KS-20527 DIESEL ENGINE-ALTERNATOR

115KW (J86647)

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1. GENERAL

1.1 Scope

1.11 This section covers installation and test of 115KW diesel engine-alternators supplied by Allis Chalmers Mfg. Co., Harvey, Illinois.

1.12 Tests are based on the following circuit diagrams:

SD-81100-01	Alarm Circuit
SD-81223-01	Alarm Circuit
SD-81489-01	Transfer Breaker Circuit
SD-81796-01	J87249 Battery Charger
SD-81935-01	Engine-Alternator Schematic
SD-82021-01	Power Plant Schematic

1.2 Inspection

1.21 As soon as possible after the unit is received remove shipping materials and make a complete inspection of the engine-alternator and associated equipment and parts. Examine carefully for visible defects and damage.

1.22 Report any defects, damage or missing parts in accordance with established routines.

1.3 Description of Engine-Alternator

1.31 The basic set consists of an engine alternator mounted on four vibration isolators and a floor-mounted control cabinet. Four jack screws, inside the base, are furnished to lift the set high enough to place isolators. The radiator may either be on the set or remote. Shutters are available for the front of the radiator, whether it is set-mounted or remote.

1.32 The set may be furnished with or without an enclosure. The enclosed set has two removable covers on each side. As a further option the interior of the enclosure may be coated with sound-absorbing material.

1.33 An available cold weather starting aid consists of an Immersion Heater for the engine coolant. The Immersion Heater and associated Thermostat keep block temperature between 85-100° F.

1.34 An extended lube oil supply is available. It uses a Ren lube oil regulator valve to keep a constant crank-case oil level. A shut-off valve is furnished in the input line to the Ren valve.

1.35 The upper part of the control cabinet has a hinged front cover on which is mounted meters, alarm lamps and control switches. The interior of the cabinet contains relays, control breakers, a main breaker and customer's connections. The lower portion of the cabinet houses the J87249 Rectifier and the Roosa-Tronic Load Compensator, if furnished.

1.4 Description of Operation

1.41 The sets are arranged for manual starting and loading.

1.42 The method of starting is as follows. Depress POWER ON Button; POWER ON and PRESS TO START lamps light. Before 30 seconds have elapsed depress the PRESS TO START Button. After 30 seconds the PRESS TO START lamp goes out.

NOTE: A TD Timer (30 seconds) is provided to prevent a Low Oil Pressure shutdown until the set is running and lube oil pressure has built up to normal value.

1.43 The normal method of stopping is to depress the PRESS TO STOP Button. This releases the Fuel Solenoid and shuts the set down. The POWER ON lamp goes out.

1.44 An electrical EMERGENCY STOP is furnished on the set and usually a Remote Emergency Stop is provided outside the engine room door. There is also a mechanical Emergency Stop linkage furnished on the set. This will trip the circuit breaker if it is closed. Alarm indications will be the same as shown in paragraph 1.46 and it will be necessary to reset the circuit in the same way to remove the alarm indications.

1.45 When the set is running the following major troubles will stop the set, trip the circuit breaker, light the BREAKER TRIPPED lamp, light the associated alarm lamp and provide a major alarm signal to the connected alarm circuit:

LOW OIL PRESSURE	Lube Oil pressure less than 15-19 psi.
OVERSPEED	Engine speed exceeds 2100 rpm.
REVERSE POWER	Draws more than 25 KW reverse power.
HIGH WATER TEMP	Water temperature reaches 206-212° F.

1.46 The above major alarms also light the SWITCH OFF NORMAL lamp. To remove the alarm indications it is necessary to press the PRESS TO STOP Button. POWER ON lamp goes out as well as the other alarm lamps and the major alarm signal is removed. After an overspeed shutdown the RESET button on the OS Switch also has to be reset.

