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ARMY AVIATION TEST BOARD FORT RUCKER ALA

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PRODUCT IMPROVEMENT TEST OF AUTOMATIC JETCAL TESTER MODEL H119A--ETC(U)

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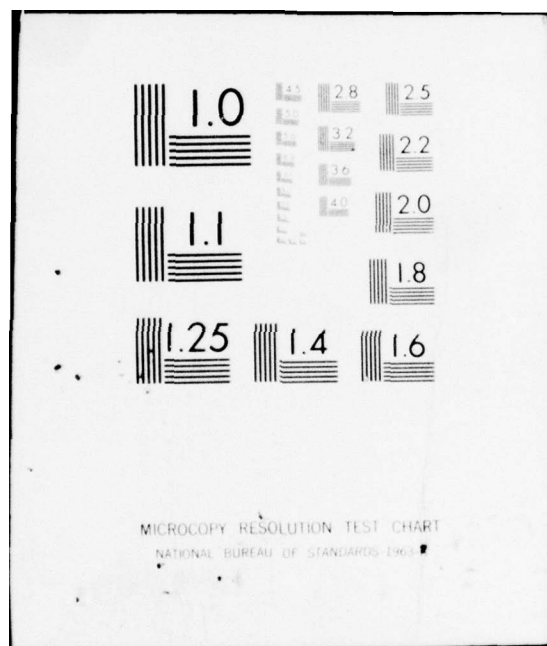
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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

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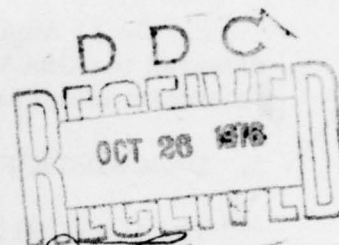
SEP 12 1968

SUBJECT: Final Report, "Product Improvement Test of Automatic Jetcal Tester Model H119A," USATECOM Project Number 4-6-5011-02

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1. REFERENCES

12 TSP.

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USATECOM-4-6-5011-02

a. Letter, AVCOM-EGGG, Headquarters, US Army Aviation Materiel Command, 11 August 1967, subject: "Request for Product Improvement Test of Jetcal Tester Model #H119A," with first endorsement, AMSTE-BG, dated 29 August 1967.

b. Final Report of Test, "Product Improvement Test of Jetcal Tester (Transistorized)," USATECOM Project Number 4-6-5011-01, US Army Aviation Test Board, 3 January 1967.

c. Service Manual for Automatic Jetcal Engine Trimmer Model H119A, 21 December 1967.

2. BACKGROUND

a. Jetcal Testers now used as standard turbine engine test equipment in the Army require manual adjustment of a slide-wire potentiometer to regulate and maintain desired temperature of the heater probes. Accurate operation of this equipment is time consuming and requires constant operator attendance.

b. The US Army Aviation Test Board (USAAVNTBD) tested a portable, transistorized model in FY 67 (reference b), found that its

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Number 4-6-5011-02

method of temperature control was similar to that of the standard model, and recommended that efforts be continued toward development of an automatic temperature control.

c. On 29 August 1967, the US Army Test and Evaluation Command directed the USAAVNTBD to conduct a product-improvement test of the automatic temperature-controlled Jetcal Tester, Model H119A.

3. DESCRIPTION OF MATERIEL

The Model H119A Jetcal Tester is a portable instrument containing the necessary circuitry, controls and accessories to check the operation of exhaust gas temperature (EGT) and revolution per minute (r.p.m.) indicating systems of jet and turbine engines. The test item features automatically controlled heater probe temperatures which closely simulate actual engine operating temperatures without operating the engine. The test item is shown in Figures 1 and 2 (inclosure 1). The standard Jetcal Tester is shown in Figures 3 and 4.

4. OBJECTIVE

To determine whether the test item is a marked improvement over the standard Tester, Exhaust Gas Temperature, Model BH-112JA36, FSN 4920-673-5514.

