

DOCID: 3842901

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AFSAG 1236

5200—SUBSTITUTION OF COMPONENT ASSEMBLIES

CAUTION: BEFORE PERFORMING MAINTENANCE OF ANY TYPE, TURN THE SELECTOR HANDLE TO THE O POSITION, AND DISCONNECT THE POWER CABLE FROM THE POWER SOURCE.

5201. General.—Before undertaking the removal or substitution of component assemblies, it may be necessary to remove the cipher machine from its case.

a. Carrying Case.—The cipher machine must be removed from the carrying case for removal of all components except the keyboard assembly.

- (1) To remove the cipher machine from the carrying case (fig. 1), press down on the stop spring which is mounted on the inner bottom of the case, and withdraw the cipher machine.
- (2) To replace the cipher machine in the carrying case, position the machine so that the two grooves in the bottom of the machine ride on the two bottom rails in the carrying case, depress the stop spring, and slide the machine into the case.

b. Office Case.—The cipher machine should be removed from the office case for removal of all components except the keyboard assembly, cipher unit, and stepping unit.

- (1) To remove the cipher machine from the office case (fig. 2), fold the cover of the case to its full rearward position. Disconnect the cipher machine and power converter cables (fig. 2(6)). Remove the four mounting nuts on the bottom of the case, and lift the cipher machine out of the case.
- (2) To replace the cipher machine in the office case, fold the cover of the case to its full rearward position. Place the machine in the case so that the four mounting studs fit into the holes on the bottom side of the case, and replace the four lock washers and mounting nuts. Tighten the nuts, and connect the cipher machine and power converter cables.

5202. Keyboard Assembly.

a. To remove the keyboard assembly (fig. 3(12) and 4(4)), turn the selector handle (fig. 3(13)) to the D position, loosen the five keyboard assembly captive screws (fig. 3(14)) using the 1/8-inch plastic handle Allen key (fig. 6(9)), and lift the assembly from the contact panel. If done with care, the sliding contact board will remain in position on the contact panel without further disassembly.

CAUTION: IF THE KEYBOARD ASSEMBLY IS NOT LIFTED VERTICALLY, THE SLIDING CONTACT BOARD AND GUIDE RAIL ASSEMBLY ALSO MAY BE LIFTED FROM THE CONTACT PANEL AND THEN DROPPED. THIS MAY RESULT IN DAMAGE TO THE SLIDING CONTACT BOARD ON THE CONTACT PANEL.

b. To replace the keyboard assembly, pull up on each of the five captive screws and turn them counterclockwise until they screw up slightly into the keyboard housing. Make sure the sliding contact board guide rail assembly is up. Carefully place the contact board on the contact panel in such a position that the left ends of the guide rails are in line with the follower assembly (plunger assembly below the tape feed wheel.)

c. Carefully replace the keyboard assembly on the contact panel.

NOTE: It may be necessary to move the selector handle slightly so that the keyboard assembly will seat itself properly.

d. Tighten the captive screws.

5203. Cipher Unit Assembly.

a. To remove the cipher unit assembly, lift up on the right- and left-hand cipher unit latches (fig. 1(5)), and lift the cipher unit assembly vertically from the stepping unit.

b. To replace the cipher unit, carefully place it on the stepping unit with the rotor windows facing the front of the machine. Push downward on the cipher unit and hook the cipher unit latch down over the rotor shaft. Press down on the cipher unit latch locking the rotor shaft in position.

DOCID: 3842901

~~CONFIDENTIAL~~

AFSAG 1236

5204. Stepping Unit Assembly.

- a. To remove the stepping unit, loosen the two captive thumb screws (fig. 1(8) and 3(8)) and lift the unit upward and slightly toward the front of the cipher machine.
- b. 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. Be sure that the rotor stepping crank (fig. 4(16)) fits into the yoke of the drive link assembly (fig. 4(8)), and lower the unit into place.

CAUTION: CARE MUST BE TAKEN NOT TO BEND THE PLUNGER CONTACTS ON THE CONTACT PANEL ASSEMBLY.

- c. Tighten the captive thumb screws.

5205. Printer Assembly.

CAUTION: WHEN HANDLING THE PRINTER ASSEMBLY, DO NOT GRASP SUCH PARTS AS THE PRINT MAGNET (fig. 2(7)), TIMING CAM SWITCHES (fig. 4(9)), OR CLUTCH TRIP MAGNET (fig. 3(17)). THESE PARTS HAVE SOLDERED ELECTRICAL CONNECTIONS AND DELICATE ADJUSTMENTS. HOLD THE PRINTER ASSEMBLY BY ITS HOUSING (fig. 3(19)).

- a. In order to remove the printer assembly, the rotor stepping unit (par. 5204) and the left-hand support bracket (subpar. b below) must first be removed.
- b. To remove the left-hand support bracket (fig. 3(20)), loosen the three rear bracket captive screws (fig. 3(15)) with the $\frac{3}{16}$ -inch T-handle Allen key (fig. 6(7)) and the front bracket captive screw with the $\frac{3}{16}$ -inch-L-shaped Allen key (fig. 6(8)).
- c. To remove the printer assembly, loosen the four printer assembly captive screws (fig. 3(16) and 4(11)) with the $\frac{3}{16}$ -inch T-handle Allen key (fig. 6(8)), and lift the printer assembly vertically from the contact panel.
- d. To replace the printer assembly, position the printer so that the four studs on the assembly line up with the four inserts on the base assembly, and tighten the four printer assembly captive screws into the inserts.

5206. Contact Panel Assembly.

CAUTION: WHEN HANDLING THE CONTACT PANEL ASSEMBLY (fig. 5(11)), GRASP IT BY ITS EDGES. BE CAREFUL NOT TO EXERT ANY PRESSURE OR FORCE ON THE ELECTRICAL WIRING OR ELECTRICAL COMPONENTS MOUNTED ON ITS LOWER SURFACE. EXERT NO SIDEWAYS PRESSURE ON THE EXPOSED TIPS OF THE PRESSURE CONTACTS. WHEN PLACING THE ASSEMBLY FLAT ON A TABLE OR BENCH, SUPPORT IT NEAR THE FOUR CORNERS SO THAT THE ELECTRICAL COMPONENTS DO NOT REST DIRECTLY ON THE BENCH TOP.

- a. Before the contact panel assembly can be removed, it is necessary to remove the following components: keyboard assembly and sliding contact board, cipher unit, stepping unit, ~~left- and right-hand support brackets (fig. 3(6) and (20))~~, and the printer assembly (see par. 5201 thru 5205).
- b. To remove the contact panel assembly (fig. 5(11)), loosen the six contact panel mounting screws (fig. 5(13)) with the $\frac{3}{32}$ -inch plastic handle Allen key (fig. 6(10)) and lift the contact panel vertically from the base.

~~CONFIDENTIAL~~

31

ORIGINAL

DOCID: 3842901

~~CONFIDENTIAL~~

AFSAG 1236

- c. To replace the contact panel assembly, place it flat on the base and tighten the six contact panel mounting screws.

Note: Be sure that the electrical wiring is not pinched between the contact panel assembly and the metal supporting and mounting studs.

- d. When replacing a defective contact panel assembly with a new one, it is necessary to transfer the neon glow lamp (fig. 5(9)) and the six tubes (fig. 5(4), (5), (6), (7), (16), and (17)) from the old to the new contact panel assembly.
- (1) To remove the neon glow lamp, unscrew the plastic cover, twist the lamp counterclockwise, and lift it from the socket.
 - (2) To replace the glow lamp, insert it in its socket so that the projections on the lamp line up with the slots in the socket, push the lamp downward, and twist it clockwise until it is locked in place. Screw on the plastic cover.
 - (3) To remove the tubes, first remove the metallic shields by depressing them and turning them counterclockwise until they can be lifted off vertically. Then, grasp each tube firmly and pull it out of its socket.
 - (4) To replace the tubes, match the projecting pins on the bottom of each tube with the holes in the tube socket, and press the tube down firmly until it is properly seated. Replace the metallic shields.

5207. AC Power Converter Assembly.

- a. To remove the AC power converter (fig. 1(6)) from the office case:
- (1) Disconnect the power cable (fig. 2(6)) from the cipher machine to the power converter.
 - (2) Unwind the input power cord from the rear of the case.
 - (3) Loosen the four power converter captive thumb screws (fig. 3(1)), and withdraw the power converter from the office case.
- b. To replace the AC power converter in the office case:
- (1) Thread the AC power cord through the hole in the rear of the office case.
 - (2) Place the power converter in position and tighten the captive thumb screws.
 - (3) Connect the power converter power cable (fig. 2(6)) to the cipher machine power cable.

CONFIDENTIAL

32

ORIGINAL

DOCID: 3842901

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AFSAG 1236

5300--TROUBLE SHOOTING

5301. **Simplified Trouble-Shooting Chart.**—Following is a simplified trouble-shooting chart. This trouble-shooting chart is to be used only in conjunction with the test procedure outlined in paragraph 5006. This is not a complete trouble chart. Its main purpose is to associate the troubles as indicated in the test with the major component most commonly responsible. The troubles and remedies are indexed by the test paragraph number within which the trouble will be noted. Instructions pertaining to the removal and replacement of component assemblies are contained in section 5200 of this document.

*Test Par.
No. 5006*

Trouble and Remedy

- a. Motor does not operate
1. Check power cable terminal connections
 2. Replace fuses
 3. Replace power supply
 4. Check and clean contacts under keyboard assembly
 5. Check and clean contacts on both sides of sliding contact board
 6. Check and clean contacts under printer assembly
 7. Replace assemblies found with defective contacts
 8. Replace printer unit
 9. Replace keyboard assembly
 10. Replace sliding contact board
 11. Replace contact panel assembly
- Motor overspeeds
1. Replace printer assembly
 2. Replace power supply
- a(1) Neon glow lamp does not light
1. Replace neon glow lamp
 - * 2. Replace shift tube
 3. Check and clean contacts under keyboard assembly
 4. Check and clean contacts on both sides of sliding contact board
 5. Check and clean contacts under printer assembly
 6. Replace components which have defective contacts
 7. Replace printer assembly
 8. Replace contact panel assembly
- a(2) Neon glow lamp does not go out
- * 1. Replace shift tube
 2. Check and clean contacts under keyboard assembly
 3. Check and clean contacts on both sides of sliding contact board
 4. Replace keyboard assembly
 5. Replace sliding contact board
 6. Replace contact panel assembly
- a(3) Counter does not reset
1. Replace stepping unit

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33

ORIGINAL

See Note, pp. 80

DOCID: 3842901

CONFIDENTIAL

AFSAG 1236

*Test Par.
No. 5006*

Trouble and Remedy

a(4).....No printing on tape

- * 1. Replace print tube
- 2. Replace sharpener tube
- * 3. Replace gate tube
- 4. Replace printer assembly
- 5. Replace keyboard assembly
- 6. Replace sliding contact board
- 7. Replace contact panel assembly

Poor quality of printing

- * 1. Replace print and sharpener tube
- 2. Replace printer assembly
- 3. Replace contact panel assembly

Dropped characters--do not print

- 1. Check and clean contacts under keyboard
- 2. Check and clean contacts on both sides of sliding contact board
- 3. Check and clean contacts under printer assembly
- 4. Replace components which have defective contacts

No spacing on tape

- 1. Replace printer assembly

Poor spacing on tape

- 1. Check paper tape for sticking
- 2. Flatten paper tape roll
- 3. Replace printer assembly

Letters print instead of numerals

- * 1. Replace shift tube
- 2. Replace printer assembly
- 3. Replace contact panel assembly

Repetitive printing or spacing

- 1. Replace gate tube
- 2. Replace printer assembly

a(6).....Print one character only and stop

- 1. Check and clean contacts under keyboard assembly
- 2. Check and clean contacts on both sides of sliding contact board
- 3. Replace unit which has defective contacts
- 4. Replace contact panel assembly

