KS-22673, LISTS 1 THROUGH 8
TURBINE ENGINE-DRIVEN ALTERNATOR
750/900 KW AUTOMATICALLY OR MANUALLY CONTROLLED
REQUIREMENTS AND ADJUSTING PROCEDURES

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1. GENERAL

INTRODUCTION

1.01 This section covers the apparatus requirements and adjusting procedures for the KS-22673, Lists 1 through 8, automatically or manually controlled, turbine engine-driven alternators.

1.02 The Equipment Test List is affected.

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

1.03 These sets are manufactured by Solar Turbines Incorporated. The sets have a base capacity of 938 kilovolt-amperes (kVA), 750 kilowatts (kW) at 0.8 lagging-to-unity power factor, and a peak capacity of 1125 kVA and 900 kW. Depending upon the list number, the sets are rated at 208, 230/240, 480, or 4160 volts, and are arranged for 60-Hz, 3-phase, 4-wire, ABC-phase rotation, with manual or automatic control. List numbers are used to identify sets as follows:

List 1—208-Volt Alternator Set, On-Set Control

List 2—230/240-Volt Alternator Set, On-Set Control

List 3—480-Volt Alternator Set, On-Set Control

List 4—208-Volt Alternator Set, Arranged for Remote Control and Equipped With Remote Control Circuit for Use With List 9 or 10 Remote Control Cabinet

List 5—230/240-Volt Alternator Set, Arranged for Remote Control and Equipped With Remote Control Circuit for mounting in a List 9 or 10 Remote Control Cabinet

List 6—480-Volt Alternator Set, Arranged for Remote Control and Equipped With Remote Control Circuit for Use With List 9 or 10 Remote Control Cabinet

List 7—4160-Volt Alternator Set, Arranged for Remote Control and Equipped With a 208-Volt Remote Control Circuit for mounting in a List 9 or 10 Remote Control Cabinet

List 8—4160-Volt Alternator Set, Arranged for Remote Control and Equipped

With a 480-Volt Remote Control Circuit for mounting in a List 9 or 10 Remote Control Cabinet

List 9—Remote Control Cabinet for One or Two List 4, 5, 6, 7, or 8 Remote Control Circuits

List 10—Remote Control Cabinet for One, Two, or Three List 4, 5, 6, 7, or 8 Remote Control Cabinet

List 11—Inlet Silencer

List 12—Inlet Flexible Section

List 13—Turbine Exhaust Silencer (Moderate Degree of Attenuation)

List 14—Turbine Exhaust Silencer (High Degree of Attenuation)

List 15—Turbine Oil Mist Precipitator.

1.04 Reference shall be made to Section 020-010-711 for additional information covering general requirements and definitions.

1.05 ***Asterisk (*):*** Requirements marked with an asterisk necessitate dismantling or dismounting of apparatus or involve adjustments. No check is necessary unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

Danger: Because the sets may be arranged to start automatically, voltages are present within the main or remote control panel. It is necessary before making any adjustments on either the set or its control equipment to render the automatic control and dc equipment inoperative. To accomplish this, follow the instructions covered in Section 155-211-301. Rendering the set inoperative does not remove hazardous voltage from the commercial side of the line.

1.06 Hunting, as applied to engines, is a condition where the speed of the engine is periodically rising and falling. Hunting is sometimes continuous and sometimes intermittent.

1.07 The information contained in this section takes precedence over the manufacturer's manual wherever differences occur. For example, some cleaning fluids are prohibited by telephone operating companies.

Danger 1: When working around an engine, particularly near any part of the fuel system, avoid the use of an open flame or a portable lamp without a suitable protecting guard.

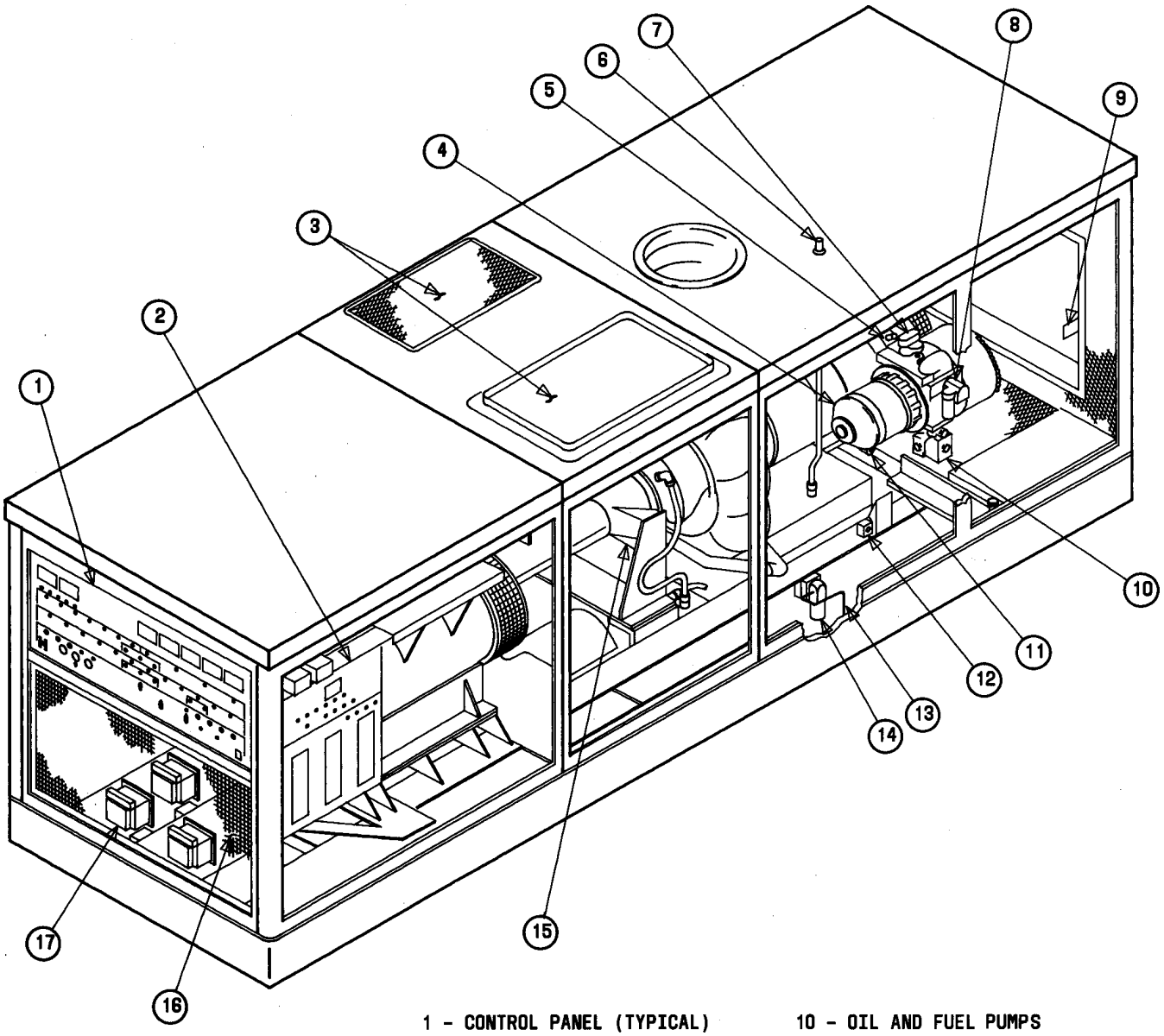
Danger 2: The gases present in an empty or partially filled fuel tank are highly explosive. Do not attempt to expel these gases by flushing the tank with water. This will not provide adequate protection.

1.08 If the fuel tank or piping, including vent and fill pipes, requires repairs involving the use of an open flame or of tools likely to cause sparks, discuss the matter with the supervisor. The supervisor may find it desirable to have a new tank or piping provided or may obtain the services of a specialist to repair the tank or piping. (Refer to Section 065-320-301, Engine Fuel and Care of Fuel Tanks.)

1.09 Procedures included in this section for maintaining the requirements parallel in part with the information contained in the Solar Turbines Incorporated Instruction Manual SD-3270 which will be furnished with each set. This manual covers in detail additional information which would be required for complete servicing or overhaul of the equipment and for general everyday maintenance. See Fig. 1 and 2.

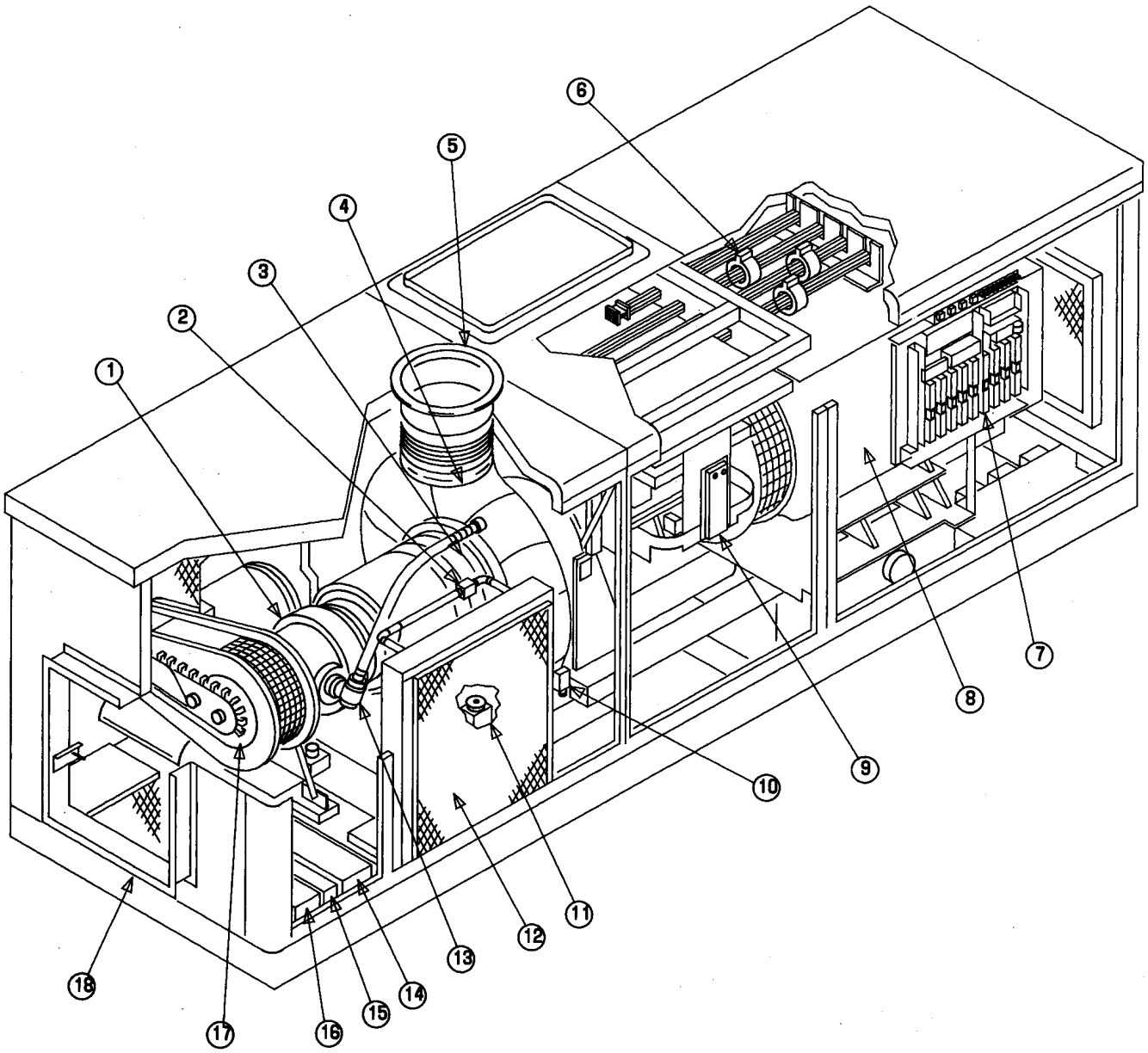
1.10 The following sections and drawings may be helpful in locating problems or in adjustment procedures with the Turbine Engine-Driven Alternator and its components listed in this section:

SECTION	TITLE
010-700-010	Engineering Complaints Origination and Processing
020-010-711	General Information
065-320-301	Engine Fuel Storage Operating Methods
155-211-301	KS-22673, L1 through L8, Gas Turbine Engine-Alternator Operating Methods
171-123-101	Test Loads for Power Equipment, Description



1 - CONTROL PANEL (TYPICAL)
2 - VOLTAGE REGULATOR PANEL
3 - COOLING VENTS
4 - STARTER
5 - MAGNETIC PICKUP NO. 1 SPEED MONITOR
6 - OIL TANK VENT
7 - HYDRAULIC PUMP
8 - HIGH PRESSURE FUEL FILTER
9 - T1 SENSOR
10 - OIL AND FUEL PUMPS
11 - IGNITION EXCITER
12 - CRANK/PURGE SWITCH
13 - CUSTOMER FUEL INLET
14 - FUEL STRAINER
15 - REDUCTION DRIVE
16 - ALTERNATOR VENTILATION AIR INTAKE
17 - POTENTIAL TRANSFORMERS

Fig. 1—Alternator Set Major Components—Right Side



1 - TURBINE ENGINE
2 - THERMOSTATIC MIXING VALVE
3 - TEMPERATURE SENSORS (T5)
4 - TEMPERATURE SENSORS (T7)
5 - EXHAUST
6 - CURRENT TRANSFORMERS (TYPICAL)
7 - CUSTOMER TIE POINTS
8 - ALTERNATOR
9 - ALTERNATOR CIRCUIT BREAKER (TYPICAL)
10 - OIL TEMPERATURE SWITCH
11 - OIL FILLER
12 - OIL COOLER AND FAN MOTOR
13 - BLEED AIR VALVE
14 - FUEL BOOST PUMP
15 - OIL FILTER
16 - FUEL FILTER
17 - MAGNETIC PICKUP NO. 2 (FUEL CONTROL)
18 - ENGINE AIR INTAKE

Fig. 2—Alternator Set Major Components—Left Side

DRAWINGS	DESCRIPTION
SD-82581-01	208, 230/240 or 480-Volt Set, Local or Remote Control
SD-82582-01	Plant Circuit 4160-Volt Set, Arranged for Remote Control
SD-82583-01	208, 230/240, 480, or 4160-Volt Remote Control Circuit.

SUBDIVISIONS

1.11 Information in both Part 3, REQUIREMENTS, and Part 4, ADJUSTING PROCEDURES, has been arranged to correspond with each topic as shown in Table A.

2. APPARATUS

2.01 ***List of Tools, Gauges, Test Equipment, and Materials (Equivalents may be substituted):*** In addition to the tools and instruction information furnished with the engine, the following list of tools, gauges, test equipment, and materials, or equivalents, is required for the completion of the requirements and adjusting procedures in this section.

