TROUBLESHOOTING

Diesel Engine Diagnosis

GENERAL

1. Diesel engine problems are usually caused by the engine or fuel system. The injection pump is very rarely the cause of fuel system problems.
2. Before beginning fuel system tests, first check that the engine compression, valve timing and other major systems are within specifications.

PRELIMINARY CHECKS

1. Before performing fuel system checks, ensure that the engine is in good running condition. If necessary, first check the compression, timing and major components or systems.
2. Check the air filter, and clean or replace it if necessary.
3. Check that there is sufficient fuel in the tank.
4. Check if the fuel is contaminated with gasoline or other foreign elements. Only good-quality diesel fuel should be used.
5. Bleed air from the system by pumping the priming.
6. Check for water in the fuel filter and fuel tank, and drain as necessary.
7. If the engine will not crank or if it cranks slowly, first troubleshoot the electrical system.

PRECAUTION:

1. **The basic troubleshooting procedures for the diesel engine (valve clearance, compression, bearings, valves, pistons, etc.) are the same checks you would make for gasoline engine.**
2. **Repair of the injection pump requires considerable skill and use of a special test bench.**

ENGINE WILL NOT CRANK

(Possible Cause)	(Check Procedure and Correction Method)
1. LOOSE OR CORRODED BATTERY CABLES	Check cables from battery to starter and make necessary repairs.
2. DISCHARGED BATTERY	Check alternator output and drive belt. If necessary, repair. (See page CH-5)
3. INOPERATIVE STARTER	Check for battery voltage at starter terminals 30 and 50. If Okay, see STARTING SYSTEM for repair procedure. (see page ST-15)

ENGINE CRANKS SLOWLY-WILL NOT START

HINT: **Minimum cranking speed:**

Cold	**HZJ80 (A/T) and HDJ80 (A/T)**	**110 rpm**
	Others	**100 rpm**
Hot		**150 rpm**

(Possible Cause)	(Check Procedure and Correction Method)
1. LOOSE OR CORRODED BATTERY CABLES	Check cables from battery to starter and make necessary repairs.
2. DISCHARGED BATTERY	Check alternator output and drive belt. If necessary, repair. (See page CH-5)
3. IMPROPER ENGINE OIL	Check engine oil. If improper viscosity, drain and refill with oil of viscosity recommended by manufacturer. (See page LU-6)

ENGINE CRANKS NORMALLY BUT WILL NOT START

(Possible Cause)	(Check Procedure and Correction Method)
1. NO FUEL TO NOZZLE	Loosen any one injection pipe union nut from its nozzle holder. Crank engine for about 5 seconds while confirming that fuel is being discharged from pipe. If fuel is coming out, begin diagnosis from item 4. If not, begin from item 2.
2. NO FUEL CUT SOLENOID OPERATION	With starter switch turned ON, check for fuel cut solenoid operation noise (clicking sound) while repeatedly connecting and disconnecting fuel cut solenoid. If no noise, check if there is battery voltage to solenoid when starter switch is ON. If battery voltage is confirmed, fuel cut solenoid is faulty and should be replaced. If no voltage, refer to ELECTRICAL DIAGNOSIS and make necessary repairs.
3. NO FUEL INTO INJECTION PUMP	Disconnect inlet hoses from fuel filter, and feed clean fuel from separate container directly into fuel pump. HINT: When feeding fuel tank directly into pump, keep container at same level as vehicle fuel tank. If engine starts, either fuel filter or line between fuel tank and filter is clogged and should be repaired accordingly. If engine still does not start (no fuel intake), check fuel line between filter and pump. If normal, pump is faulty and should be replaced.
4. FUEL LEAKAGE FROM INJECTION PIPES	Check for loose unions or cracks. If leaking, tighten to standard torque or, if necessary, replace pipe(s).
5. INOPERATIVE PRE-HEATING OPERATION	With starter switch turned ON and glow plug indicator light illuminated, check that there is voltage applied to glow plug. If not, refer to ELECTRICAL DIAGNOSIS and repair as necessary.

6. FAULTY GLOW PLUG OPERATION

Check glow plug for continuity.

If no continuity, a broken wire is indicated and glow plug should be replaced.

7. IMPROPER INJECTION TIMING

Check injection timing. (See page EM-27)

Plunger stroke:

1PZ	**0.82–0.88 mm (0.0323–0.0346 in.)**
1HZ	**1.03–1.09 mm (0.0406–0.0429 in.)**
1HD-T	**1.29–1.35 mm (0.0508–0.0531 in.)**

If not as above, injection pump is improperly adjusted.

