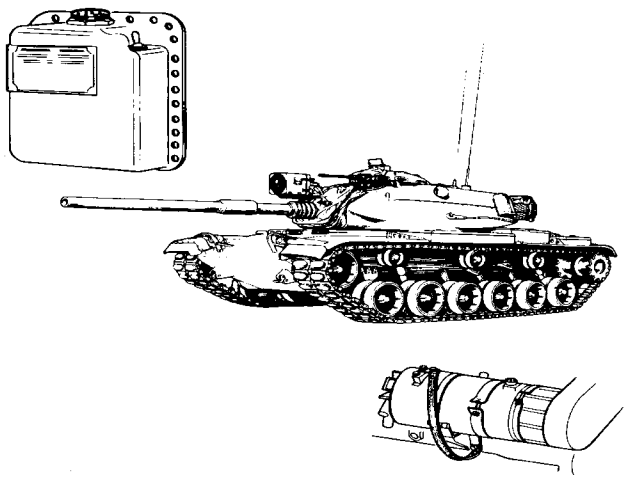
TECHINACAL BULLETIN

TROUBLESHOOTING

THE 650 ANP

CHANGING SYSTEM

(THE M60A1 RISE WAY)



HEADQUARTERS, DEPARTMENT OF THE ARMY

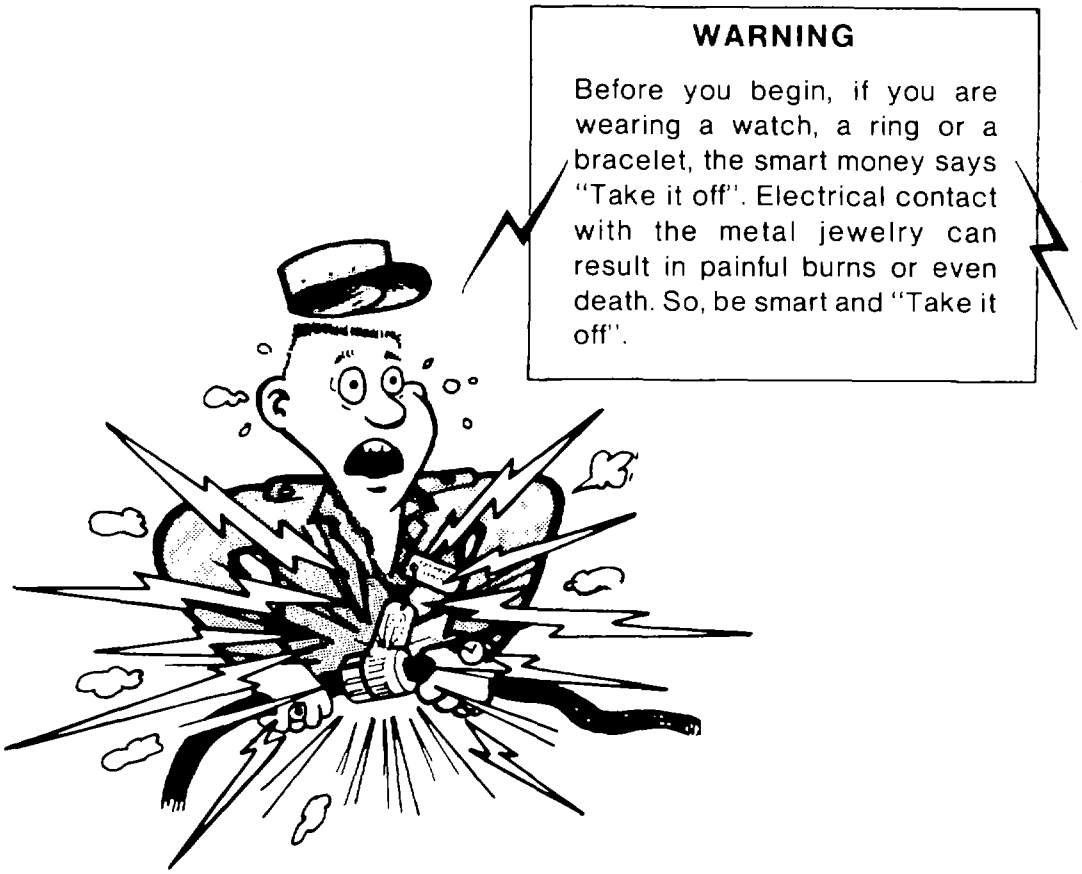
August 1982

WHAT THIS BULLETIN IS ALL ABOUT ...

This bulletin has been designed to help you, the track vehicle mechanic in the field, to better understand the 650 Ampere Charging System. In basic terms the 650 AMP Charging System consists of the engine driven oil cooled generator, the voltage regulator, the vehicle batteries and associated harnesses and cables

The only tools needed to troubleshoot the charging system using this bulletin are the AN/URM-105 Multimeter (or equal) and the "T" Test Harness 1 1674369 which is part of the special tools and test equipment for the vehicle

Just follow the steps in the troubleshooting procedure or use the troubleshooting logic diagram foldout to locate the weak or broken link in your charging system chain. Near the logic diagram is a schematic which you will find helpful in identifying the harnesses, disconnects and circuits that you will be tracing and measuring.



Never try to "Jump" over or around a relay This may result in a serious burn or damage to the electrical system due to overload.

The NSN 2920-00-441-8137 generator and NSN 61 1 0- 00-467-4000 regulator on your M6OA1 (RISE) tanks have a manufacturer's warranty for 30/24 months respectively or 2000 vehicle hours. The date of manufacture is stamped on the data plate.

However, the warranty will self destruct if these items are tampered with, abused, or even if they get beat up on the way back to the manufacturer So if anything goes wrong with the alternator or regulator that your 20-1 Tech Manual troubleshooting won't cure, never try to fix it yourself, that will blow the warranty. Take the item off very carefully, tag it with ex-change tag (DA Form 2402) per TM 38-750, Chapter 3, para. 3-2, page 3-1, and send it on through channels for warranty service.

Likewise, all DS/GS maintenance types are asked not to repair (or even test) a warranty item They just make sure it's well wrapped and send It on to the end of the line which is:

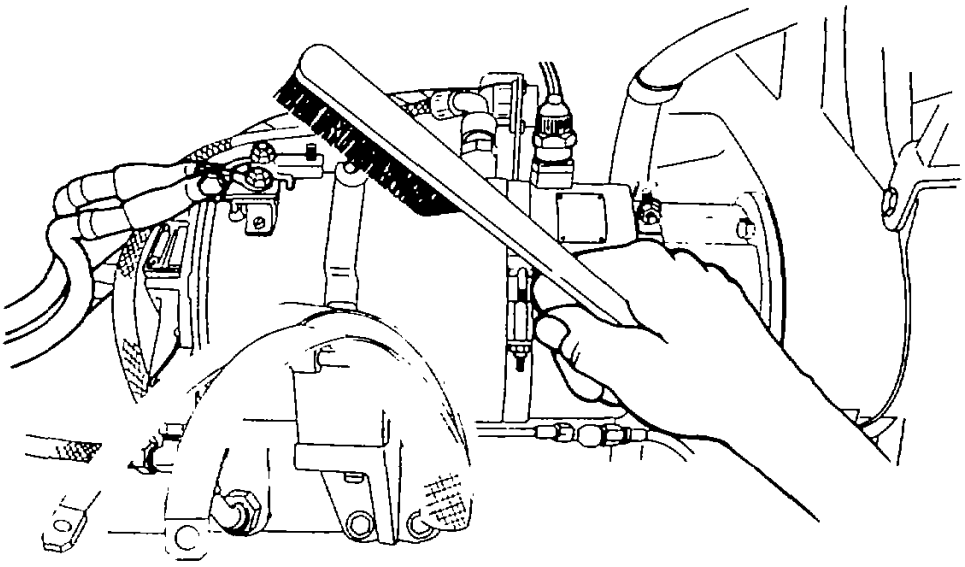
For Conus Units
Anniston Army Depot
Attn:
DRXAN-PP
Anniston, AL 36201

