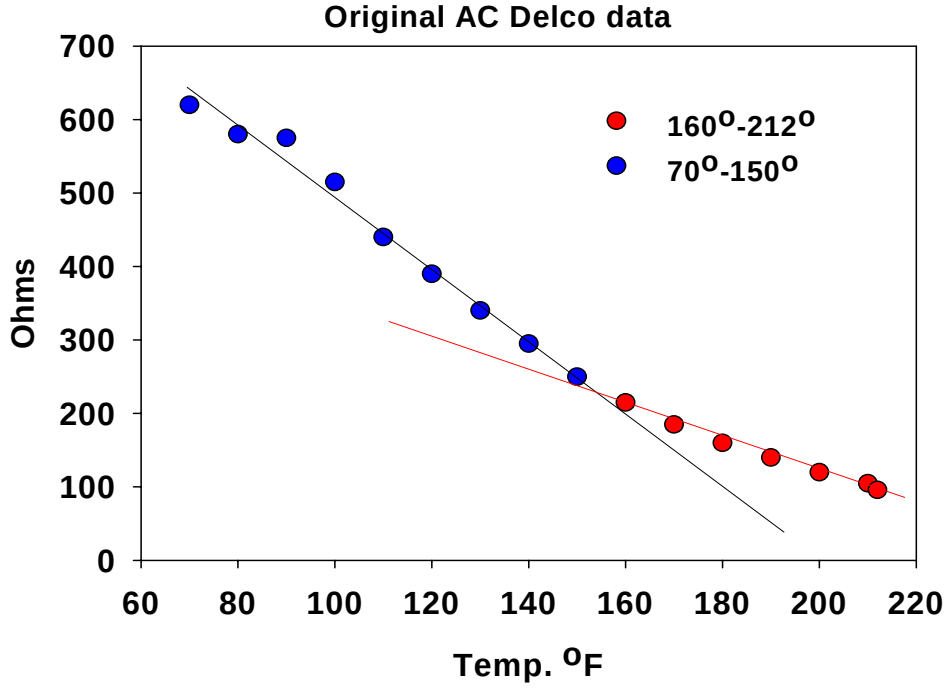
You also need to look at your temperature gauge. There is a 90 ohm resistor on the back of it. Make sure it isn't burnt out. Also make sure that the silver terminal on the gauge has a good ground to the cluster.





In the picture above you can see that the Standard Brands, Niehoff and G.M. sending units look identical. I would surmise they were all built by the same manufacturer. You can also see that two of them already have teflon tape on them. Lots of people will tell you not to use it but I disagree.


Temp sender data from Tim Welsh (a.k.a. Buns)
on Corvette Forum
Typical from Barry K's tech pages
Original AC Delco
New AC Delco
Std Motor TS6
Niehoff
Wells TU5 from their
Web Site
Temp Ohms
100 440-295
220 88-72
Ohms
Temp. OF
0
100
200
300
400
500
600
700
60
80
100
120
140
160
180
200
220


Original AC Delco data
160O-212O
70O-150O
Ohms
Temp. OF
0
100
200
300
400
500
600
700
60
80
100
120
140
160
180
200
220

