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REPORT NO. 8A-80

OPERATION AND SERVICE INSTRUCTIONS

GAS TURBINE ENGINE TESTER ASSEMBLY

PART NO.

290270-1-1

290270-2-1

THE GARRETT CORPORATION

AIRESEARCH MANUFACTURING DIVISION

PHOENIX, ARIZONA

March 25, 1966

Revision 1, June 15, 1979

TO: HOLDERS OF GAS TURBINE ENGINE TESTER ASSEMBLY PART NO. 290270-1-1/-2-1  
OPERATION AND SERVICE INSTRUCTIONS MANUAL 8A-80 DATED MARCH 25, 1966

REVISION NO. 1 DATED JUNE 15, 1979

Due to the extent of the changes involved in this revision, this publication has been reprinted in its entirety. Please remove and discard all pages of prior issues and replace with Revision 1 dated June 15, 1979.

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HIGHLIGHTS

<u>Chapter/Section/Pages</u>	<u>Description of Change</u>
8A-80	
Title Page	Added revision date.
INTRODUCTION	
Page 1	Added coverage for Tester Part No. 290270-2-1. Added application for each tester.
Page 3	Changed page 3/4 to page 3.
Page 4	Added Table 2.
DESCRIPTION	
Page 5	Revised general description to define application of tachometer transfer switch.
Pages 6 and 7	Revised to define tester application for tachometer transfer switch.
Page 8	Changed title of Figure 2-1.
OPERATING PROCEDURES	
Pages 9 and 11	Added use of Tester Part No. 290270-2-1 to procedures.
PERIODIC INSPECTION	
Page 14	Corrected error in electrical schematic.
Page 14A/14B	Added Figure 4-1A, electrical schematic for Tester Part No. 290270-2-1.
MAINTENANCE	
Page 16	Added Figure 5-1 for tester parts identification.
Pages 17 through 20	Completely revised parts list to latest configuration.

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SECTION I  
INTRODUCTION

1-1. IDENTIFICATION.

1-2. This publication comprises the operation and service instructions for a Gas Turbine Engine Tester Assembly (hereinafter referred to as a Tester) Part No. 290270-1-1/-2-1, manufactured by The Garrett Corporation, AiResearch Manufacturing Division, Phoenix, Arizona.

1-3. PURPOSE AND LEADING PARTICULARS.

1-4. The Tester is used for operational testing and trouble shooting of a gas turbine engine. The Tester is portable and is designed to check and monitor operation of the engine under various operating conditions which occur during the normal operation of the engine. A branched electrical special purpose cable assembly, hereinafter referred to as the cable assembly, is required for connecting the Tester to the gas turbine engine's electrical system. (See figure 1-1.)

1-5. The 290270-1-1 tester is required to test Gas Turbine Engines equipped with Mechanical Speed Switch and the 290270-2-1 tester is required to test Gas Turbine Engines with Electronic Speed Switch.

TABLE I. LEADING PARTICULARS

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PHYSICAL CHARACTERISTICS

Type ..... Portable  
 Overall Dimensions ..... 9.0 x 13.0 x 14.0 inches  
 Weight ..... 30.0 LBS (APPROX)

ELECTRICAL REQUIREMENTS

DC Power Supply ..... 28 volts

ELECTRICAL INSTRUMENTS

DC Voltmeter ..... 0 to 30 Volts  
 Tachometer Indicator ..... Percent of RPM  
 Exhaust Temperature Indicator ..... 0° to 1000°C  
 Oil Temperature Indicator ..... 50° to 150°C

PNEUMATIC INSTRUMENTS

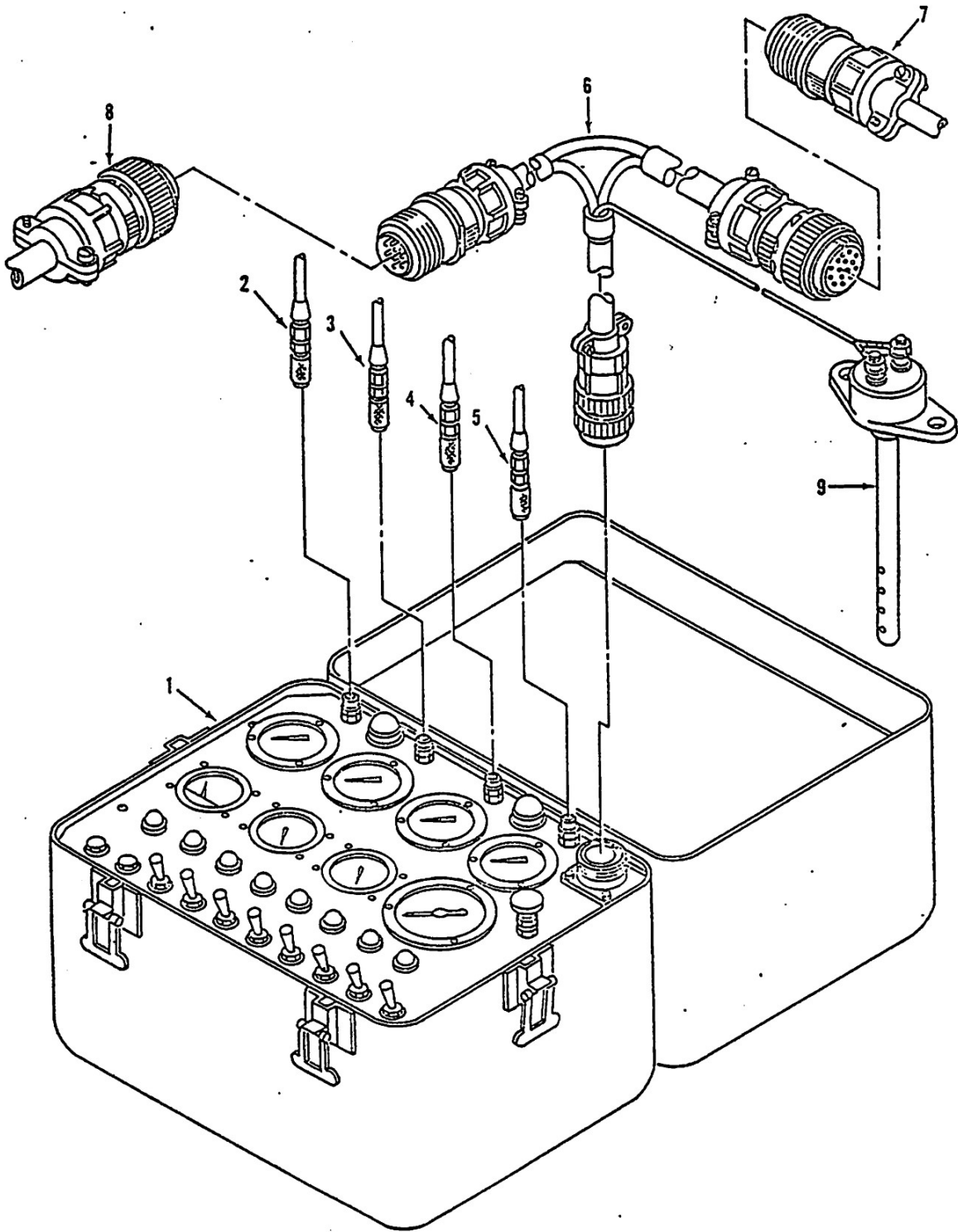
Control Air Pressure Gage ..... 0 to 60 PSI

