

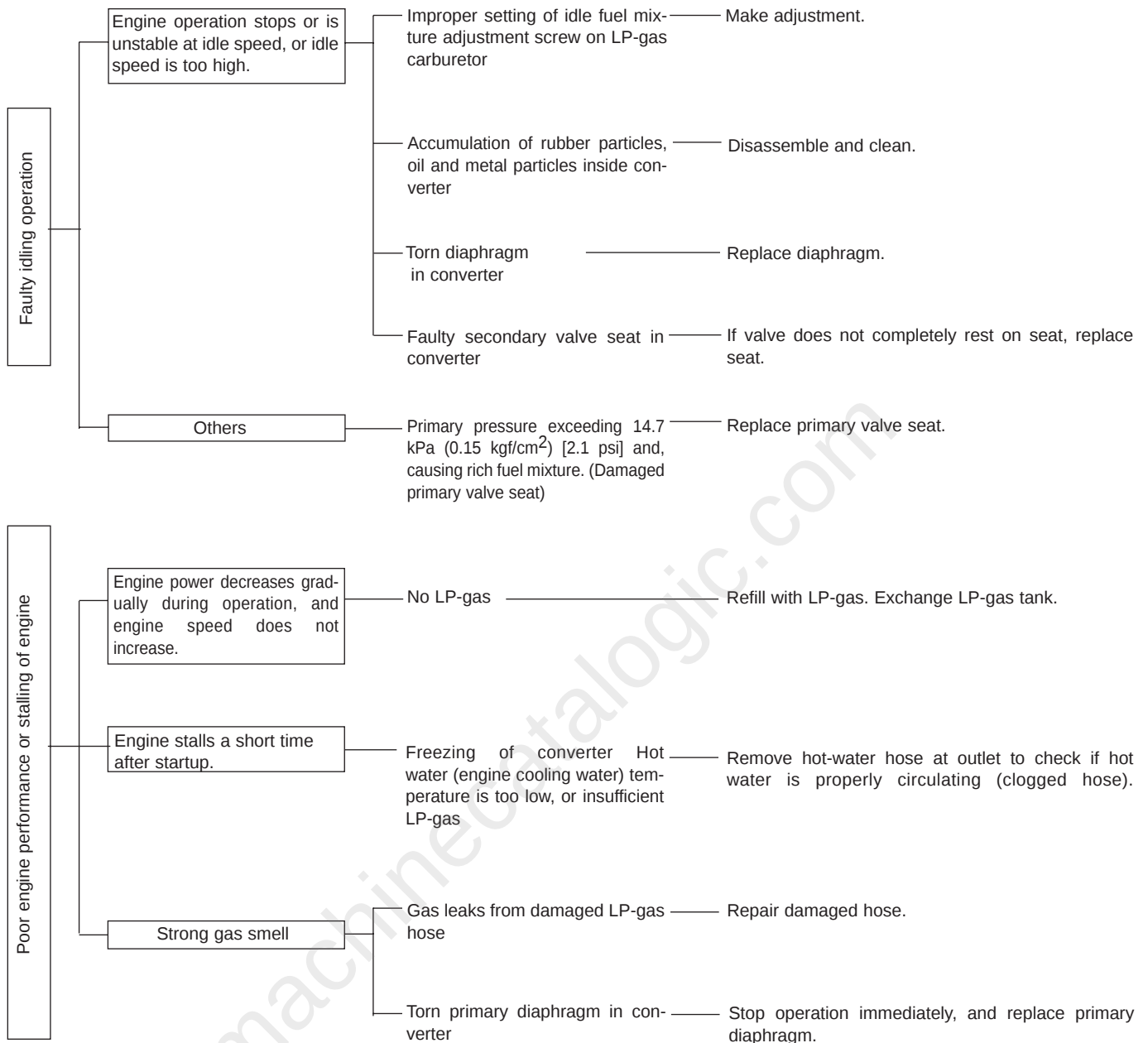


Service Manual

Liquefied Petroleum Gas Supplement

4G63	AA0001-ZZ9999
4G64	AA0001-ZZ9999
6G72	0A0001-0Z9999

PRE CARB TROUBLESHOOTING



STRUCTURE AND FUNCTION

Systems Operation

1. Explanation of Operation

4G63 (2.0 L.) & 4G64 (2.4 L.) LPG closed loop fuel control system with 3 way catalyst.