5. SCOPE AND METHOD

The USAAVNTBD conducted the product-improvement test of the Model H119A Jetcal Tester at Fort Rucker, Alabama, during the period June 1968 - August 1968. The test item was operated on a comparison basis with the standard tester on CH-47(), OV-1(), and UH-1() aircraft, using the operating instructions provided with the unit. Time required to set up the test item for operation, maintenance man-hours, skill levels, categories of maintenance, and discrepancies noted were recorded. Ability of the test item to withstand extended periods of field usage was determined by closely simulating the actual conditions of field usage and post operation detailed examination.

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SUBJECT: Final Report, "Product Improvement Test of Automatic
Jetcal Tester Model H119A," USATECOM Project
Number 4-6-5011-02

6. SUMMARY OF RESULTS

A detailed summary of results is contained in inclosure 1. Following are significant findings:

a. The test item performed, and failed to perform, the same functions as the standard tester. However, the test item, with its automatic temperature control, stabilized temperatures 30 percent quicker than the standard tester, and maintained these temperatures without constant monitoring. The test item also had a self-calibrating capability not incorporated in the standard tester.

b. The test item and the standard tester are capable of attaining temperatures up to 1200°C. However, design limitations of the heater probes restrict the use of temperatures above 800°C., which are required for the T55 (CH-47), T63 (OH-6A) and T74 (U-21A) engines.

c. T53-L-13 engines, containing six thermocouples, could not be checked with the heater probes provided.

d. Dual EGT indicating systems, as found on the AH-1G, cannot be functionally checked during engine operation.

e. Six deficiencies and two shortcomings were noted and are listed in inclosure 2. Except for the power source requirements and the automatic temperature control, all limitations, deficiencies, and shortcomings applied equally to the test item and the standard tester.

7. DISCUSSION

The significant improvement in the test item is the automatic temperature control. This feature not only simplifies operation and reduces time required for operation, but also provides greater temperature accuracy and control.

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SUBJECT: Final Report, "Product Improvement Test of Automatic
Jetcal Tester Model H119A," USATECOM Project
Number 4-6-5011-02

8. CONCLUSIONS

a. The Model H119A Tester is potentially a marked improvement over the current standard Model BH112JA36 Tester in that it incorporates an automatic temperature control and a self-calibrating capability. However, the test item does not expand the operating capability of the standard tester.

b. The test item, like the standard tester, cannot adequately test all turbine powered aircraft in the Army inventory.

9. RECOMMENDATIONS

It is recommended that:


a. The deficiencies listed in inclosure 2 be corrected.

b. After correction of deficiencies, the Model H119A Tester be check tested for consideration as a replacement for the standard tester.

c. The shortcomings be corrected as technically and economically feasible.

FOR THE PRESIDENT:

2 Incl
as


H. R. NUTT
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DETAILED SUMMARY OF RESULTS

USATECOM Project No. 4-6-5011-02

1. Weight and Dimensions. The weight and dimensions of the test item in comparison with the standard tester (including accessories) were:

	<u>H119A</u> <u>(TEST ITEM)</u>	<u>BH112JA36</u> <u>(STANDARD)</u>
Length	21 inches	21 inches
Width	15 inches	15 inches
Height	23.5 inches	22.5 inches
Volume	7,392 cubic inches	7,077 cubic inches
Weight	104 pounds	104 pounds

2. Operational Suitability.

a. Operational functions and capabilities of the test item were identical to those of the standard tester and, when used on a comparison basis, exhibited the same accuracy and precision in performing the following functions:

- (1) Complete functional test of aircraft EGT system.
- (2) Determine accuracy of engine r. p. m. system.
- (3) Monitor EGT and r. p. m. during engine trimming.
- (4) Test engine thermocouple harness for error.
- (5) Test aircraft EGT indicator.
- (6) Test resistance and insulation of aircraft EGT circuit.
- (7) Calibrate EGT indicators.

INCLOSURE 1

(8) Calibrate aircraft EGT harness resistance.

b. The following functions could not be accomplished using either the test item or the standard tester:

(1) Test continuity of thermocouples in parallel harness. This test requires a special continuity heater probe, P/N BH3810-40, which was not furnished.

(2) Test individual thermocouples on a bench. This test applies to jet or turbine engines on which individual thermocouples may be removed. Army aircraft engines on which the Jetcal Tester was used are equipped with thermocouples which are installed in a fixed loop and cannot be individually removed.