FUEL AND HYDRAULIC INSTRUMENTS

Lo-Fuel Pressure Gage ..... 0 to 30 PSI  
 Hi-Fuel Pressure Gage ..... 0 to 400 PSI  
 Oil Pressure Gage ..... 0 to 100 PSI

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Figure 1-1. Typical Gas Turbine Engine Tester Assembly Connections

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◆ KEY TO FIGURE 1-1

1. INSTRUMENT CASE AND PANEL
2. FUEL PUMP INLET HOSE
3. FUEL PUMP DISCHARGE PRESSURE HOSE
4. OIL PRESSURE HOSE
5. FUEL GOVERNOR CONTROL AIR PRESSURE HOSE
6. TYPICAL CABLE ASSEMBLY (CUSTOMER PROCURED)
7. ENGINE WIRING HARNESS CONNECTOR
8. REMOTE CABLE ASSEMBLY RECEPTACLE
9. TYPICAL ENGINE EXHAUST GAS THERMOCOUPLE

SECTION II  
DESCRIPTION

2-1. GENERAL DESCRIPTION.

2-2. The Tester consists basically of the following major components: fuel pressure gages, oil pressure gage, control air pressure gage, fuel, oil, and control air pressure hose assemblies, control bleed air valve, tachometer indicator, exhaust temperature indicator, oil temperature indicator, dc voltmeter, lo-oil light, starter light, 10% light, external fuel light, ignition light, ready to load light, load light, overspeed light, panel lights, power switch, rotate-run switch, start switch, tachometer transfer switch (PN 290270-1-1 only), panel light switch, oil temperature switch, EGT transfer switch, load switch, overspeed switch, ground check and 95% check switch, and instrument panel enclosed in a metal portable carrying case.

2-3. MAJOR COMPONENTS.

2-4. The function of the major components of the Tester are described as follows. (See figure 2-1.)

HI-FUEL pressure gage (2) is used to indicate operating fuel pressure of engine.

LO-FUEL pressure gage (5) is used to indicate inlet fuel pressure from remote fuel boost pump.

OIL pressure gage (8) is used to indicate operating oil pressure of engine.

CONTROL AIR pressure gage (12) is used to indicate operating control air pressure of engine.

Fuel pressure hose assemblies (3,6), oil pressure hose assembly (9), and control air pressure hose assembly (11) are used to connect the Tester to the engine test ports.

CONTROL BLEED air valve (14) is used to vary control air pressure to the fuel control, thereby simulating thermostat actuation during engine exhaust overtemperature condition.

Tachometer indicator (15) shows turbine speed in percent of RPM.

Exhaust temperature indicator (7) is used to indicate turbine exhaust gas temperature of engine.

Oil temperature indicator (35) shows oil temperature of engine while engine is running.

DC voltmeter (34) is used for measuring direct current remote electrical power.

TABLE 2. GSE TESTER/CABLE APPLICATION

ENGINE	A/C MODEL	SW. TYPE	CABLE/KIT	TESTER
GTCP36-4, -4A	F-28	MECH S/S	290272-1-1	290270-1-1
GTCP30-95, -121, -121A, -141	CONVAIR 240, DART 600	MECH S/S	290276-2-1	290270-1-1
GTP30-95, -141 (121A ON 640)	CONVAIR 340/440, DART 640	MECH S/S	290276-2-1	290270-1-1
GTCP85-98D	DC9	MECH S/S	290307 (290210-1-1 KIT)	290270-1-1
GTCP36-6	GULFSTREAM II	MECH S/S	290390-1-1	290270-1-1
GTCP36-16	YS11	MECH S/S	290390-1-1	290270-1-1
GTCP85-98	727-100	MECH S/S	293132-1 KIT	290270-1-1
GTCP85-129	B737	MECH S/S	290343 (290419-1-1 KIT)	290270-1-1
GTCP30-142C	HFB320, HANSA JET	MECH S/S	290443-1 KIT	290270-1-1
GTCP30-142F	NORTHROP A9	MECH S/S	291239-1	290270-1-1
GTCP36-28	VFW614	MECH S/S	293148-1	290270-1-1
GTCP36-16A	G222	MECH S/S	293704-1	290270-1-1
GTCP85-98, C, CK	B-727	ELECT S/S	294131-1	290270-2-1
GTCP85-129	B-737	ELECT S/S	294110-1	290270-2-1
GTCP85-98D	DC9	ELECT S/S	UNASSIGNED	290270-2-1

LO-OIL pressure light (17) indicates when engine oil pressure is below pre-determined value.

