TM 11-5835-224-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DS, GS, AND DEPOT MAINTENANCE MANUAL
INCLUDING REPAIR PARTS AND SPECIAL TOOL LISTS

CODER-BURST TRANSMISSION GROUP
AN/GRA-71

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 1969

CAUTION

Before taking resistance measurements on the transistorized circuits of the KE-8B keyer and the KA-3 keyer adapter, refer to paragraph 2-2*c*(1).

TECHNICAL MANUAL
No. 11-5835-224-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *25 July 1969*

DS, GS, and Depot Maintenance Manual

INCLUDING REPAIR PARTS AND SPECIAL TOOL LISTS CODER-BURST TRANSMISSION GROUP AN/GRA-71

---

*This manual supersedes TM 11-5835-224-45, 15 February 1967, and TM 11-5835-224-45P, 24 June 1966.

CHAPTER 1

FUNCTIONING OF CODER-BURST TRANSMISSION GROUP AN/GRA-71

Section I. GENERAL

1-1. Scope

a. This manual contains direct support and depot maintenance instructions for Coder-Burst Transmission Group AN/GRA-71 components. It describes the mechanical and electrical functioning of the components and includes instructions for troubleshooting and adjustments, depot assembly removal and replacement, testing, and maintenance. The purpose, operation, and interoperation of the various circuits in this equipment are explained in this chapter. No maintenance is required at general support category.

b. The complete technical manual for this equipment includes TM 11-5835-224-12.

Note. Appendix B is current as of 1 May 1969.

c. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-ME-NMP-AD, Fort Monmouth, N. J. 07703.

Note. For applicable forms and records, refer to TM 11-5835-224-12.

1-2. Indexes of Equipment Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to the latest issue of DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Coder-Burst Transmission Group AN/GRA-71 Block Diagram

a. Component designations established and used throughout TM 11-5835-224-12 will be used in this technical manual.

b. Coder-Burst Transmission Group AN/GRA-71 contains a Coder, Tape MX-4496/GRA-71 (CO/B-8 coder), a Coder, Tape MX-4495/GRA-71 (CO-3B cartridge), two identical magazines, Recording Tape MA-9/GRA-71 (CA-3B cartridge), a Keyer KY-468/GRA-71 (KE-8B keyer), and a Adapter, Keyer, MX-4498/GRA-71 (KA-3 keyer adapter).

c. These units are described in (1) through (5) below, and are also illustrated in figure 1-1. TM 11-5835-224-12 contains additional general information.

(1) *CO/B-8 coder.*

(*a*) The CO/B-8 coder enables an operator to record Morse-encoded messages on a magnetic tape contained in the CA-3B cartridge.

(*b*) The message is stored in two tracks on tape in the form of precisely spaced, magnetic impulses representing Morse-encoded characters. Magnetic impulses representing dots are recorded in one track, and magnetic impulses representing dashes are recorded in the other track.

(2) *CO-3B coder.*

(*a*) The purpose of the CO-3B coder is the same as that of the CO/B-8: to generate magnetic impulses for subsequent recording on magnetic recording tape. It is somewhat less automatic than the CO/B-8, in that each dot and dash element of a character is generated and recorded individually by way of its keyboard.

(*b*) The dot and dash keys drive an electrical impulse generating system which automatically generates an impulse to form either a dot or dash element.

(3) *CA-3B cartridge.*

(*a*) The sole function of the CA-3B cartridge is to carry and store the magnetic tape used for recording Morse-encoded messages. The CA-3B cartridge has a capacity of 12 1/2 feet of instrument grade magnetic recording tape, including the *lead* portion (at the beginning), and the *residual* portion (at the end).

(*b*) The CA-3B cartridge is a mechanical device consisting of a miniature tape transport and magnetic recording tape.

(4) *KE-8B keyer.*

(*a*) The function of the KE-8B keyer is to pick up the intelligence from the CA-3B cartridge magnetic tape and to generate a perfectly spaced Morse code dot whenever a dot impulse occurs, and a perfectly spaced dash whenever a dash pulse occurs.

(*b*) The KE-8B keyer contains a spring motor to drive the CA-3B cartridge, and electronic circuits for converting the tape-recorded impulses into properly spaced Morse code keying signals. Also, a circuit (referred to as IDY generator) is provided for sending dots at 300 words per minute (wpm), and for erasing the magnetic tape within the CA-3B cartridge.

(5) *KA-3 keyer adapter.*

(*a*) The KA-3 keyer adapter connects the KE-8B keyer output to the input of Radio Transmitter T-784/GRC-109 (or whatever transmitter has been adapted for use). In this capacity, the KA-3 keyer adapter converts the KE-8B keyer output keying impulses into transmitter modulation signals.

(*b*) The KA-3 keyer adapter supplies 12 volts direct current (dc) at 50 milliamperes (ma) to the KE-8B keyer, and is also a watertight carrying case for storing a CO/B-8 coder, CO-3B coder, KE-8B keyer, two CA-3B cartridges, an extra character dial, and a camel's-hair cleaning brush.

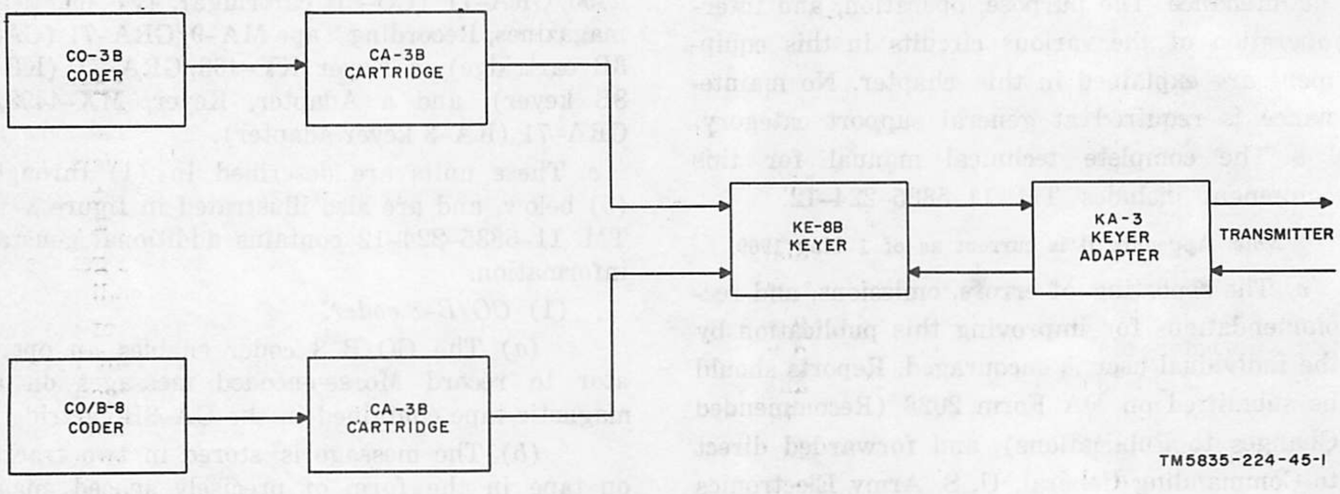


Figure 1-1. AN/GRA-71, block diagram.

Section II. INTERCOMPONENT SIGNAL PATH OF AN/GRA-71

1-4. AN/GRA-71 Intercomponent Signal Path

The AN/GRA-71 intercomponent signal path (fig. 1-1) is sequentially, from the CO-3B coder or CO/B-8 coder to the CA-3B cartridge, to the KE-8B keyer, to the KA-3 keyer adapter, and then to Radio Transmitter T-784/GRC-109. The CA-3B cartridge is locked in position on either coder where Morse code impulses are recorded on the tape. The CA-3B cartridge is then removed from one of the coders (tape rewind is automatic) and locked in position on the KE-8B keyer.

1-5. Pulse Train

Magnetic tape impulses are converted, in the KE-8B keyer, to a properly timed and shaped pulse train, and passed on to the KA-3 keyer adapter where actual transmitter keying takes place.

Section III. FUNCTIONING OF CO/B-8 CODER

1-6. CO/B-8 Coder Block Diagram

For descriptive purposes, the CO/B-8 coder mechanism is divided into eight basic sections according to function. Figure 1-2 shows electrical and mechanical operating functions.

1-7. Operating Handle

The operating handle is used to rotate the dot and dash coding camshafts to cause the coding mechanism to function. Travel of the operating handle is only 90° during a complete downstroke. This 90° excursion is converted and drives the coding camshafts through 360° of rotation through a 4-to-1 ratio gear train. Camshaft driving is initiated from the *starting* position of the operating handle. When the operating handle reaches a maximum downward position, all impulses for the selected character have been recorded on the tape.

1-8. Character Dial and Coding Wheel

The character dial is used to index a hole pattern (for the selected character) over a set of dot and dash sensing pins. For this purpose, the character dial is attached direct to the coding wheel. The character dial is the external disk containing etched alphabet characters. It can be rotated in either direction to choose the character to be recorded.

a. Character Dials. Two character dials are supplied with the CO/B-8 coder. One side of both dials is etched with characters. To change the character dials, remove a flathead screw, countersunk in the center of the dial, and then lift off the dial. When changing dials, be sure that the locating pin is well seated in the locating hole in the dial before attempting to tighten the flathead screw.

b. Coding Wheel. The coding wheel is the internal disk that rotates with the character dial and sets up a mechanical Morse equivalent of the selected character for the two coding assemblies. The coding wheel contains two rows of holes for each character on the dial. One row corresponds to the dots in the character; the other row corresponds to the dashes in the character. A detent device (indexing roller) aligns and holds the coding wheel in position during recording of a character.

1-9. Dot and Dash Coding Assemblies

The dot and dash coding assemblies are used to sense and convert the mechanical pattern of holes in the coding wheel into a pattern of electrical impulses to be recorded on magnetic tape. In this capacity, the coding assemblies drive the spacing mechanism, the impulse generator, and the dot and dash switching assemblies. Each coding assembly consists of four sensing pins, six coding levers (some are not used), four or five coding cams, coding lever bail, switch-and-bellcrank actuator, bellcrank, and a stroking finger. Essentially, a dot or dash is detected when a sensing pin enters a hole in the coding wheel. This action causes a coding lever to pivot, the coding lever bail to engage, and the switch-and-bellcrank actuator to close a switch to the dot or dash track on the recording head. As the actuator closes the switch, it also positions a stroking finger to engage a spacing universal bar; the impulse generator is then actuated, which causes a current impulse to be delivered to the dot or dash track on the recording head. The stroking finger is then brought down, engaging the spacing universal bar, and the tape is advanced.

1-10. Impulse Generator (CO/B-8 Coder)

The impulse generator is the electrical powerplant or the CO/B-8 coder. It consists of a permanent-magnet structure with a flat, spring steel armature surrounded by a coil. Whenever the armature is stroked by the impulse generator actuating cam (attached to the dot coding camshaft), its vibration causes an impulse of current to flow in the coil winding. The current impulse is delivered to a half-wave rectifier, consisting of a series diode-resistor combination which clips off the positive portion of the alternating current (ac) wave and delivers only a negative impulse to the switching assemblies. The ac output of the generator must be rectified, because ac will not place an impulse on the tape.

1-11. Dot and Dash Switching Assemblies (CO/B-8)

The negative current impulse from the generator is switched to either the dot or dash track winding on the dual-track recording head by means of two single-pole, double-throw (spdt) switches that comprise the switching assemblies. These switches are actuated by their respective switch-and-bell-crank actuators whenever a hole is detected by a sensing pin. Normally, these switches ground the head windings when they are not in use to prevent stray pickup from being recorded.

When either switch is engaged by its respective switch-and-bellcrank actuator, it opens the groundpath and connects its respective head track to the impulse generator in anticipation of the current impulse.

1-12. Recording Head (CO/B-8)

Whenever an impulse of current passes through either winding on the recording head, iron oxide particles embedded in the magnetic tape are magnetically polarized. This magnetic polarization creates a magnetic impulse on the tape which produces the actual recording process.

1-13. Spacing Mechanism (CO/B-8)

The spacing mechanism is used for proper tape advance of dots, dashes, character spaces, and word spaces. The advancing mechanism is controlled by the dash spacing universal bar. As this bar is depressed, it engages a feed pawl and causes the pawl to advance a feed ratchet one or two teeth. For dashes and word spaces the dash spacing universal bar is depressed to its limit to allow a two-tooth movement of the pawl, and for dots it is partially depressed (by the dot spacing universal bar) to allow only a one-tooth movement.

1-14. Sequence of Functioning (CO/B-8)

a. When a character is selected on the character dial, its Morse hole-pattern on the coding wheel is moved into coding position directly over the dot and dash sensing pins. If the character contains dots, holes will appear above the appropriate dot sensing pins; if the character contains dashes, holes will appear above the appropriate dash sensing pins.

b. As the operating handle is pulled, camshafts in the dot and dash coding assemblies rotate. Attached to each camshaft is a set of cams (under the coding levers) with their recessed edges displaced 60° apart. Spring-loaded coding levers ride the cams on each assembly, and each lever pivots in sequence as the camshaft rotates through 360°. As each lever pivots, it lifts the sensing pin up to the coding wheel so that a dot sensing pin and a dash sensing pin rise as a pair, with each 60° rotation of the camshafts. If a sensing pin finds a hole in the coding wheel, it passes through the hole and a dot or dash is recorded. If no hole is found, the sensing pin strikes against the coding wheel and nothing is recorded.

c. There are only four sets of sensing pins on the coding levers. The first and last coding levers do not have sensing pins attached to them, because the coding wheel has no holes above the first and last coding levers. The first set of coding levers (farthest from the impulse generator) is not used; only the dot coding lever is used in the last set (closest to the impulse generator). This last dot coding lever is used for automatic character spacing rather than hole detecting.

d. The sensing pin scanning sequence begins with the outside hole on the coding wheel and works inward. There is a hole in the coding wheel for each dot or dash in every character; two holes are never adjacent, because this condition would allow both a dot and a dash to be recorded simultaneously. Character *P*, for example, has holes in the dot row above the first and fourth sensing pins, and holes in the dash row above the second and third sensing pins.

e. Assume that the character *E* to be indexed is in the coding position. The first dot sensing pin will enter the hole in the coding wheel. The first dash sensing pin is blocked by the lack of a hole and it strikes against the coding wheel. As the first dot sensing pin enters the hole, it allows its respective spring-loaded coding lever to pivot, and the dot coding lever bail depresses. This bail is depressed by any dot coding lever if its pin enters a hole. Since both the dot switch and the dot bellcrank are directly connected to the bail through the switch-and-bellcrank actuator, the dot switch is closed, and the bellcrank pushes the stroking finger outward to engage the dot universal bar. Simultaneously, the impulse generator armature is moved into cocked position by the impulse generator actuating cam.

f. The sensing pin is now in the hole, the dot switch to the recording head is closed, the stroking finger is in the engaging position, and the impulse generator armature is cocked. Further rotation of the operating handle releases the armature sharply, which causes an impulse of current to be delivered to the dot track, and a magnetic impulse is recorded in the dot channel on the tape. Following impulse delivery, the stroking finger is pushed downward by a lever that follows the dot stroking cam, and the stroking finger engages and depresses the dot spacing universal bar. This movement causes the spacing mechanism to advance the feed ratchet one tooth for the dot space. A one-tooth advance on the feed ratchet rotates the cartridge drive gear to cause a two-baud, or 0.030-inch tape advance.

g. Continuing rotation of the operating handle causes the above coding sequence to be repeated on each of the three remaining active dot coding levers; but, since no holes occur in these three remaining positions, no magnetic impulse is recorded and no tape advance occurs.

h. Operation of the dash coding assembly is the same as the dot coding sequence, except that the dash stroking finger engages the dash spacing universal bar and causes the feed ratchet to advance two teeth to cause a four-baud, or 0.060-inch tape advance.

i. In the final movement of the operating handle, the last (sixth) dot coding lever pivots. The sensing pin is missing from this lever which allows it to pivot completely despite the lack of a hole in the coding wheel. The last (sixth) dash coding lever has no effect because its cam is not recessed.

j. As the last coding lever pivots, the dot coding lever bail is again depressed, which causes both the dot switch to be closed and the bellcrank to push the stroking finger outward to engage the dot spacing universal bar. Normally, the impulse generator is cocked and released just after the stroking finger is pushed out; but the impulse generator actuating cam has no depression at this position, and therefore, no impulse is generated or recorded on the tape.

k. As the operating handle approaches its stop, the stroking finger is pushed downward and depresses the dot spacing universal bar. Again this movement causes the spacing mechanism to advance the feed ratchet one tooth for a dot space, therefore, the final action of the operating handle creates a blank dot space which is the automatic character space at the end of each character.

l. When the word-space button is operated, it depresses the dash spacing universal bar, and causes the feed ratchet to advance two teeth to cause a four-baud, or 0.060-inch advance. This four-baud advance, added to the three-baud space that follows each character, gives a seven-baud space between words.

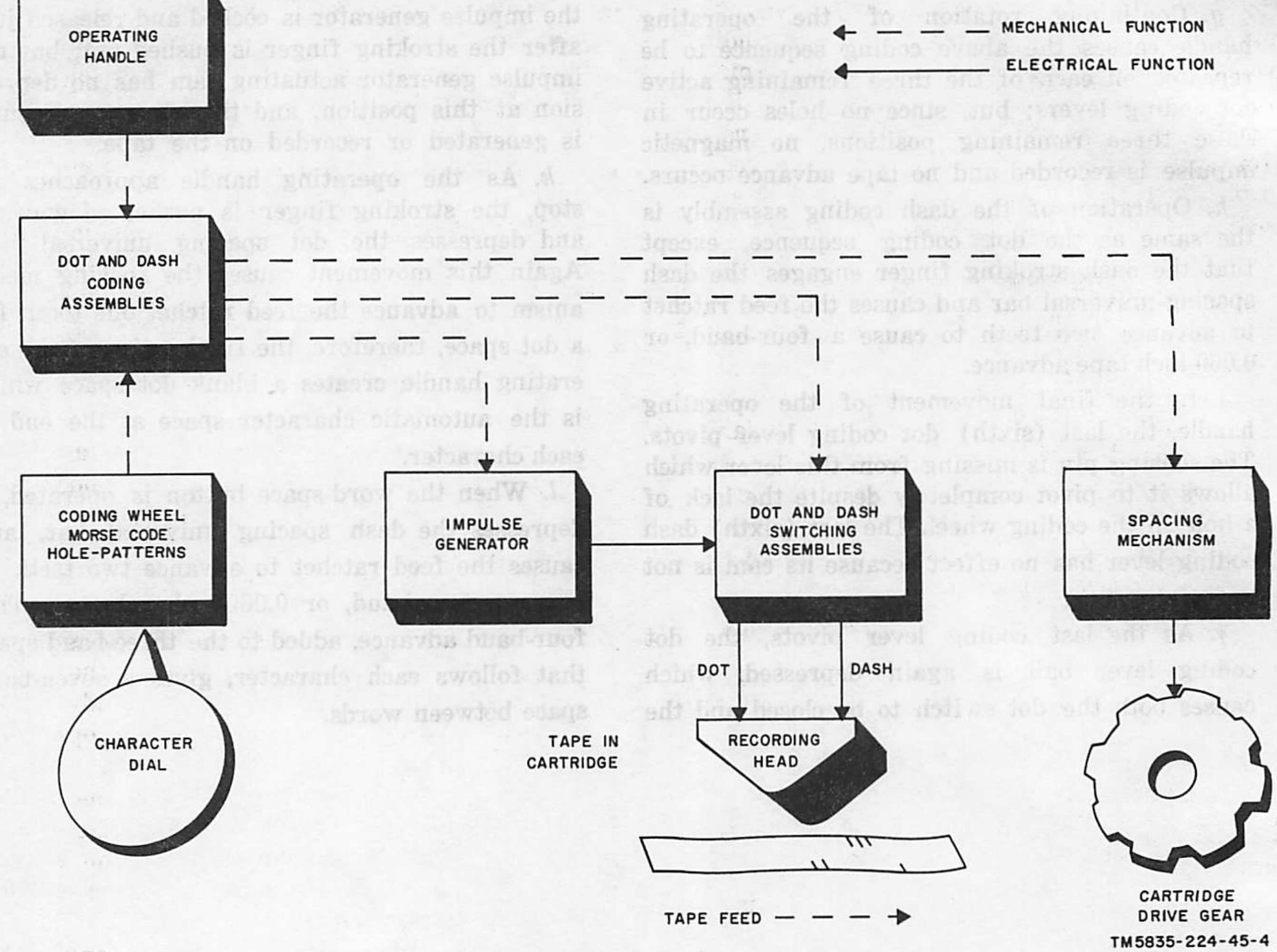


Figure 1-2. CO/B-8 coder, block diagram.

Section IV. FUNCTIONING OF CO-3B CODER

1-15. CO-3B Coder Block Diagram

For descriptive purposes, the CO-3B coder mechanism (fig. 1-3) may be divided into five basic sections, according to function. A description of each function is given in paragraphs 1-16 through 1-20.

1-16. Keyboard

The keyboard consists of the dot, dash, and space keys. When the dot key is depressed, it engages and depressed both the spacing universal bar and the impulse generator universal bar, and closes the dot switch to the dot track of the recording head. When the dash key is depressed, it also engages and depresses both the spacing universal bar and the impulse generator universal bar, but closes the dash switch to the dash track of the recording head. When the space key is depressed, only the spacing universal bar is depressed.

1-17. Impulse Generator (CO-3B)

The impulse generator is the electrical powerplant of the CO-3B coder. It consists of a permanent-magnet structure with a flat, spring steel armature surrounded by a coil. The CO-3B coder and the CO/B-8 coder impulse generators are identical. Refer to paragraph 1-10.

1-18. Dot and Dash Switching Assemblies (CO-3B Coder)

The negative-current impulse from the generator is switched to either the dot or dash track winding on the dual-track recording head by means of two spdt switches that comprise the switching assemblies. These switches are actuated by their respective dot or dash key. Normally, the switches ground the head windings when they are not in use, to prevent stray pickup from being recorded. When either switch is engaged by its respective key, the switch opens the groundpath and connects its respective recording head track to the impulse generator in anticipation of the current impulse.

1–19. Recording Head (CO–3B Coder)

Whenever an impulse of current passes through either track on the recording head, iron oxide particles embedded in the magnetic tape are magnetically polarized. This magnetic polarization creates a magnetic impulse on the tape, which produces the actual recording process.

1–20. Spacing Mechanism (CO–3B Coder)

The spacing mechanism is used for proper tape advance of dots, dashes, and spaces. Information given in paragraph 1–11 is also applicable to the CO–3B coder.

1–21. Sequence of Functioning (CO–3B Coder)

a. As the dot key is depressed, the following actions take place:

(1) The dot spacing universal bar is depressed.

(2) The dot switch is closed.

(3) The impulse generator universal bar is depressed.

b. When the dot key depresses the dot spacing universal bar, the bar engages the spacing mechanism feed pawl and causes it to index one tooth of the feed ratchet in anticipation of rotating the feed ratchet one tooth when the key is released.

c. When the dot key is depressed, the dot switch actuator bar engages the dot switch leaf, closes the switch which opens the dot track ground circuit, and connects the dot track to the impulse generator in anticipation of the current impulse.

d. When the dot key depresses the impulse generator universal bar, it strokes the impulse generator armature. An impulse of current is delivered to the dot track of the recording head through the previously closed dot switch and a dot impulse is recorded.

e. As the dot key is released, its return (upward) motion causes the feed pawl to rotate the feed ratchet one tooth (as previously indexed) for the dot space. This one-tooth advance on the feed ratchet causes a two-baud, or 0.030-inch tape advance.

f. When the dot key is depressed, the spacing mechanism is indexed one tooth, the dot switch is closed, and an impulse is recorded. When the key is released, the spacing mechanism advances the tape 0.030 inch, the dot switch is opened, and the dot track is returned to ground.

g. Dash key (fig. 2–12) operation is the same as the dot key operation, except that the dash switch is closed and the spacing mechanism is advanced two teeth; the tape is advanced 0.060 inch for the dash space.

h. When the space key is depressed, only the spacing universal bar is depressed, which causes the feed ratchet (fig. 2–11) to be indexed one tooth. When the space key is released, the spacing mechanism is advanced one tooth and causes the tape to be advanced 0.030 inch for a space.

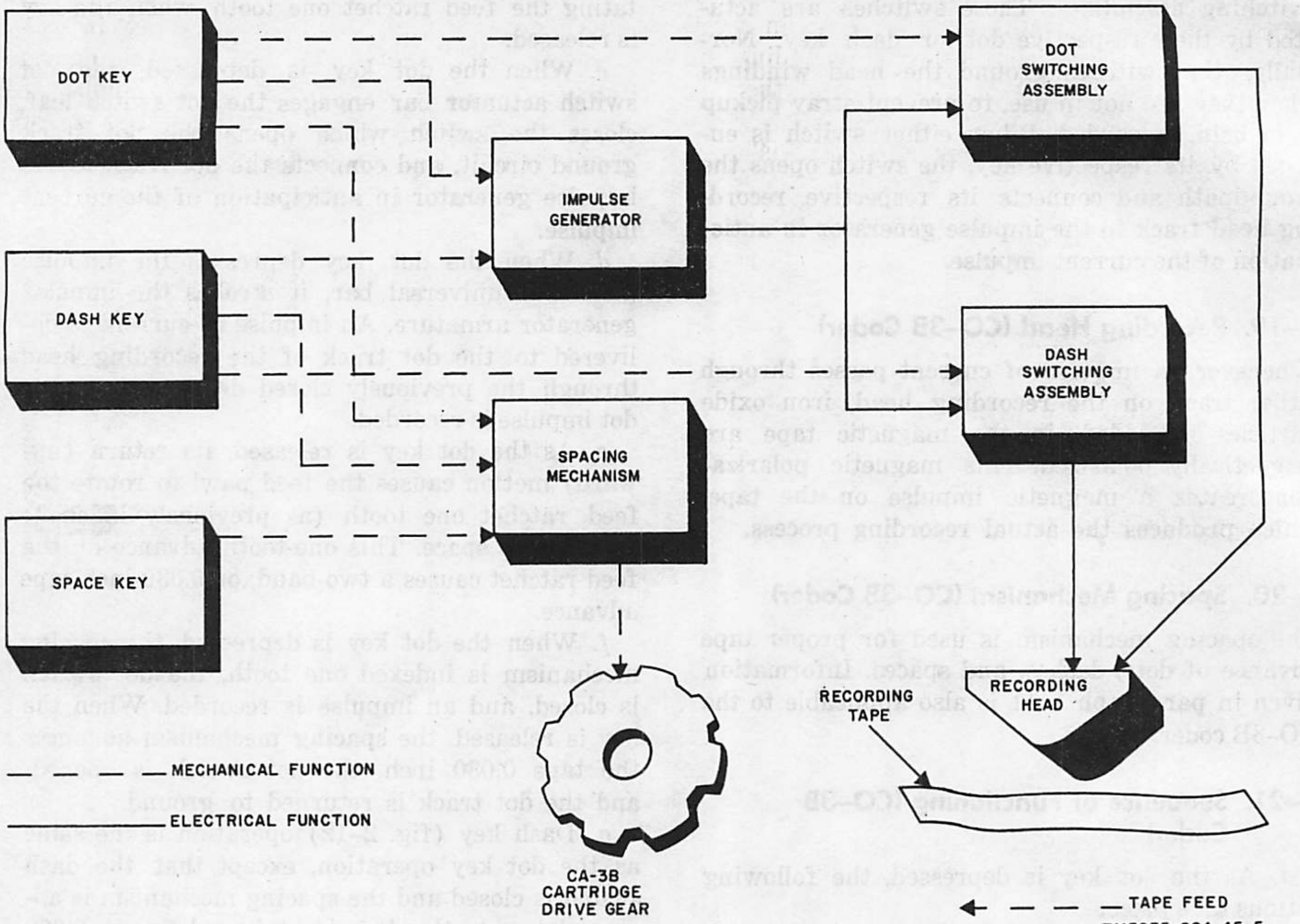


Figure 1-3. CO-3B coder, block diagram.

Section V. FUNCTIONING OF CA-3B CARTRIDGE

1-22. CA-3B Cartridge, Block Diagram

In operation, the CA-3B cartridge (fig. 1-4) is attached to the CO-3B coder or CO/B-8 coder for recording; the takeup spool of the CA-3B cartridge is driven clockwise by the drive gear of the operating CO/B-8 or CO-3B coder and causes the tape to advance over the operating CO/B-8 or CO-3B coder recording head. The CA-3B cartridge is also attached to the KE-8B keyer for transmitting the recorded message. The CA-3B cartridge takeup spool is driven clockwise by the KE-8B keyer drive gear and causes the tape to be advanced over the KE-8B keyer reading head.

1-23. Functional Description of CA-3B Cartridge

a. Automatic Rewind of CA-3B Cartridge. When the CA-3B cartridge is detached from any component, an automatic rewind system rewinds the tape on the storage spool.

b. Tape Travel Control. The distance of tape travel through the CA-3B cartridge is controlled by a system of auto-stop gears. One pair of gears stops the storage spool at its starting point, maintains initial spring tension, and causes automatic rewinding. The second pair of gears stops rotation of the takeup spool when the tape has been rewound onto the storage spool. This condition is accomplished by the interlocking action of the two auto-stop pins located on each pair of auto-stop gears.

c. Takeup Auto-Stop Gears. The takeup auto-stop gears limit the number of revolutions in either direction that the takeup spool can rotate so that it is in position to start rewinding immediately, and stops before the end of the tape arrives.

d. Storage Spool. The storage spool is used to store enough tape to meet the demands of the takeup spool. The auto-stop gears on the storage spool keep the rewind spring in position to function properly and prevent damage from over winding, and limit the number of revolutions in either direction that the storage spool can rotate.

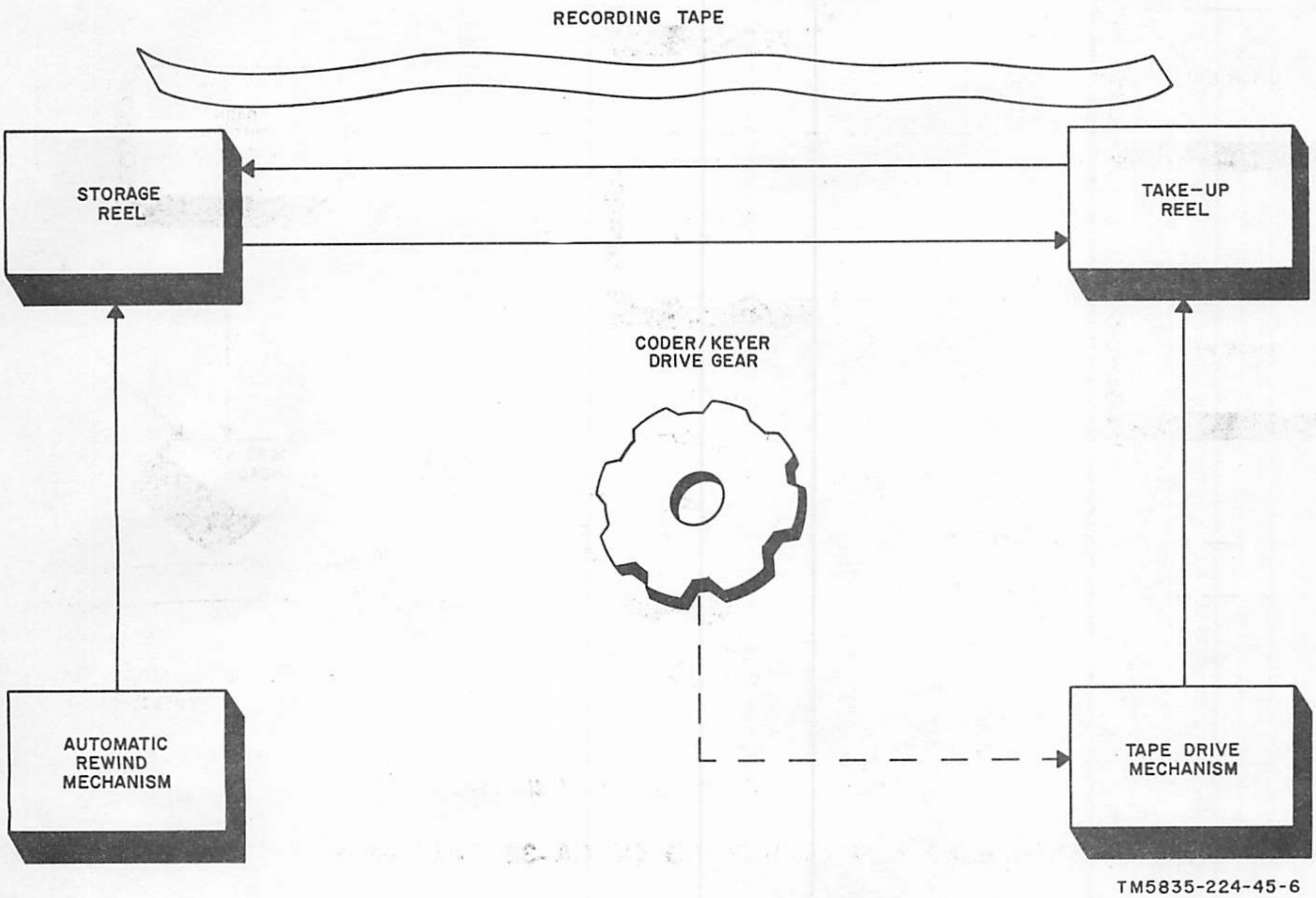


Figure 1-4. CA-3B cartridge.

Section VI. FUNCTIONING OF KE-8B KEYER

1-24. KE-8B Keyer Block Diagram

The mechanical section of the KE-8B keyer (fig. 1-5) pulls the magnetic tape in the CA-3B cartridge over the reading head at a normal speed of 4.5 inches per second. Accurately controlled tape speed is vital to proper Morse output keying. The motor speed is maintained at a smooth and constant level by a flyball governor which is coupled to the motor through an inverse idler gear. This gear also serves as the braking surface for the friction brake connected to the motor ON-OFF switch.

1-25. Drive Gears

The exposed drive gear at the top of the KE-8B keyer meshes with the CA-3B cartridge drive gear to supply driving power from the KE-8B keyer motor to the CA-3B cartridge takeup spool. Mechanical energy is stored in the drive motor by winding a foldout, windup crank. About 30 turns of the crank will fully wind the motor to maximum energy from a completely rundown condition. After winding is completed, energy is retained in the motor spring by a ratchet arrangement which prevents the spring from unwinding except when the motor ON-

OFF switch is in the ON position. Damage from over-winding is prevented by a safety device that permits slippage when tension exceeds a certain preset limit.

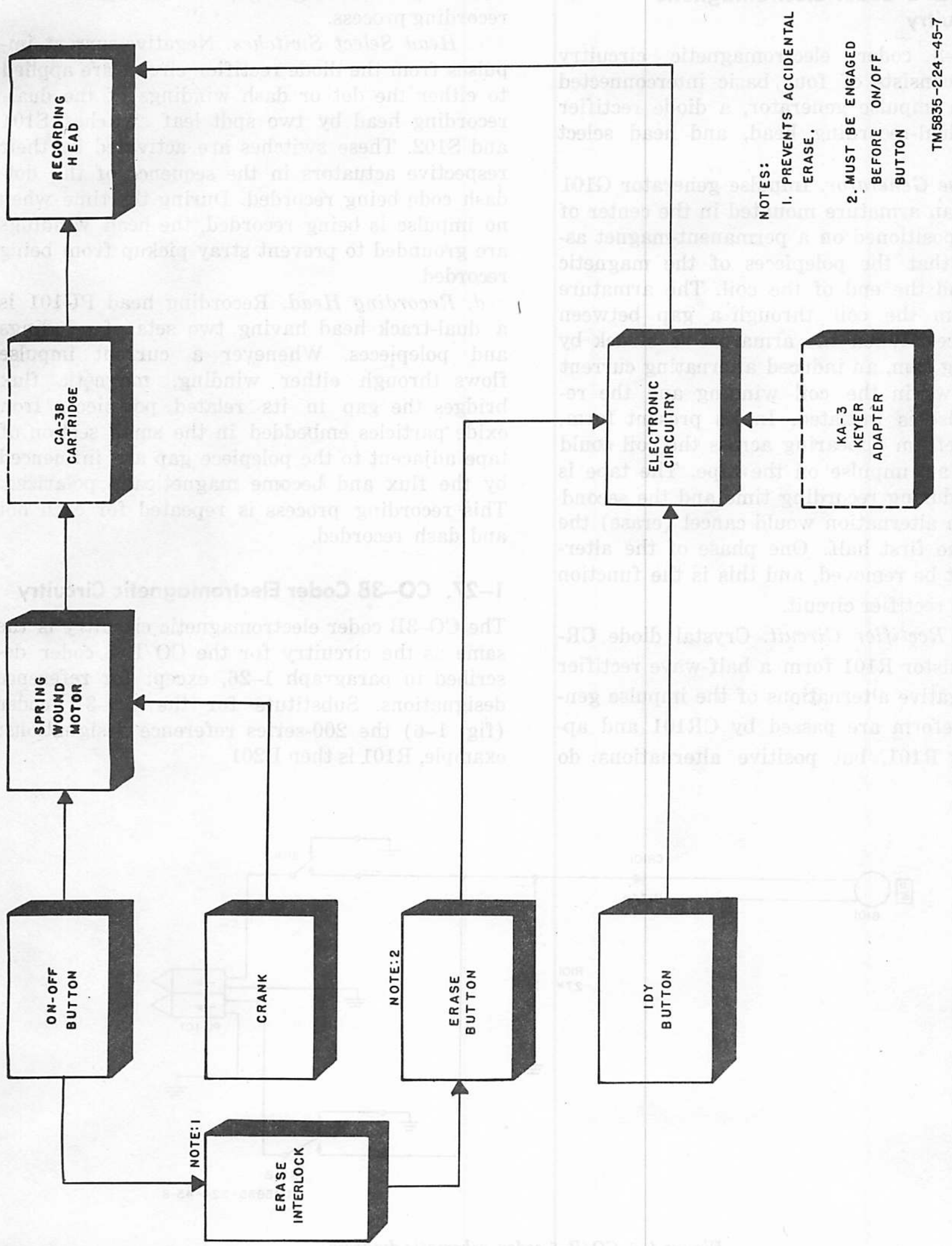


Figure 1-5. KE-8B keyer, block diagram.

Section VII. FUNCTIONING OF CO/B-8 AND CO-3B CODERS
ELECTROMAGNETIC CIRCUITRY

1-26. CO/B-8 Coder Electromagnetic Circuitry

The CO/B-8 coder electromagnetic circuitry (fig. 1-6) consists of four basic interconnected circuits; an impulse generator, a diode rectifier circuit, a dual-recording head, and head select switches.

a. Impulse Generator. Impulse generator G101 consists of an armature mounted in the center of a coil and positioned on a permanent-magnet assembly so that the polepieces of the magnetic wrap around the end of the coil. The armature extends from the coil through a gap between the polepieces. When the armature is struck by its actuating cam, an induced alternating current impulse flows in the coil winding and the recording pulse is initiated. In its present form, the ac waveform appearing across the coil could not record an impulse on the tape. The tape is motionless during recording time and the second half of each alternation would cancel (erase) the effect of the first half. One phase of the alternation must be removed, and this is the function of the diode rectifier circuit.

b. Diode Rectifier Circuit. Crystal diode CR-101 and resistor R101 form a half-wave rectifier circuit. Negative alternations of the impulse generator waveform are passed by CR101 and appear across R101, but positive alternations do not. Only negative-going pulses are used in the recording process.

c. Head Select Switches. Negative-current impulses from the diode rectifier circuit are applied to either the dot or dash windings of the dual-recording head by two spdt leaf switches S101 and S102. These switches are activated by their respective actuators in the sequence of the dot-dash code being recorded. During the time when no impulse is being recorded, the head windings are grounded to prevent stray pickup from being recorded.

d. Recording Head. Recording head PU101 is a dual-track head having two sets of windings and polepieces. Whenever a current impulse flows through either winding, magnetic flux bridges the gap in its related polepiece. Iron oxide particles embedded in the small section of tape adjacent to the polepiece gap are influenced by the flux and become magnetically polarized. This recording process is repeated for each dot and dash recorded.