(3) Test overheat detection sensing elements. This test requires a special TEMPCAL heater probe, P/N BH1278, which was not furnished.

(4) Calibrate overheat detection sensing elements. Army aircraft on which the Jetcal Tester was used are equipped with continuous wire overheat detection systems, which cannot be adjusted or calibrated.

c. Testing at the maximum thermocouple temperature ($816^{\circ}\text{C}.$) of the CH-47() helicopter could not be accomplished because the maximum temperature of the heater probes on both the test item and the standard tester is limited to $800^{\circ}\text{C}.$

d. The EGT system of the T53-L-13 engine, modified to incorporate six thermocouples, could not be tested with either the test item or the standard tester. A special heater probe is required which was not available.

e. The test item was limited by design to 115-volt, 60-Hertz (Hz) power for operation of the heater probes, but could use 115-volt, 50- to 400-Hz power for all other operations. The standard tester could use 115-volt, 50- to 400-Hz power for all operations.

f. Neither the test item nor the standard tester had the capability to check temperature measurement of the EGT system during engine run on those aircraft having dual EGT indicating systems (AH-1G Helicopter).

g. The manually adjusted temperature control of the standard tester required familiarity to operate, and stabilized heater probe temperatures were difficult to maintain. The automatic temperature control of the test item simplified operation, required less time to heat to peak temperatures, and smoothly stabilized and maintained desired temperature settings automatically within one degree centigrade for indefinite periods of time.

h. The test item contained a manually adjustable calibration signal to check the accuracy of the temperature and r. p. m. indicating circuits prior to each use. The standard tester did not contain this feature.

3. Human Factors. The ground-handling "push" handle was too short for easy ground handling of the tester.

4. Installation and Operation Requirements.

a. The time required to set up the test item for operation averaged 14 man-minutes, which was identical to that required to set up the standard tester.

b. The time required to heat the heater probes and stabilize at 600°C. averaged 10 minutes for the test item compared to 16 minutes for the standard tester.

c. Direct-support maintenance personnel with a 68F series MOS were required to operate and maintain the test item.

5. Reliability and Maintainability.

a. No discrepancies occurred during installation and operation of the test item and no maintenance was required during the test period.

b. Operating instructions were printed on the inside of the instrument case lid, and were contained in a service manual provided with the test item. These instructions were satisfactory with the exception that, throughout the manual and on the instrument case lid, only 115-volt, 400-Hz electrical power was listed as the power source.

c. Maintenance instructions contained in the service manual were reviewed and considered adequate.

d. Detailed examination of the test item after field usage revealed that it was well constructed of solid-state electronic components, built of quality materials, and continued to function with precision and accuracy.