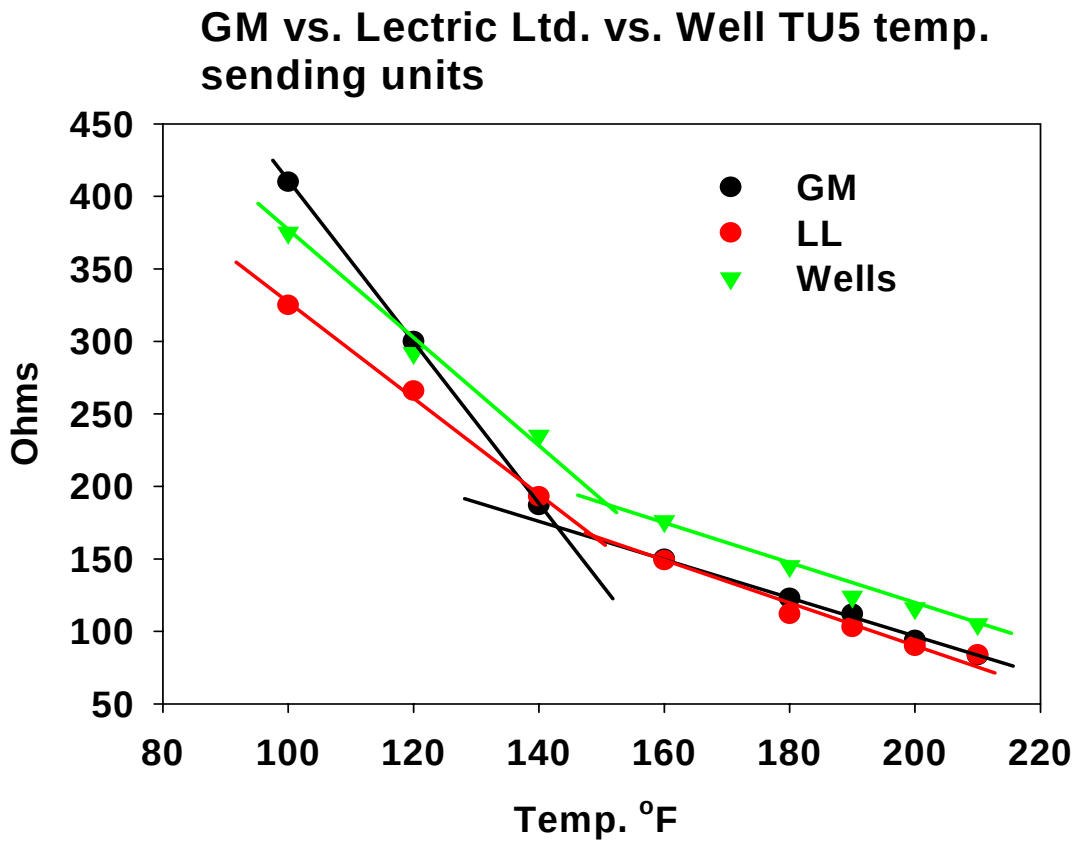
Note the **nonlinearity of the curve** for Tim's **original AC Delco** sending unit as well as those in the figure above. This is why using the variable resistor can produce misleading results as noted by 62Jeff below. At 212 ^{o}F all the units read between 80-84 ohms with the exception of the original AC Delco which reads 96 ohms.

62Jeff
"Remember that installing a variable resistor **lets you tune your gauge to be accurate for a given temp,** at the expense of accuracy in the other ranges."

Willcox Corvette
"You are 100 percent correct! **Adding resistance only makes the instrument correct at one setting!** Adjustable potentiometers are available from Radio Shack for about 5.00 or less if you want to go this route. Or once you know the resistance variable from chart I posted, you can purchase the needed resistor from the same place for about 1.00. This will dial you in for one temperature but the gauge is not linier and other readings will suffer."

MrD
"The LL and Wells sending units did not really match up every GM value but what I found interesting was the LL sending unit consistently has higher resistance values (or lower depending on how you view it) than the Wells unit."

Data supplied by Dennis (MrD)			
Temp	**GM Ohms**	**LL Ohms**	**Wells Ohms**
100	410	325	375
120	300	266	292
140	187	193	235
160	150	149	176
180	123	112	145
190	112	103	124
200	94	90	116
210	83.5	84	105