Repeats in a nonrhythmic manner

- 1. Replace printer assembly
- 2. Replace contact panel assembly

a(7).....Rotor or rotors do not step

- 1. Check and clean contacts under stepping unit
- 2. Check and clean contacts under printer assembly

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ORIGINAL

* See Note pg 31

DOCID: 3842901

CONFIDENTIAL

AFSAG 1236

*Test Par.**No. 5006**Trouble and Remedy*

3. Replace units which have defective contacts
4. Replace stepping unit

b(2).....Machine fails to make automatic cycle

1. Check and clean contacts under keyboard assembly
2. Check and clean contacts on both sides of sliding contact board
3. Replace unit which has defective contacts
4. Replace keyboard assembly
5. Replace sliding contact board
6. Replace contact panel assembly

b(2)(d).....No rotors step

1. Check and clean contacts under keyboard assembly
2. Check and clean contacts on both sides of contact board
3. Replace unit which has defective contacts
4. Replace stepping unit

One rotor steps

1. Replace stepping unit

b(4).....No printing or stops printing before count is reached

1. Check and clean contacts under cipher unit
2. Check and clean contacts under stepping unit
3. Check and clean contacts of all rotors and apply Lubriplate
4. Check and clean contacts of end plate assemblies
5. Replace units which have defective contacts
6. Replace cipher unit
7. Replace stepping unit

Does not print five-letter groups

1. Replace printer assembly
2. Replace keyboard assembly
3. Replace sliding contact board

b(10).....Rotors do not agree

1. Replace stepping unit
2. Replace cipher unit

b(11).....Tapes do not agree

1. Replace stepping unit
2. Replace cipher unit

b(14).....Seventy-two characters not printed

1. Retype sentence
2. Check and clean contacts under cipher unit
3. Check and clean contacts under stepping unit
4. Check and clean contacts between cipher unit and rotor stepping unit
5. Replace units which have defective contacts

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35

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AFSAG 1236

*Test Par.
No. 5006**Trouble and Remedy*

6. Check, clean, and apply Lubriplate to contacts of all rotors
7. Check and clean contacts under keyboard
8. Check and clean contacts on both sides of sliding contact board

Neon glow lamp does not light when FIG key is depressed

1. Check and clean contacts under keyboard assembly
2. Check and clean contacts on both sides of sliding contact board
3. Replace unit which has defective contacts
4. Replace printer assembly

Neon glow lamp lights but machine does not print

1. Replace printer assembly

Neon glow lamp does not go out when LET key is depressed

1. Replace printer assembly

g(3) Does not decipher

1. Retype enciphered version and redecipher
2. Replace stepping unit
3. Replace cipher unit

Letters and numerals garbled

1. Replace printer assembly
2. Replace stepping unit
3. Replace cipher unit

NOTE: Operational peculiarities may be noticed when new type 2021 tubes are substituted for defective tubes. Because of slight manufacturing tolerances and varying inter-electrode reactions certain type 2021 tubes will not function properly in the critical circuits of the FIG 7. Further, some 2021 tubes will operate in one FIG 7 and will not operate in another. This fact should be considered when this type tube is replaced. If negative results are experienced when a new type 2021 tube is inserted in the unit, the operator should try several other new 2021 tubes until satisfactory operation is obtained.

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36

ORIGINAL

DOCID: 3842901

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AFSAG 1236

5400—CLEANING

5401. General Instructions.—Cleaning should be carried out as prescribed in these instructions, and should be confined to the items specified. Take care not to disturb springs or adjustments. Dirt and dust are to be removed from the exposed surfaces of the machine with the sash-brush-type cleaning brush (fig. 6(1)). Troubles frequently develop later as a result of careless cleaning. The instructions in this section have been purposely arranged to prevent such troubles, and it is therefore important that they be closely followed.

- a. *Frequency.*—Scheduled cleaning periods cannot be definitely prescribed because of varying operating conditions. The factors of dust, humidity, temperature, and the volume of traffic must be taken into consideration when setting up cleaning schedules.
- b. *Authority.*—Obtain the necessary authority for release of the equipment.

5402. Flat Head and Pressure Contacts.

- a. *Flat Head Contacts.*—Thoroughly clean the flat head contacts (fig. 4(2) and (12), and 5(14) and (15)) with a rough, dry cloth. Put a small quantity of Lubriplate #105 (fig. 6(4)) on a piece of Twiljean (fig. 6(2)) or any other lint-free cloth. Fold the cloth and rub it gently between the fingers so as to work the lubricant into the fabric. Wrap the cloth around a finger and rub the cloth lightly across the contact surfaces. The lubricant should be worked into the contacts and all excess wiped off.
- b. *Pressure Contacts.*—Clean the pressure contacts by polishing them with the canvas cleaning block assembly. Do not put Lubriplate on the pressure contacts.

Note: All flat head and pressure contacts (fig. 4 and 5) should be thoroughly cleaned whenever a component assembly is replaced.

5403. Cipher Unit Assembly.—Remove the cipher unit (see subpar. 5203a).

- a. Remove the right-hand end plate by raising its latch (fig. 5 (3)) and sliding the end plate off the rotor shaft. *Take care not to tip the assembly or the rotors will slide off the shaft.*
- b. Invert the cipher unit shell assembly, allowing the eight rotors to slide off the rotor shaft.

CAUTION: NOTE THE SEQUENCE IN WHICH THE ROTORS ARE REMOVED SO THAT THEY MAY BE REPLACED IN THE SAME ORDER (fig. 5(2) and (19), and par. 2001).

- c. Clean the ~~pressure contacts (fig. 4(14)) and the~~ flat head contacts of the left- and right-hand end plates (see par. 5402).
- d. The following procedure is to be used for cleaning each of the eight rotors:
 - (1) Clean the pressure contacts using the canvas cleaning block (fig. 6(6)).
 - (2) Clean the flat head contacts (see par. 5402).

5404. Stepping Unit Assembly.

- a. Remove the rotor stepping unit (see subpar. 5204a).
- b. Clean the contacts of the two reentry blocks (fig. 4(17)). Clean the stepping unit contact block (fig. 4(18)) with the canvas cleaning block.

5405. Printer Assembly.—Remove the printer assembly (see par. 5205).

- a. Clean the print magnet assembly (fig. 2(7)) using the small sashbrush-type cleaning brush (fig. 6(12)). *Take care not to bend the reeds.*

CONFIDENTIAL

37

ORIGINAL

DOCID: 3842901

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AFSAG 1236

- b. Clean the pressure contacts on the under side of the printer assembly (fig. 4(10)) using the canvas cleaning block.
- c. Remove the inked ribbon (see subpar. 5005e). Clean the figured wheel (fig. 1(9)) with the toothbrush-type cleaning brush (fig. 6(11)) saturated with cleaning solvent, if available. The characters on the figured wheel can be reached through the slot at the top of the ribbon track. Clean the characters thoroughly. Replace the ribbon.

5406. Keyboard Assembly.—Remove the keyboard assembly (see par. 5202). Clean all flat head contacts (see par. 5402).

5407. Contact Panel Assembly.

- a. Clean the top surface of the contact panel assembly with the sashbrush-type cleaning brush, paying particular attention to the small spaces between adjacent pressure contacts.
- b. Clean the pressure contacts (fig. 5(8) and (10)) with the canvas cleaning block.
- c. Clean flat head contacts (fig. 5(14) and (15)) as outlined in paragraph 5402.
- d. Clean the canopy of the lamp socket assembly with a piece of dry, lint-free cloth.

Note: For reassembly instructions, see section 5200.

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AFSAG 1236

5500—REPLACEMENT ASSEMBLIES AND TOOLS

5501. Replacement Assemblies.—The assemblies listed in the following table are to be requisitioned through normal Service channels.

<i>Stock Number</i>	<i>Assembly</i>
CE-11111	Carrying Case Assembly
CE-11371	Keyboard Assembly
CE-11566	Printer Assembly
CE-11691	Typewriter Ribbon
CE 11693	Paper Tape
CE-11811	Contact Board and Guide Rail Assembly
CE-11941	Contact Panel Assembly
CE-14504	Base Assembly
CE-14516	Fuse (Cipher Machine)
CE 14517	Neon Glow Lamp
CE-14563	AC Power Converter Assembly
CE-14569	Cipher Unit Assembly—AFSAM 207 (Order by short title as registered cryptographic equipment)
CE-14570	Stepping Unit Assembly—AFSAM 107 (Order by short title as registered cryptographic equipment)
CE-14592	Fuse (Power Converter)
CE-14671	Accessories Case Cover
CE-14676	Accessories Case
JAN2D21	Tube Type 2D21
JAN12AX7	Tube Type 12AX7

5502. Recommended Tools (fig. 6).—The following list of tools are recommended for use in the maintenance of AFSAM 7 as outlined in this document.

<i>Stock Number</i>	<i>Recommended Tools</i>
CE-855	Twiljean Cloth
CE-871	Toothbrush-type Cleaning Brush
CE-872	Sashbrush-type Cleaning Brush
CE 10175	$\frac{1}{8}$ -inch Allen Key
CE-14685	Small Sashbrush-type Cleaning Brush
CE-14687	$\frac{3}{32}$ -inch T-handle Allen Key
CE-14688	$\frac{1}{16}$ -inch T-handle Allen Key
100973	Cleaning Block Assembly
100978	Web Strap
108805	Lubriplate #105
CE-14795	$\frac{3}{32}$ -inch Plastic Handle Allen Key
CE-14796	$\frac{1}{8}$ -inch Plastic Handle Allen Key

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39

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AFSAG 1236

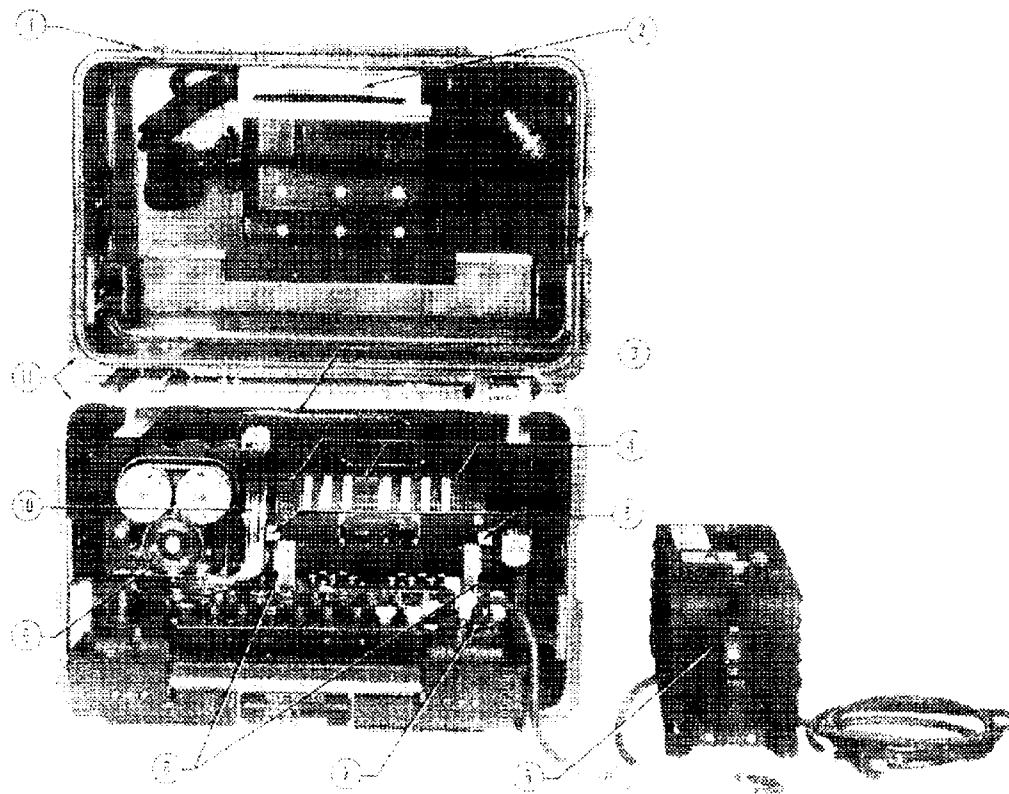


Figure 1

- | | |
|-------------------------------------|--|
| 1. Cover Holsing Latch | 7. Power Cable and Cover Plate Assembly |
| 2. Copy Holder | 8. Stepping Unit Assembly Captive Thumb Screws |
| 3. Spare Paper Tape Holder | 9. Figured Wheel |
| 4. Cipher Unit Assembly Index Marks | 10. Paper Tape Container |
| 5. Cipher Unit Latch Assemblies | 11. Carrying Case |
| 6. AC Power Converter Assembly | |

