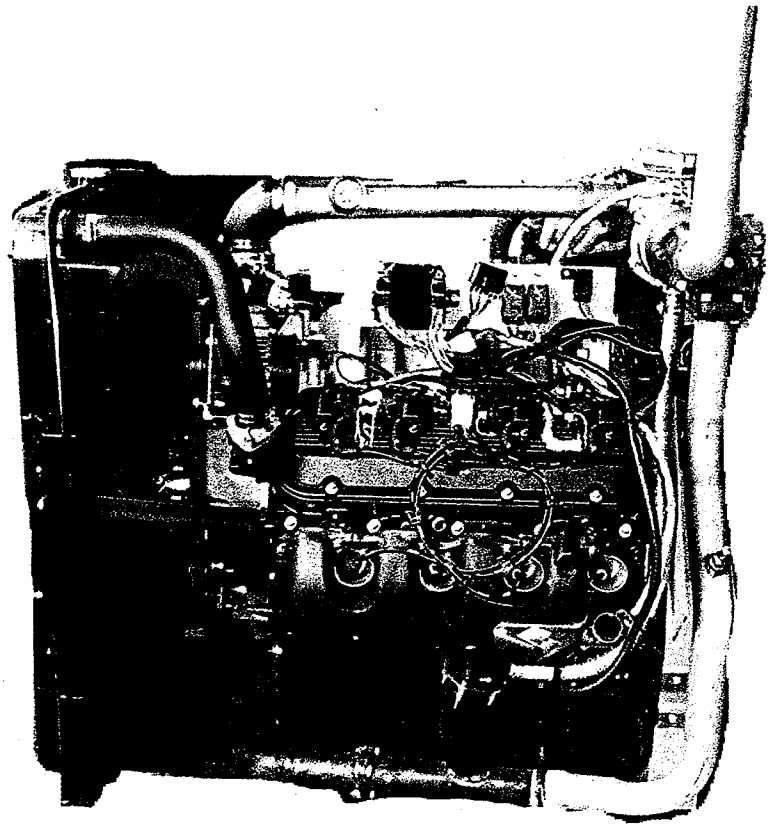
KEM EQUIPMENT, INC.

INDUSTRIAL ENGINE OPERATOR'S MANUAL

MODEL—GMG-881



KEM EQUIPMENT, INC.
10800 S.W. Herman Road
Tualatin, OR 97062
Phone: 503-692-5012 Fax: 503-692-1098
email: KemPower@Hotmail.com

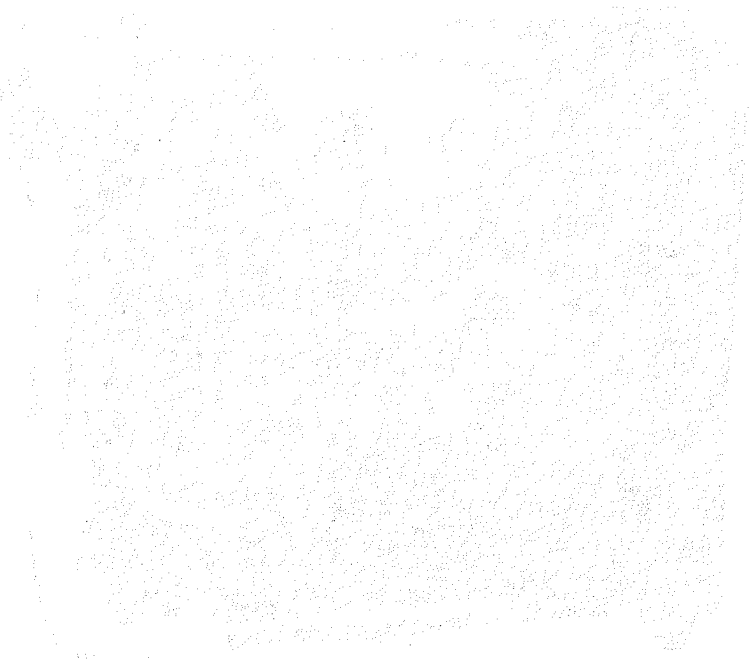


TABLE OF CONTENTS

FORWARD

1.0 Operation
- 1.1 Engine Model and Engine Serial Number
- 1.2 Fuel, Coolant and Lubricant
- 1.3 Instrumentation

2.0 Inspection and Maintenance
- 2.1 Maintenance Schedule
- 2.2 Intake and Exhaust Systems
- 2.3 Air Cleaner
- 2.4 Engine Oil Pan
- 2.5 Oil Filter
- 2.6 Fuel Filter
- 2.7 Coolant

