Section 4

MAINTENANCE
FOREWORD

This section is divided into six parts, designated A, B, C, D, E, and F. Page, paragraph, figure, and table numbering include the section number and part designation letter as a prefix; for example, the first page in part A is numbered 4A-1, the third page in part C is numbered 4C-3, etc.

Part A covers expansion or conversion of the original equipment. Subjects covered include repositioning the turntables for the large CCIR reels, converting from one tape width to another, adding optional accessory items such as the second tape scrape flutter idler and the rear covers for consoles, adding more channels, and converting from a reproduce-only to a record-reproduce equipment.

Part B explains routing maintenance, including cleaning, demagnetizing, lubricating, and overall performance checks of the equipment.

Part C is concerned with normal adjustment and alignment procedures which will usually suffice to correct any fault indicated by the overall performance checks. This includes both tape transport adjustments and electronic alignment.

Parts D, E, and F describe corrective maintenance procedures for the magnetic heads, tape transport, and electronic assemblies respectively.

Reference to the Table of Contents and to the Index should make it relatively easy to find any information included herein.

Section 4

MAINTENANCE
Part A. Conversion and Expansion

4A.1 REPOSITIONING TURNTABLES

The takeup and rewind assemblies, which include the turntables, are secured to the reel guards through slotted holes in the top plate. This allows those assemblies and guards to be moved toward or away from the center of the transport. As shipped from the factory, both assemblies are positioned as far as possible toward the center, allowing reels up to 10-1/2 inches in diameter to be used.

If it is desired to operate with the 11-1/2 inch CCIR reels, both turntables can be easily repositioned. At the back of the tape transport, loosen the three self-locking nuts (Item 77, Fig. 6-9) which secure each assembly to the reel guard. Slide both the takeup and rewind assemblies as far as possible away from the center of the transport. Check that the flat portion of the reel guards are parallel to the top edge of the transport, and that the turntables are centered in the guards, then tighten the nuts.

Note that when the turntables are positioned fully outward two or more transports cannot be mounted side-by-side on standard 19-inch racks, because the reels protrude over the edge of the racks.

4A.2 TAPE WIDTH CONVERSION

4A.2.1 General

Changing from 1/2-inch to 1/4-inch magnetic tape, and vice versa, is easily accomplished. As far as the tape transport proper is concerned, it is necessary only to rotate two tape guides in their mountings. The head assembly must be changed, and sometimes the head cable box assembly (which is located at the back of the transport) must be changed.

4A.2.2 Rotating Tape Guides

To rotate the tape guides, one on the reel idler assembly and the other on the takeup tension arm assembly, simply lift the guides against the spring pressure and turn them until the appropriate face of the guides (1/4-inch or 1/2-inch) is in the tape threading path. The guides snap down into position when properly aligned.

4A.2.3 Changing Head Assembly

First remove the stainless steel head housing overlay (cover) by loosening the captive screw on the slanted back surface of the head assembly. (Note that if this is a four position

head, the switching knob at the middle of the overlay must be unscrewed before the cover will come free.) Disconnect all head connectors (see Fig. 4A-1). Remove the two screws which secure the head assembly to the top plate, and (using care not to bump or scratch the scrape flutter idler) lift the complete head assembly up and off. If the head cable box assembly must be changed (refer to paragraph 4A.2.4) do that before replacing the heads.

Replace the assembly in the reverse order of its removal, first cleaning the mounting surfaces on both the tape transport and the head assembly of any dirt or dust. Also, be sure the head connectors are plugged into the correct receptacles as shown in Fig. 4A-1.

Catalog numbers of the various head assemblies are listed in the parts lists, Section 6.

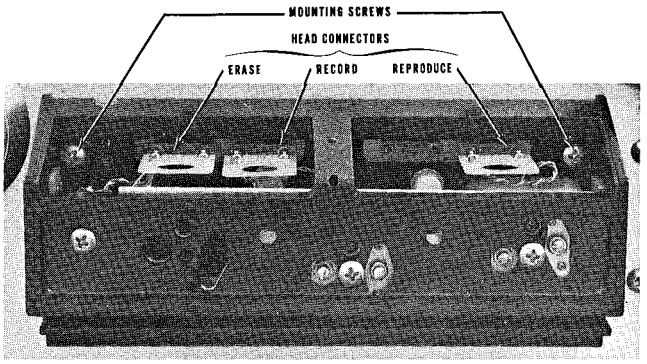

Fig. 4A—1. Head Assembly, Overlay Removed

4A.2.4 Changing Head Cable Box

Only under two conditions is it necessary to change the head cable box.

(a) If the equipment is being expanded to operate with more channels than originally planned. For example, if the recorder was ordered as a one or two channel, 1/4-inch tape, machine and is being converted to three or four channels using 1/2-inch tape. Note that the box need not be changed when converting from three or four channels, 1/2-inch tape, to one or two channels, 1/4-inch tape, except as noted in (b).

(b) If the conversion is to 1/4-inch tape using the special four stack head assembly. If the equipment is then re-converted to operate with 1/2-inch tape, the box must again be changed.

To change the head cable box, first remove the head assembly (refer to paragraph 4A.2.3). (Note that if the head cable box is being removed for inspection, it is not necessary to remove the head assembly; simply remove the head overlay and disconnect the heads from the receptacles.) Disconnect all head cables from the receptacles at the back of the electronic assemblies. Manually support the head cable box at the back of the transport, and remove the two screws (see Fig. 4A-2) located immediately behind the head assembly. This frees the box and it can be removed. Replacement is in the reverse order of removal.

Catalog numbers of various configurations of the head cable boxes are included in the parts lists, Section 6.

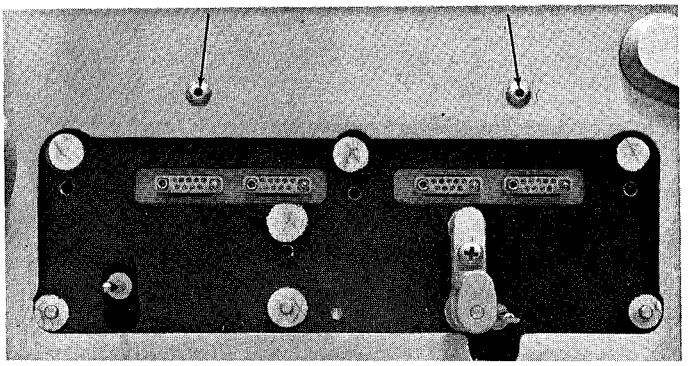

Fig. 4A—2. Mounting Screws, Head Cable Box

4A.3 ADDING SCRAPE FLUTTER IDLER

Standard equipment is furnished with one tape scrape flutter idler mounted on the top plate so that it is between positions 3 and 4 of the head assembly. Facilities are provided for mounting a second such idler, which can be ordered as an optional accessory.

The optional tape scrape flutter idler kit is available under Catalog No. 4010069. This kit contains the idler, a mounting screw, and a lock washer.

NOTE

When two idlers are employed, the rollers are of different diameters, to minimize any rotational interaction. The idler with

the small roller (3/8 inch) must be mounted so that it is between head positions 3 and 4. The idler with the large roller (15/32 inch) must be mounted so that it is between head positions 2 and 3.

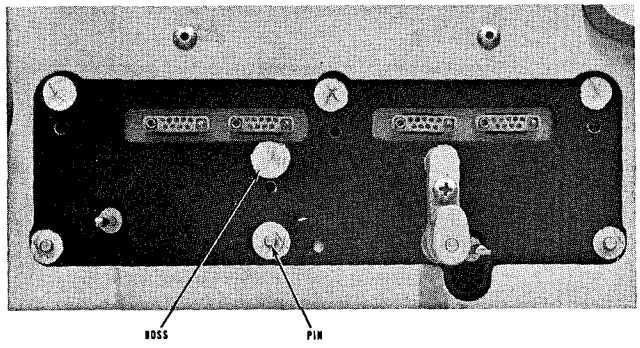

Fig. 4A—3. Mounting , Tape Scrape Flutter Idler

To install the optional idler, remove the head assembly (refer to paragraph 4A.2.3). A locating pin, threaded hole, and raised boss are located as shown in Fig. 4A-3. Place the idler in position on the locating pin and boss, and secure it to the top plate using the screw and washer (see Fig. 4A-4). Replace the head assembly.

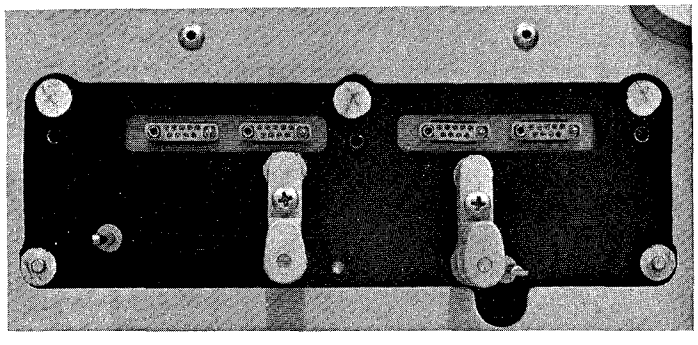

Fig. 4A—4. Scrape Flutter Idler Installed

4A.4 ADDING CHANNELS

4A.4.1 General

It is comparatively simple to add channels to an existing system. Any such expansion of course requires changing the head assembly (refer to paragraph 4A.2.3) and the head cable box (refer to paragraph 4A.2.4). It is then necessary to add one electronic assembly, and an equalizer for each additional channel required. (The electronic assembly includes the plug-in record, reproduce and bias amplifier printed circuit boards). The equipment will operate with any number of channels up to four.

4A.4.2 Record/Reproduce Electronics

In addition to the electronic assemblies and equalizers, one electronic interconnecting cable (Catalog No. 4050442) is required for each channel to be added. Optional accessory plug-in input units (balanced line transformer, microphone preamplifier, etc., as described in Section 1) may be desired. Other items required to mount the electronics are described in following paragraphs.

For mounting in racks, or in custom consoles, secure the electronic assemblies in position adjacent to the existing assemblies. Mounting dimensions are shown in Section 2, Installation.