STARTER light (19) indicates when power is provided to a remote starter solenoid.

10% light (21) indicated when engine turbine speed is less than 10% RPM.

EXT FUEL light (23) indicates when power is available to remote fuel supply.

IGN light (26) indicates when power is available to engine ignition coil.

READY TO LOAD light (28) indicates when engine 95% speed switch actuates and engine is ready for load.

LOAD light (30) indicates when load switch (29) is on and engine electrical system has power to load solenoid.

O.S. light (33) indicates when engine overspeed switch actuates.

Panel lights (4, 10) are used to illuminate Tester instrument panel.

POWER switch (16) is used to energize and de-energize the Tester and engine power circuit.

ROTATE-RUN switch (18) is used in the RUN position to start and operate engine. In the Rotate position, it is used to motor rotate the engine without starting.

START switch (20) is used to energize circuit for starting engine.

TACH TRANS switch (22) is used to transfer speed indication from Tester tachometer-indicator (15) to remote tachometer-indicator. (Component of PN 290270-1-1 only.)

PANEL LIGHT switch (24) is used to provide power to panel illumination lights (4, 10).

OIL TEMP switch (25) is used to provide power to Tester oil temperature indicator (35) and transfer engine oil temperature indication to remote indicator.

EGT TRANS switch (27) is used to transfer engine exhaust gas temperature indication from Tester exhaust temperature indicator (7) to remote exhaust temperature indicator.

LOAD switch (20) is used to actuate the engine load solenoid.

O.S. switch (31) is used to provide power to electrically simulate an engine overspeed condition to stop the engine.

GRD CHK - 95% CHK switch (32) when in the 95% CHK position, is used to locate a malfunction in the loading circuit of the engine. When in the GRD CHK position, it is used to determine remote flight ground relay position.

2-5. AUXILIARY EQUIPMENT.

2-6. A customer procured cable assembly is required for connecting the Tester to a gas turbine engine electrical system and a remote electrical system.

2-7. A typical cable assembly consists of a branched electrical wiring harness with electrical connectors. (See 6, figure 1-1.)

KEY TO FIGURE 2-1

- |                                      |   |
|--------------------------------------|---|
| 1. INSTRUMENT PANEL                  | 20. START SWITCH                              |
| 2. HI-FUEL PRESSURE GAGE             | 21. 10% LIGHT                                 |
| 3. HI-FUEL HOSE ASSEMBLY (Not shown) | 22. TACH TRANS SWITCH<br>(PN 290270-1-1 only) |
| 4. PANEL LIGHT                       | 23. EXT FUEL LIGHT                            |
| 5. LO-FUEL PRESSURE GAGE             | 24. PANEL LIGHT SWITCH                        |
| 6. LO-FUEL HOSE ASSEMBLY (Not shown) | 25. OIL TEMP INDICATOR SWITCH                 |
| 7. EXH TEMP INDICATOR                | 26. IGN LIGHT                                 |
| 8. OIL PRESSURE GAGE                 | 27. EGT TRANS SWITCH                          |
| 9. OIL HOSE ASSEMBLY (Not shown)     | 28. READY TO LOAD LIGHT                       |
| 10. PANEL LIGHT                      | 29. LOAD SWITCH                               |
| 11. AIR HOSE ASSEMBLY (Not shown)    | 30. LOAD LIGHT                                |
| 12. CONTROL AIR PRESSURE GAGE        | 31. O.S. SWITCH                               |
| 13. CABLE ASSEMBLY RECEPTACLE        | 32. GRD CHK 95% CHK SWITCH                    |
| 14. CONTROL BLEED AIR VALVE          | 33. O.S. LIGHT                                |
| 15. TACHOMETER-INDICATOR             | 34. DC VOLTMETER                              |
| 16. POWER SWITCH                     | 35. OIL TEMPERATURE INDICATOR                 |
| 17. LO-OIL PRESSURE LIGHT            | 36. CAP                                       |
| 18. ROTATE-RUN SWITCH                | 37. NUT                                       |
| 19. STARTER LIGHT                    | 38. HALF COUPLING                             |

