COMBINATION 505D/521A POWER PLANT
OPERATING METHODS

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1. GENERAL

1.01 The 521A inverter power plant may be used in combination with the 505D motor-alternator power plant. The 505D/521A power plant can contain a maximum combination of seven KS-15626, KS-15993, or KS-15994 motor-alternators and KS-19738 inverters including the emergency motor-alternator. The combination plant supplies power for the 12-coaxial system. Refer to Fig. 1 for the various 505D/521A power plant lineups. The plant is primarily intended for use in the L3 carrier system but may be used whenever its characteristics and design apply. Refer to Fig. 2 and Fig. 3 for block diagrams of a typical 505D/521A power plant (power room and carrier room).

1.02 This section is reissued to add reference to the YB and YD options and to revise the list of tools and test apparatus in Part 2, the operating information in Part 3, the routine checks in Part 4, and the trouble information in Part 5. This reissue does not affect the Equipment Test List.

Warning: This power plant includes automatic equipment and voltages as high as 4400 volts. Extreme caution should be exercised to prevent the accidental starting of the parts of the power plant on which maintenance work is to be performed. Before starting work on the power plant, prevent the automatic starting of equipment by removing fuses, blocking relays, operating switches, etc, as necessary.

Caution: While performing some maintenance, it may be necessary to turn the power down on the associated coaxial cable to prevent possible switching transients from damaging the associated repeater equipment. Before turning the power down on the coaxial cable, be certain that all associated terminals are notified of the

PLANT LINEUP FOR COMBINATION 505D AND 521A PLANTS SHOWING POSSIBLE MAIN CONFIGURATIONS (FOR 16kVA ONLY). THE 505D PLANT: TRANSFER CONTROL BAYS, J86448B L2, AND J86448C L2. THE 521A PLANT: J86854A REGULAR INVERTER, NO START CONTROL BAYS FOR ALTERNATORS ARE SHOWN.

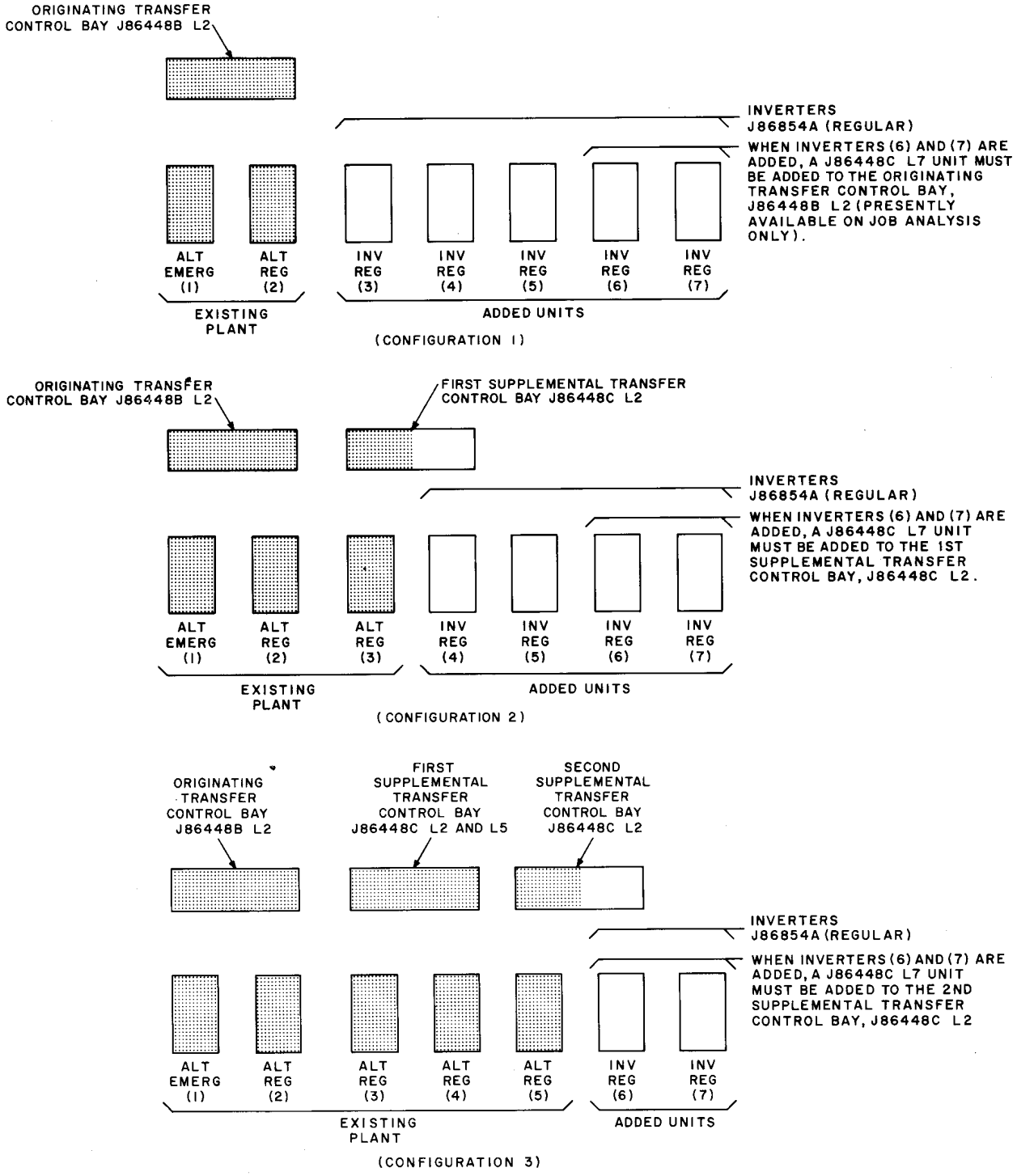


Fig. 1—505D/521A Power Plant—Possible Main Configurations

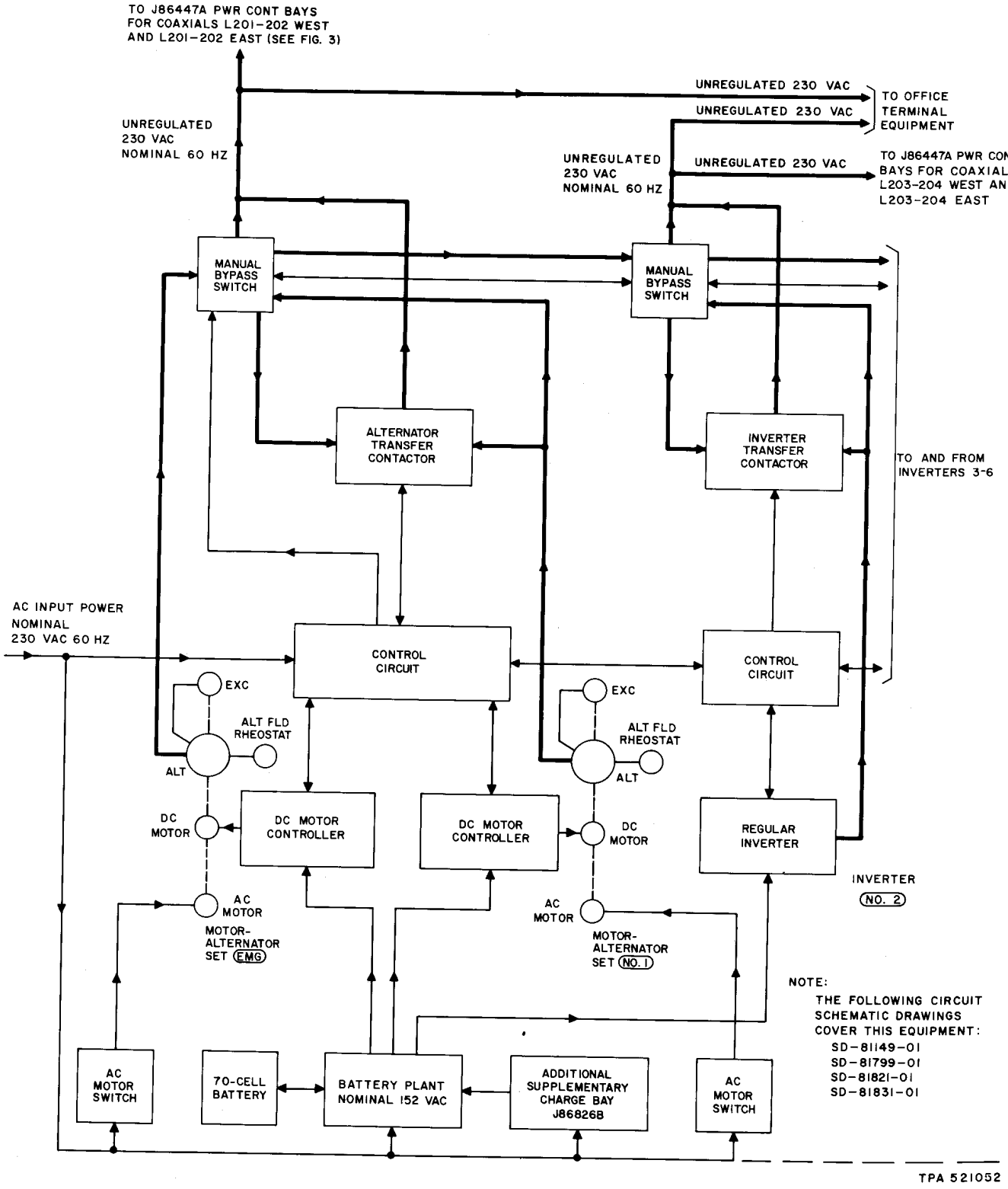


Fig. 2—Typical 505D/521A Power Plant (Power Room)—Block Diagram

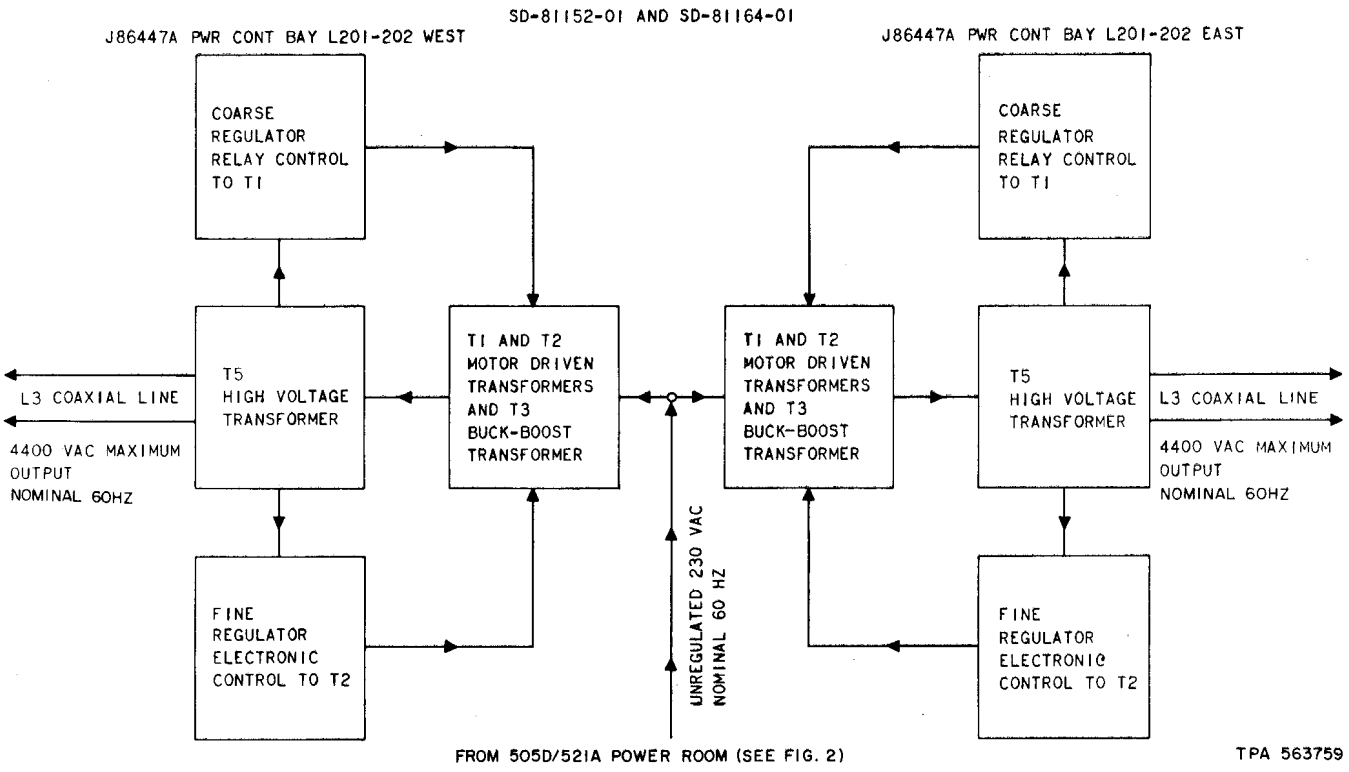


Fig. 3—Typical 505D/521A Power Plant (Carrier Room)—Block Diagram

forthcoming actions and that all necessary precautions are taken. When maintenance work has been completed, be certain to restore the circuits to normal operation.

1.03 The combination plant provides nominal ac outputs of 230 volts, 60 Hz. Each motor-alternator in the plant consists of an alternator, an ac motor, and a dc motor. The motor-alternators in the plant normally operate from a nominal ac input service voltage of 230 volts, 60 Hz, and can also operate from a +152 volt (70-cell) dc battery plant. The motor-alternators are rated at 10KVA, 16KVA, or 21KVA (MD). The inverters in the plant always operate from a +152 volt (70-cell) dc battery plant and are rated at 16KVA.

1.04 The instructions given in this section are based on the following circuit schematic drawings. For detailed descriptions of circuit operation, refer to the corresponding circuit descriptions.

SD-81149-01, Iss 21B—L3 Carrier Telephone, 230 VAC Power Supply Circuit, 2 Motor-Alternator-Automatic Control, 505D Plants

SD-81152-01, Iss 23—Power Control Circuit For L3 Carrier Telephone, 0-4400 Volts, 60 Cycles, Regulated Current, 1.5 Amps, 505D & 521A Plant—J86447

SD-81164-01 Iss 8—Regulator Circuit, Current-Electronic Type—J86262A

SD-81799-01 Iss 8—L3 Carrier Inverter Plant, 521A Plant, Regular Supply Control Circuit—J86854A

SD-81821-01, Iss 3D—Combination 505D/521A Plants, Regular Application Schematic

SD-81831-01, Iss 4AR—Inverter Circuit For L3 Carrier, Regulated Semi-conductor Type, 16KVA, 230V, PF (0.8-1.0) Lag, Single-Phase, 60-Hz—KS-19738

If this section is to be used with equipment or apparatus that is associated with earlier or later issues of the circuit schematic drawings, reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

1.05 The voltage that is applied to the L3 coaxial cable is determined by the length of the power section. A power section is the series loop through the center conductor of two coaxial lines with the primary windings of the auxiliary transformer at each repeater point connected in series with the center conductor of the two coaxial lines. The voltage that is applied to the L3 coaxial cable is obtained by stepping up the output voltage of each motor-alternator and automatically regulating the stepped up output to maintain a constant alternating current for the coaxial lines. The approximate constant current used on the coaxial lines is 1.5 amperes for a PS1 system or 1.6 amperes for a PS2 system. The alternating current for a power section is held constant by the two variable motor-driven autotransformers in the associated PWR CONT (power control) bay. One of the autotransformers is used for coarse adjustments and the other autotransformer is used for fine adjustments. The coarse-adjust autotransformer is controlled by a voltage relay and the ± 3 percent cams of the fine-adjust autotransformer. The fine-adjust autotransformer is controlled by an electronic-regulating circuit. Both the coarse-adjust and fine-adjust autotransformers respond to voltage drops across a resistance that is in series with the L3 coaxial lines.

1.06 Each motor-alternator in the combination plant consists of a dc motor, an ac motor, and a self-excited alternator mounted on a common shaft. The motor-alternator, under manual control, is started and brought up to normal speed and voltage limits by the dc motor. The drive is then transferred manually to the ac motor for normal operating conditions. When the alternator is on ac drive, the field of the dc motor is connected to the battery through a high resistance. An ac power failure or low voltage condition automatically disconnects the ac power from the ac motor, applies battery to the dc motor, and short-circuits the high field resistance causing the dc motor to operate and provide alternator drive.

1.07 The regular and emergency motor-alternators in the plant are driven by the ac motors under normal operating conditions. A voltage transfer control circuit causes the motor-alternator drive to automatically transfer from the ac motors to the dc motors when the ac input voltage drops below approximately 80 percent of nominal value. When the ac input power is restored, the motor-alternators will automatically transfer from the dc motors back to the ac motors when the ac input voltage has been at least 90 percent of nominal value for approximately 1 minute. If the motor-alternator fails to keep the output voltage about 225 volts, the voltage relays will cause the motor-alternator to transfer to the dc motor. If the output voltage from a regular motor-alternator drops below 205 volts for more than 1/2 second, the voltage relays will cause the load to transfer from the regular motor-alternator to the emergency motor-alternator.

1.08 The emergency motor-alternator is used as a common emergency motor-alternator for a combination of from one to six regular motor-alternators and inverters. Under normal operating conditons, the emergency motor-alternator runs continuously at no load and will automatically replace any regular motor-alternator or inverter that fails, goes low in supplying output voltage, or is removed from service for maintenance.

1.09 If the motor-alternators in the plant were operating on the dc motors (due to an ac power failure) and all the motor-alternators were transferred back to the ac motors at the same time (ac power restored), the resulting load surge might reduce the ac input voltage to the ac motors below the line monitor transfer point. This could cause the motor-alternators to transfer back and forth repeatedly. To prevent the ac input voltage to the ac motors from dropping below the line monitor transfer point, an alternator-sequencing circuit restores the motor-alternators in the plant to ac drive sequentially on an individual basis following an ac power failure (ac power now restored). The emergency motor-alternator would be the first unit to transfer back to ac drive.

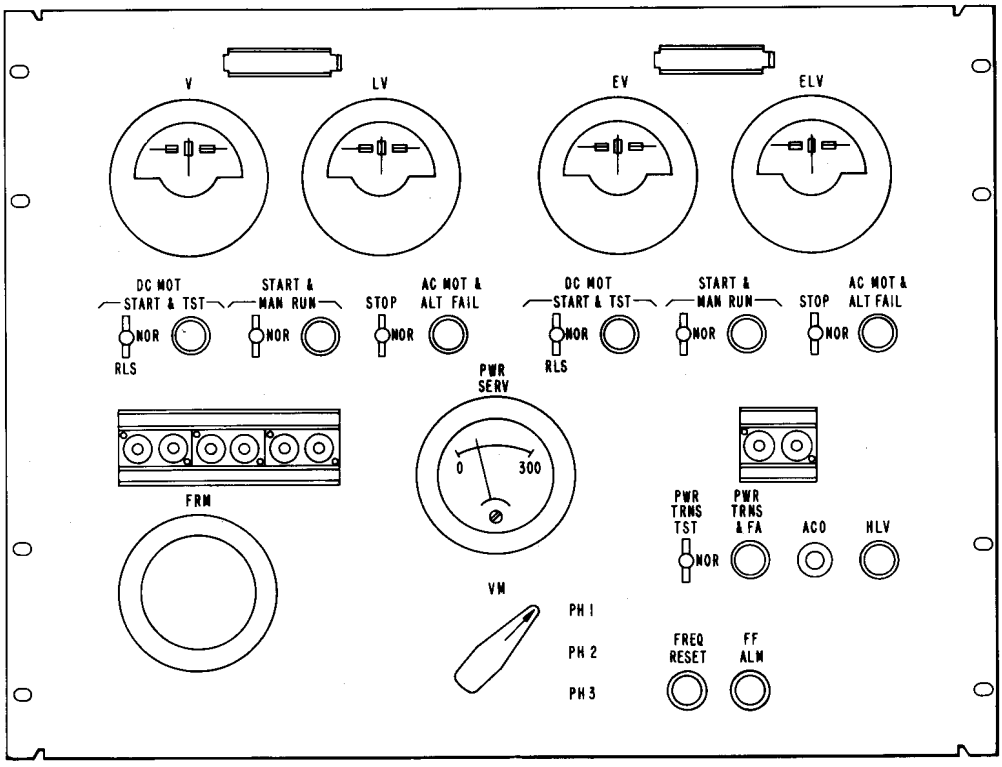
1.10 The plant contains an originating TRANSFER CONTROL bay and as many SUPL (supplementary) TRANSFER CONTROL bays as required. The originating TRANSFER CONTROL bay contains the common control circuit that is used to automatically transfer the load from a faulty regular motor-alternator to the emergency motor-alternator and also contains the circuits for

checking the automatic transfer from ac to dc drive. Originating TRANSFER CONTROL bays and SUPL TRANSFER CONTROL bays can contain the motor-alternator controls for one or two motor-alternators. Refer to Fig. 4 and Fig. 5 for control panel illustrations of the TRANSFER CONTROL and SUPL TRANSFER CONTROL bays.

1.11 A NOR-ALT BYPASS switch is provided in the originating TRANSFER CONTROL bay or SUPL (supplementary) TRANSFER CONTROL bay for each of the regular motor-alternators in the plant. When the NOR-ALT BYPASS switch is in the NOR position, the load is connected to the regular motor-alternator output through this switch. When the NOR-ALT BYPASS switch is in the ALT BYPASS position, depending on the wiring connections of the plant, the load is connected either to the output of the emergency alternator (standard) or directly to the ac input power (MD).

1.12 There is a START CONTROL or EMG START CONTROL bay for each of the motor-alternators in the plant. This bay contains the relays, contactors, and resistors for controlling the starting and operation of the motor-alternators.

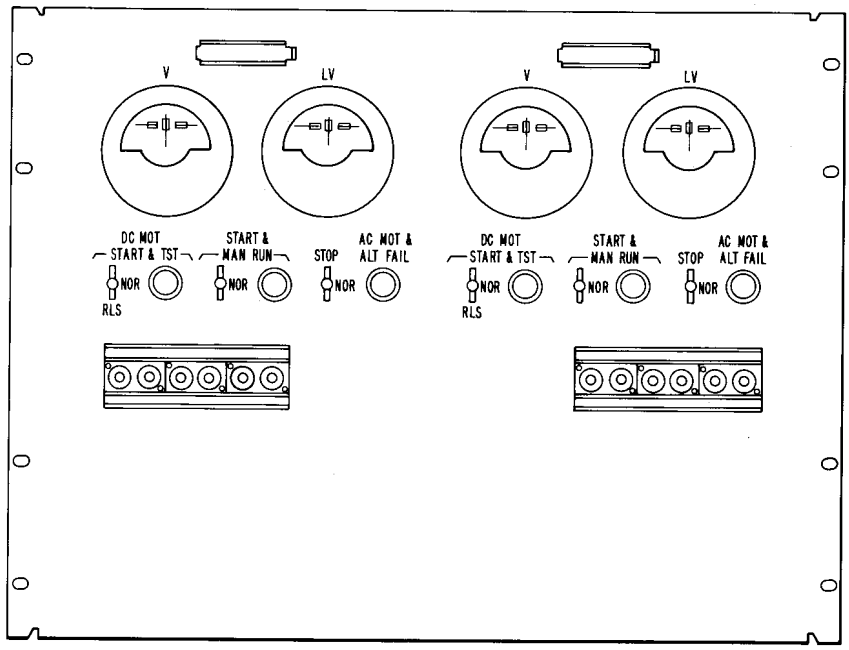
1.13 A frequency monitor circuit (ZH option, SD-81149-01) may be provided in the plant for the motor-alternators to monitor the ac input service frequency. If the frequency monitor circuit is provided and the ac input service frequency drifts out of limits, the motor-alternators will automatically transfer from ac to dc drive. When the frequency transfer occurs, the FF ALM lamp, PWR TRNS & FA lamp, and office audible and visual alarms are activated. When the ac input service frequency



NOTE:
THE CONTROL PANEL OF THE "TRANSFER CONTROL" BAY CONTAINS THE COMMON CONTROLS AND THE CONTROLS FOR ONE REGULAR AND ONE EMERGENCY MOTOR-ALTERNATOR.

ES-529919

Fig. 4—Control Panel of TRANSFER CONTROL Bay



NOTE:
THIS CONTROL PANEL OF A "SUPL TRANSFER CONTROL" BAY CONTAINS THE CONTROLS FOR TWO REGULAR MOTOR-ALTERNATORS.

TPA 550929

Fig. 5—Control Panel of SUPL TRANSFER CONTROL Bay

returns to normal, the FREQ RESET key must be depressed to allow the motor-alternators to return to ac drive.

> ***Note:*** ▶The YB option has been developed to provide a frequency monitor circuit with automatic reset for use at unattended sites or where line frequency transients cause frequent transfers of the plant to dc drive. The automatic reset feature enables the plant to return to ac drive without attention from operating personnel. The YD option, which may be added to the YB option, provides an additional feature which disables the frequency monitor prior to and during return of the plant to ac drive. YD option is intended for use at sites using ac sources which cannot accept the 505D plant motor-alternators load without reacting in a manner that affects the frequency monitor circuit.◀

1.14 An output voltage limiter circuit (ZM and ZN or ZQ options, SD-81149-01) may be provided in the plant to limit the motor-alternator output voltage to a value between 240 and 250 volts when the motor-alternators are driven by the unregulated dc motors. If the output voltage limiter circuit is provided in the plant, the 16KVA, KS-15994 L2 motor-alternators use the ZM and ZQ options and the 16KVA, KS-15626 L2 motor-alternators (MD) use the ZM and ZN options. If the ac output voltage from a dc motor driven motor-alternator increases to 240 volts, the voltage limiter circuit will regulate the alternator field coil current to hold the output voltage from the motor-alternator between 240 and 250 volts or drive the output voltage down toward 230 volts. If the output voltage from the motor-alternator is driven down toward 230 volts, the output voltage may stabilize at some voltage less than 240 volts. When the motor-alternator output increases to the 240 volts, the OVERVOLT lamp on the power plant lights and an office visual and audible alarm is activated. After the ac output voltage from the motor-alternator is restored to normal, the RESET OVERVOLT (S1) key must be depressed to extinguish the OVERVOLT lamp and the office visual and audible alarms.

When the output voltage limiter circuit is provided in the plant, a CLAMP DISABLE (S1) switch [may be called LIMITER DISABLE (S1) switch] is included. The switch can be used to bypass the output voltage limiter circuit. Under normal operating conditions the CLAMP DISABLE (LIMITER DISABLE) (S1) switch should be in the open position.

1.15 An overspeed shutdown circuit (ZT option, SD-81149-01) may be provided in the combination plant for the motor-alternators. The overspeed shutdown circuit is used to monitor the frequency of the nominal 230-volt ac outputs from the motor-alternators. If the frequency of the 230-volt ac output from a motor-alternator increases (motor speed increases), a point will be reached where the associated OS1 relay will de-energize. When the OS1 relay de-energizes, the motor-alternator will shut down, the OS FAIL and AC MOT & ALT FAIL lamps on the plant light, and the office visual and audible alarms are activated. After the motor-alternator has shut down due to a de-energized OS1 relay, the NOR-STOP key on the TRANSFER CONTROL bay must be operated to the STOP position to re-energize the OS1 relay.

1.16 Each inverter in the combination plant must be started manually by the inverter INPUT (S501) switch. The load on an inverter can be manually disconnected from the inverter by the OUTPUT (S502) switch. The CONTROL OFF switch on the REGULAR PLANT CONTROL panel can be used to disable the automatic control circuits of the inverter. Switches are provided for testing the alarm circuits of the inverter. Alarms are provided in the inverter to indicate fuse, circuit breaker, and monitor failures. Refer to Fig. 6 for an illustration of the KS-19738 inverter and Fig. 7 for a partial view of a 521A power plant lineup. Refer to Fig. 8 for a photograph of the REGULAR PLANT CONTROL panel.

1.17 The plant contains PWR CONT bays that are connected to the L3 coaxial lines. Each regular motor-alternator or inverter will normally power two PWR CONT bays. The required line current for the transmit and receive lines of the PWR CONT bay should be specifed on cards or tape and posted directly above each of the two associated ammeters on the bay. The PWR CONT bay is equipped with manual controls that allow the line currents to be raised or lowered for performing tests and maintenance work. Refer to Fig. 9 for an illustration of the PWR CONT bay and to Fig. 10 for a control panel illustration of this bay.

