Operation & Maintenance Manual for

GPU-4060-T-CUP

(& GPU-4060-T-CUP-28)

Ground Power Unit

CHAPTER 2

MAINTENANCE

Ground Power Unit

GPU-4060-CUP
(Version: 200903)

Chapter 2
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Maintenance

1. Periodic Maintenance

In order to ensure a properly running unit, periodic maintenance and inspections are necessary. In addition to the pre-operational instructions given in Chapter 1 the unit must be maintained on a regular basis and any malfunctions or problems with the unit must be fixed at once. Prolonging repairs on machinery that is running improperly may create an unsafe situation and will increase mechanical problems.

When working on any system in the unit, extreme caution must be used to avoid personal injury or death.

⚠WARNING:

KEEP HANDS AND LOOSE CLOTHING AWAY FROM ROTATING MACHINERY AND BELTS.

⚠WARNING:

ELECTRIC SHOCK MAY RESULT IN SEVERE INJURY OR DEATH. ALWAYS SHUT UNIT OFF AND DISCONNECT THE BATTERY BEFORE PERFORMING ANY MAINTENANCE.

NOTE:

Wet-stacking

Wet-stacking is common and may be expected in diesel engines operated under light load. Light loads do not allow the engine to reach the most efficient operating temperature for complete combustion of fuel. The unburned fuel collects in the exhaust system to create the condition known as wet-stacking. Wet-stacking is recognizable by fuel oil wetness around the exhaust manifold, pipes, and muffler.

To alleviate wet-stacking in lightly loaded engines, it is recommended that the machine be connected to a load bank after 200 hours of use and operated under full rated load for one hour. This will burn away and evaporate the accumulation of fuel in the exhaust system. This clean-out procedure should be considered as periodic maintenance for machines operated under light load.

A. Lubrication and Maintenance

The following charts show the frequency of maintenance required on the listed components.

Component	Maintenance Required (1)
Engine air filter	Check* daily.
Engine oil and filter	Check daily; change every 500 hours.
Engine fuel filter	CUMMINS Change every 500 Hours**
Fan belts	Check every 500 hours.
Engine coolant	Check daily; change every 24 months.
Generator bearing	Lubricate every 2,500 hours
Latches and hinges	Lubricate every 300 hours or 6 months
Fuel pre-filter* **	**Clean*** every 500 hours**
Wheels	Rotate every 1200 hours or 24 months. Torque wheel lug nuts every 300 hours or 6 months
Wheel hubs and fifth wheel hub	Repack bearings every 24 months
Check engine air filter	Daily
Check engine oil and filter	Daily
Check engine coolant	Daily
Steam wash engine radiator	250 hours
Change engine oil and filter	500 hours
Check fan belts	500 hours
Change engine fuel filter	CUMMINS - 500 hours
Torque wheel lug nuts	300 hours or 6 months
Lubricate latches and hinges	300 hours or 6 months
Lubricate generator bearing	2,500 hours
Rotate wheels	1200 hours or 24 months
Repack bearings on wheel hubs and fifth wheel hub	24 months
Change engine coolant	24 months

* Change as required as shown by visual inspection.

** After changing the fuel filter, prime the fuel pump (Refer to CUMMINS ENGINE MANUAL / Chapter 5).

*** The strainer element inside the fuel pre-filter is a re-usable item and is washable in solvent. **If use JET-A1 fuel the pre-filter must be changed per 500 hours.**

(1) NOTE:

This operation should be performed at more frequent intervals under dusty or low temperature conditions. The time schedules indicated in Chart 1 are approximate. They are based on average conditions. Reduction of the interval shown may be necessary under harsh operating conditions such as low engine temperature, excessively heavy loads, and high oil temperatures, or operation in particularly arid or dusty environments.

LUBRICATION & MAINTENANCE BY HOURS - CHART 1

B. Filters and Lubricants

Filters and lubricants for periodic maintenance are listed below. The chart includes the name, GPU part number, and description of the item needed to maintain this unit.

NOMENCLATURE	ACE P/N CUMMINS	DESCRIPTION
Engine Air Filter	1014120	Air filter
Engine Oil Filter	1033394-P2	Oil filter
Engine Oil*	1012342 (15w40)	Engine oil
Engine Fuel Filter	1037763-P2	Fuel filter/water separator element
	1037763-P1	Fuel Filter
Engine pre-filter**	10002830**	Strainer element
Engine Coolant	1033604-50	Ethylene glycol
Hinge/latch lubricant	UMO1-9	Lubricating oil
Generator bearing grease	UMG5-2	Bearing grease
Radiator fan/alternator belt	10001029-P4	

*This oil is recommended for use in ambient temperatures ranging from 0°F to 120°F. For information on recommended oil for harsher ambient temperatures consult the Engine Manufacturer's manual.

**This pre-filter only use JET-A1 fuel

FILTERS & LUBRICANTS
CHART 2

(1) Lubrication Schedule

The time schedules indicated in Chart 1 are approximate. They are based on average operating conditions. It may be necessary to reduce the times shown under harsh operating conditions such as low engine temperatures, excessively heavy loads, and high oil temperatures, intermittent operation, or operation in particularly arid or dusty environments.

(2) Oil Specification

Engine oil recommended by the manufacturer is identified by Mil. Spec. MIL-L-2104D or MIL-L-2104E. Further information on oil specifications is contained in the Manufacturer's Literature in Chapter 5.

(3) Oil Viscosity

The use of a 15W-40 grade oil is recommended for year round service. Additional information is contained in the Engine Manufacturer's Manual.

(4) Changing Engine Oil

Follow the instructions contained in the Manufacturer's Manual.

(5) Changing Engine Oil Filter

Follow the instructions in the Manufacturer's Manual.

