

G38 Kohler Engine

Safety, Operation, Maintenance & Parts Manual

079385 Engine G38 Kohler EFI **rev. D**

Safety is our #1 concern!

Form #2241

Used with:

LT40HD

rev. K7.05

LT40HD Supers

rev. K4.02

LT50HD

rev. A6.01



WARNING! Read and understand this manual before using this machine.

California
Proposition 65 Warning



WARNING: Breathing gas/diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Always start and operate the engine in a well-ventilated area.
If in an enclosed area, vent the exhaust to the outside.
Do not modify or tamper with the exhaust system.
Do not idle the engine except as necessary.

For more information go to **www.P65warnings.ca.gov**.



WARNING: Drilling, sawing, sanding or machining wood products can expose you to wood dust, a substance known to the State of California to cause cancer. Avoid inhaling wood dust or use a dust mask or other safeguards for personal protection.

For more information go to **www.P65Warnings.ca.gov/wood**.

Active Patents assigned to Wood-Mizer, LLC

Wood-Mizer, LLC has received patents that protect our inventions which are a result of a dedication to research, innovation, development, and design. Learn more at: woodmizer.com/patents

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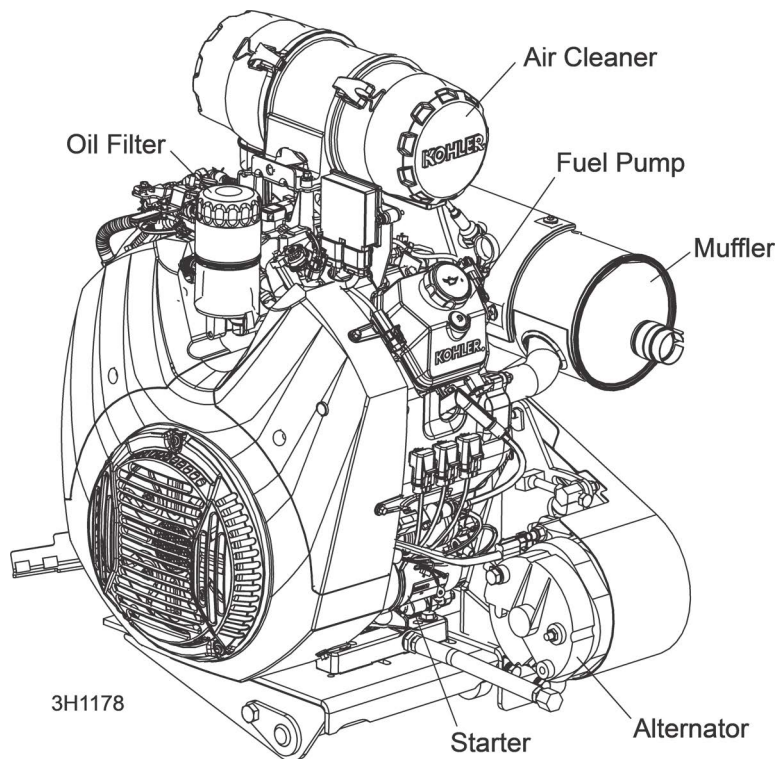
SECTION 1 ABOUT THIS MANUAL

This manual is provided as a supplement to the equipment manufacturer's manuals. This manual provides information specific to the use of this equipment on the Wood-Mizer® sawmill. Refer to the sawmill operator's manual and manufacturer's manual before attempting to operate this equipment.

NOTICE Read the sawmill operator's manual and engine manufacturer's manual for instructions and safety precautions before operating this equipment.

The information and instructions given in this manual do not amend or extend the limited warranties for the equipment given at the time of purchase.






G38 ENGINE



SECTION 2 OPERATION

2.1 Starting The Engine

ENGINE CONTROL PANEL LIGHTS

-  *Alternator Charge Indicator:* Lights up if the alternator is not charging the battery
-  *Engine Temperature Indicator:* Not used.
-  *Key Switch Indicator:* Lights up when the key is in either the on or accessory (#1 or #3) position.
-  *Oil Indicator:* Lights up if the oil pressure is too low. The engine will automatically switch to low idle if a low oil condition occurs.
-  *Glow Plug Indicator:* Not used.

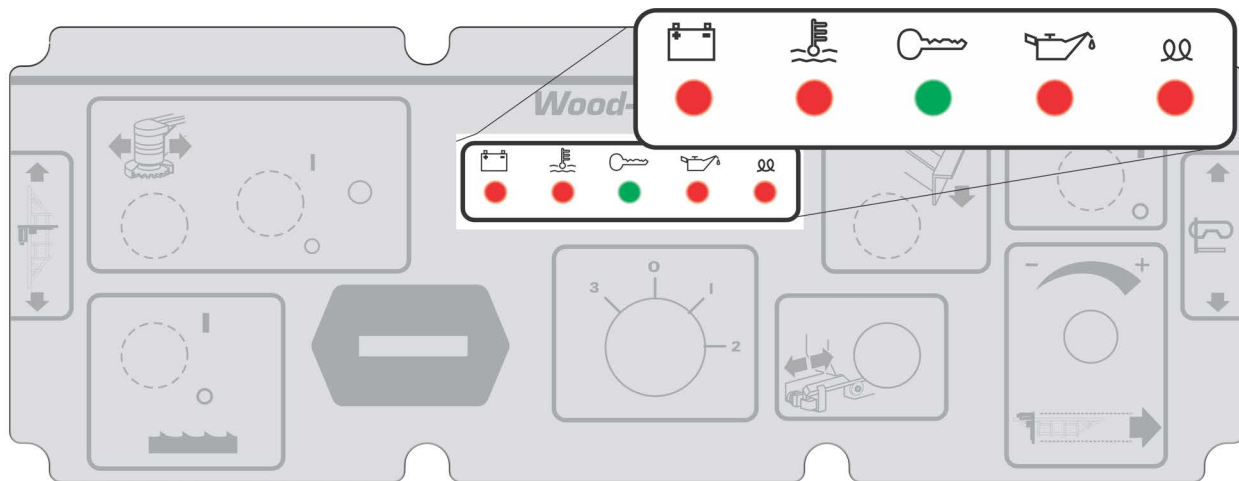


FIG. 2-1

ENGINE START

⚠ DANGER! Always be sure the blade is disengaged and all persons are out of the path of the blade before starting the motor. Failure to do so will result in serious injury.

⚠ DANGER! Operate your engine/machine only in well ventilated areas. The exhaust gases of your engine can cause nausea, delirium and potentially death unless adequate ventilation is present.

⚠ DANGER! Never operate an engine with a fuel or oil leak. The leaking fuel or oil could potentially come in contact with hot surfaces and ignite into flames.

⚠ WARNING! Be sure the power feed switch is in the neutral position before turning the key switch to the on (#1) or accessory (#3) position. This prevents accidental carriage movement, which may cause serious injury or death.

⚠ WARNING! Do not operate engine without proper and operational spark arrester/muffler. Sparks emitted from the engine exhaust could ignite surrounding materials, causing serious injury or death.

⚠ WARNING! EPA Compliant Gas Tanks Only: Always relieve all fuel pressure inside the tank prior to filling or connecting fuel fittings. Failure to do so may result in fuel spillage.

WARNING! EPA Compliant Gas Tanks Only: Disconnect the fuel tank when not in use or during transportation. Failure to do so may result in engine flooding or fuel spillage.

NOTE: When the clutch handle is engaged, an accelerator pump is activated which supplies fuel to the engine carburetor. To avoid flooding the carburetor and possibly fouling the spark plugs, do not engage the clutch lever repeatedly without the engine running.

ENGINE SHUTOFF

Turn the key switch to the off (#0) position.

SECTION 3 MAINTENANCE

Refer to the manufacturer's manual for maintenance intervals and procedures unless otherwise instructed in this manual. Follow the manufacturer's recommendations for dusty conditions.

NOTICE Refer to the manufacturer's manual for complete maintenance instructions. This manual only provides information about additional procedures or procedures to be performed at different time intervals than found in the manufacturer's manuals



WARNING! Clean sawdust from all guards, vents, control boxes, or any area where sawdust may gather **after every shift**. Failure to do so may result in fire, causing death or serious injury.



3.1 Safety

Use caution when performing maintenance or service to the engine.



DANGER! Always be aware of and take proper protective measures against rotating shafts, pulleys, fans, etc. Always stay a safe distance from rotating members and make sure that loose clothing or long hair does not engage rotating members resulting in possible injury.

DANGER! Engine components can become very hot during operation. Avoid contact with any part of a hot engine. The exhaust components of your engine are especially hot during and following operation. Contact with hot engine components can cause serious burns. Therefore, never touch or perform service functions on a hot engine. Allow the engine to cool sufficiently before beginning any service function.



WARNING! Remove the blade before performing any engine service. Failure to do so may result in serious injury.

WARNING! Always wear proper and necessary safety equipment when performing service functions. Proper safety equipment includes eye protection, breathing protection, hand protection and foot protection.

3.2 Cooling System

1. Wash the engine or brush off sawdust and debris every 50 hours of operation.
2. Clean the grass screen, cooling fins, and external surfaces.
3. Remove any dust, dirt or oil.
4. See engine manual for further instructions.

3.3 Air Cleaner

Replace the outer air cleaner cartridge and check the inner cartridge every 250 hours of operation or more often if operating the sawmill in dirty conditions or if engine performance indicates a new cartridge is necessary.



CAUTION! Do not clean elements with water or compressed air. Do not handle the inner element unless it is to be changed. Handle new elements carefully. Contact with the element could cause damage and prevent the filter from operating properly.

Replace the inner air cleaner cartridge every 1200 hours of operation or more often if operating the sawmill in dirty conditions.

