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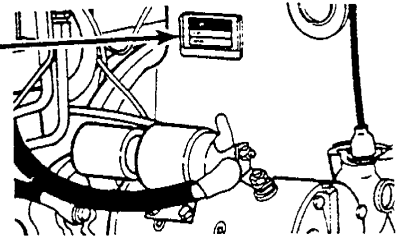
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Section 1010

GENERAL ENGINE SPECIFICATIONS 680 CK Series E Loaders

THE MODEL AND ENGINE SERIAL NUMBER PLATE IS LOCATED ON THE RIGHT HAND SIDE OF THE ENGINE ABOVE THE CRANKING MOTOR.



General

DIESEL ENGINES

Type	4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order	1-3-4-2
Bore	4-5/8 Inches
Stroke	5 Inches
Piston Displacement	336 Cubic Inches
Compression Ratio	16.5 to 1
No Load Governed Speed	2330 to 2370 RPM
Rated Engine Speed	2200 RPM
Engine Idling Speed	700 to 750 RPM
*Valve Tappet Clearance (Exhaust)	(Hot) .020 Inch (Cold) .025 Inch
(Intake)	(Hot and Cold) .015 Inch

*Hot Settings Are Made After The Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.

Piston and Connecting Rods

Rings per Piston	3
Number of Compression Rings	2
Number of Oil Rings	1
Type Pins	Full Floating Type
Type Bearing	Replaceable Precision, Steel Back, Copper-Lead Alloy Liners

Main Bearings

Number of Bearings	5
Type Bearings	Replaceable Precision, Steel Back, Copper-Lead Alloy Liners

Engine Lubricating System

Oil Pressure	45 to 60 Pounds with Engine Warm and Operating at Rated Engine Speed
Type System	Pressure and Spray Circulation
Oil Pump	Gear Type
Oil Filter	Full Flow Spin on Type
Oil Capacity With Filter	11 U.S. Quarts
Without Filter	10 U.S. Quarts

Fuel System

Fuel Injection Pump	Robert Bosch, Type PES Multiple Plunger
Pump Timing	34 Degrees Before Top Dead Center (Port Closing)
Fuel Injectors	Pencil Type (Opening Pressure 3200 PSI)
Fuel Transfer Pump	Plunger Type, Integral Part of Injection Pump
Governor	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
1st Stage Fuel Filter	Full Flow Spin on Type
2nd Stage Fuel Filter	Full Flow Spin on Type

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Section 1050

**MAINTENANCE
AND
LUBRICATION**

FUEL, FLUIDS AND LUBRICANTS

COMPONENT	CAPACITY		SPECIFICATIONS
	U.S.	Metric	
Fuel tank	30 gallons	113.5 liters	
Engine crankcase oil			
With filter change	11 quarts	10.4 liters	Engine oil: Case HDM oil (CD Commercial class D) MIL-L-45199B Above 32° F (0° C) SAE 30 10° to 50° F (-12° to 10° C) SAE 20W Below 40° F (4° C) SAE 10W
Without filter change	10 quarts	9.5 liters	
Hydraulic system			
Total	35 gallons	133 liters	Case TCH Fluid Alternate oils Engine oil - SD - Service class D or CA - Commercial class A Above 32° F (0° C) SAE 10W Below 32° F. (0° C) . . . SAE 5W Type C-2 Transmission and hydraulic fluid such as Tenneco Hytrans Fluid.
Reservoir refill	13.8 gallons	52.2 liters	
Forward/Reverse transmission refill	12 quarts	11.4 liters	Case TCH Fluid
Synchromesh transmission	6.4 pints	3.0 liters	Case FDL Multipurpose Gear Lubricant or (SAE 90, API-GL-4, MIL-L-2105B)
Rear Axle			
Center bowl	13.5 quarts	12.8 liters	Hypoid Gear Oil, API-GL-5 SAE 90 or SAE 80W/90 - -15° F. (-26° C) and above SAE 80W - -15° F. (-26° C) to +70° F. (+21° C) SAE 75W - -40° F. (-40° C) to +35° F. (+2° C)
Planetaries - each	3 pints	1.4 liters	
Cooling System	32 quarts	30.2 liters	Ethylene glycol type antifreeze and water should be mixed for prevailing temperatures. Follow manufacturer's specifications.
Alcohol evaporator	1 pint	0.5 liters	Clean wood alcohol
Batteries	As required		Add colorless, odorless drinking water.
Grease fittings	As required		No. 2 moly disulfide grease Alternate grease: Multipurpose lithium-soap base grease.
Wheel bearings	As required		Number 2 wheel bearing grease.