1.18 ▶The inverter checks in this section are to be used when the inverter is used in the 505D/521A power plant. For inverter checks when the inverter is used in a dedicated application, see Section 161-233-301.◀

1.19 Designations used in this plant (controls, etc.) that are preceded by E refer to the emergency motor-alternator.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
KS-6278	Connecting clips (4 reqd)
KS-6320	Orange Stick
KS-19168 L1	Cord, 6 Feet Long, 14 Gauge or Equivalent, Equipped With Hubbell Cap No. 5666
265C	Burnisher
411C	Test Picks (2 reqd)
R-1102	Spudger
W1AY	Cord, 8-1/2 Feet Long, Equipped With two 360A Tools (2 reqd)
720A	▶Battery Pick-up Tool◀
141	▶Cord Tip◀
1W13A	893 Cord, 3 Feet Long, Equipped With two 360A Tools
—	185-JO Cable, 3 Feet Long, (2 reqd)
—	3-Inch C Screwdriver
—	Connecting Jumpers
—	Relay Blocks
—	Insulating Tools

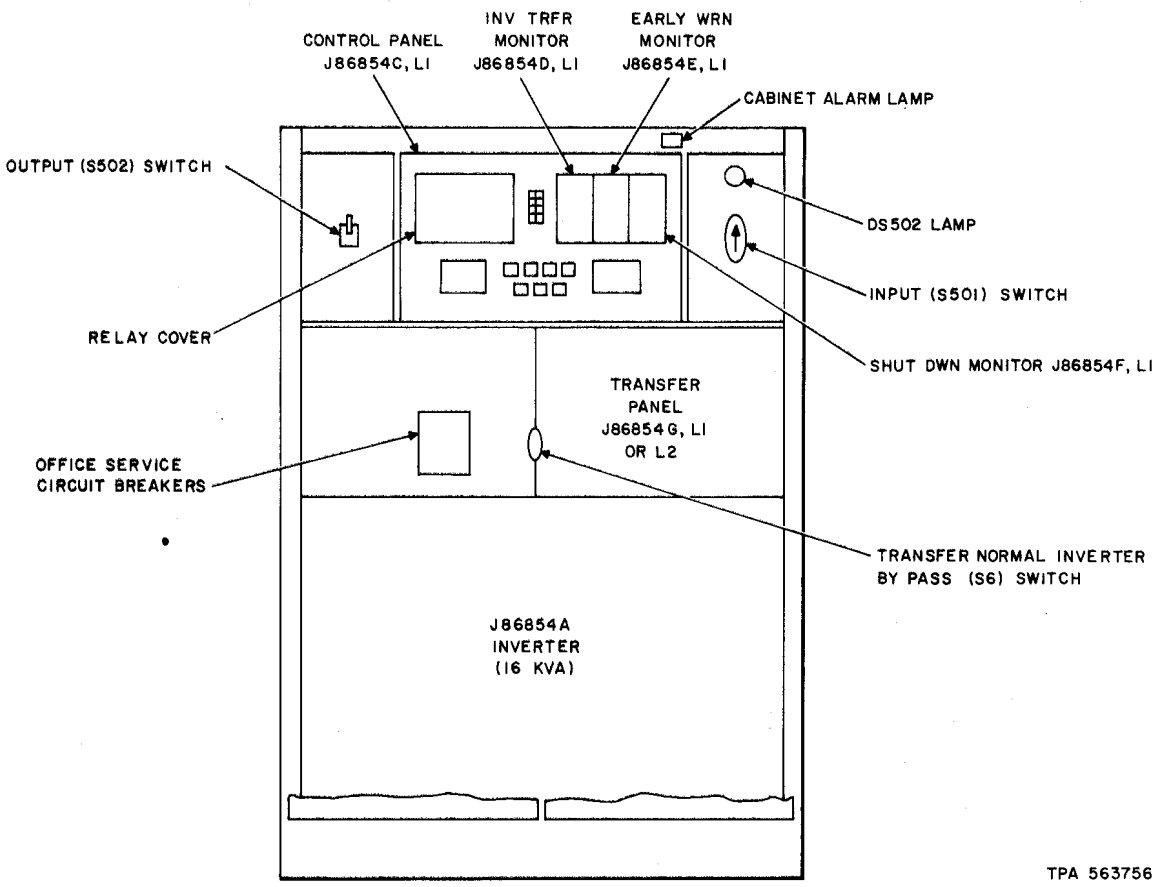


Fig. 6—KS-19738 Inverter

CODE OR SPEC NO.	DESCRIPTION
KS-3008	Stopwatch
KS-14510	Volt-Ohm-Milliammeter
—	Weston Model 622 AC-DC Thermo Voltmeter (300/150/75/30/15) (See Note 1)
—	Weston Model 904 AC Voltmeter, True RMS (300/150)
—	Hewlett-Packard 5221A Electronic Counter
—	Hewlett-Packard 202C or 200CD Oscillator
—	Tachometer, Boulin Instrument Corp., Type A or No. 5
—	*Variac, W5HMT, General Radio Co., 240-Volt, 2-Ampere, Single Phase, 50- to 60-Hz Input—0- to 280-Volt Output
—	Tektronix 545B Oscilloscope With CA-Type Adapter or Equivalent (Not required for normal maintenance)

*Registered trademark of the General Radio Co.

Note 1: ▶A digital multimeter such as the Hickok 3420 is a preferable substitute for these meters.◀

Note 2: Equivalent may be substituted.

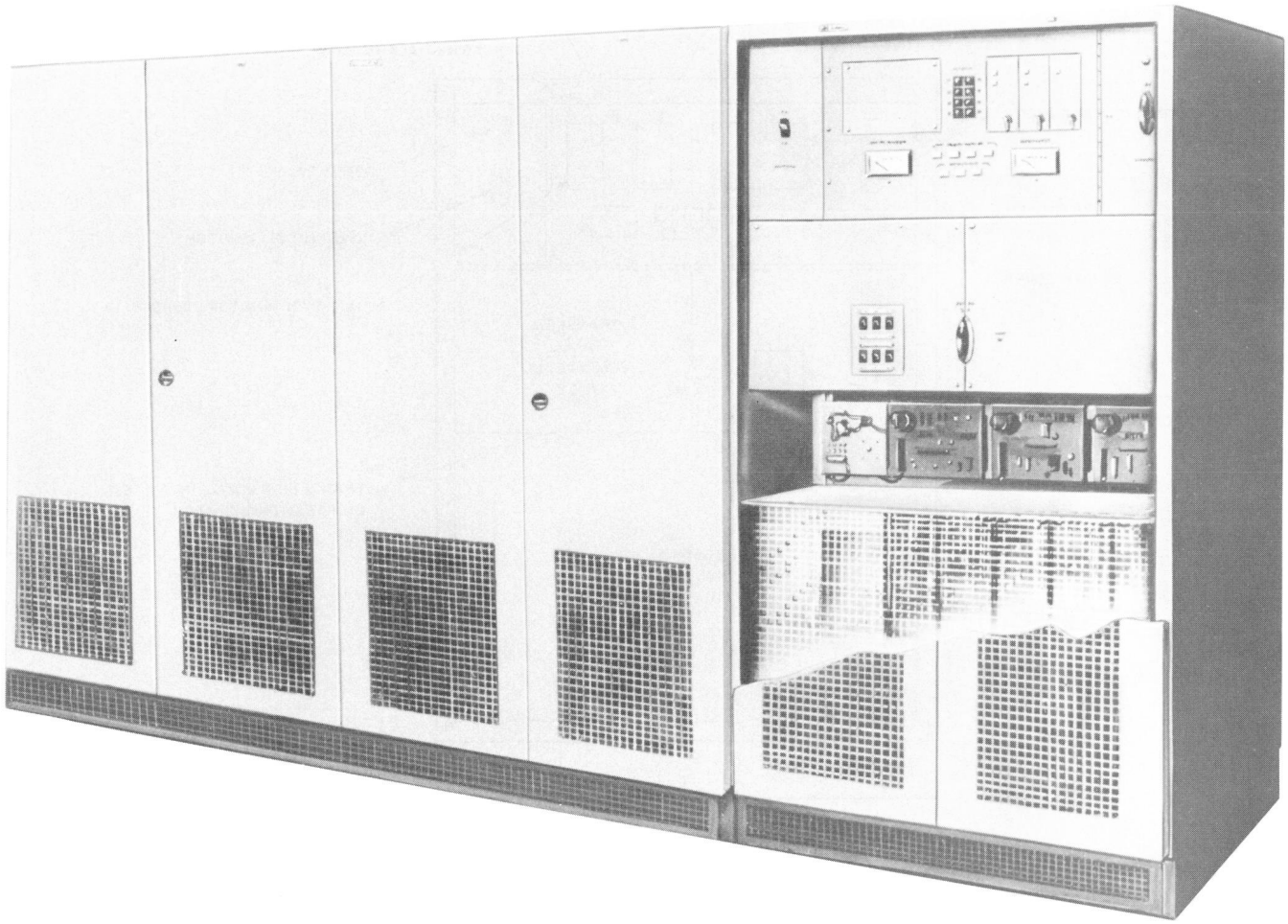


Fig. 7—Partial View of 521A Power Plant Lineup—Cutaway View Shows a KS-19738 Regular Inverter

3. OPERATION

A. PWR CONT Bay Power Turnup Procedure

3.01 To turn the power up on the associated L3 lines at the PWR CONT bay, proceed as follows.

Warning: Before turning power up on the associated L3 lines, verify that men are not working on the associated lines and that the TURN DOWN lamp on the PWR CONT bay is lighted to prevent personnel injuries from occurring.

Caution: If there is an equalizing repeater or a remote terminal repeater (fed on a constant basis) in the power section, do not turn the power up until the power has been completely turned down for at least 5 minutes. At these locations, a plate voltage limiter circuit provides a load on the plate power supply to limit the plate voltage when the power is being turned up on the associated L3 lines. If the power is turned down on the L3 lines and is then turned back up before the minimum 5-minute interval, the associated amplifiers and regulators will be subjected to excess voltages.

(1) Verify that all maintenance on the associated L3 line or PWR CONT bay has been completed.

(2) Operate the ACO key to release the VSD relay lock-up circuit which will close the SS contactor.

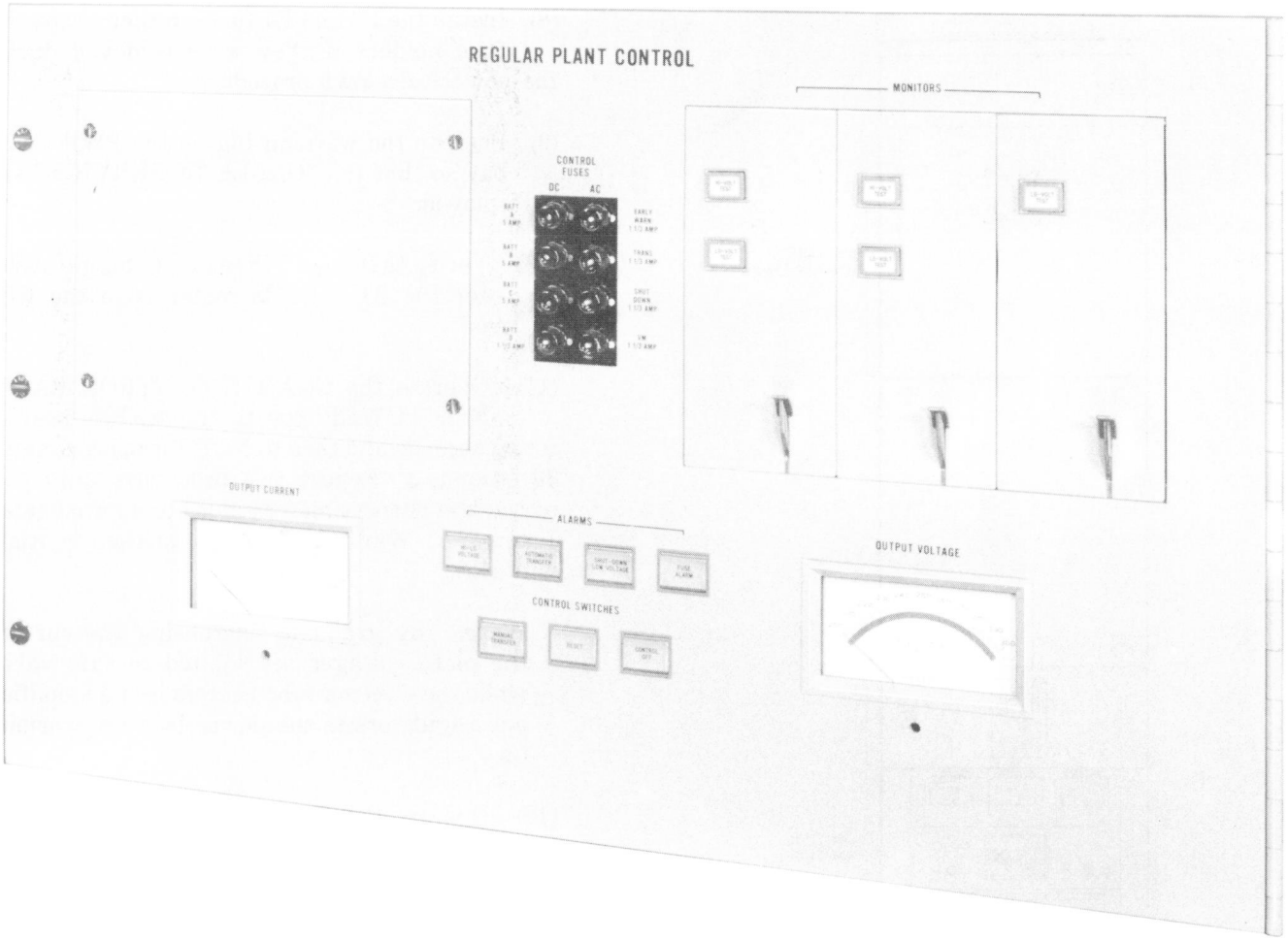


Fig. 8—J86854C Control Panel of KS-19738 Regular Inverter

Note: Failure to operate the ACO key when the audible alarm is activated will prevent the power turnup because the VSD relay circuit will be locked up.

Requirement: The audible alarm is silenced.

(3) Verify that the POWER CONTROL FAILURE and TURNDOWN lamps are lighted on the PWR CONT bay.

(4) Verify that the following controls on the PWR CONT bay are positioned as indicated.

COARSE CONTROL MANUAL-NOR AUTO key to MANUAL

COARSE CONTROL RAISE-NOR-LOWER key to NOR

FINE CONTROL NOR-OFF switch to OFF

(5) Connect the PWR cable terminal plugs that are associated with the power loop to the input of the power separation filters.

(6) Install the cover that is used to cover the PWR cable terminal plugs on the rear of the power separation filter panel.

(7) Install the COAXIAL LINE (A) fuse in its respective fuse holder.

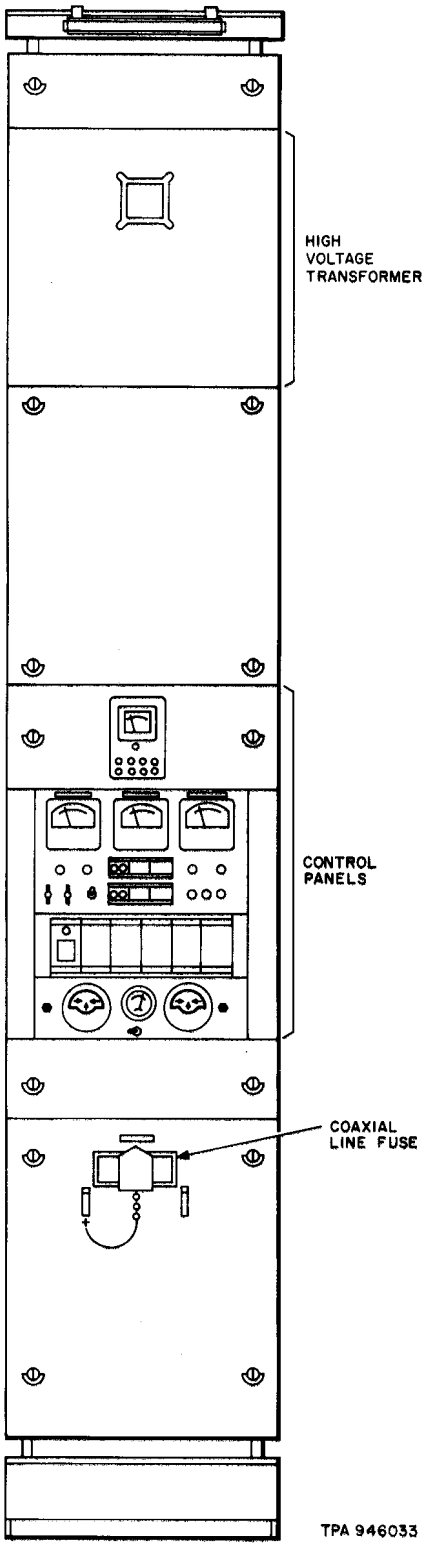


Fig. 9—PWR CONT Bay

(8) Install the F3 and F4 fuses in their respective fuse holders if they were removed during the power turndown procedure.

(9) Position the warning tag on the PWR CONT bay so that the "CABLE IN SERVICE" side is displayed.

(10) Verify that the UNREG-REG toggle switch for the AC VOLTS meter is in the REG position.

(11) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position for ▶2 seconds and then to NOR for approximately 30 seconds.◀ Repeat this procedure until both of the line current meters indicate approximately 1 ampere. Wait 45 seconds and then continue with (12).

Note: By gradually increasing the current, the plate voltages are limited to safe values while the electron tube heaters in the amplifiers and regulators in the power loop are warming up.

(12) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position for ▶2 seconds and then to NOR for approximately 30 seconds.◀ Repeat this procedure until the AC VOLTS meter indicates the nominal regulated voltage (usually 230 volts).

Note: Allow the line voltage and current to stabilize and then continue with (13).

(13) Observe the indication on the PLT CUR meter.

Requirement: The PLT CUR meter indicates 200 milliamperes.

Note: If the requirement in (13) is met, proceed to (15). If the requirement is not met, continue with (14).

(14) Adjust the ADJ CUR potentiometer until the PLT CUR meter indicates 200 milliamperes.

(15) Observe the indications on the two line current meters of the PWR CONT bay.

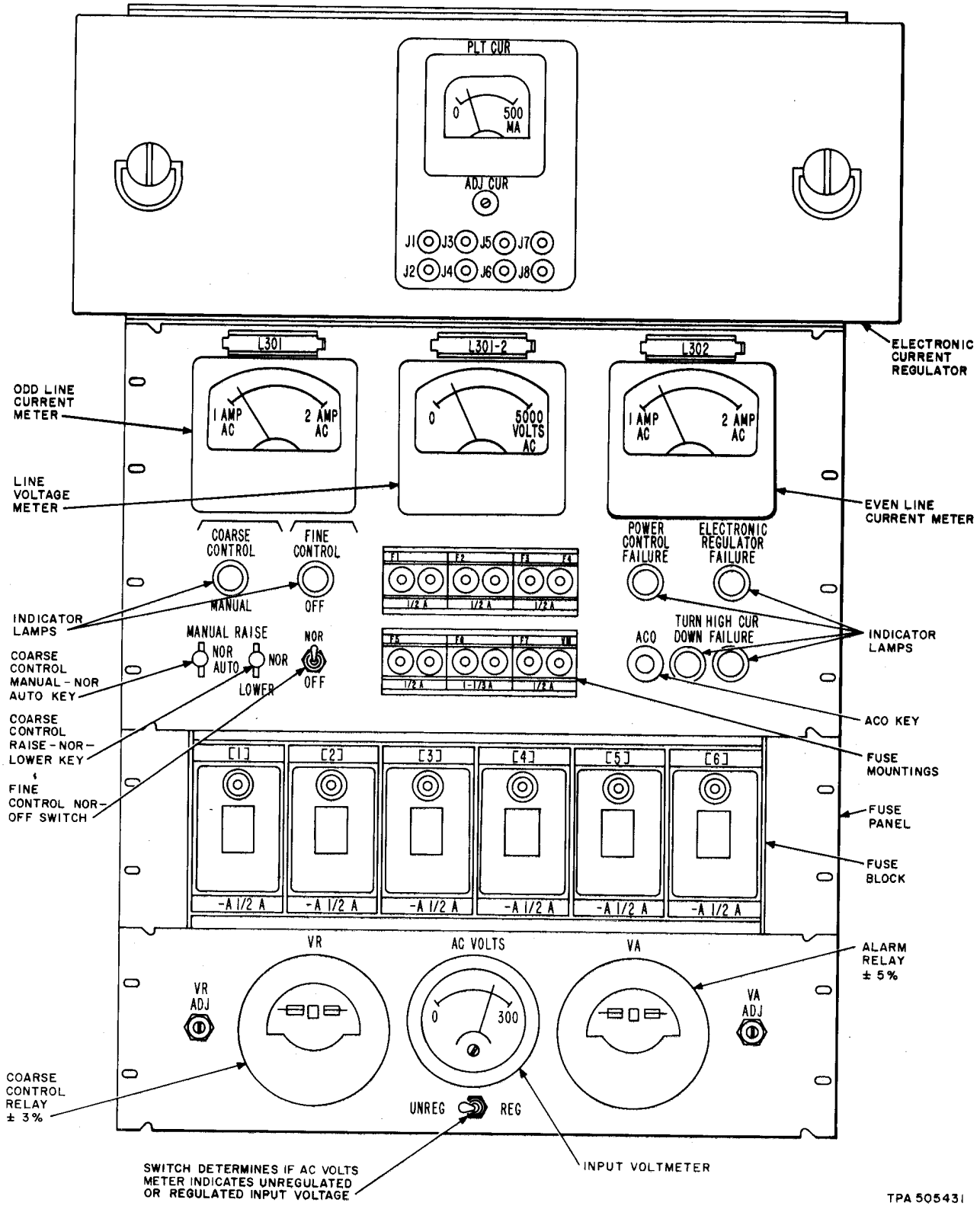


Fig. 10—Control Panel of PWR CONT Bay

Requirement: The line current meters indicate the required line current.

Note 1: The required line current should be posted directly above the associated line current meters.

Note 2: If the line current indicated on the line current meters is not within $\pm$0.01 ampere of the posted line current value, trouble conditions may be present in the associated amplifiers and regulators of the power loop.

(16) Verify that the armatures of the VR and VA relays are midway between the low and high contacts.

(17) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(18) Operate the FINE CONTROL NOR-OFF switch to the NOR position.

Requirement: The FINE CONTROL OFF lamp extinguishes. After a time delay of approximately 3 seconds, the ELECTRONIC REGULATOR FAILURE lamp on the PWR CONT bay extinguishes.

Note: If the ELECTRONIC REGULATOR FAILURE lamp extinguishes, proceed to (33). If the ELECTRONIC REGULATOR FAILURE lamp remains lighted, the T2 autotransformer is not in the midposition. To adjust the T2 autotransformer to the midposition and to extinguish the ELECTRONIC REGULATOR FAILURE lamp, continue with (19).

(19) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(20) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(21) Remove the front cover from the PWR CONT bay that is directly above the PLT CUR (plate current) meter.

(22) Loosen the wingnut that holds the T2 autotransformer in place.

(23) Pull the T2 autotransformer outward to make the unit accessible.

(24) Turn the knob of the T2 autotransformer until the pointer is in the midposition.

(25) Push the T2 autotransformer back into the PWR CONT bay and tighten the wingnut that holds the autotransformer in place. Verify that the autotransformer will not move.

(26) Install the cover that was removed from above the PLT CUR meter.

(27) Observe the indication on the AC VOLTS meter.

Requirement: The AC VOLTS meter should indicate the nominal regulated voltage (usually 230 volts).

Note: If the requirement in (27) is met, proceed to (29). If the requirement is not met, continue with (28).

(28) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position for 1 second and then to NOR for approximately 15 seconds until the AC VOLTS meter indicates the nominal regulated voltage (usually 230 volts). Repeat this procedure until the AC VOLTS meter indicates the required regulated voltage.

Note: Allow the line voltage and current to stabilize and then continue with (29).

(29) Observe the indication on the PLT CUR meter.

Requirement: The PLT CUR meter indicates 200 milliamperes.

Note: If the requirement in (29) is met, proceed to (31). If the requirement is not met, continue with (30).

(30) Adjust the ADJ CUR potentiometer until the PLT CUR meter indicates 200 milliamperes.

(31) Verify that the armatures of the VR and VA relays are midway between the low and high contacts.

(32) Repeat steps (17) and (18).

(33) Observe the indications on the two line current meters (even and odd L3 lines) of the PWR CONT bay.

Requirement: The difference between the two line current meter indications should be less than 50 milliamperes for power sections that contain 15 or less repeaters. The difference between the two line current meter indications should be less than 75 milliamperes for power sections with 16 or more repeaters.

Note: If the requirement in (33) is not met, trouble conditions may be present in the associated amplifiers and regulators of the associated L3 lines or there may be a short or open in the associated L3 lines. If trouble conditions are present, turn the power down on the associated L3 lines in accordance with 3.02, clear the troubles, and then repeat the entire power turn-up procedure beginning with step (1).

(34) Observe the indications on the associated L3 line pilot indicators.

Requirement: The associated L3 line pilot indicators indicate 0 $\pm$0.1dB.

(35) Clear all associated L3 line pilot alarms in both directions of transmission.

Note: If the associated L3 line pilot alarms cannot be cleared, measure the alarms to determine their locations and perform the necessary maintenance to clear the alarms.

(36) Remove the J68839A (39A) or J68839B (39B) thermistor control set from the associated L3 line and have the terminal switching center at the opposite end of the power loop remove their thermistor control set from the same L3 line.

(37) If no maintenance is to be performed that will require the use of the protection lines, restore the protection lines to normal operation. (See Sections 359-010-125 and 359-075-301.) Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note 1: The protection lines should be restored to normal operation immediately after the power has been turned up so that emergency transfers to the protection lines can occur if necessary.

Note 2: After restoring the associated L3 power loop to normal operation, it may be necessary to equalize the power loop due to excessive line current variations. Refer to the appropriate Bell System Practices for information on line equalization.

(38) Complete the restoration portion of the associated power disconnect-restoration card or cards (Form P-1643) per local instructions.

B. PWR CONT Bay Power Turndown Procedure

3.02 To turn the power down on the associated L3 lines at the PWR CONT bay, proceed as follows.

Caution: Before turning the power down on the associated L3 lines, notify the terminal switching centers in all directions of transmission of the forthcoming actions. Verify that no associated L3 switching routines are to be performed; verify that no associated repeater or line maintenance is to be performed; and verify that no other associated routine checks or maintenance are to be performed that will require the use of the L3 protection lines. Verify that the associated L3 protection lines are available for service. Perform the necessary procedures to remove all service from the associated L3 lines (odd and even) that make up the power loop served by the PWR CONT bay.

(1) Notify the terminal switching centers in all directions of transmission that the power is to be turned down on a L3 power loop.

(2) If the power is to be turned down on a regular power loop, transfer the service that is normally on the regular power loop over to the protection power loop. If the power is to be turned down on a protection power loop, and the protection power loop is carrying service, transfer the service on the protection power loop back to the regular power loop that normally carries the service. (See Sections 359-010-125 and 359-075-301.)

Note: When the OUT SERV (green) lamp on the associated REC L3 line bay is lighted, continue with (3).

(3) Connect the J68839A (39A) or J68839B (39B) thermistor control set to the associated L3 line and have the terminal switching center at the opposite end of the power loop do the same. The thermistor control sets will protect the associated amplifiers and regulators in the main switching stations.

Note: Do not disturb the L3 line potentiometers.

(4) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(5) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(6) Verify that the UNREG-REG toggle switch for the AC VOLTS meter is in the REG position.

(7) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the LOWER position and hold until the AC VOLTS meter on the bay indicates zero.

Requirement: An audible alarm is activated and the POWER CONTROL FAILURE lamp lights shortly after the power turndown procedure is started. The TURNDOWN lamp lights when the AC VOLTS meter on the bay indicates 0 volts.

(8) Depress the ACO key.

Requirement: The audible alarm is silenced.

(9) Remove the COAXIAL LINE (A) fuse from its respective fuse holder in the PWR CONT bay.

Note: All power has now been removed from the associated L3 power loop.

(10) If maintenance is to be performed on the PWR CONT bay, remove the F3 and F4 fuses from their respective fuse holders.

(11) If maintenance is to be performed on the coaxial cable, position the warning tag on the PWR CONT bay so that the "MEN WORKING ON CABLE" side is displayed.

(12) Fill out the disconnect portion of a power disconnect-restoration card (Form P-1643) for each party or crew requesting the power turndown. Place the cards in the ticket holder directly below the warning plate on the PWR CONT bay.

(13) Verify that the green CA TERM lamps on the cable terminal panels for the associated power loop are lighted.

Note: The cable terminal panels are located at the top rear of the line bays and are associated with the power separation filter panels.