3.4 Fuel Filter

Replace the fuel filter every 100 hours of operation or as required for engine performance.

3.5 Battery

Check the battery electrolyte level every 50 hours of operation. See manufacturer's manual for instructions.

DANGER! Batteries expel explosive gases. Keep sparks, flames, burning cigarettes, or other ignition sources away at all times. Always wear safety goggles and a face shield when working near batteries. Failure to do so will cause serious injury.

WARNING! Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

3.6 Alternator Belt

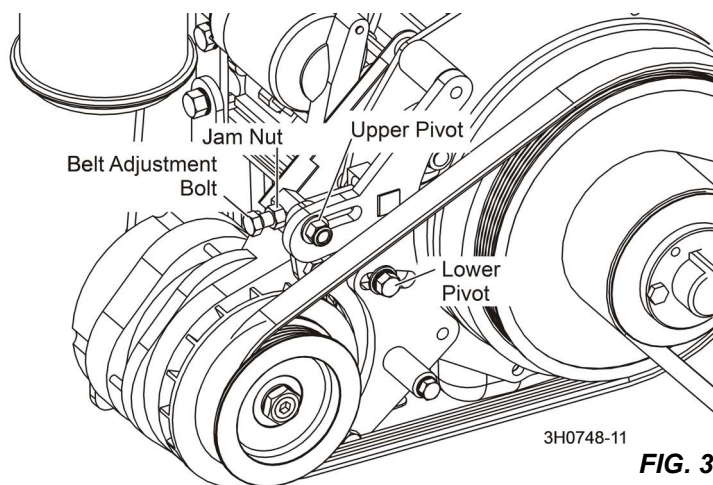
The belt tension should be checked after the first 100 hours of operation, when the battery is not charging properly or when the alternator belt is squealing.

If the battery continues to not charge properly or the belt continues to squeal after the initial belt adjustment, replace the belt.

1. Release the blade tension and remove the blade from the sawmill if necessary.
2. Turn the key switch to OFF (0) and remove the key.
3. Remove the drive belt cover and alternator cover.
4. Use a belt tension gauge to measure the belt tension.
5. Place the gauge on the belt at the midpoint between the two pulleys.

If the belt has more than 3/16" at 9 lb. of deflection, tighten the belt as described below.

6. Loosen the upper pivot, lower pivot and the adjustment bolt jam nut.
7. Turn the belt tension adjustment bolt clockwise to tighten the belt, counterclockwise to loosen the belt.
8. Adjust the bolt until the proper belt tension is achieved.



CAUTION! Do not overtighten the alternator belt. Damage to the alternator will occur.

9. After the alternator belt has been tensioned, tighten the adjustment bolt jam nut.
10. Tighten the upper and lower pivots and replace the belt covers.

3.7 RPM Adjustments

WARNING! Remove the blade before performing any engine service. Failure to do so may result in serious injury.

Check the RPM with a tachometer every 200 hours of operation.

Engine	High End RPM	Low End RPM
G38	3600	1500

Before checking the RPM, check oil, fuel, and coolant levels and make sure belt and brake strap tensions are correct (See Sawmill Maintenance).

1. Ensure the throttle cable does not affect the engine RPM when the clutch handle is disengaged or the cable is not bent or kinked.

NOTE: It is important that the above components are aligned. Proper alignment allows any slack in the cable (when engine is idling) to slide down into the cable spring. This maintains free operation of the cable and prevents the cable from kinking.

2. Ensure the shoulder bolt does not rub against the crankcase vent tube.
 1. Start the engine to measure the low-end RPM.
 2. Refer to the engine manual to adjust the low-end RPM.
 3. Engage the clutch handle to throttle the engine and measure the high-end RPM. The high-end RPM is factory-set at 3600.
 4. Readjust the throttle cable if necessary to increase or reduce the high-end engine speed.

The throttle cable should be tensioned just enough so that the engine revs as soon as the clutch/brake handle is engaged.

NOTE: A properly adjusted throttle will extend the cable spring 1/4" to 3/8" (6.4 - 9.5 mm) when running and have a slight amount of slack in the cable when idling.

3.8 Miscellaneous Maintenance

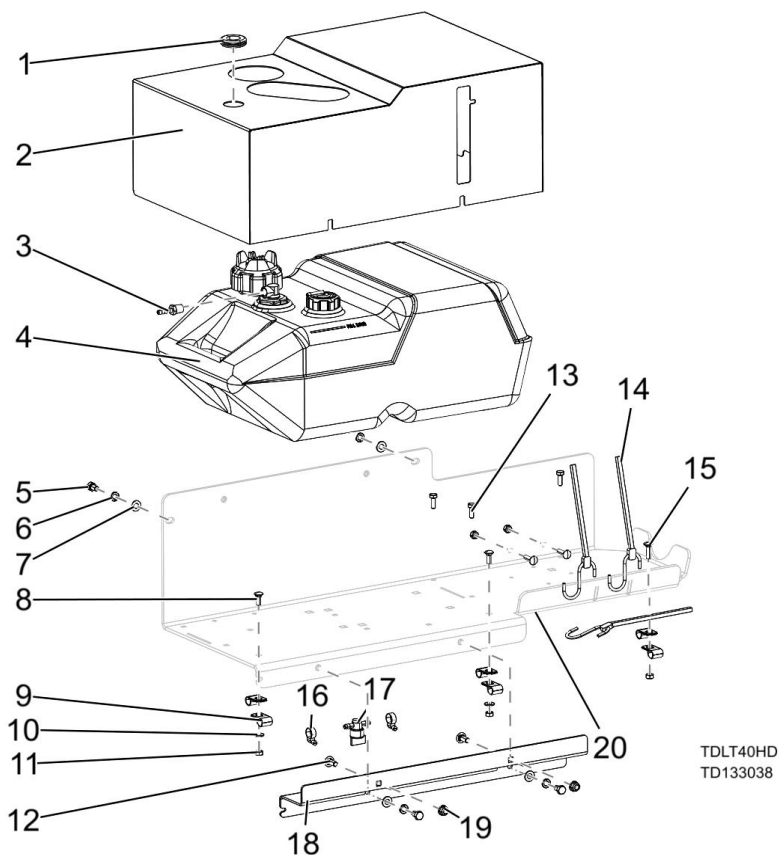
Clean and inspect the spark arrester every 50 hours of operation.

Replace if damaged.

Review the manufacturer's engine manual for maintenance intervals.

SECTION 4 REPLACEMENT PARTS

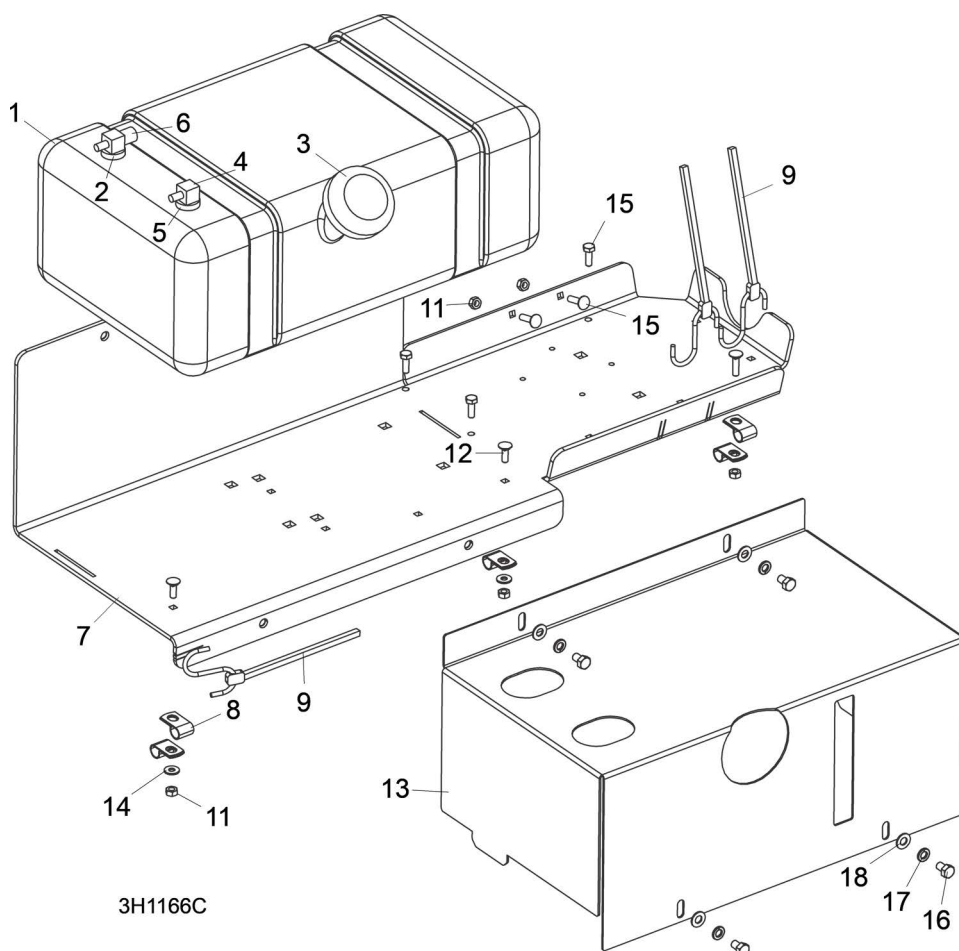
4.1 Fuel Tank



REF	PART #	DESCRIPTION	COMMENTS	QTY.
1	P702	Grommet, 7/8In IDx1 1/4In Groove Dia		1
2	130288	Cover Weldment, Fuel Tank, Domestic		1
3	P05393	Barb, 1/4 Hose 1/4NPT		1
4	130286	Fuel Tank, Domestic 6 Gal		1
5	F05006-15	Bolt, 5/16-18x1/2 HH Gr5		4
6	F05011-13	Washer, 5/16 Split Lock		4
7	F05011-17	Washer, 5/16 SAE Flat		4
8	F05005-113	Bolt, 1/4-20x3/4 Carriage		2
9	P07584	Clamp, 1/2EMT Coated		6
10	F05011-11	Washer, 1/4 SAE Flat		2
11	F05010-21	Nut, 1/4-20 Swaged		5
12	F05006-86	Bolt, 5/16-18x3/4 Carriage		2
13	F05005-123	Bolt, 1/4-20x3/4 HH Gr5		3
14	P11668	Strap, 20 Rubber W/Hooks		3
15	F05005-34	Bolt, 1/4-20 X 1 Carr		3
16	P649	Hose Clamp, 7/32in-5/8in		2
17	P851	Valve, Fuel, In Line Shut Off		1
18	130283	Extension, Fuel Tray		1
19	F05010-221	Nut, 5/16-18 Flanged Hex Nylock		2