1.47 Four minor alarms are provided. These are RECT FAIL, PRELIM COOLANT TEMP, COOLANT HEATER FAIL (Immersion Heater) and BREAKER TRIP. If the set is running these do not cause a shutdown. However, it is necessary to clear the trouble before the minor alarm signal to the alarm circuit is removed.

1.48 The main breaker is electrically operated. Buttons are provided for closing and opening the breaker and indicating lamps are provided to show whether it is closed or open. The breaker may be operated manually after pulling the motor mechanism up out of the way.

1.49 In case the breaker trips out from overload or is shunt-tripped due to a trouble condition it must be reset to the OFF position. This can be done either manually or electrically.

1.491 To reset the breaker manually, pull the motor mechanism up out of the way and push the breaker knob to the OFF position. Then turn the drive screw so that the breaker knob lines up with the slot in the motor mechanism.

1.492 To reset the breaker electrically, first clear the fault. Then restart the set. With alternator voltage available press the CIRCUIT BREAKER OPEN button. When the BREAKER TRIPPED lamp goes out the breaker has reset to the OFF position.

1.5 Associated Information

1.51 Section 129 in this handbook covers leveling and vibration isolator adjustments.

1.52 Section 132 in this handbook covers piping information.

1.53 Section 130 in this handbook covers paralleling information.

1.54 Section 19 in Handbook 18 covers information on charging starting batteries.

1.55 Section 133 in this handbook covers antifreeze and rust inhibitor information for cooling systems.

2. PRECAUTIONS

2.1 Engine-Alternator

2.11 When working on the engine, disconnect the B- battery lead on the Starting Battery.

CAUTION: BEFORE DISCONNECTING THE LEAD IT WILL BE NECESSARY TO REMOVE AN INPUT FUSE ON THE J87249B RECTIFIER, OR DAMAGE WILL OCCUR TO THE RECTIFIER. THEN REMOVE THE OUTPUT FUSE FROM THE RECTIFIER.

2.12 The starting motor should not be operated more than 30 seconds at a time to avoid overheating the motor. Also, wait one minute between cranking attempts. If the engine fails to start DO NOT press the START button again until the engine stops rotating.

2.13 Immediately after starting observe lube oil pressure on the gauge. If no oil pressure is shown after 10-15 seconds immediately stop the engine with the STOP button.

2.14 When an Immersion Heater is furnished be sure that CB-5 Breaker (in the cabinet) is open until the radiator is filled with solution. Also, be sure that the valves opening into the Immersion Heater chamber are open when filling the cooling system.

2.15 Routine runs should not be made on these sets without loading the set to at least 30% rated capacity. Also, when started for short demonstration runs, the set should not be shut down before water temperature has reached 125° F.

2.2 J87249 B2 Rectifier

2.21 Install output fuse (F4) before installing the input fuse because resultant open-circuit voltage will damage the charger. When disconnecting the rectifier remove an AC input fuse before removing the output fuse.

2.22 For 208 volt input insert COM & 208V fuses. For 200-240 volt input insert COM & 240 fuses. In no case shall 208V and 240V fuses be inserted at the same time.

2.23 If the J87249 Rectifier is to be off for several days be sure to disconnect the rectifier by pulling out the rectifier connection plug as well as removing the rectifier fuses. A bleeder resistor in the rectifier is not disconnected by removing the output fuse and this resistor will discharge the battery.

3. TOOLS, TEST SETS AND RECORDS

3.1 Tools and Test Sets

Note	Quan.	Code	Description
	1	R-2705	Tachometer, Hand
	1	R-3404	Phase Sequence Indicator
1	3	R-3413	Wire & Lug Assembly
	1	ITE-1000	AC Voltmeter
	1	ITE-4442	Volt-Ohmmeter
	1	ITE-4474	DC Power Voltmeter
2	1	ITE-4782	150KW AC/DC Test Load
	1	ITE-4824	Hasler Tachometer

NOTE 1: For connecting ITE-4782 Test Load.

