

## ELECTRICAL POWER - ADJUSTMENT/TEST

### 1. General

- A. This adjustment/test procedure is designed to furnish maintenance technicians with tools and information needed to test and troubleshoot various functions of the electrical system (voltage, over voltage protection, generator control unit operation, etc.). Included in this section are the following topics:
- (1) Fabrication of Generator Control Unit (GCU) Test Box.
    - (a) This topic covers fabrication of the GCU test box and provides a detailed list of parts needed to build the box.
  - (2) Electrical System Adjustment/Test.
    - (a) This topic provides information needed to test various electrical systems using the GCU test box. Included within this topic are matrix tables, a legend used in conjunction with the matrix tables and a starter/generator wiring diagram.

### 2. Fabrication of GCU Test Box

- A. Fabrication Procedures (Refer to Figure 501).
- (1) Refer to Figure 501 for fabrication and wiring of the text box.
  - (2) For fabrication of GCU test box, refer to Table 501 for a listing of wire gage and terminals.

**Table 501. GCU Test Box Material Requirements**

WIRE CODE	GA	MATERIAL	TERMINALS	
-50 thru -54	20	-20-9	MS25036-101	SOLDER
-55	16	-16-9	MS25036-106	SOLDER
-56 thru -73	20	-20-9	MS25036-101	SOLDER
-74	20	-20-9	MS25036-101	M39029/30-217 (NOTE 1)
-75	20	-20-9	MS25036-101	M39029/30-217 (NOTE 1)
-76 thru -78	20	-20-9	M39029/30-217 (NOTE 1)	MS25036-101
-79	16	-16-9	M39029/30-218 (NOTE 1)	MS25036-106
-80 thru -97	20	-20-9	M39029/30-217 (NOTE 1)	MS25036-101
-98 thru -115	20	-20-9	MS25036-101	SOLDER
-116	16	-16-9	MS25036-106	SOLDER
-117 thru -121	20	-20-9	MS25036-101	SOLDER
-122	20	-20-9	SOLDER	SOLDER
-123	20	-20-9	SOLDER	SOLDER
-124 thru -140	16	-16-9	SOLDER	SOLDER
-141	20	-20-9	SOLDER	MS25036-101
-142 thru -152	20	-20-9	SOLDER	SOLDER
-153	20	-20-9	SOLDER	MS25036-101
-154	20	-20-9	MS25036-101	MS25036-101
-155	16	-16-9	MS25036-106	MS25036-101
-187	20	-20-9	SOLDER	SOLDER
-196	20	-20-9	SOLDER	SOLDER
-198	16	-16-9	MS25036-106	MS25036-110

**NOTE 1:** Typical. Use this part number to order if necessary.

### 3. Electrical System Adjustment/Test

- A. Prepare Airplane For Test.
- (1) Electrical system components shall be installed per factory installation.

- (2) Fuel tanks shall be closed.
- (3) Airplane shall be parked and grounded.
- (4) All switches shall be in the off or normal position.
- (5) Ensure that battery has a good state of charge.

**NOTE:** The following procedure is performed with the GCU test box, an analog display multimeter and applicable airplane wiring diagrams.

- (6) Disengage the following circuit breakers on the forward firewall power junction box:
  - (a) KEEP ALIVE 1.
  - (b) KEEP ALIVE 2.
  - (c) CLOCK.
- (7) Disengage all circuit breakers on the circuit breaker panel with exception of START CONT, GEN CONT, GEN FIELD, and all circuit breakers labeled BUS 1 PWR and BUS 2 PWR .
- (8) Disconnect battery connector from battery.

**B. Generator Control Unit Check. (Refer to Figure 502).**

- (1) Disconnect electrical connector from GCU and connect to GCU test box receptacle.
- (2) Place OHMS/LIGHTS switch on the GCU test box to the OHMS position.

**CAUTION:** Insulate or secure power wires PB1 and PB40 to avoid inadvertent contact with airframe.

- (3) Disconnect power wires PB1 and PB40 from large terminal of the starter/generator. Refer to Chapter 80, Starter/Generator - Maintenance Practices.
- (4) Disconnect speed sensor connector from starter/generator. Verify high resistance of over 1000 ohms between pins X and Y on GCU test box, and between pins X and Y and airframe ground.
- (5) Connect speed sensor connector to starter/generator. Verify low resistance of 200 ohms or less between pins X and Y on GCU test box.
- (6) Measure resistance between pin G and airplane ground. Resistance shall be less than 1.0 ohm.
- (7) Measure resistance between pin B and airplane ground. Resistance shall be approximately 2.0 ohms, but not greater than 4.0 ohms.
- (8) Visually verify the following wire connections on the starter/generator:
  - (a) Wire PB6 to terminal A.
  - (b) Wire PB5 to terminal D.
  - (c) Wires PB2, PB3, PB4 and PB25 to terminal E.
- (9) Connect a well-regulated external power supply to airplane and set at 28.0 VDC, +0.5 or -0.5 VDC.
- (10) Place airplane's external power switch in the BUS position.
- (11) Place VOLT/AMMETER selector switch to the VOLT position. Voltmeter shall read 28.0 VDC.
- (12) Move selector switch on GCU Test Box from OHMS to LIGHTS.
- (13) Using the Engine Not Running Matrix Table, verify proper GCU operation and light indications.
  - (a) If GCU test box lights indicate a fault, refer to Table 502, Matrix Table Fault Analysis to determine cause.
- (14) Verify battery switch is ON and start switch is in the START position. Verify voltage at starter/generator wire PB1 and PB40 to ground is 28.0 VDC.
- (15) Turn start switch to the OFF position.
- (16) Place battery switch to OFF position. Turn external power unit off. Do not reconnect starter/generator.

