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OIL, BRAKE & EGR WARNING LAMP CIRCUITS

The TR 250 had a total of 6 "warning" lights - Alternator, brake failure, low oil pressure, turn signals, hazard flasher, and high beams. The later TR6 models had two additional warning lights, - fasten seat belts and EGR. This chapter will cover the low oil pressure, brake failure, and EGR lamps, while the remaining lamps will be covered in other chapters.

OIL AND BRAKE WARNING LAMPS

Figures 1 and **2**, below, depict the wiring scheme for the low oil and brake warning lamps for the TR 250 and the '69 - '72 TR6. Electrically, they are identical, the only difference being the use of a splice in the TR6 models in place of the bullet/sleeve connection used in the TR250.

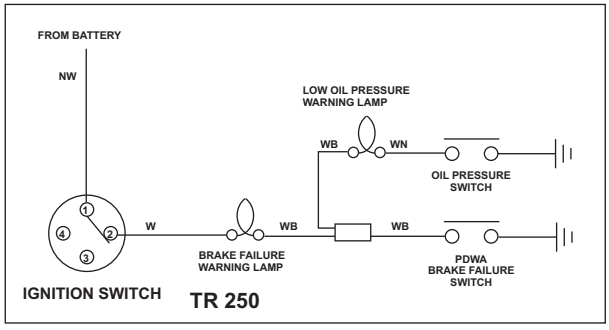


FIGURE 1

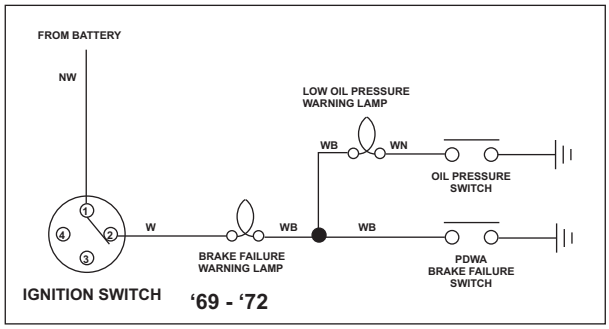


FIGURE 2

These are somewhat peculiar circuits, in that the oil pressure switch operates both lights dimly, while the brake failure switch operates only the brake failure light, and at full brilliance. As peculiar as it seems, there is a good reason for this. When you first turn the key on to start your car, the engine oil pressure is low, so the oil pressure switch is closed. The oil warning light will be on as a means of verifying that the bulb is good. When you start your car, you should be in the habit of checking the bulb to be sure that it does work. The brake failure switch, on the other hand, will never be closed unless there has been a brake failure, so there is no way to arrange for the brake failure light to come on when you turn the key on if the light were to be wired only to the brake failure switch. By wiring the lights as shown, both bulbs can be tested at startup. Brake failure being considered the most severe event, the designers chose this bulb to be the one that is at full brilliance when lit. **Figure 3** below illustrates what happens when the key is initially turned on.

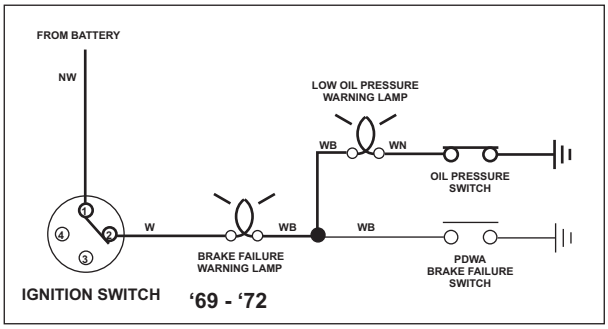


FIGURE 3

With the key on and the oil pressure not yet up to normal, current flows from the battery, through the ignition key, through the two bulbs in series, through the oil pressure switch, and then to ground. The two bulbs will each receive 6 volts, one half of their rated 12 volts, and will be lit rather dimly. This is also the same situation that will occur should the oil pressure drop after the engine has been running. Rather then seeing just the brightly lit oil pressure lamp, you will see both lamps lit. This could be confusing, but shouldn't be, as you have the oil pressure gauge to monitor. In fact, barring a catastrophic oil pump failure, you shouldn't be surprised to see the lamps come on, as you should have been watching the gauge to begin with.