NOTE 2: Due to the heat produced by this load it should be placed outside or in a doorway for the test.

3.2 Records

ID-946	Engine-Alternator Test Record
ID-1275	Lubrication Record
ID-1285	Storage Battery Report
SD-4-1313	Test Trouble Record
SD-4-1315	Summary of Tests

4. INSTALLATION

4.1 Preliminary

NOTE: Four jackscrew holes are provided in the outer edge of the base. The vibration isolators mount under base cross-members approximately 6-1/4 inches inside the edge of the base.

4.11 The floor or pedestal under the unit shall slope not more than 1/4" in 10 feet. Also, the mounting areas for the isolators shall not vary more than 1/32 inch in height from each other. Floor coverings such as linoleum or tile must be removed under the isolators so that the base of each isolator rests on the floor.

4.12 The isolators have ribbed anti-walk material on the bottom. Isolators are generally fastened to the floor in Earthquake Areas only. Drawing ED-80730-11 (Earthquake Area Fastening Details) does not cover KS-20527 sets and the Installer should request this information through established channels. Remove the ribbed material on the bottom of the isolator before fastening isolators to the floor or to a steel plate when plates are used.

4.13 The control cabinet should be fastened to the floor in all sites.

4.14 When the set is received have the riggers move it into position and install the vibration isolators. Isolators can be installed later, however, using the jack screws provided with the set to raise it high enough to place the isolators.

4.15 Open CB-5 Breaker (inside the cabinet) when an Immersion Heater is provided.

4.16 Remove the grill from the lower front of the control cabinet.

4.2 J87249 B2 Rectifier

4.21 Install the J87249 B2 Rectifier in the area provided (lower right hand corner).

4.22 Remove all fuses from the rectifier. Remove the cover from the rectifier and ascertain that the following list number is marked on the card (according to the battery used):

List TA - 20 cell nickel-cadmium battery (setting is 28.5 volts)

List TB - 12 cell lead-acid battery (setting is 26.0 volts)

4.23 With the AC input to the rectifier disconnected plug the output capacitor into the rectifier. Then plug the set connection into the capacitor.

4.24 Install the output fuse (F4) on the J87249 B2. Then install the AC input fuses (COM and 208V or 240V) on the rectifier.

CAUTION: Insert 208V or 240V fuse according to the commercial line voltage.

4.25 Install the remote AC line fuses for the rectifier.

4.26 With the charger operating check charging voltage. Use the ITE-4474 DC Power Voltmeter for checking the voltage. Connect the voltmeter across the DC OUTPUT jacks on the rectifier unless these are inaccessible, in which case measure voltage across the start battery terminals.

4.27 Measure charging current with a voltmeter across 4A/VOLT jacks on the J87249 B2. The voltmeter used for this should be a good 3V DC meter, or the 3 volt scale of ITE-4442 may be used. Each volt indicated = 4 amperes, less 0.4 amperes for R15 bleeder resistor current.

4.28 Measure voltage and current and observe that after several hours the voltage reaches the required float voltage and that charging current reduces to a very low value.

4.3 Engine-Alternator

4.31 Open the lube oil drain valve and drain out any oil or residue left in the system. Then close the drain valve. Also close the shutoff valve (1/2 inch valve) in the inlet line to the Ren Valve (Lube Oil Level Regulator), when this is furnished.

4.32 Add 17 quarts of lube oil to the crankcase through the oil filler opening.

NOTE 1: Approximately 22 quarts of lube oil will be required to fill the crankcase (17 quarts), lube oil filters (4 quarts) and Vortox Air Cleaner (1 quart) initially, where A Ren Valve is not furnished. When a Ren Valve is furnished, a bypass lube oil filter with an 8 quart capacity is also furnished. Total lube oil requirement with Ren Valve will then be 30 quarts. However, the external lube oil system will supply the additional oil required (12 quarts) to the crankcase through the Ren Valve.