**C. External Power Check.**

- (1) Place airplane external power switch to the BUS position and airplane battery switch to OFF.
- (2) Ensure all circuit breakers are disengaged on the circuit breaker panel with exception of START CONT, GEN CONT, GEN FIELD, and all circuit breakers labeled BUS 1 PWR and BUS 2 PWR.
- (3) Apply external power to the airplane and increase voltage until airplane power is cut off. This cutoff shall occur at 31.5 VDC, +0.5 or -0.5 VDC.

- (4) Decrease external power voltage to 0.0 VDC. Ensure all airplane power remains off.
  - (5) Slowly increase external power voltage until airplane system is reactivated. This shall occur at 22.0 VDC, +1.0 or -1.0 VDC.
  - (6) Set external power voltage to 28.5 VDC or 10 amp maximum.
  - (7) Place airplane battery switch to ON position. With ammeter selector switch placed to BATT position, check to verify battery is being charged.
  - (8) Turn BATT switch to OFF position. Turn external power switch to OFF position.
  - (9) Disconnect external power unit.
  - (10) Reconnect wiring to starter/generator.
- D. GCU Check with Engine Running. (Refer to Figure 503 and Figure 504).
- (1) Start engine. Refer to Pilot's Operating Handbook and Approved Airplane Flight Manual.
  - (2) Using the Matrix Table With Engine Running, verify proper GCU operation and light indications.
    - (a) If GCU test box lights indicate a fault, refer to Table 502 and Figure 504 to determine cause and remedy of fault indication.
  - (3) Shut down airplane.
  - (4) Turn battery and external power switches OFF.
  - (5) Remove GCU Test Box.
  - (6) Reconnect airplane wiring to GCU.

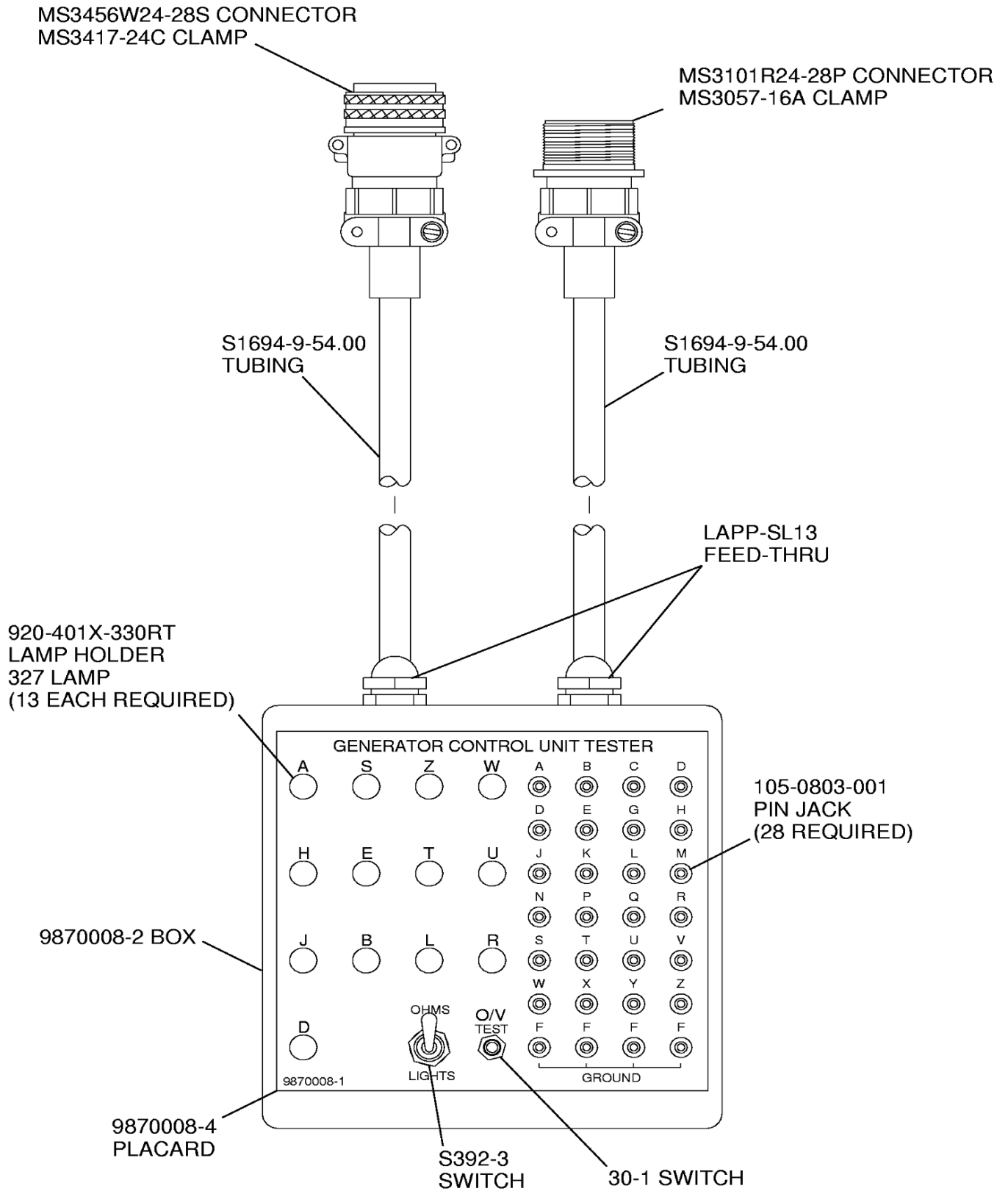
**Table 502. Matrix Table Fault Analysis**

