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TO START OR NOT TO START
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About this time of year, I see a more frequent occurrence of engine cranking problems in the shop. Once the ambient temperature starts to drop, the starting circuit gremlins come out. Generally, there are two kinds of cranking problems: no-crank and slow-crank. The slow-crank problems are tougher to diagnose and are usually the result of more than one problem. In this article, I will describe some simple procedures to help troubleshoot problems with the battery portion of the starting system, as well as the proper way to jump start any BMW.

A good plan for troubleshooting any poor cranking problem should start with a strong word of caution. Don't jump to any conclusions. Too many times a battery is replaced only to have the starting problem return within the first week. Begin with the simple things first. Are there any visibly bad connections at the battery terminals, starter solenoid or ground connections on the engine block? Check to see that the alternator belt is not loose and therefore not providing a sufficient system charge. How about the condition of the battery terminals? Are the terminals coated with a build up of corrosion? Are the terminals secure? Is the battery filled to the proper level with electrolyte? Is the battery even the correct size and type for your BMW? Check the cold cranking amperage (CCA) rating of the battery and compare it to the recommended size listed in your owner's manual. If all of these things are good, then you may simply have an old or weak battery. However, if the battery is relatively new (2 years or newer) and won't crank the engine, you may be facing a number of gremlins that are causing the battery's weakened state. Some examples might be an alternator or voltage regulator problem, a starter motor or starter bendix problem or the dreaded parasitic electrical system drain.

The most logical thing to do at this point if nothing simple is found is to test the battery. You need to eliminate a few of the unknowns and the battery is the best place to begin when dealing with the starter circuit. The battery must first be eliminated as the problem since it provides the voltage needed to force current through the starter motor. Without sufficient voltage, especially under load, any other tests will be inaccurate.

On batteries with removable caps (older BMW batteries and most aftermarket replacement types) look for a bad cell. Remove the caps and watch the cells while a helper cranks the engine. If any cell "boils" when you try to start the engine, you are done - and so is the battery. (Please protect your skin and eyes when working around any battery). If there is no boiling, you will need to check each cell with a hydrometer (available for under \$15.00 at any local parts store). Uniformly low readings may simply mean the battery is discharged, through no fault of its own. If specific gravity is below 1.225 on all cells (75% of full charge), the battery needs to be recharged before further testing. It is too weak to crank the starter at the proper speed. To recharge the battery, disconnect the battery from the car's electrical system and hook it up to a charger. Overnight on a trickle charger should bring a discharged battery back to good condition (an inexpensive 12 volt charger can be purchased at any number of stores and should be considered a must in everyone's garage). If one cell in the battery is 50 points lower than its neighboring cells, that cell is bad, which usually means the battery is bad. Specific gravity readings above 1.225 in all cells mean the battery is healthy and not the problem.

But what if the battery has no removable caps? All newer BMW and certain aftermarket batteries are made this way and sold as maintenance free batteries. Unfortunately, like most things that claim the maintenance free label, they just don't seem to last as long as something that receives a minor amount of maintenance. An accurate digital volt ohm meter (DVOM) is needed to check the state of charge in sealed-top batteries (also available at a number of stores at less than \$50.00 and is useful for most anything electrical around the house). Measure no-load voltage across the battery posts. If the reading is lower than 12.45 volts (75% of full charge), the battery must be recharged before testing. No-load voltage of 12.45 volts or higher, measured across the posts, means the battery is strong enough to properly operate the starter.

If the battery is uniformly discharged, you may be tempted to slap a new battery in the tray, without any more diagnostics. Don't do it just yet. What you don't know at this point is why the battery is discharged. If it's just plain tired and that is the only problem, the new battery is certainly a part of the fix you're looking for. But if the old battery died an early death because the charging system couldn't keep it fully charged or there is a system drain, then a new battery certainly won't do any better after a short period of time.