For USAREUR Units:
US Army Maintenance Plant, Mainz
Attn DRXMZ-MT
APO 09185

If you have any questions on the warranty, contact the Tank Automotive Materiel Readiness Command, Attn DRSTA-M Warren, Michigan, 48090

CHECK THIS OUT

Remember, missing, broken or unconnected ground straps can really mess up your generator/alternator or the entire electrical system Even a loose ground strap can cause trouble. Make sure the ground straps are tight Check for good solid metal-to- metal contact. If paint or rust is evident at the ground strap bonding point, use emery cloth, steel wool or a wire brush and brighten up both surfaces, then tighten the straps down.



3

DO YOU HEAR A CLICK?

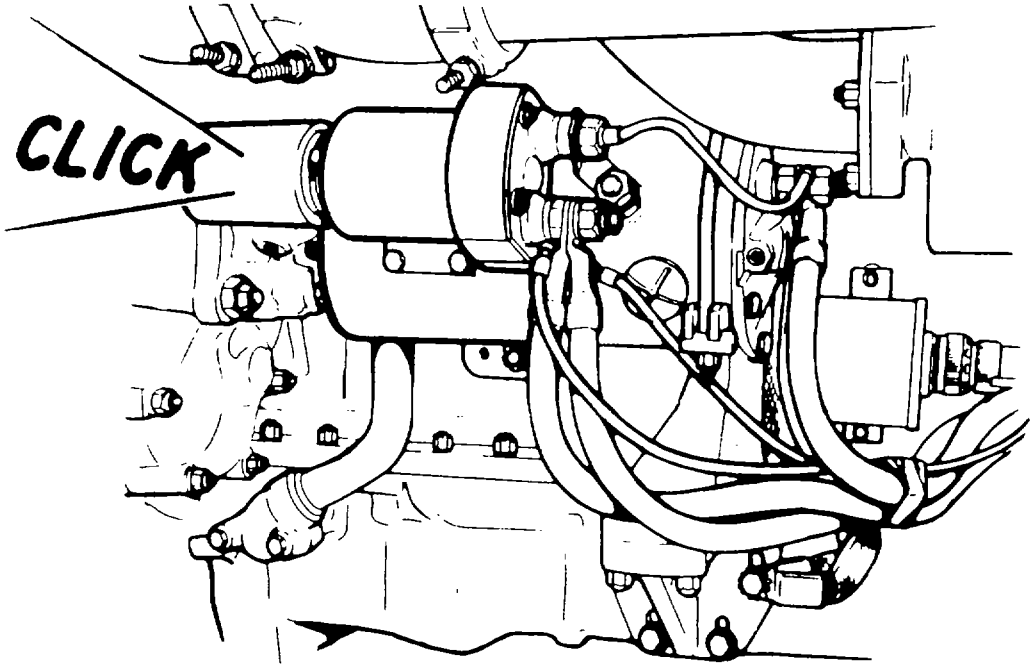
What should a track vehicle mechanic do when the starter only "clicks" when he tries to start a tank engine?

> **NOTE**
> The center connection of the (+) when measured to vehicle chassis (GROUND) Do not touch probe against outer case because of possible short to ground

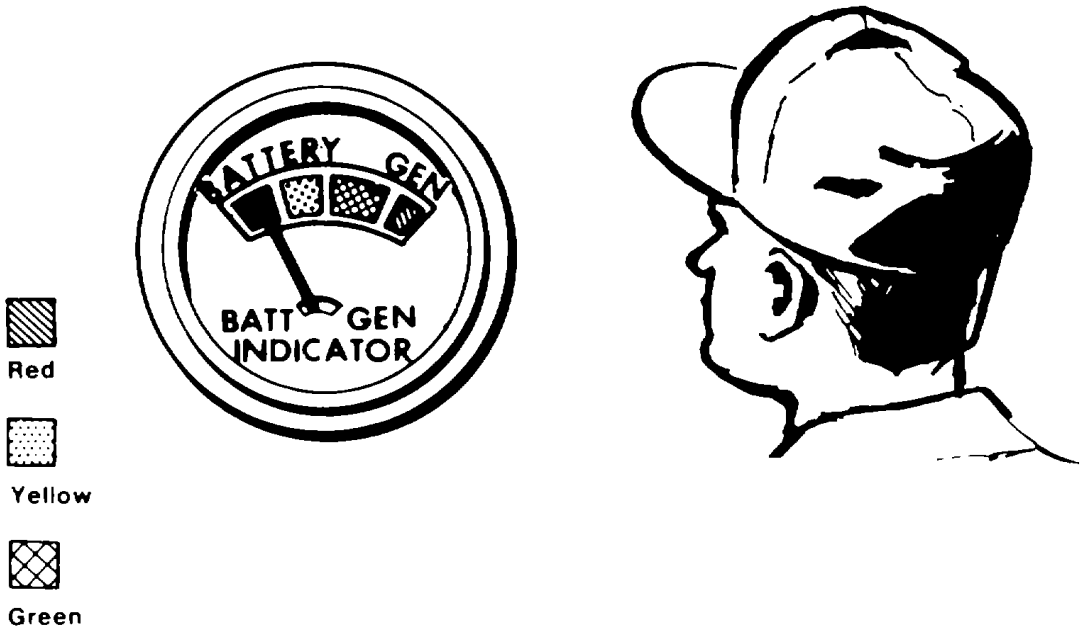
A quick check at the slave receptacle for 24 volts is an easy way to check battery voltage

If you have 24 volts at the slave receptacle, troubleshoot the system in accordance with your 20-1 Technical Manual

If you do not have 24 volts at the slave receptacle is positive either in the batteries, the slave receptacle or in the connecting harness First check the specific gravity of the batteries with the hydrometer Then check the battery cable terminals for good electrical contact and tightness. Next check the harnesses, then the slave receptacle



I. PRELIMINARY CHECKS



1 BATTERY-GENERATOR INDICA- TOR POINTER IN THE LEFT RED AREA WITH ENGINE NOT RUNNING.

Place MASTER BATTERY switch in OFF position
Check If specific gravity of batteries is above 1 225

a. If yes, refer to TM 9-2350-257-20-1 troubleshooting procedures for the battery-generator indicator.
b. If no, charge batteries, and clean and tighten battery connections

2 BATTERY-GENERATOR INDICATOR POINTER IN YELLOW AREA WITH ENGINE RUNNING

With engine running, check for 25 to 30 VDC at slave receptacle.

NOTE
The center connection of the slave receptacle is positive (+) when measured to vehicle chassis (GROUND) Do not touch probe against outer case because of possible short to ground

a. If 25 to 30 VDC exists, refer to TM 9-2350-257-20-1 troubleshooting procedures for the battery-generator indicator.
b. If less than 25 VDC exists proceed to TROUBLESHOOTING PROCEDURE step 1

3 BATTERY-GENERATOR INDICATOR INDICATES GENERATOR IS OVERCHARGING WITH POINTER IN RIGHT RED

With engine running, check for 25 to 30 VDC at slave receptacle.