<b>TROUBLE</b>	<b>PROBABLE CAUSE</b>	<b>REMEDY</b>
ANY LAMP ON GCU TEST BOX EXCEPT "S" AND "E" ILLUMINATES BEFORE GCU IS CONNECTED.	Faulty wiring or switch.	Check wiring to associated switch. Clear all faults before connecting GCU.
LAMP "A" INOPERATIVE.	Faulty wiring between GEN FLD breaker and current limiter in Power Box.	Check wires. Repair or replace.
LAMP "S" INOPERATIVE.	Faulty wiring between START CONT breaker and current limiter on Bus in Power Box.	Check wires. Repair or replace.
LAMP "E" INOPERATIVE.	GEN CONT SENSE breaker open or faulty.	Reset breaker or replace.
LAMP "Z" INOPERATIVE. (WITH LAMP "W" ILLUMINATED, EXCEPT ON O/V TEST).	Faulty GCU.	Check lamp "Z". Replace lamp "Z". If ok, replace GCU.
LAMP "W" INOPERATIVE.	Faulty wiring through GEN FLD breaker GEN switch, BAT switch, STR switch, IGN switch, and START CONT breaker.	Check wiring. Repair or replace wiring.
LAMP "H" INOPERATIVE. AFTER START.	Start switch ON or faulty GCU.	Verify start switch OFF, Check wiring. Repair or replace GCU.
LAMP "T" INOPERATIVE.	Faulty GEN switch wiring or faulty GCU.	Check GEN switch, generator wiring or anti-cycle breaker.
LAMP "V" INOPERATIVE.	Faulty GEN switch wiring or faulty GCU.	Check GEN switch wiring. Check power from pin "V" when lamp "A" is illuminated. If not, replace GCU.

LAMP "J" INOPERATIVE.	Faulty GEN switch wiring or faulty GCU.	Check GEN switch wiring. Check power from pin "V" when lamp "A" is illuminated. If not, replace GCU.
LAMP "D" INOPERATIVE.	Faulty wiring or GEN CONT breaker open.	Check GEN CONT breaker connections through limiter.
LAMP "B" ILLUMINATES BEFORE ENGINE START.	Faulty wiring.	Check wire from generator to GCU for proper connections and continuity.

