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ARMY FIELD FORCES

REPORT

OF

BOARD NO 1, OCAFF PROJECT NO CE 1552

SERVICE TEST OF AFSAN 7 CONVERTER

NOT TO BE DISCLOSED
TO FOREIGN NATIONALS

138217

31 DECEMBER 1953

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HEADQUARTERS BOARD NO 1
Office, Chief of Army Field Forces
Fort Bragg, N C

31 December 1953

REPORT OF PROJECT NO CE 1552
SERVICE TEST OF AFSAM 7 CONVERTER

1. (~~CONFIDENTIAL~~) AUTHORITY:

KL-7 hereafter

a. Directive:

(1) Letter, ATDEV-5(C) 400.112(C), 8 May 1952, subject: "Service Test of AFSAM 7 Converter."

(2) Eight AFSAM 7 sets were received for test 14 April 1953.

b. Purpose: To determine suitability and adequacy of AFSAM 7 for issue to Army Field Forces units.

2. (~~CONFIDENTIAL~~) REFERENCES:

a. AFSAG 1236, "Interim Operating Instructions for Pollux Crypto-systems - Joint" (Confidential).

b. Letter, GNBA-CE 311.5(CE 1552), Hq Army Field Forces Board No 1 to Chief, Army Security Agency, 15 May 1953, subject: "Partial Report, Service Test of AFSAM 7 Converter" (Secret).

c. Letter, ATING 78/710 400.3/3(C)(9 March 51), OCAFF, 9 March 1951, subject: "Basis of Issue for AFSAM 7 and AFSAY 804" (Secret).

3. (~~SECRET~~) DESCRIPTION OF MATERIEL:

a. The ^{KL-7} AFSAM 7 is a keyboard-operated, tape-printing cipher machine, designed on a unit subassembly basis. The AFSAM 7 is intended

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primarily for off-line encryption of tactical literal communications within the division to supersede, but not replace in all instances, the Converter M-209. The equipment is electrically-driven, and was designed to encipher and decipher messages at a speed up to 60 words per minute. In its weatherproof carrying case, the equipment is approximately 15 inches wide, 10 inches high, 14 inches deep, and weighs 29 1/2 pounds. It is designed to operate directly from nominal 24-volt dc vehicular and aircraft electrical systems and, with the addition of a small power converter, from 115/230-volt, 50/60-cycle ac power sources (Appendix C.1).

b. The base (AFSAM 7) is RESTRICTED and Non-Serial. The rotor stepping unit (AFSAM 107) and the cipher unit (AFSAM 207) are CONFIDENTIAL Serial (Registered) material. Cryptologic clearance is not required for maintenance and operating personnel.

4. (~~CONFIDENTIAL~~) BACKGROUND: Army Ground Forces submitted military characteristics for an off-line cryptomechanism for use in low echelons to Army Security Agency in 1945, and a research and development project was established in 1947. In 1948 at a meeting of the Army Security Agency Technical Committee, the military characteristics were revised and approved by the Army and the Air Force. Following initial development at Army Security Agency, a contract was awarded for further research and development and engineering models. The latter were satisfactorily demonstrated to the Services and plans were made to proceed with procurement. As a result of the recent Korean emergency, Armed Forces Security Agency. (now National Security Agency), Army Security Agency, and Army Field Forces agreed to waive formal service test in order to expedite procurement of the equipment. In May 1951, this board was directed to conduct an informatory test of the equipment. The equipment failed during test and was returned to Army Security Agency for modification. Current tests were conducted on the modified equipment.

5. (~~SECRET~~) SUMMARY OF TESTS:

- a. The equipment was satisfactory with respect to:
- (1) Physical characteristics (Test No 1, Appendix A).
 - (2) Suitability for encryption and decryption of tactical message traffic with minor exceptions (Test No 2, Appendix A).

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(3) Ruggedness with minor exceptions (Test No 4, Appendix A).

(4) Capabilities and facilities offered as compared with those provided by cryptographic equipment available in the division (Test No 5, Appendix A).

(5) Time required daily for preventive maintenance and operational adjustments, including key setting (Test No 6, Appendix A).

(6) Suitability of the shock mounts of the AFS/M 7 and vehicular mountings (Test No 7, Appendix A).

(7) Portability (Test No 8, Appendix A).

(8) Operator training requirements (Test No 9, Appendix A).

(9) Maintenance (Test No 14, Appendix A).

(10) Field maintenance personnel training requirements (Test No 14, Appendix A).

(11) Operation with power sources for which designed (Test No 15, Appendix A).

b. The equipment was unsatisfactory with respect to:

(1) Interference (Test No 11, Appendix A).

(2) Accessories provided (Test No 12, Appendix A).

(3) Weatherproofness (Test No 13, Appendix A).

(4) Protection of the equipment from high voltages (Test No 15, Appendix A).

(5) Power cable connectors (Test No 16, Appendix A).

(6) Instruction manual (Test No 17, Appendix A).

c. Tests to determine if the AFS/M 7 meets requirements for operation and storage set forth in current directives pertaining to temperature, humidity, and barometric pressure performance of Army Field Forces equipment have not been completed. Results will be forwarded when available.

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~~SECRET~~6. ~~(SECRET)~~ DISCUSSION:

a. The military characteristics for AFSAM 7 require an equipment which, in an immersionproof transport case, will weigh not more than 20 pounds with a volume of .7 cubic foot. The AFSAM 7 in its weatherproof transport case weighs 29 1/2 pounds and has a volume of 1.2 cubic feet. The machine itself weighs 18 1/2 pounds and has a volume of .9 cubic foot. The AFSAM 7 has been designed for 24-volt operation and will be used in a tactical vehicle as a normal method of employment in tactical echelons. Weight and size of the AFSAM 7 are considered satisfactory for the use intended. The AFSAM 7 was not included in Project No CE 4251, "Waterproof Requirements for Communication Equipment Under Development," but it compares with respect to intended application with Teletypewriter Set AN/PGC-2(). In July 1953, this board concurred that the AN/PGC-2() be considered sheltered equipment which would require moistureproofness instead of weatherproofness.

b. For operational adjustment including key setting, the time required during daylight hours averaged 15 minutes and, during darkness, 16 1/2 minutes, under field conditions. However, time required for key setting can be reduced to a matter of seconds, since each AFSAM 7 will have issued with it an extra cipher unit assembly and rotor set with which the entire key setting for the succeeding day may be made in advance and substituted at the appropriate time.

c. The Army Field Forces requirement for AFSAM 7 was predicated upon eventual replacement of the M-209. The AFSAM 7 will replace the M-209 where vehicular or nominal 115/230-volt ac power supplies are available. In addition, it will enable replacement of certain higher echelon cryptographic equipment within the Field Army. Where power is not available, pending production and issue of the AFSAM 17, a new mechanical cipher device, it will be necessary that some units retain a limited number of Converter M-209.

d. Following the test conducted at Fort Bragg, a conference was held at Headquarters Army Security Agency to review the results of test so that timely action could be taken on deficiencies found during the service test (Appendix F).