C. Air Filter

The air filter is a dry disposable type with an integral filter element. A definite time schedule for changing the element cannot be determined because of varying operating conditions. Check the filter daily and change as required.

(1) Air Filter Replacement (See Figure 1)

(a) Loosen the clamp on the turbocharger intake.

(b) Loosen the clamp on the air filter.

(c) Remove the air filter and discard.

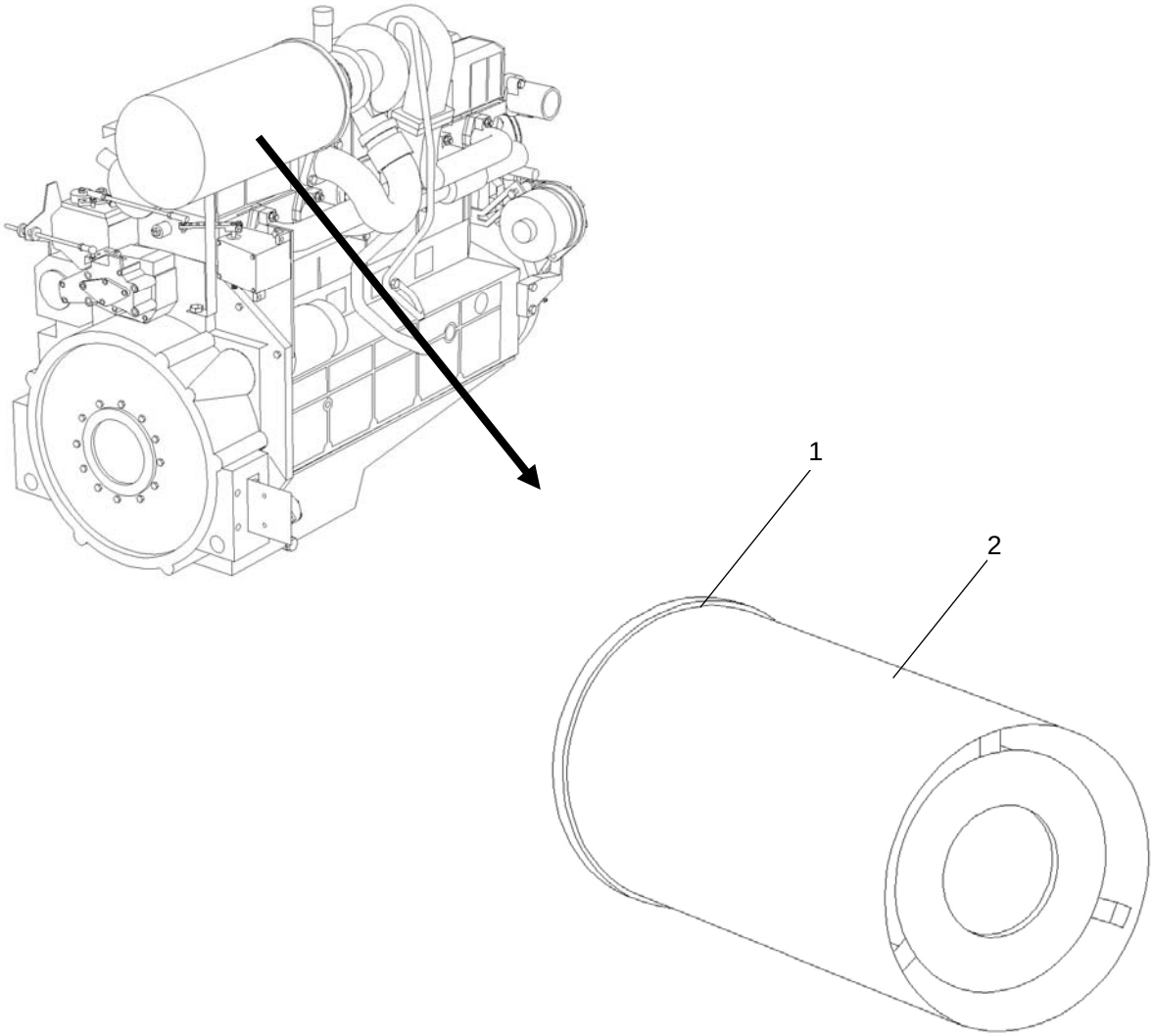
CAUTION:

DO NOT ATTEMPT TO CLEAN OR REUSE THE AIR FILTER.

(d) Install a new air filter.

(e) Tighten the clamp on the turbocharger.

(f) Tighten the clamp on the air filter.



1 ...Clamp
2 ...Air filter

FILTER ELEMENT REMOVAL
FIGURE 1

D. Engine Fuel

(1) Quality

Use of diesel fuel of either Grade No.1-0 or No.2-0 is recommended. Further information on fuel specifications can be found in the Engine Manufacturer's Manuals.

(2) Fuel Filter

Refer to the Manufacturer's Literature in Chapter 5 for information on removal and replacement of the fuel filter elements.

E. Cooling System

⚠WARNING:

DO NOT USE METHYL ALCOHOL BASE ANTIFREEZE.
DO NOT USE METHOXY PROPANOL ANTIFREEZE.
DAMAGE MAY OCCUR TO THE RUBBER SEALS ON THE CYLINDER LINERS, WHICH ARE IN CONTACT WITH THE COOLANT.

A permanent type (ethylene glycol) antifreeze is recommended for use in the cooling system. It must be ethylene glycol type, contain not more than 0.1% anhydrous metasilicate, and meet General Motor's performance specification GM1899M or be formulated to GM6038M (or equivalent). Further information on coolant requirements may be found in the Manufacturer's Literature in Chapter 5.

F. Belts

Three V-belts from the crankshaft pulley are used to drive the alternator, the radiator fan, and the coolant/fuel pump. For proper engine operation these belts should be in good condition and at the proper tension at all times.