6. Deficiencies and Shortcomings. Six deficiencies and two shortcomings were noted and are listed in inclosure 2.

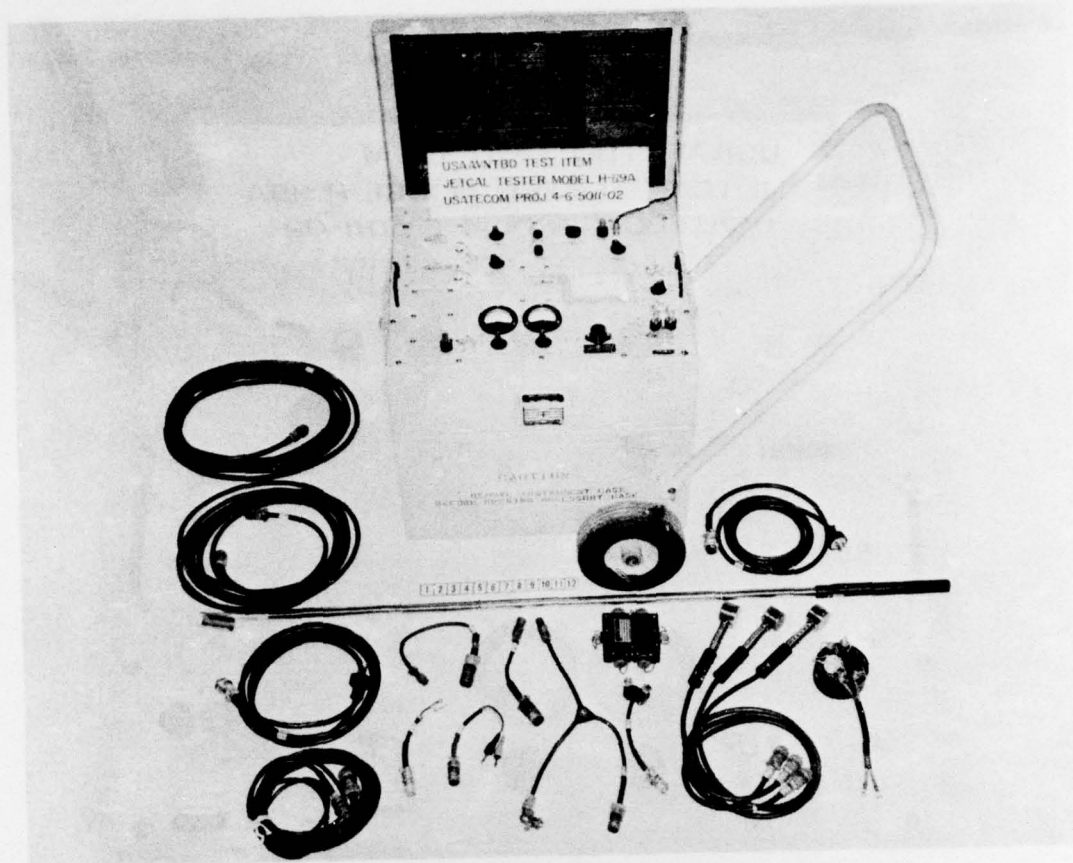


Figure 1. Model H119A Tester