RUN-IN MAINTENANCE CHART

NOTE: The following charts are based on maximum intervals. If the machine operates in severe conditions, service more often.

NOTE: See page 1050-2 for a listing of fluids and lubricants.

INTERVAL	SERVICE	INSTRUCTIONS
Every Two Hours Until Stabilized	Check wheel nut and bolt torque. Front - 170 foot-pounds torque. Rear - 220-240 foot-pounds torque. Check rear axle mounting bolts. 320-420 foot-pounds torque. Check swing cylinder plate mounting bolts. 500 foot-pounds torque. Check upper swing tower pivot pin nut. 1000 foot-pounds torque.	Section 9012. Section 9012.
After First 20 Hours	Change engine crankcase oil. Replace engine oil filter. Check drive belt tension. Service fuel system.	Section 2047. Section 8016. Section 3010.

SCHEDULED MAINTENANCE CHART

INTERVAL	SERVICE	INSTRUCTIONS
Every 10 Hours or Daily Whichever Occurs First	Grease loader and backhoe pivot points. Check engine crankcase oil level. Check hydraulic oil level. Check radiator coolant level. Drain moisture from air reservoir. Grease inner Extendahoe dipper. Grease front axle pivots. Check machine and ground under it for leaks. Check fuel sediment bowl for water or sediment. If found, drain bowl, 1st stage filter and fuel tank.	Section 7011. Section 3010.








INTERVAL	SERVICE	INSTRUCTIONS
Every 50 Hours or Weekly, Whichever Occurs First	Grease steering king pins. Grease driveshaft universals and slip spline. Check battery electrolyte level. Check Forward/Reverse transmission oil level. Grease brake shafts and slack adjusters. Check tire pressures.	Section 6014. Section 7013. Section 5011.
Every 150 Hours	Change engine oil.	
Every 250 Hours	Check rear axle oil level. Check synchromesh transmission oil level. Clean alcohol evaporator filter. Grease seat post. Lubricate shuttle control lever. Grease loader and backhoe control lever grease fittings.	Section 6020. Section 6018. Section 7020.
Every 300 Hours	Replace engine oil filter.	Section 2047.
Every 500 Hours	Drain deposits from fuel tank. Check drive belt tension. Change fuel filters. Check ROPS as indicated. Repack front wheel bearings.	Sections 7014, 8016 Section 3010. Section 9019. Section 5017.
Every 1000 Hours or Yearly, Whichever Occurs First	Change hydraulic reservoir oil. Replace hydraulic oil filter. Clean hydraulic filter by-pass screen. Change forward/reverse transmission oil. Clean forward/reverse transmission suction screen.	Section 6014. Section 6014.

INTERVAL	SERVICE	INSTRUCTIONS
Every 1000 Hours or Yearly, Whichever Occurs First (Cont'd)	Change synchromesh transmission oil. Change rear axle oil. Clean air compressor cylinder head (by dealer only).	Section 6018. Section 6020. Section 7014.
Every 2000 Hours or Yearly, Whichever Occurs First	Disassemble and clean alcohol evaporator (by dealer only). Drain, flush and refill cooling system.	Section 7020.
Every 3000 Hours	Rebuild or replace air compressor (by dealer only).	Section 7014.
As Required	Service air cleaner element when restriction indicator shows red band. After wheel has been removed for service and reinstalled, check wheel nut/bolt torque every two hours until stabilized. Replace fire extinguisher shell. Fill alcohol evaporator with clean wood alcohol. Check the over-the-center boom stop pad for deterioration. Replace as required. The pad bolt torque is 9 foot-pounds.	Section 2051. Section 9012.