REF	PART #	DESCRIPTION	COMMENTS	QTY.
20	103943	Weldment, Fuel Tank LT40/50		1
	R02423-1	Hose, Fuel 3/16" EPA 15G CARB	Not shown	7.5ft
	R02423-2	Hose, Fuel 1/4" EPA 15G CARB	Not shown	6.8ft
	064654	Grommet, Remote Vent	Not shown	1
	064653	Remote Vent w/ Valve	Not shown	1

4.2 Fuel Tank



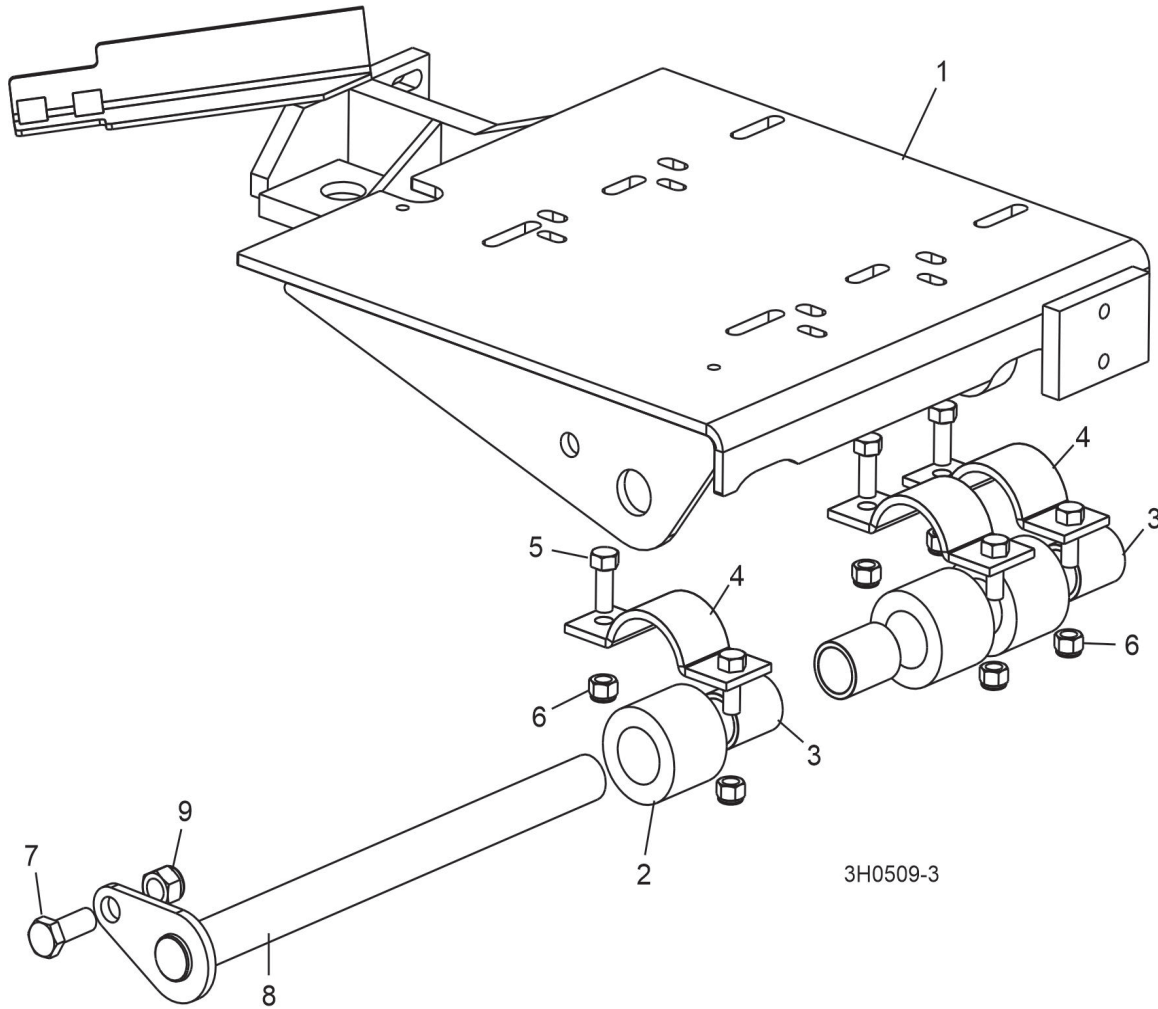
REF	PART #	DESCRIPTION	COMMENTS	QTY.
	074821	TRAY ASSEMBLY, GAS CAN		1
1	103878	Tank, 5 Gallon Low Pro EPA Fuel	Available in assemblies only.	1
2	061250	Grommet, Shut Off		1
3	061251	Gas Cap, LT15		1
4	061252	Valve, Slosh		1
5	061253	Grommet, Slosh Valve		1
6	074943	Fitting, Fuel Pick-Up With Shut-Off		1
7	103943	Tank Weldment, Fuel LT40/50		1
8	P07584	Clamp, 1/2" EMT Coated		6
9	P11668	Strap, 20" Rubber		3
10	F05005-34	Bolt, 1/4-20 X 1" Carriage Head		3
11	F05010-21	Nut, 1/4-20 Hex Lock		5
12	F05005-113	Bolt, 1/4-20 x 3/4" Carriage		2
13	103867	Cover, Fuel Tank		1
14	F05011-11	Washer, 1/4" SAE Flat		2
15	F05005-123	Bolt, 1/4-20 x 3/4" Hex Head Grade 5		3
16	F05006-15	Bolt, 5/16-18 x 1/2" Hex Head Grade 5		4
17	F05011-13	Washer, 5/16" Split Lock		4
18	F05011-17	Washer, 5/16" SAE Flat		4
	R02423-1	Hose, Fuel 3/16" EPA 15G CARB		8 Ft.

REF	PART #	DESCRIPTION	COMMENTS	QTY.
	R02423-2	Hose, Fuel 1/4" EPA 15G CARB		8 Ft.

