

J86657 GUARDIAN*
24-KW AND 40-KW AC RESERVE SYSTEM
DESCRIPTION

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1.01 This section describes the GUARDIAN 24-kW and 40-kW AC Reserve System designated

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J86657 (Fig. 1).

(a) This system includes the following equipment:

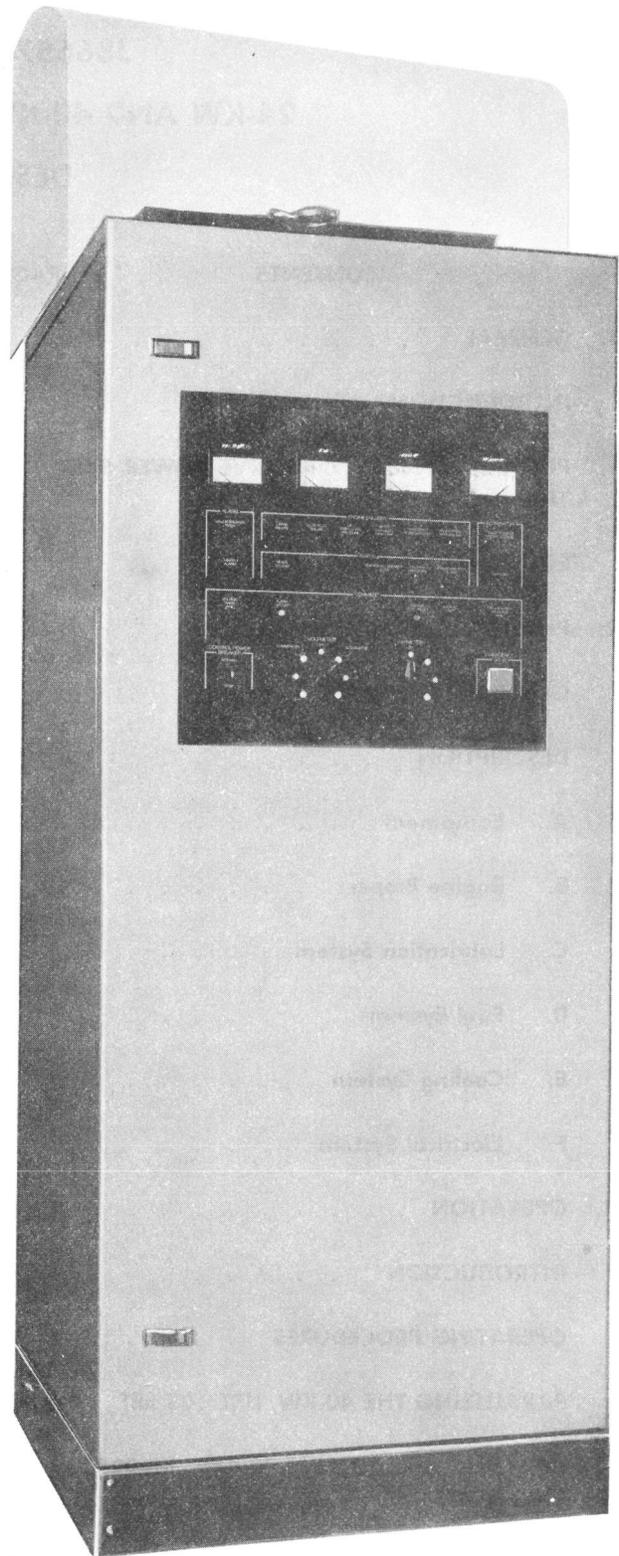
- KS-22344 Diesel Engine Alternator
- J85520 Engine Alternator Control
- 203B Power Unit
- 202E1 Power Unit
- 281B Power Unit
- Start and Control Batteries
- Battery Charging Rectifier
- Output Circuit Breaker
- Control Relays
- Meters
- Exhaust Silencer
- Ducts and flexible section for the cooling air intake and discharge.

(b) The following optional equipment can be provided:

- Outside ductwork to prevent snow from blocking the ventilation system of the set
- An immersion heater for the cooling system
- Equipment to provide for the remote mounting of the control panel that is normally mounted on the enclosure door of the set
- ♦Dummy load banks (24-kW only).♦

1.02 This section is being reissued for the reasons listed below. Revision arrows are used to emphasize the more significant changes. This issue does not affect the Equipment Test List.

- (a) To incorporate the 40-kW KS-22344 Diesel Engine-Alternator
- (b) To include dummy load banks as optional equipment for the 24-kW set
- (c) To extend Table A to include atmospheric pressure, to add output ratings for the 40-kW sets and to extend Table A to include 12 entries.



**Fig. 1—♦J86657 24- or 40-KW AC Reserve System—
Front View♦**

- (d) To extend Table B to include the 40-kW set and rate the J86657A and J86657D Mfr Disc.

1.03 This issue of the section is based on the following schematic drawings (SDs):

SD-82525-01, Issue 4B—Automatic Diesel Engine Alternator 24-kW, 3-Phase, 120-240 Volt, 60-Hertz, KS-22344

SD-82526-01, Issue 1—Automatic Diesel Engine Alternator, 24-kW, 1-Phase, 120-240 Volt, 60-Hertz, KS-22344

SD-82527-01, Issue 1—Power Plant Application Schematic

SD-82531-01, Issue 1—Microcomputer Controller for Diesel Engine Alternator Set, J85520

SD-82326-01, Issue 1—203-Type Power Unit

SD-82324-01, Issue 1—202-Type Power Unit

SD-82501-01, Issue 1—281-Type Power Unit

If this section is to be used with equipment or apparatus reflecting an earlier or later issue of the SD(s), reference should be made to the SDs and circuit descriptions (CDs) to determine the extent of the changes and the manner in which the section may be affected.