Figure 501 : Sheet 1 : GCU Test Box Fabrication

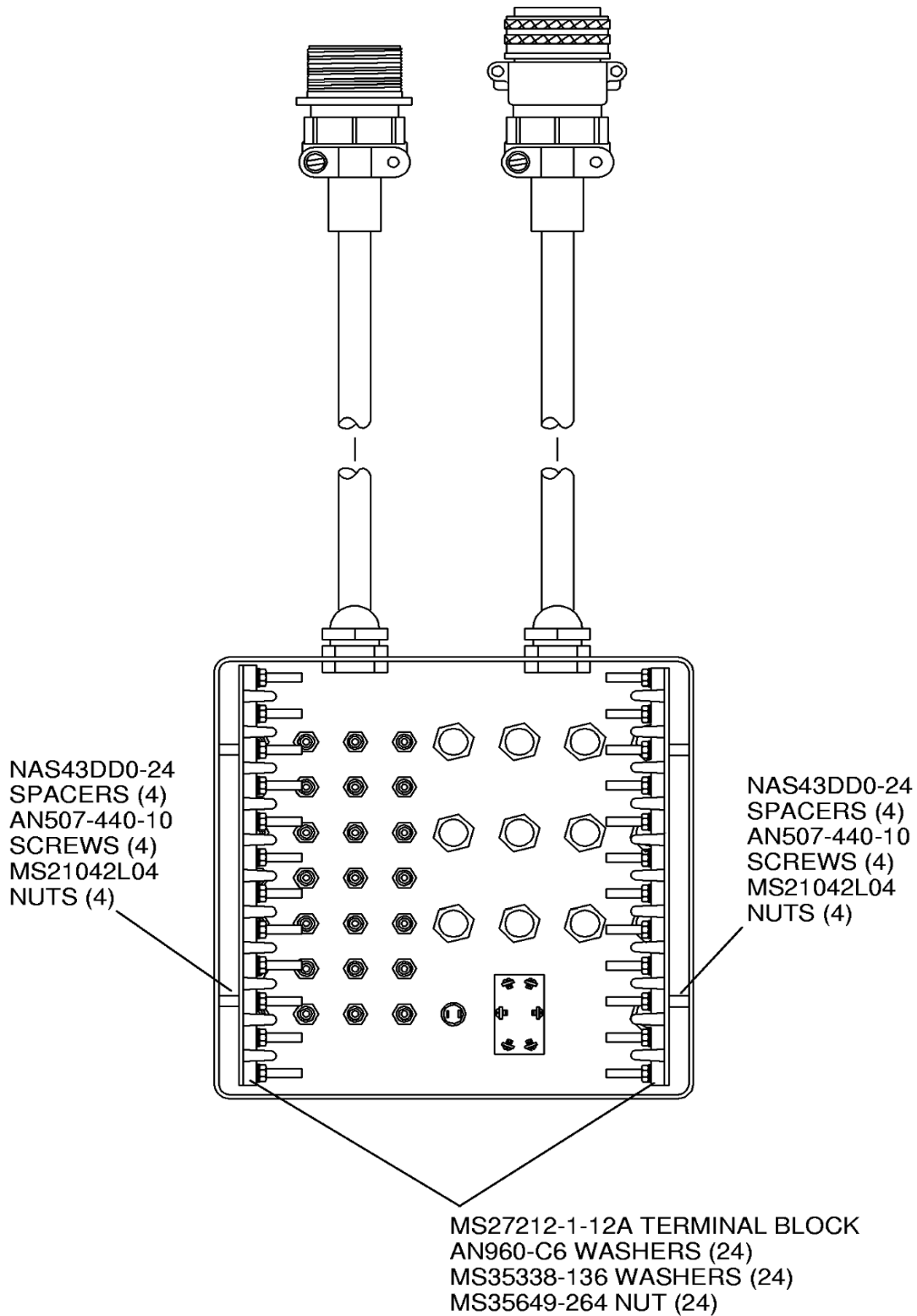
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Figure 501 : Sheet 2 : GCU Test Box Fabrication

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Figure 501 : Sheet 3 : GCU Test Box Fabrication

