



Operation Manual

4.3L LP AND 5.7L LPG/CNG INJECTED ENGINES

Mobile Alternative Fuel

KEM EQUIPMENT INC.

10800 SW HERMAN RD.

PH 503-692-5012 FAX 503-692-1098

TUALATIN, OR. 97062

WEB: WWW.KEMEQUIPMENT.COM EMAIL: KEMPOWER@KEMEQUIPMENT.COM

PC8031 REV-G

EQUIPMENT QUICK REFERENCE

ENTER THE INFORMATION BELOW:

EQUIPMENT MANUFACTURER:

CONTACT NAME:

PH#

EQUIPMENT MODEL #

EQUIPMENT SERIAL #

ENGINE SERIAL#

NOTES:



WARNING—FOLLOW INSTRUCTIONS

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.



WARNING—OUT-OF-DATE PUBLICATION

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to contact KEM Equipment. The revision level is shown at the bottom of the front cover after the publication number. If your publication is not there, please contact your customer service representative to get the latest copy.



WARNING—OVERSPEED PROTECTION

The engine, turbine, or other type of prime mover should be equipped with an over-speed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage. The over-speed shutdown device must be totally independent of the prime mover control system. An over-temperature or over-pressure shutdown device may also be needed for safety, as appropriate.



WARNING—PROPER USE

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.



CAUTION—BATTERY CHARGING

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.



CAUTION—ELECTROSTATIC DISCHARGE

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge of body static before handling the control. (with power to the control turned off) contact a grounded surface and maintain contact while handling the control.
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

- A **WARNING** indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.
- A **CAUTION** indicates a potentially hazardous situation, which, if not avoided, could result in damage to equipment or property.
- A **NOTE** provides other helpful information that does not fall under the warning or caution categories.

TABLE OF CONTENTS

INTRODUCTION	Page 8
How to use this Manual	
ENGINE IDENTIFICATION	Page 9
Parts and Service Literature	
STARTING THE ENGINE	Page 11
Fuel System Supplier Malfunction Indicator Light (MIL)	
STOPPING THE ENGINE	Page 12
Normal Conditions Fuel System Supplier	
MAINTENANCE INSTRUCTIONS	Page 13
Initial Start up Maintenance Routine Maintenance Scheduled Preventive Maintenance Engine Oil Level Check Adding Engine Oil	
CHANGING ENGINE OIL FILTER	Page 14-15
Engine Oil Quality Engine Oil Recommendation Oil Filter	
ENGINE AIR CLEANER	Page 16
COOLING SYSTEM	Page 17-18
Cooling Level Radiator and Fan Drive Belts Serpentine Belt	
FUEL INJECTED ENGINES	Page 19-21
LPG Fuel Specifications CNG Fuel Specifications Fuel Quality Changes Fuel Filter Power Loss at Higher Elevations	
IGNITION SYSTEMS	Page 22
Type of Ignition System Ignition Timing	

SPARK PLUGS**Page 23**

SPECIFICATIONS**Page 24-26**

Quick Reference Chart
General Engine Specifications
Maintenance Schedule

WARRANTY**Page 27-34**

Industrial Warranty Emission
Control Warranty Emission
Warranty Parts List

DIAGNOSTIC ERROR CODES**Page 35-42**

Powertrain On Board Diagnostics (OBD) Systems Check
SPN Fault Codes

FUEL PRESSURES (EXPECTED)**Page 43**

LPG Fuel
CNG Fuel

WIRING SCHEMATICS**Page 44-48**

Main Engine Harness
Customer Interface
Pedal Harness Extension
Williams Pedal
Teleflex Pedal
5.7L LPG
5.7L CNG
5.7L LPG/CNG New Injector
4.3L LP New Injector

INTRODUCTION

KEM Equipment, Inc. is pleased that you have selected a **GM Powertrain** engine for your requirements. **KEM Equipment, Inc.** takes great pride in our tradition of quality products produced from the **GM Powertrain** line of industrial gasoline and alternative fuel engines.

KEM Equipment, Inc. engines are inspected and tested before leaving the factory. However, certain checks should be made before placing the engine into regular service. Please read the initial start-up inspection requirements in the Maintenance section of this manual on page 26.

HOW TO USE THIS MANUAL


This manual contains instructions on the safe operation and preventive maintenance of your KEM Equipment **GM Powertrain** industrial engine. We urge you to read this manual prior to startup of the engine.

The Table of Contents permits you to quickly open the manual to any section. KEM Equipment, Inc. engines are built with a variety of standard and/or optional components to suit a broad range of customer requirements. This manual **does not** identify equipment as standard or optional. All the equipment described in this manual may or may not be found on your engine or power unit.

The description and specifications contained in this manual were in effect at the time of publication. KEM Equipment, Inc. reserves the right to discontinue models at any time, or to change specifications or design without notice and without incurring obligation.

ENGINE IDENTIFICATION

An identification placard is affixed to the engine. The label contains the engine family number and a part number, which identifies the engine from other KEM engines. The engine part number and serial number are required when seeking information concerning the engine and/or ordering replacement service parts.

IMPORTANT ENGINE & EMISSION CONTROL INFORMATION		
<input type="checkbox"/> EMERGENCY CONSTANT SPEED ONLY	<input checked="" type="checkbox"/>	<input type="checkbox"/> CONSTANT SPEED ONLY
ENGINE FAMILY	SERIAL #	MODEL #
EXHAUST EMISSION CONTROL SYSTEM		RATED HP/KW
<input type="checkbox"/> SFI	<input type="checkbox"/> MIX	<input type="checkbox"/> ECM
<input type="checkbox"/> HO2S	<input type="checkbox"/> TWC	<input type="checkbox"/> PCV
THIS ENGINE IS CERTIFIED TO OPERATE ON:		1-800-304-0751 KEM EQUIPMENT INC.
<input type="checkbox"/> GASOLINE	<input type="checkbox"/> LPG	<input type="checkbox"/> NATURAL GAS
EMISSION STANDARDS [G/KW-HR]		 10800 SW HERMAN RD. TUALATIN, OR 97062
<input type="checkbox"/> 1.7 HC+NOX, 7.9 CO	<input type="checkbox"/> 1.34 VOC, 2.68 NOX, 5.36 CO	
<input type="checkbox"/> 2.7 HC+NOX, 4.4 CO	<input type="checkbox"/> 0.8 HC+NOX, 20.6 CO	
THIS ENGINE COMPLIES WITH U.S. EPA REGULATIONS FOR STATIONARY ENGINES 19KW OR GREATER.		PC 10222 REV.E
SPARK PLUG GAP: <input type="checkbox"/>		NO OTHER ADJUSTMENTS NEEDED

ENGINE FAMILY: This is the designation number that is registered for certification.

SERIAL NUMBER: This number identifies each individual engine. This number should also be recorded for the ease of obtaining information or parts for this engine. Record engine information on **page 3** for future quick reference when ordering parts.

MODEL NUMBER: This is the part number for the engine, this number should be recorded for ease of obtaining information or parts for this engine.

EXHAUST EMISSION CONTROL SYSTEM: The type of control/controls will be marked.

RATED HP/KW: This is the maximum rated power at which the emissions standards were met.

THIS ENGINE IS CERTIFIED TO OPERATE ON: The fuel type or types will be marked.

EMISSION STANDARDS [G/KW-HR]: The standard to which the engine is certified will be marked.

Parts and Service

Replacement parts can be obtained from KEM Equipment, Inc. by calling the Parts Department. The engine part number and serial number will be required when seeking information and/or ordering parts.

Technical support for KEM POWER engines can be obtained by contacting
KEM Equipment Inc. 503-692-5012

STARTING THE ENGINE



WARNING: All internal combustion engines give off various fumes and gases while running. Do not start or run the engine in a closed or poorly ventilated area where exhaust gases may accumulate. Avoid breathing these gases as they may contain poisonous carbon monoxide and other gases, which can endanger your health or life if inhaled steadily for a few minutes.



CAUTION: If the engine stalls or falters during starting, wait 3 to 4 seconds before reengaging the starter. This will prevent possible damage to the starter or the engine. Do NOT operate the starter for periods longer than 30 seconds at a time. An interval of at least 1-minute should be observed between cranking periods to protect the starter from overheating.