(14) ***Warning: Be certain to disconnect the PWR cable terminal plugs from the correct line bay associated with the power loop to prevent personnel injuries from occurring.***

(15) Disconnect the PWR cable terminal plugs that are associated with the power loop from the input of the power separation filters.

Note: The PWR cable terminal plugs are accessible by removing the panel cover on the rear of the power separation filter panel.

C. Transferring Load From Regular Motor-Alternator to Emergency Motor-Alternator

3.03 To transfer the load from a regular motor-alternator to the emergency motor-alternator, proceed as follows.

Caution 1: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines.

Caution 2: Return the load to the regular motor-alternator as soon as possible to enable the emergency motor-alternator to be used for automatic transfers should a regular motor-alternator or inverter fail.

(1) Verify that the AMPS meter on the EMG START CONTROL bay indicates zero.

(2) ***Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the EMG START CONTROL bay as hazardous voltages are present.***

Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the EMG START CONTROL bay. If the Hubbell receptacle is not provided but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

Requirement: The Weston Model 904 voltmeter should indicate the nominal no-load voltage as specified by local instructions.

Note: If the requirement in (2) is met, proceed to (4). If the requirement is not met, continue with (3).

(3) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions.

(4) Operate the START & MAN RUN key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the START & MAN RUN position.

Requirement: The START & MAN RUN lamp lights and the load transfers to the emergency motor-alternator.

(5) Verify that the AMPS meter on the EMG START CONTROL bay indicates the nominal output current.

(6) Observe the indication on the Weston Model 904 voltmeter that is connected to the EMG START CONTROL bay.

Requirement: The Weston Model 904 voltmeter indicates the nominal output voltage of 230 $\pm$3 volts.

Note: If the requirement in (6) is met, proceed to (8). If the requirement is not met, proceed to (7).

(7) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

(8) Disconnect the Weston Model 904 voltmeter from the EMG START CONTROL bay.

D. Transferring Load From Emergency Motor-Alternator Back to Regular Motor-Alternator

3.04 To transfer the load from the emergency motor-alternator back to the regular motor-alternator, proceed as follows.

Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the START CONTROL bay as hazardous voltages are present.

Caution: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines.

(1) Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the START CONTROL bay for the regular motor-alternator. If the Hubbell receptacle is not provided but test jacks have been locally wired in for the connection of an external voltmeter, connect the

Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

Requirement: The Weston Model 904 voltmeter should indicate the nominal no load voltage as specified by local instructions.

Note: If the requirement in (1) is met, proceed to (3). If the requirement is not met, continue with (2).

(2) Adjust the ALT VOLTS ADJ potentiometer on the START CONTROL bay until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions.

(3) Operate the START & MAN RUN key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: The START & MAN RUN lamp extinguishes and the load transfers back to the regular motor-alternator.

(4) Verify that the AMPS meter on the START CONTROL bay for the regular motor-alternator indicates the nominal output current.

(5) Observe the indication on the Weston Model 904 voltmeter that is connected to the START CONTROL bay.

Requirement: The Weston Model 904 voltmeter indicates the nominal output voltage of 230 $\pm$3 volts.

Note: If the requirement in (5) is met, proceed to (7). If the requirement is not met, continue with (6).

(6) Adjust the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

(7) Disconnect the Weston Model 904 voltmeter from the START CONTROL bay.

E. Removing Motor-Alternator From Service

3.05 To remove a motor-alternator from service, proceed as follows.

Caution 1: Operating the NOR-ALT BY-PASS switch on a regular motor-alternator to the ALT BYPASS position may cause the service to be interrupted on the L3 lines associated with the motor-alternator.

Caution 2: Restore the motor-alternator to service as soon as possible to enable the emergency motor-alternator to be used for automatic transfers should a regular motor-alternator or inverter fail.

(1) If the motor-alternator to be removed from service is supplying power to the load, transfer the load from the motor-alternator to the associated emergency or regular motor-alternator in accordance with 3.03 or 3.04.

(2) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the associated motor-alternator which is to be removed from service to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights and the motor-alternator transfers to dc drive (AR relay inside of associated EMG START CONTROL or START CONTROL bay should close).

(3) Operate the STOP-NOR key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the associated motor-alternator to the STOP position.

Requirement: The motor-alternator shuts down as indicated by the slowly decreasing indication on the associated EMG START CONTROL or START CONTROL bay voltmeter. If the plant is equipped with an overspeed shutdown circuit (ZT option) and the Class A change in SD-81149-01, Issue 25A has been incorporated into the plant, the AC MOT & ALT FAIL lamp should light.

Note: Wait until the VOLTS meter on the associated EMG START CONTROL or START CONTROL bay indicates zero before continuing with (4).

(4) Operate the ON-OFF toggle switch inside of the associated EMG START CONTROL or START CONTROL bay for the motor-alternator being removed from service to the OFF position.

(5) Remove the associated motor-alternator ac line fuse, 152-volt dc fuse, and the alarm fuse from the supply panel. Be certain to remove the alarm fuse first.

Note 1: The −24 volt supply battery is now disconnected from the start motor.

Note 2: A NOR-ALT BYPASS switch is provided for each regular motor-alternator to allow maintenance to be performed on the associated LOAD TRNS relays with the voltage removed from the relays. When the NOR-ALT BYPASS switch is in the NOR position, the load is connected to the regular motor-alternator output. When the NOR-ALT BYPASS switch is in the ALT BYPASS position, depending upon the wiring option, the load is either connected to the emergency motor-alternator (standard) or directly to the ac input power (MD).

(6) If maintenance is to be performed on the LOAD TRNS relays of a regular motor-alternator, operate the NOR-ALT BYPASS switch inside the lower front of the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay to the ALT BYPASS position.

F. Restoring Motor-Alternator to Service

3.06 To restore a motor-alternator to service, proceed as follows.

(1) If a regular motor-alternator is to be restored to service, verify that NOR-ALT BYPASS switch in the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay is in the NOR position.

(2) Verify that the PWR TRNS TST-NOR key on the TRANSFER CONTROL bay is in the NOR position.

(3) Verify that the START & MAN RUN key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator being restored to service is in the START & MAN RUN position.

Note: If the START & MAN RUN key is not in the START & MAN RUN position, the motor-alternator being restored to service will not start.

(4) Install the associated motor-alternator ac line fuse, 152-volt dc fuse, and the alarm fuse in the supply panel. Be certain to install the alarm fuse last.

(5) Operate the ON-OFF toggle switch inside of the EMG START CONTROL or START CONTROL bay for the motor-alternator being restored to service to the ON position.

Note: The −24 volt supply battery is now connected to the start motor.

(6) Operate the STOP-NOR key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator being restored to the NOR position.

Requirement: An audible alarm is momentarily activated. The motor-alternator being restored starts on dc drive.

Note: Allow the motor-alternator output voltage to stabilize, as indicated on the associated EMG START CONTROL bay or START CONTROL bay voltmeter, before continuing with (7). If the plant is equipped with an overspeed shutdown circuit (ZT option) and the Class A change in SD-81149-01, Issue 25A has been incorporated into the plant, the AC MOT & ALT FAIL lamp should also extinguish before continuing with (7).

(7) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the motor-alternator transfers to ac drive (AR relay inside of associated EMG START CONTROL or START CONTROL bay should open).

(8) If the motor-alternator being restored to service is to supply power to the load, transfer the load from the associated emergency or regular motor-alternator back to the

motor-alternator being restored in accordance with 3.03 or 3.04, as applicable.

Note: If a motor-alternator has been out of service for several hours and is then put into service, the motor-alternator will tend to run a little faster than normal and it may be necessary to readjust the output voltage from the motor-alternator after the unit has warmed up. If the motor-alternator has been out of service for several hours and is then put into service, allow the output voltage from the motor-alternator to stabilize and then recheck the output voltage by continuing with (9).

(9) ***Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the EMG START CONTROL or START CONTROL bay as hazardous voltages are present.***

Connect the Weston Model 904 voltmeter connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the associated EMG START CONTROL or START CONTROL bay for the motor-alternator being restored to service. If the Hubbell receptacle is not provided but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

Requirement: The Weston Model 904 voltmeter should indicate the nominal no-load voltage as specified by local instructions for an unloaded motor-alternator or the nominal full-load voltage of 230 $\pm$3 volts for a loaded motor-alternator.

Note: If the requirement in (9) is met, proceed to (11). If the requirement is not met, continue with (10).

(10) Adjust the ALT VOLTS ADJ potentiometer on the associated EMG START CONTROL or START CONTROL bay until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions for an unloaded motor-alternator or the nominal full load of 230 volts for a loaded motor-alternator.

(11) Disconnect the Weston Model 904 voltmeter from the EMG START CONTROL or START CONTROL bay.

G. Transferring Motor-Alternators From DC Drive Back to AC Drive After Power Service Frequency Has Returned to Normal, Plant Equipped With Frequency Monitor Circuit (ZH option)

3.07 If the power service frequency goes out of limits, the motor-alternators will transfer to dc drive and activate the FF ALM lamp, PWR TRNS & FA lamp, and office audible and visual alarms. To transfer the motor-alternators from dc drive back to ac drive after the power service frequency has returned to normal, proceed as follows.

(1) Momentarily depress the FREQ RESET key.

Requirement: After a time delay of approximately 200 to 280 seconds (power service frequency remains within allowable limits), the motor-alternators will transfer to ac drive in sequence. When the motor-alternators transfer to ac drive, the FF ALM lamp, the PWR TRNS & FA lamp, and the office audible and visual alarms extinguish.

(2) If the power service frequency goes out of limits during the time delay interval (FREQ RESET key depressed to transfer plant to ac drive), the motor-alternators will not transfer to ac drive. If the motor-alternators do not transfer to ac drive, momentarily depress the FREQ RESET key again to transfer the motor-alternators to ac drive.

H. Restoring Motor-Alternator to Service After Overspeed Shutdown Occurs, Motor-Alternators Equipped With Overspeed Shutdown Circuit (ZT option)

3.08 If the speed of a motor-alternator increases beyond allowable limits, an overspeed shutdown will occur and activate the OS FAIL lamp, AC MOT & ALT FAIL lamp, and office audible and visual alarms. To restore a motor-alternator to service after an overspeed shutdown has occurred, proceed as follows.

(1) Verify that the condition that caused the 230-volt ac output frequency to increase has been corrected.

(2) Operate the STOP-NOR key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator that has shut down to the STOP position and then back to the NOR position.

Requirement: The OS FAIL lamp, AC MOT & ALT FAIL lamp, and office audible and visual alarms extinguish.

(3) After the OS FAIL and AC MOT & ALT FAIL lamps extinguish, operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator that has shut down to the RLS position and then back to the NOR position.

Requirement: The DC MOT START & TST lamp on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator extinguishes and the motor-alternator transfers to ac drive.

I. Restoring Output Voltage Limiter Circuit to Normal Operation, Motor-Alternators Equipped With Output Voltage Limiter Circuit (ZM option)

3.09 If the output voltage from a motor-alternator exceeds the allowable voltage limits, the OVERVOLT lamp and office audible and visual alarms are activated. To restore the output voltage limiter circuit to normal operation, depress the RESET OVERVOLT key on the TRANSFER CONTROL bay. After the key is depressed, the OVERVOLT lamp and office audible and visual alarms extinguish.

J. Transferring Load From Inverter to Emergency Motor-Alternator

3.10 To transfer the load from an inverter to the emergency motor-alternator, proceed as follows.

Caution 1: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines.

Caution 2: Return the load to the inverter as soon as possible to enable the emergency motor-alternator to be used for automatic transfers should a regular motor-alternator or inverter fail.

(1) Verify that the AMPS meter on the EMG START CONTROL bay indicates zero.

(2) ***Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the EMG START CONTROL bay as hazardous voltages are present.***

Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the EMG START CONTROL bay. If the Hubbell receptacle is not provided but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

Requirement: The Weston Model 904 voltmeter should indicate the nominal no-load voltage as specified by local instructions.

Note: If the requirement in (2) is met, proceed to (4). If the requirement is not met, continue with (3).

(3) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions.

(4) Depress the MANUAL TRANSFER (S5) switch on the inverter from which the load is to be transferred.

Requirement: The MANUAL TRANSFER lamp lights and the load transfers to the emergency motor-alternator.

(5) Observe the indication on the Weston Model 904 voltmeter that is connected to the EMG START CONTROL bay.

Requirement: The Weston Model 904 voltmeter indicates the nominal output voltage of 230 volts.

Note: If requirement in (5) is met, proceed to (7). If the requirement is not met, continue with (6).

(6) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

Note: When the load of the inverter is transferred to the emergency motor-alternator, the load from any other motor-alternator or inverter cannot transfer to the emergency motor-alternator.

K. Transferring Load From Emergency Motor-Alternator Back to Inverter

3.11 To transfer the load from the emergency motor-alternator back to the inverter, proceed as follows.

Caution: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines.

(1) Observe that the MANUAL TRANSFER lamp is lighted on the inverter.

(2) Connect the Weston Model 622 voltmeter, set on the 300 volts ac scale, across the terminals of the OUTPUT VOLTAGE (M2) voltmeter of the inverter.

Requirement: The Weston Model 622 voltmeter should indicate the nominal no-load voltage as specified by local instructions.

Note: If the requirement in (2) is met, proceed to (4). If the requirement is not met, continue with (3).

(3) Adjust the FIELD VOLT ADJ (R307) potentiometer on the regulator circuit board until the Weston Model 622 voltmeter indicates the nominal no-load voltage as specified by local instructions.

(4) Depress the MANUAL TRANSFER (S5) switch.

Requirement: The MANUAL TRANSFER lamp extinguishes and the load will transfer back to the inverter.

(5) Verify that the inverter is supplying the required output voltage to the load in accordance with 4.11.

L. Removing Inverter From Service

3.12 To remove an inverter from service, proceed as follows.

Caution: Restore the inverter to service as soon as possible to enable the emergency motor-alternator to be used for automatic transfers should a regular motor-alternator or inverter fail.

(1) Transfer the load on the inverter to the emergency motor-alternator in accordance with 3.10.

(2) Operate the TRANSFER NORMAL-INVERTER BYPASS (S6) switch on the inverter to the INVERTER BYPASS position.

Requirement: The AUTOMATIC TRANSFER, RESET, and cabinet alarm lamps light.

Caution: Do not operate the TRANSFER NORMAL-INVERTER BYPASS (S6) switch on any other inverter to the INVERTER BYPASS position. Operating the switch on another inverter to the INVERTER BYPASS position will cause the emergency motor-alternator to transfer from the load on the highest numbered bus to the load on the lowest numbered bus.

(3) Operate the OUTPUT (S502) switch to the OFF position.

(4) Operate the INPUT (S501) switch to the OFF position.

Requirement: The DS502 red lamp extinguishes (lamp located directly above INPUT switch).

(5) Depress the CONTROL OFF (S9) switch to de-energize the −24 volt control circuit.

Requirement: The CONTROL OFF lamp lights and the MANUAL TRANSFER, AUTOMATIC TRANSFER, and RESET lamps extinguish.

M. Restoring Inverter to Service

3.13 To restore an inverter to service, proceed as follows.

(1) Depress the CONTROL OFF (S9) switch to energize the −24 volt control circuit.

Requirement: The CONTROL OFF lamp extinguishes and the MANUAL TRANSFER, AUTOMATIC TRANSFER, and RESET lamps light.

Caution: Be certain that the CONTROL OFF lamp on the inverter is extinguished. If the CONTROL OFF lamp on the inverter is not extinguished, the inverter automatic transfer circuit is disabled.

(2) Operate the INPUT (S501) switch to the CHARGE position.

Requirement: The DS502 red lamp lights (lamp located directly above INPUT switch).

Note: If the DS502 red lamp does not light when the INPUT (S501) switch is in the CHARGE position, verify that the LOGIC TEST (S101) switch (switch on LOGIC POWER SUPPLY) is in the OFF position and that the DS501 lamp is lighted (lamp on input filter panel in rear of regular inverter).

Caution: Do not operate the INPUT (S501) switch on the inverter to the ON position until the DS502 red lamp lights.

(3) After the DS502 red lamp lights, operate the INPUT (S501) switch to the ON position.

(4) Operate the OUPUT (S502) switch to the ON position.

Requirement: The OUTPUT VOLTAGE (M2) voltmeter should indicate the nominal no-load voltage as specified by local instructions.

(5) Operate the TRANSFER NORMAL-INVERTER BYPASS (S6) switch to the TRANSFER NORMAL position.

(6) Depress the RESET (S8) switch.

Requirement: The RESET, AUTOMATIC TRANSFER, and cabinet alarm lamps extinguish.

(7) Transfer the load on the emergency motor-alternator back to the inverter in accordance with 3.11.

4. ROUTINE CHECKS

Caution 1: Before performing any routine checks or maintenance on the combination plant; verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenance is to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments, relay blocks, relay strapping, etc, on the power equipment being checked and not, by mistake, on the power equipment that is supplying power to the L3 coaxial lines.

Caution 2: All L3 power equipment should be operating normally before performing any routine checks on the plant to prevent equipment failures from occurring.

Note 1: When performing routine checks or maintenance on the 505D power plant, it is advisable to have copies of the associated circuit schematic drawings and circuit descriptions available to aid in locating relay terminals, etc.

Note 2: ⧫Due to the undesirable effects of load transfers; it would be desirable to perform as many of the routine checks as possible, which require the load to be transferred, at one time. That is, when the load is transferred to the standby unit, perform as many checks as possible before returning the load to the regular unit.⧫

A. Clean Ventilating Passages

4.01 Keep all ventilating passages unobstructed to ensure adequate cooling during operation.

B. Voltage Transfer Control Circuit Check (TRANSFER CONTROL Bay)

4.02 To check the voltage transfer control circuit of the TRANSFER CONTROL bay, proceed as follows.

Note: Two personnel are required to perform some parts of this check.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

(2) Perform the necessary procedures to obtain use of the protection lines (see Sections 359-010-125 and 359-075-301).

Caution: Before lowering the rectifier output voltages in the associated dc power plant, verify that the dc power plant is not supplying power to any associated equipment that might cause equipment failures.

(3) Lower the rectifier output voltages in the associated dc power plant to prevent overshoot problems from occurring when the motor-alternators are transferred to dc drive.

Note: The minor float alarms may be activated.

(4) If necessary, depress the ACO key on the associated dc power plant to extinguish the audible float alarms.

(5) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for one of the motor-alternators in the plant to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights and the associated motor-alternator transfers to dc drive (indicated by the closing of the AR1 relay inside of the associated START CONTROL bay).

(6) After the output voltage from the motor-alternator which was transferred to dc drive stabilizes and the associated alarms extinguish, repeat (5) for all of the remaining motor-alternators in the plant. Be certain to allow the output voltage from each motor-alternator that is transferred to the dc drive to stabilize and the associated alarms to extinguish before transferring the next motor-alternator to dc drive.

(7) Restore all rectifiers in the associated dc power plant to normal operation.

(8) ***Warning: Use rubber gloves and a fuse puller when removing the three 3-ampere fuses that are associated with the voltage transfer control circuit to prevent personal injuries from occurring.***

Open the door on the fuse panel and remove the three 3-ampere, 230-volt fuses that are associated with the voltage transfer control circuit.

Requirement: The PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and an audible alarm is activated.

(9) Depress the ACO key on the TRANSFER CONTROL bay.

Requirement: The DC MOT START & TST lamp and the audible alarm extinguish.

(10) Connect a strap between terminal 3 of the VR2 relay and terminal 3 of the VR3 relay.

(11) Using the KS-14510 volt-ohm-milliammeter, set on the 300 AC VOLTS scale, determine which side of the fuse holders are carrying voltage.

(12) Connect the output of the W5HMT Variac to the L1 and L2 leads on the equipment side of the fuse holders. Verify that the ON-OFF switch of the Variac is in the OFF position and that the voltage-control knob is in the zero position before connecting the Variac to the L1 and L2 leads.

(13) Connect the Variac to a nominal 230-volt ac input.

Note: If the Variac has been locally wired for 115-volt input, 230-volt output operation;

connect the Variac to a nominal 115-volt ac input.

(14) Operate the VM switch on the TRANSFER CONTROL bay to the PH1 position.

(15) Connect the Weston Model 904 voltmeter, connected for the 300 VOLT scale, to the L1 and L2 leads on the equipment side of the fuse holders (connected to the same leads as the Variac).

(16) Operate the ON-OFF switch on the Variac to the ON position and adjust the voltage-control knob of the Variac until the Weston Model 904 voltmeter indicates the nominal ac input power service voltage that is usually available to the TRANSFER CONTROL bay.

Requirement: The PWR TRNS & FA lamp extinguishes and the associated DC MOT START & TST lamps light one at a time.

(17) Observe the indication on the PWR SERV meter of the TRANSFER CONTROL bay.

Requirement: The PWR SERV meter should indicate the same ac input power service voltage that is indicated on the Weston Model 904 voltmeter [see (16)]. If the indications are not the same, rotate the adjustment screw of the PWR SERV meter until its indication agrees with the indication on the Weston Model 904 voltmeter.

Note: If the requirement in (17) is not met, the Variac is not connected to the L1 and L2 leads on the equipment side of the fuse terminals. The ac input power service voltage must be determined to ensure that the Variac is connected to the correct phase. For example, when power is applied across one phase, another phase will indicate slightly less voltage, and the other phase will indicate a much lower voltage. Typical indications would be PH1 = 240 volts, PH2 = 215 volts, and PH3 = 35 volts when the Variac is connected for a PH1 (L1 and L2) connection. The L1, L2, and L3 leads should have been properly marked in the fuse box to prevent the possibility of improper connections.

(18) Connect a jumper between terminals 1 and 2 on the bottom of the H relay in the TRANSFER CONTROL bay. This strap is to remain connected through step (75).

Note: The H relay is located behind the rear door on the TRANSFER CONTROL bay.

(19) Remove the top cover from the TR relay.

Note: The TR relay is located behind the front doors of the TRANSFER CONTROL bay.

(20) Slowly rotate the Variac voltage-control knob ccw until the VR1 relay releases.

Note: The operation of the VR1 relay cannot be observed. The release of the VR1 relay is indicated by the release of the TR relay.

Requirement: The VR1 relay releases (indicated by release of TR relay) in accordance with the voltage value specified in Table A (voltage indicated on the Weston Model 904 voltmeter). When the TR relay releases, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights, the DC MOT START & TST lamps on the TRANSFER CONTROL bay and SUPL TRANSFER CONTROL bay extinguish, and the office audible and visual alarms are activated.

(21) Depress the ACO key on the TRANSFER CONTROL bay to extinguish the office audible alarms.

(22) Slowly rotate the Variac voltage-control knob cw until the VR1 relay just operates.

Requirement: The VR1 relay operates (indicated by operation of TR relay) in accordance with the voltage value specified in Table A (voltage indicated on the Weston Model 904 voltmeter). When the TR relay operates, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual alarms extinguish.

Note: If the requirements in (20) and (22) are met, proceed to (29). If the requirements are not met, continue with (23).

(23) Rotate the VR1 potentiometer fully ccw.

TABLE A
VOLTAGE SETTINGS FOR OPERATION OF VR1 RELAY

	KS-15626 OR KS-15994 MOTOR-ALTERNATORS CONNECTED FOR 190-220 VOLT OPERATION KS-15520 OR KS-15993 MOTOR-ALTERNATORS CONNECTED FOR 190-200 VOLT OPERATION		KS-15626 OR KS-15994 MOTOR-ALTERNATORS CONNECTED FOR 221-250 VOLT OPERATION	
	VR RELAY RELEASES	VR RELAY OPERATES	VR RELAY RELEASES	VR RELAY OPERATES
VOLTAGE REQUIREMENT	165-170 Volts AC	180-200 Volts AC	184-190 Volts AC	200-225 Volts AC
If Voltage requirement is not met, adjust to	165 Volts AC	The operate point cannot be adjusted	184 Volts AC	The operate point cannot be adjusted

(24) Adjust the Variac voltage-control knob until the Weston Model 904 voltmeter indicates the VR1 relay release voltage.

(25) Rotate the VR1 potentiometer cw until the VR1 relay releases (indicated by the release of the TR relay). When the TR relay releases, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual and audible alarms are activated.

(26) Depress the ACO key on the TRANSFER CONTROL bay to extinguish the office audible alarms.

(27) Rotate the Variac voltage-control knob cw until the VR1 relay operates (indicated by the operation of the TR relay). When the TR relay operates, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual alarms extinguish.

(28) Repeat (20) through (22).

Note: If the VR1 relay fails to meet the release and operate requirements specified in Table A after the VR1 potentiomter has been adjusted, adjust the VR1 relay in accordance with the appropriate circuit requirement tables and Section 040-257-701.

(29) Rotate the Variac voltage-control knob fully ccw.

(30) Operate the ON-OFF switch on the Variac to the OFF position.

(31) Remove the strap from terminal 3 of the VR2 relay and terminal 3 of the VR3 relay.

(32) Connect a strap between terminal 7 of the VR2 relay and terminal 3 of the VR3 relay.

(33) Connect a strap between terminals 3 and 7 of the VR1 relay.

(34) Connect a strap between the L1 and L3 leads on the equipment side of the fuse holders.

(35) Verify that the VM switch on the TRANSFER CONTROL bay is in the PH1 position.

(36) Operate the ON-OFF switch on the Variac to the ON position.

(37) Rotate the Variac voltage-control knob cw until the Weston Model 904 voltmeter indicates the nominal ac input power service voltage that is usually available to the TRANSFER CONTROL bay.

(38) Observe the indication on the PWR SERV meter of the TRANSFER CONTROL bay.

Requirement: The PWR SERV meter indicates the same ac input power service voltage that is being indicated on the Weston Model 904 voltmeter [see (37)].

Note: If the requirement in (38) is not met, the Variac is not connected to the L1 and L2 leads on the equipment side of the fuse terminals.

(39) Operate the VM switch on the TRANSFER CONTROL bay to the PH2 position.

(40) Observe the indication on the PWR SERV meter of the TRANSFER CONTROL bay.

Requirement: The PWR SERV meter indicates the same ac input service voltage that is being indicated on the Weston Model 904 voltmeter.

Note: If the requirement in (40) is not met, the strap is not connected between the L1 and L3 leads on the equipment side of the fuse terminals.

(41) Slowly rotate the Variac voltage-control knob ccw until the VR2 relay releases.

Note: The operation of the VR2 relay cannot be observed. The release of the VR2 relay is indicated by the release of the TR relay.

Requirement: The VR2 relay releases (indicated by the release of the TR relay) in accordance with the voltage value specified in Table A (voltage indicated on the Weston Model 904 voltmeter). When the TR relay releases the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual and audible alarms are activated.

(42) Depress the ACO key on the TRANSFER CONTROL bay to extinguish the office audible alarms.

(43) Slowly rotate the Variac voltage-control knob cw until the VR2 relay just operates (indicated by the operation of the TR relay).

Requirement: The VR2 relay operates (indicated by the operation of the TR relay) in accordance with the voltage value specified in Table A (voltage indicated on the Weston Model 904 voltmeter). When the TR relay operates, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual alarms extinguish.

Note: If the requirements in (41) and (43) are met, proceed to (50). If the requirements are not met, continue with (44).

(44) Rotate the VR2 potentiometer fully ccw.

(45) Adjust the Variac voltage-control knob until the Weston Model 904 voltmeter indicates the VR2 relay release voltage.

(46) Rotate the VR2 potentiometer cw until the VR2 relay releases (indicated by the release of the TR relay). When the TR relay releases, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual and audible alarms are activated.

(47) Depress the ACO key on the TRANSFER CONTROL bay to extinguish the office audible alarms.

(48) Rotate the Variac voltage-control knob cw until the VR2 relay operates (indicated by the operation of the TR relay). When the TR relay operates, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual alarms extinguish.

(49) Repeat (41) through (43).

Note: If the VR2 relay fails to meet the release and operate requirements specified in Table A after the VR2 potentiometer has been adjusted, adjust the VR2 relay in accordance with the appropriate circuit requirement tables and Section 040-257-701.

(50) Rotate the Variac voltage-control knob fully ccw.

(51) Operate the ON-OFF switch on the Variac to the OFF position.

(52) Remove the strap that is connected between the L1 and L3 leads on the equipment side of the fuse holders.

(53) Remove the strap from terminals 3 and 7 of the VR1 relay.

(54) Remove the strap from terminal 7 of the VR2 relay and terminal 3 of the VR3 relay.

(55) Connect a strap between terminal 7 of the VR1 relay and terminal 7 of the VR2 relay.

(56) Connect a strap between the L2 and L3 leads on the equipment side of the fuse holders.

(57) Operate the VM switch on the TRANSFER CONTROL bay to the PH1 position.

(58) Operate the ON-OFF switch on the Variac to the ON position.