4.3

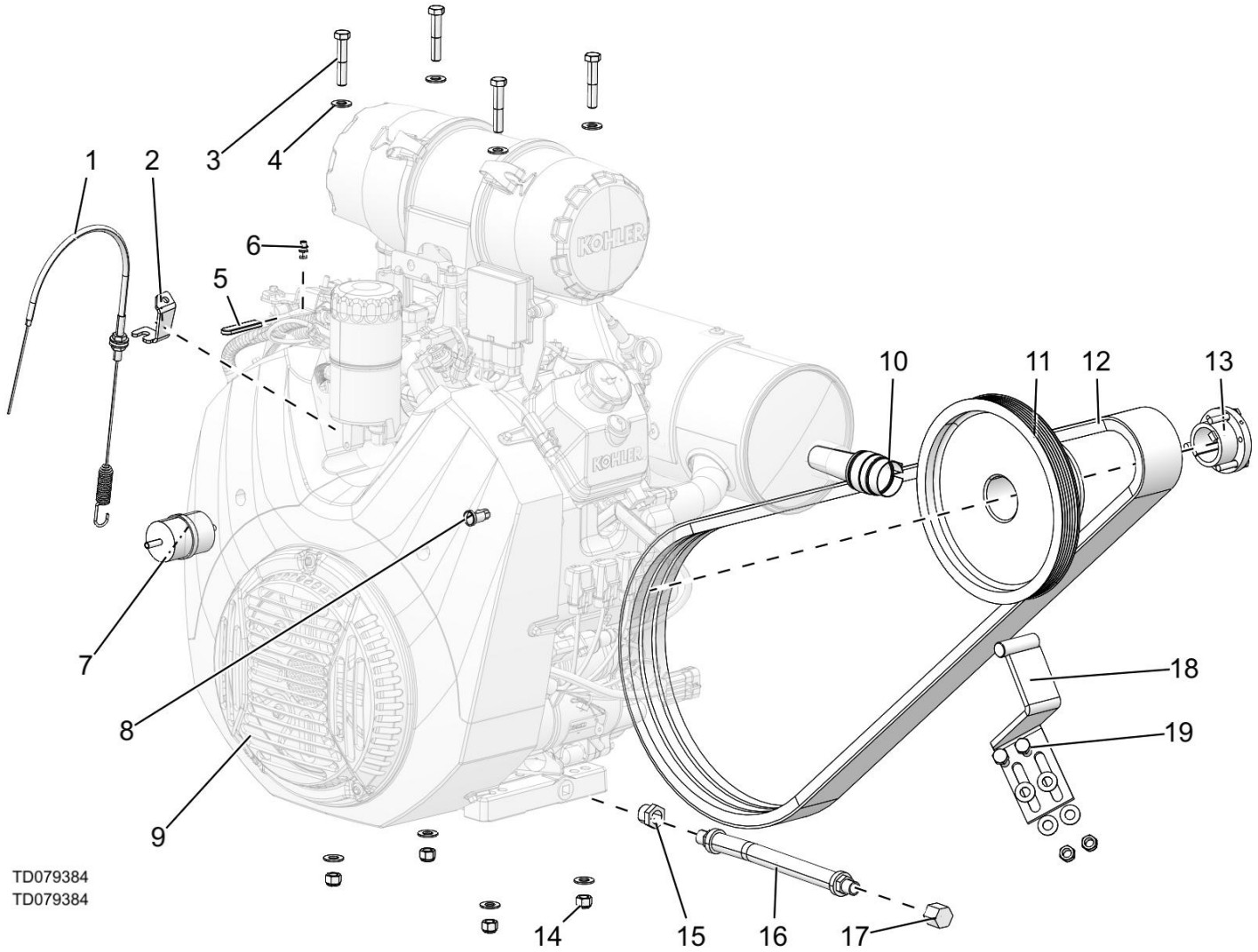
4.4

4.5 Engine Mount Assembly



REF	PART #	DESCRIPTION	COMMENTS	QTY.
	016319	Mount Kit, Kohler Engine	Service Kit including bushings and hardware	1
1	014514	Mount Weldment, Kohler Engine	Available in assemblies only.	1
	016380	Bushing Assembly, Motor Mount		3
2	016378	Bushing, 2" OD x 2"	Available in assemblies only.	1
3	016379	Bearing, 1" x 1 1/4" x 2"	Available in assemblies only.	1
4	014540	Clamp Weldment, Motor Mount Pivot Bushing		3
5	F05007-7	Bolt, 3/8-16 X 1" Hex Head		3
6	F05010-10	Nut, 3/8-16 Hex Nylon Lock		6
7	F05008-37	Bolt, 1/2-13 X 1 1/4" Hex Head Grade 5		1
8	014154	Pin Weldment, Engine Mount Pivot		1
9	F05010-8	Nut, 1/2-13 Nylon Lock		1

4.6 Engine Assembly



TD079384
TD079384

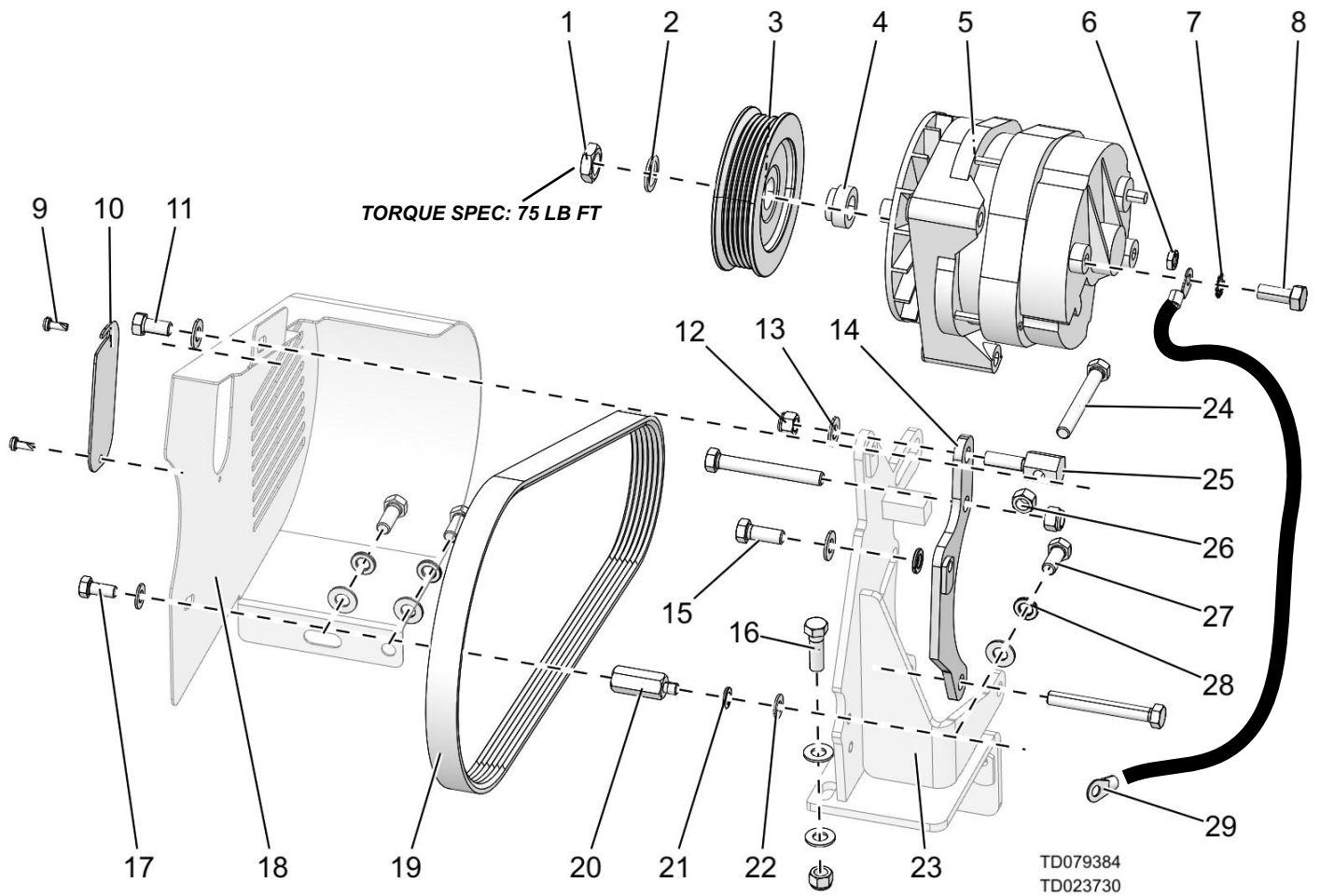
REF	PART #	DESCRIPTION	COMMENTS	QTY.
	CEG38	Cover, G35 (G38) Engine		1
	079385	Assembly, LT40/50 G38 Kohler EFI Engine		1
1	034809	Cable Assembly, D10 Throttle		1
2	003222	Bracket, 1/8 G38 Throttle		1
3	F05007-124	Bolt, 3/8-16 x 2 HH Grd 5 YZD		4
4	F05011-3	Washer, 3/8 Flat SAE		12
5	003229	Grip, 1/16x3/8x2 Black Vinyl		1
6	048904	Throttle Fitting, Swivel		1
7	P12758	Filter, Kohler Fuel #25-050-8S1		1
8	E20482	Light, Red 12Volt ,187 Tabs		1
9	079384	Engine, 38HP Kohler EFI Gas		1
	014717	Filter, 13/15/19/25HP Kohler Engine Oil	Service parts	1
	061371	Assembly, Starter 25 098 21S		1
	046553	Air Filter, Primary Element		1
	046554	Air Filter, Inner Element		1

4 Replacement Parts

Engine Assembly

REF	PART #	DESCRIPTION	COMMENTS	QTY.
	061426	Plug, Spark Kohler 62 132 04-S		1
	061156	Pump, Fuel 62 559 01S Low Pressure		1
	061231	Pump Electric, Fuel G26 25 755 73-s		1
		24 050 13-S Filter, fuel		1
		25 850 03-S KIT, Extended life oil change		1
		25 519 04-S Coil, Ignition (EFI - RFI/EMC)		1
		25 418 23-S Sensor, O2 (G38)		1
10	079744	Spark Arrestor Assembly, G38 Kohler Straight		1
11	003206	Sheave, 5Vx4.06x8.5 Poly-V, G38		1
12	016556	Belt, 3/5VL750		1
13	016535	Bushing, SHx1 7/16		1
14	F05010-10	Nut, 3/8-16 Hex Nyl Lock		6
15	003227	Bushing, 1/2 MPTx3/8 FPT Brass		1
16	P10082	Hose, 3/8NPTx9 5/8 Rubber		1
17	P04332	Cap, 3/8 Pipe Galvanize		1
		Alternator Parts	(See Section 4.7)	
		Engine Mount Parts	(See Section 4.5)	
18	015058	Bracket Weldment, Clutch Enhance.	Located inside sawhead	1
19	F05007-7	Bolt, 3/8-16x1 HH	Uses 4 F05011-3 washers and 2 F05010-10 nuts cited above	2