Section 1051

TORQUE CHART

U.S. AND METRIC TORQUE SPECIFICATIONS**Grade 5 Bolts, Nuts and Studs (Dry Threads)**

Thread size	Ft-lbs	N m		Thread size	Ft-lbs	N m
1/4"-20 NC	5-10	7-13		3/4"-10 NC	235-285	319-386
1/4"-28 NF	10-15	13-20		3/4"-16 NF	270-330	366-447
5/16"-18 NC	15-20	20-27		7/8"-9 NC	360-440	488-597
5/16"-24 NF	15-20	20-27		7/8"-14 NF	395-490	536-664
3/8"-16 NC	25-35	34-47		1"-8 NC	520-640	705-867
3/8"-24 NF	30-40	41-54		1"-12 NF	575-705	780-955
7/16"-14 NC	45-55	61-74		1-1/8"-7 NC	720-820	976-1111
7/16"-20 NF	50-60	68-81		1-1/8"-12 NF	790-970	1071-1315
1/2"-13 NC	65-85	88-115		1-1/4"-7 NC	1010-1240	1370-1681
1/2"-20 NF	80-100	109-135		1-1/4"-12 NF	1115-1365	1512-1850
9/16"-12 NC	100-120	135-163		1-3/8"-6 NC	1315-1610	1783-2182
9/16"-18 NF	110-130	149-176		1-3/8"-12 NF	1510-1850	2047-2508
5/8"-11 NC	135-165	183-223		1-1/2"-6 NC	1745-2135	2366-2894
5/8"-18 NF	160-200	216-271		1-1/2"-12 NF	1880-2420	2549-3281

Grade 8 Bolts, Nuts and Studs (Dry Threads)

Thread size	Ft-lbs	N m		Thread size	Ft-lbs	N m
1/4"-20 NC	10-15	13-20		3/4"-10 NC	340-420	461-569
1/4"-28 NF	15-20	20-27		3/4"-16 NF	380-460	515-623
5/16"-18 NC	20-30	27-40		7/8"-9 NC	540-660	732-894
5/16"-24 NF	25-30	34-40		7/8"-14 NF	595-725	807-982
3/8"-16 NC	40-50	54-67		1"-8 NC	810-990	1098-1342
3/8"-24 NF	45-55	61-74		1"-12 NF	900-1100	1220-1491
7/16"-14 NC	60-80	82-102		1-1/8"-7 NC	1150-1400	1559-1898
7/16"-20 NF	70-90	95-122		1-1/8"-12 NF	1295-1585	1756-2148
1/2"-13 NC	100-120	136-162		1-1/4"-7 NC	1640-2000	2224-2711
1/2"-20 NF	110-130	149-176		1-1/4"-12 NF	1800-2200	2440-2982
9/16"-12 NC	135-165	183-223		1-3/8"-6 NC	2140-2620	2901-3552
9/16"-18 NF	155-190	210-257		1-3/8"-12 NF	2450-3000	3322-4067
5/8"-11 NC	200-240	271-325		1-1/2"-6 NC	2845-3475	3857-4711
5/8"-18 NF	215-265	292-359		1-1/2"-12 NF	3200-3900	4339-4880

U.S. AND METRIC TORQUE SPECIFICATIONS**Hydraulic Fittings (Steel)**

Dash Size	Tube O.D. Hose I.D.	Thread Size	37° Flare Torque		Straight Thread O-ring Torque	
			Ft-lbs	N m	Ft-lbs	N m
4	1/4"	7/16"-20	6-12	8-16	12-19	16-25
5	5/16"	1/2"-20	8-16	11-21	16-25	22-33
6	3/8"	9/16"-18	10-25	14-33	25-40	34-54
8	1/2"	3/4"-16	15-42	20-56	42-67	57-90
10	5/8"	7/8"-14	25-58	34-78	58-92	79-124
12	3/4"	1-1/16"-12	40-80	54-108	80-128	108-174
14	7/8"	1-3/16"-12	60-100	81-135	100-160	136-216
16	1"	1-5/16"-12	75-117	102-158	117-187	159-253
20	1-1/4"	1-5/8"-12	125-165	169-223	165-264	224-357
24	1-1/2"	1-7/8"-12	210-250	258-338	250-400	339-542