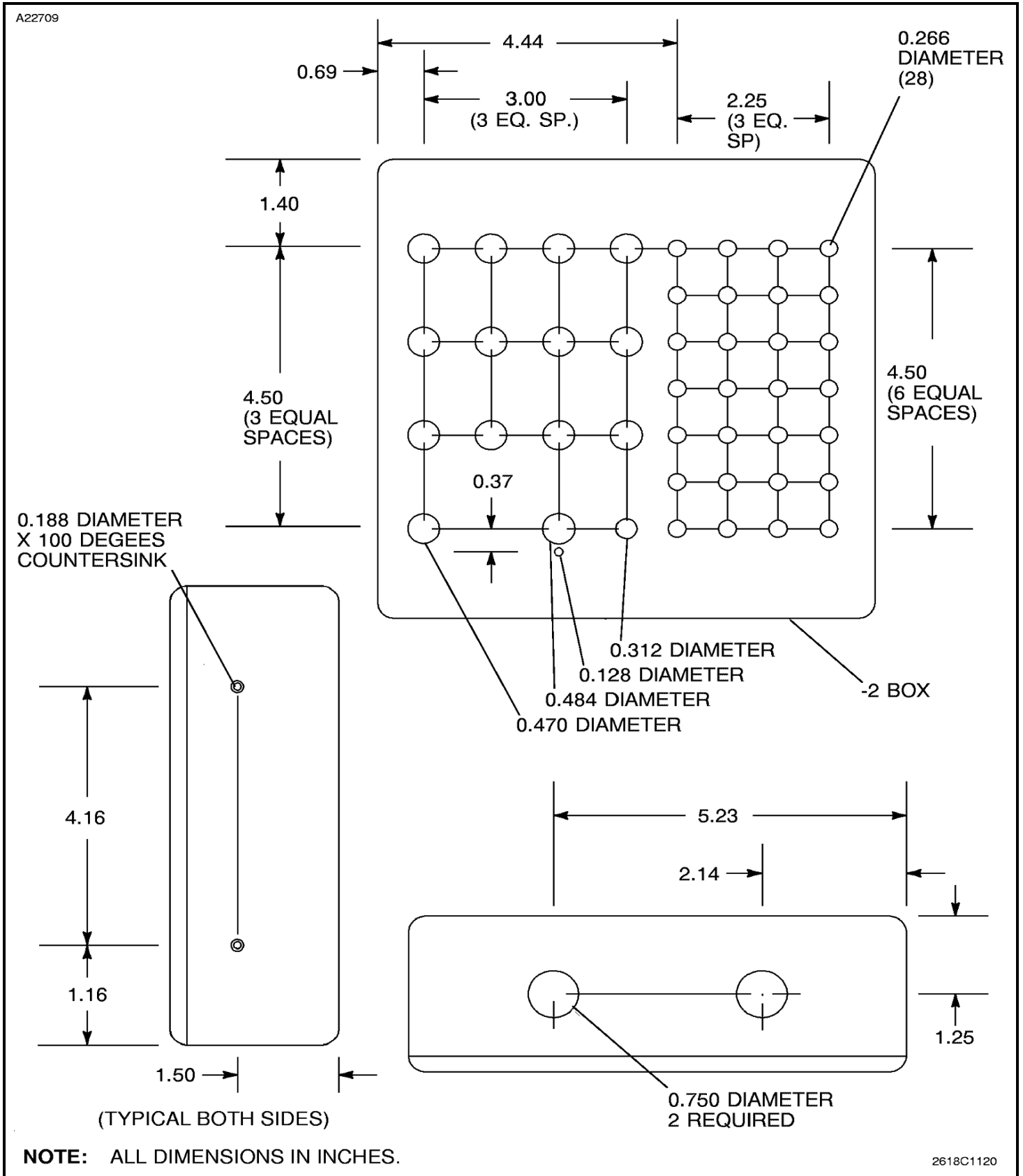


Figure 501 : Sheet 4 : GCU Test Box Fabrication

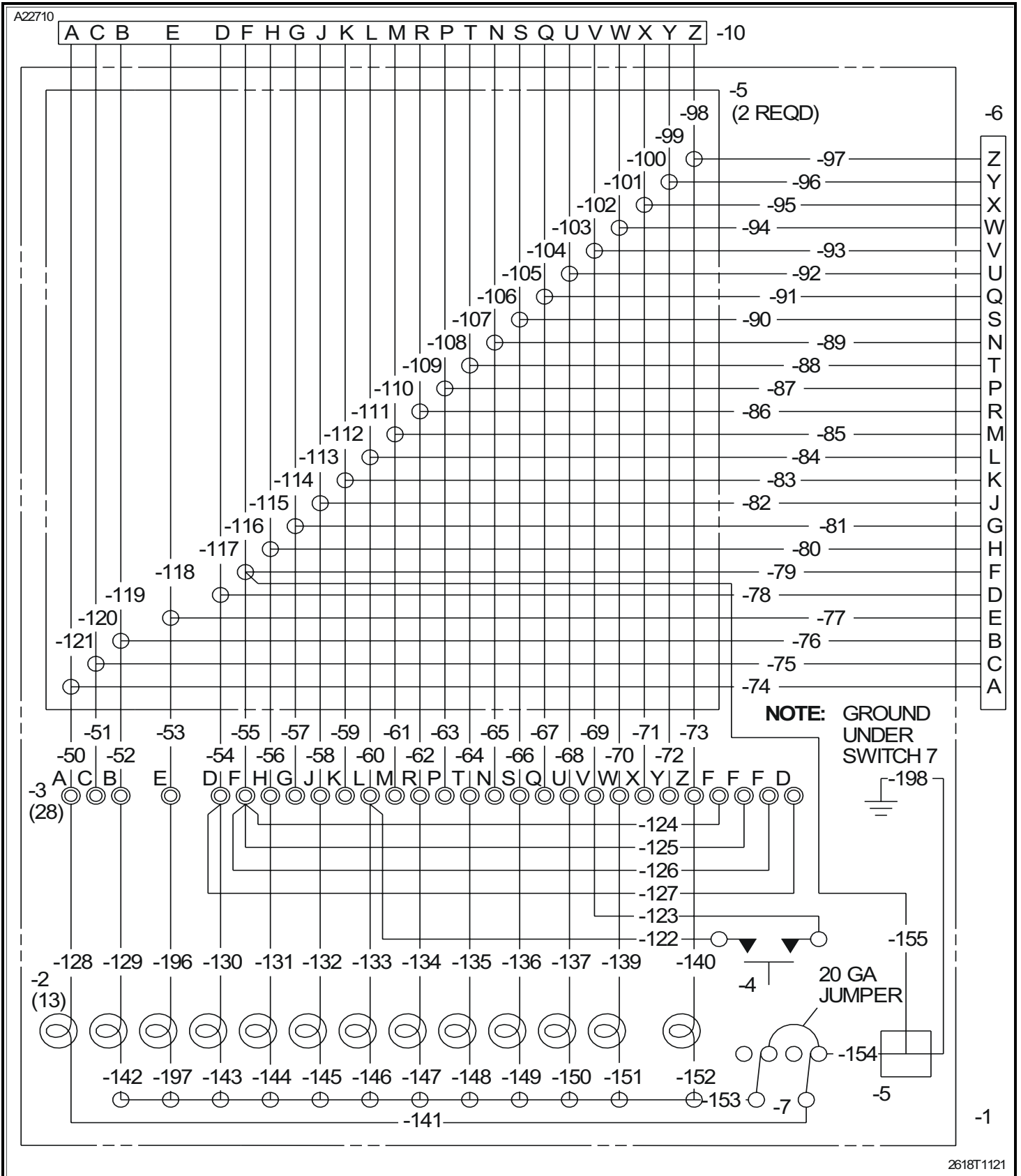




Figure 502 : Sheet 1 : Engine Not Running Matrix Table

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<b>POWER IN OR OUT OF THE GCU</b>	PWR IN	PWR IN	PWR OUT	PWR IN	PWR OUT	PWR IN	PWR IN	PWR IN	PWR IN	PWR IN	PWR OUT	PWR IN	PWR IN
<b>GCU PIN IDENTIFICATION</b>	PWR IN	START PWR	START CONT	START SIG	GEN/CONT	GEN/CONT SENSE	ANTI-CYCLE	GEN RE-SET	GEN ON	SHUNT FIELD	O/V TEST	GEN TRIP	REG VOLT
	<b>A</b>	<b>S</b>	<b>Z</b>	<b>W</b>	<b>H</b>	<b>E</b>	<b>T</b>	<b>U</b>	<b>J</b>	<b>B</b>	<b>L</b>	<b>R</b>	<b>D</b>
<b>ACTION TAKEN</b>													
1. Ship's battery disconnected external power switch to "BUS".		ON				ON							
2. Pull start cont breaker.		OFF				ON							
3. Reset start cont breaker.		ON				ON							
4. Battery switch to "ON", then "OFF".		ON				ON							
5. Fuel boost switch to "NORMAL".		ON				ON							
6. Fuel boost switch to "ON", then "OFF".		ON				ON							
7. Generator switch to "TRIP".		ON				ON							
8. Generator switch to "RESET".		ON				ON							
9. Start switch to "START", then to "OFF".		ON				ON							
10. Ignition switch to "ON", then to "NORMAL".		ON				ON							
11. Verify battery switch is off. Reconnect ship's battery then turn battery switch "ON".		ON				ON							
12. Turn battery switch and Ext PWR switch "OFF" and connect test harness to GCU.		ON				ON							
13. External PWR switch to "BUS".		ON				ON							
14. Battery Switch to "ON".		ON	OFF	OFF		ON							

