

certain circumstances while the vehicle is stopped. Under normal conditions after the vehicle has been driven with the transmission in a forward drive position at a speed greater than or equal to 15 kph (9.32 mph), when the driver stops the vehicle by depressing the service brake pedal, the gasoline engine will stop and the transmission will automatically shift to Neutral even though the transmission shift lever remains in Drive. When the driver removes his foot from the service brake pedal, hydraulic brake pressure is maintained, the starter automatically engages the vehicle engine and the engine starts up. After the engine starts, the transmission automatically shifts internally from Neutral back to Drive, hydraulic brake fluid pressure is automatically released, and the vehicle may start to move slowly forward due to creep force from the idling engine and automatic transmission. When the accelerator is depressed, the vehicle moves in the direction directed by the transmission shift lever position.

Since IST does not provide creep force when the service brake is applied, there is no indication of the direction of vehicle movement until after the driver's foot has been completely removed from the service brake pedal. After release of the service brake pedal, the service brakes remain fully engaged until the engine is restarted and the transmission automatically shifts into a forward drive position. This automatic chain of events occurs very rapidly after the service brake pedal is released, however, the sequence may or may not be completed by the time the driver depresses the accelerator.

As IST is not in effect in Reverse, the engine does not shut off when the transmission is in Reverse. Therefore, the propulsion system provides creep force as a result of the idling engine and the automatic transmission. In forward gears, when the accelerator is depressed, the engine or the engine assisted by the electric motor accelerates the vehicle. The electric motor is used to assist the gasoline engine when extra motive power is required, and to restart the engine after idle-stop.

The Honda system receives input from numerous sensors throughout the vehicle. The ECU will not allow the engine to stop when the vehicle comes to a stop and the transmission lever is in Reverse, Low or S mode (another low gear); immediately after the engine starts; when the air conditioning is in "Auto Switch" mode; when the engine water temperature, the transmission oil temperature, ambient temperature or energy in the battery are low; when electrical load is high; and during

sudden (panic) braking. Also, when the engine is stopped and the transmission shift lever is shifted from Drive to Reverse, Low, or Park, the engine restarts immediately while the service brake pedal is depressed.

#### **IV. Previous Related Rulemaking Action—ZEMCO Petition**

In 1979, ZEMCO Inc. asked for an interpretation of S3.1.3 in FMVSS No. 102. ZEMCO wanted to market an add-on fuel savings device that conflicted with S3.1.3. The ZEMCO system could be installed on all vehicles as original or after-market equipment and would automatically control the shutdown and restarting of the vehicle engine in order to conserve fuel at times when the vehicle would be otherwise stopped with the engine running at idle speed. The ZEMCO system did not exhibit creep force when the engine was stopped and was employed in both the forward and reverse gears.

As a result of ZEMCO's request for an interpretation and subsequent petition for rulemaking, NHTSA commenced rulemaking to amend S3.1.3. As part of the rulemaking process, NHTSA tested the operational safety of the ZEMCO system. Several safety concerns surfaced during testing such as the delay in engine restarting, the lack of an automatic shut-off feature for the system when the driver parks the vehicle and leaves without specifically turning off the fuel savings system, the effects on other vehicle functions, vehicle stalling on restart and the avoidance of engine shutdown under certain conditions. These safety concerns resulted in the agency publishing a notice of termination of rulemaking in the **Federal Register** of March 27, 1984 (49 FR 11692). In the termination notice, NHTSA also encouraged further research and development in the area of fuel economy devices.

#### **V. Notice of Proposed Rulemaking**

The following describes NHTSA's rulemaking proposal to amend FMVSS No. 102 and the four major issues addressed in the rulemaking: first, the significance of reverse drive and the park position; second, the importance of creep force; third, the level of creep force to be specified; and fourth, the safety need for fail-safe provisions for automatic engine stopping and restarting while the transmission and/or transmission shift lever are in gear.

##### *A. Reed Interpretation Letter, the Significance of Reverse Drive and the Park Position*

In 1991, Mr. Brett Reed of Morse Controls, Inc. submitted a request for an

interpretation of FMVSS No. 102 as it applies to electronic transmission shift controls. Mr. Reed specifically asked about controls that operate automatic transmissions used in heavy trucks and recreational vehicles (RVs) and on solenoid operated power shift transmissions used in various on and off highway vehicles. In his letter, Mr. Reed cited S3.1.3, which requires that the engine starter be inoperative when the transmission shift lever is in a forward or reverse drive position. The main question posed was if the intent of the standard was to render the starter engine inoperative when the transmission shift lever is in a forward or reverse drive position or when the transmission was in a forward or reverse drive gear. Mr. Reed noted that when FMVSS No. 102 was written, transmission levers communicated with transmissions via mechanical linkages and therefore the transmission shift lever always matched the gear position of the transmission.

With the introduction of electronic shift systems and fully electronic controlled transmissions, communication between the transmission shift lever and the transmission is rarely performed by direct mechanical means. This raises the possibility that the transmission shift lever position may not match the gear currently engaged by the transmission in situations where the transmission control circuitry overrides the shift lever selection in the interest of safety, transmission protection or other criteria related to performance and specific applications. The concern was that some systems automatically shift to Neutral within the transmission when the engine is started, however, the transmission shift lever remains in some other position. In these cases, the transmission shift lever position does not coincide with the status of the transmission. Mr. Reed sought an interpretation stating that the intention of S3.1.3 was that the engine starter shall be inoperative when the transmission is in a forward or reverse drive position.

NHTSA's response of September 16, 1991 essentially stated that the transmission shift lever position and the gear position of the transmission must always agree. Since this interpretation in 1991, electronically controlled transmissions have become more prevalent. Today, electronically controlled transmissions are not only on large trucks and recreational vehicles, but are also appearing in the passenger car fleet. In addition, vehicle electronic control systems and control algorithms have become more sophisticated, which