4.7 Alternator Assembly



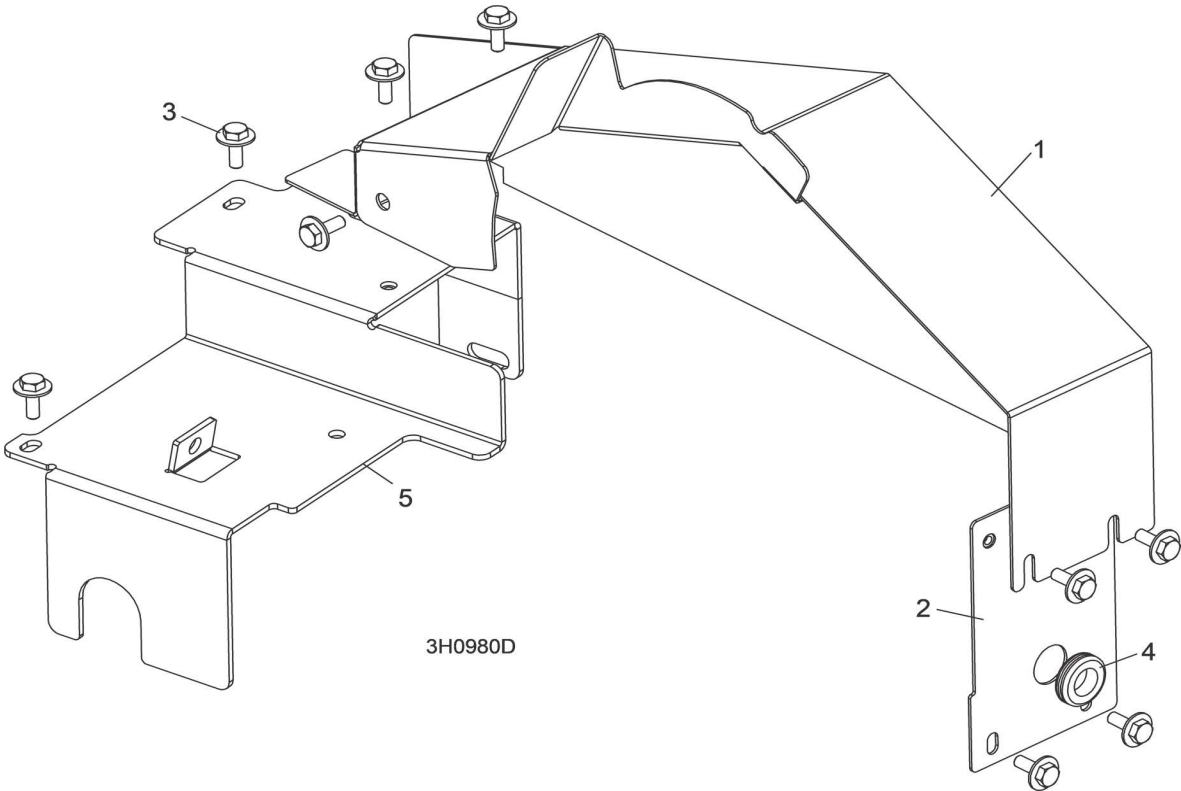
REF	PART #	DESCRIPTION	COMMENTS	QTY.
	023730	Alternator Assembly, 140 Amp		1
1	023695_3	Nut, 140 Amp Alt. Pulley	Torque pulley nut to 75 lb ft	1
2	023695_2	Washer, 140 Amp Alt. Pulley		1
3	023694	Pulley, 140A Alternator		1
4	036571	Spacer, 023694 Alt Sheave		1
5	023695	Alternator, 140 Amp		1
6	F05010-76	Nut, M8x1.25 Metric Jam		1
7	F05011-36	Washer, 3/8 Star External		1
8	F81003-11	Bolt, M10-1.5x25 HH CI 8.8		1
9	F05015-17	Bolt, #10-24x1/2 PH		2
10	023794	Plate, Belt Guard Access		1
11	F05007-27	Bolt, 3/8-16x3/4 HH Gr2		1
12	F05010-10	Nut, 3/8-16 Hex Nyl Lock		3
13	F05011-3	Washer, 3/8 Flat SAE		8
14	015875	Plate Weldment, Kubota Alt Mount		1
15	F05007-87	Bolt, 3/8-16x1 Gr5 HH		2

4 Replacement Parts

Alternator Assembly

REF	PART #	DESCRIPTION	COMMENTS	QTY.
16	F05007-123	Bolt, 3/8-16x 1 1/4 HH Gr5		1
17	F05006-5	Bolt, 5/16-18x3/4 HH Gr2		1
18	003216	Guard Weldment, 140A Alt G38		1
19	023709	Belt, 6PK425 Fib.		1
	003202	Mount Assy, 140 Alt. G38		1
20	107089	Spacer, 5/8 Hex x1-1/2		1
21	F05011-13	Washer, 5/16 Split Lock		1
22	F05011-17	Washer, 5/16 SAE Flat		2
23	107138	Mount Weldment, 140 Alt G38		1
24	F05007-1	BOLT, 3/8-16X3 HH FULL THRD, ZN		3
25	023764	Stud, 140 Alt. Tensioner		1
26	F05010-1	Nut, 3/8-16 Hex		1
27	F05007-185	Bolt, 3/8-16x7/8 HH Gr5		2
28	F05011-4	Washer, 3/8 Split Lock		4
29	017770	Wire Assembly, Ground Jumper		1
	015969	Wire Assembly, 61/140 Amp Alternator Plug		1
	024308	Wire Assembly, Alternator to Starter		1

4.8 Engine Pulley Guards



REF	PART #	DESCRIPTION	COMMENTS	QTY.
1	003220	Guard Weldment, G35 (G38) Engine Pulley		1
2	003263	Plate Weldment, G35 (G38) Engine Pulley Guard Mount		1
3	F05005-134	Bolt, 1/4-20 x 3/4" Hex Head With Conical Washer		9
4	P11764	Grommet, 5/8" ID Rubber		1
5	015962	Guard, Kohler Side Engine Pulley		1

APPENDIX A EFI DIAGNOSTIC INSTRUCTIONS

Section 5 EFI Fuel System

Troubleshooting

General

When troubleshooting a problem on an engine with EFI, basic engine operating problems must be eliminated first before faulting the EFI system components. What appears to be an EFI problem could be something as simple as a fuel tank with debris in the bottom or a plugged vent. Be sure the engine is in good mechanical operating condition and all other systems are operating properly before attempting to troubleshoot the EFI system.

Troubleshooting Guide

Engine starts hard or fails to start when cold

1. Fuel pump not running
2. Faulty spark plugs
3. Old/stale fuel
4. Incorrect fuel pressure
5. Crankshaft position sensor loose or faulty
6. TPS set incorrect (ECU Reset and TPS Learn)
7. TPS faulty
8. Engine temp sensor faulty
9. Faulty coils
10. Low system voltage
11. Faulty injectors
12. Faulty battery
13. Loose or corroded connections

Engine starts hard or fails to start when hot

1. Faulty spark plugs
2. Fuel pump not running
3. Fuel pressure low
4. Insufficient fuel delivery
5. TPS set incorrect (ECU Reset and TPS Learn)
6. Crankshaft position sensor loose or faulty
7. TPS faulty
8. Engine temp sensor faulty
9. Faulty injectors

Engine stalls or idles roughly (cold or warm)

1. Faulty spark plugs
2. Insufficient fuel delivery
3. TPS set incorrect
4. TPS faulty
5. Faulty engine temperature sensor
6. Faulty injectors

Engine misses, hesitates, or stalls under load

1. Fuel injector(s), fuel filter, fuel line, or fuel pick-up dirty/restricted
2. Dirty air cleaner
3. Insufficient fuel pressure or fuel delivery
4. Vacuum (intake air) leak
5. Improper governor setting, adjustment or operation
6. TPS faulty, mounting problem or TPS Learn Procedure incorrect
7. Bad coil(s), spark plug(s), or wires

Low Power

1. Faulty/malfunctioning ignition system
2. Dirty air filter
3. Insufficient fuel delivery
4. Improper governor adjustment
5. Plugged/restricted exhaust
6. One injector not working
7. Basic engine problem exists
8. TPS faulty or mounting exists
9. Throttle plate in throttle body not fully opening to WOT stop (if so equipped)

Fuel System



WARNING: Fuel System Under Pressure!

The fuel system operates under high pressure. System pressure must be relieved through the fuel connector and the fuel pump module (see page 5.2) prior to servicing or removal of any fuel system components. Do not smoke or work near heaters or other fire hazards. Have a fire extinguisher handy and work only in a well-ventilated area.

The function of the fuel system is to provide sufficient delivery of fuel at the system operating pressure of 39 psi \pm 3. If an engine starts hard, or turns over but will not start, it may indicate a problem with the EFI fuel system. A quick test will verify if the system is operating.

1. Disconnect and ground the spark plug leads.
2. Complete all safety interlock requirements and crank the engine for approximately 3 seconds.

3. Remove the spark plugs and check for fuel at the tips.
 - a. If there is fuel at the tips of the spark plugs the fuel pump and injectors are operating.
 - b. If there is no fuel at the tips of the spark plugs, check the following:
 - 1) Make sure the fuel tank contains clean, fresh, proper fuel.
 - 2) Make sure that the vent in the fuel tank is open.
 - 3) Make sure the fuel tank valve (if so equipped) is fully opened.
 - 4) Make sure the battery is supplying proper voltage.
 - 5) Check that the fuses are good, and that no electrical or fuel line connections are damaged or broken.
 - 6) Test fuel pump module operation as described earlier under Fuel Pump – Service.
4. The MIL will blink a series of times. The number of times the MIL blinks represents a number in the blink code.
5. A sequence of four digits make up a fault code. There is a one (1) second pause between the blinks of a fault code. There is a three (3) second pause between separate fault codes. After the fault code(s) are blinked a two digit 61 is blinked to indicate the program has completed.
 - a. It's a good idea to write down the codes as they appear, as they may not be in numerical sequence.
 - b. Code 61 will always be the last code displayed, indicating the end of code transmission. If code 61 appears immediately, no other fault codes are present.

Fault Codes

The ECU continuously monitors engine operation against preset performance limits. If the operation is outside the limits, the ECU activates the MIL, if equipped, and stores a diagnostic code in its fault memory. If the component or system returns to proper function, the ECU will turn off the MIL. If the MIL stays illuminated, it warns the customer a fault is currently happening, and dealer service is required. Upon receipt, the dealer technician can access the fault code(s) to help determine what portion of the system is malfunctioning. The 4-digit fault codes available are listed on page 5.29.

The codes are accessed through the key switch and displayed as blinks or flashes of the MIL. Access the codes as follows:

1. Check that the battery voltage is above 11 volts.
2. Start with the key switch OFF.
3. Turn the key switch to the ON and OFF, then ON and OFF, then ON, leaving it on in the third sequence. Do not start the engine. The time between sequences must be less than 2.5 seconds.