If the engine is equipped with a manual clutch it must be disengaged prior to starting the engine. Starting the engine with the clutch engaged imposes unnecessary strain on the battery, starter, and driven components.

Fuel System Supplier

KEM supplies the EFI engine management system. These engine management systems are available in LPG or CNG fuel configurations. Using a MEFI 5 and GFI Fuel Injectors.

Malfunction Indicator Light



NOTE: The lamps will not flash the error codes. To retrieve and reset the error codes a diagnostic scan tool is required. Some equipment manufacturers are using CAN-BUS displays that can retrieve the error codes. See the equipment manufacturer's instructions to retrieve the error codes with their device. The check engine and check gauges lights will illuminate with the key on. The check gauges light will turn off if the engine is not started in a timely manner.

There are two lights on the dash to indicate engine related problems. The operator is responsible to scan for illuminated bulbs during the course of engine operation.

The first indicator is the **Check Engine Light**. The check engine light conveys to the operator that a fault exists that is related to the emissions control system. When this light is illuminated a fault code has been set that requires immediate attention or engine component damage could conceivably occur.

Please stop operation of engine as soon as safely possible. Request that a technician inspect the fault code setting, he or she will connect a scan tool to determine the cause of the check engine light illuminating, repair the problem and clear the codes. The check engine light related codes are caused by sensor output and/or conditions that adversely affect the emissions output of the engine. Some of the components that can cause problems are: crank sensor, cam sensor, fuel injectors, regulators, O2 sensors (pre or post), ignition system and MAP sensor.

The second indicator is the **Check Gauges Light**. This bulb will illuminate when a non-emissions related issue occurs. Items that can cause these codes are high or low - oil pressure and coolant temperature. Various power relays operation, system voltage etc. The lighting of this fault indicator would indicate to the operator that the gauges for oil pressure and coolant temperature should be checked immediately and action taken to eliminate engine damage.

There are safeties in the calibration that will turn off the engine, or enable a limp mode situation if the sensor output is out of the normal range. (low oil pressure when the engine is at rated speed for instance). If the engine should shut down for no apparent reason, check this lamp. Similar to the MIL, the fault code will have to be read and cleared before continuing vehicle operation (after repairing the root problem).

STOPPING THE ENGINE



WARNING: Avoid injury when checking a hot engine. Allow the engine to cool down before removing the radiator cap.



CAUTION: Before restarting the engine ensure that both the coolant system and the engine oil level have been checked and re-filled if necessary.

Normal Conditions

Following normal operating conditions, **lower the engine speed to idle**, pushing the throttle cable in on mechanical systems, or with electronic speed control systems to return to idle.

If the machine is equipped with a clutch, move the clutch lever to the disengaged position.

Run the engine at idle for a few minutes to allow the engine components and coolant system to cool down before turning the ignition switch to the OFF position.

MAINTENANCE INSTRUCTIONS

Initial Startup Maintenance

The initial start-up checks must be made before putting the engine into service. Please refer to the Maintenance Schedule on page 26 and perform the initial start-up operations in the sequence shown in column 1.

Routine Maintenance

Routine maintenance provides the best solution for making sure that the engine is ready when you are. The following are some routine service points:

- Make frequent checks for engine oil and coolant leaks
- Follow and repair any oil or coolant leaks
- Check battery condition and cables frequently
- Keep the engine air filter clean
- Monitor engine coolant temperature
- Monitor engine oil pressure
- Check voltmeter and charging system

Scheduled Preventive Maintenance

Refer to the Maintenance Schedule on page 26 to ensure that all of the maintenance items listed are checked and replaced at the recommended hours.

Engine Oil Level Check



CAUTION: Do not operate the engine with the oil level below the bottom of the dipstick or 'Add' mark on the dipstick, or above the top or 'Full' mark on the dipstick.

The engine oil level should be checked daily. It is recommended that the oil be checked just before the engine is started for the first time for the day. The oil level should be between the 'ADD' and the 'FULL' marks on the dipstick.

Adding Engine Oil

It is normal to add some oil in the period of time between oil changes. The amount will vary with the severity of operation. When adding or replacing engine oil, be sure the oil meets or exceeds the recommended specification.

CHANGING THE OIL AND FILTER

Under normal operating conditions, the engine oil and filter must be changed every 175 hours or every 3 months whichever occurs first. Use of premium quality oil and filters is recommended.

The oil and filter should be changed more often if the engine is operating in severe conditions, such as dirty areas, or during cold weather. No oil additives or break-in oil are recommended.

Engine Oil Quality



IMPORTANT: Use only engine oils displaying the American Petroleum Institute (API) “Starburst” Certification Mark “FOR GASOLINE ENGINES” on the container.

Gasoline engines that are converted for Liquid Propane Gas or Natural Gas fuel **MUST** use oils labeled ‘**FOR GASOLINE ENGINES**’. Do not use oils that are specifically formulated for Diesel Engines only. CC or CD classification oils, even when labeled Heavy Duty or for Natural Gas Engines, **ARE NOT ACCEPTABLE**.

To achieve proper engine performance and durability, it is important that you use only engine lubricating oils of the correct type in your engine. Quality oil also provides maximum efficiency for crankcase ventilation systems, which reduces pollution.

Engine Oil Recommendation

Multi-viscosity oils are recommended, SAE 10W-30 is recommended for your engine from 0 degrees F (-18 degrees C) or above. If ambient temperature are consistently below 0 degrees F, SAE 5W-30 oil should be used. Synthetic oils are not recommended for industrial or stationary engines.

Motor oils meeting ILSAC (International Lubricant Standardization & Approval Committee) GF-4 standards. The GM spec for this oil is 9986231. Motor oils meeting this spec receive the API (American Petroleum Institute) Starburst or Dexos 1 symbols:



Oil Filter



IMPORTANT: Ensure the old filter gasket is removed prior to installing the new filter.

The KEM **GM Powertrain** engines use an AC Delco (or equivalent) oil filter as original equipment. An equivalent oil filter must be used when servicing the engine (see Engine Specification for the recommended oil filter for your engine).

The filter protects your engine from harmful, abrasive, or sludgy particles without blocking the flow of oil to vital engine parts.

To replace the filter, use a proper filter wrench to remove the filter. Clean the filter-mounting base and lightly coat the gasket surface of the new filter with engine oil. Hand tighten the filter until the gasket contacts the base, then tighten another ½ turn. Fill the engine with the correct amount of oil, run the engine and check for oil leaks at the drain plug and filter gasket. Tighten as necessary to stop any oil leakage.

ENGINE AIR CLEANER



CAUTION: Service the air cleaner more frequently under severely dusty or dirty conditions.

The engine air cleaner filters air entering the engine intake system and acts as a Silencer, and flame arrester when assembled to the intake system.

Air that contains dirt and grit produces an abrasive fuel mixture, which may cause severe damage to the cylinder walls and piston rings. Damage to the cylinder walls and piston rings will cause high oil consumption and shorten engine life.

A restricted or dirty air cleaner will cause a rich fuel mixture and rough engine operation. Thus, it is extremely important that the air cleaner be serviced properly at the recommended intervals.

Remove the primary air cleaner element from the air cleaner assembly and inspect the element for foreign material restrictions or signs of excessive wear or damage. Replace the element if necessary.

Remove all dust and foreign matter from air cleaner housing.

Reinstall the air cleaner element. Reinstall the air cleaner cap, and securely fasten the retaining clips.

COOLING SYSTEM

KEM Equipment and GM Powertrain recommends the use of **DEX COOL** coolant in all **GM** engines. A **50/50** mixture is recommended.



WARNING: Never remove the radiator cap under any condition while the engine is operating. Failure to follow these instructions could result in damage to the cooling system, engine, or cause personal injury.



CAUTION: DO NOT add coolant or water to any engine that has become overheated until the engine cools. Adding coolant or water to an extremely hot engine can result in a cracked block or cylinder head.

Coolant Level

Check the coolant level of the radiator daily and only when the engine is cool. Generally a good time to do this is just prior to starting the engine for the first time each day.