1-27. CO-3B Coder Electromagnetic Circuitry

The CO-3B coder electromagnetic circuitry is the same as the circuitry for the CO/B-8 coder described in paragraph 1-26, except for reference designations. Substitute for the CO-3B coder (fig. 1-6) the 200-series reference designations; example, R101 is then R201.

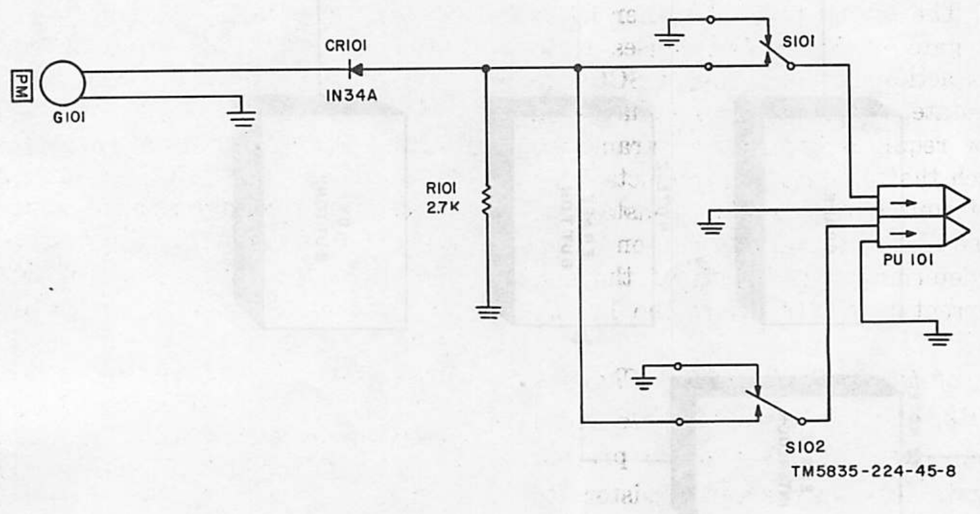


Figure 1-6. CO/B-8 coder, schematic diagram.

Section VIII. FUNCTIONING OF KE-8B KEYER ELECTRONIC CIRCUITS

1-28. Electronic Circuits in KE-8B Keyer

The function of the electronic circuits in the KE-8B keyer (fig. 1-7) is to generate a 3.3-millisecond (ms) dot when an impulse appears on the dot side of the reading head, and a 10-millisecond dash when an impulse appears on the dash side. For this purpose, a dot channel and a dash channel are used, fed from separate windings on the reading head. Both the dot and dash channels are identical (fig. 4-6), except for their timing circuits in the output multivibrators. Both multivibrators operate a common switch Q11 in the output circuit for keying Radio Transmitter T-784/GRC-109. A 150-cycle per second (cps) oscillator (controlled by the IDY (identification) switch) generates a continuous triggering input to the dot channel to key Radio Transmitter T-784/GRC-109 at the rate of 300 words per minute for IDY.

Note. Silicon-controlled rectifiers will be prefixed SCR: for example, SCR3.

a. Operation of Q1, Q2, SCR3, and SCR4. As the tape in the CA-3B cartridge passes over the reading head, magnetic impulses in the dot track appear as electrical pulses across the DOT winding of the head. These pulses, about 1 millisecond in duration and 8 to 16 millivolts (mv) in amplitude, are delivered to feedback stabilizer amplifiers Q1 and Q2, the output of which is used to control a one-shot multivibrator (SCR3, SCR4). Stage SCR3 is normally off, stage SCR4 is normally on. The signal from amplifier Q2 is applied to the gate of SCR3 and causes it to switch on. This action, in turn, causes SCR4 to flip to its off state. A change in the charge on capacitor C4 is required before the parameters of SCR4 are such that SCR4 again conducts. This condition is determined by the time constant of the R7, R8, and C4 combination. The on duration of SCR3 determines the width of the dot, and the on current in SCR3 drives the keying circuit.

b. Functions of Other Parts in Dot Channel. Diodes CR5, CR2, and CR4 free the SCR gates after triggering. Resistors R9 and R6 prevent triggering on gate leakage current. Resistor R4 determines the voltage level of the gate on SCR3. Resistor R12 prevents interference by C4 with the turnoff pulse, and R8 is selected and installed during manufacturing tests to establish accurately the time constant of the dot multivibrator.

c. Keying Output Circuit. Anode current from SCR3 of the dot channel, or SCR7 of the dash channel, is applied to the base of Q9. As Q9 saturates, its initial-collector current in N2 overcomes direct current in N1 and switches square loop core T1. At the end of the dot or dash, base drive is removed from Q9 which turns off to allow N1 current to reset the core.

d. Keying Circuits SCR10 and Q11. Keying circuits SCR10 and Q11 are electrically isolated from the rest of the circuitry, and derive operating power from the KA-3 keyer adapter. Keying output is taken from terminals D and F of J1.

e. IDY Generator. IDY generator Q12 (a unijunction transistor) is a relaxation-type oscillator turned on by a grounding of a base through IDY switch S2. Positive-output pulses developed across R44 are applied to the dot multivibrator through C16 and CR4. The IDY generator frequency is nominally 150 cps. Variations of up to 8 cycles, above or below, may be encountered across the operating temperature range. The positive temperature coefficient of the unijunction transistor compensates for the negative temperature coefficient of C13.

f. Voltage Regulator and Protector. Because the stability of the IDY generator and the accuracy of dot and dash timing circuits are adversely affected by voltage variations, a voltage regulator circuit, consisting of Q13, CR11 through CR15, and other associated components are built into the electronics section. This network serves to maintain proper voltage relationships during varying temperatures and varying supply voltage values. It is important, for example, to control the reference voltage applied to the bases of the dot and dash multivibrators, since this voltage determines the firing point of SCR3 and SCR7 and, therefore, the width of dot and dash keying pulses.

g. Reverse Polarity Protection. Reverse polarity protection is provided by Q14, which is diode-connected in series with the electronic circuits It will not conduct if reverse polarity is connected.

h. Tape Erasing. A mechanical interlock on the control panel forces the operator to slide the erase switch before the motor ON-OFF switch can be pushed to its full ON position and the tape erased. During erasing operation, the motor pulls the tape across the reading head just as it does in message transmission.

i. Two Windings on Reading Head. The two windings on the reading head are connected by a diode (CR6) which provides signal isolation between the windings, but provides a dc path when the erase switch grounds one side of the dot head and applies 12 volts to one side of the dash head. Current flowing through the series-connected windings depolarizes the tape as it passes, because current flow produces a magnetic field opposite to that set up during recording of the message.

1-29. Electronic Operating Characteristics

The chart below describes the electronics section characteristics, their range, and their values.

Characteristic	Minimum	Nominal	Maximum
Operating temperatures (° C)	-20	25	55
Supply voltage	10.75	12.0	14.0
Signal input (mv)	8.8	16.0	
Noise input (mv)			2.9
Key line voltage (key up)	6		35
Key line current (ma) (key down)	1.5		50
Key line leakage (ma) (35 volts, 25° C)			0.17
Key down drop (volts):			
50 ma at 25° C		1.75	2.3
50 ma at -55° C		2.03	2.9
IDY frequency (all conditions)	142	150	158
Power drain (ma)		(12 v input)	(14 v input)
Idle		28	28
Running		28	34
Erase		38	44

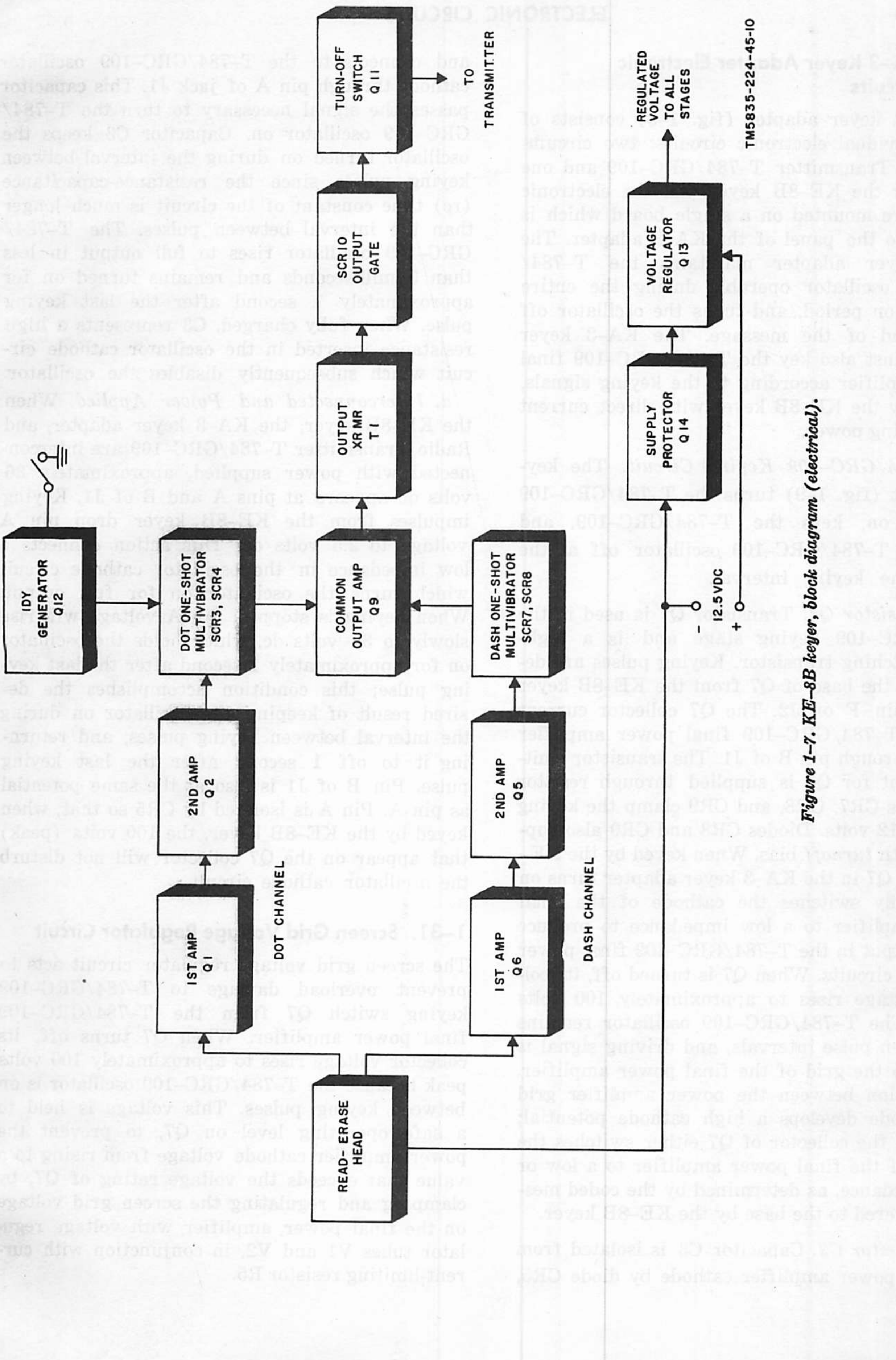


Figure 1-7. KE-8B keyer, block diagram (electrical).

Section IX. FUNCTIONING OF KA-3 KEYER ADAPTER ELECTRONIC CIRCUITS

1-30. KA-3 Keyer Adapter Electronic Circuits

The KA-3 keyer adapter (fig. 1-8) consists of three individual electronic circuits: two circuits for Radio Transmitter T-784/GRC-109 and one circuit for the KE-8B keyer. All the electronic circuits are mounted on a single board which is attached to the panel of the KA-3 adapter. The KA-3 keyer adapter maintains the T-784/GRC-109 oscillator operable during the entire transmission period, and turns the oscillator off at the end of the message. The KA-3 keyer adapter must also key the T-784/GRC-109 final power amplifier according to the keying signals, and supply the KE-8B keyer with direct current for operating power.

a. T-784/GRC-109 Keying Circuit. The keying circuit (fig. 1-9) turns the T-784/GRC-109 oscillator on, keys the T-784/GRC-109, and turns the T-784/GRC-109 oscillator off at the end of the keying interval.

b. Transistor Q7. Transistor Q7 is used in the T-784/GRC-109 keying stage and is a high-speed switching transistor. Keying pulses are delivered to the base of Q7 from the KE-8B keyer through pin F on J2. The Q7 collector current keys the T-784/GRC-109 final power amplifier cathode through pin B of J1. The transistor emitter current for Q7 is supplied through resistor R4. Diodes CR7, CR8, and CR9 clamp the keying signal to 12 volts. Diodes CR8 and CR9 also supply Q7 with *turnoff* bias. When keyed by the KE-8B keyer, Q7 in the KA-3 keyer adapter turns on and rapidly switches the cathode of the final power amplifier to a low impedance to produce power output in the T-784/GRC-109 final power amplifier circuits. When Q7 is turned off, its collector voltage rises to approximately 100 volts (peak). The T-784/GRC-109 oscillator remains on between pulse intervals, and driving signal is applied to the grid of the final power amplifier. Rectification between the power amplifier grid and cathode develops a high cathode potential; therefore, the collector of Q7 either switches the cathode of the final power amplifier to a low or high impedance, as determined by the coded message delivered to the base by the KE-8B keyer.

c. Capacitor C3. Capacitor C3 is isolated from the final power amplifier cathode by diode CR5, and connects to the T-784/GRC-109 oscillator cathode through pin A of jack J1. This capacitor passes the signal necessary to turn the T-784/GRC-109 oscillator on. Capacitor C3 keeps the oscillator turned on during the interval between keying pulses since the resistance-capacitance (rc) time constant of the circuit is much longer than the interval between pulses. The T-784/GRC-109 oscillator rises to full output in less than 5 milliseconds and remains turned on for approximately 1 second after the last keying pulse. When fully charged, C3 represents a high resistance inserted in the oscillator cathode circuit which subsequently disables the oscillator.

d. Interconnected and Power Applied. When the KE-8B keyer, the KA-3 keyer adapter, and Radio Transmitter T-784/GRC-109 are interconnected with power supplied, approximately 36 volts dc appears at pins A and B of J1. Keying impulses from the KE-8B keyer drop pin A voltage to 2.5 volts dc. This action connects a low impedance in the oscillator cathode circuit which turns the oscillator on for full output. When keying is stopped, pin A voltage will rise slowly to 36 volts dc, which holds the oscillator on for approximately 1 second after the last keying pulse; this condition accomplishes the desired result of keeping the oscillator on during the interval between keying pulses, and returning it to off 1 second after the last keying pulse. Pin B of J1 is also at the same potential as pin A. Pin A is isolated by CR5 so that, when keyed by the KE-8B keyer, the 100 volts (peak) that appear on the Q7 collector will not disturb the oscillator cathode circuit.

1-31. Screen Grid Voltage Regulator Circuit

The screen grid voltage regulator circuit acts to prevent overload damage to T-784/GRC-109 keying switch Q7 from the T-784/GRC-109 final power amplifier. When Q7 turns off, its collector voltage rises to approximately 100 volts peak because the T-784/GRC-109 oscillator is on between keying pulses. This voltage is held to a safe operating level on Q7, to prevent the power amplifier cathode voltage from rising to a value that exceeds the voltage rating of Q7, by clamping and regulating the screen grid voltage on the final power amplifier with voltage regulator tubes V1 and V2, in conjunction with current-limiting resistor R5.

1-32. Power Supply Circuit

a. The power supply portion of the KA-3 keyer adapter provides 12-volt dc operating power to the KE-8B keyer. This circuit derives its input from the T-784/GRC-109 filament supply which may be 6.3 volts, 50 to 400 cycles per second; a 6.3-volt square wave; or 6.3 volts dc.

b. The power supply consists of an input bridge, a dc-to-dc converter, an output bridge rectifier, and a ripple filter and Zener diode regulator. Transistors Q3 through Q6 form the input bridge network that enables the power supply to operate from any of the three types of filament supply input. The dc-to-dc converter consists of toroidal transformer T1, switching transistors Q1 and Q2, and associated circuitry.

c. The rectified and doubled output of the dc-to-dc converter is applied to the two-stage ripple filter, consisting of L1-C4 and L2-C6. Zener diode CR6, across the power supply output, regulates the output voltage to 12 volts dc at 50 milliamperes.

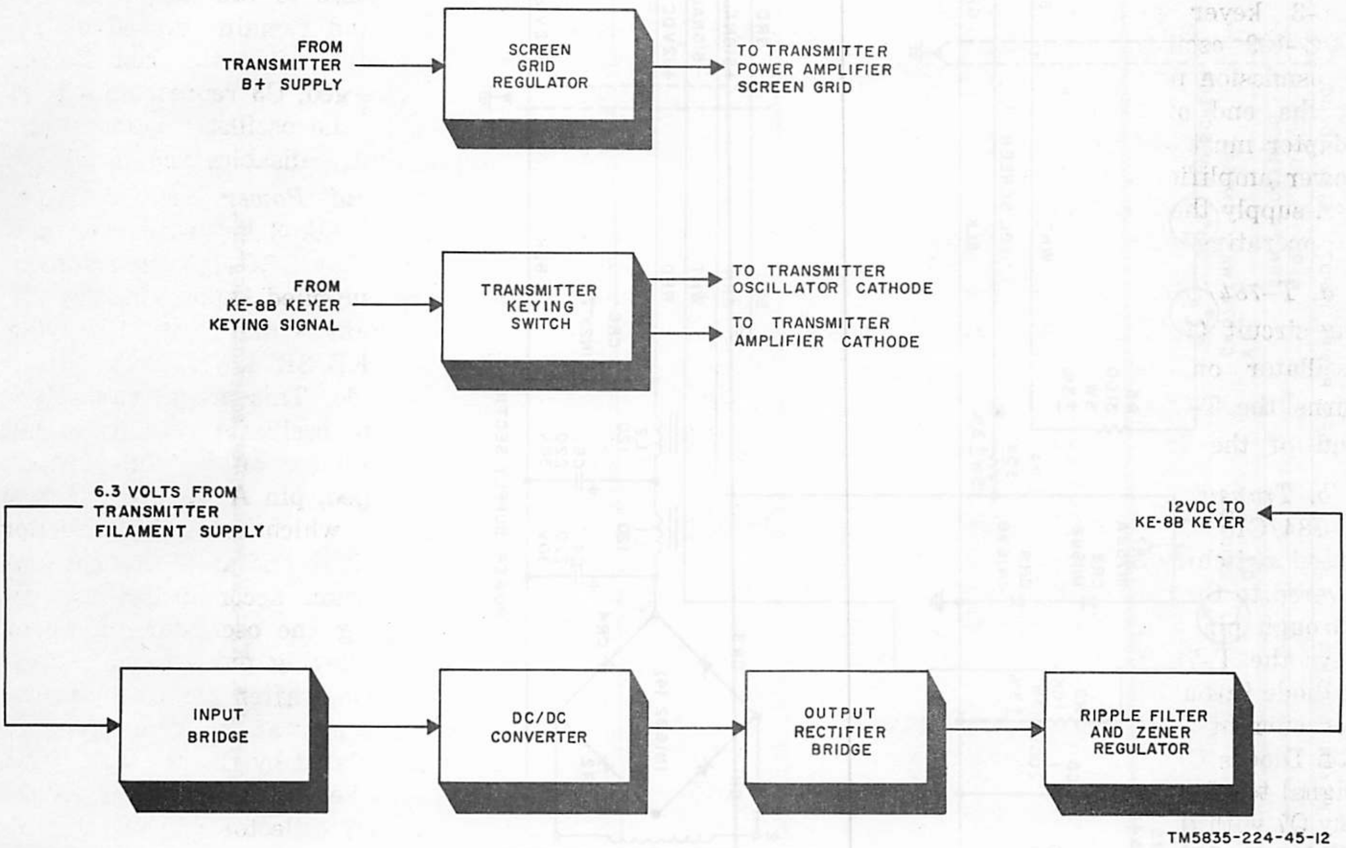


Figure 1-8. KA-3 keyer adapter, block diagram (electrical).

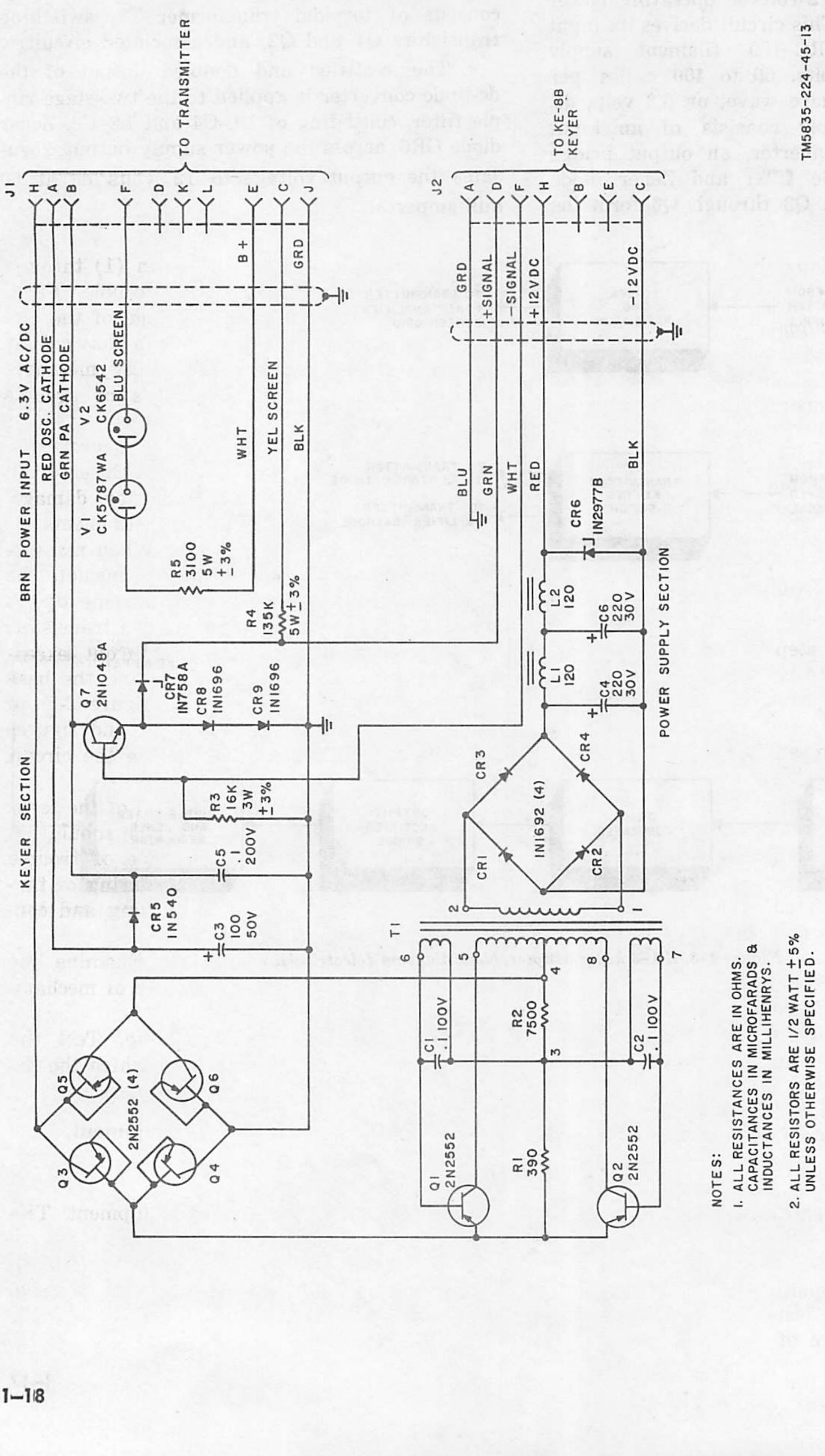


Figure 1-9. KA-3 keyer adapter, schematic diagram.

CHAPTER 2

TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING PROCEDURES

2-1. General Instructions

The direct support and depot maintenance procedures in this manual *supplement* the procedures described in the organizational maintenance manual. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at organizational category, is carried to a higher maintenance category in this manual. Sectionalizing, localizing, and isolating techniques used in the troubleshooting procedures are more advanced.

2-2. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective AN/GRA-71 is to sectionalize the fault. Sectionalization means tracing the fault to a major component. The second step is to localize the fault. Localization means tracing the fault to a defective part responsible for the abnormal condition. A fault, such as a burned-out resistor, can often be located by sight, smell, and hearing. Other faults may require isolation by checking voltages and resistances.

b. Sectionalization. Listed below is a group of tests arranged to reduce unnecessary work and to aid in tracing trouble in a defective AN/GRA-71. The AN/GRA-71 consists of five units: CO/B-8 coder, CO-3B coder, KE-8B keyer, CA-3B cartridge, and KA-3 keyer adapter. The first step is to locate the unit, or units, at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All meter readings, or other visual signs, should be observed and an attempt made to sectionalize the fault to a particular unit.

(2) *Operational tests.* Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault.

c. Localization. The tests listed in (1) through (4) below will aid in isolating trouble. First, localize the trouble to a single stage of the circuit; then isolate the trouble within that circuit by voltage resistance, and continuity measurements. Use the following methods of trouble localization:

(1) *Voltage and resistance measurements.* This equipment is transistorized. Observe all cautions given to prevent transistor damage. Make voltage and resistance measurements in this equipment *only as specified.* When measuring voltages, use tape or sleeving to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin the transistor. (For example, if the bias is shorted out, excessive current between the emitter and the base would ruin the transistor.) Use figure 2-5 to obtain the correct voltage readings, and figures 1-6, 1-9, 4-5, and 4-6 to determine the circuit resistances.

(2) *Intermittent troubles.* In all of the tests, the possibility of intermittent trouble should not be overlooked. If present, this type of trouble often may be made to appear by jarring or tapping the equipment. Check the wiring and connections to the units of the set.

(3) *Mechanical adjustments.* Examine the entire set to eliminate the possibility of mechanical misadjustment.

(4) *Transistor or tube testing.* Test the transistor or tube of the stage in which the defective part is being isolated.

2-3. Direct Support Tools, Test Equipment, and Materials

a. Tools.

(1) Tool Kit, Electronic Equipment TK-100/G.

(2) T-socket head screw wrench (0.028).

(3) 3/16 inch by 3 inch open-end wrench.

(4) 1/4 inch by 3 inch open-end wrench (fig. 2-13).

(5) Tool Kit, Radio Repair TK-115/G.

(6) Burnisher, Contact TL-557/U (FSN 5120-255-4458).

b. Test Equipment Required. The test equipment required is given in the chart below along with its technical manual.

Test equipment	Technical manual
Multimeter TS-352B/U	TM 11-6625-366-15
Test Set, Electron Tube TV-7/U	TM 11-6625-274-12
Test Set, Transistor TS-1836/U	TM 11-6625-539-15

c. Materials.

(1) Cleaning Compound, FSN 7930-395-9542.

(2) Lubricating Oil, Instrument (OIA), MIL-L-6085.

(3) Magna-See.

Section II. DIRECT SUPPORT TROUBLESHOOTING

2-4. General

Direct support troubleshooting procedures for the AN/GRA-71 are given in this section. They include procedures that can be performed with the tools and test equipment authorized for direct support.

2-5. Direct Support Troubleshooting Procedures

Use the following procedures to isolate mechanical and electrical troubles in the AN/GRA-71.

a. Mechanical Troubles. Because of the physical characteristics of the AN/GRA-71 components, internal mechanical functions can be inspected by removing the covers and observing the mechanisms while the components are operated. Check to be sure that mechanical assemblies function smoothly, without binding or excessive friction; then listen for rasping or squeaking sounds that could be caused by dirt, sand, or lack of lubrication. For top cover removal instructions, refer to paragraphs 3-2 through 3-6.

CAUTION

Before making continuity measurements, be sure to disconnect power from the KE-8B keyer and KA-3 keyer adapter. Failure to do so may result in damage to the ohmmeter.

b. Electrical Troubles. Most of the electrical troubles occur at switch contacts and various connection points in the AN/GRA-71 components. When it has been determined that a particular circuit is faulty, check all the readily accessible contacts and connection points in the faulty circuit. If this check does not reveal the trouble, make appropriate voltage and resistance measurements to localize the trouble. Refer to the schematic diagrams corresponding to a faulty AN/GRA-71 component (fig. 1-6, 1-9, 2-5, or 4-6) for circuit details, part values, and normal voltage and resistance values.

2-6. CO/B-8 Coder Troubleshooting Procedure

Use the following procedure, as appropriate, to isolate mechanical and electrical troubles in the CO/B-8 coder. Refer to figures 2-1 and 2-2 for parts location.

a. Failure of a recording impulse to be recorded on tape can be caused by any of the conditions listed below. This failure may be observed by immersion in Magna-See solution (fig. 4-11, TM 11-5835-224-12).

(1) Dirt or iron oxide has collected on the recording head surface. If this is the case, clean the surface of the recording head with a soft, lint-free cloth dampened with alcohol. Wipe dry and polish thoroughly.

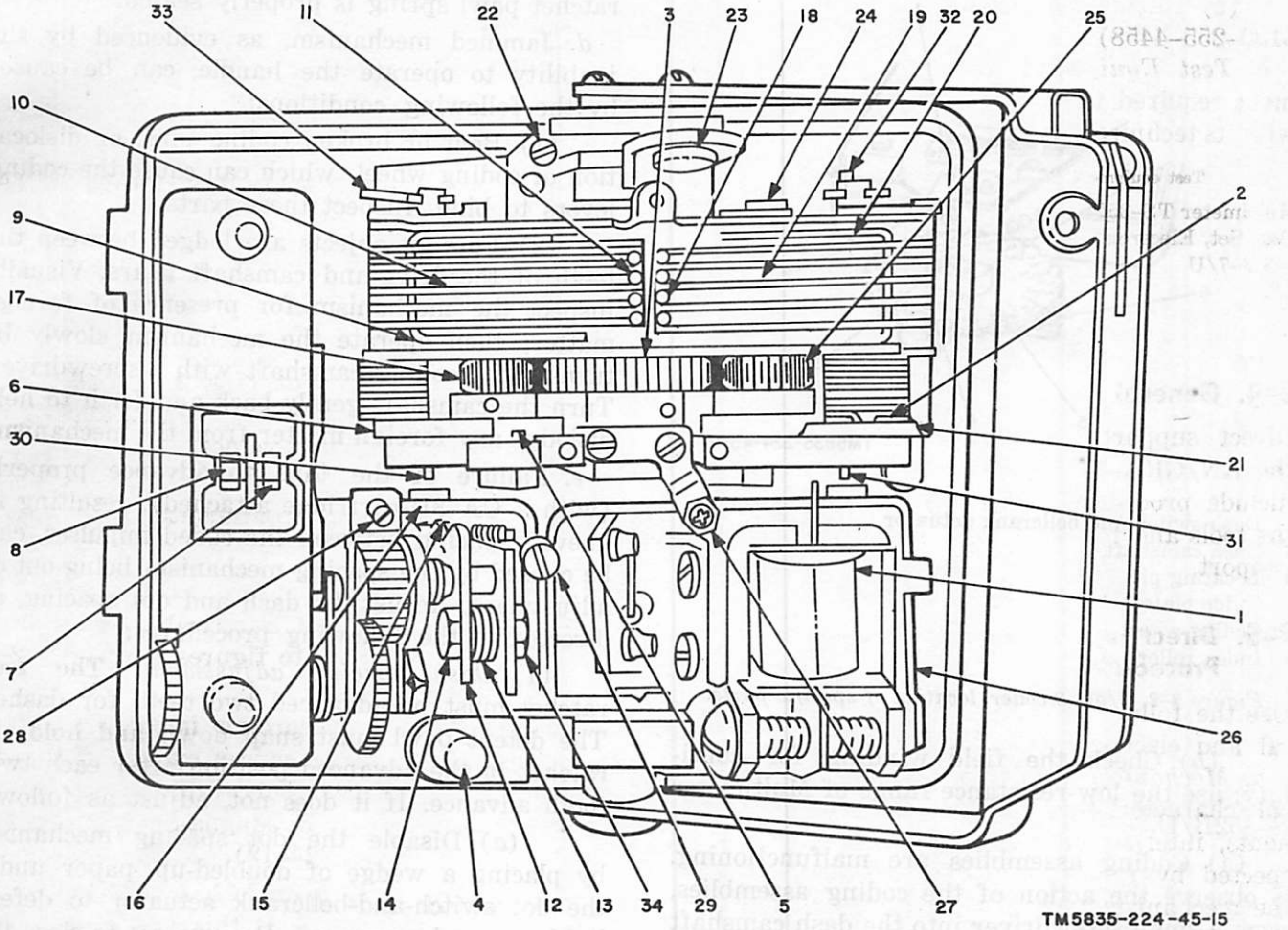
(2) The recording head is set too low. It should extend one-sixteenth of an inch above the head block surface (fig. 2-9). If readjustment is necessary, proceed as follows:

(*a*) Remove the bottom cover of the CO/B-8 coder.

(*b*) Loosen the two screws (A, fig. 2-9). This condition will allow the recording head to be raised or lowered easily. (The head can be raised from the underside of the chassis.)

(*c*) Set the head one-sixteenth of an inch above the head block surface and retighten the A-screws.

(*d*) The head centerline should be positioned one-twentieth of an inch from the center line of the locking pins in the direction of the coder mechanism. If it is necessary to adjust the recording head beyond the simple height adjustment, the screws (B, fig. 2-9) are used to position the head one-twentieth of an inch off center



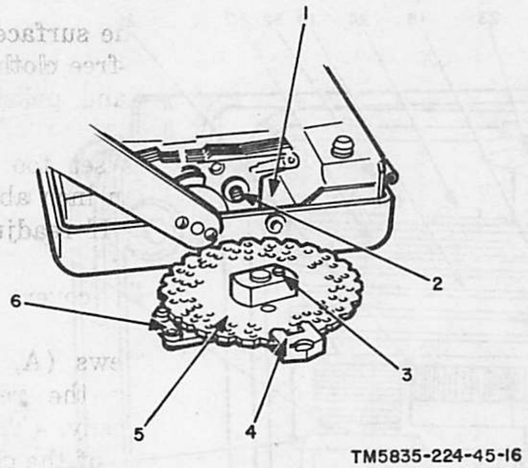
1 Impulse generator
2 Dot stroking cam tension pawl spring
3 Operating handle drive gear
4 Word-space button
5 Dash stroking cam
6 Dash stroking cam tension pawl
7 Dash track recording head
8 Dot track recording head
9 Dash coding lever bail
10 Dash coding levers
11 Dash coding pins
12 Detent pawl
13 Detent pawl spring
14 Hexagonal-head eccentric pivot
15 Feed ratchet
16 Dash spacing universal bar
17 Dash camshaft drive gear
18 Dot coding pins
19 Dot coding levers
20 Dot coding lever bail
21 Dot stroking cam tension pawl
22 Handle back-stop screw and locknut
23 Handle drive ratchet and spring
24 Dot camshaft
25 Dot camshaft drive gear
26 Dot spacing universal bar
27 Locknut dot stop screw
28 Dash spacing universal bar stop screw
29 Dot to dash universal bars adjust screw
30 Dash stroking finger
31 Dot stroking finger
32 Dot bellcrank
33 Dash bellcrank actuator clip
34 Detent pawl locknut

Figure 2–1. CO/B–8 coder, parts location.

as well as to provide azimuth adjustment. When adjusting the B-screws, adjust both the screws equally; be sure to loosen the A-screws just enough to hold the head gently while turning the B-screws. Retighten the A-screws after correct alignment is achieved.

(3) The impulse generator is not functioning. Isolate the trouble as follows:

(*a*) Visually inspect the generator magnet for any foreign matter that could interfere with the free movement of the armature or short-circuit the field windings.



1 Dash switch and bellcrank actuator
2 Dash camshaft
3 Locating pin
4 Guide plate
5 Coding wheel
6 Index roller

Figure 2-2. C/oB-8 coder, location of specific parts.

(*b*) Check the field winding for continuity; use the low-resistance range of Multimeter TS-352B/U.

(4) Coding assemblies are malfunctioning. To observe the action of the coding assemblies, insert a small screwdriver into the dash camshaft slot and turn the camshaft clockwise with the coding wheel in place (fig. 2-2). The sequence of operation is described in paragraph 1-7. Remove the coding wheel to closely observe the action; both sets of coding levers will move simultaneously. To disable one set, place a steel rule, or other flat object, over the pins on that side and hold them down. If, by observing the sequence of operation as outlined above, the trouble is not yet apparent, further disassembly may be necessary. Turn in to a higher category of maintenance.

b. A dot and a dash simultaneously recorded on the tape can be caused by dirt on the switch contacts. Clean the switch contacts with a burnishing tool. Also, check for bent switch leaves. If the leaves are bent, carefully straighten and align them to proper position with a spring bender.

c. The operating handle is loose and the coding mechanism does not operate. This condition can be caused by the failure of the handle drive ratchet pawl to engage the tooth on the ratchet. First, make sure that the last stroke is completed; then check to be sure that the handle drive ratchet pawl spring is properly seated.

d. Jammed mechanism, as evidenced by the inability to operate the handle, can be caused by the following conditions:

(1) Bent or broken coding pins, or dislocation of coding wheel, which can cause the coding levers to bind. Inspect these parts.

(2) Foreign objects are lodged between the teeth of the drive and camshaft gears. Visually inspect the mechanism for presence of foreign matter; then operate the mechanism slowly by turning the coding camshaft with a screwdriver. Turn the camshaft gently back and forth to help dislodge any foreign matter from the mechanism.

e. Failure of the tape to advance properly (with a CA-3B cartridge attached), resulting in uneven spacing between the coded impulses, can be caused by the spacing mechanism being out of adjustment. Adjust the dash and dot spacing, as directed in the following procedures:

(1) *Dash spacing adjustment*. The feed ratchet must be advanced two teeth for dashes. The detent pawl must snap down and hold the ratchet in the advanced position after each two-tooth advance. If it does not, adjust as follows:

(*a*) Disable the dot spacing mechanism by placing a wedge of doubled-up paper under the dot switch-and-bellcrank actuator to defeat its downward movement. Be sure not to close the lower leaf of the switch with the wedge of paper.

(*b*) Loosen the detent pawl locknut slightly. Turn the hexagonal-head pivot (on eccentric) with a thin, one-fourth inch open-end wrench one-eighth of a turn toward the coding mechanism; then retighten the locknut.

(*c*) Insert a small screwdriver into the dash camshaft slot and turn the camshaft clockwise very slowly to observe the following: As the stroking finger depresses the dash spacing universal bar, the spacing mechanism feed pawl should advance the feed ratchet two teeth. Two clicks should be heard as the feed ratchet is advanced. As the dash spacing universal bar reaches its maximum downward position, the spacing mechanism detent pawl should hold the feed ratchet in place as the universal bar returns to *home* (maximum upward) position. If the condition is not corrected (tape still fails to advance properly), proceed to the procedure given in (*d*) below.

(*d*) If the condition is worse, loosen the detent pawl locknut slightly and turn the hexagonal-head eccentric pivot one-quarter turn toward the word-space button. Retighten the locknut and perform the procedures given in (*c*) above. The mechanism should now advance two teeth for dashes.

(*e*) Remove the paper wedge from the dot switch-and-bellcrank actuator.

(2) *Dot spacing adjustment.* The feed ratchet must be advanced one tooth for dots. The detent pawl must snap down and hold the ratchet in the advanced position after each one-tooth advance.