Section 5 EFI Fuel System

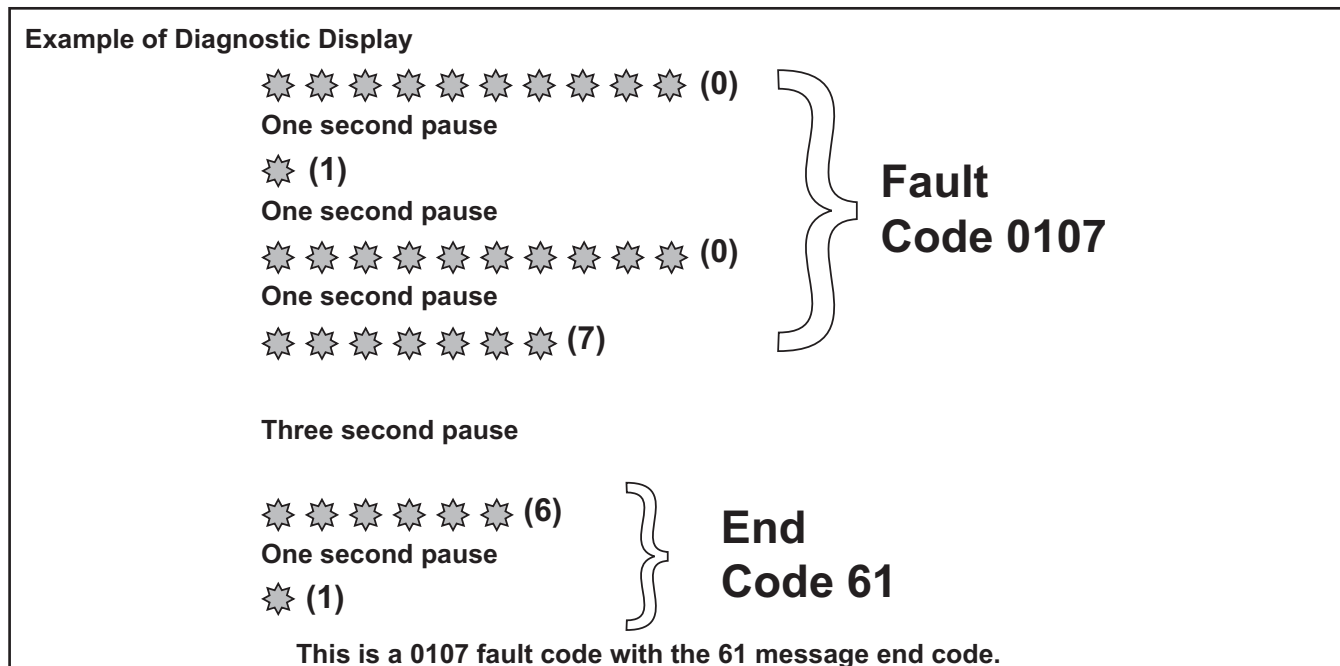


Figure 5-29.

After the problem has been corrected, the fault codes may be cleared by following the ECU Reset and TPS Learn Procedures.

The chart on the following page lists the fault codes, and what they correspond to. Following the chart is a list of the individual codes with an explanation of what triggers them, what symptoms might be expected, and the probable causes.

A MIL may not be provided with the engine. If the equipment manufacturer has not added a MIL to the equipment, one can be added easily for quick diagnostics. The main engine to vehicle connection will have a tan wire which is the ground for the MIL. Either incandescent or LED type bulbs can be used for the MIL as long as they do not draw more than 0.1 amps. The bulb needs to be rated at 1.4 Watts or less, or needs to have a total resistance of 140 Ω or more. LEDs typically draw less than 0.03 amps. Attach +12 volts to the positive terminal of the bulb and attach the ground terminal of the bulb to the tan wire.

Diagnostic Code Summary

Fault Code	Connection or Failure Description
0031	Oxygen Sensor Heater Circuit High Voltage
0032	Oxygen Sensor Heater Circuit Low Voltage
0107	Manifold Absolute Pressure Sensor Circuit Low Voltage or Open
0108	Manifold Absolute Pressure Sensor Circuit High Voltage
0112	Intake Air Temperature Sensor Circuit Low Voltage
0113	Intake Air Temperature Sensor Circuit High Voltage or Open
0117	Coolant/Oil Temperature Sensor Circuit Low Voltage
0118	Coolant/Oil Temperature Sensor Circuit High Voltage or Open
0122	Throttle Position Sensor Circuit Low Voltage or Open
0123	Throttle Position Sensor Circuit High Voltage
0131	Oxygen Sensor 1 Circuit Low Voltage, or Open
0132	Oxygen Sensor 1 Circuit High Voltage
0171	Maximum Adaptation Limit Exceeded
0172	Minimum Adaptation Limit Exceeded
0174	Lean Fuel Condition at High Load (Open Loop)
0201	Injector 1 Circuit Malfunction
0202	Injector 2 Circuit Malfunction
0230	Fuel Pump Module Circuit Low Voltage or Open
0232	Fuel Pump Module Circuit High Voltage
0336	Crankshaft Position Sensor Noisy Signal
0337	Crankshaft Position Sensor No Signal
0351	Cylinder 1 Ignition Coil Malfunction
0352	Cylinder 2 Ignition Coil Malfunction
0562	System Voltage Low
0563	System Voltage High
61	End of Code Transmission

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Code:	0031
Component:	Oxygen Sensor Heater
Fault:	O2S Heater Circuit High Voltage

Condition: System voltage too high, shorted connection or faulty sensor.

Possible Causes:

1. Oxygen Sensor Related
 - a. Sensor connector or wiring problem.
 - b. Sensor damaged.
 - c. Pin circuit wiring or connectors at Black 7.
2. ECU Related
 - a. ECU-to-harness connection problem.

Code:	0032
Component:	Oxygen Sensor Heater
Fault:	O2S Heater Circuit Low Voltage

Condition: System voltage too low, open connection or faulty sensor.

Possible Causes:

1. Engine Wiring Harness Related
 - a. Pin circuit wiring or connectors.
 1. ECU Black pin 7.
 2. Broken wire.
2. Oxygen Sensor Related
 - a. Sensor connector or wiring problem.
3. Poor system ground from ECU to engine or battery to engine.

Code:	0107
Component:	Manifold Absolute Pressure Sensor
Fault:	MAP Circuit Low Voltage or Open

Condition: Intake manifold leak, open connection or faulty sensor.

Possible Causes:

1. MAP Sensor Related
 - a. Sensor malfunction.
 - b. Vacuum leaks from loose manifold or sensor.
2. Wire Harness Related
 - a. Poor grounding or open circuit.
 - b. Wire harness and connectors loose, damaged or corroded.
 - c. Pin circuit wiring or connectors at Black 10, 11 and 16.
3. Bad TPS Learn.

Code:	0108
Component:	Manifold Absolute Pressure Sensor
Fault:	MAP Circuit High Voltage

Condition: Intake manifold leak, shorted connection or faulty sensor.

Possible Causes:

1. MAP Sensor Related
 - a. Sensor malfunction.
 - b. Vacuum leaks from loose manifold or sensor.
2. Wire Harness Related
 - a. Poor grounding.
 - b. Pin circuit wiring or connectors at Black 11.
3. Bad TPS Learn.

Code:	0112
Component:	Intake Air Temperature Sensor
Fault:	Intake Air Temperature Sensor Circuit Low Voltage

Condition: Shorted connection, faulty sensor or shorted wire.

Possible Causes:

1. Temperature Sensor Related
 - a. Sensor wiring or connection.
2. Engine Wiring Harness Related
 - a. Pin circuits Black 10 and Black 8 may be damaged or routed near noisy signal (coils, alternator, etc.).
 - b. ECU-to-harness connection problem.

Code:	0113
Component:	Intake Air Temperature Sensor
Fault:	Intake Air Temperature Sensor Circuit High Voltage or Open

Condition: Shorted connection, faulty sensor, broken wire or connection.

Possible Causes:

1. Temperature Sensor Related
 - a. Sensor wiring or connection.
2. Engine Wiring Harness Related
 - a. Pin circuits ECU Black pin 10 and 8 may be damaged.
 - b. ECU-to-harness connection problem or broken wire.

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Code:	0117
Component:	Coolant/Oil Sensor
Fault:	Coolant/Oil Temperature Sensor Circuit Low Voltage

Condition: Shorted connection, faulty sensor or shorted wire.

Possible Causes:

1. Temperature Sensor Related
 - a. Sensor wiring or connection.
2. Engine Wiring Harness Related
 - a. Pin circuits Black 10 and Black 14 maybe damaged or routed near noisy signal (coils, stator, etc.).
 - b. ECU-to-harness connection problem.

Code:	0118
Component:	Coolant/Oil Sensor
Fault:	Coolant/Oil Temperature Sensor Circuit High Voltage or Open

Condition: Shorted connection, faulty sensor, open connection or broken wire.

Possible Causes:

1. Temperature Sensor Related
 - a. Sensor wiring or connection.
2. Engine Wiring Harness Related
 - a. Pin circuits ECU Black pin 10 and 14 may be damaged.
 - b. ECU-to-harness connection problem or broken wire.
3. System Related
 - a. Engine is operating above the 176°C (350°F) temperature sensor limit.

Code:	0122
Component:	Throttle Position Sensor (TPS)
Fault:	TPS Circuit Low Voltage or Open

Condition: Open connection, broken wire or faulty sensor.

Possible Causes:

1. TPS Related
 - a. TPS bad or worn internally.
2. Engine Wiring Harness Related
 - a. Broken or shorted wire in harness.
 1. ECU Black pin 10 to TPS pin 1.
 2. ECU Black pin 12 to TPS pin 3.