Maintain coolant level in the overflow tank to the cold line when engine is cold, make sure radiator core is always covered with coolant before daily startup of the engine. Whenever coolant level checks are made, inspect the condition of the radiator cap rubber seal. Make sure it is clean and free of any dirt particles, which would keep it from seating on the filler neck seat. Rinse off with clean water if necessary. Also make sure that the filler neck seat is free of any dirt particles. Use only permanent-type coolant when refilling or flushing the coolant system. Recommended mix 50/50 is normal up to a maximum of 60% **Dex cool** 40% water.



CAUTION: DO NOT mix DEX-COOL (pink/orange colored) with traditional (green) ethylene glycol. Refer to the mixture chart on the container for additional antifreeze protection information. DO NOT use alcohol or methanol antifreeze, or mix them with the specified coolant. Plain water may be used in an emergency (except in freezing temperatures), but replace it with the specified coolant as quickly as possible to avoid damage to the system.

Radiator

Inspect the exterior of the radiator for obstructions. Remove all bugs, dirt or foreign material with a soft brush or cloth. Use care to avoid damaging the core fins. If available, use low-pressure compressed air or a stream of water in the opposite direction of the normal airflow.

Check all hose and connections for leaks. If any of the hoses are cracked, frayed, or feel spongy, they must be replaced.

Drive Belts

The water pump is usually belt driven. The same belt may also drive the fan and/or the alternator. The drive belts should be properly adjusted at all times. A loose belt can cause improper alternator, fan and water pump operation, in addition to overheating.

NOTE: Make sure the belt tensioner is within the proper operating range.

Serpentine Belt

Some **GM Powertrain** engines utilize serpentine belts on the front of the engine. This type of belt system incorporates a belt-tensioning device that keeps the belt at the proper tension. No adjustments are necessary.

This belt should be checked routinely for cracks or 'checking' on the groove side of the belt. If cracks or 'checking' are apparent the belt must be changed.

FUEL INJECTED ENGINES



WARNING: LPG and CNG fuels have the potential of causing severe burns if it contacts your skin.

LPG Fuel Specification



WARNING: LPG vehicles carry liquefied petroleum gas stored at pressures up to 200 psi. Even though LPG is inherently safe, extra caution should be used when performing any service or maintenance operation. Leakage of high-pressure gas can cause serious injury. Never attempt to service a LPG vehicle fuel system until the system pressure has been safely vented. Always vent system pressure in a well-ventilated area.

The KEM fuel system was designed for use with LPG fuel that complies with HD5 or HD10 LPG fuel standards. Use of non-compliant LPG fuel may require more frequent service intervals and will disqualify the user from warranty claims.

CNG Fuel Specification



WARNING: HIGH PRESSURE CNG vehicles carry natural gas stored at pressures up to 3600 psi. Even though CNG is inherently safe, extra caution should be used when performing any service or maintenance operation. Leakage of high-pressure gas can cause serious injury. Never attempt to service a CNG vehicle fuel system until the system pressure has been safely vented. Always vent system pressure in a well ventilated area.

The KEM fuel system was designed for use with CNG that complies with the Society of Automotive Engineers (SAE) established standard. This standard is, minimum methane content of 95% (SAE J1616).

Note: If you are not familiar with this fuel system and the high pressure fuel line connections, consult a service dealer. You may call KEM EQUIPMENT for assistance in locating a service dealer near your area.

Fuel Quality Changes



NOTE: Sudden changes in fuel quality, including geographical regions may effect engine operation. A nominal period of time may be required for the engines emissions control system to self learn and adjust to the changes.

If proper engine operation does not resume within one hour, contact a service dealer or the **KEM Service Department** for additional support. **503-692-5012**



CAUTION: Failure to change the fuel system filter as recommended can result in premature failure of fuel injection system components.



WARNING: Use extreme care when changing the fuel filter. LPG and CNG is highly flammable and under pressure. It should not be exposed to open flame, sparks, or hot engine components. Allow the engine to cool to ambient temperature prior to changing fuel filters.



WARNING: Fuel is under HIGH pressure, consult equipment dealer before servicing fuel system.

Fuel Filter

The fuel filter is used in the fuel supply line to the engine. This helps prevent contaminants from plugging the fuel injectors. The fuel filter is located in the supply line between the fuel tank and the engine. This filter protects the fuel injectors from debris in the fuel tank. **This filter must be changed every 500 hours or every 6 months whichever occurs first.** See Maintenance schedule page 26.

Power Loss at Higher Elevations

Fuel injected engines will lose 3.5% power for every 1000 feet the engine is operated above sea level. All fuel injection systems installed by KEM Equipment, Inc. are equipped with a "manifold absolute pressure sensor" (MAP Sensor). The MAP sensor senses barometric pressure and automatically corrects the fuel system calibration for changes in altitude. This means the air/fuel mixture will always be optimized, regardless of elevation (or barometric pressure), however, the engine will still lose 3.5% power for every 1000 FT. increase in elevation.

All engines will experience power loss when operated at elevations above sea level, unless they are turbocharged or supercharged. Turbochargers and superchargers are mechanical pumps that put extra air into the engine to make up for the lower air density at higher elevations.

IGNITION SYSTEMS



WARNING: High voltage ignition system. Electrical shock hazard.

Types of Ignition Systems

Three types of ignition systems are used on KEM engines. Solid state electronic distributor, electronic distributor with Electronic Control Module (ECM) and distributor-less electronic ignition with ECM.

Ignition Timing



CAUTION: Tampering with the distributor will cause poor engine performance or failure.

An authorized KEM EQUIPMENT, INC. dealer must perform checking or adjustment.

Ignition timing was set at the factory and requires no in-field adjustment.

SPARK PLUGS



CAUTION: Always use the recommended spark plug for your engine, hotter or colder plugs, or similar plugs that are not exact equivalents to the recommended plugs, can cause permanent engine damage, reduce the engines useful life, and cause many other problems such as hard starting, spark knock and run-on, premature failure of catalyst and exhaust emissions may occur.

Spark plugs should be replaced at the recommended intervals as described in the Maintenance Schedule on page 26.

Use only the recommended spark plugs or an equivalent as described in the General Specifications pages 23-24.

Spark plug gap should be adjusted as recommended in the General specifications pages 23-24.

QUICK REFERENCE CHART	
ENGINE	5.7L
OIL FILTER (BLOCK MOUNT)	PR-25
OIL FILTER (REMOTE MOUNT)	PF-2
LP HIGH PRESSURE FILTER	A3-514
LP REGULATOR FILTER	A7-170
CNG HIGH PRESSURE FILTER	SEE EQUIPMENT MFG
CNG LOW PRESSURE FILTER	A3-546
*AIR FILTER	SEE EQUIPMENT MFG
DISTRIBUTOR CAP	10452459
DISTRIBUTOR ROTOR	10452457
SPARK PLUGS	41-101
SPARK PLUG GAP	.040"
PCV VALVE	2-9210
GENERAL ENGINE SPECIFICATIONS	
ENGINE	5.7L
TYPE	V-8
DISPLACEMENT	350 CID
VALVE CONFIGURATION	PUSHROD ACTUATED
VALVE LIFTERS	HYDRAULIC ROLLER
BORE X STROKE INCHES	4.00X3.48
BALANCE METHOD	EXTERNAL
INTAKE MANIFOLD	CENTER DOWN DRAFT
FIRING ORDER	1-8-4-3-6-5-7-2
OIL CAPACITY W/ FILTER	6 QTS
FUEL TYPE	LPG/CNG
ENGINE ROTATION	CCW (flywheel end)

***Air filter part number may vary by OEM application**

QUICK REFERENCE CHART	
ENGINE	4.3L
OIL FILTER (BLOCK MOUNT)	PF-47E
OIL FILTER (REMOTE MOUNT)	PF-2
LP HIGH PRESSURE FILTER	A3-514
LP REGULATOR FILTER	A7-170
CNG HIGH PRESSURE FILTER	SEE EQUIPMENT MFG
CNG LOW PRESSURE FILTER	A3-546
*AIR FILTER	SEE EQUIPMENT MFG
DISTRIBUTOR CAP	10452458
DISTRIBUTOR ROTOR	104477219
SPARK PLUGS	41-101
SPARK PLUG GAP	.040"
PCV VALVE	FIXED ORIFICE
GENERAL ENGINE SPECIFICATIONS	
ENGINE	4.3L
TYPE	V-6
DISPLACEMENT	262 CID
VALVE CONFIGURATION	PUSHROD ACTUATED
VALVE LIFTERS	HYDRAULIC ROLLER
BORE X STROKE INCHES	4.00X3.48
BALANCE METHOD	INTERNAL/EXTERNAL
INTAKE MANIFOLD	CENTER DOWN DRAFT
FIRING ORDER	1-6-5-4-3-2
OIL CAPACITY W/ FILTER	5 QTS
FUEL TYPE	LPG/CNG
ENGINE ROTATION	CCW (flywheel end)