(*a*) Be sure that the dash spacing and the dash spacing adjustment are correct, as described in the procedures given in (1) above.

(*b*) Disable the dash spacing mechanism by placing a wedge of doubled-up paper under the dash switch-and-bellcrank actuator to prevent its downward movement. Be sure not to close the lower leaf of the switch with the wedge of paper.

(*c*) Insert a small screwdriver into the dot camshaft slot and turn the camshaft counterclockwise very slowly to observe the following: As the stroking finger depresses the dot spacing universal bar, the spacing mechanism feed pawl should advance the feed ratchet one tooth. One click should be heard as the feed ratchet is advanced; then, as the dot spacing universal bar reaches its maximum downward position, the spacing mechanism detent pawl should hold the feed ratchet in place as the universal bar returns to *home* position. If a one-tooth advance is not evident, and the dash spacing is correct, proceed to the procedures given in (*d*) below.

(*d*) Loosen the interlock screw locknut and turn the interlock screw one-eighth turn clockwise; retighten the locknut.

(*e*) Perform the procedures given in (*c*) above. If a one-tooth advance is not observed, turn the interlock screw another one-eighth turn, retighten the locknut, and perform the procedure given in (*c*) above again.

(*f*) Remove the paper wedge from the dash switch-and-bellcrank actuator.

2-7. CO-3B Coder Troubleshooting Procedure

Use the procedures given in *a*, *b*, and *c* below to isolate the mechanical and electrical troubles in the CO-3B coder.

a. Failure of a recording impulse to be recorded on tape (evidenced by immersion in Magna-See solution) can be caused by any of the following conditions:

(1) Dirt or iron oxide has collected on the recording head surface. Clean the surface of the recording head with a soft, lint-free cloth dampened with alcohol. Wipe dry and polish thoroughly.

(2) The recording head is set too low. It should extend one-sixteenth of an inch above the head block surface (fig. 2-10). If readjustment is necessary, proceed as follows:

(*a*) Remove the bottom cover of the coder.

(*b*) Loosen the two screws (A, fig. 2-10). This condition will allow the recording head to be raised or lowered easily. (The head can be raised from the underside of the chassis.)

(*c*) Set the head one-sixteenth of an inch above the head block surface and retighten the A-screws.

(*d*) The head centerline should be positioned one-twentieth of an inch from the centerline of the locking pins in the direction of the coder mechanism. If it is necessary to adjust the recording head beyond the simple height adjustment, the screws (B, fig. 2-10) are used to position the head one-twentieth of an inch off center as well as to provide azimuth adjustment. When adjusting the B-screws, adjust both screws equally; be sure to loosen the A-screws just enough to hold the head gently while turning the B-screws. Retighten the A-screws after correct alignment is achieved.

(3) Impulse generator is not functioning. Isolate the trouble as follows:

(*a*) Visually inspect the generator magnet for any foreign matter that could interfere with the free movement of the armature or short-circuit the field winding.

(*b*) Check the field winding for continuity; use the low resistance range of Multimeter TS-352B/U.

b. A dot and a dash simultaneously recorded on tape can be caused by dirt on the switch contacts. Clean the switch contacts with a crocus cloth. Also, check for bent switch leaves. If the leaves are bent, carefully straighten and align them to their proper positions.

c. The failure of the tape to advance properly, resulting in uneven spacing between the coded impulses, can be caused by the spacing mechanism for proper cartridge drive gear rotation and tape advancement as follows:

(1) Attach a CA-3B cartridge to the CO-3B coder.

(2) Depress and release the dash key 15

times; check each time for a two-tooth feed pawl index on the downstroke, and two-tooth feed ratchet rotation on the upstroke (fig. 2-11). Adjust the detent pawl if it does not come to rest properly after each rotation. Loosen the detent pawl screw to adjust. Retighten the screw after adjustment.

(3) Depress and release the dot key 30 times; check each time for a one-tooth feed pawl index on the downstroke, and a one-tooth feed ratchet rotation on the upstroke. Operation should be correct if the procedures given in (2) above were performed accurately.

(4) Observe the overtravel stop and spring (A, fig. 2-12) action during the following procedure.

(*a*) Depress the dash key *slowly* and allow it to return *slowly*. See that on the downward motion, the dash key pin engages the overtravel stop and causes it to be pushed toward the recording head; as the dash key returns upward, spring tension pushes the overtravel stop back to the normal position.

(*b*) Depress the space key. See that the space key downward motion stops when the spacing universal bar engages the top of the overtravel stop.

(*c*) Depress the dot key. See that the dot key downward motion stops when the spacing universal bar engages the top of the overtravel stop.

(5) Check the spacing mechanism action during the following procedures:

(*a*) Depress the dash key *very slowly*. See that the spacing mechanism action begins almost immediately as the key is depressed.

(*b*) Depress the dot key *very slowly*. See that the spacing mechanism action is not immediate as the key is depressed.

(*c*) If the dot key must be depressed more than one-eighth of an inch to actuate the spacing mechanism action, proceed to the procedures given in (6) below. If the spacing mechanism action begins before the dot key is depressed one-eighth of an inch, the spacing mechanism is normal and is correctly adjusted.

(6) Depress the dash key and release very slowly. Be sure that the feed pawl clicks twice as it indexes two teeth. Depress the dash key again and *release very slowly*. If the feed pawl travels (overshoots) farther than one-thirty-second of an inch after the second click is heard, insert a screwdriver between the spacing universal bar and the universal bar stop (B, fig. 2-12) and bend the stop upward one-sixty-fourth of an inch. Repeat the procedures given in (2) and (3) above. Repeat this procedure, if necessary, to limit feed pawl overshoot to one-thirty-second of an inch.

2-8. CA-3B Cartridge Troubleshooting Procedure

Use the following procedure, as appropriate, to isolate troubles in the CA-3B cartridge. Refer to figures 2-3 and 3-7 for parts location.

a. The recording tape may come loose from the takeup spool because the attaching tape has lost its adhesive quality. If the tape should come loose from the storage spool, attach the recording tape to the wakeup spool as follows:

(1) Open and remove the hinged lid.

(2) Remove the spool cover by removing the three attaching screws.

(3) Rotate the takeup spool counterclockwise until it encounters the rewind auto-stop pins (2, fig. 2-3).

(4) Thread the free end of the tape over the tension idler (fig. 3-7), and over the tape guides. Be sure that the dull surface of the tape is on the outside.

(5) Pull out enough tape from the storage spool to make a complete extra turn around the takeup spool, and attach the tape to the core with a short length of pressure-sensitive adhesive tape. The extra turn provides a full turn of the tape completely around the core of the spool when it is at rest. This condition insures a lasting attachment and prevents the adhesive tape from contaminating or touching the overlying layers of the recording tape.

(6) Check the rewind action by rotating the takeup spool fully clockwise; then allow the storage spool to rewind completely. There should be no slack during or after rewind.

b. If the mechanism becomes jammed by any foreign matter in the gear train, remove the obstructing matter from the gear teeth with a camel's-hair brush, or use a toothpick if dirt is packed in the gear teeth.

c. Tape rewinding too slowly (6 seconds or more) can be caused by the following cond tions:

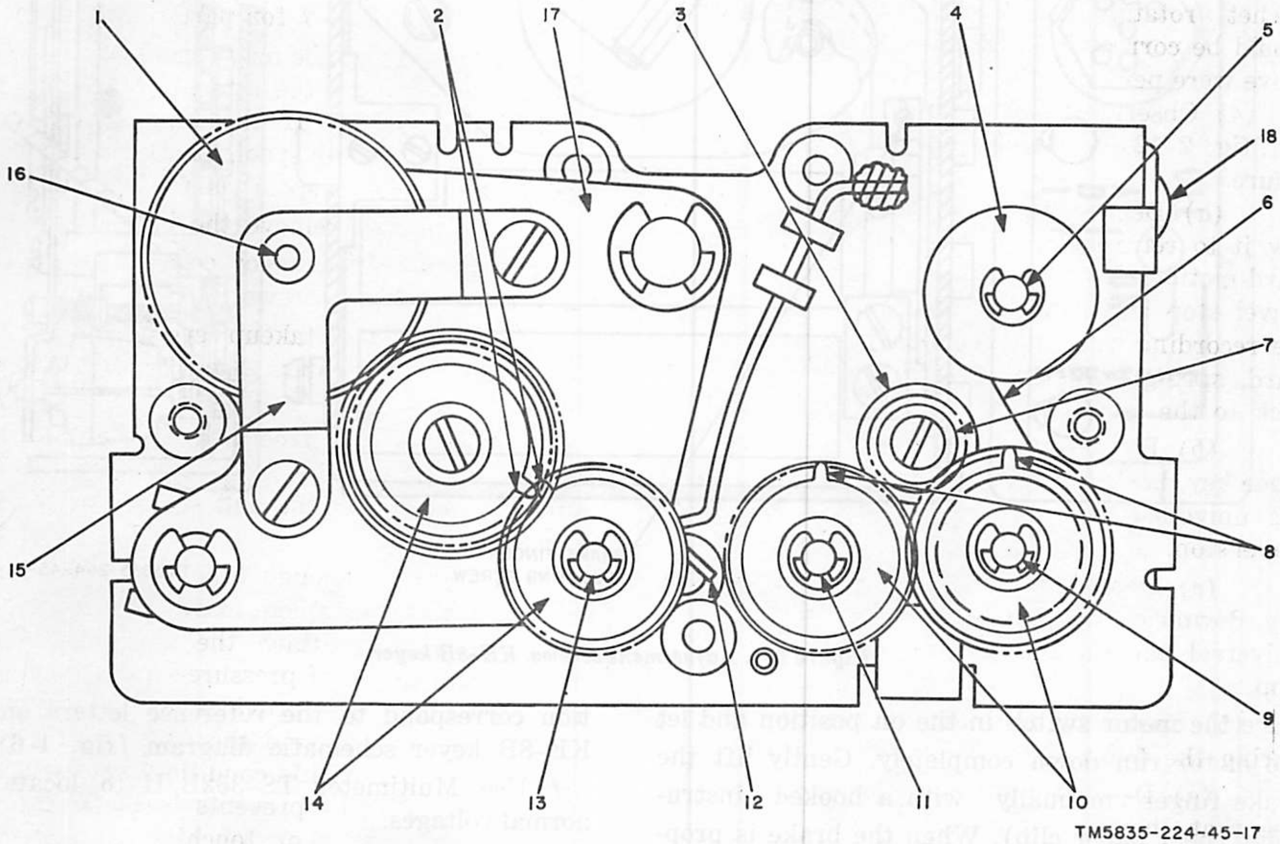
(1) Tape drive gear (1, fig. 2-3) operates sluggishly due to dirt or lack of lubrication Clean and lubricate the drive gear (fig. 3-8, TM 11-5835-224-12).

WARNING

Prolonged breathing of cleaning compound is dangerous; be certain that adequate ventilation is provided. Cleaning compound is flammable; do not use near an open flame. Avoid contact with the skin; wash off any that spills on your hands.

(2) Tape sticks on the tape guides because of dirt on the guides. Clean the surface of the guides with cleaning compound.

(3) Sleeve bearings are dry. Lubricate the bearings with 1 or 2 drops of oil (OAI). Remove any excess oil with a dry, lint-free cloth.



1 Tape drive gear
2 Rewind auto-stop pins
3 Storage spool drive gear bearing
4 Rewind spring feed
5 Rewind spring feed bearing
6 Rewind spring
7 Storage spool drive gear
8 Takeup auto-stop pins
9 Takeup auto-stop gear bearing
10 Takeup auto-stop gears
11 Takeup auto-stop gear bearing
12 Drive assembly tension spring
13 Rewind auto-stop gear bearing
14 Rewind auto-stop pins
15 L-bracket
16 Drive gear bearing
17 Drive assembly plate
18 Tension idler arm

Figure 2-3. CA-3B cartridge, parts location.

2-9. KE-8B Keyer Troubleshooting Procedure

Use the procedures given in *a* through *e* below to isolate troubles in the KE-8B keyer.

a. The drive motor running too slow or too fast is caused by the drive motor speed control being out of adjustment. Adjust the motor speed as instructed in paragraph 2-16.

b. If the motor does not stop when the motor ON-OFF switch is turned OFF, clean the brake disk surface with cleaning compound while the motor is running.

c. If the motor still continues to run when the switch is in the off position, adjustment of the brake is necessary. To check the adjustment,

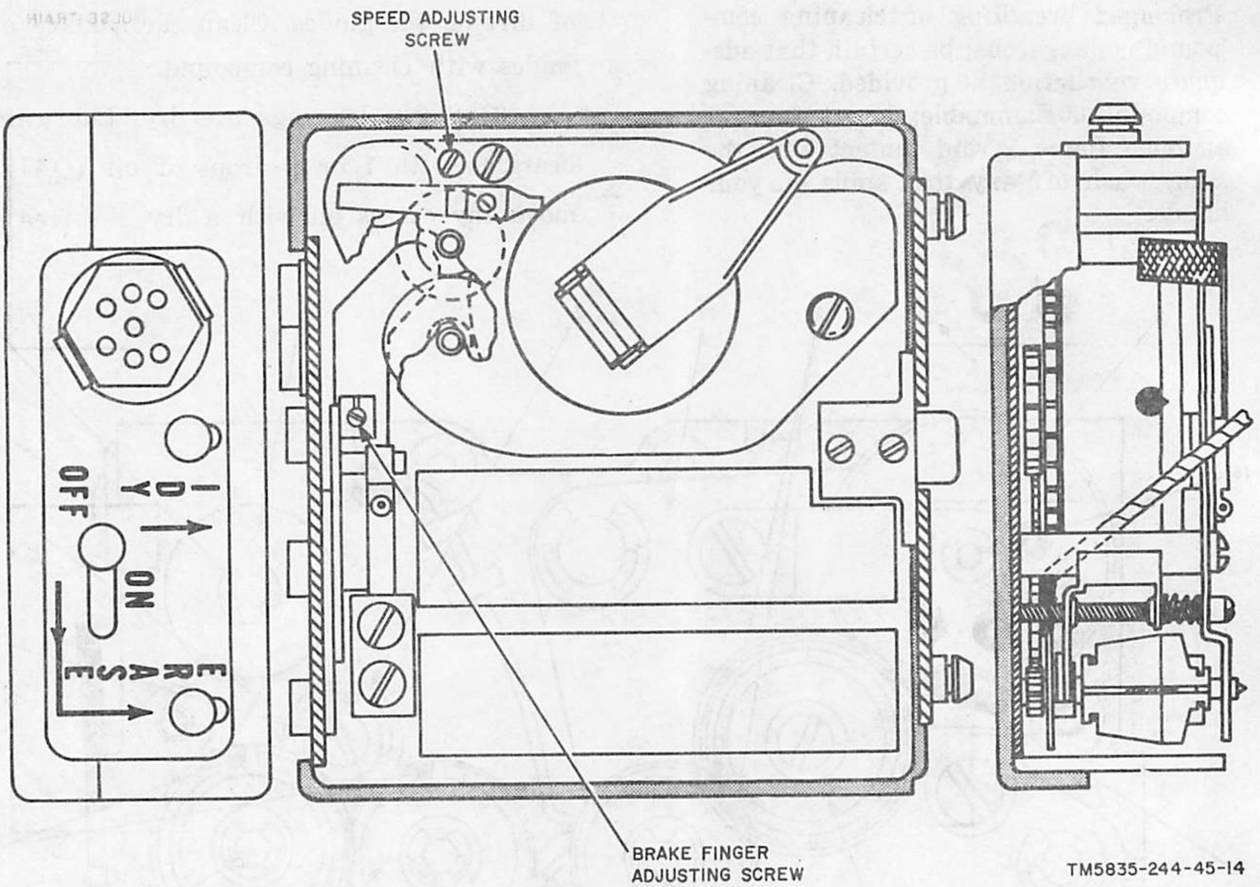


Figure 2-4. Adjustment screws, KE-8B keyer.

place the motor switch in the on position and let the motor run down completely. Gently lift the brake finger manually with a hooked instrument (bent paper clip). When the brake is properly adjusted, there will be very little, if any, movement of the motor when the brake finger is lifted. If the motor starts up again when the brake finger is raised manually, turn the brake finger adjusting screw (fig. 2-4) counterclockwise about one-quarter of a turn. Repeat as required until the adjustment is achieved.

d. Dropouts in the output pulse train may be caused by dirt on the reading head. Clean the reading head as instructed in paragraph 2-6*a*(1).

e. Absence of a signal output from the KE-8B keyer normally indicates electrical trouble in the KE-8B keyer. Isolation of the trouble can be made easier by the use of the test point illustration (fig. 2-5), which contains key dc voltages. Reference letters on test point illustration correspond to the reference letters on the KE-8B keyer schematic diagram (fig. 4-6).

f. Use Multimeter TS-352B/U to locate abnormal voltages.

2-10. KA-3 Keyer Adapter Troubleshooting Procedure

Use the procedures given in *a* through *g* below to isolate troubles in the KA-3 keyer adapter.

a. Failure of the KA-3 keyer adapter to key Radio Transmitter T-784/GRC-109 may be remedied by one of the following measures:

(1) Check connectors P1 and P2 (fig. 2-7) to be sure that the connector plugs are clean and well seated in receptacles. Check for bent or broken pins.

(2) Visually inspect the KE-8B keyer to be sure that the reading head is clean and that a CA-3B cartridge, which contains a previously recorded tape, is properly attached.

(3) Check Q7 and associated circuitry (fig. 1-9).

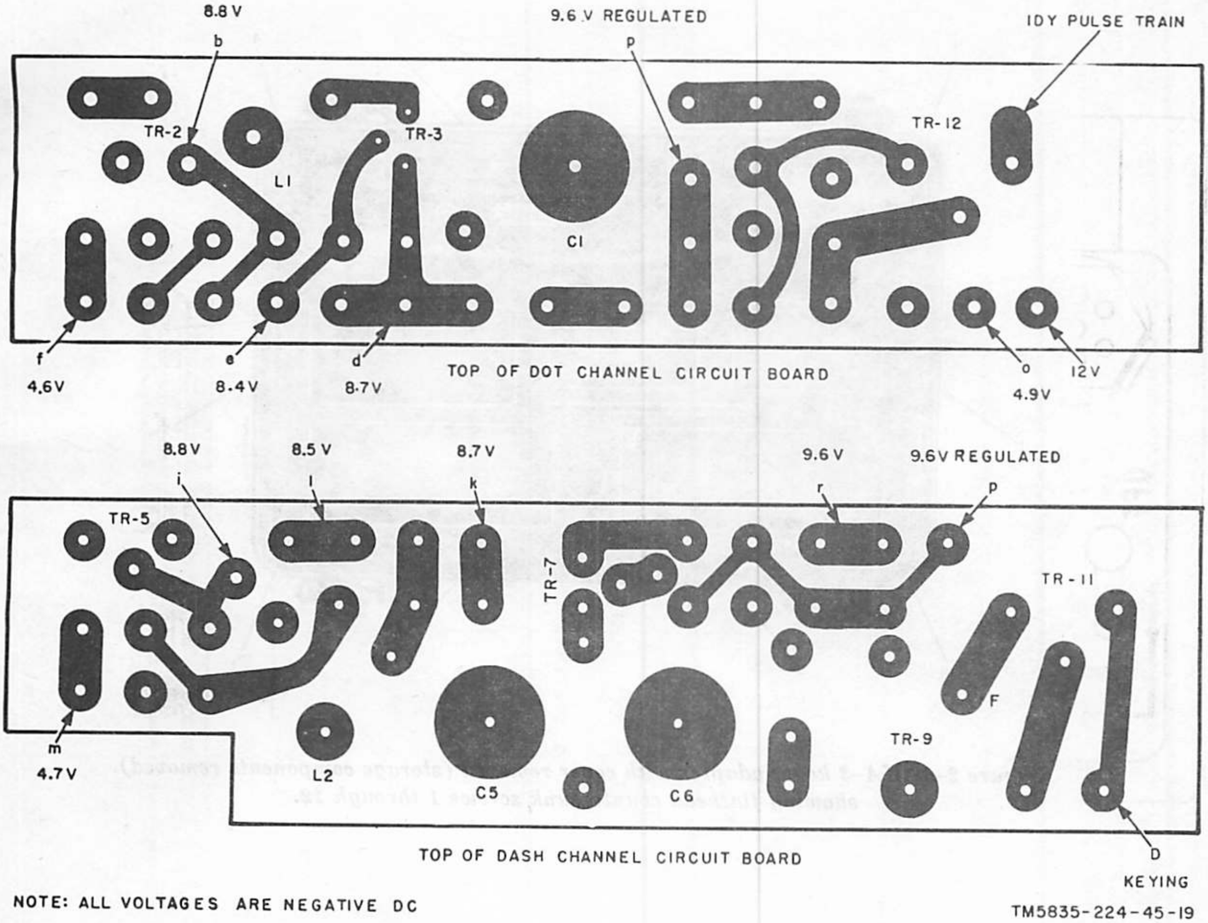


Figure 2–5. Voltage test points, KE–8B keyer modules.

(4) Check V1 and V2 and associated circuitry (fig. 1–9).

(5) Check the T–784/GRC–109 oscillator and power amplifier circuits.

(6) Check the P2 connections (fig. 2–7) to be sure that the KA–3 keyer adapter is supplying power to KE–8B keyer.

b. Failure of the T–784/GRC–109 oscillator to turn off at the end of the transmitting period may be caused by one of the following defects:

(1) Capacitor C3 not charging sufficiently (fig. 1–9). Check C3 and CR5.

(2) Defective component in the T–784/GRC–109 oscillator cathode circuit. Check the component values and replace if defective.

c. Absence of power being supplied to the KE–8B keyer indicates component failure in the KA–3 keyer adapter power supply or absence of a 6.3-volt input to the KA–3 keyer adapter from the T–784/GRC–109 filament supply. Make the following checks to isolate the trouble.

(1) Check P1 (fig. 2–7) to be sure that it is clean and properly connected.

(2) Make continuity checks on T1, L1, and L2 (fig. 1–9).

(3) Check the connector on the T–784/GRC–109 that mates with P1 on the KA–3 keyer adapter for 6.3 volts on pin H, and ground on pin J.

(4) Test transistors, rectifiers, and other power supply components.

d. Dropouts in transmitted signal are normally caused by dirt on the reading head of the KE–8B keyer. Clean the recording head as instructed in paragraph 2–7*a*(1).

e. Figure 2–6 shows the location of 12 screws on the KA–3 keyer adapter cover.

f. Figures 2–7 and 2–8 show the parts location on the KA–3 keyer adapter.

g. Use Test Set, Electron Tube TV–7/U to test voltage regulator tubes V1 and V2, and the Test Set, Transistor TS–1836/U to check transistors suspected of being defective.

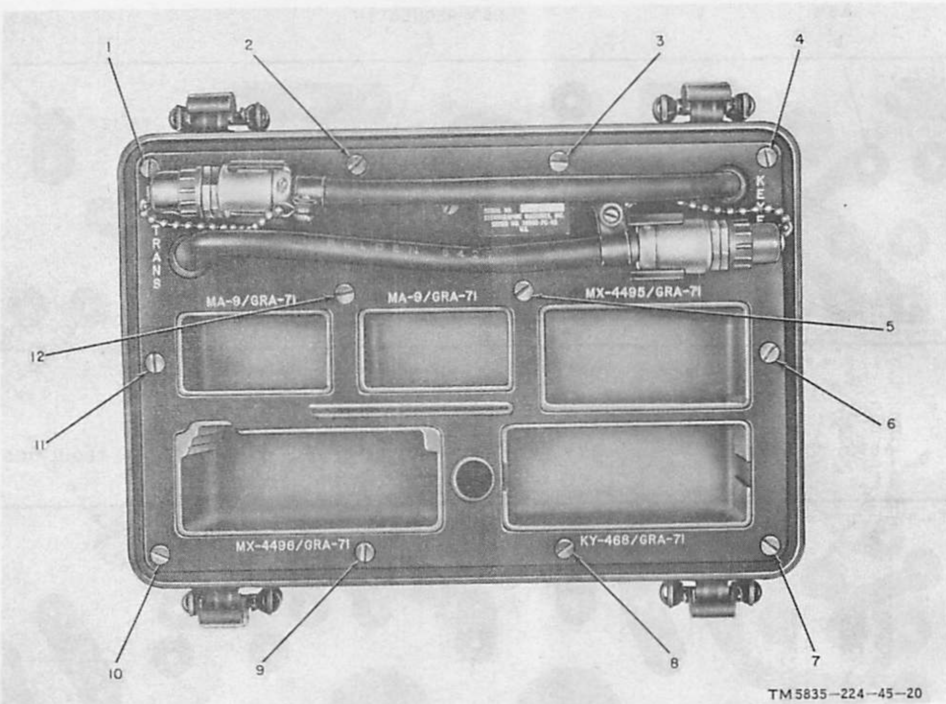


Figure 2-6. KA-3 keyer adapter with cover removed (storage components removed). showing flathead countersunk screws 1 through 12.

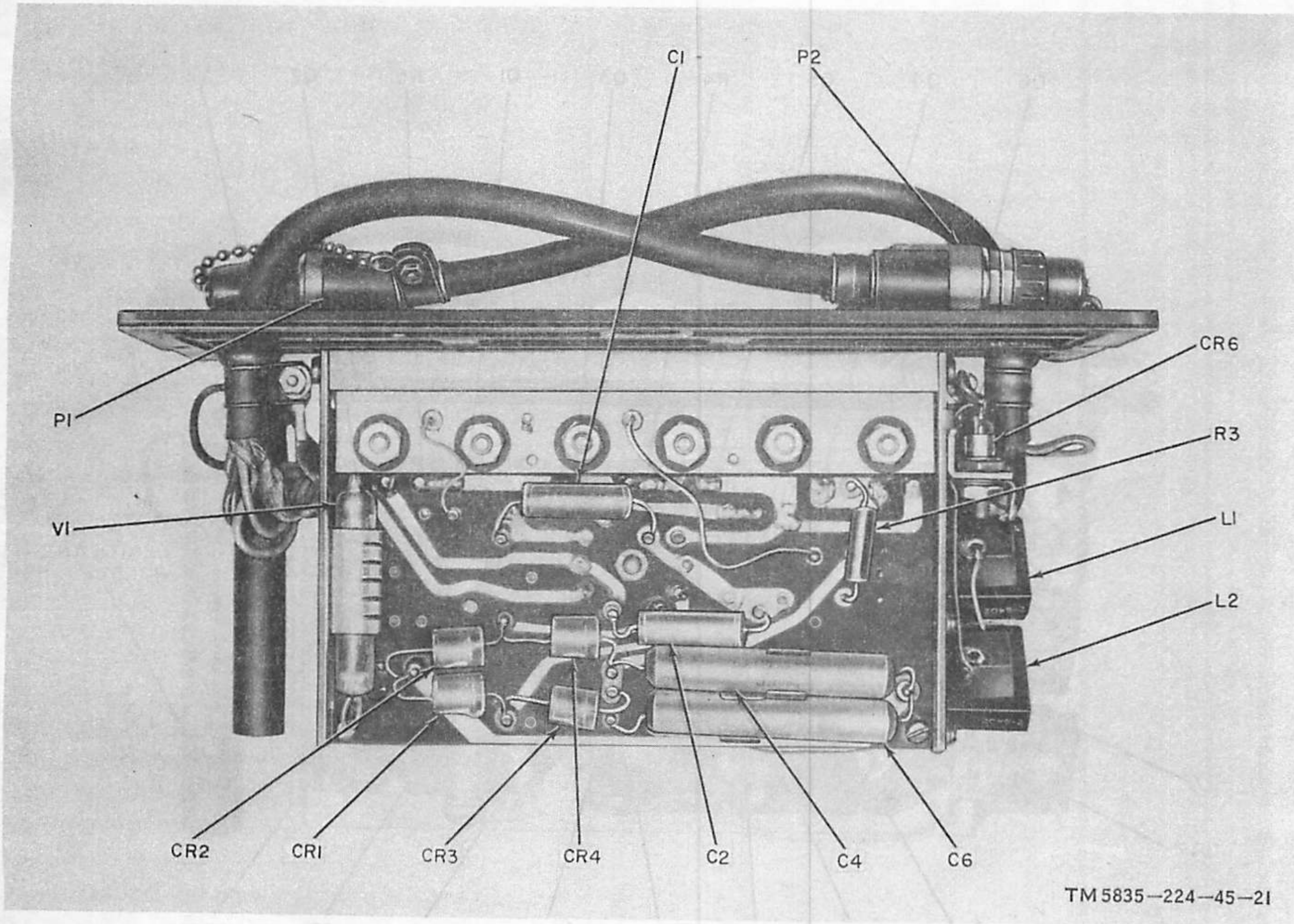


Figure 2–7. KA–3 keyer adpater, parts location, top view.

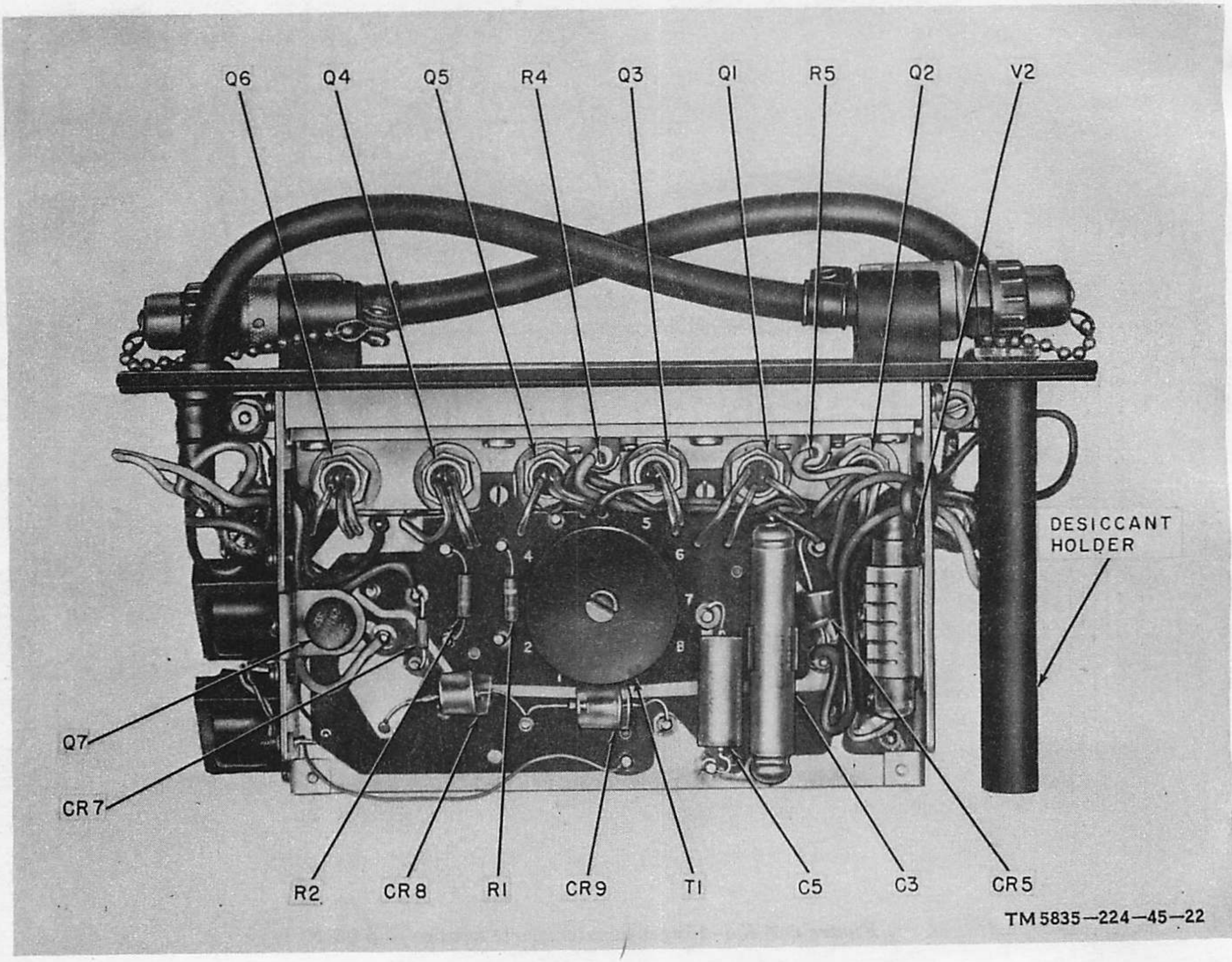


Figure 2-8. KA-3 keyer adapter, parts location, bottom view.

Section III. DIRECT SUPPORT ADJUSTING PROCEDURES

2-11. General

This section contains adjustment procedures and tolerance requirements for the AN/GRA-71. Adjustment procedures are arranged in the proper sequence for a complete readjustment of the set. When making individual adjustments, check all related adjustments. Where removal of parts or subassemblies is necessary to make an adjustment, reference is made to specific paragraphs for removal and replacement instructions.

2-12. Head Adjustment for CO/B-8 and CO-3B Coders
(fig. 2-9 and 2-10)

Use the following adjustment procedure as appropriate for both the CO/B-8 and the CO-3B coders.

a. Height Adjustment. Remove one of the coders from its bottom cover. Loosen each of the A-screws shown in figures 2-9 and 2-10. This action will allow the recording head to be raised or lowered easily. The recording head can be raised from the underside of the chassis. Set the recording head about one-sixteenth inch above the head block surface, and retighten the A-screws.

b. Azimuth Adjustment. The recording head centerline should be positioned 0.050 inch away from the centerline of the locking pins, in the direction of the coding assembly. If it is necessary to adjust the recording head beyond simple height adjustment, use the B-screws shown in figures 2-9 and 2-10 to position the recording head 0.050 inch off center as well as to give azimuth adjustment. If it is necessary to adjust the B-screws, adjust both B-screws equally and be sure to loosen the A-screws just enough to hold the recording head gently while turning the B-screws. Retighten the A-screws after correct alignment is achieved.

2-13. Head Adjustment for KE-8B Keyer

Use the following adjustment procedure for positioning the read-erase head.

a. Height Adjustment. Remove the KE-8B keyer from its case. Loosen the head alignment screw (27, fig. 3-5) just enough to hold the head gently. This condition will allow the head to be raised or lowered easily. Set the head five sixty-fourths inch above the case, and retighten the screws.

b. Centering Adjustment. The head centerline should be positioned 0.050 inch away from the centerline of the locking pins, in the direction of the keyer assembly. If it is necessary to adjust the head beyond simple height adjustment, use the head mounting screws (34 and 35, fig. 3-5) to position the head 0.050 inch off center. Before setting the head alignment screw, loosen the head mounting screws (34 and 35, fig. 3-5) just enough to hold the head gently while turning the adjusting screw. Retighten the head mounting screws after correct alignment is achieved.

2-14. Spacing Mechanism Adjustment for CO/B-8 Coder

Adjust the dot and dash spacing mechanism for proper tape advance. Typical wrenches are shown in figure 2-13.

a. Dash Spacing Adjustment. The feed ratchet must be advanced two teeth for dashes. The detent pawl must snap down and hold the feed ratchet in the advance position after each two-tooth advance.

(1) Disable the dot spacing mechanism by placing a wedge of doubled-up paper under the dot switch-and-bellcrank actuator to prevent its downward movement.

(2) Loosen the detent pawl locknut slightly. Turn the hexagonal-head pivot (an eccentric) with a thin, one-fourth inch, open-end wrench one-eighth turn toward the coding mechanism, and then retighten the locknut.

(3) Insert a small screwdriver into the dash camshaft slot, and turn the camshaft clockwise very slowly to observe the following corrected action: as the stroking finger depresses the dash spacing universal bar, the spacing mechanism feed pawl should advance the feed ratchet two teeth; two clicks should be heard as the feed ratchet is advanced; then, as the dash spacing universal bar reaches maximum downward position, the spacing mechanism detent pawl should hold the feed ratchet in place as the universal bar returns to its home (maximum upward) position. If this condition is not corrected (tape still fails to advance properly), proceed to (4) below.

(4) If the condition appears to be worse, loosen the detent pawl locknut slightly and turn the hexagonal-head pivot one-quarter turn toward the word-space button. Retighten the lock-

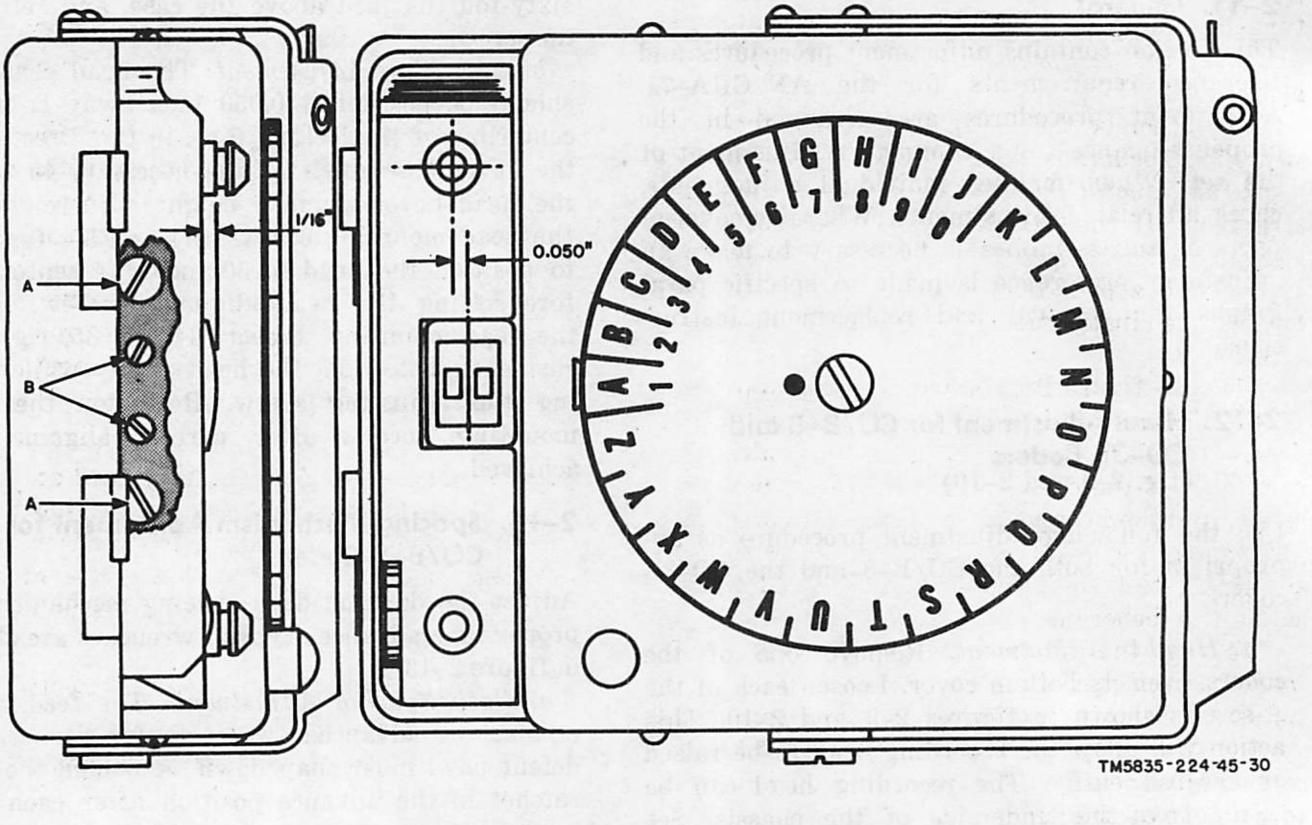


Figure 2–9. CO/B–8 coder recording head adjustment.