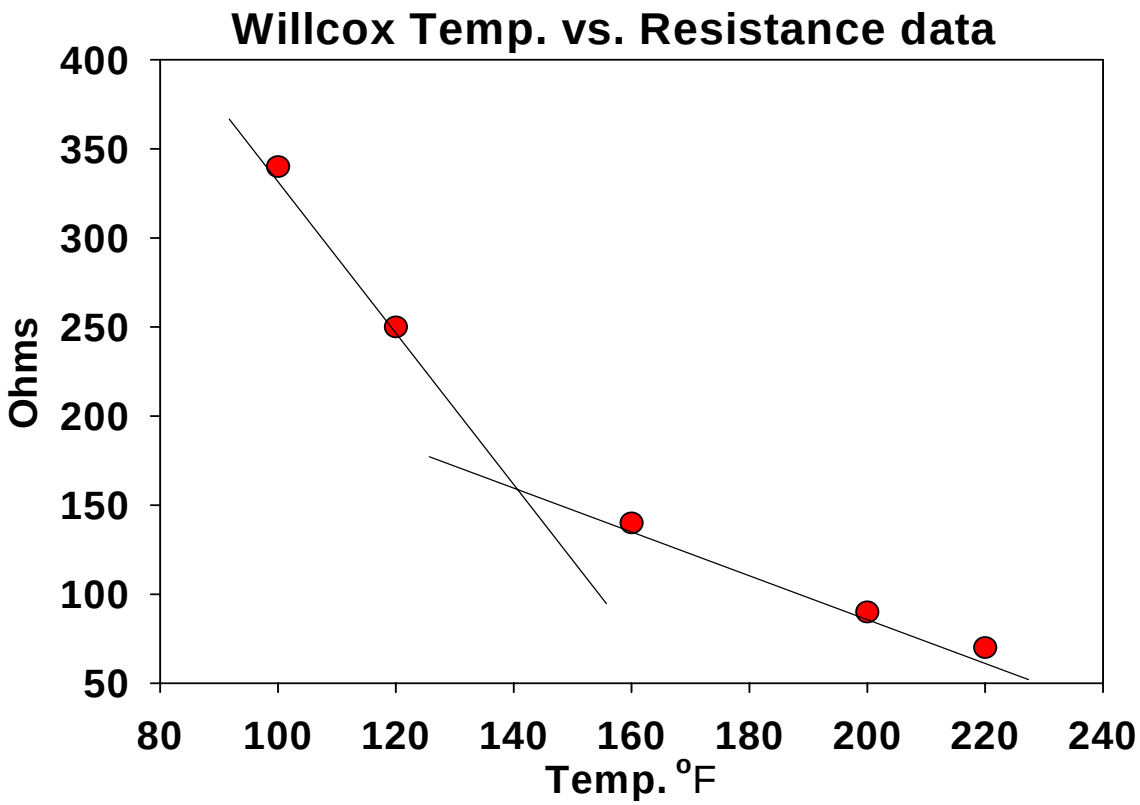


Above is Dennis' (MrD) **temp. vs. resistance** data plotted out. It appears the GM sender has a steeper slope over the 100° – 140° range whereas the slopes for the LL and Wells senders are similar but the LL sender reads about 40Ω-50Ω lower than the Wells. At 120°, the GM and Wells units are quite close. Over the 160-220° range the slopes for all three units are similar but the Wells reads about 25Ω higher than the GM and LL units which are quite similar.

Willcox Corvette
"You can check the accuracy of your sending unit by this scale."

220 degrees = 70 ohms
200 degrees = 90 ohms
160 degrees = 140 ohms
120 degrees = 250 ohms
100 degrees = 340 ohms

"Installing a resistor inline can drop the dash gage to where you need it but it will only make the gage accurate at that set point."



Barry K

"…BTW, the AC Delco sender unit pictured above may have been sold under the Delco name, but it's obviously a newer style sender unit and as you mentioned, probably identical to the others and most likely off the same production line as the others shown. It is NOT the same as a real original Delco sending unit. You can see it doesn't have the correct markings on it.

Here is a pic (below) showing three real, original GM Delco temp sender units. The one on the left was the one that went bad out of my '65, the other two are used units I located that are correct original units also from the 60's, not aftermarket replacements or new style Delco units. Finding used or NOS original units was the only was I finally found to get accurate temp readings when the first unit in my car went bad. I refused to go with the wired in resistor method for the simple reason as already mentioned by Jeff - it's only accurate at one temp."

JohnZ
The chances of teflon tape affecting the gauge reading are remote - the pipe threads are very sharp, and cut through the tape with little effort. Even if the tape did affect the grounding of the sender to the manifold, it would make the gauge read LOWER, not higher (higher resistance = lower gauge reading).