If the battery was recharged and appears to have a good post to post no-load charge, then it's time to find out how good it really is. After charging the battery, the artificial surface charge on the battery must be removed by applying a load to the battery. You can do this by simply reinstalling the battery and turning on the head lamps for two to three minutes. Disconnect the battery and recheck the post to post no-load charge. If 12.45 volts or higher is indicated, you are ready to load test the battery. Since an accurate battery load test requires a fairly expensive variable load tester, it is best to find someone to do this for you. Remove the battery from the car and transport it, preferably in a plastic container. (Note: A clean battery, void of acid build up or leaks, will always be appreciated by the testing facility. Also, remember that battery acid/corrosion eats through clothing and car interiors. This will also give you a chance to clean or neutralize the battery tray in the car). Any shop/store selling batteries will load test your battery, usually for free. Have the battery test performed with a load equal to one-third of the battery's CCA. The test should last at least 10 seconds but no more than 15 seconds.

If the battery reading is less than 9.6 volts with the electrolyte at 70° F, the battery is no good and should be replaced. Changes in temperature of the electrolyte will affect acceptable voltage levels. A good rule of thumb is to deduct 0.1 volt for every 10 degrees in temperature of the electrolyte. For example, at 40°F, the battery can read 9.3 volts after the load test and still be o.k. If the temperature is above 70°F, add 0.1 volt for every 10 degrees. Optimally, you would like to see 10.0-10.5 volts from a strong battery.

After reinstalling the battery, if the cranking speed is good, the discharged battery was the starter circuit culprit. Although the starter circuit may be working properly, you must now determine why the battery was discharged. Your next step is to check for an electrical system drain. The easiest way to do so is to connect your DVOM in series between the negative battery post and negative battery cable end. Set the meter on the 10 amp scale and make sure you have an artificial drain on the system. For example, if the battery is located in the trunk and the trunk lid is open, make sure the courtesy light is not on and that the contact switch is off (depressed). This applies to a door contact if the battery is under the back seat, or the hood if the battery is in the engine compartment. Remember that some cars have alarm contacts under the hood and back seat. These should also remain in a normally closed position, especially if you are testing the alarm system in an active mode as part of the electrical system drain.

With the car shut down, key out, and all contacts closed, the normal drain on the system should be 20 - 30 mA with no more than 60 mA on the latest larger systems. Make note that most cars take several minutes to settle out. Initially, you might think you have found, for example, a 2.4 amp draw only to see it disappear after all relay or general modules shut down.

If all readings during an electrical system test look good and there is no appreciable drain on the system, then you are left with one of 2 situations. Either you have an intermittent electrical drain or a charging system problem. Both of these problems are best left to a professional with equipment and expertise to properly troubleshoot.

If you find yourself in the position of needing to jump start your car, my best advise is don't. Not only should you not jump start your car but don't jump start somebody else's car. The possibility of damage to certain electrical components from a voltage spike installing or removing jumper cables is too great. The best method is to disconnect the battery cables and charge the battery.

However, in certain circumstances jump starting may not be avoidable. To protect the electrical system in your car, follow these simple procedures to reduce the risk of damaging sensitive electrical components.

- Make sure neither car is touching.
- Ensure that both cars have batteries of the same voltage and approximate amp hour rating.
- Take care to avoid arcing of the jumper cables on the positive or negative posts.
- Connect the positive jumper cable first to the vehicle receiving the jump and then to the vehicle providing the jump. All newer BMW's have a B+ junction post under the hood that should be utilized. Avoiding spark around a battery is a good idea for obvious reasons.
- Connect the negative jumper cable to a chassis ground first on the car to be jumped and then on the car used to jump start. Most newer BMW's also provide a ground lug usually located on either the front fenderwell or shock tower.
- There is no need to start the engine of the car providing the jump start.
- After double checking all cable connections for secure contact, attempt to start the car with the weak battery.
- After the vehicle starts, allow it to run for a minute with the cables connected. Then switch on the headlights or heater blower prior to disconnecting the jumper cables. This will minimize the voltage surge the moment the cables are disconnected.
- Disconnect the negative jumper cable leads from both cars and then disconnect the positive cable.
- If used, make sure the B+ junction post is securely recovered to prevent inadvertent shorting.

Starting problems always seem to happen without warning because unfortunately, like most things that seem to work fine, we ignore them until they discontinue working. Keep in mind that a battery with a minor amount of attention should last for at least four years. The lesson, as always, is that with a little preventative maintenance you will not be stranded in a potentially inconvenient situation.