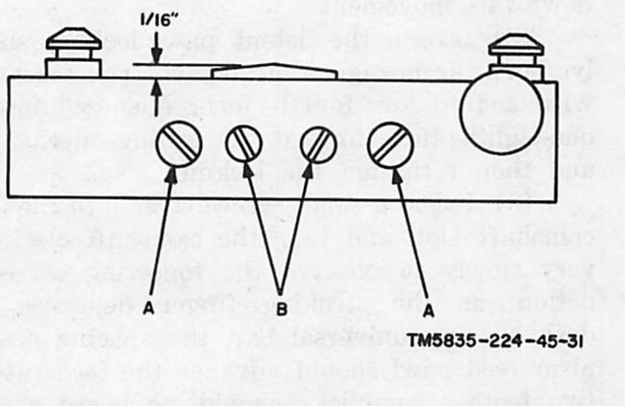


Figure 2–10. Co–3B coder recording head adjustment.

nut, and perform the procedure given in (3) above. The mechanism should advance two teeth for dashes.

(5) Remove the paper wedge from the dot switch-and-bellcrank actuator.

b. Dot Spacing Adjustment. The feed ratchet must be advanced one tooth for dots. The detent pawl must snap down and hold the ratchet in the advanced position after each one-tooth advance.

(1) Make sure that the dash spacing and the dash spacing adjustment are correct as described in *a* above.

(2) Disable the dash spacing mechanism by placing a wedge of doubled-up paper under the dash switch-and-bellcrank actuator to defeat its downward movement. Be certain not to close the lower leaf of the switch with the wedge of paper.

(3) Insert a small screwdriver into the dot camshaft slot, and turn the camshaft counterclockwise very slowly to observe the following action: as the stroking finger depresses the dot spacing universal bar, the spacing mechanism feed pawl should advance the feed ratchet one tooth; one click should be heard as the feed ratchet is advanced; then, as the dot spacing universal bar reaches its maximum downward position, the spacing mechanism detent pawl should hold the feed ratchet in place as the universal bar returns to its home position. If a one-tooth advance is not evident and dash spacing is correct, proceed to (4) below.

(4) Loosen the interlock screw locknut, and turn the interlock screw one-eighth turn clockwise; then retighten the locknut.

(5) Perform the procedure given in (3) above. If a one-tooth advance is not observed, turn the interlock screw another one-eighth turn and perform the procedure given in (3) above again.

(6) Remove the paper wedge from the dash switch-and-bellcrank actuator.

c. *Additional CO/B-8 Coder Adjustment Instructions.* If the CO/B-8 coder does not space correctly after having been adjusted as instructed in *a* and *b* above, readjust the spacing by following the instructions given in (1) through (13) below:

(1) A, figure 2-14 illustrates the top view of the dot and dash adjustment screws for the CO/B-8 coder. B, figure 2-14 illustrates the side view of the dash spacing universal bar stop screw, and the hexagonal-head eccentric pivot adjustment screw. C, figure 2-14 illustrates the position a (steel engineer) ruler is placed to deactivate a bellcrank and stroking finger.

(2) If the adjustments (fig. 2-1) were made correctly at the factory, the dash spacing universal bar stop screw, the dot to dash universal bars adjust screw, and locknut dot stop screw adjustments will not be necessary. Only the adjustment of the hexagonal-head eccentric pivot screw is necessary; however, each adjustment will be discussed here. To simplify the adjustment procedure, the adjustment screws will be referred to by the numbers (1) through (4) as assigned below, and used on A, figure 2-14.

(*a*) Dash spacing universal bar stop screw (1).

(*b*) Dot to dash universal bars adjust screw (2).

(*c*) Locknut dot stop screw (3).

(*d*) Hexagonal-head eccentric pivot screw (4).

(3) The screw (1) functions as follows:

(*a*) Adjusts the clearance between the stroking finger and the tab on the dash spacing universal bar.

(*b*) It adjusts the rest position of the driving pawl.

(*c*) It adjusts the amount of spring tension which returns the driving pawl to its rest position.

(*d*) It adjusts the rest position of tab 2 (B, fig. 2-14) on the dash spacing universal bar.

(4) The screw (1) is adjusted as follows:

(*a*) Disable the dot spacing mechanism by placing a paper clip or a steel engineer ruler edge under the bellcrank (C, fig. 2-14) to prevent the downward motiion of the bellcrank, and to prevent the stroking finger from actuating the dot spacing universal bar.

(*b*) There must be play between the screws (2) and the dash spacing universal bar (A, fig. 2-14).

(*c*) Insert a small screwdriver into the end of the dash camshaft slot and turn the camshaft clockwise slowly until the leaf spring on the impulse generator *pings* into position. Lift the holding pawl from the ratchet gear by pressing on its end momentarily. Adjust the screw (1) until the tab on the dash spacing universal bar almost touches the dash stroking finger. This is the initial adjustment.

(5) The screw (4) adjusts the position of the feed ratchet teeth so that there are an integral number of teeth between the driving pawl rest position and the holding pawl position. The play between the driving pawl and the mating ratchet tooth is controlled by adjustment of the screw (4).

(6) Adjust the screw (4) as instructed below:

(*a*) Turn the screw (4) adjustment head until the edge with the mark (B, fig. 2-14) is horizontal. (The mark identifies the eccentric position.)

(*b*) Press slowly and gently on the dash spacing universal bar with a small screwdriver and observe the driving pawl. (This can also be accomplished by pressing on the space pushbutton slowly and gently.) Play will be noticed by movement of the driving pawl before it engages a ratchet tooth. This play can be diminished by rotating the ratchet tooth toward the driving pawl rest position, by using the hexagonal-head eccentric pivot screw (4), turning it toward the driving pawl. Do not remove it completely since the driving pawl, when returning to its rest position, may hang up on the top of the ratchet tooth if the returning spring is not strong enough. Play may be introduced by turning the screw (4) in the opposite direction. The mark on the screw (4) should be approximately 35° from the horizontal position, toward the code assemblies.

(7) The adjustment of the screws (1) and (4) is checked as follows:

(*a*) Push the space button down completely, slowly, and release very slowly many times, and make certain that the feed ratchet gear is advanced two teeth each time. Make sure that the driving pawl returns to its rest position every time after it passes over two teeth; touching it gently with a screwdriver will make it fall back to its rest position if it is *hung up*. If hung up, repeat (4), (5), and (6) above.

(*b*) If the stop for the space pushbutton will not allow the two advances of the ratchet teeth to take place, raise the screw (1) by turning it counterclockwise, thereby allowing the dash spacing universal bar tab 2 to raise up higher.

(*c*) If the driving pawl does not return to its rest position because of the lack of return spring (1) (B, fig. 2-14) tension, lower the screw (1), and repeat the procedures given in (4), (5), and (6) above.

(*d*) Disable the dot spacing mechanism as indicated in (4)(*a*) above and operate the dash spacing mechanism as indicated in (4)(*c*) above. Make sure that the dash stroking finger does not move the dash spacing universal bar sufficiently when the impulse generator *pings* to move the ratchet gear a tooth. If it does, lower the screw (1) by turning it clockwise. Proper adjustment of the screws (1 and 4) must be made so that two advances of the ratchet teeth occur as the dash spacing universal bar is pushed by the stroking finger and the dash spacing mechanism is operated slowly with the screwdriver.

(*e*) Each time that the screw (1) is adjusted, adjustment of the screw (4) must be repeated ((4), (5), and (6) above).

(*f*) Each time that an adjustment is made, first release the locknut and then lock it after adjustment. Use very little hand pressure because the hexagonal-head eccentric pivot screwhead will break off easily.

(*g*) Make sure that return spring ends are not stretched, the bearings are lubricated (sparingly), and that there is no binding in the mechanism.

(8) A summary of the overall check on the adjustment screws (1 and 4) are as follows:

(*a*) Disable the dot spacing mechanism as indicated in (4)(*a*) above and operate the dash spacing mechanism as indicated in (4)(*c*) above and observe the following sequence of events.

1. The dash coding pins are activated.

2. The dash electrical contacts are activated.

3. The bellcrank pushes the stroking finger out above the dash spacing universal bar.

4. The electrical impulse generator rings before the ratchet gear advances.

5. The stroking finger pushes the dash universal spacing bar so that the ratchet gear advances two teeth.

(*b*) The space pushbutton is pressed gently and slowly several times. The ratchet gear should advance two teeth each time.

(*c*) Check the play between the driving pawl and the ratchet tooth as indicated in (6)(*b*) above.

(9) The screw (3) adjusts the rest position of the dot spacing universal bar, the clearance between the dot stroking finger, and the dot spacing universal bar tab.

(10) Adjustment of the screw (3) for the dot spacing mechanism is made as follows:

(*a*) Make sure that there is play between the adjustment screw (2) and the dash spacing universal bar.

(*b*) Make sure that the dot spacing universal bar is not binding against the impulse generator leaf spring, thereby preempting the function of the screw (3). If the impulse generator is repositioned, the output voltage must be rechecked after the impulse spring is readjusted and adjustment of the screws (1) and (4) must be repeated.

(*c*) Be sure that there is no binding of the dot spacing universal bar and that the return spring is functioning properly.

(*d*) Disable the dash spacing mechanism by placing a paper clip or metal ruler (C, fig. 14) under the dot bellcrank similar to the one in (4)(*a*) above.

(*e*) Insert a small screwdriver into the end of the dot camshaft slot and turn the camshaft clockwise slowly until the leaf spring on the impulse generator *rings* into position. In A, figure 14, adjust the screw (3) until the tab on the dot spacing universal bar is closest to the stroking finger as possible without touching the impulse generator leaf spring or the dot spacing universal bar.

(11) The screw (2) adjusts the play between the dot spacing universal bar and the dash spacing universal bar. Motion of the dot spacing universal bar is transmitted to the dash spacing universal bar after the play introduced by the screw (2) is used up. Motion of the dash spacing universal bar is not transmitted to the *dot* spacing universal bar.

(12) Continue to operate the dot spacing mechanism after the *ring* is obtained as indicated in (10)(*e*) above. The dot stroking finger will push the dot spacing universal bar. Adjust the screw (2) so that enough play is introduced and

that only sufficient motion is transmitted from the dot universal spacing bar to the dash spacing universal bar to make the ratchet gear advance only one tooth by the action of the dot stroking finger.

(13) A summary of the overall check on adjustment screw (2) and (3) are—

(*a*) Disable the dash spacing mechanism as indicated in (10)(*d*) above and operate the dot spacing mechanism by inserting a small screwdriver into the end of the dash camshaft and by turning clockwise slowly, observe the following:

1. The dot coding pins are activated.

2. The dot electrical contacts are activated at the same time.

3. The bellcrank pushes the stroking finger out above the dot spacing universal bar at the same time.

4. The electrical impulse generator *rings* into position and the ratchet gear does not advance.

5. The stroking finger pushes the dot spacing universal bar so that the dot spacing universal bars initial motion absorbs the play between it and the dash spacing universal bar. The remaining downward motion of the dot spacing universal bar moves the dash spacing universal bar downward sufficient to move the ratchet gear one tooth.

6. If necessary, repeat the procedure given in (9) through (12) above.

2–15. Spacing Mechanism Adjustment for CO–3B Coder

(fig. 2–12)

Adjust the dot and dash spacing mechanism for proper tape advance as follows:

a. Attach a CA–3B cartridge to the CO–3B coder.

b. Depress and release the dash key 15 times, checking for a two-tooth feed pawl index on the downstroke and a two-tooth feed ratchet rotation on the upstroke each time (fig. 2–11). Adjust the detent pawl accordingly if it does not come to rest properly after each rotation. To adjust the detent pawl, loosen the detent pawl screw and press down on the phosphor bronze detent, away from the impulse generator, thereby moving the feed ratchet gear to take up any play between the feed pawl and feed ratchet gear. Retighten the detent pawl screw and recheck the operation.

c. Depress and release the dot key 30 times, checking for a one-tooth feed pawl index on the downstroke and a one-tooth feed ratchet rotation on the upstroke each time. Operation should be correct if the procedure in *b* above was performed accurately.

d. Observe the overtravel stop and spring (A, fig. 2–12) action during the following procedure:

(1) Depress the dash key slowly, and allow it to return slowly. Check to see that, on the downward motion, the dash key pin engages the overtravel stop, causing it to be pushed toward the recording head. As the dash key returns upward, spring tension pushes the overtravel stop back to normal position.

(2) Depress the space key. Check to see that the space key downward motion stops when the spacing universal bar engages the top of the overtravel stop.

(3) Depress the dot key. Check to see that the dot key downward motion also stops when the spacing universal bar engages the top of the overtravel stop.

e. Observe the spacing mechanism action during the following procedure:

(1) Depress the dash key very slowly. Check to see that the spacing mechanism action begins almost immediately as the key is depressed.

(2) Depress the dot key very slowly. Check to see that the spacing mechanism action is not immediate as the key is depressed.

(3) If the dot key must be depressed more than one-eighth inch to actuate the spacing mechanism action, proceed to *f* below. If the spacing mechanism action begins before the dot key is depressed one-eighth inch, then the spacing mechanism action is normal and adjustment is correct.

f. Depress the dash key very slowly. Check to see that the feed pawl clicks twice as it indexes two teeth. The second click should occur just when the dash key reaches its maximum downward position. Depress the dash key again very slowly. If the feed pawl travels (overshoots) farther than one thirty-second of an inch after the second click is heard, insert a screwdriver between the spacing universal bar and the spacing universal bar stop (B, fix. 2–12) and bend the stop upward one sixty-fourth inch. Repeat the procedures given in *e*(2) and (3) above. Repeat this procedure again, if necessary, to limit feed pawl overshoot to one thirty-second of an inch.

2-16. Motor Speed and Brake Adjustment of KE-8B Keyer

a. Motor Speed Check. An occasional check should be made to insure correct operating speed of the drive motor for proper CA-3B cartridge drive gear rotation and tape advance speed. Check the motor speed as follows:

(1) With the motor ON-OFF switch in the OFF position, wind the motor to full power.

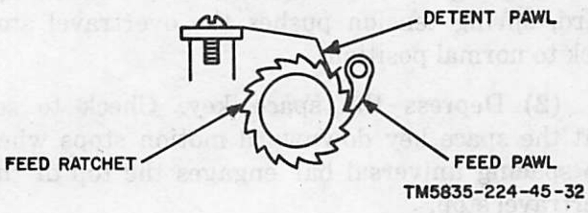


Figure 2-11. CO-3B coder feed ratchet travel adjustment.

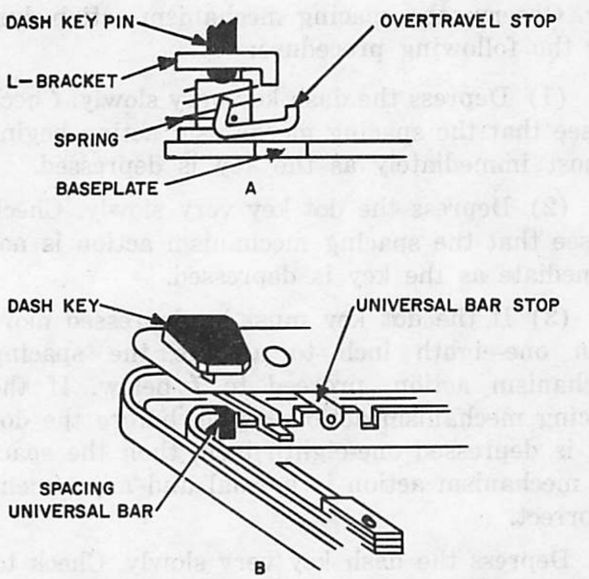


Figure 2-12. CO-12. CO-3B coder universal bar travel adjustment.

(2) Place a piece of white adhesive tape near the outer rim of the takeup spool on the CA-3B cartridge so that it is plainly visible when the OA-3B cartridge is attached to the KE-8B keyer.

(3) Slide the motor ON-OFF switch to its ON position. Count the number of revolutions of the takeup spool in 20 seconds. It should revolve *25 times in 20 seconds.* The KE-8B keyer output gear drives the tape spool at the speed of 78 revolutions per minute (rpm).

(4) Repeat the procedures in (1), (2), and (3) above two or more times, and take the average of the three runs as an accurate index of motor speed. If the motor is running too slow or too fast, proceed to *b* below.

b. Motor Speed Adjustment. Turn the speed adjusting screw (fig. 2-4) clockwise to increase the motor speed and counterclockwise to decrease the motor speed. Repeat the motor speed check (*a* above) to check the result of adjustment. Readjust and recheck the motor speed repeatedly until the speed of 75 rpm is attained.

c. Motor Brake Check. To check the brake adjustment, place the motor ON-OFF switch to ON and let the motor run down completely. Gently lift the brake finger manually with a hooked instrument (bent paper clip). When the brake is properly adjusted, there will be very little, if any, movement of the motor when the brake finger is lifted. If the motor starts up again when the brake finger is raised manually, proceed to *d* below.

d. Motor Brake Adjustment. To increase braking force, turn the brake finger adjusting screw (fig. 2-4) counterclockwise about one-quarter turn. Lift the brake finger (*c* above). If the motor still starts up, turn the brake finger adjusting screw counterclockwise a little more. Repeat as required until adjustment is achieved. (To make the brake finger adjusting screw accessible, set the motor ON-OFF switch to OFF).

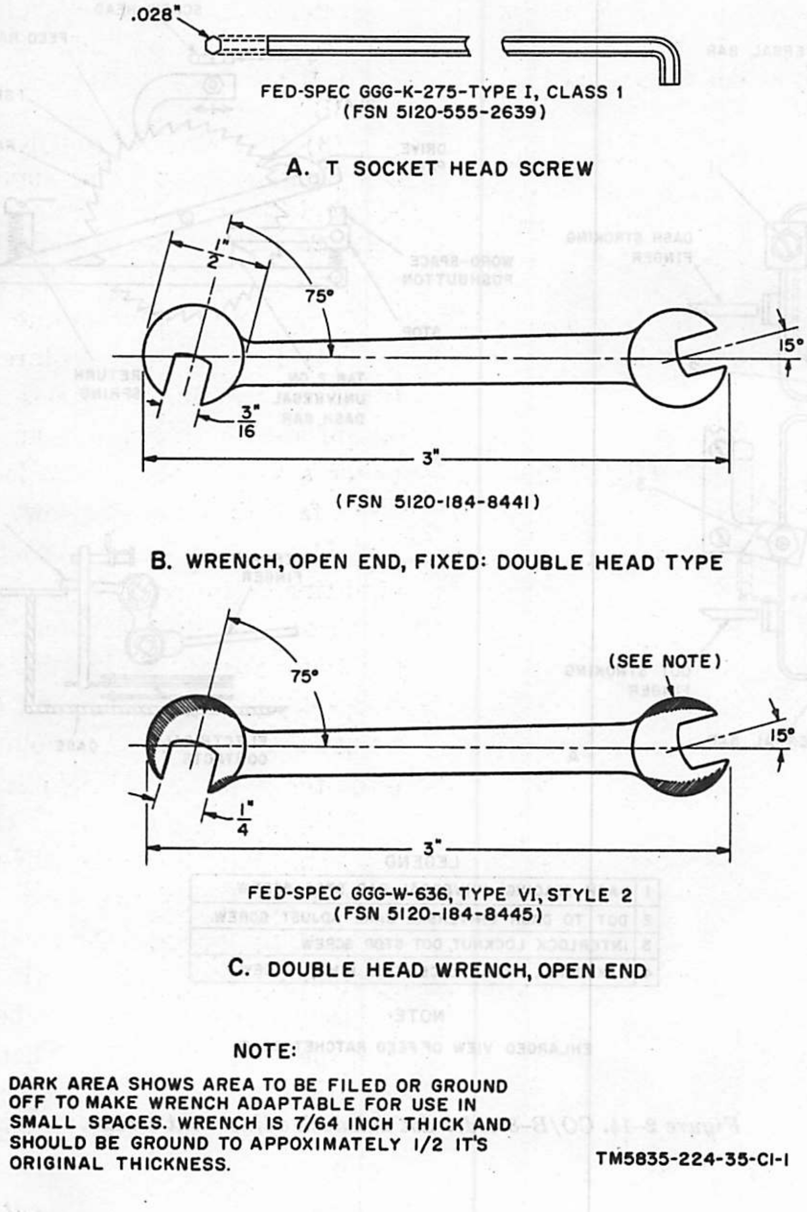
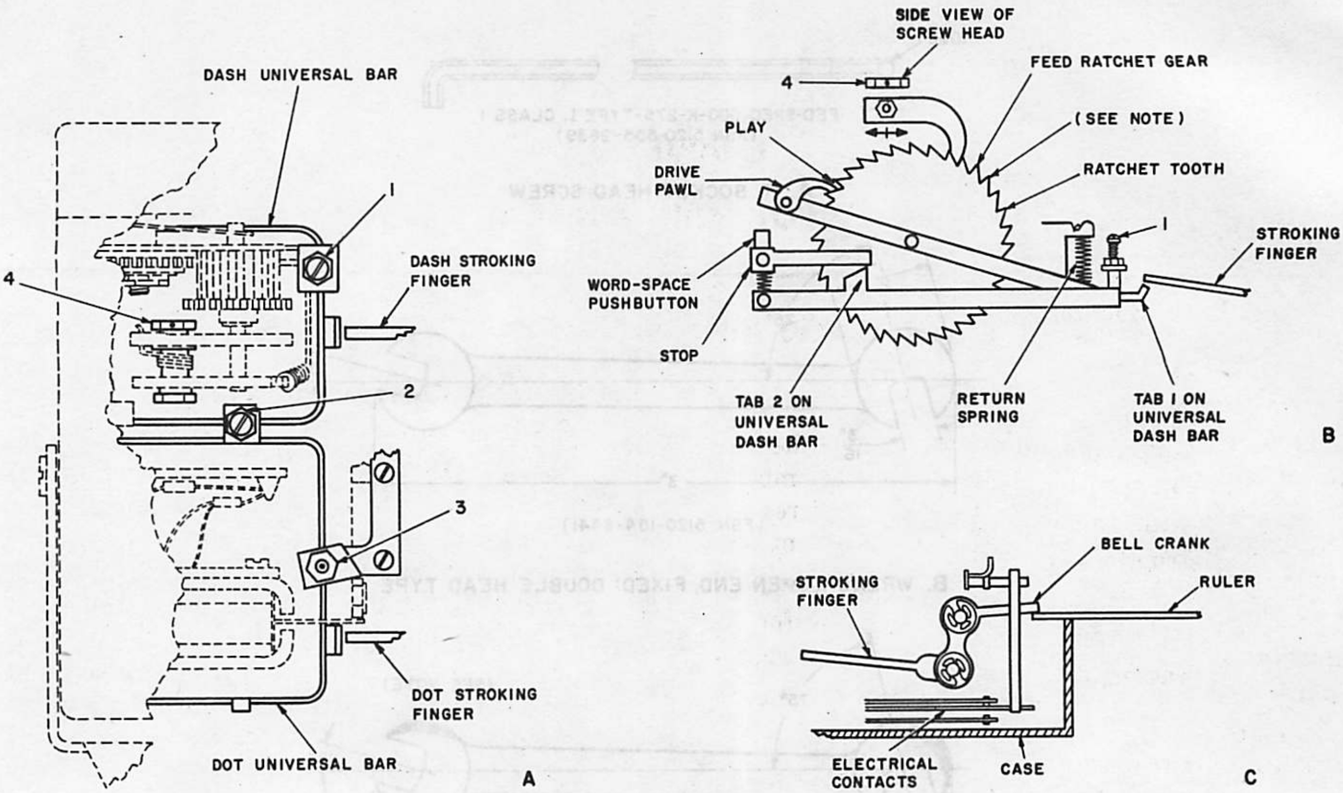


Figure 2–13. Typical wrenches for adjusting CO/B–8 coder dot and dash spacing mechanisms.



LEGEND

I	DASH SPACING UNIVERSAL BAR STOP SCREW.
2	DOT TO DASH UNIVERSAL BARS ADJUST SCREW.
3	INTERLOCK LOCKNUT, DOT STOP SCREW.
4	HEXAGONAL - HEAD ECCENTRIC PIVOT SCREW

NOTE:

ENLARGED VIEW OF FEED RATCHET GEAR.

TM5835-224-35-CI-2

Figure 2-14. CO/B-8 coder dot and dash adjustment screws.

CHAPTER 3

DEPOT MAINTENANCE

Section I. REMOVAL AND REPLACEMENT OF MAJOR ASSEMBLIES

3-1. General

This section includes instructions for the removal and replacement of the major assemblies of the AN/GRA-71. Use these procedures in conjunction with the repair and equipment adjustment instructions given in paragraphs 3-7 through 3-12 and 2-11 through 2-16. Refer to paragraphs 3-7 through 3-12 for detailed disassembly and reassembly instructions of the major assemblies.

Note. Before removing a part in any of the AN/GRA-71 components, note the position of the part and the placement of the leads. Install the replacement parts in the same position as the original parts to avoid a possible impairment of the normal operating capability.

a. Removal and Disassembly.

(1) Disassemble the AN/GRA-71 only to the extent necessary to inspect, replace a defective part, or adjust the mechanism that is in need of maintenance.

(2) When removing springs that are very similar in appearance, tag or otherwise identify each spring to assure proper identification during reassembly.

b. Reassembly and Replacement.

CAUTION

When securing the parts in place, be careful not to tighten the mounting screws or the nuts excessively. Failure to observe this caution can result in broken screws or stripped threads.

(1) Inspect all removed parts for evidence of excessive wear or damage. Install only the parts that are unquestionably serviceable.

(2) Check to be sure that the mating gears and the mechanical linkages are engaged properly before tightening the mounting screws or nuts.

3-2. CO/B-9 Coder Removal and Replacement

a. Remove the hinged recording head lid by opening it and sliding it off the hinge pins.

b. To remove the character dial, remove the character dial attaching screw (14, fig. 3-2) at the center and lift the dial free from the shaft and the locating pin.

c. Loosen and remove the three screws from the two sides and the back of the top cover (15). Lift off the top cover to expose the coding wheel (12) and internal mechanism.

d. Rotate the coding wheel (12) to align the two large access holes adjacent to the flats on the hub above the two coding wheel mounting screws. Insert a small screwdriver through the access holes and remove the screws.

e. Remove the small, roundhead screw from the H-shaped guide plate located 90° clockwise from the recording head (16). Gently lift off the coding wheel (12) to expose the coding assemblies.

f. When replacing the coding wheel (12), position it carefully over the screw holes and lower it slowly into place. This action allows the coding lever pins to enter the guide slots in the coding wheel (12) bracket. Operating the handle during this procedure also helps the pins to enter the guide slots.

g. When removal of the bottom cover (head adjustment, impulse generator check) is necessary, unscrew the four screws in the bottom, and lift the internal mechanism free of the cover. When reinstalling the bottom cover, tighten the screws with moderate pressure to avoid stripping the thread.

3-3. CO-3B Coder Removal and Replacement

a. Depress the lid release button and open the lid.

b. Remove the two screws from the top cover

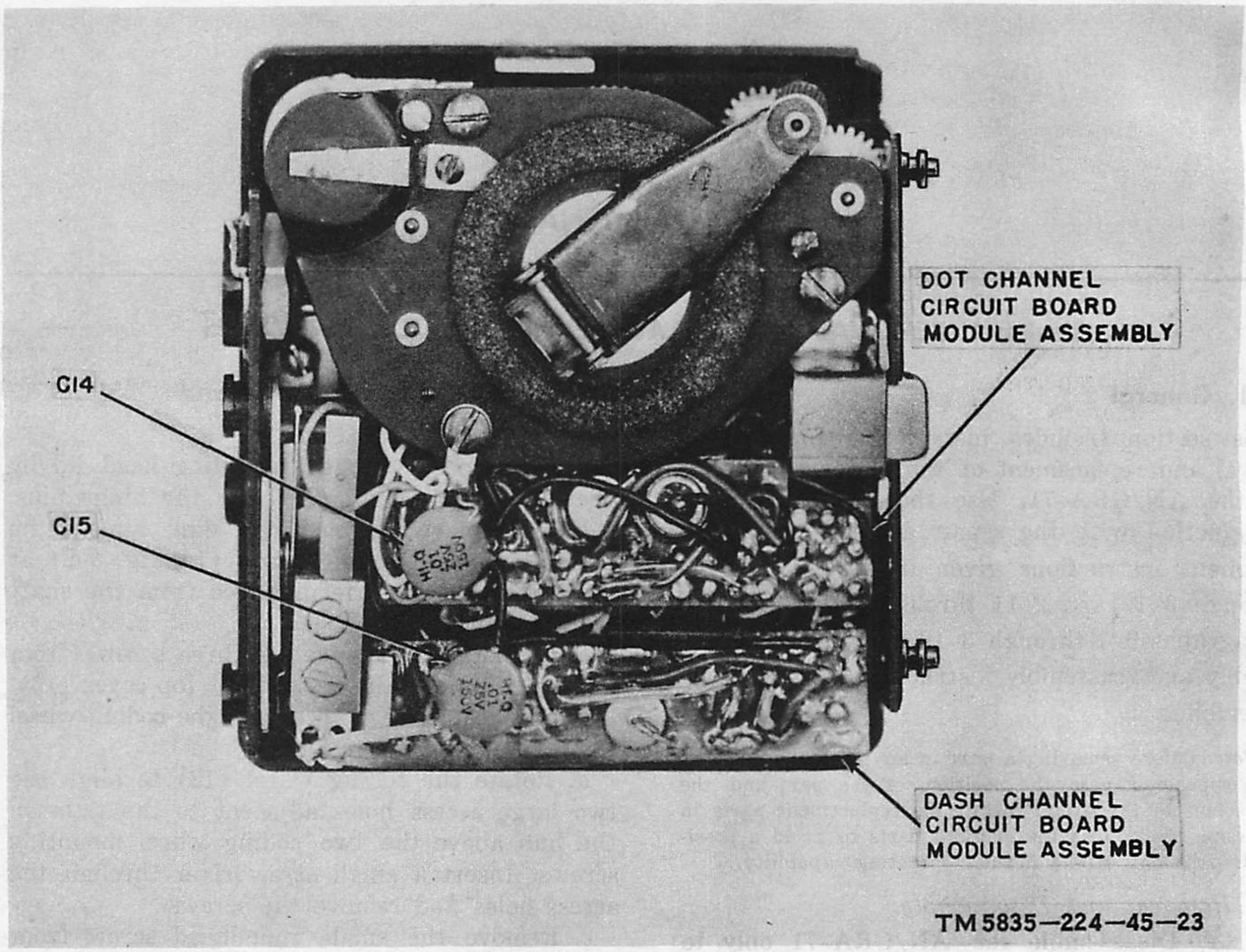


Figure 3–1. KE–8B keyer, parts location.

and lift off the cover to expose the internal mechanism.

c. Remove the four screws from the bottom cover, lift the internal mechanism out of the bottom cover, and place the mechanism on a soft cloth.

d. To replace the CO–3B coder, reverse the procedures given in *a*, *b*, and *c* above.

3–4. CA–3B Cartridge Tape Removal and Replacement

Procedures necessary to disassemble the CA–3B cartridge for service and tape replacement are given in *a* and *b* below.

a. Remove the three spool cover attaching screws, and lift off the spool cover to expose the tape spools.

b. Remove the three screws in the surface of the gear cover. Lift off the gear cover to expose the tape drive gear and the auto-stop gears.

c. To replace the CA–3B cartridge, reverse the procedures given in *a* and *b* above.

3–5. KE–8B Keyer Removal and Replacement

a. To remove the hinged reading head lid, open it and swing it fully back; then slide it off the hinge pin.

b. Remove the two screws from the right and the left sides of the top cover.

c. Unfold the windup crank from its recess to an approximately perpendicular position. Carefully lift off the top cover to expose the internal mechanism shown in figure 3–1. Fold the windup crank back down into the upper left-hand corner to avoid damage to the circuit boards during repair.

d. If it is necessary to remove the bottom cover, remove the four screws from the bottom cover and carefully lift the internal mechanism out of the cover.

e. To replace the KE–8B keyer, reverse the procedures given in *a*, *b*, *c*, and *d* above.

3-6. KA-3 Keyer Adapter Removal and Replacement

a. To disassemble the KA-3 keyer adapter, remove the panel by removing the 12 flathead countersunk screws only, as shown in figure 2-6. *Do not remove any other screws from the panel.* The panel and the electronics section may now be removed by lifting the panel straight up and out of the case. Remove and replace the panel slowly to avoid damaging the electronic circuitry. Disassembly other than panel removal is unnecessary.

b. To replace the KA-3 keyer adapter, reverse the procedure given in *a* above.

Section II. DEPOT REPAIR PROCEDURES

3-7. Scope of Depot Repair

CAUTION

All depot repair procedures must be performed by personnel thoroughly trained in miniature tape recorder equipment maintenance. Equipment operating with minor faults may fail completely as a result of efforts by inexperienced personnel to correct simple defects.

a. Extent of Depot Repair. Depot repair of the AN/GRA-71 includes the procedures listed in (1) through (6) below:

(1) Inspection of equipment and determination of repair procedures required.

(2) Removal of the appropriate major assembly.

(3) Disassembly. (Perform disassembly only to the extent required to reach the defective part).

(4) Reassembly.

(5) Replacement and adjustment of major assembly.

(6) Test of repaired assembly.

b. General Repair Techniques. Refer to the work request sheet and do any available maintenance records to assist in determining the condition of the equipment. Inspect the equipment thoroughly to determine the extent of repair required. For specific repair techniques, refer to the troubleshooting procedures (para 2-4 through 2-10) and the removal and replacement instruction (para 3-1 through 3-6). When parts are disassembled, examine the wearing surfaces of all cams, gears, springs, and bearings for evidence of excessive wear. Inspect the condition of all wiring, including connectors, and printed circuit modules (fig. 3-1).

c. General Repair Procedure. Most replaceable parts of the AN/GRA-71 components can be easily reached and replaced without special procedures. The exploded views (fig. 3-2 through 3-6) illustrate the order of parts disassembly and reassembly. Some part locations and identifications are covered in other illustrations of this chapter. Disassembly components only to the extent necessary to replace a defective part.

3-8. Repair of CO/B-8 Coder

a. Inspection. Examination of the CO/B-8 coder operational sequence may be necessary to locate a malfunction within the coder. To help isolate a malfunction to a particular part or subassembly, review the following paragraphs:

(1) Paragraphs 1-6 through 1-14, functioning of the CO/B-8 coder.

(2) Paragraph 1-26, CO/B-8 electromagnetic circuitry.

(3) Paragraph 2-5, direct support troubleshooting procedures.

(4) Paragraph 2-6, CO/B-8 coder troubleshooting procedure.

b. Removal of Major Assembly. Remove the CO/B-8 coder assembly from its case as instructed in paragraph 3-1 and 3-2.

c. Disassembly of CO/B-8 Coder. Disassemble the CO/B-8 coder only to the extent necessary to replace a defective part. Part locations are shown in figures 2-1 and 2-2. The exploded view (fig. 3-2) illustrates the order of assemblage for replaceable parts and subassemblies. When removing the springs or other parts that are very similar in appearance, tag or otherwise identify them to assure proper identification during reassembly.

d. Reassembly. Inspect all the removed parts for evidence of excessive wear or damage; then reassemble only the parts that are unquestionably serviceable. Check to be sure that the mating gears are engaged properly before tightening the mounting screws or the nuts. Reassemble in the order shown in figure 3-2.

e. Replacement of Major Assembly. Replace the CO/B-8 coder assembly in its case as instructed in paragraphs 3-1 and 3-2.

f. Adjustment. After a defective part or subassembly has been replaced and the CO/B-8 coder is reassembled properly, it should be checked for proper operation. Readjustment of the CO/B-8 coder may be necessary at this time, expecially if a subassembly containing a timing or tolerance adjustment had been disassembled during the course of repair. Refer to paragraphs 2-6, 3-14, and 3-16 for adjustment data.

3-9. Repair of CO-3B Coder

a. Inspection. A comprehensive examination of the CO-3B coder operational sequence may be necessary to locate a malfunction within the CO-3B coder. For help in isolating a malfunction to a particular part of a subassembly, refer to the following:

(1) Functioning of CO-3B coder (para 1-15 through 1-21).

(2) CO-3B coder electromagnetic circuitry (para 1-27).

(3) Direct support troubleshooting procedures (para 2-5).

(4) CO-3B coder troubleshooting procedure (para 2-7).

b. Removal of Major Assembly. Remove the CO-3B coder from its case as instructed in paragraphs 3-1 and 3-3.

c. Disassembly of CO-3B Coder. Disassemble the CO-3B coder only to the extent necessary to replace a defective part. The exploded view, figure 3-3, illustrates the order of assemblage for replaceable parts and subassemblies. When removing springs or other parts that are very similar in appearance, tag or otherwise identify them to assure proper identification during reassembly.

d. Reassembly. Inspect all removed parts for evidence of excessive wear or damage and then reassemble only parts that are unquestionably serviceable. Check to be sure that mating parts are properly engaged before tightening the mounting screws or nuts. Reassemble in the order shown in the exploded view (fig. 3-3).

e. Replacement of Major Assembly. Replace CO-3B coder assembly in its case as instructed in paragraphs 3-1 and 3-3.

f. Adjustment. After a defective part or subassembly has been replaced and the CO-3B coder is reassembled properly, it should be checked for operation. Readjustment of the CO-3B coder may be necessary, at this time, especially if a subassembly containing a timing or tolerance adjustment has been disassembled during the course of repair. Refer to paragraphs 2-7, 2-12, and 2-15 for adjustment data.

3-10. Repair of CA-3B Cartridge

a. Inspection. A visual examination of the internal mechanism of the CA-3B cartridge is necessary to locate a malfunction. For help in isolating a malfunction to a particular part or subassembly, refer to the following:

(1) Functioning of the CA-3B cartridge (para 1-22 and 1-23).

(2) Direct support troubleshooting procedures (para 2-5).

(3) CA-3B cartridge troubleshooting procedure (para 2-8).

b. Removal of Major Assembly. Remove the CA-3B cartridge tape from its case as instructed in paragraph 3-4.

c. Disassembly of CA-3B Cartridge. Disassemble the CA-3B cartridge only to the extent necessary to replace a defective part. Parts location is shown in figure 2-3. The exploded view, figure 3-4, illustrates the order of assemblage for replaceable parts. When removing gears or other parts that are very similar in appearance, *tag or otherwise identify* them to assure proper identification during reassembly.

d. Reassembly. Inspect all removed parts for evidence of excessive wear or damage, and then reassemble only parts that are unquestionably serviceable. Check to be sure that mating gears are engaged properly before tightening the mounting screws.

e. Replacement of Major Assembly. Replace the tape assembly in its case as instructed in paragraph 3-4.

f. Adjustment. After a defective part has been replaced and the CA-3B cartridge has been reassembled properly, it should be checked for smooth operation. No adjustment is required of the tape mechanism.

3-11. Repair of KE-8B Keyer

a. Inspection. A comprehensive examination of the KE-8B keyer operational sequence may be necessary to locate a malfunction within the KE-8B keyer. For help in isolating a malfunction to a particular part or subassembly, refer to the following:

(1) Functioning of the KE-8B keyer (para 1-24 and 1-25).

(2) Functioning of the electronic circuits in the KE-8B keyer (para 1-28 and 1-29).

(3) Direct support troubleshooting procedures (para 2-5).

(4) KE-8B keyer troubleshooting procedure (para 2-9).

b. Removal of Major Assembly. Remove the KE-8B keyer assembly from its case as instructed in paragraphs 3-1 and 3-5.

c. Disassembly of KE–8B Keyer. Disassemble the KE–8B keyer only to the extent necessary to replace a defective part. Parts location are shown in figure 3–1. The exploded view, figure 3–5, illustrates the order of assemblage for replaceable parts and subassemblies. When removing parts that are very similar in appearance, *tag* or *otherwise identify* them to assure proper identification during reassembly.

d. Reassembly. Inspect all removed parts for evidence of excessive wear or damage, and then reassemble only parts that are unquestionably serviceable. Check to be sure that mating parts are engaged properly before tightening the mounting screws or nuts. Reassemble in the order shown in the exploded view (fig. 3–5).

e. Replacement of Major Assembly. Replace the KE–8B keyer assembly in its case as instructed in paragraphs 3–1 and 3–5.

f. Adjustment. After a defective part or subassembly has been replaced and the KE–8B keyer is reassembled properly, it should be checked for proper operation. If readjustment of the KE–8B keyer is necessary at this time, refer to paragraphs 2–9, 2–13 and 2–16 for adjustment instructions.