(1) Checking Belt Tension

Check belt tension every 500 hours of engine operation. Belts that are too tight will cause damage to the bearing of the alternator and/or water pump. A loose belt will slip and cause in-efficient operation of the alternator and/or the water pump.

To check the belt tension, press each belt firmly with the thumb at a point halfway between the alternator and crankshaft pulleys. The belt should deflect approximately 3/4 inch (19mm).

(2) Belt Adjustment

To adjust the belt tension, loosen the alternator mounting bolts and move the alternator to obtain the correct tension. Retighten the alternator mounting bolts.

When new belts are fitted, it will be necessary to run the engine for a short period to allow the belts to "bed-in" and any initial stretching to occur.

G. Generator Maintenance

The 400 Hz generator requires no maintenance or service other than periodic cleaning and lubrication. Refer to the specific generator manual (TLD Generator Manual) in chapter 5 for more information.

(1) Cleaning

When inspection determines cleaning is necessary, clean the generator as follows.

(a) Wipe loose dirt from the exterior painted surfaces with a clean lint-free cloth. Remove stubborn accumulations of dirt with an approved detergent or solvent. Clean all ventilating parts with a vacuum cleaner or filtered compressed air at a pressure of 25 to 40 psi.

WARNING:

USE EXTREME CARE WHEN USING NAPHTHA. USE ONLY IN WELL VENTILATED AREAS, AWAY FROM OPEN FLAMES AND SPARKS.

(b) Clean the inside of the generator with a vacuum cleaner or use dry filtered air at a pres- sure of 25 to 40 psi. Remove stubborn accumulations of dirt and grease from windings with naphtha.

(c) Clean electrical contacts such as relay contacts, switch contacts, and terminals with an approved contact cleaner.

NOTE:

Do not file contacts.

(2) Adjustment

The generator itself requires no adjustments.

H. Battery

Two 12 volt batteries wired in series produce a 24 VDC system which supplies power for operation of the engine electrical system and the clearance and panel lights.

(1) Battery Location

The battery is located on the right side of the unit by the generator. The battery is easily accessible for checking and maintenance.

(2) Battery Care

(a) Maintain battery in fully charged condition.

(b) Ensure battery is fastened securely to prevent damage.

(c) Maintain battery fluid at the proper level.

(d) Keep the battery terminal posts and clamps clean.

(3) Liquid Level

⚠WARNING:

NEVER ALLOW SPARKS OR OPEN FLAME TO COME NEAR THE BATTERY. AVOID SPILLING ELECTROLYTE ON HANDS OR CLOTHING.

The electrolyte level in each cell should be above the plates at all times to prevent battery failure. When the electrolyte level is low, add pure distilled water. Do not use hydrant water or any water that has been in contact with a metal container.

NOTE:

It is especially important to keep the battery at a full charge for cold weather operation. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours to ensure the fluid is thoroughly mixed or damage to the battery will result from the water freezing.

2. Preventative Maintenance

A. Engine

(1) Fuel

(a) Check fuel level daily.

(b) Check fuel filters and change elements in accordance with the instructions in the Manufacturer's Literature in Chapter 5.

(c) Open the fuel tank drain every 400 hours to drain off water and sediment.

(2) Lubrication

(a) Check the crankcase oil level daily.

(b) Lubricate in accordance with the Lubrication & Maintenance Chart 1 on Page 2.

(3) Coolant

(a) Check coolant level daily.

(b) Inspect for signs of rust or corrosion. Inspect for signs of leakage. Inspect hoses for deterioration or cracking.

(4) Exhaust System

(a) Inspect muffler and pipe-work for signs of approaching failure.

(b) Check for any gasket or joint leaks.

B. Electrical System (Engine, 24 VDC)

(1) Lights

Check all lights for correct operation daily. Replace any defective bulbs as soon as discovered.

(2) Wiring and Connections

Inspect all cables and leads for broken, worn or damaged insulation. Check electrical connections for tightness.

C. Electrical System (Generator, 115 VAC)

The 400 Hz generator and controls are designed to be as maintenance free as possible. No periodic maintenance adjustments are necessary, however regular checks should be made to be sure all controls, instruments, etc. are working correctly.

(1) Monitoring Instruments.

Ensure the Generator Control Module's display is in proper working condition each time the unit is started.

(2) Indicating Lights

Check the lamps in all of the indicating lights at each start up. Fault indicating lights may be checked by pressing the lamp test button.

(3) Protective Circuits

Check operation of all protective modules to be certain they will function in the event of a fault in the output circuit.

(4) Wiring and Connections

(a) Check all cables, leads and wiring for broken, worn, or damaged insulation.

(b) Check all connections for tightness.

Removal / Installation

This section explains the removal and installation of major components. Detailed instructions and diagrams help the mechanic, while cautions and warnings make the mechanic aware of potential hazards.

⚠WARNING:

UNIT MUST BE DISCONNECTED AND SHUT-OFF BEFORE ATTEMPTING TO WORK ON OR REMOVE ANY COMPONENT. DISCONNECT THE ENGINE BATTERY TO PREVENT ACCIDENTAL START OR SHOCK.

1. Engine/Generator Removal/Installation

The engine and generator must be removed as an assembly. After the assembly is removed from the unit, the engine and generator may be separated.

A. Remove the exhaust system components.

B. Drain the coolant, unbolt the fan guard and remove the radiator.

C. Disconnect the battery cables.

D. Disconnect the fuel lines and plug the ends.

E. Disconnect the electrical connector where the engine harness plugs into the electrical box. Tag and disconnect any wires to frame mounted electrical components.

⚠WARNING:

THE ENGINE/GENERATOR ASSEMBLY IS HEAVY. A LIFTING DEVICE MUST BE USED TO REMOVE THESE COMPONENTS.