Figures 4 and **5**, next page, illustrate what happens when the brake failure switch is actuated. As you can see, it doesn't matter then what position the oil pressure switch is in. With the brake failure switch closed, ground is applied to the high side of the oil lamp, so having a ground on the low side or not makes no difference.

The oil pressure switch, by the way, is a SPST, momentary, normally closed switch. Which means the switch is closed when it is out of the car and on the bench,

and it is only open as long as oil pressure is applied. The contacts do not retain their position in the absence of oil pressure as would a maintained switch.

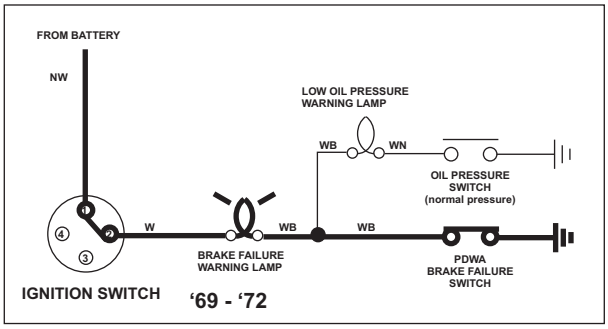


FIGURE 4

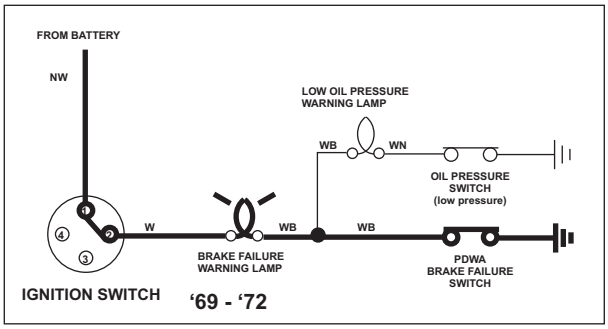


FIGURE 5

Figure 6 below show the same circuit for the '73 - '75 TR6. The circuit is identical to the circuits above, except for the oil pressure switch configuration. In this circuit, the oil switch is a SPDT momentary switch, with one normally open and one normally closed contact. In engineering terms, this is a momentary form C switch.

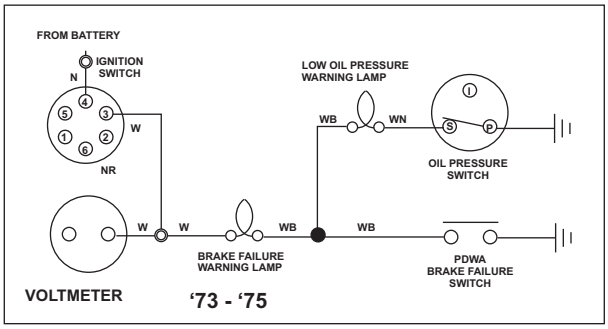


FIGURE 6

Figures 7 and **8**, right, depicts the wiring arrangement for the '76 TR6. At least I think it does! To the best of my knowledge, there is no published schematic anywhere that correctly depicts this aspect of the '76 TR6 wiring. ***Every*** schematic I've seen has had a glaring error/ommision in this area of the wiring. The information I've shown here comes from talking with '76 TR6 owners via the Internet, and piecing together the information received. One owner confirmed part of the wiring, while another confirmed a different part, and another confirming yet another part. This circuit differs from the previous circuits in two ways: a different approach to testing the bulbs, and the addition of a switch to warn if the handbrake is on.