NOTE 2: Always use Series 3 lubricants with the following SAE ratings:

Ambient above 32° F.	SAE 30
Ambient 0° F to 32° F.	SAE 20
Ambient 0° F and below	SAE 10W

4.33 Add about one quart of engine oil to the VORTOX OIL Bath Air Cleaner. Loosen the wing nuts and remove the lower portion of the cleaner. Take out the prefilter and add oil to the cup until the level reaches the mark on the disc. Replace the prefilter and reinstall the lower portion of the air cleaner.

4.34 Add coolant to a set-mounted radiator as follows: Fill to within 1-1/2" of the filler neck (approximately 40 quarts). Rust inhibitor must always be used unless antifreeze will be used. Refer to Section 133 in this handbook for information on antifreeze and rust inhibitors.

CAUTION: If there is an Immersion Heater be sure that the valves at each end of the heater chamber are open.

4.35 After the cooling system has been filled, the Immersion Heater can be turned on. Insert the AC fuses in the AC Service Cabinet and close CB-5 Breaker in the cabinet.

4.36 Remove the plug in the rear of the alternator bell housing.

4.37 Temporarily disconnect a lead from the Fuel Solenoid. This will be reconnected later as soon as the lube oil filters have been filled by cranking the engine for about 20 seconds without allowing it to start.

4.4 Remote Radiator and Cooling System

4.41 Install piping and wiring in accordance with job drawings.

4.42 Install isolators under the remote radiator at the marked locations and bolt the radiator down in accordance with job drawings.

4.43 Install the thermometers in the engine inlet and outlet connections.

4.44 Fill the cooling system when all piping is complete. Capacity of the remote radiator will be marked on the radiator and engine block capacity will be marked on the engine. Capacity of the complete system, including piping, will have to be calculated and the correct amount of rust inhibitor or antifreeze added. Refer to Section 133 in this handbook.

5. INITIAL START

NOTE: To prevent external alarms from coming in disconnect external alarm connection until paragraph 8.

5.1 Preliminary

5.11 Open the cabinet door and ascertain that the main breaker and the small breakers are open. Where a Remote Radiator is furnished make certain that RFM Breaker is open.

NOTE: If CB5 Breaker for an Immersion Heater is already closed, it can remain closed.

5.12 If a Remote Radiator is furnished close the disconnect switch on the radiator.

5.13 Connect the ITE-4782 Test Load to the load side of the alternator breaker.

5.14 Operate DROOP Switch (if furnished) to DROOP. A DROOP Switch is furnished with a Roosa-Tronic Load Compensator. For isochronous operation this DROOP Switch must be at ISOCH position.

5.15 Operate the CROSS CURRENT Switch to the desired position. This switch for single set operation should be at UNIT position and for any set that will be paralleled should be at PARA position.

5.16 Turn ALTERNATOR VOLTS ADJUST Control full CCW. Turn VOLTMETER SELECTOR Switch to ALTERNATOR 1-2 position. Operate SYNCH LIGHT Switch to OFF.

5.17 When a Roosa-Tronic Load Compensator is furnished, procced as follows:

5.171 Put the plug into the bottom of the unit.

5.172 Disconnect the bottom lead from MAC1 terminal and temporarily insulate the end of the lead.

5.18 Close Breakers CB1, CB3, CB4, CB5 and CB6.

NOTE: Breakers CB3, CB4 and CB5 are alarmed. CB6 Breaker feeds commercial power to the voltmeter and is not alarmed. It is not essential that CB6 be closed if commercial voltage is not provided on terminals CA, CB and CC.

5.2 Priming Fuel Systems

NOTE: Fix any leaks observed in the fuel system during the priming operation before running the set.

5.21 Open the valve in the fuel suction line to the set.

5.22 Turn RUN/PRIME valve on the set to PRIME position. (PRIME position is parallel to the fuel line).

5.23 Loosen the vent plugs on the top of the two fuel filters (left side of engine). Place rags around the vent openings to absorb fuel.