(59) Rotate the Variac voltage-control knob cw until the Weston Model 904 voltmeter indicates the nominal ac input service voltage that is usually available to the TRANSFER CONTROL bay.

(60) Observe the indication on the PWR SERV meter of the TRANSFER CONTROL bay.

Requirement: The PWR SERV meter indicates the same ac input service voltage that is being indicated on the Weston Model 904 voltmeter [see (59)].

Note: If the requirement in (60) is not met, the Variac is not connected to the L1 and L2 leads on the equipment side of the fuse terminals.

(61) Operate the VM switch on the TRANSFER CONTROL bay to the PH3 position.

(62) Observe the indication on the PWR SERV meter of the TRANSFER CONTROL bay.

Note 1: The PWR SERV meter indicates the same ac input service voltage that is being indicated on the Weston Model 904 voltmeter.

Note 2: If the requirement in (62) is not met, the strap is not connected between the L2 and L3 leads on the equipment side of the fuse terminals.

(63) Slowly rotate the Variac voltage-control knob ccw until the VR3 relay releases (indicated by the release of the TR relay).

Note: The operation of the VR3 relay cannot be observed. The release of the VR3 relay is indicated by the release of the TR relay.

Requirement: The VR3 relay releases (indicated by the release of the TR relay) in accordance with the voltage value specified in Table A (voltage indicated on the Weston Model 904 voltmeter). When the TR relay releases, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual and audible alarms are activated.

(64) Depress the ACO key on the TRANSFER CONTROL bay to silence the office audible alarms.

(65) Slowly rotate the Variac voltage-control knob cw until the VR3 relay just operates (indicated by the operation of the TR relay).

Requirement: The VR3 relay operates (indicated by the operation of the TR relay) in accordance with the voltage value specified in Table A (voltage indicated on the Weston Model 904 voltmeter). When the TR relay operates, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual alarms extinguish.

Note: If the requirements in (63) and (65) are met, proceed to (72). If the requirements are not met, continue with (66).

(66) Rotate the VR3 potentiometer fully ccw.

(67) Adjust the Variac voltage-control knob until the Weston Model 904 voltmeter indicates the VR3 relay release voltage.

(68) Rotate the VR3 potentiometer cw until the VR3 relay releases (indicated by the release of the TR relay). When the TR relay releases, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual and audible alarms are activated.

(69) Depress the ACO key on the TRANSFER CONTROL bay to silence the office audible alarms.

(70) Rotate the Variac voltage-control knob cw until the VR3 relay operates (indicated by the operation of the TR relay). When the TR relay operates, the PWR TRNS & FA lamp on the TRANSFER CONTROL bay lights and the office visual alarms extinguish.

(71) Repeat (63) through (65).

Note: If the VR3 relay fails to meet the release and operate requirements specified in Table A after the VR3 potentiometer has been adjusted, adjust the VR3 relay in accordance with the appropriate circuit requirement tables and Section 040-257-701.

(72) Rotate the Variac voltage-control knob fully ccw.

(73) Operate the ON-OFF switch on the Variac to the OFF position.

(74) Remove the strap that is connected between the L2 and L3 leads on the equipment side of the fuse holders.

(75) Remove the strap from terminal 7 of the VR1 relay and terminal 7 of the VR2 relay.

(76) Remove the strap from terminals 1 and 2 on the bottom of the H relay in the TRANSFER CONTROL bay.

Note: The H relay is located behind the rear door on the TRANSFER CONTROL bay.

(77) Operate the VM switch on the TRANSFER CONTROL bay to the PH1 position.

(78) Disconnect the Weston Model 904 voltmeter and the Variac from the L1 and L2 leads on the equipment side of the fuse holders.

(79) Disconnect the Variac from the nominal ac input power.

(80) ***Warning: Use rubber gloves when installing the three 3-ampere fuses that are associated with the voltage transfer control circuit to prevent personal injuries from occurring.***

Install the three 3-ampere, 230-volt fuses that are associated with the voltage transfer control circuit.

Requirement: After a time delay of 10 to 50 seconds, the TR relay operates.

(81) Install the top cover on the TR relay.

(82) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for one of the motor-alternators in the plant to the RLS position and then to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the associated motor-alternator transfers to ac drive (indicated by the opening of the AR relay inside of the associated START CONTROL bay).

(83) After the output voltage from the motor-alternator that was transferred to ac drive stabilizes and the associated alarms extinguish, repeat (82) for all of the remaining motor-alternators in the plant. Be certain to allow the output voltage to stabilize and the associated alarms to extinguish before transferring the next motor-alternator to ac drive.

(84) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation (see Section 359-010-125 and 359-075-301). Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

C. Transfer Relay Check (TRANSFER CONTROL Bay)

4.03 To check the transfer relay circuit of the TRANSFER CONTROL bay, proceed as follows.

Caution: Before lowering the rectifier output voltages in the associated dc power plant, verify that the dc power plant is not supplying power to any associated equipment that might cause equipment failures.

(1) Lower the rectifier output voltages in the associated dc power plant to prevent overshoot problems from occurring when the motor-alternators are transferred to dc drive.

Note: The minor float alarms may be activated.

(2) If necessary, depress the ACO key on the associated dc power plant to extinguish the audible float alarms.

(3) Operate the PWR TRNS TST-NOR key on the TRANSFER CONTROL bay to the PWR TRNS TST position.

Requirement: All motor-alternators will transfer to dc drive (indicated by the closing of the AR relays inside of the associated START CONTROL bays), the PWR TRNS & FA lamp will light, and office visual and audible alarms will be activated.

(4) Depress the ACO key on the TRANSFER CONTROL bay.

Requirement: The office audible alarms are silenced.

(5) Operate the PWR TRNS TST-NOR key on the TRANSFER CONTROL bay to the NOR position.

Requirement: If a motor-alternator sequencing control circuit is not provided in the plant, the motor-alternators will transfer back to ac drive in accordance with (a). If the plant is equipppd with a B option (A&M only) motor-alternator sequencing control circuit, the motor-alternators will transfer back to ac drive in accordance with (b). If the plant is equipped with E or F option motor-alternator sequencing control circuit, the motor-alternators will transfer back to ac drive in accordance with (c).

Note: When a motor-alternator sequencing control circuit is provided in the plant, the sequencing control circuit prevents all of the motor-alternators in the plant from transferring back to ac drive at the same time. If all of the motor-alternators were to transfer back to ac drive at the same time, a load surge might result, and ac input voltage to the motor-alternators might dip below the line monitor transfer point of the motor-alternators and cause repeated transfers to and from ac drive.

(a) After a time delay of approximately 1 minute, all of the motor-alternators in the plant will transfer to ac drive and the PWR TRNS & FA lamp extinguishes.

(b) After a time delay of approximately 1 minute (depending upon how many regular motor-alternators are in the plant), the emergency motor-alternator and the first regular motor-alternator transfer to ac drive. At approximately 20-second intervals, the second, third, and fourth regular motor-alternators are transferred to ac drive and the PWR TRNS & FA lamp extinguishes.

(c) After a time delay of approximately 1 minute (depending upon how many regular motor-alternators are in the plant), the emergency motor-alternator will transfer to ac drive. After approximately 25 seconds, the first regular motor-alternator transfers to ac drive. After approximately 20 seconds, the second regular motor-alternator transfers to ac drive. After approximately 5 seconds, the third regular motor-alternator transfers to ac drive. After approximately 25 seconds the fourth regular motor-alternator transfers to ac drive. After approximately 20 seconds, the fifth regular motor-alternator transfers to ac drive. After approximately 5 seconds, the sixth regular motor-alternator transfers to ac drive and the PWR TRNS & FA lamp extinguishes.

Note: The requirements in (c) should be applied only to the number of regular motor-alternators provided in the plant.

(6) Restore all rectifiers in the associated dc power plant to normal operation.

D. Motor-Alternator High and Low Voltage Checks

4.04 To check the high and low voltage circuits of the motor-alternators, proceed as follows.

Note: Two personnel may be required to perform some parts of this check.

(1) Verify that the AMPS meter on the EMG START CONTROL bay indicates zero.

(2) ***Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the EMG START CONTROL bay as hazardous voltages are present.***

Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the EMG START CONTROL bay. If the Hubbell receptacle is not provided on the bay but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

(3) Slowly rotate the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Model 904 voltmeter indicates 241.5 volts.

(4) Connect a strap from the C terminal of the EV relay [located behind rear door of TRANSFER CONTROL bay] to the common (ground) load bus in the TRANSFER CONTROL bay.

(5) Adjust the EV potentiometer on the TRANSFER CONTROL bay until the high contact of the EV relay just closes.

Requirement: The HLV lamp on the TRANSFER CONTROL bay lights and office visual and audible alarms are activated.

(6) Block the ELV2 relay in the TRANSFER CONTROL bay operated.

(7) Block the EMF relay in the TRANSFER CONTROL bay released.

(8) Slowly rotate the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay cw until the low contact of the EV relay in the TRANSFER CONTROL bay just closes.

Note: As the ALT VOLTS ADJ potentiometer is rotated through the normal voltage range, the HLV lamp on the TRANSFER CONTROL bay and the office visual alarm will extinguish.

Requirement: The HLV lamp on the TRANSFER CONTROL bay lights when the low contact of the EV relay closes and the office visual and audible alarms are activated when the Weston Model 904 voltmeter indicates between 217 and 220 volts.

(9) Rotate the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay ccw until the Weston Model 904 voltmeter indicates the nominal no load voltage as specified by local instructions.

Requirement: The HLV lamp on the TRANSFER CONTROL bay and the office audible alarms extinguish.

(10) Remove the strap from the C terminal of the EV relay and the common load bus in the TRANSFER CONTROL bay.

(11) Block the VA relay in the TRANSFER CONTROL bay released.

Note: The VA relay is blocked to prevent office visual and audible alarms from being activated.

(12) Connect a strap between terminals 1 and 2 of the ELV1 potentiometer on the TRANSFER CONTROL bay.

(13) Slowly rotate the ALT VOLTS ADJ potentiometer on the associated EMG START CONTROL bay cw until the Weston Model 904 voltmeter indicates ▶190 volts.◀

(14) Adjust the ELV2 potentiometer on the TRANSFER CONTROL bay until the low contact of the ELV relay closes.

Requirement: The ELV1 relay in the TRANSFER CONTROL bay operates.

(15) Slowly rotate the ALT VOLTS ADJ potentiometer on the associated EMG START CONTROL bay ccw until the Weston Model 904 voltmeter indicates ▶210 volts.◀

(16) Remove the strap from terminals 1 and 2 of the ELV1 potentiometer on the TRANSFER CONTROL bay.

(17) Adjust the ELV1 potentiometer on the TRANSFER CONTROL bay until the low contact of the ELV relay closes.

Requirement: The ELV1 relay in the TRANSFER CONTROL bay operates.

(18) Rotate the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay ccw until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions.

(19) Remove the blocking tools from the ELV2, EMF, and VA relays in the TRANSFER CONTROL bay.

(20) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

(21) Perform the necessary procedures to obtain the use of the protection lines (see Sections 359-010-125 and 359-075-301).

(22) Transfer the load from a regular motor-alternator to the emergency motor-alternator in accordance with 3.03.

(23) ***Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the START CONTROL bay as hazardous voltages are present.***

Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the START CONTROL bay for the regular motor-alternator under test. If the Hubbell receptacle is not provided but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

(24) Slowly rotate the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay until the Weston Model 904 voltmeter indicates 241.5 volts.

(25) Adjust the V potentiometer on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay until the high contact of the V relay just closes.

Requirement: The HLV lamp on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay lights and office visual and audible alarms are activated.

(26) Block the LV2 relay in the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay operated.

(27) Block the MF relay in the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay released.

(28) Slowly rotate the ALT VOLTS ADJ potentiometer on the START CONTROL bay cw until the low contact of the V relay in the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay just closes.

Note: As the ALT VOLTS ADJ potentiometer is rotated through the normal voltage range, the HLV lamp on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay and the office visual alarm extinguish.

Requirement: The HLV lamp on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay lights when the low contact of the V relay closes and the office visual and audible alarms are activated

when the Weston Model 904 voltmeter indicates between 217 and 220 volts.

(29) Rotate the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay ccw until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions.

Requirement: The HLV lamp on the TRANSFER CONTROL bay and the office audible alarm extinguish.

(30) Block the VA relay in the TRANSFER CONTROL bay released.

Note: The VA relay is blocked to prevent office visual and audible alarms from being activated.

(31) Connect a strap between terminals 1 and 2 of the LV1 potentiometer on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay.

(32) Slowly rotate the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay cw until the Weston Model 904 voltmeter indicates ▶190 volts.◀

(33) Adjust the LV2 potentiometer on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay until the low contact of the LV relay closes.

Requirement: The LV1 relay in the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay operates.

(34) Slowly rotate the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay ccw until the Weston Model 904 voltmeter indicates ▶210 volts.◀

(35) Remove the strap from terminals 1 and 2 of the LV1 potentiometer on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay.

(36) Adjust the LV1 potentiometer on the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay until the low contact of the LV relay closes.

Requirement: The LV1 relay in the TRANSFER CONTROL or SUPL TRANSFER CONTROL bay operates.

(37) Rotate the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay ccw until the Weston Model 904 voltmeter indicates the nominal no-load voltage as specified by local instructions.

(38) Remove the blocking tools from the VA, MF, and LV2 relays.

(39) Transfer the load on the emergency motor-alternator to the associated regular motor-alternator in accordance with 3.04.

(40) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation (see Sections 359-010-125 and 359-075-301). Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

E. Motor-Alternator Speed Adjustments (Motor-Alternators Not Equipped With TD Relays)

4.05 To check the speed adjustments of the motor-alternators not equipped with TD relays, proceed as follows.

Note: When TD relays are not provided in the motor-alternators, overshoot problems may result.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: The motor-alternators in the plant should not be allowed to operate on dc drive for long periods of time during dc motor speed checks.

(2) Perform the necessary procedures to obtain the use of the protection lines (see Sections 359-010-125 and 359-075-301).

(3) Transfer the load of a regular motor-alternator in the plant to the emergency motor-alternator in accordance with 3.03 (1) through (7).

(4) ***Caution: Before lowering the rectifier output voltages in the associated dc power plant, verify that the dc power plant is not supplying power to any associated equipment that might cause equipment failures.***

Lower the rectifier output voltages in the associated dc power plant to prevent overshoot problems from occurring when the motor-alternators are transferred to dc drive.

Note: The minor float alarms may be activated.

(5) If necessary, depress the ACO key on the associated dc power plant to silence the audible float alarms.

(6) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL bay or SUPL TRANSFER CONTROL bay for one regular motor-alternator in the plant to the DC MOT START & TST position so that the battery plant voltage can be maintained at the nominal discharge value of approximately ◗2◖ volts per cell.

Note: The normal L3 coaxial load must be used when adjusting the dc motor speed of a motor-alternator.

(7) Observe the indication on the Weston Model 904 voltmeter that is connected to the loaded emergency motor-alternator.

Requirement: The Weston Model 904 voltmeter indicates 230 volts.

Note: If the requirement in (7) is met, proceed to (9). If the requirement is not met, continue with (8).

(8) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

(9) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL bay for the emergency motor-alternator to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights and the emergency motor-alternator transfers to dc drive (AR relay inside of EMG START CONTROL bay should close). The Weston Model 904 voltmeter should indicate 230 $\pm$3 volts.

Note: If the requirement in (9) is met, proceed to (16). If the requirement is not met, continue with (10).

(10) ***Caution: Do not attempt to change the strap connections of the R1 or R2 resistors unless the emergency motor-alternator has been completely removed from service (emergency motor-alternator at a standstill) to prevent equipment damage from occurring.***

Remove the emergency motor-alternator from service in accordance with 3.05.

(11) Adjust the dc motor speed of the emergency motor-alternator by restrapping the fine sections of the R1 and R2 resistors (1/2, 1, or 2 ohms) that are in the EMG START CONTROL bay. Move the dc motor controller P3 and P9 leads on the R1 and R2 resistors as necessary to readjust the dc motor speed.

Note: If the resistance of the R1 and R2 resistors is increased, the speed of the dc motor will be increased, which will increase the output voltage from the emergency motor-alternator. If the resistance of the R1 and R2 resistors is decreased, the speed of the dc motor will be decreased, which will decrease the output voltage from the emergency motor-alternator.

(12) Operate the STOP-NOR key on the TRANSFER CONTROL bay for the emergency motor-alternator to the NOR position.

Requirement: An audible alarm is momentarily activated. The emergency motor-alternator starts on dc drive.

Note: Allow the AC MOT & ALT FAIL lamp on the TRANSFER CONTROL bay to extinguish and then continue with (13).

(13) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL bay for the emergency motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp will extinguish and the emergency motor-alternator will transfer to ac drive (AR relay inside of EMG START CONTROL bay should open).

(14) Transfer the load from a regular motor-alternator to the emergency motor-alternator in accordance with 3.03 (1) through (7).

(15) Repeat (7) through (9).

(16) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL bay for the emergency motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp will extinguish and the emergency motor-alternator will transfer to ac drive (AR relay inside of EMG START CONTROL bay should open).

(17) Disconnect the Weston Model 904 voltmeter from the EMG START CONTROL bay.

(18) Transfer the load on the emergency motor-alternator to the associated regular motor-alternator in accordance with 3.04(1) through (6).

(19) Observe the indication on the Weston Model 904 voltmeter that is connected to the loaded regular motor-alternator.

Requirement: The Weston Model 904 voltmeter indicates 230 volts.

Note: If the requirement in (19) is met, proceed to (21). If the requirement is not met, continue with (20).

(20) Adjust the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

(21) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights and the regular motor-alternator transfers to dc drive (AR relay inside of associated START CONTROL bay should close). The Weston Model 904 voltmeter should indicate 230 $\pm$3 volts.

Note: If the requirement in (21) is met, proceed to (28). If the requirement is not met, continue with (22).

(22) ***Caution: Do not attempt to change the strap connections of the R1 or R2 resistors unless the regular motor-alternator has been completely removed from service (regular motor-alternator at a standstill) to prevent equipment damage from occurring.***

Remove the regular motor-alternator from service in accordance with 3.05.

(23) Adjust the dc motor speed of the regular motor-alternator by restrapping the fine sections of the R1 and R2 resistors (1/2, 1, or 2 ohms) that are in the associated START CONTROL bay. Move the dc motor controller P3 and P9 leads on the R1 and R2 resistors as necessary to readjust the dc motor speed.

Note: If the resistance of the R1 and R2 resistors is increased, the speed of the dc motor will be increased, which will increase the output voltage from the regular motor-alternator. If the resistance of the R1 and R2 resistors is decreased, the speed of the dc motor will be decreased, which will decrease the output voltage from the regular motor-alternator.

(24) Operate the STOP-NOR key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: An audible alarm is momentarily activated. The regular motor-alternator starts on dc drive.

Note: Allow the AC MOT & ALT FAIL lamp on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to extinguish before continuing with (25).

(25) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the regular motor-alternator transfers to ac drive (AR relay inside of associated START CONTROL bay should open).

(26) Transfer the load from the associated emergency motor-alternator back to the regular motor-alternator under test in accordance with 3.04(1) through (6).

(27) Repeat (19) through (21).

(28) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the regular motor-alternator transfers to ac drive (AR relay inside of associated START CONTROL bay should open).

(29) Disconnect the Weston Model 904 voltmeter from the associated START CONTROL bay.

(30) Connect the Weston Model 904 voltmeter to the associated START CONTROL bay for the next regular motor-alternator to be tested [see 3.04(1)].

(31) Repeat the procedures in (19) through (30) that apply, on all of the regular motor-alternators in the power plant (see note).

Note: In (6), one regular motor-alternator in the plant was transferred to dc drive so that the battery plant voltage could be maintained at the nominal discharge value of approximately ▮2◀ volts per cell. After testing the remaining regular motor-alternators in the plant that are operating on ac drive, operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL bay or SUPL TRANSFER CONTROL bay for the regular motor-alternator that was transferred to dc drive in step (6) to the NOR position. ▮Then transfer one of the regular motor-alternators that has been tested in (19) through (30), to dc drive in accordance with (6). Repeat (19) through (30).◀

(32) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator that is operating on dc drive to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the regular motor-alternator transfers to ac drive (AR relay inside of associated START CONTROL bay should open).

(33) Disconnect the Weston Model 904 voltmeter from the associated START CONTROL bay of the last regular motor-alternator tested.

(34) Restore all rectifiers in the associated dc power plant to normal operation.

(35) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation (see Sections 359-010-125 and 359-075-301). Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur, if necessary.

F. Motor-Alternator Speed Adjustments (Motor-Alternators Equipped With TD relays)

4.06 To check the speed adjustments of the motor-alternators equipped with TD relays, proceed as follows.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines.

Caution: The motor-alternator in the plant should not be allowed to operate on dc drive for long periods of time during dc motor speed checks.

(2) Perform the necessary procedures to obtain the use of the protection lines (see Sections 359-010-125 and 359-075-301).

(3) Transfer the load of a regular motor-alternator in the plant to the emergency motor-alternator in accordance with 3.03(1) through (7).

Note: Before lowering the rectifier output voltages in the associated dc power plant, verify that the dc power plant is not supplying power to any associated equipment that might cause equipment failures.

(4) Lower the rectifier output voltages in the associated dc power plant to prevent overshoot problems from occurring when the motor-alternators are transferred to dc drive.

Note: The minor float alarms may be activated.

(5) If necessary, depress the ACO key on the associated dc power plant to extinguish the audible float alarms.

(6) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for one regular motor-alternator in the plant to the DC MOT START & TST position so that the battery plant voltage can be maintained at the nominal discharge value of approximately ▶2 volts◀ per cell.

Note: The normal L3 coaxial load must be used when adjusting the dc motor-speed of a motor-alternator.

(7) Observe the indication on the Weston Model 904 voltmeter that is connected to the associated loaded emergency motor-alternator.

Requirement: The Weston Model 904 voltmeter indicates 230 volts.

Note: If the requirement in (7) is met, proceed to (9). If the requirement is not met, continue with (8).

(8) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

(9) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL bay for the emergency motor-alternator to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights and the emergency motor-alternator transfers to dc drive (AR relay inside of EMG START CONTROL bay should close). The Weston Model 904 voltmeter should indicate 230 $\pm$3 volts.

Note: If the requirement in (9) is met, proceed to (16). If the requirement is not met, continue with (10).

(10) ***Caution: Do not attempt to change the strap connections of the R1 or R2 resistors unless the emergency motor-alternator has been completely removed from service (emergency motor-alternator at a standstill) to prevent equipment damage from occurring.***

Remove the emergency motor-alternator from service in accordance with 3.05.

(11) Adjust the dc motor-speed of the emergency motor-alternator by restrapping the fine sections of the R1 and R2 resistors, and, if necessary, by readjusting the TD relay setting. Refer to Fig. 6 for additional information. Move the dc motor controller P3 and P9 leads on the R1 and R2 resistors and readjust the TD relay in accordance with Table B.

Note 1: The TD relay setting and the resistance between terminals P3 and P9 of the R1 and R2 resistors must be adjusted so that the ac output voltage from the motor-alternator is stable at approximately 225 volts before the TD relay operates. The setting of the TD relay may be extended from

TABLE B
TD RELAY ADJUSTMENT

	DECREASE F1-A2	DECREASE TD SETTING	INCREASE TD SETTING	INCREASE P3-P9	DECREASE P3-P9	INCREASE F1-A2
Over Voltage Surge	3		2	1		
Voltage Drop below 215V		2			3	1
Final Volts above 234V on discharge battery	1					
Final Volts below 228V on discharge battery						1

5 seconds to 1 minute, if necessary, to stabilize the ac output voltage from the motor-alternator before the TD relay operates (see Fig. 11).

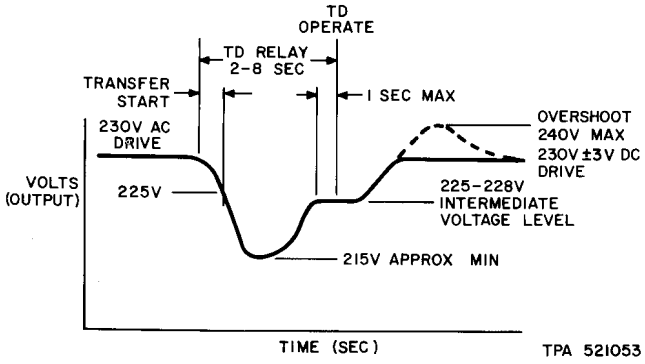


Fig. 11—Illustration Showing Change in AC Output Voltage VS Time During Transfer From AC to DC Drive

Note 2: The resistance that is shorted out between the P3 and P9 leads on the R1 and R2 resistors controls the intermediate voltage level and may vary from 1 to 4 ohms, depending upon the characteristic of the motor-alternator. The settings given in Table B in numbered sequence may be varied to give the best transfer characteristics over the range of the office battery (usually 140 to 152 volts).

Note 3: If the resistance of R1 and R2 resistors is increased, the speed of the dc motor will be increased, which will increase the output voltage from the emergency motor-alternator. If the resistance of the R1 and R2 resistors is decreased, the speed of the dc motor will be decreased, which will decrease the output voltage from the emergency motor-alternator.

Note: Make the adjustments in accordance with the numbered sequence in order to improve the dc speed stability.

(12) Operate the STOP-NOR key on the TRANSFER CONTROL bay for the emergency motor-alternator to the NOR position.

Requirement: An audible alarm is momentarily activated. The emergency motor-alternator starts on dc drive.

Note: Allow the AC MOT & ALT FAIL lamp on the TRANSFER CONTROL bay to extinguish and then continue with (13).

(13) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL bay for the emergency motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the emergency motor-alternator transfers to ac drive (AR relay inside of EMG START CONTROL bay should open).

(14) Transfer the load from an associated regular motor-alternator to the emergency motor-alternator in accordance with 3.03(1) through (7).

(15) Repeat (7) through (9).

(16) Operate the DC MOT START & TST-NOR-RLS key on the TRANSFER CONTROL bay for the emergency motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp will extinguish and the emergency motor-alternator transfers to ac drive (AR relay inside of EMG START CONTROL bay should open).

(17) Disconnect the Weston Model 904 voltmeter from the EMG START CONTROL bay.

(18) Transfer the load on the emergency motor-alternator to the associated regular motor-alternator in accordance with 3.04(1) through (6).

(19) Observe the indication on the Weston Model 904 voltmeter that is connected to the loaded regular motor-alternator.

Requirement: The Weston Model 904 voltmeter indicates 230 volts.

Note: If the requirement in (19) is met, proceed to (21). If the requirement is not met, continue with (20).

(20) Adjust the ALT VOLTS ADJ potentiometer on the associated START CONTROL bay until the Weston Model 904 voltmeter indicates 230 volts.

(21) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights and the regular motor-alternator transfers to dc drive (AR relay inside of EMG START CONTROL bay should close). The Weston Model 904 voltmeter should indicate 230 $\pm$3 volts.

Note: If the requirement in (21) is met, proceed to (28). If the requirement is not met, continue with (22).

(22) ***Caution: Do not attempt to change the strap connections of the R1 or R2 resistors unless the regular motor-alternator has been completely removed from service (regular motor-alternator at a standstill) to prevent equipment damage from occurring.***

Remove the regular motor-alternator from service in accordance with 3.05.

(23) Adjust the dc motor-speed of the regular motor-alternator by restrapping the five sections of the R1 and R2 resistors and if necessary, by readjusting the TD relay setting. Refer to Fig. 11 for additional information. Move the dc motor controller P3 and P9 leads on the R1 and R2 resistors and readjust the TD relay in accordance with Table B.

Note 1: The TD relay setting and the resistance between terminals P3 and P9 of the R1 and R2 resistors must be adjusted so that the ac output voltage from the motor-alternator is stable at approximately 225 volts before the TD relay operates. The setting of the TD relay may be extended from 5 seconds to 1 minute, if necessary, to stabilize the ac output voltage from the motor-alternator before the TD relay operates (see Fig. 11).

Note 2: The resistance that is shorted out between the P3 and P9 leads on the R1 and R2 resistors controls the intermediate voltage level and may vary from 1 to 4 ohms, depending upon the characteristic of the motor-alternator. The settings given in Table B in numbered sequence may be varied to give the best transfer characteristics over the range of the office battery (usually 140 to 152 volts).

Note 3: If the resistance of the R1 and R2 resistors is increased, the speed of the dc motor will be increased, which will increase

the output voltage from the regular motor-alternator. If the resistance of the R1 and R2 resistors is decreased, the speed of the dc motor will be decreased, which will decrease the output voltage from the regular motor-alternator.