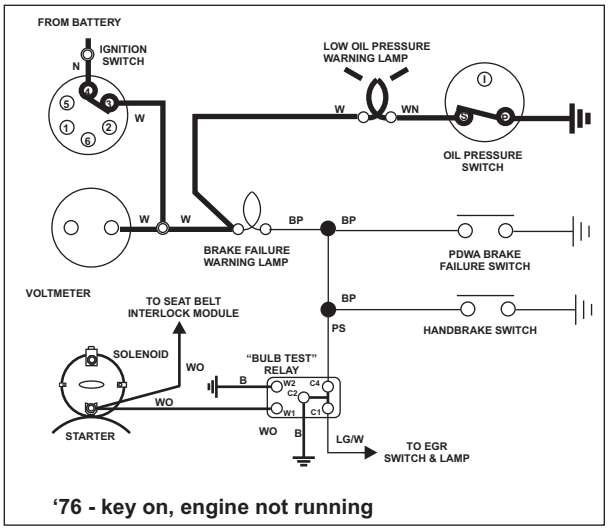


FIGURE 7

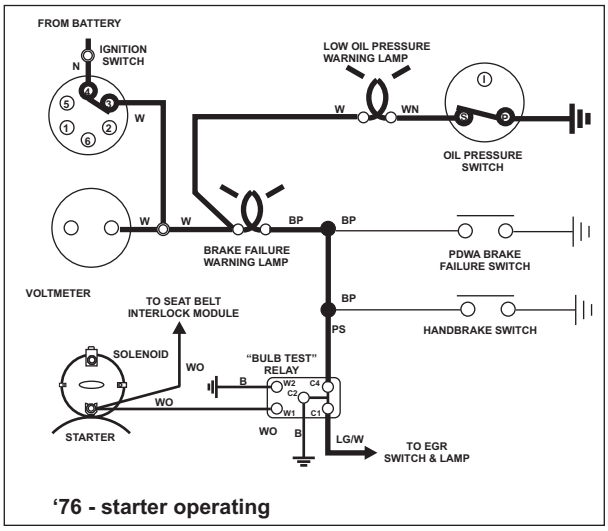


FIGURE 8

To implement the new testing scheme, power to the low oil pressure lamp was moved to the white wire from the ignition switch. Now, when the ignition key is turned on, but the oil pressure is not yet up to normal, the low oil pressure light will be on at full brilliance, as power is no longer routed through the brake failure lamp. Thus, if the low oil pressure lamp doesn't come on, you know there is a problem in the circuit, most likely a bad bulb - just as before, but the indication is a bit brighter than before, and is independent of the brake failure warning lamp.

The new hand brake warning switch operates exactly the same as the brake failure switch. If the brake lamp is on after the engine has started, you either have the hand brake on or a failure in the brake system.

The brake warning lamp is tested by either the fact that the handbrake is on, or by the operation of the bulb test relay. This relay (which I have labeled "bulb test relay" because it serves no other function in a '76 model) is operated by a direct connection to the starter motor, so that the relay is energized any time the starter motor is operating. When the relay is energized, contacts C1, C2, and C4 are shorted together inside the relay. Contact C2 is connected externally to ground, which then connects the wires to relay terminals C1 and C4 to ground also. When this happens, the effect is the same as if either the hand brake or the brake failure switch has operated, and the brake failure lamp is lit at full brilliance.

EGR SERVICE INTERVAL WARNING LAMP

The '76 TR6 added an EGR service warning light to remind the driver when it is time for the EGR system to be serviced. The circuit diagram for this is shown in **figure 8** below. To implement the warning light circuit for the '76 model year, the speedometer cable was split into two pieces; a longer piece from the transmission to a small service interval counter mounted under the hood, atop the driver's side (LH) footwell and next to the windshield wiper motor, and a smaller piece from the service interval counter to the speedometer. Inside the counter, the speedometer cable operates a cam through a set of gears. After 25,000 miles have been driven, the cam actuates a switch, closing it to provide a ground to the "service EGR" warning lamp. The contacts stay closed until manually reset by a service technician with a special key. If you don't have the special reset key, it's not real difficult to "jury rig" one.

As a side note, if you should want to remove the counter, the one-piece speedometer cable from the earlier models will fit perfectly.