Split Flange Mounting Bolts (Grade 5, Dry Threads)

Flange Size	Thread Size	Torque	
		Ft-lbs	N m
1/2"	5/16"-18 NC	15-20	20-25
3/4"	3/8"-16 NC	20-25	26-33
1"	3/8"-16 NC	20-25	26-33
1-1/4"	7/16"-14 NC	35-45	47-61
1-1/2"	1/2"-13 NC	45-55	61-74
2"	1/2"-13 NC	55-65	74-88
2-1/2"	1/2"-13 NC	80-90	104-122
3"	5/8"-11 NC	140-150	190-203

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Section 2001

ENGINE DIAGNOSIS

GENERAL INFORMATION

Before making any repairs or adjustments on an engine, a mechanic or technician must properly diagnose the trouble.

Locating the trouble and repairing it is only part of the job, a technician must find and eliminate the cause of the trouble as well. Too many repairs are made with no thought to removing the causes that made the repair necessary.

For any engine to start or perform properly, three main requirements must be present.

1. FUEL
2. COMPRESSION
3. IGNITION

When any of these requirements are not present or limited by some mechanical reason the engine will not start or fails to operate properly throughout the power range.

1. FUEL. Fuel system problems can be present anywhere from the fuel tank, through the filters and injection pump as well as the injectors. Correct injection pump timing is important in the overall fuel system performance.

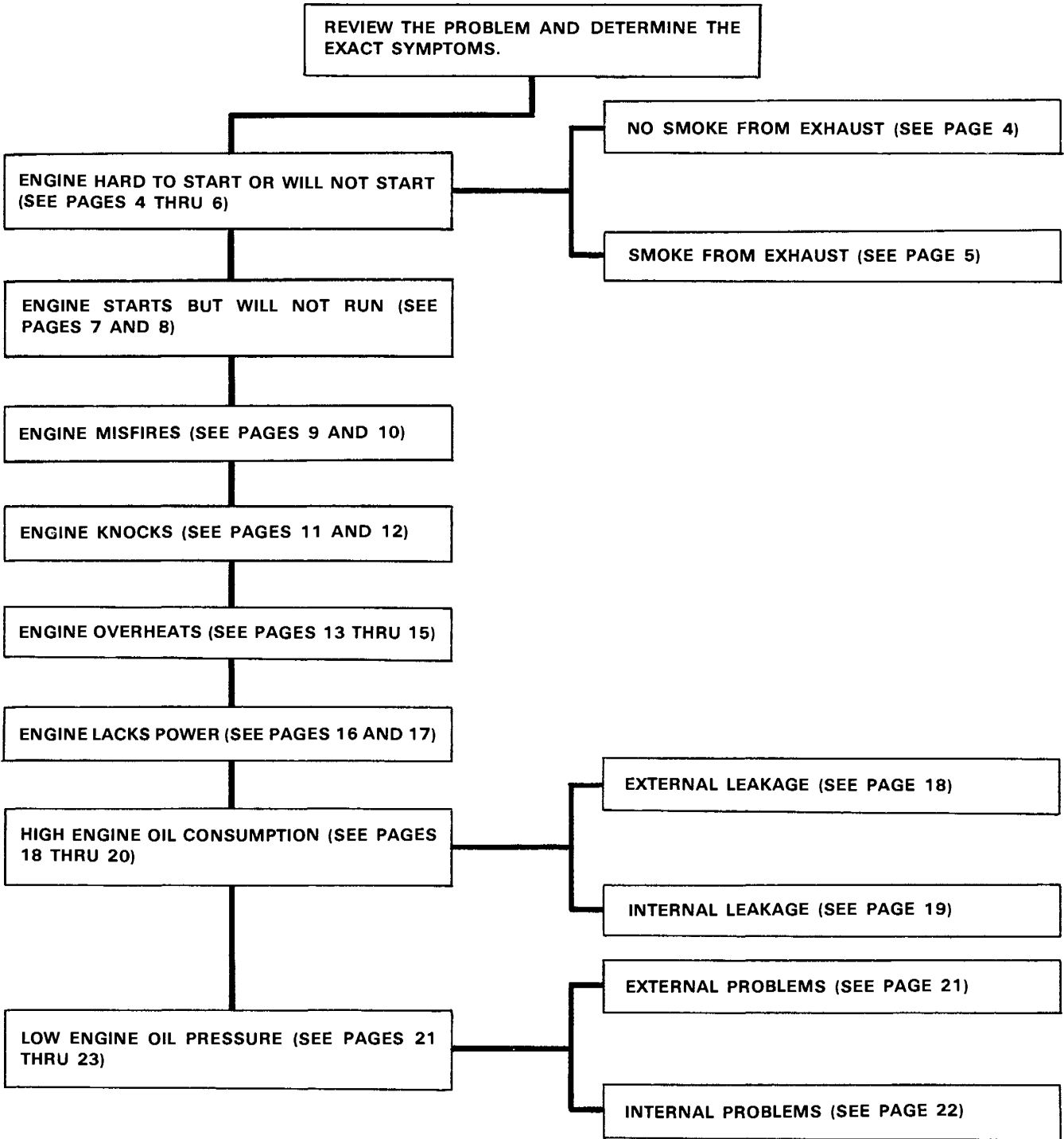
2. COMPRESSION. Compression on an engine is related to the "breathing function".