TOOLS	DESCRIPTION
—	Hand Suction Pump or Portable 55-gallon drum with a mounted hand pump
—	Hand-type Grease Gun, such as Lincoln Engineering Co. No. 5958
KS-14797	Oiler
—	Torque Wrench with 0 - 100 pound-feet capacity
—	Bleeder valve & gauge
—	Brush Spring Lifter-(fabricated from 1/8-inch welding rod or stiff wire)
—	Hot Plate (or other safe source of heat)
—	Vacuum Cleaner

GAUGES	DESCRIPTION
—	MINIMITE* (Model 31101) Pyrometer Indicator
R-1032	Thermometer
—	Spring Tester
R-3076	Manometer

TEST EQUIPMENT	DESCRIPTION
ADM-5	Cathrode-Ray Tube (CRT)† Display Terminal

MATERIALS	DESCRIPTION
KS-20599, L4	Digital Multimeter (DMM) or equivalent
KS-7993	Test cords, 2 conductor, 9 feet 6 inches long, 2 spaded tips at each end
KS-20538	Volt-Ohm-Milliammeter
RS-2732	Adapter Cable

MATERIALS	DESCRIPTION
—	0.032-inch diameter Stainless Steel Lockwire
—	0.020-inch diameter Stainless Steel Lockwire
KS-16321	Lube Oil
KS-7473	Bearing Grease, Sodium-Lithium
—	Base Stoddard Solvent
—	Drain Container
—	Lint Free Cloth
—	150 Grit Sandpaper

*Trademark of Thermo Electric Company

†Manufactured by Lear Siegler, Inc.

TABLE A

REQUIREMENT AND PROCEDURE INDEX

HEADINGS	REQUIREMENTS PARAGRAPH NO.	PROCEDURE PARAGRAPH NO.
LUBRICATION		
Lubrication and Recommended Intervals	3.01	4.01
Lube Oil Tank	3.02	4.02
Lube Oil Conditions	3.03	4.03
Alternator	3.04	4.04
Precipitator, Turbine, and Oil Mist	3.05	4.05
Record of Lubrication	3.06	4.06
Lubrication Oil Pressure	3.07	4.07
Lubrication Oil Temperature	3.08	4.08
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Alllowable Exhaust Back Pressure Versus Inlet Restriction	3.11	4.11
Exhaust Temperature	3.12	4.12
Fuel Manifold and Nozzle Assembly	3.13	4.13
Fuel System Filter Assembly	3.14	4.14
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Fuel Strainer	3.17	4.17
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AUTOMATIC SHUTDOWN AND ALARM DEVICES		
Overspeed Shutdown Device	3.27	4.27
Lube Oil Pressure Switch	3.28	4.28
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Shear Coupling Replacement	3.30	4.30
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Voltages	3.31	4.31

TABLE A (Contd)

REQUIREMENT AND PROCEDURE INDEX

HEADINGS	REQUIREMENTS PARAGRAPH NO.	PROCEDURE PARAGRAPH NO.
STARTING SYSTEM		
Starting and Control Batteries	3.32	4.32
Starter Motor Brush Removal and Replacement	3.33	4.33
Igniter (Spark) Plug	3.34	4.34
Lockwiring	3.35	4.35
TEST AND ROUTINE RUNS		
Test Run	3.36	4.36
Routing Run	3.37	4.37
CONTROL EQUIPMENT		
Microcomputer Controller	3.38	4.38
Timers	3.39	4.39

3. REQUIREMENTS

LUBRICATION

3.01 ***Lubrication and Recommended Intervals:*** This specification establishes criteria to determine when a lube oil change is required and provides a recommended lube oil change and oil sampling procedure. Lube oils listed in Table B may be used.

3.02 ***Lube Oil Tank:*** Before the start of each run, the lube oil level should be at the FULL mark on the dipstick. Check after each 24 hours of continuous operation. There is no need to change lube oil that was previously listed in this section unless:

(1) The lube oil has been in use for 500 hours or more of engine operation.

(2) The lube oil is found unsatisfactory as a result of chemical analysis.

Note 1: If either condition (1) or (2) applies, the commercial oils listed in Table B should be used immediately.

Note 2: Used lube oil must be subjected to periodic chemical analysis to assure that its condition is satisfactory. In this manner the lube oil tank need only be drained and filled when the lube oil condition is unsatisfactory. It is recommended that lube oil samplings be taken after each quarterly exercise routine described in paragraph 3.37.

TABLE B

RECOMMENDED LUBE OIL

BRAND NAME	POUR POINT°F	APPLICATION (SEE NOTE)	OIL COMPANY
SHC-824 BRAYCO-778 SUNTHETIC-35	—65°	All Climates	MOBIL BRAY SUN
DTE-LIGHT TERESTIC-43	+20° +15°F	Average Ambient Temperature	MOBIL EXXON
TERESTIC-47	+15°F	Higher Ambient Temperature	EXXON

Note: Oil tank temperature shall be 10°F above the pour point or higher at engine start up.

3.03 ***Lube Oil Conditions:*** If the lube oil is found to exceed the following parameters, it is to be considered unsatisfactory.

(1) The viscosity exceeds plus 25 percent or minus 10 percent as compared to its original viscosity.

(2) The water content of the oil exceeds 2000 PPM.

(3) The neutralization (acid) number of the lube oil exceeds 1.0 or shows an aggregate change over the base lube oil greater than 0.5.

(4) The content of silicon (dust) in the lube oil exceeds 15 PPM.

3.04 ***Alternator:*** The alternator bearings are lubricated at the following intervals.

(1) Front alternator bearings are lubricated after each 3200 hours of operation.

(2) Rear alternator bearings are lubricated after each 3200 hours of operation.

3.05 ***Precipitator, Turbine, and Oil Mist:*** An oil mist precipitator, L15, has been made available as an option for use with the KS-22673 gas turbine to eliminate the visible oil mist that normally emanates from the lube oil tank breather pipe. When the precipitator is operating properly, a pilot lamp located on the control panel glows continuously. If the lamp glows intermittently, trouble exists in that "heavy dirt" exists in the system and will subside when proper circulation is obtained.

3.06 ***Record of Lubrication:*** A record of lubricating oil used in the turbine shall be kept during the installation period. This record should include the type and batch number of the lube oil, the initial quantity placed in the lube oil tank, and the quantity of makeup added. The record of lubrication, with the accrued number of starts and hours of operation noted therein, shall be turned over to the operating company with the equipment.

3.07 ***Lubricating Oil Pressure (Fig. 3):*** During engine operation, if the pressure fails to build up to 33.75 to 36.25 pounds per square inch gauge (psig) or drops below 24.5 psig above 66 percent speed, the OIL PRESSURE switch is activated, the LOW OIL PRESSURE LED on the control panel will light, an alarm will sound, and the engine will shut down.

3.08 ***Lubricating Oil Temperature:*** During engine operation, the temperature of the lubricating oil should not exceed 182°F; if it does, the oil temperature switch will activate, and the HIGH LUBE OIL TEMP LED on the control panel will light, an alarm will sound, and the engine will shut down.

ENGINE

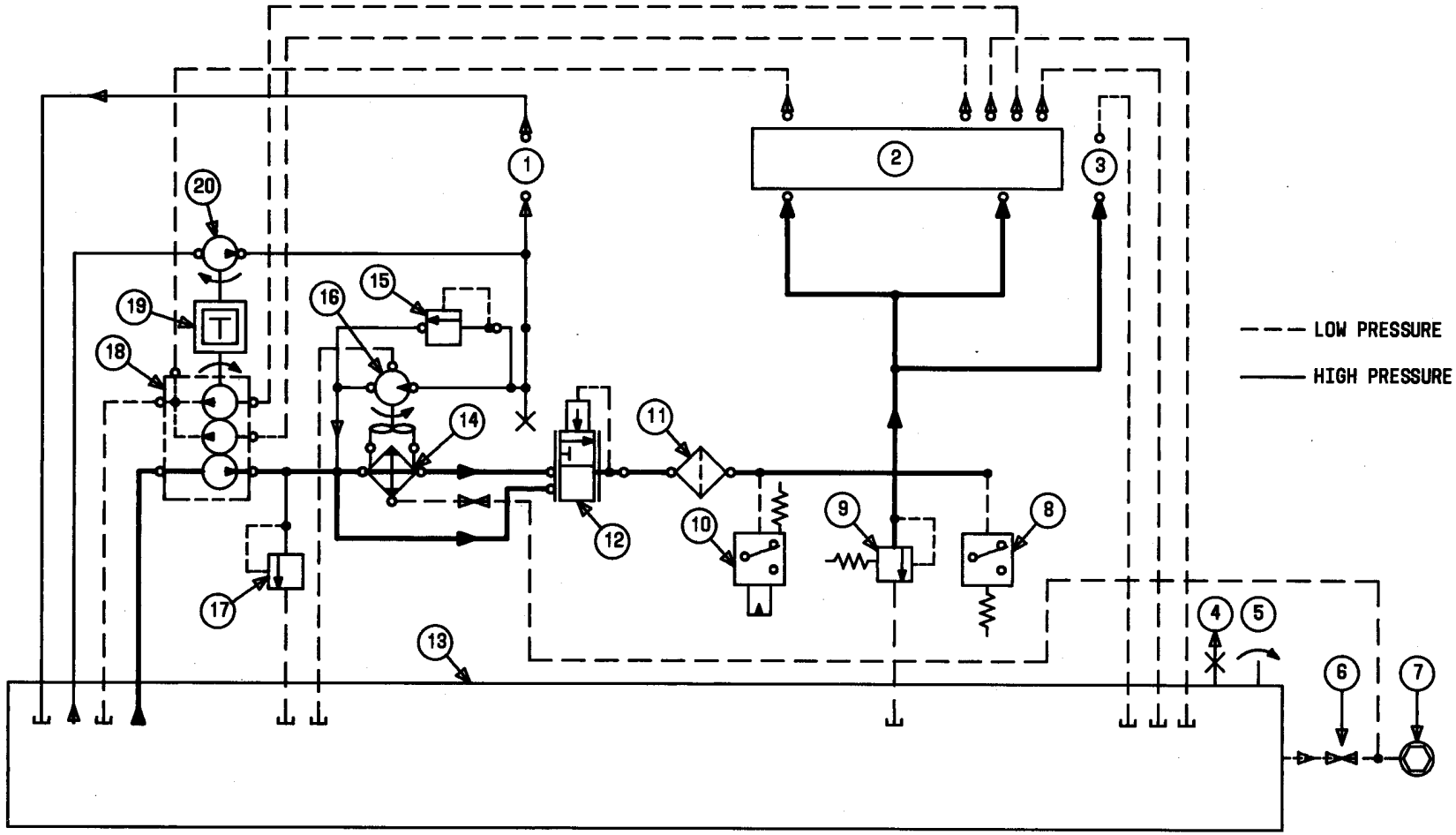
3.09 ***Speed:*** The speed of the set at all loads between no-load and full load shall be such that the frequency shall remain at the reference frequency of 60 Hz displayed by the FREQUENCY meter located on the control panel.

3.10 ***Power:*** The capacity of the set will vary with altitude, combustion air inlet temperature, and inlet and exhaust losses. Table C gives the maximum alternator output in KW for various combinations of altitude and inlet temperature. The temperatures are for the combustion air entering the turbine enclosure inlet flange. The power output values are based on zero inlet and exhaust losses. Tables D and E are to be used to correct the output values from Table C for input and exhaust losses. The formula for the correct power value is as follows:

Maximum Power Output = Output at Zero Loss ***less inlet and exhaust losses***

3.11 ***Allowable Exhaust Back Pressure Versus Inlet Restrictions:*** The maximum exhaust back pressure allowed per inlet restriction is as follows:

INLET RESTRICTION INCHES OF WATER	MAXIMUM ALLOWABLE BACK PRESSURE INCHES OF WATER
1	10
2	8
3	6



1 – ACTUATOR
2 – ACCESSORY DRIVE AND BEARINGS 1, 2, AND 3
3 – REDUCTION DRIVE
4 – TANK FILL
5 – TANK VENT
6 – HAND VALVE FOR TANK DRAIN
7 – DRAIN
8 – PRESSURE SWITCH
9 – PRESSURE CONTROL VALVE
10 – OIL TEMPERATURE SWITCH
11 – OIL FILTER
12 – TEMPERATURE CONTROL VALVE
13 – OIL TANK
14 – OIL COOLER
15 – RELIEF VALVE
16 – HYDRAULIC MOTOR
17 – RELIEF VALVE
18 – HYDRAULIC PUMP
19 – TURBINE ENGINE
20 – HYDRAULIC PUMP

Fig. 3—Lubrication System Schematic

TABLE C

MAXIMUM POWER (KILOWATTS) FOR ALTITUDE AND INLET AIR TEMPERATURE (ZERO LOSSES)

ALTITUDE—FEET	INLET AIR TEMPERATURE, °F										STANDARD PRESSURE INCH HEIGHT
	-20	0	+20	+40	+60	+75	+80	+90	+100	+120	
Sea Level						900	880	815	780	670	29.92
500					900	880	860	800	765	655	29.38
1000					900	870	850	785	750	645	28.86
1500					900	855	835	775	740	635	28.33
2000					900	840	820	760	730	625	27.82
2500					900	825	810	750	715	615	27.31
3000				900	880	810	790	730	700	600	26.81
3500				900	860	790	775	715	685	590	26.32
4000				900	850	780	765	710	680	580	25.84
4500				900	830	770	755	700	670	575	25.36
5000				900	825	755	740	685	655	565	24.89
5500			900	895	815	745	730	675	645	555	24.43
6000			900	885	805	740	720	665	640	550	23.93

TABLE D

POWER LOSS IN KILOWATTS FOR INLET LOSS

INLET LOSS INCHES OF WATER	OUTPUT POWER (KILOWATTS) FROM TABLE C							
	550	600	650	700	750	800	850	900
0	0	0	0	0	0	0	0	0
1	3.4	3.6	3.8	4.0	4.2	4.3	4.5	4.7
2	6.8	7.2	7.6	8.0	8.4	8.6	9.0	9.4
3	10.2	10.8	11.4	12.0	12.6	12.9	13.5	14.1

TABLE E

POWER LOSS IN KILOWATTS FOR EXHAUST LOSS

EXHAUST LOSS INCHES OF WATER	OUTPUT POWER (KILOWATTS) FROM TABLE C							
	550	600	650	700	750	800	850	900
0	0	0	0	0	0	0	0	0
1	2.1	2.2	2.25	2.3	2.4	2.45	2.5	2.6
2	4.2	4.4	4.5	4.6	4.8	4.9	5.0	5.2
3	6.3	6.6	6.75	6.9	7.2	7.35	7.5	7.8
4	8.4	8.8	9.0	9.2	9.6	9.8	10.0	10.4
5	10.5	11.0	11.25	11.5	12.0	12.25	12.5	13.0
6	12.6	13.2	13.5	13.8	14.4	14.7	15.0	15.6

3.12 ***Exhaust Temperature:*** The exhaust temperature and temperature reading devices should be checked as follows:

(a) When the set is operating at maximum power output, and with back pressure not in excess of requirements in paragraph 3.11, the engine exhaust temperature shall not exceed 945°F. Use the exhaust temperature meter located on the control panel.

(b) After every 100 hours of engine operation or after 50 starts, whichever occurs first, check the condition of the exhaust thermocouple assembly installed in the exhaust collector. Inspect assembly and each thermocouple for signs of erosion, broken, or bent wire, or other visible damage.

Warning: Avoid the use of any fuel oil which contains any trace of acid. Its presence in the fuel oil will be injurious to numerous parts of the fuel injection equipment. Etching or corrosion of the nozzles, nozzle valves, bodies, pumps, etc, due to acids will greatly impair their efficiency and may destroy their function.

3.13** ***Fuel Manifold and Nozzle Assembly: The fuel nozzles and holders (Fig. 4) shall be clean and free from acid, gum, dirt, or any other foreign material. The type and cleanliness of fuels affect the maintenance schedule for the nozzles and holders. It is recommended that an inspection be made after 1000 hours of engine operation or after 200 starts, whichever occurs first.