3–12. Repair of KA–3 Keyer Adapter

a. Inspection. Visually inspect the KA–3 keyer adapter for damaged electronic parts, a cracked printed circuit board, or bent or broken connectors as instructed in paragraph 2–10. To isolate a trouble to a specific electronic part, refer to the following:

(1) Functioning of electronic circuits for KA–3 adapter (para 1–30).

(2) Direct support troubleshooting procedures (para 2–5).

(3) KA–3 keyer adapter troubleshooting procedure (para 2–10).

b. Removal of Major Assembly. Remove the KA–3 keyer adapter assembly from its case as instructed in paragraph 3–6.

c. Disassembly of KA–3 Keyer Adapter. Construction of the KA–3 keyer adapter allows parts to be removed without disturbing other parts of the assembly. Parts location are shown in figure 2–8. The exploded view, figure 3–6, illustrates the order of assemblage of replaceable parts.

d. Reassembly. Reassemble in the order shown in the exploded view (fig. 3–6).

e. Replacement of Major Assembly. Replace the KA–3 keyer adapter assembly in its case as instructed in paragraph 3–6.

f. Adjustment. No adjustment of the KA–3 keyer adapter is required.

3–13. Tape Replacement Procedure

When it is necessary to replace the recording tape in the CA–3B cartridge, follow the procedure given in *a* through *n* below carefully to assure proper operation of the automatic rewind mechanism. The distance of tape travel through the CA–3B cartridge in either direction is limited by the interlocking action of the auto-stop pins in the takeup and rewind auto-stop gears. This feature is intended to maintain the same starting and finishing points on the tape to prevent tape damage or breakage from excessive tension at completion of rewind. When installing a new tape, refer to figure 3–7 and proceed as follows:

a. Open and remove the hinged reading head lid.

b. Remove the spool cover by removing the three spool cover attaching screws and lifting the spool cover off to expose the tape spools.

c. Remove the end of the old tape from the core of the takeup spool, and allow it to dangle free.

d. Unwind the tape from the storage spool. When tape is fully unwound, loosen the end from the core and apply tension with the finger to slow and control automatic rewinding speed of the empty storage spool. Discard the old recording tape.

e. Inspect the cores of both spools. Remove any residue remaining from the old adhesive tape.

WARNING

Compressed air is dangerous and can cause serious bodily harm. It can also cause mechanical damage to the equipment. Do not use compressed air to dry parts where cleaning compound has been used.

f. Obtain 12 1/2 feet of new Instrument Grade magnetic recording tape, Minnesota Mining & Manufacturing Co., Type 428. Examine for dust, lint, and other foreign matter. If necessary, the tape may be blown clean with dry, compressed air. *Do not* use solvent or any other cleaning substance on the tape. Do not handle the tape any more than absolutely necessary. When handling the tape, always avoid making fingerprints on the tape.

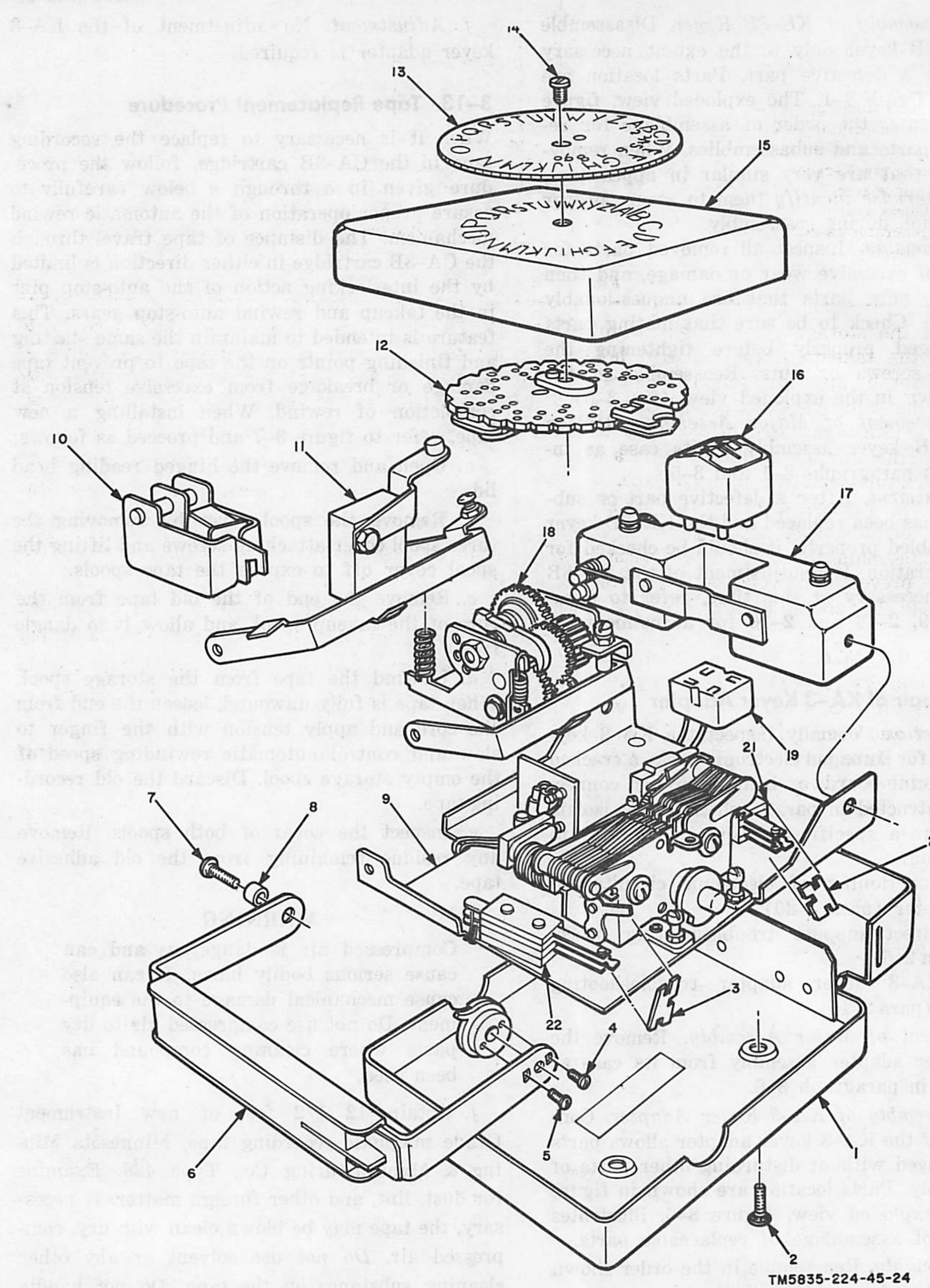


Figure 3-2. CO/B-8 coder, exploded view.

1 Bottom cover
2 Bottom cover attaching screw
3 Dot switch actuator clip
4 Handle lever attaching screw
5 Handle lever attaching screw
6 Operating handle assembly
7 Handle lever pivot spacer
8 Handle lever spacer
9 Coding chassis assembly
10 Impulse generator assembly
11 Spacing assembly
12 Coding wheel
13 Character dial
14 Character dial attaching screw
15 Top cover
16 Recording head
17 Recording head mounting block
18 Feed ratchet assembly
19 Recording head connector
20 Dash switch actuator clip
21 Dash switch assembly
22 Dot switch assembly

Figure 3-2—Continued.

g. Rotate the storage spool clockwise until it encounters the takeup auto-stops, and hold it in this position by applying thumb pressure.

h. With the shiny side of the tape facing the core, firmly attach one end of the tape to the back side of the storage spool core with a short length of pressure-sensitive adhesive tape.

i. Allow the storage spool to rewind slowly, controlling rewind speed with thumb or finger pressure while maintaining sufficient tension on the tape to prevent wrinkling or loose winding. There should be about 1 inch of loose tape remaining.

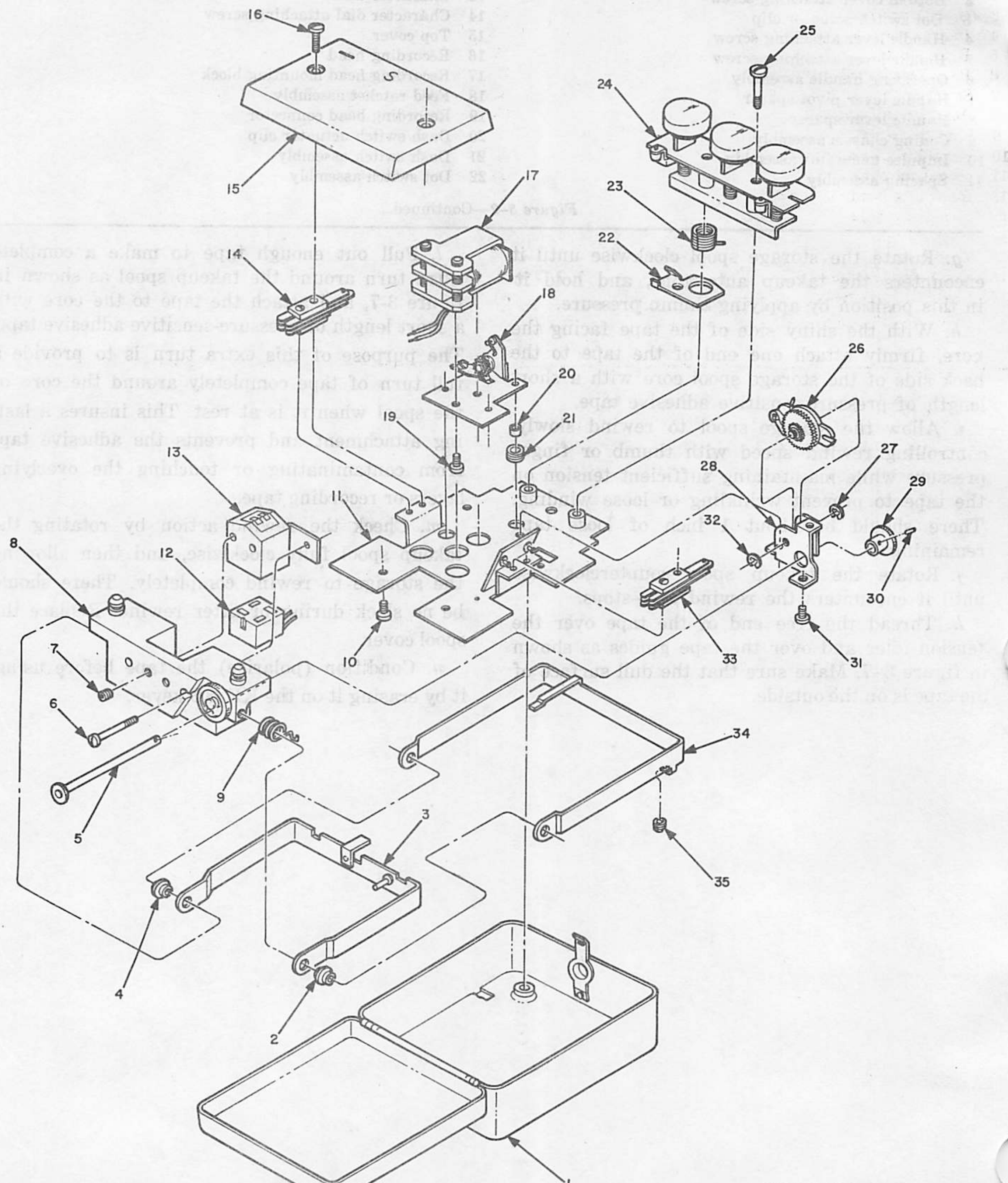
j. Rotate the takeup spool counterclockwise until it encounters the rewind auto-stops.

k. Thread the free end of the tape over the tension idler and over the tape guides as shown in figure 3-7. Make sure that the dull surface of the tape is on the outside.

l. Pull out enough tape to make a complete extra turn around the takeup spool as shown in figure 3-7, and attach the tape to the core with a short length of pressure-sensitive adhesive tape. The purpose of this extra turn is to provide a full turn of tape completely around the core of the spool when it is at rest. This insures a lasting attachment and prevents the adhesive tape from contaminating or touching the overlying layers or recording tape.

m. Check the rewind action by rotating the takeup spool fully clockwise, and then allowing the storage to rewind completely. There should be no slack during or after rewind. Replace the spool cover.

n. Condition (polarize) the tape before using it by erasing it on the KE-8B keyer.



TM5835-224-45-25

Figure 3-3. CO-3B coder, exploded view.

1 Case
2 Inner universal bar bearing
3 Inner universal bar
4 Inner universal bar bearing
5 Drive shaft
6 Head bracket mounting screw
7 Setscrew
8 Head mounting block
9 Spring
10 Headblock mounting screw
11 Mounting plate
12 Recording head connector
13 Recording head
14 Dash switch
15 Top cover
16 Top cover mounting screw
17 Generator assembly
18 Generator plate assembly
19 Generator mounting screw
20 Spacer
21 Grommet
22 Overtravel cam
23 Spring
24 Pushbutton assembly
25 Pushbutton assembly mounting screw
26 Ratchet assembly
27 Retaining ring
28 Feed mechanism frame
29 Drive shaft gear
30 Pin
31 Feed mechanism mounting screw
32 Retaining ring
33 Dot switch
34 Outer universal bar
35 Spring

Figure 3-3—Continued.

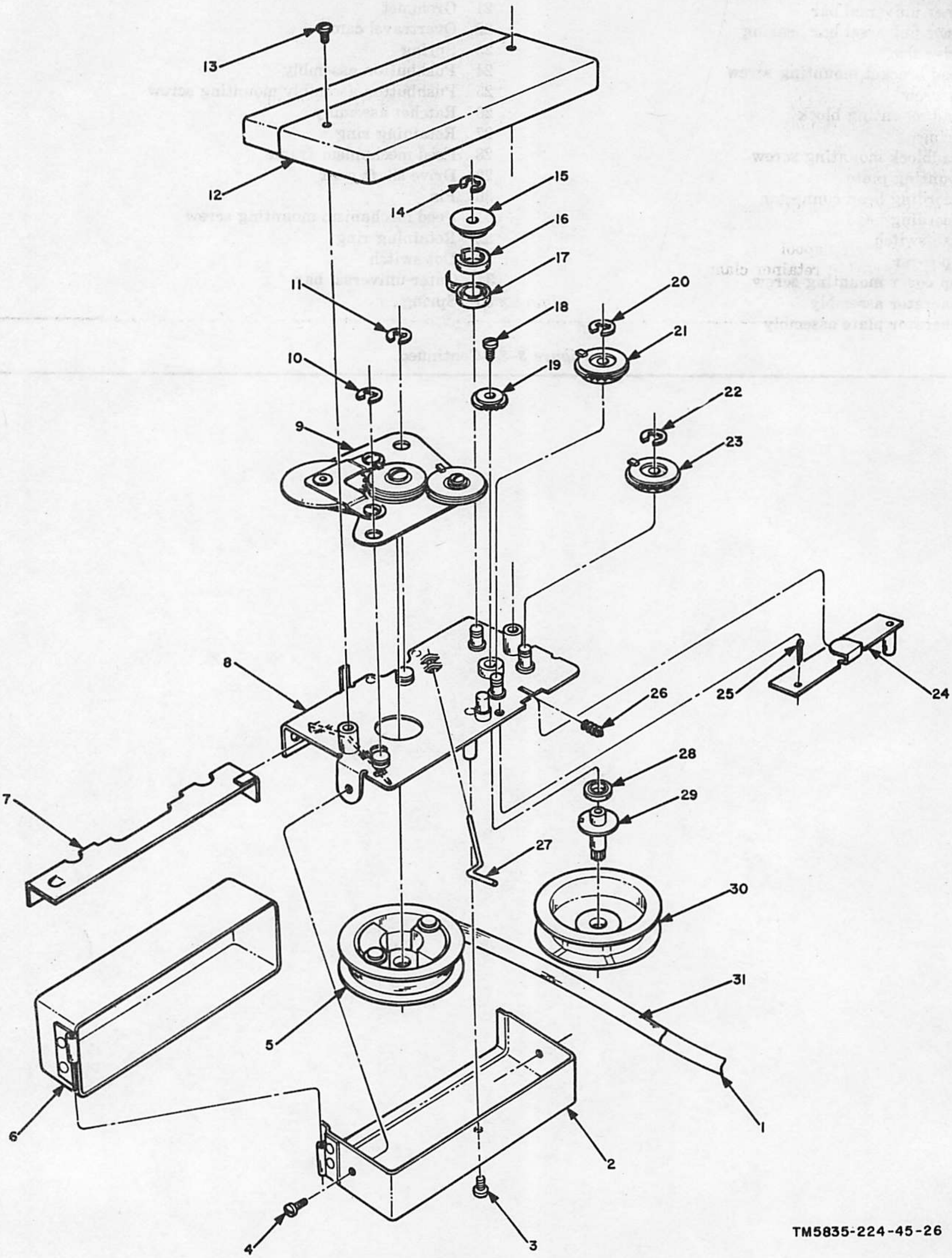


Figure 3-4. CA-3B cartridge, exploded view.

1 Adhesive attaching tape
2 Spool cover
3 Spool cover attaching screw
4 Spool cover attaching screw
5 Storage spool
6 Lid
7 Latch plate
8 Base plate assembly
9 Drive plate assembly
10 Retaining ring
11 Retaining ring
12 Gear cover
13 Gear cover attaching screw
14 Retaining ring
15 Negator spring spool
16 Negator spring retainer clamp
17 Negator spring
18 Storage spool drive gear mounting screw
19 Storage spool drive gear
20 Retaining ring
21 Takeup auto-stop gear
22 Retaining ring
23 Takeup auto-stop gear
24 Takeup arm assembly
25 Cotter pin
26 Spring
27 Spring
28 Takeup spool bearing
29 Takeup spool shaft
20 Takeup spool
31 Magnetic recording tape

Figure 3-4—Continued.

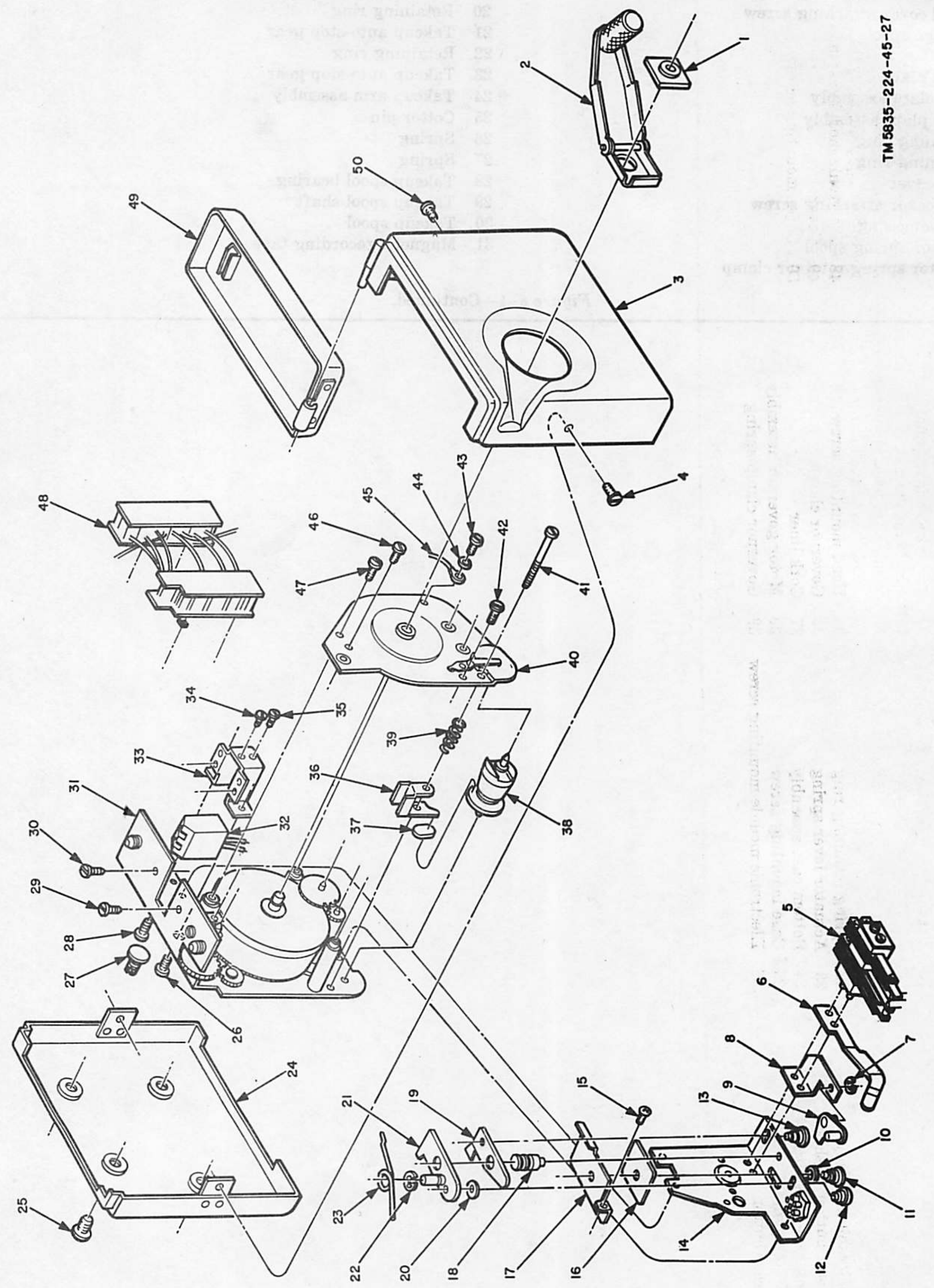


Figure 3-5. KE-8B keyer, exploded view.

1 Crank assembly retaining nut
2 Crank assembly
3 Top case assembly
4 Cover mounting screw
5 Switch assemblies
6 Brake finger
7 Retaining ring
8 Bellcrank bracket
9 Bellcrank assembly
10 Motor button washer
11 Motor on-off switch
12 IDY button
13 Erase button
14 Control panel
15 Brake finger setscrew
16 Slide spring
17 Motor actuator slide
18 Erase release lever stud
19 Erase release lever
20 Actuator lever spacer
21 IDY actuator lever
22 Spring retaining ring
23 Actuator lever spring
24 Bottom case assembly
25 Case mounting screw
26 Electronic module mounting screw
27 Head alignment screw
28 Electronic module mounting screw
29 Head bracket mounting screw
30 Head bracket mounting screw
31 Motor chassis assembly
32 Read-erase head
33 Read-erase head supporting bracket
34 Head mounting screw
35 Head mounting screw
36 Governor clamp
37 Cork liner
38 Motor governor assembly
39 Governor clamp spring
40 Motor assembly top plate
41 Speed regulating screw
42 Motor top plate mounting screw
43 Motor top plate mounting screw
44 Flat washer
45 Ground lug
46 Mounting screw
47 Motor top plate mounting screw
48 Electronic module assembly
49 Cover
50 Cover mounting screw

Figure 3-5—Continued.

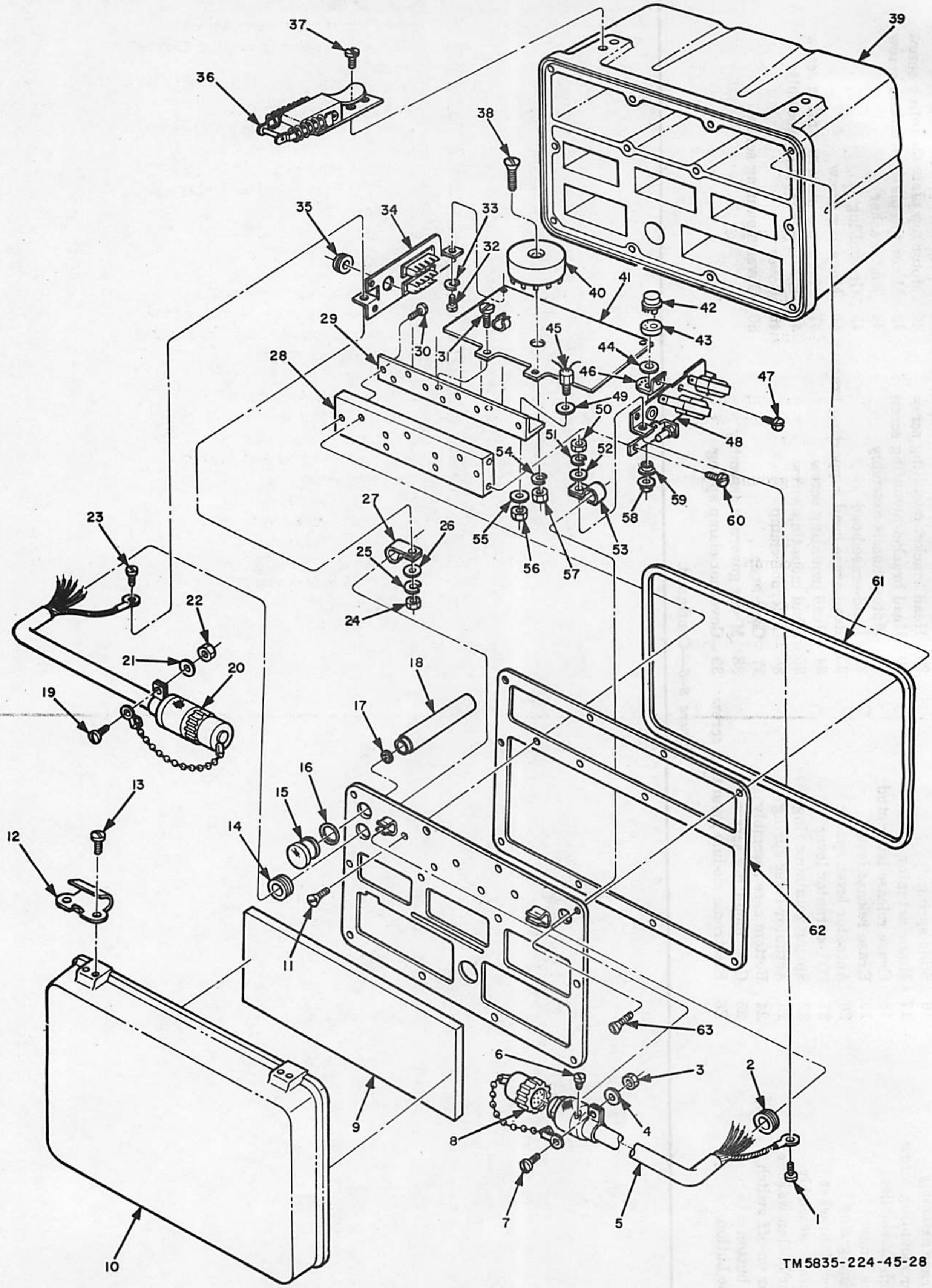


Figure 3-6. KA-3 keyer adapter, exploded view.

1 Keyer cable ground screw
2 Keyer cable ground grommet
3 Keyer cable groundnut
4 Keyer cable ground washer
5 Keyer cable
6 Keyer connector screw
7 Keyer cable clamp chain screw
8 Keyer connector cap
9 Sponge rubber pad
10 Top cover
11 Top panel mounting screw
12 Latch bracket
13 Latch bracket screw
14 Transmitter cable grommet
15 Desiccant plastic cap
16 Desiccant cap O-ring
17 Desiccant screen
18 Desiccant holder
19 Transmitter cable clamp chain screw
20 Transmitter cable connector cap
21 Cable clamp washer
22 Cable clamp nut
23 Transmitter cable ground screw
24 Cable clamp nut
25 Cable clamp lockwasher
26 Cable clamp flat washer
27 Transmitter cable clamp
28 Chassis mounting block
29 Chassis mounting bracket
30 Mounting bracket screw
31 Printed circuit board mounting screw
32 Mounting bracket screw
33 Mounting bracket lockwasher
34 Voltage regulator mounting bracket
35 Grommet
36 Latch assembly
37 Latch mounting screw
38 Power transformer mounting screw
39 Case
40 Power transformer
41 Printed circuit board assembly
42 Transistor Q7
43 Heat sink
44 Flat washer
45 Heat sink
46 Transistor mounting bracket
47 Transistor mounting bracket screw
48 Power supply choke support bracket
49 Heat sink mica washer
50 Cable clamp nut
51 Cable clamp lockwasher
52 Cable clamp flat washer
53 Keyer cable clamp
54 Power transformer lockwasher
55 Fiber washer
56 Heat sink stud nut
57 Power tranformer nut
58 Transistor stud nut
59 Nylon spacer
60 Mounting bracket screw
61 Washer, rubber
62 Gasket, rubber
63 Screw, plate

Figure 3-6—Continued.

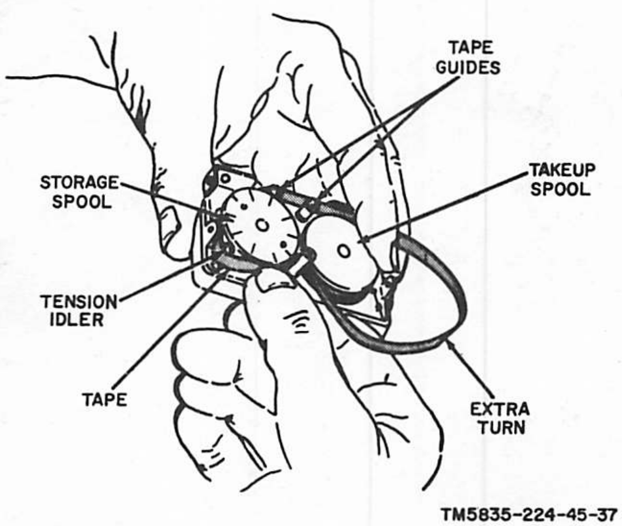


Figure 3-7. Recording tape replacement.

CHAPTER 4
DEPOT OVERHAUL STANDARDS

4-1. Applicability of Depot Overhaul Standards

The tests outlined in this chapter are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

4-2. Applicable References

a. Repair Standards. Applicable procedures the depots performing these tests and the general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements for testing this equipment.

b. Technical Publications. This manual and TM 11-5835-224-12 are the only publications applicable to this equipment.

c. Modification Work Orders. Perform all modification work orders applicable to this equipment before making the test specified. DA Pam 310-7 list all available MWO's.

4-3. Test Equipment, Tools, Materials, and Other Equipment

All test equipment, tools, materials, and other equipment required to perform the testing procedures given in this chapter are listed below.

a. Test Equipment and Tools.

Nomenclature	Federal stock No.	Technical manual
Code Recorder RD-60/U	5805-164-7323	TM 11-5533
Oscilloscope AN/USM-140A	6625-987-6603	TM 11-6625-535-15
Time Work Generator AN/USM-108	6625-987-9564	TM 11-6625-542-15
Frequency Meter AN/USM-26	6625-543-1356	TM 11-5057
Multimeter TS-352B/U	6625-242-5023	TM 11-6625-366-15
Chatillon Type R Tension Gauge or equivalent	6670-246-8465	
Hewlett-Packard Electronic Stroboscope or equivalent	6625-223-5150	
L.S. Starrett Co. No. 711G Dial Run-Out Indicator or equivalent.	5210-591-2771	
Tool Kit, Electronic Equipment TK-100/G	5180-605-0079	

b. Materials.

(1) Resistor, 47 Kilohm (K), 2-watt.
(2) Resistor, 5.4K, 2-watt.
(3) Capacitor, 250 micromicrofarad ($\mu\mu$f), 200-volt.
(4) Capacitor, 0.001 microfarad (μf), 200-volt.
(5) Diode, 1N914A, or equivalent.
(6) Bulb, light, 60-watt.
(7) Resistor, 10K, 2-watt.
(8) Connector, Coaxial Tee UG-274A.
(9) Four Cables, Coaxial RG-58/U.
(10) M7P Winchester electric connector, or equivalent (mates with connector on KE-8B keyer).
(11) Three Connectors UG-260/U.
(12) Connector UG-111/U.
(13) Hookup wire No. 22, 20 ft.

c. Other Equipment Required. The only other equipment required is Radio Transmitter T-784/GRC-109, FSN 5820-892-0880, which is covered in TM 11-5820-474-14.

4-4. Test Objectives

The objectives of the tests which follow are given below:

a. To determine the physical condition of the equipment.

b. To check the system for exactness of reproduction under actual operating conditions.

c. To check the KE-8B keyer's ability to deliver properly timed and shaped dot, dash, and IDY pulses to the transmitter keying circuit of the KA-3 keyer adapter.

d. To provide mechanical tests to finalize the tests and inspections.

4-5. Physical Tests and Inspections

a. Test Equipment and Materials. None required.

b. Test Connections and Conditions. None required.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	None.	None.	*a.* Remove the components from the pockets in the KA-3 keyer adapter. Inspect the cases and chassis for damage, missing parts, and defective condition of paint. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable. Screwheads, receptacles, and other plated parts will not be painted or polished with abrasives.	*a.* No damage is evident or parts missing. External surfaces to be painted do not show bare metal. Panel lettering is legible.
			b. Inspect the KA-3 keyer adapter connector cable clamps located on the top panel.	*b.* Connector cable clamps must not be bent out of shape or broken.
			c. Inspect the handle and extension on the CO/B-8 coder, and the windup crank on the KE-8B keyer.	*c.* The handle must not be broken or bent, and the windup crank should not be stuck, deformed, or broken.
			d. Inspect the word-space button on the CO/B-8 coder, and the dot, space, and dash keys on the CO-3B coder.	*d.* The work-space button and the dot, space, and dash keys must not be stuck or broken.
			e. Inspect the IDY, erase, and motor on-off switches on the KE-8B keyer.	*e.* These switches must not be broken or loose.
			f. Inspect the lids on the CO-3B coder, KE-8B keyer, and CA-3B cartridges.	*f.* The lids must not be deformed or bent on their hinges.
			g. Inspect the gears in the CO/B-8 coder, CO-3B coder, KE-8B keyer, and CA-3B cartridges.	*g.* The gears must not stick or bind.
2	None.	None.	*a.* Inspect the KA-3 keyer adapter for missing, loose, broken, or bent trunk latches.	*a.* The trunk latches must not be loose, broken, or bent.
			b. Inspect the desiccant by viewing it through the transparent holder cap.	*b.* The color should be blue.
3	None.	None.	*a.* Inspect the locking pins and locking grasps on the CO/B-8 coder, CO-3B coder, and KE-8B keyer.	*a.* The locking pins and locking grasps must not be loose when mounted.
			b. Inspect the locking plates on the two CA-3B cartridges.	*b.* The locking plates must not exhibit stiffness or tight operation.

4-6. AN/GRA-71 System Test

a. Test Equipment and Materials.

(1) Code Recorder RD-60/U.

(2) Radio Transmitter T-784/GRC-109, or adaptable transmitter.

(3) Resistor R1, 5.4K, 2-watt.

(4) Resistor R2, 47K, 2-watt.

(5) Capacitor C2, 250 $\mu\mu f$, 200-volt.

(6) Capacitor C1, 0.001 μf, 200-volt.

(7) Diode 1N914A, or equivalent (CR1).

(8) Bulb, light 60-watt.

b. Test Connections and Conditions. Remove the components from the component pockets of the KA-3 keyer adapter, and connect the equ the equipment as shown in figure 4-1. Turn on the equipment, and allow a 5-minute warmup before proceeding.

Note. Figures 4-3 and 4-4 provide an addition means for feeding the KE-8B keyer output into the RD-60/U without using KA-3 keyer adapter, a transmitter and its power supply, and a detector circuit.

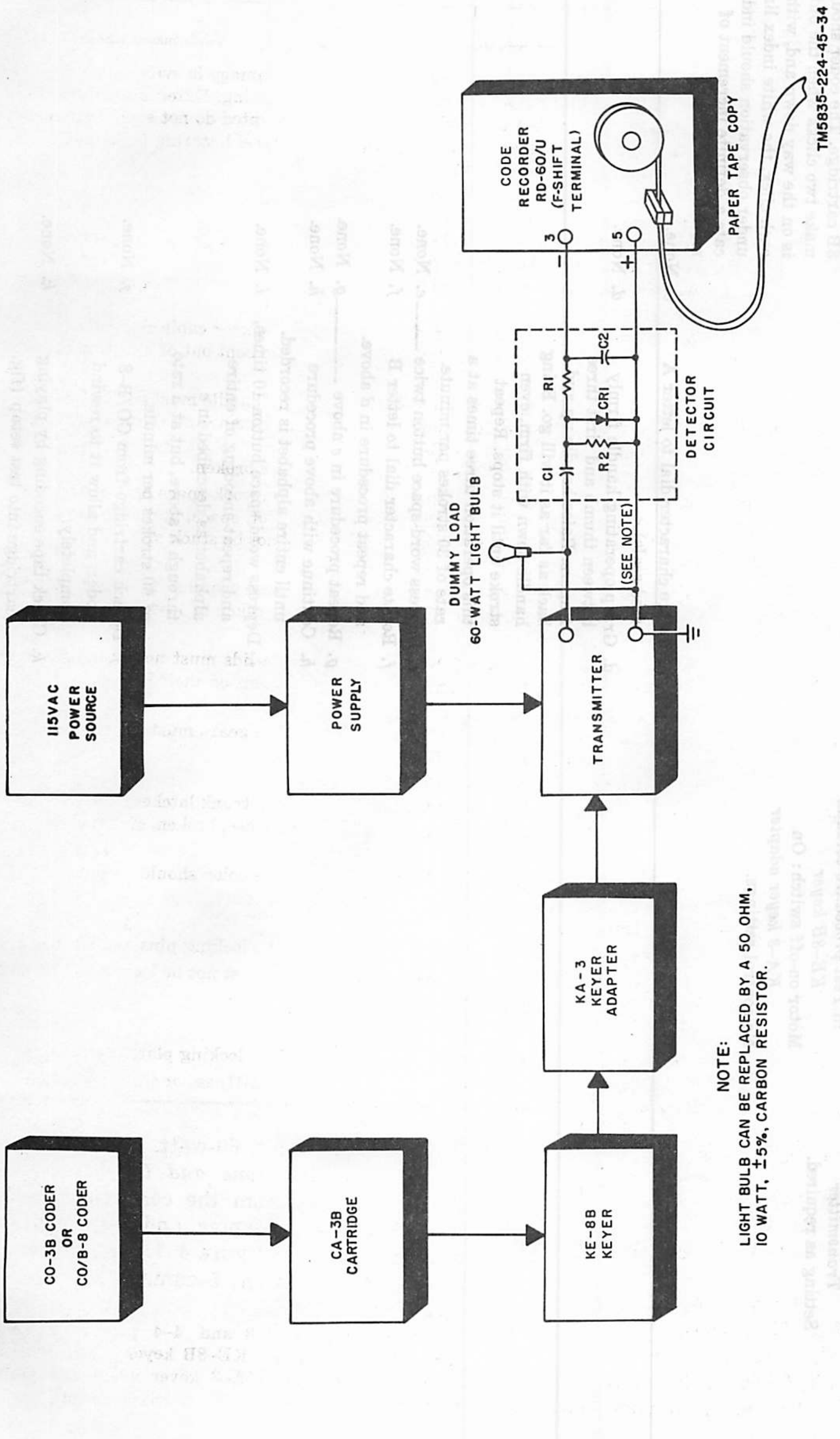


Figure 4-1. AN/GRA-71 system test setup.

c. *Procedure.*

Step No.	Test equipment / Control settings	Equipment under test / Control settings	Test procedure	Performance standard
1	*RD-60/U* SPEED RANGE switch: HIGH AC switch: ON OPERATE-STANDBY switch: OPERATE *Transmitter* Setting as required.	*CA-3B cartridge* No control settings. *CO/B-8 coder* Character dial: Rotate to letter A. Character dial: Rotate to letter B. Character dial: Rotate as instructed in *Test procedure* column. *KE-8B keyer* Motor on-off switch: On *KA-3 keyer adapter* No control settings.	*a.* Attach a CA-3B cartridge that has been erased to CO/B-8 coder.	*a.* None.
			b. Depress word-space button six times to move exposed tape past recording head.	*b.* As the word-space button of the CO/B-8 coder is depressed, note the white radial index lines on the right-hand spool of the CA-3B cartridge. The coder should make two clicks when the button is on the way down and, with each click, the white index line under observation should indicate a definite increment of motion.
			c. Rotate character dial to letter A (red scale).	*c.* None.
			d. Grasp operating handle firmly between thumb and first three fingers. Raise handle up and back as far as it will go. Bring handle down with firm, even stroke until it stops. Repeat this operation three times at a rate of 30 strokes per minute.	*d.* None.
			e. Depress word-space button twice	*e.* None.
			f. Rotate character dial to letter B and repeat procedure in *d* above.	*f.* None.
			g. Repeat procedure in *e* above	*g.* None.
			h. Continue with above procedure until entire alphabet is recorded.	*h.* None.
			i. Depress word-space button 10 times, and repeat encoding of entire alphabet as described in *c* through *h* above, but at a rate of 60 strokes per minute.	*i.* None.
			j. Detach cartridge from CO/B-8 coder, and allow it to rewind completely.	*j.* None.
			k. Check tape encoding by playing cartridge into test setup (fig. 4-1).	*k.* None.