***Air filter part number may vary by OEM application**

MAINTENANCE SCHEDULE									
CHECK POINT	SERVICE INTERVAL								
	DAILY	EVERY 175 HOURS OR ONE MONTH	EVERY 500 HOURS OR 3 MONTHS	EVERY 750 HOURS OR 4 MONTHS	EVERY 1000 HOURS OR 6 MONTHS	EVERY 1250 HOURS OR 8 MONTHS	EVERY 1500 HOURS OR 9 MONTHS	EVERY 2000 HOURS OR 12 MONTHS	EVERY 3000 HOURS OR 18 MONTHS
GENERAL MAINTENANCE									
Inspect fuel system for leaks	PRIOR TO ANY SERVICE OR MAINTENANCE ACTIVITY								
Inspect engine for fluid leaks	X								
Check engine oil	X								
Replace engine oil and filter		X							
Inspect accessory drive belts				X					
Inspect vacuum lines and fittings			X						
Inspect all fuel hoses and fittings		X							
Inspect ECM isolation mounts for cracks and wear; replace as necessary			X						
Inspect throttle control function	X								
Check for MIL at key on. If MIL remains illuminated after starting (it is indicating a fault), Check function of check gauges light. refer to page 10-11	X								
Check engine compression									X
ENGINE COOLANT									
Check engine coolant level	X								
Replace coolant								X	
Inspect coolant hoses for leaks, cracks, swelling, or deterioration	X								
ENGINE IGNITION									
Inspect battery for case damage and corroded cables	X								
Inspect ignition system					X				
Replace spark plugs					X				
LPG FUEL SYSTEM									
Replace LP fuel filter				X					
Inspect fuel lock off for leaks				X					
Ensure lock-off stops fuel flow when engine is off					X				
Test regulator pressure					X				
Inspect pressure regulator vapor hose for deposit build-up clean or replace as necessary					X				
Inspect regulator for fuel/coolant leaks					X				
Inspect injector hoses for wear, cracks, or deterioration					X				
AIR INTAKE									
Check air filter restriction indicator	X								
Check for leaks in air intake and filtration system			X						
Inspect air filter element			X						
Clean air filter element	Replace air filter element as conditions require or at 500 hours								
Inspect throttle body for loose bolts or vacuum leaks					X				
ENGINE EXHAUST SYSTEM									
Inspect engine for exhaust leaks	X								
Inspect catalyst/muffler for cracks, leaks, and damage					X				
Replace oxygen Sensor(s)							X		

WARRANTY

CERTIFIED EMISSIONS INDUSTRIAL ENGINE LIMITED WARRANTY

1. KEM Equipment, Inc. "the company" warrants each new Industrial engine, and factory installed accessories, to be free from defects in material and workmanship for the life of the warranty.

2. The warranty shall be in force only after KEM receives a properly completed Warranty Registration Form (**See warranty form on page 28**) from the original purchaser. The Warranty commences on the date of the first retail purchase and applies to the original and subsequent purchasers. However, in no event shall the duration of the Warranty exceed three (3) years or 2500 hours measured from the original retail sale date.

All subsequent purchasers must inform KEM in writing of the sale of the engine (and pay a \$150.00 transfer fee) to continue the warranty. If notification and payment is not received by KEM within 30 days of the resale, the warranty will be null and void.

3. The company obligation is limited to repairing or replacing those parts that are defective in material and workmanship only. At KEM's option it may replace such part with a part of equal quality to remedy any malfunction resulting from a defect in material or workmanship. Optionally, KEM may provide for the repair or replacement of any defective part at the selling dealership or a service center of KEM'S choice. KEM will make payment reimbursements for labor to replace such part as previously provided in the then current flat rate manual.

4. KEM distributors or service centers must be advised of any warranty related problem prior to the expiration of the warranty.

5. This warranty will **not** apply to:

Use of accessories or parts not manufactured or sold by KEM Equipment, Inc.

Neglect; failure to follow maintenance schedules; accident; abnormal operation; misuse or negligence; improper maintenance or installation; racing or unapproved engine modifications.

Problems arising from incorrect installation or modifications to the exhaust components, fuel lines, cooling system components; or engine damage due to incorrect electrical connections.

Rust, corrosion, invasion effects of weather, or electrolysis.

Detonation or operation with fuels, oils or lubricants, which are not suitable for use with this product. Detonation causes: Poor fuel quality, overloading of engine, improper gear, engine overheating, excessive backpressure, incorrect ignition timing.

Reimbursement for: Storage charges, rental charges of any type, inconvenience of any type, loss of time or income, expense of returning KEM product to a service facility, towing, lodging, travel time, loss or damage to personal property.

- 6.** Reasonable access must be provided to the product for warranty service.
- 7.** Warranty service must be requested by delivering the product for inspection to the retailer from whom the product was purchased or any convenient Industrial Service Center.
- 8.** Proof of warranty must be provided at time of request for warranty service. A properly completed warranty registration must be on file with KEM.
- 9.** Accurate service records must be available at the time of a warranty request.
- 10.** Distributors, dealers and service providers are not agents for KEM. The company's obligation under this warranty is strictly and exclusively limited to the repair or replacement of defective parts and does not authorize any person to create for it any obligation of liability in connection with this product nor does the company assume any obligation due to incorrect or defective installation by the dealer.
- 11.** All incidental and/or consequential damages are excluded from this warranty. Implied warranties are limited to the life of this warranty. All implied warranties including merchantability fitness for a particular purpose or otherwise are disclaimed in their entirety after expirations of the appropriate 3 year / 2500 hour warranty period. This warranty gives you specific rights, and you may also have other rights, which may vary from state to state.
- 12.** KEM reserves the right to change or improve design of any product previously assembled without notice and without obligation.
- 13.** In the event that a warranty claim is required outside of the continental United States, with the exception of Alaska, Hawaii and Canada there may be additional charges to the engine owner. KEM will not warranty any engine outside the continental United States, with the exception of Alaska, Hawaii and Canada unless competent and trained personnel are available to provide service to the engine.

KEM EQUIPMENT CERTIFIED ENGINE REGISTRATION CARD			
PO BOX 546 - 10800 SW HERMAN ROAD TUALATIN, OR 97062 (503-692-5012)			
DEALER NAME		DEALER PH#	
DEALER ADDRESS	CITY	STATE	ZIP CODE
ENGINE MODEL #	EQUIPMENT MODEL #	TYPE OF EQUIPMENT CIRCLE ONE	
ENGINE SERIAL #	EQUIPMENT SERIAL #	AERIAL LIFT	FORK LIFT PUMP
		GENERATOR	CARPET CLEANER
		OTHER	
		RENTAL UNIT	YES NO
IN SERVICE DATE			
OWNER NAME		PHONE #	
ADDRESS	CITY	STATE	ZIP
THIS CARD MUST BE ON FILE AT KEM EQUIPMENT BEFORE ANY WARRANTY CLAIMS ARE SUBMITTED			

1. KEM Equipment, Inc. “the company” warrants each new industrial engine, and factory installed accessories, to be free from defects in material and workmanship for the life of the warranty.

2. The warranty shall be in force only after KEM receives a properly completed Warranty Registration Form. **(See example warranty form on page 28)** The warranty commences on the date of the first retail purchase or when the equipment is first placed in service and applies to the original and subsequent purchasers. However, in no event shall the duration of the Warranty exceed three (3) years or 2500 hours measured from the original retail sale date. All subsequent purchasers must inform KEM in writing of the sale of the engine to continue the warranty. If notification is not received by KEM within 30 days of the resale, the warranty will be null and void.