5.24 Operate Deming pump handle with slow even strokes until the fuel coming out of the vents on the fuel filters is free of bubbles.

5.25 Stop pumping. Close vents on the fuel filters. Turn RUN/PRIME valve to RUN position.

5.3 Starting

CAUTION: Do not crank more than 30 seconds at one time if engine fails to fire. Then wait about 2 minutes before attempting another start.

5.31 Crank the engine for approximately 20 seconds to fill the lube oil filters. This is done as follows: Depress the POWER ON button. POWER ON and PRESS TO START lamps light. Depress the PRESS TO START button and release after about 20 seconds. Then depress PRESS TO STOP button.

5.32 Add about 4 quarts of lube oil to the crankcase of sets without a Ren Valve. For sets with Ren Valves, observe that lube oil is flowing into the crankcase to replenish the oil held in the lube oil filters.

5.33 Reconnect the lead that was removed from the Fuel Solenoid.

5.34 Start the engine as follows: Depress POWER ON button. POWER ON and PRESS TO START lamps light. Depress the PRESS TO START button and release after the engine fires.

NOTE: PRESS TO START button must be depressed within 30 seconds after POWER ON button is depressed. Otherwise, the TD timer times out operating LOPR relay. This gives a LOW OIL PRESSURE indication and the engine cannot be cranked.

5.35 As soon as the engine comes up to speed check speed with an R-2705 or ITE-4824 Tachometer. Insert the tachometer in the end of the alternator shaft. Adjust speed with the RAISE or LOWER Switch to about 1820 rpm when a Roosa-Tronic Load Compensator is furnished or, to about 1872 rpm when a Load Compensator is not furnished.

NOTE: If unable to use a tachometer on the end of the alternator use the frequency meter on the panel as reference (1820 rpm is 60.6 hertz and 1872 rpm is 62.4 hertz).

5.36 Observe lube oil pressure as soon as the engine is running. If no pressure is indicated shut the engine down immediately with the PRESS TO STOP button.

5.37 After setting no-load speed adjust voltage to the desired value, which should match commercial service voltage.

NOTE: If voltage does not buildup it will be necessary to flash the exciter field. Stop the set by depressing the PRESS TO STOP Button. Remove cover plate from the lower left hand side of the alternator. Apply 12 volts DC (from start battery string) for about 5 seconds as follows: + to T14 (FF+) and - to T13 (FF-). Then reconnect the lead and restart the set.

5.38 Observe that a set-mounted shutter assembly opens as soon as the lube oil pressure comes up.

5.4 No-Load Run

5.41 With alternator voltage available use the R-3404 Phase Sequence Indicator and check that alternator output voltage is 1-2-3 order. If it is not 1-2-3 order this will have to be corrected before starting the set again.

5.42 Where a remote radiator is furnished close the RFM breaker on the control cabinet. Observe that the remote fan starts and turns in the right direction. If direction of rotation is incorrect shut the set down and interchange two of the three line leads between the control cabinet and the fan disconnect switch at some convenient point.

5.43 Allow the engine to run for about 30 minutes at no load. Observe that lube oil pressure remains about 30 psi. Also observe that engine water temperature steadily increases but remains approximately 185° F.

5.44 Where shutters are furnished on a remote radiator, observe that these shutters begin to open when water temperature reaches the range 130-160° F. and that they are fully open when water temperature reaches 170-185° F.

5.5 Governor Checks and Adjustments

5.51 Requirements

5.511 If a Roosa-Tronic Load Compensator is furnished, the governor should have a speed drop of 1% from no-load to full-load (16-20 rpm or 0.53 - 0.67 hertz). Then, when the Load Compensator is connected and adjusted, the speed from no-load to full-load should remain approximately the same (isochronous).