3. ECU Black pin 16 to TPS pin 2.

3. Throttle Body Related
 - a. Throttle shaft inside TPS worn, broken, or damaged.
 - b. Throttle plate loose or misaligned.
 - c. Throttle plate bent or damaged allowing extra airflow past, or restricting movement.
4. ECU Related
 - a. Circuit providing voltage or ground to TPS damaged.
 - b. TPS signal input circuit damaged.

Code:	0123
Component:	Throttle Position Sensor (TPS)
Fault:	TPS Circuit High Voltage

Condition: Shorted connection or faulty sensor.

Possible Causes:

1. TPS Sensor Related
 - a. Sensor connector or wiring.
 - b. Sensor output affected or disrupted by dirt, grease, oil, wear.
 - c. Sensor loose on throttle body manifold.
2. Throttle Body Related
 - a. Throttle shaft or bearings worn/damaged.
3. Engine Wiring Harness Related
 - a. ECU pins Black 10, 12 and 16 damaged (wiring, connectors).
 - b. ECU pins Black 10, 12 and 16 routed near noisy electrical signal (coils, alternator).
 - c. Intermittent 5 volt source from ECU (pin Black 16).
 - d. ECU-to-harness connection problem.

Code:	0131
Component:	Oxygen Sensor
Fault:	O2S 1 Circuit Low Voltage

Condition: Open connection, broken wire or faulty sensor.

Possible Causes:

1. Oxygen Sensor Related
 - a. Sensor connector or wiring problem.
 - b. Sensor contaminated, corroded or damaged.
 - c. Poor ground path.
 - d. Pin circuit wiring or connectors.
ECU Black pin 10 or 17.

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2. TPS Learn Procedure Incorrect
 - a. Lean condition (check oxygen sensor signal with VOA and see Oxygen Sensor section).
3. Engine wiring harness related such as a cut wire, broken or pinched.

Code:	0132
Component:	Oxygen Sensor
Fault:	O2S 1 Circuit High Voltage

Condition: Shorted connection or faulty sensor.

Possible Causes:

1. Oxygen Sensor Related
 - a. Sensor connector or wiring problem.
 - b. Sensor contaminated or damaged.
 - c. Poor ground path.
 - d. Pin circuit wiring or connectors.
ECU Black pin 10 or Black pin 17.
2. Engine Wiring Harness Related
 - a. Difference in voltage between sensed voltage and actual sensor voltage.
 - b. Short in wire harness.

Code:	0171
Component:	Fuel System
Fault:	Maximum adaptation limit exceeded

Condition: Fuel inlet screen/filter plugged, low pressure at high pressure fuel line, TPS malfunction, shorted connection, faulty sensor, low fuel or wrong fuel type.

Possible Causes:

1. Oxygen Sensor Related
 - a. Corrosion or poor connection.
 - b. Sensor contaminated or damaged.
 - c. Air leak into exhaust.
 - d. Poor ground path.
 - e. Pin circuit wiring or connectors.
 1. ECU Black pin 10 or Black pin 17.
2. TPS Sensor Related
 - a. Throttle plate position incorrect during Learn procedure.
 - b. TPS problem or malfunction.
3. Engine Wiring Harness Related
 - a. Difference in voltage between sensed voltage and actual sensor voltage.
 - b. Problem in wiring harness.
 - c. ECU-to-harness connection problem.

4. Systems Related
 - a. Ignition (spark plug, plug wire, ignition coil).
 - b. Fuel (fuel type/quality, injector, fuel pressure too low, fuel pump module or lift pump).
 - c. Combustion air (air cleaner dirty/restricted, intake leak, throttle bores).
 - d. Base engine problem (rings, valves).
 - e. Exhaust system leak (muffler, flange, oxygen sensor mounting boss, etc.).
 - f. Fuel in the crankcase oil.

Code:	0172
Component:	Fuel System
Fault:	Minimum adaptation limit exceeded

Condition: Too high pressure at high pressure fuel line, TPS malfunction, shorted connection, faulty sensor or fuel pump module failure.

Possible Causes:

1. Oxygen Sensor Related
 - a. Sensor connector or wiring.
 - b. Sensor contaminated or damaged.
 - c. Poor ground path.
 - d. Pin circuit wiring or connectors.
ECU Black pin 10 or 17.
2. TPS Sensor Related
 - a. Throttle plate position incorrect during Learn procedure.
 - b. TPS problem or malfunction.
3. Engine Wiring Harness Related
 - a. Difference in voltage between sensed voltage and actual sensor voltage.
 - b. Problem in wiring harness.
 - c. ECU-to-harness connection problem.
4. Systems Related
 - a. Ignition (spark plug, plug wire, ignition coil).
 - b. Fuel (fuel type/quality, injector, fuel pressure too high, fuel pump module or lift pump).
 - c. Combustion air (air cleaner dirty/restricted).
 - d. Base engine problem (rings, valves).
 - e. Fuel in the crankcase oil.
 - f. Fuel pump module is over filled.
 - g. Lift pump diaphragm is ruptured.

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Code:	0174
Component:	Fuel System
Fault:	Lean fuel condition

Condition: Fuel inlet screen/filter plugged, low pressure at high pressure fuel line, TPS malfunction, shorted connection or faulty sensor.

Possible Causes:

1. TPS Learn Incorrect
 - a. Lean condition (check oxygen sensor signal with VOA and see Oxygen Sensor section).
2. Engine Wiring Harness Related
 - a. Pin circuit wiring or connectors. ECU pin Black 10, 12, 16 and 17.
3. Low Fuel Pressure
 - a. Plugged filters.
 - b. Bad lift pump.
4. Oxygen Sensor Related
 - a. Sensor connector or wiring problem.
 - b. Exhaust leak.
 - c. Poor ground.
5. Poor system ground from ECU to engine, causing rich running while indicating lean.
6. Fuel pump module connection. See Fuel Components.

Code:	0201
Component:	Fuel Injector
Fault:	Injector 1 Circuit Malfunction

Condition: Injector damaged or faulty, shorted or open connection.

Possible Causes:

1. Injector Related
 - a. Injector coil shorted or opened.
2. Engine Wiring Harness Related
 - a. Broken or shorted wire in harness. ECU pin Black 5.
 - b. Wiring from Ignition.
3. ECU Related
 - a. Circuit controlling injector #1 damaged.

Code:	0202
Component:	Fuel Injector
Fault:	Injector 2 Circuit Malfunction

Condition: Injector damaged or faulty, shorted or open connection.

Possible Causes:

1. Injector Related
 - a. Injector coil shorted or opened.
2. Engine Wiring Harness Related
 - a. Broken or shorted wire in harness. ECU pin Black 6.
 - b. Wiring from Ignition.
3. ECU Related
 - a. Circuit controlling injector #2 damaged.

Code:	0230
Component:	Fuel Pump
Fault:	Circuit Low Voltage or Open

Condition: Shorted or open connection.

Possible Causes:

1. Fuel Pump Related
 - a. Fuel pump module open or shorted internally.
2. Engine Wiring Harness related
 - a. Broken or shorted wire in harness. ECU pin Black 9 or Grey 17.
3. ECU Related
 - a. The ECU is damaged.

Code:	0232
Component:	Fuel Pump
Fault:	Circuit High Voltage

Condition: Shorted connection.

Possible Causes:

1. Fuel Pump Related
 - a. Fuel pump module damaged internally.
2. Charging Output System Too High.

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Code:	0336
Component:	Crankshaft Position Sensor
Fault:	Crankshaft Position Sensor Noisy Signal

Condition: Air gap incorrect, loose sensor, faulty/bad battery, shorted or faulty connection, faulty sensor or faulty sensor grounding.

Possible Causes:

1. Crankshaft Position Sensor Related
 - a. Sensor connector or wiring.
 - b. Sensor loose or air gap incorrect.
2. Crankshaft Position Sensor Wheel Related
 - a. Damaged teeth.
 - b. Gap section not registering.
3. Engine Wiring Harness Related
 - a. Pin circuit wiring or connectors.
ECU pin Black 4 and Black 13.
 - b. ECU-to-harness connection problem.
4. Ignition System Related
 - a. Non-resistor spark plug(s) used.
 - b. Faulty or disconnected ignition coil or secondary lead.

Code:	0337
Component:	Crankshaft Position Sensor
Fault:	Crankshaft Position Sensor No Signal

Condition: Air gap incorrect, loose sensor, open or shorted connection or faulty sensor.

Possible Causes:

1. Crankshaft Position Sensor Related
 - a. Sensor connector or wiring.
 - b. Sensor loose or air gap incorrect.
2. Crankshaft Position Sensor Wheel Related
 - a. Damaged teeth.
3. Engine Wiring Harness Related
 - a. Pin circuit wiring or connectors.
ECU pin Black 4 or Black 13.
 - b. ECU-to-harness connection problem.
4. If code is stored in fault history and starts normally. Clear code, no other service required.

Code:	0351
Component:	Ignition Coil
Fault:	Cylinder 1 Ignition Coil Malfunction

Condition: Broken wire in harness (may not be visible), shorted connection or faulty sensor.

Possible Causes:

1. Engine Wiring Harness Related
 - a. Connection to ignition or fuse.
 - b. Pin circuit wiring or connectors.
ECU pin Black 1.
 - c. ECU-to-harness connection problem.
2. Ignition System Related
 - a. Incorrect spark plug(s) used.
 - b. Poor connection to spark plug.

Code:	0352
Component:	Ignition Coil
Fault:	Cylinder 2 Ignition Coil Malfunction

Condition: Broken wire in harness (may not be visible), shorted connection or faulty sensor.

Possible Causes:

1. Engine Wiring Harness Related
 - a. Connection to ignition or fuse.
 - b. Pin circuit wiring or connectors.
ECU pin Grey 10.
 - c. ECU-to-harness connection problem.
2. Ignition System Related
 - a. Incorrect spark plug(s) used.
 - b. Poor connection to spark plug.