Danger: Hazardous voltages and currents may be encountered in the J86657 power plants. Avoid all contact with terminals to prevent injuries from occurring. Do not allow a test pick to touch two metal parts at the same time as dangerous and destructive short circuits may occur.

PURPOSE OF J86657 RESERVE POWER SYSTEM

1.04 The J86657 ac reserve power plants are intended for application where space is a problem, although the plants may be applied wherever a 24- or 40-kW capacity ac reserve power plant is required. As a result of the vertical design (see Fig. 2 and 3) of the plant, the floor space required for either

the 24- or 40-kW set is 34 inches by 36 inches. They are especially suited for buildings designed without space allocated for the typical ac reserve plant. Some locations where these plants might apply are No. 2 ESS and No. 3 ESS buildings, radio relay stations, and locations having Operations Support Systems.

EQUIPMENT CHARACTERISTICS

1.05 These plants, when equipped with an electrically operated transfer switch, are fully automatic. Commercial power is monitored and if low voltage persists for a time interval, exceeding that set on the start delay timer, the control circuit automatically starts the set. After a warm-up interval, the alternator assumes the office load. When commercial power returns, the office load is automatically returned to commercial power and the set is shutdown.

1.06 ♦The equipment is designed to start without the cold starting option (KS-22344, L7, immersion heater), if the outside ambient temperature is greater than 40°F. The equipment will operate within the design specifications if the outside ambient temperature is not greater than 100°F or less than -20°F.♦ The room ambient temperature must not exceed +35°F minimum and +110°F maximum. The altitude of the engine-alternator installation and ambient temperature affects the available output as shown in Table A.

1.07 These sets are provided with an electric (isochronous) governor. ♦However, the 40-kW is the only set which has the option of being paralleled.♦ Voltage regulation is 2 percent of the nominal voltage within the following limits:

- 30°F temperature variance
- Any steady load from no load to full load
- 0.8 lagging power factor
- 60 Hz output frequency.

1.08 The capacity of the engine alternator set is shown in Table B.

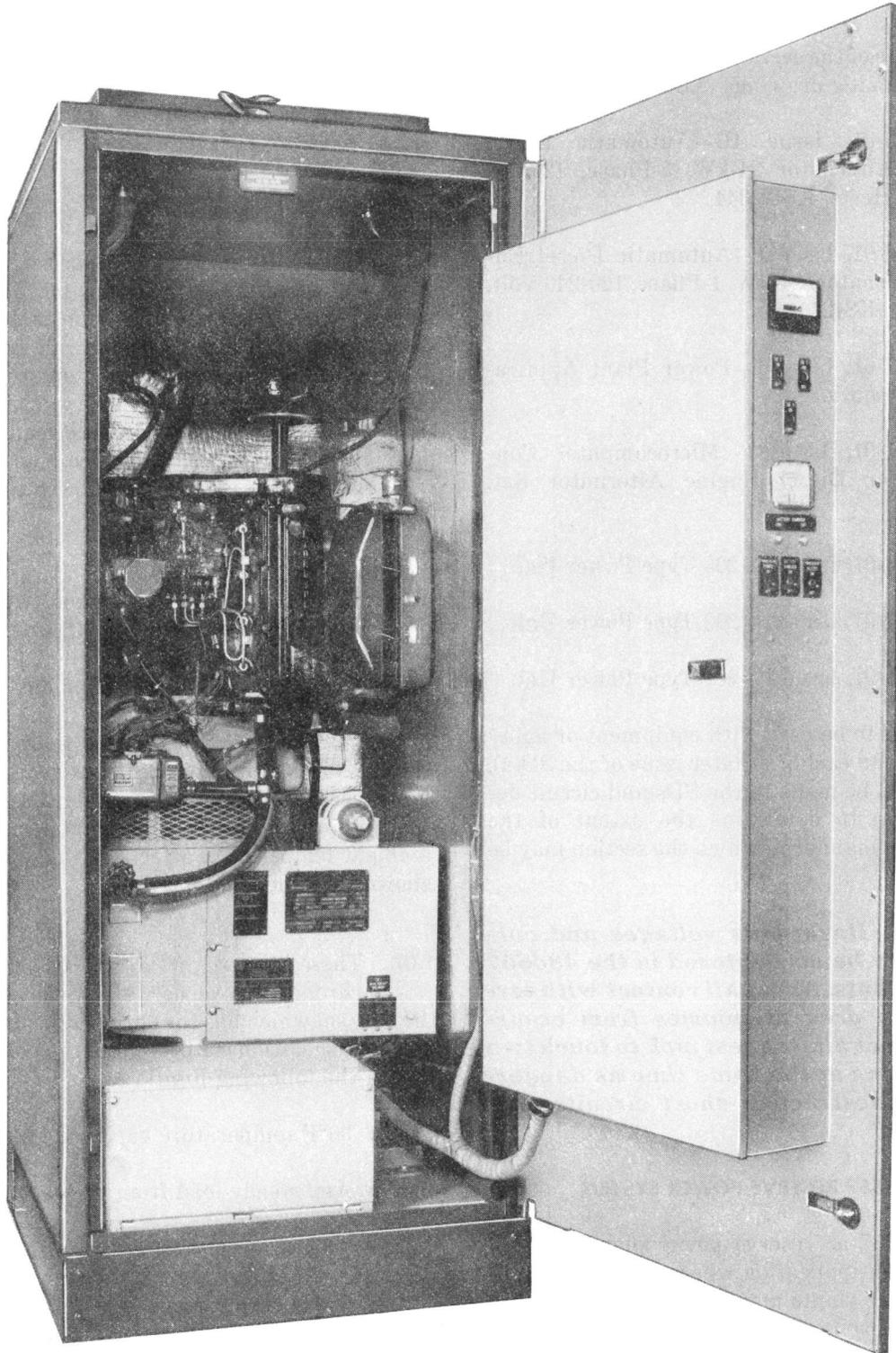


Fig. 2—J86657 24- or 40-KW AC Reserve System—Front Panel Open

COOLING AIR EXHAUST FROM THE TOP OF THE CABINET
(THE EXHAUST DUCT IS NOT SHOWN IN THIS VIEW)