3.0 Governors
- 4.1 Velocity
- 4.2 Electronic (GAC)
- 4.3 Electronic Governor

4.0 Troubleshooting

FORWARD

The necessary safety precautions and regulations have been observed in the design, choice of materials and manufacture of your Industrial Power Unit package. It has been run-in, tested and adjusted at the factory.

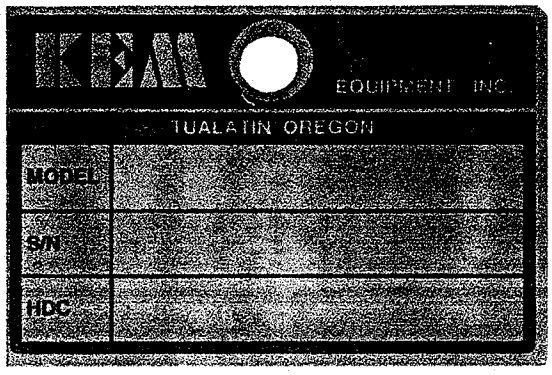
However, maximum engine performance and longevity is not possible without regard to maintenance. Therefore, this manual is presented, and should be used as a guide in setting forth a maintenance program and schedule.

In the interest of safety be sure to refit any guards and protective devices that may have been removed during work on the engine.

To prevent pollution to the environment, please retain and properly dispose of old fuel and oil.

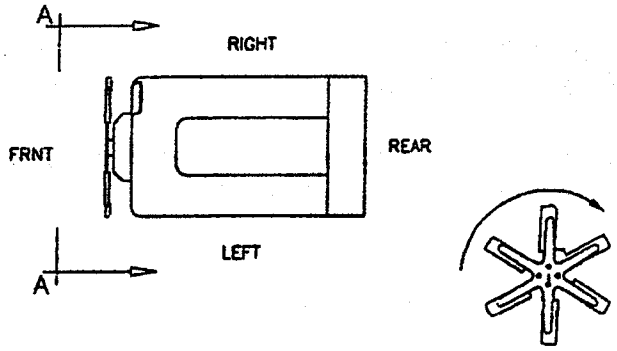
1.1 ENGINE MODEL AND SERIAL NUMBER

General Description:



Identification placard is located on the Right side of the engine, under the starter.

General Description:
The terms "front and rear", "right and left" as well as fan rotation are shown below.



Hot Date Code is stamped on the serial plate. ***Example: V0109AH***

Number 9 indicates the model year of your engine. Letters indicate GM engine code.
You will need this engine code to order parts.

1.2 FUEL, COOLANT AND LUBRICANT

Periodical replenishment and replacement of oil and coolant are the key to the best maintenance, trouble-free performance, and increase of service life of the engine.

GENERAL LUBRICATION INSTRUCTIONS

1. Lubricate every necessary part as specified in "Periodic Check and Service Chart".
2. Always apply the oil of optimum viscosity to ambient temperature. In cold weather, use of too high viscosity oil can be often a cause of difficult engine starting.
3. Prior to the lubrication, be sure to clean oiler, grease gun, oil fillers, grease nipples, etc. If grease nipples or other oil filler parts are broken or bent, replace them t once with new ones.
4. If excessive leaks are noticed from oil seals or packings, etc., replace the seals or packings at once to stop leaks.

Always use clean fuel and pay attention to the following when handling the fuel.