(24) Operate the STOP-NOR key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: An audible alarm is momentarily activated. The regular motor-alternator starts on dc drive.

Note: Allow the AC MOT & ALT FAIL lamp on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay to extinguish and then continue with (25).

(25) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the regular motor-alternator transfers to ac drive (AR relay inside of associated START CONTROL bay should open).

(26) Transfer the load from the associated emergency motor-alternator back to the regular motor-alternator in accordance with 3.04.

(27) Repeat (19) through (21).

(28) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator to the NOR position.

Requirement: The DC MOT START & TST lamp will extinguish and the regular motor-alternator will transfer to ac drive (AR relay inside of associated START CONTROL bay should open).

(29) Disconnect the Weston Model 904 voltmeter from the associated START CONTROL bay.

(30) Connect the Weston Model 904 voltmeter to the associated START CONTROL bay for the next regular motor-alternator to be tested [see 3.04(1)].

(31) Repeat the procedures in (19) through (30) that apply, on all of the regular motor-alternators in the power plant.

Note: In (6), one regular motor-alternator in the plant was transferred to dc drive so that the battery plant voltage could be maintained at the nominal discharge value of approximately ▶2 volts◀ per cell. After testing the remaining regular motor-alternators in the plant that are operating on ac drive, operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator that was transferred to dc drive in (6) to the NOR position. ▶Then transfer one of the regular motor-alternators, previously tested on ac drive, to dc drive in accordance with (6). Repeat (19) through (30).◀

(32) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the regular motor-alternator that is operating on dc drive to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the regular motor-alternator will transfer to ac drive (AR relays inside of associated START CONTROL bays should open).

(33) Disconnect the Weston Model 904 voltmeter from the associated START CONTROL bay of the last regular motor-alternator tested.

(34) Restore all rectifiers in the associated dc power plant to normal operation.

(35) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation (see Sections 359-010-125 and 359-075-301). Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

G. KS-15994 and KS-15626 Regular or Emergency Motor-Alternator Output Voltage Limiter Check, Motor-Alternators Equipped With Output Voltage Limiter Circuit (ZM option)

4.07 To check the motor-alternator output voltage limiter circuit, proceed as follows.

(1) If the motor-alternator being tested is a regular motor-alternator, transfer the load from the regular motor-alternator to the emergency motor-alternator in accordance with 3.03.

Note: The motor-alternator being checked should not be supplying power to the load.

(2) Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the TP5 and TP6 test jacks on the OVERSPEED SHUTDOWN (CP2) circuit pack.

Requirement: The Weston Model 904 voltmeter should indicate approximately 115 volts.

Note: If the requirement in (2) is not met, the required voltage is not available on the secondary of the T1 transformer in the OVERSPEED SHUTDOWN (CP2) circuit pack. The absence of voltage on the secondary of the T1 transformer could be caused by an open T1 transformer or defective input circuit.

(3) Disconnect the Weston Model 904 voltmeter from the OVERSPEED SHUTDOWN (CP2) circuit pack.

(4) ***Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the START CONTROL or EMG START CONTROL bay as hazardous voltages are present.***

Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the associated EMG START CONTROL or START CONTROL bay for the motor-alternator under test. If the Hubbell receptacle is not provided but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe caution and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

(5) Slowly rotate the ALT VOLTS ADJ potentiometer on the associated EMG START CONTROL or START CONTROL bay ccw to increase the voltage until the OVERVOLT lamp on the bay lights and the office visual and audible alarms are activated.

Requirement: When the OVERVOLT lamp on the bay lights, the Weston Model 904 voltmeter indicates 240 $\pm$1 volts for all regular motor-alternators and the KS-15994 L2 emergency motor-alternators or 241 $\pm$2 volts for the KS-15626 L2 emergency motor-alternators.

Note: If the requirement in (5) is met, proceed to (11). If the requirement is not met, continue with (6).

(6) Adjust the ALT VOLTS ADJ potentiometer on the EMG START CONTROL or START CONTROL bay until the Weston Model 904 voltmeter indicates 235 volts.

(7) Momentarily depress the RESET OVERVOLT key on the EMG START CONTROL or START CONTROL bay.

Requirement: The OVERVOLT lamp and office visual alarms extinguish and office audible alarms are silenced.

(8) Rotate the R3 potentiometer on the OUTPUT VOLTAGE LIMITER SENSE CIRCUIT AND AMPLIFIER (CP1) circuit pack (located in EMG START CONTROL or START CONTROL bay) fully ccw.

(9) Slowly rotate the ALT VOLTS ADJ potentiometer on the EMG START CONTROL or START CONTROL bay ccw until the Weston Model 904 voltmeter indicates 240 volts for all regular motor-alternators and the KS-15994 L2

emergency motor-alternators or 241 volts for the KS-15626 L2 emergency motor-alternators.

(10) Slowly rotate the R3 potentiometer on the OUTPUT VOLTAGE LIMITER SENSE CIRCUIT AND AMPLIFIER (CP1) circuit pack (located in EMG START CONTROL or START CONTROL bay) cw until the OVERVOLT lamp on the bay lights and office visual and audible alarms are activated.

(11) Rotate the ALT VOLTS ADJ potentiometer on the EMG START CONTROL or START CONTROL bay cw until the Weston Model 904 voltmeter indicates 235 volts.

(12) Momentarily depress the RESET OVERVOLT key on the EMG START CONTROL or START CONTROL bay.

Requirement: The OVERVOLT lamp and office visual alarms extinguish, and office audible alarms are silenced.

(13) Disconnect the Weston Model 904 voltmeter from the EMG START CONTROL or START CONTROL bay.

(14) If the motor-alternator being tested is a regular motor-alternator, transfer the load from the emergency motor-alternator back to the regular motor-alternator in accordance with 3.04.

(15) Repeat these procedures for each motor-alternator in the power plant.

H. Motor-Alternator Overspeed Shutdown Circuit Check, Motor-Alternators Equipped With Overspeed Shutdown Circuit (ZT option)

4.08 To check the motor-alternator overspeed shutdown circuit, proceed as follows.

(1) If the motor-alternator being tested is a regular motor-alternator, transfer the load from the regular motor-alternator to the emergency motor-alternator in accordance with 3.03.

Note: The motor-alternator being checked should not be supplying power to the load.

(2) Remove the OS (70A) fuse in the associated EMG START CONTROL or START CONTROL bay for the motor-alternator under test from its respective fuse holder.

(3) Obtain a low frequency, low power Hewlett Packard 202C or 200CD oscillator. If a low power oscillator is not available obtain a high power (3-watt) 201C oscillator or equivalent. If a high power oscillator is used, connect a 600-ohm, 5-watt resistor in series with the output of the oscillator.

(4) Connect the output of the oscillator to the TP5 and TP6 test jacks on the OVERSPEED SHUTDOWN (CP2) circuit pack. If the high power oscillator is used, be certain that the resistor is between the output of the oscillator and the OVERSPEED SHUTDOWN (CP2) circuit pack.

(5) Also connect the Hewlett Packard 5221A electronic counter or equivalent to the TP5 and TP6 test jacks on the OVERSPEED SHUTDOWN (CP2) circuit pack. If necessary, use adapter plugs, etc.

(6) Set the AMPLITUDE control knob on the oscillator to maximum and adjust the frequency control knob of the oscillator until the electronic counter indicates 60 Hz.

(7) Slowly increase the frequency of the oscillator until the motor-alternator shuts down and the OS FAIL lamp lights.

Requirement: The electronic counter indicates between 72.5 and 75.0 Hz.

Note: If the requirement in (7) is met, proceed to (30). If the requirement is not met, continue with (8).

(8) Disconnect the oscillator and electronic counter from the OVERSPEED SHUTDOWN (CP2) circuit pack.

(9) Connect the Weston Model 904 voltmeter, connected for the 75-volt scale, to the 600-ohm output of the oscillator.

(10) Set the frequency control knob of the oscillator to 60 Hz.

(11) Adjust the AMPLITUDE control knob of the oscillator until the Weston Model 904 voltmeter indicates 40 volts.

(12) Disconnect the Weston Model 904 voltmeter from the oscillator.

(13) Rotate the R3 potentiometer on the OVERSPEED SHUTDOWN (CP2) circuit pack fully cw.

(14) Install the OS (70A) fuse in the associated EMG START CONTROL or START CONTROL bay for the motor-alternator under test in its respective fuse holder.

(15) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator under test to the DC MOT START & TST position.

Requirement: The DC MOT START & TST lamp lights.

(16) Operate the NOR-STOP key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator under test to the STOP position and then back to the NOR position.

Requirement: The OS FAIL lamp extinguishes and the motor-alternator starts slowly on dc drive.

Note: Allow the AC MOT & ALT FAIL lamp on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator under test to extinguish and then continue with (17).

(17) Operate the DC MOT START & TST-NOR-RLS key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator under test to the RLS position and then back to the NOR position.

Requirement: The DC MOT START & TST lamp extinguishes and the motor-alternator transfers to ac drive (AR relay inside of associated EMG START CONTROL or START CONTROL bay should open).

(18) Remove the OS (70A) fuse in the associated EMG START CONTROL or START CONTROL bay for the motor-alternator under test from its respective fuse holder.

(19) Connect the output of the oscillator to the TP5 and TP6 test jacks on the OVERSPEED SHUTDOWN (CP2) circuit pack. If the high power oscillator is used, be certain that the resistor is between the oscillator and the OVERSPEED SHUTDOWN (CP2) circuit pack.

(20) Also connect the electronic counter to the TP5 and TP6 test jacks on the OVERSPEED SHUTDOWN (CP2) circuit pack. If necessary, use adapter plugs, etc.

(21) Adjust the oscillator frequency until the frequency counter indicates 74 $\pm$1/4 Hz.

(22) Slowly rotate the R3 potentiometer on the OVERSPEED SHUTDOWN (CP2) circuit pack ccw until the OS relay releases.

Requirement: The motor-alternator shuts down and the OS FAIL lamp lights.

(23) Operate the NOR-STOP key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator under test to the STOP position.

(24) Slowly decrease the oscillator frequency until the frequency counter indicates 72 Hz. Observe that the OS relay operates.

(25) Operate the NOR-STOP key on the associated TRANSFER CONTROL or SUPL TRANSFER CONTROL bay for the motor-alternator under test to the NOR position.

(26) Slowly increase the oscillator frequency until the frequency counter indicates 75 Hz. Observe that the OS relay releases.

(27) Disconnect the oscillator and electronic counter from the OVERSPEED SHUTDOWN (CP2) circuit pack.

(28) Repeat (14) through (17).

(29) Repeat (2) through (7).

(30) Disconnect the oscillator and electronic counter from the OVERSPEED SHUTDOWN (CP2) circuit pack.

(31) Repeat (14) through (17).

(32) If the motor-alternator being tested is a regular motor-alternator, transfer the load from the emergency motor-alternator back to the regular motor-alternator in accordance with 3.04.

(33) Repeat these procedures for each motor-alternator in the power plant.

I. Motor-Alternator Line Frequency Monitor Calibration Check, Plant Equipped With Frequency Monitor Circuit (ZH option)

4.09 To check the calibration of the motor-alternator line frequency monitor, proceed as follows.

Note: The KS-16631 L1 line frequency monitor relay can only be calibrated by the manufacturer. If any of the requirements in this check are not met, refer the matter to the supervisor.

(1) Remove either the + (plus) or – (minus) lead from the FRM meter relay.

(2) Rotate the adjustment screw of the FRM meter until the indicator is directly over the zero adjust mark on the FRM meter scale.

(3) Connect the + (plus) or – (minus) lead that was removed in (1) back to the FRM meter relay.

Note: Obtain a copy of the Bell System Practice (155 Division) covering the emergency engine-alternator associated with the 505D power plant. Refer to the section for additional information on the emergency engine-alternator.

(4) Transfer the 505D power plant to the associated emergency engine-alternator.

(5) Decrease the speed of the emergency engine-alternator (which lowers the frequency) until a simulated low frequency transfer occurs.

Requirement: The FF ALM lamp on the TRANSFER CONTROL bay lights and the office alarms are activated when the frequency is lowered to 58.5 Hz.

(6) Increase the speed of the emergency engine-alternator until the frequency is returned to a nominal 60 Hz.

(7) Momentarily depress the FREQ RESET key on the TRANSFER CONTROL bay.

Requirement: The FF ALM lamp on the TRANSFER CONTROL bay and the office alarms extinguish.

(8) Increase the speed of the emergency engine-alternator until a simulated high frequency transfer occurs.

Requirement: The FF ALM lamp on the TRANSFER CONTROL bay lights and the office alarms are activated when the frequency is increased to 63 Hz.

(9) Decrease the speed of the emergency engine-alternator until the frequency is returned to a nominal 60 Hz.

(10) Momentarily depress the FREQ RESET key on the TRANSFER CONTROL bay.

Requirement: The FF ALM lamp on the TRANSFER CONTROL bay and the office alarms extinguish.

(11) Transfer the 505D power plant from the emergency engine-alternator back to the commercial ac input.

J. Inverter OUTPUT VOLTAGE (M2) Voltmeter Calibration Check

4.10 To check the calibration of the inverter output voltage (M2) voltmeter, proceed as follows.

(1) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, across the terminals of the OUTPUT VOLTAGE (M2) voltmeter of the inverter.

(2) Observe the indications on the Weston Model 622 voltmeter and the OUTPUT VOLTAGE (M2) voltmeter of the inverter.

Requirement: The OUTPUT VOLTAGE (M2) voltmeter indicates the same value as the Weston Model 622 voltmeter.

Note: If the requirement in (2) is met, proceed to (4). If the requirement is not met, continue with (3).

(3) Adjust the zero adjust screw of the OUTPUT VOLTAGE (M2) voltmeter until its indication agrees with the indication on the Weston Model 622 voltmeter.

(4) Place a small strip of masking tape, with the date of calibration written on it, across the zero adjust screw of the OUTPUT VOLTAGE (M2) voltmeter.

(5) Disconnect the Weston Model 622 voltmeter from the inverter.

K. Inverter Output Voltage Check

4.11 To check the inverter output voltage, proceed as follows.

Caution: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 line. (See Note 2 under Part 4.)

(1) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, across the terminals of the OUTPUT VOLTAGE (M2) voltmeter of the inverter.

Requirement: The Weston Model 622 voltmeter should indicate the nominal output voltage as specified by local instructions.

Note: If the requirement in (2) is met, proceed to (4). If the requirement is not met, continue with (3).

(3) Adjust the FIELD VOLT ADJ (R307) potentiometer on the associated regulator circuit board until the Weston Model 622 voltmeter indicates the nominal output voltage as specified by local instructions.

(4) Disconnect the Weston Model 622 voltmeter from the inverter.

L. Inverter EARLY WRN MONITOR Alarm Check

4.12 To check the alarms of the inverter EARLY WRN MONITOR plug-in unit, proceed as follows.

(1) Depress and hold the LO-VOLT TEST (S2) switch on the EARLY WRN MONITOR.

Requirement: The LO-VOLT TEST, HI-LO VOLTAGE and cabinet alarm lamps light.

(2) Release the LO-VOLT TEST (S2) switch.

Requirement: The LO-VOLT TEST, HI-LO VOLTAGE, and cabinet alarm lamps extinguish.

(3) Depress and hold the HI-VOLT TEST (S1) switch on the EARLY WRN MONITOR.

Requirement: The HI-VOLT TEST, HI-LO VOLTAGE, and cabinet alarm lamps light.

(4) Release the HI-VOLT TEST (S1) switch.

Requirement: The HI-VOLT TEST, HI-LO VOLTAGE, and cabinet alarm lamps extinguish.

M. Inverter EARLY WRN MONITOR Operation Check

4.13 To check the operation of the inverter EARLY WRN MONITOR plug-in unit, proceed as follows.

Caution: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines. (See Note 2 under Part 4.)

(1) Verify that the inverter under test is supplying the required output voltage to the load in accordance with 4.11.

(2) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, across the terminals of the OUTPUT VOLTAGE (M2) voltmeter of the inverter.

(3) Mark the position of the FACTORY VOLT ADJ (R301) potentiometer on the regulator circuit board of the inverter.

Caution: The FACTORY VOLT ADJ (R301) potentiometer must be returned to its original factory setting to allow the inverter to operate properly.

(4) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer cw until the HI-LO VOLTAGE and cabinet alarm lamps light.

Requirement: The Weston Model 622 voltmeter should indicate 225 $\pm$1 volts.

Note: Be certain to note the voltage value at which the alarm lamps lighted for possible future reference.

(5) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer back to the marked position.

Requirement: The HI-LO VOLTAGE and cabinet alarm lamps extinguish.

(6) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer ccw until the HI-LO VOLTAGE and cabinet alarm lamps light.

Requirement: The Weston Model 622 voltmeter should indicate 235 $\pm$1 volts.

Note: Be certain to note the voltage value at which the alarm lamps lighted for possible future reference.

(7) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer back to the marked position.

Requirement: The HI-LO VOLTAGE and cabinet alarm lamps extinguish.

(8) Disconnect the Weston Model 622 voltmeter from the inverter.

Note: If the requirements in (4) through (7) are met, proceed to 4.14. If any of the requirements are not met, continue with (9).

(9) Remove the inverter from service in accordance with 3.12.

(10) Remove the EARLY WRN MONITOR plug-in unit from the inverter.

Note: If a properly adjusted spare EARLY WRN MONITOR plug-in unit is not available, proceed to (13). If a properly adjusted spare EARLY WRN MONITOR plug-in unit is available, continue with (11).

(11) Install the properly adjusted spare EARLY WRN MONITOR plug-in unit in the inverter.

(12) Restore the inverter to service in accordance with 3.13.

(13) Place the EARLY WRN MONITOR plug-in unit on a work bench.

(14) Connect a -24 volt input to terminal 6 and ground to terminal 7 of the P1 plug.

(15) Using suitable cords and connecting clips, connect the output of the Variac to terminals 1 and 2 of the T3 transformer. Verify that the ON-OFF switch of the Variac is in the OFF position and that the voltage control knob is in the zero position.

(16) Connect the Variac to a nominal 230-volt ac input.

Note: If the Variac has been locally wired for 115-volt operation, connect the Variac to a nominal 115-volt ac input.

(17) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, to terminals 1 and 2 of the T3 transformer (connected to the same terminals as the Variac).

(18) Operate the ON-OFF switch of the Variac to the ON position and adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 230 volts.

Note: Allow the EARLY WRN MONITOR plug-in unit to warm up for approximately 10 minutes and then continue with (19).

(19) Adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 221 volts.

(20) Rotate the R3 (low voltage) potentiometer fully cw.

(21) Verify that the LVL1 relay is operated.

(22) Slowly rotate the R3 (low voltage) potentiometer ccw until the LVL1 relay just releases.

(23) Adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 230 volts.

(24) Rotate the R2 (high voltage) potentiometer fully ccw.

(25) Verify that the HLV1 relay is released.

(26) Slowly rotate the R2 (low voltage) potentiometer cw until the HLV1 relay just operates.

Note: If the LVL1 relay released in (22) and the HLV1 relay operated in (26), proceed to (32). If the LVL1 relay did not release in (22) or the HLV1 relay did not operate in (26), it will be necessary to restrap the terminals of the EARLY WRN MONITOR plug-in unit by continuing with (27).

(27) Operate the ON-OFF switch of the Variac to the OFF position.

(28) Disconnect the −24 volt input from the EARLY WRN MONITOR plug-in unit.

(29) If the voltage value noted in (4) or (6) was higher than the required voltage, change the terminal straps on the EARLY WRN MONITOR in accordance with the next ***higher*** numbered step in the following list. If the voltage value noted in (4) or (6) was lower than the required voltage, change the terminal straps on the EARLY WRN MONITOR in accordance with the next ***lower*** numbered step in the following list.

1—None
2—E15 to E16
3—E14 to E15
4—E13 to E14
5—E14 to E16
6—E13 to E14 and E15 to E16
7—E13 to E15
8—E13 to E16

(30) Connect a −24 volt input to terminal 6 and ground to terminal 7 of the EARLY WRN MONITOR P1 plug.

(31) Repeat the procedures in (17) through (26). Be certain to follow the procedures in the note of (26).

(32) Rotate the voltage-control knob of the Variac fully ccw and then operate the ON-OFF switch to the OFF position.

(33) Disconnect the Weston Model 622 voltmeter and the Variac from the EARLY WRN MONITOR.

(34) Disconnect the −24 volt input and ground from the EARLY WRN MONITOR.

Note: If a properly adjusted spare EARLY WRN MONITOR plug-in unit is not being used in the inverter, proceed to (37). If a properly adjusted spare EARLY WRN MONITOR plug-in unit is being used in the inverter, continue with (35).

(35) Remove the inverter from service in accordance with 3.12.

(36) Remove the spare EARLY WRN MONITOR plug-in unit from the inverter.

(37) Install the original EARLY WRN MONITOR plug-in unit in the inverter.

(38) Restore the inverter to service in accordance with 3.13.

(39) Repeat (1) through (7) to verify the proper operation of the EARLY WRN MONITOR plug-in unit.

N. INV TRFR MONITOR Alarm Check

4.14 To check the alarms of the INV TRFR MONITOR plug-in unit, proceed as follows.

(1) Depress and hold the LO-VOLT TEST (S4) switch on the INV TRFR MONITOR.

Requirement: The LO-VOLT TEST lamp lights.

(2) Release the LO-VOLT TEST (S4) switch.

Requirement: The LO-VOLT TEST lamp extinguishes.

(3) Depress and hold the HI-VOLT TEST (S3) switch on the INV TRFR MONITOR.

Requirement: The HI-VOLT TEST lamp lights.

(4) Release the HI-VOLT TEST (S3) switch.

Requirement: The HI-VOLT TEST lamp extinguishes.

O. INV TRFR MONITOR Operation Check

4.15 To check the operation of the INV TRFR MONITOR plug-in unit, proceed as follows.

(1) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, across the terminals of the OUTPUT VOLTAGE (M2) voltmeter of the inverter.

Requirement: The Weston Model 622 voltmeter should indicate the nominal output voltage as specified by local instructions.

Note: If the requirement in (1) is met, proceed to (3). If the requirement is not met, continue with (2).

(2) Adjust the FIELD VOLT ADJ (R307) potentiometer until the Weston Model 622 voltmeter indicates the nominal output voltage as specified by local instructions.

(3) Mark the position of the FACTORY VOLT ADJ (R301) potentiometer on the regulator circuit board of the inverter.

Caution: The FACTORY VOLT ADJ (R301) potentiometer must be returned to its original factory setting to allow the inverter to operate properly.

Note: The IT relay is operated (contacts open) under normal operating conditions. The IT relay is under the panel that is directly above the inverter OUTPUT CURRENT (M1) ammeter.

(4) Block the IT relay operated.

Note: The HI-LO VOLTAGE lamp lights, when the FACTORY VOLT ADJ ((R301) potentiometer is rotated cw or ccw from its marked position and extinguishes when the DV1 relay releases.

(5) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer cw until the DV1 relay releases.

Requirement: The Weston Model 622 voltmeter should indicate 218 $\pm$1 volts. Observe that the cabinet alarm lamp is lighted.

Note: Be certain to note the voltage value at which the DV1 relay released for possible future reference.

(6) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer back to the marked position.

Requirement: The cabinet alarm lamp is extinguished.

(7) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer ccw until the DV1 relay releases.

Requirement: The Weston Model 622 voltmeter should indicate 242 $\pm$1 volts. Observe that the cabinet alarm lamp is lighted.

Note: Be certain to note the voltage value at which the DV1 relay released for possible future reference.

(8) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer back to the marked position.

Requirement: The cabinet alarm lamp is extinguished.

Note: If the requirements in (5) through (8) are met, proceed to (51). If any of the requirements are not met, continue with (9).

(9) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer cw until the Weston Model 622 voltmeter indicates 218 volts.

Note: The R2 and R3 potentiometer on the INV TRFR MONITOR are accessible by opening the REGULAR PLANT CONTROL panel.

(10) Rotate the R3 (low voltage) potentiometer on the INV TRFR MONITOR fully cw.

(11) Verify that that DV1 relay is operated.

(12) Slowly rotate the R3 (low voltage) potentiometer on the INV TRFR MONITOR ccw until the DV1 relay releases.

(13) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer ccw until the Weston Model 622 voltmeter indicates 242 volts.

(14) Rotate the R2 (high voltage) potentiometer on the INV TRFR MONITOR fully ccw.

(15) Verify that the DV1 relay is operated.

(16) Slowly rotate the R2 (high voltage) potentiometer on the INV TRFR MONITOR cw until the DV1 relay releases.

(17) Slowly rotate the FACTORY VOLT ADJ (R301) potentiometer back to the marked position.

Note: If the DV1 relay released in (12) and (16), proceed to (51). If the DV1 relay did not release in (12) and (16), continue with (18).

(18) Disconnect the Weston Model 622 voltmeter from the inverter.

(19) Unblock the IT relay.

(20) Remove the inverter from service in accordance with 3.12.

(21) Remove the INVR TRFR MONITOR plug-in unit from the inverter.

Note: If a properly adjusted spare INVR TRFR MONITOR plug-in unit is not available, proceed to (24). If a properly adjusted spare INVR TRFR MONITOR plug-in unit is available, continue with (22).

(22) Install the properly adjusted spare INVR TRFR MONITOR plug-in unit in the inverter.

(23) Restore the regular inverter to service in accordance with 3.13.

(24) Place the INV TRFR MONITOR plug-in unit on a work bench.

(25) Connect a −24 volt input to terminal 6 and ground to terminal 7 of the P2 plug.

(26) Using suitable cords and connecting clips, connect the output of the Variac to terminals 1 and 2 of the T2 transformer. Verify that the ON-OFF switch of the Variac is in the OFF position and that the voltage control knob is in the zero position.

(27) Connect the Variac to a nominal 230-volt ac input.

Note: If the Variac has been locally wired for 115-volt operation, connect the Variac to a nominal 115-volt ac input.

(28) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, to terminals 1 and 2 of the T2 transformer (connected to the same terminals as the Variac).

(29) Operate the ON-OFF switch of the Variac to the ON position and adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 230 volts.

Note: Allow the INV TRFR MONITOR plug-in unit to warm up for approximately 10 minutes and then continue with (30).

(30) Adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 213 volts.

(31) Rotate the R3 (low voltage) potentiometer fully cw.

(32) Verify that the LVL2 relay is operated.

(33) Slowly rotate the R3 (low voltage) potentiometer ccw until the LVL2 relay just releases.

(34) Adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 238 volts.

(35) Rotate the R2 (high voltage) potentiometer fully ccw.

(36) Verify that the HLV2 relay is released.

(37) Slowly rotate the R2 (high voltage) potentiometer cw until the HLV2 relay just operates.

Note: If the LVL2 relay released in (33) and the HLV2 relay operated in (37), proceed to (43). If the LVL2 relay did not release in (33) or the HLV2 relay did not operate in (37), it will be necessary to restrap the terminals of the INV TRFR MONITOR plug-in unit by continuing with (38).

(38) Operate the ON-OFF switch of the Variac to the OFF position.

(39) Disconnect the −24 volt input from the INV TRFR MONITOR.

(40) If the voltage value noted in (5) or (7) was higher than the required voltage, change the terminal straps on the INV TRFR MONITOR in accordance with the next ***higher*** numbered step in the following list. If the voltage value noted in (5) or (7) was lower than the required voltage, change the terminal straps on the INV TRFR MONITOR in accordance with the next ***lower*** numbered step in the following list.

1—None
2—E15 to E16
3—E14 to E15
4—E13 to E14
5—E14 to E16
6—E13 to E14 and E15 to E16
7—E13 to E15
8—E13 to E16

(41) Connect a −24 volt input to terminal 6 and ground to terminal 7 of the INV TRFR MONITOR P2 plug.

(42) Repeat the procedures in (28) through (37). Be certain to follow the procedures in the note of (37).

(43) Rotate the voltage-control knob of the Variac fully ccw and then operate the ON-OFF switch to the OFF position.

(44) Disconnect the Weston Model 622 voltmeter and the Variac from the INV TRFR MONITOR.

(45) Disconnect the −24 volt input and ground from the INV TRFR MONITOR.

Note: If a properly adjusted spare INV TRFR MONITOR plug-in unit is not being used in the inverter, proceed to (48). If a properly adjusted spare INV TRFR MONITOR plug-in unit is being used in the regular inverter, continue with (46).

(46) Remove the inverter from service in accordance with 3.12.

(47) Remove the spare INV TRFR MONITOR plug-in unit from the inverter.

(48) Install the original INV TRFR MONITOR plug-in unit in the inverter.

(49) Restore the regular inverter to service in accordance with 3.13.

(50) Repeat (3) through (8) to verify the proper operation of the INVR TRFR MONITOR plug-in unit.

(51) Unblock the IT relay.