F. Unbolt and lift out the engine/generator assembly, leaving the front engine mount attached to the engine.

G. The installation of the engine/generator assembly is the reverse of the removal procedure.

2. Engine/Generator Coupling/Uncoupling

The engine/generator assembly must be removed from the unit before the assembly can be split. Follow the procedures outlined in the Engine/Generator Removal of this section.

A. Engine and Generator Uncoupling

(1) Remove the generator exciter cover and screen cover.

(2) Tag and disconnect the exciter leads from the two terminals labeled “+” and “-“.

(3) Remove the large screw, lock-washer and spacer from the end of the shaft.

(4) Slide the exciter armature off the shaft. Do not lever or pull on the heat sink plates, these are delicate components and will be damaged by excessive force.

(5) Mark the position of the fan on the shaft. This will assist in aligning the fan upon reassembly.

(6) Loosen the two bolts securing the fan halves to the shaft.

(7) Remove the bolts securing the drive plates to the engine flywheel.

(8) Support the generator and remove the bolts securing the generator adapter ring to the engine flywheel housing.

(9) Slide the generator rearward until the drive plates are clear of the engine.

B. Engine and Generator Coupling

This procedure assumes that the generator is partially disassembled following it's removal from the engine. If this is not the case, follow items 1 through 6 of Section A prior to this sequence of instructions.

(1) Support the generator and position it behind the engine.

(2) Slide the generator forward ensuring that both drive plates and the adapter seat into the fly-wheel recess and housing correctly.

(3) Bolt the generator to the flywheel housing using M10-1.50 x 30 mm hex head class 8.8 screws and lock-washers. Torque to 33 LB-FT.

(4) Bolt the drive plates to the flywheel using 3/8-16 x 25 mm hex head Grade 8 screws and flat washers. Torque to 40 LB-FT.

(5) Locate the fan approximately 1/2 inch from the baffle and realign the marks on the shaft. Tighten the fan bolts to 75 LB-FT.

(6) Replace the screen cover.

(7) Measure the shaft extension and compare it to the dimensions given in the Manufacturer's Literature (See Chapter 5).

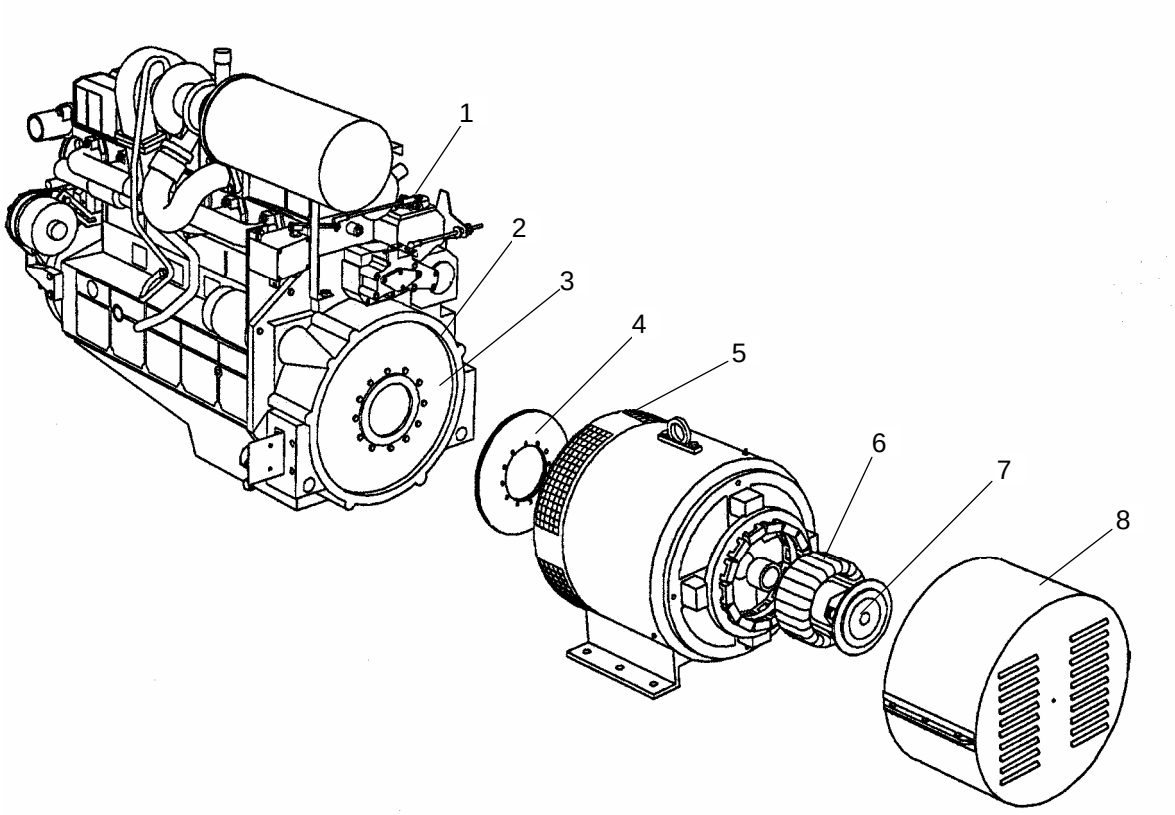
(8) Slide the exciter armature back onto the shaft. Ensure the keyway is located correctly.

(9) Replace the spacer, lock-washer, and the large screw in the end of the shaft. Torque to 200 LB-FT.

(10) Reconnect the two exciter leads on the terminals marked "+" and "-". Ensure that the correct polarity is observed.

(11) Replace the exciter cover.

(12) Turn the engine/generator through at least one complete revolution. Check for any unusual noises or resistance to motion.