Note: The presence of acid in fuel oil may be detected by dipping one end of a piece of Fisher Alkacid Test Ribbon in the fuel oil for a few seconds. If the fuel is free of acid, the ribbon will turn blue or green. If the fuel contains acid, the ribbon will turn yellow, orange, or red depending upon the degree of acidity.

3.14 ***Fuel System Filter Assembly (where provided):*** In connection with the storage of fuel oil, care should be exercised to prevent dirt from entering the fuel storage tanks. Refer to Section 065-320-301 for information on recommended fuels and requirements for handling and storage. See Fig. 4 for the fuel schematic. A fuel filter/water separator assembly (if provided) is to be installed between the main tank and the day tank (if provided) to assure cleaner fuel; if a day tank is not provided, the filter assembly will be installed between the main tank and the alternator set. Filter elements (2) shall be replaced after 100 hours of engine operation or after 50 starts.

Note: If a fuel system filter assembly is provided or the day tanks are not provided, it will be necessary to take into account a pressure drop of 4-1/2 psi maximum (11 feet of fuel) across the filter in computing the total lift required for the engine boost pump or the auxiliary pumps.

3.15 ***Low Pressure Fuel Filter (5 Micron):*** The low pressure fuel filter (Fig. 4) is a full-flow filter with 2 micron filter elements. The filter is located between the boost pump and the engine-driven fuel pump. The filter also acts as a reservoir to ensure a fuel source to the fuel pump during initial engine starting. Elements should be replaced when the high-pressure fuel filter element (paragraph 3.16) is replaced.

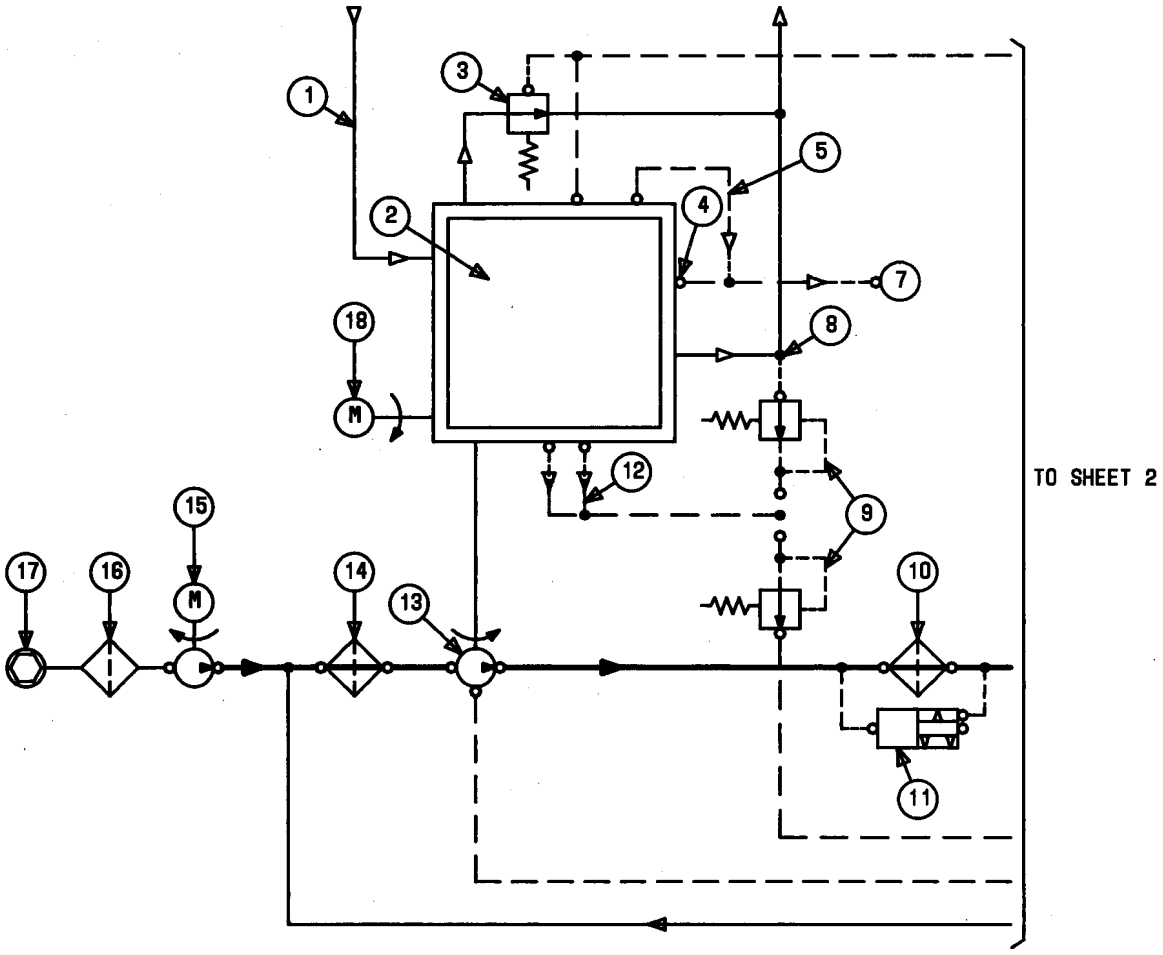
3.16 ***High Pressure Fuel Filter (10 Micron):*** The high pressure fuel filter (Fig. 4) is located downstream from the engine-driven fuel pump. Element replacement will be made when differential pressure exceeds 35 psi and the red plunger extends (pops up) from the differential pressure indicator.

3.17 ***Fuel Strainer (75 Micron):*** To check the fuel strainer (Fig. 4), proceed as follows:

(a) Rotate the scraper handle on top of the fuel oil strainer housing five turns to clean the element before the start of each run and after each 8 hours of continuous operation.

(b) Drain into an acceptable container the loose residue and sediment from the bottom of the housing as required.

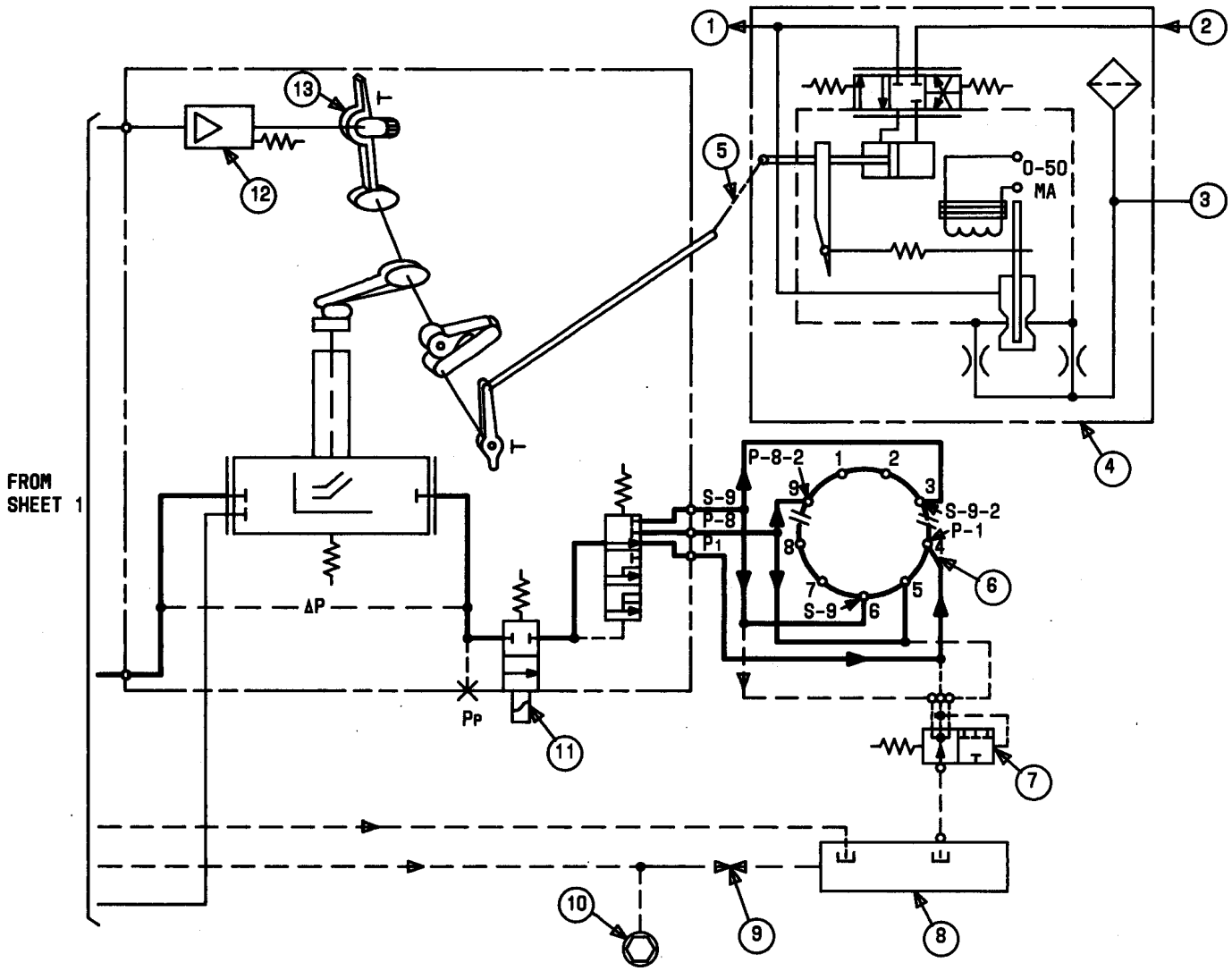
(c) Remove and clean strainer element every 100 hours of engine operation or 50 starts, whichever occurs first. After 300 hours or 3 years of en-



1 – AIR INTAKE DUCT
2 – TURBINE ENGINE
3 – GEAR PUMP
4 – TURBINE OUTPUT SHAFT SEAL
5 – SEAL BUFFER AIR LINE
6 – EXHAUST COLLECTOR
7 – TO GEARBOX OUTPUT SHAFT SEAL
8 – EXHAUST COLLECTOR DRAIN
9 – PRESSURE VALVE
10 – FILTER
11 – INDICATOR FOR FILTER
12 – COMBUSTION DRAINS
13 – CONTROL VALVE
14 – FILTER
15 – BOOST PUMP
16 – STRAINER
17 – FUEL INLET
18 – STARTER MOTOR

– – – LOW PRESSURE
——— HIGH PRESSURE

Fig. 4—Fuel System Schematic (Sheet 1 of 2)



1 - RETURN OIL TO LUBE TANK
2 - OIL SUPPLY - 3 GPM AT 1000 PSIG PRESSURE
3 - ANALOG SIGNAL FROM ELECTRONIC CONTROL SYSTEM
4 - ACTUATOR
5 - LINKAGE
6 - FUEL NOZZLE MANIFOLD VIEW FACING NOZZLES
7 - FUEL NOZZLE PURGE VALVE
8 - PURGE TANK
9 - HAND VALVE
10 - DRAIN PORT
11 - MAIN FUEL SHUT-OFF VALVE
12 - ACCELERATOR CONTROL
13 - FUEL CONTROL VALVE

——— HIGH PRESSURE FUEL

– – – LOW PRESSURE FUEL (DRAIN)

Fig. 4—Fuel System Schematic (Sheet 2 of 2)

gine operation, whichever occurs first, replace filter elements and scraper assembly. If necessary, replace more frequently depending upon fuel oil condition.

*3.18 ***Combustor Parts:*** When the fuel nozzles and holders are being inspected (see paragraph 3.13), inspect combustor inner and outer liners and combustor dome for cracks, warpage, worn out pins, and other signs of malfunctions.

*3.19 ***Turbine Nozzles:*** When the combustion chamber is disassembled, the first stage turbine nozzle vanes should be inspected for cracks or other defects.

3.20 ***Exhaust System:*** Daily or before each engine start-up, verify that no obstruction is in the exhaust system or flammable material is close to any part of the ducting. Correct condition as required.

3.21 ***Engine Fuel Drain System:*** The engine fuel drain system (Fig. 4) drains any collection of fluids from the combustion chamber case, purge valve, and exhaust collector into an accumulator tank. The tank shall be periodically drained after a maximum of 10 engine shutdowns.

3.22 ***Compressor Air Inlet:*** After every 100 hours of engine operation or 50 starts, whichever occurs first, check condition of air inlet filter (if installed). Inspect compressor air inlet for dirt or foreign object entry. Clean as required.

3.23 ***Sixth Stage Bleed Air Valve:*** The sixth stage bleed air valve is to be checked for wear and cleaned when necessary, or every 500 hours of engine operation or 200 starts, whichever occurs first.

3.24 ***Lube Oil Filter:*** The lube oil filter element shall be removed and replaced after every 100 hours of engine operation or 50 starts, whichever occurs first, or more frequently, if necessary.

3.25 ***Oil Cooling System:*** The oil cooler is an oil-to-air radiator which is fan-cooled and is capable of transferring 180,000 British thermal units per hour (BTUH) from 40-gallons per minute (GPM) oil at 120°F ambient and sea level pressures. The oil cooler fins shall be cleaned after every 100 hours of engine operation or more often depending upon room conditions. The fan motor is a high-pressure, gear-type positive displacement hydraulic motor. The motor drives the fan at approximately 1800 rpm to provide cooling air for the enclosure and cooler.

3.26 ***Leaks:*** There shall be no leaks. Periodically check all lines and hoses for chafing, and check grommets and clamps for deterioration. Replace as necessary.

AUTOMATIC SHUTDOWN AND ALARM DEVICES

3.27 ***Overspeed Shutdown Device:*** The overspeed shutdown device shall operate automatically to stop the engine by cutting off the fuel supply to the combustion chamber when the engine reaches 108 percent of the designed operating speed. To check the overspeed shutdown device (magnetic pickup No. 1), using a digital multimeter (DMM) set on 1 KOHM scale, measure resistance between terminals 11 and 12 of TB306. The DMM indicates a maximum resistance of 200 ohms.

3.28 ***Lube Oil Pressure Switch:*** After 300 hours or 3 years of engine operation, whichever occurs first, check the LUBE OIL PRESSURE switch as follows:

(1) Place a bleeder valve and gauge between the accessory gearbox and the oil pressure switch.

(2) Manually start the engine.

(3) Using a suitable container to bleed oil into, open the bleeder valve.

(4) Check the actuation of the LUBE OIL PRESSURE switch.

(5) Manually shut down the engine.

(6) Recheck the actuation of the LUBE OIL PRESSURE switch.

Note: LUBE OIL PRESSURE switch should actuate at 25.5 to 24.5 pounds per square inch (psi) of decreasing pressure as the engine is shut down.

(7) When engine has coasted to a stop, remove bleeder valve and gauge.

3.29 ***High Lube Oil Temperature Switch:*** The HIGH LUBE OIL TEMPERATURE

switch shall operate to shut the engine down when the temperature of the lubricating oil reaches approximately 200°F. The HIGH LUBE OIL TEMPERATURE switch shall be removed from the engine after every 300 hours or 3 years of engine operation, whichever occurs first, to determine if it meets the following requirements:

Note: The HIGH LUBE OIL TEMPERATURE switch will be removed before this scheduled time if a malfunction indicates the need for prior inspection.

(1) To test the operation of the switch, remove HIGH LUBE OIL TEMPERATURE switch from the engine.