(52) Disconnect the Weston Model 622 voltmeter from the inverter.

P. Inverter SHUT DWN MONITOR Alarm Check

4.16 To check the alarms of the inverter SHUT DWN MONITOR plug-in unit, proceed as follows.

(1) Depress and hold the LO-VOLT TEST (S7) switch on the SHUT DWN MONITOR.

Requirement: The LO-VOLT TEST lamp lights.

(2) Release the LO-VOLT TEST (S7) switch.

Requirement: The LO-VOLT TEST lamp extinguishes.

Q. Inverter SHUT DWN MONITOR Operation Check

4.17 To check the operation of the inverter SHUT DWN MONITOR plug-in unit, proceed as follows.

Caution: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines. (See Note 2 under Part 4.)

(1) Transfer the load from the inverter to the emergency motor-alternator in accordance with 3.10.

Caution: Restore the inverter to service as soon as possible to enable the emergency motor-alternator to be used for automatic transfers should a regular motor alternator or inverter fail.

Warning: Do not touch exposed metal parts when connecting or disconnecting an external voltmeter across the terminals of the panel voltmeter on the EMG START CONTROL bay as hazardous voltages are present.

(2) Connect the Weston Model 904 voltmeter, connected for the 300-volt scale, to the Hubbell receptacle (ZR option) on the EMG START CONTROL bay. If the Hubbell receptacle is not provided on the bay but test jacks have been locally wired in for the connection of an external voltmeter, connect the Weston Model 904 voltmeter to the test jacks on the bay. If the Hubbell receptacle is not provided and test jacks have not been locally wired in, observe warning and connect the Weston Model 904 voltmeter across the terminals of the panel voltmeter on the bay.

(3) Mark the position of the ALT VOLTS ADJ potentiometer on the EMG START CONTROL bay.

Caution: The ALT VOLTS ADJ potentiometer must be returned to the original setting after testing is complete.

Note: The IT relay should be operated and the DX1 relay should be released at this time. The IT and DX1 relays are under the panel that is directly above the OUTPUT CURRENT (M1) ammeter.

(4) Manually release the IT relay and block the IT and DX1 relays released.

Note 1: As the ALT VOLTS ADJ potentiometer is rotated from the original factory setting, various audible and visual alarms will be activated.

Note 2: The DV2 relay should be released at this time. The DV2 relay is located behind the TRANSFER PANEL.

Caution: If it is necessary to remove the panel, care should be exercised to avoid dropping metal objects into the circuits below.

(5) Slowly rotate the ALT VOLTS ADJ potentiometer cw until the DV2 relay operates.

Requirement: The Weston Model 904 voltmeter should indicate 202 $\pm$2 volts.

Note 1: Be certain to note the voltage value at which the DV2 relay operated for possible future reference.

Note 2: If the requirement in (5) is met, proceed to (41). If the requirement is not met, continue with (6).

Note 3: The R3 potentiometer on the SHUT DWN MONITOR is accessible by opening the REGULAR PLANT CONTROL panel and removing the EARLY WRN and INV TRFR MONITORS.

(6) Rotate the R3 potentiometer on the SHUT DWN MONITOR fully cw.

Note: If the inverter is shut down, depress the RESET (S8) switch on the inverter.

(7) Adjust the ALT VOLTS ADJ potentiometer until the Weston Model 904 voltmeter indicates 202 volts.

(8) Verify that the DV2 relay is released.

(9) Slowly rotate the R3 potentiometer on the SHUT DWN MONITOR ccw until the DV2 relay operates.

(10) Slowly rotate the ALT VOLTS ADJ potentiometer back to the marked position.

Note: If the DV2 relay is operated in (9), proceed to (42). If the DV2 relay did not operate in (9), continue with (11).

(11) Disconnect the Weston Model 904 voltmeter from the inverter.

(12) Remove the inverter from service in accordance with 3.12.

(13) Remove the SHUT DWN MONITOR plug-in unit from the inverter.

Note: If a properly adjusted spare SHUT DWN MONITOR plug-in unit is not available, proceed to (17). If a properly adjusted spare SHUT DWN MONITOR plug-in unit is available, continue with (14).

(14) ◗Unblock the IT and DX1 relays.◖

(15) Install the properly adjusted spare SHUT DWN MONITOR plug-in unit in the inverter.

(16) Restore the inverter to service in accordance with 3.13.

(17) Place the SHUT DWN MONITOR plug-in unit on a work bench.

(18) Connect a −24 volt input to terminal 6 and ground to terminal 7 of the P3 plug.

(19) Using suitable cords and connecting clips, connect the output of the Variac to terminals 1 and 2 of the T3 transformer. Verify that the ON-OFF switch of the Variac is in the OFF position and that the voltage control knob is in the zero position.

(20) Connect the Variac to a nominal 230-volt ac output.

Note: If the Variac has been locally wired for 115-volt operation, connect the Variac to a nominal 115-volt ac input.

(21) Connect the Weston Model 622 voltmeter, set on the 300-volt ac scale, to terminals 1 and 2 of the T3 transformer (connected to the same terminals as the Variac).

(22) Operate the ON-OFF switch of the Variac to the ON position and adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 230 volts.

Note: Allow the SHUT DWN MONITOR plug-in unit to warm up for approximately 10 minutes and then continue with (23).

(23) Adjust the voltage-control knob of the Variac until the Weston Model 622 voltmeter indicates 196 volts.

(24) Rotate the R3 potentiometer fully cw.

(25) Verify that the LVL3 relay is operated.

(26) Slowly rotate the R3 potentiometer ccw until the LVL3 relay just releases.

Note: If the LVL3 relay released in (26), proceed to (32). If the LVL3 relay did not release in (26), it will be necessary to restrap the terminals of SHUT DWN MONITOR plug-in unit by continuing with (27).

(27) Operate the ON-OFF switch of the Variac to the OFF position.

(28) Disconnect the −24 volt input from the SHUT DWN MONITOR.

(29) If the voltage value noted in (5) was higher than the required voltage, change the terminal straps on the SHUT DWN MONITOR in accordance with the next ***higher*** numbered step in the following list. If the voltage value noted in (5) was lower than the required voltage, change the terminal straps on the SHUT DWN MONITOR in accordance with the next ***lower*** numbered step in the following list.

1—None
2—E15 to E16
3—E14 to E15
4—E13 to E14
5—E14 to E16
6—E13 to E14 and E15 to E16
7—E13 to E15
8—E13 to E16

(30) Connect a −24 volt input to terminal 6 and ground to terminal 7 of the SHUT DWN MONITOR P3 plug.

(31) Repeat the procedures in (19) through (26). Be certain to follow the procedures in the note of (26).

(32) Rotate the voltage-control knob of the Variac fully ccw and then operate the ON-OFF switch to the OFF position.

(33) Disconnect the Weston Model 622 voltmeter and the Variac from the SHUT DWN MONITOR.

(34) Disconnect the −24 volt input and ground from the SHUT DWN MONITOR.

Note: If a properly adjusted spare SHUT DWN MONITOR plug-in unit is not being used in the inverter, proceed to (37). If a properly adjusted spare SHUT DWN MONITOR plug-in unit is being used in the inverter continue with (35).

(35) Block the IT and DX1 relays released.◀

(36) Remove the inverter from service in accordance with 3.12.

(37) Remove the spare SHUT DWN MONITOR plug-in unit from the inverter.

(38) Install the original SHUT DWN MONITOR plug-in unit in the inverter.

(39) Restore the inverter to service in accordance with 3.13.

(40) Repeat (1) through (5) to verify the proper operation of the SHUT DWN MONITOR plug-in unit.

(41) Slowly rotate the ▶ALT VOLTS ADJ◀ potentiometer back to the marked position.

(42) ▶Unblock the IT and DX1 relays.◀

(43) Depress the RESET (S8) switch on the inverter.

(44) Transfer the load on the emergency motor-alternator back to inverter in accordance with 3.11.

(45) Disconnect the Weston Model 904 voltmeter from the inverter.

R. Inverter Shutdown Time Delay Check

4.18 To check the operation of the inverter shutdown time delay circuit, proceed as follows.

▶***Caution: Load transfers should be kept to a minimum to reduce the possible switching transients that might appear on the associated L3 lines (see Note 2 under Part 4.)***◀

(1) Transfer the load from the inverter to the emergency motor-alternator in accordance with 3.10.

▶***Caution: Restore the inverter to service as soon as possible to enable the emergency motor-alternator to be used for automatic transfers should a regular motor-alternator or inverter fail.***

Note: The IT relay should be operated and the DX1 relay should be released at this time. The IT and DX1 relays are under the panel that is directly above the OUTPUT CURRENT (M1) ammeter on the inverter.

(2) Manually release the IT relay and block the IT relay released.◀

(3) Insulate the No. 4 contact of the DX1 relay.

(4) Prepare to measure a time delay in seconds, using the KS-3008 stopwatch.

Note: ▶The DV2 relay is located behind the TRANSFER PANEL.

Caution: If it is necessary to remove the panel, care should be exercised to avoid dropping metal objects into the circuits below.◀

(5) Connect a jumper from frame ground to the M (right) terminal of the DV2 time delay relay.

Requirement: After a time delay of 6 seconds, the DX1 relay operates.

(6) Disconnect the jumper from the M (right) terminal of th DV2 relay and frame ground.

(7) Depress the RESET (S8) switch on the inverter.

Note: If the requirement in (5) is met, proceed to (10). If the requirement is not met, continue with (8).

(8) If the DX1 relay operated in less than 6 seconds, rotate the timer control knob slightly cw to increase the time delay. If the DX1 relay operated in more than 6 seconds, rotate the timer control knob slightly ccw to decrease the time delay.

(9) Repeat (4) through (7).

(10) Remove the insulation from the No. 4 contact of the DX1 relay.

(11) Unblock the IT relay.

(12) ➧Depress the RESET (S8) switch on the inverter.➧

(13) Transfer the load on the emergency motor-alternator back to the inverter in accordance with 3.11.

S. Inverter Battery Fuse Alarm Check

4.19 To check the battery fuse alarms of the inverter, proceed as follows.

Note: The IT relay is operated (contacts open) under normal operating conditions. The IT relay is under the panel that is directly above the OUTPUT CURRENT (M1) ammeter.

(1) Block the IT relay operated.

Note: ➧The later design of fuse caps for 70-type fuses contains an aperture or slot adjacent to the hole for the colored bead, providing access to the alarm test point (see Fig. 12). The new P-344900 fuse cap assembly is for use on non-modular fuse blocks (18A, 19A, and 21A) and the P-11F667 fuse cap assembly is for use on modular fuse blocks (22- through 27-type). This sytle cap should be used when testing fuse alarm.

Caution: Due to possible fuse and/or equipment damage, the former procedure of testing fuse alarms by inserting a 411C tool or a 266C tool (wire burnisher) held in a 265C tool (contact burnisher holder) beside the colored bead on older fuse caps without the slot or aperture, should be discontinued.

(2) Prepare the alarm test cord by connecting one end of the WIAY testing cord to the 141 cord tip and 720A voltage pickup tool. (The KS-6278 connecting clip may be used to replace the 720A voltage pickup tool.) On the opposite end of the WIAY testing cord, connect the 411C test tool (see Fig. 13).

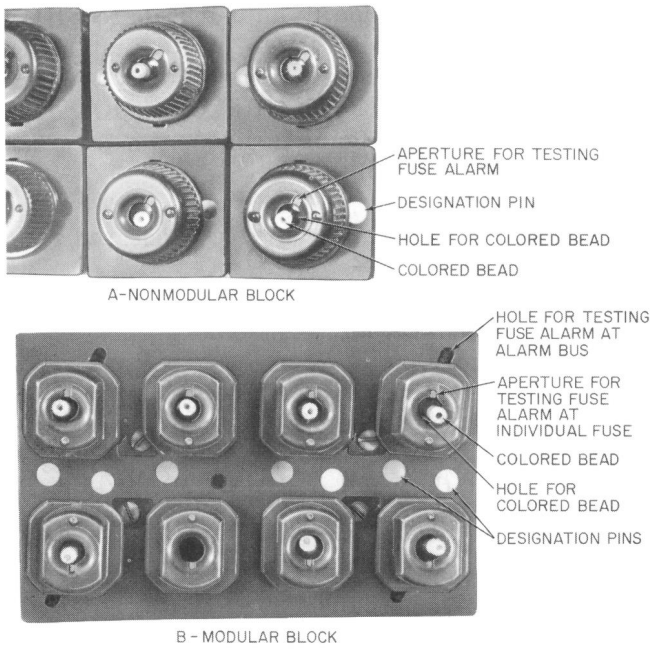


Fig. 12—➧Typical 70-Type Fuse Cap➧

(3) Install the 720A voltage pickup tool in a spare 70 type fuse position. (If the 720A tool is not available, obtain the same polarity voltage supply by connecting a KS-6278 connecting clip with the WIAY testing cord to the positive or negative bus bar.)

Caution: Test only the fuses associated with the same polarity and voltage level supply.

(4) With the tip of the 411C tool (attached to the battery connected WIAY cord) touch

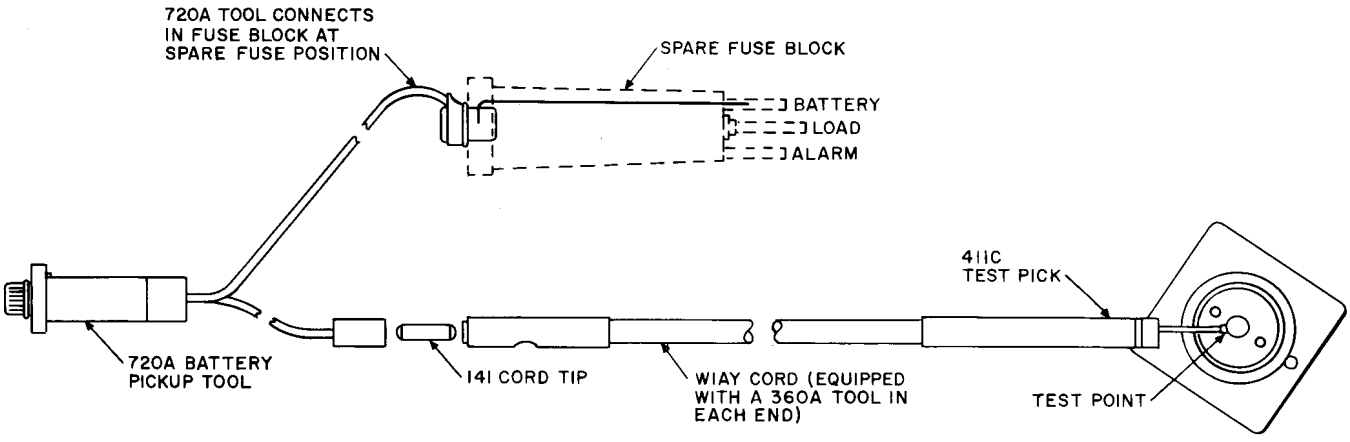


Fig. 13—Fuse Alarm Testing Cord-Tool Connection

the exposed alarm test point on the fuse cap of the BATT A fuse holder.

Requirement: An office audible alarm is activated. The FUSE ALARM and cabinet alarm lamps light.

Note: Tests made at the individual fuse cap check the contact between the fuse cap and the alarm bus bar. On modular type fuse blocks, there is also an aperture in the corner of the fuse block to test directly to the alarm bus bar (see Fig. 12).

(5) Remove the 411C tool from the fuse cap.

Requirement: The office audible alarm is silenced. The FUSE ALARM and cabinet alarm lamps extinguish.

(6) Repeat (4) for each fuse.

(7) Remove the 720A tool from the spare fuse position. (If the KS-6278 connecting clip is used, disconnect the clip from the bus bar.)

(8) Repeat (2) through (7), substituting the BATT B, BATT C, and BATT D fuse holders for the BATT A fuse holder.

(9) Unblock the IT relay.

T. Inverter DC Filter Network Fuse Alarm Check

4.20 To check the dc filter network fuse alarms of the inverter, proceed as follows.

Note: The IT relay is operated (contacts open) under normal operating conditions. The IT relay is under the panel that is directly above the OUTPUT CURRENT (M1) ammeter.

(1) Block the IT relay operated.

(2) Remove the 70-type fuse from the F505 fuse holder (fuse located in rear of inverter).

(3) Insert a blown 70-type fuse in the F505 fuse holder.

Requirement: An office audible alarm is activated. The FUSE ALARM and cabinet alarm lamps light.

(4) Remove the blown 70-type fuse from the F505 fuse holder.

Requirement: The office audible alarm is silenced. The FUSE ALARM and cabinet alarm lamps extinguish.

(5) Install the original 70-type fuse in the F505 fuse holder.

(6) Repeat (2) through (5), substituting the F507, F509, F511, F513, F515, F529, F531, F533, and F535 fuse holders for the F505 fuse holder.

(7) Unblock the IT relay.

U. Inverter AC Filter Network Fuse Alarm Check

4.21 To check the ac filter network fuse alarms of the inverter, proceed as follows.

Note: The IT relay is operated (contacts open) under normal operating conditions. The IT relay is under the panel that is directly above the OUTPUT CURRENT (M1) ammeter.

(1) Block the IT relay operated.

(2) Remove the 70-type fuse from the F516 fuse holder (fuse located in rear of inverter).

(3) Insert a blown 70-type fuse in the F516 fuse holder.

Requirement: An office audible alarm is activated. The FUSE ALARM and cabinet alarm lamps light.

(4) Remove the blown 70-type fuse from the F516 fuse holder.

Requirement: The office audible alarm is silenced. The FUSE ALARM and cabinet alarm lamps extinguish.

(5) Install the original 70-type fuse in the F516 fuse holder.

(6) Repeat (2) through (5), substituting the F518, F520, F522, and F524 fuse holders for the F516 fuse holder.

(7) Unblock the IT relay.

V. PWR CONT Bay Line Current Check

4.22 To check the PWR CONT bay line current, proceed as follows.

(1) Position the following controls on the PWR CONT bay as indicated.

COARSE CONTROL MANUAL-NOR AUTO key to MANUAL

COARSE CONTROL RAISE-NOR-LOWER key to NOR

FINE CONTROL NOR-OFF switch to OFF

(2) Verify that the UNREG-REG toggle switch for the AC VOLTS meter is in the REG position.

(3) Observe the indication on the AC VOLTS meter.

Requirement: The AC VOLTS meter should indicate the nominal regulated voltage (usually 230 volts).

Note: If the requirement in (3) is met, proceed to (5). If the requirement is not met, continue with (4).

(4) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position for 1 second and then to NOR for approximately 15 seconds until the AC VOLTS meter indicates the nominal regulated voltage (usually 230 volts). Repeat this procedure until the AC VOLTS meter indicates the required regulated voltage.

Note: Allow the line voltage and current to stabilize and then continue with (5).

(5) Observe the indication on the PLT CUR meter of the PWR CONT bay.

Requirement: The PLT CUR meter indicates 200 milliamperes.

Note: If the requirement in (5) is met, proceed to (7). If the requirement is not met, continue with (6).

(6) Adjust the ADJ CUR potentiometer until the PLT CUR meter indicates 200 milliamperes.

(7) Observe the indications on the two line current meters of the PWR CONT bay.

Requirement: The line current meters indicate the required line current.

Note 1: The required line current should be posted directly above the associated line current meters.

Note 2: If the line current indicated on the line current meters is not within ± 0.01 ampere

of the posted line current value, trouble conditions may be present in the associated amplifiers and regulators of the power loop.

(8) Verify that the armatures of the VR and VA relays are midway between the low and high contacts.

(9) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(10) Operate the FINE CONTROL NOR-OFF switch to the NOR position.

Requirement: The FINE CONTROL OFF lamp extinguishes. After a time delay of approximately 3 seconds, the ELECTRONIC REGULATOR FAILURE lamp extinguishes.

Note: If the ELECTRONIC REGULATOR FAILURE lamp extinguishes, proceed to (25). If the ELECTRONIC REGULATOR FAILURE lamp remains lighted, the T2 autotransformer is not in the midposition. To adjust the T2 autotransformer to the midposition and to extinguish the ELECTRONIC REGULATOR FAILURE lamp, continue with (11).

(11) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(12) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(13) Remove the front cover from the PWR CONT bay that is directly above the PLT CUR (plate current) meter.

(14) Loosen the wingnut that holds the T2 autotransformer in place.

(15) Pull the T2 autotransformer outward to make the unit accessible.

(16) Turn the knob of the T2 autotransformer until the pointer is in the midposition.

(17) Push the T2 autotransformer back into the PWR CONT bay and tighten the wingnut that holds the autotransformer in place. Verify that the autotransformer will not move.

(18) Install the cover that was removed from above the PLT CUR meter.

(19) Observe the indication on the AC VOLTS meter.

Requirement: The AC VOLTS meter should indicate the nominal regulated voltage (usually 230 volts).

Note: If the requirement in (19) is met, proceed to (21). If the requirement is not met, continue with (20).

(20) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position for 1 second and then to NOR for approximately 15 seconds until the AC VOLTS meter indicates the nominal regulated voltage (usually 230 volts). Repeat this procedure until the AC VOLTS meter indicates the required regulated voltage.

Note: Allow the line voltage and current to stabilize and then continue with (21).

(21) Observe the indication on the PLT CUR meter.

Requirement: The PLT CUR meter indicates 200 milliamperes.

Note: If the requirement in (21) is met, proceed to (23). If the requirement is not met, continue with (22).

(22) Adjust the ADJ CUR potentiometer until the PLT CUR meter indicates 200 milliamperes.

(23) Verify that the armatures of the VR and VA relays are midway between the low and high contacts.

(24) Repeat steps (9) and (10).

(25) Observe the indications on the two line current meters (even and odd L3 lines) of the PWR CONT bay.

Requirement: The difference between the two line current meter indications should be less than 50 milliamperes for power sections that contain 15 or less repeaters. The difference between the two line current meter indications should be less than 75 milliamperes for power sections with 16 or more repeaters.

Note: If the requirement in (25) is not met, trouble conditions may be present in the associated amplifiers and regulators of the associated L3 lines or there may be a short or open in the associated L3 lines. If trouble conditions are present, turn the power down on the associated L3 lines in accordance with 3.02, clear the troubles, and then turn the power up on the associated L3 lines in accordance with 3.01.

(26) Observe the indications on the associated L3 line pilot indicators.

Requirement: The associated L3 line pilot indicators indicate 0 $\pm$0.1 dB.

(27) Clear all associated L3 line pilot alarms in both directions of transmission.

Note: If the associated L3 line pilot alarms cannot be cleared, measure the alarms to determine their locations and perform the necessary maintenance to clear the alarms.

W. PWR CONT Bay VR Voltage Relay Check

4.23 To check the operation of the VR voltage relay in the PWR CONT bay, proceed as follows.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: Before performing this routine check on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenance are to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments, relay blocks, relay strapping, etc on the PWR CONT bay being checked and not, by mistake, on the PWR CONT bay that is supplying power to the associated L3 lines.

(2) Perform the necessary procedures to obtain the use of the protection lines. (See Sections 359-010-125 and 359-075-301.)

(3) Verify that the UNREG-REG switch on the PWR CONT bay is in the REG position.

(4) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(5) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(6) Observe the moving contact of the VR relay.

Requirement: The moving contact of the VR relay is midway between the high and low contacts.

Note: If the requirement in (6) is met, proceed to (8). If the requirement is not met, continue with (7).

(7) Adjust the VR ADJ (R1) potentiometer until the moving contact of the VR relay is midway between the high and low contacts.

(8) Observe the indications on both ammeters of the PWR CONT bay and record their values.

(9) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the right high contact of the VR relay makes.

Requirement: The two ammeters on the PWR CONT bay indicate that the cable current is approximately 3 percent above the nominal

values recorded in (8) and the L1 relay (located in rear of PWR CONTROL bay) operates.

Note: If the requirement in (9) is met, proceed to (12). If the requirement is not met, continue with (10).

(10) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is 3 percent above the nominal values recorded in (8).

(11) Remove the front cover from the VR relay and adjust the right high contact screw of the VR relay until the right high contact of the VR relay just makes.

Note: If the VR relay cannot be properly adjusted by the right high contact screw of the VR relay, adjust the VR relay in accordance with Section 040-254-701.

(12) Install the front cover on the VR relay.

(13) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the LOWER position in small increments until the left low contact of the VR relay makes.

Requirement: The two ammeters on the PWR CONT bay indicate that the cable current is approximately 3 percent below the nominal values recorded in (8) and the R1 relay (located in rear of PWR CONT bay) operates.

Note: If the requirement in (13) is met, proceed to (17). If the requirement is not met, continue with (14).

(14) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is 3 percent above the nominal values recorded in (8).

(15) Remove the front cover from the VR relay and adjust the left low contact screw of the VR relay until the left low contact of the VR relay just makes.

Note: If the VR relay cannot be properly adjusted by the left low contact screw of the VR relay, adjust the VR relay in accordance with Section 040-254-701.

(16) Install the front cover on the VR relay.

(17) If the requirement in (9) or (13) was not met, repeat (8), (9), and (13).

(18) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the two ammeters on the PWR CONT bay indicate the required nominal line current values.

Note: The required line current should be posted directly above the associated line current meters.

(19) Operate the FINE CONTROL NOR-OFF switch to the NOR position.

Requirement: The FINE CONTROL OFF lamp extinguishes.

(20) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(21) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation (see Sections 359-010-125 and 359-075-301). Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

X. PWR CONT Bay VA Voltage Relay Check

4.24 To check the operation of the VA voltage relay in the PWR CONT bay, proceed as follows.

(1) Notify the switching centers in all directions of transmission that routine checks are to

be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: Before performing this routine check on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenance are to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments, relay blocks, relay strapping, etc, on the PWR CONT bay being checked and not, by mistake, on the PWR CONT bay that is supplying power to the associated L3 lines.

(2) Perform the necessary procedures to obtain the use of the protection lines. (See Sections 359-010-125 and 359-075-301.)

(3) Verify that the UNREG-REG switch on the PWR CONT bay is in the REG position.

(4) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(5) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(6) Observe the moving contact of the VA relay.

Requirement: The moving contact of the VA relay is midway between the high and low contacts.

Note: If the requirement in (6) is met, proceed to (8). If the requirement is not met, continue with (7).

(7) Adjust the VA ADJ (R2) potentiometer until the moving contact of the VA relay is midway between the high and low contacts.

(8) Observe the indications on both ammeters of the PWR CONT bay and record their values.

(9) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the right high contact of the VA relay makes.

Requirement: The two ammeters on the PWR CONT bay indicate that the cable current is approximately 5 percent above the nominal values recorded in (8), the L2 relay (located in rear of PWR CONT bay) operates, office major audible and visual alarms are activated, and the POWER CONTROL FAILURE lamp lights.

Note 1: If the office major audible alarm is activated, depress the ACO key to silence the audible alarm.

Note 2: If the requirement in (9) is met, proceed to (12). If the requirement is not met, continue with (10).

(10) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is 5 percent above the nominal values recorded in (8).

(11) Remove the front cover from the VA relay and adjust the right high contact screw of the VA relay until the right high contact of the VA relay just makes.

Note: If the VA relay cannot be properly adjusted by the right high contact screw of the VA relay, adjust the VA relay in accordance with Section 040-254-701.

(12) Install the front cover on the VA relay.

(13) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the LOWER position in small increments until the left low contact of the VA relay makes.

Requirement: The two ammeters on the PWR CONT bay indicate that the cable current is approximately 5 percent below the nominal values recorded in (8), the R2 relay (located in rear of PWR CONT bay) operates, office major audible and visual alarms are activated, and the POWER CONTROL FAILURE lamp lights.

Note 1: If the office major audible alarm is activated, depress the ACO key to silence the audible alarm.

Note 2: If the requirment in (13) is met, proceed to (18). If the requirement is not met, continue with (14).

(14) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is 5 percent below the nominal values recorded in (8).

(15) Remove the front cover from the VA relay and adjust the left low contact screw of the VA relay until the left low contact of the VA relay just makes.

Note: If the VA relay cannot be properly adjusted by the left low contact screw of the VA relay, adjust the VA relay in accordance with Section 040-254-701.

(16) Install the front cover on the VA relay.

(17) If the requirement in (9) or (13) was not met, repeat (8), (9), and (13).

(18) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the two ammeters on the PWR CONT bay indicate the required nominal line current values.

Note: The required line current should be posted directly above the associated line current meters.

(19) Operate the FINE CONTROL NOR-OFF switch to the NOR position.

Requirement: The FINE CONTROL OFF lamp extinguishes.