NOTE

The center connection of the slave receptacle is positive (+) when measured to vehicle chassis (GROUND)

NOTE

When removing or replacing connectors, a spanner wrench must be used to avoid damaging connector shells.

At the completion of the following battery-generator-regulator troubleshooting malfunctions procedures, ensure that all wiring harnesses, cables, and other components have been reconnected and secured

SPANNER WRENCH

a. If 25 to 30 VDC exists, refer to TM 9-2350-257-20-1 troubleshooting procedures for the battery-generator Indicator.

b. If more than 30 VDC exists, proceed to TROUBLESHOOTING PROCEDURE, step 1.

NOTE

Both the RISE and RISE passive harness number is shown in the troubleshooting procedures which follow The RISE passive harness number is in parenthesis adjacent to the RISE harness number. For ex- ample harness 11673839 (11655747)

II. TROUBLESHOOTING PROCEDURES

CAUTION

With engine running, do not disconnect generator harness at engine disconnect or bulkhead.

STEP 1

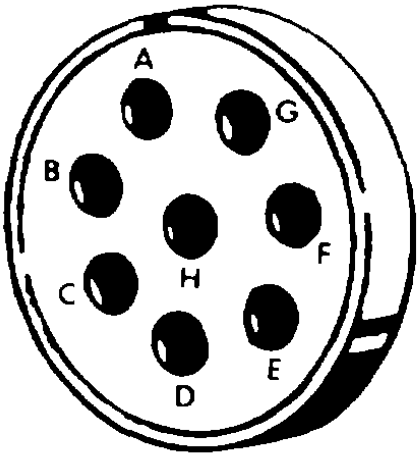
Stop engine Place MASTER BATTERY switch In OFF position.

Open turret platform access door.

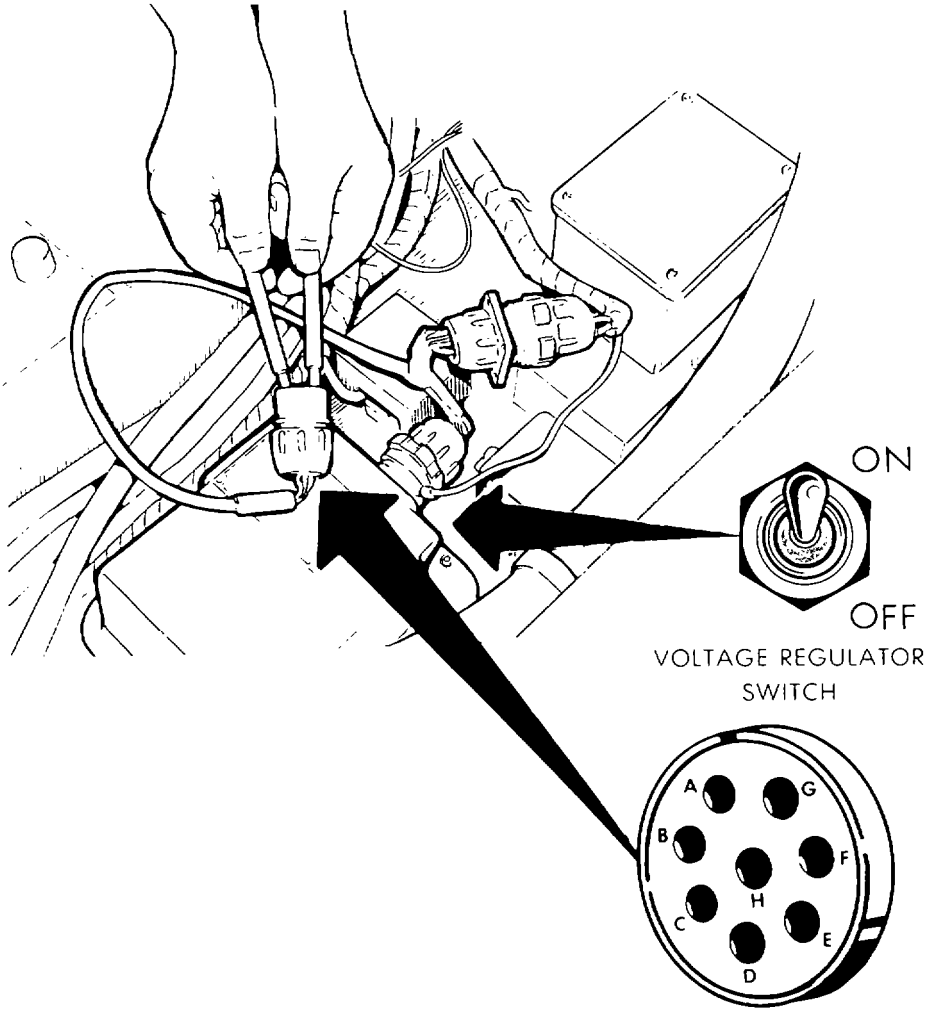
Disconnect harness 11673835 connector from voltage regulator

Connect generator/regulator test harness ("T" harness) 11674369 to harness 11673835 connector "T" harness is part of special tool and test equipment listing for your vehicle Do not connect "T" harness to regulator at this time.

AT VOLTAGE REGULATOR



11673835



STEP 2

To ensure overvoltage protection circuit breaker on the voltage regulator is in the ON (UP) position, turn the overvoltage circuit breaker to the OFF (DOWN) position, then to the ON (UP) position, before performing further tests Connect "T" harness to regulator.

Check continuity from socket C of the test harness to vehicle chassis (GROUND)

a. If continuity exists, proceed to step 3.
b. If continuity does not exist, repair harness 11673835 (GROUND).

NOTE

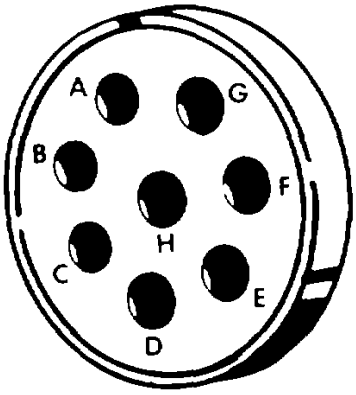
Use only Multimeters TS-352 B/6, AN/URM-105, or approved equivalents for all voltage and resistance measurements in this procedure

STEP 3

Place MASTER BATTERY switch to ON Place FUEL PUMP switch to ON Measure voltage 22 to 26 VDC on "T" harness socket A (+) to socket C (-) (Circuit 1A).

a. If 22 to 26 VDC exists, proceed to step 10

b. If 22 to 26 VDC does not exist, proceed to step 4



''T'' HARNESS

STEP 4

Place MASTER BATTERY switch to the OFF position

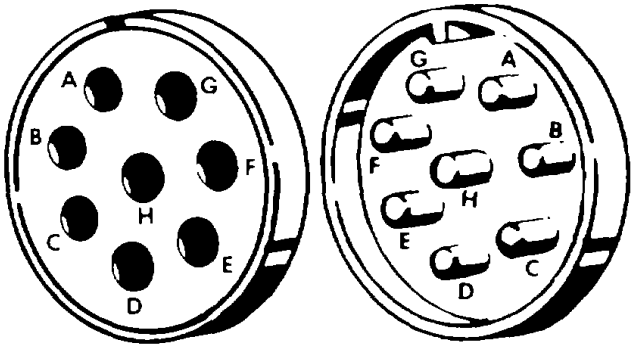
Disconnect harness 11673835 from the driver's master control panel.