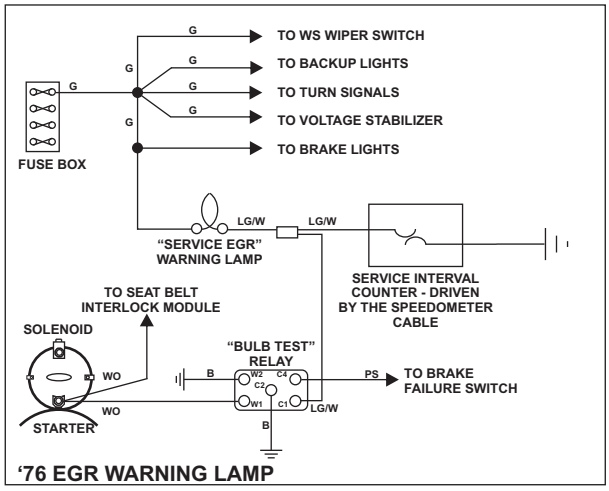


FIGURE 8

The same bulb test relay used in the oil and brake warning circuit is also used to test the EGR warning lamp, as described previously. **Figure 9** above right, shows the operation of the circuit when the bulb test relay is operated.

With the relay energized, the light green/white wire from the EGR bulb is grounded through the C1, C2, and C4 contacts of the relay, and the bulb is lit. Every time you start the car, the bulb is illuminated as a means of checking that the bulb is operable. Much ado over nothing actually, as the bulb only informs you that you have driven over 25,000 miles since the last time it came on and you had the counter reset, nothing that your odometer won't tell you. It's actually quite effective, though, as most folks, particularly those that aren't mechanically inclined, will be quite bothered by a warning light shining, and will more than likely take the car to a shop to find out what the trouble is.

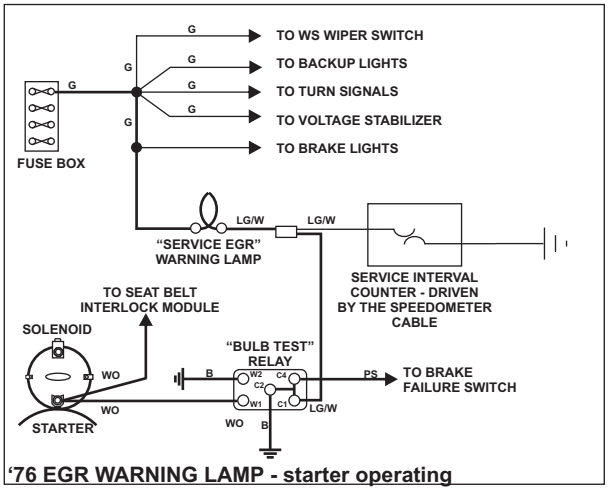


FIGURE 9

Figure 10 below illustrates the operation of the circuit when the counter has reached the magic number. At that time, the contacts inside the counter will close, illuminating the bulb.

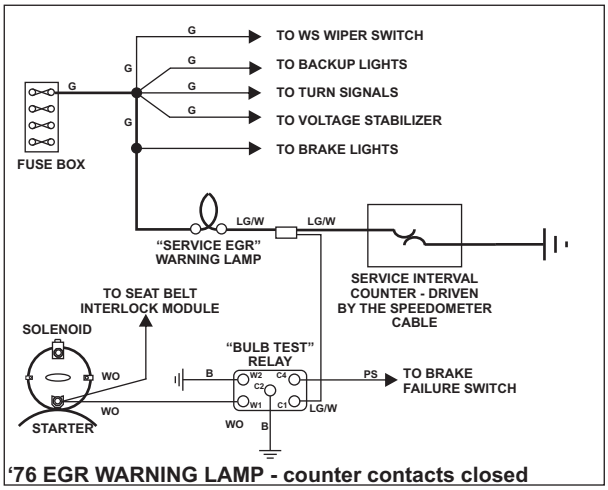


FIGURE 10

In this case, current flows from the "green" fuse, through the bulb, and then to ground through the counter contacts.

TROUBLESHOOTING

OIL AND BRAKE WARNING LAMPS

These lamps receive power from the ignition switch via a white wire. The ignition switch also feeds the ignition coil, alternator warning lamp, and the "green" fuse. It is assumed that you have power to these other devices, so no need to check for power at the ignition switch (if you didn't have power to the white wires, I'm assuming that you would be fixing that problem rather than this one)

TR 250 and pre 1976 TR6:

Step 1). The most obvious starting point would be to check the bulbs to see if they are bad. These bulbs are a bit hard to get to, though, so other, easier, tests should be performed first. With the key on but the engine not running, pull the white/brown wire from the oil pressure sender and connect it to ground. If the lights come on, you have a bad oil pressure switch. If not, either one or both of the bulbs are bad, no power is getting to the bulbs, or there is a break or bad connection in the wiring, which will need to be repaired. Go to step 2.