Proper compression is affected by the air cleaner condition, muffler restriction, valve condition and operation including proper valve adjustment, cylinder head gaskets condition of sleeves, rings, pistons, camshaft, and camshaft timing.

3. IGNITION. Ignition is the result of adequate compression to develop enough heat in the air charge on the compression stroke to fire the fuel being injected into the engine cylinders. Proper spray pattern and atomization of the fuel by the injector is very important. Timing the fuel injection pump to the engine to a precise degree BTDC is a vital requirement for proper ignition.

The engine diagnosis contained in the following pages covers many trouble symptoms, the causes, and what will be necessary to repair or eliminate the problem. Under each symptom are listed the most common and re-occurring problems progressively to the not so common problems. Locate your problem symptom in the diagnosis chart and refer to the pages listed for the probable causes and remedies.

ENGINE DIAGNOSIS CHART



ENGINE HARD TO START OR WILL NOT START

NO SMOKE FROM EXHAUST

1. Fuel Shut-Off Not Open Completely.

Improper cable adjustment, damaged cable, cable slipping in clamps, misadjusted or inoperative solenoid will not completely return fuel shut-off lever to open position. Check lever to be sure it is opening completely. A partially opened lever limits the amount of fuel to the injection pump and results in low engine horsepower.

2. Final Air Filter Plugged

A dirty filter will cause rich fuel mixture and low engine power. Check filter restriction indicator and service final air filter if required.

3. Slow Cranking Speed

Starter must crank engine 200 to 300 RPM in order to ignite the diesel fuel. Check engine RPM while cranking. If cranking is slow, check starter amperage draw to help determine the following defective areas: batteries, cables, solenoid, and starting motor.

Slow cranking speed can be caused by the following internal and external engine defects: scuffing and scoring of pistons and sleeves, improper crankshaft or camshaft end play, defective rod or crank bearings, oil pump, air compressor, water pump or hydraulic pump.

4. Fuel Supply Shut Off or No Fuel

Check that fuel tank shutoff valve is open. Check fuel supply in tank.

5. Air In Fuel System

Bleed fuel system until fuel flows steadily with no bubbles. Check for air leaks at fittings between tank and fuel pump.

6. Camshaft Damaged

A sheared key in the cam drive gear or a broken cam shaft will throw valve timing out of sequence affecting engine operation. Remove cylinder head cover and check valve timing in reference to crankshaft timing marks with a dial indicator.

7. Fuel Injection Nozzle Not Seated In Head.

A nozzle that is not seated in the cylinder head will let compression leak by and not produce enough heat to fire the injected fuel. Check for damaged nozzle gasket or seals, lose nozzle, or broken stud.

8. Fuel Line Plugged

A fuel line plugged with dirt will not let fuel through to the injection pump. Remove line at fuel filters and check for fuel flow through line.

9. Clogged Fuel Filter

Check and service fuel filters.