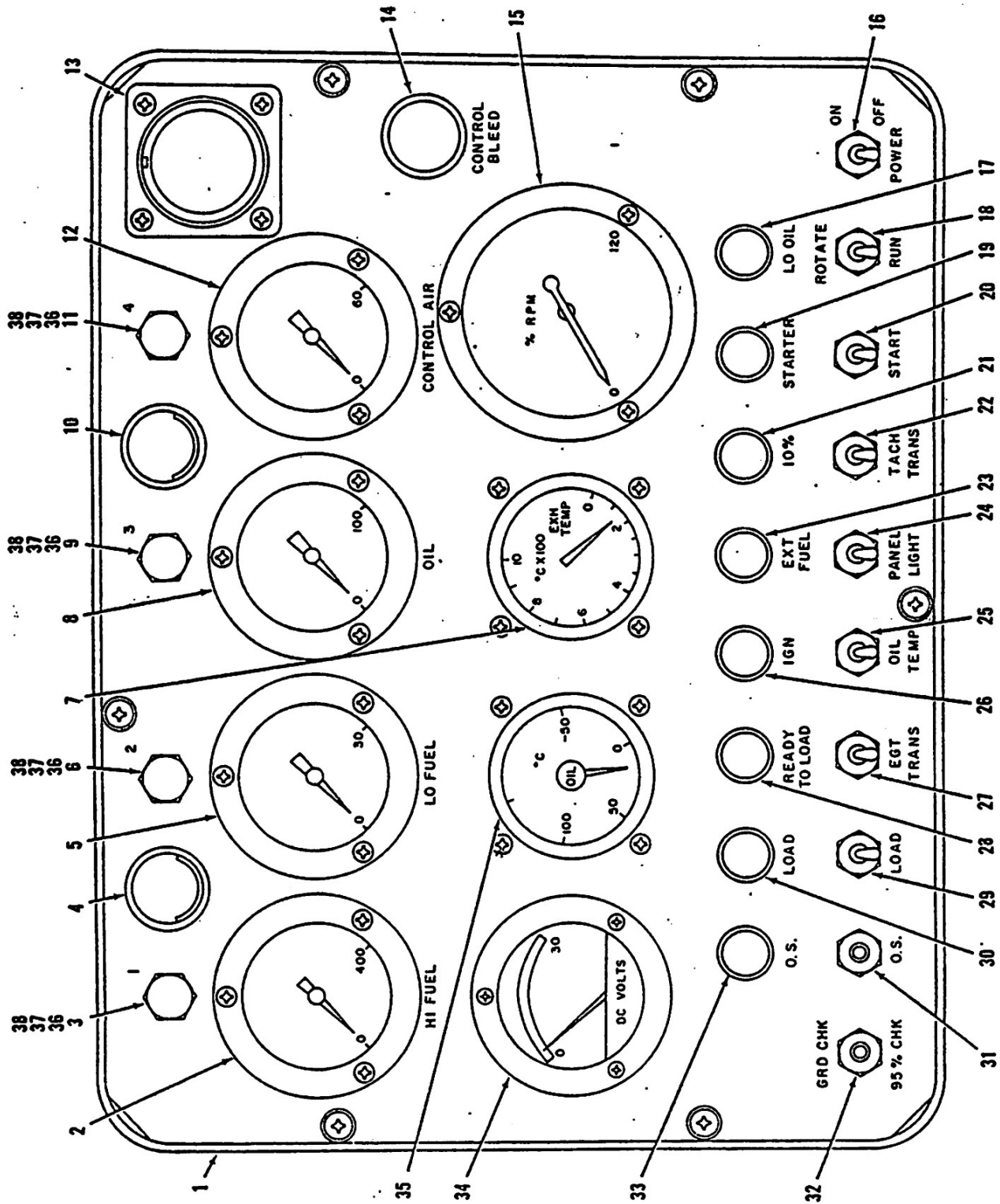


Figure 2-1. Typical Gas Turbine Engine Tester Assembly Panel

SECTION III  
OPERATING PROCEDURES

3-1. GENERAL.

3-2. In general, operating procedures will be determined by the type of gas turbine engine to be tested and the tests to be performed. A thorough understanding of the purpose and function of the major components of the Tester as described in Section II will enable the technician to competently operate the Tester. Reference should be made to the applicable service manual instructions for the particular engine to be tested in order to determine proper test procedures and test values required.

CAUTION

The following information on how to connect and operate the Tester is a typical example on how the Tester can be used. The applicable service manual for each engine to be tested must be consulted prior to testing any gas turbine engine, otherwise serious damage to the engine may result. Values referred to in the text are typical only.

3-3. TESTER CONNECTING PROCEDURES.

3-4. Prior to operating an engine with the 290270-1-1/-2-1 Tester, the following procedures must be accomplished.

a. Remove remote cable assembly receptacle from engine wiring harness connector. Connect a typical cable assembly to Tester, engine and remote customer connection as follows.

(1) Install connector marked "Cable Assy to Tester" in Tester receptacle. (See figure 1-1.)

(2) Install receptacle marked "To Engine Conn." in engine wiring harness connector (7, figure 1-1).

(3) Install connector marked "To Customer Conn." in remote cable assembly receptacle (8, figure 1-1).

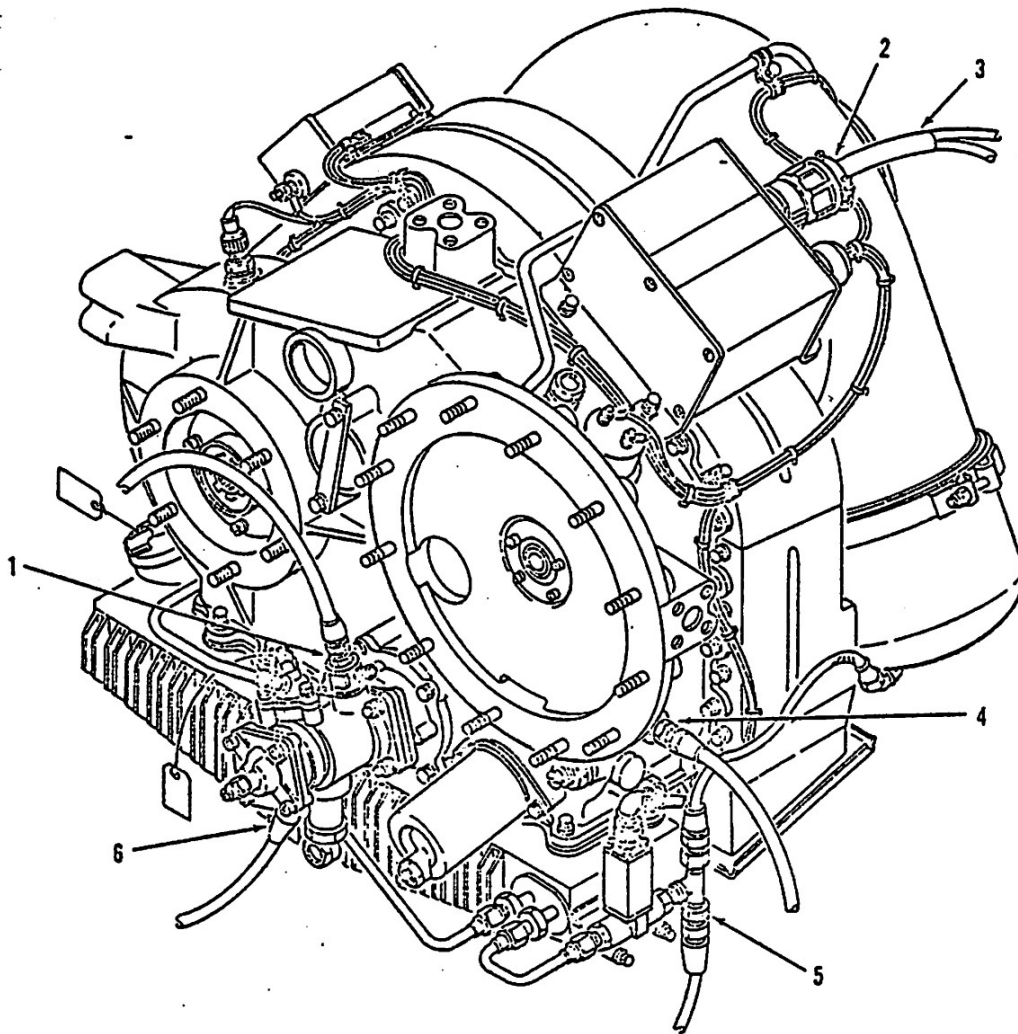
b. Connect fuel, oil and air hose assemblies as follows.