Portable cases for the electronic assemblies come in two sizes. One (Catalog No. 4150330) will accommodate two assemblies, the other (Catalog No. 4150331) will accommodate four. In expanding a one or two channel portable system to three or four channels, a new case is therefore required. If it is desired to have all electronic assemblies in one case, order the 4150331 case. Two 4150330 cases may be used for three or four channel portable systems; these would be stacked one on top of the other while operating. Note that for one channel or three channel equipment, a blank panel (Catalog No. 4290620) is available for the unused space. Each electronic assembly is secured in the case by two 12-24 x 3/4 oval head Phillips screws, together with white nylon cup washers.

Mounting additional electronic assemblies in an Ampex console requires adding two electronics supports (Catalog No. 4260404) for each such assembly. First remove the top cover over the existing electronics, and the uppermost existing electronics assembly. The new supports then are bolted to the existing supports (one on each side per channel) by two 6-32 x 5/8 pan head screws, two flat washers, two lock washers, and a 6-32 hex nut (see Fig. 4A-5). When the supports are secured in position, replace the top cover and mount the electronic assemblies. Each assembly

is secured to the supports by two 12-24 x 3/4 oval head Phillips screws, together with two white nylon cup washers.

Fig. 4A—5. Installing Electronics Supports, Console

NOTE

If the console is equipped with the optional accessory rear covers (refer to paragraph 4A.5) individual covers (Catalog No. 4040984) should be ordered for each additional electronic assembly.

Connecting the electronic assemblies to the tape transport, to the heads, and to the input/output lines is explained in Section 2, Installation.

4A.4.3 Reproduce-only Electronics

When ordering reproduce-only electronics to be added to an existing system, order the equalizer printed circuit board in addition to the reproduce-only module (the module includes the reproduce printed circuit board). Catalog numbers of the equalizers and the module are included in the parts lists, Section 6.

The reproduce-only electronic tray will hold up to four modules, so it makes no difference in the installation of additional modules if the system is rack-mounted or console mounted. To install the module, remove the plug-in reproduce board from the chassis. Remove the front cover of the electronic tray, slide the chassis into position in the tray, and secure it with three No. 6 self-tapping screws (inserting the screws up through the bottom of the tray). Plug the equalizer in the receptacle at the front of the reproduce board, then slide the reproduce board in the guides on the chassis until it mates with its receptacle.

Connecting the captive power cable, the reproduce head cable, and the output line, is explained in Section 2, Installation.

4A.5 REAR COVERS, CONSOLE

No rear covers are provided on standard console-mounted equipment. If such covers are required, they are available as an optional accessory. Rear cover assembly, Catalog No. 4010076, consists of a rear cover for the console base, and one rear cover for each electronic position. The assembly is numbered 4010076-01 through -04, corresponding to one channel through four channels of electronics. Rear covers can be ordered separately; for the console base order Catalog No. 4040982, and for electronic assemblies Catalog No. 4040984.

The rear covers are secured to the uprights through captive, spring-loaded, thumb screws which mate with threaded holes in the uprights.

4A.6 CONVERSION, RECORD AND REPRODUCE

Converting from a reproduce-only to a record/reproduce equipment (or vice versa) can be easily accomplished. Such conversion consists of changing the printed circuit board in the electronics power supply (record/reproduce equipment uses a card with both a power supply and a master bias oscillator, the bias oscillator is omitted on

the reproduce-only card), changing the head assembly and head cable box, and adding the applicable electronic assemblies.

The power supply printed circuit board simply plugs into a receptacle in the electronic power supply box on the back of the transport. Changing the head assembly and head cable box is described in paragraphs 4A.2.3 and 4A.2.4. Adding electronic assemblies is described in paragraph 4A.4.

Catalog numbers for the power supply boards, all head and head cable box assemblies, and the electronics assemblies are included in the parts lists in Section 6.

Section 4

MAINTENANCE
Part B. Routine Maintenance

4B.1 CLEANING

Heads, and all other components in the tape threading path, must be cleaned after each eight hour operating period, or oftener if visual inspection indicates the need. This is to remove the oxide from the magnetic tape, which will be deposited on such components and which will affect equipment performance if allowed to build up.

CAUTION

When cleaning the heads, use only the recommended solvent (some solvents will damage the heads). Do not allow the solvent to drip or spray on plastic finishes or on the tire of the capstan idler. Do not use any metal tools which might scratch the heads.

Clean the heads by moistening a cotton-tipped applicator with Ampex Head Cleaner, Catalog Nos. 4010823 or 087-007. Clean each head thoroughly.

Use iso-propyl alcohol to clean all tape guiding elements, the capstan, and the capstan idler. Do not use the head cleaning solution on these components, it will damage the rubber tire on the capstan idler and cause tape slippage if applied to the capstan.

Clean the scrape flutter idler(s) using a dry cotton-tipped applicator. Be sure to remove all oxide from the holder assemblies at the top and bottom of the roller.

4B.2 DEMAGNETIZING

Heads and other components in the tape threading path occasionally acquire a degree of permanent magnetization which can result in increased noise and distortion, and the partial erasure of high frequencies on recorded tapes. Demagnetize after each eight hour operating period, or oftener if there is any suspicion that demagnetization is required, using an Ampex Head Demagnetizer (Catalog No. 4010820) or equivalent.

Step 1: Turn equipment power off, and remove any tape that is on or near the transport (tape would be partially erased by the action of the demagnetizer).

Step 2: Cover the tips of the demagnetizer with pressure sensitive tape to prevent scratching the heads, and plug the demagnetizer into a source of 110-120 volt a-c power.

Step 3: Bring the tips of the demagnetizer into very light contact with the head, posi-

tioned so the tips straddle the gap in the center of the head.

Step 4: With a slow, smooth motion, run the tips up and down the stack several times. Then slowly withdraw the demagnetizer (slow withdrawal is required for effective demagnetization).

Step 5: Repeat Steps 3 and 4 at all head stacks, at the tape guides on the reel idler and takeup tension arm, and at the scrape flutter idlers.

Step 6: Withdraw the demagnetizer at least three feet from the recorder before unplugging it from the power source.

4B.3 LUBRICATING

4B.3.1 General

Bearings in the capstan drive motor, the capstan idler, and the scrape flutter idler, are the only components requiring lubrication.

Ampex Lubricating Oil (Catalog Nos. 4010825 or 087-579) should be used for the drive motor and capstan idler. Equivalent oils are available from Esso Standard Oil Co. (Teresso No. 47) and Socony Mobil Oil Co. (Mobiloil DTE Medium).

Special equipment and oil are required for the scrape flutter idler(s). These are described in paragraph 4B.3.4

4B.3.2 Initial Lubrication, Drive Motor

When the equipment is first received, or if a replacement capstan drive motor is installed, it is possible that some time has elapsed since the motor was operated. If this is the case, the motor bearing might be dry--even though there is oil in the reservoir. Running the motor under this condition may result in damage to the bearing before the oil in the reservoir can reach it. Initial lubrication before operation is therefore required.

Using a knife blade, or some similar tool, gently pry the cone shaped dust cap (Item 11 or 12, Fig. 6-8) from the top plate. Removal of the dust cap exposes a portion of the bearing end ball on the motor. While manually rotating the capstan, apply four or five drops of oil around the base of the capstan shaft (where it enters the motor).

When the oil has worked down around the shaft, hold the takeup tension arm away from its rest position, using a piece of pressure sensitive tape. Apply power to the equipment, and allow the drive motor to operate for approximately 15 minutes. Wipe off any excess oil and replace the dust cap.

4B.3.3 Scheduled Lubrication, Drive Motor and Capstan Idler

Scheduled lubrication of the drive motor and capstan idler is required every three months or after each 1,000 hour operating period, whichever occurs first.

To lubricate the drive motor, pry off the capstan dust cap the same as for initial lubrication (paragraph 4B.3.2). Some motors have an oil hole in the bearing end bell, accessible when the dust cap is removed; fill the oil reservoir through that hole. Other motors, which do not have an oil hole, are lubricated by applying 10 drops of oil around the base of the capstan shaft (do not overlubricate); passages are provided for the oil to reach the bearing. Wipe off any excess oil, and replace the dust cap.

Lubricating the capstan idler bearing requires prying off the dust cap from the idler hub. This exposes a felt washer. Place not more than three drops of oil on this washer. Do not overlubricate.

CAUTION

If oil is spilled or thrown on the rubber tire of the idler, clean it immediately using iso-propyl alcohol. Oil will cause deterioration of the tire.

4B.3.4 Scheduled Lubrication, Scrape Flutter Idler

Ultrasonic cleaning and lubrication of scrape flutter idlers is required after each 2,000 hour operating period, or once a year, whichever occurs first. It is recommended that this be accomplished by a local jeweler or watchmaker, most of whom have the ultrasonic cleaner and special jewel oil required.

To remove the complete scrape flutter idler assembly, first remove the head assembly (refer to paragraph 4A.2.3). The idler assembly is secured to the top plate by one screw and lock washer. Remove the screw and lift the idler off the locating pin. Save the screw and lock washer.

Have the jeweler or watchmaker remove the two jewel holders and the roller, by loosening the two set screws (Item 6, Fig. 6-7) at the front of the assembly and sliding the holders (Item 1, Fig. 6-7) out of the yoke (Item 4, Fig. 6-7). The two holders and the roller are then to be cleaned ultrasonically.

NOTE

If the ultrasonic cleaning does not remove all traces of oxide from the shafts of the roller, polish them with jeweler's rouge, or some similar substance, until all oxide is removed. If such polishing is required, re-clean the roller ultrasonically before assembly.

After the ultrasonic cleaning, the jewel bearings in the holders are to be lubricated. Use one drop of jewel oil (or Ampex precision instrument oil No. 087-239), administered with a No. 21 gauge hypodermic needle, on each bearing.

Great care must be taken during reassembly. Scribe marks are used both to identify the upper and lower jewel holders and to indicate correct positioning. The upper holder is scribed on the top circular surface, the lower holder on the periphery. The scribe marks are to be aligned with the centerline of the set screws as shown in Fig. 6-7. Clearance and endplay of the roller must be as noted on Fig. 6-7.

If the recorder is equipped with two scrape flutter idlers (a second one can be ordered as an optional accessory, see paragraph 4A.3) the rollers will be of different diameters---the smaller 3/8 inch, the larger 15/32 inch. This configuration is required to minimize rotational interaction between the two idlers, which could cause increased flutter. The idlers must be mounted in the correct positions on the transport, as explained in paragraph 4A.3.