8. (w/ ACSD) IMPROPER COLD START ADVANCE AND FAST IDLE

Check timer piston stroke and fast idle lever opening angle with an injection pump tester when cold start advance is operated.

9. FAULTY INJECTION NOZZLES

Check injection pressure with a nozzle tester. (See page FU-10 or 20)

Opening pressure:

1PZ and 1HZ **135–155 kg/cm^2 (1,920–2,205 psi) (13,239–15,200 kPa)**

1HD-T

No.1 opening pressure **180–190 kg/cm^2 (2,560–2,702 psi) (17,652 – 18,633 kPa)**

No.2 opening pressure (Inspection pressure) **132–138 kg/cm^2 (1,877–1,963 psi) (12,945–13,533 kPa)**

If not as above, nozzle adjustment is improper and pressure should be readjusted.

If pressure cannot be adjusted to specification, replace injection nozzle.

ROUGH IDLE WITH WARM ENGINE

(Possible Cause)	(Check Procedure and Correction Method)
1. IMPROPER ADJUSTMENT OF ACCELERATOR CABLE	With accelerator pedal released, check that adjusting lever is in contact with idle speed adjusting screw. Also check if accelerator cable or linkage is catching on something. If necessary, adjust so that lever is in contact with screw, or make other required repairs.
2. IDLE SPEED TOO LOW	Check idle speed. (See page EM-27) **Idle speed:** **1PZ 600 – 700 rpm** **1HZ M/T 600 – 700 rpm** **1HZ A/T 660 – 760 rpm** **1HD-T M/T 600 – 700 rpm** **1HD-T A/T 750 – 850 rpm** HINT: If less than standard, idling would normally be rough. If not as above, adjust with idle speed adjusting screw.
3. FUEL LEAKAGE	Check for leaks at injection pump connections, pump distributive head bolts, injection nozzles and delivery valve holders. Tighten any loose connections to specified torque or replace parts as necessary.
4. IMPROPER INJECTION TIMING	Refer to step 7 of ENGINE CRANKS NORMALLY BUT WILL NOT START, above.

5. IMPROPER OPERATION OF INJECTION NOZZLES OR DELIVERY VALVES

With engine idling, loosen injection pipe to each cylinder in order, and check if idle speed changes.

If no change, a faulty cylinder is indicated.
Check according to following procedure.

- Faulty injection nozzle

Check injection nozzle with a nozzle tester.
(See page FU-10 or 20)

Opening pressure:

1PZ and 1HZ **135 – 155 kg/cm^2 (1,920 – 2,205 psi) (13,239 – 15,200 kPa)**

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If not as above, nozzle adjustment is improper and pressure should be readjusted.

If pressure cannot be adjusted to specification, replace injection nozzle.

- Faulty delivery valve

If injection pressure is as specified, delivery vale is defective and should be replaced.

ENGINE SUDDENLY STOPS

(Possible Cause)	(Check Procedure and Correction Method)
1. ENGINE WILL NOT RE-START	Check to see if engine re-starts according to prescribed procedure. If not, refer to ENGINE CRANKS NORMALLY BUT WILL NOT START, above, and repair as necessary.
2. ROUGH IDLE	Refer to ROUGH IDLE WITH WARM ENGINE and repair accordingly.
3. MALFUNCTION OF FUEL CUT SOLENOID	Refer to ENGINE CRANKS NORMALLY BUT WILL NOT START, above, and check accordingly. HINT: No operation noise from fuel cut solenoid may be due to loose electrical connections, so check connectors before proceeding with further repairs.
4. NO FUEL INTO INJECTION PUMP	Refer to step 3 of ENGINE CRANKS NORMALLY BUT WILL NOT START, above.

LACK OF POWER

HINT:

- First check that the air cleaner is not clogged or the engine overheating.
- Not applicable if the customer desires an output power higher than specified for that vehicle. For accuracy, adjust with a chassis dynamo.

(Possible Cause)	(Check Procedure and Correction Method)
1. IMPROPER ADJUSTMENT OF ACCELERATOR CABLE	With accelerator fully depressed, check that adjusting lever is in contact with maximum speed adjusting screw. Also check if accelerator cable or linkage is catching on something. If necessary, adjust so that lever is in contact with screw, or make other required repairs.
2. INSUFFICIENT MAXIMUM SPEED	Check maximum speed. (See page EM-27) **Maximum speed:** **1PZ and 1HZ 4,500 – 4,700 rpm** **1HD-T 4,300 – 4,500 rpm** If not as above, adjust with maximum speed adjusting screw.