3. The company obligation is limited to repairing or replacing those parts that are defective in material and workmanship only. At KEM’s option it may replace such part with a part of equal quality to remedy any malfunction resulting from a defect in material or workmanship. Optionally, KEM may provide for the repair or replacement of any defective part at the selling dealership or a service center of KEM’S choice. KEM will make payment reimbursements for labor to replace such part as previously provided in the then current flat rate manual.

4. KEM distributors or service centers must be advised of any warranty related problem prior to the expiration of the warranty.

5. This warranty will *not* apply to:

Use of accessories or parts not manufactured or sold by KEM Equipment, Inc.
Neglect, failure to follow maintenance schedules, accident, abnormal operation, misuse or negligence, improper maintenance, or installation. Racing or unapproved engine modifications.

Problems arising from incorrect installation or modifications to the exhaust components, fuel lines, cooling system components, or engine damage due to incorrect electrical connections.

Rust, corrosion, invasion of weather, or electrolysis. Detonation or operation with fuels, oils or lubricants: which are not suitable for use with this product. Detonation causes: Poor fuel quality, overloading of engine, improper gear, engine overheating, excessive backpressure or incorrect ignition timing.

Reimbursement for: storage charges, rental charges of any type, inconvenience of any type, loss of time or income, expense of returning a KEM product to a service facility, towing, lodging, travel time, loss or damage to personal property.

6. Reasonable access must be provided to the product for warranty service.

7. Warranty service must be requested by delivering the product for inspection to the retailer from whom the product was purchased or any convenient Industrial Service Center.

8. Proof of warranty must be provided at time of request for warranty service. A properly completed warranty registration must be on file with KEM.

9. Accurate service records must be available at the time of a warranty request.

10. Distributors, dealers and service providers are not agents for KEM. The company's obligation under this warranty is strictly and exclusively limited to the repair or replacement of defective parts and does not authorize any person to create for it any obligation of liability in connection with this product nor does the company assume any obligation due to incorrect or defective installation by the dealer.

11. All incidental and/or consequential damages are excluded from this warranty. Implied warranties are limited to the life of this warranty. All implied warranties disclaimed in their entirety after expirations of the appropriate 3-year / 2500 hour warranty period. This warranty gives you specific rights, and you may also have other rights, which may vary from state to state.

12. KEM reserves the right to change or improve design of any product previously assembled without notice and without obligation.

13. In the event that a warranty claim is required outside of the continental United States, with the exception of Alaska, Hawaii and Canada there may be additional charges to the engine owner. KEM will not warranty any engine outside the continental United States, with the exception of Alaska, Hawaii and Canada unless competent and trained personnel are available to provide service to the engine.

EMISSION CONTROL WARRANTY

GENERAL EMISSIONS WARRANTY COVERAGE

KEM Equipment, Inc. warrants to the ultimate engine purchaser and each subsequent purchaser that the Off-Road Large Spark-Ignition engines produced and certified by KEM Equipment, Inc. are designed, built, and equipped so as to conform to all applicable California ARB and U.S. EPA regulations. KEM warrants that all such engines are also free from defects in materials and workmanship.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board, U.S. EPA and KEM Equipment, Inc. are pleased to explain the emission control system warranty on your new 2010 and subsequent model year emission certified engine (or brand equipment). New off-road large spark ignition (LSI) engines must be designed, built and equipped to meet stringent Federal and State anti-smog standards. KEM Equipment, Inc. warrants that the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the carburetor, regulator or fuel injection system, ignition system, engine computer unit (ECM), Catalytic converter, and air induction system. Also included may be sensors, hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, KEM Equipment, Inc. will repair your LSI engine at no cost to you including diagnosis, parts, and labor.

MANUFACTURERS WARRANTY COVERAGE

The new 2010 model year off-road large spark-ignition engines are warranted for three years or 2500 hours of service, whichever occurs first from the date the equipment is delivered to the first retail purchaser or when the equipment is first placed in service. If any emission-related part on the engine is defective, the part will be repaired or replaced by an authorized KEM Equipment, Inc. dealer. For five years or 3500 hours of service (whichever occurs first) if any emission-related part specially noted with coverage for five years or 3500 hours is defective, the part will be repaired or replaced by an authorized KEM Equipment, Inc. dealer.

OWNER'S WARRANTY RESPONSIBILITIES

As the off-road LSI engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. KEM Equipment, Inc. recommends that you retain all records covering maintenance on your off-road engine, but KEM Equipment, Inc. cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the off-road large spark-ignition engine owner, you should however be aware that KEM Equipment, Inc. may deny you warranty coverage if your off-road large spark ignition engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Depending on the model of engine you have purchased, your engine may be designed to operate on LPG, Gasoline, and/or Natural Gas fuels. Use of any other fuel may result in your engine no longer operating in compliance with applicable emission requirements.

You are responsible for initiating the warranty process. KEM Equipment, Inc. suggests that you present your off-road large spark-ignition engine to a KEM Equipment, Inc. dealer as soon as a problem exists. The warranty repair should be completed by the dealer as expeditiously as possible.

If you have any questions regarding your warranty rights and responsibilities, you should contact **KEM Equipment, Inc. at 503- 692-5012.**

WHAT IS COVERED

Below is a list of the systems that affect emissions on your engine. Emission control components on these systems are covered by the emissions warranties as applicable. If failure of one of the components listed below results in failure of another part, both will be covered by this warranty. For detailed information concerning specific components covered by these emission control systems warranties, ask your dealer.

General Emissions Warranty Parts List 3 years or 2,500 hours, whichever comes first.

FUEL METERING SYSTEM

Fuel Injection system
Air/fuel ratio feedback and control system
Carburetor system, (internal parts and/or, pressure regulator, fuel mixer or Injection system)

AIR INDUCTION SYSTEM

Air intake system
Catalyst or Thermal Reactor System

POSITIVE CRANKCASE VENTILATION (PCV) System:

PCV valve.
Oil filler cap.

IGNITION CONTROL SYSTEM

Ignition module(s).
Engine Control Module.

MISCELLANEOUS ITEMS USED IN ABOVE SYSTEMS (Unless a normal wear part)

Vacuum, temperature, and time sensitive valves and switches.
Sensors used for electronic controls.
Hoses, belts, connectors, assemblies, clamps, fittings, tubing, sealing gaskets or devices, and mounting hardware
Pulleys, belts and idlers.

STARTERS AND ALTERNATORS

Starters and Alternators are warranted for a period of One Year or 1500 hours or whichever occurs first.

**HIGH PRICED EMISSIONS WARRANTY PARTS LIST – 5 years or 3,500 hours,
Whichever occurs first.**

INTAKE MANIFOLD:

5.7L PC10395
4.3L GM 12600781

CATALYTIC CONVERTER:

5.7L CM07-5724
4.3L CM07-4320

HARNESS:

5.7L PC10376
4.3L PC10411

VAPORIZER:

5.7L CNG 2007-1030-1
5.7L LP A7-434
4.3L LP A7-434

ADD-ON or MODIFIED parts: as defined in California Code of Regulations Section 1900 (b) (1) and (b)(10), Title 13, may not be used. Such use will, at the discretion of KEM Equipment, Inc., be grounds for disallowing a warranty claim. KEM Equipment, Inc. **will not** be liable under this article to warrant failures of warranted parts caused by the use of such an add-on or modified part.

POWERTRAIN ON BOARD DIAGNOSTIC (OBD) SYSTEM CHECK



WARNING: Fire, Shock, and Burn Danger: When performing any diagnostics or service work use caution. This system has extreme fuel pressures and a high voltage ignition.



CAUTION: Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts. Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control). Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around any printed circuit boards. Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

Verify that none of the following preliminary inspections/tests reveal the cause of the vehicle concern before beginning diagnosis:

Ensure that the battery is fully charged.

Ensure that the battery cables are clean and tight. Inspect for any open fuses.

Ensure that the grounds are clean, tight, and in the correct location.

Inspect the easily accessible systems or the visible system components for obvious damage or conditions that could cause the concern. This would include checking to ensure that all connections/connectors are fully seated and secured.

Inspect for aftermarket devices that could affect the operation of the system. Search for applicable service bulletins.

Install a scan tool. Verify that the scan tool powers up.

Ignition ON, Engine OFF, verify communication with all of the control modules on the vehicle.