Regulatory Background:

MCFA has developed an emissions-compliant control system. The control system is a closed-loop system with a 3-way catalytic converter as standard. It utilizes electronic fuel delivery with "drive-by-wire" throttle and governor control. The key system component is the Electronic Control Unit (ECU) that monitors various sensors on the truck, and controls engine performance to pre-programmed specifications. The two main sub-systems are:

- Fuel control
- Throttle and governor control

The benefit to the user is a vast improvement in indoor air quality, engine drivability and performance, maintenance and fuel economy.

2. Terminology

Engine management systems use a variety of acronyms and system specific terms. The following list of terms and acronyms are used in the CARB 1 Tier 1 system. (Reference SAE J1330 terminology.)

A/F	Air Fuel Mixture
BAT	Battery Voltage
CAT	Catalytic Converter
ECU	Electric Control Unit
EGO	Exhaust Gas Oxygen Sensor
ET	Engine Temperature (Engine block temp.)
FCSV	Fuel Control Solenoid Valve
MAP	Manifold Absolute Pressure
OXY	Oxygen
RPM	Engine Revolutions per Min.
SFL	System Fault Light
SFC	System Fault Code

Sub-system Operating Principles

1. Fuel Control:

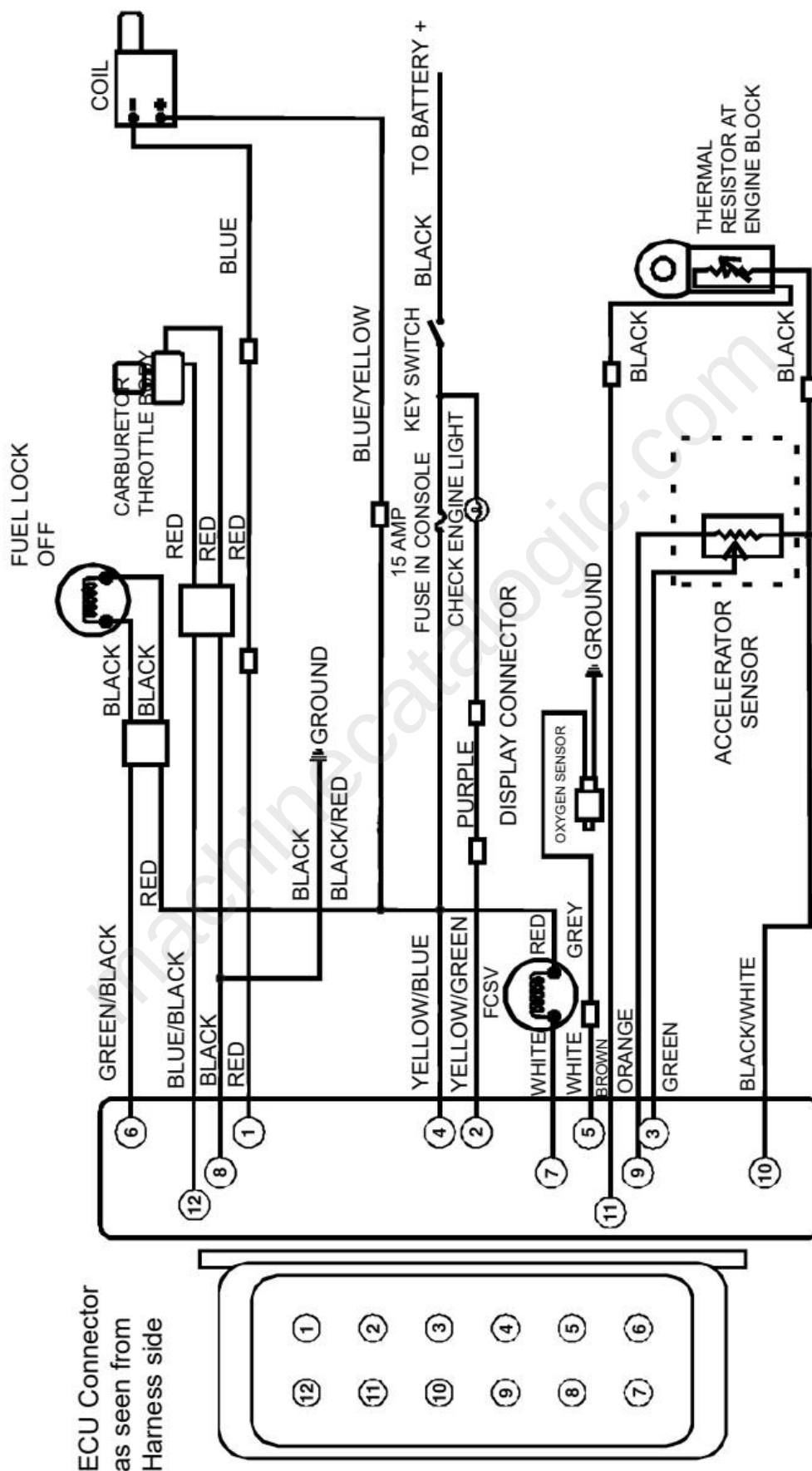
The fuel control system utilizes a "closed loop" fuel control strategy. The "Closed loop" method is used to calculate the correct air and fuel mixture ratio (A/F) based on ECU programming using data collected from sensor inputs while the engine is operating. This sub-system monitors four engine parameters and transmits this information to the ECU. The ECU is able to adjust the fuel supply by varying the output to the fuel control solenoid valve (FCSV). The inputs and output for this subsystem are as follows:

- 1) Engine manifold pressure (MAP) is an indicator of engine load. Higher loads result in a numerically higher MAP value.
- 2) Engine speed to indicate current engine revolutions per minute (RPM)

SCHEMATICS

2. CARB 1 Tier 1 Wiring Schematic

S15G SYSTEM



INSPECTION AND ADJUSTMENT

3. Converter (vaporizer) inspection and adjustment

(1) Hot-water hose inspection

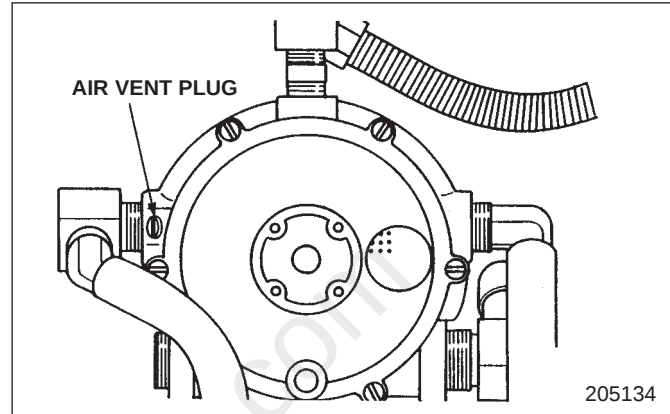
The converter uses heat supplied by the engine cooling water to vaporize fuel. Inspect the hot-water hoses for damage.

(2) Bleeding converter

If hot water does not circulate properly, bleed the converter to remove air trapped in the water core.

To bleed the converter, remove the air vent plug on the side of the converter, and let the engine idle.

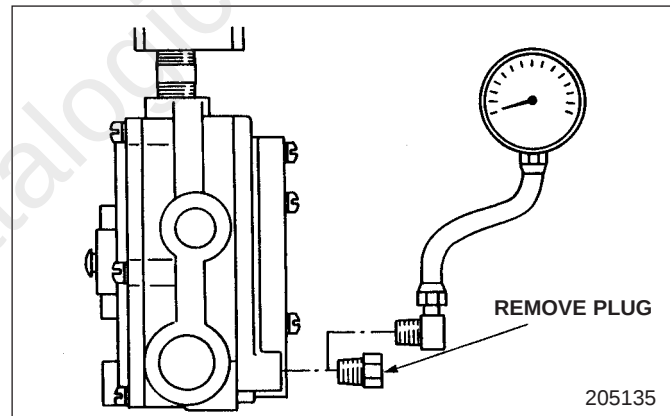
After making sure that intermittent flows of coolant with air from the plug hole have changed to a smooth flow, install the plug. (Apply ThreeBond No. 1142 or equivalent sealant on plug threads.)