Step No.	Test equipment	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
				l. Read the tape, and check the characteristics specified in *l*(1) through (4) of the *Performance standard* column.	*l.* Tape must have the following characteristics: (1) The intelligence contained on the RD-60/U tape should be identical with that originally impressed on the magnetic tape of the CA-3B cartridge. (2) Dash-dot width relationship: 3:1 (dot equals one baud). (3) Pulse shape, reasonably square at the output of KE-8B keyer. (4) Word-space, 7 bauds; character space, 3 bauds; element or within character space, 1 baud.
2	Same as step No. 1.	*Transmitter* Settings as required.	*CA-3B cartridge* No control settings. *CO-3B coder* No control settings. *KE-8B keyer* Motor on-off switch: On *KA-3 keyer adapter* No control settings.	*a.* Attach a CA-3B cartridge that has been erased and has passed final inspection to CO-3B coder.	*a.* None.
				b. Depress space key about 10 times to move exposed tape past recording head.	*b.* As the space key is depressed, note the white radial index lines on the right-hand spool of the CA-3B cartridge. A slight resistance will be felt when the key is on the way down. On the way up, there should be a slight click and the white index line under observation should indicate an increment of motion. The foregoing process should be repeated for several successive clicks.
				c. Code the tape as follows: five dashes, two spaces, and five dots, coded at the rate of one key depression per second.	*c.* None.
				d. Code the tape as follows: five spaces, five dashes, two spaces, and five dots coded at the rate of two key depressions per second.	*d.* None.

Step No.	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
				e. Code the tape as follows: five spaces, five dashes, two spaces, and five dots coded at the rate of three key depressions per second.	*e.* None.
				f. Code the tape as follows: space, dot, space, dash for five consecutive times at the rate of one key depression per second, then two per second, and then three per second.	*f.* None.
				g. Repeat the procedure given in *a* through *f* above.	*g.* None.
				h. Detach CA–3B cartridge, and allow it to rewind completely.	*h.* None.
				i. Play CA–3B cartridge into test setup (fig. 4–1).	*i.* None.
				j. Read the tape, and check for exactness of reproduction; check for characteristics specified in the *Performance standard* column.	*j.* Same as *l*, step No. 1.

4–7. KE–8B Keyer Tests

a. Test Equipment and Materials.

(1) Oscillator AN/USM–140A.
(2) Time Work Generator AN/USM–108.
(3) Frequency Meter AN/USM–26.
(4) Power Supply (12-volt direct current (dc) ±10 percent, 100 ma).
(5) Multimeter TS–352B/U.
(6) Resistor, 10K, 2-watt.
(7) Three Connectors UG–260/U.
(8) Connector UG–111/U.
(9) Connector, Coaxial Tee UG–274A.
(10) Cable, Coaxial RG–58/U.
(11) Hookup wire No. 22.
(12) M7P Winchester electric connector, or equal (mates with connector on KE–8B keyer).

b. Test Connections and Conditions. Connect the equipment as shown in figure 4–2. Turn on the equipment and allow it to warmup for 5 minutes before proceeding.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	*AN/USM-26* POWER switch: ON FUNCTION SELECTOR: Frequency FREQUENCY UNIT: 10 sec std gate time MAL VAL GATE switch: Closed MIXING FREQUENCY: 0 *AN/USM-140A* POWER switch: ON CALIBRATOR switch: OFF SWEEP OCCURRENCE switch: Normal HORIZONTAL DISPLAY switch: Internal sweep X1 SWEEP TIME switch: 2 milliseconds/CM SWEEP MODE switch: Internal trigger PLUG-IN PREAMP: CHANNEL SELECTOR switch to alternate CHANNEL A and B SENSITIVITY controls: Set to position that allows convenient viewing of pulse amplitude. VERNIER: Calibrated *AN/USM-108* POWER ON switch: ON Pushbutton switch: 1 millisecond	*KE-8B keyer* IDY switch: ON Motor ON-OFF switch: On *KA-3 keyer adapter* No control settings	*a.* Operate the IDY button on the KE-8B keyer, and measure the IDY frequency on the AN/USM-26. *b.* Operate the IDY button on KE-8B keyer and observe waveform on AN/USM-140A (channel A). *c.* Prerecord a series of dots on a test tape, play the tape through the KE-8B keyer, and measure the dot pulse duration on the oscilloscope. (Compare with time mark pulse displayed on CHANNEL B as an aid to determine pulse duration.) *d.* Same as above except measure the dot pulse frequency. *e.* Prerecord a series of dashes on a test tape, play the tape through the KE-8B keyer, and measure the dash pulse duration on the AN/USM-140A. (Compare with time marks on CHANNEL B.) *f.* Same as *e* above *g.* Same as *e* above *h.* Measure the peak-to-peak voltage of the keyer pulse train, and measure the supply line voltage. Record voltages and compare.	*a.* IDY frequency shall be 150 ±5 cps. *b.* IDY on-off ratio shall be 50% (symmetrical) ±5%. *c.* Dot duration shall be 3.33 ±0.33 milliseconds. *d.* Dot frequency shall be 150 ±5 cps. *e.* Dash duration shall be 10.0 ±0.5 milliseconds. *f.* Space duration within characters shall be 3.33 ±0.90 milliseconds average over the length of the tape with 3 readings of the tape. *g.* Space duration between characters shall be 10.0 ±1.0 milliseconds average over the length of the tape. *h.* Peak-to-peak voltage of pulse train shall be essentially the same as keyer line supply voltage (-12 v).
2	*TS-352B/U* FUNCTION switch: DC CURRENT Black test lead: OHMS -DC ± AC jack Red test lead + DC CURRENT jack	Same as for step No. 1 above.	Measure and record the current drain, using an ammeter (part of the TS-352B/U), during operation of the KE-8B keyer in step No. 1*h* above.	Current drain of keyer shall not exceed 40 ma.

Step No.	Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
3	Same as step No. 1.		Erase the test tape, using the erase function on the KE-8B keyer. Play the erased tape through the KE-8B keyer, and observe the AN/USM-140A.	Erase function operates properly if a zero amplitude is observed on the AN/USM-140A.

4-8. Mechanical Tests and Inspections

a. Test Equipment and Materials.

(1) Chatillon Type R Tension Gauge or equivalent.

(2) Hewlett-Packard electronic stroboscope or equivalent.

(3) L.S. Starrett Co. No. 711G Dial Run-Out Indicator or equivalent.

b. Test Connections and Conditions. These tests should be performed at a room temperature of approximately 70°F. Variances from the performance standards given in the tests can usually be traced to dirt or lack of lubrication. Check for dirt or lack of lubrication before making any corrective adjustments.

c. Procedure.

Step No.	Test equipment	Control settings: Equipment under test	Control settings	Test procedure	Performance standard
1	*Chatillon Type R Tension Gauge or equipment* None.	*CO/B-8 coder*	None.	*a.* Check handle operation. The force required for unextended handle *breakaway* shall be measured by means of a tension gage.	*a.* Operation of the handle, required for character generation, shall be smooth with no detectable binding throughout the entire movement. The force required for extended handle *breakaway* at points along arc of travel shall not exceed 25 oz at room temperature.
				b. Check force required for operation of word-space button by means of tension gage.	*b.* The force required to operate the word-space button for operation of the space advance mechanism shall average 32 ±6 oz at room temperature.
				c. Check force required for operation of the character dial in either direction at the periphery.	*c.* Force to operate character dial shall be 5 ±2 oz in either direction, at room temperature.
2	Same as step No. 1.	*CO-3B coder*	None.	*a.* Verify that depression of either dot or dash key operates generator rachet one tooth.	*a.* The depression of either dot or dash key operates generator rachet one tooth.
				b. Operate the dot, dash, and space buttons, and measure the force by means of a tension gage.	*b.* Force requirements are as follows: (1) The maximum force without bottoming required to operate the dot button shall be between 20 to 35 oz.

Step No.	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
					(2) The maximum force without bottoming required to operate the dash button shall be between 20 to 35 oz. (3) The maximum force without bottoming required to operate the space button shall be between 6 to 18 oz.
3	None required.	None.	*CA–3B cartridge*	*a.* Check to see that the CA–3B cartridge meets the seating, locking, rocking, and releasing requirements.	*a.* The CA–3B cartridge seats easily, locks firmly, does not rock, and releases easily.
				b. Visually check for minimum number of turns on tape takeup spool.	*b.* The takeup spool shall be covered by at least 1 turn of magnetic tape and the attaching tape shall not be visible.
				c. Run cartridge to the end of travel on keyer, and visually check reverse on storage spool.	*c.* The tape storage spool shall have a minimum of 1 turn, and the attaching tape shall not be visible.
				d. Check CA–3B cartridge for smooth winding and rewinding.	*d.* The CA–3B cartridge winds and rewinds smoothly.
4	*L.S. Starrett Co. No. 711G. Dial Run-Out Indicator or equivalent*	Same as step No. 3.		*a.* Check CA–3B cartridge for maximum wobble, using runout indicator.	*a.* The allowable wobble of either tape spool shall not exceed ±0.002 inch.
	None.			*b.* Attach CA–3B cartridge to KE–8B keyer, and check to see that neither binding nor sluggish action is detectable during rewind when a fully wound CA–3B cartridge is removed from KE–8B keyer and stopped every 1 1/2 to 3 turns of tape takeup spool.	*b.* A fully wound CA–3B cartridge rewinds smoothly and quietly, in any position or attitude of the cartridge, when removed from the KE–8B keyer. Complete rewind is accomplished in 3 1/2 seconds. Neither binding nor sluggish action is detectable during rewind.
5	*Hewlett-Packard Electronic Stroboscope or equivalent*	None.	*KE–8B keyer*	*a.* Inspect gear alignment, and check gear train operation.	*a.* Gears are properly aligned, and gear train is free running with minimum backlash.
				b. Turn crank one-half turn, and allow KE–8B keyer to run down while observing output gear.	*b.* Output gear shall stop and then reverse rotation for at least a fraction of a turn.
				c. Check to see that there is some resistance (spring tension) to pushing the slide button to the off position.	*c.* When the slide button is pushed to off position, some resistance to the motion of the slide button shall be detected at least one thirty-second of an inch before the slide button reaches its stop.

Step No.	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
				d. Turn windup crank clockwise, stopping at various angles of rotation.	*d.* During windup in normal direction (clockwise), the KE-8B keyer motor shall wind smoothly and shall not attempt to unwind when winding is stopped and crank is released.
				e. Inspect for brake slippage	*e.* The brake shall not slip when fully wound unless an attempt is made to overwind the motor. The brake should slip to prevent overwind but not enough to allow the spring to start unwinding.
				f. Governor assembly: (1) Inspect for operation by turning windup crank 1 or 2 turns with slide button in on position. (2) Check governor assembly rotation and speed consistancy with a stroboscope.	*f.* The governor shall meet the following requirements: (1) Governor assembly slows down, stops, and rotates in reverse direction before coming to a final stopped position. (2) The governor rotates at 2520 ±70 rpm, and the speed remains constant through at least 75% of rundown time.
				g. Check spring capacity	*g.* The spring shall have capacity for two consecutive cartridge runs from full wind to complete rundown.
				h. Check force at periphery of output gear, using Chatillon Type R Tension Gauge.	*h.* Force at the periphery of output gear shall exceed 200 grams through 75% of rundown time.
				i. Check IDY and erase slide buttons for proper operation. Check for interference of slide buttons and case.	*i.* IDY and erase slide buttons operate easily and return to off positions automatically when released. Case does not interfere with button operation. IDY and erase interlock are operative.

4-9. Summary of Depot Test Data

a. A summary of the depot tests and their performance standards is provided below as a convenient reference to this information.

b. It may be convenient to use a checklist arranged in a similar manner for recording the test findings and comparing the findings with the performance standards.

Table 4-1. Coder-Burst Transmission Group AN/GRA-71

Test item	Test findings	Performance standard
1. AN/GRA-71: Characteristics check of system as recorded on paper tape.		*a.* Dash-dot width relationship: 3 to 1 (dot equals two baud). *b.* Square-shaped pulse. *c.* Word space: 7 bauds. Character space: 3 bauds. *d.* Message capacity of cartridge: 4,500 dots or 9,000 bauds at 150-cps dot frequency.
2. KE-8B keyer:		
a. IDY frequency check		*a.* IDY frequency: 150 ±5 cps.
b. IDY wave shape check		*b.* 50% on-off ratio (symmetrical square wave) ±5%.
c. Dot duration check		*c.* Dot duration: 3.33 ±0.33 milliseconds.
d. Dot frequency check		*d.* Dot frequency: 150 ±5 cps.
e. Dash duration check		*e.* Dash duration: 10.0 ±0.5 milliseconds.
f. Space duration within characters check.		*f.* Space duration within characters: 3.33 milliseconds, ±0.90.
g. Space duration between characters check.		*g.* Space duration between characters: 10.0 ±1.0 milliseconds.
h. Peak-to-peak voltage of keyer pulse train.		*h.* Peak-to-peak voltage: 12 volts.
i KE-8B keyer current drain		*i.* Current drain shall not exceed 40 ma.
j. Erase function check		*j.* Erase function is proper if near zero in amplitude.
3. CO/B-8 Coder:		
a. Handle operation and force required.		*a.* 25 oz max *breakaway* force.
b. Word-space button tension		*b.* 36 ±4 oz avg.
c. Force required to operate		*c.* 4 ±1 oz.
d. Operational inspection		*d.* Operation is smooth with no erratic binding.
4. CO-3D coder:		
a. Force required for dot button		*a.* 20-35 oz.
b. Force required for dash button.		*b.* 20-35 oz.
c. Force required for space button.		*c.* 6-18 oz.
d. Operational inspection		*d.* Operation is smooth with no erratic binding.
5. CA-3B cartridge:		
a. Cartridge tape		*a.* Instrument grade.
b. Magazine seating, locking, rocking, and releasing.		*b.* CA-3B cartridge seats easily, locks firmly without rocking, and releases easily.
c. Left spool, number of turns at rest.		*c.* 1 1/3 turns min.
d. Right spool, number of turns at rest and attaching tape visibility.		*d.* One full turn. Attaching tape shall not be visible.
e. Wind and rewind of tape		*e.* Tape winds and rewinds smoothly.
f. Wobble (spool)		*f.* Not to exceed 0.002 inch.

Table 4-1. Coder Burst Transmission Group AN/GRA-71—Continued

Test item	Test findings	Performance standard
5. CA-3B Cartridge—Continued.		
g. Rewind (binding and sluggish action).		*g.* Rewind shall be smooth and quiet with magazine held in any position.
h. Rewind of fully wound cartridge.		*h.* Complete rewind shall be accomplished in 3 1/2 seconds.
i. Operational inspection		*i.* Operation is smooth with no erratic binding.
6. KE-8B keyer:		
a. Gear alignment and gear train operation.		*a.* Visually aligned, free running, with minimum backlash.
b. Resistance to slide button motion.		*b.* Some resistance shall be detected one thirty-second of an inch before button reaches its stop.
c. Windup crank		*c.* Motor winds smoothly and does not attempt to unwind when crank is released.
d. Brake slippage		*d.* There should be no brake slippage when motor is fully wound.
e. Governor assembly:		*e.* Proceed as follows:
(1) Operation		(1) Assembly shall slow down, stop, and rotate in reverse direction before finally stopping completely.
(2) Rotation speed and speed consistency.		(2) 2,520 $\pm$70 rpm constant throughout at least 70% of rundown time.
(3) Spring capacity		(3) Assembly must run through two magazine loads of tape without rewind.
(4) Force at periphery of output gear.		(4) 200 grams minimum throughout 75% of rundown time.
f. Operational inspection		*f.* Operation is smooth with no erratic binding.
g. Check IDY and erase slide buttons for proper operation.		*g.* Buttons operate easily and return to off positions automatically when released.

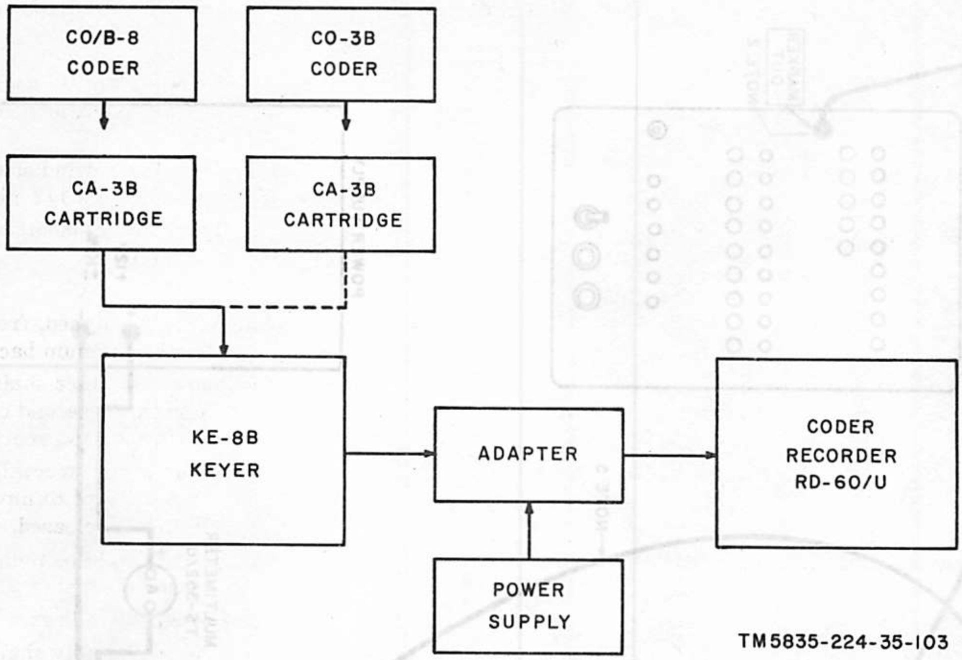


Figure 4-2. KE-8B keyer test setup.

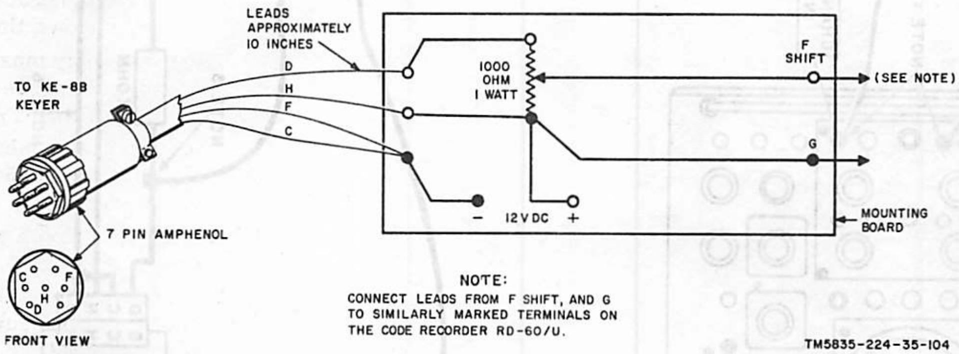


Figure 4-3. KE-8B keyer output fed direct to Coder, Recorder RD-60/U through an adapter, block diagram.

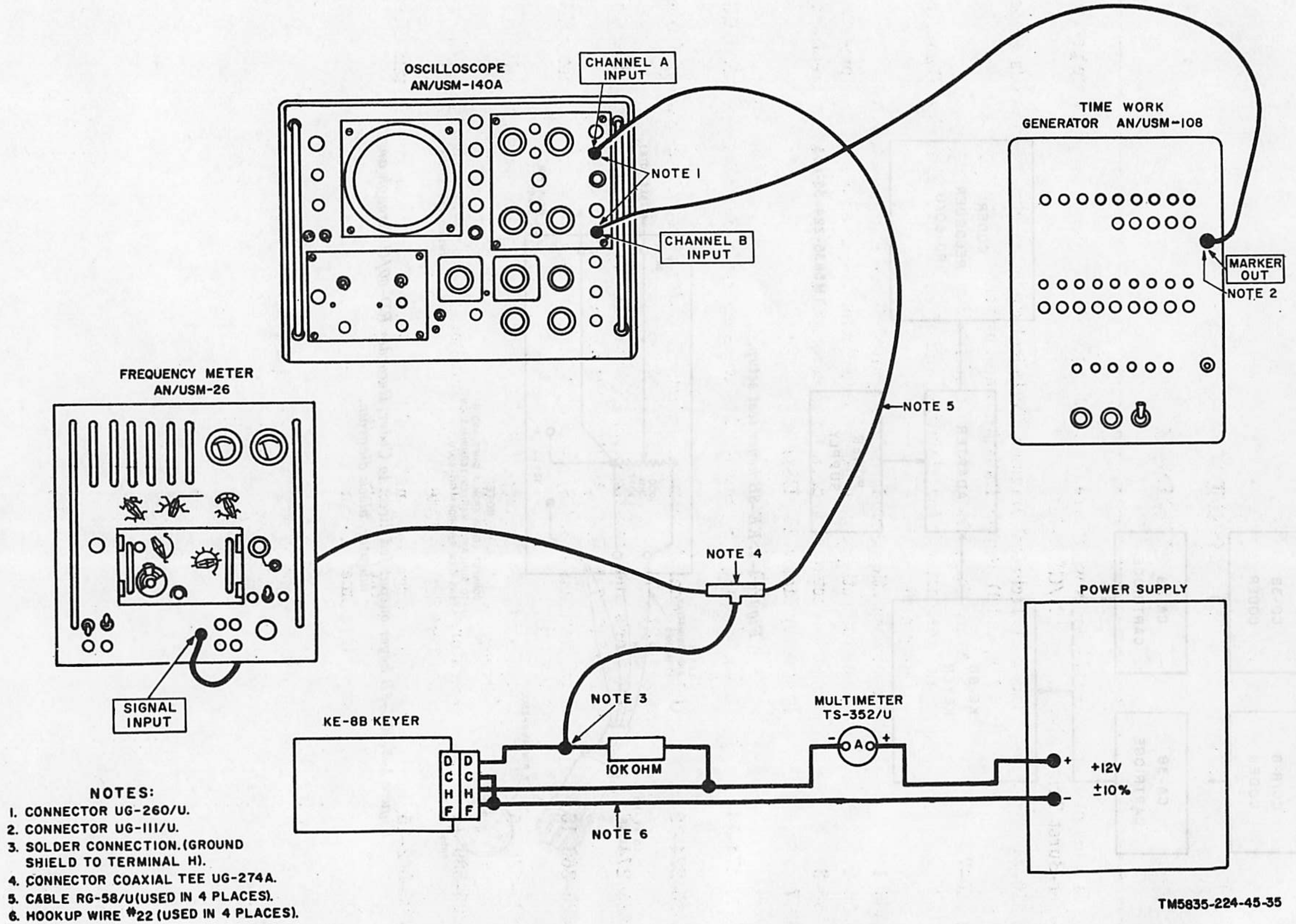


Figure 4-4. Adapter used to feed KE-8B keyer output direct to input of Coder Recorder RD-60/U, wiring diagram.

APPENDIX A

REFERENCES

Following is a list of applicable references which are available to the DS and depot maintenance personnel of Coder-Burst Transmission Set AN/GRA-71:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U.S. Army Equipment Index of Modification Work Orders.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TM 11-5057	Frequency Meter AN/USM-26.
TM 11-5533	Code Recorder RD-60/U.
TM 11-5820-474-14	Organizational, DS, and GS Maintenance Manual: Radio Set AN/GRC-109.
TM 11-5835-224-12	Organizational Maintenance Manual: Coder-Burst Transmission Group AN/GRA-71.
TM 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
TM 11-6625-366-15	Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 11-6625-535-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Oscilloscope AN/USM-140A.
TM 11-6625-539-15	Operator, Organizational, Field and Depot Maintenance Manual: Transistor Test Set TS-1836/U.
TM 11-6625-542-15	Operator, Organizational, Field and Depot Maintenance Manual: Electronic Marker Generator AN/USM-108.
TM 38-750	Army Equipment Record Procedures.

APPENDIX B
DEPOT REPAIR PARTS

Section I. INTRODUCTION

B-1. Scope

This manual contains a list of repair parts required for the performance of depot maintenance for Coder Burst-Transmission AN/GRA-71. (This appendix is current as of 1 May 1969.)

Note. No special tools, test, and support equipment are required.

B-2. General

The repair parts list is divided into the following sections:

a. Repair Parts for Direct Support, General Support and Depot Maintenance, Section II. Repair parts authorized for depot maintenance are included in this section. No parts authorized at direct support and general support.

Note. All indexes noted below are cross referenced to index numbers. The index numbers appear in ascending sequence in column 1 of the repair parts list (para B-3*a*). The index number for the particular item will be the same for the item in all sections of this publication.

b. Federal Stock Number Cross-Reference to Index Number, Section III. This is a cross-reference index of Federal stock numbers to index numbers.

c. Reference Designation Cross Reference to Index Number, Section IV. This is a cross reference index of reference designations and/or item numbers to index numbers.

B-3. Explanation of Columns

An explanation of the columns is given below.

a. Source, Maintenance, and Recoverability Codes (SMR) and Index Numbers Column. The first line in this column lists the applicable SMR codes for the part. Listed in ascending order directly below the SMR codes is the index number assigned to the repair part.

(1) *Source Code (S).* The selection status and source for the listed item is noted here. Source codes and their explanations are as follows:

Code	Explanation
P	Applies to repair parts that are stocked in or supplied from the GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.
M	Applies to repair parts that are not procured or stocked but are to be manufactured at indicated maintenance categories.
X2	Applies to repair parts that are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization; if not obtainable through cannibalization, such repair parts will be requisitioned with supporting justification through normal supply channels.

(2) *Maintenance code (M).* The lowest category of maintenance authorized to install the listed item is noted here.

Code	Explanation
O	Organizational maintenance
H	General support maintenance
D	Depot maintenance

(3) *Recoverability code (R).* The information in this column indicates whether unserviceable items should be returned for recovery or salvage. Recoverability code and its explanation is as follows:

Note. When no code is indicated in the recoverability column, the part will be considered expendable.

Code	Explanation
R	Applies to repair parts and assemblies which are economically repairable at DSU and GSU activities and normally are furnished by supply on an exchange basis.

b. Federal Stock Number Column. The Federal stock number for the item is listed in this column.

c. Description Column. This column includes the Federal item name and any additional description of the item required, the manufacturer's part number (reference number), and the applicable five-digit Federal Supply Code for Manufacturers (para B-5). For subsequent appearances of the same item, the manufacturer's code and part number (reference number) are omitted. The words "same as" followed by the index number assigned to the item when it first appeared in the list will follow the item name, e.g., "RESISTOR, FIXED, COMPOSITION: SAME AS A298". Usable on code column is not used.

d. Unit of Measure Column. The unit used as a basis of measure (e.g., ea, pr, ft, yd, etc.) is indicated in this column.

e. Quantity Incorporated in Unit Column. The quantity of repair parts in an assembly is given in this column.

g. Maintenance Allowance Column. Not used.

f. One-Year Allowances Per 100 Equipments/Contingency Planning Purposes Column. Opposite the first appearance of each item, the total quantity required for distribution and contingency planning purposes is indicated. The range of items indicates total quantities of all authorzied items required to provide for adequate support of 100 equipments for one year.

g. Depot Maintenance Per 100 Equipments Column. This column indicates the total quantity of each item authorzied depot maintenance for 100 equipments. Subsequent appearances of the same item will have no entry in this column, but will have a reference in the description column to the first appearance of the item.

h. llustrations Column.

(1) *Figure number (a).* Not used.

(2) *Item No. or reference designation (b).* The callout number or reference designation used to reference the item appears in this column.

B–4. Location of Repair Parts

a. This appendix contains two cross-reference indexes (sec III and IV), to be used to locate a repair part when either the Federal stock number (manufacturer's part number), or reference designation is known. The first column in each cross-reference index is prepared, as applicable, in numerical or alphanumerical sequence. The last column of each cross-reference index lists the index number assigned to the part.

b. Refer to the appropriate cross-reference index (para B–2*b*, *c*), and note the index number in the last column; then refer to the repair parts list to locate the index number which is listed in ascending order in column 1 of the repair parts list.

B–5. Federal Supply Codes

This paragraph lists the Federal supply code and the associated manufacturer's name.

Code	Manufacturer
00213	Sage Electronics Corp.
00656	Aerovox Corp.
01121	Allen-Bradley Co.
03508	General Electric Co. Semi-Conductor Products Dept.
04381	Gates Washer & Mfg. Co.
06915	Richo Plastic Co.
07497	Amphenol Corp. Amphenol Cable Div.
07933	Raytheon Co Components Div Semiconductor operation
09725	Texaco Canada Ltd.
11911	Solid State Electronics Corp.
14288	Advance Screw Products, Inc.
18510	Zaring Industries, Inc.
18915	Bircher Corp., The Industrial Division
40920	MPB Corp.
46859	Philco Corp.
70485	Alantic India Rubber Works, Inc.
71785	Cinch Mfg. Co. & Howard B Jones Div.
72962	Elastic Stop Nut Corp of America
73957	Groov Pin Corp.
75042	I. R. C., Inc.
75497	Lamerson and Sessions Co.
76385	Minor Rubber Co., Inc.
78046	Salisbury W H and Co., Inc.
79136	Waldes Kohinoor, Inc.
82389	Switchcraft, Inc.
83125	General Instrument Corp. Capacitor Div.
84792	Heppner Mfg. Co.
88245	Litton Industries USECO DIV.
89799	Arvin Industries, Inc.
91637	Dale Electronics, Inc.
93713	United Transformer Co. Manufacturers Div.
95139	Process Gear Co., Inc.
95238	Continental Connector Corp.
95566	Arnold Engineering Co.
95739	Schildmeier, H. C., Co.
95987	Weckesser Co., Inc.
96906	Military Standards
98003	Niesen Hardware Corp.

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
A001	5820-056-6856	CODER BURST-TRANSMISSION AN/GRA-71: SC-DL-556000; (This item is nonexpendable)													
		GROUP 1 ADAPTER MX-4498/GRA-71 (KA-3)													
X2-D A004		CASE AND PANEL: 556007; 89799		ea	1										
X2-D A005		CASE ASSEMBLY: 556008; 89799		ea	1										
X2-D A006		PANEL-POWER SUPPLY: 556011; 89799		ea	1										
X2-D A007		PANEL ASSEMBLIES: 556012; 89799		ea	1										
X2-D A008		PANEL: 556013; 89799		ea	1										
X2-D A009		TUBE ASSEMBLY: 556014; 89799		ea	1										
X2-D A010		TUBE: 556015; 89799		ea	1										
X2-D A011		SCREEN: 556016; 89799		ea	1										
M-D A012		LABEL: 556017; 89799		ea	1										
P-D A013	5820-939-7216	POWER SUPPLY: SM-D-556018; 89799		ea	1							4	3		
P-D A014	5999-941-5070	HEAT SINK: SM-D-556019; 89799		ea	1							4	3		
X2-D A015		MOUNT: 556020; 89799		ea	1										
X2-D A016		PLATE ASSEMBLY: 556021; 89799		ea	1										
X2-D A017		PLATE: 556022-1; 89799		ea	1										
X2-D A018		RETAINER: 556021-1; 18915		ea	2										
X2-D A019		RIVIT: MS16535-32; 96906		ea	8										
X2-D A020		PLATE: 556022-2; 89799		ea	1										
M-D A021		BRACKET: 556025; 89799		ea	1										
P-D A022	5820-942-0133	PRINTED CIRCUIT BOARD ASSEMBLY: SM-D-556023; 89799		ea	1							4	3		
X2-D A023		PRINTED CIRCUIT BOARD: 556024; 89799		ea	1										
X2-D A024		CLIP: 556023-1; 89799		ea	3										
X2-D A025		RIVET: MS16535-88; 96906		ea	3										
X2-D A026		TERMINAL: 556023-2; 88245		ea	6										
X2-D A027		TERMINAL: 556023-3; 89799		ea	26										
P-D A030	5999-941-5080	HEAT SINK: SM-D-556018; 89799		ea	1							4	3		
X2-D A031		WASHER: 556027; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A032		BRACKET: 556028; 89799		ea	1										
X2-D A033		WASHER: 556018-1; 09725		ea	1										
P-H A034	5961-088-2571	TRANSISTOR: 2N2552; 09725		ea	6							20	18		
P-H A035	5905-926-0384	RESISTOR: 3105M-3100-3; 00213		ea	1							4	3		
P-D A036		RESISTOR: 3105M-13500-3; 00213		ea	1							4	3		
P-D A037	5961-061-8172	TRANSISTOR: 2N1048A; 96906		ea	1							4	3		
P-D A038	5961-813-5736	DIODE: 1N2977B; 96906		ea	1							4	3		
P-D A039	5960-272-8545	TUBE: 5787WA; 96906		ea	1							160	153		
P-D A040	5960-553-7091	TUBE: 6542; 96906		ea	1							180	175		
P-D A041	5905-279-1890	RESISTOR: RC20GF391J; 96906		ea	1							4	3		
P-D A042	5905-249-4195	RESISTOR: RC20GF752J; 96906		ea	1							4	3		
P-D A043	5905-941-3536	RESISTOR: RS-2C, 16K ±3%; 91637		ea	1							4	3		
P-D A044	5910-825-1637	CAPACITOR: CP05A1KC104K3; 96906		ea	1							4	3		
P-D A045	5910-688-2822	CAPACITOR: CP05A1KB104K3; 96906		ea	2							8	6		
P-D A046	5910-807-9139	CAPACITOR: CL25BH221UP3; 96906		ea	2							8	6		
P-D A047	5910-683-3734	CAPACITOR: CL25BJ101UP3; 96906		ea	1							4	3		
P-D A048	5950-926-0746	REACTOR, FIXED: SM-B-556030; 18510		ea	2							8	6		
P-D A049	5950-940-8107	TRANSFORMER: SM-C-556031; 18510		ea	1							4	3		
P-D A050	5961-572-4526	DIODE: 1N540; 03508		ea	1							4	3		
P-D A051	5961-894-0684	DIODE: 1N758A; 96906		ea	1							4	3		
P-D A052	5961-814-4251	DIODE: 1N1692; 09725		ea	1							4	3		
P-D A053	5961-027-5247	DIODE: 1N1696; 09725		ea	1							4	3		
P-D A054	5325-263-6650	GROMMET: 263; 70485		ea	2							8	6		
X2-D A056		SCREW: MS-35245-56; 96906		ea	1										
X2-D A057		SCREW: MS35233-45; 96906		ea	4										
X2-D A058	5305-531-9520	SCREW: MS35233-2; 96906		ea	18										
X2-D A059	5305-576-5793	SCREW: MS35233-28; 96906		ea	4										
X2-D A060	5305-550-5002	SCREW: MS35233-13; 96906		ea	2										
X2-D A061	5305-058-6833	SCREW: MS35233-12; 96906		ea	17										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A062	5310-058-2949	LOCK WASHER: MS35337-78; 96906		ea	12										
X2-D A063		LOCK WASHER: MS35337-79; 96906		ea	4										
X2-D A064	5310-262-3620	LOCK WASHER: MS35337-80; 96906		ea	1										
X2-D A065		NUT HEX: MS35649-85; 96906		ea	1										
X2-D A066		CLIP: V1007; 06915		ea	2										
P-D A067	5330-945-3879	GASKET: SM-C-556034; 76385		ea	1							4	3		
P-D A068	5325-939-7358	GROMMET: G538; 78046		ea	1							4	3		
P-D A069	5325-039-7456	GROMMET: G618; 78046		ea	1							4	3		
M-D A070		CABLE ASSEMBLY: 556035-1; 89799		ea	1										
X2-D A071		CABLE: C007LGF720SJ0360; 96906		ea	1										
P-D A072	5935-632-3198	CONNECTOR: C10-20P; 95238		ea	1							4	3		
P-D A073	5935-999-9594	ADAPTER, CABLE TO CONNECTOR: SM-C-556037; 89799		ea	2							8	6		
X2-D A075		SCREW: MS35274-4; 96906		ea	6										
X2-D A076		SCREW: AN565DC4H2; 96906		ea	2										
M-D A077		CABLE ASSEMBLY: 556035-2; 89799		ea	1										
X2-D A078		CABLE: C005LGF520SJ0323; 96906		ea	1										
P-D A079	5935-259-6794	CONNECTOR PLUG: C7-20P; 95238		ea	1							4	3		
P-D A080	5935-999-9594	ADAPTER, CABLE TO CONNECTOR: SAME AS A073		ea	1										
X2-D A082		SCREW: SAME AS A075		ea	4										
X2-D A083		SCREW: SAME AS A076		ea	1										
X2-D A084		CONNECTOR ASSEMBLY: 556038-1; 89799		ea	1										
P-D A085	5935-058-6404	SHIELD ELECTRICAL: MS24018-8; 96906		ea	2							8	6		
P-D A086	5935-755-8568	CONNECTOR, SOCKET: C10-20S; 95238		ea	1							4	3		
X2-D A087		CHAIN: 556039; 89799		ea	2										
X2-D A089		CONNECTOR ASSEMBLY: 556038-2; 89799		ea	1										
P-D A090	5935-058-6404	SHIELD ELECTRICAL: SAME AS A085		ea	1										
P-D A091	5935-259-3278	CONNECTOR: C7-20S; 95238		ea	1							4	3		
X2-D A092		CHAIN: SAME AS A087		ea	1										
X2-D A094		CLAMP: WC5/16-4-128; 95987		ea	4										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A095		SCREW: MS35231-14; 96906		ea	2										
X2-D A096	5305-576-7493	SCREW: MS35233-15; 96906		ea	2										
X2-D A097		SCREW: 556011-2; 96906		ea	17										
X2-D A098		SCREW: 556011-3; 89799		ea	4										
X2-D A099		WASHER: 556011-4; 89799		ea	4										
X2-D A100		WASHER: 556011-5; 89799		ea	4										
X2-D A101	5310-595-6211	WASHER: MS15795-303; 96906		ea	2										
X2-D A102		LOCK WASHER: 556011-6; 89799		ea	2										
X2-D A103	5310-058-2949	LOCK WASHER: SAME AS A062		ea	2										
X2-D A104		NUT, BRASS: 556011-10; 89799		ea	2										
X2-D A105		NUT: MS35649-44; 96906		ea	3										
P-D A106	5330-923-4280	GASKET, RUBBER: SM-C-556040; 76385		ea	1							4	3		
P-D A107	5340-543-4091	CATCH, CLAMPING: 556041-1; 98003		ea	4							16	12		
P-O A108	7920-920-7154	BRUSH DUSTING: 556042; 89799		ea	1							12	5		
P-D A109	5330-923-4278	PLUG, PLEXIGLAS: SM-C-556043; 89799		ea	1							4	3		
M-D A110		LABEL: 556044; 89799		ea	1										
P-D A111	5330-248-3835	O-RING: MS29513-10; 96906		ea	1							4	3		
X2-D A112		SCREW: 556007-1; 89799		ea	12										
X2-D A113		STUD, DRIVE: 556007-2; 89799		ea	16										
X2-D A114		COVER ASSEMBLY: 556046; 89799		ea	1										
M-D A115		COVER: 556047; 89799		ea	1										
P-D A116	5820-999-1847	PAD, CUSHIONING: SM-B-556048; 76385		ea	1							4	3		
P-D A117	5340-571-2569	STRIKE, CATCH: SM-C-556041-2; 89799		ea	4							18	12		
X2-D A118		STUD DRIVE: 556046-1; 89799		ea	8										
		GROUP 2 MAGAZINE RECORD MA-9(CA-3B)													
X2-D A120		MAGAZINE ASSEMBLY: 556144; 89799		ea	2										
P-D A121	5820-939-7300	PLATE ASSEMBLY: SM-C-556145; 89799		ea	2							8	6		
X2-D A122		PLATE ASSEMBLY: 556146; 89799		ea	2										
X2-D A123		PLATE: 556147; 89799		ea	2										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A124		STUD: 556148; 89799		ea	4										
X2-D A125		STUD: 566149; 89799		ea	2										
X2-D A126		GUIDE: 556150; 89799		ea	4										
X2-D A127		STUD: 556151; 89799		ea	2										
X2-D A128		BEARING: 556152; 89799		ea	2										
X2-D A129		STUD: 556153; 89799		ea	4										
X2-D A130		STUD: 556154; 89799		ea	4										
X2-D A131		STUD: 556155; 89799		ea	2										
X2-D A132		STUD: 556156; 89799		ea	2										
X2-D A133		LATCH PLATE: 556157; 89799		ea	2										
X2-D A134		STUD: 556158; 89799		ea	4										
X2-D A135		SPRING: 556159; 89799		ea	1										
X2-D A136	5340-816-4239	RETAINING RING: MS16633-1012; 96906		ea	5										
P-D A137	5820-939-7301	PLATE ASSEMBLY: SM-C-556160; 89799		ea	2							8	6		
X2-D A138		STAKE ASSEMBLY: 556161; 89799		ea	2										
X2-D A139		PLATE: 556162; 89799		ea	2										
X2-D A140		BEARING: 556163; 89799		ea	2										
X2-D A141		BEARING: 556164; 89799		ea	2										
X2-D A142		STUD: SAME AS A130		ea	1										
X2-D A143		GEAR ASSEMBLY: 556165; 89799		ea	2										
X2-D A144		GEAR: 556166-4; 95139		ea	2										
X2-D A145		BEARING: 556167; 89799		eas	2										
X2-D A146		GEAR STOP: 556168; 89799		ea	8										
X2-D A147		BEARING: S-156-312-FHH; 40920		ea	2										
X2-D A148		GEAR ASSEMBLY: 556169; 89799		ea	2										
X2-D A149		GEAR: 556166-3; 95139		ea	2										
X2-D A150		SHAFT: 556170; 89799		ea	2										
X2-D A151		SCREW: 556160-2; 89799		ea	31										
X2-D A152		BRACKET ASSEMBLY: 556171; 89799		ea	2										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A153		BRACKET: 556172; 89799		ea	2										
X2-D A154		BEARING: SAME AS A141		ea	2										
X2-D A155		LOCK WASHER: 556160-3; 89799		ea	4										
X2-D A156		RETAINING RING: MS16633-4009; 96906		ea	22										
X2-D A157	5305-531-9520	SCREW: SAME AS A058		ea	1										
X2-D A158		GEAR: 556166-2; 95139		ea	2										
X2-D A159		SPOOL: 556173; 89799		ea	2										
X2-D A160		GEAR ASSEMBLY: 556174; 89799		ea	1										
X2-D A161		GEAR: 556166-1; 95139		ea	2										
X2-D A162		GEAR STOP: SAME AS A146		ea	1										
P-D A163	5820-940-8134	SPOOL ASSEMBLY: SM-C-556175; 89799		ea	1							4	3		
X2-D A164		SPOOL ASSEMBLY: 556176; 89799		ea	1										
X2-D A165		SPOOL: 556177-1; 89799		ea	1										
X2-D A166		STUD: 556178; 89799		ea	4										
X2-D A167		BRAKE SHOE: 556179; 89799		ea	4										
X2-D A168		RETAINING RING: SAME AS A156		ea	2										
P-D A169	5835-939-7470	GEAR ASSEMBLY: SM-B-556180; 89799		ea	2							8	6		
X2-D A170		GEAR: 556181-2 ; 89799		ea	2										
X2-D A171		BEARING: 556182; 89799		ea	2										
X2-D A172		GEAR STOP: SAME AS A146		ea	1										
P-D A173	5835-999-7313	GEAR ASSEMBLY: SM-B-556183; 89799		ea	2							8	6		
X2-D A174		GEAR: 556181-3; 95139		ea	2										
X2-D A175		GEAR STOP: SAME AS A146		ea	1										
X2-D A176		BEARING: 556184; 89799		ea	2										
X2-D A177		SHAFT: 556185; 89799		ea	2										
X2-D A178		BEARING: SAME AS A147		ea	2										
X2-D A179		SPOOL: 556177-2; 89799		ea	2										
X2-D A180		GEAR: 556181-1; 95139		ea	2										
P-D A181	5835-939-2136	SPRING, SPIRAL TORSION: SM-B-556186; 89799		ea	2							8	6		