(2) Connect a volt-ohm-milliammeter (VOM), set to the 1 KOHM scale, to the switch contacts.

Warning: Do not allow VOM test leads to touch side of can as erroneous readings will result.

(3) Place the sensing element and VOM test leads into an open can of lube oil.

(4) Place a thermometer into the can of lube oil.

Danger: The can of lube oil should be heated away from any area which would present a fire hazard. When heating the can of lube oil, excercise extreme care to avoid accidentally starting a fire. Avoid bodily contact with the hot oil.

(5) Using a hot plate or other safe source of heat, heat can of lube oil.

(6) The VOM should initially indicate ohms resistance and then indicate high resistance when HIGH LUBE OIL TEMPERATURE switch contacts close.

(7) Place the thermometer immersed in the lube oil as near the sensing element of the switch as possible.

(8) Temperature indication from the thermometer shall be approximately 200°F.

(9) Remove the HIGH LUBE OIL TEMPERATURE switch from the can of lube oil.

(10) Remove the can of lube oil from heat source and allow to cool before disposal.

Note: Be sure source of heat is turned off.

(11) Connect the HIGH LUBE OIL TEMPERATURE switch to the engine.

3.30 ***Shear Coupling Replacement:*** If an overcurrent or short circuit alarm is indicated, there may be a shear coupling failure. The shear coupling is located on the coupling between the reduction drive output shaft and the alternator input shaft. Make a visual inspection and if the bolts are sheared, replace per paragraph 4.30.

ALTERNATOR AND EXCITER

3.31 ***Voltages:*** With the engine-alternator operating at its rated speed, the voltage regulator shall hold steady state voltage at a regulated point to within 1/2 percent, as load is varied from zero to rated voltage.

STARTING SYSTEM

3.32 ***Starting and Control Batteries (Lead-acid Type):*** The maintenance and type of batteries are as follows.

Danger: Avoid creation of sparks, including those from static electricity, or the use of an open flame near batteries since the gas given off by the batteries is highly explosive.

(a) ***Maintenance and Charging of Batteries:*** Maintain and charge a lead-acid battery in accordance with the manufacturer's specification and requirements. The voltage setting should be 2.25 volts per cell ±0.02 volt or 27 volts per battery ±0.24 volt.

(b) ***Type of Batteries:*** Types of batteries are as follows:

- Start Batteries—Lead-acid Type D8D (Delco 761A)
- Control Batteries—Lead-acid Type 349A (Delco).

3.33 ***Starter Motor Brush Removal and Replacement:*** Starter motor brush wear will vary under certain conditions. After every 100 hours of engine operation or 50 starts, whichever occurs

first, inspect starter motor brushes for pits, cracks, uneven wear, discoloration, etc.

3.34 ***Igniter (Spark) Plug:*** After every 500 hours of engine operation or 200 starts, whichever occurs first, the igniter plug electrode shall be inspected for insulation cracks and excessive thermal discoloration. Clean or replace as necessary.

3.35 ***Lockwiring:*** Periodically inspect nuts and bolts to ensure lockwire integrity is maintained. When lockwiring a nut or bolthead, always install the lockwire in such a manner that if a nut or bolt begins to loosen, it will put tension on the lockwire. See Fig. 5.

TEST AND ROUTINE RUNS

3.36 ***Test Run:*** Test runs should be performed as follows:

(a) At the time of turnover, a 3-hour preliminary run shall be made at various loads from no load to not exceeding full load of the alternator. At the satisfactory completion of the 3-hour preliminary run, a 2-hour official test run at full load shall be made. Following this, the engine shall be operated for 30 minutes carrying the anticipated load, if known, otherwise at full load.

(b) In addition to the requirements in (a), the applicable requirements of Section 171-123-101 shall be met.

3.37 ***Routine Run:*** Routine runs should be performed as follows:

(a) ***Monthly:*** At least once a month, routine the engine at 100 percent speed under no-load conditions for 30 minutes.

(b) ***Every 3 months:*** Once every 3 months, routine the engine for ***30 minutes*** with full or office load.

Note: It is suggested that a record be maintained of all running data and maintenance performed on the set.

CONTROL EQUIPMENT

3.38 ***Microcomputer Controller:*** The microcomputer controller has been completely calibrated prior to shipment and normally requires no field calibration. Adjustments should not be necessary on any component of the microcomputer controller after installation testing. If calibration is necessary, adjust only those controls for which procedures are given. Lower the control panel to gain access to make an adjustment.

3.39 ***Timers:*** The electronic timers utilized by the KS-22673 engine-alternator set are located on the microprocessor controller boards. Requirements for these timers are as follows:

TIMER	NOMINAL SETTING
•WARM UP (WUT)	15 sec ±1 sec
•NO LITE (NLT)	25 sec ±1 sec
•OVERCRANK (OCT)	70 sec ±5 sec
•RUN (RT)	30 min ±2.5 min
•HOLD OVER (HOT)	15 min ±1.5 min
•COAST DOWN (CDT)	3 min ±0.3 min
•OVERLOAD (OLT)	15 sec ± 1 sec
•START DELAY (SDT)	*

*The length of this start delay is determined by the customer. A nominal setting may be either 5, 12, 30, or 60 seconds ±1 second.

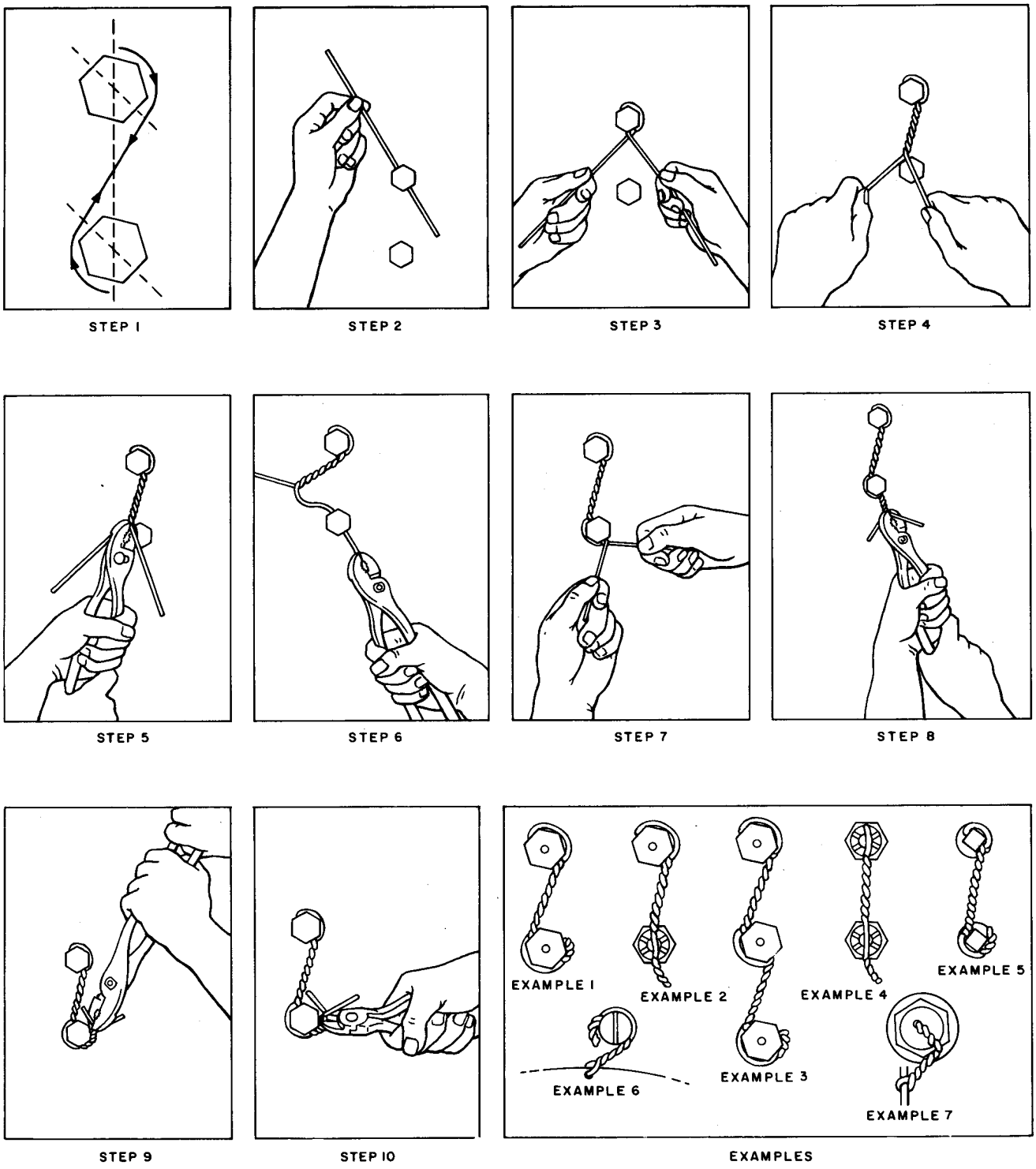


Fig. 5—Lockwiring Methods

4. ADJUSTING PROCEDURES

Danger: In power rooms, care should be exercised when using petroleum spirits for cleaning purposes. Avoid the use of an open flame or a portable lamp without a protecting guard, particularly near any part of the fuel system. Always provide adequate ventilation and suitable containers for storage of petroleum spirits. Always observe local safety practices.

Note: Refer to Fig. 1 and 2 for location of components.

LUBRICATING OIL SYSTEM

4.01 ***Lubrication and Recommended Intervals:*** Lubrication systems should be checked periodically to ensure proper operation.

4.02 ***Lube Oil Tank:*** To check lube oil tank, proceed as follows:

(a) ***Lube Oil Level:*** If the oil level in the oil tank is below the specified limits, add oil of the same type and grade through the oil filler tube, located on the left side of the engine, until the level of the oil as indicated on the dipstick is at the full mark. If the oil is to be checked after a run, wait at least 10 minutes before checking to allow the oil contained in the system to drain back into the tank.

Note: Whenever the oil level is checked, observe if the lube oil level in the oil sump shows a higher level than previously noted. The oil system should be checked for leak-down from higher levels.

Warning: Any substitution or use of nonapproved lubricants, or mixing of brands, or types of lubricants may cause considerable damage and void engine warranty.

(b) ***Drain Oil Procedure:*** Changing engine lube oil may be accomplished in several ways. The two preferred methods for draining the lube oil are as follows:

(1) In some engine-alternator installations, the oil drain may be plumbed to an outside storage container and drained by gravity-flow when the lube oil drain valve is opened.

(2) Another method uses a portable 55-gallon drum on which is mounted a hand pump. A flexible hose is connected at the oil drain and to the pump. The lube oil can then be pumped into the 55-gallon drum.

Note: All connections to the oil drain should be properly secured to avoid any oil spills.

(c) ***Lube Oil Changing Procedure:*** To change lube oil, proceed as follows:

(1) Start and run engine for 30 minutes at no-load until lube oil reaches operating temperature.

(2) Shut down engine. Allow engine to cool to a comfortable working temperature (approximately 2 hours).

(3) Drain the lube oil tank as described in (b).

(4) Drain the lube oil filter and cooler as described in paragraphs 4.24 and 4.25.

(5) Verify oil drain valve is closed and pour 30 gallons of lube oil into tank.

(6) Use the PURGE CRANK switch and crank the engine for approximately 30 seconds. Add approximately 5 gallons of lube oil to fill oil tank to specified mark on dipstick.

(7) Clean all spilled lube oil from engine compartment and area.

Note: After the lube oil change is completed, take separate samples of lube oil, one from the lube oil tank and another from the lube oil drum (record batch number) for analysis. Subsequent samples of lube oil, one from the lube oil tank and another from the main reduction gear box, shall be taken immediately following every quarterly exercise routine run. A record of all lube oil samples should be kept to establish a "base-line" of metallic content in the lube oil for that engine for comparison with subsequent sampling. (See paragraph 3.06.)

(d) ***Oil Sampling Procedure:*** To take an oil sample, proceed as follows:

Warning: Exercise care in handling and storing sampling device to ensure freedom from contamination.

(1) Start and run the engine approximately 30 minutes at no-load until lube oil reaches operating temperature.

(2) Shut down engine, wait approximately 1 hour for engine to cool down to a safe working temperature.

(3) Take a sample of oil from the bottom of the oil tank using a sampling device recommended by the analyzing laboratory.

(e) ***Oil Analysis Procedure:*** To request an oil analysis of lube oil samples, include the following information with the request:

(1) Date of sampling

(2) Total operating hours of engine

(3) Total number of engine starts

(4) Quantity of "make-up" oil (gallons), since the last oil change

(5) Engine package serial number

(6) Type and brand name of lube oil used.

4.03 ***Lube Oil Condition:*** No procedure is required for the lube oil condition.

Note: Sample of lube oil taken from the reduction gear box is to be analyzed for the presence of solids and metal. It need not be analyzed for oil condition, since that is to be done using an oil sample taken from the oil tank.

Warning: Exercise care in handling and storing sampling device to ensure freedom from contamination.

4.04 ***Alternator:*** Alternator bearings are lubricated as follows. Grease fittings located at the front (exciter end) and rear (shaft extension end) of the alternator enable the rotor bearings to be lubricated without disassembling the machine. Use a hand-type grease gun filled with a reliable brand of high grade, sodium-lithium base bearing grease with an NLGI No. 2 consistency, similar to KS-7473. Weigh the grease gun before and after adding grease to each bearing. Add 2 ounces of grease to the front bearing after the proper interval of accrued generator operating time. Add 2 ounces of grease to the rear bearing after the proper interval of operation. At each lubrication interval, carefully inspect the rotor shaft adjacent to the bearings. If leakage of grease past the bearing bracket grease seals is noted, remove the drain plugs from the bearing housings and allow excess grease to drain off. Be sure to replace the drain plugs before operating the generator.

4.05 ***Precipitator, Turbine Oil Mist:*** No procedure is required for the precipitator, turbine oil mist.

4.06 ***Record of Lubrication:*** No procedure is required for record of lubrication. See Note in subparagraph 4.02(c).

4.07 ***Lubricating Oil Pressure:*** Check for cause of low oil pressure or loss of oil as follows:

(a) Check lube oil level in oil tank.

(b) Check lines for air or oil leaks.

(c) Check lube oil pressure relief valve.

(d) Check lube oil pressure switch.

(e) Check lube oil pump.

4.08 ***Lubricating Oil Temperature:*** Check for cause of high lubricating oil temperature as follows:

(a) Check for dirty or clogged heat transfer area (radiator core) on oil cooler.

(b) Check oil level.

(c) Check oil cooler fan for proper operation.

(d) Check for proper circulation of oil through cooler.

(e) Replace OIL TEMPERATURE switch.

ENGINE

4.09 ***Speed:*** The main controlling factor for engine speed will be found within the control equipment (paragraph 4.38); however, before adjustment, verify the following:

(a) Fuel supply is adequate.

(b) Fuel filters and lines are clear.

(c) Fuel control valve is functioning properly.

(d) Fuel pump is operating properly.

4.10 ***Power:*** Each engine-alternator is provided with a nameplate on which is stamped the output capacity of the alternator. Loads on the alternator should be such that volts, amperes, or kilowatts are not exceeded for more than a few minutes. Loss of power is generally due to one or more of the following causes:

- Insufficient fuel flow
- Low-pressure fuel filter clogged
- High-pressure fuel filter clogged
- Defective fuel control valve.

Note: It is essential that a sufficient supply of fresh air be available at the engine air intake. A clogged air intake will seriously impair engine operation and a loss of power will result.