1.....Engine
2.....Flywheel housing
3.....Flywheel
4.....Drive plate
5.....Screen cover
6.....Exciter armature
7.....Large screw, lock washer, and spacer
8.....Exciter cover

ENGINE/GENERATOR COUPLING/UNCOUPLING PROCEDURE
FIGURE 4

3. Electrical Box Removal/Installation

A. Unplug the electrical connectors leading to the electrical box.

B. Disconnect the generator wires to the contactor.

C. Disconnect the output cables from the terminal blocks on the sides of the electrical box.

D. Remove the nuts holding the electrical box to the rubber vibration mounts and lift the box off of the unit.

E. Reverse the above steps for installation.

4. Radiator Removal/Installation

⚠WARNING:

LET THE ENGINE COOL BEFORE ATTEMPTING TO REMOVE THE RADIATOR. COOLANT AND COMPONENTS CAN REACH VERY HIGH TEMPERATURES.

A. Drain the engine coolant through the pet cocks located on the radiator.

B. Remove the radiator hoses.

C. Unbolt the fan guard.

D. Remove the radiator mounting bolts.

E. Lift the radiator off of the unit.

NOTE:

Retain and replace any shims that may be under the radiator mounts.

F. Reverse the above steps for installation.

Troubleshooting

1. General Practice

Before troubleshooting the ACE Ground Power Unit and its associated components, the following areas of the unit should be checked:

A. Engine Electrical System

The engine's electrical system should be in proper working order.

B. Engine Oil

The engine oil should be filled to the proper level and the engine oil pressure should normal.

C. Unit Electrical System

Check the battery disconnect switch, emergency stop switch, and F2 fuse. Check all electrical connections for loose or broken wires.

2. Troubleshooting Chart

This chart should be used in conjunction with the electrical schematics and connection diagrams to find the problem and understand the remedy.

Problem	Cause	Remedy
Engine and Controls		
1. Engine will not start. Starter will not crank engine.	A. Battery disconnect switch (S1) or emergency stop Switch (S2) open/defective.	A. Check for proper operation of S1 and S2. 24 VDC should be passing Through both switches.
	B. Battery (BT1/BT2) discharged or loose ground.	B. Insure the voltage across the batteries is approximately 24 VDC. Check the battery terminals. Insure 24 VDC is reaching the starter relay terminal and ignition switch.
	C. Defective F2 Fuse	C. Replace fuse
	D. Defective S3 ignition switch.	D. Replace switch
	E. Defective auxiliary starter relay (K2).	E. Momentarily connect a jumper wire between the terminals of the auxiliary starter relay (K4). If the starter motor (B1) attempts to crank the engine, it indicates the auxiliary starter relay (K4) is defective. Replace.
	F. Defective starter relay (K1).	F. Momentarily connect a #1/0 jumper wire between the hot side of the starter relay (K1) and the starter motor (B1) input terminal. If the starter motor (B1) attempts to crank the engine, it indicates the starter relay (K1) is defective. Replace.
	G. Defective starter motor (B1).	G. If the starter motor (B1) did not operate in Remedy C above, the starter motor (B1) is defective. Replace.
	H. Defective starter lockout relay (K8).	H. Replace relay
	I. Internal seizure	I. If all engine starting components are functioning properly and the starter motor is unable to crank the engine, an internal seizure is indicated. Contact the engine manufacturer for repair.

Problem	Cause	Remedy
Engine and Controls (Cont'd)		
2. Engine will not start. Cranking Speed Low.	A. Low battery output	A. Check battery (BT1). Recharge or replace.
	B. Loose starting circuit connections or faulty cables.	B. Check all connections and cables. Tighten or replace as required.
	C. Improper lubricating oil viscosity.	C. Check the oil. See the engine manual (Manufacturer's Literature, Chapter 5).
3. Engine will not start. Cranking speed normal.	A. Low fuel.	A. Add fuel.
	B. Defective check valve (V1) on fuel suction line.	B. Remove and check the operation of the valve.
	C. Loose connections, damaged hose, or fuel lines between tank and fuel pump.	C. Tighten all fittings and connections. Replace any damaged hoses or fuel lines.
	D. Plugged or defective fuel filter.	D. Change filter. Check gaskets and hoses for leaks.
	E. Faulty fuel pump.	E. Check the pump. Refer to the engine manual or contact the manufacturer.
	F. Defective injector.	F. Check the injector. Refer to the engine manual (Manufacturer's Literature, Chapter 5). **Note:** With fuel system problems, it may be necessary to bleed the air out of the system after repair. See the engine manual for bleeding instructions.
	G. Defective engine fault relay (K4).	G. Replace relay.
	I. Defective electronic control Module (ECM) (C3).	I. Replace the ECM.

Problem	Cause	Remedy
Engine and Controls (Cont'd)		
4. Engine starts but stops in 5 seconds after the ignition switch (S3) is released to the run position.	A. Ignition switch run contact bad.	A. Replace switch.
	B. Cool down timer (K7) defective.	B. Replace relay.
	C. Engine shutdown circuit may have functioned normally to stop the engine because of low oil pressure.	C. Display the measured values and fault messages by holding in the diagnostic request switch (S5). Refer to chapter 5 for a list of code definitions. Repair the engine fault. Contact the engine manufacturer or TLD if necessary.
	D. Excessive speed droop or surging condition at startup, maladjusted ECM (C3), or binding fuel rack.	D. Check fuel pump rack for binding or replace the ECM. Consult engine manufacturer.
5. Engine will not come up to rated speed when the engine switch (S6) is placed to the rated speed position.	A. Faulty engine switch (S6).	A. With the engine running at idle speed, place the engine switch (S6) in the rated speed position and check for 24 VDC. Replace the switch if defective.
	B. Defective idle/rated speed relay (K5).	B. Replace relay.
	C. Defective engine cool down / idle relay.	C. Replace relay.
	D. Defective optional low fuel float switch (S102) or relay (K102).	D. Replace switch or relay.
	E. Actual low fuel condition on units with optional low fuel ramp down.	E. Add fuel.
	F. Electronic Control Module (ECM) (C3) reporting codes or is defective.	F. Determine the engine fault(s) by holding in the diagnostic request switch (S5). Refer to chapter 5 for a list of code definitions. Repair the engine fault. Contact the engine manufacturer or TLD if necessary.