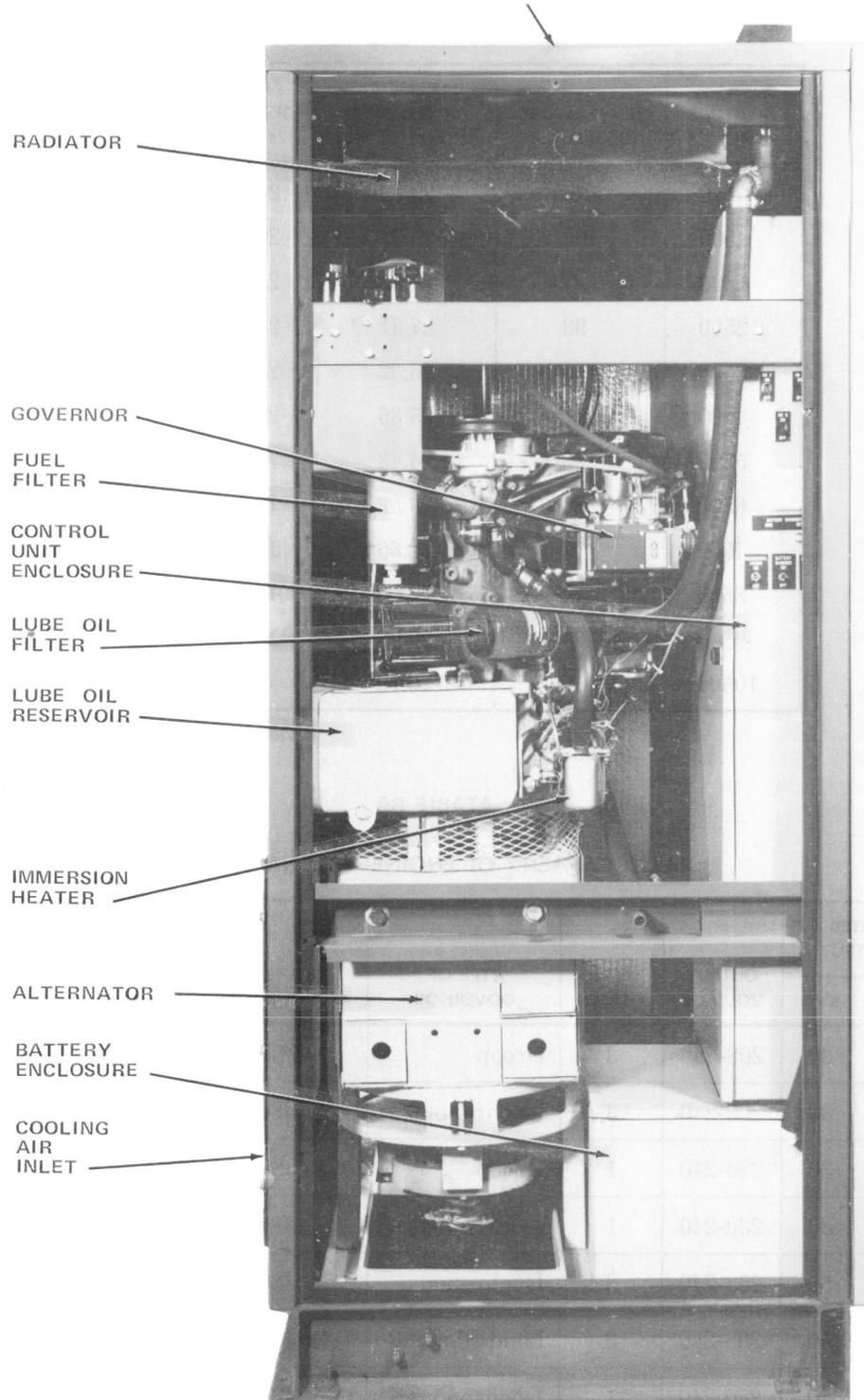


Fig. 3—J86657 24- or 40-KW AC Reserve System—Left Side Panel Removed

♦TABLE A♦

**OUTPUT VERSUS TEMPERATURE
AND ALTITUDE**

ALTITUDE (FEET)	TEMPERATURE (DEGREES, F)	BARAMETRIC PRESSURE (INCHES OF HG)	OUTPUT (24 KW)	OUTPUT (40 KW)
0	100	29.92	24.0	40.0
500	100	29.38	23.6	39.1
1500	97	28.33	23.2	38.2
2500	93	27.31	22.5	37.5
3500	90	26.32	22.0	36.7
4500	86	25.36	21.2	35.9
5500	83	24.43	20.5	35.2
6500	80	23.53	19.9	34.4
7500	77	22.65	18.9	33.7
8500	74	21.80	18.7	32.7
9500	71	20.98	18.1	32.2
10500	68	20.18	17.5	31.5