Step 2). Replace the W/N wire from the oil pressure switch, and remove the white/black wire from the pressure differential warning actuator (PDWA) switch. Connect this wire to ground. If the brake failure lamp now lights, the problem was in the oil pressure switch wiring or a bad bulb. If not, the brake warning bulb is bad, no power is getting to the bulbs, or there is a break or bad connection in the wiring. Go to step 3.

Step 3). If the bulbs didn't light in either of the above tests, the next step should be to test the brake warning light bulb. To do this, you will have to remove either the speedometer or the tachometer to get access to the lamp. If the bulb is good, you have a break in the white wiring to the lamp holder, or the lamp holder is bad, and will need to be repaired or replaced. See the lamp wiring test section later in this chapter for further testing details.

1976 TR6 only

Oil pressure warning lamp:

Unlike the earlier models, which had no way of operating the warning lamps for testing if the oil pressure switch failed, both of the failure warning lamps on the '76 model are tested every time the engine is started, and the brake failure warning lamp is tested every time the hand brake is operated. Consequently, the testing for this model has two directions - one if neither of the lights work, and another if only one of the bulbs is inoperable.

A). If neither light works when you turn on the key, crank the starter, or operate the hand brake, there is a problem in the wiring from the ignition switch to the lamps. As stated previously, it is assumed that the other loads fed from the ignition switch via the white wire are working properly, therefore, there must be a break or a bad connection in the white wire from the ignition switch to the warning lamps, which will need to be repaired. It is, of course, possible that you have multiple problems, so if the white wire isn't the problem, proceed with the individual steps outlined below for each warning lamp.

B). Only one lamp is inoperable:

Low oil pressure warning lamp:

Step 1). With the ignition key on, remove the white/brown wire from the oil pressure switch, and touch it to ground. If the light comes on, the pressure switch is bad. If not, go to step 2.

Step 2). Remove the oil pressure warning light bulb and test the bulb. If the bulb is good, there is a break or a bad connection in the wiring to the lamp. See the lamp wiring test section below for further testing details.

Brake warning lamp:

Step 1). Does the EGR lamp work properly? If not, go to the EGR repair section. If so, go to step 2.

Step 2). Does the brake light come on when the handbrake is operated (with the ignition key on)? If so, there is a break or a bad connection in the purple/slate wire to the bulb test relay. If not, go to step 3.

Step 3). Remove the brake warning light bulb and test the bulb. If the bulb is good, there is a break or a bad connection in the wiring to the lamp. See the lamp wiring test section below for further testing details.

EGR SERVICE WARNING LAMP

The EGR warning lamp receives power from the "green" fuse. The WS wipers, WS washer, turn signals, gauges, and heater fan all receive power from this fuse, so if ***ANY*** of these items work, then you have power at the fuse. If ***NONE*** of these items work, go to the power distribution chapter and resolve the power issue before proceeding.

Step 1). With the hand brake off, start the engine and observe the brake warning lamp. If neither the brake warning light nor EGR lamp works while the starter is engaged, there is a problem with the bulb test relay circuit. Go to step 2. If the brake lamp works but the EGR lamp doesn't, go to step 4.

Step 2). Remove the white/orange wire from the relay and lay aside. There will be no power on this wire during this test, so there will be no danger of sparks unless you forget to replace it before you start the car later. You ***MUST***

remove this wire before proceeding with this test, however, as severe damage may result to your wiring if you don't. The other end of this wire is attached to the starter motor. The internal resistance of the starter motor is near zero, approximately ½ ohm, which will look like a short circuit to ground for the test lead you will be hooking up to the relay.