Verify that SPN 65559 is not set

If SPN 65559 is set, refer to *SPN 65559*.

Attempt to start the engine. Verify that the engine cranks.

If the engine does not crank, refer to *SPN 66001* or *SPN 66002* (if equipped). If the vehicle is not equipped with an ECM controlled starter relay, repair the starting system.

Attempt to start the engine. Verify the engine starts and idles.

Important: Do not clear any SPNs unless instructed to do so by a diagnostic procedure.

Use the appropriate scan tool selections to obtain SPNs from each of the vehicle modules. Verify there are no SPNs reported from any module.

If any SPNs are present diagnose any current SPNs in the following order:

Any of the following: 630, 65580, 65581, or 65582.

SPN 627.

Component level SPNs.

System level SPNs.

Any remaining SPNs.

DIAGNOSTIC ERROR CODES

SPN 94

SPN Descriptors

SPN 94 FMI 3: Fuel Pressure Sensor Voltage Above Normal or Shorted High

SPN 94 FMI 4: Fuel Pressure Sensor Voltage Below Normal or Shorted Low

SPN 94 FMI 15: Fuel Pressure Data Valid But Above Normal Range-Least Severe Level

SPN 94 FMI 17: Fuel Pressure Data Valid But Below Normal Range-Least Severe Level

SPN 100

SPN Descriptors

SPN 100 FMI 3: Engine Oil Pressure (EOP) Sensor Circuit Voltage Above Normal or Shorted High

SPN 100 FMI 4: Engine Oil Pressure (EOP) Sensor Circuit Voltage Below Normal or Shorted Low

SPN 100 FMI 17: Engine Oil Pressure (EOP) Sensor Data Valid But Below Normal Range-Least Severe Level

SPN 105

SPN Descriptors

SPN 105 FMI 3: Manifold Air Temperature (MAT) Sensor Circuit Voltage Above Normal or Shorted High

SPN 105 FMI 4: Manifold Air Temperature (MAT) Sensor Circuit Voltage Below Normal or Shorted Low

SPN 106

SPN Descriptors

SPN 106 FMI 0: Manifold Absolute Pressure (MAP) Sensor Circuit Voltage Data Valid But Above Normal

SPN 106 FMI 1: Manifold Absolute Pressure (MAP) Sensor Circuit Voltage Data Valid But Below Normal

SPN 106 FMI 3: Manifold Absolute Pressure (MAP) Sensor Circuit Voltage Above Normal or Shorted High

SPN 106 FMI 4: Manifold Absolute Pressure (MAP) Sensor Circuit Voltage Below Normal or Shorted Low

SPN 110

SPN Descriptors

SPN 110 FMI 3: Engine Coolant Temperature (ECT) Sensor Circuit Voltage Above Normal or Shorted High

SPN 110 FMI 4: Engine Coolant Temperature (ECT) Sensor Circuit Voltage Below Normal or Shorted Low

SPN 110 FMI 15: Engine Coolant Temperature (ECT) Sensor Circuit Voltage Data Valid But Above Normal Range-Least Severe Level

SPN 174

SPN Descriptors

SPN 174 FMI 3: Fuel Temperature (FT) Sensor Circuit Voltage Above Normal or Shorted High

SPN 174 FMI 4: Fuel Temperature (FT) Sensor Circuit Voltage Below Normal or Shorted Low

SPN 627

SPN Descriptor

SPN 627 FMI 15: System Voltage Data Valid But Above Normal Range-Least Severe Level

SPN 627 FMI 17: System Voltage Data Valid But Below Normal Range-Least Severe Level

SPN 630, 65580, 65581, or 65582

SPN Descriptors

SPN 630 FMI 13: Cal Memory Out of Calibration

SPN 65580 FMI 12: CPU Bad Intelligent Device or Component

SPN 65581 FMI 12: MHC Failure Bad Intelligent Device or Component

SPN 65582 FMI 12: NV RAM Failure Data Erratic, Intermittent or Incorrect

SPN 636

SPN Descriptors

SPN 636 FMI 2: Crankshaft Position (CKP) Sensor Circuit Data Erratic, Intermittent or Incorrect

SPN 636 FMI 8: Crankshaft Position (CKP) Sensor Signal Abnormal Frequency or Pulse Width

SPN 651, 652, 653, 654, 655, 656, 657, or 658

SPN Descriptors

SPN 651 FMI 3: Fuel Injector 1 Voltage Above Normal or Shorted High

SPN 651 FMI 5: Fuel Injector 1 Current Below Normal or Open Circuit

SPN 652 FMI 3: Fuel Injector 2 Voltage Above Normal or Shorted High

SPN 652 FMI 5: Fuel Injector 2 Current Below Normal or Open Circuit

SPN 653 FMI 3: Fuel Injector 3 Voltage Above Normal or Shorted High

SPN 653 FMI 5: Fuel Injector 3 Current Below Normal or Open Circuit

SPN 654 FMI 3: Fuel Injector 4 Voltage Above Normal or Shorted High

SPN 654 FMI 5: Fuel Injector 4 Current Below Normal or Open Circuit

SPN 655 FMI 3: Fuel Injector 5 Voltage Above Normal or Shorted High

SPN 655 FMI 5: Fuel Injector 5 Current Below Normal or Open Circuit

SPN 656 FMI 3: Fuel Injector 6 Voltage Above Normal or Shorted High

SPN 656 FMI 5: Fuel Injector 6 Current Below Normal or Open Circuit

SPN 657 FMI 3: Fuel Injector 7 Voltage Above Normal or Shorted High

SPN 657 FMI 5: Fuel Injector 7 Current Below Normal or Open Circuit

SPN 658 FMI 3: Fuel Injector 8 Voltage Above Normal or Shorted High

SPN 658 FMI 5: Fuel Injector 8 Current Below Normal or Open Circuit

SPN 65541, 65542, 65543, 65544, 65545, 65546, 65547, or 65548

SPN Descriptors

SPN 65541 FMI 4: Ignition Coil 1 Voltage Below Normal or Shorted Low

SPN 65559

SPN Descriptors

SPN 65559 FMI 11: CAN Bus Hardware Fault Root Cause Unknown

SPN 65560

SPN Descriptors

SPN 65560 FMI 9: CAN Bus Governor Command Abnormal Update Rate

SPN 65561, 65562

SPN Descriptors

SPN 65561 FMI 0: Oxygen Sensor Bank A Sensor 1 Data Valid But Above Normal

SPN 65561 FMI 1: Oxygen Sensor Bank A Sensor 1 Data Valid But Below Normal

SPN 65561 FMI 3: Oxygen Sensor Bank A Sensor 1 Voltage Above Normal or Shorted

High

SPN 65561 FMI 4: Oxygen Sensor Bank A Sensor 1 Voltage Below Normal or Shorted Low

SPN 65561 FMI 5: Oxygen Sensor Bank A Sensor 1 Current Below Normal or Open Circuit

SPN 65562 FMI 0: Oxygen Sensor Bank A Sensor 2 Data Valid But Above Normal

SPN 65562 FMI 1: Oxygen Sensor Bank A Sensor 2 Data Valid But Below Normal

SPN 65562 FMI 3: Oxygen Sensor Bank A Sensor 2 Voltage Above Normal or

Shorted High

SPN 65562 FMI 4: Oxygen Sensor Bank A Sensor 2 Voltage Below Normal or Shorted

Low

SPN 65562 FMI 5: Oxygen Sensor Bank A Sensor 2 Current Below Normal or Open Circuit

SPN 65565

SPN Descriptors

SPN 65565 FMI 0: Fuel Trim Bank 1 Data Valid But Above Normal

SPN 65565 FMI 1: Fuel Trim Bank 1 Data Valid But Below Normal

SPN 65567

SPN Descriptors

SPN 65567 FMI 8: Oxygen Sensor Bank 1 Sensor 1 Abnormal Frequency or Pulse Width

SPN 65567 FMI 10: Oxygen Sensor Bank 1 Sensor 1 Abnormal Rate of Change

SPN 65570

SPN Descriptors

SPN 65570 FMI 2: Cam Phaser W Data Erratic, Intermittent, or Incorrect

SPN 65570 FMI 4: Cam Phaser W Voltage Below Normal or Shorted Low

SPN 65570 FMI 5: Cam Phaser W Short High or Open

SPN 65570 FMI 7: Cam Phaser W Accuracy Mechanical System Not Responding or Out of Adjustment