Check continuity from harness connector 11673835 pin C (Circuit 1 A) to socket A on the "T" harness.

a. If continuity does not exist, repair harness 11673835.

b. If continuity exists, proceed to step 5.

AT MASTER CONTROL PANEL



''T'' HARNESS 11673835

STEP 5

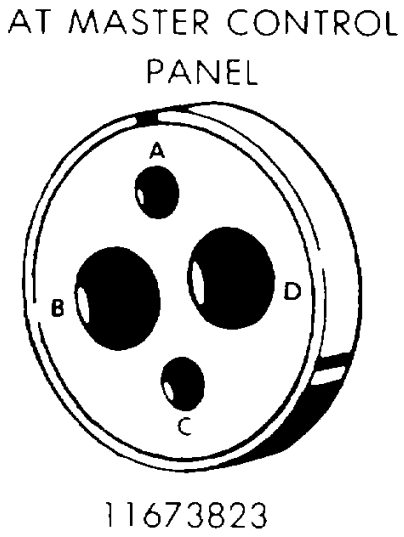
Connect harness 11673835 to the driver's master control panel.

Disconnect harness 11673823 connector (Circuit 10) from the driver's master control panel

Place MASTER BATTERY switch to the ON position.

Measure voltage 22 to 26 VDC at harness 11673823 connector (Circuit 10) on socket B (+) to vehicle chassis (GROUND) a. If 22 to 26 VDC exists, proceed to step 6

b. If 22 to 26 VDC does not exist, troubleshoot Circuit 10 per the technical manual



STEP 6

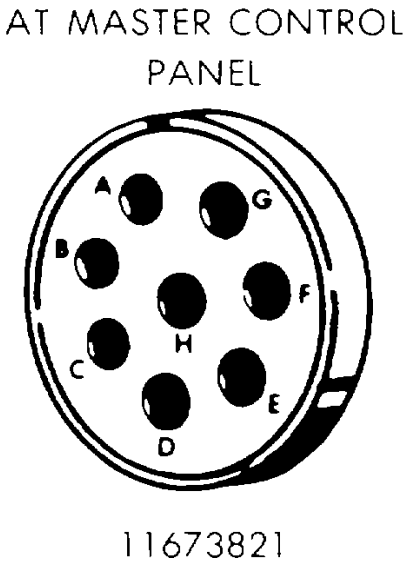
Place MASTER BATTERY switch to OFF position.

Remove driver's master control panel. Refer to TM 9-2350-257-20-1.

Check continuity harness 11673821 (11655751) connector socket C (Circuit 1A) at the driver's master control panel to the harness 11673821 (11655751) terminal at the fuel pump switch Packard connector.

a. If continuity exists, proceed to step 7.

b. If continuity does not exist, repair harness (11673821) (11655751).

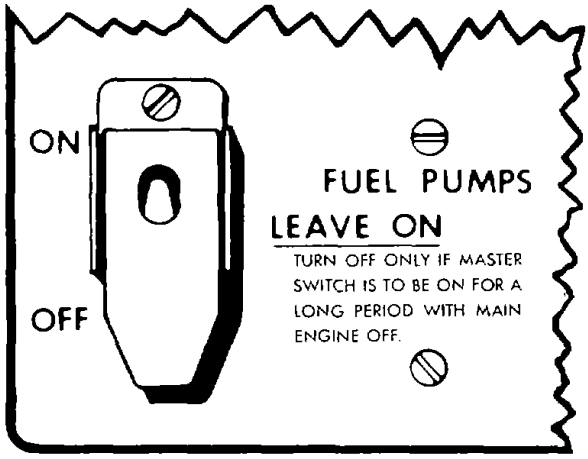


STEP 7

Check continuity across the FUEL PUMP switch terminals (Circuit 1 A)

To verify switch operation, operate switch several times while making the continuity check

a. If continuity exists and switch operates satisfactorily, leave switch ON Proceed to step 8
b. If continuity does not exist, replace the FUEL PUMP switch

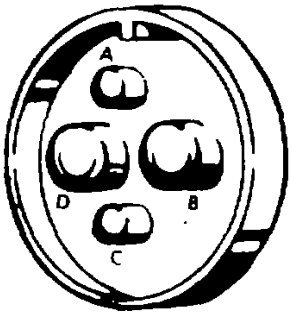


STEP 8

Check continuity from harness connector 11673839 (11655747) pin B (Circuit 10) through to terminal at input side of FUEL PUMP switch (Circuit 1A) If continuity exists, proceed to step 9

If continuity does not exist, repair harness 11673839 (11655747) Circuit 10/Circuit 1A

IN MASTER CONTROL PANEL



11673839

STEP 9

Reconnect all connectors on driver's master control panel securely and reconnect voltage regulator after removing "T" harness.

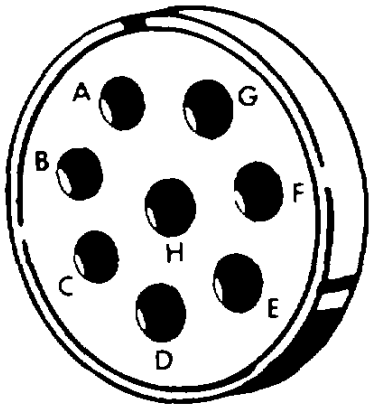
Start engine and observe the battery generator indicator It should be in the green area If It is in the red or yellow area, refer to step 10. If in the green area, system Is O.K No further testing is required. Install driver's master control panel Refer to TM 9-2350-257-20-1

STEP 10

Place MASTER BATTERY and FUEL PUMP switches to the OFF position. Disconnect voltage regulator Install "T" harness as In step 1.

Using "T" harness check accessory relay resistance from "T" harness socket F to vehicle GROUND Accessory relay coil resistance shall be 100-200 ohms.

a. If resistance is not indicated, proceed to step 11.
b. If accessory relay coil resistance exists, proceed to step 12



''T'' HARNESS

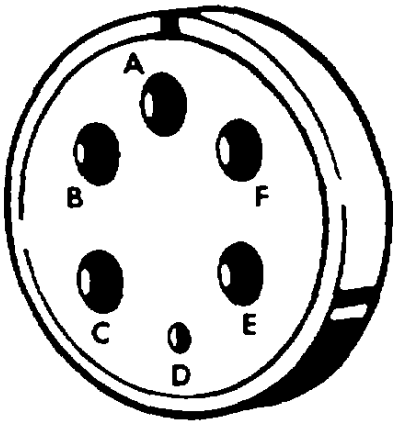
STEP 11

Remove harness 11673835 connector from the accessory relay.

Check accessory relay resistance between connector from pin F and pin D Resistance shall be 100-200 ohms.

a. If resistance is as Indicated, repair harness 11673835
b. If resistance is not as indicated, replace assessory relay.

IN ACCESSORY RELAY



11673835

CAUTION

DO NOT allow battery ground cable assemblies to come in contact with vehicle chassis or GROUND while disconnected.

Harness 11673827 contains battery voltage.

DO NOT allow connector to come in contact with GROUND or vehicle chassis.

STEP 12

Disconnect three battery ground cable assemblies, located behind driver's seat bolted to the torsion bar cover.