7. ~~(CONFIDENTIAL)~~ CONCLUSIONS:

a. AFSAM 7, when modified to correct deficiencies listed in Appendix B, will be suitable and adequate for issue to Army Field Forces units for use in temperate climates.

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b. The AFSAM 7 will supersede, but not replace in all instances, Converter M-209.

8. (~~CONFIDENTIAL~~) RECOMMENDATIONS:

a. AFSAM 7 be modified to correct deficiencies listed in Appendix B, adopted as Standard for use in temperate climates, and issued as proposed in Appendix E.

b. AFSAM 7 be tested in the Arctic, but such tests not delay Standardization for use in temperate climates.

c. Converter M-209 in excess of two be withdrawn from all orders within the Field Army following completion of distribution of AFSAM 7 and related systems material.

Clyde M. Faltan
CLYDE M. FALTAN
Colonel, Artillery
President

APPENDICES:

- A - Details of Test.
- B - Deficiencies and Suggested Modifications.
- C - Photographs and Charts.
- D - Coordination.
- E - Proposed Basic of Issue.
- F - Report of Conference.

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~~SECRET~~APPENDIX A - DETAILS OF TESTREPORT OF TEST - PROJECT NO CE 1552

Tests were conducted by Major Wilfred C. Washcoe, Signal Corps, other personnel of the Communication and Electronics Service Test Division, the 82d Airborne Signal Company, and the 66th Signal Battalion (Corps).

1. ~~(SECRET)~~ TEST NO 1

- a. Purpose: To determine characteristics of the equipment.
- b. Method: Equipment was measured, weighed, and inspected. Throughout the service test, characteristics of the equipment were evaluated.

c. Results:(1) Approximate dimensions and weights:

<u>Item</u>	<u>Width Inches</u>	<u>Height Inches</u>	<u>Depth Inches</u>	<u>Weight Pounds</u>
AFSAM 7 w/AFSAM 107, 207, and printer assembly	12	6 1/2	12	18 1/2
Operate-Transport Case	15	10	14	11
AFSAM 7 Complete	15	10	14	29 1/2
Vehicular Mount, MT-791/U	13	8 1/2	3 5/8	10 3/4
Vehicular Mounting Plate	13 3/4	1	9	9 1/2
Power Converter	10	6	4	6 1/2
Rotors, in case	8	5	5 1/2	4 3/4

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A.1 (CE 1552)

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(2) The AFSAM 7 was a keyboard-operated, tape-printing cipher machine, designed on a unit assembly basis. The complete machine consisted of the following subassemblies (Appendix C.2):

(a) Base assembly - a magnesium supporting frame on which the other subassemblies were mounted. The frame was equipped with tracks which engage a double set of shock mounts in the carrying case, and a spring-loaded stop pin which prevented unintentional withdrawal of the machine.

(b) Keyboard assembly - a typing keyboard with internal sliding contact panel which established the various circuits of the machine by means of the function controller. Power was introduced to the machine through a power cable attached to the keyboard assembly. The cable lacked facility for connection to vehicular power supply.

(c) Contact panel assembly - a plastic panel containing the instrument wiring, fixed contacts which establish instrument connections and the various electrical components.

(d) Printer assembly - an electro-mechanical unit which provided mechanical power, high voltage used in the electrical circuits, timed electrical pulses which initiate the printing, and the spacing and printing of the paper tape.

(e) Stepping unit assembly - a unit which is removable either separately or with the cipher unit attached. It stopped the rotors during operation and had rotor set keys for individual rotor stepping.

(f) Cipher unit assembly - a metal can with built-in end-plate circuitry. It contained eight rotors and provided a means for enciphering and deciphering. Two assemblies are included in the basic "AFSAM 7 Set."

(g) Carrying case assembly - a shock resistant and weatherproof container for transporting the equipment. It included a copy holder and carrying space for operator's night light, power cable, and additional tape and ribbon. Night light was not included.

(h) Alternative current power converter assembly - an accessory unit which provided 21-31 volts dc power to AFSAM 7 from a 115/230-volt, 50/60-cycle power source.

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C.2 (CE 1552)

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(3) The AFSAM 7 required a set of eight rotor assemblies for operation, each consisting of eight cores, eight retaining rings, eight alphabet rings, seven notch rings, and one wide stationary ring. Two sets of rotor assemblies for each crypto system are supplied with the AFSAM 7 crypto set (Appendix C.3). Also required was a keylist, from which daily Signal Operation Instructions extracts were made.

2. ~~(SECRET)~~ TEST NO 2

a. Purpose: To determine suitability of the AFSAM 7 for use for encryption and decryption of tactical message traffic.

b. Method: The AFSAM 7 was operated in fixed and mobile field installations. Tactical message traffic was encrypted and decrypted. Power was supplied to the equipment from vehicular battery sources and from various engine generator equipments utilizing the 115/230-volt ac to 24-volt dc power converter. Personnel with various skills (Test No 9) operated the equipment during rainy and dry weather, and during daylight and darkness. Operation during darkness was conducted by lantern light.

c. Results: The equipment operated satisfactorily. After an average of approximately two hours of practice with the new type flat keyboard, all operators with previous typing experience agreed that it was satisfactory. A skilled typist accomplished 68 words per minute encrypting, and 48 groups per minute decrypting.

(1) Deficiencies noted were:

(a) Cover containing copy holder would not remain in place during operation (Appendix C.1).

(b) Cover containing copy holder lacked facility for holding tape copy.

(c) Handle on function controller was too long and interfered with operation of the keyboard.

(d) Operators were unable to read last 10 characters printed without removing tape from printer.

(e) Five to seven printed characters were blurred when ribbon reversed during printing operation.

(f) Equipment occasionally substituted figures for letters without any particular pattern on both encipher and decipher.

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A.3 (CE 1552)

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(g) Equipment lacked a tape moistener for use in pasting copy.