4.11 ***Allowable Back Pressure Versus Inlet Restriction:*** When the set has been running for 15 minutes at a constant partial load, read the exhaust gas temperature at the designated probe location or from the exhaust gas temperature meter on the engine-alternator control panel. Using a water-filled U-tube manometer, measure the actual back pressure of the exhaust system at a point as close as possible to where the temperature was read. Determine the back pressure of the intake air duct with the water manometer. Knowing the engine load, exhaust gas temperature, and inlet air restriction, determine the maximum allowable back pressure. See Fig. 6. If the measured value of the exhaust system back pressure is less than or equal to the value obtained in Fig. 6, the exhaust system is satisfactory.

4.12 ***Exhaust Temperature:*** Verify the integrity of the exhaust temperature (T7) thermocouple assembly as follows:

(1) Remove each thermocouple retaining nut and thermocouple from the exhaust collector.

(2) Inspect harness assembly and each thermocouple for signs of erosion, broken or bent wire, or other visible damamge. Replace any damaged thermocouple.

(3) Disconnect thermocouple harness from TB308 terminal 7 (chromel, +) and terminal 8 (alumel, −).

(4) Check that insulation resistance between thermocouple leads and shield and thermocouple leads and engine structure is greater than 50 KOHMS.

(5) Check that thermocouple loop resistance is less than 14 ohms.

(6) Reconnect the harness.

(7) Move OPERATION SELECTOR SWITCH to MANUAL, apply heat to each thermocouple while observing the exhaust temperature meter on the control panel. The meter must show a temperature increase as heat is applied to each thermocouple.

(8) Replace defective thermocouples as required; if problem still exists, it is recommended that contact with Solar Field Service be made through Western Electric in accordance with Section 010-700-010.

FUEL SYSTEM

4.13 ***Fuel Manifold and Nozzle Assembly:*** The fuel manifold and nozzle assembly should not be disturbed. If nozzles become clogged or dam-

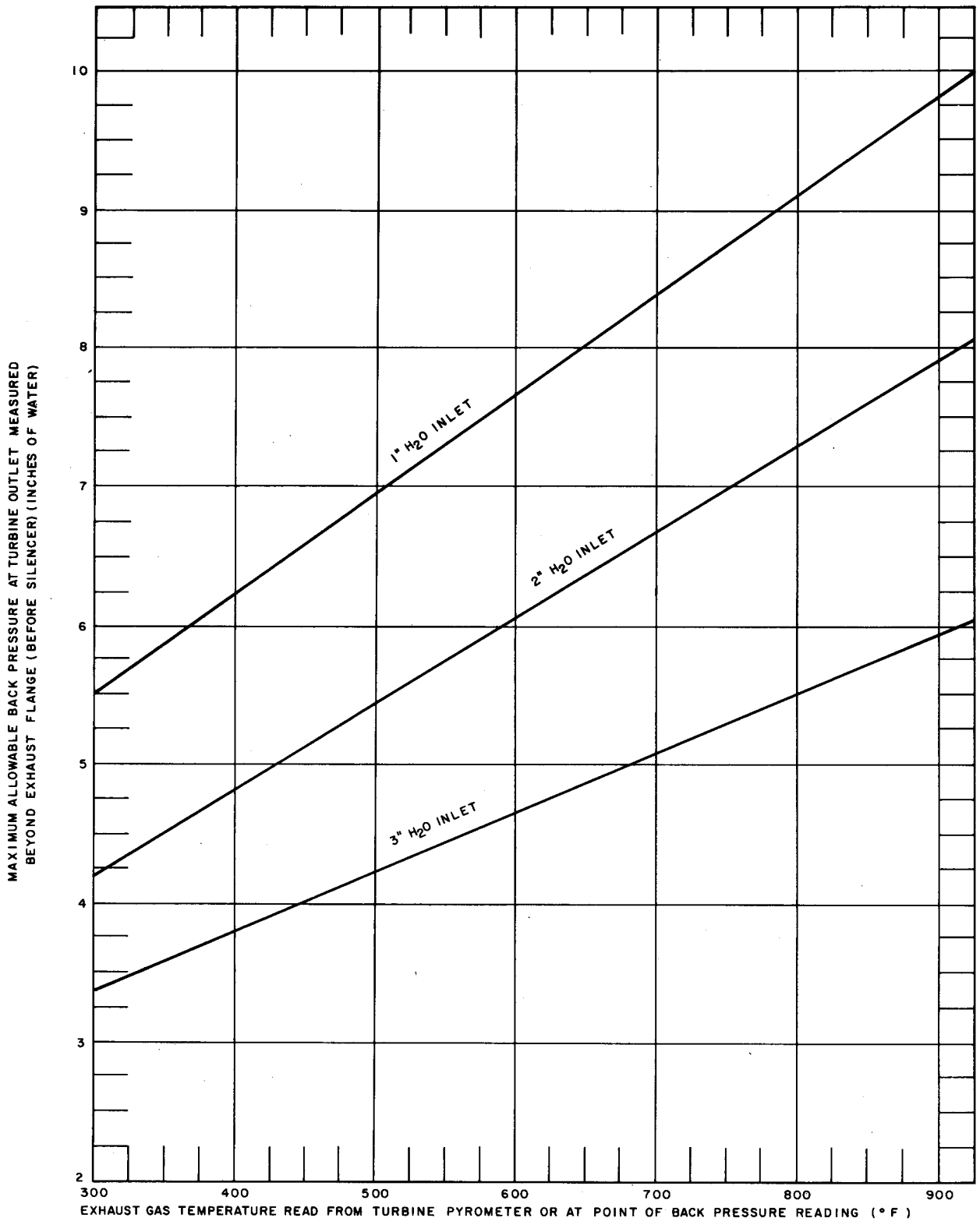


Fig. 6—Maximum Allowable Exhaust Line Back Pressure Versus Exhaust Gas Temperature

aged, replacement may be necessary. It is recommended that contact with Solar Field service be made through Western Electric in accordance with Section 010-700-010 for an order to check the nozzle manifold assembly. If replacement is required, it is recommended that Solar Field Service Personnel perform the work.

4.14 ***Fuel System Filter Assembly:*** If a fuel system filter assembly (FSFA) is provided, change the fuel system filter assembly as follows:

(1) If the engine is in service, open valve on bypass fuel line and close cutoff valve on inlet and outlet line of the fuel filter assembly.

(2) Loosen spin handle on each filter and remove caps.

(3) Remove micronic filter elements.

(4) Replace new elements (No. 2020SM-Racor Ind.).

(5) Install caps and tighten spin handles to a snug fit.

(6) Open inlet and outlet cutoff valves. Close bypass valve if it was opened in (1).

(7) Verify cap does not leak. If leakage does occur, tighten spin handle to correct.

4.15 ***Low-Pressure Fuel Filter (5 Micron):*** To change the low-pressure fuel filter (Fig. 7), proceed as follows:

(a) The engine must be shut down to change filter elements. The following procedures describe element replacement:

(1) Close fuel supply line shutoff valve.

(2) Drain filter by removing plug in bottom of filter body; collect fuel in a suitable container.

(3) Remove clamping ring assembly and top cover; discard cover gasket.

(4) Remove element retaining nut and discard element sealing gasket; then remove and discard elements.

(5) Clean element retaining nut, clean inside the filter body, and install new filter elements.

(6) Install new element sealing gasket; then, install element retainer nut. Torque nut to 10 ±2 pound-feet.

(7) Replace drain plug.

(8) Install cover using new gasket. Install and tighten clamping ring.

(9) Open fuel supply line shutoff valve.

(b) To ensure proper operation of the fuel system, it is extremely important that the system be free of air. If the fuel system is opened for any reason, or if the fuel supply tank runs dry, the fuel system must be bled to eliminate entrapped air. Bleed fuel system as follows:

(1) Ensure that there is an adequate supply of fuel in the fuel supply tank and that the external fuel shutoff valve is open.

(2) Ensure that fuel supply lines are tightly connected.

(3) Loosen low-pressure fuel filter vent cap to provide air bleed. Circle (not cover) vent with a rag to catch vented fuel.

(4) Depress the PURGE CRANK pushbutton. Fuel boost sump starts.

(5) When filter is full and all air is exhausted from vent, close vent cap.

(6) Release the PURGE CRANK pushbutton.

(7) Connect a suitable length of hose to hand valve at output side of high-pressure fuel filter. Place open end of hose in a suitable container.

(8) Depress the PURGE CRANK pushbutton to FUEL PURGE. Fuel boost pump operates and engine cranks.

(9) Allow engine to crank until fuel flows steadily without bubbles. Close valve and release the PURGE CRANK pushbutton.

(10) Remove drain hose.

(11) Use suitable material to catch spilled fuel and remove the fuel control valve bleed screw.

(12) Depress the PURGE CRANK pushbutton and allow fuel to bleed, then replace the bleed screw.

(13) Release the PURGE CRANK pushbutton.

(14) Initiate engine start. If no lightoff occurs before engine reaches 15 percent speed, shut down engine and attempt another start.

(15) If engine fails to start after three consecutive attempts, repeat fuel system bleeding procedure; air may still be entrapped in the system, preventing a successful start.

4.16 ***High-Pressure Fuel Filter (10 Micron):*** To change the high-pressure fuel filter (Fig. 8), proceed as follows:

(a) The engine must be shut down to change the high-pressure fuel filter element. The following procedure describes filter element replacement.

(1) Remove lockwire between case and head assembly.

(2) Unscrew case from head assembly; collect spilled fuel in a suitable container.

(3) Grasp element firmly and rock from side to side while pulling straight down. The element will come away.

(4) Push new element onto center stem in head assembly, ensuring that it is pushed up as far as it will go.

Warning: Do not use a wrench to tighten case into head assembly.

(5) Screw case into head assembly by hand until shoulder of case is tight against bottom of head assembly.

(6) Replace lockwire.

(b) To ensure proper operation of the fuel system, it is extremely important that the system be free of air. If the fuel system is opened for any reason, or if the fuel supply tank runs dry, the fuel system must be bled to eliminate entrapped air. Bleed fuel system by performing procedures in subparagraph 4.15(b).

4.17 ***Fuel Strainer (75 Micron):*** To perform maintenance on the fuel strainer, proceed as follows:

(a) Normally, the only maintenance required is to rotate the handle to pass a scraper around the element and drain sediment collected in the housing. The engine must be shut down when sediment is drained. The following procedure describes removal and cleaning of the fuel strainer with the engine shut down.

(1) Close shutoff valve in fuel supply line.

(2) Drain strainer by removing plug in bottom of housing; collect fuel in a suitable container.

(3) Remove housing from head by removing four nuts, washers, and clamping ring.

(4) Unscrew element and knife assemlby from head.

(5) Clean element and knife assembly in Stoddard solvent, or equivalent; blow solvent from element with compressed air.

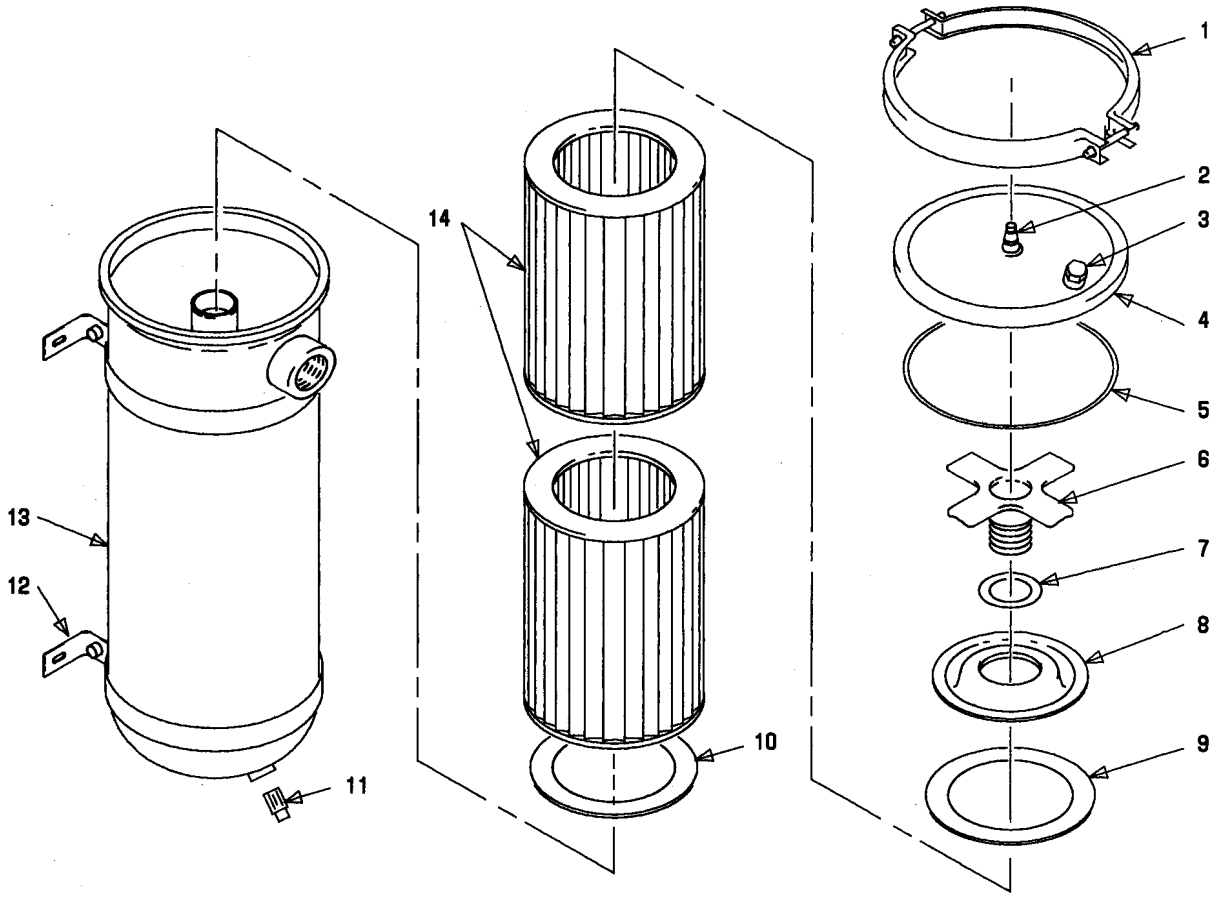
(6) Install clean element and knife assembly in head.

(7) Clean housing and install drain plug. Fill housing with clean fuel and install over element. Secure with clamping ring, washers, and nuts.

(8) Open shutoff valve in fuel supply line.

(b) To ensure proper operation of the fuel system after cleaning the fuel strainer, it is extremely important that the system be free of air. If the fuel system is opened for any reason, the fuel system must be bled to eliminate entrapped air. Bleed fuel system by performing procedures in subparagraph 4.15(b).