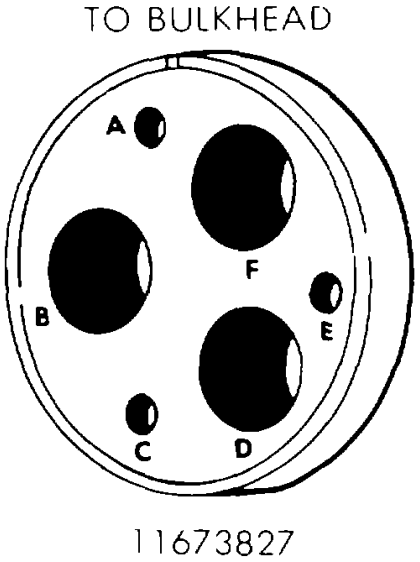
Disconnect generator harness 11673827 (Circuit 2) from the bulkhead.

Connect three battery ground cable assemblies.

Check for 22-26 VDC from socket E to ground and socket F to ground or harness connector 11673827.

Disconnect three battery ground cable assemblies.

a. If voltage is present at both sockets, proceed to step 13.
b. If voltage is not present, repair/replace harness 11673827.



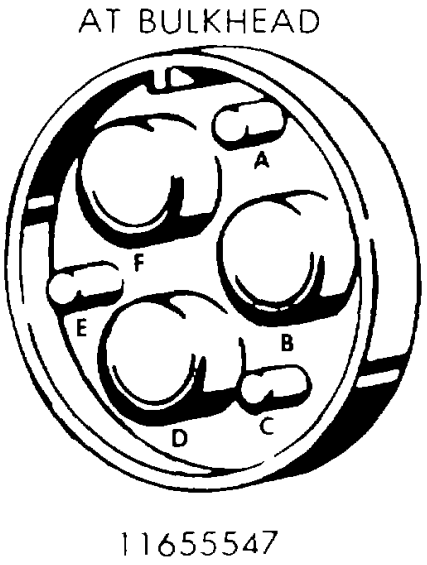
11673827

STEP 13

Perform resistance checks of the generator per chart 1.

a. If generator checks per chart 1, proceed to step 14.

b. If generator does not check per chart 1, proceed to step 18.



CAUTION

Prior to performing a resistance check of the generator, discharge the radio interference suppressor (REASON Voltage may be present because the suppressor is attached to Circuit 2 Damage to the multimeter could occur with the selector switch In the ohms position.) Use an insulated piece of wire, place one end on pin F or B and ground the other end of the wire to the vehicle chassis. This procedure may have to be repeated several times to completely drain the suppressor. Make a final voltage check, when no voltage is indicated it is safe to perform the resistance check.

CHART I

Use only the RX1 scale for these measurements.

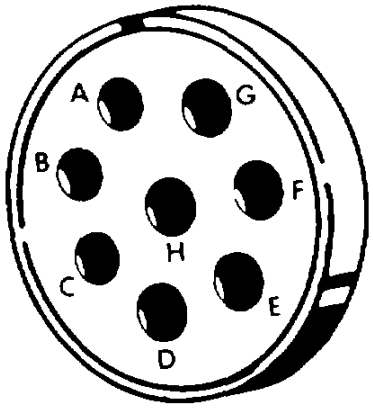
Generator Bulkhead Harness Connector	From (+)	To(-)	Resistance Ohms
11655547	GROUND	F (Circuit 2)	Infinite
11655547	F (Circuit 2)	GROUND	30-45
11655547	GROUND	B (Circuit 2)	Infinite
11655547	B (Circuit 2)	GROUND	30-45

STEP 14

Perform resistance checks per chart II

a. If generator checks per chart II, proceed to step 21.

b. If generator does not check per chart II, proceed to step 15



"T" HARNESS

CHART II

CAUTION

Use only the RX1 scale for these measurements.

Connector	From (+)	To(-)	Resistance Ohms
Test Harness	E (Circuit 1)	GROUND	1-3
Test Harness	B (Circuit 534)	GROUND	5-12
Test Harness	D (Circuit 533)	GROUND	12-15
Test Harness	GROUND	D (Circuit 533)	Infinite

STEP 15

Disconnect harness 11673835 from the bulkhead.

Perform resistance checks of the generator per chart III.

a. If generator checks per chart III, repair harness 11673835.

b. If generator does not check per chart III, proceed to step 16.

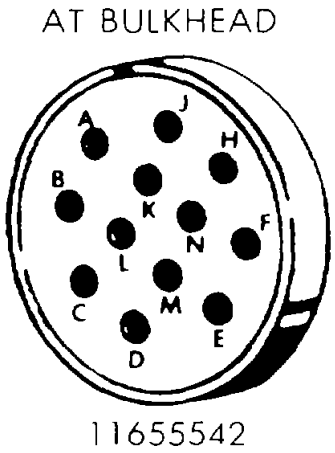


CHART III

CAUTION

Use only the RX1 scale for these measurements.

Bulkhead Engine Accessory Connector	From (+)	To(-)	Resistance Ohms
11655542	J (Circuit 1)	GROUND	1-3
11655542	L (Circuit 534)	GROUND	5-12
11655542	C (Circuit 533)	GROUND	12-15
11655542	GROUND	C (Circuit 533)	Infinite

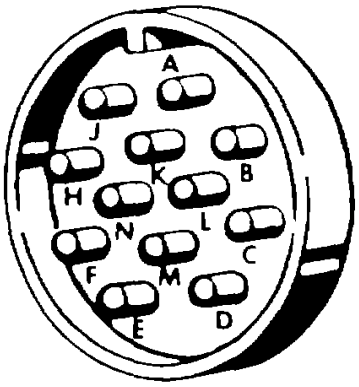
STEP 16

Disconnect harness 11655542 at the engine disconnect.

Perform resistance checks of the generator per chart IV (Checks should be made at the pin side of the connector.)

a. If generator checks per chart IV, repair harness 11655542.
b. If generator does not check per chart IV, proceed to step 17.

AT ENGINE DISCONNECT



11655456

CHART IV

Engine Disconnect Accessory Connector	From ('+)	To (-)	Resistance Ohms
11655456	J (Circuit 1)	GROUND	1-3
11655456	L (Circuit 534)	GROUND	5-12
11655456	C (Circuit 533)	GROUND	12-15
11655456	GROUND	C (Circuit 533)	Infinite

STEP 17

REMOVE POWERPLANT.

Disconnect harness 11655456 connectors from generator.

Perform continuity checks between harness 11 655456 connectors at generator and engine disconnect connector per chart V.

a. If continuity does not exist, repair harness 11655456

b. If continuity exists per chart V, generator is defective Replace generator.