4B.4 CHECKING OVERALL PERFORMANCE

4B.4.1 General

These checks should be performed at regularly scheduled intervals to determine if tape transport adjustment or electronic alignment is required. Adjustment and alignment procedures are described in part C of this section, paragraphs 4C.2, 4C.3, and 4C.4.

Wherever the use of blank tape is mentioned in the explanation of the performance checks, it is permissible to use tape that is recorded with material that is not necessary to save. Such material will be erased during the recording portion of the procedure.

NOTE

Always bulk-erase tape that was prerecorded on equipment employing a different head configuration than the recorder being checked. It is possible that the prerecorded material would not be completely erased during the record process, and cross talk might then cause false indications.

Checking the performance of reproduce-only equipment is explained at the start of each descriptions of overall checking procedures.

4B.4.2 Test Equipment Required

Signal Generator, Hewlett Packard Model 200C or equivalent.
Vacuum Tube Voltmeter, AC, Hewlett Packard Model 400D or equivalent.
Wave analyzer (if available).
Flutter Meter, Mincom (Bahr) Model B8100 or equivalent.
Ampex Standard Flutter Test Tapes, as applicable: (1/4-inch)

15 ips:	No. 01-31316-01
7 1/2 ips:	No. 01-31326-01
3 3/4 ips:	No. 01-31336-01 (flutter tapes for 1/2-inch equipment available on special order.)

Noise Filter (see Fig. 4B-1) or
ASA "A" Curve Filter (see Fig. 4B-2)

4B.4.3 Test Conditions

LINE TERMINATION switch on back of electronics assemblies in ON position to terminate equipment.

Dummy plug in INPUT ACCESS socket (not accessory transformer or preamp).

Heads cleaned and demagnetized.

Top and bottom covers installed on electronic assemblies.

Magnetic tape of low noise type (MMM No. 201 or equivalent).

4B.4.4 Overall Frequency Response Check

4B.4.4.1 General

The frequency response of a reproduce only equipment can be checked by recording the tape, as described, on a properly adjusted recorder with the same head track configuration as the reproducer. If such a recorder is unavailable, make the check with a standard tape (steps 2 through 9, paragraph 4C.3.7) bearing in mind the low frequency limitations noted for this such procedure.

4B.4.4.2 Normal Checkout

The procedure which follows will give a precise indication of overall frequency response using external meters. An operational check, accurate to approximately ±1 db when using the equipment vu meters, is described in paragraph 4B.4.4.3.

Step 1: Apply power and thread blank tape on the equipment. Select the desired tape speed, and position the REEL switches in accordance with the size of reel hubs used.

Step 2: Connect the signal generator to the INPUT receptacle. Set it to 500 Hz at a nominal 1 volt rms level.

Step 3: Connect the vtvm to the OUTPUT receptacle.

Step 4: Place the OUTPUT SELECTOR switch in the INPUT position, and adjust the RECORD LEVEL control to achieve the vtvm indication shown in Table 4B-1. (The level is dependent on tape speed and on whether the equipment is strapped for a +8 dbm or +4 dbm operating level output.)

OUTPUT STRAPPING	TAPE SPEED	VTVM INDICATION
+8 dbm	15 ips	0 dbm
	7-1/2 ips	-10 dbm
	3-3/4 ips	-10 dbm
+4 dbm	15 ips	-4 dbm
	7-1/2 ips	-14 dbm
	3-3/4 ips	-14 dbm

Table 4B—1. Record Level, Frequency Response Check

Step 5: Place the tape in motion, with the channel under test operating in the record mode.

Step 6: Place the OUTPUT SELECTOR switch in the REPRO position, and adjust the REPRODUCE LEVEL control to achieve the same output level quoted in Table 4B-1. While thus simultaneously recording and reproducing, change the frequency of the signal generator in discrete steps, noting the response as indicated on the vtvm. This response should be within specifications throughout the frequency range for the tape speed involved (refer to Specifications, Section 1).

Step 7: If this is two channel equipment with an additional quarter track head, select the quarter track head and repeat Step 6, noting the frequency response.

Step 8: Select the second tape speed, and repeat Steps 4, 5, and 6. Repeat Step 7 if applicable.

Step 9: Repeat the entire procedure for all other channels.

Any of the following listed causes can result in the response not meeting specifications:

a. Heads need cleaning or demagnetizing (refer to paragraphs 4B.1 and 4B.2).

b. Head azimuths incorrectly adjusted (refer to paragraphs 4C.3.6 and 4C.3.8).

c. Bias level incorrectly adjusted (refer to paragraph 4C.3.7).

d. Reproduce equalization incorrectly adjusted (refer to paragraphs 4C.3.7 and 4C.3.9).

e. Record calibration incorrectly adjusted (refer to paragraph 4C.3.7).

f. Record equalization incorrectly adjusted (refer to paragraph 4C.3.10).

g. Tape tensions incorrectly adjusted (refer to paragraph 4C.2.3).

h. Signal generator output not flat.

4B.4.4.3 Response Check, Operational

An operational check of overall frequency response, accurate to approximately ±1 db, can be made using an Ampex Standard Alignment Test Tape, a signal generator, and the equipment vu meters. On multichannel equipment the check can be made simultaneously on all channels, because the test tapes are recorded full track and the signal generator can be connected in parallel to all INPUT connectors. Catalog numbers of the test tapes are included in Table 4C-8.

Step 1: Apply power and select tape

speed. Position the REEL switches in accordance with the size of the reel hubs being used.

Step 2: Thread the applicable standard alignment tape on the transport.

Step 3: Start the standard alignment tape in motion, and proceed to the level set tone on the tape. (At the 15 ips speed, all tones are recorded at normal level. At 3-3/4 and 7-1/2 ips, only the last tone on the tape is at standard operating level.)

Step 4: As the level set tone is reproduced, adjust the reproduce level control(s) to achieve a 0 indication on the equipment vu meter. Lock the control in that position.

Step 5: Remove the standard tape from the equipment, winding it back to its original reel as explained in paragraph 4C.3.1.

Step 6: Connect the signal generator to the INPUT connector(s), setting it to provide a nominal 1 volt rms output at 1,000 Hz (15 ips), 500 Hz (7-1/2 ips), or 250 Hz (3-3/4 ips).

Step 7: Thread blank tape on the equipment and start it in motion with the channel(s) under test operating in the record mode.

Step 8: Place the OUTPUT SELECTOR switch in the INPUT position and adjust the RECORD LEVEL control(s) to achieve a 0 indication on the vu meter(s).

Step 9: (Applicable for tape speeds of 3-3/4 ips and 7-1/2 ips. For 15 ips operation continue at Step 10.) While recording and reproducing, switch the OUTPUT SELECTOR back and forth between the INPUT and REPRO positions, backing off the RECORD LEVEL control and advancing the REPRODUCE LEVEL control. Continue this adjustment as far as is possible while still maintaining a vu meter indication of 0 reproduce level. It should be possible to reduce the record level to from -15 to -20 on the vu meter.

Step 10: Place the OUTPUT SELECTOR in the REPRO position, while still recording and reproducing. Change the frequency of the signal generator in discrete steps across the frequency band of the tape speed being used (refer to Overall Frequency Response specification, paragraph 1.7). Note the response as indicated on the vu meter.

4B.4.5 Overall Signal-to-Noise Check

Noise on reproduce-only equipment can be checked as explained after the steps for the overall check.

This check requires the use of either a noise filter which will attenuate noise frequencies that are outside of the audible range, or an ASA "A" curve filter. A schematic diagram of the noise filter is furnished in Fig. 4B-1, of the ASA filter in Fig. 4B-2.

Step 1: Apply power, and thread blank tape on the equipment. Select tape speed and position the REEL switches in accordance with the size of reel hubs being used.

Step 2: Connect the signal generator to the INPUT receptacle. Set it to 500 Hz at a nominal 1 volt rms level.

Step 3: Connect the noise filter or ASA filter to the OUTPUT receptacle, then connect the vtvm to the output of the filter.

Step 4: Place the OUTPUT SELECTOR switch in the INPUT position. Adjust the RECORD LEVEL control to achieve either a +14 dbm (output strapped for +8 dbm operating level output) or a +10 dbm (output strapped for a +4 dbm operating level output) indication on the vtvm.

Step 5: Place the tape in motion, with the channel under test operating in the record mode (be sure the head gate is closed). Record a section of tape with the 500 Hz signal (which is being recorded at peak level).

Step 6: Stop tape motion and rewind the tape to the beginning of the recording made in Step 5.

Step 7: Remove the signal generator from the INPUT receptacle. Place the OUTPUT SELECTOR switch in the REPRO position.

Step 8: Start the tape in motion, with the channel under test again operating in the record mode but with no input signal (be sure the head gate is closed). The noise level, while thus erasing the 500 Hz signal, will be indicated on the vtvm.

Step 9: Select the second tape speed, and repeat Steps 4 through 8.

Step 10: Repeat the entire procedure for all other channels.

Using the noise filter, the signal-to-noise ratio is computed from peak record level, which is 6 db higher than normal record level. If the equipment is strapped to provide a +8 dbm operating level output, the signal-to-noise ratio is therefore 14 db better than the vtvm indication in Step 8 (for example, if the vtvm indicates -46 dbm the signal-to-noise ratio is 60 db). Similarly, if the strapping is for a +4 dbm operating level output, the signal-to-noise is 10 db better than the vtvm indication.

When an "A" weighted curve noise measurement is being made, using the ASA filter, add either 10 db (+8 dbm output) or 6 db (+4 dbm output) to the vtvm indication.

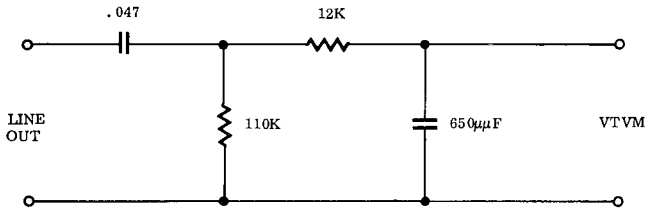

Fig. 4B—1. Noise Filter

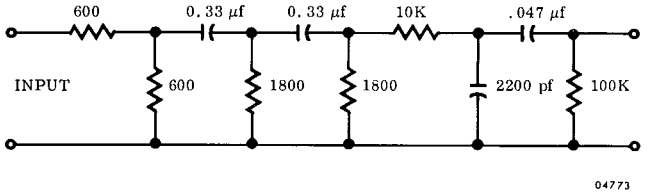

Fig. 4B—2. ASA "A" Curve Filter

If the signal-to-noise ratio does not meet the specifications quoted in Section 1, there are many possible causes, including the following:

a. Heads need cleaning or demagnetizing (refer to paragraphs 4B.1 and 4B.2).

b. Magnetic tape not as specified (refer to paragraph 4B.4.3).

c. External fields from nearby motors, generators, etc.

d. Making noise check with head gate open.

e. Erase current not peaked (refer to paragraph 4C.3.7).

f. Head cables rubbing against moving parts on transport.

g. Head azimuth incorrectly adjusted (refer to paragraphs 4C.3.6 and 4C.3.8).

h. Head height incorrectly adjusted (refer to paragraph 4D.2).

i. Tape wrap or head zenith incorrectly adjusted (refer to paragraph 4D.3).

j. Record or reproduce level incorrectly adjusted (refer to paragraph 4C.3.7).