(20) Operate the COARSE CONTROL MAN-UAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(21) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation (see Sections 359-010-125 and 359-075-301). Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

Y. PWR CONT Bay NV Relay Check

4.25 To check the operation of the NV relay in the PWR CONT bay, proceed as follows.

Note: When performing this check, it is necessary to lower the cable current below 0.5 ampere. It is preferred that this check be performed when the PWR CONT bay has been taken out of service for some other reason to prevent line equalization difficulties from occurring.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: Before performing this routine check on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenance are to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments, relay blocks, relay strapping, etc, on the PWR CONT bay being checked and not, by mistake, on the PWR CONT bay that is supplying power to the associated L3 lines.

(2) Perform the necessary procedures to obtain the use of the protection lines. (See Sectons 359-010-125 and 359-075-301.)

(3) Verify that the UNREG-REG switch on the PWR CONT bay is in the REG position.

(4) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(5) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the LOWER position in small increments until the NV relay releases.

(6) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the NV relay operates.

Requirement: The associated ammeter on the PWR CONT bay indicates approximately 75 percent of nominal current for a PS1 system or 70 percent of nominal current for a PS2 system.

Note: If the requirement in (6) is met, proceed to (11). If the requirement is not met, continue with (7).

(7) Rotate the R3 potentiometer on the PWR CONT bay fully cw.

Note: The R3 potentiometer is located below the VA ADJ potentiometer and behind the front cover that is directly below the AC VOLTS meter on the PWR CONT bay.

(8) Operate the RAISE-NOR-LOWER key to the necessary RAISE or LOWER position in small increments until the associated ammeter on the PWR CONT bay indicates approximately 75 percent of nominal current for a PS1 system or 70 percent of nominal current for a PS2 system.

(9) Slowly rotate the R3 potentiometer on the PWR CONT bay ccw until the NV relay operates.

(10) Repeat (5) and (6).

(11) Operate the RAISE-NOR-LOWER key to the RAISE position in small increments until the two ammeters on the PWR CONT bay indicate the required nominal line current values.

Note: The required line current should be posted directly above the associated line current meters.

(12) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(13) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation. (See Sections 359-010-125 and 359-075-301.) Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

Z. PWR CONT Bay Electronic Current Regulator Check

4.26 To check the electronic current regulator in the PWR CONT bay, proceed as follows.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: Before performing this routine check on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenance are to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments, relay blocks, relay strapping, etc, on the PWR CONT bay being checked and not, by mistake, on the PWR CONT bay that is supplying power to the associated L3 lines.

(2) Perform the necessary procedures to obtain the use of the protection lines. (See Sections 359-010-125 and 359-075-301.)

(3) Verify that the UNREG-REG switch on the PWR CONT bay is in the REG position.

(4) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(5) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(6) Remove the front cover from the PWR CONT bay that covers the T2 fine control transformer.

(7) Temporarily mark the position of the manual-adjusting shaft pointer of the T2 fine control transformer, with reference to a stationary point on the transformer.

(8) Observe the indications on both ammeters of the PWR CONT bay and record their values.

(9) Push and rotate the manual-adjusting shaft knob of the T2 fine control transformer until the two ammeters on the PWR CONT bay indicate that the line current has risen approximately 0.08 ampere.

(10) Operate the FINE CONTROL NOR-OFF switch to the NOR position and observe the T2 fine control transformer for overshooting or oscillation.

Requirement: The FINE CONTROL OFF lamp extinguishes, the manual adjusting shaft pointer of the T2 fine control transformer returns to the approximate position marked in (7), and the two ammeters on the PWR CONT bay indicate that the line current is within $\pm$0.01 ampere of the values recorded in (8).

Note 1: The GC (gain control) and AH (anti-hunt) potentiometers are located behind the front cover that surrounds the PLT CUR meter.

Note 2: If the T2 fine control transformer is overshooting or oscillating, adjust the AH (anti-hunt) potentiometer until the overshooting or oscillation stops.

Note 3: If the requirement in (10) is met, proceed to (13). If the requirement is not met, continue with (11).

(11) Adjust the GC (gain control) potentiometer until the manual adjusting shaft pointer of the T2 fine control transformer returns to the approximate position marked in (7) and the two ammeters on the PWR CONT bay indicate that the line current is within $\pm$0.01 ampere of the values recorded in (8).

Note: An adjustment of the GC (gain control) potentiometer will affect the ADJ CUR potentiometer setting.

(12) Adjust the ADJ CUR potentiometer until the PLT CUR meter indicates 200 milliamperes.

(13) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(14) Push and rotate the manual-adjusting shaft knob of the T2 fine control transformer until the two ammeters on the PWR CONTROL bay indicate that the line current has decreased approximately 0.08 ampere.

(15) Operate the FINE CONTROL NOR-OFF switch to the NOR position and observe the T2 fine control transformer for overshooting or oscillation.

Requirement: The FINE CONTROL OFF lamp extinguishes, the manual adjusting shaft pointer of the T2 fine control transformer returns to the approximate position marked in (7), and the two ammeters on the PWR CONT bay indicate that the line current is within $\pm$0.01 ampere of the values recorded in (8).

Note 1: See Notes 1 and 2 in (10).

Note 2: If the requirement in (15) is met, proceed to (19). If the requirement is not met, continue with (16).

(16) Adjust the GC (gain control) potentiometer until the manual adjusting shaft pointer

returns to the approximate position marked in (7) and the two ammeters on the PWR CONT bay indicate that the line current is within ± 0.01 ampere of the values recorded in (8).

Note: An adjustment of the GC (gain control) potentiometer will affect the ADJ CUR potentiometer setting.

(17) Adjust the ADJ CUR potentiometer until the PLT CUR meter indicates 200 milliamperes.

(18) If the requirement in (10) or (15) was not met, repeat (5), (7), (8), (9), (10), (13), (14), and (15).

(19) Install the front cover on the PWR CONT bay that covers the T2 fine control transformer.

(20) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(21) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation. (See Sections 359-010-125 and 359-075-301.) Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfer to the protection lines can occur if necessary.

(22) If it was necessary to adjust the GC (gain control), AH (anti-hunt) or ADJ CUR potentiometers in this check, allow the PWR CONT bay to warm up for approximately 4 hours and repeat this entire check, beginning with step (1).

AA. PWR CONT Bay Cable Overcurrent Monitor Switch Calibration Check

4.27 To check the calibration of the cable overcurrent monitor switch in the PWR CONT bay, proceed as follows.

Note 1: If it is necessary to calibrate the cable overcurrent monitor switch in these procedures, the PWR CONT bay must be removed from service. It is preferred that this check be performed when the PWR CONT bay has been taken out of service for some other reason to prevent line equalization difficulties from occurring.

Note 2: Before performing this check, obtain a copy of SD-81152-01 and refer to Fig. B of the schematic drawing throughout this check for reference information.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: Before performing this routine check on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenance are to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments, relay blocks, relay strapping, etc, on the PWR CONT bay being checked and not, by mistake, on the PWR CONT bay that is supplying power to the associated L3 lines.

(2) Perform the necessary procedures to obtain the use of the protection lines. (See Sections 359-010-125 and 359-075-301.)

(3) Remove the front cover that is directly below the AC VOLTS meter on the PWR CONT bay to make the VRS1 and VRS2 relay diodes accessible.

(4) If the PWR CONT bay is equipped with option F (VRS3 relay wired in), follow the procedures under that heading. If the PWR CONT bay is equipped with option G (VRS3 relay

not wired in), follow the procedures under that heading.

Option F (VRS3 Relay Wired in

(a) Open the rear door of the PWR CONT bay.

(b) Remove the cover from the SS contactor.

(c) Using the KS-14510-volt-ohm-milliammeter, determine which side of the SS contactor is ground (24 volts would be on the other side).

(d) Connect a jumper from ground to the ground side of the SS contactor (terminal C3 of the SS contactor coil).

(e) Remove the plastic cover from the top of the VSD relay (located in rear of bay) and block the VSD relay released.

Caution: Failure to connect a jumper from ground to the ground side of the SS contactor (terminal C3 of the SS contactor coil) before making this check will de-energize the coaxial line. Failure to block the VSD relay released before making this check will prevent the circuit from returning to normal after the check has been completed.

(f) Using the W1AY cord equipped with two 411C test picks, bridge across the two diodes that oppose current flow to the associated VRS1 relay.

Requirement: After approximately 3/4 second delay, the HIGH CUR FAILURE lamp lights.

(g) Remove the test picks from the two diodes.

Requirement: The HIGH CUR FAILURE lamp extinguishes.

(h) Using a W1AY cord equipped with two 411C test picks, bridge across the two diodes that oppose current flow to the associated VRS2 relay.

Requirement: After approximately 3/4-second delay, the HIGH CUR FAILURE lamp lights.

(i) Remove the test picks from the two diodes.

Requirement: The HIGH CUR FAILURE lamp extinguishes.

(j) Remove the block from the VSD relay and install the plastic top cover on the VSD relay.

(k) Disconnect the jumper that is connected from ground to the ground side of the SS contactor (terminal C3 of the SS contactor coils).

(l) Install the cover of the SS contactor.

(m) Close the rear door of the PWR CONT bay.

Note 1: If the requirements in (f), (g), (h), and (i) were met, proceed to (36). If any requirements were not met, continue with (5).

Note 2: The calibration procedures in (5) through (35) for the cable overcurrent monitor switch can only be used for the PWR CONT bays equipped with option D (449A diodes). If these calibration procedures cannot be used for your system, refer the matter to the supervisor and proceed to (36).

Option G (VRS3 Relay Not Wired in)

(a) Using a W1AY cord equipped with two KS-6278 connecting clips, strap the S and C leads by connecting the connecting clips to the 1T and 2B terminals of the VSD relay.

(b) Insulate the 3T contact of the VSD relay.

Caution: Failure to strap the S and C leads by connecting the connecting clips to the 1T and 2B terminals of the VSD relay before making this check will de-energize the coaxial line. Failure to insulate the 3T contact of the VSD relay before making this check will prevent the circuit from returning to normal after the check has been completed.

(c) Using a W1AY cord equipped with two 411C test picks, bridge across the two diodes that oppose current flow to the associated VRS1 relay.

Requirement: After approximately 3/4-second delay, the HIGH CUR FAILURE lamp lights.

(d) Remove the test picks from the two diodes.

Requirement: The HIGH CUR FAILURE lamp extinguishes.

(e) Using a W1AY cord equipped with two 411C test picks, bridge across the two diodes that oppose current flow to the associated VRS2 relay.

Requirement: After approximately 3/4-second delay, the HIGH CUR FAILURE lamp lights.

(f) Remove the test picks from the two diodes.

Requirement: The HIGH CUR FAILURE lamp extinguishes.

(g) Remove the insulation from the 3T contact of the VSD relay.

(h) Remove the connecting clips from the 1T and 2B terminals of the VSD relay.

Note 1: If the requirements in (c), (d), (e), and (f) were met, proceed to (35). If any requirements were not met, continue with (5).

Note 2: The calibration procedures in (5) through (34) for the cable overcurrent monitor switch can only be used for the PWR CONT bays equipped with option D (449A diodes). If these calibration procedures cannot be used for your system, refer the matter to the supervisor and proceed to (35).

(5) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(6) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(7) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the necessary RAISE or LOWER position until the two ammeters on the PWR CONT bay indicate the ***Nominal Line Current.***

Note: The required line current should be posted directly above the associated line current meters.

(8) Connect the KS-14510 volt-ohm-milliammeter, set on the 60AC VOLTS scale, to the TS1 lead terminal at the S1 diode stack and to the G lead terminal between the S1 and S2 diode stacks. Observe the indication on the KS-14510 meter and record the value of the indication.

Note: The indication on the KS-14510 meter is called the ***Nominal Voltage.***

(9) Disconnect the KS-14510 meter from the PWR CONT bay.

(10) Connect th KS-14510 meter, set on the 60 AC VOLTS scale, to the TS2 lead terminal at the S2 diode stack and to the G lead terminal between the S1 and S2 diode stacks. Observe the indication on the KS-14510 meter and record the value of the indication.

Note: The indication on the KS-14510 meter is called the ***Nominal Voltage.***

(11) Disconnect the KS-14510 meter from the PWR CONT bay.

(12) Turn down the power on the L3 power loop associated with the PWR CONT bay by following the procedures in 3.02.

(13) Disconnect the TS1 lead from the terminal of the S1 diode stack.

(14) Disconnect the G lead from the terminal between the S1 and S2 diode stacks.

(15) Disconnect the TS2 lead from the terminal of the S2 diode stack.

(16) Connect the output of the Variac to the TS1 lead terminal at the S1 diode stack and to the G lead terminal between the S1 and S2 diode stacks. Verify that the ON-OFF switch of the Variac is in the OFF position and that the voltage control knob is in the zero position

before connecting the Variac to the PWR CONT bay.

(17) Connect the KS-14510 meter, set on the 300 AC VOLTS scale, to the TS1 lead terminal at the S1 diode stack and to the G lead terminal between the S1 and S2 diode stacks.

(18) Connect the Variac to a nominal 230-volt ac input.

Note: If the Variac has been locally wired for 115-volt operation, connect the Variac to a nominal 115-volt ac input.

(19) Operate the ON-OFF switch of the Variac to the ON position.

(20) Very slowly rotate the voltage control knob on the Variac cw until the HIGH CUR FAILURE lamp lights. When the HIGH CUR FAILURE lamp lights, observe the indicaton on the KS-14510 meter and record the value of the indication.

Note: The indication on the KS-14510 meter is called the ***Operate Voltage.***

Requirement: Using the ***Nominal Line Current*** obtained in (7), the ***Nominal Voltage*** recorded in (8), and the ***Operate Voltage recorded in (20), calculate the cable overcurrent monitor operate point by using the following formula:***

Cable Overcurrent Monitor
Operate Point = Nominal
Line Current x Operate Voltage
÷ Nominal Voltage

The cable overcurrent monitor operate point must be between 1.9 and 2.1 amperes.

Note: If the requirement in (20) is met, proceed to (22). If the requirement is not met, continue with (21).

(21) If the cable overcurrent monitor operate point is above 2.1 amperes, short out one, two, or all three of the forward biased 420A or 446B diodes of VRS1, as necessary, until the requirement in (20) is met. If the requirement cannot be met with the three forward biased 420A or 446B diodes of VRS1 shorted out or if the cable overcurrent monitor operate point is below 1.9 amperes, check for the following defective components: S1 diode stack; CF1, CF2,or CF3 capacitors; VRS1 diodes; VRS1 relay; VRS3 relay (if provided); RF1 resistor; or CR1 diode.

(22) Operate the ON-OFF switch of the Variac to the OFF position and rotate the voltage control knob fully ccw.

Requirement: The HIGH CUR FAILURE lamp extinguishes.

(23) Disconnect the KS-14510 meter and the Variac from the PWR CONT bay.

(24) Connect the output of the Variac to the TS2 lead terminal at the S2 diode stack and to the G lead terminal between the S1 and S2 diode stacks Verify that the ON-OFF switch of the Variac is in the OFF position and that the voltage control knob is in the zero position before connecting the Variac to the PWR CONT bay.

(25) Connect the KS-14510 meter, set on the 300 AC VOLTS scale, to the TS2 lead terminal at the S2 diode stack and to the G lead terminal between the S1 and S2 diode stacks.

(26) Operate the ON-OFF switch of the Variac to the ON position.

(27) Very slowly rotate the voltage control knob on the Variac cw until the HIGH CUR FAILURE lamp lights. When the HIGH CUR FAILURE lamp lights, observe the indication on the KS-14510 meter and record the value of the indication.

Note: The indication on the KS-14510 meter is called the ***Operate Voltage.***

Requirement: Using the ***Nominal Line Current*** obtained in (7), ***Nominal Voltage recorded in (10), and the Operate Voltage*** recorded in (27), calculate the cable overcurrent monitor operate point by using the following formula:

Cable Overcurrent Monitor
Operate Point = Nominal

Line Current x Operate Voltage
÷ Nominal Voltage

The cable overcurrent monitor operate point must be between 1.9 and 2.1 amperes.

Note: If the requirement in (27) is met, proceed to (29). If the requirement is not met, continue with (28).

(28) If the cable overcurrent monitor operate point is above 2.1 amperes, short out one, two, or all three of the forward biased 420A or 446B diodes of VRS2, as necessary, until the requirement in (27) is met. If the requirement cannot be met with the three forward biased 420A or 446B diodes of VRS2 shorted out or if the cable overcurrent monitor operate point is below 1.9 amperes, check for the following defective components: S2 diode stack; CF4, CF5, or CF6 capacitors; VRS2 diodes; VRS2 relay; VRS3 relay (if provided); RF2 resistor; of CR2 diode.

(29) Operate the ON-OFF switch of the Variac to the OFF position and rotate the voltage control knob fully ccw.

Requirement: The HIGH CUR FAILURE lamp extinguishes.

(30) Disconnect the KS-14510 meter and the Variac from the PWR CONT bay.

(31) Connect the TS2 lead to the TS2 lead terminal of the S2 diode stack.

(32) Connect the G lead to the G lead terminal between the S1 and S2 diode stacks.

(33) Connect the TS1 lead to the TS1 lead terminal of the S1 diode stack.

(34) Turn the power up on the L3 lines associated with the PWR CONT bay by following the procedures in 3.01.

(35) Install the front cover that is directly below the AC VOLTS meter on the PWR CONT bay.

(36) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation. (See Sections 359-010-125 and 359-075-301.) Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

AB. PWR CONT Bay Failure Alarm Check

4.28 To check the operation of the PWR CONT bay failure alarm circuit, proceed as follows.

(1) Notify the switching centers in all directions of transmission that routine checks are to be performed that will tie up the protection lines and determine that the protection lines are available.

Caution: Before performing this routine check on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other routine checks or maintenace are to be performed that will require the use of the L3 protection lines. Be certain to perform adjustments relay blocks, relay strapping, etc, on the PWR CONT bay being checked and not, by mistake, on the PWR CONT bay that is supplying power to the associated L3 lines.

(2) Perform the necessary procedures to obtain the use of the protection lines. (See Sections 359-010-125 and 359-075-301.)

(3) Verify that the UNREG-REG switch on the PWR CONT bay is in the REG position.

(4) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the MANUAL position.

Requirement: The COARSE CONTROL MANUAL lamp lights.

(5) Operate the FINE CONTROL NOR-OFF switch to the OFF position.

Requirement: The FINE CONTROL OFF lamp lights.

(6) Observe the indication on both ammeters of the PWR CONT bay and record their values.

(7) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the LOWER position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is 5 percent below the nominal values recorded in (6).

Requirement: After approximately 1/2 second, the POWER CONTROL FAILURE lamp lights and the office audible and visual alarms are activated.

(8) Depress the ACO key to silence the office audible alarm.

(9) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is equal to the nominal values recorded in (6).

Requirement: The POWER CONTROL FAILURE lamp and the office visual alarm extinguish.

(10) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the RAISE position in small increments until the two ammeters on the PWR CONT bay indicate that the cable current is 5 percent above the nominal values recorded in (6).

Requirement: After approximately 1/2 seconds, the POWER CONTROL FAILURE lamp lights and the office audible and visual alarms are activated.

(11) Depress the ACO key to silence the office audible alarm.

(12) Operate the COARSE CONTROL RAISE-NOR-LOWER key to the LOWER position in small increments until the two ammeters on the PWR CONT bay indicate the required nominal line current values.

Note: The required line current should be posted directly above the associated line current meters.

Requirement: The POWER CONTROL FAILURE lamp and the office visual alarm extinguish.

(13) Operate the FINE CONTROL NOR-OFF switch to the NOR position.

Requirement: The FINE CONTROL OFF lamp extinguishes.

(14) Operate the COARSE CONTROL MANUAL-NOR AUTO key to the NOR AUTO position.

Requirement: The COARSE CONTROL MANUAL lamp extinguishes.

(15) If no other routine checks are to be performed that require use of the protection lines, restore the protection lines to normal operation. (See Sections 359-010-125 and 359-075-301.) Notify the switching centers in all directions of transmission that the protection lines have been restored to normal operation.

Note: The protection lines should be restored to normal operation immediately after the associated routine checks have been performed so that emergency transfers to the protection lines can occur if necessary.

AC. PWR CONT Bay Electronic Current Regulator Failure Alarm Check

4.29 To check the electronic regulator failure alarm circuit in the PWR CONT bay, proceed as follows.

(1) Remove the front cover from the PWR CONT bay that is directly above the PLT CUR meter.

Note: The A limit switch is located on the bottom of the T2 fine control transformer and at the end of travel of the transformer.

(2) Using an orange stick, manually operate the A limit switch on the T2 fine control transformer.

Requirement: After approximately 30 seconds, the ELECTRONIC REGULATOR FAILURE lamp on the PWR CONT bay lights and the office audible and visual alarms are activated.

(3) Release the A limit switch and depress the ACO key.

Requirement: The ELECTRONIC REGULATOR FAILURE lamp on the PWR CONT bay and visual alarms extinguish. The office audible alarm is silenced.

Note: The D limit switch is located on the bottom of the T2 fine control transformer and at the end of travel of the transformer.

(4) Using an orange stick, manually operate the D limit switch on the T2 fine control transformer.

Requirement: After approximately 30 seconds, the ELECTRONIC REGULTOR FAILURE lamp on the PWR CONT bay lights and the office audible and visual alarms are activated.

(5) Release the D limit switch and depress the ACO key.

Requirement: The ELECTRONIC REGULATOR FAILURE lamp on the PWR CONT bay and visual alarms extinguish. The office audible alarm is silenced.

(6) Install the front cover on the PWR CONT bay that is directly above the PLT CUR meter.

AD. PWR CONT Bay Fuse Alarm Check

4.30 To check the fuse alarm circuit in the PWR CONT bay, proceed as follows.

(1) Verify that the UNREG-REG switch on the PWR CONT bay is in the REG position.

(2) Remove the 70-type fuse from the VM alarm fuse holder.

(3) Install a blown 70-type fuse in the VM alarm fuse holder.

Requirement: The POWER CONTROL FAILURE lamp lights, the indication on the AC VOLTS meter drops to 0, and the office audible and visual alarms are activated.

(4) Remove the blown 70-type fuse from the VM alarm fuse holder.

(5) Install the original 70-type fuse removed in (1) in the VM alarm fuse holder.

Requirement: The POWER CONTROL FAILURE lamp extinguishes, the indication on the AC VOLTS meter returns to the nominal voltage value, and the office audible and visual alarms extinguish.

(6) Remove the 70-type fuse from the F3 fuse holder.

(7) Install a blown 70-type fuse in the F3 alarm fuse holder.

Requirement: The POWER CONTROL FAILURE lamp lights and the office audible and visual alarms are activated.

(8) Remove the blown 70-type fuse from the F3 fuse holder.

(9) Install the original 70-type fuse removed in (6) in the F3 fuse holder.

Requirement: The POWER CONTROL FAILURE lamp and visual alarms extinguish. The office audible alarm is silenced.

(10) Repeat (6) through (9) for the F4 and F6 fuse holders.

Note: This check is not a complete check of all alarm fuses and only proves that the alarm circuit has the ability to function normally. If any alarm fuse other than the VM, F3, F4, or F6 fuses are removed from their respective fuse holders, the associated L3 lines will be de-energized.

5. TROUBLES

General

5.01 Troubles that occur in the combination plant are normally indicated by various audible and visual alarms. Before performing maintenance on parts of the plant, operate switches, remove fuses, or block relays, as necessary to prevent accidental starting of equipment in the plant. When troubles exist in the plant, it is extremely important to remember that each regular motor-alternator and inverter are normally supplying power to two PWR CONT bays. If maintenance is to be performed

on a regular motor-alternator or inverter, transfer the load on the regular unit to the emergency motor-alternator to prevent service interruptions.

Warning: This power plant includes automatic equipment and voltages as high as 4400 volts. Extreme caution should be exercised to prevent the accidental starting of the parts of the power plant on which maintenance work is to be performed. Before starting work on the power plant, prevent the automatic starting of equipment by removing fuses, blocking relays, operating switches, etc, as necessary.

Caution 1: While performing some maintenance, it may be necessary to turn the power down on the associated coaxial cable to prevent possible switching transients from damaging the associated repeater equipment. Before turning the power down on the coaxial cable, be certain that all associated terminals are notified of the forthcoming actions and that all necessary precautions are taken. When maintenance work has been completed, be certain to restore the circuits to normal operation.

Caution 2: Before performing any maintenance on the PWR CONT bay, verify that no L3 switching routines are to be performed, verify that no repeater or line maintenance is to be performed, and verify that no other maintenance is to be performed that will require the use of the L3 protection lines.

Caution 3: In making continuity checks, use the ohmmeter portion of the KS-14510 volt-ohm-milliammeter. Do not use the X10,000 position for testing semiconductors as the higher voltage may damage them.

Note: When performing maintenance on the 521A power plant, it is advisable to have copies of the associated circuit schematic drawings and circuit descriptions available to aid in locating relay terminals, etc.

5.02 When any kind of trouble is encountered, decide whether to locate the trouble with the equipment operating or de-energized. The inverters have been designed to make some parts accessible for testing with the power connected. The test jacks are available when the front doors are open. Trouble is easier to find if the equipment can be fully energized. However, if the trouble is of a nature that causes excessive output from the equipment, perform the initial steps with the system de-energized, and energize it for short periods only while electrical measurements are made. Also, operation for more than a few minutes at a time while trouble exists, even though the output may not be excessive, may result in overheating of some components. It is essential, when testing, to be alert to the need for quickly shutting down the inverter at any time until the trouble is localized and cleared.

Inverter Troubles

5.03 This troubleshooting procedure for inverters is based upon the use of signals available at the test points. In general, the signals to be monitored at these points are waveforms to be observed on an oscilloscope. The oscilloscope with the adapter has the facility to present two inputs, A and B. The polarity switch on the oscilloscope is to be set to A + B; input A on the adapter to + and input B to −. The oscilloscope is to be grounded. Test probe A is to be connected to the first test point given, and test probe B to the second.

Caution: High voltage may be present on the oscilloscope case if it is not grounded. Do not connect a ground lead to any nongrounded portion of the inverter when the oscilloscope is grounded, as components may be damaged.

5.04 In checking circuit packs and semiconductor devices, refer to Section 032-173-301.

5.05 The following component checks should indicate the most likely source of trouble and are not all-inclusive. The basic faults that can occur fall into three main categories:

(a) No output voltage

(b) Low output voltage

(c) High output voltage.

In all checks of the inverter, the OUTPUT switch (S502) should be OFF. Switch (S102) should be OFF except where indicated otherwise.

Preliminary Checks

5.06 When a trouble is encountered, perform the following preliminary checks:

(1) Operate INPUT switch (S501) to OFF.

(2) Check all the 500-series fuses for a blown fuse.

(3) If any 70-type fuse is blown, check the associated capacitor(s) for a short.

(4) If F503 is blown, check the associated components for an open or short.

(5) If F501 or F526 is blown, remove F526 and ensure that F501 is a good fuse.

(6) Check for a shorted rectifier (CR503, CA504, CR507, or CR508) by measuring the resistance between TB505-1 and TB515-6, TB515-5, TB516-6, and TB516-5.

Requirement: The meter should read near zero in one direction and near infinity in the other direction.

(7) If F502 or F527 is blown, remove F527 and ensure that F502 is a good fuse.

(8) Check for a shorted SCR (CR501, CR502, CR505, or CR506) as follows:

(a) Disconnect the SCRs gate lead at TB513-5, TB514-5, TB517-5, and TB518-5.

(b) Isolate the SCRs by disconnecting the anode from the circuit.

(c) With an ohmmeter, measure the resistance between the anode and cathode in both directions.

Caution: Do not measure to the gate terminal.

Requirement: A reading of less than 1 K ohms in either direction indicates a shorted SCR.

(d) Replace any shorted SCRs and reconnect all terminals disconnected earlier.

Note: The SCRs may also be checked by disconnecting their gate leads at TB513-5, TB514-5, TB517-5, and TB518-5.

(9) Ensure that fuses F501, F502, F526, and F527 are good.

(10) Operate switch S502 to OFF and S101 and S102 to ON.

(11) Operate S501 to CHARGE.

(12) Using the KS-14510 meter, check for 30 volts dc between TP502-TP507, TP503-TP507, TP504-TP510, and TP506-TP510. If the voltage is near zero, one or more of CR501 through CR508 is defective. The faulty component(s) can be further isolated by operating S501 to OFF and removing F526.

(13) Operate S501 to CHARGE.

(14) Using the KS-14510 meter, check for 30 volts dc between TP504-TP510 and TP506-TP510. If the meter indicates 30 volts or more, the defective unit is one or more of CR501 through CR504. If the voltage is low, the defective unit is one or more of CR505 through CR508.

(15) Operate S501, S101, and S102 to OFF and replace F526.

(16) Reconnect the SCR gate leads.

(17) To isolate the particular faulty SCR and/or rectifier, refer to (6) and/or(8).