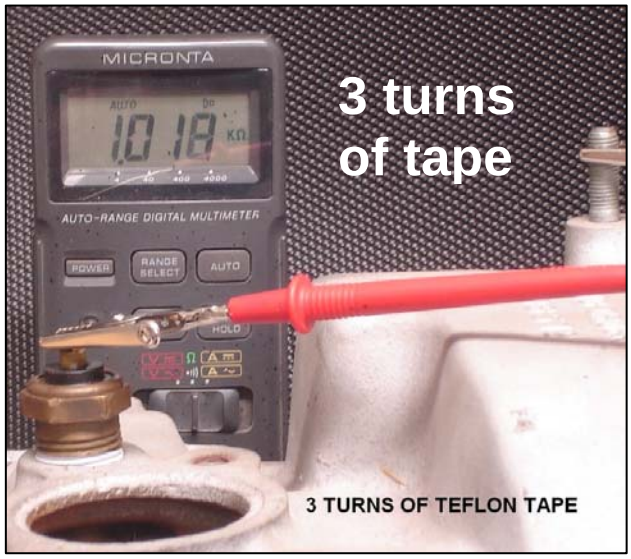
JohnZ
The original **GM #1513321** senders (that still work) are hard to find; I have a **"Standard" ST-6** in my '67, and it's right on the money - just lucky, I think.

Willcox Corvette
Teflon tape is one of the most over used tapes in the world IMHO. There is nothing wrong with using Teflon tape on your sender it's how you use it that counts!

Teflon tape us supposed to be used on the first two or three threads and is not used as a sealing tape! It is used as a lubricant to allow the pipe threads to seat further in the mating surface.

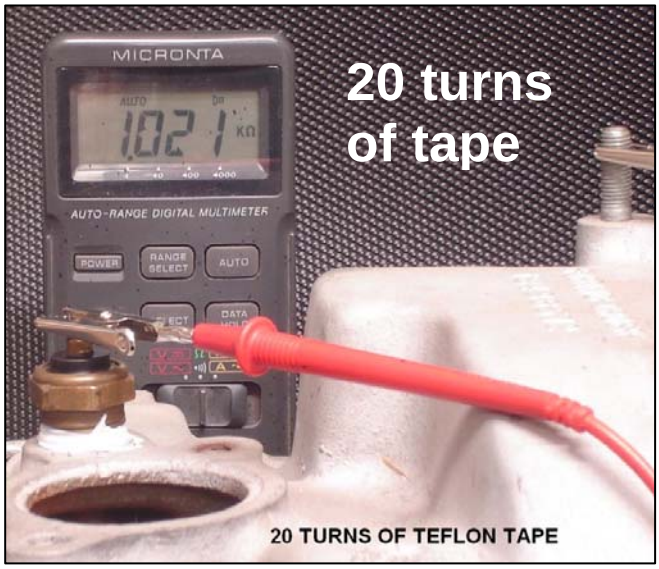
Willcox Inc

Buns (Tim Welsh) - Teflon Tape Myth-----Busted!



Quote:

> Originally Posted by **JohnZ**
> *The chances of teflon tape affecting the gauge reading are remote - the pipe threads are very sharp, and cut through the tape with little effort. Even if the tape did affect the grounding of the sender to the manifold, it would make the gauge read LOWER, not higher (higher resistance = lower gauge reading).*



These pics tell the story:

You have to love data!!!! DZ

Continuing info on the subject:

John Z

Quote:

> Originally Posted by **62Jeff**
> *Is the Temp gauge basically measuring current through the Pink/Black wire, to Ground via the Green wire?*

Yes, it is. The black/pink wire feeds a constant 12V to a coil in the gauge, and the other end of the coil is connected through the green wire to the temp sender. The temp sender contains a thermistor (variable-resistance element) whose resistance to ground changes with temperature. As the temperature goes up, the resistance goes down, increasing current flow through the coil to ground, which moves the needle to the right.