(3) Primary chamber pressure measurement

Remove the plug located on the back side of the converter. Mount an R (PT) 1/4 connector and a pressure gauge to the pressure measuring port. Operate the engine with LP-gas. If the pressure indication shows a value from 9.8 to 14.7 kPa (0.1 to 0.15 kgf/cm²) [1.4 to 2.1 psi], it is normal. If the pressure is less than 9.8 kPa (0.1 kgf/cm²) [1.4 psi], the engine lacks power on an upgrade inclination. If the pressure is higher than 14.7 kPa (0.15 kgf/cm²) [2.1 psi], the engine produces high output power but fuel consumption increases.

If the measured pressure is outside the specified range, disassemble the converter and replace the secondary seat.



1. Connect diagnostic monitor to the data port located below the rubber plug on the ECU.
2. Turn the key switch to "ON" but do not start the engine.
3. On the S-15G diagnostic screen, locate the "Pedal Angle"

Note: The diagnostic monitor displays units rather than voltage. 0 units equal 0 volts. 255 units equal 5 volts

4. The value displayed should be between 28 to 45 units when the foot pedal is fully released. . (One "unit" equals .0196 volts) If the value displayed is either below or above this value, adjustment is required. The potentiometer mounted to the throttle sensor has 2 set screws, loosen slightly to allow either clockwise or counter clockwise rotation depending on if the values are too high or too low. Rotate the potentiometer to 35 +/- 5 units and use the data monitor screen to monitor the results. (Depending on specific truck model, throttle sensor removal from the mounting bracket may be necessary, but the electrical connection will remain connected)
5. Once rotated to the correct value, retighten the setscrews securing the potentiometer to the throttle sensor. Reinstall the throttle sensor and the floor plate, if removal was required. This now completes the adjustment for the idle or minimum settings. The high idle or maximum setting will now be adjusted with floor plate installed.

Note: Do not apply excessive force to accelerator without floor plate installed. Damage to potentiometer may occur.

6. Fully depress the foot pedal with sufficient force to simulate actual use by an operator and apply pressure slowly. While depressed fully note the voltage units value displayed on the diagnostic screen. The correct value should be

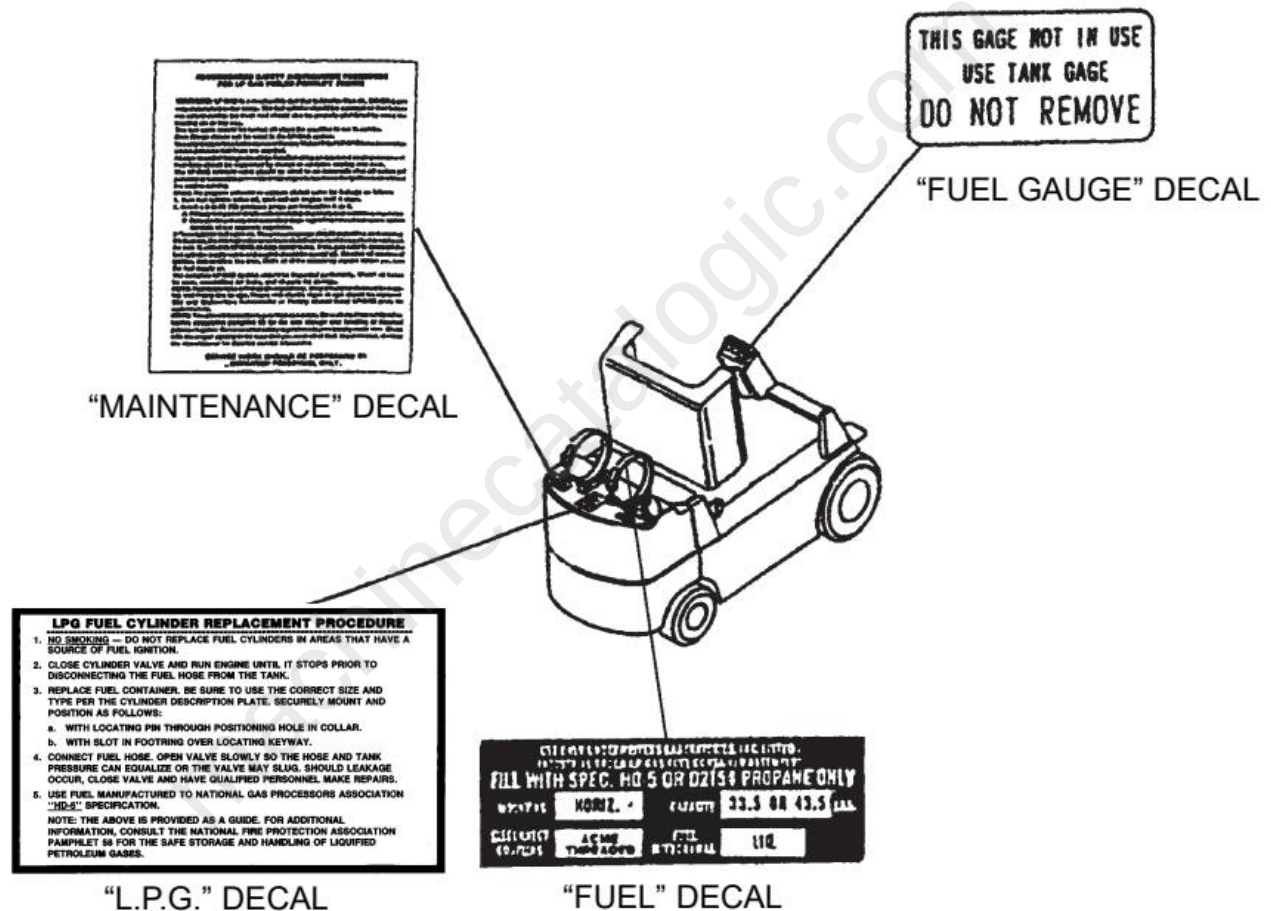
195 +/-5 units. If readjustment is necessary, loosen the locknut on the foot pedal stop bolt and adjust the height as necessary. Repeat this procedure until the correct foot pedal travel is attained to reach the desired value.