(18) Operate INPUT switch (S501) to CHARGE, S101 to ON, and S102 to OFF.

(19) Using the KS-14510 meter, check for 30 $\pm$1 VDC between TP104(+) and TP103(−) and 152 VDC nominal (battery terminal voltage) between TP102(+) and TP103(−).

(20) If TP104-TP103 reads zero, check fuses F101, F102, and F103.

(21) If the fuses are good and TP102-TP103 reads 152 VDC, disconnect P201 from the master logic board.

(22) If TP104-TP103 now reads 30±1 VDC, check for possible shorts in the master logic board (Q202, Q203) and/or slave logic board (Q402, Q403).

(23) If the voltage between TP104-TP103 is still low or zero, check the voltage across CR101 and CR102 (15 volts across each).

(24) Check C102 for a short.

(25) Reconnect P201 to the master logic board if the power supply board is working satisfactorily.

(26) Using the oscilloscope, check the waveform between TP501-TP507 and TP508-TP507. If the waveform is not similar to Fig. 14, the trouble is most likely in the master logic board, or a shorted gate to cathode in CR501 or CR502.

(27) Check the waveform between TP509-TP510 and TP505-TP510. If the waveform is not similar to Fig. 14, the trouble is most likely in the master logic and/or the slave logic boards or a shorted gate to cathode in CR505 or CR506.

(28) If the trouble has not been located, continue checking as given in 5.07 and/or 5.08 as appropriate.

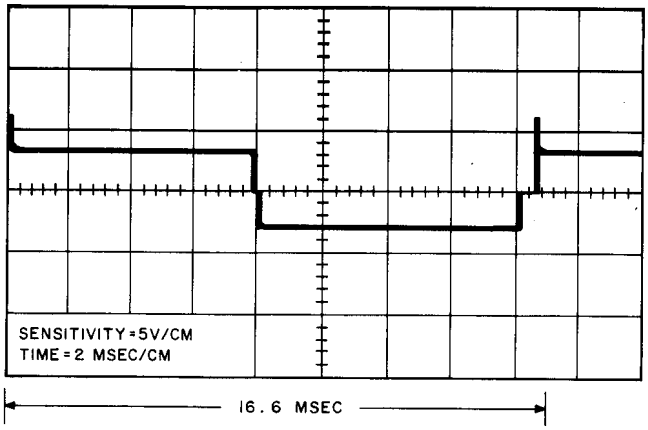


Fig. 14—Gate Waveform

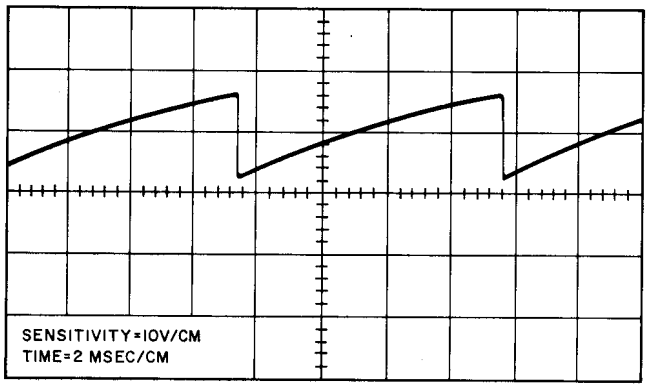


Fig. 15—Master Oscillator Waveform

No Output Voltage

5.07 If the waveform at TP501-TP507, TP508-TP507 was not similar to that shown in Fig. 14, perform the following checks.

(1) Using the KS-14510 meter, check the voltage between TP205-TP204. If the voltage is not 30 volts dc, relay S201 is probably faulty.

(2) Connect the oscilloscope to TP201-TP204.

(3) If the waveform is not as shown in Fig. 15, check Q201.

(4) Check that the waveform between TP202-TP204 and TP203-TP204 is similar to Fig. 16.

(5) If the waveforms are not similar to that shown in Fig. 16, check Q202 and Q203.

(6) If the waveform is still incorrect, replace the master logic circuit pack.

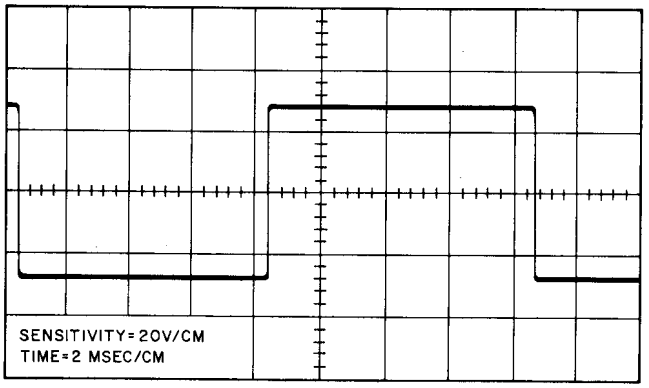


Fig. 16—Master and Slave Oscillator Drive Waveforms

(7) If the waveform at TP501-TP507 and TP508-TP507 is now correct, check the waveform at TP509-TP512 and TP505-TP510.

(8) If the above waveforms are not correct, check the waveform between TP402-TP404 and TP403-TP404 and compare to Fig. 16.

(9) If the above waveforms are correct, check for defective CR409 through CR414 and CR423.

(10) If the waveform is not correct, continue checking per 5.08(a) and/or (b).

Low Output Voltage

5.08 If the output voltage is low, follow the procedure in (a) or (b) as appropriate.

(a) ***No Blown Fuses:*** If no blown fuses were found, proceed as follows.

(1) Operate INPUT switch (S501) to ON and switch S101 to OFF.

(2) Check that the unfiltered inverter output waveform at TP511-TP512 is correct per Fig. 17.

(3) If the waveform is approximately as shown, with a symmetrical shape and a fairly high ratio of positive or negative time to zero time, the trouble may be in the output filter.

(4) Check C513-C515 for a short.

(5) If the waveform is symmetrical but with a high percentage of zero time, operate INPUT switch (S501) to CHARGE AND S101 to ON.

(6) Check that the waveform between TP401-TP406 is similar to Fig. 18.

(7) If the waveform shows the same peak votage but too rapid a rise, check Q301 and CR312 (should have approximately 8 volts across it).

(8) If the trouble is not found, replace the regulator circuit pack.

(9) If there is little or no rise to the peak level shown, check for a defective CR314, Q401, CR407, CR408, or shorted C401.

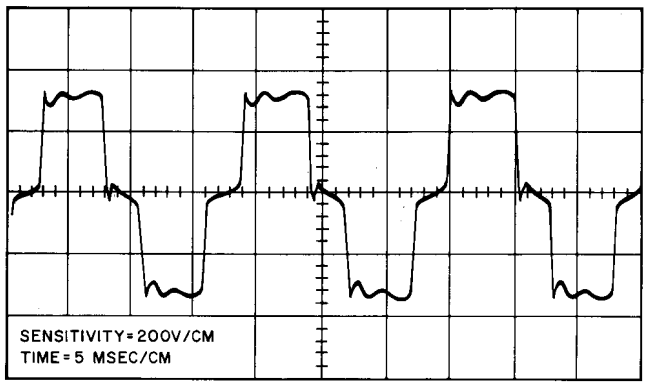


Fig. 17—Unfiltered Inverter Output Waveform

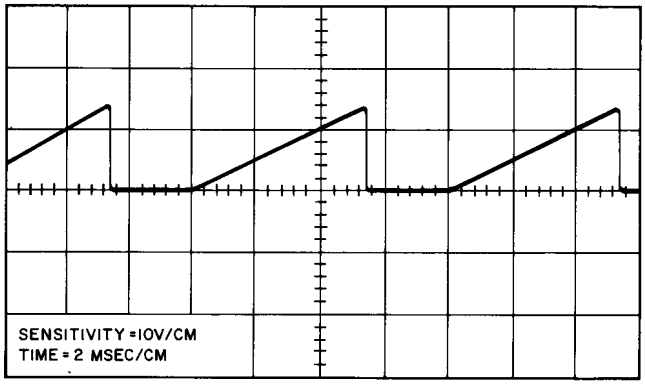


Fig. 18—Slave Oscillator Waveform

(10) If the trouble is not found, replace the slave logic pack.

(11) If there is severe distortion or no zero time, continue checking per 5.08(b).

(b) ***Blown Power Fuse (F501, F502, F526, or F527):*** If a blown power fuse is found, proceed as follows.

(1) Operate INPUT switch (S501) to CHARGE, switch S101 to ON, and S102 to OFF.

(2) Compare all gate waveforms (TP501-TP507, TP508-TP507, TP505-TP510, and TP509-TP510) with Fig. 14.

Note: Make certain the waveforms go both positive and negative; there is a slight hesitation at zero when switching from one polarity to

the other with the positive portion beginning with a relatively high spike.

(3) If the waveform at TP501-TP507 and/or TP508-TP507 is not correct, check that the waveform between TP202-TP204 and TP203-TP204 is similar to Fig. 16.

(4) If the waveform is correct, check for a defective CR208 through CR213 or CR222.

(5) If the waveform is not correct, check Q201, Q202, and Q203.

(6) If the defective component is not found, replace the master logic pack.

(7) If the waveform at TP505-TP510 and/or TP509-TP510 is not correct, check that the waveform between TP402-TP404 and TP403-TP404 is similar to Fig. 16.

(8) If the waveform is correct, check for a defective CR409 through CR414 or CR423.

(9) If the defective component is not found, replace the slave logic circuit pack.

(10) If the waveform is not correct, check as given in 5.08(a).

(11) If one or more of fuses F501, F502, F526, or F527 continues to blow when the inverter is turned ON and all waveforms are correct, the problem could be an SCR breaking down at high voltage.

(12) If F501 or F526 blows, high-voltage breakdown could be occuring in CR501 and/or CR502.

(13) If F502 or F527 blows, high-voltage breakdown could be occurring in CR505 and/or CR506.

Note: If the replacement of the appropriate SCRs results in satisfactory inverter operation, high-voltage SCR breakdown was the problem. One of the two SCRs removed from the inverter may be satisfactory. Check these components for conformity to the breakdown voltage requirement in accordance with their data sheet.

High Output Voltage

5.09 If the output voltage is high, proceed as follows.

(1) Operate INPUT switch (S501) to OFF.

(2) Check fuses F301 and F302.

(3) If F301 and/or F302 are/is blown, check CR301 and CR302 for shorts.

(4) Operate OUTPUT switch (S502) and switch S101 to OFF and INPUT switch (S501) to ON.

(5) Connect the KS-14510 meter to TP301-TP302.

(6) After checking the ac output voltage, operate INPUT switch (S501) to OFF and disconnect the meter.

(7) If no voltage was indicated, check wiring and connections from inverter output to the regulator circuit pack.

(8) If voltage is present, operate INPUT switch (S501) to CHARGE and switch S101 to ON.

(9) Check CR312 (approximately 8.2 volts across it) and Q301.

(10) If the defective component cannot be found, replace the regulator circuit pack.

(11) If additional checks are required, refer to 5.10 Plant Troubles.◀

Plant Troubles

5.10 Various troubles that occur in the power plant, the possible causes, indications, and suggested remedies are given in the following tables. Should any of the following troubles develop, it is suggested that the possible causes be checked in the order given. If the trouble is not found, check for loose or open connections or short circuits due to foreign matter lying across wiring terminals. These tables are not all-inclusive and are meant only to be aids in locating possible trouble conditions that might occur.

Warning: If an oscilloscope is connected to the inverter and the oscilloscope case is ungrounded, high voltage may be present on the oscilloscope case.

Caution: Do not connect a ground lead of the oscilloscope to any nongrounded portion of the inverter when the oscilloscope is grounded because various components may be damaged.

TABLE C

TRANSFER CONTROL, SUPL TRANSFER CONTROL, START CONTROL, AND EMG START CONTROL BAYS AND MOTOR-ALTERNATORS TROUBLE CHART

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(a) Lockup on dc drive due to low motor-alternator output voltage.	AC MOT & ALT FAIL lamp lighted. Major audible and visual alarms activated.	ALT VOLTS ADJ potentiometer not properly adjusted.	Adjust ALT VOLTS ADJ potentiometer in accordance with 4.04.
		Defective alternator or dc exciter.	Operate motor-alternator on ac drive at no load. Connect Weston Model 904 voltmeter to motor-alternator and check output voltage. Observe Model 904 voltmeter for a stable 230-volt indication.
		LV relay out of adjustment.	Adjust LV relay in accordance with 4.04.
		Defective LV transformer.	Transfer load on the motor-alternator to associated emergency or regular motor-alternator in accordance with 3.03 or 3.04. Check resistance of LV transformer with KS-14510 volt-ohm-milliammeter.
		Defective LV varistors.	Test 27D varistors as diodes (refer to Section 032-173-301).
		Shorted LV capacitor.	Check LV capacitor (refer to Section 032-110-501).
		Shorted V network.	Check V network (refer to Section 032-110-501).
		Short circuit on the coaxial cable.	Determine if maintenance is being performed on cable. Locate and repair short circuit.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(b) Overspeed shutdown occurs.	AC MOT & ALT FAIL lamp lighted. OS lamps lighted. Major audible and visual alarms activated.	DC motor speed of a motor-alternator not properly adjusted.	Remove motor-alternator from service in accordance with 3.05. Check dc motor speed adjustment in accordance with 4.05 or 4.06.
		Defective R1 or R2 resistors.	Check continuity of resistors using KS-14510 volt-ohm-milliammeter.
		Overspeed shutdown circuit not properly adjusted.	Adjust overspeed shutdown circuit in accordance with 4.08.
		ALT VOLTS ADJ potentiometer not properly adjusted.	Adjust ALT VOLTS ADJ potentiometer in accordance with 4.04.
(c) Motor-alternator(s) transfer to dc drive.	PWR TRNS & FA lamp lighted Minor audible and visual alarms activated.	Major ac input power service voltage change, unbalance, or failure.	Observe PWR SERV voltmeter and operate VM switch to PH1, PH2, and PH3 position respectively to check for an open phase. If necessary, determine reason for lost phase.
		Blown fuse in ac input power service cabinet.	Transfer load on the motor-alternator to associated emergency or regular motor-alternator in accordance with 3.03 or 3.04. Replace blown ac input service fuse. Restart motor-alternator and restore it to normal operation. If fuse blows again, determine sequence of operation. Check wiring for shorts or grounds.
		VR relays out of adjustment.	Check VR relay adjustments in accordance with 4.02.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(d) Output voltage from a motor-alternator exceeds 240 volts.	OVERVOLT lamp lighted. Minor audible visual alarms activated.	DC motor above steady state synchronous speed when plant transfers from ac to dc drive.	Adjust speed of the dc motor in accordance with 4.05 or 4.06.
			Check adjustment of the motor-alternator overspeed shutdown circuit in accordance with 4.08.
			Verify that CLAMP DISABLE (S1) switch is not closed.
		Defective output voltage limiter sense circuit and amplifier (CP1) circuit pack.	Replace defective output voltage limiter sense circuit and amplifier (CP1) circuit pack with a factory adjusted unit. Perform check in 4.07.
(e) Motor-alternators transfer from ac to dc drive.	PWR TRNS & FA lamp lighted. FF ALM lamp lighted. Minor audible and visual alarms activated.	Frequency of ac input power service voltage is out of limits.	Check frequency of ac input power service voltage at L1, L2 and L3 leads using Hewlett-Packard 5221A electronic counter or equivalent. After power service frequency has returned to normal, restore plant to normal operation in accordance with 3.07.
(f) High or low output voltage from a motor-alternator.	HLV lamp lighted. Minor audible and visual alarms activated.	Minor change or variation of ac input power service voltage.	Check ac input power service voltage between three phases using the Weston Model 904 voltmeter.
		ALT VOLTS ADJ potentiometer not properly adjusted.	Adjust ALT VOLTS ADJ potentiometer in accordance with 4.04.
		V relay not properly adjusted.	Adjust V relay in accordance with 4.04.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
		Defective alternator or dc exciter.	Operate motor-alternator on ac drive at no load. Connect Weston Model 904 voltmeter to motor-alternator and check output voltage. Observe Model 904 voltmeter for a stable 230 volt indication.
		Defective V Varistors.	Test 27D varistors as diodes (refer to Section 032-173-301).
		Shorted V capacitor.	Check V capacitor (refer to Section 032-110-501).
		Shorted V network.	Check V network (refer to Section 032-110-501).
		Short circuit on coaxial cable.	Determine if maintenance is being performed on cable. Locate and repair short circuit.
(g) -24 volt fuse blown.	PWR TRNS & FA lamp lighted. Major audible and visual alarms activated.	Short circuit or grounded lead.	RT fuse blown--Check relay test block and replace RT fuse. D fuse blown--Check AF, AR, FA, LV1, LV2, MA, MB, MS, OL, and TD relays and ST MOTOR CONTROLLER. Replace D fuse. E fuse blown--Check FF and LOAD TRNS relays. Replace E fuse. F fuse blown--Check the EC and A relays. Replace F fuse.
(h) Output voltage limiter circuit and amplifier	PWR TRNS & FA lamp lighted. Major audible and visual alarms	Defective output voltage limiter sense circuit and	Replace 70A, 1-1/3 ampere, LMTR fuse. If fuse blows,

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(LMTR) fuse blows.	activated.	amplifier (CP1) circuit pack.	replace output voltage limiter sense circuit and amplifier (CP1) circuit pack with a factory adjusted unit and then replace the LMTR fuse.
(i) Overspeed shutdown circuit (OS) fuse blows.	PWR TRNS & FA lamp lighted. Major audible and visual alarms activated.	Defective overspeed shutdown (CP2) circuit pack.	Replace 70A, 1-1/3 ampere, OS fuse. If fuse blows, replace overspeed shutdown (CP2) circuit with a factory adjusted unit and replace OS fuse again.

TABLE D
INVERTER TROUBLE CHART

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(a) Low inverter output voltage.	Office audible alarm activated. HI-LO VOLTAGE lamp lighted. Cabinet alarm lamp lighted.	FIELD VOLT ADJ (R307) potentiometer not properly adjusted.	Adjust FIELD VOLT ADJ (R307) potentiometer in accordance with 4.11.
		Defective POWER CIRCUIT.	Connect Weston Model 622 voltmeter, set on the 300-volts ac scale, to TP301 and TP302 test points on POWER CIRCUIT. If voltmeter does not indicate 230 ±3 volts, repair defective POWER CIRCUIT. Disconnect voltmeter from POWER CIRCUIT.
		Defective REGULATOR CIRCUIT.	Connect Tektronix 545B oscilloscope to TP301 and TP302 test points on REGULATOR CIRCUIT. If oscilloscope does not indicate 60 ±1 Hz, repair defective REGULATOR CIRCUIT. Disconnect oscilloscope from the REGULATOR CIRCUIT.
		Blown inverter power fuse F501, F502, F526, or F527 (no fuse alarm indication).	Check gate waveforms in accordance with 5.08(b) to determine which components are defective. Replace blown fuse.
		EARLY WRN MONITOR plug-in unit not properly adjusted or defective.	Adjust EARLY WRN MONITOR plug-in unit in accordance with 4.13. If EARLY WRN MONITOR cannot be properly adjusted, repair or replace defective unit.
(b) High output voltage from the inverter.	Office audible alarm activated HI-LO VOLTAGE lamp lighted. Cabinet alarm lamp lighted.	FIELD VOLT ADJ (R307) potentiometer not properly adjusted.	Adjust FIELD VOLT ADJ (R307) potentiometer in accordance with 4.11.
		Defective POWER CIRCUIT.	Connect Weston Model 622 voltmeter, set on 300-volts ac scale,

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
			to TP301 and TP302 test points on POWER CIRCUIT. If voltmeter does not indicate 230 ±3 volts, repair defective POWER CIRCUIT. Disconnect voltmeter from POWER CIRCUIT.
		Defective REGULATOR CIRCUIT.	Connect Tektronix 545B oscilloscope to TP301 and TP302 test points on REGULATOR CIRCUIT. If the oscilloscope does not indicate 60 ±1 Hz, repair defective REGULATOR CIRCUIT. Disconnect oscilloscope from REGULATOR CIRCUIT.
		EARLY WRN MONITOR plug-in unit not properly adjusted or defective.	Adjust EARLY WRN MONITOR plug-in unit in accordance with 4.13. If EARLY WRN MONITOR cannot be properly adjusted, repair or replace defective unit.
(c) No output voltage from inverter.	Office audible alarm activated. AUTOMATIC TRANSFER lamp lighted. RESET lamp lighted. Cabinet alarm lamp lighted. OUTPUT VOLTAGE (M2) voltmeter indicates zero.	Component Q201, Q202, or Q203 on MASTER LOGIC CIRCUIT defective.	Check gate waveforms and voltages in accordance with 5.07 to determine which components are defective. Replace defective components.
		Component CR409, CR414, or CR423 on SLAVE LOGIC CIRCUIT defective.	Check gate waveforms and voltages in accordance with 5.07 to determine which components are defective. Replace defective components.
(d) Inverter load has automatically transferred to emergency motor-alternator.	Office audible alarm activated. AUTOMATIC TRANSFER lamp lighted. HI-LO VOLTAGE lamp lighted. Cabinet alarm lamp lighted.	FIELD VOLT ADJ (R307) potentiometer not properly adjusted.	Adjust FIELD VOLT ADJ (R307) potentiometer in accordance with 4.11.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
		Defective POWER CIRCUIT.	Connect Weston Model 622 voltmeter, set on 300-volts ac scale, to TP301 and TP302 test points on POWER CIRCUIT. If voltmeter does not indicate 230 ±3 volts, repair defective POWER CIRCUIT. Disconnect voltmeter from POWER CIRCUIT.
		Defective REGULATOR CIRCUIT.	Connect Tektronix 545B oscilloscope to TP301 and TP302 test points on the REGULATOR CIRCUIT of inverter. If oscilloscope does not indicate 60 ±1 Hz, repair defective REGULATOR CIRCUIT. Disconnect oscilloscope from the REGULATOR CIRCUIT.
		Blown inverter power fuse F501, F502, F526, or F527 (no fuse alarm indication).	Check gate waveforms in accordance with 5.08 (b) to determine which components are defective. Replace blown fuse.
	Office audible alarm activated. AUTOMATIC TRANSFER lamp lighted. Cabinet alarm lamp lighted.	INV TRFR MONITOR plug-in unit not properly adjusted or defective.	Adjust INVR TRFR MONITOR plug-in unit in accordance with 4.15. If INVR TRFR MONITOR plug-in unit cannot be properly adjusted, repair or replace defective unit.
(e) Inverter SHUTDOWN LOW VOLTAGE alarm lamp lighted.	Office audible alarm activated. SHUTDOWN LOW VOLTAGE lamp lighted. RESET lamp lighted. Cabinet alarm lamp lighted.	FIELD VOLT ADJ (R307) potentiometer not properly adjusted.	Adjust FIELD VOLT ADJ (R307) potentiometer in accordance with 4.11.
		Defective POWER CIRCUIT.	Connect Weston Model 622 voltmeter, set on 300-volts ac scale, to TP301 and TP302 test points on POWER CIRCUIT. If voltmeter does not indicate 230 ±3 volts,

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
			repair defective POWER CIRCUIT. Disconnect voltmeter from POWER CIRCUIT.
		Defective REGULATOR CIRCUIT.	Connect Tektronix 545B oscilloscope to TP301 and TP302 test points on REGULATOR CIRCUIT. If oscilloscope does not indicate 60 ±1 Hz, repair defective REGULATOR CIRCUIT. Disconnect oscillator from REGULATOR CIRCUIT.
		Blown inverter power fuse F501, F502, F526, or F527 (no fuse alarm indication).	Check gate waveforms in accordance with 5.08 (b) to determine which components are defective. Replace blown fuse.
		SHUT DWN MONITOR plug-in unit not properly adjusted or defective.	Adjust SHUT DWN MONITOR plug-in unit in accordance with 4.17. If SHUT DWN MONITOR plug-in unit cannot be properly adjusted, repair or replace defective unit.
(f) Circuit breaker CB1, CB2, or CB3 tripped to the OFF position. If Z option is provided circuit breaker CB4 through CB6 may also be tripped to OFF position.	Office audible alarm activated. FUSE ALARM lamp lighted.	Grounds in associated office equipment.	Check for grounds in associated office equipment and clear grounds if necessary.
		Overload on associated office terminals.	Operate tripped circuit breaker to ON position. If circuit breaker trips immediately to the OFF position, determine source of overload at office terminals and repair if necessary.
		Defective circuit breaker.	Operate tripped circuit breaker to ON position. If circuit breaker trips to OFF position (not immediately), determine if circuit breaker is defective and replace if necessary.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(g) Blown dc input filter fuse.	The FUSE ALARM lamp lighted. Associated HI-LO voltage lamp may be lighted.	Shorted dc input filter capacitor.	Remove associated 500 series, Bussman 30-ampere fuse and associated 70B, 2-ampere alarm fuse. Check dc input filter capacitors in accordance with Section 032-110-501 and replace any capacitors found to be defective.
(h) Blown ac output filter fuse in a regular or stand-by inverter.	FUSE ALARM lamp lighted. Associated HI-LO voltage lamp may be lighted.	Shorted ac output filter capacitor.	Remove associated 500 series, Bussman, 15-ampere fuse and associated 70B, 2-ampere alarm fuse. Check the ac output filter capacitors in accordance with Section 032-110-501 and replace any capacitors found to be defective.

TABLE E
PWR CONT BAY TROUBLE CHART

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(a) Turndown failure	TD lamp lighted. AC VOLTS meter indicates zero. SS relay operated.	Low or open current on coaxial cable.	Determine if maintenance is being performed on cable. Locate and repair cause for low or open current on the coaxial cable.
		NV relay not properly adjusted.	Adjust the NV relay in accordance with 4.25.
	TD lamp lighted. AC VOLTS meter indicates zero. SS relay operated. Main discharge fuse blown.	Short circuit or ground on coaxial cable near terminal.	Determine if maintenance is being performed on cable. Locate and repair short or ground on cable.
(b) High current failure.	HIGH CUR FAILURE lamp lighted. Associated line current meter indicates that line current is in excess of 2 amperes. SS relay operated.	Short circuit or ground on coaxial cable some distance away from terminal.	Determine if maintenance is being performed on cable. Locate and repair short or ground on the cable.
		VRS1 diodes short-circuited.	Turn power down at PWR CONT bay in accordance with 3.02. Test VRS1 diodes in accordance with Section 032-173-301.
		Electronic current regulator not properly adjusted.	Adjust electronic current regulator in accordance with 4.26.
		T5 high voltage transformer taps not properly adjusted and/or L1 through L8 resistors defective.	Check output voltage form transformer and change voltage taps as required. (See SD-81152-01). Check L1 through L8 resistors with KS-14510 volt-ohm-milliammeter and replace if necessary.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
(c) Line current varies more than 5%.	POWER CONTROL FAILURE lamp lighted. AC VOLTS meter indicates high or low voltage. Major audible and visual alarms activated.	Defective electron tubes.	Using KS-14510 volt-ohm milliammeter, set on 3AC VOLTS scale, connect the negative lead to J5 jack and the positive lead to J1, J2, J3, and J4 jacks in sequence. If any voltage is below the average, replace associated electron tube.
	POWER CONTROL FAILURE lamp lighted. AC VOLTS meter indicates low voltage. Major audible and visual alarms activated.	T1 transformer taps not properly connected.	Using KS-8039 volt-milliammeter, set on 300-VOLTS scale, connect negative lead to J8 jack and positive lead to the J7 jack. If meter does not indicate between 155 and 165 volts, remove F1 and F2 fuses and change secondary taps of T1 transformer as required. (See SD-81164-01.)
	POWER CONTROL FAILURE lamp lighted. AC VOLTS meter indicates low voltage. F1, F2, or F3 fuse blown. Major audible and visual alarms activated.	Short circuit in T1 or T2 transformer.	Using KS-14510 volt-ohm-milliammeter, check resistance of transformers after turning power down on the PWR CONT bay.
(d) High or low output from PWR CONT bay.	POWER CONTROL FAILURE lamp lighted. AC VOLTS meter indicates high or low voltage. Major audible and visual alarms activated.	VR relay not properly adjusted.	Adjust VR relay in accordance with 4.23.
		VR rectifier stack defective.	Check VR rectifier stack and replace the stack if necessary.
		VA relay not properly adjusted.	Adjust VA relay in accordance with 4.24.
		VA rectifier stack defective.	Check VA rectifier stack and replace stack if necessary.

TROUBLE	INDICATION	POSSIBLE CAUSE	REMEDY
		T1 coarse control transformer defective.	Check T1 transformer and replace if necessary.
		Motor drive of T1 coarse control transformer not working properly.	Check operation of motor drive using RAISE-NOR-LOWER key to activate motor drive.