With the key in "on" or "accessory", disconnect the green wire at the sender - the gauge should peg to full cold (infinite resistance). Then ground the sender wire connector to the engine, and the gauge should peg to hot (zero resistance).

The green wire goes through the multiple connector on the engine side of the fuse block, and those terminals frequently become corroded, which will screw up the gauge reading.

John Z

Quote:

> Originally Posted by **62Jeff**
> *Thanks for everyone's replies.*
>
> *Why is the gauge grounded to the cluster, if it's reading the ground through the temp sending unit?*

Because there are two coils in the gauge, and both ends of the circuit require a ground reference. **The diagram below is for C1 or C3 fuel gauges, but the circuit is the same as that used in the temp gauge - 12V to the gauge, and variable resistance to ground at the sender end.** The explanation of how the circuit works below is from my CE article on fuel gauge diagnostics, but it **also applies to how the temp gauge works:**

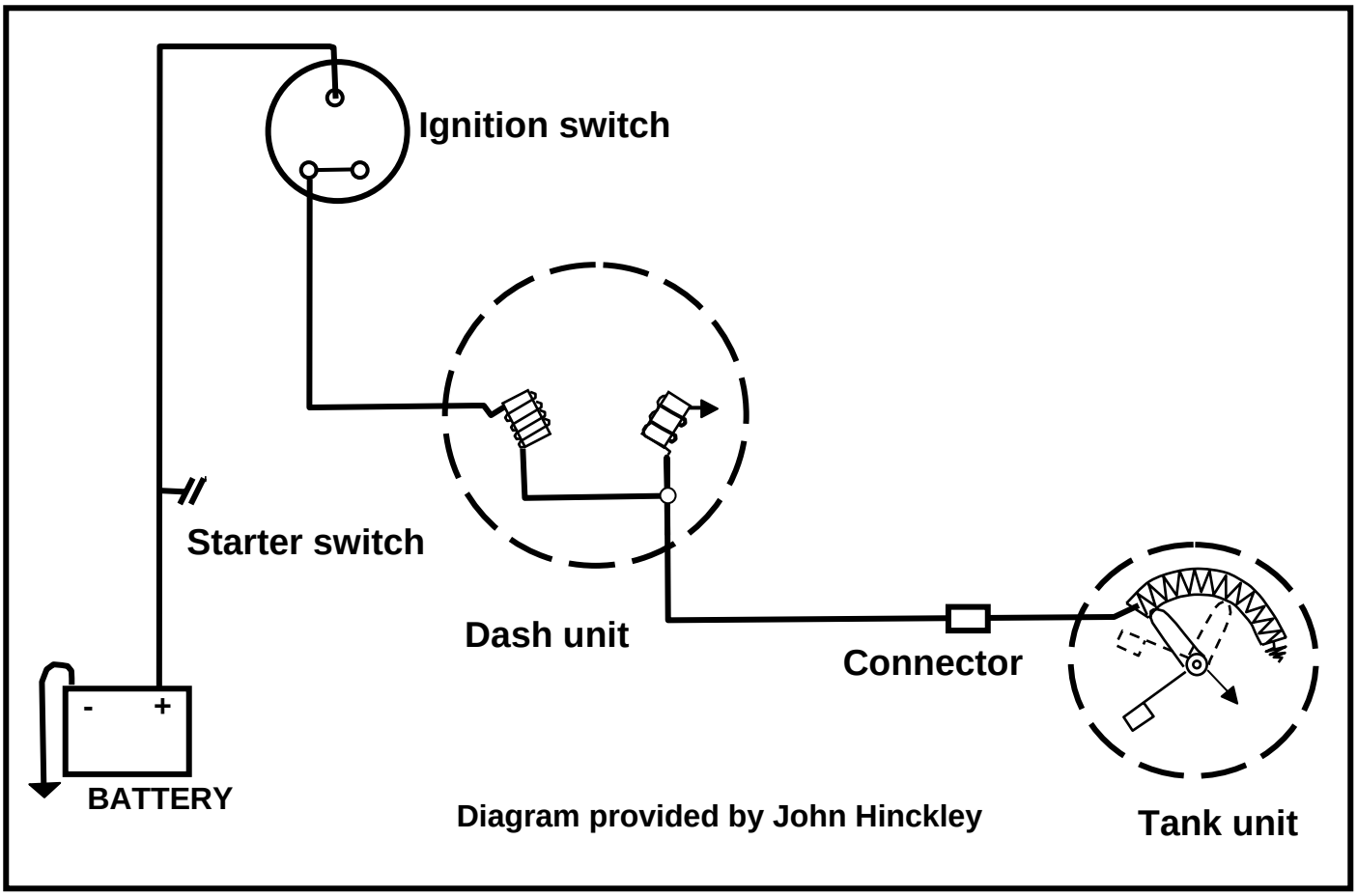
Dash Gauge: The dash fuel gauge has two coils in it – the limiting coil on the left, and the operating coil on the right, each with different resistance; the pivoting needle has a counterweight on it that holds the needle at “empty” unless magnetic attraction from the operating coil moves it. The limiting coil gets 12 volts from the ignition switch, and passes it to the operating coil, which is grounded through the gauge case.