7. Once adjusted, re-tighten the locknut on the foot pedal stop bolt.
8. Remove diagnostic equipment and re-install the rubber plug over the data port on the ECU.

ACTIONS TO BE TAKEN IN THE EVENT OF A FAILURE

- (19) DO not completely fill the tank. The fuel expands when it gets warm and it may overflow. This will create a fire hazard.
- (20) Only trained and authorized personnel should fill or exchange LP-gas tanks.
- (21) Do not drop, throw, roll or drag LP-gas tanks. Do not strike LP-gas tanks or any associated parts of the tanks or fuel systems.
- (22) Check the LP-gas tank for secure mounting. Loose tanks can cause pressure fuel lines to leak, resulting in personal injury.
- (23) Carefully read the caution labels.

(MCFA only)



207151

3. CARB 1 TIER 1 ECU Pin Location

Pin #	Color	Function
1	Red(R)	TACH Signal (To coil NEG)
2	Yellow/Green (Y/G)	Console System Fault Light (Check Engine Light NEG)
3	Green (G)	Throttle Pedal Sensor (0.3-4.7 volt input to ECU)
4	Yellow /Blue (Y/L)	Battery Power (Key switched-Fused)
5	White (W)	Oxygen Sensor (Signal to ECU)
6	Green/Black (G/B)	(NEG connection to ECU) LPG Lock Off
7	White (G)	Fuel Control Solenoid Valve (NEG connection to ECU)
8	Black (B)	Battery NEG to truck frame
9	Orange (OR)	Pedal Angle Sensor (5 volt source from ECU)
10	Black/White (B/W)	Pedal Sensor Filtered Ground (NEG connection to ECU)
11	Brown (Br)	Engine Temperature Sensor (Signal to ECU)
12	Blue/Black (L/B)	Throttle Body Governor Signal (Variable voltage output from ECU)