5.512 If a Roosa-Tronic Load Compensator is not furnished the governor should have a speed droop of 4% (72 rpm) from no-load to full-load. (70-74 rpm or 2.3-2.5 hertz).

5.52 Mechanical DROOP Check

5.521 Start the set and close the circuit breaker.

5.522 Apply 115KW unity power factor load with the ITE-4782 Test Load.

5.523 Adjust speed to 1800 rpm (60 hertz) and voltage to desired value, if necessary.

5.524 Open the circuit breaker and then check speed or frequency.

5.525 The speed or frequency change from full-load to no-load should be within the range shown in paragraph 5.511 or 5.512.

5.526 The knurled screw on the rear of the governor controls the speed droop. Turn the adjustment screw CW to increase the droop, or, CCW to decrease the droop.

5.527 Make any necessary readjustments of the speed DROOP screw and recheck the droop until it falls within the required range in paragraph 5.511 or 5.512.

5.53 Roosa-Tronic Compensator Adjustments

NOTE 1: This compensator is dependent on alternator voltage and current and is voltage-sensitive. Factory adjustments are at 208 or 240 volts, depending on which voltage is ordered. If the set is operated at a voltage other than 208 or 240 the following adjustments should be made by the Installer and these should be repeated whenever the alternator voltage is changed to a different value.

NOTE 2: The following information is a trimming procedure. A complete adjustment procedure is included in the Supplier's Manual.

5.531 Shut down the set and reconnect the lead to MAC1 Terminal.

5.532 Start the set.

5.533 Adjust no-load speed to 1800 rpm (60 Hertz). Also make certain that alternator voltage is set for desired value.

5.534 Connect ITE-4442 (12V DC scale), in turn, across test points TP1-TP2, TP2-TP3 and TP3-TP4. These voltages should be zero. If not, adjust the associated control between the test points (R1, R2 or R3) for zero voltage on each pair of test points. Then disconnect ITE-4442.

5.535 Close the alternator breaker. Apply 115 KW load with the ITE-4782 Test Load.

5.536 The speed at full-load should remain at 1800 rpm (60 hertz). If it changed from the no-load setting adjust R6 control on the Roosa-Tronic Compensator until the frequency is 60 hertz at 115KW load.

6. OVERSPEED TRIP TEST

6.1 With the engine shut down do the following:

6.11 Loosen the jam nut on the high idle adjustment screw on the governor and turn this screw out five turns (CCW).

6.12 If a Roosa-Tronic Load Compensator is furnished, pull the plug out of the device.

6.2 Start the set.

6.3 The following operations take two men. Have one man insert the R-2705 Tachometer into the end of the alternator shaft to read speed while the second man overspeeds the engine. Overspeed the engine by operating the ENGINE SPEED Switch in the RAISE direction.

6.4 The engine should shut down in the range of 2100-2150 rpm. At shutdown observe that the OVERSPEED/REVERSE POWER and SWITCH OFF NORMAL lamps light.

6.5 Before the set can be restarted the PRESS TO STOP Button must be depressed, which extinguished the lamps and removed a major alarm indication. There is also a manual reset button on the top of the Overspeed Switch housing that must be depressed.

6.6 The overspeed trip switch is a centrifugal switch. To adjust the operating point, loosen the cap screw on the side of the case and turn the top of the device CCW to increase the trip setting, or, turn the top of the device CW to decrease the trip setting. After the adjustment lock the position with the cap screw.

6.7 After shutdown do the following:

6.71 Replace the plug in the end of the alternator.

6.72 If a Roosa-Tronic Load Compensator is furnished, insert the plug.

6.73 Depress the POWER ON Switch. Then operate the ENGINE SPEED Switch in the LOWER direction for about 10 seconds.

6.74 Before the TD timer times out, start the set.

6.75 After the engine is up to speed set speed with the ENGINE SPEED Switch to 63 hertz (1890 rpm).

6.76 Turn in the high idle limit screw against the governor arm and lock it in position with the locknut.

6.77 Reduce no-load speed to normal value.

7. REVERSE POWER TEST

NOTE: This test will be made if the test has a reverse power relay (parallel sets only).