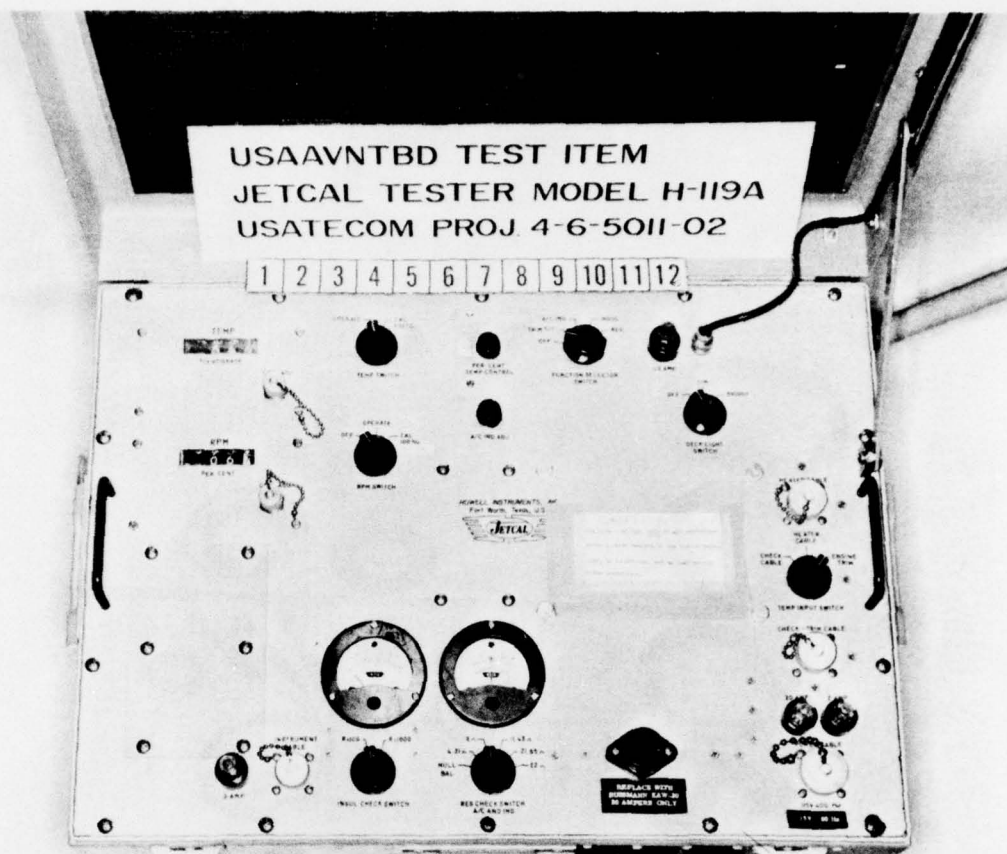


Figure 2. Control panel of Model H119A Tester

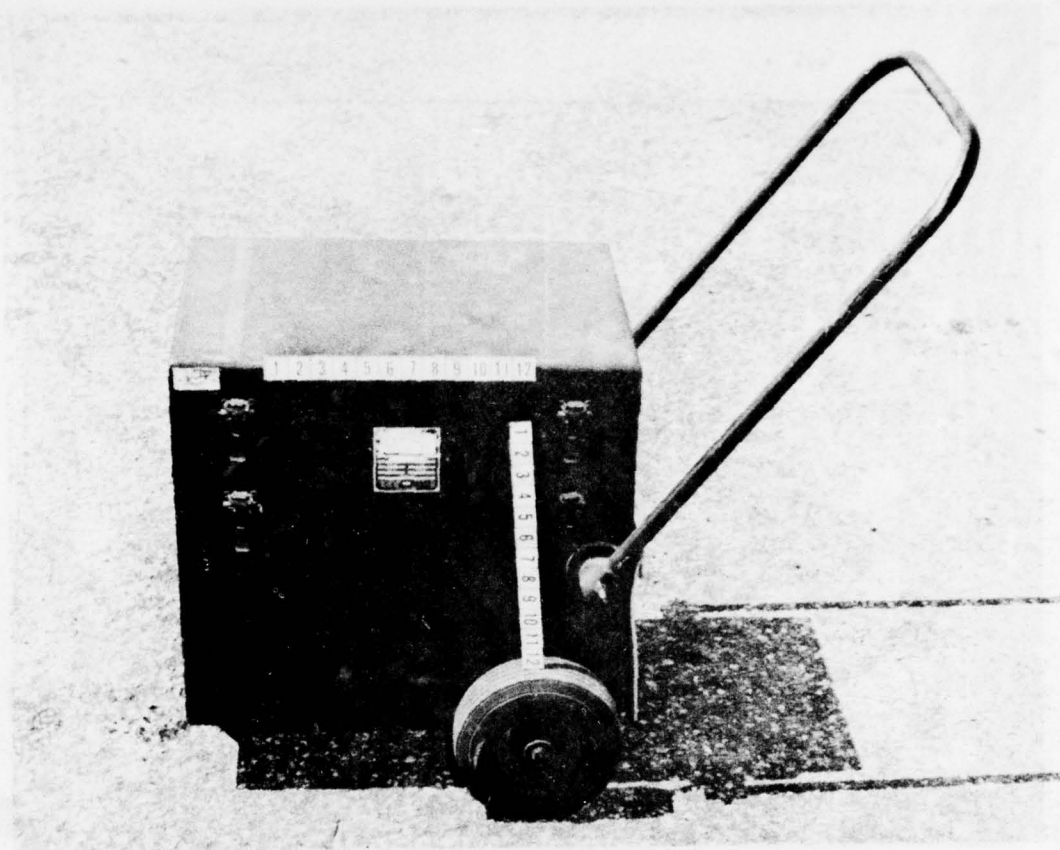


Figure 3. Model BH112JA36 Tester (Standard)