LIFT TRUCK OPTIONS

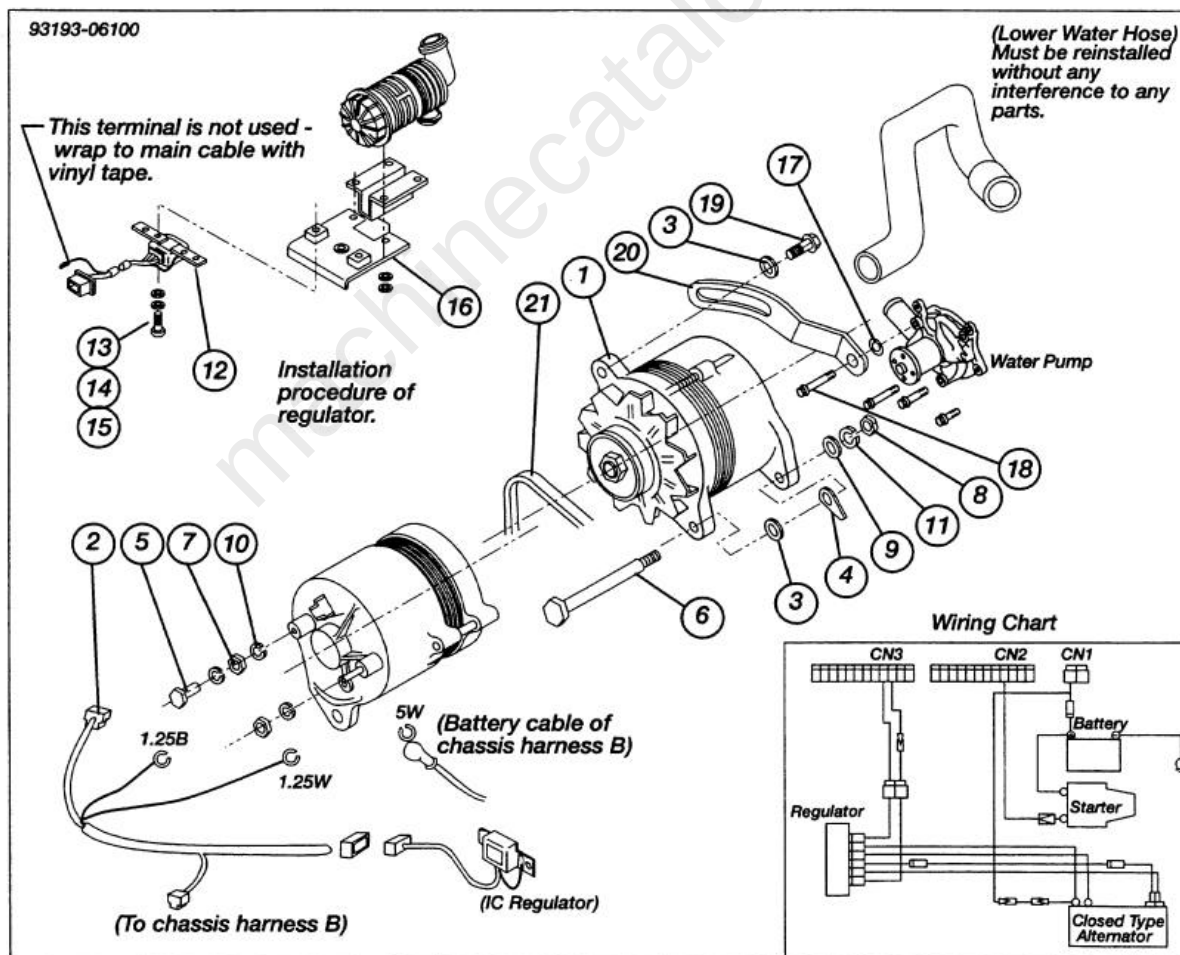
OPTION NUMBER: 93193-06100	DESCRIPTION: ALTERNATOR KIT
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1. Description

This alternator is of enclosed (dust-proof) type and meets the requirements for Type GS&LPS of the Standard of Underwriter's Laboratories, Inc., U.S.A.

2. Installation

- (1) Replace the existing standard alternator with the enclosed type and install the latter in place.
- (2) Referring to "Alternator-regulator wiring diagram" for each model, connect the wires.
- (3) To install this alternator, add bracket and use V-belt of this kit.
- (4) Replace the radiator hoses.
- (5) To install this alternator, install spacer and adjust the clearance to a minimum by shimming. Tighten the nut to 2.5 to 3 kgf.m.



Full Version Available

Caterpillar GC15 Forklift LPG Service Manual (99729-85100)

Caterpillar GC15 Forklift service manual, LPG fuel system and engine service data.
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