SERVICE BULLETIN

NUMBER: SB-221-037
DATE: 2/13/04
MODEL: E-Tech™, ASET™

(Also applies to Mack Trucks Australia)

INTERMITTENT 3-4 (ENGINE POSITION SENSOR) FAULT CODE TROUBLESHOOTING

The electronic malfunction lamp can illuminate briefly, and a 3-4 fault code (engine position sensor) can be logged intermittently under the following conditions:

- When the engine is accelerated progressively to high idle while the vehicle is in neutral
- Under a hard pull (engine load greater than 75%) with an engine speed between 1,490–1625 rpm

The 3-4 fault code can be reproduced consistently when either of the above conditions are met. When the code is active, engine load and speed will drop suddenly, causing a brief but pronounced engine stumble.

NOTE

Outside of the above mentioned operational conditions, engine load and speed ranges, the engine functions correctly with no active codes.

NOTE

A 3-4 fault code that consistently remains active is usually the result of an electrical defect or improper adjustment of the engine position sensor depth (relative to the cam gear). The *V-MAC® III Service Manual,* 8-211, provides extensive electrical diagnostic procedures for this sensor.

E-Tech™ engines having Step 4 EECU software should be upgraded to the Step 5 OEM datafile part No. 1MS595. E-Tech™ engines being upgraded to the Step 5 OEM datafile part No. 1MS595, will require upgrades to both the VECU and the EECU so that a software mismatch is prevented. For engines already having Step 5 EECU software, the EECU must be verified to ensure it contains the OEM datafile part No. 1MS595, as this datafile is least likely to experience intermittent occurrences of the 3-4 fault code.

Should an intermittent 3-4 fault code be encountered, perform the following checks in the order listed:

1. Ensure that the fault can be duplicated.
2. Ensure that the engine position sensor is properly adjusted and secured in the timing cover as described in service bulletin SB-273-004. If the sensor is properly adjusted and secured in the timing cover, proceed with item 3.

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3. Check that the ring gear has not slipped on the flywheel. Also, check that ring gear position relative to the cam gear has not changed. An out-of-phase condition between the flywheel ring gear and the cam timing gear can occur if there is excessive wear in the timing gear train. To perform these checks, use the V-MAC® III E-Tech™/ASET™ Engine Flywheel and Cam Gear Timing Check procedure outlined at the end of this bulletin. If these checks indicate that the ring gear has not slipped on the flywheel and that the ring gear and cam gear are in phase with each other, proceed with item 4.
4. Remove the engine electronic control unit (EECU) from the vehicle exhibiting the intermittent 3-4 condition and install it on a similarly configured vehicle. Run the engine and determine if the condition occurs. If the 3-4 fault code occurs under the same conditions on both vehicles, the problem resides with the EECU, making replacement of the EECU necessary. If the condition is NOT duplicated on the second vehicle, proceed with item 5.
5. Replace the vibration damper. The vibration may be faulty even if there is no evidence of external leakage or damage. If the vibration damper is to be replaced, use the larger 13.5″ diameter damper (part No. 404GB498C). The larger damper is a direct replacement for the 12″ damper, and should be used as the replacement for all engine models.

NOTE

Use of a heat gun to determine vibration damper functionality is NOT an acceptable diagnostic procedure. When the viscosity of the fluid inside the vibration damper deteriorates, engine torsional vibrations increase. The engine position sensor is sensitive to the increase in torsional vibrations, and torsional vibrations will change as engine temperature increases or decreases. The only method of diagnosing a faulty vibration damper is to replace the damper.

If replacing the vibration damper does not correct the intermittent 3-4 condition, proceed with item 6.

6. Sensor position relative to the cam gear (depth) is set by shims, whereas sensor positioning in the side-to-side and up-down directions is maintained by the sensor mounting hole in the timing gear cover. If none of the above steps corrected the intermittent 3-4 condition, replace the timing cover.

V-MAC® III E-Tech™/ASET™ Engine Flywheel and Cam Timing Check (Check for Fault Code 3-4 or 3-2)

1. Engine Position Sensor, Flywheel and Cam Gear Timing Check
    a. Disconnect the harness connector from the flywheel sensor, then use the starter motor to crank the engine for up to 10 seconds. If the engine starts using only the engine position sensor as the input to the V-MAC® module, a 3-2 fault code (flywheel sensor) will be logged.
    b. Turn the ignition switch OFF, then reconnect the flywheel sensor harness connector.
    c. Disconnect the harness connector from the engine position sensor, then use the starter motor to crank the engine for up to 10 seconds. If the engine starts using only the flywheel sensor as the input to the V-MAC® module, a 3-4 fault code (engine position sensor) will be logged.
    d. Turn the ignition switch OFF, then reconnect the engine position sensor harness connector.
    e. If the engine starts and runs with either one of the sensors disconnected, proceed with the following two tests. Be sure to perform both tests to ensure accurate diagnosis.
2. Flywheel Check
    a. Disconnect the harness connector from the flywheel sensor, then remove the sensor from the flywheel housing.
    b. Using the TC (top center) marking on the flywheel, rotate the engine to top dead center on cylinder No. 1.
    c. Using a paint stick, piece of chalk or grease pencil, mark a reference point on the flywheel housing to indicate the center line of any one of the flywheel ring gear teeth.
    d. Rotate the engine in the OPPOSITE direction of normal engine rotation. Using the reference point marked on the flywheel housing, count exactly 61-1/2 teeth. At that point (61-1/2 teeth), the center line between the two machined teeth on the ring gear should be aligned in the center of the flywheel sensor mounting hole.
    e. If the center line of the two machined teeth on the ring gear is not aligned in the center of the sensor mounting hole, the ring gear has slipped from its original position on the flywheel. If this has occurred, it will be necessary to replace the flywheel/ring gear assembly as a unit.
3. Cam Gear Check
    a. With the engine position unchanged from test 2 above, mark a second reference point on the flywheel housing to indicate the center line of another tooth on the ring gear.
    b. Disconnect the harness connector from the engine position sensor, then remove the sensor from the timing gear cover.
    c. Rotate the engine in the direction of normal rotation. Using the reference point marked on the flywheel housing, count exactly 34-1/2 teeth. At that point (34-1/2 teeth), the timing hole on the front face of the cam gear should be aligned in the center of the engine position sensor mounting hole in the timing gear cover.

d. If the timing hole in the timing gear is not aligned in the center of the sensor mounting hole, camshaft-to-crankshaft timing has changed and must be corrected.

e. Continue rotating the engine in the direction of normal rotation 9-3/4 more teeth. At that point (9-3/4 teeth), the second timing hole on the front face of the timing gear should be aligned in the center of the engine position sensor mounting hole in the timing gear cover.

NOTE

If camshaft-to-crankshaft timing is suspect, perform the cam timing check outlined in the applicable engine service manual.

Off-Engine Flywheel Check

1. Using a straightedge, align the crankshaft dowel pin hole with the center of the pilot bushing hole.
2. With the straightedge in alignment, count the number of teeth from the straightedge to the two machined teeth in the ring gear.
3. There should be 9 teeth between the straightedge and the two machined teeth. If more or less than 9 teeth are counted, the ring gear has slipped on the flywheel. If the ring gear has slipped on the flywheel, the flywheel and ring gear must be replaced as an assembly.

NOTE

The flywheel ring gear has 117 teeth.