To check reproduce noise, remove the tape from the equipment. Connect the vtvm, through the noise filter, to the OUTPUT receptacle. Use pressure sensitive tape, or a rubber band, to hold the takeup tension arm away from its rest position (so it does not contact the safety switch). Then press the PLAY pushbutton to put the equipment in the reproduce mode. Under these circumstances, the signal-to-noise should be as shown in Table 4B-2; note that the figures given are also computed from peak level, as explained in the overall check.

4B.4.6 Overall Distortion Check

An accurate check of distortion on this equipment requires the use of a wave analyzer, which measures individual distortion products. (An instrument that measures total harmonic distortion will be influenced by tape noise and modulation noise in addition to actual distortion.) Also, the signal generator which is used must have very low distortion (less than 0.1%) or addition and cancellation effects may occur.

To check distortion, record a 500 Hz signal, on blank tape, at normal operating level. When that signal is reproduced, the second harmonic content should not exceed 0.4%, and the third harmonic content should be between 0.6% and 1.1%.

TAPE SPEED	HEAD TYPE (1/4-inch tape)	REPRODUCE SIGNAL/NOISE
3-3/4 ips	Full Track	66 db
	Half Track	61 db
	Two Track	61 db
7-1/2 ips	Full Track	72 db
	Half Track	66 db
	Two Track	66 db
15 ips	Full Track	72 db
	Half Track	66 db
	Two Track	66 db

TAPE SPEED	HEAD TYPE (1/2-inch tape)	REPRODUCE SIGNAL/NOISE
7-1/2 ips	Three Track	66 db
	Four Track	66 db
15 ips	Three Track	66 db
	Four Track	66 db

Table 4B—2. Reproduce Signal/Noise from Peak Record Level

The most common cause of excessive second harmonic distortion is that the heads are magnetized. It could also result from a malfunctioning bias oscillator, bias amplifier, record amplifier, or reproduce amplifier. If second harmonic distortion is high, a slight adjustment of the erase adjust control (refer to paragraph 4C. 3.7) may result in improvement. However, do not try to adjust in this fashion so that the second harmonic distortion at the output is less than the distortion of the signal generator being used.

Third harmonic distortion is dependent on the type of magnetic tape that is employed, the bias setting, and the accuracy with which "normal operating level" is adjusted. A typical reel of tape will give a third harmonic distortion of 0.8% at operating level, but this might range as high as 1.1%.

Checking distortion on reproduce-only equipment requires that a properly adjusted recorder with the same head track configuration be available to record a tape.

4B.4.7 Flutter Check

This check requires the use of Ampex Standard Flutter Test Tapes (refer to paragraph 4B.4.2). These tapes are recorded on very precise equipment, and have an inherent flutter content of less than .03% rms--which for practical purposes can be ignored when making flutter measurements. Flutter test tapes are made for a specific tape speed, and can be used at only that speed (flutter meters accept only a 3,000 Hz signal). A discussion of the storage and handling of standard tapes is included under Electronic Alignment in paragraph 4C.3.1.

Measurement of flutter is the same for reproduce-only and record/reproduce equipment.

Flutter meters are sensitive to some extent to amplitude modulation, which can result from poor head-to-tape contact or from signal dropouts. Heads must therefore be cleaned and demagnetized before flutter measurements are started.

The procedure in checking flutter depends on the type of flutter meter being used, and the manufacturer's instructions should be followed. The procedure described is that used when the recommended meter (refer to paragraph 4B.4.2) is employed.

Step 1: Place the RECORD SELECTOR switches on all electronic assemblies in the SAFE position, to prevent accidentally entering the record mode and thus erasing the flutter test tape.

Step 2: Connect the OUTPUT connector to the EXT SIGNAL, SIGNAL INPUT connector on the flutter meter. On multi-channel equipment, any channel may be used for the flutter test, provided that the electronics are properly aligned.

Step 3: At the flutter meter, place the WEIGHTING control in the NAB UNWTD position, the DEMOD INPUT SELECT to the 100 MV to 5V, EXT position, the METER SELECT in the DEMOD position, and the FLUTTER control to the 0.1 or 0.3% FULL SCALE position (depending on tape speed).

Step 4: Apply power to the recorder and to the flutter meter.

Step 5: Thread the applicable flutter test tape on the tape transport, by placing the flutter test tape reel on the takeup turntable and rewinding to another reel on the supply turntable. Select tape speed in accordance with the test tape, and position the REEL switches for the size of the reel hub being used.

Step 6: Start the test tape in motion in the reproduce mode. The NORMAL indicator light on the flutter meter should illuminate. If not, there is either no reproduce output to the meter, or the DEMOD INPUT SELECT is incorrectly positioned.

Step 7: Read the flutter indication on the FLUTTER meter, if necessary repositioning the FLUTTER % FULL SCALE control. Flutter should meet the specification quoted in Section 1.

Step 8: When the measurement is completed, allow the flutter test tape to continue in motion in the reproduce mode until it is completely wound on the flutter test tape reel.

Excessive flutter can be caused by any component on the tape transport that affects the tape motion, and it is manifestly impossible to delineate all causes and remedies. However, such causes include the following:

a. Accumulations of oxide or dirt on components in the tape threading path.

b. Drive Motor: Not in synchronism (low line voltage); Excessive tape tension; defective motor capacitor; bearings defective or in need of lubrication; motor shaft bent.

c. Supply Motor: Excessive or erratic holdback tension; dragging brake; shaft bent.

d. Capstan Idler: Defective rubber tire; bearing defective or in need of lubrication;

capstan idler force incorrectly adjusted.

e. Reel Idler: Shaft bent; flywheel not balanced.

f. Head Assembly: Poor tape guiding.

g. Tape Scrape: Warped or damaged reels.

COMPONENT	ROTATIONAL RATE (Hz)		
	3-3/4 ips	7-1/2 ips	15 ips
Drive Motor (Capstan)	10	20 10	20
Capstan Idler	0.6	1.2	2.4
Reel Idler	0.8	1.6	3.2
Scrape Flutter Idler (Normal)	3.4	6.3	12.7
(Optional)	2.5	5.1	10.2

Table 4B—3. Rotational Rates

If a sound and vibration analyzer (such as a General Radio Type 1564-A) is available, flutter can be isolated to certain frequencies by connecting the analyzer to the output of the flutter meter. Comparing the results with the rotational rates shown in Table 4B-3 may then indicate the offending assembly.

Note that if the flutter is caused by components in the supply motor assembly, its frequency will vary -- being relatively low when the tape pack on the supply reel is large, and progressively increasing (with reel rotation) as the tape pack gets smaller. The takeup motor assembly seldom contributes appreciable flutter, because it is effectively isolated from the heads by the capstan and capstan idler; however, if it should do so, the flutter frequency would vary inversely with that of the supply motor, being relatively high with a small tape pack on the takeup reel and progressively decreasing as the pack grows larger.

A discussion on tape scrape flutter is included in Section 5, Principles of Operation, paragraph 5.1.8.

MAINTENANCE

Part C. Normal Adjustment and Alignment

4C.1 GENERAL

The overall performance checks for the equipment are described under Routine Maintenance, in part B of this section (paragraph 4B.4). If the recorder operates normally in all of the overall performance checks, there is no need to perform any of the adjustment or alignment procedures described herein.

Also, the procedures in this part of Section 4 apply only to readjustment or realignment of spring tensions, controls, etc. The removal or installation of assemblies, special positioning, or trouble shooting, are included in the Corrective Maintenance parts of this section (Part D. Heads; Part E. Tape Transport; and Part F. Electronic Assemblies). Transport Adjustment Procedures are described in 4C.2, Electronic Alignment Procedures in 4C.3, and Sel Sync Adjustments in 4C.4.

4C.2 TAPE TRANSPORT ADJUSTMENTS

4C.2.1 Test Equipment Required

Spring scales, 0-16 oz. and 0-10 lbs, Chatillon or equivalent.
Length of cord or twine, approximately 30 inches long, with small loop formed on one end.
Empty reel, NAB hub
Tools used by technician

4C.2.2 Measurements for Different Operating Conditions

At the factory, tape transports for one or two channel equipment are adjusted for use with 1/4-inch tape. Transports for three or four channel equipment, however, are adjusted for use with either 1/4-inch or 1/2-inch tape, so that the quick conversion feature can be realized. If only one tape width is to be employed, it may be advantageous to make adjustments for that tape only. In the following procedures, correct indications are therefore quoted for three conditions of operation:

a. For equipment which will be operated exclusively with 1/4-inch magnetic tape.

b. For equipment which will be operated exclusively with 1/2-inch magnetic tape.

c. For equipment which will be operated using the convertible feature, changed between 1/4-inch and 1/2-inch magnetic tape as required.

4C.2.3 Tape Tension

Tape tension is determined indirectly by measuring the rotational force supplied by the supply and takeup motors. Any required adjustments are made by positioning the sliders on resistors which are located beneath a cover on the back of the tape transport control box (see Fig. 4C-1). The resistors, and the adjustment they control, are listed in Table 4C-1.

RESISTOR	ADJUSTMENT FOR
R604	Supply reel holdback tension in play mode, large reel hubs.
R605	Takeup reel tension in play mode, large reel hubs.
R606	Takeup reel tension in play mode, small reel hubs.
R607	Holdback tension in fastwinding mode (supply reel in fast forward, takeup reel in rewind).
R608	Supply reel holdback tension in play mode, small reel hubs.