4.18 ***Combustor Parts:*** The combustor assembly is a straight-through annular type consisting of a three-piece combustor dome, combustor inner and outer liners, and shrouds. Because of the extremely high temperature generated by the burning fuel (approximately 3,500°F) and the design maintenance requirements of the combustor parts, it



1 - CLAMPING RING ASSEMBLY
2 - VENT VALVE
3 - FILLER PLUG AND GASKET
4 - COVER ASSEMBLY
5 - COVER GASKET
6 - ELEMENT RETAINER
7 - ELEMENT RETAINER GASKET
8 - END GUIDE
9 - ELEMENT GASKET
10 - ELEMENT GASKET
11 - DRAIN PLUG
12 - MOUNTING BRACKET
13 - CASE ASSEMBLY
14 - ELEMENT ASSEMBLY

Fig. 7—Low Pressure Fuel Filter

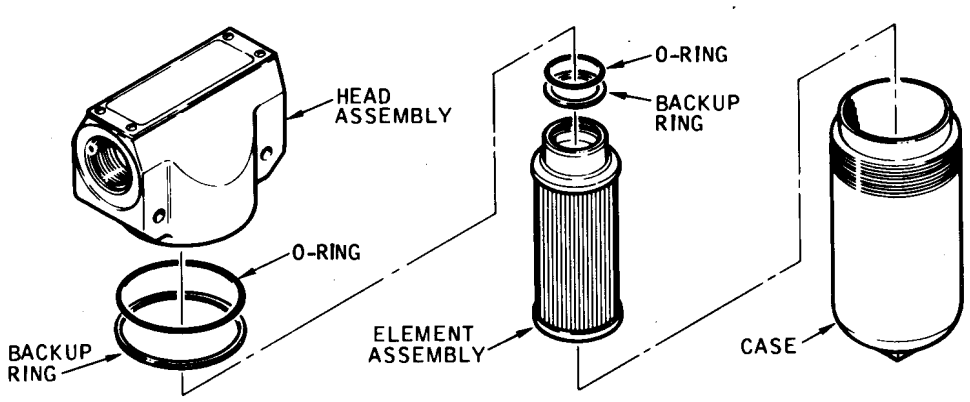


Fig. 8—High Pressure Fuel Filter

is recommended that contact be made through Western Electric in accordance with Section 010-700-010 for an order to check the condition of the combustor parts. If replacement is required, it is recommended that Solar Field Service personnel perform the work.

4.19 ***Turbine Nozzles:*** The condition of the first stage nozzle vanes is usually reflected to a lesser degree in the second and third stage nozzles vanes. Therefore, it is not necessary to disassemble the turbine and inspect these stages. However, because of the critical design of the turbine, it is recommended that contact with Solar Field Service be made through Western Electric in accordance with Section 010-700-010 for an order to check turbine nozzle condition. If replacement is required, it is recommended that Solar Field Service personnel perform the work.

4.20 ***Exhaust System:*** No procedure is required for the exhaust system.

4.21 ***Engine Fuel Drain System:*** The engine fuel drain system drains any collection of fluids from the combustor chamber case and the exhaust collector into an accumulator tank. Force flush drain lines thoroughly, using Stoddard solvent or equivalent and dry with compressed air (not to exceed 100 psig).

4.22 ***Compressor Air Inlet:*** No procedure is required on the compressor air inlet.

4.23 ***Sixth-Stage Bleed Air Valve:*** The following procedures provide removal, disassembly, cleaning, assembly, and installation instructions for the sixth-stage bleed air valve, (see Fig. 9):

(a) ***Removal and Disassembly:*** To remove and disassemble the sixth-stage bleed air valve, proceed as follows:

(1) Disconnect compressor discharge pressure air line from valve cover.

(2) Remove V-band clamps from compressor manifold port and bleed air duct flanges. Remove valve and O-ring.

(3) Remove retaining ring while holding cover to ensure that it is not pushed out by spring.

Warning: While removing cover and piston, use extreme care to prevent damage to the carbon seal.

(4) Remove cover and piston together as a single unit; then remove piston from cover.

(5) Remove carbon seal from piston and spring from valve housing.

(b) ***Cleaning:*** Clean parts by wiping with a clean, lint-free cloth dampened in Stoddard solvent, or equivalent.

(c) ***Bleed Valve Spring Inspection:*** Inspect spring for wear and check spring force using

a spring tester. Spring force must be 44 to 48 pounds at a compressed length of 2.44 inches, and 70 to 74 pounds at a compressed length of 1.44 inches. Replace spring if worn or if tension is not within noted values.

(d) ***Assembly and Installation:*** During assembly and installation, ensure no contaminants (grit, grease, etc.) are on installed parts.

Warning: Use extreme care to prevent damage to the carbon seal during reassembly of the power piston and cover.

(1) Install carbon seal on piston; install pilot portion of piston, with carbon seal installed, in bore of cover.

(2) Place spring in valve housing; install piston and cover in valve housing. Apply sufficient pressure on cover to compress spring and bottom cover in valve housing. Secure cover with retaining ring.

(3) Check piston action by inserting a clean, smooth, 5/16-inch diameter soft metal rod through air port in cover and exerting pressure on piston. Piston movement should be free and smooth against spring tension.

(4) Install bleed air valve, new O-ring, and V-band clamp on compressor manifold port. Install bleed air duct and V-band clamp to bleed air valve; position valve as required. Tighten both V-band clamps.

(5) Connect compressor discharge pressure air line to valve cover.

(6) Start engine and check for smooth acceleration and satisfactory air bleed valve operation.

4.24 ***Lube Oil Filter:*** The engine must be shut down to change filter elements. (See Fig. 10.) The following procedures describe element replacement.

(1) Place suitable container under filter in position to receive oil.

(2) Remove plug from filter body, and drain oil into container.

(3) Remove clamping ring assembly.

(4) Remove top cover and discard cover gasket.

(5) Remove element retaining nut. Discard element retainer gasket.

(6) Remove and discard element.

(7) Clean element retaining nut, inside of filter body, and then install new filter element.

(8) Install plug in filter body.

(9) Fill filter body with new oil.

(10) Install new element sealing gasket; then, install element retaining nut. Torque nut to 10 ±2 pound-feet.

(11) Install cover, using new gasket. Tighten clamping ring.

(12) Start engine and check filter for leaks.

4.25 ***Oil Cooling System:*** The oil in cooler will drain into oil tank when oil drain valve is opened. There is no procedure for the oil cooling system.

4.26 ***Leaks:*** To check for leaks, proceed as follows:

(a) When air or oil leaks in the fuel system are observed, tighten all loose fuel connections in the lines. Replace any packing or gaskets as required at any other points in the system.

(b) As a rule, there are no dangerous quantities of carbon monoxide in the exhaust from gas-turbine engines; therefore, no tests need be made to check for this gas. However, leaks in the exhaust system are usually indicated by smarting or watering of the eyes or by observing a blue haze in the engine room. To stop exhaust system leaks, replace gaskets as required or re-lead or retighten the joints in the exhaust piping.

(c) To stop a leak in the lubricating oil system, tighten all loose oil line connections and replace gaskets as required.

AUTOMATIC SHUTDOWN AND ALARM DEVICES

4.27 ***Overspeed Shutdown Device:*** If values in paragraph 3.27 are not met and magnetic

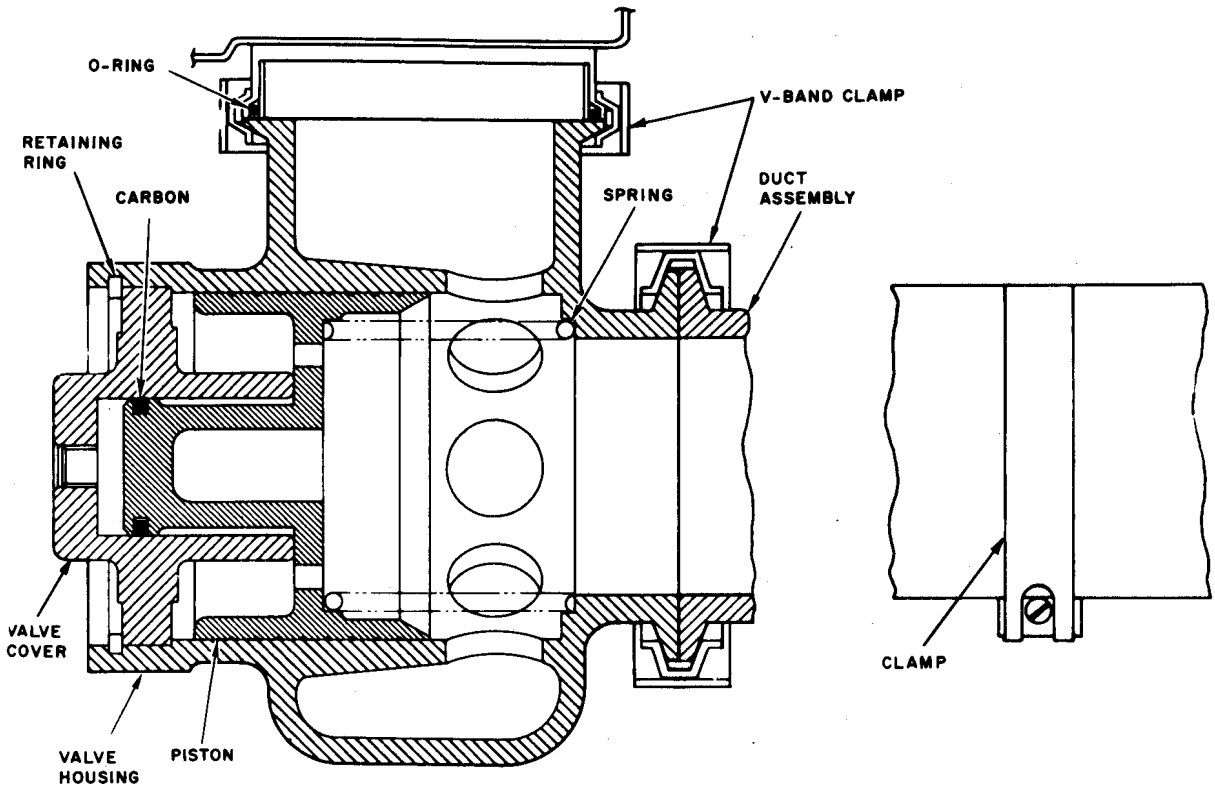


Fig. 9—Sixth-Stage Bleed Air Valve

pickup No. 1 is found to be defective, proceed as follows:

(a) ***Removal:*** To remove overspeed shutdown device, proceed as follows:

(1) Disconnect electrical plug from pickup.

(2) Loosen jam-nut and unscrew pickup from compressor case.

(b) ***Installation:*** To install overspeed shutdown device, proceed as follows:

(1) Install pickup on compressor case, and tighten by hand until contact is made with compressor spacer ring.

(2) Prevent pickup from turning, and tighten jam-nut.

(3) Connect electrical plug to pickup.

4.28 ***Lube Oil Pressure Switch:*** If a lube oil pressure switch malfunction occurs, replace switch.

4.29 ***High Lube Oil Temperature Switch:*** If a high lube oil temperature switch malfunction occurs, replace switch.

4.30 ***Shear Coupling Replacement:*** Replacing the shear coupling bolts (Fig. 11) is accomplished as follows.

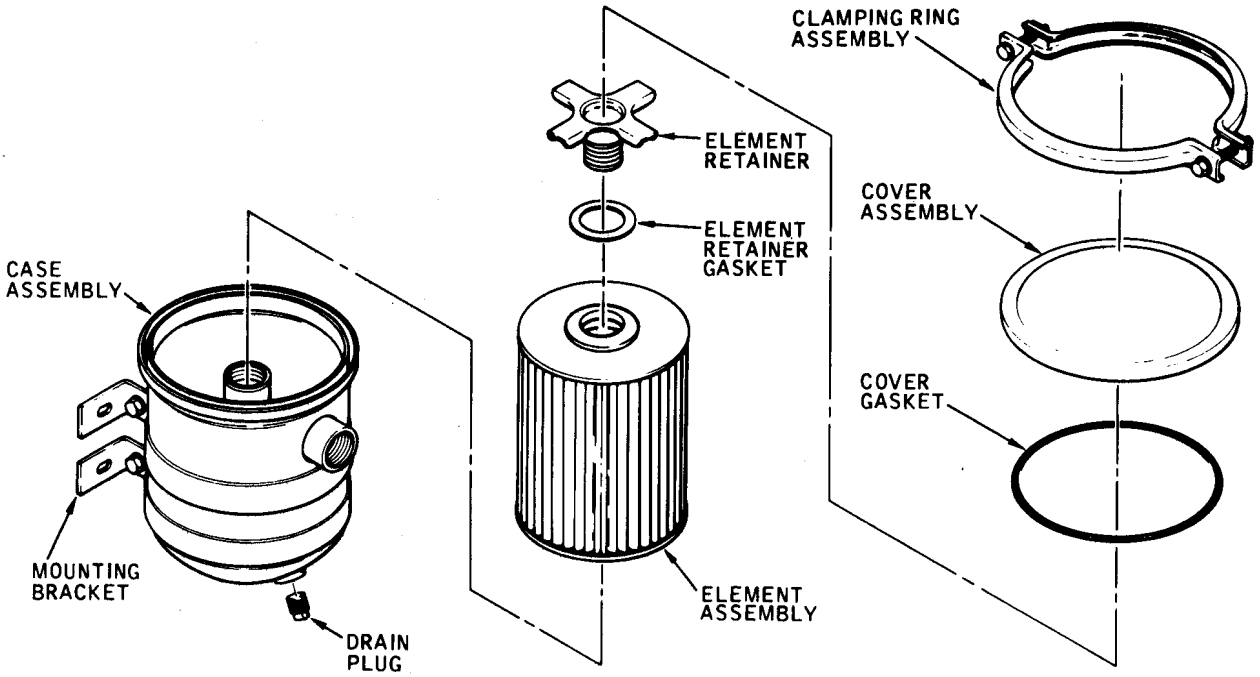


Fig. 10—Oil Filter

(1) Remove shear coupling spacer retaining bolts, nuts, and washers; remove shear coupling spacer.

(2) Remove four shear bolts.

(3) Align match marks and install new shear bolts and washers through shear coupling spacer flanges.

Note: Shear bolt nuts are on the outside of shear coupling spacer.

(4) Lubricate threads of shear bolts and face of locknut with engine lube oil.

(5) Install locknuts on shear bolts and obtain free-running torque of each locknut.

(6) Tighten locknuts uniformly. Torque each locknut, in sequence, to 49 to 50 pound-feet above individual locknut free-running torque.

(7) Position the shear coupling spacer in place between the coupling sleeves; ensure that match marks are in alignment.

(8) Install all bolts and nuts; install nuts in countersunk holes.

(9) In staggered sequence, tighten all nuts finger tight. Tighten, then in staggered sequence to 50 pound-feet torque; then, again in staggered sequence, torque to 75 to 80 pound-feet torque.