3. INTERCHANGED OVERFLOW SCREW (OUT) AND INLET (NO MARK) FITTING	HINT: Overflow screw is marked "OUT" and has an inner jet. Although both fittings are same size, they must not be interchanged.
4. FUEL LEAKAGE	Refer to step 3 of ROUGH IDLE WITH WARM ENGINE.
5. CLOGGED FUEL FILTER	Disconnect inlet hose to fuel filter, and feed clean fuel directly into pump. HINT: When feeding fuel directly into pump, keep container at same level as vehicle fuel tank. If engine condition improves, fuel filter is clogged and should be replaced. (See page FU-4) If no increase in engine condition after replacing fuel filter, check priming pump (hand pump) or perform other necessary repairs.
6. IMPROPER INJECTION TIMING	Refer to step 7 of ENGINE CRANKS NORMALLY BUT WILL NOT START.
7. FAULTY INJECTION NOZZLES	Refer to step 9 of ENGINE CRANKS NORMALLY BUT WILL NOT START.

EXCESSIVE EXHAUST SMOKE

HINT:
- Check that the air cleaner is not clogged.
- Check with the customer whether or not oil consumption has been excessive.

(Possible Cause)	(Check Procedure and Correction Method)
1. IMPROPER INJECTION TIMING	Refer to step 7 of ENGINE CRANKS NORMALLY BUT WILL NOT START. HINT: Black smoke indicates advanced timing while white smoke indicates retarded timing. Adjustments should be made accordingly.
2. CLOGGED FUEL FILTER	Refer to step 5 of LACK OF POWER. HINT: At high speed (2,000 – 3,000 rpm), a clogged filter tends to make exhaust smoke white.
3. FAULTY INJECTION NOZZLES	Refer to step 9 of ENGINE CRANKS NORMALLY BUT WILL NOT START. HINT: Excessive exhaust smoke is often caused by nozzle pressure being too low.

EXCESSIVE FUEL CONSUMPTION

HINT: Check whether clutch slipping, brakes grabbing, tires wrong size or air filter clogged.

(Possible Cause)	(Check Procedure and Correction Method)
1. FUEL LEAKAGE	Refer to step 3 of ROUGH IDLE WITH WARM ENGINE.
2. IDLE SPEED TOO HIGH	After sufficiently warming up engine, check idle speed. (See page EM-27) **Idle speed:** **1PZ 600 – 700 rpm** **1HZ M/T 600 – 700 rpm** **1HZ A/T 660 – 760 rpm** **1HD-T M/T 600 – 700 rpm** **1HD-T A/T 750 – 850 rpm** If not as above, adjust with idle speed adjusting screw.
3. MAXIMUM SPEED TOO HIGH	Check maximum speed. (See page EM-27) **Maximum speed:** **1PZ and 1HZ 4,500 – 4,700 rpm** **1HD-T 4,300 – 4,500 rpm** If not as above, adjust with maximum speed adjusting screw.
4. IMPROPER INJECTION TIMING	Refer to step 7 of ENGINE CRANKS NORMALLY BUT WILL NOT START.
5. FAULTY INJECTION NOZZLES	Refer to step 9 of ENGINE CRANKS NORMALLY BUT WILL NOT START.

ENGINE NOISE WHEN WARM
(Cranking Noise with Excessive Vibration)

(Possible Cause)	(Check Procedure and Correction Method)
1. ENGINE COOLANT TEMPERATURE TOO LOW	Check coolant temperature with coolant temperature gauge. If not sufficiently warm, thermostat is faulty and should be replaced.
2. IMPROPER INJECTION TIMING	Refer to step 7 of ENGINE CRANKS NORMALLY BUT WILL NOT START.
3. FAULTY INJECTION NOZZLES	Refer to step 9 of ENGINE CRANKS NORMALLY BUT WILL NOT START.

ENGINE WILL NOT RETURN TO IDLE

(Possible Cause)	(Check Procedure and Correction Method)
BINDING ACCELERATOR CABLE	Operate adjusting lever on top of injection pump, and check if engine returns to idle. (See page EM-27) If so, accelerator cable is binding or improperly adjusted and should be repaired accordingly. If engine does not return to idle, injection pump is faulty and should be replaced.

ENGINE WILL NOT SHUT OFF WITH KEY

(Possible Cause)	(Check Procedure and Correction Method)
IMPROPER FUEL CUT SOLENOID OPERATION	Disconnect connector of fuel cut solenoid, and check if engine stops. If so, starter switch is faulty and should be repaired as necessary or replaced. If engine does not stop, either fuel cut solenoid is faulty or there is interference by foreign particles. Repair as necessary.