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AFSAG 1236

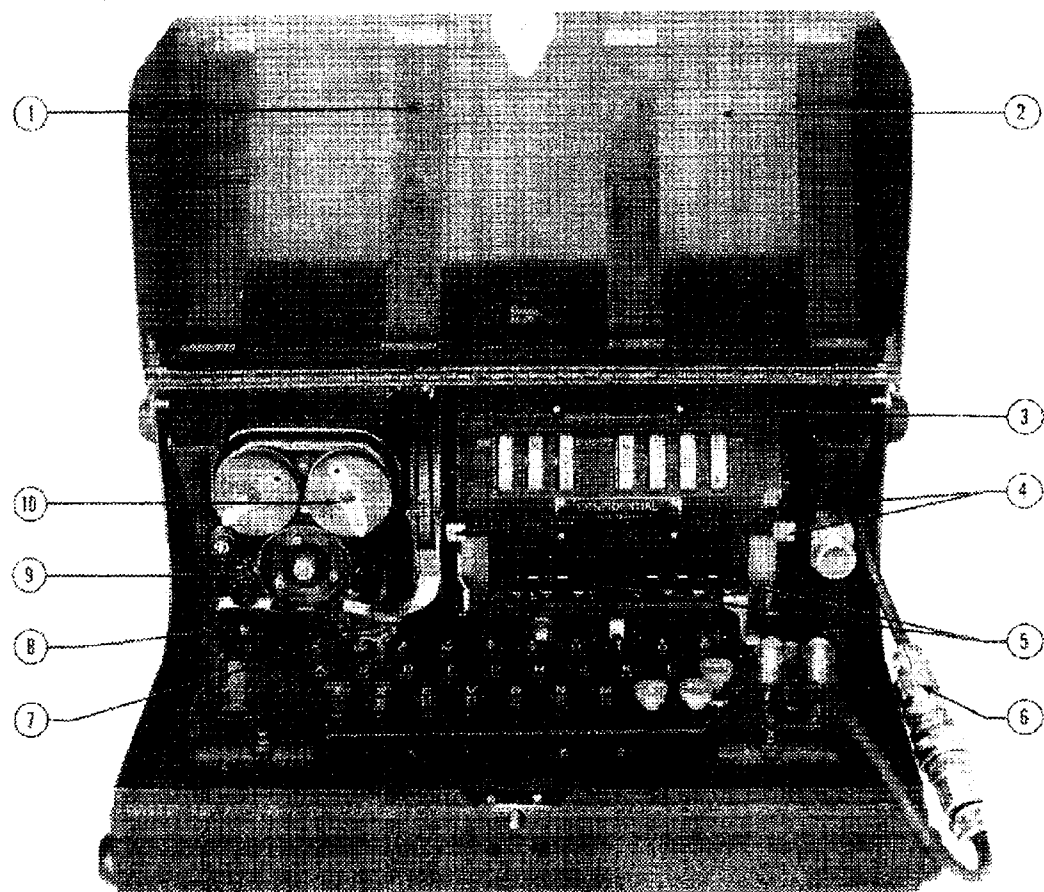


Figure 2

- | | |
|---------------------------------|--------------------------------|
| 1. Copy Holder | 6. Power Cable |
| 2. Office Case Cover | 7. Print Magnet Assembly |
| 3. Cipher Unit Assembly | 8. Paper Tape Feed Roll |
| 4. Cipher Unit Latch Assemblies | 9. Feed Roll Follower Assembly |
| 5. Set Keys | 10. Ribbon Spools |

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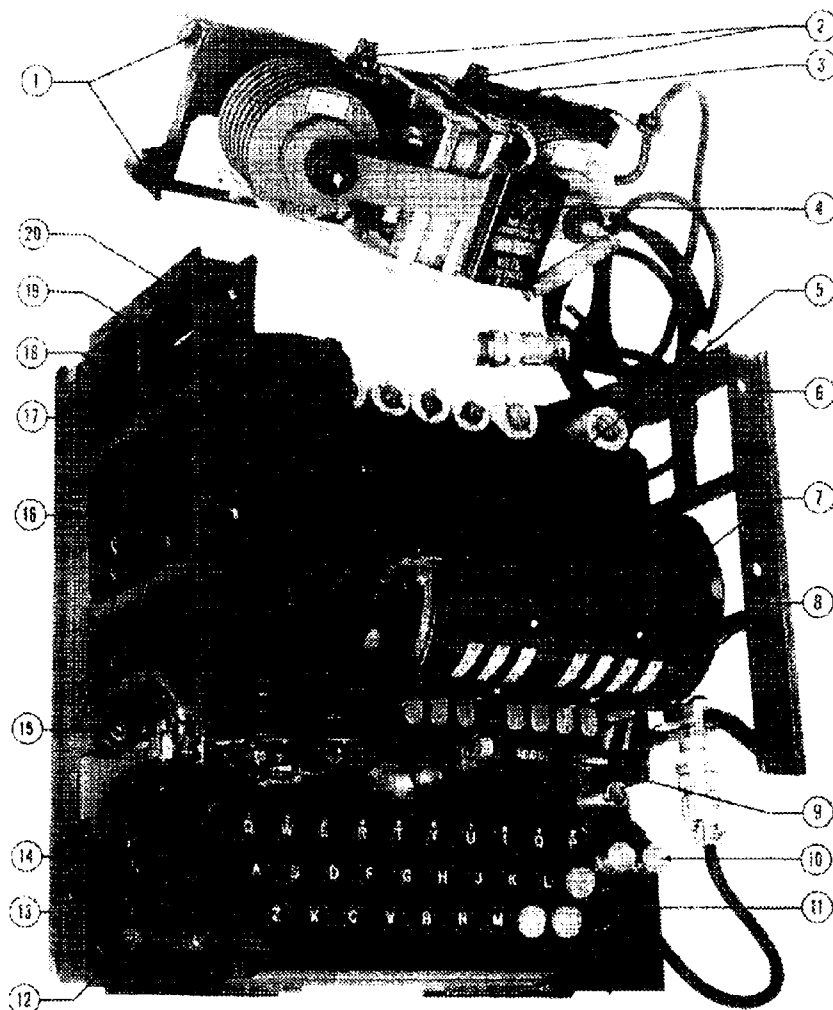


Figure 3

- | | |
|---|--|
| 1. AC Power Converter Assembly Captive Thumb Screws | 10. Fuse Holder Assemblies |
| 2. AC Power Converter Assembly Fuse Holder Assemblies | 11. Power Cable and Cover Plate Assembly |
| 3. AC Power Converter Assembly | 12. Keyboard Assembly |
| 4. AC Power Converter Selector Switch Assembly | 13. Selector Handle |
| 5. Stepping Unit Assembly | 14. Keyboard Assembly Captive Screws |
| 6. Right-hand Bracket Assembly | 15. Left-hand Bracket Captive Screws |
| 7. Cipher Unit Assembly | 16. Printer Assembly Captive Screws |
| 8. Stepping Unit Assembly Captive Thumb Screw | 17. Clutch Trip Magnet Assembly |
| 9. Counter Assembly | 18. Swivel Pin Assembly |
| | 19. Printer Assembly |
| | 20. Left-hand Support Bracket |

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AFSAG 1236

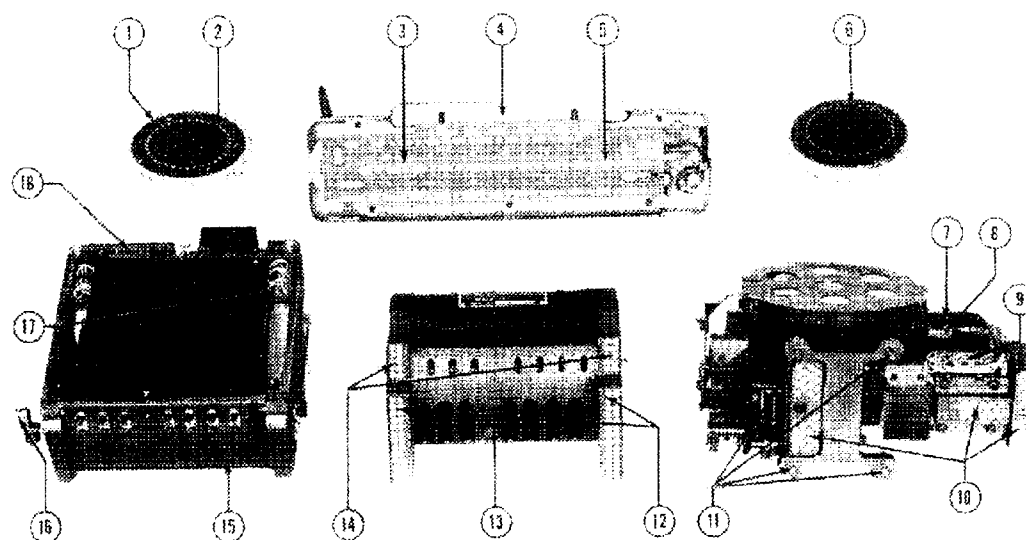


Figure 4

- 1. Rotor Assembly
- 2. Rotor Flat Head Contacts
- 3. Sliding Contact Board and Guide Rail Assembly
- 4. Keyboard Assembly
- 5. Sliding Contact Board Flat Head Contacts
- 6. Rotor Pressure Contacts
- 7. Printer Assembly
- 8. Drive Link Assembly
- 9. Timing Cam Switches
- 10. Printer Assembly Pressure Contacts
- 11. Printer Assembly Captive Screw
- 12. Cipher Unit Assembly Flat Head Contacts
- 13. Cipher Unit Assembly Shell
- 14. Cipher Unit Assembly Pressure Contacts
- 15. Stepping Unit Assembly
- 16. Rotor Stepping Crank
- 17. Reentry Circuit Contact Blocks
- 18. Stepping Unit Assembly Contact Block