(h) Equipment lacked a night light.

(2) It was noted that whenever two adjacent keys were struck simultaneously, whichever one made electrical contact first governed, and the character represented by it functioned. No damage resulted to the equipment. Upon release of the keys, the next characters struck functioned properly. The only key that functioned where another was pressed was the repeat key.

3. (~~SECRET~~) TEST NO 3

a. Purpose: To determine if the AFSAM 7 is capable of continuous operation.

b. Method: Two AFSAM 7 stations were established. Operation was conducted 23 hours per day for 7 days. Operators of various skills who had been trained during Test No 9 worked in shifts, one operator per machine with one operator and one organizational maintenance man in reserve. Reserve personnel pasted copy and performed operations incidental to the test. Tactical messages averaging 38 groups in length were encrypted on one machine and decrypted on the other. Every 12 hours the function of the equipment was interchanged. Signal Operation Instruction type keylists were used and key settings changed every 24 hours. Six moves of the stations were accomplished, two during daylight and four during darkness. Machines that developed troubles were examined and subassembly replacements made by the organizational repairman where appropriate. Failures and deficiencies were recorded. Effects on vehicular electrical systems were noted.

c. Results:

(1) A total of 96,558 groups of traffic was handled in the 7-day period. One equipment operated continuously using method described above. The other equipment developed troubles which required approximately two hours more maintenance time than the accumulated seven hours allowable for the period.

(2) Failures which required subassembly replacement were:

(a) Camming surface on rotor stepping linkage, which was spot welded, broke loose.

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- (b) AFSAM 107 casting cracked.
- (c) Timing shaft clutch pin slipped out.
- (d) Experimental latch on AFSAM 107 wore, resulting in looseness of right side of AFSAM 207.
- (e) Spring loaded stop pins in base assemblies became jammed.
- (f) Retaining rings on spring assembly pivot of printer unit came loose and allowed drive ring assembly to drop out of engagement with rotor stepping crank.

(3) Deficiencies noted were:

- (a) Rotor stepping contacts required frequent adjustment and were difficult to adjust.
- (b) Tape worked out of position laterally when pressure roller was released during rotor setting.
- (c) Tape feed pawl eccentric became maladjusted and occasionally slipped off ratchet.
- (d) Rotor retaining rings became sprung and interfered with stepping contact operating levers.
- (e) "One-step advance" feature functioned improperly when switching from "plain" to "encipher."

(4) Vehicle batteries, approximately fully charged, were able to power the AFSAM 7 for continuous operation from 16 hours to 2 days, depending upon the power rating of the batteries, before it was necessary to run the vehicle engine to generate power. After a week of continuous operation and consequent deterioration of the battery condition, the engine was operated approximately one hour on and one hour off in order to maintain a minimum battery voltage of 21 volts. Current drain at 24 volts dc was 2.5 amperes.

4. ~~(CONFIDENTIAL)~~ TEST NO 4

- a. Purpose: To determine if the AFSAM 7 is sufficiently rugged.

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A.5 (CE 1552)

b. Method:~~SECRET~~

(1) The equipment was installed and transported 60 miles over paved roads, 70 miles over dirt roads and 90 miles cross-country in each of the following vehicles:

Truck, 1/4-ton, 4x4.

Truck, 3/4-ton, 4x4.

Truck, Cargo, 2 1/2-ton, 6x6.

(2) Two of the equipments were installed and transported approximately 90 miles over dirt roads in full-track vehicle Tractor, Cargo, T43E2 (Appendix C.4).

(3) Two equipments were jumped by parachutist using standard jump techniques. One equipment was dropped twice by parachute, and two of the equipments were mounted in Truck, 1/4-ton, 4x4 and the truck dropped using standard airborne techniques. Immediately following each delivery, the equipment was examined for damage and the set was placed in operation using vehicular power sources (Appendix C.4).

(4) Throughout the test period, failures attributable to lack of ruggedness were noted.

c. Results:

(1) As a result of transport in wheeled vehicles, the following deficiencies were noted.

(a) Partially used rolls of tape expanded and came loose in the tape carrier. This disarrangement of the tape caused the tape to stick in the tape feed mechanism, resulting in overprinting and poor spacing.

(b) Carrying case stop spring broke.

(c) Screws loosened, particularly in rotors and figured wheel.

(2) No deficiencies attributable to transport in the full track vehicle were noted.

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A.6 (CE 1552)

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(3) No deficiencies attributable to jumping or dropping the equipment were noted. Equipment operated satisfactorily after recovery. In several instances, wind blowing in the drop zone during operation caused the ribbon to unwind. One or the other ribbon spools of the AFSAM 7 was free to unwind at any given time.

(4) The following additional failures which occurred during the test period were attributed to lack of ruggedness:

- (a) Monofil came out of letters engraved on rotors.
- (b) Two rotor cores became chipped.
- (c) Use of Amphenol line plug resulted in broken wire because plug came apart in more than one place.
- (d) Spare fuse clip did not spring properly; it bent and broke.

5. (~~SECRET~~) TEST NO 5

a. Purpose: To compare the capabilities and facilities offered by the AFSAM 7 with those provided by equipment available in the Field Army.

b. Method:

(1) Tactical message traffic was encrypted and decrypted using both the AFSAM 7 and Converter M-209, with operators trained on both. Differences in physical characteristics, relative ease of operation of the equipment and associated systems material, capabilities, and facilities were noted and evaluated (Appendix C.5).

(2) Cryptographic Technicians, MOS Code 1805, who worked daily with CSP 2900 (AFSAM 1, SIGABA) in the post cryptocenter at Fort Bragg were given the AFSAM 7 and associated systems material for a period of three weeks. Following familiarization and self-instruction, using instructional material furnished, they operated the AFSAM 7 daily, handling training messages. At the end of the 3-week period, they were asked to comment as to comparison of the capabilities and facilities offered by the two machines.