♦TABLE B♦

RATED CAPACITY OF ENGINE-ALTERNATOR SET

RATED OUTPUT		OUTPUT VOLTAGE	NO. OF PHASES	TYPE OF GOVERNOR	LIST NUMBERS FOR SET AND COMMON EQUIPMENT	RATING
KW	KVA					
24	30	208-240	3	Droop	J86657A, L1	Mfr Disc.
24	30	208-240	3	Isochronous	J86657B, L1	
24	30	230-240	1	Droop	J86657D, L1	Mfr Disc.
24	30	230-240	1	Isochronous	J86657E, L1	
40	50	208-240	3	Isochronous	J86657G, L1	
40	50	208-240	3	Load-Sharing	J86657H, L1	
40	50	230-240	1	Isochronous	J86657K, L1	

2. PHYSICAL DESCRIPTION

GENERAL

2.01 The diesel engine is an internal combustion engine differing from the gasoline engine, principally in the method used to introduce and ignite the fuel. The gasoline engine draws a mixture of fuel and air through the carburetor into the combustion chamber. The mixture is compressed and ignited by an electric spark. In the diesel engine, air alone is compressed in the cylinder. A charge of fuel is then sprayed into the cylinder after the air has been compressed and ignition is accomplished by the heat of compression. The engine set is designed to start with outside temperatures of +40°F or higher without an additional cold-starting aid or temperatures as low as -20°F with a cold-starting aid.

2.02 Compression ratio is the volume of space above the piston in the cylinder when the piston is at its lowest position, divided by the volume of space above the piston when it is at its highest position. As an example, an engine has a compression ratio of 6 to 1, the space above the piston, when the piston is at the bottom of its stroke, is six times the volume that it is when the piston is at the top of its stroke. Gasoline engines may have a compression ratio of approximately 6 to 1. Diesel engines may have a compression ratio as high as 23.5 to 1.

2.03 This engine operates on a four-stroke per cycle basis, usually referred to as the intake, compression, power, and exhaust strokes.

2.04 During the air intake stroke, rotation of the crankshaft drives a toothed belt that turns the overhead camshaft so that the intake valve is open. As the piston moves downward, fresh air is drawn into the cylinder.

2.05 On the compression stroke, the piston moves upward with both valves closed. There is no fuel in the cylinder, only air, and this air is compressed into a space much smaller than its original volume. At maximum pressure, approximately 483 psi for the 24-kW set and 500 psi for the 40-kW set, the air temperature is forced up to 1400°F which is far above the flashpoint for diesel fuel. As the piston reaches the top of its stroke, and the temperature of the compressed air is at its maximum, a mist of diesel fuel is injected at high pressure into the spherical prechamber.

2.06 The hot air ignites the fuel, and its burning causes the mixture to expand while the flame front spreads quickly from the prechamber to the cylinder. As the piston is now past top dead center, it is driven downward by the force of the expanding gases produced by combustion, driving the crankshaft.

2.07 As the energy of the fuel/air combustion is spent, the piston begins to move upward on its exhaust stroke. The exhaust valve opens, releasing the burned gases from the cylinder, so that the upward stroke of the piston pushes out the last of the combustion residuals. On the next downstroke of the piston, the entire cycle begins again with another intake stroke.

DESCRIPTION

A. Equipment

2.08 These sets utilize a four- or six-cylinder diesel engine equipped with water pump, oil filter, electrical governor, fuel pump, and starting motor. Modifications to the lube oil system, lube oil sump, water cooling system, and fuel injection system were necessary to permit vertical operation. The entire system; engine, alternator, cooling system, exhaust gas system, fuel transfer system, completely automatic control system, batteries, battery charger, output protection, instrumentation, and control is contained in a metal, sound attenuated, floor standing cabinet mounted on a vibration isolation pad. The cabinet measures 86 inches high, 34 inches wide, and 36 inches deep. ♦The 24-kW set weighs approximately 1400 pounds, while the 40-kW set weighs approximately 1700 pounds. ♦

B. Engine Proper

2.09 ♦The 24-kW engine is a four-cylinder, in-line, four-cycle, overhead cam, water cooled diesel engine having a displacement of 89.77 cubic inches. The 40-kW engine is a six-cylinder, in-line, four-cycle, overhead cam, water cooled diesel engine having a displacement of 146 cubic inches. The 24-kW engine operates at 3600 rpm and has a maximum fuel consumption of 2.75 gallons per hour at 24 kW. The 40-kW engine operates at 3600 rpm and has a maximum fuel consumption of 4.13 gallons per hour at 40 kW.

2.10 For either engine, the crankcase is gray cast iron and the cylinder heads are cast aluminum. The crankshaft and connecting rods are forged steel. The pistons are steel reinforced aluminum. The 24-kW crankshaft has five main bearings and the overhead camshaft has five bearings. The 40-kW

crankshaft has seven main bearings and the overhead camshaft has four bearings. The 24-kW camshaft, intermediate shaft, and fuel injection pump are driven from the crankshaft by a toothed belt. The intermediate shaft drives the oil pump. The 40-kW camshaft is driven by a toothed belt from the crankshaft. The fuel injection pump is driven by the camshaft at its opposite end. The 40-kW oil pump is driven directly by the crankshaft.

2.11 Both 24- and 40-kW camshaft lobes act directly on calibrated adjustment discs on each cam follower. There is no conventional rocker arm adjustment; discs are changed at overhaul, if necessary, to adjust valve clearances. ♦The fan, fuel boost pump, and water pump are driven from the crankshaft. Glowplugs are used with a special solid-state relay and water temperature sensor during start. A spherical precombustion chamber gives the igniting fuel/air mixture a swirl pattern to optimize flame propagation and fuel economy.