- After the end of the day's work, fill and fuel tank with fuel to its capacity. This is to expel air from the tank as otherwise the moisture in the air might condense into water drops which contaminate the fuel. Also, this gives enough time for dust and water to be separated and settle before operation on the next day.
- Store the fuel in a storage tank for at least 24 hours to allow rust and water to precipitate before use.
- When filling the fuel tank from a drum, take care not to allow deposits on the bottom of the drum to be carried over into the tank.
- Open the drain plug at the bottom of the storage and fuel tanks occasionally to drain off deposits and water.

COOLANT

Use soft water with a low impurity content as the coolant. Use of water containing salt, or water in the vicinity of a mine or spa could accelerate deposit of scale in the water jacket and corrosion of the external surface of the cylinder liner.

Use anti-corrosive in hot weather to prevent corrosion in hot weather to prevent corrosion and use anti-freeze in cold weather to prevent freezing of the coolant.

NOTE: If the coolant in the cooling system contains anti-freeze or anti-corrosive, add a solution of the same concentration as the solution initially put into the system.

Cautions on use and handling of anti-freeze

- Use a permanent type anti-freeze.
- When anti-freeze is to be applied or when the coolant with anti-freeze is to be replaced by coolant without anti-freeze to comply with the rise in the atmospheric temperature, wash and clean the cooling system.

The anti-freeze/water mixing ratio depends on the lowest temperature expected.

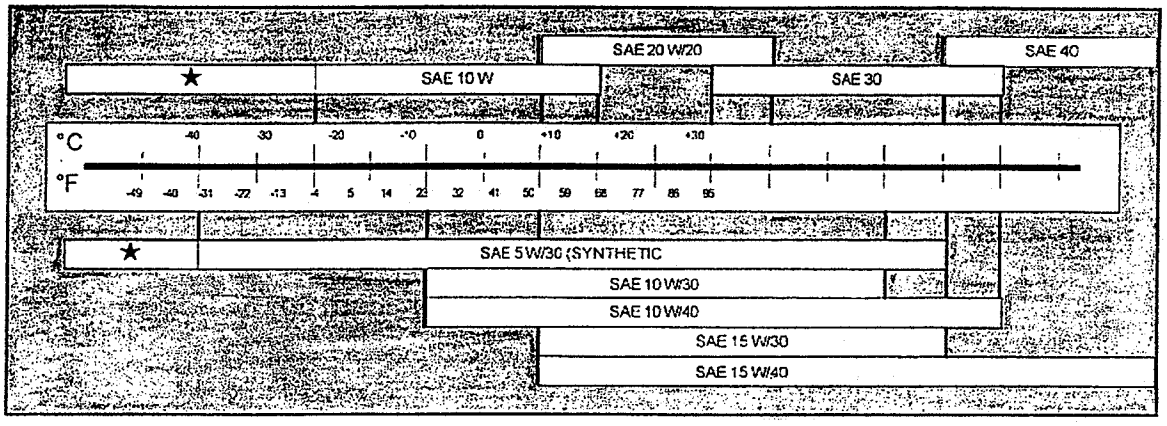
LUBRICANT

Engines which are often operated in more severe conditions require the use of higher quality engine oil. Use the oil and grease conforming to the specifications shown on the next page.

Oil and Grease		Specifications	
Engine Oil	Under normal Operating conditions	API CC or higher	40°C or above
	Under severe operating Conditions or for engine W/turbocharger.	API CD or higher	40° to -5°C SAE 30 10 to -30°C SAE 10W-30
Gear Oil		API GL-3	SAE 80 SAE 90
Brake Fluid Multipurpose type grease Clutch shifter grease		SAEJ1703 NGLI No.2 MIL-G-3545B	

Oil Viscosity

The viscosity of the oil being greatly influenced by the ambient temperature, the choice of the SAE-grade should be governed by the ambient temperature at engine site (see diagram). If temperatures temporarily fall below the limit of the SAE-grade selected, this will merely affect the starting performance, but cause no engine damage.



*Only with engine oil preheating.