Table 4C—1. Tension Adjusting Resistors

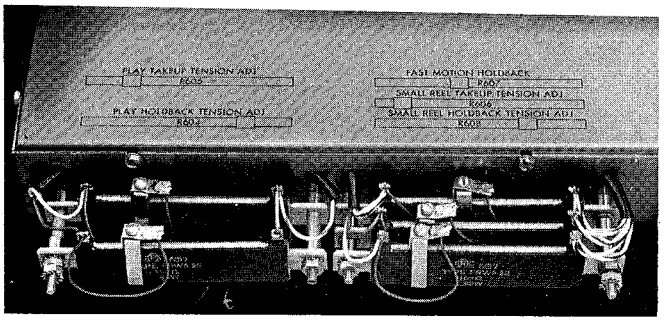

Fig. 4C—1. Tension Adjustment Points

Step 1: Apply power to the equipment. Place the REEL switches in the large reel hub positions.

NOTE

Either the high or low tape speed can be used for this procedure.

Step 2: Use pressure sensitive tape, or a rubber band, to hold the takeup tension arm away from its rest position (so it does not contact the safety switch).

Step 3: Place the empty NAB reel on the supply turntable. Wrap the cord or twine on the reel hub in a counterclockwise direction, leaving the loop at the free end of the cord.

Step 4: Insert the hook on the applicable spring scale (see Table 4C-2) in the loop on the cord. Hold the scale stationary and press the PLAY pushbutton.

Step 5: Still holding the scale stationary, tap lightly on the reel (to ensure a true reading) and note the scale indication. Correct indications are shown in Table 4C-2. Adjust R604 as required.

TYPE OF OPERATION	TENSION, LARGE HUB
1/4-inch tape only	5-6 oz.
1/2-inch tape only	8-11 oz.
1/4-inch & 1/2-inch tape	6-7 oz.

Table 4C—2. Tension, Large Reel Hub

Step 6: Continue to hold the scale stationary, and change the supply REEL switch to the small hub position. Tap on the reel and note the scale indication, which should be as shown in Table 4C-3. Adjust R608 as required (The small reel position is not used with 1/2-inch tape, so machines used only with that tape need not be checked.)

TYPE OF OPERATION	TENSION, SMALL HUB
1/4-inch tape only	2-1/2 - 3-1/2 oz.
1/4-inch & 1/2-inch tape	3 - 4 oz.

Table 4C—3. Tension, Small Reel Hub

Step 7: Return the supply REEL switch to the large reel position. Hold the scale stationary and press the FAST FWD pushbutton.

Step 8: Tap on the reel, and note the scale indication, which should be as shown in Table 4C-4.

NOTE

Resistor R607 must be adjusted so that both the supply reel holdback during fast forward and the takeup reel holdback during rewind are within tolerances.

TYPE OF OPERATION	TENSION
1/4-inch tape only	1/2 to 1 oz.
1/2-inch tape only	1 to 1-1/2 oz.
1/4-inch and 1/2-inch tape	1/2 to 1 oz.

Table 4C—4. Tension, Fast—Winding

Step 9: Press the STOP pushbutton, and change the empty NAB reel from the supply to the takeup turntable. Wind the cord or twine on the reel hub in a clockwise direction, leaving the loop at the free end of the cord.

Step 10: Repeat Steps 4 through 8 (at Step 7, press the REWIND pushbutton) with the reel on the takeup turntable. Scale indications should be the same as quoted for the supply turntable, as shown in Tables 4C-2, 4C-3, and 4C-4. Adjust the applicable resistors (R605, R606, and R607) as required.

4C.2.4 Brakes

There are two braking functions on each reel. The main brake system is used to stop reel rotation and maintain tape tension when the equipment is removed from an operating mode. The edit brake system is employed to partially release the brake bands, and thus reduce braking force, when the equipment is placed in the stop/edit mode.

A brake differential is necessary to maintain tape tension while stopping; the force at the main brakes is therefore different for each direction of reel rotation.

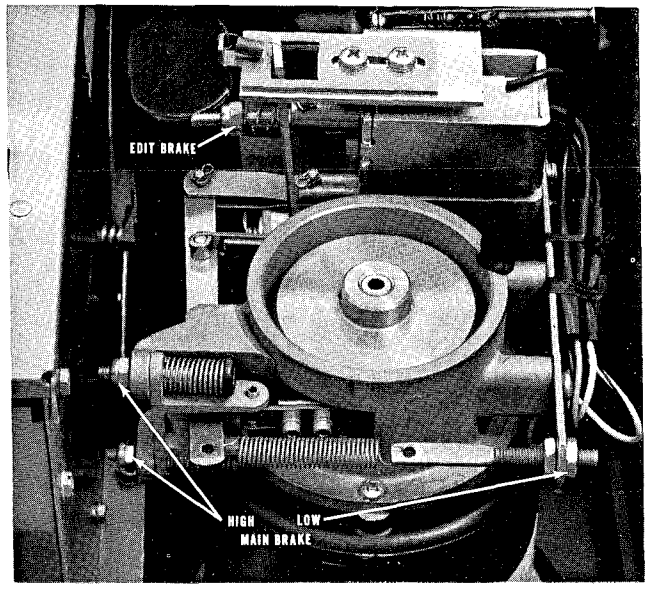

Fig. 4C—2. Brake Adjustment Points

Any required adjustments are made by tightening or loosening the nuts shown on Fig. 4C-2. In adjusting the high braking force for the main brakes, be sure to turn the two nuts an equal number of turns.

Step 1: Apply power to the equipment. Place the NAB reel on the supply turntable.

Step 2: Wrap the cord or twine on the reel hub in a counterclockwise direction, leaving the loop at the free end of the cord.

Step 3: Insert the hook on the applicable spring scale (see Table 4C-5) through the loop in the cord. Pull on the scale to make the reel rotate and note the scale indication when the reel is in slow, steady motion. This measures the high braking force of the main brake; correct indications are shown in Table 4C-5. Adjust the

	SUPPLY		TAKEUP	
TYPE OF OPERATION	CW	CCW	CW	CCW
1/4-inch tape only	4 to 5 oz.	15 to 17 oz.	15 to 17 oz.	4 to 5 oz.
1/2-inch tape only	5 to 6 oz.	16 to 21 oz.	16 to 21 oz.	5 to 6 oz.
1/4-inch & 1/2-inch tape	4 to 5 oz.	15 to 17 oz.	15 to 17 oz.	4 to 5 oz.

Table 4C—5. Braking Force, Main Brakes

high braking force as required, running the two nuts in to increase the force, or running them out to decrease the force.

NOTE

The initial force required to start reel rotation will be high. Do not take the reading until the reel is rotating slowly and steadily.

Step 4: Rewind the cord on the reel hub, still in a counterclockwise direction. Press the EDIT pushbutton to place the equipment in the stop/edit mode.

Step 5: Repeat Step 3. Minimum scale indications for the edit brakes are shown in Table 4C-6. Adjust as required; running the nut in will decrease force, running it out will increase the force. When properly adjusted there will be no differential action for directions of rotation. Press the STOP pushbutton when the measurement is completed.

NOTE

Edit brake force is not critical, and can be set to the force preferred by each operator. The minimum specified is to ensure sufficient force to hold the takeup tension arm from contacting the safety switch.

TYPE OF OPERATION	SUPPLY AND TAKEUP
1/4-inch tape only	2 oz. min.
1/2-inch tape only	2 oz. min.
1/4-inch and 1/2-inch tape	2 oz. min.

Table 4C—6. Braking Force, Edit Brakes

Step 6: Wind the cord on the reel hub in a clockwise direction. Measure the low braking force of the main brake in that direction of rotation (as explained in Step 3). Correct scale indications are shown in Table 4C-5. Adjust the low braking force as required, running the nut in to increase force, running it out to decrease force.

Step 7: Move the empty reel to the takeup turntable. Wind the cord on the hub in a clockwise direction. Measure and adjust the high braking force of the main brakes as explained in Step 3. Correct force is shown in Table 4C-5.

Step 8: Rewind the cord on the reel hub in a clockwise direction. Press the EDIT pushbutton. Measure and adjust the edit braking force as explained in Step 5. (see Table 4C-6). Press the STOP pushbutton when the measurement is completed.

Step 9: Wind the cord on the reel hub in a counterclockwise direction. Measure and adjust the low braking force of the main brake in that direction of reel rotation. The correct indication is shown on Table 4C-5.

4C.2.5 Capstan Idler

The force of the capstan idler against the capstan, during the reproduce and record modes, is determined by a pressure spring on the capstan solenoid. The force is adjusted by means of a lock nut on the capstan solenoid spade bolt (see Fig. 4C-3).

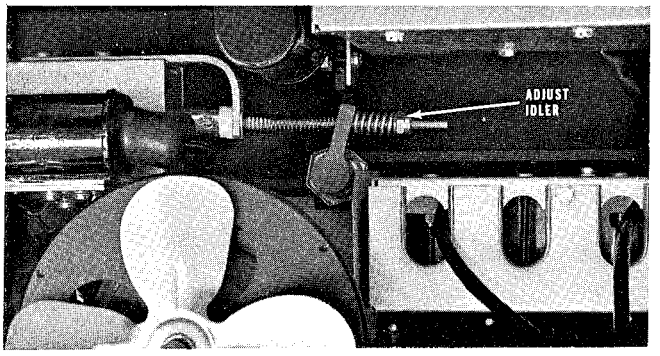

Fig. 4C—3. Capstan Idler Adjustment Point

As the temperature of the solenoid rises, its resistance will also rise. In areas where power line regulation is poor, it is advisable to allow an approximate 30 minute warm up period (with the equipment operating in the reproduce mode) before making any adjustment of the capstan idler force. At the factory, the solenoid is checked to be sure it will bottom at line voltages of 90 volts (cold) and 105 volts (hot).

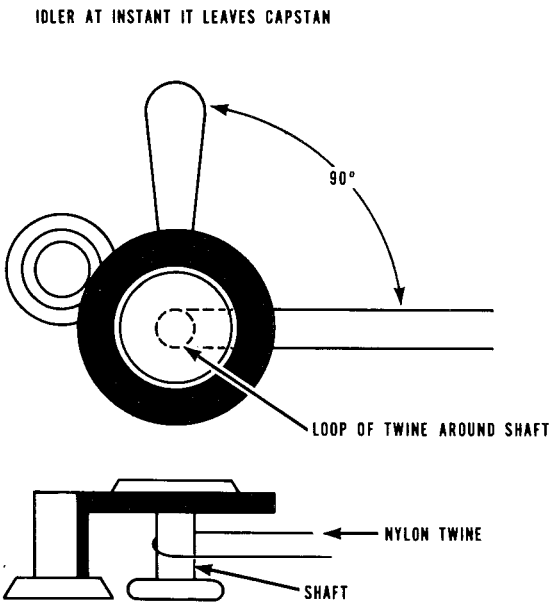

Fig. 4C—4. Measuring Force, Capstan Idler

Step 1: Apply power to the equipment. Use pressure sensitive tape or a rubber band to hold the takeup tension arm from its rest position (so it does not contact the safety switch).