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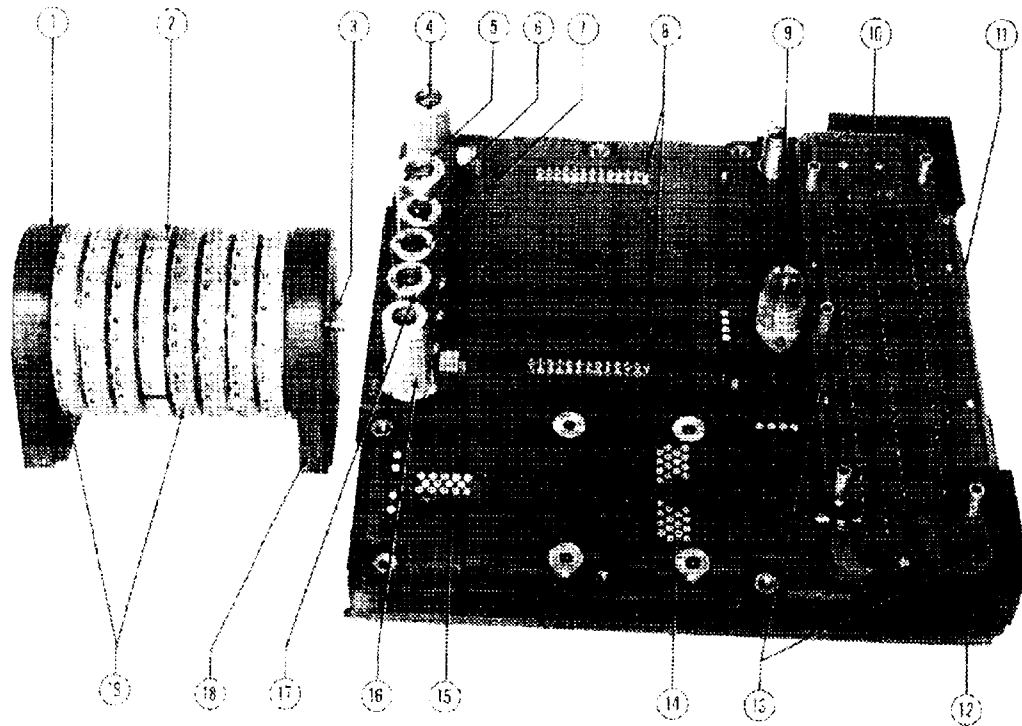


Figure 5

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|---|--|
| <ul style="list-style-type: none"> 1. Left-hand End Plate Assembly 2. Stationary Rotor 3. Right-hand End Plate Latch 4. Spare 12AX7 Tube with Shield 5. Gate Tube (12AX7) with Shield 6. Shift Tube (2D21) with Shield 7. Sharpener Tube (2D21) with Shield 8. Pressure Contacts (Cipher Unit Assembly Area) 9. Neon Glow Lamp 10. Pressure Contacts (Keyboard Assembly Area) | <ul style="list-style-type: none"> 11. Contact Panel Assembly 12. Base Assembly 13. Contact Panel Assembly Mounting Screws 14. Flat Head Contacts (Pulse Generator Area) 15. Flat Head Contacts (Timing Unit Area) 16. Spare 2D21 Tube with Shield 17. Print Tube (2D21) with Shield 18. Right-hand End Plate Assembly 19. Movable Rotors |
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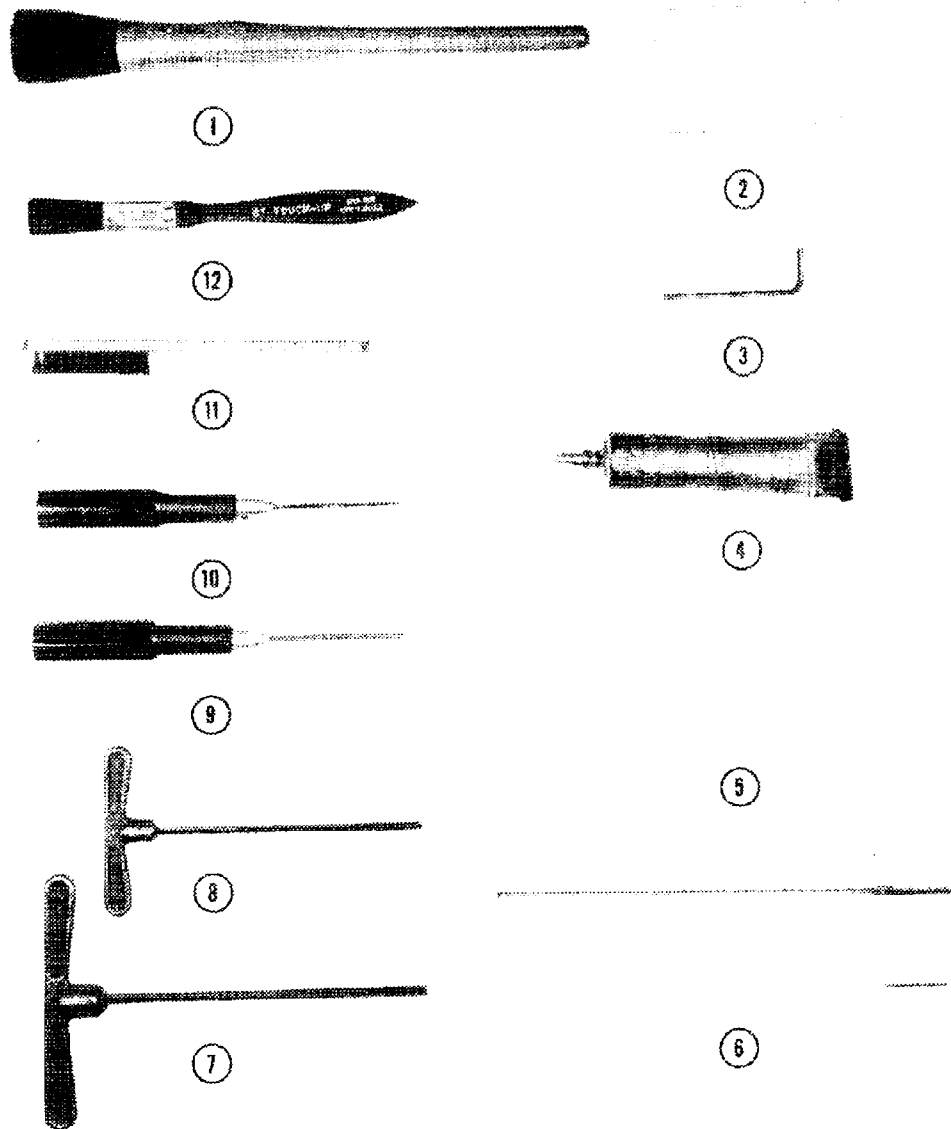


Figure 6

- 1. Sashbrush-type Cleaning Brush
- 2. Twilljean Cloth
- 3. 1/16-inch Allen Key
- 4. Lubriplate #195
- 5. Web Strap
- 6. Cleaning Block Assembly

- 7. 3/16-inch T-handle Allen Key
- 8. 5/16-inch T-handle Allen Key
- 9. 1/4-inch Plastic Handle Allen Key
- 10. 1/2-inch Plastic Handle Allen Key
- 11. Toothbrush-type Cleaning Brush
- 12. Small Sashbrush-type Cleaning Brush

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OPERATING INSTRUCTIONS FOR TSEC/KL-7 — ADONIS OPERATION

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TABLE OF CONTENTS

CHAPTER 1

Section	Paragraph	Page
1000 INTRODUCTION		
ADONIS Cryptosystems	1001	5
Amendments	1002	5
Authorization for Use	1003	5
Use With Other Equipment	1004	5
Comments and Recommendations	1005	5
1100 DESCRIPTION		
General	1101	6
Keyboard	1102	6
Power Requirements	1103	6
1200 PHYSICAL SECURITY		
General	1201	9
Access Requirements	1202	9
Telephone Handsets	1203	9
Emergency Actions	1204	9
1300 FORWARD AREA USE		
General	1301	10
Keying Material	1302	10
Access	1303	10
Physical Safeguarding	1304	10-11
Emergency Actions	1305	11

CHAPTER 2

2000 KEYING		
ADONIS Rotors	2001	13
Key Lists	2002	13-14
2100 KEYING INSTRUCTIONS		
Selection, Assembly and Arrangement of Rotors	2101	15
36-45 Letter Check	2102	15-18
System Indicators	2103	18
Message Indicator	2104	18
Message Rotor Alignment	2105	18-19

CHAPTER 3

3000 OPERATION		
Message Preparation	3001	21
Division Into Cryptoparts	3002	21
Re-encryptions	3003	21
Cryptoperiod	3004	21
Sequence of Operation in Encryption	3005	21-23
Sequence of Operation in Decryption	3006	23
Degarbling	3007	23
Check Decryption List		24

~~CONFIDENTIAL~~

ORIGINAL

~~CONFIDENTIAL~~

KAO-41C/TSEC

TABLE OF CONTENTS (Continued)

CHAPTER 4

Section		Paragraph	Page
4000	SURVEILLANCE		
	General	4001	25-26

CHAPTER 5

5000	CLEANING		
	General Instructions	5001	27
	Flat Heat Contacts	5002	27
	Pressure Contacts	5003	27

~~CONFIDENTIAL~~

KAO-41C/TSEC

CHAPTER 1
1000--INTRODUCTION

1001. ADONIS Cryptosystems.—The mythological designator ADONIS applies to the general cryptosystem produced by the cipher machine TSEC/KL-7 and TSEC/KL-47. Certain ADONIS cryptosystems, designated specifically for tactical use, are referred to as "tactical ADONIS" cryptosystems.

a. Category of Cryptosystems.—Cryptosystems employing the KL-7 are Category A as explained in the effective edition of KAG-1/TSEC.

b. Intercommunicability.—The KL-7 is cryptographically intercommunicable with the cipher machine KL-47, which is designed primarily for US Navy use. The KL-47 will encrypt not only lower case characters (letters) and numbers, but also will encrypt punctuation marks. When it is necessary for stations using the KL-47 to communicate with stations using the KL-7, all punctuation marks will be spelled out, using authorized abbreviations, in order to avoid garbles.

c. KAG-1 Reference.—The effective edition of KAG-1/TSEC or appropriate service directives will be consulted on all general cryptographic procedures such as dividing messages into message parts, codress format, system selection, insertion of classification and special handling instructions, reporting violations, etc.

1002. Amendments.—Amendments to this publication will be issued by means of printed or electrically transmitted amendments, and are to be entered upon receipt. Individuals entering such amendments shall so indicate on the "Record of Amendments" page included herein as page 1.

1003. Authorization for Use.—ADONIS cryptosystems are authorized for the encryption of messages of all classifications. Except in emergency conditions, the classification of messages shall not exceed the classification of the key list or extract to be employed.

1004. Use with Other Equipments.—Through use of the KLX-7 keyboard adaptor, the KL-7 may be operated with the TSEC/HL-1 or TSEC/HL-1B electromechanical tape reader to provide semi-automatic encryption and decryption. When the HL-1 or HL-1B is used, this publication shall be used with the effective edition of KAO-109/TSEC.

1005. Comments and Recommendations.—Comments and recommendations concerning the instructions contained herein are invited and may be submitted through the appropriate Agency, Department, or Service Cryptologic Agency to the Assistant Director, National Security Agency, 3801 Nebraska Avenue, N. W., Washington, D. C. 20305.

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5

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KAO-41C/TSEC

1100--DESCRIPTION

1101. General.—The KL-7 is a keyboard operated, tape printing cipher machine which consists of three major components; KLA-7/TSEC, rotor stepping unit, KLK-7/TSEC, cipher unit, and KLB-7/TSEC, base. The KLK-7 has a shaft on which eight rotor assemblies are mounted and is removed from the machine by lifting the latches on both sides of the unit (see figs. 1 and 2).

1102. Keyboard.—The keyboard resembles a teletypewriter keyboard and has a FIG (Figures), LET (Letters) and RPT (Repeat) key. When the RPT key is depressed together with any operative key, the unit will

operate continuously until the RPT key is released. Depressing the FIG key causes the printer to shift to upper case so the keys in the top row will print figures. The LET key causes the printer to return to lower case and print only letters. The neon glow lamp at the rear of the keyboard lights when the FIG key is depressed and is extinguished when the LET key is used.