C. Lubrication System

2.12 Thirteen quarts of oil are contained in the adapter oil sump. A low oil level switch is mounted in the sump to shut down the set should the level fall below four quarts. A dipstick in the sump is also provided. An oil temperature switch in the sump will initiate shutdown if oil sump temperature should exceed 250°F. An oil drain is provided for oil changes. The original engine oil pan has been replaced with a casting to adapt to the oil sump. Oil is drawn from the sump by a positive-displacement engine-driven pump and delivered to a full-flow, spin-on filter. Oil is pressure fed (minimum 40 psi at 3600 rpm engine speed) through internal passages to bearings, camshaft and other lubrication points. Pump pressure from the filter also charges a prelube accumulator through a check valve. Oil from the block and head returns by gravity feed through the pan and camshaft cover to the oil sump. During the start ♦of the 24-kW engine, ♦the normally closed accumulator solenoid valve is energized through the glowplug relay and opens to allow prelube oil to spray on the camshaft and cam followers. ♦During the start of the 40-kW, the normally closed accumulator solenoid valve is energized through the glowplug relay and opens to allow prelube oil to pass through the engine oil passage, lubricating all crankshaft and camshaft bearing surfaces. ♦During operation of the 24- or 40-kW engines, solenoid valve is closed and the accumulator is recharged through a check valve. For

the 24-kW engine, a positive crankcase ventilation tube carries crankcase fumes and oil mist from the oil pan to the air filter housing. For the 40-kW engine, a positive crankcase ventilation tube carries fumes and oil mist from the valve cover to the air filter housing. From there, the mixture enters the air intake ducts leading to the inlet valves. An oil pressure switch in the bottom of the head opens on increasing pressure and closes on decreasing pressure to shut down the engine in the event of oil pump failure.

D. Fuel System

2.13 The negative-head (15-foot lift maximum to base connection) fuel supply connects at the left rear of the enclosure base. Filtered fuel is delivered to the distributor type fuel injection pump. The fuel injection pump, driven by a toothed belt connected to the crankshaft on the 24-kW and to the camshaft on the 40-kW, pumps a precise amount of fuel at high pressure to the fuel injector for each cylinder, at the precise moment for injection. Surplus fuel from the injection pump and injectors is returned to the fuel cup and into the return line which terminates at a connection in the base for gravity flow to the supply tank. The fuel boost pump is a positive-displacement gear type pump driven at 3000 rpm and delivering 45 gallons per hour. The pump includes an adjustable bypass relief valve set to bypass back to the pump inlet when pressure exceeds 25 to 30 psi. The fuel filter element must be replaced at periodic intervals. The fuel injection pump and fuel injectors are critical parts of the sensitive fuel injection system. They operate with small tolerances and high pressures (1700 to 1850 psi). Faulty pumps are replaced, not repaired. Fuel injectors are tested and replaced if faulty. Diesel fuel with a Cetane rating greater than 45 is used.

E. Cooling System

2.14 The diesel engine-alternator set is cooled by a combination of forced air and liquid engine coolant. The engine coolant is a half-and-half mixture of low-mineral-content water and ethylene glycol-based antifreeze. Cooling air enters the bottom of the enclosure through the back panel and a portion is sucked into the bottom of the alternator, cooling the windings while the remainder flows around the alternator. A portion of this air enters the engine for combustion, but most is forced out the top of the enclosure, through the radiator, by an engine driven

fan. For the 24-kW engine, the fan moves 3000 cubic feet of air per minute through the radiator. For the 40-kW engine, the fan moves 4200 cubic feet of air per minute through the radiator. In passing through the compartment, it cools the oil sumps, exhaust pipe and muffler, and engine block. Engine coolant is propelled through the system by a centrifugal water pump, belt-driven at 3600 rpm from the crankshaft. On the 24-kW set, a thermostat on the pump housing blocks return of the coolant from the radiator and forces the coolant to circulate exclusively through a bypass loop (bypass hose with in-line heater, from the head back to the pump) until the coolant warms. On the 40-kW set, the thermostat is located on the left side of the engine block. At approximately 180°F, the thermostat begins to open and allows coolant from the radiator to circulate in the system. At approximately 198°F, full flow is through the radiator and the bypass is closed. Coolant level in the system is above the radiator, in a fill neck with a pressure cap (14 to 17 psi). The low water level switch is mounted in the expansion tank adjacent to the fill neck. Water vapor from the top end of the block is routed through a 1/4-inch ID hose to the radiator. A coolant temperature sensor (related to operation of the glowplug relay) and a coolant temperature switch are located at the bottom end of the head. The switch will close at 230 ±5°F to shut down the engine, as will the low water level switch in the radiator if the coolant level falls. The bypass hose from the "heater" port in the bottom end of the head includes an optional immersion heater with a thermostat switch which is closed at 100°F and opens at 120°F coolant temperature.

F. Electrical System

2.15 The alternator is a 24-kW or 40-kW, two-bearing, brushless, rotating field type. The sets include:

- A battery ammeter
- Six-digit hourmeter (99,999.9)
- A power meter scaled from 0 to 30 kW for the 24-kW set or from 0 to 50 for the 40-kW set. Both have input from a power transducer.
- 0 to 250V ac voltmeter (commercial or alternator)
- 0 to 100A ac ammeter (alternator) for the 24-kW sets and a 0 to 150A ac ammeter (al-

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ternator) for the 40-kW sets—three phase sets

- 0 to 150A ac ammeter (alternator) for the 24-kW set and a 0 to 250A ac ammeter (alternator) for the 40-kW set—single-phase sets
- 55 to 65 Hz frequency meter
- Voltmeter and ammeter selector switches
- J85520 microcomputer controller.