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	(3) DESCRIPTION: USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A182		SPOOL: 556187; 89799		ea	2										
P-D A183	5340-921-0598	SPRING RETAINING CLAMP: SM-B-556188; 89799		ea	2							8	6		
P-D A184	5820-940-8135	SPRING STAINLESS STEEL: SM-B-556189; 89799		ea	2							8	6		
P-D A185	5835-939-7469	COVER, SOUND RECORDER: SM-B-556190; 89799		ea	2							8	6		
X2-D A186		COVER: 556191; 89799		ea	2										
X2-D A187		HINGE ASSY: 556192; 89799		ea	2										
X2-D A188		HINGE: 556193; 89799		ea	2										
X2-D A189		GROOVE PIN: 556192-1; 89799		ea	5										
X2-D A191		COVER BOTTOM: 556195; 89799		ea	2										
X2-D A192	5340-598-1138	RETAINING RING: MS16633-4012; 96906		ea	5										
X2-D A193		RETAINING RING: SAME AS A156		ea	3										
X2-D A194	5340-725-0969	RETAINING RING: MS16633-4018; 96906		ea	2										
M-D A195		LABEL: 556196; 89799		ea											
X2-D A196		SCREW: 556144-2; 89799		ea	7										
X2-D A197	5305-531-9520	SCREW: SAME AS A058		ea	1										
X2-D A198		ARM ASSEMBLY: 556197; 89799		ea	2										
X2-D A199		ARM: 556198; 89799		ea	2										
X2-D A200		STUD: 556199; 89799		ea	2										
X2-D A201		SPRING: 556200; 89799		ea	2										
X2-D A202		ROLLER: 556201; 89799		ea	2										
X2-D A203	5315-291-5471	ROLL PIN: MS171431; 96906		ea	2										
X2-D A204	5340-753-3868	RETAINING RING: MS16633-4006; 96906		ea	7										
X2-D A205	7440-947-1694	TAPE MAGNETIC: SM-B-556202; 89799		ft	13							50	37.5		
X2-D A207		COVER ASSEMBLY: 556204; 89799		ea	2										
X2-D A208		COVER: 556205; 89799		ea	2										
X2-D A210		HINGE: 556206; 89799		ea	2										
		GROUP 3 CODER MX-4496 (CO/B-8)													
X2-D A214		CHASSIS ASSEMBLY: 556209; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A215		CHASSIS ASSEMBLY: 556210; 89799		ea	1										
X2-D A216		CHASSIS: 556211; 89799		ea	1										
X2-D A217		SLEEVE: 556212; 89799		ea	1										
X2-D A219		STOP: 556214; 89799		ea	3										
P-D A221	5820-939-7299	FEED MECHANISM ASSY: SM-D-556215; 89799		ea	1							4	3		
X2-D A222		ARM ASSEMBLY: 556216; 89799		ea	1										
X2-D A223		FEED ARM: 556217; 89799		ea	1										
X2-D A224		ARM: 556218; 89799		ea	1										
X2-D A225		STUD: 556072; 89799		ea	3										
X2-D A226		PAWL: 556219; 89799		ea	1										
X2-D A227		SPRING: 556220; 89799		ea	1										
X2-D A228	5340-753-3868	RETAINING RING: SAME AS A204		ea	2										
X2-D A220		GEAR ASSEMBLY: 556221; 89799		ea	1										
X2-D A230		GEAR: 556222; 89799		ea	2										
X2-D A231		GEAR: 556223; 89799		ea	1										
X2-D A232		RATCHET ASSEMBLY: 556224; 89799		ea	1										
X2-D A233		RATCHET: 556225; 89799		ea	1										
X2-D A234		SHAFT: 556226; 89799		ea	1										
X2-D A235		SHAFT: 556227; 89799		ea	1										
X2-D A236		SHAFT: 556228; 89799		ea	1										
X2-D A237		DETENT: 556229; 89799		ea	1										
X2-D A238		SPRING: 556230; 89799		ea	1										
X2-D A239		SPACER: 556231; 14288		ea	1										
X2-D A240		SPRING: 556232; 89799		ea	1										
X2-D A241		CAP: 556233; 89799		ea	2										
X2-D A242	5310-058-2950	LOCK WASHER: MS35337-77; 96906		ea	1										
X2-D A243	5310-271-4640	NUT: MS35649-24; 96906		ea	5										
X2-D A244		SCREW: MS35275-4; 96906		ea	1										
X2-D A245	5340-598-1138	RETAINING RING: SAME AS A192		ea	3										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A246	5340-816-4239	RETAINING RING: SAME AS A136		ea	1										
X2-D A247		FRAME: 556234; 89799		ea	1										
P-D A248	5820-939-7298	GEAR ASSEMBLY: SM-B-556235; 89799		ea	1							4	3		
X2-D A249		HUB: 556236; 89799		ea	1										
X2-D A250		GEAR: 556237; 95139		ea	1										
X2-D A251		THRUST WASHER: 556238; 89799		ea	1										
X2-D A252		SPRING: 556239; 89799		ea	1										
X2-D A253		WASHER: 556240; 89799		ea	1										
X2-D A254		NUT: 556241; 89799		ea	2										
P-D A255	5820-939-7297	BLOCK ASSEMBLY: SM-C-556242; 89799		ea	1							4	3		
X2-D A256		MOUNTING BLOCK: 556243; 89799		ea	1										
X2-D A257		PIN: 556100; 89799		ea	4										
X2-D A258		PRESSURE PLATE: 556127; 89799		ea	2										
X2-D A259		PIVOT: 556244; 89799		ea	1										
X2-D A260		SCREW: MS35275-18; 96906		ea	2										
X2-D A261		SCREW: AN565DC6H2; 96906		ea	4										
X2-D A262		BLOCK ASSEMBLY: 556245; 89799		ea	1										
X2-D A263		PIVOT BLOCK: 556246; 89799		ea	1										
X2-D A264		PIVOT: 556247; 89799		ea	1										
X2-D A265		PIN: 556245-1; 89799		ea	1										
X2-D A266		PIN: MS51923-147; 96906		ea	1										
P-D A267	5820-939-7296	LEVER ASSEMBLY: SM-B-556248; 89799		ea	1							4	3		
X2-D A268		LEVER: 556249; 89799		ea	1										
X2-D A269		BUTTON: 556250; 89799		ea	1										
P-D A270	5820-942-0358	BAR ASSEMBLY: SM-B-556251; 89799		ea	1							4	3		
X2-D A271		UNIVERSAL BAR: 556252; 89799		ea	1										
X2-D A273		SCREW: MS35275-13; 96906		ea	1										
P-D A274		BAR ASSEMBLY: SM-B-556253; 89799		ea	1							4	3		
X2-D A275		FEED MECHANISM: 556254; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A276		STUD: 556255; 89799		ea	1										
X2-D A277		ROLLER: S2C-5; 40920		ea	4										
P-D A278	5820-942-0134	DRIVESHAFT ASSEMBLY: SM-B-556256; 89799		ea	1							4	3		
X2-D A279		SHAFT: 556257; 89799		ea	1										
X2-D A280		GEAR: 556258-1; 89799		ea	1										
X2-D A281		SPACER: 556133; 04381		ea	2										
X2-D A282		CLIP ASSEMBLY: 556259; 89799		ea	2										
X2-D A283		CLIP: 556260; 89799		ea	2										
X2-D A284		INSULATOR: 556261; 89799		ea	2										
P-D A285	5820-930-5890	GENERATOR ASSEMBLY: SM-C-556263; 89799		ea	1							4	3		
X2-D A286		TOUNGE: 556264; 89799		ea	1										
X2-D A287		POLE BOTTOM: 556083; 84792		ea	2										
X2-D A288		POLE TOP: 556265; 84792		ea	1										
X2-D A289	6115-926-0828	COIL, WINDING GENERATOR: SM-B-556085; 89799		ea	2							10	6		
X2-D A290		MAGNET: 556086; 95566		ea	4										
X2-D A291		SCREW: AN-515-UB8-12; 96906		ea	4										
P-D A294	5930-926-2934	SWITCH: SM-C-556266-1; 82389		ea	1							4	3		
P-D A295	5930-926-2935	SWITCH: SM-C-556266-2; 82389		ea	1							4	3		
P-D A296	5961-170-4430	DIODE: 1N34A; 89799		ea	2							8	6		
P-D A297	5905-686-3798	RESISTOR: RC07GF272J; 96906		ea	1							4	3		
X2-D A298		BLOCK ASSEMBLY: 556114; 89799		ea	2										
X2-D A299		TERMINAL BLOCK: 556116; 89799		ea	2										
M-D A301		BRACKET: 556117; 89799		ea	2										
M-D A303		BRACKET: 556267; 89799		ea	1										
X2-D A304		SPRING: 556268; 89799		ea	1										
P-D A305	5835-939-7501	TAPE HEAD: OL-5; 89799		ea	2							8	6		
X2-D A306		SPRING: 556269; 89799		ea	1										
X2-D A307		SCREW: 556270; 89799		ea	1										
X2-D A308		SPRING: 556271; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D	A309		WASHER: 556272; 89799		ea	1										
X2-D	A310		WASHER: 556273; 89799		ea	1										
X2-D	A311		GROOVE PIN: GP4-062X250-50; 89799		ea	2										
X2-D	A312		GROOVE PIN: GP2-031X187-50; 89799		ea	1										
X2-D	A313	5305-579-3029	SCREW: MS35233-1; 96906		ea	13										
X2-D	A314		SCREW: SAME AS A244		ea	2										
X2-D	A315	5310-271-4640	NUT: SAME AS A243		ea	2										
X2-D	A316		SCREW: 556209-3; 89799		ea	2										
X2-D	A317	5305-058-6833	SCREW: SAME AS A061		ea	7										
X2-D	A318		SWITCH ASSEMBLY: 556274; 89799		ea	1										
P-D	A319	5820-940-8136	DAMPENER: SM-B-556275; 89799		ea	2							8	6		
P-D	A320	5330-937-9691	PAD CUSHIONING: SM-B-556276; 89799		ea	2							8	6		
P-D	A324	5820-939-7219	CODING ASSEMBLY: SM-D-556278; 89799		ea	1							4	3		
X2-D	A325		CODING SECTION: 556279; 89799		ea	1										
X2-D	A326		PLATE ASSEMBLY: 556280; 89799		ea	1										
X2-D	A327		PLATE: 556281; 89799		ea	1										
X2-D	A328		BEARING: S-187-312-FHH; 40920		ea	4										
X2-D	A329		BEARING: 556282; 89799		ea	4										
X2-D	A330		STUD: 556283; 89799		ea	5										
M-D	A331		PLATE ASSEMBLY: 556284; 89799		ea	1										
X2-D	A332		PLATE: 556285; 89799		ea	1										
X2-D	A333		STUD: 556286; 89799		ea	1										
X2-D	A334		SPACER: 556287; 89799		ea	2										
X2-D	A335		BEARING: SAME AS A328		ea	1										
X2-D	A336		CAMSHAFT ASSEMBLY: 556288; 89799		ea	1										
X2-D	A337		CAMSHAFT: 556289; 89799		ea	1										
X2-D	A338		SPACER: 556290; 89799		ea	4										
X2-D	A339		GEAR: 556291; 95139		ea	1										
X2-D	A340		CAMSHAFT: 556292; 89799		ea	1										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A341		GEAR: 556293; 95139		ea	1										
X2-D A342		GEAR: 556294; 95139		ea	1										
X2-D A343		CAM: 556295; 89799		ea	12										
X2-D A344		SHAFT ASSEMBLY: 556296; 89799		ea	1										
X2-D A345		SHAFT: 556297; 89799		ea	1										
X2-D A346		RATCHET: 556298; 89799		ea	1										
X2-D A347		GROOVE PIN: GP2-046X375-50; 73957		ea	1										
X2-D A348		BLOCK: 556299; 89799		ea	1										
X2-D A349		GEAR: 556300; 95139		ea	1										
X2-D A350	5305-543-4440	SCREW: AN565DC4H4; 96906		ea	2										
X2-D A351		SCREW: MS35275-9; 96906		ea	2										
X2-D A352	5340-200-2637	RETAINING RING: MS16624-12; 96906		ea	1										
X2-D A353		PLATE ASSEMBLY: 556301; 89799		ea	1										
X2-D A354		PLATE SUBASSEMBLY: 556302; 89799		ea	1										
X2-D A355		PLATE: 556303; 89799		ea	1										
X2-D A356		BEARING: 556304; 89799		ea	2										
X2-D A357		BEARING: SAME AS A328		ea	2										
X2-D A358		LEVER ASSEMBLY: 556305-1; 89799		ea	1										
X2-D A359		LEVER: 556306-1; 89799		ea	1										
X2-D A360		STUD: 556307; 89799		ea	2										
X2-D A361		STUD: 556308; 89799		ea	3										
X2-D A362		ROLLER: SAME AS A277		ea	1										
X2-D A363		LEVER ASSEMBLY: 556305-2; 89799		ea	1										
X2-D A364		STROKING LEVER: 2614-2-556306-2; 89799		ea	1										
X2-D A366		ROLLER: SAME AS A277		ea	1										
X2-D A367		SPRING: 556309-1; 89799		ea	1										
X2-D A368		SPRING: 556309-2; 89799		ea	2										
X2-D A369		RETAINING RING: SAME AS A156		ea	2										
X2-D A370		SPRING ASSEMBLY: 556310; 89799		ea	2										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A371		FRAME: 556311; 89799		ea	2										
X2-D A372		PIN: 556312; 89799		ea	2										
X2-D A373		SPRING: 556313; 89799		ea	12										
X2-D A374	5340-753-3868	RETAINING RING: SAME AS A204		ea	1										
M-D A375		SPACER: 556314; 89799		ea	2										
M-D A376		SPACER: 556315; 89799		ea	2										
X2-D A377		FINGER ASSEMBLY: 556316-1; 89799		ea	1										
X2-D A378		FINGER ASSEMBLY: 556316-2; 89799		ea	1										
X2-D A379		BELL CRANK ASSEMBLY: 556317-2; 89799		ea	1										
X2-D A380		BELL CRANK ASSEMBLY: 556317-1; 89799		ea	1										
X2-D A381		BELL CRANK: 556318; 89799		ea	2										
X2-D A382		STUD: SAME AS A330		ea	2										
X2-D A383		STROKING FINGER: 556319; 89799		ea	2										
M-D A384		SHIM: 556320; 89799		ea	2										
X2-D A385	5340-753-3868	RETAINING RING: SAME AS A204		ea	2										
X2-D A386		RATCHET: 556321; 89799		ea	1										
X2-D A387		CAM: 556322-1; 89799		ea	1										
X2-D A388		CAM: 556322-2; 89799		ea	1										
X2-D A389		CAM: 556323; 89799		ea	2										
X2-D A390		SPRING: 556324-1; 89799		ea	1										
X2-D A391		SPRING: 556324-2; 89799		ea	2										
X2-D A392		LEVER: 556325-1; 89799		ea	8										
X2-D A393		LEVER: 556325-2; 89799		ea	4										
X2-D A394		SHIM: 556326; 89799		ea	7										
X2-D A395		UNIVERSAL BAR: 556327-1; 89799		ea	1										
X2-D A396		UNIVERSAL BAR: 556327-2; 89799		ea	1										
X2-D A397		WASHER: 556328; 04381		ea	2										
X2-D A398		PIVOT: 556329; 89799		ea	2										
X2-D A399		SPACER: 556330; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A400		STOP: 556331; 89799		ea	1										
X2-D A401		CAP: SAME AS A241		ea	1										
X2-D A402	5340-753-3868	RETAINING RING: SAME AS A204		ea	1										
X2-D A403	5305-531-9520	SCREW: SAME AS A058		ea	6										
X2-D A404		SCREW: AN565DC2H3; 96906		ea	4										
X2-D A405		SCREW: 556278-1; 89799		ea	2										
X2-D A406		GROOVE PIN: GP2-062X250-2; 73957		ea	3										
X2-D A407		GROOVE PIN: GP2-046X250-50; 73957		ea	4										
X2-D A408		SCREW: 556278-4; 89799		ea	5										
X2-D A409		SCREW: AN565AC2H5; 96906		ea	1										
X2-D A410	5310-271-4640	NUT: SAME AS A243		ea	1										
P-D A411	5820-942-0426	HUB ASSEMBLY: SM-B-556332; 89799		ea	1							4	3		
X2-D A412		HUB SUBASSEMBLY: 556333; 89799		ea	1										
X2-D A413		LEVER ASSEMBLY: 556334; 89799		ea	1										
X2-D A414		PAWL: 556335; 89799		ea	1										
X2-D A415		STUD: 556336; 89799		ea	1										
X2-D A416		HUB: 556337; 89799		ea	1										
X2-D A417		PAWL: 556338; 89799		ea	1										
X2-D A418		SPRING: 556339; 89799		ea	1										
X2-D A419		RETAINING RING: SAME AS A156		ea	1										
P-D A420	5820-939-7218	HANDLE ASSEMBLY: SM-B-556340; 89799		ea	1							4	3		
X2-D A421		HANDLE SUBASSEMBLY: 556341; 89799		ea	1										
X2-D A422		HANDLE: 556342; 89799		ea	1										
X2-D A423		SPRING: 556343; 89799		ea	1										
X2-D A425		DETENT ASSEMBLY: 556344; 89799		ea	1										
X2-D A426		DETENT ASSEMBLY: 556345; 89799		ea	1										
X2-D A427		HANDLE: 556346; 89799		ea	1										
X2-D A428	5315-598-7286	ROLL PIN: MS171495; 96906		ea	1										
X2-D A429	5315-823-8745	ROLL PIN: MS171498; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A430		WHEEL ASSEMBLY: 556347; 89799		ea	1										
X2-D A431		PLATE ASSEMBLY: 556348; 89799		ea	1										
X2-D A432		PLATE ASSEMBLY: 556349; 89799		ea	1										
X2-D A433		PLATE: 556350; 89799		ea	1										
X2-D A434		GUIDE: 556351; 89799		ea	1										
X2-D A435		SPACER: 556352; 89799		ea	1										
X2-D A436		PIN: 556353; 89799		ea	2										
X2-D A437		STUD: SAME AS A330		ea	1										
X2-D A438		ARM ASSEMBLY: 556354; 89799		ea	1										
X2-D A439		ARM: 556355; 89799		ea	1										
X2-D A440		STUD: SAME AS A361		ea	1										
X2-D A441		ROLLER: SAME AS A277		ea	1										
X2-D A442		WHEEL: 556356; 89799		ea	1										
X2-D A443		SPRING: 556357; 89799		ea	1										
X2-D A444		BUSHING: 556358; 89799		ea	1										
X2-D A445		PIN: 556359; 89799		ea	1										
X2-D A446		SPACER: 556360; 89799		ea	2										
X2-D A447	5305-058-6833	SCREW: SAME AS A061		ea	1										
X2-D A448	5340-753-3868	RETAINING RING: SAME AS A204		ea	1										
X2-D A449		SPACER: 556361; 89799		ea	1										
X2-D A450		SCREW: 556362; 89799		ea	1										
X2-D A451		WASHER: 556363; 89799		ea	1										
X2-D A452		LINK: 556364; 89799		ea	2										
X2-D A453		SCREW: 556208-1; 89799		ea	3										
X2-D A454	5305-579-3029	SCREW: SAME AS A313		ea	2										
X2-D A455	5305-531-9520	SCREW: SAME AS A058		ea	4										
X2-D A456		SCREW: 556208-2; 89799		ea	2										
X2-D A457		COVER ASSEMBLY: 556365; 89799		ea	1										
X2-D A458		BOTTOM COVER: 556366; 89799		ea	1										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A459		PLATE: 556367; 89799		ea	1										
X2-D A460		HINDGE: 556368; 89799		ea	2										
X2-D A461		SLEEVE: 556056; 89799		ea	4										
X2-D A462		LINER: 556369; 89799		ea	1										
P-D A463	5325-249-6370	GROMMET: 1070; 70485		ea	15							50	45		
X2-D A465		COVER ASSEMBLY: 556370; 89799		ea	1										
X2-D A466		TOP COVER: 556371; 89799		ea	1										
X2-D A467		LINER: 556372; 89799		ea	1										
M-D A468		BRACKET: 556373; 89799		ea	5										
P-D A470	5820-920-5430	DIAL CHARACTER: 556374; 89799		ea	1							4	3		
P-D A471	5820-920-5429	DIAL CHARACTER: 556375; 89799		ea	1							4	3		
X2-D A472		SCREW: 556140; 89799		ea	4										
X2-D A473		SCREW: 556207-1; 89799		ea	3										
X2-D A474		SCREW: 556376; 89799		ea	1										
M-D A475		LABEL: 556377; 89799		ea	1										
X2-D A476	5835-952-0117	COVER: SM-B-556378; 89799		ea	1										
M-D A477		COVER: 556379; 89799		ea	1										
M-D A478		CLIP: 556380; 89799		ea	3										
X2-D A479		HINGE: 556381; 89799		ea	3										
X2-D A482		GROOVE PIN: 556378-3; 73957		ea	2										
		GROUP 4 KEYER KY-468 (KE-8B)													
P-D A485	5820-939-7220	CHASSIS ASSEMBLY: 556383; 89799		ea	1							4	3		
X2-D A486		CHASSIS SUBASSEMBLY: 556384; 89799		ea	1										
X2-D A487		BOTTOM CHASSIS: 556385; 89799		ea	1										
X2-D A488		BEARING: 556386; 89799		ea	1										
X2-D A489		PAWL: 556387; 89799		ea	2										
X2-D A490		STUD: 556388; 89799		ea	2										
X2-D A491		SPRING: 556389; 89799		ea	2										
X2-D A493		STUD: 556390; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A494		PIN: 556391; 89799		ea	2										
X2-D A495		INSERT: 556384-2; 75497		ea	2										
X2-D A496		BEARING: S055-187-FHH; 40920		ea	5										
X2-D A497		DRUM ASSEMBLY: 556392; 89799		ea	1										
X2-D A498		GEAR ASSEMBLY: 556393; 89799		ea	1										
X2-D A499		DRUM ASSEMBLY: 556394; 89799		ea	1										
X2-D A500		DRUM: 556395; 89799		ea	1										
X2-D A501		BEARING: 556396 89799		ea	1										
X2-D A502		GEAR: 556258-3; 95139		ea	1										
X2-D A504		COVER ASSEMBLY: 556397; 89799		ea	1										
X2-D A505		COVER: 556398; 89799		ea	1										
X2-D A506		BEARING: 556399; 89799		ea	1										
X2-D A507		SHAFT: 556400; 89799		ea	1										
X2-D A508		SPRING: 556401; 89799		ea	1										
X2-D A509	5340-263-5877	RETAINING RING: MS16624-15; 96906		ea	1										
X2-D A510		GOVENOR ASSEMBLY: 556402; 89799		ea	1										
X2-D A511		WEIGHTS: 556403; 89799		ea	1										
X2-D A512		SHAFT: 556404; 89799		ea	1										
X2-D A513		BEARING: 556405; 89799		ea	1										
X2-D A514		SPRING: 556406; 89799		ea	1										
X2-D A515		DISK: 556407; 89799		ea	1										
X2-D A516		PIN: 556408; 89799		ea	2										
X2-D A517		ARM: 556409; 89799		ea	2										
X2-D A518		PIN: 556410; 89799		ea	2										
X2-D A519		RING: 556411; 89799		ea	1										
X2-D A520		GEAR: 556258-7; 95739		ea	1										
X2-D A521		SHAFT ASSEMBLY: 556412; 89799		ea	1										
X2-D A522		SHAFT: 556413; 89799		ea	1										
X2-D A523		GEAR: SAME AS A280		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A524		SHAFT ASSEMBLY: 556414; 89799	ea	2										
X2-D A525		SHAFT: 556415; 89799	ea	1										
X2-D A526		GEAR: 556258-5; 95139	ea	2										
X2-D A527		GEAR: 556258-4; 95139	ea	1										
X2-D A528		SHAFT ASSEMBLY: 556416; 89799	ea	1										
X2-D A529		SHAFT: 556417; 89799	ea	1										
X2-D A530		GEAR: SAME AS A526	ea	1										
X2-D A531		GEAR: 556258-6; 95139	ea	1										
X2-D A532		RATCHET: 556418; 89799	ea	1										
X2-D A533		BEARING: SAME AS A496	ea	1										
M-D A534		SPACER: 556419; 89799	ea	1										
X2-D A535		POST: 556420; 89799	ea	3										
X2-D A536		GEAR: 556258-2; 95139	ea	1										
X2-D A537		SCREW: 556421; 89799	ea	1										
X2-D A538		RETAINING RING: 5133-4-H; 79136	ea	1										
X2-D A539	5305-531-9520	SCREW: SAME AS A058	ea	1										
X2-D A541		SCREW: 556383-4; 89799	ea	3										
M-D A542		BRACKET: 556422; 89799	ea	1										
X2-D A543		WASHER: 556423; 04381	ea	1										
X2-D A544		LOCKWASHER: 556383-5; 89799	ea	1										
P-D A545	5820-999-9567	TOP CHASSIS ASSEMBLY: SM-B-556424; 89799	ea	1							4	3		
X2-D A546		CHASSIS: 556425; 89799	ea	1										
X2-D A547		BEARING: 556426; 89799	ea	1										
X2-D A548		BEARING: 556427; 89799	ea	1										
X2-D A549		SPRING: 556428; 89799	ea	1										
X2-D A550		SCREW: MS35275-1; 96906	ea	2										
X2-D A551		WASHER: 556429; 89799	ea	1										
X2-D A552		SWITCH ASSEMBLY: 556430; 89799	ea	1										
X2-D A553		PANEL ASSEMBLY: 556431; 89799	ea	1										

(1) SMR CODE	INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6)(b) 21-50	(6)(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7)(b) 21-50	(7)(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10)(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D	A554		LEVER ASSEMBLY: 556432; 89799		ea	1										
X2-D	A555		LEVER: 556433; 89799		ea	1										
X2-D	A556		CONTACT: 556434; 89799		ea	1										
X2-D	A558		STUD: 556435; 89799		ea	1										
X2-D	A559		REVERSE BUTTON: 556436; 89799		ea	1										
X2-D	A560		BUTTON: 556437; 89799		ea	1										
X2-D	A561		BUTTON: 556438; 89799		ea	1										
X2-D	A562		SPRING: 556439; 89799		ea	1										
X2-D	A563		WASHER: 556440; 89799		ea	1										
M-D	A564		SPACER: 556441; 89799		ea	1										
M-D	A565		SLIDE: 556442; 89799		ea	1										
X2-D	A566		LEVER: 556443; 89799		ea	1										
X2-D	A567		PANEL: 556444; 89799		ea	1										
X2-D	A568		RETAINING RING: MS16632-4012; 96906		ea	1										
X2-D	A569		CRANK ASSEMBLY: 556445; 89799		ea	1										
X2-D	A570		BELL CRANK: 556446; 89799		ea	1										
X2-D	A571		STUD: 556447; 89799		ea	1										
X2-D	A572		CONTACT: 556448; 89799		ea	1										
M-D	A574		BRACKET: 556449; 89799		ea	1										
P-D	A575	5930-939-7322	SWITCH: SM-C-556450; 89799		ea	1							4	3		
X2-D	A576		BRAKE FINGER: 556451; 89799		ea	1										
M-D	A577		LINER: 556452; 89799		ea	1										
X2-D	A578		SPRING: 556453; 89799		ea	1										
P-D	A579	5935-284-3948	CONNECTOR RECEPTACLE: 126-198; 07497		ea	1							4	3		
X2-D	A580		RETAINING RING: SAME AS A156		ea	1										
X2-D	A581		SCREW: AN515UB2-2; 96906		ea	1										
P-D	A582	5820-942-0433	REGULATOR ASSEMBLY: SM-B-556454; 89799		ea	1							4	3		
X2-D	A583		CLAMP: 556455; 89799		ea	1										
X2-D	A584		LINER: 556456; 89799		ea	1										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A585		HANDLE ASSEMBLY: 556457; 89799		ea	1										
X2-D A586		HANDLE SUBASSEMBLY: 556458; 89799		ea	1										
X2-D A587		HANDLE ARM: 556459; 89799		ea	1										
X2-D A588		BUTTON: 556460; 89799		ea	1										
X2-D A589		STUD: 556461; 89799		ea	1										
X2-D A590		PIVOT ARM: 556462; 89799		ea	1										
X2-D A591		PIN: MS171437; 96906		ea	1										
P-D A592	5835-939-7468	COVER ASSEMBLY: SM-B-556463; 89799		ea	1							4	3		
M-D A593		COVER: 556464; 89799		ea	1										
M-D A594		CLIP: SAME AS A478		ea	1										
X2-D A596		HINGE: SAME AS A460		ea	1										
X2-D A598		CASE: 556465; 89799		ea	1										
X2-D A599		HINGE: 556466; 89799		ea	1										
X2-D A600		HINGE: SAME AS A479		ea	1										
M-D A602		CASE: 556467; 89799		ea	1										
M-D A603		CASE: 556468; 89799		ea	1										
M-D A604		BUTTON: 556469; 89799		ea	1										
M-D A605		BRACKET: SAME AS A468		ea	2										
X2-D A607		SPRING: 556470; 89799		ea	1										
X2-D A608		SCREW: 556471; 89799		ea	1										
X2-D A609		NUT: 556472; 89799		ea	1										
X2-D A610		WASHER: 556473; 89799		ea	1										
P-D A611	5835-926-0195	HEAD, SOUND RECORDER: OL-3; 89799		ea	1							4	3		
X2-D A612		CLAMP: 556475; 89799		ea	1										
M-D A613		LABEL: 556476; 89799		ea	1										
P-D A615	5325-249-6370	GROMMET: SAME AS A463		ea	4										
X2-D A616		SCREW: AN565AC4HZ; 96906		ea	2										
P-D A618	5910-940-8098	CAPACITOR, FIXED, CERAMIC: 556505; 00656		ea	2							5	2		
X2-D A620	5305-639-8315	SCREW: MS35233-11; 96906		ea	4										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A622		SCREW: SAME AS A550		ea	1										
X2-D A623		LOCK WASHER: 556382-4; 89799		ea	1										
X2-D A624		SCREW: 556504; 89799		ea	4										
X2-D A625		LUG: 556382-5; 71785		ea	1										
X2-D A626		MODULE ASSEMBLY: 556477; 89799		ea	1										
P-D A627	5820-939-7221	DASH BOARD ASSEMBLY: SM-D-556478; 89799		ea	1							4	3		
X2-D A628		BOARD: 556479; 89799		ea	1										
X2-D A629		PRINTED CIRCUIT BOARD: 556480; 89799		ea	1										
X2-D A631		BOARD: 556482; 89799		ea	1										
X2-D A632		PRINTED CIRCUIT BOARD: 556483; 89799		ea	1										
X2-D A635		BRACKET ASSEMBLY: 556484-2; 89799		ea	2										
X2-D A636		BRACKET: 556485-1; 89799		ea	2										
X2-D A637		NUT: 22NCMA126; 72962		ea	4										
X2-D A638		BRACKET ASSEMBLY: 556484-1; 89799		ea	1										
X2-D A639		BRACKET: 556485-2; 89799		ea	1										
X2-D A640		CHOKE: 556486; 93713		ea	2										L2
X2-D A641		TRANSFORMER: 556487; 18510		ea	1										T1
X2-D A642		TRANSISTOR: 2N1377; 09725		ea	1										Q11
X2-D A643		DIODE: USN 1N3287W; 96906		ea	1										CR9
X2-D A644	5960-833-2016	DIODE: USN 1N816; 96906		ea	2										CR6, CR16
X2-D A645		SC SWITCH: 556489-1; 11911		ea	1										SCR-10
X2-D A646		SC SWITCH: 556489-2; 11911		ea	4										SCR-3, SCR-4, SCR-7, SCR-8
X2-D A647		TRANSISTOR: 2N207; 46859		ea	4										Q5, Q6
X2-D A648		CAPACITOR: CS12AD680M; 96906		ea	2										C5, C6
X2-D A649	5910-855-7626	CAPACITOR: CS12AFR47K; 96906		ea	1										C12
X2-D A650		CAPACITOR: CS12AD2R7K; 96906		ea	1										C9
X2-D A651		CAPACITOR: CS12AFR68M; 96906		ea	2										C7, C8
X2-D A652		CAPACITOR: CS12AFR22M; 96906		ea	1										C11
X2-D A653		DIODE: 556491; 09725		ea	3										CR7, CR8, CR10

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A654		RESISTOR: BB1025; 01121		ea	1										R39
X2-D A655		RESISTOR: RN55G5111F; 96906		ea	1										R26
X2-D A656		RESISTOR: RN55G3010F; 96906		ea	1										R25
X2-D A660		RESISTOR: BB5115; 01121		ea	1										R38
X2-D A661		TRANSISTOR: 2N799; 07933		ea	1										Q9
X2-D A662		RESISTOR: BB5125; 01121		ea	2										R18, R41
X2-D A663		RESISTOR: BB2425; 01121		ea	1										R33
X2-D A664		RESISTOR: BB1105; 01121		ea	1										R30
X2-D A665		RESISTOR: BB1005; 01121		ea	1										R32
X2-D A666		RESISTOR: BB4725; 01121		ea	2										R19, R31
X2-D A667		RESISTOR: BB2225; 01121		ea	1										R20
X2-D A668		RESISTOR: BB2035; 01121		ea	1										R21
X2-D A669		RESISTOR: BB2025; 01121		ea	1										R24
X2-D A670		RESISTOR: BB2415; 01121		ea	1										R40
X2-D A671		RESISTOR: BB1045; 01121		ea	1										R28
X2-D A672		RESISTOR: BB7515; 01121		ea	1										R37
X2-D A673		RESISTOR: BB1615; 01121		ea	1										R29
P-D A674	5820-942-0487	DOT BOARD ASSEMBLY: SM-D-556493; 89799		ea	1							4	3		
X2-D A675		BOARD ASSEMBLY: 556494; 89799		ea	1										
X2-D A676		PRINTED CIRCUIT BOARD: 556495; 89799		ea	1										
X2-D A678		BOARD ASSEMBLY: 556496; 89799		ea	1										
X2-D A679		PRINTED CIRCUIT BOARD: 556497; 89799		ea	1										
M-D A685		BRACKET ASSEMBLY: 556498; 89799		ea	1										
M-D A686		BRACKET: 556499; 89799		ea	1										
X2-D A687		RESISTOR: SAME AS A656		ea	1										R12
X2-D A688		RESISTOR: SAME AS A655		ea	2										R7, R42
X2-D A689		CHOKE: SAME AS A640		ea	1										L1
X2-D A690		RESISTOR, VARIABLE: 556500; 75042		ea	1										R43