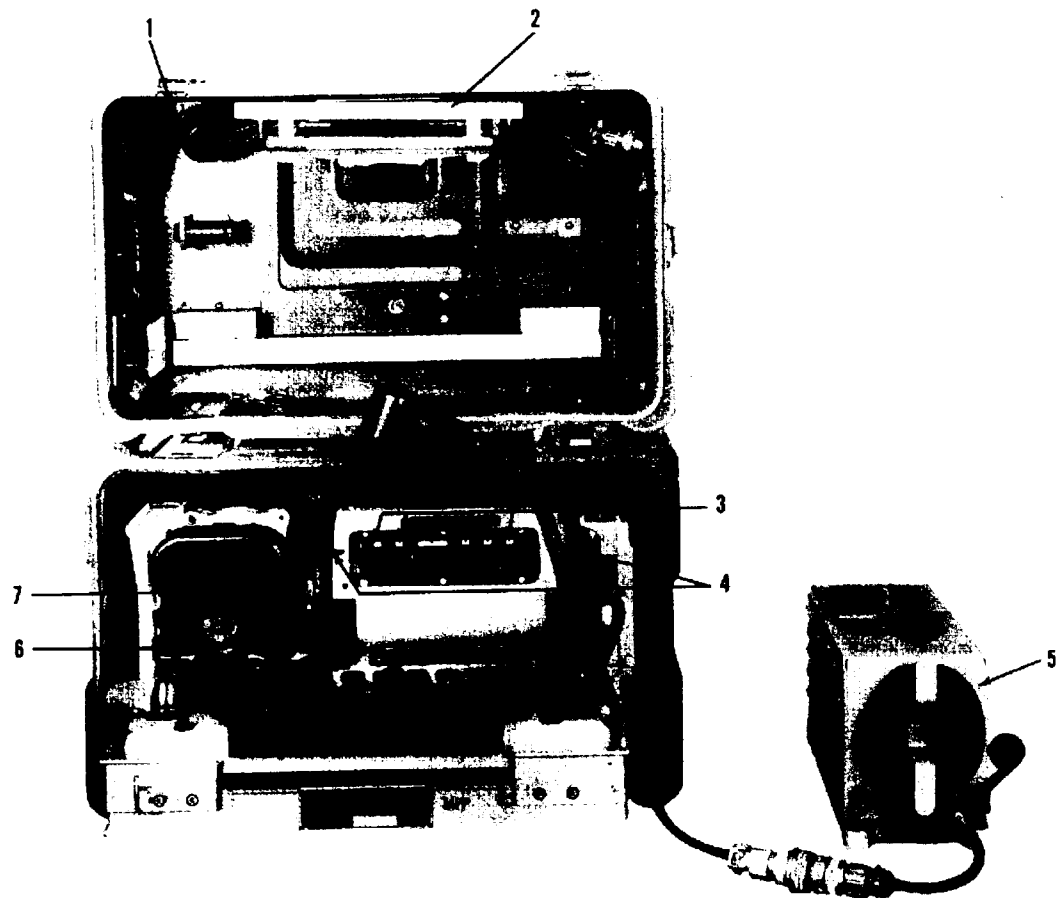
1103. Power Requirements.—The KL-7 is operated from a 21-31 volt DC power supply. A power converter may be obtained for 100-125 volt or 200-250 volt (50-60 cycle) alternating current.

6 ~~CONFIDENTIAL~~

ORIGINAL

~~CONFIDENTIAL~~

KAO-41C/TSEC



- | | |
|-------------------------------------|--------------------------------|
| 1. Carrying Case Cover | 5. AC Power Converter Assembly |
| 2. Copy Holder | 6. Tape Release Lever |
| 3. Cipher Unit Assembly Index Marks | 7. Paper Tape Container |
| 4. Cipher Unit Latch Assemblies | |

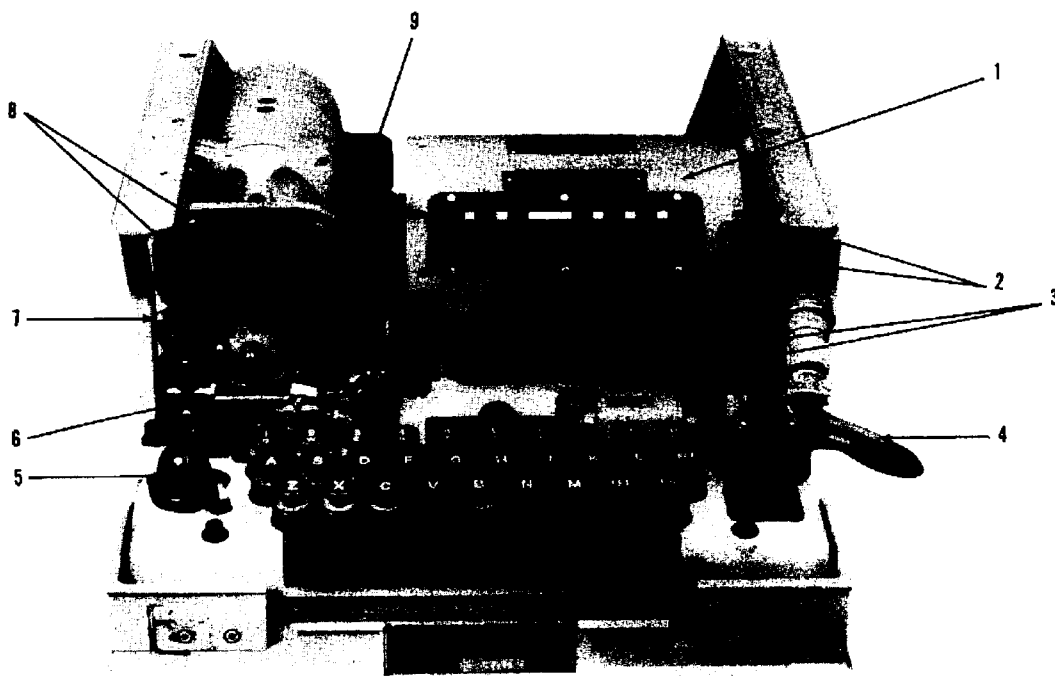
Figure 1.—TSEC/KL-7, with Carrying Case.

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KAO-41C/TSEC



- | | |
|---------------------------------|-----------------------------------|
| 1. Cipher Unit Assembly | 6. Paper Tape Holder |
| 2. Cipher Unit Latch Assemblies | 7. Tape Release Lever |
| 3. Set Keys | 8. Ribbon Spools |
| 4. Power Cable | 9. Swivel Pin (For Changing Tape) |
| 5. Selector Handle | |

Figure 2.—TSEC/KL-7, Top View.

8 ~~CONFIDENTIAL~~

ORIGINAL

~~CONFIDENTIAL~~

KAO-41C/TSEC

1200—PHYSICAL SECURITY

1201. General.—The KL-7 has been approved for use in both mobile and fixed station environments.

1202. Access Requirements.—Operators must have a clearance at least as high as the level of classified traffic to be passed, with a minimum of CONFIDENTIAL. The following table is to be used as a guideline for personnel responsible for the KL-7 and associated publications. For exceptions in using KL-7 in Forward Areas, see paragraph 1300.

1203. Telephone Handsets.—No telephone handsets shall be operated within sound range of the KL-7 during setup, check, encipher or decipher operations unless the telephone is approved for transmission in the clear of information classified at least as high as that of the key lists in use.

1204. Emergency Actions.—Holders of classified cryptomaterial and equipment will prepare an emergency plan in accordance with effective edition of KAG-1 or separate service instructions (see also par. 1305).

Item	Classification	Crypto Access Auth	Remarks
KL-7 External Viewing			See para. 1304c.
KLA-7 Rotor Stepping Unit	CONFIDENTIAL	YES	
KLB-7 Base	UNCLASSIFIED	NO	
KLK-7 Cipher Unit	CONFIDENTIAL	YES	See Note 1.
KAR- Rotor Set	SECRET/ CONFIDENTIAL	YES	See Note 2.
KAK- Key Lists	All Class.	YES	
KAO-41C Operating Instructions	CONFIDENTIAL	YES	
KAM-1 Maintenance Manual	CONFIDENTIAL	YES	
Accessories Case (Complete)	CONFIDENTIAL	YES	See Note 3.

Note 1: A cipher unit with rotor maze installed assumes the same classification as its key list.

Note 2: Tactical ADONIS rotors are CONFIDENTIAL; all others are SECRET.

Note 3: Only the spare KLK-7 is classified; if removed, case is UNCLASSIFIED.

~~CONFIDENTIAL~~

ORIGINAL

9

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KAO-41C/TSEC

1300—FORWARD AREA USE

1301. General.—The following modified procedures for handling and safeguarding the KL-7 and associated materials may be applied when the KL-7 is using "tactical ADONIS" rotors and key lists and is issued for mobile or forward area use.

1302. Keying Material.—See chapter 2 for further information on the classification of "tactical ADONIS" rotors and extracts from "tactical" key lists.

1303. Access.

a. Operators must have a clearance at least as high as the level of classified traffic to be passed, with a minimum of CONFIDENTIAL. Only those individuals whose duties require detailed and continuing access to keying material must have formal authorization for access to cryptomaterial.

b. Up to seven day's extracts of tactical keying material may be provided to personnel not having formal CRYPTO authorization.

c. Personnel assigned to guard vehicles, ships, or aircraft containing KL-7's do not require clearance or formal CRYPTO authorization but they must be responsible and trustworthy U. S. Military personnel or U. S. Government employees. (Contract personnel who are assigned to this duty must have an appropriate clearance.)

1304. Physical Safeguarding.

a. For use in mobile or forward area operations where the possibility of loss or compromise is high, sets of rotors must be afforded the same protection as key lists or key list extracts. The KL-7 may be considered to be unkeyed when the rotors and all key settings are removed and separately safeguarded. When the rotors are in place or immediately available, whether they are set to an operational setting or not, the KL-7 must receive the same physical security protection as a keyed equipment.

b. During mobile operations the amount of supporting material carried should be kept to a minimum. Use of brief key list extracts and the exclusion of maintenance manuals unless mobile maintenance facilities are to be established are examples of such reductions. When necessary, the KL-7, key lists, operating instructions and maintenance manuals may be air dropped. Equipment drops should be made so that immediate possession by U. S. personnel is probable on the ground. Key lists, rotors, operating instructions, and maintenance manuals (if carried) should be dropped in the possession of properly cleared and authorized personnel. When the situation will permit, air landing is preferred to an air drop for all cryptomaterial and especially for rotors, key lists and maintenance manuals.

c. External viewing of the KL-7 when not operating is unclassified, but should be prevented to the maximum extent feasible, especially when the rotors are installed. Viewing of the KL-7 in operation may reveal details of cryptographic operating procedures and should be denied unauthorized personnel.

d. When the rotors are removed from the KL-7 it may be stored in an area under control of U. S. Military personnel or U. S. Government employees. For example, the vehicle or aircraft in which a KL-7 is mounted may be parked in a guarded motor pool or airstrip, or the KL-7 may be left in the command post under control of the charge of quarters. The following requirements must be met for such storage.

(1) The individual responsible for the KL-7 must assure himself that protective measures against theft of the equipment have been officially provided before he leaves it, e.g., that the area is guarded.

(2) The KL-7 must be checked at least daily to insure that it is not missing, and if it is missing, immediate action to recover it shall be taken.

CONFIDENTIAL**KAO-41C/TSEC**

CHAPTER 2
2000-KEYING

2001. ADONIS Rotors.

a. Each ADONIS rotor set consists of twelve rotor cores, eleven notch rings and a stationary wide ring. An alphabet ring is permanently mounted on each rotor core. When a rotor is assembled, a notch ring (or the stationary ring) is locked on the rotor core in accordance with instructions. Eight rotor assemblies, selected from the set of twelve, are used in ADONIS operation.

b. ADONIS rotor sets are SECRET-CRYPTO and registered, except those specifically designated for tactical use, which are CONFIDENTIAL-CRYPTO and registered. Each set is identified by a short title (KAR followed by a number) and a register number (e.g., KAR-1234 Reg Nr 8). Each core is identified by a single letter from A through L. Each notch ring is identified by a number from 1 through 11. The numbers 1 through 36 appear on the side of each alphabet ring and the stationary wide ring.