Turn the ignition key on and connect a short jumper from the green wire side of the "green" fuse to the terminal where you just removed the W/O wire (should be the W1 terminal, but this very easily could have been swapped at some time in the past by a previous owner). If the relay circuit is working OK, you should hear the relay click, and see both the brake and the EGR lamp light up. If the relay doesn't click, go to step 3. If it clicks, but the lamps don't light up, go to step 4.

Step 3). If the relay didn't click, find the "W?" terminal on the relay with the black wire (should be W1, but may be W2) and connect this terminal to a good ground with a short test lead and repeat the above test. If the relay clicks, you have a bad ground to the relay. If not, the relay is defective.

Step 4). If the relay did click in step 2, but the lights didn't operate, or if only the brake light operated in step 1 remove the LG/W wire from the relay and connect it to ground with the key on. If the light doesn't work, there is a problem in the wiring or the bulb is bad. If the light does work, go to step 5.

Step 5). Reconnect the LG/W wire to the relay, and connect a short test lead between the C? Terminal with the black wire and ground (should be C2, but could be C1 or C4). Repeat test 2. If the bulb now lights, there is a problem with the ground wire to the relay, If not, the relay is bad.

Step 6). If the EGR light works in the above tests, but doesn't work when the mileage has exceeded the 25,000 mile set point, either the counter is defective or there is a break in the wiring from the lamp to the counter. With the key on, pull the wiring connector from the counter and short the pin with the LG/W wire to ground. If the bulb lights, the problem is the counter. If not, the problem is in the wiring.

PRESSURE DIFFERENTIAL WARNING ASSEMBLY (PDWA)

At the time of this writing, a new PDWA costs in the neighborhood of $350 - $400! Not something to be purchased on a whim. Fortunately, the PDWA is a very simple piece, and repairs are quite simple to make. In construction, the PDWA is nothing more than a double ended piston sliding in a simple tube. Each end of the tube is plumbed to the hydraulics of one of the dual brake systems - one end connected to the front brake lines, and the other end connected to the rear lines. See **photo 1** below for details on the construction.

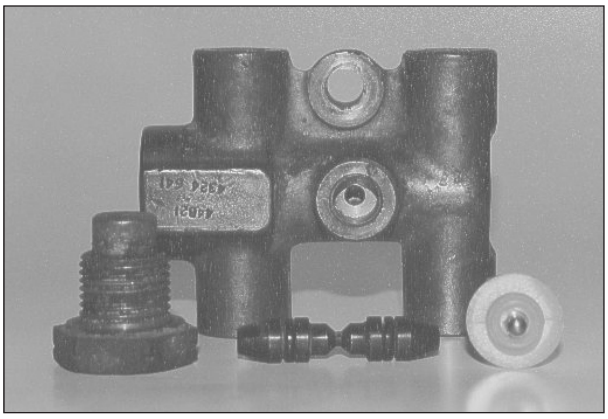


PHOTO 1

In operation, the PDWA is also quite simple. As long as each of the brake systems - front and rear - are intact, pressing on the brake pedal will pressurize each system equally. If, however, one of the systems should lose fluid, either through a slow leak or a brake line rupture, pressing on the brake pedal will not pressurize that system. In this case, the pressure in the intact system will cause the piston to move towards the un-pressurized system. As shown in **figure 11**, below, when the piston is moved off-center, it operates the switch plunger, grounding the wire lead to the switch. As stated in the previous sections, grounding of the switch lead causes the warning light to operate.