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A691	5961-615-0195	DIODE: 651C4; 09725		ea	3										CR13, CR14, CR15
X2-D A692		CAPACITOR: SAME AS A648		ea	1										C1
X2-D A693	5961-819-1611	TRANSISTOR: 2N494; 96906		ea	1										Q12
X2-D A694		SC SWITCH: SAME AS A646		ea	2										
X2-D A695		TRANSISTOR: SAME AS A661		ea	1										Q13
X2-D A699		RESISTOR: BB1035; 01121		ea	1										R17
X2-D A700		RESISTOR: SAME AS A671		ea	1										R9
X2-D A701		RESISTOR: BB8205; 01121		ea	1										R44
X2-D A702		RESISTOR: SAME AS A654		ea	1										R34
X2-D A703		RESISTOR: SAME AS A667		ea	1										R3
X2-D A704		RESISTOR: SAME AS A673		ea	1										R10
X2-D A705		RESISTOR: SAME AS A664		ea	1										R13
X2-D A706		RESISTOR: SAME AS A662		ea	1										R1
X2-D A707		RESISTOR: SAME AS A666		ea	2										R2, R14
X2-D A708		RESISTOR: SAME AS A668		ea	1										R11
X2-D A709		RESISTOR: BB2735; 01121		ea	1										R16
X2-D A710		RESISTOR: SAME AS A669		ea	1										R5
X2-D A711		RESISTOR: BB3315; 01121		ea	1										R36
X2-D A712		CAPACITOR: SAME AS A650		ea	1										C10
X2-D A713		CAPACITOR: SAME AS A651		ea	2										C2, C3
X2-D A714	5910-883-1775	CAPACITOR: CS12AFR33K; 96906		ea	1										C13
X2-D A715	5910-080-8474	CAPACITOR: CS12AF010K; 96906		ea	1										C4
X2-D A716		CAPACITOR: MCS12F333M; 83125		ea	1										C16
X2-D A717	5960-826-0853	TRANSISTOR: SAME AS A647		ea	2										Q1, Q2
X2-D A718		DIODE: SAME AS A653		ea	6										CR1, CR2, CR4, CR5, CR11, CR17
X2-D A719		DIODE: SAME AS A643		ea	2										CR3, CR12
X2-D A720		RESISTOR: SAME AS A665		ea	1										R15
X2-D A721		TRANSISTOR: SAME AS A695		ea	1										Q14
X2-D A722		DIODE: SAME AS A643		ea	1										CR18

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
		GROUP 5 CODER MX-4495 (CO-3B)													
X2-D A725		CASE ASSEMBLY:		ea	1										
X2-D A726		CASE TOP: 556051; 89799		ea	1										
X2-D A727		CASE BOTTOM: 556052; 89799		ea	1										
X2-D A728		LATCH: 556053; 89799		ea	1										
X2-D A729		HINGE: 556054; 89799		ea	1										
X2-D A730		BUTTON: 556055; 89799		ea	1										
X2-D A731		SLEEVE: 556056; 89799		ea	1										
P-D A732	5325-249-6370	GROMMET: SAME AS A463		ea	7										
P-D A734	8135-941-5030	CASE LINER: 556057; 89799		ea	2							8	6		
X2-D A735		SHIELD ASSEMBLY: 556058; 89799		ea	1										
X2-D A736		INNER SHIELD: 556059; 89799		ea	1										
X2-D A737		SPACER: 556060; 89799		ea	2										
X2-D A738		LINER: 556061; 89799		ea	1										
X2-D A739		PLATE ASSEMBLY: 556062; 89799		ea	1										
M-D A740		PLATE: 556063; 89799		ea	1										
P-D A741	5820-942-0475	FEED MECHANISM ASSEMBLY: SM-C-556064; 89799		ea	1							4	3		
P-D A743	5820-942-0483	DETENT ASSEMBLY: 556065; 89799		ea	1							4	3		
X2-D A743		RATCHET ASSEMBLY: 556066; 89799		ea	1										
X2-D A744		BEARING: 556067; 89799		ea	1										
X2-D A745		RATCHET: 556068; 95139		ea	1										
X2-D A746		GEAR: 556069-1; 95139		ea	1										
X2-D A747		LEVER: 556070; 89799		ea	1										
X2-D A748		LEVER: 556071; 89799		ea	1										
X2-D A750		PAWL: 556073; 89799		ea	1										
X2-D A751		SPRING: 556074; 89799		ea	1										
X2-D A752		WASHER: 556075; 89799		ea	1										
X2-D A753		RETAINING RING: 5133-6-C; 79136		ea	4										
X2-D A754		RETAINING RING: 5131-15-C; 79136		ea	1										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6)(b) 21-50	(6)(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7)(b) 21-50	(7)(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10)(b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A755		FRAME: 556076; 89799		ea	1										
X2-D A756		SHAFT: 556507; 89799		ea	1										
X2-D A757		DETENT: 556077; 89799		ea	1										
X2-D A758		GEAR ASSEMBLY: 556078; 89799		ea	1										
X2-D A759		GEAR: 556069-2; 95139		ea	1										
X2-D A760		HUB: 556079; 89799		ea	1										
X2-D A761	5340-598-0922	RETAINING RING: 5133-9-C; 79136		ea	2										
X2-D A762	5305-579-3029	SCREW: SAME AS A313		ea	3										
P-D A763	5820-939-7217	STRIKING ASSEMBLY: 556080; 89799		ea	1							4	3		
P-D A764	5820-930-5889	GENERATOR: SM-C-556081; 84792		ea	1							4	3		
X2-D A765		POLE TOP: 556082; 84792		ea	1										
X2-D A766		POLE BOTTOM: SAME AS A287		ea	2										
X2-D A767		TONGUE: 55048; 89799		ea	1										
X2-D A768		COIL: 556085; 84792		ea	1										
X2-D A769		MAGNET: SAME AS A290		ea	2										
X2-D A770		SCREW: SAME AS A291		ea	2										
X2-D A771		PLATE: 556087; 89799		ea	1										
X2-D A772		PLATE: 556099; 89799		ea	1										
X2-D A773		STUD: 556089; 89799		ea	1										
X2-D A774		BUSHING ASSEMBLY: 556090; 89799		ea	1										
X2-D A775		LEVER: 556091; 89799		ea	1										
X2-D A776		LEVER: 556092; 89799		ea	1										
X2-D A777		STUD: SAME AS A225		ea	1										
X2-D A778		BUSHING: 556093; 89799		ea	1										
X2-D A779		RATCHET: 556094; 95139		ea	1										
X2-D A780		PAWL: SAME AS A750		ea	1										
X2-D A781		DETENT: 556095; 89799		ea	1										
X2-D A782		SCREW: MS35233-11; 96906		ea	2										
X2-D A783		SPRING: 556096; 89799		ea	1										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A784	5305-579-3029	SCREW: SAME AS A313		ea	1										
X2-D A785		SPRING: SAME AS A751		ea	1										
X2-D A786		RETAINING RING: SAME AS A753		ea	2										
X2-D A787	5340-598-0922	RETAINING RING: SAME AS A761		ea	1										
P-D A788	5820-942-0485	MOUNTING BLOCK ASSEMBLY: SM-C-556097; 89799		ea	1							4	3		
X2-D A789		BLOCK: 556098; 89799		ea	1										
X2-D A790		BEARING: 556099; 89799		ea	2										
X2-D A791		PIN: SAME AS A257		ea	2										
X2-D A792		STUD: 556101; 89799		ea	1										
X2-D A793		BUTTON ASSEMBLY: 556102; 89799		ea	1										
X2-D A794		LEVER ASSEMBLY: 556103; 89799		ea	1										
X2-D A795		FRAME ASSEMBLY: 556104; 89799		ea	1										
X2-D A796		FRAME: 556105; 89799		ea	1										
X2-D A797		STUD: 556106; 89799		ea	2										
X2-D A798		STEM: 556107-1; 89799		ea	1										
X2-D A799		STEM: 556107-2; 89799		ea	1										
X2-D A800		STEM: 556107-3; 89799		ea	1										
X2-D A801		TOP FRAME: 556108; 89799		ea	1										
X2-D A802		SPRING: 556109; 89799		ea	3										
X2-D A803		WASHER: 556110-1; 89799		ea	1										
X2-D A804		WASHER: 556110-2; 89799		ea	2										
P-D A805	5975-939-7485	BUTTON KEY: 556111-1; 89799		ea	2							8	6		
P-D A806	5975-941-5040	BUTTON KEY: SM-B-556111-2; 89799		ea	1							4	3		
X2-D A807		BUTTON PUSH: 556112; 89799		ea	2										
X2-D A808		WASHER: 556113; 89799		ea	3										
X2-D A809		BLOCK ASSEMBLY: SAME AS A298		ea	1										
X2-D A810		TERMINAL BLOCK: SAME AS A299		ea	1										
X2-D A811		TERMINAL: 556115-1; 89799		ea	3										
M-D A812		BRACKET: SAME AS A301		ea	1										

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION — REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
M-D A814		BAR: 556118; 89799		ea	1										
M-D A815		BAR: 556119; 89799		ea	1										
X2-D A816		STUD: 556120; 89799		ea	1										
M-D A817		BRACKET: 556121; 89799		ea	1										
P-D A818	3020-942-0387	GEAR ASSEMBLY: 556122; 89799		ea	1							4	3		
X2-D A819		GEAR: 556123-1; 95139		ea	1										
X2-D A820		SHAFT: 556124; 89799		ea	1										
X2-D A821	5305-579-3029	SCREW: SAME AS A313		ea	1										
P-D A822A	5930-941-5474	SWITCH ASSEMBLY: SM-C-556125-2; 89799		ea	1							4	3		
P-D A822M	5930-941-5473	SWITCH ASSEMBLY: SM-C-556125-1; 89799		ea	1							4	3		
P-D A823	5835-939-7501	TAPE HEAD: SAME AS A305		ea	1										
X2-D A824		PRESSURE PLATE: SAME AS A258		ea	1										
X2-D A825		SCREW: SAME AS A261		ea	3										
X2-D A826		STUD: 556128; 89799		ea	2										
X2-D A827		SPRING: 556129; 89799		ea	1										
X2-D A828		BEARING: 556130; 89799		ea	2										
X2-D A829		BAR: 556131; 89799		ea	1										
X2-D A830		SPRING: 556132-1; 89799		ea	1										
X2-D A831		SPRING: 556132-2; 89799		ea	1										
X2-D A832		GEAR: 556123-2; 95139		ea	1										
X2-D A833		SPACER: SAME AS A281		ea	2										
X2-D A834		GROOVE PIN: SAME AS A407		ea	1										
X2-D A835		SLEEVE: 556134; 89799		ea	3										
P-D A836	5325-249-6370	GROMMET: SAME AS A463		ea	3										
X2-D A837	5340-282-7127	RETAINING RING: MS16624-18; 96906		ea	1										
X2-D A838		SCREW: 556062-4; 89799		ea	2										
X2-D A839	5305-531-9520	SCREW: SAME AS A058		ea	3										
X2-D A840		SCREW: 556062-5; 89799		ea	2										
X2-D A841		SCREW: 556062-6; 89799		ea	2										

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE / INDEX NO.	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION: REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
X2-D A842		SCREW: MS35271-18; 96906		ea	2										
X2-D A843	5305-058-6833	SCREW: SAME AS A061		ea	2										
X2-D A846		SPRING: 556138; 89799		ea	1										
X2-D A847		STOP: 556139; 89799		ea	1										
P-D A848	5961-170-4430	DIODE: SAME AS A296		ea	1										
P-D A849	5905-686-3798	RESISTOR: SAME AS A297		ea	1										
X2-D A850		SCREW: 556049-1; 89799		ea	2										
X2-D A851		SCREW: 556140; 89799		ea	4										
X2-D A852		SPACER: 556141; 89799		ea	1										
M-D A853		LABEL: 556142; 89799		ea	1										

SECTION III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO INDEX NUMBER

FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.
5305-058-5833	A061	5340-921-0598	A183	5835-939-7470	A169
5305-531-9520	A058	5820-056-6856	A001	5835-939-7501	A305
5305-543-4440	A350	5820-920-5429	A471	5835-952-0117	A476
5305-550-5002	A060	5820-920-5430	A470	5835-999-7313	A173
5305-576-5793	A059	5820-930-5889	A764	5905-249-4195	A042
5305-576-7493	A096	5820-930-5890	A285	5905-279-1890	A041
5305-579-3029	A313	5820-939-7216	A013	5905-686-3798	A297
5305-639-8315	A620	5820-939-7217	A763	5905-926-0384	A035
5310-058-2949	A062	5820-939-7218	A420	5905-941-3536	A043
5310-058-2950	A142	5820-939-7219	A324	5910-080-8474	A715
5310-262-3620	A064	5820-939-7220	A485	5910-683-3734	A047
5310-271-4640	A243	5820-939-7221	A627	5910-688-2822	A045
5310-595-6211	A101	5820-939-7296	A267	5910-807-9139	A046
5315-291-5471	A203	5820-939-7297	A255	5910-825-1637	A044
5315-598-7286	A428	5820-939-7298	A248	5910-855-7626	A649
5315-823-8745	A429	5820-939-7299	A221	5940-883-1775	A714
5325-249-6370	A463	5820-939-7300	A121	5910-940-8098	A618
5325-263-6650	A054	5820-939-7301	A137	5930-926-2934	A294
5325-939-7358	A068	5820-940-8134	A163	5930-926-2935	A295
5325-939-7456	A069	5820-940-8135	A184	5930-939-7322	A575
5330-248-3835	A111	5820-940-8136	A319	5930-941-5473	A822M
5330-923-4278	A109	5820-942-0133	A022	5930-941-5474	A822A
5330-923-4280	A106	5820-942-0134	A278	5935-058-6404	A085
5330-937-9691	A320	5820-942-0358	A270	5935-259-3278	A095
5330-945-3879	A067	5820-942-0426	A411	5935-259-6794	A079
5340-200-2637	A352	5820-942-0433	A582	5935-284-3948	A579
5340-263-5877	A509	5820-942-0475	A741	5935-632-3198	A072
5340-282-7127	A837	5820-942-0485	A788	5935-755-8568	A086
5340-543-4091	A107	5820-942-0487	A674	5935-999-9594	A073
5340-571-2569	A117	5820-999-1847	A116	5950-926-0746	A048
5340-598-0922	A761	5820-999-9567	A545	5950-940-8107	A049
5340-598-1138	A192	5835-926-0195	A611	5960-272-8545	A039
5340-725-0969	A194	5835-939-2136	A181	5960-553-7091	A040
5340-753-3868	A204	5835-939-7468	A592	5960-833-2016	A644
5340-816-4239	A136	5835-939-7469	A185	5961-027-5247	A053

SECTION III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO INDEX NUMBER (CONTINUED)

FEDERAL STOCK NUMBER	INDEX NO.
5961-061-8172	A037
5961-088-2571	A034
5961-170-4430	A296
5961-572-4526	A050
5961-615-0195	A691
5961-813-5736	A038
5961-814-4251	A052
5961-819-1611	A693
5961-894-0684	A051
5975-939-7485	A805
5999-941-5080	A030
6115-926-0828	A289
7440-947-1694	A205
7920-920-7154	A108
8135-941-5030	A734

REF NO.	INDEX NO.
AN515UB2-2	A581
AN-515UB8-12	A291
AN565AC2H5	A409
AN565AC4H2	A616
AN565DC2H3	A404
AN565DC4H2	A076
AN565DC6H2	A261
BB1005	A665
BB1025	A654
BB1035	A699
BB1045	A671
BB1105	A664
BB1615	A673
BB2025	A669
BB2035	A668
BB2225	A667
BB2415	A670
BB2425	A663
BB2735	A709

REF NUMBER	INDEX NO.
BB3315	A711
BB4725	A666
BB5115	A660
BB5125	A662
BB7515	A672
BB8205	A701
CS12AD2R7K	A650
CS12AD680M	A648
CS12AFR22M	A652
CS12AFR68M	A651
C005LGF520SJ0323	A078
C007LGF720SJ0360	A071
GP-2-031X-187-50	A312
GP2-046X250-50	A407
GP2-046X375-50	A347
GP2-062X250-2	A406
GP4-062X250-50	A311
MCS 12F333M	A716
MS16535-32	A019
MS16535-88	A025
MS16632-4012	A568
MS16633-4009	A156
MS171437	A591
MS35231-14	A095
MS35233-11	A782
MS35233-45	A057
MS-35245-56	A056
MS35271-18	A842
MS35274-4	A075
MS35275-1	A550
MS35275-4	A244
MS35275-9	A351
MS35275-13	A273
MS35275-18	A260
MS35337-79	A063
MS35649-44	A105

REF NUMBER	INDEX NO.
MS35649-85	A065
MS51923-147	A266
RN55G3010F	A656
RN55G5111F	A655
SM-B-556253	A274
S055-187-FHH	A496
S-156-312-FHH	A147
S-187-312-FHH	A328
S2C-5	A277
USN 1N 3287W	A643
V1007	A066
WC5/16-4-128	A094
2N1377	A642
2N207	A647
2N799	A661
22NCMA126	A637
2614-2-556306-2	A364
3105M-13500-3	A036
5131-15-C	A754
5133-4-4	A538
5133-6-C	A753
556007	A004
556007-1	A112
556007-2	A113
556008	A005
556011	A006
556011-2	A097
556011-3	A098
556011-4	A099
556011-5	A100
556011-6	A102
556011-10	A104
556012	A007
556013	A008
556014	A009
556015	A010

REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.
556016	A011	556060	A737	556096	A783
556017	A012	556061	A738	556098	A789
556018-1	A033	556062	A739	556099	A790
556020	A015	556062-4	A383	556100	A257
556021	A016	556062-5	A840	556101	A792
556021-1	A018	556062-6	A841	556102	A793
556022-1	A017	556063	A740	556103	A794
556022-2	A020	556066	A743	556104	A795
556023-1	A024	556067	A744	556105	A796
556023-2	A026	556068	A745	556106	A797
556023-3	A027	556069-1	A746	556107-1	A798
556024	A023	556069-2	A759	556107-2	A799
556025	A021	556070	A747	556107-3	A800
556027	A031	556071	A748	556108	A801
556028	A032	556072	A225	556109	A802
556035-1	A070	556073	A750	556110-1	A803
556035-2	A077	556074	A751	556110-2	A804
556038-1	A084	556075	A752	556112	A807
556038-2	A089	556076	A755	556113	A808
556039	A087	556077	A757	556114	A298
556044	A110	556078	A758	556115-1	A811
556046	A114	556079	A760	556116	A299
556046-1	A118	556082	A765	556117	A301
556047	A115	556083	A287	556118	A814
556048	A767	556085	A768	556119	A815
556049-1	A850	556086	A290	556120	A816
556050	A725	556087	A771	556121	A817
556051	A726	556088	A772	556123-1	A819
556052	A727	556089	A773	556123-2	A832
556053	A728	556090	A774	556124	A820
556054	A729	556091	A775	556127	A258
556055	A730	556092	A776	556128	A826
556056	A731 A461	556093	A778	556129	A827
556058	A735	556094	A779	556130	A828
556059	A736	556095	A781	556131	A829

SECTION III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO INDEX NUMBER (CONTINUED)

FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.
556132-1	A830	556166-3	A149	556206	A210
556132-2	A831	556166-4	A144	556207-1	A473
556133	A281	556167	A145	556208-1	A453
556134	A835	556168	A146	556208-2	A456
556138	A846	556169	A148	556209	A214
556139	A847	556170	A150	556209-3	A316
556140	A851	556171	A152	556210	A215
556141	A852	556172	A153	556211	A216
556142	A853	556173	A159	556212	A217
556140	A472	556174	A160	556214	A219
556144	A120	556176	A164	556216	A222
556144-2	A196	556177-1	A165	556217	A223
556146	A122	556177-2	A179	556218	A224
556147	A123	556178	A166	556219	A226
556148	A124	556179	A167	556220	A227
556149	A125	556181-1	A180	556221	A229
556150	A126	556181-2	A170	556222	A230
556151	A127	556181-3	A174	556223	A231
556152	A128	556182	A171	556224	A232
556153	A129	556184	A176	556225	A233
556154	A130	556185	A177	556226	A234
556155	A131	556187	A182	556227	A235
556156	A132	556191	A186	556228	A236
556157	A133	556192	A187	556229	A237
556158	A134	556192-1	A189	556230	A238
556159	A135	556193	A188	556231	A239
556160-2	A151	556195	A191	556232	A240
556160-3	A155	556196	A195	556233	A241
556161	A138	556197	A198	556234	A247
556162	A139	556198	A199	556236	A249
556163	A140	556199	A200	556237	A250
556164	A141	556200	A201	556238	A251
556165	A143	556201	A202	556239	A252
556166-1	A161	556204	A207	556240	A253
556166-2	A158	556205	A208	556241	A254

SECTION III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO INDEX NUMBER (CONTINUED)

REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.
556243	A256	556280	A326	556313	A373
556244	A259	556281	A327	556314	A375
556245	A262	556282	A329	556315	A376
556245-1	A265	556283	A330	556316-1	A377
556246	A263	556284	A331	556316-2	A378
556247	A264	556285	A332	556317-1	A380
556249	A268	556286	A333	556317-2	A379
556250	A269	556287	A334	556318	A381
556252	A271	556288	A336	556319	A383
556254	A275	556289	A337	556320	A384
556255	A276	556290	A338	556321	A386
556257	A279	556291	A339	556322-1	A387
556258-1	A280	556292	A340	556322-2	A388
556258-2	A536	556293	A341	556323	A389
556258-3	A502	556294	A342	556324-1	A390
556258-4	A527	556295	A343	556324-2	A391
556258-5	A526	556296	A344	556325-1	A392
556258-6	A531	556297	A345	556325-2	A393
556258-7	A520	556298	A346	556326	A394
556259	A282	556299	A348	556327-1	A395
556260	A283	556300	A349	556327-2	A396
556261	A284	556301	A353	556328	A397
556264	A286	556302	A354	556329	A398
556265	A288	556303	A355	556330	A399
556267	A303	556304	A356	556331	A400
556268	A304	556305-1	A358	556333	A412
556269	A306	556305-2	A363	556334	A413
556270	A307	556306-1	A359	556335	A414
556271	A308	556307	A360	556336	A415
556272	A309	556308	A361	556337	A416
556273	A310	556309-1	A367	556338	A417
556274	A318	556309-2	A368	556339	A418
556278-1	A405	556310	A370	556341	A421
556278-4	A408	556311	A371	556342	A422
556279	A325	556312	A372	556343	A423

SECTION III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO INDEX NUMBER (CONTINUED)

REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.
556344	A425	556381	A479	556413	A522
556345	A426	556382-4	A623	556414	A524
556346	A427	556382-5	A625	556415	A525
556347	A430	556383-4	A541	556416	A528
556348	A431	556383-5	A544	556417	A529
556349	A432	556384	A486	556418	A532
556350	A433	556384-2	A495	556419	A534
556351	A434	556385	A487	556420	A535
556352	A435	556386	A488	556421	A537
556353	A436	556387	A489	556422	A542
556354	A438	556388	A490	556423	A543
556355	A439	556389	A491	556425	A546
556356	A442	556390	A493	556426	A547
556357	A443	556391	A494	556427	A548
556358	A444	556392	A497	556428	A549
556359	A445	556393	A498	556429	A551
556360	A446	556394	A499	556430	A552
556361	A449	556395	A500	556431	A553
556362	A450	556396	A501	556432	A554
556363	A451	556397	A504	556433	A555
556364	A452	556398	A505	556434	A556
556365	A457	556399	A506	556435	A558
556366	A458	556400	A507	556436	A559
556367	A459	556401	A508	556437	A560
556368	A460	556402	A510	556438	A561
556369	A462	556403	A511	556439	A562
556370	A465	556404	A512	556440	A563
556371	A466	556405	A513	556441	A564
556372	A467	556406	A514	556442	A565
556373	A468	556407	A515	556443	A566
556376	A474	556408	A516	556444	A567
556377	A475	556409	A517	556445	A569
556378-3	482	556410	A518	556446	A570
556379	A477	556411	A519	556447	A571
556380	A478	556412	A521	556448	A572

SECTION III. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO INDEX NUMBER (CONTINUED)

REF NUMBER	INDEX NO.	REF NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.
556449	A574	556489-1	A645		
556451	A576	556489-2	A646		
556452	A577	556491	A653		
556453	A578	556494	A675		
556455	A583	556495	A676		
556456	A584	556496	A678		
556457	A585	556497	A679		
556458	A586	556498	A685		
556459	A587	556499	A686		
556460	A588	556500	A690		
556461	A589	556504	A624		
556462	A590	556507	A756		
556464	A593				
556465	A598				
556466	A599				
556467	A602				
556468	A603				
556469	A604				
556470	A607				
556471	A608				
556472	A609				
556473	A610				
556475	A612				
556476	A613				
556477	A626				
556479	A628				
556480	A629				
556482	A631				
556483	A632				
556484-1	A638				
556484-2	A635				
556485-1	A636				
556485-2	A639				
556486	A640				
556487	A641				

SECTION IV. INDEX-REFERENCE DESIGNATION CROSS REFERENCE TO INDEX NUMBER

REFERENCE DESIGNATION	INDEX NO.
C1	A692
C2, C3	A713
C4	A715
C5, C6	A648
C7, C8	A651
C9	A650
C10	A712
C11	A652
C12	A649
C13	A714
C16	A716
CR1, CR2	A718
CR3	A719
CR4, CR5	A718
CR6	A644
CR7, CR8	A653
CR9	A643
CR10	A653
CR11	A718
CR12	A719
CR13, CR14, CR15	A691
CR16	A644
CR17	A718
CR18	A722
L1	A689
L2	A640
Q1, Q2	A717
Q5, Q6	A647
Q9	A661
Q11	A642
Q12	A693
Q13	A695
Q14	A721
R1	A706
R2	A707
R3	A703
R5	A710
R7	A688
R9	A700
R10	A704
R11	A708
R12	A687
R13	A705
R14	A707
R15	A720
R16	A709
R17	A699
R18	A662
R19	A666
R20	A667
R21	A668
R24	A669
R25	A656
R26	A655
R28	A671
R29	A673
R30	A664
R31	A666
R32	A665
R33	A663
R34	A702
R36	A711
R37	A672
R38	A660
R39	A654
R40	A670
R41	A662
R42	A688
R43	A690
R44	A701
SCR3, SCR4	A646
SCR7, SCR8	A646
SCR10	A645
T1	A641

INDEX

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General

Distribution:

Active Army:

USASA (2)
CNGB (1)
ACSC-E (2)
Dir of Trans (1)
CofEngrs (1)
TSG (1)
CofSptS (1)
USAARENBD (2)
USAAESWBD (5)
USACDC Agcy (1)
USAMC (5)
USCONARC (5)
ARADCOM (5)
ARADCOM Rgn (2)
OS Maj Comd (4)
LOGCOMD (2) except
1st Log Comd (10)
9th Log Comd (10)
USAMICOM (4)
USATECOM (2)
USASTRATCOM (4)
USAESC (70)
MDW (1)
Armies (2) except
Seventh USA (5)
Mil Intel Bn (4)
Corps (2)
1st Cav Div (5)
Inf Div (10)
Armor Div (10)
Airborne Div (9)
Inf Bde (2)
Armor Bde (4)
Mechanized Bde (2)
Airborne Bde (2)
Svc Colleges (2)
USASESS (20)
USAADS (2)
USAAMS (2)
USAARMS (5)
USAIS (10)
USAES (2)
USAINTS (3)
USATC Armor (2)
USATC Inf (2)
USASTC (2)
WRAMC (1)
Army Pic Cen (2)
USACDCEC (10)
USAJFKCENSPWAR (25)
Instl (2) except
Fort Gordon (10)
Fort Huachuca (10)
WSMR (5)
Fort Knox (12)
Army Dep (2) except
LBAD (14)
SAAD (30)
TOAD (14)
LEAD (7)
SHAD (3)
NAAD (5)
SVAD (5)
CHAD (3)
ATAD (10)
GENDEPS (2)
SIG Sec GENDEPS (5)
Sig Dep (12)
SigFLDMS (2)
TOPOCOM (1)
USAERDAA (2)
USAERDAW (13)
USACRREL (2)
MAAG (2)
USARMIS (2)
USMACV (50)
Units org under fol TOE:
(2 cys ea)
11-57
11-97
11-98
11-117
11-127
11-155
11-157
11-158
11-500 (AA-AC)
11-587
11-592
11-597
31-105
31-106
31-107

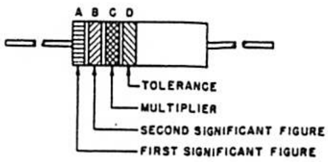
NG: State AG (3)

USAR: None

For explanation of abbreviations used, see AR 320-50.

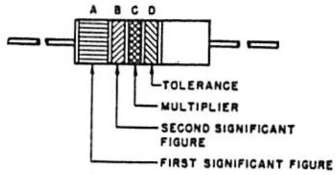
☆ U. S. GOVERNMENT PRINTING OFFICE: 1969—390921/44

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS



BAND A— Double Width Signifies Wire-wound Resistor

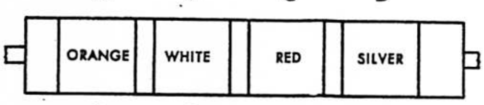
COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

BAND

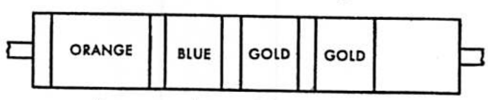
A B C D*



3 9 X100 ± 10%

BAND

A B C D*



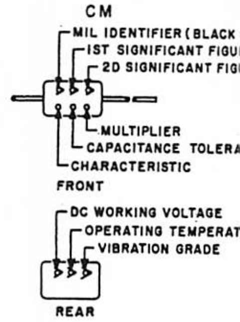
3 6 X0.1 ± 5%

NOMINAL RESISTANCE	3,900 Ohms	3.6 Ohms
RESISTANCE TOLERANCE	± 10 percent	± 5 percent

*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

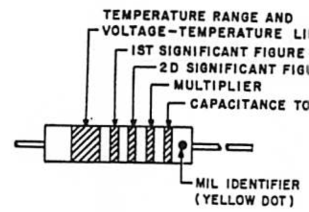
A COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

GROUP I Capacitors, Fixed,



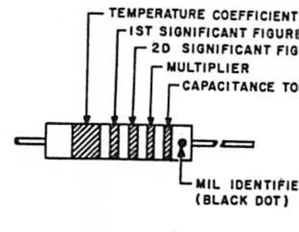
MICA-DIELECTRIC

GROUP II Capacitors, Fixed C



AXIAL LEAD

GROUP III Capacitors, Fixed, C



AXIAL LEAD

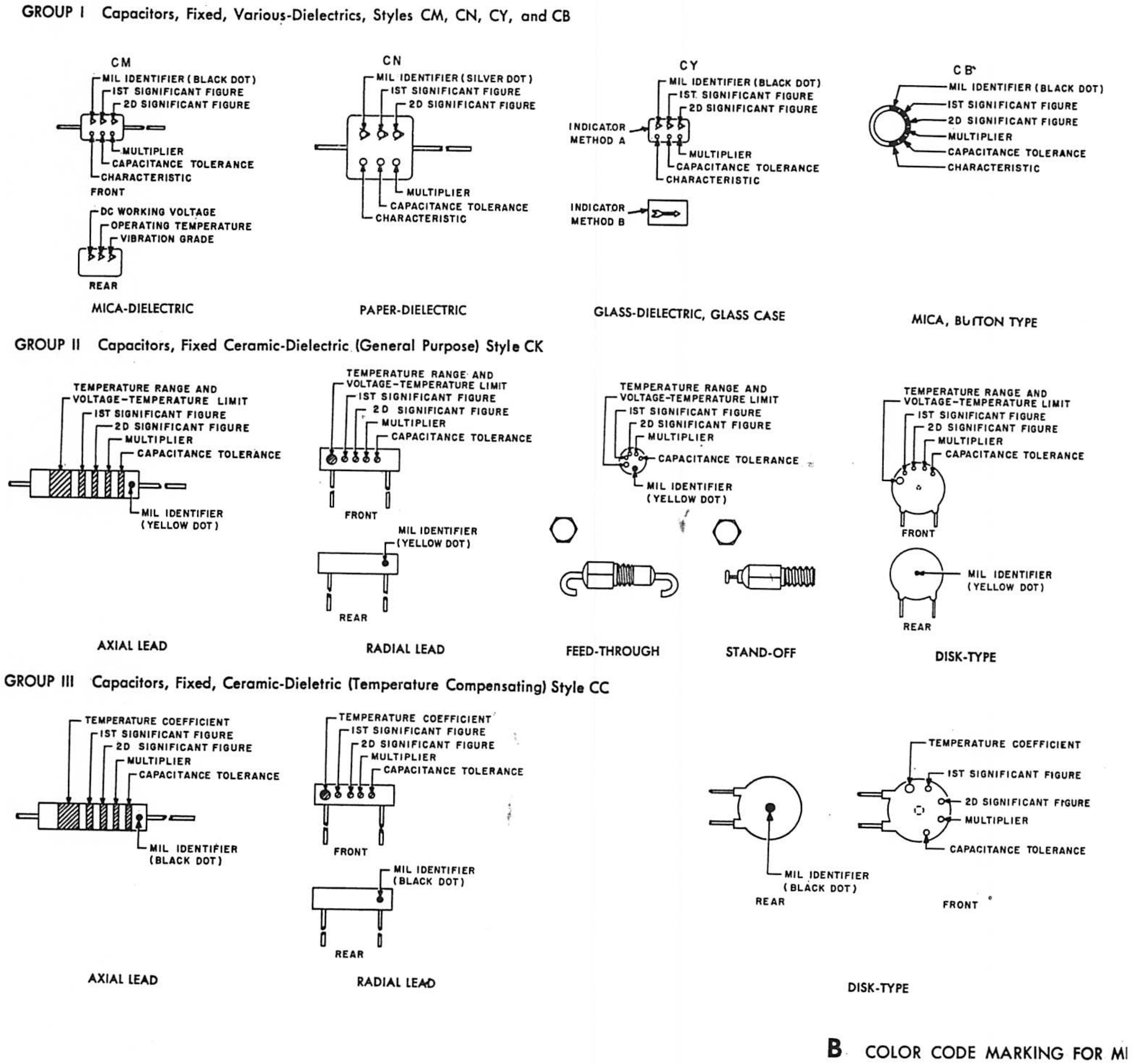


Figure 4–5. Color code marking for MIL-STD resistors, and color code marking for MIL-STD capacitors.

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				−55° to +70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			−55° to +85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					−55° to +125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											−55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

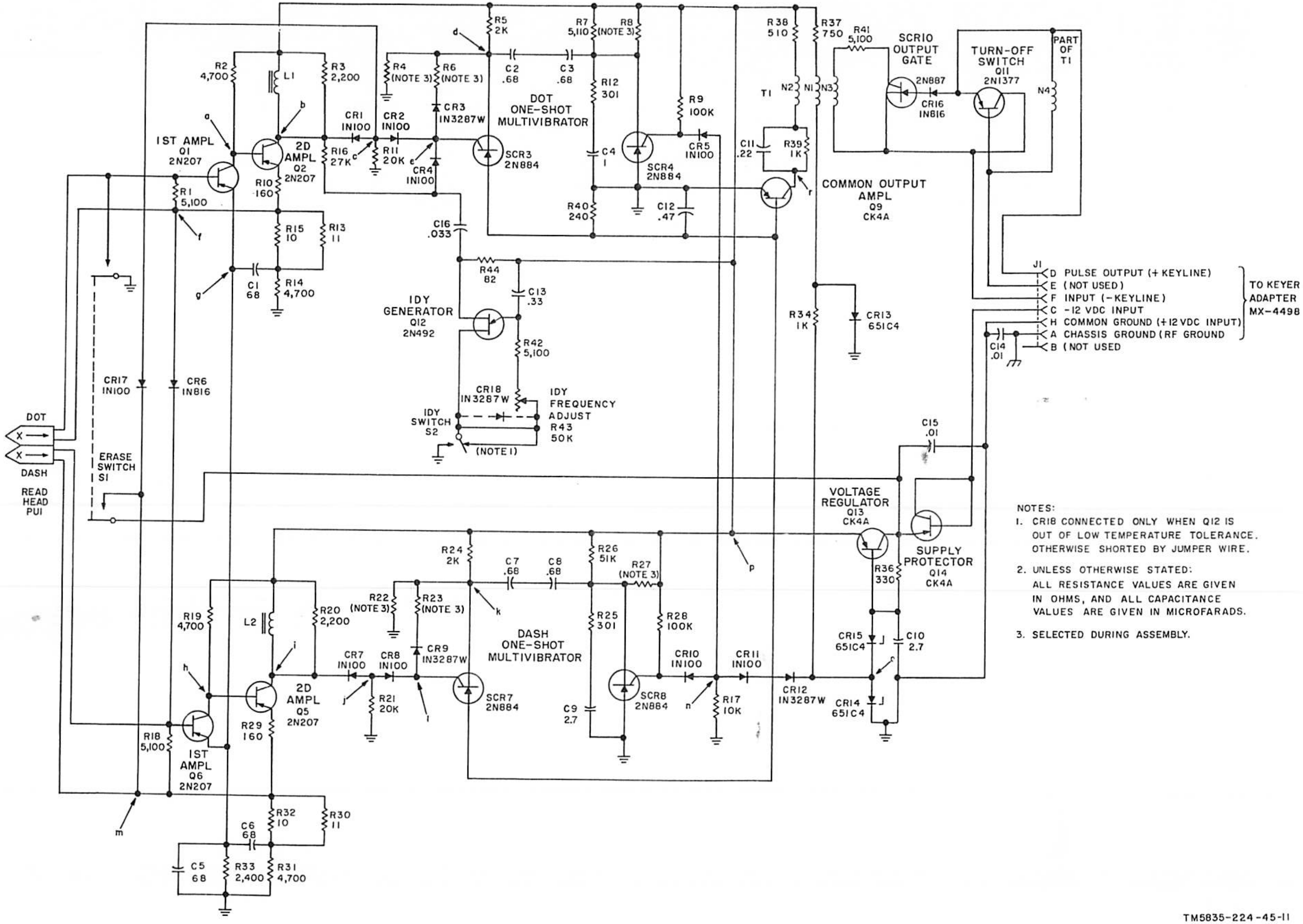
TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

R MILITARY STANDARD CAPACITORS

STD-CC



NOTES:

1. CR18 CONNECTED ONLY WHEN Q12 IS OUT OF LOW TEMPERATURE TOLERANCE. OTHERWISE SHORTED BY JUMPER WIRE.
2. UNLESS OTHERWISE STATED: ALL RESISTANCE VALUES ARE GIVEN IN OHMS, AND ALL CAPACITANCE VALUES ARE GIVEN IN MICROFARADS.
3. SELECTED DURING ASSEMBLY.

TM5835-224-45-11

Figure 4-6. KE-8B keyer, schematic diagram.