2002. Key Lists.

a. Key lists used with the KL-7 bear the designator ADONIS. ADONIS key lists are classified CONFIDENTIAL, SECRET or TOP SECRET and are marked CRYPTO.

b. The system indicator for an ADONIS key list is either a four-digit or a five-letter group which identifies the specific ADONIS key list used in encryption. Digital system indicators are always encrypted. Instructions for the encryption of digital indicators are contained in the separate keying material issued for their encryption. The assignment of digital system indicators to specific key lists is disseminated in the effective edition of KAG-18-1 or by special instructions to key list holders. Key lists employing literal indicators will have either a single indicator assigned for all succeeding editions of the key list or will have daily changing indicators listed for each

days key setting. On occasion, key lists with literal indicators may also be assigned digital indicators. When this occurs, holders of the key list will be advised as to which indicator is to be used. Normally it will be the digital indicator.

c. The following information is applicable to extracts from ADONIS key lists.

(1) Regular printed key lists contain keying data for one month. Extracts from these printed key lists shall contain no more than seven days' keying data and will be marked CRYPTO and bear the same classification as the key list from which extracted.

(2) Master key lists may contain keying data for more than 31 days. Extracts from master key lists shall contain no more than seven days' keying data and need not be marked CRYPTO. Master key lists are issued for use in tactical ADONIS operation only.

(3) Key list extracts are not registered, but should be assigned copy numbers for local accounting until destroyed.

(4) The short title of the key list may appear on an extract if desired for convenience, but this short title should be preceded by the words "Extract of".

(5) Extracts from SECRET master key lists shall be classified either SECRET or CONFIDENTIAL, depending on the highest classification of the traffic to be encrypted using the keying data involved.

d. Normally, no ADONIS key list or extract thereof will be used for encryption of messages of higher classification than that of the key list or extract to be employed. Except in emergency conditions, TOP SECRET messages shall be encrypted using TOP SECRET key lists only.

e. Key lists specifically designated for training purposes shall not be used for the encryption of operational traffic.

CONFIDENTIAL**ORIGINAL****13**

CHAPTER 2
 2000—KEYING

2001. ADONIS Rotors.

a. Each ADONIS rotor set consists of twelve rotor cores, eleven notch rings and a stationary wide ring. An alphabet ring is permanently mounted on each rotor core. When a rotor is assembled, a notch ring (or the stationary ring) is locked on the rotor core in accordance with instructions. Eight rotor assemblies, selected from the set of twelve, are used in ADONIS operation.

b. ADONIS rotor sets are ~~SECRET~~—CRYPTO and registered, except those specifically designated for tactical use, which are ~~CONFIDENTIAL~~—CRYPTO and registered. Each set is identified by a short title (KAR followed by a number) and a register number (e.g., KAR-1234 Reg Nr 6). Each core is identified by a single letter from A through L. Each notch ring is identified by a number from 1 through 11. The numbers 1 through 36 appear on the side of each alphabet ring and the stationary wide ring.

2002. Key Lists.

a. Key lists used with the KL-7 bear the designator ADONIS. ADONIS key lists are classified ~~CONFIDENTIAL~~, ~~SECRET~~ or ~~TOP SECRET~~ and are marked CRYPTO.

b. The system indicator for an ADONIS key list is either a four-digit or a five-letter group which identifies the specific ADONIS key list used in encryption. Digital system indicators are always encrypted. Instructions for the encryption of digital indicators are contained in the separate keying material issued for their encryption. The assignment of digital system indicators to specific key lists is disseminated in the effective edition of KAG-18-1 or by special instructions to key list holders. Key lists employing literal indicators will have either a single indicator assigned for all succeeding editions of the key list or will have daily changing indicators listed for each

days key setting. On occasion, key lists with literal indicators may also be assigned digital indicators. When this occurs, holders of the key list will be advised as to which indicator is to be used. Normally it will be the digital indicator.

c. The following information is applicable to extracts from ADONIS key lists.

(1) Regular printed key lists contain keying data for one month. Extracts from these printed key lists shall contain no more than seven days' keying data and will be marked CRYPTO and bear the same classification as the key list from which extracted.

(2) Master key lists may contain keying data for more than 31 days. Extracts from master key lists shall contain no more than seven days' keying data and need not be marked CRYPTO. Master key lists are issued for use in tactical ADONIS operation only.

(3) Key list extracts are not registered, but should be assigned copy numbers for local accounting until destroyed.

(4) The short title of the key list may appear on an extract if desired for convenience, but this short title should be preceded by the words "Extract of".

(5) Extracts from ~~SECRET~~ master key lists shall be classified either ~~SECRET~~ or ~~CONFIDENTIAL~~, depending on the highest classification of the traffic to be encrypted using the keying data involved.

d. Normally, no ADONIS key list or extract thereof will be used for encryption of messages of higher classification than that of the key list or extract to be employed. Except in emergency conditions, ~~TOP SECRET~~ messages shall be encrypted using ~~TOP SECRET~~ key lists only.

e. Key lists specifically designated for training purposes shall not be used for the encryption of operational traffic.

f. Key settings change daily. Each key list contains the following information for each date.

- (1) A list of the cores to be placed in the eight positions in the cipher unit.
- (2) The settings of the alphabet rings for seven cores.
- (3) The setting of the stationary ring on the core in the fourth position.
- (4) The notch rings to be used with seven cores (listed in conjunction with the letter of the alphabet ring to which the notch ring bench marks are set).
- (5) The 36-45 letter check groups.
- (6) The system indicator to be used for the GMT date of encryption for those key lists employing daily changing indicators.

g. Rotor assemblies are listed from left to right in the order in which they are to be inserted in the cipher unit. The arrangement of the keying data in an ADONIS key list is illustrated below.

Note 1: Blank spaces on alphabet rings are indicated in key lists by the letters which precede them in the alphabet printed in conjunction with a plus sign (+). Thus, "J+" indicates the space between the letters J and K, "M+" indicates the space between M and N, etc. There are ten such spaces on each alphabet ring.

Note 2: Some key lists will contain a second column of letter check groups separated by a heavy black line from the other keying data. The KAR on which the additional letter check groups are based is indicated at the top of the column. Ordinarily this KAR will have been superseded. The group in this additional column shall be used only when higher authority directs that the specified KAR will be used beyond its normal supersession date.

Amend 3. (Use of sample key list is prohibited for on-the-air use)

Sample Key List

POSITION IN MACHINE		1		2		3		4		5		6		7		8		36-45 LTR CHECK GRP	
DATE	CORE	ALPH RING SET	NOTCH RING SET	CORE	ALPH RING SET	NOTCH RING SET	CORE	ALPH RING SET	NOTCH RING SET	CORE	ALPH RING SET	NOTCH RING SET	CORE	ALPH RING SET	NOTCH RING SET	CORE	ALPH RING SET		NOTCH RING SET
H 24	8-D			A 12															

ND 2

NEW KEY LIST... AT OF
 CTED ADONIS KEY LISTS HAS BEEN CHANGED. FORM
 KEY LIST IS A SIX FOUR PAGE BOOKLET CONTAINING THREE ONE
 OF KEY WITH A SCRAMBLE DESIGN PATTERN ON THE REVERSE OF
 #L PAGES. THE LAST 2 PAGES IN THE BOOK ARE BLANK. THE
 S ARE ASSEMBLED KEY SIDE DOWN WITHIN A FRONT AND BACK
 R THAT CONTAIN HANDLING INSTRUCTIONS AND A DISPOSITION
 RD. THE INDIVIDUAL PAGES ARE PERFORATED FOR EASE OF
 VAL. NEW KEY LIST PACKAGING FEATURES GLUING THE SIDES OF
 BOOKLET TOGETHER WITH A YELLOW GLUE DAINTED OVER WITH
 OM STRIPES OF ANOTHER COLOUR, LEAVING ONE CORNER OPEN FO
 R OPENING AND REMOVAL OF PAGES. THE FINISHED BOOKLET IS
 OXOMATELY 3 INCHES BY 7 INCHES AND WILL BE PACKAGED IN A
 TIC WRAPPER. THIS WRAPPER MUST NOT BE REMOVED FROM THE KE
 PRIOR TO 24 HOURS BEFORE IMPLEMENTATION. THE BOOKLET
 LD BE OPENED CAREFULLY TO AVOID TEARING PAGES. THE FRONT
 R MAY BE LOSSEMED BY SLIPPING A SHARP INSTRUMENT SUCH AS
 E INTO THE OPEN CORNER OF THE BOOKLET AND RUNNING IT ARC
 GLUED EDGES OF THE PAGE. AS NEEDED INDIVIDUAL PAGES MAY
 ENED IN THE SAME WAY.

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KAO-41C/TSEC

2100—KEYING INSTRUCTIONS

2101. Selection, Assembly and Arrangement of Rotors.—The elements of the rotors are selected and assembled to settings appearing in the key list for the GMT date of encryption and are then placed in the cipher unit in the order in which they are listed in the key list. The key list contains eight numbered columns, one for each of the eight rotor assemblies used. Rotors are assembled as shown in figures 3(1) through 3(4) on pages 16 and 17. The example uses the sample key list depicted above and the photographs show the assembly of rotors in the first and the fourth columns of that key list.

a. Each column of the key list designates a rotor core to be used in that position of the rotor maze. An alphabet ring is permanently mounted on each rotor core. The alphabet ring is set by pressing down on the ring and rotating it to align the designated number with the bench mark arrow on the flat side of the rotor core.

b. The notch ring to be used with each core is specified by the key list. The notch ring is placed on the rotor core by aligning the notch ring arrow beside the small hole which appears on the edge of the rotor core on the pressure contact side. The notch ring is set by pressing down on the ring aligning its bench marks until they bracket the designated letter on the associated alphabet ring.

c. The stationary wide ring is placed on the rotor core in the same manner as the notch ring. It is aligned to the proper setting by placing the designated number beside the small hole on the pressure contact side of the rotor.

d. After assembly, check each rotor to insure that it is assembled according to the settings appearing in the key list, and that neither the notch ring nor alphabet ring will rotate relative to the core. Place each rotor in the cipher unit as soon as assembled. **ADONIS ROTORS ARE NOT REVERSIBLE, AND MUST ALWAYS BE PLACED IN THE CIPHER UNIT WITH THE FLAT SIDE IN.** The stationary wide ring

assembly must always be placed in the fourth position in the cipher unit.

e. After insertion of the assembled rotors in the cipher unit, replace the endplate making certain the endplate latch is engaged in the grooves on the shaft and place the cipher unit on the stepping unit. Make certain the two latches are then securely engaged.

f. Rotors are disassembled by reversing the above procedures.

2102. 36-45 Letter Check.

a. The 36-45 letter check groups are provided in the key lists as a means of performing a check on the operation of the machine and upon the correctness of the rotor assembly and arrangement. The letter check is made in the following manner:

(1) After the rotors have been assembled and placed in the cipher unit, and the cipher unit has been placed in the machine, turn the selector handle to "P" (Plaintext). Allow time for the machine to warm up. It is ready for operation when the keyboard will print.

(2) Hold back the tape release lever (see figs. 1 and 2), which is located to the upper left of the paper tape feed roll (to save tape), and align to the white bench marks on the cipher unit the seven visible rotors to AAAAAAA by depressing each of the rotor-set keys. The rotor-set keys are located below the rotor windows when the cipher unit is in place.

(3) Turn the selector handle to "E" (Encrypt). (Note that the rotor maze steps once.)

(4) Set the stroke counter to zero. Press and hold the "L" key; while holding the "L" key, press and hold the "RPT" key until at least 45 letters (nine groups) have been printed on the tape.