Step 2: Tie the two ends of the cord together, so it forms a continuous loop. Place the loop over the capstan idler, positioning it on the capstan idler shaft between the idler and the arm (see Fig. 4C-4).

Step 3: Press the PLAY pushbutton. The idler will move to contact the capstan, and both will rotate.

Step 4: Insert the hook on the spring scale through the loop, and pull the cord taut at a 90° angle to the idler arm.

Step 5: Pull on the scale, noting the indication at the point where the idler barely loses contact with the capstan (the idler will stop rotating at that point). Correct indications are given on Table 4C-7.

TYPE OF OPERATION	INDICATION
1/4-inch tape only	5 to 6 lbs
1/2-inch tape only	5 to 6 lbs
1/4-inch and 1/2-inch tape	5 to 6 lbs

Table 4C—7. Capstan Idler Force

Step 6: After completing any required adjustment, check that the capstan idler solenoid will bottom in the reproduce mode. If not, the adjusting lock nut must be run out until bottoming is possible.

4C.2.6 Tape Lifter

The automatic tape lifter mechanism is controlled by a solenoid which is energized in either of the fast-winding modes. A spring provides coupling between the solenoid plunger and the tape lifter mechanism. When the solenoid is deenergized, there should be no slack between the solenoid plunger, the spring, and the tape lifter bracket. However, the spring should not be extended, and the tape lifter arms at the base of the posts should be 1/16-inch from the end of the slot. When the solenoid energizes, the tape lifter arms should move to a position 1/16-inch from the other end of the slot.

Any condition other than that described requires a complete adjustment of the tape lifter mechanism. This is considered a corrective maintenance procedure, which is covered in part E of this section, paragraph 4E.9.

4C.3 ELECTRONIC ALIGNMENT

4C.3.1 Standard Alignment Test Tapes

In the electronic alignment procedures, the reproduce function is adjusted to a standard while playing an Ampex Standard Alignment Test Tape. The record circuit is then adjusted to provide normal operation, using the reproduce circuit as a reference.

Standard test tapes are precisely recorded in an Ampex laboratory under stringently controlled conditions. They must be handled and stored with proper care if they are to retain their usefulness over extended periods of time. The following points should be given particular attention in this respect.

a. Clean and demagnetize the heads, and other components in the tape threading path, before installing a standard test tape.

b. Do not store the test tapes in areas where extremes in temperature or humidity are encountered.

c. Store the test tapes under the conditions existing after a normal play run--not after it is run in a fast-winding mode.

After extensive use, the standard tape will exhibit signs of deterioration. High frequen-

cy tones may be down as much as 2 db, and flutter indications may rise even though actual flutter remains unchanged. This impairment is caused by demagnetization of the recorded signal in repeated passes through the tape path; by physical deformation of the tape due to tape tension, changes in temperature and humidity, etc; and by increased dropouts resulting from tape wear.

When using a standard tape, thread it in the normal path from the supply to the takeup turntables. During the alignment procedures, use the rewind and fast forward modes as necessary. When alignment is completed, allow the tape to be completely wound on the takeup reel. Then change that reel to the supply turntable, and the standard tape reel to the takeup turntable. Thread the tape, place the equipment in the reproduce mode, and wind the tape back on its original reel while in that mode.

Note that all tones on 15 ips standard alignment tapes are recorded at operating level. On tapes for slower speeds, all tones except the last are recorded 10 db below operating level.

4C.3.2 Test Equipment Required

Voltmeter, dc, 20,000 ohms-per-volt.
Vacuum Tube Voltmeter, ac, Hewlett Packard Model 400D or equivalent.
Signal Generator, Hewlett Packard Model 200C or equivalent.
Noise Filter (see Fig. 4B-1) or
ASA "A" Curve Filter (see Fig. 4B-2).
Ampex Standard Alignment Tapes as applicable (see Table 4C-8).
Usual tools used by technician.

TAPE SPEED	TYPE OF EQUALIZATION	MAGNETIC TAPE	
		1/4-inch	1/2-inch
15 ips	NAB	01-31311-01	01-31311-05
	AME	01-31312-01	01-31312-05
	CCIR	01-31313-01	01-31313-05
7-1/2 ips	NAB	01-31321-01	01-31321-05
	CCIR	01-31323-01	01-31323-05
3-3/4 ips	120 micro sec	01-31331-01	----------
	200 micro sec	01-31334-01	----------

Table 4C—8. Catalog Numbers, Standard Alignment Tapes

4C.3.3 Test Conditions

LINE TERMINATION switch on back of electronics assemblies in ON position to terminate equipment.

Dummy plug in INPUT ACCESS socket (not accessory transformer or preamp).

Heads cleaned and demagnetized.

Covers installed on electronics.

Magnetic tape of low noise type (MMM No. 201 or equivalent).

4C.3.4 Introduction to Alignment Procedures

Procedures described in paragraphs 4C.3.5 through 4C.3.8 will usually suffice to correct any deficient operation revealed by the Overall Performance Checks (refer to part B, paragraph 4B.4). Other adjustments, which are seldom required, are included in paragraphs 4C.3.9 and 4C.3.10. Sel-Sync adjustments are described in paragraph 4C.4.

4C.3.5 Power Supply Adjustment

The electronics power supply, together with the bias and erase oscillator, is mounted on a plug-in printed circuit board which is located within the power supply box behind the tape transport. Proper operation of the supply can be checked by connecting the dc voltmeter across pins 9 (positive) and 5 of any of the four receptacles (J701 through J704) on the power supply box. With the equipment operating in the reproduce mode, the voltmeter should indicate 39 volts(-1/2 +1 volt).

If need for adjustment is indicated by the foregoing check, open the cover on the power supply box (see Fig. 4C-5).

WARNING

Full power line voltage is present within this box. Use special care not to touch the fuse post or transformer leads while making the following adjustments.

A variable resistor (R712) adjusts the regulated voltage output. With the voltmeter connected as previously described, place the equipment in the reproduce mode. Adjust R712 (see Fig. 4C-5) to achieve an indication of 39 volts (±1/2 volt).

4C.3.6 Reproduce Head Azimuth Adjustment

In adjusting head azimuth on record/reproduce equipment, the vu meters on each electronic assembly can be used to measure the output of each head simultaneously. This is particularly convenient for multi-channel equipment, because the simultaneous metering allows easy determination of the optimum setting. For reproduce-only machines, vtvm's must be connected to the output connector; either use as many vtvm's as there are head tracks, or use a trial and error method--adjusting first one head, then another and working back and forth to reach an optimum setting.

Standard alignment tapes for the 15 ips speed have all tones recorded at normal operating level, while standard tapes for slower speeds have all tones (except the last) recorded at 10 db

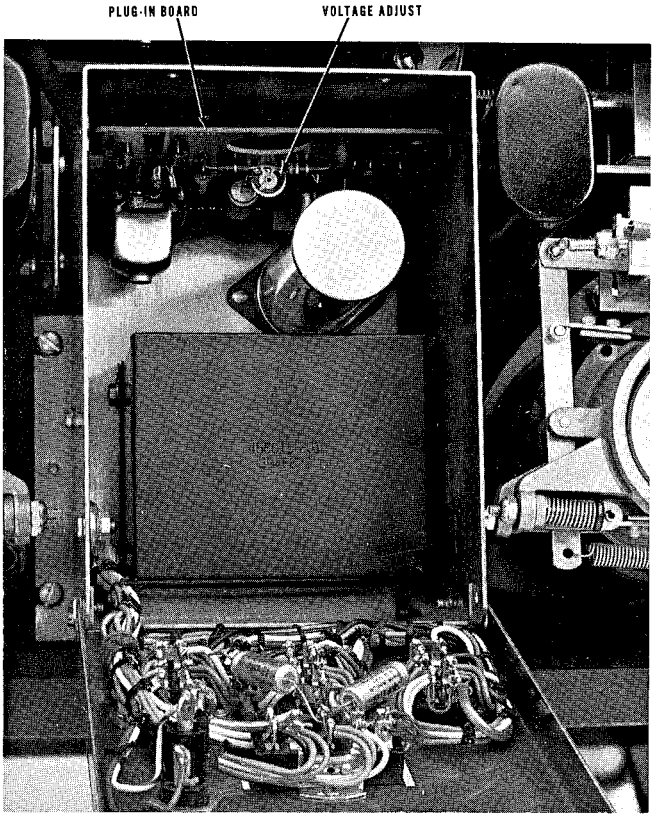

Fig. 4C—5. Power Supply Box, Opened

below operating level. If record/reproduce equipment provides a 15 ips speed, make the adjustment at normal operating level at that speed. If this is a 3-3/4 and 7-1/2 ips recorder/reproducer, it will probably be necessary to turn the REPRODUCE LEVEL control full clockwise (do not exceed an indication of 0 on the vu meter) in Step 7. For reproduce-only equipment, adjust the level control to achieve any convenient vtvm indication.

CAUTION

Do not tamper with any nut or screw on the head assembly other than the nut for azimuth adjustment.

Step 1: Remove the head overlay (cover), by loosening the captive screw on the angled back surface of the cover.

Step 2: Apply power to the equipment. Select tape speed (15 ips if available) and position the REEL switches in accordance with the size of reel hubs to be used.

Step 3: Position the RECORD SELECTOR switch(es) on all record/reproduce electronics assemblies in the SAFE position. This prevents accidentally entering the record mode and erasing the standard tape.

Step 4: Place the OUTPUT SELECTOR switch(es) on all record/reproduce electronic assemblies in the REPRODUCE position.

Step 5: Thread the standard alignment tape, applicable to the tape speed involved, on the tape transport. If this is a reproduce-only equipment, connect the vtvm(s) to the output connector(s).