Since a too viscous oil causes starting difficulties, the choice of the viscosity grade during winter operation should be governed by the ambient temperature prevailing at the time of starting the engine, Oil changes as f function of ambient temperatures can be avoided by using multigrade oils, which are again subject to the oil change intervals recommended.

Checking Oil Level

The oil level may be checked by two methods:

1. **Dipstick**
   Pull out dipstick, wipe clean and reinsert as far as it will go, then withdraw. The oil level should be between the marks indicated on the dipstick. If the level is only up to or even below the lower mark, top with oil immediately, preferably up to the upper marking on dipstick.

2. **Sight gauge (when applicable)**
   The oil level in the sight gauge will be approximately 1-½ inches down from the top of the glass when the engine oil level is maximum. Verify by checking the dipstick.

GMPT INDUSTRIAL ENGINE INFORMATION

Engine oil requirement:
Type
API-"SH"
Weight - SAE 30 for above 40°F
SAE 15W40 for above 0°F
SAE 10W30 for all temperatures

Oil Changes
Change oil and filter ever 125 hours or 3 months, whichever comes first.

(NOTE: OEM air cleaners, PCV system, or engine operating temperatures may vary the oil change interval).

Oil Temperatures:
Upper limit if 266°F
Ideal running temperature is 221°F
Lower limit is 176°F

Lubrication System: (Maximum allowable degree angles of engine).
8.5 degrees with the front of the engine down.
18 degrees with the rear of the engine down
20 degrees side to side

1.3 INSTRUMENTATION

Oil Pressure (20 to 50 PSI)

The oil pressure will vary according to temperature and the viscosity of the oil. If the oil is relatively light, on a warm day the gauge will register on the low end of the scale or approximately 20 PSI. Conversely, if the oil is heavy, on a cold day, gauge readings of 50 PSI would be expected.

Coolant Temperature (160-195°F)

The coolant temperature is regulated by a thermostat.

Volt Meter (12-15 volts)

Primarily the voltmeter is provided to indicate the condition of the battery. If the gauge registers in the red above 15 volts, shut the engine down and investigate. The engine will not automatically shut down in the unlikely event of over-voltage.

Should the voltage drop below approximately 12 volts, there will not be enough power to runt the electrical system and the engine will quit running.

If the gauge registers in the red below 12 volts, check the condition of the battery.

2.0 INSPECTION AND MAINTENANCE

To prolong the life of the engine and maintain top operating conditions at al times, it is important that the engine is checked and serviced at regular intervals.

Periodic Inspection and Maintenance

1. The simple inspection and maintenance procedures are summarized below. An emergency engine should also be inspected and maintained according to the maintenance standard table described in the chart below.

2. Determine the inspection and maintenance intervals by checking the service meter readings. When the engine is operated under poor or severe conditions, perform inspection and maintenance earlier.

See following pages for maintenance schedules.

2.1 MAINTENANCE SCHEDULE

	CHECK AND SERVICE ITEM		SERVICE INTERVALS						REMARKS
			EVERY 10 HRS.	EVERY 60 HRS.	EVERY 125 HRS.	EVERY 250 HRS.	EVERY 500 HRS.	EVERY 1000 HRS.	
ENGINE GENERAL	Starting condition & noise			O					
	Low speed & acceleration (rated condition)			O					Check for hunting
	Exhaust condition			O					
	Cylinder head, manifold & mounting bracket installation			O*				O	*Applicable to new engines only
	Compression pressure							O	
	Valve clearance			O*					*New engines only
	Air cleaner element (cyclone type)	Condition				O			
		Replace						●	
	Air cleaner element (flat type)	Condition				O			
		Replace					●		
	Check turbocharger bearing for rotating conditions Check oil feed pipe joints							O	
LUBRICATION	Oil leaks			O					
	Damaged hose							O	
	Engine oil pan	Check oil for contamination & quantity	O						
		Replace Oil			●	●	●		*On new engine, be sure to replace engine oil
	Oil filter element	Replace Oil			●	●	●		
FUEL SYS	Leaks-check hose for damage & deterioration			O					
	Fuel filter	Clogging				O			
COOLING SYSTEM	Water leaks-Check hose for damage/deterioration		O						
	Replace coolant & clean system						O		Clean system before & after use of antifreeze
	Loose or damaged V-belt		O						
	Damaged fan, mounting condition of fan						O		
	Radiator	Water quality	O						
		Cap function				O			
		Clogged and/or damaged core					O		
	Lubrication of water pump and idler pulley				O				
ELECTRICAL	Battery	Electrolyte quantity			O				Every 2 weeks-every week in summer.
		Specific gravity of electrolyte				O			
		Connected condition of terminals				O			
	Loose electrical wiring connections and loose or damaged insulators				O				
MISC.	Check emergency stop equipment for operation				O				
	Lubrication of clutch shifter and fork shaft							O	Use clutch shifter grease.
	Lubrication of bearings case (for direct drive type)							O	Use clutch shifter grease.
	Check meters, gauges and pilot lamps					O			