CAUTION:

DO NOT USE ANY OF THE FIVE-LETTER GROUPS APPEARING ON THE TAPE AS THE MESSAGE INDICATOR OR THE MESSAGE ROTOR ALIGNMENT.

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ORIGINAL

15

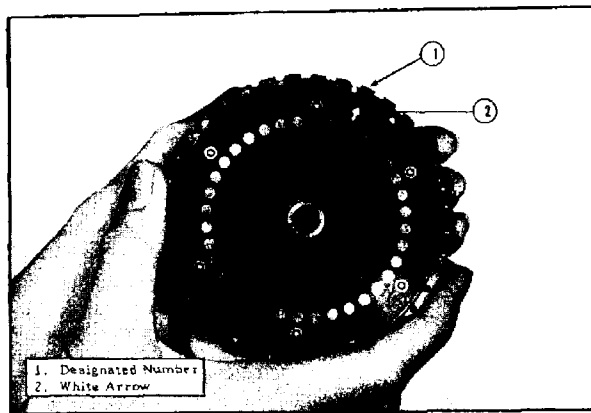


Figure 3(1)

Setting alphabet ring to bench mark arrow on rotor core:

- (1) Depress the alphabet ring and rotate the ring until the designated number (24) is beside the white arrow on the rotor core.
- (2) Release the alphabet ring and check to insure that it is firmly locked in position and that it will not rotate relative to the core.

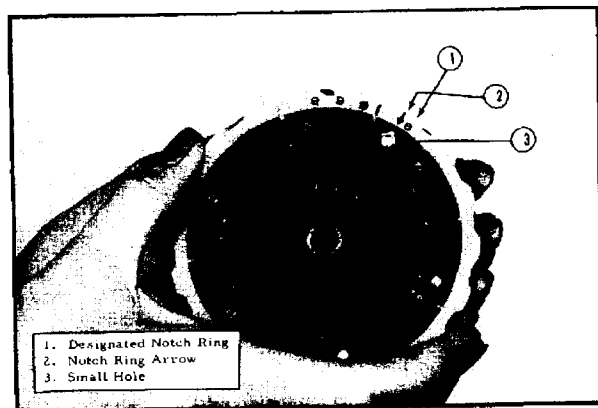


Figure 3(2)

Placement of notch ring on rotor core:

- (1) Select the designated notch ring (8) and place it on the rotor core with the black arrow of the notch ring opposite the small hole near the edge of the rotor core.
- (2) Depress the notch ring and rotate the ring to lock it in position on the rotor core.

Figures 3(1), 3(2).—Assembly of ADONIS Rotors in Accordance with a Key List.

~~CONFIDENTIAL~~

KAO-41C/TSEC

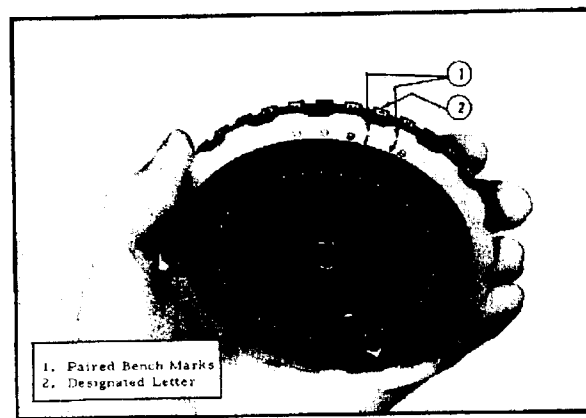


Figure 3(3)

Setting notch ring to designated letter of alphabet ring:

- (1) Depress the notch ring and rotate it relative to the core until the paired bench marks (line and arrow) bracket the designated letter of the alphabet ring (D).
- (2) Release the notch ring. Check to insure that both the alphabet ring and notch ring are firmly locked in position, and that neither will rotate relative to the core.

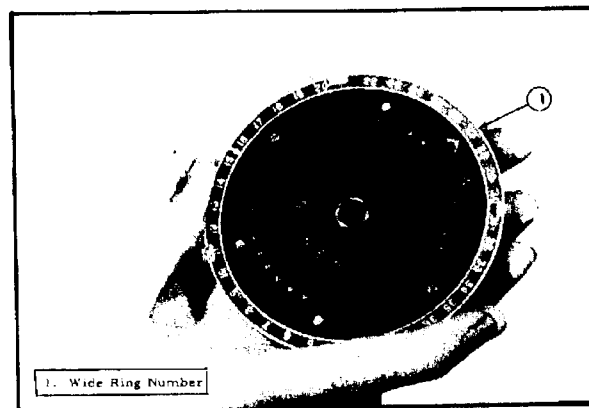


Figure 3(4)

Placement of stationary ring (wide ring) on rotor core:

- (1) Select the core listed in the fourth column of the key list (G) and hold it with the spring contacts up.
- (2) Place the stationary ring on the core so the arrow on the ring points to the small hole near the edge of the rotor core.
- (3) Depress the ring and rotate it until the small hole is opposite the WIDE RING number (27) designated in the key list. Release the ring and check to insure that it is firmly locked in position.

Figures 3(3), 3(4).—Assembly of ADONIS Rotors in Accordance with a Key List.

~~CONFIDENTIAL~~

ORIGINAL

17

(5) Tear off the tape and compare the last two encrypted groups with the 36-45 letter check group appearing in the effective key list. The letter check tape must be destroyed immediately after comparison. If the groups are not identical, the above procedures should be repeated, and all steps carefully checked.

b. If the 36-45 letter check cannot be made successfully and rechecks have indicated that the correct rotors, rotor assemblies, rotor arrangements, etc., have been used, dirty rotor or cipher unit contacts, faulty mechanical operation, or an error in the printing of the letter check in the key list may be the cause.

(1) If more than one machine, cipher unit, and set of rotors is available, attempt to produce the letter check using the different equipment. If the same letter check is found consistently with both sets of equipment, it should be assumed that the letter check is incorrectly printed in the key list and normal operation may continue.

(2) If spare equipment is not available, the equipment shall be set up according to the previous day's arrangement. If the letter check for the previous day is made successfully, it may be assumed that the equipment is functioning properly and normal operation may continue. If the letter check for the previous day cannot be made successfully, the equipment shall not be used until maintenance has been performed.

2103. System Indicators.—System indicators are encrypted when prescribed by appropriate Service, Department, or Agency instructions. KAG-18-1 and KAL-11 are used in conjunction for the encryption of system indicators.

2104. Message Indicator.

a. The message indicator consists of five random letters and is used to determine the message rotor alignment as explained in paragraph 2105. **THE MESSAGE INDICATOR SHALL BE DIFFERENT FOR EACH MESSAGE OR MESSAGE PART.** When it is necessary, as in the case of a service, to re-encrypt a message, or part, or any portion thereof, a different message indicator shall be used. Bonafide five-letter

words, abbreviations, etc., will not be used as message indicators.

b. Previously prepared message indicators shall always be used. These shall either be selected from a prefabricated indicator tape or shall be generated on the machine in the following manner.

(1) Place a random assembly and arrangement of rotors in the machine (not an arrangement prescribed in the key list).

(2) Randomly align the rotors, move the selector handle to "E" and by typing letters and words at random, produce a tape of five-letter groups.

c. The random groups should be used, one at a time, as message indicators. As each is used it should be torn off the roll and pasted on the message form, message log, etc., to prevent possible re-use.

CAUTION:

DO NOT DEVIATE FROM THESE PROCEDURES IN SELECTING RANDOM INDICATORS. DO NOT STEP THE ROTORS TO A RANDOM ALIGNMENT AND COPY THE RESULT AS THE MESSAGE INDICATOR.

2105. Message Rotor Alignment.—The alignment of the rotors at the beginning of encryption and decryption is the message rotor alignment. It is derived from the message indicator in the following manner:

a. With the selector handle at "P", align the seven visible rotors to AAAAAAA by depressing, in order, each of the rotor-set keys.

b. Select a random five-letter message indicator as described in paragraph 2104 and paste it on the message form, message log, etc.

c. Turn the selector handle to "E" (note that the rotor maze steps once).

d. With the selector handle at "E", encrypt the five letters of the message indicator. The resulting five encrypted letters printed on the tape forms the five letters of the message rotor alignment.

e. Tear off the tape.

f. Return the selector handle to "P", align the first five rotors to the encrypted

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KAO-41C/TSEC

five letters printed on the tape by depressing, in order, the rotor-set keys. Use the alignment of the first and second rotors as the alignment of the sixth and seventh rotors, respectively. This completes the message rotor alignment.

For Example:

Message Indicator
(Random) DWBRP
Result Printed on Tape
(Encrypted Indicator) H A F T B

Completed Message Rotor

Alignment H A F T B H A

CAUTION:

DO NOT TRANSMIT THE COMPLETED MESSAGE ROTOR ALIGNMENT OR ANY PORTION THEREOF AS THE MESSAGE INDICATOR.

g. Destroy the tape on which the encrypted message indicator is printed.

~~CONFIDENTIAL~~

CHAPTER 3

3000—OPERATION

3001. Message Preparation.—Messages to be encrypted with the KL-7 will be prepared in accordance with effective edition of ACP 121 or applicable Department or Agency instructions.

3002. Division into Cryptoparts.—Message length in ADONIS cryptosystems is limited to 900 groups, exclusive of indicators. When the plain text of a message will yield more than 900 groups of cipher text, the following instructions apply.

Amend 1
a. Divide the message between words so that no part will exceed the ~~900~~ group limitation. (200)

b. Encrypt each part using a NEW MESSAGE INDICATOR.

c. Number each cryptopart in plain language, e.g.,

PART ONE OF THREE PSLAV INDIA
TANGO PAPA ALFA TANGO

PART TWO OF THREE PSLAV DELTA
ROMEO OSCAR QUEBEC XRAY

FINAL PART OF THREE PSLAV YANKEE
TANGO ECHO GOLF KILO

3003. Re-encryptions.—Whenever a message OR ANY OF THE PLAIN TEXT THEREOF was once encrypted and transmitted and is again encrypted by the originator or any addressees, the following rules apply:

a. A different message indicator shall be selected for the re-encryption.

b. A different DTG and a different filing time shall be used with the re-encrypted version. If the original DTG is used for reference purposes, it must be buried in the text of the re-encrypted message.

c. There will be no external linkage between the original message and the re-encryption.

3004. Cryptoperiod.

a. ADONIS cryptosystems have variable elements, called keying elements, which

change on a daily basis; for example, rotor arrangement and rotor assembly. Key changes shall be made at 0001Z (GMT).

b. Messages shall be encrypted using the key for the GMT date indicated by the external date-time group; for example, a message with an external DTG of 240200Z, to be encrypted at 232200R (local time) shall be encrypted using the daily keying elements for the 24th day.

c. When it is determined at the end of a cryptoperiod that a backlog of messages will require more than one hour encryption time and DTGs have already been assigned, a new external DTG should be assigned to each message by the cryptocenter and the original DTG should be buried in the text for encryption.

3005. Sequence of Operations in Encryption. (see CHECKLIST on page 24)

a. Prepare the KL-7 rotors for operation in accordance with paragraph 2101 and insure the letter check (par. 2102) agrees with the letter check listed in last column of key list.

b. Align rotors and encrypt message indicator as indicated in paragraph 2105.

c. With the selector handle at "P", type the message heading, space several times, and type the system indicator which identifies the keying data used for encryption, then type the phoneticized message indicator.

d. With the rotors aligned to the message rotor alignment (encrypted message indicator), turn the selector handle to "E" (note the rotor maze steps once).

e. Set the stroke counter to zero.

f. Type the message text to be encrypted.

(1) The KL-7 will cause an encrypted "J" to decrypt as a "Y" and an encrypted "Z" to decrypt as an "X". Phoneticize the letters J, Y, X and Z when encrypting such text as callsigns, proper names, etc.,

CONFIDENTIAL

ORIGINAL

21

which might otherwise be inaccurate when decrypted.