Figure 502 : Sheet 2 : Engine Not Running Matrix Table

(CONT'D)													
<b>POWER IN OR OUT OF THE GCU</b>	PWR IN	PWR IN	PWR OUT	PWR IN	PWR OUT	PWR IN	PWR IN	PWR IN	PWR IN	PWR OUT	PWR IN	PWR IN	PWR IN
<b>GCU PIN IDENTIFICATION</b>	PWR IN	START PWR	START CONT	START SIG	GEN/CONT	GEN/CONT SENSE	ANTI-CYCLE	GEN RE-SET	GEN ON	SHUNT FIELD	O/V TEST	GEN TRIP	REG VOLT
<b>ACTION TAKEN</b>	<b>A</b>	<b>S</b>	<b>Z</b>	<b>W</b>	<b>H</b>	<b>E</b>	<b>T</b>	<b>U</b>	<b>J</b>	<b>B</b>	<b>L</b>	<b>R</b>	<b>D</b>
15. Start switch to "START".		ON	ON	ON		ON							
16. Start switch to "MOTOR".		ON	ON	ON		ON							
17. Ext power switch to "STARTER".		ON				ON							
18. Start switch to "START".	ON	ON	ON	ON		ON			ON				ON
19. External power switch to "OFF".	ON	ON	ON	ON		ON			ON				ON
20. Generator switch to "TRIP".		ON				ON							
21. Generator switch to "ON".	ON	ON	ON	ON		ON			ON				ON
22. Generator switch to "RESET".	ON	ON	ON	ON		ON	ON	ON					ON
23. Generator switch to "ON".	ON	ON	ON	ON		ON			ON				ON
24. Push O/V switch (6) on GCU Test Box.		ON		ON		ON					ON & OFF		
25. Start switch to "OFF", then start.	ON	ON	ON	ON		ON			ON				ON

**GENERAL NOTES**

IF LIGHTS DO OR DO NOT DISPLAY AS MATRIX CHART INDICATES, WIRING ASSOCIATED FOR THAT INDICATOR LIGHT(S) SHOULD BE CHECKED.

BULBS IN GCU TEST BOX CAN BE CHECKED BY DISCONNECTING GCU TEST BOX FROM AIRPLANE AND APPLYING 28.0 VDC TO CORRESPONDING PIN JACK AND GROUND TO PIN JACK F.

PINS OF THE GCU CORRELATE TO THE PIN JACKS AND LIGHTS OF THE GCU TEST BOX.

