TIRE PRESSURE MONITORING SYSTEMS

A Challenge For the Tire Technician

Tire pressure monitoring systems (TPMS) will become a daily part of our service activity. Maintaining the proper tire pressure is imperative for vehicle stability and control. Crash statistics involving vehicles with under-inflated tires are alarming. Legislation has been passed requiring vehicle manufacturers to incorporate a low tire pressure monitoring system into their vehicles. Seventy percent of the 2007 vehicles and one-hundred percent of all 2008 passenger cars and light trucks under 10K GVW will be equipped with the TPM system. With these systems come some challenges and opportunities.

Most of the vehicles you will be servicing will utilize a system referred to as a direct TPM system. This design system utilizes radio and sensor technology to monitor the tire pressure levels in each tire. A typical system, such as the Nissan application illustrated in Fig. 1, incorporates a sensor-transmitter integrated with a tire valve positioned in each wheel. The sensors transmit air pressure signals in the form of a radio frequency signal. Mounted in the roof panel is an antenna that receives the signals transmitted from the tire pressure sensors. The low tire pressure warning control unit/receiver reads the air pressure signals received by the antenna and may activate a warning light and buzzer. Some models contain an instrument cluster display unit that displays the air pressure of each tire.

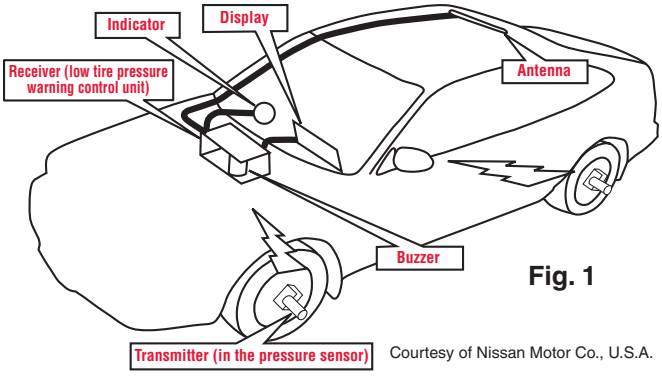

Fig. 1

Courtesy of Nissan Motor Co., U.S.A.

The TPM system on a 2006 Chevrolet truck and SUV utilizes the Powertrain Control Module (PCM), Body Control Module (BCM), Instrument Panel Cluster (IPC), Driver Information Center (DIC), Passenger Door Module (PDM) or Remote Control Door Lock Receiver (RCDLR), a radio frequency (RF) transmitting pressure sensor in each wheel/tire, and the serial data circuit to perform the system functions.

The PDM receives and translates the data contained in each sensor transmission, and sends the tire pressure and location data to the DIC. If the TPM system detects a low tire pressure condition, a “Check Tire Pressure” message will be displayed on the DIC, and the low tire pressure indicator is displayed on the IPC. The PDM/RCDLR can detect malfunctions within the TPM system. Should a malfunction be detected, the DIC will display a “Service Tire Monitor” warning message.

SENSOR RE-LEARN

The tire pressure sensors must be put through a learn process or be re-trained any time a sensor is replaced, the tires have been replaced or rotated, or the battery disconnected. Each sensor has its own identification code and its position must be matched to the system for proper sensor monitoring and tire/wheel location. The procedures for performing the learn process vary from one vehicle manufacturer’s system to another. TPMS diagnostic tools are available to perform the sensor learn procedure. On some systems, the learn process can be accomplished by increasing or decreasing the air pressure in the tires. When using this procedure, do not exceed the tire’s rated maximum inflation pressure. On some systems, adjusting the air pressure may immediately turn out the low pressure warning lamp, and other systems may require a minute or longer. On some systems, if the vehicle has been parked for longer than 15 minutes, the system information is only updated once per hour. In that case, it may require an hour for the warning light to turn off, following a tire pressure adjustment. Some systems require that the vehicle be parked for a minimum of 15 minutes for the system to be ready to learn a new sensor ID code.

When installing a new sensor, be aware that some sensors are shipped in the off mode. The sensor must be taken out of this mode, prior to performing the learn procedure. Procedures for taking a sensor out of the stationary mode or activating it vary from one vehicle manufacturer to another. A service guide is a must-have tool, as no one procedure covers all systems.