7.1 Perform the REVERSE POWER TEST in accordance with paragraph 9, Section 130 of this handbook.

7.2 As a matter of information the amount of reverse power that will trip the circuit breaker should be in the range of 20-30 KW. If the set draws reverse power in this range in parallel with another set, the breaker will trip and the set will shut down. The BREAKER TRIP, SWITCH OFF NORMAL and OVERSPEED/REVERSE POWER lamps light.

7.3 Before the set can be restarted the PRESS TO STOP button must be depressed, which extinguishes all lamps and removes external alarm indications. The main circuit breaker will have to be relatched, as explained in paragraph 1.49.

NOTE: The BREAKER TRIP lamp indicates the breaker has tripped although the indication on the motor operator is that the breaker is at ON position. The BREAKER ON lamp will also be lighted.

8. ACCESSORY TESTS AND ALARMS

NOTE: The following have been factory-set and tested. If adjustment appears necessary, refer to the supplier's manual.

8.1 LOP: This switch opens when lube oil pressure builds up to 21-25 psi and closes when pressure drops to 15-19 psi or lower. Simulate switch operation with the set not running by depressing POWER ON button. In about 30 seconds the TD timer times out. LOW OIL PRESSURE and SWITCH OFF NORMAL lamps light and a major alarm comes in. Push the PRESS TO STOP button to cancel the alarm indications.

8.2 PCTS: This switch closes and lights PREL WATER TEMP/JACKET HEATER FAIL lamp and gives a minor alarm when coolant temperature is 193-197° F. There is no shutdown when the set is running. Remove the switch cover and at some point, with the set running, simulate switch operation by a temporary jumper across M1-L1 terminals. Remove the jumper to cancel alarms.

8.3 HCT: This switch trips the breaker, shuts down the engine, lights HIGH WATER TEMP lamp and gives a major alarm when coolant temperature reaches 207-211° F. Contacts of the switch remain closed until coolant temperature reduces to 197-201° F. Remove the switch cover. Sometime during test simulate closure of the switch by a temporary jumper across M1-L1 terminals on the switch. Remove the jumper. Cancel alarms by depressing PRESS TO STOP button. Relatch the breaker.

8.4 CHF: This switch is included with an Immersion Heater. It closes when coolant temperature drops below 50° F, lights PREL WATER TEMP/JACKET HEATER FAIL lamp and brings in a minor alarm. Remove the switch cover and simulate switch closure by a temporary jumper across M1-L1 terminals. Remove the jumper to cancel alarm indications.

9. MAINTENANCE DURING INSTALLATION

9.1 Before Starting (Engine Cold)

9.11 Check lube oil level in the crankcase. Pull dipstick and observe level of oil. Oil level should be:

With Ren Valve: Between STATIC ADD and FULL.

Without Ren Valve: Above RUN ADD.

9.12 When the Ren Valve is not used keep oil level above the RUN ADD mark by adding oil, but do not bring the cold level up to the RUN FULL mark.

9.13 Check that the voltage of the starting battery is within the following range:

Lead-Acid: 26.0 - 26.3 volts

Nickel-Cadmium: 28.3 - 28.5 volts.

Measure across the battery terminals with ITE-4474 Voltmeter if the DC OUTPUT jacks on J87249 Rectifier are inaccessible.

9.14 Check coolant level in the radiator. It should be approximately 1-1/2 inches below the bottom of the radiator filler neck. For a remote radiator the coolant level should be up to the high level point on the sight glass.