2.16 The set has a 12-volt engine start system and a 24-volt control system. Each system has its own 12-volt battery with a common charger. Twenty-four volt power is supplied by the 281B 12-to-24 volt converter. The 24-volt system includes the J85520 microcomputer controller: 202E1 provides two power supplies for plus and minus 12V dc, and 203B provides plus 5V dc. The 12-volt engine battery system provides power for the glowplugs, fuel solenoid, electronic governor system and starter motor. On start command, the glowplug relay is energized and contacts close to energize the plugs and prelube relay with 12V dc. When water temperature permits, the crank relay, starter, solenoid relay, and the electronic governor are energized by the microprocessor and contacts close to energize the starter, governor and fuel solenoid, and the starter cranks. Cranking stops and glowplugs are deenergized when 15 percent speed is reached, deenergizing the crank relay.

3. OPERATION

INTRODUCTION

3.01 The power plant is fully automatic and should require no day-to-day routine adjustments. Normally, the plant is in a standby condition, ready to assume the office load should commercial ac power fail.

Danger: Hazardous voltages and currents may be encountered in the J86657 power plants. Avoid all contact with terminals to prevent injuries from occurring. Do not allow a test pick to touch two metal parts at the same time as dangerous and destructive short circuits may occur.

OPERATING PROCEDURES

3.02 To place the diesel-alternator in automatic standby operation, perform the following:

- (1) Verify that commercial service is available on terminals 1, 2, and 3 to power the ac service failure monitors.
- (2) Verify that essential service is available on terminals 5 and 6 to power the battery charger and immersion heater.
- (3) Verify toggle switches S109, S110, and S111 are closed. S111 controls the immersion heater and may be left open during summer conditions.
- (4) Close circuit breakers CB1, CB2, CB3, CB5, CB6, and CB7. Close CB4 located on the control panel last.
- (5) Note that indicators MAJ CB and NCB CLOSE are energized.
- (6) Operate the RESET/STOP pushbutton to clear the MAJ CB alarm.
- (7) On the 40-kW, List 103, place the Operation Selector Switch in the auto position.
- (8) The power plant is now ready for automatic standby service.

Note: Detailed operating procedures for routine maintenance, acceptance, company order, and trouble clearing tasks are contained in the associated TOP Section 155-197-001.

3.03 Mounted on the control panel (Fig. 4) are the following controls, instruments and indicators:

- Kilowatt Meter:** The kilowatt meter monitors alternator output power. The scale on the 24-kW unit ranges from 0 to 30 kW. On the 40-kW sets, the scale is 0 to 50 kW.
- AC Voltmeter:** The ac voltmeter displays commercial or alternator line-to-line or line-to-neutral voltage selected with voltmeter selector switch. The scale on the voltmeter ranges from 0 to 250V.
- AC Ammeter:** The ac ammeter displays alternator output amperage on the line selected with the selector switch. For the 24-kW sets, the single-phase units have scales from 0 to 150A while the three-phase units have scales from 0 to