Tank Sending Unit: The sending unit contains a wirewound variable resistor, and a contact wiper arm connected to the float rod and to ground; when the tank is empty, the wiper contact is at the beginning of the resistance, providing zero ohms to ground, and when the tank is full, the wiper contact is at the end of the resistance, providing 30 ohms (C1) or 90 ohms (C3) of resistance to ground.

How It Works: When the key is “on”, current is supplied to the limiting coil, and to the operating coil, through their common connection. From here, the current can go two ways – through the operating coil to ground, or through the tan wire to the variable resistor in the sending unit to ground.

When the tank is empty, the contact wiper in the sending unit cuts out the variable resistor entirely, so most of the current from the gauge will pass to the sending unit and directly to ground while very little current will pass through the operating coil in the gauge, causing the gauge to show “empty”.

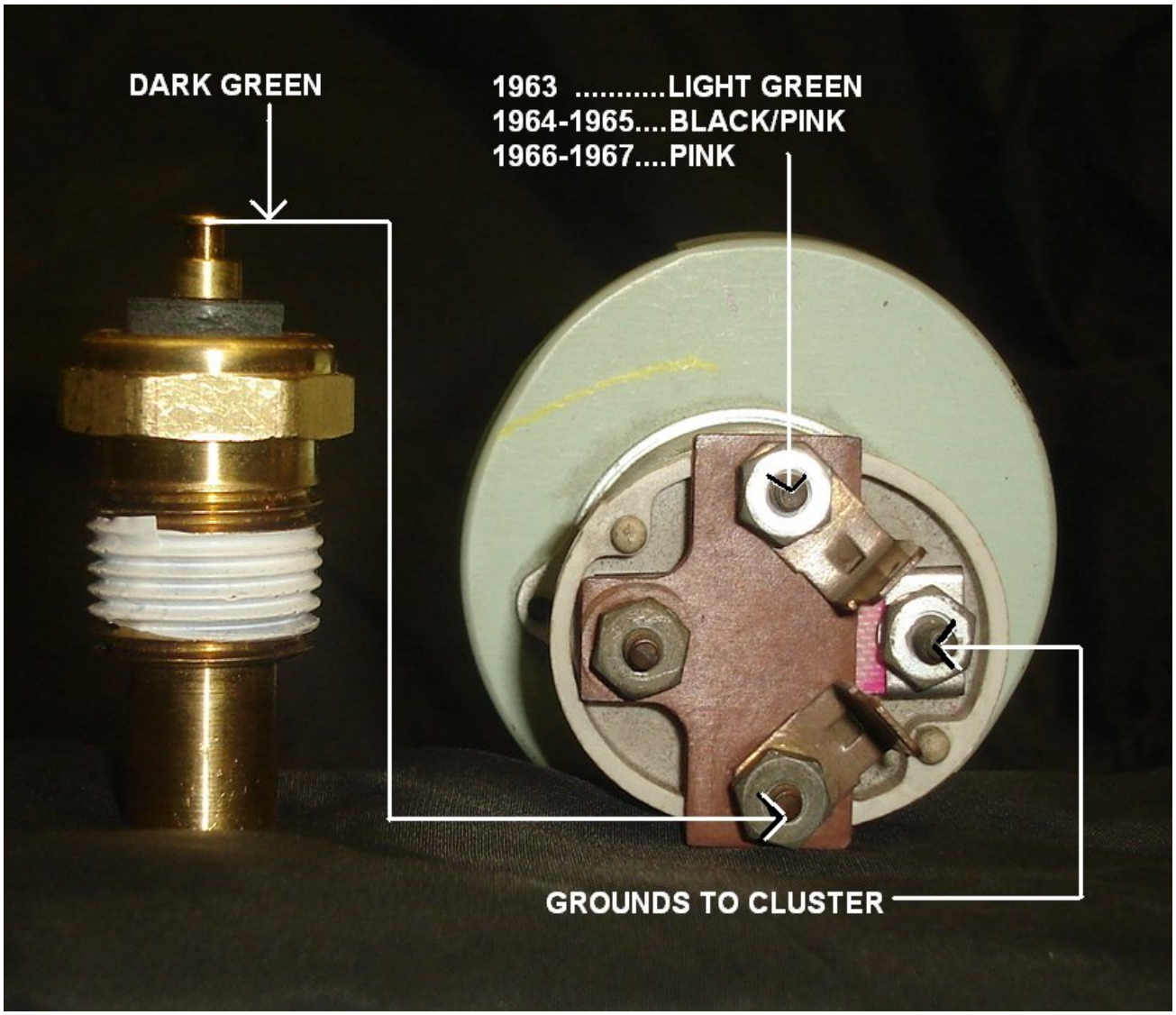
When the tank is full, the contact wiper in the sending unit is at the other end of the variable resistor, placing more resistance between the tan wire and ground; this forces more current through the operating coil in the gauge to ground, which attracts the gauge needle and moves it to the “full” side of the gauge. This is a simple resistance circuit, dependent only on power to the gauge, variable resistance in the tank unit, and good grounds at both ends.