Figure 503 : Sheet 1 : Matrix Table with Engine Running

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<b>POWER IN OR OUT OF THE GCU</b>	PWR IN	PWR IN	PWR OUT	PWR IN	PWR OUT	PWR IN	PWR IN	PWR IN	PWR IN	PWR OUT	PWR IN	PWR IN	PWR IN
<b>GCU PIN IDENTIFICATION</b>	PWR IN	START PWR	START CONT	START SIG	GEN/CONT	GEN/CONT SENSE	ANTI-CYCLE	GEN RE-SET	GEN ON	SHUNT FIELD	GEN ON	GEN TRIP	REG VOLT
	<b>A</b>	<b>S</b>	<b>Z</b>	<b>W</b>	<b>H</b>	<b>E</b>	<b>T</b>	<b>U</b>	<b>J</b>	<b>B</b>	<b>L</b>	<b>R</b>	<b>D</b>
<b>ACTION TAKEN</b>													
1. Start engine per POH and bring generator on line.	ON	ON			ON	ON			ON	ON *			ON

**GENERAL NOTES**

DO NOT START ENGINE UNTIL ALL CHECKS AND PROCEDURES OUTLINED IN EXTERNAL POWER CHECK HAVE BEEN COMPLETED.

IF LIGHTS DO (OR DO NOT) DISPLAY AS MATRIX CHART INDICATES, WIRING ASSOCIATED WITH THAT INDICATOR LIGHT(S) SHOULD BE CHECKED.

BULBS IN THE GCU TEST BOX CAN BE CHECKED BY DISCONNECTING THE GCU TEST BOX FROM THE AIRPLANE AND APPLYING 28.0 VDC TO CORRESPONDING PIN JACK AND GROUND TO PIN JACK F.

PINS OF THE GCU CORRELATE TO THE PIN JACKS AND LIGHTS OF THE GCU TEST BOX.

\* MONITORING OF GENERATOR EXCITATION VOLTAGE WILL RESULT IN LIGHT "B" BEING IN A DIM MODE (MAY NOT BE VISIBLE) AT THE TIME. AS THE POWER LEVER IS ADVANCED, THE INTENSITY OF THE LIGHT WILL DECREASE.