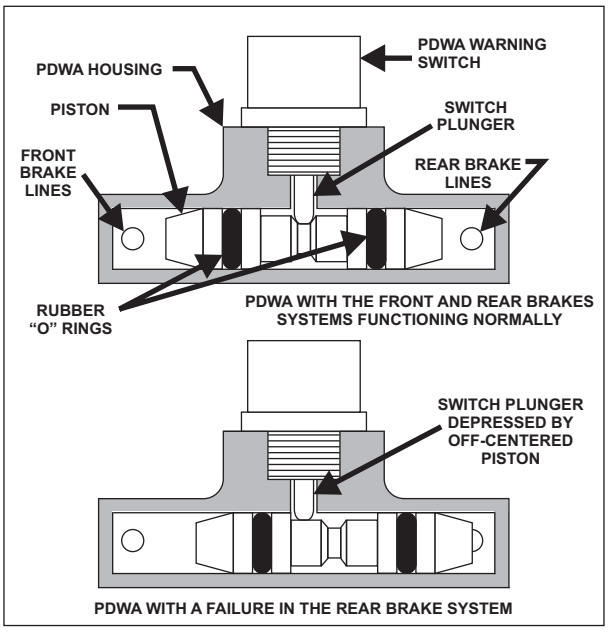


FIGURE 11

The most common problem with the PDWA is misadjustment of the piston, usually after doing brake work that requires the brakes to be bled. As you open the brake bleeders to remove air, the low pressure in that side of the brake system causes the piston to move off center. In this case, all that is needed is to open one of bleeders in

the opposite brake system while pressing the brake pedal just enough to cause the piston to re-center.

If the PDWA does need work, all that is normally required in the way of repair is a disassembly and a thorough cleaning. In severe cases of internal corrosion, it may be necessary to bore out the cylinder and re sleeve it. The condition of the piston is usually of no real concern, as it will never, hopefully, be operated again, at least not until the next time you bleed the brakes. It is only important that the rubber "O" ring fit well, both to the piston and to the bore. The "O" rings are the only things that rub within the cylinder. As long as they make a good contact with both the cylinder and the piston, and provide a pressure seal between the two brake systems, all is OK.

REPLACEMENT UNITS

If you don't have a PDWA, or if yours is really beyond repair, replacements are usually easy to come by from another make of British car. There is nothing marque specific about them, other than the mounting details and type of fittings - metric vs SAE. An MGB unit will fit a TR quite nicely. As a matter of fact, it would not be at all difficult to have one manufactured for you, if you know a reasonably priced machine shop, or have your own shop.

ELIMINATING THE PDWA

Often, out of frustration, owners are tempted to lift the lead to the PDWA to get the warning light to go out, rather than trying to get the piston re-centered. Or, if the PDWA is really bad, it might be tempting to just eliminate it altogether. Personally, I don't recommend this approach for a couple of reasons. First of all, if you are driving your car at low speeds, especially as you drive it in and out of the garage and around the neighborhood while working on it, it doesn't take much braking power to stop the car. You might not even notice that one of the brake systems has failed. Once you get out on the highway, and at highway speeds, and you need to make an emergency stop, the loss of one of the brake systems will be very much noticed, especially if the front system is the one that failed. The advance warning that the PDWA gives you could save your life.

Secondly, if the piston is off-centered, causing the light to stay on, and you just disconnect it, you have no reason at all to believe that the "O" rings are still good and the two brake systems are indeed isolated from one another. If not, and you have a failure of one system, just as soon as you put your foot down hard on the brake pedal, leakage through the "O" rings will quickly reduce the pressure to the good side, leaving you with no brakes at all!

If you do eliminate the PDWA, it is ***ABSOLUTELY VITAL*** that you ensure complete separation of the two braking systems, front and rear! Either remove the PDWA altogether, and reconnect the brake lines - front to front, and rear to rear - or plug the cylinder between the two systems. As a matter of fact, anytime you do brake work on your car, it would be a good idea to check the operation and isolation function of the PDWA. You should be replacing your brake fluid on a regular basis anyway, so that would be a good time to check the PDWA. It isn't very hard to get to, and disassembly is not at all difficult.

LAMP WIRING TESTS

Testing the warning lamp wiring can be a bit difficult, as the wiring is bound up in the wiring harness, and there is a rubber boot over the bulb holders. **Photo 2** below shows a bulb holder that has been removed from the car, and the rubber boot pulled back. As you can see, one of the wires is connected to the shell of the lamp holder, while the other wire is connected to the center conductor, or "bullet" assembly. By pushing the center wire into the holder, the bullet can be pushed out for access.

The prongs which hold the lamp in place are isolated from the body of the holder (shell) so the wire that is connected to the shell is also insulated from the tachometer, speedometer, or other bulb holder.

Once you have the bulb holder out, and the wires exposed, it is a simple matter to use a voltmeter or test lamp to look for the presence of power, or an ohmmeter to test for continuity on the wire.