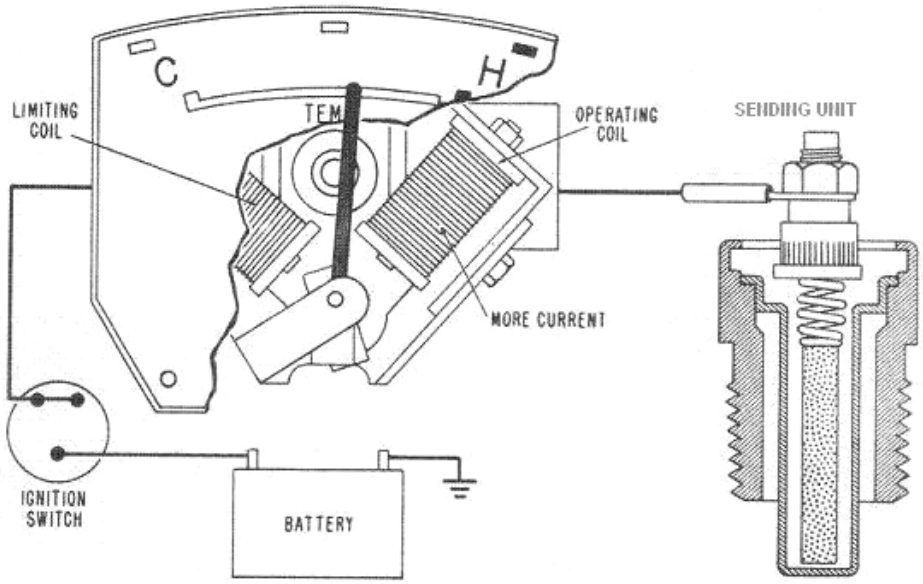
Buns

Jeff, I'm wondering if he has the gauge spade terminals in the wrong place. I think it's possible to do this. My gauge is not installed, so I will take a look.