SYMBOLS=O-Check, adjust or lubricate. / ●-Replace oil, grease or element.

2.2 INTAKE AND EXHAUST SYSTEM

Checking Engine Exhaust Emissions

After the engine has fully warmed up, check the color of exhaust gas.

Colorless or faint blue	Good
Black	Bad, showing incomplete combustion
White	Bad, showing combustion of oil forced up.

Please note: Exhaust gas which is really colorless or faint blue will look white due to winter weather.

2.3 AIR CLEANER

A dirty air cleaner element, if left as it is will decrease engine output. It will also cause increased fuel consumption, increase in harmful contents of exhaust emissions as well as black smoke.

Cyclone Type Air Cleaner

1. **Remove the dust cup and withdraw the element.** On a double element type cleaner, be sure not to remove the inner element when the outer element is cleaned. The inner element should be removed only when the outer element is replaced. Make sure that both elements are replaced at the same time.
2. **Prior to installation, clean the inside of the case and dust cup,** and slowly insert the element. If the air cleaner is placed in a horizontal position, install the dust cup so that the assembling direction indicating mark of the cup with face upward.

NOTE: Make sure that the element and dust cup are securely installed. If left loose, dust will be drawn in and the air cleaner will fail to function properly.

2.4 ENGINE OIL

Replace engine oil-after the first 60 hours and every 250 hours thereafter.

On a new engine, be sure to replace the oil after the first 60 hours of operation.

1. After shutdown, remove the oil while it is still hot. At the same time, the oil filter should be replaced.
2. Install the drain plug and pour in fresh engine oil from the oil filter port up to the FULL mark on the level gauge.
3. After running the engine at idle for several minutes recheck the oil level.

NOTE: A badly contaminated or deteriorated oil should be replaced regardless of the replacement intervals. **Replace the oil filter element each time that the oil is replaced.**

2.5 OIL FILTER

Replace element – Every 125 hours

NOTE: The element cannot be washed and reused.

1. Remove the element by turning counterclockwise. If the element is hard to loosen, use a special tool (filter wrench) for easier removal.
2. Prior to installation of a new element, apply a thin coat of engine oil to the packing of the element and tighten the element fully with a special tool (filter wrench).
3. If the element only has been replaced without replacing the engine oil, replenish to proper level and check the level.
4. After installation, thoroughly wipe away spilt oil, start the engine, and check for oil leaks from the packing.

2.6 FUEL FILTER

The fuel filter separates and removes foreign substances and precipitated water contained in fuel. Over a long period of service, however, the filter will be clogged with foreign substances. So the filter should be replaced at regular intervals.

Replace element – Every 500 hours.

1. Remove the element, while using care not to spill fuel.
2. **The element cannot be washed and reused.**
3. After installation, bleed the fuel system and check for fuel leaks.

2.7 COOLANT

Replace coolant and clean system – Every 500 hours.

Scale and rust are formed in the radiator and engine water jacket in the curse of time. It is important to clean the radiator and water jacket to remove deposits of scale and rusts as they cause reduction of the cooling efficiency. Also make sure that the system is cleaned if the coolant contains anti-rust or anti-freeze.