NOTE

Voice announcements on the standard tape can be monitored through headsets or an amplifier/loudspeaker plugged into the PHONES jack, or through an amplifier/loudspeaker connected to the output.

Step 6: Start the standard tape in motion in the reproduce mode.

Step 7: If the adjustment is being made at 15 ips, adjust the REPRODUCE LEVEL control on each electronic assembly to achieve a vu meter indication of 0 as the first tone on the standard tape is reproduced. (Any convenient indication on the vtvm is used for reproduce-only equipment.) If a slower speed is being used, it may be impossible to achieve this level; if so, simply turn the REPRODUCE LEVEL control full clockwise.

Step 8: The second tone on the standard tape is the azimuth adjustment tone. As this tone is reproduced, turn the azimuth adjustment nut (not the screw) for the reproduce head (see Fig. 4C-6) to achieve a maximum output indication as indicated on the vu meters (or vtvm). If this is a multi-channel equipment and all heads do not peak at exactly the same setting, adjust for optimum output of all heads in the stack.

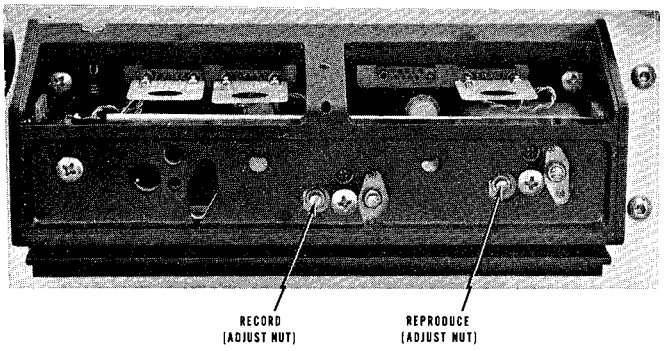

Fig. 4C—6. Head Azimuth Adjustment Nuts

NOTE

If the azimuth is far out of adjustment, minor peaks may be observed on each side of the correct setting. Proper adjustment will be unmistakable, because it will result in an output obviously higher than the minor peaks.

When the adjustment is completed, replace the head overlay.

4C.3.7 Reproduce/Record Alignment

If record/reproduce equipment is to be operated a major part of the time at one speed, that is the speed which should be used in making the initial alignment run (where bias and record levels are set and calibrated). In those cases where both speeds will be used on an approximately equal basis, it is recommended that the initial run be made at 7-1/2 ips, which provides the optimum bias and record adjustments for both the 3-3/4 - 7-1/2 ips and the 7-1/2 - 15 ips equipment. The second run, for the other speed, will then be concerned only with reproduce equalization for that speed.

In adjusting reproduce equalization (Steps 1 through 9) at the 15 ips speed, the equipment vu meters can be used. However, since record level calibration (and reproduce-only equipment) requires an external vtvm, the following procedure will be explained using the external meter. For reproduce-only equipment complete Steps 1 through 9.

Step 1: Remove the cover over the plug-in boards at the front panel of the electronics assembly (or remove the front cover from the reproduce-only electronics tray).

Step 2: Apply power to the equipment. Select tape speed, and position the REEL switches in accordance with the size of the reel hubs to be used.

Step 3: Position the RECORD SELECTOR switches on all record/reproduce electronic assemblies in the SAFE position. This will pre-

vent accidentally entering the record mode and thus erasing the standard tape.

Step 4: Place the OUTPUT SELECTOR switch of the record/reproduce channel to be tested in the REPRODUCE POSITION.

Step 5: Connect the vtvm to the OUTPUT connector of the channel to be tested.

Step 6: Thread the standard alignment tape, applicable to the tape speed involved, on the tape transport.

Step 7: Start the standard tape in motion in the reproduce mode. As the first tone is reproduced adjust the REPRODUCE LEVEL control on the channel under test to achieve an output level indication on the vtvm as shown on Table 4C-9. Lock the control in that position.

OUTPUT STRAPPING	TAPE SPEED	VTVM INDICATION
+8 dbm	15 ips	+8 dbm
	7-1/2 ips	-2 dbm
	3-3/4 ips	-2 dbm
+4 dbm	15 ips	+4 dbm
	7-1/2 ips	-6 dbm
	3-3/4 ips	-6 dbm

Table 4C—9. Output Level, Reproduce Equalization

Step 8: The standard tape is next recorded with a series of tones, starting with the highest frequencies. As these tones are reproduced, adjust the appropriate HIGH FREQ control, at the front of the reproduce board, as necessary to achieve the flattest possible response, within specifications. However, the reproduce response must not be moved more than ±2 db from the theoretical response curve (refer to Figs. 6-32, 6-33, and to paragraph 4F.10); if any further adjustment were required it would indicate some other trouble in the record/reproduce process, which should not be corrected by equalization adjustment.

NOTE

The standard tape is recorded full track. When such a tape is reproduced by a half-track or multi-track head, the "fringing" effect makes response indications invalid at frequencies below 700 Hz (15 and 7-1/2 ips) or 500 Hz (3-3/4 ips). This effect, which causes high indications at the lower frequencies, does not occur when tapes are recorded and reproduced using heads of the same configuration.

Step 9: If the test is being made at 7-1/2 or 3-3/4 ips, as the last tone on the tape is reproduced adjust the REPRODUCE LEVEL control to achieve a +8 dbm or +4 dbm indication on the vtvm (level on record/reproduce equipment is dependent on output strapping). The record/reproduce equipment vu meter should indicate 0 (±3/4 db).

This completes the reproduce equalization adjustment, and the setting of reproduce level to the reference required for record calibration. Do not change this reference level until after the completion of Step 18.

Step 10: Remove the standard tape, after winding it back on its original reel in the reproduce mode as explained in paragraph 4C.3.1.

Step 11: Connect the signal generator to the INPUT connector, leaving the vtvm connected to the output.

Step 12: Set the signal generator to provide a nominal 1 volt rms output at the appropriate frequency:

15 ips	1,000 Hz
7-1/2 ips	500 Hz
3-3/4 ips	250 Hz

Step 13: Thread blank tape on the equipment. At the electronic assembly place the OUTPUT SELECTOR switch in the BIAS position, and the RECORD SELECTOR switch in the READY position. Start the tape in motion, with the channel under test operating in the record mode.

Step 14: Adjust the ERASE ADJ control, at the front of the bias amplifier module, to achieve a peak indication on the equipment vu me-

ter, readjusting the BIAS CAL control as necessary to keep the meter indicator on scale. The peak is very broad. It is recommended that when the approximate peak is found that the control be turned counterclockwise until a definite drop is discerned on the vu meter. Then turn the control very slowly clockwise, passing through the peak until the meter indication justs starts to fall. Back off on the control just to the point where the drop-off began.

Step 15: Move the OUTPUT SELECTOR switch to the REPRO position. Adjust the BIAS ADJ control to achieve maximum output as indicated on the vtvm.

Step 16: Return the OUTPUT SELECTOR to the BIAS position. Adjust the BIAS CAL control to achieve a 0 indication on the equipment vu meter.

Step 17: Move the OUTPUT SELECTOR switch back to the REPRO position. Set the signal generator to provide a 500 Hz output. Adjust the RECORD LEVEL control to achieve a +8 or +4 dbm indication on the vtvm (level is dependent on output strapping).

Step 18: Move the OUTPUT SELECTOR switch to the INPUT position. Adjust the REC CAL control, at the front of the record module, to achieve a 0 indication on the equipment vu meter.

Step 19: Disconnect the signal generator from the INPUT connector. Repeat Steps 2 through 9 for the second tape speed, using the appropriate standard alignment tape and adjusting the applicable HIGH FREQ control.

Step 20: Repeat the entire procedure for all other channels.

4C.3.8 Record Head Azimuth Adjustment

This adjustment is similar to the reproduce head azimuth adjustment. While simultaneously recording and reproducing, the record head azimuth is adjusted to coincide with that of the reproduce head (which was previously adjusted to a standard reference position while playing the standard alignment tape). This procedure is not applicable to reproduce-only equipment.

CAUTION

Do not tamper with any nut or screw on the head assembly other than the nut for azimuth adjustment.

Step 1: Remove the head overlay (cover), by loosening the captive screw on the angled back surface of the cover.

Step 2: Connect the signal generator to the INPUT connector. If this is a multi-channel equipment, connect the signal generator to all INPUT connectors (in parallel).

Step 3: Apply power to the equipment, select tape speed, and position the REEL switches in accordance with the size of the reel hubs to be used.

Step 4: Set the signal generator to provide a nominal 1 volt rms output level at the appropriate frequency:

15 ips	15,000 Hz
7-1/2 ips	15,000 Hz
3-3/4 ips	7,500 Hz

Step 5: Thread blank tape on the equipment.

Step 6: Place the RECORD SELECTOR switch for each channel in the READY position.

Step 7: Place the OUTPUT SELECTOR switch for each channel in the INPUT position, and adjust the RECORD LEVEL control(s) to achieve the following indication on the vu meter(s):

15 ips	0
7-1/2 ips	-10
3-3/4 ips	-10

Step 8: Place the OUTPUT SELECTOR switch for each channel in the REPRO position, and start tape in motion with all channels operating in the record mode.

Step 9: While thus simultaneously recording and reproducing adjust the REPRODUCE LEVEL control(s) to achieve a 0 indication on the vu meters (if the adjustment is being made at 7-1/2 or 3-3/4 ips, it may be impossible to reach the 0 level. In that case, simply turn the REPRODUCE GAIN control full clockwise).

Step 10: Adjust the record head azimuth nut..not the screw.. (see Fig. 4C-6) to achieve maximum output as indicated on the vu meter(s). If this is a multi-channel recorder, and all heads do not peak at exactly the same setting, adjust for optimum output of all heads in the stack.

NOTE

Minor peaks may be observed on each side of the correct setting. Proper adjustment will be unmistakable, however, for it will result in an obviously higher output.

Step 11: To return the reproduce level to the normal operating condition, replace the head overlay and change the frequency of the signal generator to 500 Hz. While simultaneously recording and reproducing, place the OUTPUT SELECTOR switch in the INPUT position and adjust the RECORD LEVEL control to achieve a 0 indication on the vu meter. Then change the OUTPUT SELECTOR switch to the REPRO position and adjust the REPRODUCE LEVEL control to obtain a 0 indication on the vu meter.