Here is a pic of what it should look like.



Also, instead of working on my car, I put this together:



THE TEMPERATURE GAUGE HAS 2 COILS SPACED 90 DEGREES APART, WITH AN ARMATURE AND INTEGRAL POINTER AT THE INTERSECTION OF THE COIL AXIS.
THE SENDING UNIT HAS NO MOVING PARTS AND IS BASICALLY AN ELECTRICAL RESISTOR WHICH CHANGES RESISTANCE WITH CHANGES IN TEMPERATURE.
THE LIMITING COIL IS CONNECTED TO 12 VOLTS AND TO GROUND.
THE OPERATING COIL IS CONNECTED TO 12 VOLTS AND TO THE SENDER. THE RESISTANCE ALLOWS MORE CURRENT TO FLOW THRU THE OPERATING COIL AS THE ENGINE WARMS UP, CAUSING THE OPERATING COIL TO BALANCE THE CONSTANT MAGNETISM OF THE LIMITING COIL.

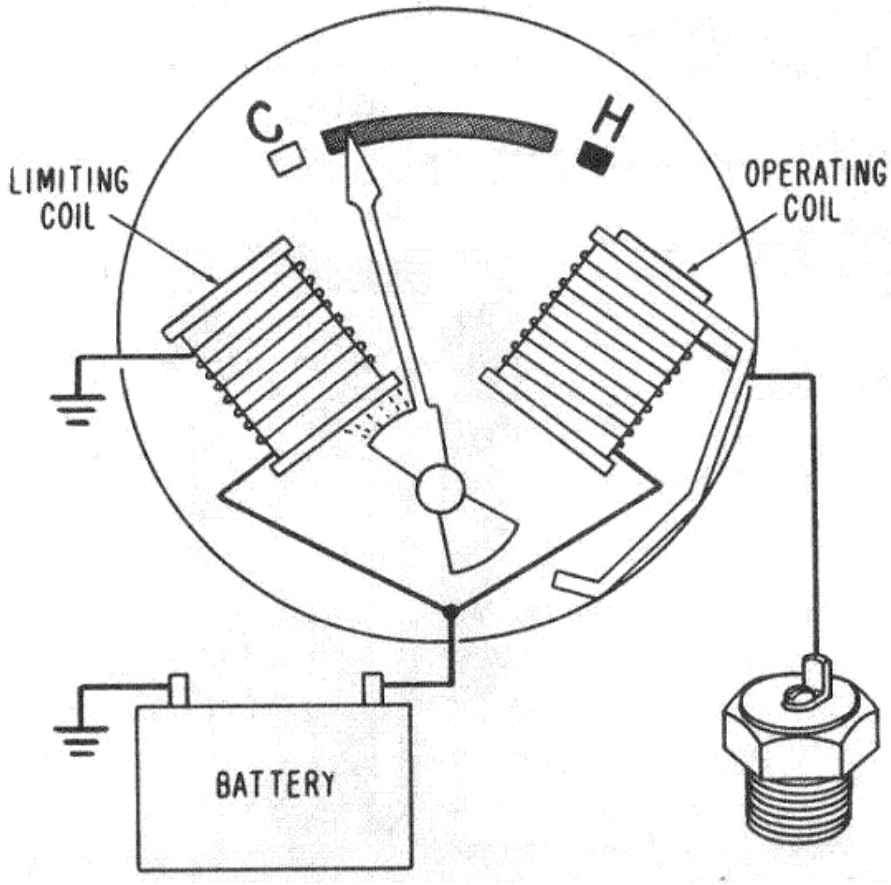


Diagram by
Tim Welsh
a.k.a. “Buns”

Buns

I checked my temperature gauge, and yes, that brown insulator can go on 4 different ways, so I think maybe you could stick a camera up there and snap a pic of the connections.

JOliver

Also, the resistor that is under that fiber insulator has to be installed correctly as well, it is pictured above and goes from the 9 o clock to the 3 o clock, there are 2 washers that if not put on to space that resistor it doesn't make contact.

There is also a fiber gasket that is not shown above.

Jason