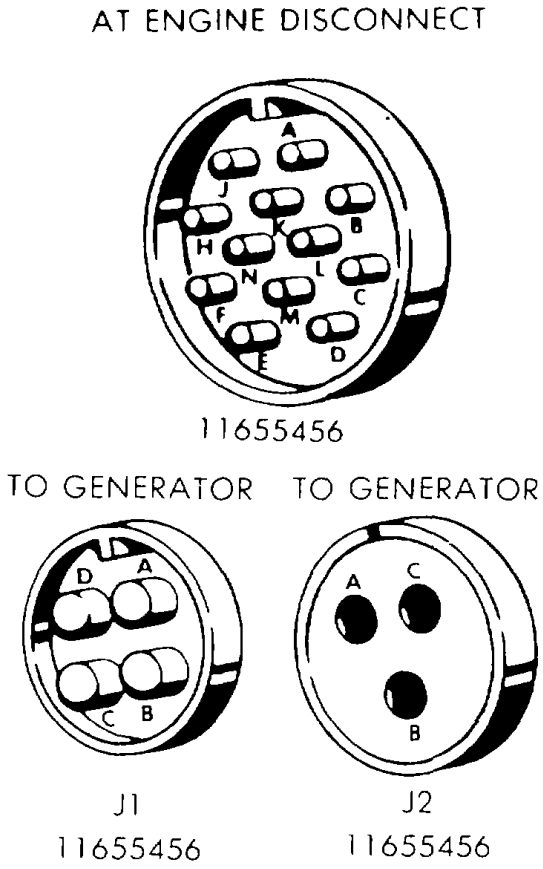


CHART V

Engine Disconnect Accessory Connector	From Pin	11655456 Connector	To Generator Connectors Pin/Socket
11655456	Pin J (Circuit 1)	Field (J2)	Socket C (Generator Top)
11655456	Pin L (Circuit 534)	AC (J1)	Pin B (Generator End)
11655456	Pin C (Circuit 533)	AC (J1)	Pin A (Generator End)

STEP 18

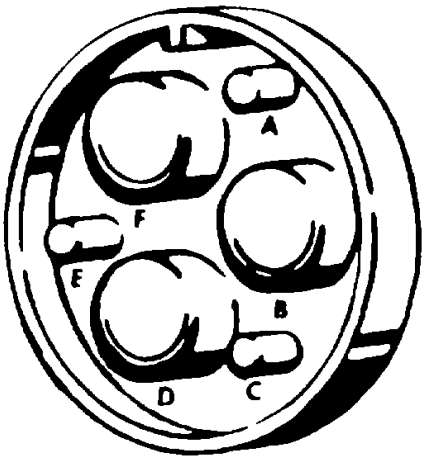
Disconnect harness 11655547 from engine disconnect.

Perform resistance checks of the generator per chart VI.

a. If generator checks per chart VI, repair harness 11655547.

b. If generator does not check per chart VI, proceed to step 19.

AT ENGINE DISCONNECT



11655451

CHART VI

CAUTION

Use only the RX1 scale for these measurements.

Engine Disconnect Harness Connector	From (+)	To (-)	Resistance Ohms
11655451	GROUND	D (Circuit 2)	Infinite
11655451	D (Circuit 2)	GROUND	30-45
11655451	GROUND	B (Circuit 2)	Infinite
11655451	B (Circuit 2)	GROUND	30-45

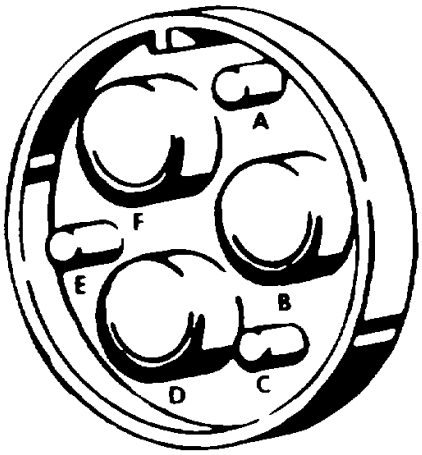
STEP 19

REMOVE POWERPLANT

Perform continuity checks between cable 11655451 connections at generator and engine disconnect connector per chart VII.

a. If continuity exists per chart VII, check resistance values across generator output block studs per chart VI If generator checks, go to step 20. If it does not check, replace generator.

AT ENGINE DISCONNECT



11655451

b. If continuity does not exist per chart VII, repair cable 11655451.

CHART VII

Disconnect Connector	From Pin/Socket	To Generator
11655451	Pin D (Circuit 2)	B-
11655451	Pin B (Circuit 21	B-

20

STEP 20

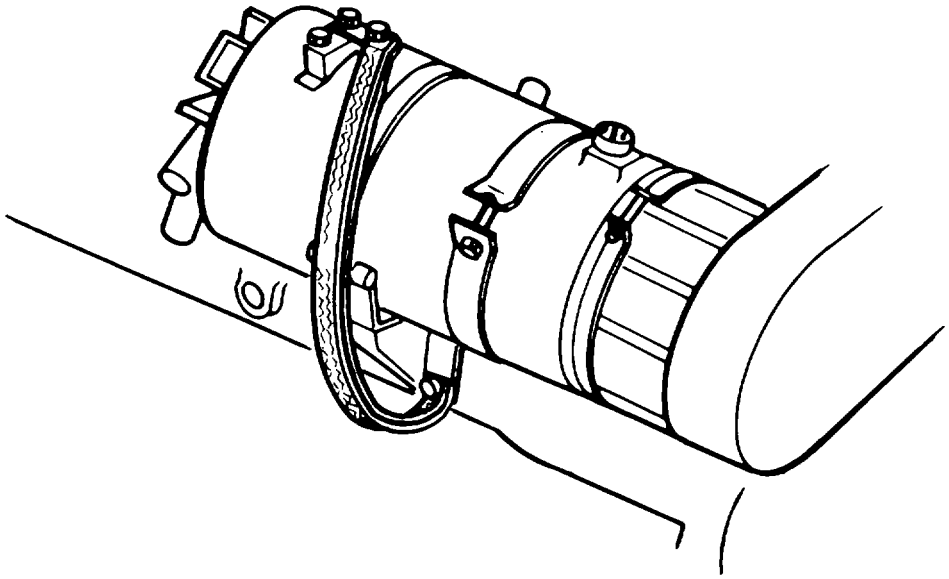
Perform continuity checks between both 11655470-1 strap connections at generator and GROUND.

a. If continuity exists, replace generator.

b. if continuity does not exist or a resistance is found, clean/repair both 11655470-1 straps.

CAUTION

Ensure that the test harness connector sockets do not come in contact with the vehicle or ground. The sockets contain battery voltage.



Make all necessary connections to install ground hop kit between engine and vehicle. Proceed to step 21.

STEP 21

Replace harnesses removed for the preceeding tests Connect three battery ground cable assemblies.

Connect "T" harness to the regulator.

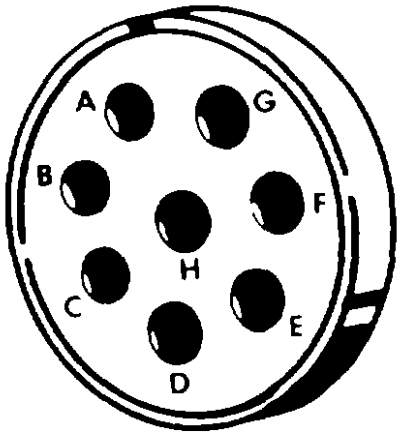
Place MASTER BATTERY switch to ON position.

Place FUEL PUMP switch to ON position.

Check the "T" harness for voltages per chart VIII.

a. If voltage exists per chart VIII, proceed to step 22.

b. If voltage does not exist at sockets E and C (GROUND), replace voltage regulator.



"T" HARNESS

CHART VIII

Voltage Connector	From (+)	To (-)	VDC
Test Harness	B	C (GROUND)	0
Test Harness	D	C (GROUND)	0
Test Harness	E	C (GROUND)	20 to 24
Test Harness	F	C (GROUND)	0

CAUTION

Prior to starting engine, verify that turret power is OFF to prevent accidental traversing of the turret. (TURRET POWER switch is located at gunner's station.)