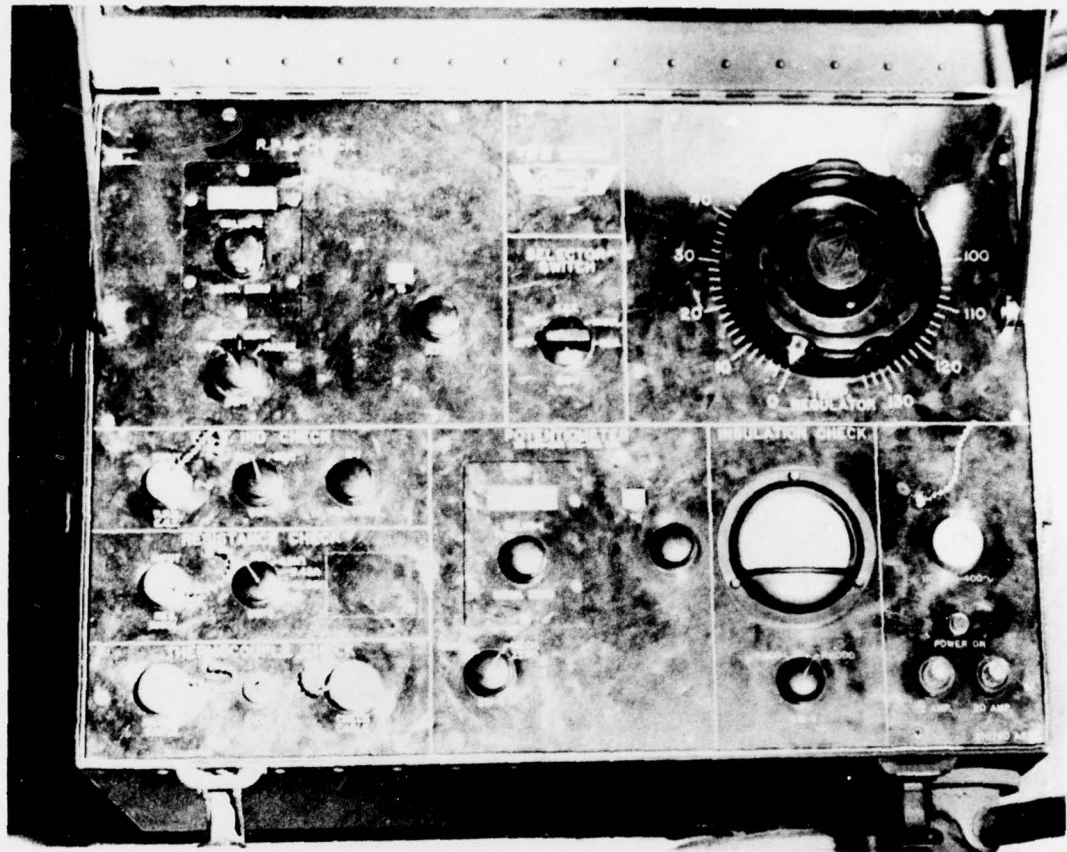


Figure 4. Control panel of standard tester

DEFICIENCIES AND SHORTCOMINGS

USATECOM Project No. 4-6-5011-02

1. Deficiencies. The following deficiencies were discovered during the test:

<u>Deficiency</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
a. Continuity heater probe was not provided to check continuity of thermocouples in parallel harness.	Provide a satisfactory continuity heater probe.	Heater probe, part number BH3810-40, was not provided for test.
b. Tempcal heater probe was not provided to check overheat detection sensing elements.	Provide a satisfactory heater probe.	Tempcal probe, part number BH1278, was not provided for test.
c. Heater probes were not provided to check T53-L-13 engines incorporating six thermocouples.	Provide special heater probes to accommodate the six-thermocouple T53-L-13 engine.	
d. The 800°C. maximum heat limitation of the heater probes was not sufficient for testing the maximum thermocouple temperature of the T55 engine (CH-47()) (816°C.).	Provide heater probes capable of operation up to at least 1200°C.	This deficiency would also apply to the T63 (OH-6A) (requiring 999°C.) and the T74 (U-21A) (requiring 1090°C.) engines.

INCLOSURE 2

<u>Deficiency</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
e. EGT measurement could not be accomplished during engine run on those aircraft having dual EGT indicating systems (AH-1G Helicopter).	Provide the capability to monitor EGT on the AH-1G Helicopter during engine run.	
f. Electrical power source required to heat the heater probes was limited to 115 volts, 60 Hertz only.	Provide the capability to operate the tester on a variable electrical power source of 115 volts, 50 to 400 Hertz for all test functions.	This capability is required when using the CH-47() APU as electrical power source.

2. Shortcomings. The following shortcomings were discovered during the test:

<u>Shortcoming</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
a. The Service Manual listed 115 volts, 400 Hertz as the electrical power source for all operational functions.	Correct the publication to show applicable electrical power source for each operational function.	
b. The ground-handling "push" handle was too short.	Lengthen the handle to a minimum of 36 inches total length.	