(2) Space normally between words. The cipher text will be printed on the tape in five-letter groups.

(3) The letter "X" may be used in lieu of punctuation in the message text. Punctuation marks, where required for clarity, must be spelled out or abbreviated. Numbers should normally be spelled out in order to prevent garbles in the message text. In certain circumstances where message texts are composed primarily of digits (e.g., weather traffic, logistic traffic, etc.) the encryption of digits may be authorized by higher authority.

(4) If a typing error occurs during encryption of literal traffic which will affect the sense of the message, type the word "ERASE" preceded and followed by a space, repeat the last correct word, NOT A NUMBER, and continue the message from that point. If an error is made during encryption of digital traffic, return to lower case by striking the LET key, type the word ERASE, preceded and followed by a space. Strike the FIG key to return to upper case, repeat the last digital group known or assumed to be correct, and continue the message from that point.

g. If the last group of cipher text does not contain five letters, strike the space bar once and encrypt as many random letters as necessary to complete the group. If the machine is in upper case, first strike the LET key, strike the space bar once, and then encrypt as many random letters as necessary to complete the final group.

h. After the text has been encrypted, move the selector handle to "P" and type the system indicator.

i. Advance the tape until the printing is clear of the tape channel and tear off the tape.

j. The following illustrates the arrangement of system and message indicators which shall be used.

37135 NOVEMBER SIERRA JULIETT
 1 2
ALFA PAPA BVPLQ FKROC DLQQO
 3
NXMSD ZLDXI 37135
 3 1

1. System indicator (repeated at end of text; may also be literal).

2. Message indicator (each letter phonetized).

3. Encrypted text.

k. Randomly disarrange the rotor alignment reached at the end of encryption.

l. Except under the conditions stated in paragraph 3004m, every message shall be completely check decrypted to verify that the operating instructions have been carefully followed and that the encrypted text is decipherable. If two or more operators are available, the check decryption should be performed by an operator other than the one who performed the original encryption. If possible, a different set of cryptomaterials should be used. THE CHECK DECRYPTION SHALL BE MADE BEFORE TRANSMISSION OF THE ENCRYPTED MESSAGE EXCEPT IN CASES OF EMERGENCY. In cases of emergency, the message may be transmitted and then check decrypted. If an error is discovered after an encrypted message has been transmitted, appropriate corrective actions should be taken by means of an explanatory cryptoservice as explained in the effective edition of KAG-1.

m. When a complete check decryption cannot be made because of the urgency of the message or other cogent reason, a partial check decryption of each message or cryptopart will be made as follows:

(1) Examine the message as though it were an incoming message.

(2) Follow the normal sequence of operations for decryption as contained in paragraph 3005.

(3) Decrypt the first ten groups.

(4) Press the RPT and L keys simultaneously and permit the machine to run until the stroke counter reaches 50 characters LESS than the number of characters in the cipher text.

(5) Decrypt the last ten groups.

(6) If all items check properly and the first and last ten groups decrypt correctly, it can be assumed that the message has been correctly encrypted.

~~CONFIDENTIAL~~

KAO-41C/TSEC

n. Randomly disarrange the alignment reached by the rotors on completion of the check decryption.

3006. Sequence of Operations in Decryption.

a. Prepare the KL-7 rotors for operation in accordance with paragraph 2102 and insure letter check agrees with key list.

b. With the selector handle at "P", align the seven rotors to AAAAAAA by depressing the rotor-set buttons.

c. Move the selector handle to "E" and encrypt the message indicator *RECEIVED*.

d. Return the selector handle to "P" and align the five letters printed on the tape on the first five rotors from left to right.

e. Complete the rotor alignment by repeating the alignments of rotors 1 and 2 on rotors 6 and 7 respectively.

f. Destroy the tape containing the first five letters of the rotor alignment.

g. Turn the selector handle to "D" (Decrypt). (Note the rotors step once as the selector passes from "P" to "E".)

h. Set the stroke counter to zero.

i. Type the encrypted text of the message, exclusive of indicators. Disregard the spaces between groups. The plain text will be printed on the tape in normal word lengths. The X will be printed in lieu of Z, and the Y in lieu of J, e.g., XERO for ZERO, and YUMP for JUMP.

j. After completing decryption, advance the tape until the printing is clear of the tape channel, and tear off the tape.

k. Randomly disarrange the rotor alignment reached at the end of decryption.

l. Prior to delivery of the messages to addressees, the message must be edited in

accordance with the effective edition of KAG-1.

3007. Degarbling.

a. If no plain text appears:

(1) Compare the group count against the actual number of groups in the message. If different, add random groups to make up the difference or subtract the difference and attempt to decrypt again.

(2) The Message Rotor Alignment may be incorrect. Attempt to decrypt using the 36-45 letter check alignment, then using AAAAAAA and finally the alignment reached by the rotors *AFTER* derivation of the correct rotor alignment.

(3) The DTG may be in error. Try to decrypt using the key for the day before and the day following the DTG. Try the key list for the previous month and the following month.

b. If some plain text appears: Write down the rotor alignment at the "point of garble". The "point of garble" is the fourth character of the last group known to be correct. The fifth character of this group must not be used since the stepping of the rotors as the selector handle passes from "P" to "E" or "D", will make up for that missing fifth character. Compare group count against actual number of groups. If not the same, add or delete characters or groups at the "point of garble" to make up the difference.

c. If the message cannot be decrypted, a cryptoservice request for re-encryption must be sent and the undecipherable message brought to the attention of the officer-in-charge. He will determine how much time, if any, should be spent in attempting to degarble it and if any special action should be taken.

~~CONFIDENTIAL~~

ORIGINAL

23

CHECK-DECRYPTION LIST

DATE _____

Msg. No.	1	2	3	4	5	6	7	8	9	10	11	12
a. Correct Cryptosystem used.												
b. Correct key list and system indicator for system, month and day.												
c. Letter check made. (Tape destroyed.)												
d. Message indicator selected at random and not previously used in this crypto-period.												
e. Message rotor alignment derived correctly.												
f. Message or part does not exceed ^{Am} 200 groups. 1200												
g. Complete check decryption performed by different operator if possible, (1) using only the copy of the message as prepared and ready for transmission;												
(2) using different crypto-equipment, if possible;												
(3) none of the groups obtained in making the letter check used as message rotor alignment or message indicator (tape destroyed).												
OPERATOR'S INITIALS												
CHECK OPERATOR'S INITIALS												

Note: Extracts of this page need not be marked CRYPTO.

~~CONFIDENTIAL~~

KAO-41C/TSEC

CHAPTER 4
4000—SURVEILLANCE

4001. General.—The specific physical and cryptographic insecurities applicable to the ADONIS cryptosystems are described below. Whenever an insecurity is detected, the cryptosecurity officer or officer in charge should be notified. He will prepare the necessary report and submit it in accordance with the effective edition of KAG-1 by the means shown.

a. Physical Insecurities.—Any physical insecurities pertaining to the KL-7, rotors, classified components, printed key lists, or extracts of printed key lists, maintenance manuals, operating instructions, or pages thereof, will be reported by message in accordance with the effective edition of KAG-1.

b. Locally Extracted Keying Material. All known or suspected physical compromises of master key lists or locally extracted keying material from master key lists will be reported to the commander issuing the keying material. He will take the necessary action to evaluate the compromise and notify holders in event supersession is warranted.

c. Cryptographic Insecurities.—Cryptographic insecurities shall be reported by letter (except (3) below which must be reported by message), together with a copy of the cipher text of the message involved, directly to the Assistant Director, National Security Agency, 3801 Nebraska Avenue, N. W., Washington, D. C. 20305, ATTN: S13.

(1) Any reuse of a message indicator on the same daily key list setting. Specify if the reused indicator was for a re-encryption of the same message or for encryption of two or more different messages or cryptoparts. Notify the originator by message that the messages involved must be paraphrased in accordance with the appropriate paragraph of KAG-1.

(2) Encryption of a message or any part of the plain text thereof in which a rotor is discovered to have missed two or more scheduled steps, or to step two or more

times when not scheduled. If there are more than two improper steps of a rotor, *the originator shall withdraw the faulty machine from use until it has been repaired.*

(3) Faulty encryption resulting in monoalphabetic substitution. This fault is the result of encryption in which none of the rotors step. The easiest way to recognize this is by noting that a particular letter in cipher text, the monoalphabetic version of the encrypted spaces in the message, will recur at word-length intervals. Describe in detail the cause of the monoalphabetic substitution. Action to be taken is:

(a) If the originator notes this fault, he shall send a cryptoservice message to all addressees which states that the original message will not decipher due to faulty encryption which resulted in monoalphabetic substitution and that the original message must be considered compromised and will not be serviced. The originator must also provide addressees with a re-encryption of the original message, if the information is still required.

(b) If an addressee notes the fault, he shall notify the originator and all addressees by encrypted message. The originator must then take the action outlined in (a) above.

(4) Transmission of a message having more than ~~one~~ groups to a cryptopart. *Am*
State the number of groups sent.

(5) Transmission in the clear of any alignment reached by the rotors during or at the end of a previous transmission.

(6) Transmission in the clear of any portion of the 36-45 letter check sequence.

(7) Message indicator obviously not selected at random (bonafide words, abbreviations, use of any five letters which appear on the rotors at the end of a previous message or cryptopart).

(8) Transmission in the clear of the message rotor alignment or any five consecutive letters thereof (for example, use

~~CONFIDENTIAL~~

ORIGINAL

25

DOCID: 3842900

~~CONFIDENTIAL~~

KAO-41C/TSEC

of the first five letters of the rotor alignment as the message indicator).

(9) Encryption of a message using AAAAAAA as the message rotor alignment.

(10) Use of the alignment reached by the rotors after encryption of the message indicator as the message rotor alignment, i.e., failure to align the message rotor alignment after its derivation.

~~CONFIDENTIAL~~

KAO-41C/TSEC

CHAPTER 5

5000—CLEANING

5001. General Instructions.—Care must be taken not to disturb springs or adjustments when performing first echelon maintenance. Dirt and dust are to be removed from the exposed surfaces of the machine with the sash-brush-type cleaning brush. Troubles frequently develop later as a result of careless cleaning. Cleaning should be carried out as prescribed in these instructions and should be confined to the following items:

- a. Contacts on bottom and side of KLK-7 endplates.
- b. Contacts on stepping unit where KLK-7 rests.
- c. Rotors.

Note: Definite cleaning schedules should not be prescribed since such factors as dust, humidity, temperature, and the volume of traffic must be the determining factors.

5002. Flat Head Contacts.—If the flat head contacts on the bottom of the KLK-7 endplates, inside the removable KLK-7 end-

plate, or the rotors themselves appear black or badly corroded, thoroughly clean them with the eraser provided in the accessories kit. Put a medium coating of cleaner-lubricant on the surface of those contacts which are subject to friction and spread the lubricant with twilljean cloth. Under normal operating conditions, the eraser should not be used more than once every 30 days to clean the rotor contacts. Also clean and put a medium coating of cleaner-lubricant on all rotor brushings (hole in center of rotor) and the shaft of the KLK-7 on which they are inserted.

5003. Pressure Contacts.—Clean the pressure contacts by polishing them with the canvas cleaning block assembly. **DO NOT PUT LUBRICANT ON THE PRESSURE CONTACTS.** All flat head and pressure contacts on endplate *inside* KLK-7, on stepping unit beneath KLK-7, and on the rotors themselves, should be thoroughly cleaned with a clean lint-free cloth or canvas cleaning block whenever a component assembly is replaced.

~~CONFIDENTIAL~~

ORIGINAL **27**
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~~CONFIDENTIAL~~ ~~CRYPTO~~

KAO-41C/TSEC

CONFIDENTIAL

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