(1) Remove cap from ports (1,5, figure 3-1). Install fuel pump inlet hose (2, figure 1-1) to port (1, figure 3-1). Install fuel pump discharge pressure hose (3, figure 1-1) to port (5, figure 3-1).

(2) Remove cap from port (6, figure 3-1). Install air pressure hose (5, figure 1-1) from Tester to port (6, figure 3-1).

(3) Remove cap from port (4, figure 3-1). Install oil pressure hose (4, figure 1-1) from Tester to port (4, figure 3-1).





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1. FUEL PUMP INLET PORT
2. CABLE ASSEMBLY (TO ENGINE CONNECTOR)
3. CABLE ASSEMBLY (FROM TESTER)
4. OIL PRESSURE PORT
5. FUEL PUMP DISCHARGE PRESSURE PORT
6. FUEL GOVERNOR CONTROL AIR PRESSURE PORT

Figure 3-1. Typical Tester to Gas Turbine Connections

3-5. TESTER OPERATING PROCEDURES.

3-6. The operation of a gas turbine engine may be checked using 290270-1-1/-2-1 Tester as follows. (See figure 2-1.)

WARNING

When checking operation of an engine, all personnel must stand clear of the planes of rotation of engine compressor, turbine wheels and high temperature exhaust duct.

- a. Place power switch (16) in ON position.
- b. Place rotate-run switch (18) in RUN position.
- c. Actuate panel light switch (24) if illumination from panel lights (4,10) is desired.

CAUTION

Energize oil temp indicator switch only if engine has oil temperature bulb connected to Tester to prevent damage to oil temperature indicator circuit in Tester.

- d. Place all other switches down or in de-energized position except O.S. switch (31) and GRD-CHK-95% CHK switch (32) which must be in center position to be de-energized.

Note

If engine being tested is installed in an aircraft, refer to applicable section of aircraft manual for procedures necessary to place aircraft equipment and systems in a safe and operable condition.

- e. Energize start switch (20). The engine shall start and accelerate to NO-LOAD governed speed automatically.

CAUTION

Stop engine immediately by placing the power switch (16) in OFF position, if any of the following conditions occur: ignition failure (flameout), IGN light (26) fails to come on at approximately 10% speed and starter light fails to go off at a predetermined starter cutout speed, exhaust gas temperature excessive during acceleration steady-state operating condition, excessive turbine wheel speed. (Refer to applicable service manual on engine to be tested for correct engine speed, and temperature limits.

f. As engine accelerates, observe that LO-OIL pressure light (17) is on only until a predetermined oil pressure value is obtained. (Refer to applicable service manual on engine being tested for true values.)

g. Observe that starter light (18) will remain on until starter cutout speed is obtained. (Refer to applicable service manual on engine being tested for true values.)

h. Observe that 10% light (21) will remain on only until approximately 10 percent speed is obtained. (Refer to applicable service manual on engine being tested for true values.)

i. Observe that the EXT fuel light (23) will remain on at all times during engine operation.

j. Observe that the IGN light (26) will come on at approximately 10 percent speed and go off at approximately 95 percent speed. (Refer to applicable service manual on engine being tested for true values.)

k. Observe that the ready to load light (28) will come on at approximately 95-percent speed. (Refer to applicable service manual on engine being tested for true values.)

l. Load engine as follows. Actuate load switch (29), load light (30) will come on indicating circuit is complete and power is applied to engine load solenoid.

m. If load light (30) does not come on or load cannot be applied to engine when load switch (29) is actuated, place GRD-CHK-95% CHK switch (32) in 95% CHK position. The 10% light (21) must come on to determine if load circuit is complete.

---

n. Place GRD-CHK-95% CHK switch (32) in GRD CHK position. The O.S. light (33) must come on to indicate correct position of remote flight/ground relay.

---

o. Operate control bleed air valve (14) to apply air to engine fuel control simulating thermostat actuation during engine exhaust overtemperature condition.

p. Stop engine as follows. De-energize load switch (29), allow engine to operate for approximately one minute at no-load, then place power switch (16) in OFF position or energize O.S. switch (31). The O.S. light (33) will come on to indicate power is provided from the engine overspeed circuit to the tested circuit to electrically simulate an overspeed condition thereby stopping the engine.

#### Note

The engine will also stop and the O.S. light (33) will come on when engine overspeed is obtained.

q. If it is desired to rotate engine without benefit of ignition or fuel, place rotate-run switch (18) in ROTATE position and power switch (16) in ON position. (Refer to applicable service manual on engine being tested for procedure pertaining to engine rotation.)

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SECTION IV  
PERIODIC INSPECTION

4-1. PRE-OPERATION INSPECTION.