(3) In connection with Tests No 3 and 9, Cryptographic Technicians, MOS Code 1805, and Mechanics, MOS Code 1801, of the 66th

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Signal Battalion (Corps), and 82d Airborne Signal Company were asked to comment on the capabilities and facilities offered by AFSAM 7 as compared to CSP 2900.

c. Results:

(1) Using method b(1), above, the following differences between the AFSAM 7 and Converter M-209 were noted:

	<u>AFSAM 7</u>	<u>M-209</u>
Weight, in case	29 1/2 pounds	7 pounds
Size, in case	15" x 10" x 14"	8" x 4" x 6 1/2"
Power	Electrical, 24-volt, dc	Manual
Classification of traffic authorized for handling	All classification	Confidential and Restricted
Traffic Presentation	Printed and spaced word lengths or five-letter cipher groups on 3/8" wide tape, including figures	Same, except lacks provision for figures
Cryptoprecautions required	None	Variable spacing, bisection, avoidance of stereotypes, encrypted indicators
Average time required to set up daily key	12 minutes	10.6 minutes
Traffic handling rate, over extended period, using 38-group messages	24 messages encrypted per hour, including headings	5 messages encrypted per hour, hand-written headings

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A.8 (CE 1552)

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	<u>AFSAM 7</u>	<u>M-209</u>
Machine speed capability	60 words-per-minute key-board	5 words-per-minute

(2) The AFSAM 7 had the following facilities and capabilities not present in the M-209:

- (a) Provision for attachment of operator's light for night operation.
- (b) Rapid means for accomplishing message headings, including use of figures.
- (c) Interchangeable subassemblies for speed of maintenance and repair.
- (d) Spare cipher unit and rotor set, which permitted daily key for two days to be set up separately. This facility made key change a matter of seconds.
- (e) Automatic rotor stepping, using key set levers.

(3) The AFSAM 7 had the following limitations not encountered in the M-209:

- (a) Machine subassemblies, AFSAM 107 and 207, and the rotors, were Confidential Serial (Registered) material and controlled in cryptochannels.
- (b) Signal Operation Instructions keylist material required extraction from Secret Serial, master keylists supplied by Army Security Agency. Current practice permits composing of Signal Operation Instructions keylist material for M-209 in the field.

(4) The cryptographic technicians and mechanics queried in methods b(2) and b(3), above, were of the unanimous opinion that the AFSAM 7 was superior in all respects to the CSP 2900. The advantages of the AFSAM 7 were found to be:

- (a) Better suited to use in Field Army, because of lesser weight, smaller size, greater portability and more rugged construction.

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- (b) Convenience of semi-automatic rotor stepping, using rotor set keys.
- (c) Elimination of requirement for variable spacing and bisection.
- (d) Lower classification of basic machine, which would be issued to the field as non-serial matter.
- (e) Better and faster keyboard, more suited to touch typing, after familiarization.
- (f) Easier to maintain, in view of the subassembly replacement facility.

6. (~~SECRET~~) TEST NO 6

a. Purpose: To determine the time required daily for preventive maintenance and operational adjustment, including key setting.

b. Method: Throughout the period of test, the average time required for daily preventive maintenance and operational adjustment was noted.

c. Results:

(1) An average of 15 minutes daily was required for preventive maintenance of the AFSAM 7. This included cleaning contacts on all subassemblies and rotors.

(2) The average time required for daily operational adjustment, including one key setting, was 15 minutes during daylight and 16 1/2 minutes at night using lantern light.

(3) Initially, it was necessary to augment rotor contact cleaning materials furnished with the equipment. An ordinary ruby eraser was used as a mild abrasive to clean dry rotor contacts. Less frequent cleaning of rotors was required after use of a rotor contact lubricant was begun.

(4) Following equipment deficiencies were noted:

(a) Raised numerals on stator ring were difficult to identify during key change.

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(b) Flat contact on Rotor AAG4, Series 45, was improperly molded, resulting in insufficient contact surface.

7. (~~CONFIDENTIAL~~) TEST NO 7

a. Purpose: To determine suitability of the shock mounts of the AFSAM 7 and of the vehicular mounting base when installed in representative military vehicles to include full-tracked vehicles.

b. Method: The AFSAM 7 was mounted in Truck, Utility, 1/4-ton, 4x4, M38; Truck, 3/4-ton, 4x4, M37; Truck, Cargo, 2 1/2-ton, 6x6, M135; Tractor, Cargo T43E2; and L-19 type aircraft. A special vehicular mount supplied by National Security Agency (NSA) and the Standard type Mounting MT-791/U were used (Appendices C.6, C.7, and C.8).

c. Results: Shock mounts on the AFSAM 7 frame and case and on both vehicular mounts were satisfactory. The NSA mount was heavier than the Standard type mount and had more rigid shock mounts. The use of the NSA mount required the installation of four special fittings, supplied by NSA, on the AFSAM 7 case. The use of Mounting MT-791/U required the installation of a channel plate on the AFSAM 7 case to match the Standard type mount.

8. (~~CONFIDENTIAL~~) TEST NO 8

a. Purpose: To determine if the equipment can be manpacked.

b. Method: Two equipments in their carrying cases were lashed to packboards and manpacked a total of 18 miles.

c. Results: The lashing method prescribed by NSA provided an unbalanced load. A new lashing method which provided a balanced load was developed during test and is shown in Appendix C.9. Manpacking of the equipment presented no other special problem and in each instance following manpack, the equipment was placed in operation in the field using either vehicular power source or an engine generator set with the 115/230-volt ac to 24-volt dc power converter.

9. (SECRET) TEST NO 9

a. Purpose: To determine the average time required to train an operator for AFSAM 7.

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b. Method:~~SECRET~~

(1) Twelve men were selected from various activities at Fort Bragg and Pope Air Force Base for operator training on AFSAM 7. The men had MOS Codes as follows:

- Two each Pole Lineman, 3238.
- One each Intelligence Analyst, 1636.
- Two each Light Weapons Infantryman, 4745.
- Three each Light Vehicle Driver, 4345.
- Two each Field Radio Repairman, 3648.
- Two each Cryptographic Specialist, 4805.

The men were given instruction in classes of four men each. Each man participated in setting up a machine in accordance with the daily keylist and performing the 36-45 letter check.

(2) Two men, one Cryptographic Specialist, 4805, and one Manual Teletypewriter Operator, 4237, each unfamiliar with AFSAM 7, were given the interim operating instructions and a keylist. They were instructed to set up one machine for a particular date and perform the 36-45 letter check.

(3) Twenty men were selected from various activities at Fort Bragg for operator and 1st echelon maintenance training on AFSAM 7. The men had MOS Codes as follows:

- Four each Signal Message Supervisor, 1674.
- Four each Cryptographic Specialist, 4805.
- Three each Cryptographic Supervisor, 1805.
- One each Radar Repair Supervisor, 1952.
- Two each Cryptographic Equipment Repairman, 1801.
- Two each Pole Lineman, 3238.