Figure 504 : Sheet 1 : Starter/Generator Wiring Diagram

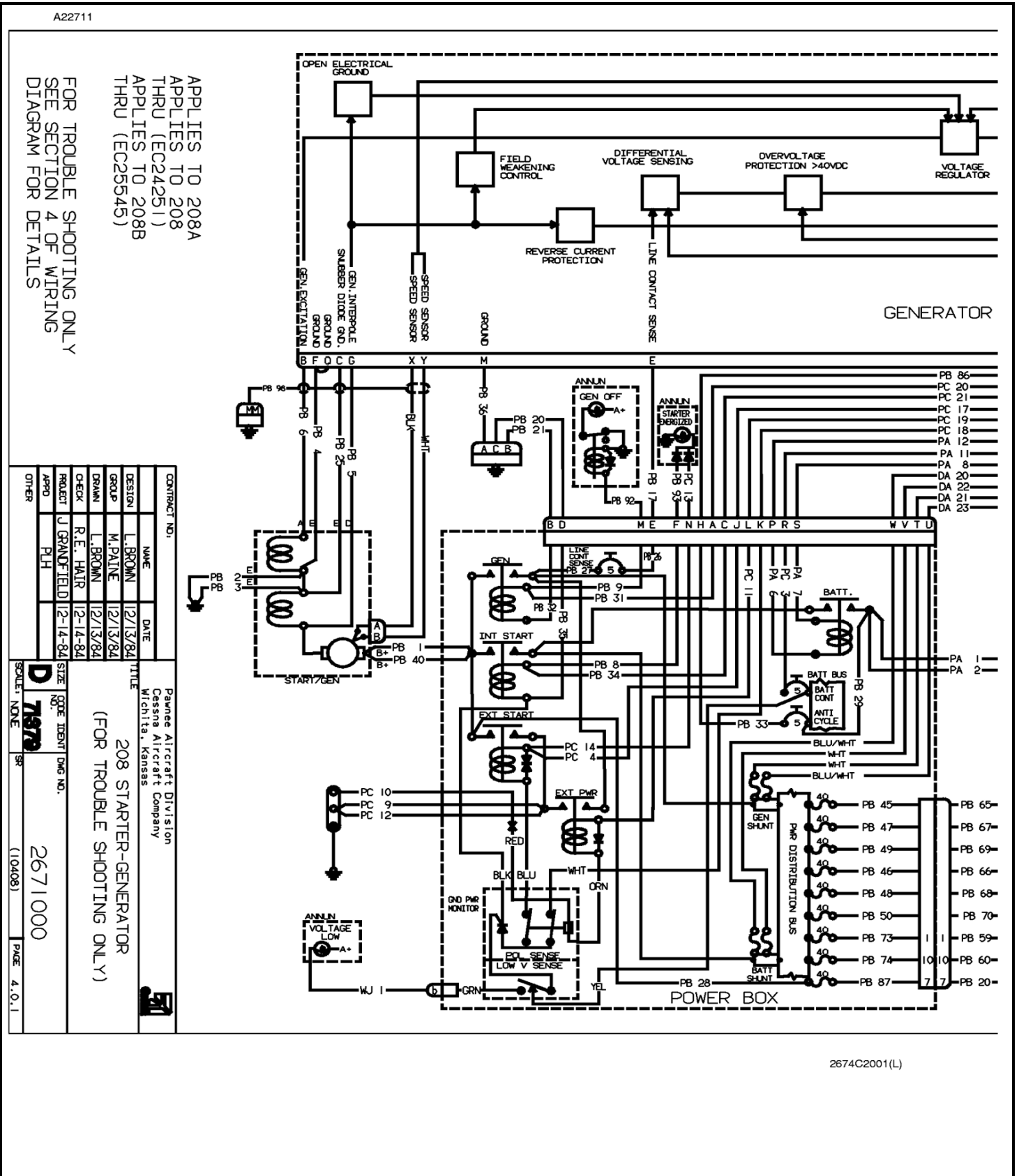
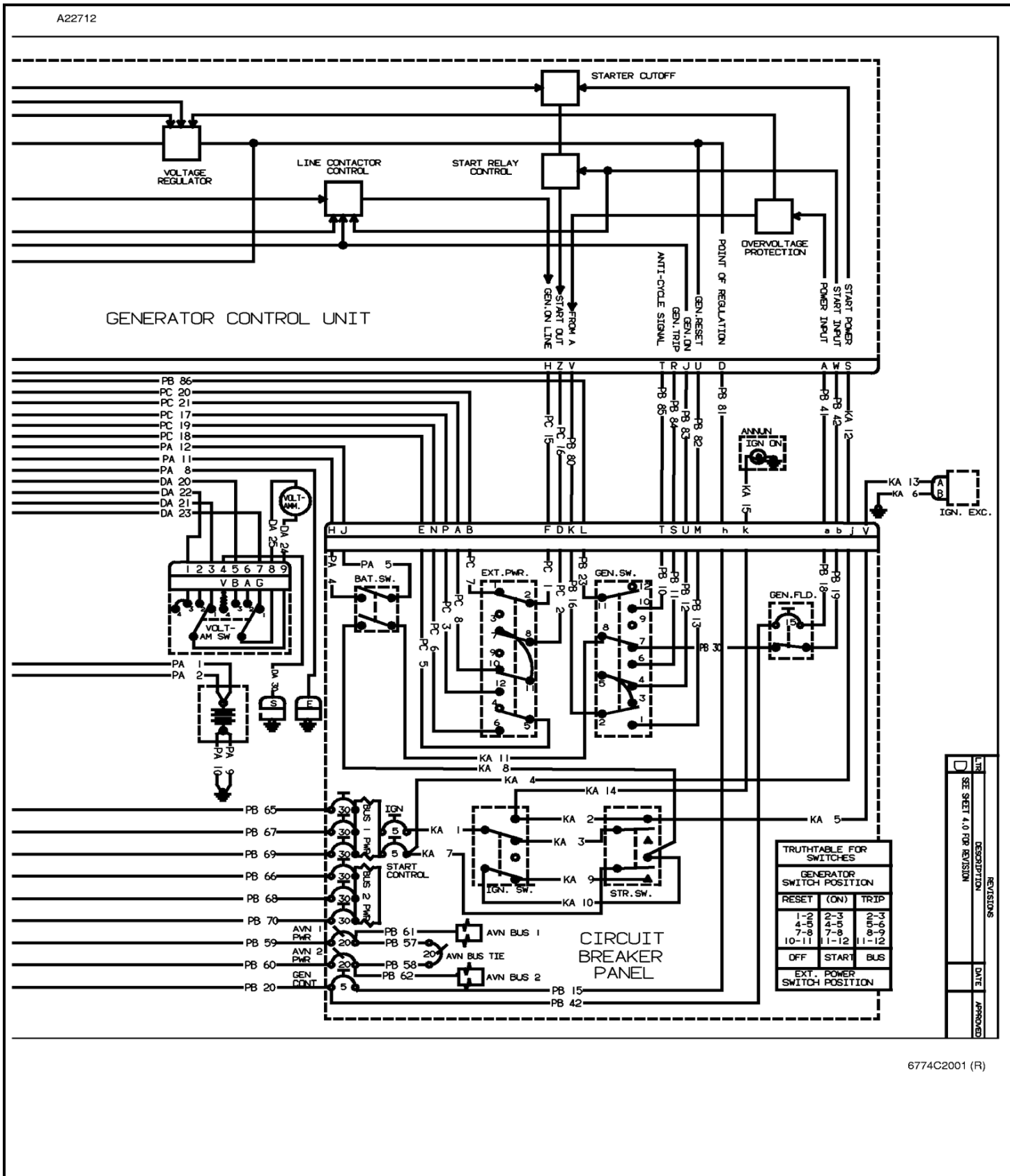


Figure 504 : Sheet 2 : Starter/Generator Wiring Diagram



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