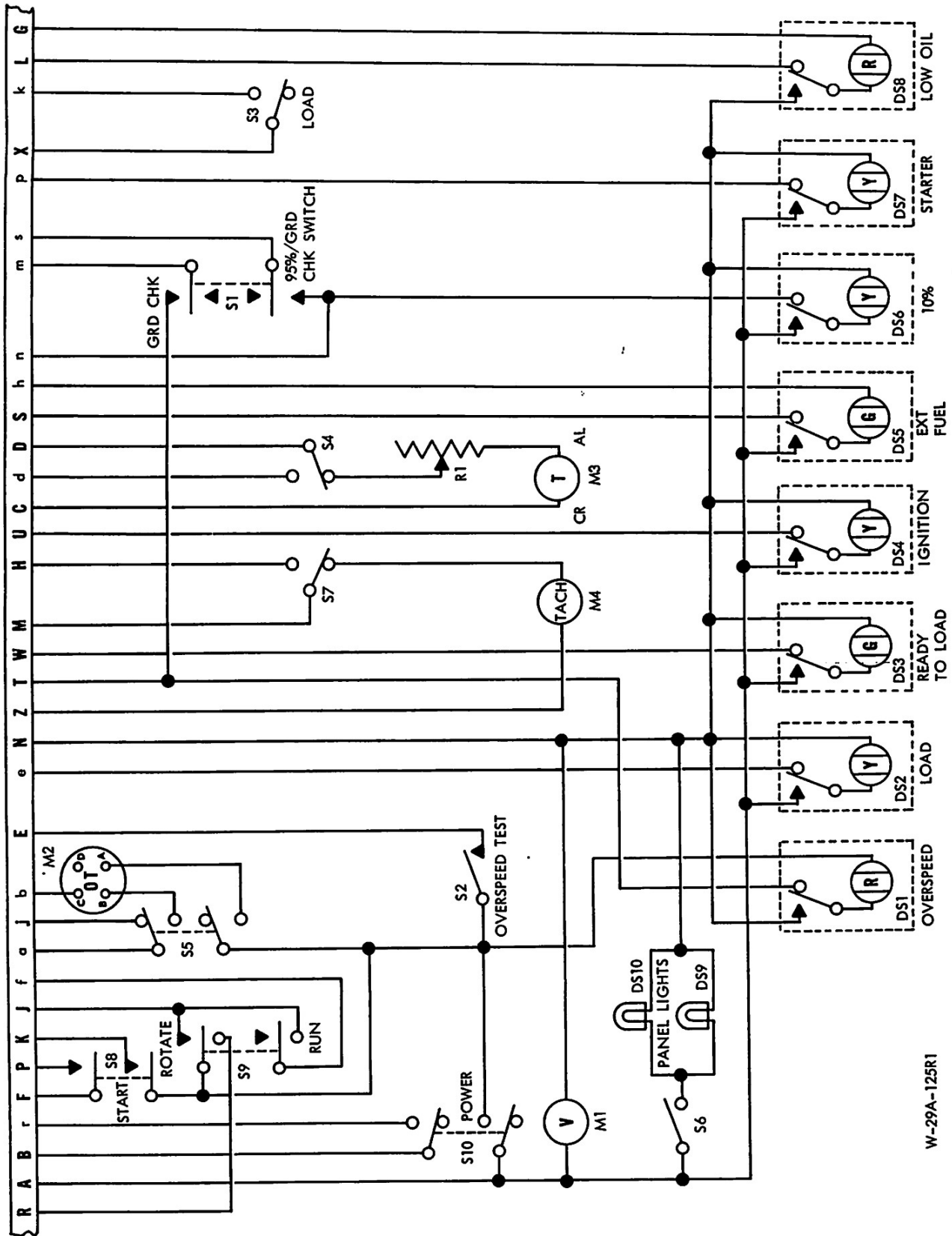
4-2. Prior to operating the tester, the following inspection procedures must be accomplished.

- a. Check that all wiring and hose connections are in proper positions.
- b. Check that all test connections are properly and securely installed.
- c. Check that load switch (29, figure 2-1) is in the "OFF" position prior to starting engine.
- d. Check for stuck needles and broken glass on dials of the indicators on Tester panel.

4-3. THIRTY-DAY INSPECTION.

4-4. Every 30 days, the following inspection must be accomplished:

- a. Check all parts visually for obvious wear or damage.
- b. Check plumbing for evidence of leakage.
- c. Check that electrical wiring is free of frayed insulation, broken wires, defective or loose terminals, corrosion, and electrical short circuits. (See figure 4-1, Electrical Schematic of Tester).
- d. Check action of all switches.
- e. Check all indicator light assemblies for defective or burned out lamps.
- f. Check calibration of all instrumentation. Refer to Section V for calibration information.
- g. Check that all fuel, oil, and pneumatic lines and fittings are in good condition.
- h. Check that all fittings are properly tightened.



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Figure 4-1. Electrical Schematic of Tester PN 290270-1-1