When cleaning the system, heat the coolant to 80°C or higher and keep the engine idling. If the water temperature is lower, the thermostat is closed to shut off flow of the coolant to the radiator, making it impossible to clean the system thoroughly.

1. Open the radiator cap and open the drain cocks of the engine crankcase and radiator to remove the coolant.
2. Close the drain cocks and pour coolant into radiator. Run the engine until the coolant is heated to about 80°C.
3. If there is considerable scale or rust, pour in a cleaning solution and run the engine until the solution is heated to about 80°C.

Coolant Cont.

4. Continue to idle the engine for about 30 minutes.
5. After stopping the engine, open the drain cocks of the engine crankcase and radiator to drain off the coolant completely.
6. Close the drain cocks and pour in coolant to rinse the system thoroughly. Rinse until dirty water no longer runs out.
7. Use soft water and fill until it flows out from the overflow pipe.
   NOTE: USE SOFT WATER. Use of well water or river water may cause scaling or rusting. Add anti-corrosive to water in hot season to prevent corrosion and add anti-freeze in cold season to prevent freezing of the coolant.
8. After filling the coolant, run the engine for awhile. After stopping the engine, check the coolant level and replenish, if necessary. This rechecking of the coolant level is necessary because the coolant level will fall after initial operation as a result of expelling air from the system.

4.0 TROUBLESHOOTING

ADJUSTMENT INSTRUCTIONS

1. Regulators are *preset* and should not need any adjusting. *Ecolo* valve has to have manual adjustment to where you feel you have a good balance of idle and not toggling too rich under load.

   NOTE: Each and every regulator is tested and tuned at the plant before being released for sale. Do not tamper with it unless there is a strong possibility that it may not be set correctly. To reset the pressure regulator to base setting, proceed from point 2. and there after. If the regulator is believed to be in good order proceed from point 6. and there after.

2. **CLOSE** gently and completely the Positive idle screw (8mm hex) & the Sensitivity screw (10mm hex) on the side of the pressure regulator.
   Disconnect the Gas vapor hose and the regulator run/shut-off solenoid power wire.

3. Energize the regulator's run/shut-off solenoid with a jumper wire (constant battery power). There should be **NO** gas output from the regulator/vapor hose very **little**.

4. **OPEN** the sensitivity screw (10mm hex) gently uintil Gas starts or increases flowing from the regulator/vapor hose. Leave it at this setting if the screw is equipped with a stay spring. Lock the lock nut when provided.

5. Remove the jumper wire and reconnect all systems to running condition.

6. While cranking to start the engine, **OPEN** the Positive idle screw. Continue opening and adjusting it, until the engine fires well, starts and idles well.

7. Start and run the engine until the operating temperature is stable. Bring engine RPM to 3,000 and hold steady. Adjust the Gas Flow control valve for the best air/Gas mixture.

8. **ONLY IF NEEDED,** fine tune the Sensitivity screw for best idle and exhaust emission, it should read toggling **0.400** to **0.700** volts with the transmission in Drive. Also check for engine stalling while operating the power steering.

5.1 Troubleshooting

PROBLEM	POSSIBLE CAUSE	SUGGESTED TEST
Engine does not start	Stuck linkage/frozen shaft	Move linkage by hand. Assess smoothness, friction, and return spring force.
	Power not applied to control	Disconnect starter motor solenoid. Disconnect harness from governor. Activate application. Test for +12 V between +12V pin and ground pin.
	+5V output shorted to ground	Disconnect starter motor solenoid. Activate application. Test for +5V between +5V OUT pin and AUX1-pin.
	MPU gap too large	Remove and reinstall MPU per OEM's instructions. Rotate engine manual to check for interference.
	MPU signal connection open	Disconnect harness from governor. Activate application. Test for 2 Vrms between MPU+ pin and MPU+ pin and MPU-pin.
	Ignition signal connection open	Disconnect harness from governor. Activate application. Test for bouncing voltage between IGN pin and ground pin.