Problem	Cause	Remedy
Engine and Controls (Cont'd)		
5. Engine will not come up to rated speed when the engine switch (S6) is placed to the rated speed position (cont'd).	G. Actuator defective (Deutz only).	G. Replace actuator.
	H. Defective fuel pump.	H. Replace pump. Contact the engine manufacturer.
6. Engine goes to over-speed when the engine switch (S9) is placed in the rated speed	A. Electronic control module (ECM) (C3) requires calibration.	A. Engine program incorrect. Contact manufacturer for reprogramming.
7. Engine is unsteady.	A. Insufficient fuel.	A. Check the fuel supply and return line for leaks and kinks.
	B. Fuel pump defective.	B. Replace pump. Contact engine Manufacturer.
	C. Electronic Control Module (ECM) (C3) reporting codes or is defective.	C. Determine the engine fault(s) by holding in the diagnostic request switch (S5). Refer to chapter 5 for a list of code definitions. Repair the engine fault. Contact the engine manufacturer or TLD if necessary.
8. Engine lacks power.	A. Insufficient fuel.	A. See 7B.
	B. Insufficient inlet air.	B. Check the air cleaner restriction Indicator. Replace the filter if necessary.
	C. Restricted exhaust system.	C. Check the exhaust pipe for restrictions. Check the muffler for a clogged condition. Replace as required.
	D. Electronic Control Module (ECM) (C3) reporting codes or is defective.	D. Determine the engine fault(s) by holding in the diagnostic request switch (S5). Refer to chapter 5 for a list of code definitions. Repair the engine fault. Contact the engine manufacturer or TLD if necessary.

Problem	Cause	Remedy
Generator and Controls		
1. Voltage does not build up to the rated value after the rated speed switch (S6) is held to up position.	A. Faulty rated speed switch (S6).	A. Check the rated speed switch. Replace as required.
	B. Faulty idle/rated speed relay (K5).	B. Check the build up voltage relay contact (K5). Replace as required.
	C. No input power to terminals L and N on the voltage regulator.	C. Check the wiring to the rated speed switch (S6) and idle/rated speed relay (K5). Correct the wiring as required.
	D. Fuse blown on the voltage regulator.	D. Replace fuse. If the fuse blows again, determine the cause of the overload.
	E. Low residual voltage.	E. Flash field (Refer to generator manual).
	F. Poor or no connection between the exciter field and regulator terminals Field+ and Field-.	F. Correct the wiring and check the connections.
	G. Reverse polarity connections between the exciter field and regulator terminals Field+ and Field-.	G. Connect correctly and flash field to restore the residual voltage.
	H. Engine is not up to rated Speed. Electronic Control Module (C3) defective.	H. Conduct a diagnostic check of Electronic Control Module (C3) Replace a defective ECM.
	I. Faulty voltage regulator	I. Test. If faulty, replace the regulator.
	J. Faulty printed circuit board.	J. Replace the regulator.
	K. Defective rectifiers in the exciter, defective exciter windings, or defective generator.	K. Observe the operation of the exciter and generator. Refer to the generator instruction manual for additional information.

Problem	Cause	Remedy
Generator and Controls (Cont'd)		
2. Voltage high; not controllable with the voltage adjustment.	A. No voltage to sensing terminals Phase A, Phase B, and Phase C.	A. Correct the wiring.
	B. Faulty regulator circuit board.	B. Replace the regulator.
	C. Regulator power stage SCR's or diodes faulty.	C. Replace the voltage regulator.
3. Voltage high; Controllable with the voltage adjustment.	A. Improper connection of sensing signal to the regulator terminals Phase A, Phase B, and Phase C.	A. Correct the wiring to the regulator.
	B. Voltage display inaccurate	B. Connect a test voltmeter to check the operation of the generator output. Calibrate or replace as required.
	C. Faulty SCR1 and SCR2	C. Replace the regulator.
	D. Faulty regulator circuit board.	D. Replace the voltage regulator.
4. Poor regulation.	A. The engine is not up to rated speed or the engine speed is fluctuating	A. Check engine speed. Ensure engine speed is correct and stable.
	B. Faulty regulator circuit board	B. Replace the voltage regulator.
	C. Faulty regulator power stage diodes or SCR's.	C. Replace the voltage regulator.
5. Poor voltage stability.	A. Voltage at the regulator input power terminals L and N is too low	A. Raise the input voltage to 115 VAC.
	B. Faulty circuit board or regulator power stage SCR's and/or diodes	B. Replace the voltage regulator.
	C. Fault in the exciter or generator	C. Refer to the generator manual
6. Voltage recovery slow on load change.	A. Faulty engine Electronic Control Module (C3), plugged fuel filter, or plugged fuel supply and return lines.	A. Check fuel supply and return lines ensure they are not plugged. Check fuel filter, replace as necessary. If problem is on the engine Electronic Control Module, call engine service.