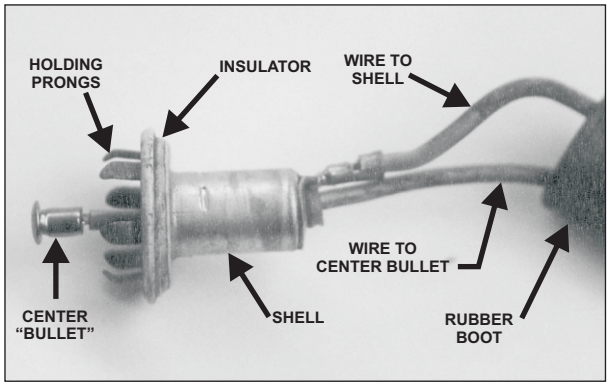
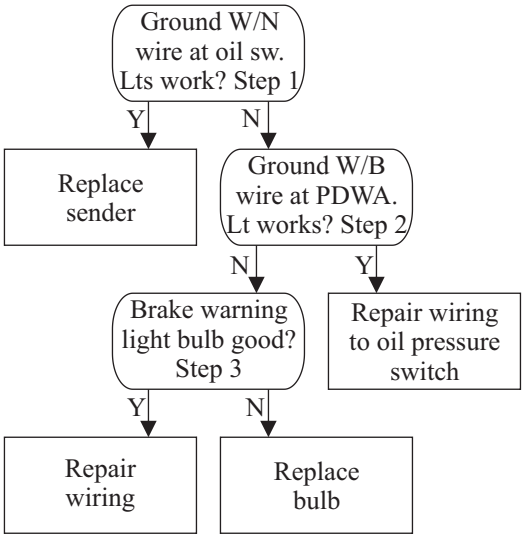


PHOTO 2

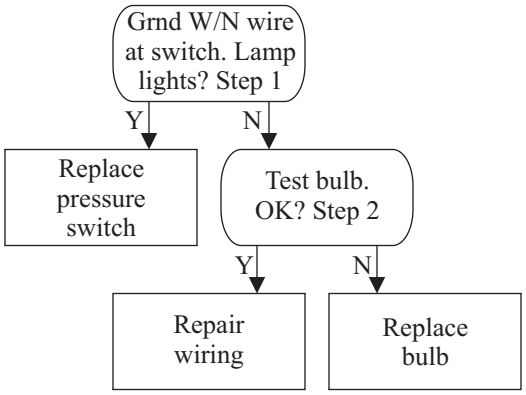
TROUBLESHOOTING FLOW DIAGRAMS

OIL AND BRAKE WARNING LAMPS TR 250 - '75 TR6

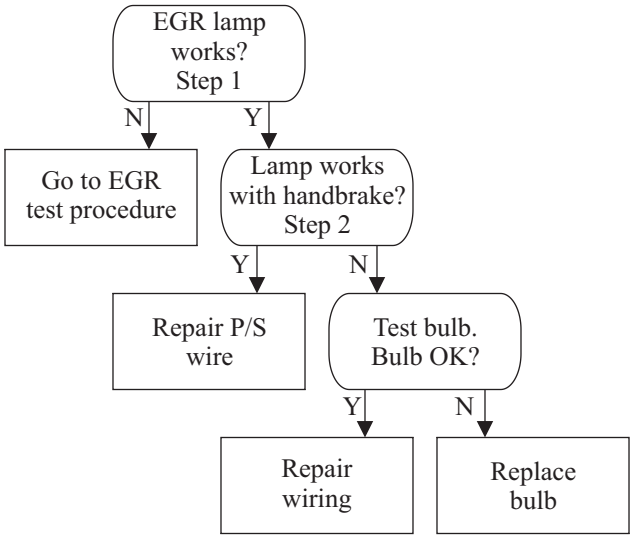


OIL AND BRAKE WARNING LAMPS '76 TR6

OIL PRESSURE LAMP



BRAKE WARNING LAMP



TROUBLESHOOTING FLOW DIAGRAMS

EGR SERVICE WARNING LAMP