SPN 65590, 65591, 65592, 65593, 65594, 65595, 65596, 65597, 65598, or 65599

SPN Descriptors

SPN 65590 FMI 7: Misfire Mechanical System Not Responding or Out of Adjustment

SPN 65591 FMI 7: Misfire Cylinder 1 Mechanical System Not Responding or Out of Adjustment

SPN 65592 FMI 7: Misfire Cylinder 2 Mechanical System Not Responding or Out of Adjustment

SPN 65593 FMI 7: Misfire Cylinder 3 Mechanical System Not Responding or Out of Adjustment

SPN 65594 FMI 7: Misfire Cylinder 4 Mechanical System Not Responding or Out of Adjustment

SPN 65595 FMI 7: Misfire Cylinder 5 Mechanical System Not Responding or Out of Adjustment

SPN 65596 FMI 7: Misfire Cylinder 6 Mechanical System Not Responding or Out of Adjustment

SPN 65597 FMI 7: Misfire Cylinder 7 Mechanical System Not Responding or Out of Adjustment
SPN 65598 FMI 7: Misfire Cylinder 8 Mechanical System Not Responding or Out of Adjustment
SPN 65599 FMI 7: Misfire Random Mechanical System Not Responding or Out of Adjustment

SPN 65601, 65602, or 65610

SPN Descriptors

SPN 65601 FMI 2: Throttle Position (TP) Sensor 2 Data Erratic, Intermittent or Incorrect
SPN 65602 FMI 2: Throttle Position (TP) Sensor 1 Data Erratic, Intermittent or Incorrect
SPN 65610 FMI 2: Throttle Position (TP) Sensor 1 and 2 Data Erratic, Intermittent or Incorrect

SPN 65604, 65605, or 65613

SPN Descriptors

SPN 65604 FMI 2: Pedal Position (PP) Sensor 2 Data Erratic, Intermittent or Incorrect
SPN 65604 FMI 12: Pedal Position (PP) Sensor 2 Bad Intelligent Device or Component
SPN 65605 FMI 2: Pedal Position (PP) Sensor 1 Data Erratic, Intermittent or Incorrect
SPN 65605 FMI 12: Pedal Position (PP) Sensor 1 Bad Intelligent Device or Component
SPN 65613 FMI 2: Pedal Position (PP) Sensor 1 and 2 Data Erratic, Intermittent or Incorrect

SPN 65615, 65616, or 65618

SPN Descriptors

SPN 65615 FMI 7: Electronic Throttle Control (ETC) Actuation Fault Mechanical System Not Responding or Out of Adjustment
SPN 65616 FMI 12: Electronic Throttle Control (ETC) Process Fault Bad Intelligent Device or Component
SPN 65618 FMI 7: Electronic Throttle Control (ETC) Return Fault Mechanical System Not Responding or Out of Adjustment

SPN 65620 or 65621

SPN Descriptors

SPN 65620 FMI 4: 5 Volt Reference A Circuit Voltage Below Normal or Shorted Low
SPN 65621 FMI 4: 5 Volt Reference B Circuit Voltage Below Normal or Shorted Low

SPN 65675 or 65676

SPN Descriptor

SPN 65675 FMI 11: Catalytic Converter A Efficiency Root Cause Unknown

SPN 65710

SPN Descriptors

SPN 65710 FMI 31: Emergency Stop Warning Not Available

SPN 65723

SPN Descriptors

SPN 65723 FMI 2: Camshaft Position (CMP) Sensor Circuit Data Erratic, Intermittent or Incorrect

SPN 65723 FMI 7: Camshaft Position (CMP) Sensor Mechanical System Not Responding or Out of Adjustment

SPN 65723 FMI 8: Camshaft Position (CMP) Sensor Signal Abnormal Frequency or Pulse Width

SPN 66001

SPN Descriptor

SPN 66001 FMI 3: Starter Relay Low Side Driver Voltage Above Normal or Shorted High

SPN 66001 FMI 5: Starter Relay Low Side Driver Current Below Normal or Open Circuit

SPN 66002

SPN Descriptor

SPN 66002 FMI 4: Starter Relay High Side Driver Voltage Below Normal or Shorted Low

SPN 66002 FMI 5: Starter Relay High Side Driver Current Below Normal or Open Circuit

SPN 66003

SPN Descriptor

SPN 66003 FMI 3: Malfunction Indicator Lamp (MIL) Driver Voltage Above Normal or Shorted High

SPN 66003 FMI 5: Malfunction Indicator Lamp (MIL) Driver Current Below Normal or Open Circuit

SPN 66004

SPN Descriptor

SPN 66004 FMI 3: Service Vehicle Soon Lamp (SVS) Voltage Above Normal or Shorted High

SPN 66004 FMI 5: Service Vehicle Soon Lamp (SVS) Current Below Normal or Open Circuit

SPN 66010

SPN Descriptor

SPN 66010 FMI 3: Slow Mode Lamp Voltage Above Normal or Shorted High

SPN 66010 FMI 5: Slow Mode Lamp Current Below Normal or Open Circuit

SPN 66013 or 66014

SPN Descriptor

SPN 66013 FMI 3: Powertrain Relay Voltage Above Normal or Shorted High

SPN 66013 FMI 5: Powertrain Relay Current Below Normal or Open Circuit

SPN 66014 FMI 4: Powertrain Relay Contact Voltage Below Normal or Shorted Low

SPN 66017

SPN Descriptors

SPN 66017 FMI 4: Fuel Pump Relay 1 Voltage Below Normal or Shorted Low

SPN 66017 FMI 5: Fuel Pump Relay 1 Current Below Normal or Open Circuit

SPN 66018

SPN Descriptor

SPN 66018 FMI 3: Tachometer Voltage Above Normal or Shorted High

SPN 66018 FMI 5: Tachometer Current Below Normal or Open Circuit

SPN 66019

SPN Descriptors

SPN 66019 FMI 3: Oxygen Sensor Bank A Sensor 1 Heater Voltage Above Normal or Shorted High

SPN 66019 FMI 5: Oxygen Sensor Bank A Sensor 1 Heater Current Below Normal or Open Circuit

SPN 66019 FMI 8: Oxygen Sensor Bank A Sensor 1 Heater Abnormal Frequency or Pulse Width

SPN 66021

SPN Descriptors

SPN 66021 FMI 3: Oxygen Sensor Bank A Sensor 2 Heater Voltage Above Normal or Shorted High

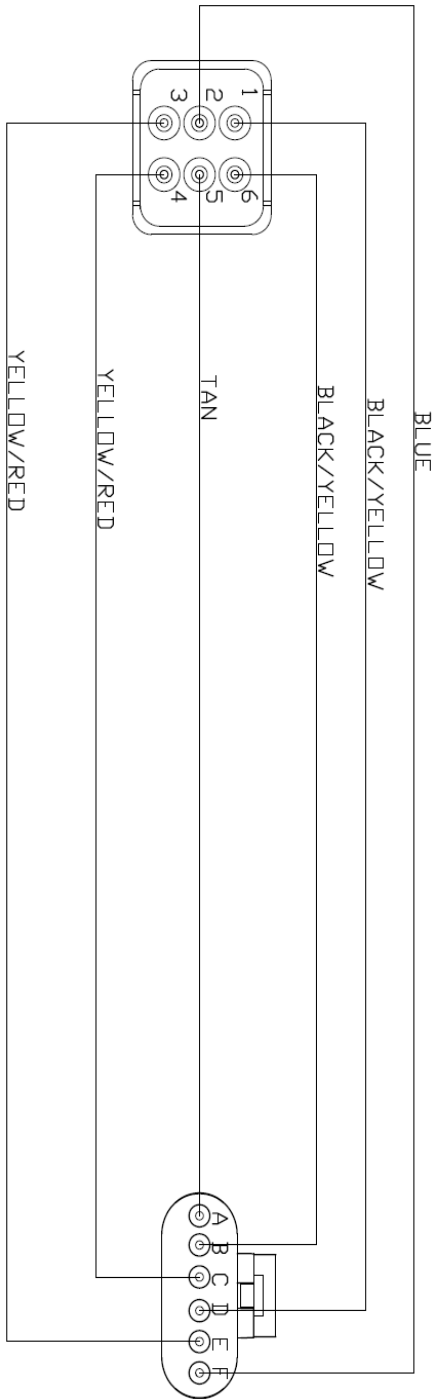
SPN 66021 FMI 5: Oxygen Sensor Bank A Sensor 2 Heater Current Below Normal or Open Circuit