STEP 22

Start engine Set Idle speed to 750 RPM Obtain minimum load by turning OFF all lights, ventilator blowers and radio equipment

Check voltages at the "T" harness per chart IX.

CAUTION

* This point must be measured on the AC scale of the meter.

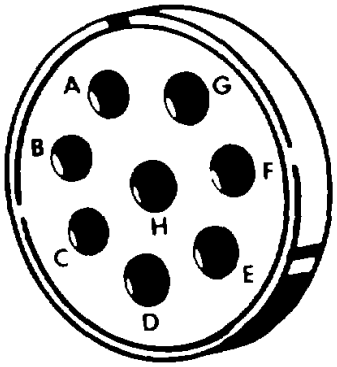
Set meter on applicable scale.

a. It voltage between A and C is not between 25-30 VDC, replace voltage regulator

b. If voltage between pins E and C is not between 1-5 VDC, replace the voltage regulator

c. If voltage between pins F and C is not between 24-29 VDC. replace the voltage regulator

d. If voltage between D and C is not between 10-20 VAC, * replace generator.



"T" HARNESS

CHART IX

Connector	From (+)	To (-)	Voltage
Test Harness	A	C (GROUND)	25-30 VDC
Test Harness	E	C (GROUND)	1-5 VDC
Test Harness	F	C (GROUND)	24-29 VDC
Test Harness	D	C (GROUND)	10-20 VAC*

III.SPECIAL INSTRUCTIONS FOR POTENTIOMETER ADJUSTMENT

1. If you have a regulator with serial number 0001 through 3879 and it does not have a 1/4" yellow stripe above the Bendix nameplate, follow these instructions to adjust the regulator current limit potentiometer:

a. Disconnect the regulator from the vehicle in the manner prescribed in TM 9-2350-257-20-1-3 and place the device on a clean, well lighted work bench.

b. Remove the base place from the regulator and carefully scrape away all conformal coating from potentiometer R18 (ref Fig. 3-3a). Turn the adjusting screw on potentiometer 25 complete turns (360) clockwise.

c. Reseal the potentiometer (R 18) with a sealing compound that conforms to MIL-1-46058 (kit NSN 5970-00- 181-0190).

2. Reinstall the base plate in the following manner

a. Coat both sides of the cover gasket with a thin layer of grease that con- forms to MIL-S-8660B, NSN 6850- 00-880-7616 (8 oz. tube).

b. Assemble the base plate to the regulator enclosure by replacing all screws and nuts, holding the screw heads and tightening all nuts until a snug fit is achieved.

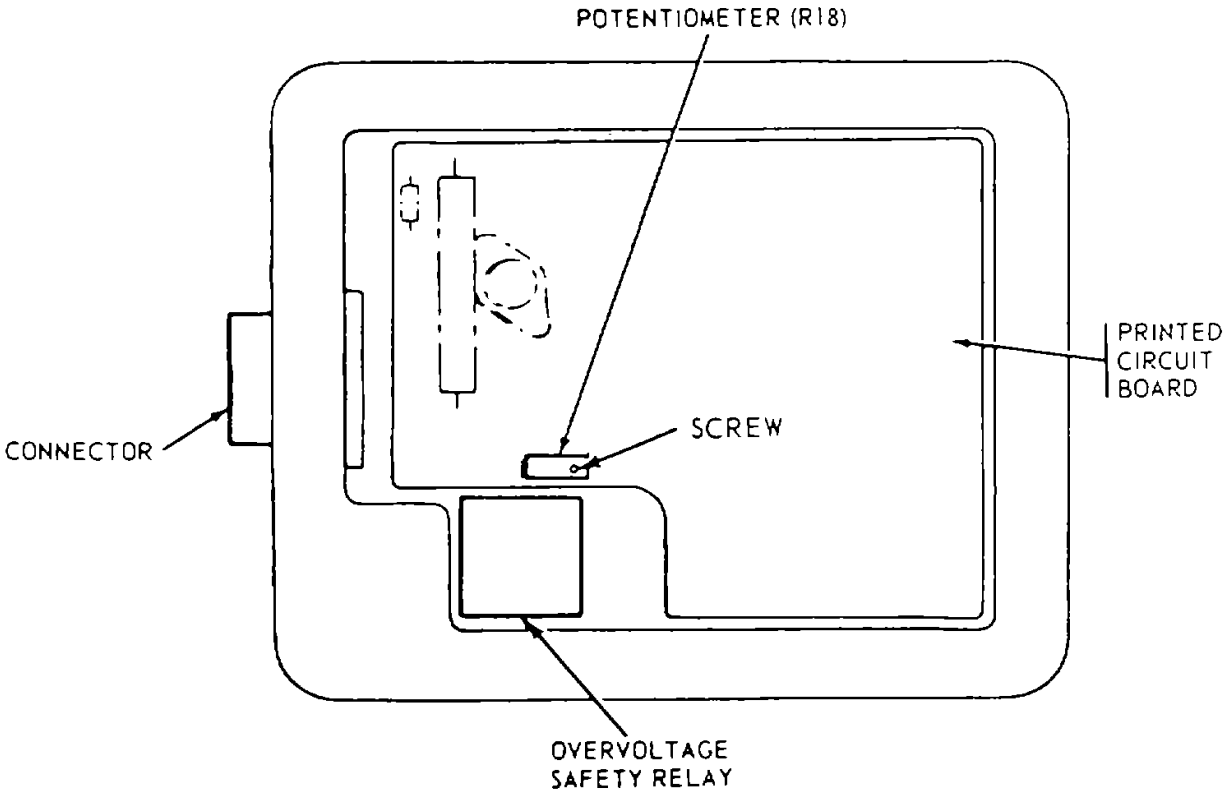
c Tighten all screws to the recommended torque (10-12 inch-pounds) in the following sequence:

4 corner screws
3 center screws
remaining screws

3 Regulator Identification

a. Apply a stripe of yellow paint or ink, approximately 1/4 inch wide x 3 inches long, on the housing directly above the Bendix nameplate for Identification.

b. Ink Marking Epoxy Base MIL-I- 43553, NSN 7510-00-145-0062 (1 oz), or NSN 7510-00-888-8526 (1 qt.)