ALTERNATOR AND EXCITER

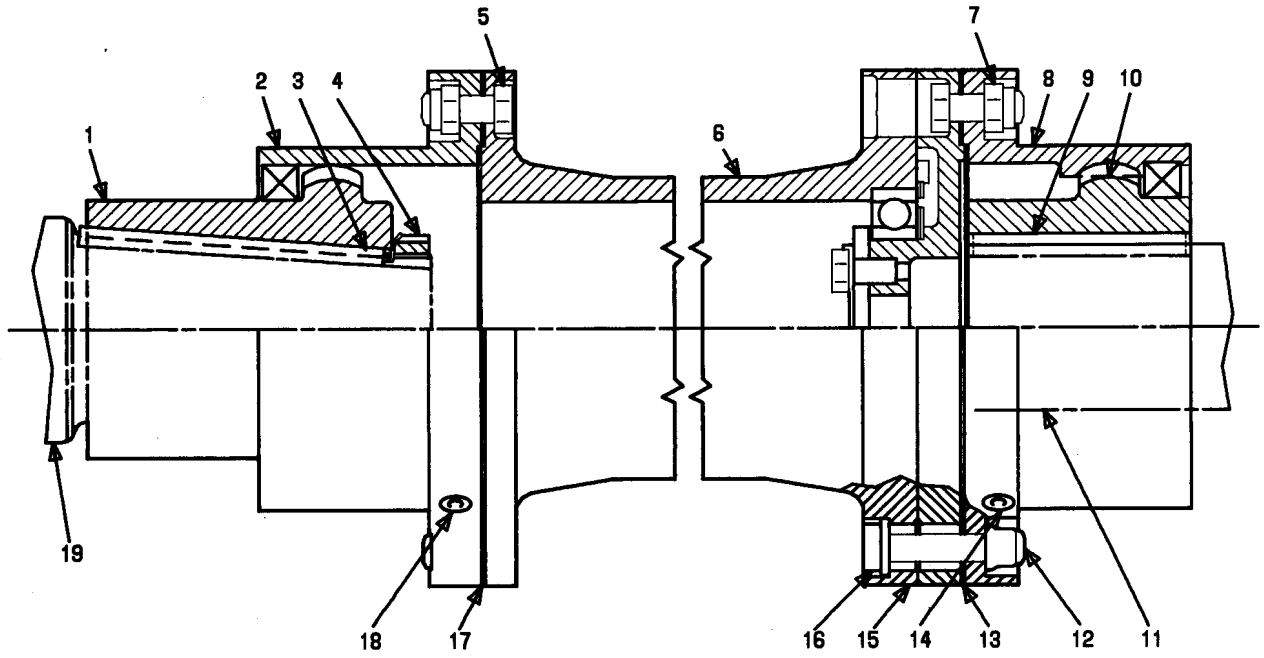
4.31 ***Voltages:*** To adjust the voltage, proceed as follows:

(a) The voltage regulator requires very little maintenance and should not be disturbed. An occasional cleaning will be necessary. The component parts of the voltage regulator are not subject to wear and do not deteriorate noticeably with age.

(b) If the regulator is furnished and interconnected as part of a generator set, then factory testing has been done and the generator set is ready for operation.

(1) ***Voltage Range Adjustment:*** Turning of the screwdriver slot of rheostat on the PC board raises or lowers the range as desired. For initial operation, set the VAR to midpoint and then adjust to obtain rated voltage.

(2) ***Stability Adjustment:*** Turning of the screwdriver slot of rheostat R33 on the PC board varies the RC time-constant of the stabilizing feedback network. In most cases, this is all that is required for initial start-up



1 - COUPLER HUB
2 - SPACER COUPLING
3 - KEY
4 - LOCKOUT AND WASHER (NOTE 1)
5 - BOLT AND LOCKNUT (12 REQ'D) (NOTE 2)
6 - COUPLING SPACER ASSEMBLY (MATCHED SET)
7 - BOLT AND LOCKNUT (8 REQ'D) (NOTE 2)
8 - SPACER COUPLING
9 - KEY
10 - COUPLING HUB
11 - ALTERNATOR SHAFT (REF)
12 - ALIGN HOLES WITH MATCHED-MARKS AT ASSEMBLY
13 - GASKET
14 - GREASE PLUG (2 PLACES)
15 - SHEAR SECTION
16 - SHEAR BOLT, WASHER, AND LOCKNUT (4 REQ'D) (NOTE 3)
17 - GASKET
18 - GREASE PLUG (2 PLACES)
19 - REDUCTION DRIVE OUTPUT SHAFT (REF)

NOTES:
1. TORQUE TO 200 TO 220 FT/LB
2. TORQUE TO 75 TO 80 FT/LB
3. TIGHTEN LOCKNUT TO 49 TO 50 FT/LB ABOVE SELF-LOCKING TORQUE

Fig. 11—Shear Coupling Assembly

adjustment. Stability can be roughly checked without a load by quickly adjusting the VAR from rated voltage to 90 percent of rated voltage. Voltage should stabilize after a few oscillations. If stability cannot be obtained by manipulation of R33, check the following:

- Verify that the engine operates at constant speed without any sign of oscillation.

- Determine the dc voltage applied to the exciter field. If it is too low, then about 10 percent external resistance may have to be added in series with the exciter field.

(3) ***Underfrequency Protection Adjustment:*** Voltage regulators furnished with this feature are factory adjusted to protect the system from underfrequency operation. However, it is good practice to recheck this as follows:

- Connect a temporary voltmeter across regulator terminals E1 to E3. Start the engine and use the VAR to adjust voltage to rated value. Set the engine speed to 95 percent of its rating. Adjust rheostat R47 on the PC board in a cw direction until line voltage starts to decrease.

- Stop, and adjust R47 very slowly in a ccw direction until rated voltage is just barely restored. This completes the checkout. The voltage regulator will now act similar to a volts per cycle regulator whenever speed drops below 95 percent of rated speed.

STARTING SYSTEM

4.32 ***Starting and Control Batteries (Lead-acid):*** The starting battery is a D8D (or equivalent) and type UL18 (or equivalent) is used as the control battery. For specific description and requirements, refer to the manufacturer's manual.

4.33 ***Starter Motor Brush Removal and Replacement:*** To remove and replace starter motor brush, proceed as follows:

(a) ***Brush Removal:*** Remove brush as follows:

Note: A brush spring lifter will be necessary for this operation. This may be fabricated from a piece of stiff wire (such as 1/8-inch welding wire) by bending the end to form a hook that can be inserted under the loop of the brush spring.

(1) Loosen clamp screws on brush cover band. Lift band free.

Danger: Brush dust is extremely poisonous. Do not inhale or take internally. Always wash hands after contact.

Warning: Exercise care during brush removal to prevent damage to brush leads. Do not allow brush springs to snap against brushes as brushes are easily damaged.

(2) Remove screw attaching brush lead terminal to brush holder. Using lifter, pull brush spring away from brushes; lift brushes from brush holder, one pair at a time.

(3) Discard brushes if they are cracked, chipped, leads frayed or loose, or if the carbon is worn to within 1/8 inch of wear groove (a vertical groove, cut in the outer side faces of each of the two larger brushes, extending from the "pigtail" and approximately 3/4 inch). If the brushes are allowed to wear into the grooved area, the commutator may be damaged.

(4) If new brushes are to be installed, proceed to (c).

(b) ***Brush Installation:*** Install brush as follows:

Note: If the used brushes are returned to matching holders in exactly the same position as removed, run-in procedure is not necessary.

(1) Locate brushes in identical holder and identical position as when removed. Install screws through brush lead terminals and tighten.

Warning: Brush material is soft and brittle. Handle carefully. Do not allow brush spring to snap against brush.

(2) Carefully release brush spring; remove wire hook.

(3) Install brush cover band.

(c) ***Brush Run-In Procedure:*** Check brush run-in as follows:

(1) If brushes are worn to 1/8-inch of the wear groove and commutator is in good condition with no heavy grooves or burned areas, remove and discard the six brush assemblies.

(2) Using a vacuum cleaner, remove all brush dust from the unit.

(3) Cut a piece of 150 grit sandpaper the same width as the commutator and approximately 6 inches long.

(4) Starting with the top brush holder; slide the sandpaper, grit side up, under the holder. Install a new brush and, holding the sandpaper firmly around the commutator diameter, work it back and forth until the carbon dust shows the full width of the sandpaper. Lift the brush enough to remove the sandpaper and repeat for the remainder of the brushes.

(5) Clean the unit as indicated in (2).

4.34 ***Igniter (Spark) Plug:*** The following tests should be performed on a routine basis:

Danger: The ignition system is a high-voltage system; use special care.

(a) ***Removal:*** To remove igniter plug, proceed as follows:

(1) Disconnect input connector from ignition exciter.

(2) Disconnect input connector from fuel shutoff solenoid valve.

(3) Remove two bolts and washers securing igniter plug to combustor case and remove igniter plug and gasket.

(b) ***Inspection:*** To inspect igniter plug, proceed as follows:

(1) Check that electrode is not excessively burned.

(2) Check that insulator is not cracked.

(3) Check that body has not been corroded by contact with grommet in combustor liner.

(c) ***Functional Test:*** To test igniter plug, proceed as follows:

(1) Attach igniter plug to a metal surface of the engine where it can be seen easily by the operator and provide a common ground between the spark plug and ignition exciter.

(2) Connect a source of 24-volt dc power to ignition exciter input connection; ***pin A must be connected to dc negative.***

(3) Observe spark; plug should emit a series of strong sparks in rapid succession.

Note: If satisfactory operation is not obtained, check ignition exciter and cable.

(d) ***Repair:*** Repair is not feasible. If damaged, or if performance is not satisfactory, replace with a new plug.

(e) ***Installation:*** To install igniter plug, proceed as follows:

Note: Alignment of the igniter plug mounting hole in combustor liner and boss on combustor case is essential for proper assembly.

(1) Install the igniter plug with a new gasket on combustor case; secure with screws and lockwire.

(2) Connect the ignition cable to the igniter plug.

(3) Install electrical connectors to ignition exciter and fuel shutoff valve.

4.35 ***Lockwiring Procedure:*** The following procedures should be performed when lockwiring (Fig. 5) is desired:

(a) Use 0.032-inch diameter stainless steel lockwire for general applications in all locations accessible by routine servicing procedures. Use 0.020-inch diameter stainless steel lockwire for number eight or smaller screws, for electrical harness coupling units, and in other tight places where it is not practical to use 0.032-inch diameter wire.

(b) Lockwire all drilled boltheads, plugs, screws, etc, except those with self-locking nuts or

lockwashers. Bolts should be lockwired in pairs where possible. When reassembling, be sure to replace lockwire wherever it was removed.

(c) When installing lockwire, always check that the wire is installed in such a way that it tends to tighten the nuts or bolts being secured, so that if the nut or bolt begins to loosen, it will put the lockwire in tension. The examples shown in Fig. 5 are for right-hand thread screws; for left-hand threads, the loops on the boltheads or nuts would be pulling in the opposite direction.

TEST AND ROUTINE RUNS

4.36 ***Test Run:*** During the test run, various loads for the engine-alternator may be obtained by varying the amount of load connected to the alternator load terminals. Discuss loading arrangements with the proper supervisor. When sufficient office or building load is not available or service reactions are involved in its use, artificial load may be necessary. See Section 171-123-101 for information concerning artificial loads. Any troubles which are likely to develop will probably be noticed during a test run and may be corrected before the set is needed at a time of power failure.

4.37 ***Routine Run:*** When sufficient office or building load is not available, artificial loads may be necessary to perform requirements per Section 171-123-101.

CONTROL EQUIPMENT

4.38 ***Microcomputer Controller System:*** To gain access to an adjustment, loosen three screws at the top of the control panel and lower the hinged panel. Adjustments and set-up procedures for the Microcomputer Controller System should be performed as indicated in subparagraphs (a) through (j).

Danger: Some high-voltage components can store and maintain a residual voltage for several hours after the unit has stopped. An electric shock can result from contact with such components. Prior to any troubleshooting of electrical circuits, ensure that all external power is disconnected from the alternator set. Discharge all high-voltage circuits by using a heavy insulated cable and shorting each phase to ground before working on, or around, the equipment.

Warning: Make adjustment only on areas where procedures are specified. If problem area is not resolved, contact the Solar Field Representative through Western Electric in accordance with Section 010-700-010.

(a) ***Setting Start Delay Sequence Procedure:*** The engine start-up is delayed to ensure that the ac failure is not just momentary. The length of this start delay is determined by two DIP switches on the ZZ210 microcomputer controller board (J85520 board). Table F shows which switch combination dictates various start delay times.

TABLE F

PROPER POSITION OF DIP SWITCHES FOR CORRECT START DELAY TIME

START DELAY (SECONDS)	DIP SWITCHES POSITION	
	SWITCH 1	SWITCH 2
5	Open	Open
12	Closed	Open
30	Open	Closed
60	Closed	Closed

(b) ***Set-up Procedure for Adjusting Meters:*** The AC AMPERES, POWER FACTOR, KW, % SPEED, and TEMPERATURE meters may be adjusted by displaying analog parameters on a CRT that indicates the correct readings. The following procedure should be used to obtain the analog parameters and set the meters that are not indicating parallel readings:

(1) Acquire a ADM-5 CRT terminal.

Note: Switches and the ADM-5 CRT terminal must be set as in the following steps to allow for proper interfacing with the J85529, ZZ211, microcomputer controller board.

(2) Set microswitches on SW1, located on back panel of the CRT, as indicated in Table G.

Note: The SW1 switch is the switch for setting Baud Rate on the CRT.

TABLE G

PROPER POSITION OF SWITCHES ON SW1

SWITCH ON SW1		POSITION	
NO.	BAUD RATE	ON	OFF
1	75		X
2	110		X
3	150		X
4	300		X
5	600		X
6	1200	X	
7	2400		X
8	4800		X
9	9600		X
10	19.2K		X

(3) Set microswitches on SW2, located on the back panel of the CRT, as indicated in Table H.

Note: The SW2 is the switch for setting up the options on the CRT.

(4) Set microswitches on SW3, located internally in the CRT, as indicated in Table I.

Note: To gain access to SW3 switch, remove the two screws underneath the front of the CRT and hinge the upper assembly to the rear. The SW3 switch is located on the back of the circuit board inside the CRT.

(5) Connect the RS-232 adapter cable, used to interface the J85529 microcomputer controller board and CRT, between the MODEM connection of the CRT and the P2 plug of the ZZ211 board (J85529 microcomputer controller board) located behind the control panel.

(6) Operate CB203 circuit breaker to the OFF position.

(7) Operate rocker switch on the back of the CRT to the ON position.

(8) Verify that SW3 switch on the ZZ210 board (J85520 microcomputer controller board) is in the open position.

Note: The SW3 switch is the third rocker dip switch in a bank of seven rocker dip switches.

TABLE H

PROPER POSITION OF SWITCHES ON SW2

SWITCH ON SW2	SETUP OPTION
1	Off
2	Auto New Line Off
3	60 Hz
4	RS 232
5	Full Duplex
6	Bit 8=0
7	Parity Inhibit
8	2 Stop Bit
9	Even Parity
10	8 Bit Word Length

TABLE I

PROPER POSITION OF SWITCHES ON SW3

SWITCH ON SW3		POSITION	
NO.	ACCESS	ON	OFF
1	Local		X
2	103	X	
3	202		X
4	Code		X
5	EXT		X
6	EOT		X

(9) Operate CB203 circuit breaker to the ON position.

(10) Mechanically adjust meters for an indication of zero.

(11) Operate the OPERATION SELECTOR SWITCH to the MANUAL position.

(12) Depress the MANUAL START pushbutton to start the engine.

(13) Close the alternator circuit breaker.

(14) After the set has had time to warm up and all settings have settled, observe meters on the control panel and observe indications that appear on the CRT screen as shown in Fig. 12.