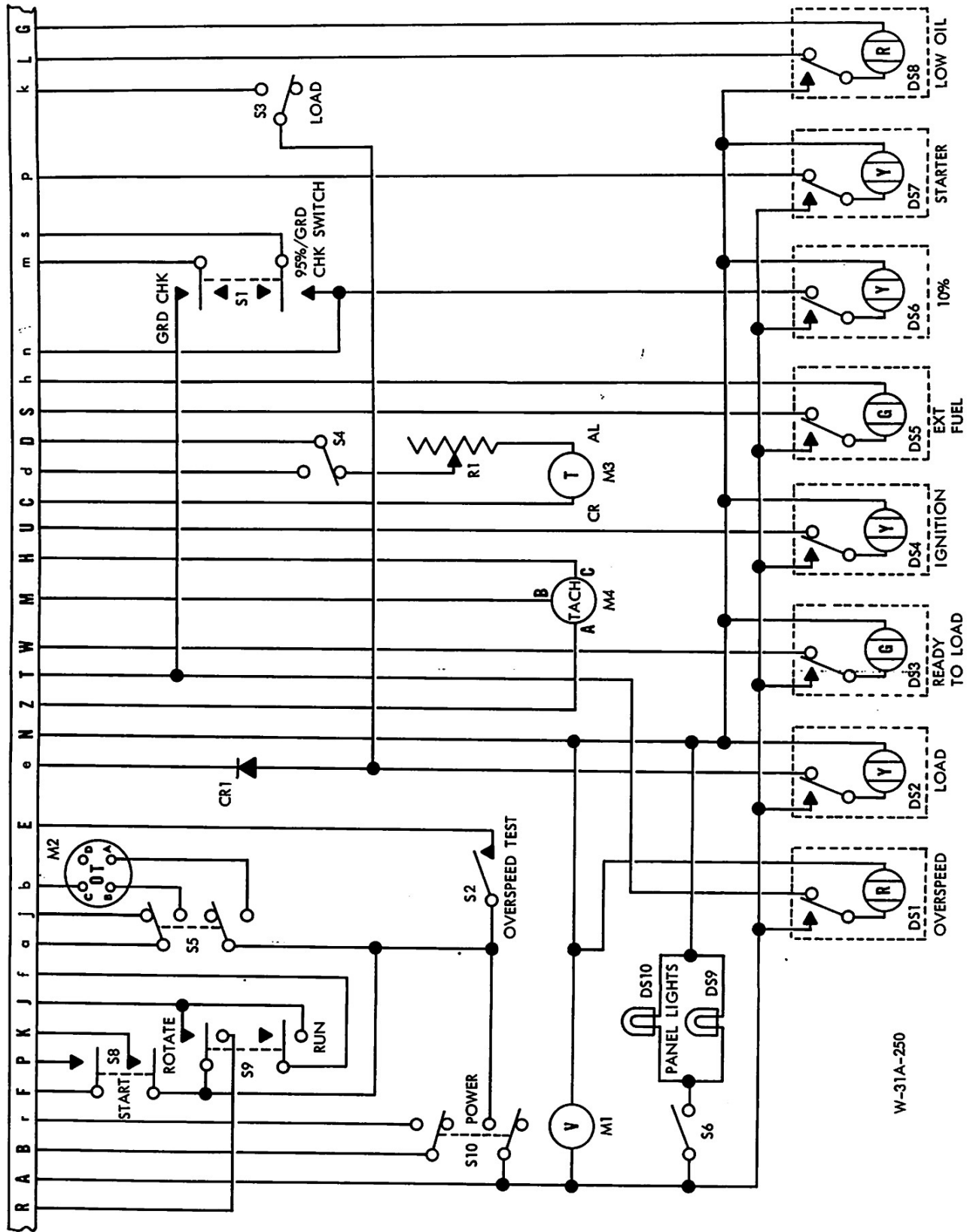


Figure 4-1A. Electrical Schematic of Tester PN 290270-2-1

SECTION V  
MAINTENANCE

5-1. CALIBRATION CHECKS.

5-2. The calibration of all Tester pressure gages may be checked by connecting certified test instruments in parallel with Tester instrument and comparing indications through full instrument range.

Note

Calibration checks and procedures should be accomplished in accordance with good instrument shop practice. Refer to applicable manufacturing publication for repair and calibration instructions for individual instruments.

5-3. At initial use of Tester, the exhaust temperature electrical loop resistance must be checked as follows.

a. Remove Tester panel attaching screws and lift panel to obtain access to temperature indicating circuit components.

b. Tag and disconnect lead wires from exhaust temperature indicator terminals on rear of instrument panel to remove indicator from loop.

c. Using a Model 1432U decade resistance box (General Radio Co, Cambridge, Massachusetts) having an accuracy of  $\pm 0.05$ -percent, check total resistance of circuit between exhaust temperature indicator and typical exhaust gas thermocouple. Electrical resistance shall be  $8.0 \pm 0.35$  ohms. If total resistance is not within specified limit, adjust slide of variable resistor in Tester to obtain correct resistance.

CAUTION

When checking total resistance, be sure that resistance is measured through customer-furnished cable assembly and typical exhaust gas thermocouple.

d. Remove decade resistance box, attach lead wires, and replace panel of Tester, using previously removed screws.

5-4. TROUBLE SHOOTING.

5-5. Trouble is isolated to a particular component which fails to operate properly and the failure is generally obvious as to source. Component failures should be thoroughly investigated to eliminate the possibility that malfunction was not caused by faulty operating procedures or bad connections.

5-6. REPAIR AND REPLACEMENT.

5-7. Repair and replacement procedures consist of replacement of defective components, repair or replacement of plumbing, wiring, and replacement of standard parts such as nuts, bolts, gaskets, washers, etc. All repair and replacement procedures should be accomplished in accordance with good shop practice. Refer to Table II, List of Replacement Parts, for parts that are replaceable. Reference should be made to the applicable manufacturer's instructions for repair and replacement of parts within individual components.