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One each Central Office Supervisor, 1261.

One each Chief Repeaterman, 1187.

One each Intermediate Speed Radio Operator, 4740.

One each Field Radio Repair Supervisor, 1648.

The men were given instruction, as required for proficiency, in the operation of the machine, changing of key, rotor assembly, and encrypted message handling.

(4) Seven men were selected, five from the Fort Bragg Cryptocenter, and two from Wire Section, CESTD, Board No 1, OCAFF, for self-instruction in operation of the equipment and 1st echelon maintenance. They had MOS Codes as follows:

Four each Cryptographic Specialists, 4805.

One each Cryptographic Supervisor, 1805.

Two each Chief Repeaterman, 1187.

They were instructed to work with the machine and interim operating instructions until they could set up the machine to the daily key, encrypt and decrypt traffic, and perform 1st echelon maintenance.

c. Results:

(1) Using method b(1), above, upon completion of 40 minutes of instruction, and 30 minutes practice, each man set up the equipment and performed the 36-45 letter check satisfactorily. On the following day, each man repeated the operation.

(2) Using method b(2), above, the two men required 25 minutes to complete the task satisfactorily.

(3) Using method b(3), above, persons with previous field-cryptographic experience (Cryptographic Specialists, MOS Code 4805; Cryptographic Supervisor, MOS Code 1805; and Cryptographic Equipment Repairman, MOS Code 1801) completed the instruction and became proficient in set-up, check of the equipment, and 1st echelon maintenance in approximately 1 1/2 to 3 hours. Others, without previous cryptographic experience, required 5 to 7 hours.

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(4) Using method (4), above, the Cryptographic Specialists and Supervisor, each skilled in fixed station CSP 2900 operation, required approximately 1 1/2 hours to complete the task. The others, with no previous experience, required approximately 8 hours of study and practice.

10. (~~CONFIDENTIAL~~) TEST NO 10

a. Purpose: To determine the distance at which acoustical noise caused by the AFSAM 7 can be heard.

b. Method: AFSAM 7 was located in open and wooded areas on quiet evenings and operated in the encipher position. Maximum distance at which the equipment was audible was noted and compared with the distances over which the idling vehicle engine and a Converter M-209 could be heard.

c. Results:

<u>Equipment</u>	<u>Distance Audible Open Area</u>	<u>Distance Audible Wooded Area</u>
AFSAM 7	2100 feet	2000 feet
Truck, 1/4-ton, 4x4	1000 feet	900 feet
Truck, 3/4-ton, 4x4	2100 feet	2000 feet
Converter, M-209	2400 feet	2200 feet

11. (~~CONFIDENTIAL~~) TEST NO 11

a. Purpose: To determine if the AFSAM 7 will cause electrical interference to representative communication and electronic equipment.

b. Method:

(1) The AFSAM 7 was operated on 110-volt ac power in the same room with Radio Receiver R-270. Interference checks were made across the entire frequency range of the receiver with the limiter turned off.

(2) AFSAM 7 was operated from a separate 24-volt dc power source within 6 feet of the antenna of Radio Sets AN/PRC-8, -9

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-10, AN/GRC-9, AN/GRR-5, AN/GRC-3 and SCR-506. Interference checks were made across the entire frequency range of the equipment to determine the presence of radiated interference. The radio sets were then separated from the AFSAM 7 until no further interference was noted.

(3) (a) AFSAM 7 and Radio Set AN/GRC-9, each operating from separate 24-volt dc power supplies, were separated until no further radiated interference could be detected.

(b) The two equipments were then connected to a common 24-volt dc power source. Interference checks were made across the entire frequency range of the receiver with its antenna connected and again with the antenna disconnected.

(4) Method b(3)(a), above, was repeated using Radio Sets AN/PRC-8, -9, and -10; and methods b(3)(a) and (b), above, were repeated using Radio Sets AN/GRR-5, AN/GRC-3 and SCR-506, instead of Radio Set AN/GRC-9.

(5) AFSAM 7 was operated in close proximity to Radio Set AN/TPS-1D.

c. Results:

(1) Key click interference was noted over the entire frequency band of Receiver R-270 (1250 to 2500 kc and 2.5 to 40 mc). No motor noise was detected.

(2) Radiated key click interference was noted over the entire frequency band 2 to 12 mc of Radio Set AN/GRC-9 when separated from the AFSAM 7 up to approximately 9 feet. Beyond 9 feet, no interference was detected. Radiated key click interference was noted over the entire frequency band 1.5 to 18 mc of Radio Set AN/GRR-5 when separated from the AFSAM 7 up to approximately 30 feet. No interference was detected beyond this distance. A slight amount of interference was detected at 20 mc with Radio Set AN/PRC-8 when placed within 4 feet of AFSAM 7. This interference was not objectionable. No interference was detected over the entire frequency band of Radio Sets AN/PRC-9 and -10. A slight amount of interference was noted from 20 to 22 mc on Radio Set AN/GRC-3 when placed within 6 feet of AFSAM 7. This was not objectionable. When using Radio Set SCR-506 key click interference was noted from 3.8 to 6 mc and motor noise 5.4 to 6 mc.

(3) With the antenna connected to Radio Set AN/GRC-9 operating from a common power source but outside the radiated field as

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determined in method b(2), above, motor noise was noted from 2 to 12 mc. The intensity of the motor noise began to decrease after 10 mc and key click interference became more pronounced. With the antenna disconnected no motor noise could be detected; however, key click was noted from 3.4 to 12 mc. From 4.4 to 3.4 mc there was a gradual decrease in intensity.

(4) No objectionable interference was noted when using Radio Sets AN/PRC-8, -9, or -10. Conducted key click interference was noted from 5 to 18 mc using Radio Set AN/GRR-5, both with antenna connected and disconnected. With the antenna connected to AN/GRR-5 motor noise was detected from 1.5 to 18 mc when the motor was started. No motor noise could be detected while running or when the antenna was disconnected from the Radio Set AN/GRR-5. With the antenna connected, key click and motor interference were noted at spot frequencies over the band 20 to 27.9 mc on Radio Set AN/GRC-3. With the antenna disconnected, interference was undistinguishable from background noise. With the antenna connected, key click and motor noise were noted over the entire range of Radio Set SCR-506.

(5) No interference was noted when the equipment was operated at 100 feet and 10 feet from the Radio Set AN/TPS-1D.