10. Wrong Fuel or Contaminated Fuel

Wrong fuel or contaminated fuel can cause the unit not to run, or to have preignition and detonation causing serious damage to the engine. Drain fuel tank and refill with correct fuel.

11. Sticking Rack Control

A sticking rack control will not let the fuel injection pump accept any fuel. Remove cap from front of injection pump to see if rack moves when throttle lever is moved.

12. Piston Rings Worn

As piston rings become worn, they lose tension and ability to seal and wipe lubrication oil off cylinder walls. Take a compression test to determine piston ring condition. If readings are low, squirt a small amount of oil into the cylinder and retest. If compression comes up because the oil helps the rings seal, it will be necessary to install new piston rings and possibly sleeve and pistons.

13. Injection Pump Malfunction

A malfunctioning injection pump will usually under-fuel the engine. Adjust or replace the injection pump.

ENGINE HARD TO START OR WILL NOT START

SMOKE FROM EXHAUST

1. Slow Cranking Speed

Starter must crank engine 200 to 300 RPM in order to ignite the diesel fuel. Check engine RPM while cranking. If cranking is slow, check starter amperage draw to help determine the following problem areas: batteries, cables, solenoid, and starting motor.

Slow cranking speed can be caused by the following internal and external engine defects: scuffing and scoring of pistons and sleeves, improper crankshaft or camshaft end play, worn rod or crank bearings, oil pump, air compressor, water pump or hydraulic pump.

2. Fuel Shut-Off Not Open Completely.

Improper cable adjustment, damaged cable, cable slipping in clamps, misadjusted or inoperative solenoid will not completely return fuel shut-off lever to open position. Check lever to be sure it is opening completely. A partially opened lever limits the amount of fuel to the injection pump and results in low engine horsepower.

3. Low Compression

Low compression on several cylinders makes the engine hard to start and also does not generate enough heat to properly fire on all cylinders and continue running. Make a compression check on the engine.

4. Final Air Filter Plugged

A dirty filter will cause rich fuel mixtures and low engine power. Check filter restriction indicator and service final air filter if required.

5. Fuel Injection Nozzles Malfunctioning

Low cracking pressure, improper spray pattern, or plugged spray orifice will affect proper combustion in engine cylinders. Remove and test the fuel injection nozzles.

6. Engine Timing Incorrect

Combustion will not occur in the cylinder at the correct moment (degrees BTDC) if the engine timing is incorrect. This can cause pre-ignition or detonation and serious damage to the engine. Check for proper engine timing.

7. Piston Rings Worn

As piston rings become worn, they lose tension and ability to seal and wipe lubricating oil off cylinder walls. Take a compression test to determine piston ring condition. If readings are low, squirt a small amount of oil into the cylinder and retest. If compression comes up because the oil helps the rings seal, it will be necessary to install new piston rings and possibly sleeve and pistons.

8. Valve Push Rods Bent

Bent push rods will affect valve operation and not allow cylinders to get a full charge of fuel and air, or not exhaust properly. This can usually be distinguished by excessive valve tappet noise. Remove cylinder covers and check for bent push rods.

9. Clogged Fuel Filter

Check and service fuel filters.

10. Fuel Injection Nozzle Not Seated In Head

A nozzle that is not seated in the cylinder head will let compression leak by and not produce enough heat to fire the injected fuel. Check for damaged nozzle gasket or seals, loose nozzle, or broken stud.

11. Tune-up Specifications Wrong

Check engine and unit serial number plates for correct specifications when performing engine tune-up.

12. Piston and Sleeves Scuffed and Scored

Scuffing starts as a very small surface disturbance of torn out metal particle. This helps break down lubrication which increases heat and spreads the scuffing to adjacent areas. Scuffing and scoring are caused by malfunctioning of the lubrication system or cooling system, incorrect timing, detonation, pre-ignition, lugging or overloading, improperly fitted parts, and improper break-in procedure. Remove piston assemblies and inspect.