Problem	Cause	Remedy
#1 Output Load Contactor Operating Circuit		
1. #1 output load contactor(K10) will not close when the #1 output contactor switch (S10) is held in the CLOSE position. The generator is running at normal voltage, and the generator protective circuit green LED light is on.	A. Faulty wiring and connections in the load contactor actuating circuits	A. Check all wiring and connections in the load contactor circuits.
	B. Defective #1 output contactor switch (S10)	B. Connect a jumper wire between terminals 4 and 5 on the #1 output contactor switch (S10). If the contactor closes, replace the contactor switch.
	C. Defective rectifier bridge (CR1)	C. With jumper wire connected in step B above, check the voltage across "+" and "-" terminals on the rectifier bridge (CR1). If the voltage is not approximately 103 VDC, replace the rectifier.
	D. Defective load contactor coil	D. Disconnect leads at the load terminals X and Y. Check the coil resistance between these terminals. The resistance should be approximately 100 ohms for Prestolite contactor, and 700 ohms for Contactor Industries contactor. If the coil is defective, replace the complete load contactor.
2. #1 output load contactor (K10) will close when the #1 output contactor switch (S10) is held in the CLOSE position. Opens immediately when the switch is released to the center ON position.	A. 28.5 VDC feed-back voltage is not reaching the #1 output plug interlock relay (K11) from the aircraft for the following reasons:	A. Hold the #1 output contactor switch in the CLOSE position and measure the voltage at terminal E or F to the ground on the #1 output terminal panel. Voltage should be 28.5 VDC. If not, check the following possible causes:
	B. Aircraft rejecting power	B. Check the aircraft's on board electrical system and controls.
	C. Pins in the plug are damaged, especially the E and F pins.	C. Check the plug thoroughly for damaged pins.
	D. E and F leads of the aircraft cable are defective.	D. Check the continuity between the E and F pins to the E and F leads on the other end of the cable. Ensure there are no broken E and F leads.

Problem	Cause	Remedy
#1 Output Load Contactor Operating Circuit (Cont'D)		
2. #1 output load contactor (K10) will close when the #1 output contactor switch (S10) is held in the CLOSE position. Opens immediately when the switch is released to the center ON position.	E. Plug is not properly mated with the receptacle on the aircraft.	E. Ensure the plug is making a good contact with the receptacle on the aircraft.
	F. Faulty #1 output plug interlock relay (K11).	F. Place the #1 output test bank switch (S11) to the test bank position. If the #1 output load contactor will now remain closed, replace the #1 output plug interlock relay (K11).
3. #1 output load contactor (K10) opens during power delivery and engine shuts down.	A. Defective engine, protective devices or engine fault .	A. Corrective action:
	(1) The engine protections may have functioned normally to stop the engine due to engine fault.	(1) Display the measured values and fault messages via the panel diagnostic connector and interface device. Consult the engine manufacturer for an evaluation of the fault messages displayed. Reprogram the Electronic Control Module or repair the engine as required.
	(2) Low fuel shut down	(2) This is an optional system. If the unit is equipped with a low fuel shutdown circuit, ensure there is enough fuel in the fuel tank.

Problem	Cause	Remedy
Generator Protective Circuit		
1. #1 and #2 output load contactors (K10 and K12) open during power delivery. The over voltage message displayed on VR.	A. The over-voltage condition is caused by a defective voltage regulator or generator.	A. Observe the display on VR. The overvoltage protection is set to trigger at 130V with 2 seconds time Delay. Over Voltage shutdown and Indication. Set Voltage to 115V, confirm that the Green LED is ON, and turn on the 400 Hz output contractors. Increase Voltage slowly until the Green LED goes off and the red LED comes ON. Confirm that Over Voltage threshold is 130V. Confirm that the display shows "FAULT LATCHED, OVER VOLTAGE" in 2 seconds time delay, and that the 400 Hz output contactors opened. Lower Voltage to 115V and check that the fault condition remains latched. Push any front panel switch to clear the fault indication, confirm that display returns to normal, green LED comes back on, and the 400 Hz Contactors can be closed again.
2. #1 output load contactors (K10 and K12) open during power delivery. The under-voltage message displayed on VR.	A. The under-voltage condition is caused by a detective	A. Observe display on VR. The under-voltage protection is set to trigger at 100V with 7 seconds time delay. Under Voltage shutdown and indication. Set voltage to 115V, confirm that the Green LED is ON, and turn on the 400 Hz output contactors. Decrease voltage slowly until the green LED goes off and the red Led comes on. Confirm that Under Voltage threshold is 100V. Confirm that the display shows "FAULT LATCHED, UNDER VOLTAGE" in 7 seconds time delay.

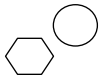
Problem	Cause	Remedy
Generator Protective Circuit (Cont'd)		
3. #1 output load contactors (K10 and K12) open during power delivery. The over-frequency message displayed on VR.	A. Electronic Control Module or engine fuel system Malfunction.	A. Display the measured values and fault messages via the panel diagnostic Connector and interface device. Correct system fault. The Over frequency is set to trigger At 420 Hz with 5 seconds time Delay. The operating speed of Electronic engine is programmed to provide 400 Hz on the generator output. Confirm the actual GPU output frequency is 400 Hz and that LCD indicates 400 Hz. The GPU output frequency can be reduced or increased by toggling the over/under frequency simulator switch. Toggle up increase frequency, toggle down decrease frequency. Increase frequency to 420 Hz and confirm that over frequency threshold is 420 Hz. Confirm that the display shows "FAULT LATCHED, OVER FREQUENCY" in 5 seconds time delay. Confirm contactors open.

Problem	Cause	Remedy
Generator Protective Circuit (Cont'd)		
4. #1 output load contactors (K10andK12)open during power delivery. The under-frequency message displayed on VR.	A. Electronic Control Module or engine fuel system malfunction.	A. Display the measured values and fault messages via the panel diagnostic connector and interface device. Correct system fault. The under Frequency is set to trigger at 380 Hz with 7 seconds time delay. The operating speed of Electronic engine is programmed to provide 400 Hz on the generator output. Confirm the actual GPU output frequency is 400 Hz and that LCD indicates 400 Hz. The GPU output frequency can be reduced or increased by toggling the over/under frequency simulator switch. Toggle up increase frequency, toggle down decrease frequency. Decrease frequency to 380 Hz and confirm that under frequency threshold is 380 Hz. Confirm that the display shows "FAULT LATCHED, UNDER FREQUENCY" in 7 seconds time delay. Confirm contactors open.
5. #1 output load contactors (K10 and K12) open during power delivery. The overload message is displayed in VR.	A. An overload condition occurred which caused the overload to trip.	A. No remedy is given if there is a true overload condition.