12. (~~SECRET~~) TEST NO 12

a. Purpose: To determine if the accessories provided with the AFSAM 7 are suitable and adequate.

b. Method: In conjunction with Tests No 2, 3, 4, and 8, opinions of using personnel were obtained to determine if the accessories provided were adequate, properly marked, and necessary.

c. Results: It was determined that the accessories provided were properly marked and necessary. Using personnel stated that the following additional accessories were required to enable efficient operation and first echelon maintenance of the AFSAM 7:

(1) An accessory case equipped with interior fittings to carry and store the following items:

- (a) The ac power converter assembly.
- (b) A stopping unit assembly.

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- (c) Two cipher unit assemblies.
 - (d) Tube puller.
 - (e) Tube pin straightener.
 - (f) Tape moistening tool.
 - (g) Cleaning and lubricating materials.
 - (h) Spare bulbs for night light and figures shift light.
 - (i) Required documents.
- (2) A tube puller.
 - (3) A tube pin straightener.
 - (4) A tape moistening tool.
 - (5) Cutter, tape, thimble, Teletype No 72638 or equivalent.
 - (6) Ruby eraser, or equivalent, for cleaning rotor contacts.
 - (7) Night light.

13. ~~(CONFIDENTIAL)~~ TEST NO 13

a. Purpose: To determine if the MFSM 7 is sufficiently weather protected for field use.

b. Method: Tests No 2, 3, and 4 were performed during the period 14 April to 15 May 1953 in the vicinity of Fort Bragg, North Carolina. Conditions included fair, hot, damp, and rainy weather. The equipment was installed and operated in vehicles with and without tops.

c. Results:

(1) The equipment operated satisfactorily under canvas shelter, and in the open under conditions of heavy dew and fog, with the exception that the gummed side of the tape was exposed to the

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weather where it entered the tape chute. Surface moisture, resulting from early morning dew, caused the tape to stick with resultant overprinting and mis-spacing. The equipment failed to operate in the open in rainfall.

(2) As a result of the exposure in the open to rain and heavy dew, the following deficiencies were noted:

(a) Metal parts corroded, particularly cap screws and sheet metal parts of the ribbon assembly.

(b) Sliding contact board swelled, resulting in a tight fit which interfered with the operation of the function controller.

(3) Machine lacked dust protection. Dust and dirt caused poor contact between rotors and in various contact assemblies, caused faulty printer unit operation, and resulted in garbled traffic.

14. ~~(CONFIDENTIAL)~~ TEST NO 14

a. Purpose: To determine ease of maintenance of the AFSAM 7.

b. Method:

(1) Throughout the period of test, the following were recorded:

(a) Number of times the equipment was out of service, cause of and remedial action taken for all failures.

(b) Special tools and test equipment required for repair of the equipment.

(c) Accessibility of components and ease of maintenance.

(2) Eight personnel of varied previous training and experience were trained in the field maintenance of the equipment. Time required to train a field maintenance man was noted.

c. Results:

(1) (a) The 8 machines used during the 30-day test were out of service and required subassembly replacement 12 times. Eight

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additional subassembly replacements made during test were determined later to have been unnecessary. Inexperienced maintenance personnel drew incorrect conclusions as regards source of trouble with the result that unnecessary subassembly replacement occurred.

(b) Troubles and failures encountered, their causes, remedial action taken, and special tools required are recorded in Appendix C.11.

(c) In addition to the tools provided with the equipment (Appendix C.10), a tube puller and a tube pin straightener were required.

(d) The left captive screws in the printer unit were inaccessible. The use of subassemblies made all other components accessible for field maintenance.

(2) Personnel with the following MOS Codes required training periods as indicated below to train them in the field maintenance of the AFSAM 7:

<u>Job Title</u>	<u>MOS Code No</u>	<u>Training Time Required</u>
Cryptographic Equipment Repairman	1801	3 hours
Field Radio Repairman	3648	5 hours
Chief Repeaterman	1187	8 hours
Pole Lineman	3238	12 hours

15. (~~CONFIDENTIAL~~) TEST NO 15

a. Purpose:

(1) To determine if the AFSAM 7 will operate satisfactorily from the power sources for which designed.

(2) To determine if the AFSAM 7 and its accessory power converter are protected from high voltage power supply and if excessive voltage will cause damage to the equipment.

b. Method:

(1) The equipment was operated, using the following power sources:

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- (a) Vehicular electrical system, 21 - 26 volts dc.
 - (b) Battery electrical system with rectifier charging, 21 - 31 volts dc.
 - (c) Aircraft electrical system, 27.5 volts dc.
 - (d) Nominal 115-volt, 60-cycle commercial power source using the accessory power converter, 95 - 130 volts ac.
 - (e) Nominal 230-volt, 60-cycle commercial power source using the accessory power converter, 190 - 250 volts ac.
 - (f) Engine Generator PU-181/PGC-1 using the accessory power converter, 95 - 130 volts ac.
- (2) The AFSAM 7 was connected to 110-volt and 220-volt ac power supplies without using the 115/230-volt ac to 24-volt dc power converter.
- (3) The accessory power converter, set for 115-volt operation, was connected to 220-volt ac power supply.

c. Results:

- (1) Using method b(1), above, the AFSAM 7 operated satisfactorily.
- (2) During the test outlined in method b(1)(f), above, the governor on the Power Unit PU-181/PGC-1 failed and voltages as high as 180 volts ac were impressed on the converter with resultant over-voltage on the AFSAM 7. The AFSAM 7 operated continuously without activation of keyboard. At the end of 10 minutes the fuses had not blown in either the power converter or the AFSAM 7 and the test was discontinued to enable repair of the power unit. No damage to the machine resulted.
- (3) Using method b(2), above, when the 24-volt dc equipment was connected directly to 115-volt ac power line, one of the line fuses blew. Both line fuses blew when the equipment was connected to a 220-volt ac power source.
- (4) Using method b(3), above, the fuse in the converter unit blew.

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(5) It was noted that the machines tested operated more efficiently at approximately 27 volts dc. Voltages in excess of 24 volts were encountered only during the period when the vehicle engine was running and the generator charging or immediately thereafter.

16. (~~CONFIDENTIAL~~) TEST NO 16

a. Purpose: To determine the suitability and adequacy of power line connectors provided on AFSAM 7 for various types of field installation.

b. Method: Throughout the period of test, suitability and adequacy of the power connectors were evaluated.

c. Results:

(1) The Amphenol line plug provided for connection of the power cable to the AFSAM 7 came apart in more than one place, and caused broken wires. A simple durable plug with locking device was required.