ENGINE HARD TO START OR WILL NOT START

SMOKE FROM EXHAUST (Cont'd)

13. Cylinder Head Gasket Blown

A blown cylinder head gasket will cause one or two cylinders to lose power and cause an engine miss. It can also cause cooling system pressure to rise and blow engine coolant out the radiator overflow. Take a compression test to help determine a defective head gasket or, remove thermostats and fan belts, run engine, and check for gas bubbles rising in coolant in the water manifold.

14. Piston Ring Installation Faulty or Broken Rings

Many times piston rings are installed wrong, upside down, wrong size, or expanders are cut-off on three piece oil rings and overlapping the expander. Be sure to carefully read instructions before installing piston rings. Damaged rings can cause scoring of the pistons and sleeves and cause the engine to use oil.

15. Valves sticking

Sticking valves can be caused by improper replacement of valve guides, no lubrication, rust vapors, bent valves, or carbon. A stick-

ing valve will cause an engine miss and the valve could also hit the piston causing internal damage.

16. Wrong Fuel or Contaminated Fuel

Wrong fuel or contaminated fuel can cause the unit not to run or to have preignition and detonation causing serious damage to the engine. Drain fuel tank and refill with correct fuel.

17. Injection Pump Malfunction

A malfunctioning injection pump will usually under-fuel the engine. Adjust or replace the injection pump.

18. Fuel Injection Line Cracked.

A cracked, chaffed or damaged fuel injector line will allow the fuel to escape externally and not inject fuel into the cylinder. This will cause an engine miss and low horsepower. Leaking fuel from a damaged injector line can easily be seen.

ENGINE STARTS BUT WILL NOT RUN

1. Fuel Shut-Off Not Open Completely

Improper cable adjustment, damaged cable, cable slipping in clamps, misadjusted or inoperative solenoid will not completely return fuel shut-off lever to open position. Check lever to be sure it is opening completely. A partially opened lever limits the amount of fuel to the injection pump and results in low engine horsepower.

2. Final Air Filter Plugged

A dirty filter will cause rich fuel mixtures and low engine power. Check filter restriction indicator and service final air filter if required.

3. Air In Fuel System

Bleed fuel system until fuel flows steady with no air bubbles. Check for air leaks at fittings between fuel tank and injection pump.

4. Low Fuel Supply

Check fuel supply in tank and refill if necessary.

5. Injection Pump Rack Control Sticking

A sticking rack control will not allow the fuel injection pump to accept any fuel. Remove cap from front of pump and check that rack moves when throttle lever is moved.

6. Low Compression

Low compression on several cylinders makes the engine hard to start and also does not generate enough heat to properly fire on all cylinders and continue running. Make a compression check on the engine.

7. Valve Push Rods Bent

Bent push rods will affect valve operation and not allow cylinders to get a full charge of fuel and air, or not exhaust properly. This can usually be distinguished by excessive valve tappet noise. Remove cylinder covers and check for bent push rods.

8. Camshaft Damaged

A sheared key in the cam drive gear or a broken camshaft will throw valve timing out of sequence, affecting engine operation. Remove cylinder cover and check valve timing in reference to crankshaft timing marks with a dial indicator.

9. Wrong Fuel or Contaminated Fuel

Wrong fuel or contaminated fuel can cause the unit not to run or to have preignition and detonation causing serious damage to the engine. Drain fuel tank and refill with correct fuel.

10. Clogged Fuel Filter

Check and service fuel filters.

11. Fuel Injection Nozzles Malfunctioning

Low cracking pressure, improper spray pattern, or plugged spray orifice will affect proper combustion in engine cylinders. Remove and test the fuel injection nozzles.

12. Cylinder Head Gasket Blown

A blown cylinder head gasket will cause one or two cylinders to lose power and cause an engine miss. It can also cause cooling system pressure to rise and blow engine coolant out the radiator overflow. Take a compression test to help determine a defective head gasket or, remove thermostats and fan belts, run engine, and check for gas bubbles rising in coolant in the water manifold.

13. Piston Rings Worn

As piston rings become worn, they lose tension and ability to seal and wipe lubricating oil off cylinder walls. Take a compression test to determine piston ring condition. If readings are low, squirt a small amount of oil into the cylinder and retest. If compression comes up because the oil helps the rings seal, it will be necessary to install new piston rings and possibly sleeve and pistons.