REGULATOR WITH BASE PLATE REMOVED

APPENDIX A REFERENCES

Technical Manuals

TM 9-2350-257-20-1-1,
TM 9-2350-257-20-1-2,
TM 9-2350-257-20-1-3,
TM 9-2350-257-20-1-4

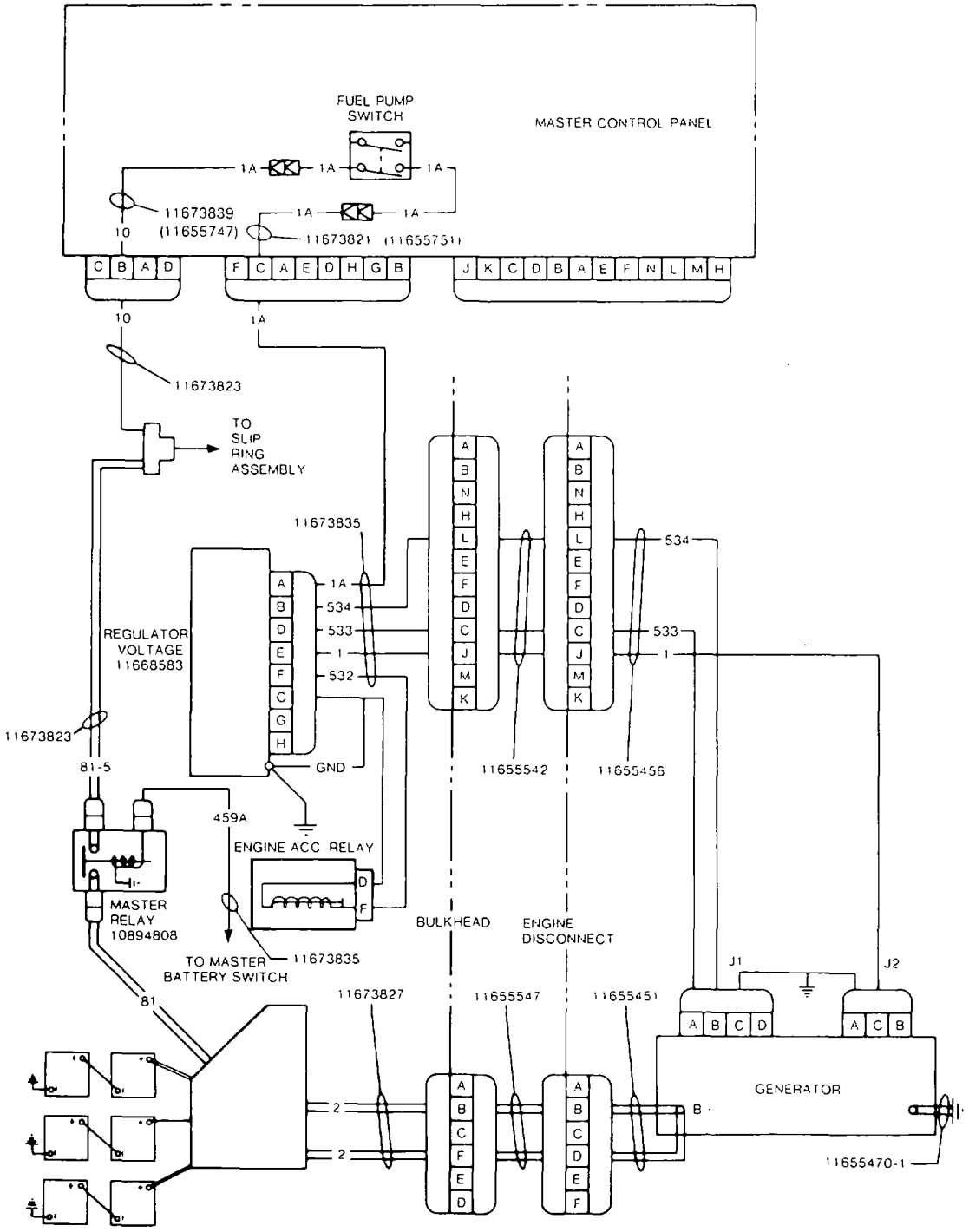
Organizational Maintenance Manual: Tank, Combat, Full-Tracked 105-MM Gun, M60A1 (Rise) (Hull) (NSN 2350-00-116-9765) and Tank, Combat, Full-Tracked, 105-MM Gun, M60A1 (Rise Passive) (Hull) (NSN 2350-01-059-1503).

TM 9-2350-257-20P-1

Organizational Maintenance Repair Parts and Special Tools List: Tank, Combat, Full-Tracked 105-MM Gun, M60A1 (Rise) (Hull) (NSN 2350-00-116-9765).

TM 38-750

The Army Maintenance Management System (TAMMS).



Generator/regulator circuit - schematic diagram.

By Order of the Secretary of the Army:

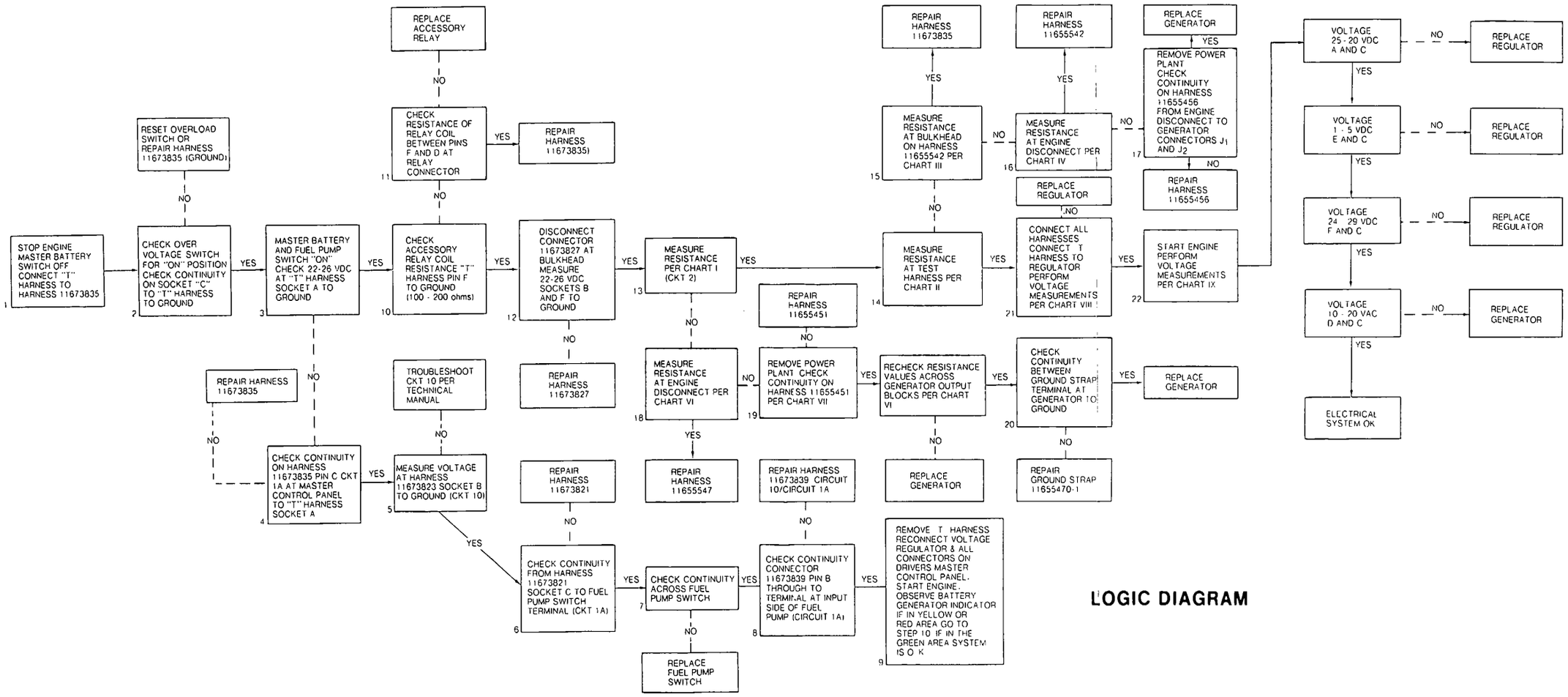
E.C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General United States Army
The Adjutant General

Distribution:

DA Form 12-37, Org Maint rqr for Tank cbt, Full Tracked 105mm Gun M60A1 (Rise).(Block 1065).



LOGIC DIAGRAM

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