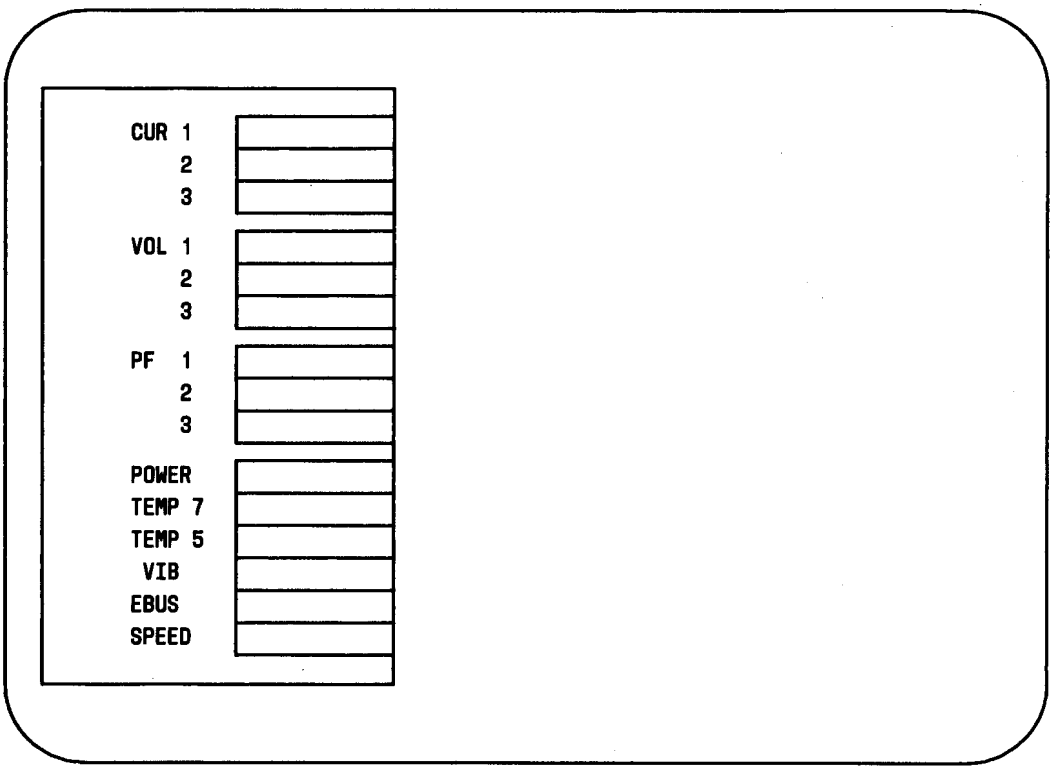


Fig. 12—Analog Parameters on CRT Screen

(15) If control panel meters differ from indications on the CRT screen, adjust meter potentiometer for individual meter that requires adjustment.

(c) ***Adjust AC AMPERES Meter:*** To adjust the AC AMPERES meter on the control panel, proceed as follows:

(1) Observe corresponding alternator current indication on the CRT screen under CUR.

Note: The alternator current indication on the CRT screen has a multiplier of 10. If the space is blank at CUR on the CRT, the current is 0 amperes.

(2) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust R6 potentiometer until the indication on the control panel AC AMPERES meter has the same indication as the corresponding CUR number displayed on the CRT screen.

(d) ***Adjust POWER FACTOR Meter:*** To adjust the POWER FACTOR meter on the control panel, proceed as follows:

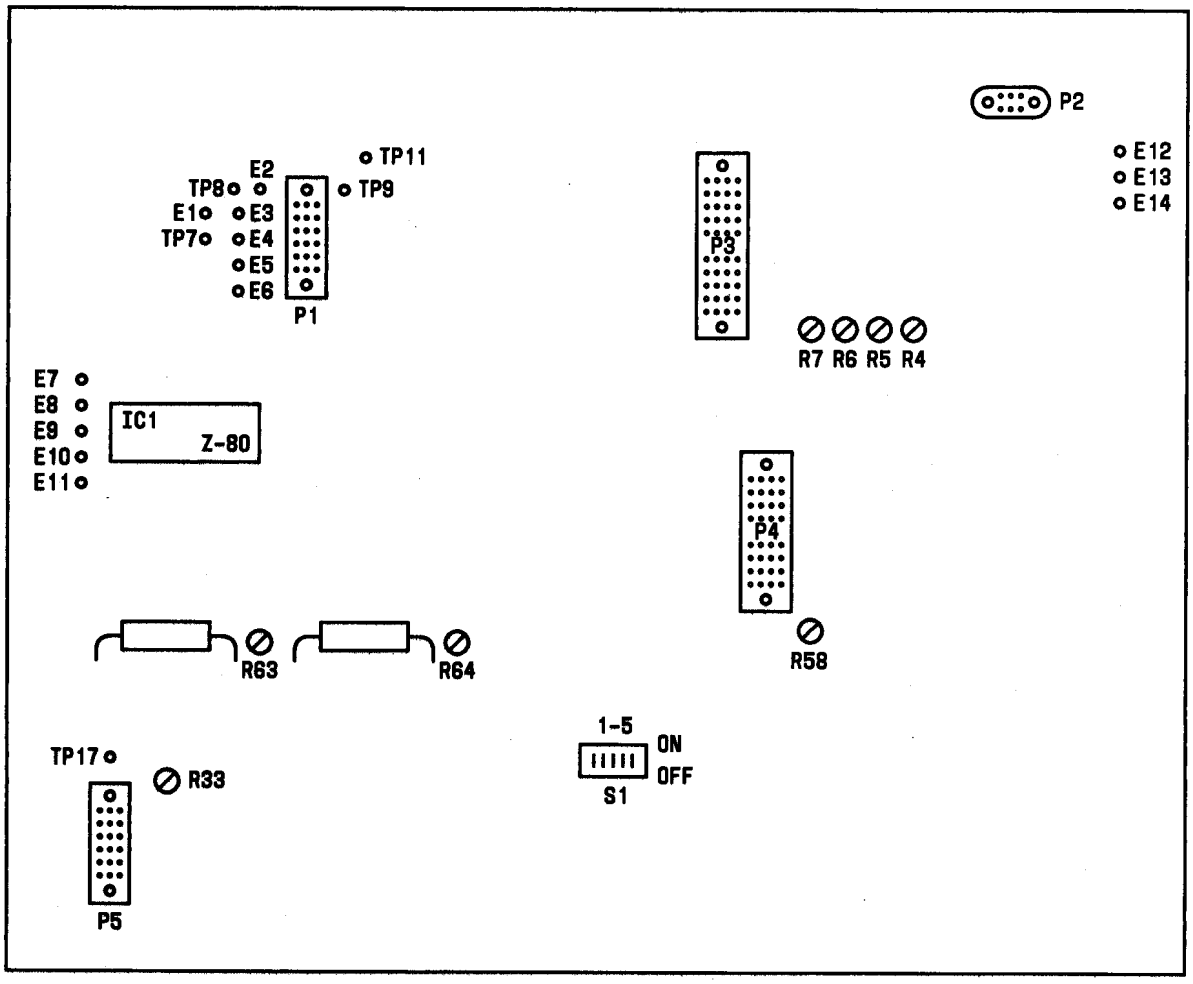
(1) Observe corresponding power factor indication on the CRT screen under PF.

Note: The power factor indication on the CRT screen is indicated in percent. If the space is blank at PF on the CRT, the power factor is zero.

(2) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust R5 potentiometer until the indication on the control panel POWER FACTOR meter has the same indication as the corresponding PF number displayed on the CRT screen.

(e) ***Adjust KW (Kilowatt) Meter:*** To adjust the KW meter on the control panel, proceed as follows:

(1) Observe corresponding POWER indication on CRT screen under POWER.



THERMOCOUPLE INPUT POTENTIOMETER:

T7 – R63
T5 – R64

METER OUTPUT POTENTIOMETER:

SPEED	– R58
TEMP	– R7
CURRENT	– R6
POWER FACTOR	– R5
POWER	– R4

Fig. 13—Potentiometers Located on J85529 (ZZ211) Microcomputer Controller Board

Note: The power indication on the CRT screen is indicated in kilowatts. If the space is blank at POWER on the CRT, the power is 0 kilowatts.

(2) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust the R4 potentiometer until the indication on the control panel KW meter has the same indication as the corresponding POWER number displayed on the CRT screen.

(f) ***Adjust % SPEED Meter:*** To adjust the % SPEED meter on the control panel, proceed as follows:

(1) Observe corresponding speed indication on CRT screen under SPEED.

Note: The speed indication on the CRT screen is in percent. If the space is blank at SPEED on the CRT, the percent is zero. A blank should only appear during an idle operation of the set.

(2) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust the R58 potentiometer until the indication on the control panel % SPEED meter has the same indication as the corresponding SPEED (percent) number displayed on the CRT screen.

(g) ***Adjust TEMPERATURE Meter:*** To adjust the TEMPERATURE meter on the control panel, proceed as follows:

(1) Observe corresponding TEMPERATURE indication on the CRT screen under TEMP 7.

Note: The temperature indication on the CRT screen is in °F (degrees Fahrenheit).

(2) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust R7 potentiometer until the indication on the control panel TEMPERATURE meter has the same indication as the corresponding TEMP 7 number displayed on the CRT screen.

(h) ***Final Meter Setpoints:*** Check each meter with its corresponding entry displayed on the CRT screen. If all meters are set properly, proceed as follows:

(1) Operate the OPERATION SELECTOR SWITCH to the OFF position.

(2) After the set has coasted to a stop, operate CB203 circuit to the OFF position.

(3) Verify that the SW3 switch on the ZZ210 board (J85520 microcomputer controller board, see Fig. 13) is in the open position.

(4) Operate rocker switch on the back of the CRT to the OFF position.

(5) Disconnect the RS-232 adapter cable from the MODEM connection of the CRT and the P2 plug of the ZZ211 board.

(6) Operate the CB203 circuit breaker to the ON position.

(7) Operate the OPERATION SELECTOR SWITCH to the desired position.

(i) ***Temperature Setpoints (T7):*** To check temperature setpoints (T7), proceed as follows:

Note: A recommended pyrometer indicator (or equivalent) is MINIMITE, Model 31101, manufactured by Thermo Electric Company, Saddle Brook, New Jersey. The temperature scale of this instrument is for use with chromel-alumel thermocouples, and the circuit is compensated for ambient temperature. Do not use millivolt scale; ambient temperature compensation is removed when millivolt scale is selected. Instrument should be zeroed in accordance with manufacturer's instructions.

(1) Move OSS to OFF.

(2) Disconnect thermocouple wires from the engine at TB308 terminals 7 and 8 and connect the pyrometer to these points.

(3) Make connections as shown in Fig. 14.

(4) Move OSS to MANUAL.

(5) Depending on setpoint under adjustment, adjust millivolt source for an indicated reading on the pyrometer of:

900°F	PRE HIGH EXHAUST TEMP (Steady Lamp)
945°F	HIGH EXHAUST TEMP (Steady Lamp)

(6) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust R63 potentiometer ccw until lamp extinguishes, then adjust cw until lamp lights.

(7) Check setting by adjusting the signal source output downward until lamp extinguishes, then slowly increase output until lamp lights. The indicated pyrometer reading should be within 7°F of desired setpoint.

(8) Restore system connections to normal configuration.

(j) ***Temperature Setpoints (T5):*** To check temperature setpoints (T5), proceed as follows:

Note: A recommended pyrometer indicator (or equivalent) is MINIMITE, Model 31101, manufactured by Thermo Electric Company, Saddle Brook, New Jersey. The temperature scale of this instrument is for use with chromel-alumel thermocouples, and the circuit is compensated for ambient temperature. Do not use millivolt scale; ambient temperature compensation is removed when millivolt scale is selected. Instrument should be zeroed in accordance with manufacturer's instructions.

(1) Move OPERATION SELECTOR SWITCH to OFF.

(2) Disconnect thermocouple wires from the engine at TB308 terminals 5 and 6 and connect the pyrometer to these points.

(3) Make connections as shown in Fig. 15.

(4) Move OSS to MANUAL.

(5) Depending on setpoint under adjustment, adjust millivolt source for an indicated reading on the pyrometer of:

400°F	LIGHT OFF TEMP LED
1170°F	PRE HIGH EXHAUST TEMP (Blinking LED)
1300°F	HIGH EXHAUST TEMP (Blinking LED)

(6) Located on the J85529 microcomputer controller board (ZZ211), see Fig. 13, adjust R64 potentiometer ccw until lamp extinguishes, then adjust cw until appropriate lamp lights.

(7) Check setting by adjusting the signal source output downward until lamp extinguishes, then slowly increase output until lamp lights. The indicated pyrometer reading should be within 7°F of desired setpoint.

(8) Restore system connections to normal configuration.

4.39 ***Timers:*** See paragraph 4.38 for the applicable timer.

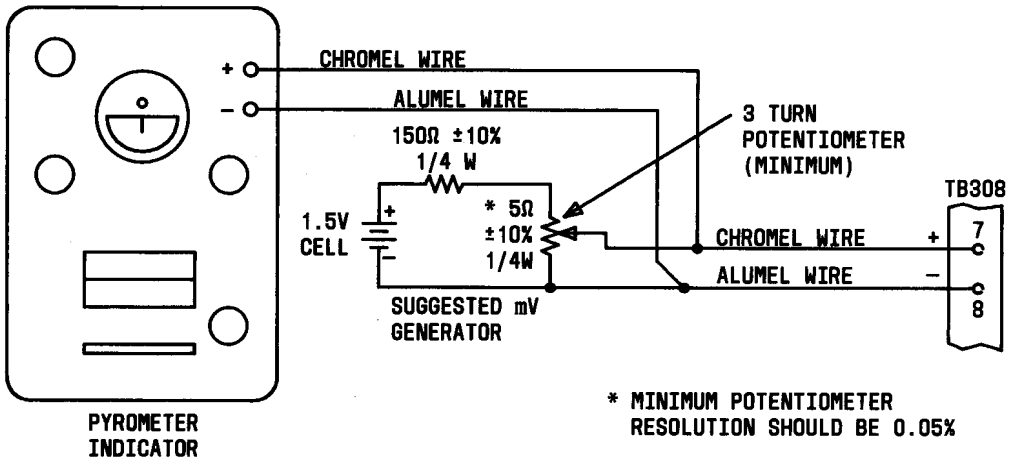


Fig. 14—Temperature Monitor Calibration (T7 Input)

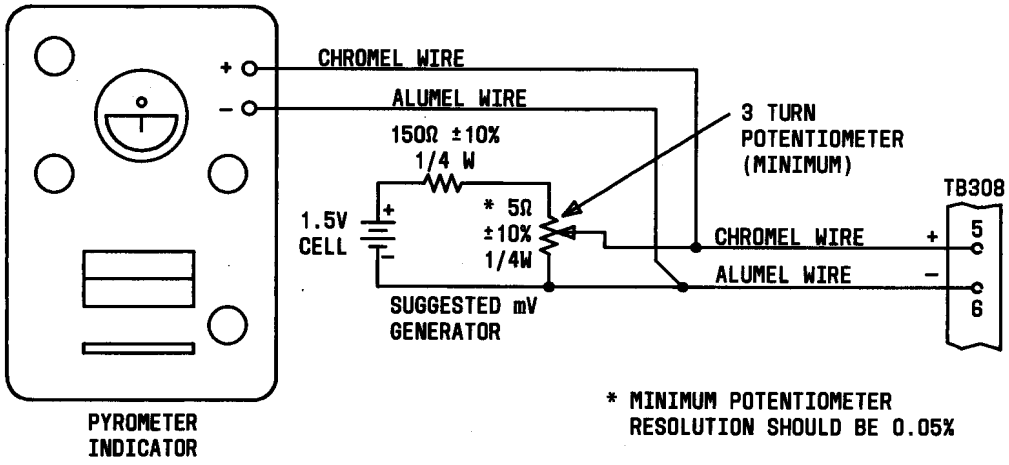


Fig. 15—Temperature Monitor Calibration (T5 Input)