SPN 66021 FMI 8: Oxygen Sensor Bank A Sensor 2 Heater Abnormal Frequency or Pulse Width

EXPECTED FUEL PRESSURE CHARTS FOR LPG AND CNG

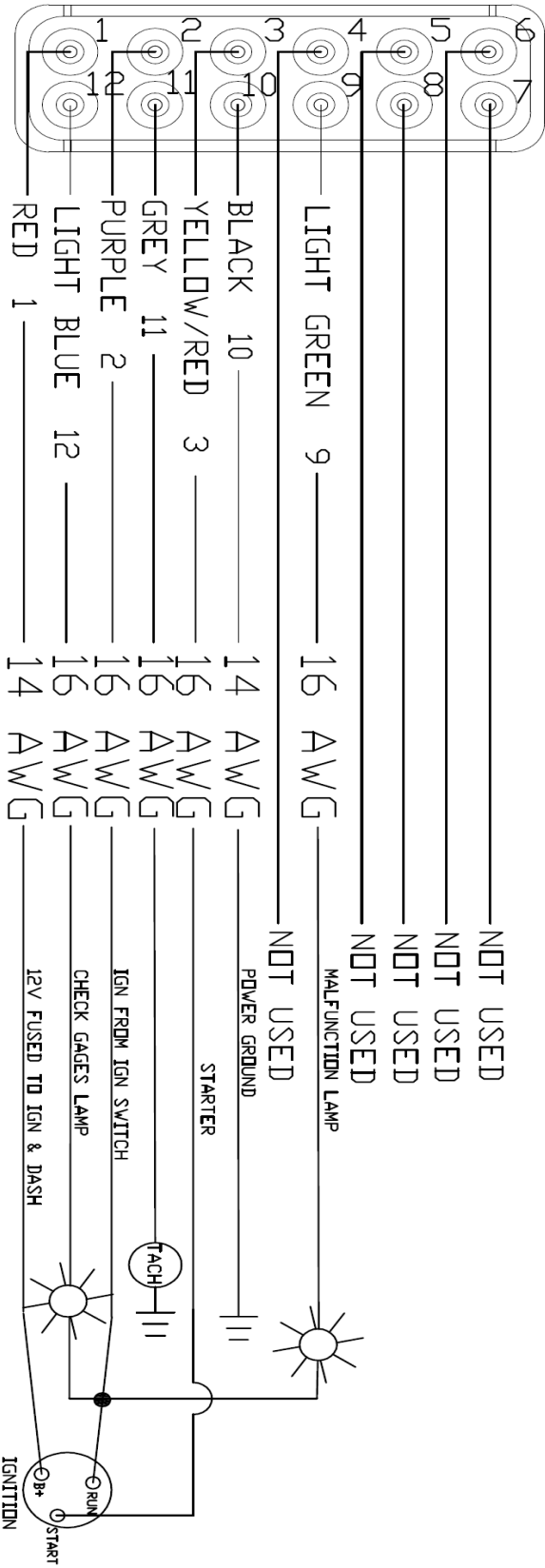
LPG						CNG					
Manifold Pressure				Fuel Pressure		Manifold Pressure				Fuel Pressure	
Absolut	Gau	Absolut	Gau	Gau	Gaug	Absolut	Gau	Absolut	Gau	Gau	Gaug
kPa	kPa	In Hg	In	kPa	PSI	kPa	kPa	In Hg	In	kPa	PSI
0	10	0.00	29.5	-10	-1.5	0	10	0.00	29.5	90	13.1
10	90	2.95	26.5	0	0.0	10	90	2.95	26.5	10	14.5
20	80	5.91	23.6	10	1.5	20	80	5.91	23.6	11	16.0
30	70	8.86	20.6	20	2.9	30	70	8.86	20.6	12	17.4
40	60	11.81	17.7	30	4.4	40	60	11.81	17.7	13	18.9
50	50	14.76	14.7	40	5.8	50	50	14.76	14.7	14	20.3
60	40	17.72	11.8	50	7.3	60	40	17.72	11.8	15	21.8
70	30	20.67	8.8	60	8.7	70	30	20.67	8.8	16	23.2
80	20	23.62	5.9	70	10.2	80	20	23.62	5.9	17	24.7
90	10	26.58	2.9	80	11.6	90	10	26.58	2.9	18	26.1
100	0	29.53	0.0	90	13.1	100	0	29.53	0.0	19	27.6

72" long



TOLERANCES	XXX ± .010 XX ± .015 X ± .030	MAX ± 1/16" max.		Equipment, Inc.
DRG	BT PART	SCALE 1/1		
DRW	Joe T	DATE 5/17/07		

CUSTOMER INTERFACE HARNESS



TO DIMENSIONS XX = 8.00 X = 8.00 N = 8.11 XX = 8.12 X = 8.12 N = 8.11		XXX = 8.11/2 XXX = 8.11/2 XXX = 8.11/2	
DATE AS NOTED		DATE 1/12/09	
TIME SF		SCALE C	
APP'D		REV PC 8340	

Equipment, Inc.
Customer Interface Wiring MERT 5

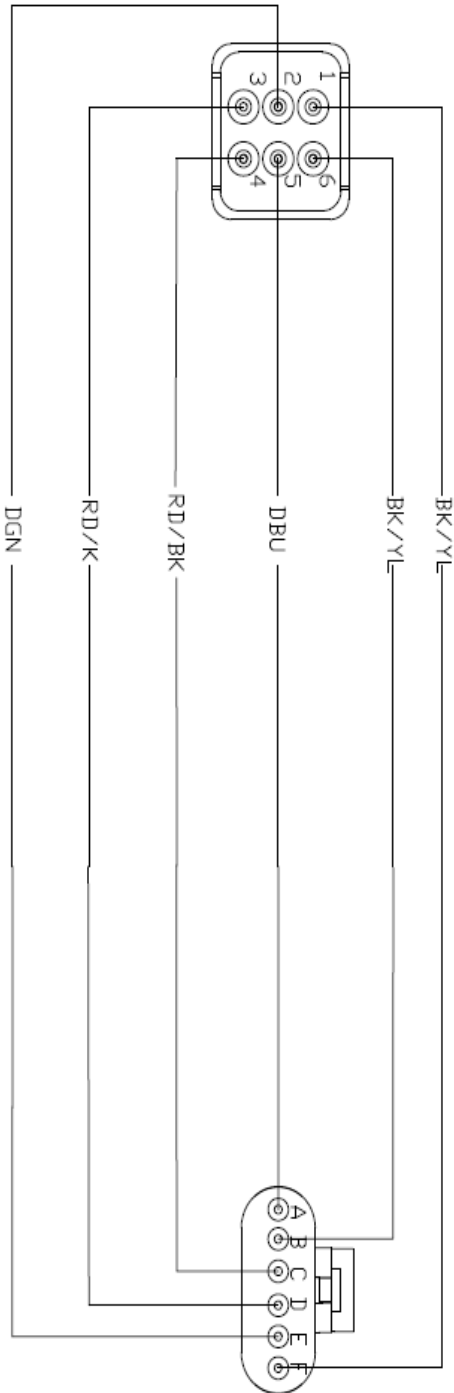
6 PIN
 DT06-6S
 0468-201-16141
 VSS

CONNECTOR
 TERMINAL
 VEIICE

72"

FOOT PEDAL
 12066-317
 12103881
 15305351

CONNECTOR
 TERMINAL
 SEAL



16 gauge on all wire unless specified

TOLERANCES		UNLESS SPECIFIED	
SIZE	FINISH	SIZE	FINISH
±.005	±.005	±.005	±.005
BY PART		BY PART	
JOB T		JOB T	
DATE 5/17/07		DATE 5/17/07	
PC 8121		PC 8121	
C		B	

Equipment, Inc.

PEDAL EXTENSION TELEFLEX