(2) The equipment lacked provision for connecting power cable to vehicular power supplies. A male scintilla plug and matching female receptacle with battery and ground cords were used for this purpose during test, but were heavier duty items than were required.

17. (~~SECRET~~) TEST NO 17

a. Purpose: To determine suitability and adequacy of the interim operating instructions, keylist and other systems material furnished with the AFSAM 7.

b. Method: Throughout the test, AFSAK 3208 Pollux Crypto-Training Key List - Army/Air Force and AFSAG 1236 Interim Operating Instructions for Pollux Cryptosystems-Joint, were used for the operation and maintenance of the equipment. Deficiencies were noted.

c. Results:

(1) No deficiencies were noted in AFSAK 3208.

(2) AFSAG 1236 was inadequately bound for field use. Cover lacked moistureproofing, deteriorated when exposed to heavy dew. Detailed deficiencies as to content are included in Appendix B, Items 42 - 54.

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18. (~~CONFIDENTIAL~~) TEST NO 18

a. Purpose: To determine if AFSAM 7 meets the requirements for operation and storage set forth in current directives pertaining to temperature, humidity, and barometric pressure performance of Army Field Forces equipment.

b. Method: Arrangements were made for this board to participate in climatic tests to be conducted on the equipment by the Air Proving Ground at Eglin Air Force Base, Florida.

c. Results: Results will be forwarded when available.

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SECRETAPPENDIX B - DEFICIENCIES AND SUGGESTED MODIFICATIONSREPORT OF TEST - PROJECT NO CE 1552

<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
	<u>AFSAM 7</u>	
1.	(CONFIDENTIAL) Power cable lacked facility for connecting to 24-volt vehicular power supply (Test No 1, Appendix A).	Provide a kit for vehicular mounting of the AFSAM 7 to include suitable electrical fittings, i.e., an easily mountable receptacle with battery and ground leads and a matching male plug.
2.	(CONFIDENTIAL) Machine lacked operator nightlight, although receptacle for it was available (Test No 1, Appendix A).	
3.	(CONFIDENTIAL) Case cover containing copy holder would not remain in place when operating (Test No 2, Appendix A).	Provide fastening device for holding the cover in a suitable position so that copy is readily visible to the operator.
4.	(CONFIDENTIAL) Cover containing copy holder lacked facility for holding tape copy for decryption (Test No 2, Appendix A).	Provide a slotted member as part of the bottom front clip on the message holder for holding tape with index marks at a beginning point and at the end of ten groups.
5.	(CONFIDENTIAL) The handle on selector assembly was too long (Test No 2, Appendix A).	Shorten approximately 1 inch.
6.	(CONFIDENTIAL) Operators were unable to read last 10 characters printed without removing tape (Test No 2, Appendix A).	Provide means to enable operator to read final portion of tape printed.

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
7.	(CONFIDENTIAL) Five to seven printed characters were illegible when ribbon reversed during printing operation (Test No 2, Appendix A).	Modify ribbon reversal arrangement to allow legible printing during reversal.
8.	(CONFIDENTIAL) Equipment occasionally substituted figures for letters without any particular pattern on both encipher and decipher (Test No 2, Appendix A).	
9.	(CONFIDENTIAL) Camming surface on rotor stepping linkage, which is spot welded, broke loose (Test No 3, Appendix A).	
10.	(CONFIDENTIAL) AFSAM 107 casting cracked (Test No 3, Appendix A).	Re-examine the spacing of inserts used with fastening screws, since they were mis-spaced in casting that cracked.
11.	(CONFIDENTIAL) Timing shaft clutch pin slipped out (Test No 3, Appendix A).	Provide better retention of clutch pin.
12.	(CONFIDENTIAL) Experimental latch wore, resulting in looseness of right side of AFSAM 207 (Test No 3, Appendix A).	
13.	(CONFIDENTIAL) Rotor stepping contacts required frequent adjustment and were difficult to adjust (Test No 3, Appendix A).	Provide more separator clearance between switches in switch pile-ups and, if feasible, additional space for adjustment.
14.	(CONFIDENTIAL) Spring loaded stop pins in base assemblies became jammed in base plate (Test No 3, Appendix A).	

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
15.	(CONFIDENTIAL) Retaining rings on spring assembly pivot of printer unit came loose, allowing drive link assembly to drop out of engagement with rotor stepping crank (Test No 3, Appendix A).	
16.	(CONFIDENTIAL) Tape worked out of position laterally when pressure roller was released during rotor setting (Test No 3, Appendix A).	
17.	(CONFIDENTIAL) Tape feed pawl eccentric frequently became maladjusted, occasionally slipped off ratchet (Test No 3, Appendix A).	Provide improved feed pawl ratchet design as demonstrated in factory sample.
18.	(CONFIDENTIAL) Rotor retaining rings became sprung and interfered with stepping contact operating levers (Test No 3, Appendix A).	
19.	(CONFIDENTIAL) "One-step advance" switching from plain to encipher functioned improperly (Test No 4, Appendix A).	
20.	(CONFIDENTIAL) Partially used rolls of tape expanded in tape case during cross-country transport, resulting in poor tape advance and blurred printing (Test No 4, Appendix A).	Provide either a locking device for use during transit or instructions directing that tape be removed from printer channel and gummed down to prevent expansion during transit.
21.	(CONFIDENTIAL) Carrying case stop spring broke (Test No 4, Appendix A).	Make stop spring of heavier material.

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
22.	(CONFIDENTIAL) Screws loosened, particularly in rotors and in the figured wheel (Test No 4, Appendix A).	Provide means for locking screws where appropriate.
23.	(CONFIDENTIAL) One or the other ribbon spools was free to unwind, resulting in unwound ribbon, especially during operation in windy weather (Test No 4, Appendix A).	Provide slight drag, in the unwind position, on each spool.
24.	(CONFIDENTIAL) Monofil came out of letters engraved on rotor (Test No 4, Appendix A).	Provide better engraving and fill with white durable material.
25.	(CONFIDENTIAL) Two rotor cores became chipped (Test No 4, Appendix A).	
26.	(CONFIDENTIAL) Use of the Amphenol line plug resulted in broken wire because plug came apart in more than one place (Tests No 4 and 16, Appendix A).	Provide a simpler, durable plug with locking device.
27.	(CONFIDENTIAL) Spare fuse clip did not spring properly; it bent and broke (Test No 4, Appendix A).	
28.	(CONFIDENTIAL) Raised numerals on stator ring were difficult to identify (Test No 6, Appendix A).	Engrave numbers and fill with a white durable material.
29.	(CONFIDENTIAL) Flat contact on Rotor AAC4, Series 45, was improperly molded, resulting in insufficient contact surface (Test No 6, Appendix A).	Provide quality control through inspection of rotors.