Code:	0562
Component:	System Voltage
Fault:	System Voltage Low

Condition: Faulty voltage regulator, bad fuse or shorted connection.

Possible Causes:

1. Corroded Connections
2. Bad Stator
3. Bad Battery
 - a. Low output charging system.
 - b. Poor magnet in flywheel.
 - c. Bad or missing fuse.

Code:	0563
Component:	System Voltage
Fault:	System Voltage High

Condition: Faulty voltage regulator or shorted connection.

Possible Causes:

1. Faulty Rectifier-Regulator
2. Bad Stator.
3. Bad Battery.

Code:	61
Fault:	End of Code Transmission

Troubleshooting Flow Chart

The following flow chart provides an alternative method of troubleshooting the EFI system. The chart will enable you to review the entire system in about 10-15 minutes. Using the chart, the accompanying diagnostic aids (listed after the chart), and any signaled fault codes, you should be able to quickly locate any problems within the system. See Figure 5-30.

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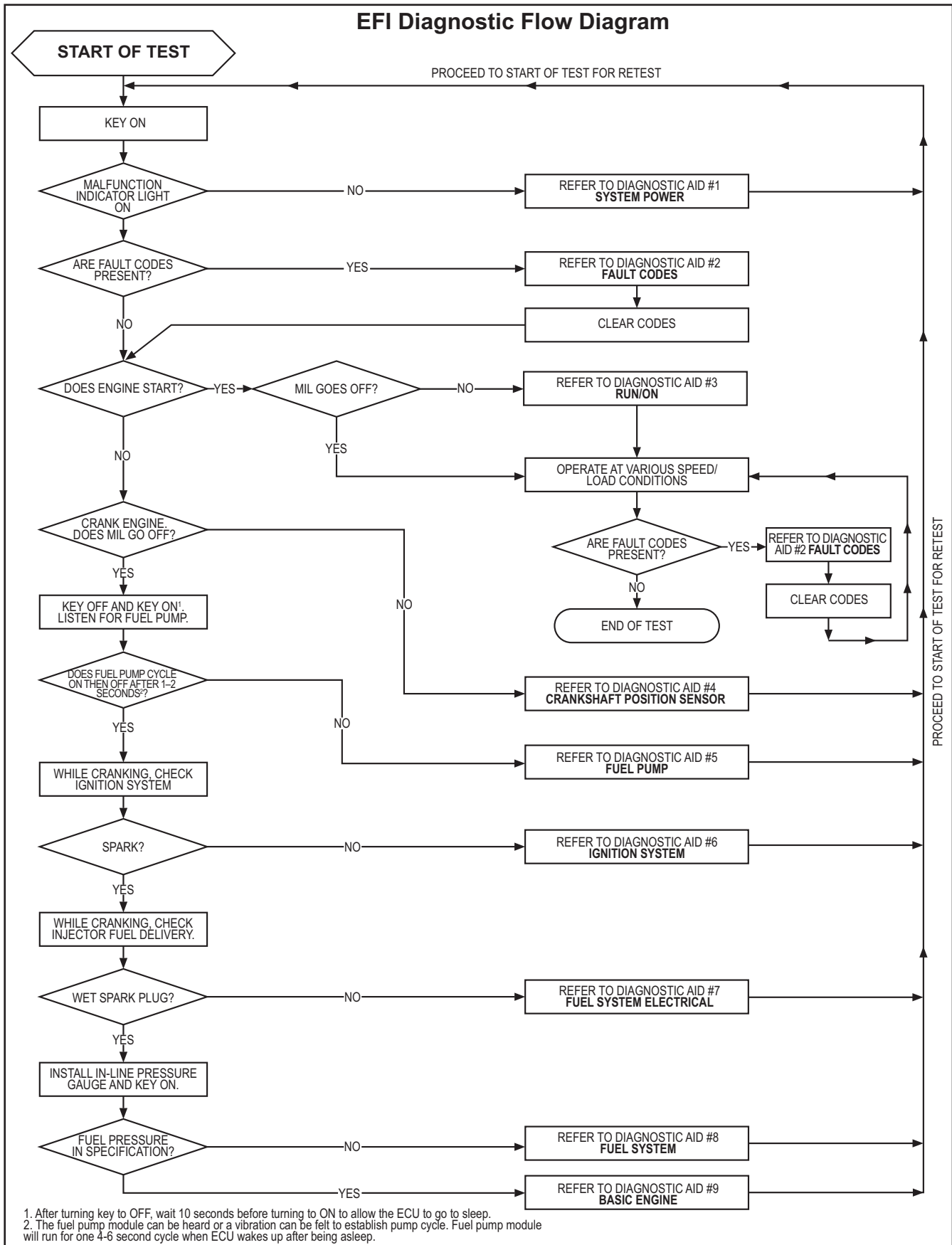


Figure 5-30. Troubleshooting Flow Chart.

Flow Chart Diagnostic Aids

Diagnostic Aid #1 SYSTEM POWER

(MIL does not illuminate when key is turned ON)

NOTE: MIL is installed by vehicle OEM. Twelve volt supply to bulb will be part of vehicle wire harness. Kohler key switch model will have MIL on engine with 12V supply to bulb.

Possible causes:

1. Battery
2. Main system fuse
3. MIL light bulb burned out
4. MIL electrical circuit problem
Pin circuits Grey 3.
5. Ignition switch
6. Permanent ECU power circuit problem
Pin circuit Black 18.
7. Switched ECU power circuit problem
Pin circuit Black 15.
8. ECU grounds
9. ECU

Diagnostic Aid #2 FAULT CODES

(Refer to detailed fault code listing before flow chart and servicing information for the respective components)

- Code 0031 - Oxygen Sensor Heater Circuit High Voltage
- Code 0032 - Oxygen Sensor Heater Circuit Low Voltage
- Code 0107 - Manifold Absolute Pressure Sensor Circuit Low Voltage or Open
- Code 0108 - Manifold Absolute Pressure Sensor Circuit High Voltage
- Code 0112 - Intake Air Temperature Sensor Circuit Low Voltage
- Code 0113 - Intake Air Temperature Sensor Circuit High Voltage or Open
- Code 0117 - Coolant/Oil Temperature Sensor Circuit Low Voltage
- Code 0118 - Coolant/Oil Temperature Sensor Circuit High Voltage or Open
- Code 0122 - TPS Circuit Low Voltage or Open
- Code 0123 - TPS Circuit High Voltage
- Code 0131 - O2S 1 Circuit Low Voltage or Open
- Code 0132 - O2S 1 Circuit High Voltage
- Code 0171 - Maximum adaptation limit exceeded
- Code 0172 - Minimum adaptation limit exceeded
- Code 0174 - Lean fuel condition at high load or open loop
- Code 0201 - Injector 1 Circuit Malfunction
- Code 0202 - Injector 2 Circuit Malfunction

Code 0230 - Fuel Pump Module Circuit Low Voltage or Open

Code 0232 - Fuel Pump Module Circuit High Voltage

Code 0336 - Crankshaft Position Sensor Noisy Signal

Code 0337 - Crankshaft Position Sensor No Signal

Code 0351 - Cylinder 1 Ignition Coil Malfunction

Code 0352 - Cylinder 2 Ignition Coil Malfunction

Code 0562 - System Voltage Low

Code 0563 - System Voltage High

Code 61 - End of Code Transmission.

Diagnostic Aid #3 RUN/ON

(MIL remains ON while engine is running)*

Possible causes:

1. All current fault codes will turn on MIL when engine is running.

NOTE: Either incandescent or LED type bulbs can be used for the MIL as long as they do not draw more than 0.1 amps. The bulb needs to be rated at 1.4 Watts or less, or needs to have a total resistance of 140 Ω or more. LEDs typically draw less than 0.03 amps.

Diagnostic Aid #4 CRANKSHAFT POSITION SENSOR

(MIL does not turn off during cranking)

Possible causes:

1. Crankshaft position sensor
2. Crankshaft position sensor circuit problem, pin circuits Black 4 and Black 13.
3. Crankshaft position sensor/toothed wheel air gap
4. Toothed wheel
5. Flywheel key sheared
6. ECU

Diagnostic Aid #5 FUEL PUMP

(fuel pump not turning on)

Possible causes:

1. Main fuse
2. Fuel pump circuit problem, pin circuits Black 9 and Grey 17.
3. Fuel pump module

Diagnostic Aid #6 IGNITION SYSTEM

(no spark)

Possible causes:

1. Spark plug
2. Plug wire
3. Coil
4. Coil circuit(s), pin circuits Grey 10 and Black 1.
5. ECU grounds

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6. ECU
7. Vehicle safety interlocks, ground signal on safety wire.

Diagnostic Aid #7 FUEL SYSTEM ELECTRICAL (no fuel delivery)

Possible causes:

1. No fuel
2. Air in high pressure fuel line
3. Fuel valve shut OFF
4. Fuel filter/line plugged
5. Injector circuit(s), pin circuits Black 5 and Black 6
6. Injector
7. ECU grounds
8. ECU
9. Lift pump not working

Diagnostic Aid #8 FUEL SYSTEM (fuel pressure)

Possible causes for low fuel system pressure:

1. Low fuel
2. Fuel filter plugged
3. Fuel supply line plugged
4. Lift fuel pump - insufficient fuel supply
5. Fuel pump (lift or module) - internally plugged

Possible causes for high fuel system pressure:

1. Pressure regulator not functioning properly inside fuel pump module.

Diagnostic Aid #9 BASIC ENGINE (cranks but will not run)

Possible causes:

1. Refer to basic engine troubleshooting charts within service manual sections 3, 5, and 7.