Repairs

1. Torque Charts

When working on the equipment it is important to follow general mechanic guidelines. Charts 5 and 6 show the proper torque required on several different types of bolts. These charts should be used when any repairs are made to the unit or its components.

HEAD									
SIZE/TYPE	SAE GRADE 2	SAE GRADE 3	SAE GRADE 5	SAE GRADE 6	SAE GRADE 7	SAE GRADE 8	SOCKET HEAD	SET SCREW	S.S. CAP & MACH.
NO.6	---	---	---	---	---	---	---	9 LB/IN	9.6 LB/IN
NO.8	---	---	---	---	---	---	---	16 LB/IN	20 LB/IN
NO.10	---	---	---	---	---	---	---	30 LB/IN	23 LB/IN
1/4	6	9	9	12.5	12.5	13	14	70 LB/IN	75 LB/IN
5/16	11	17	18	24	24	28	30	12	11
3/8	19	30	31	43	43	46	50	18	20
7/16	30	47	50	69	69	75	81	29	31
1/2	45	69	75	106	106	115	121	43	43
9/16	66	103	110	150	150	165	176	63	57
5/8	93	145	150	209	209	225	240	100	92
3/4	150	234	250	350	350	370	395	146	124
7/8	202	372	378	550	550	591	629	---	194
1	300	551	583	825	825	893	964	---	259
1 1/8	474	872	782	1304	1304	1410	1523	---	390

RECOMMENDED ASSEMBLY TORQUE VALUES LB/FT
CHART 5

HEAD MARKING	4.8	8.8	9.8		12.9	12.9
SIZE	METRIC CLASS 4.8	METRIC CLASS 8.8	METRIC CLASS 9.8	METRIC CLASS 10.9	METRIC CLASS 12.9	SOCKET HEAD 12.9
M6	4.5	8.5		12	14.5	
M8	11	20		30	35	
M10	21	40		60	70	
M12	37	70		105	120	
M14	60	110		165	190	
M16	92	175		225	300	
M18	125	250		350	410	
M20	180	350		500	580	
M22	250	475		675	800	
M24	310	600		850	1000	
M27	450	875		1250	1500	
M30	625	1200		1700	2000	
M33	850	1650		2350	2750	
M36	1075	2100		3000	3500	

RECOMMENDED ASSEMBLY TORQUE VALUES (N-M)
CHART 6

2. Adjustments

The GPU-4000 ground power unit uses the TLD-designed Generator Control Module which eliminates the need for periodic switch and relay setting adjustments. The following is a list of adjustments that are available to maintenance and operations personnel, depending on different airline requirements.

A. Operations Personnel Adjustments

1. **Current Limiting for optional 28.5 VDC output** - adjustable from 500-2500 amps in 100 amp increments – use this adjustment to limit the maximum DC current that is supplied to the airplane.
    i. Actuate the rated speed switch to turn on the generator control module
    ii. Actuate the DC contactor switch to close the DC contactor
    iii. Press the 'right scroll' button or 'left scroll' button on the Generator Control Module to change the maximum current setting, right to increase and left to decrease.
    iv. Press the scroll up or scroll down buttons to save the setting.

B. Maintenance Personnel Adjustments

2. **400 Hz AC voltage setting** – adjustable from 96 to 136 VAC, no load, in 0.5 Volt increments. Units are factory set at 115 VAC, no load. The large range is provided to allow for proving the over and under voltage protection settings are functioning properly.
    i. Actuate the rated speed switch to turn on the generator control module.
    ii. Following the menu tree found in section 2-6, press a combination of the up, down, left, and right scroll buttons on the generator control module to get to the AC line drop compensation section.
    iii. Press the left scroll button to decrease or the right scroll button to increase the line drop compensation percentage.
    iv. Hit scroll up or scroll down to save the setting.

3. **400 Hz AC line drop compensation** – adjustable from 0-5%. Units are factory set at 2% assuming a standard 30' cable is used. If older or longer cables are used, increase the setting to compensate for the increased resistance in the cable. The goal is to maintain 115 VAC at the load bank with a 90 KVA load applied.
    i. The steps to change the settings are the same as 3 above.

4. **28.5 VDC line drop compensation** – adjustable from 0-50%. The goal is to maintain 28.5 VDC at the DC load bank when applying a 1000 amp load to the GPU, assuming a standard 4/0 30' cable is being used. The units are factory set at approximately 40%.
    i. The steps to change the settings are the same as 2 above.

3. Schematics

(1) Using the Schematics and Connection Diagrams

A. Component Codes

All components on the schematic and connection diagrams carry a designation number (e.g. DS1, M1), which aid in identifying and discussing. The codes are as follows:

B..... Motor
BT ..... Battery
C ..... Major component or capacitor
CB ..... Circuit breaker
CR..... Rectifier bridge
DS ..... Light
F..... Air filter, fuse, or cooling fan
G ..... Gauge
HR..... Heater
K..... Relay
L ..... Solenoid or governor actuator
M ..... Meter or magnetic speed sensor
P..... Port or plug
R ..... Resistor, rheostat, or sender
S..... Switch
T..... Transformer or thermostat
TB ..... Terminal block
V..... Valve
VR ..... Voltage regulator
W..... Jumper
X..... Receptacle

(2) Schematics and Connection Diagrams

The following pages are the exact diagrams used to construct your GPU. When discussing with TLD field technicians, be sure to reference the 7 digit drawing number located in the lower right corner of each drawing and have the unit's 6 digit serial number available.