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
30.	(CONFIDENTIAL) NS1 method of lashing AFSAM 7 case to pack-board provided unbalanced load (Test No 8, Appendix A).	Change to technique of lashing shown in Appendix C.9. Add instructions and an illustration to AFSAG 1236.
31.	(CONFIDENTIAL) Machine lacked radio frequency filtering interference suppression, particularly over the 2 - 40 mc AM band (Test No 11, Appendix A).	
32.	(CONFIDENTIAL) Accessories were inadequate (Test No 12, Appendix A).	Provide accessory case; tube puller; tube pin straightener; tape moistening tool with cutter; and ruby eraser.
33.	(CONFIDENTIAL) Gummed side of tape was exposed to weather where it entered the tape chute (Test No 13, Appendix A).	Provide a means of protecting the gummed side of tape.
34.	(CONFIDENTIAL) Tape stuck as result of moisture (Test No 13, Appendix A).	Provide tropicalized tape.
35.	(CONFIDENTIAL) Metal parts corroded, particularly cap screws and sheet metal parts of ribbon assembly (Test No 13, Appendix A).	
36.	(CONFIDENTIAL) Sliding contact board swelled as result of moisture and failed to slide (Test No 13, Appendix A).	Provide tolerances in fitting to allow for slight swell.
37.	(CONFIDENTIAL) Machine lacked dust protection when in operating position (Test No 13, Appendix A).	Provide dust protection where necessary, particularly at AFSAM 207 rotor louvers.
38.	(CONFIDENTIAL) Left captive screws on printer unit were inaccessible (Test No 14, Appendix A).	Provide accessibility holes through left bracket assembly.

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
39.	(CONFIDENTIAL) Fusing of the machine and accessory power converter inadequate for protection against abnormal voltages (Test No 15, Appendix A).	
40.	(CONFIDENTIAL) Machines were adjusted for efficient operation at higher than normal wheeled vehicular voltage (Test No 15, Appendix A).	Provide adjustment for optimum operation at approximately 24 volts.
41.	(CONFIDENTIAL) AFSAG 1236 was inadequately bound for field use. It lacked moistureproofing (Test No 17, Appendix A).	Provide a more durable cover treated for use in the field in damp weather.

INTERIM OPERATING INSTRUCTIONS - AFSAG 1236

42.	(CONFIDENTIAL) Instructions omit "36-45 letter check group" which is part of keylist shown in diagram, Item 1202b (Page 11, Item 1202a).	Add as Item 1202a(7).
43.	(CONFIDENTIAL) Diagram omits the system indicator mentioned in Item 1202a(6) (Page 11, Item 1202b).	Add system indicator to diagram.
44.	(CONFIDENTIAL) Instructions lack precautionary comment to assure ring is seated firmly (Page 13, Item 2001c).	After "ring in position" add "making certain that it is seated firmly in place." Reason: In several instances during test, rings became sprung, did not seat firmly; with consequent interference with the stopping notch pattern.
45.	(CONFIDENTIAL) Document fails to explain how to disassemble and reassemble rotors (Page 13, Item 2001).	Revise Item 2001 to include assembly and disassembly of rotors, with illustration. Reason: This is a new technique, and should be explained and illustrated.

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
46.	(CONFIDENTIAL) Second sentence is incorrect in respect to Page 13, Item 2002a(1).	Make Item 2002a(1) agree with Item 5006a, which is correct in this respect. Reason: Frequently, keyboard is dead after light comes on after depressing figures key. An average of 15 seconds is required for circuits to reach an operating condition. The light sometimes can be lighted in four or five seconds.
47.	(CONFIDENTIAL) Last sentence of Item 2002b lacks emphasis (Page 14, Item 2002b).	Italicize last sentence of Item 2002b. Reason: It is noted that elsewhere throughout the document, emphasis is effected by use of italics or capital letters. This sentence is considered important enough for such treatment.
48.	(CONFIDENTIAL) Items omit maximum current or wattage requirement (Page 25, Item 5005e; page 29, Item 5108).	Indicate approximate maximum current or wattage required in each case. Reason: For convenience.
49.	(CONFIDENTIAL) Method described for replacing keyboard assembly is more involved than necessary (Page 30, Item 5202b).	Revise instructions. Reason: It is easier to place the sliding contact board in place over the control panel, and then position the keyboard assembly.
50.	(CONFIDENTIAL) It is unnecessary to remove the support brackets in order to remove the contact panel assembly (Page 31, Item 5206a).	Revise instructions. Reason: Simplify maintenance.
51.	(CONFIDENTIAL) Item 14 is incorrect (Page 43, Figure 4).	Change listing. Reason: Contacts are flat headed.

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<u>NO</u>	<u>DEFICIENCIES</u>	<u>SUGGESTED MODIFICATIONS</u>
52.	(CONFIDENTIAL) This item conflicts with paragraph 2403a(2) of AFSAG 1210A which permits burial of classification at any point in the text (Page 14, Item 2003b).	Make the two documents agree. Reason: To facilitate secure operation.
53.	(CONFIDENTIAL) Stepping unit replacement instructions are incomplete. They fail to caution against inadvertent bending of plunger contacts on the contact panel assembly (Page 31, Item 5204b).	Replace Item 5204b with material substantially as follows: "To replace the stepping unit, tilt it backward at approximately a 45-degree angle and engage the slots in the stepping unit blocks with the slots in the mounting blocks on the base of the cipher machine, making certain that the rotor stepping crank (Figure 4(16)) fits into the yoke of the drive link assembly (Figure 4(8)), and lower the unit into place. CAUTION: CARE MUST BE TAKEN NOT TO BEND THE PLUNGER CONTACTS ON THE CONTACT PANEL ASSEMBLY."
54.	(CONFIDENTIAL) Instructions are lacking on the following: <ol style="list-style-type: none"> a. Lashing of AFSAM 7 to a Quartermaster packboard. b. Emergency destruction data covering keylist and disarrangement of rotors. c. Vehicular installation including mounting and electrical fittings. d. Trouble-shooting for "shift to figures." e. Tube selection. 	

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