QUIRKS CAN AFFECT SYSTEM OPERATION

With any new system comes a learning curve for the vehicle manufacturers and the service technicians. My experience has been that once the system has been put into service,

the true test begins to determine how well the system will function without deficiencies. In my opinion, the TPM system will pose many challenges. I can't remember a system that has come with so many precautions so early on, and especially direct from the vehicle manufacturers. Servicing the system will require training, discipline and good service information. Consider the following cautions illustrated by the vehicle manufacturers:

Sensitive System… The vehicle manufacturers establish a TPM sensor pressure range for a specific tire type and size for a given vehicle. The TPM system has been designed based on the original equipment wheels and tires. Installing non-OE type tires, such as those with steel body plies in the sidewall (run-flat tires), is not recommended and may result in an erratic or non-functional TPM system operation. Further, the system operation may be impaired or damaged when using replacement equipment that is not compatible with the system. Sensor damage or inaccurate sensor signals may result when incompatible aftermarket custom wheels are installed.

Sensor Learn Procedure… When the technician is performing a sensor learn procedure, he must be certain that no other sensor learn procedures are being performed simultaneously on a nearby vehicle. Also, it is imperative that the tire pressure is not being adjusted on another vehicle equipped with a TPM system within a close proximity. The range of distance that can produce electrical interference varies from 3 to 10 feet, depending on the vehicle manufacturer's system. The systems are extremely sensitive and can read the tire pressure sensor signals from a nearby vehicle, while in the learn mode. Learn procedures should not be performed until all problems are resolved, and the tire pressure in all four tires has been adjusted. Performing a learn procedure while the vehicle is parked on an alignment rack or lift is not recommended. The metal from the lift or alignment rack can transfer the RF signals, causing the learn procedure to fail, sometimes setting diagnostic trouble codes.

Pressure Changes… Variations in the ambient temperature affect tire pressure. A decrease in the ambient temperature of 10 degrees F results in a tire pressure decrease of 1 psi. A significant decrease in temperature could reduce the tire pressure below the TPM sensor set-point. If the tire pressure is not adjusted at cold temperature, the tire pressure may drop enough to be detected by the TPM system, which will activate the low pressure warning light. Some vehicle manufacturers caution that if the tires have been subjected to use, or exposed to direct sunlight, move the vehicle into a shaded area and allow the tires to cool before adjusting the air pressure.

Sealants… Vehicle manufacturers caution against the use of tire sealants on vehicles equipped with TPM systems, as the chemical may clog the tire pressure sensors. Casting leaks are not uncommon on vehicles equipped with aluminum wheels, due to the porosity of the casting. In the past, most would inject a tire sealant through the valve stem and this would eliminate the air leak. GM has cautioned its dealers that this procedure is not accepted on vehicles equipped with the TPM system. Instead, the air leak should be located and the casting sealed with an adhesive sealant — GM P/N 12378478 or equivalent.

Radio Frequency Interference… RFI is an electrical noise generated by the electrical system. A number of components such as electric motors, electrical accessories, cellular telephones, remote transmitters, power inverters and portable entertainment equipment can generate RFI, affecting the operation of the TPM system.

Poor Sensor Reception… Nissan cautions that no metal film or any metal parts should be placed on the windows, as it may affect the reception of the tire pressure sensor's signals, resulting in an improper TPM system operation.

Mazda cautions that their system may behave erratically under the following conditions:

1) If an electrical device or equipment near the vehicle shares the same frequency as the tire pressure sensors.
2) If a metal object is placed near the center of the dash, or a large metal object is placed in the right rear seat, it may block RF signals from the tire pressure sensors to the receiver unit.
3) The use of a digital device such as a personal computer or a current converter device that can cause an RFI condition with the receiver unit.
4) If excess snow or ice accumulates, especially around the wheels.
5) When tires with steel reinforcement in the sidewalls are installed.
6) When tire chains are installed.

Most vehicle manufacturers identify similar circumstances that can result in erratic behavior of their TPM system. Being aware of these conditions can save the technician a lot of frustration and wasted diagnostic time.

Many different type monitoring systems will be encountered on the various vehicles, each with its own technology and required service procedures. Factory information is a must when servicing vehicles equipped with a TPM system. One of the best sources we have located for service information is the Mitchell manual titled "Tire Pressure Monitoring Systems Guide." Mitchell has captured and illustrated factory service information and procedures involving the TPM systems found on domestic and import applications. The manual is a must-have for any service facility that offers tire replacement, rotations or repairs.

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