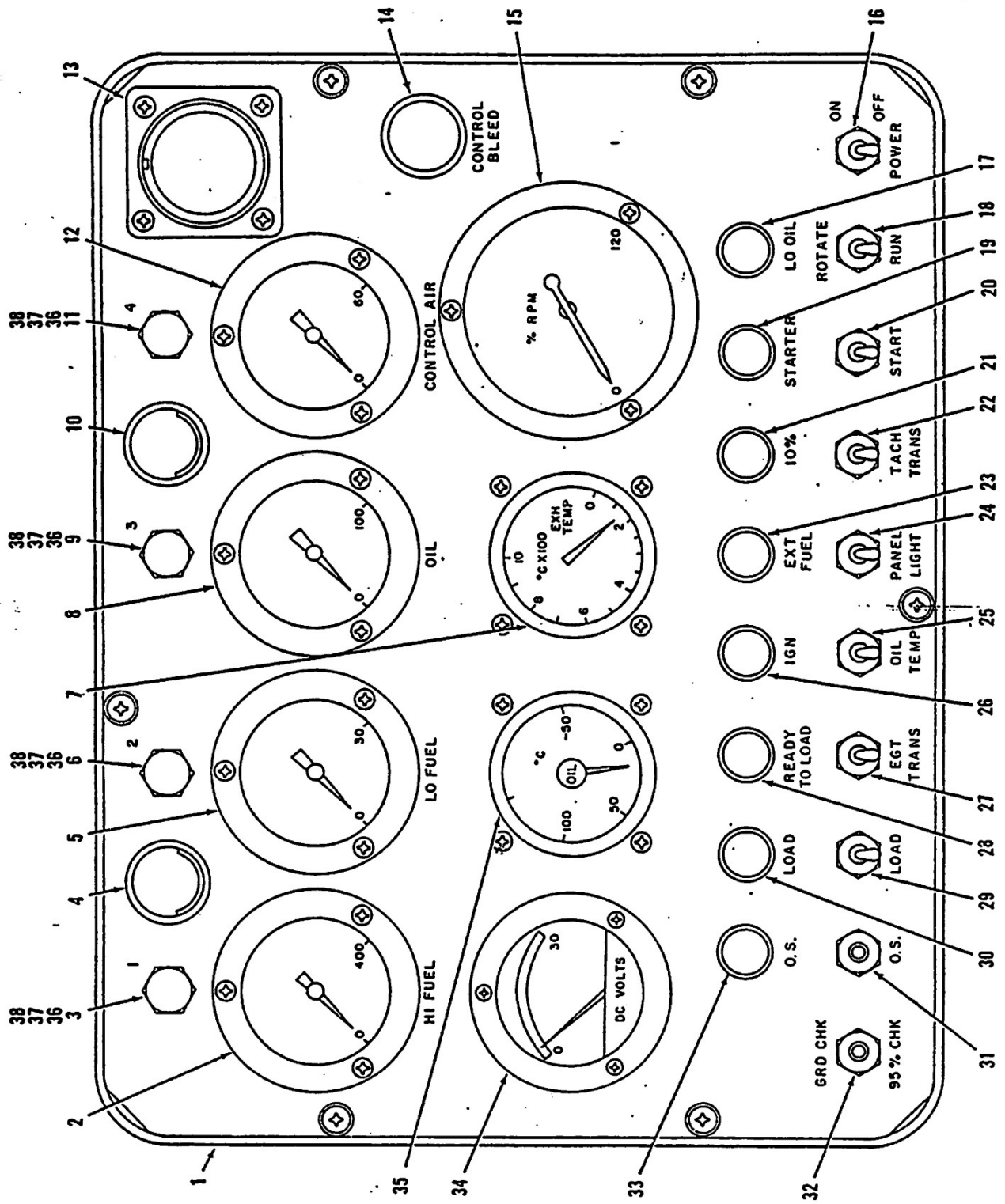


Figure 5-1. GTE Tester Parts Identification



## KEY TO FIGURE 5-1

INDEX NO.	PART NO.	NOMENCLATURE	MANUFACTURER
1	283616-1	Instrument Panel (290270-1-1 only)	AiResearch MFG CO, Phoenix, AZ
	295080-1	Instrument Panel (290270-2-1 only)	AiResearch MFG CO, Phoenix, AZ
2	361-521-9014	Hi-Fuel Press Gage	AiResearch MFG CO, Phoenix, AZ
3	283618-4	Hi-Fuel Hose Assembly	AiResearch MFG CO, Phoenix, AZ
4, 10	469-502-9003	Light Assembly (Use 462-501-9002 Incandescent Lamp)	AiResearch MFG CO, Phoenix, AZ
5	361-521-9001	Lo-Fuel Press Gage	AiResearch MFG CO, Phoenix, AZ
6	283618-3	Lo-Fuel Hose Assembly	AiResearch MFG CO, Phoenix, AZ
7	MJ2 Class 2	EGT Indicator	AiResearch MFG CO, Phoenix, AZ
8	361-521-9004	Oil Pressure Gage	AiResearch MFG CO, Phoenix, AZ
9	283618-2	Oil Press Hose Assembly	AiResearch MFG CO, Phoenix, AZ
11	283618-1	Air Hose Assembly	AiResearch MFG CO, Phoenix, AZ
12	361-521-9002	Control Air Press Gage	AiResearch MFG CO, Phoenix, AZ
13	MS3102R28-21P	Connector	
14	771-563-9101	Control Bleed Air Valve	AiResearch MFG CO, Phoenix, AZ
15	303298-5	Tachometer Ind (290270-1-1 only)	AiResearch MFG CO, Phoenix, AZ
	MU-1	Tachometer Ind (290270-2-1 only)	AiResearch MFG CO, Phoenix, AZ

## KEY TO FIGURE 5-1 (CONT)

INDEX NO.	PART NO.	NOMENCLATURE	MANUFACTURER
16	MS35059-22	Switch	
17, 33	MS25331-6-313	Light Assembly	
18	MS35059-31	Switch	
19, 21, 26, 30	MS25331-8-313	Light Assembly	
20	MS35059-30	Switch	
22	MS35058-23	Tach Transfer Switch (290270-1-1 only)	
23, 28	MS25331-7-313	Light Assembly	
24, 29	MS35058-22	Switch	
25	MS35059-23	Switch	
27	MS35058-23	Switch	
31	MS35058-28	Switch	
32	MS35059-27	Switch	
34	MR26B030DCVVR	D.C. Voltmeter	AiResearch MFG CO, Phoenix, AZ
35	MS28009-4	Oil Temperature Indicator	AiResearch MFG CO, Phoenix, AZ
36	194-520-9008	Cap (Hi-Fuel)	AiResearch MFG CO, Phoenix, AZ
	194-519-9008	Cap (Lo-Fuel)	AiResearch MFG CO, Phoenix, AZ
	AE92764E	Cap (Oil)	AiResearch MFG CO, Phoenix, AZ
	AE92766E	Cap (Control Air)	AiResearch MFG CO, Phoenix, AZ
37	AN924-4	Nut	
38	234-542-9104	Half Coupling (Hi-Fuel)	AiResearch MFG CO, Phoenix, AZ

## KEY TO FIGURE 5-1 (CONT)

INDEX NO.	PART NO.	NOMENCLATURE	MANUFACTURER
38 (Cont)	234-542-9004	Half Coupling (Lo-Fuel)	AiResearch MFG CO, Phoenix, AZ
	234-560-9110	Half Coupling (Oil)	AiResearch MFG CO, Phoenix, AZ
	234-560-9310	Half Coupling (Control Air)	AiResearch MFG CO, Phoenix, AZ