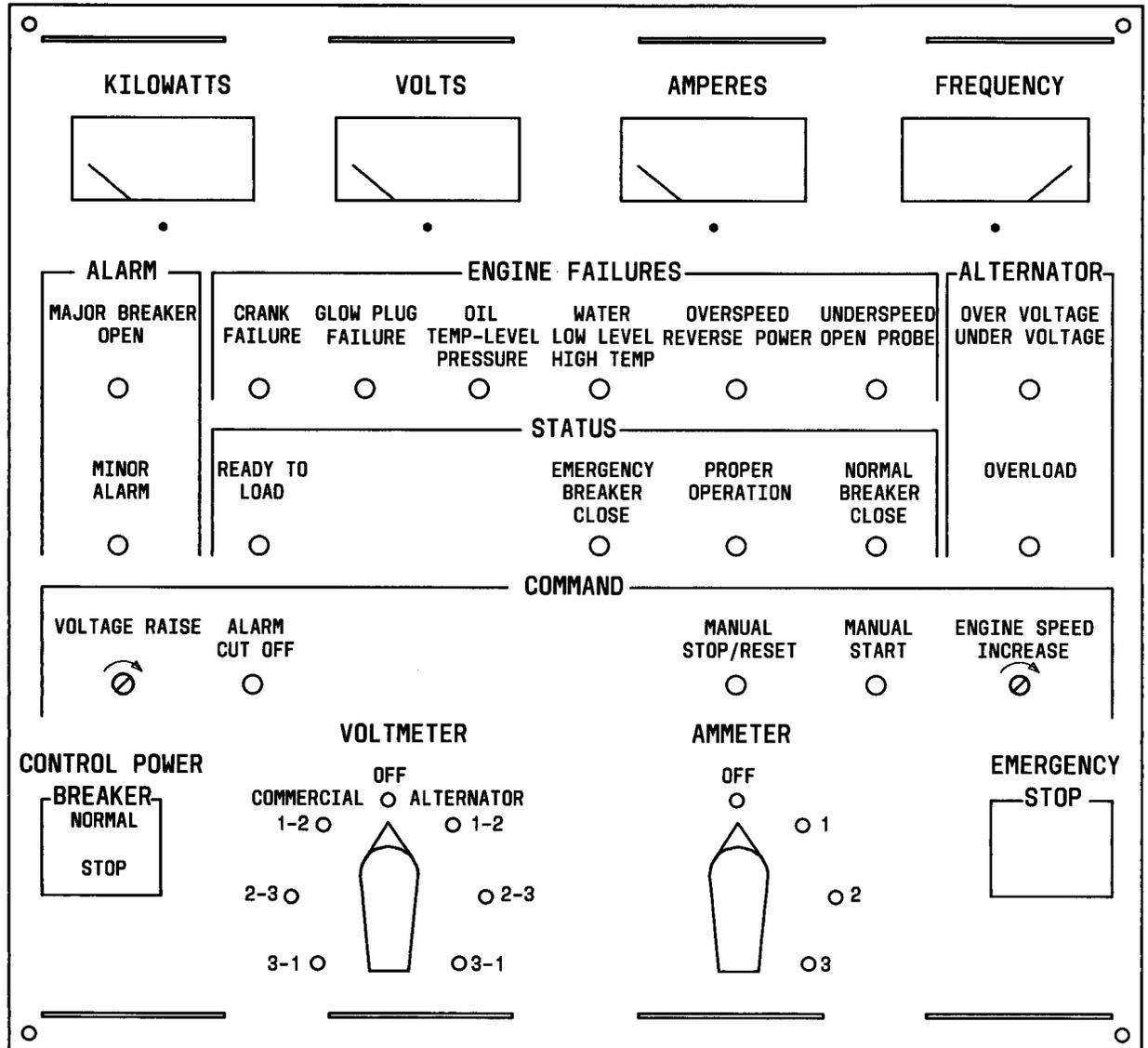


Fig. 4—Typical J86657 24- or 40-kW Control Panel

100A. For the 40-kW sets, the single-phase units have scales from 0 to 250A while the three-phase units have scales from 0 to 150A.

(d) **Frequency Meter:** The frequency meter monitors output frequency (frequency may be controlled by adjusting the Engine Speed Increase Rheostat). The scale is from 55 to 65 Hz.

(e) **Alarm LEDs:** One of two alarms light to indicate that either a major breaker is open or a minor alarm condition exists.

(f) **Engine Failure LEDs:** The alarms consist of separate LEDs that light to indicate:

- (1) Cranking failure
- (2) Glowplug failure
- (3) Low oil pressure, high oil temperature, low oil level
- (4) Low coolant level, high coolant temperature

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- (5) Overspeed or reverse power
- (6) Underspeed or open probe.
- (g) **Alternator LEDs:** One of two alarms light to indicate either an over or undervoltage (one alarm) condition exists or that an overload condition exists (separate alarm).
- (h) **Status LEDs:** Individual lights indicate the following:
 - (1) The alternator is ready to load
 - (2) The emergency breaker is closed
 - (3) The set is operating properly
 - (4) The normal breaker is closed
 - (5) Only on the List 103 of the 40-kW set (Fig. 5), the alternator circuit breaker is open
 - (6) Only on the List 103 of the 40-kW set, the alternator circuit breaker is closed.
- (i) **Command Controls:** The following group of devices control the engine-alternator sets:
 - (1) **Voltage raise rheostat** increases voltage with a clockwise motion
 - (2) **Alarm cutoff pushbutton** deactivates alarm circuits
 - (3) **Manual stop/reset pushbutton** clears alarms and stops the unit
 - (4) **Manual start pushbutton** activates unit
 - (5) **Engine speed increase rheostat** increases frequency with a clockwise motion
 - (6) **Alternator circuit breaker open pushbutton** (only with the 40 kW, List 103) opens the alternator circuit breaker
 - (7) **Alternator circuit breaker close** (only with the 40 kW, List 103) closes alternator circuit breaker
- (j) **Control Power Breaker:** This switch opens or closes the power circuit breaker. The switch

is mounted on the left bottom part of the control panel.

- (k) **Operation Selector Switch:** (only with the 40 kW, List 103) allows operator to put the set in manual or automatic operation.
- (l) **Voltmeter Selector Switch:** This seven position switch allows the operator to select the voltage displayed on the voltmeter.
- (m) **Ammeter Selector Switch:** This four-position switch allows the operator to select which current phase is displayed on the ammeter.
- (n) **Emergency Stop Pushbutton:** This pushbutton disables the alternator set. The pushbutton is located on the lower right part of the control panel.

PARALLELING THE 40-KW, LIST 103 SET

Danger: Only the KS-22344, L103, units should be paralleled.

3.04 The following instructions cover paralleling a 40-kW, KS-22344, L103, manually controlled set with another 40-kW, KS-22344, L103 set. In order to parallel the two sets they must be connected electrically. Refer to SD-82527-01 for proper installation of interconnection wiring. At this time, paralleling a 40-kW, KS-22344, L103 with another set, not of the same rating, is possible but not without analysis.

3.05 To parallel two isochronous 40-kW, KS-22344 (List 103) sets, one of which is running and carrying load, the following procedures are performed on the incoming set:

- (a) Move the OSS (operation selector switch) of the oncoming set to the MANUAL operation position.
- (b) Depress and hold the MANUAL START pushbutton until the contacts close. This action energizes the glowplugs and prelubes the crankshaft and camshaft.
- (c) After the oncoming set has started, adjust both sets so that the voltages of the oncoming