9.2 During Operation

9.21 Check for unusual vibration and noise.

9.22 Check for signs of unusual operating conditions.

9.23 Check voltage, frequency and load conditions.

9.24 Check for exhaust system leaks and leaks in remote cooling systems.

9.3 Other Items

9.31 Periodically check electrolyte level in batteries and fill in accordance with published instructions.

9.32 Periodically check battery charging rate (4AMP/VOLT) terminals on the J87249 Rectifier. Also periodically check battery voltage by measuring across the start battery terminals with the ITE-4474 Voltmeter.

9.33 Check for leaks in fuel system, cooling system and lube oil system and correct as necessary.

9.34 Routine the engine weekly until turn-over. A run of at least 1-hour each week will be required with a minimum load equal to about 30% of rating (34.5KW).

10. GENERAL TROUBLES AND CAUSES

10.01 Engine will not crank

Weak start battery.

Loose battery connection.

10.02 Engine cranks but does not start

Defective fuel pump.

Restricted fuel filter or strainer.

Insufficient fuel.

Air in fuel system.

Failure of Fuel Solenoid.

Fuel system not primed.

Defective foot valve in fuel tank.

10.03 Hard Starting

Defective turbo-charger.

Air in fuel system.

Insufficient fuel pressure.

Clogged Air Cleaner.

Excessive exhaust system back pressure.

Weak start battery.

Improper fuel.

Low ambient temperature.

Incorrect SAE rating of lube oil.

Defective foot valve in fuel tank.

10.04 Engine Stops

RUN/PRIME Valve left on PRIME.

Refer to alarm lamp indication below:

(1) OVERSPEED

Overspeed Governor set too low.

Defective Overspeed Governor.

(2) LOW OIL PRESSURE

See Paragraph 10.06

(3) HIGH WATER TEMPERATURE

See Paragraph 10.05

(4) REVERSE POWER

Failure in parallel operation.

10.05 Engine Overheats

Thermostats fail to open.

Restricted passages in lube oil cooler.

Defective water pump.

Loose or broken fan belts.

Excessive KW load.

Clogged radiator passages.

Low coolant level.

Radiator shutters not open.

10.06 Low Lube Oil Pressure

Insufficient lube oil in crankcase.

Defective lube oil pressure regulator.

Leaks in lube oil lines.

Defective lube oil pump.

Clogged lube oil filters.

10.07 Exhaust Smoke Analysis

Black or grey smoke.

Incompletely burned fuel.

Clogged air cleaner.

Improper fuel.

Insufficient combustion air.

Excessive exhaust back pressure.

Light load (less than 30%).

Blue Smoke

Operating temperature too low (open thermostat).

Internal fuel or lube oil leaks.

Injection nozzle not operating properly.

White Smoke

Improper fuel.

Faulty injection nozzles.

10.08 Engine Knocks

Lube oil diluted by fuel.

Injection timing incorrect.

Defective fuel injection pump.

10.09 Engine Runs Unevenly

Fuel supply erratic or insufficient.

Defective governor.

Operating temperature too low.

Defective Roosa-Tronic Compensator (optional).

10.10 Low Lube Oil Level

Insufficient lube oil in crankcase.

Ren Valve positioned incorrectly.

Inlet valve to Ren Valve not fully open.

10.11 High Lube Oil Level

Ren Valve positioned incorrectly.

Defective Ren Valve.

10.12 Vibration On the Set

Unbalanced alternator armature.

Excessive grease in alternator bearing.

Loose electrical connections.

10.13 No Output Voltage or Low Output Voltage

Faulty diodes in alternator.

Loss of exciter residual magnetism. (flash-field - see Note after Par. 5.37).

10.14 Erratic Voltage

Loose connections.

Faulty connections.

Engine governor unstable.

Incorrect setting of R11 on Voltage regulator circuit-board.

10.15 High Output Voltage and Voltage is Uncontrollable

Open F1 fuse in Voltage regulator.

Defect in regulator printed circuit-board.

Vertical line at side of paragraphs indicates requirements.

Manager, Product Engineering