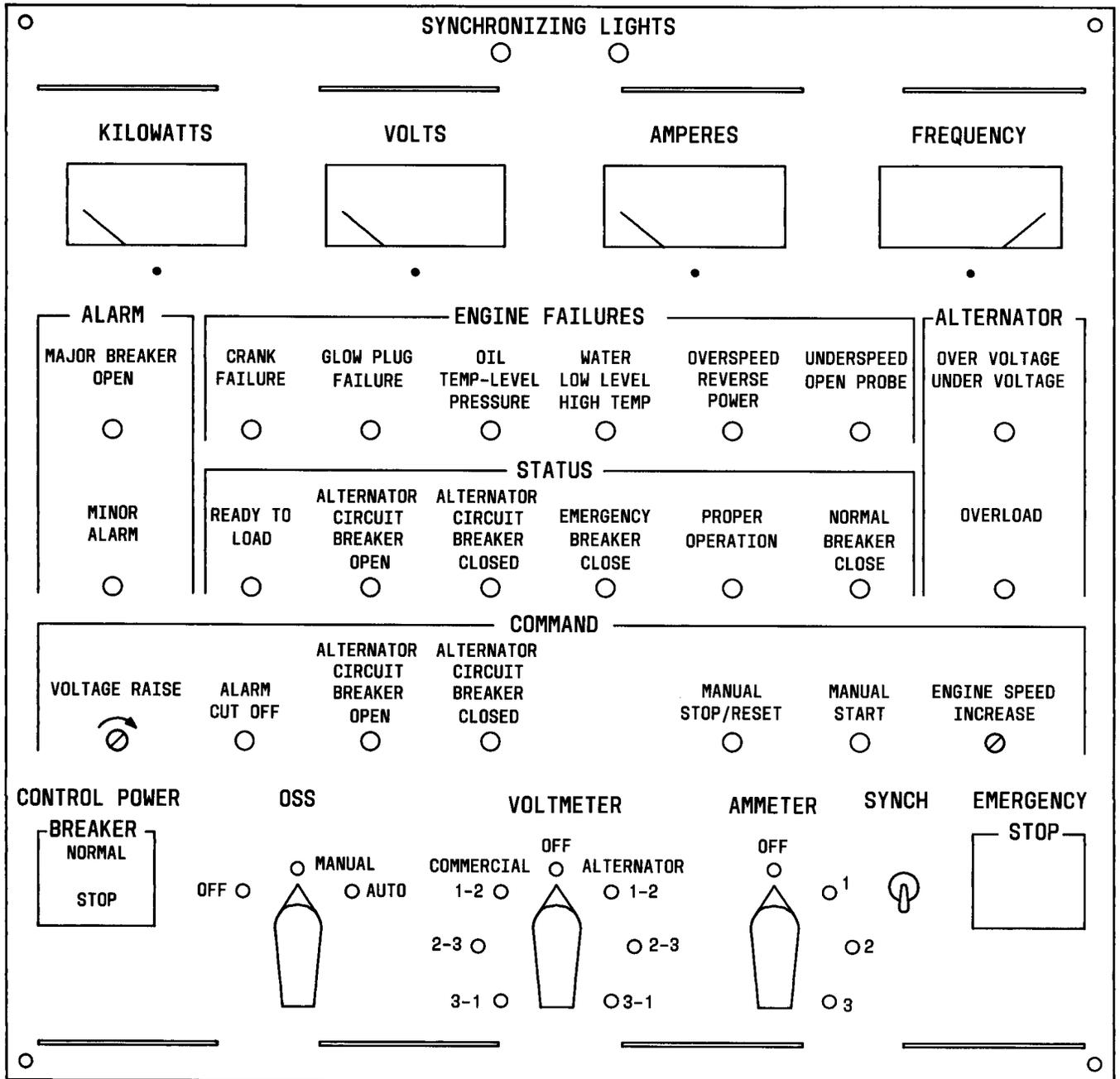


Fig. 5—Typical J86657 KS-22344, L103, 40 kW Control Panel

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set and the operating set are the same, as indicated by the panel voltmeters.

- (d) Operate the SYNCH switch of the oncoming set to the ON position.
- (e) Match the frequency of the oncoming set to the operating set by actuating the ENGINE SPEED INCREASE in a clockwise or counter-clockwise direction of the oncoming set as necessary, until both sets are operating at the same frequency. A slow increase and decrease in brilliancy of the SYNCHRONIZING LIGHTS will indicate when both sets are operating at the same frequency.
- (f) Estimate the time interval during the period when the lamps are dark or least brilliant.
- (g) At the midpoint of the dark or least brilliant period, parallel the sets by depressing the ALTERNATOR CIRCUIT BREAKER CLOSE pushbutton of the oncoming set.
- (h) Operate SYNCH switch to the OFF position.

STOPPING PARALLELED 40-KW, KS-22344, L103 UNITS

3.06 Stopping the 40-kW, KS-22344, L103, sets may be accomplished as follows:

- (a) Reduce the nonessential load (devices such as elevators, lights, etc) by opening the appropriate circuit breakers.

Caution: *The combined kW readings of the two units must not exceed the rating of the running set.*

- (b) If one set is capable of handling the load, transfer the load from one set (shut down set)

to the other set (running set) by operating the ALTERNATOR CIRCUIT BREAKER OPEN pushbutton on the shutdown set.

- (c) Stop the shutdown set by moving the OSS to the OFF position.
- (d) The running set will shutdown automatically after the load has automatically transferred to commercial power and the run timer has timed out.⚡

4. MAINTENANCE

INTRODUCTION

4.01 For proper operation of the J86657 power plant, scheduled maintenance must be performed on the plant. A properly maintained power plant provides identification of trouble conditions. The plant may be operated in manual mode for tests and adjustments.

4.02 Craft personnel are notified of trouble conditions by audible and visible major and minor alarms.

MAINTENANCE TASKS

4.03 Routine, acceptance, and trouble clearing procedures are contained in TOP Section 155-197-001.

ACCESSIBILITY

4.04 The front of the cabinet is hinged to permit access to the diesel-alternator. Both side panels may be removed for maintenance purposes.