4C.3.9 Low Frequency Reproduce Equalization

This procedure will be required infrequently. The adjustment requires access to the front of the plug-in boards so the small cover must be removed from the front panel of the electronics assembly (or the front cover removed from the reproduce-only electronic tray).

The procedure consists of adjusting the low frequency response of the reproduce circuit to compensate for head "bumps", which occur at those frequencies. The adjustment on reproduce-only equipment requires that a properly adjusted recorder, with the same head track configuration, be available to record the tape. That tape is then played back on the reproducer while the adjustment is made.

Step 1: Connect the vtvm to the OUTPUT connector.

Step 2: Connect the signal generator to the INPUT connector. Set it to 500 Hz at a nominal 1 volt rms level.

Step 3: Apply power to the equipment. Select tape speed, and position the REEL switches in accordance with the size of the reel hubs to be used.

Step 4: Thread blank tape on the equipment.

Step 5: Place the OUTPUT SELECTOR switch in the INPUT position, and adjust the RECORD LEVEL control as necessary to achieve normal record level (+8 dbm or +4 dbm, depending on output strapping) as indicated on the vtvm.

Step 6: Place the OUTPUT SELECTOR switch in the REPRO position, and start the tape in motion with the channel under test operating in the record mode.

Step 7: Adjust the REPRODUCE LEVEL control as necessary to achieve normal operating level (+8 dbm or +4 dbm, depending on output strapping) as indicated on the vtvm.

Step 8: While thus simultaneously recording and reproducing, sweep the signal generator frequency between 250 Hz and 30 Hz, noting the magnitude of any positive-going or negative-going head bumps.

Step 9: Adjust the appropriate LO FREQ control at the front of the reproduce board to achieve the flattest possible response, within specifications. This is accomplished by adjusting for an equal magnitude of head bump excursions from the reference frequency of 500 Hz.

Step 10: Repeat Steps 8 and 9 for the second tape speed, adjusting the appropriate LO FREQ control.

Step 11: Repeat the entire procedure for all other channels.

4C.3.10 Record Equalization

The small cover over the plug-in modules must be removed from the front panel of the electronics assembly. The procedure is not applicable for reproduce-only equipment.

Step 1: Repeat Steps 1 through 4 of the Low Frequency Reproduce Equalization procedure, paragraph 4C.3.9.

Step 2: Place the OUTPUT SELECTOR switch in the INPUT position, and adjust the RECORD LEVEL control to achieve a vtvm indication as shown in Table 4C-10. This establishes the 500 Hz reference level.

TAPE SPEED	OUTPUT STRAPPING	VTVM INDICATION
15 ips	+8 dbm +4 dbm	+8 dbm +4 dbm
7-1/2 ips	+8 dbm +4 dbm	-10 dbm -14 dbm
3-3/4 ips	+8 dbm +4 dbm	-10 dbm -14 dbm

Table 4C—10. Record Level, Record Equalization

Step 3: Change the frequency of the signal generator as applicable for the tape speed involved.

15 ips	18,000 Hz
7-1/2 ips	15,000 Hz
3-3/4 ips	8,000 Hz

Step 4: Start the tape in motion, with the channel under test operating in the record mode.

Step 5: Place the OUTPUT SELECTOR switch in the REPRO position.

Step 6: While thus simultaneously recording and reproducing, change the frequency of the signal generator in discrete steps to cover the high end of the response spectrum for the tape speed involved. Adjust the HI SPEED or LOW SPEED control, at the front of the record board, for the flattest possible high frequency response, in reference to 500 Hz, in accordance with specifications.

Step 7: Repeat Steps 3 through 6 for the second tape speed.

Step 8: Repeat the entire procedure for all other channels.

4C.4 SEL-SYNC ADJUSTMENTS

4C.4.1 Test Equipment Required

Ampex Standard Alignment Tape as applicable (see Table 4C-8)
Tools normally used by technician

4C.4.2 Test Conditions

LINE TERMINATION switch on back of electronics assembly in ON position to terminate equipment.

Dummy plug in INPUT ACCESS socket (not accessory transformer or preamp).

Heads cleaned and demagnetized.

Covers installed on electronics.

Both adjustments require access to the back panels of the electronics assemblies. Sel-Sync adjustment is not applicable for reproduce-only equipment.

4C.4.3 Sel-Sync Level Adjustment

Step 1: Place the RECORD SELECTOR switch on each electronic assembly in the SAFE position. This will prevent entering the record mode accidentally and thus erasing the standard alignment tape.

Step 2: Apply power, select tape speed, and position the REEL switches in accordance with the size of the reel hubs to be used.

Step 3: Thread the applicable standard alignment tape on the transport.

Step 4: Place all OUTPUT SELECTOR switches in the REPRO position.

Step 5: Advance the standard alignment tape to the operating level tone. (This will be the first tone on a 15 ips standard tape, the last tone on a tape for slower speeds.)

Step 6: As the operating level tone is reproduced, check that the REPRODUCE LEVEL controls are adjusted to provide a 0 indication on the equipment vu meters.

Step 7: Rewind the standard tape to the beginning of the operating level tone. Place all RECORD SELECTOR switches in the SEL SYNC position.

Step 8: Place the standard tape in motion in the reproduce mode. As the operating level tone is reproduced, adjust the SEL SYNC GAIN controls (on the back panel of each electronic assembly) to achieve a 0 indication on the equipment vu meter.

Step 9: Remove the standard tape, after winding it on its original reel as explained in paragraph 4C.3.1.

4C.4.4 Sel-Sync Bias Trap Adjustment

When the Sel-Sync feature is used, the bias from a channel that is recording could leak into an adjacent channel which is operating in the Sel-Sync mode. Nothing would be recorded on the latter channel, but visual monitoring (using the vu meters) might be masked. A trap is therefore provided to minimize such bias leakage.

The bias trap is adjusted at the factory, and there should be no need for readjustment. If the bias from channels which are recording causes objectionable vu meter indications on channels which are operating in Sel-Sync, the adjustment is quite easily accomplished. Operate one channel at a time under Sel-Sync, and all other channels in the record mode. Adjust the Sel-Sync BIAS TRAP control, on the back panel of the electronic assembly operating in Sel-Sync, to null the vu meter indication.

Section 4

MAINTENANCE

Part D. Heads, Corrective Maintenance

4D.1 GENERAL

Cleaning and demagnetizing the heads is explained in part B, Routine Maintenance. Adjusting the head azimuth is explained under Electronic Alignment Procedures in Part C, Normal Adjustment and Alignment. Changing the complete head assembly is described in Part A, Conversion and Expansion.

4D.2 ADJUSTING HEAD HEIGHT

4D.2.1 Record/Reproduce Heads (Not 1/4-Track)

The height of all heads was precisely set at the factory, and no adjustment should be required unless a head stack is changed.

Step 1: Remove the head housing overlay (cover) by loosening the captive screw on the angled back surface.

Step 2: Thread tape on the equipment, and place it in motion at the high tape speed.

Step 3: Loosen the two nuts (items 42 and 43, Fig. 6-1) on the two slotted head screws (Item 39, Fig. 6-1, or 30, Fig. 6-3) approximately 1/4 turn.

Step 4: Turning both the same number of turns, turn the two hex socket set screws (see Fig. 4D-1) clockwise until the head laminations are barely visible at the bottom edge of the tape.

Step 5: Carefully counting the turns required, turn the two hex socket set screws (in equal turns) counterclockwise until the head laminations are barely visible above the top edge of the tape.

Step 6: Now turn the two set screws clockwise exactly half the number of turns counted in Step 5. Turn the two nuts loosened in Step 3 clockwise until they are snug.

Step 7: Check head zenith and tape wrap (refer to paragraph 4D.3). Check head azimuth (refer to Electronic Alignment, paragraphs 4C.3.6 and 4C.3.8).

4D.2.2 Quarter Track Record/Reproduce Heads

To set the height of a quarter-track record or reproduce head, start by repeating Steps 1, 2, and 3, paragraph 4D.2.1. Then adjust the two hex socket set screws so that the mu-metal portion of the upper head in the stack is exactly even with the top edge of the tape.

4D.2.3 Erase Heads

The height of erase heads are adjusted by using shims, in thicknesses of .010, .002, .003, and .005 inch. These are available from Ampex under Part Nos. 4350025-01, 4350025-02, 4350025-

03, and 4350025-04 respectively. The head must be removed each time shims are added or removed. It is held in position by one cross head screw (item 40, Fig. 6-1 and item 31, Fig. 6-3).

For all except quarter track erase heads, use shims until the ferrite portion of the top head in the stack is just visible at the top edge of the tape. Then add shims until that portion of the bottom head in the stack is barely visible below the bottom edge of the tape. Then remove exactly half the shim thickness required to move the head from the top to bottom of the tape.

If a quarter track erase head is employed on some special equipment, use shims to position the ferrite portion of the top head in the stack so that it is even with the top edge of the tape. Then remove shims to raise the head .006 mils. (The erase head is wider than record or playback heads so must be positioned above the top edge of the tape.)

4D.3 ADJUSTING TAPE WRAP AND ZENITH

The tape must contact the heads so that the gap is centered in the tape contact area. Also, the tape must contact the top of the head and the bottom of the head equally well.

To check both tape wrap and head zenith, use a grease pencil or crayon to lightly cover the face of the head. Thread tape on the equipment, start it in motion at the high tape speed, and allow it to run for approximately ten seconds. Lift the tape from the head, and examine the coating on the head. The area cleaned by the tape should extend an equal distance from each side of the head gap (in the center of the head). This checks tape wrap. The area should also be equally clean at the top and bottom of the tape contact area. This checks head zenith.

If adjustment of the tape wrap is indicated as necessary, remove the head housing overlay (cover) by loosening the captive screw on the angled back surface. Loosen the large cross head mounting screw (item 40, Fig. 6-1, or 31, Fig. 6-3). Directly behind the mounting screw there is a hole, with a smaller cross head screw visible in that hole. Loosen the small cross head screw, and use a screw driver (at the side of the stack) to pry the head stack (not the can) in the indicated direction. Tighten the screws, being sure the shield can is aligned with the head shield on the head gate, and recheck the tape wrap as described in the preceding paragraph. Repeat the adjustment as required until the tape wrap is correct. Note that the erase head is adjusted for tape wrap simply by loosening the mounting screw and rotating the head.

To adjust head zenith, use the two hex socket set screws (also used for head height adjustment see Fig. 4D-1). Running the set screw toward the front of the head assembly in, and the set screw toward the back of the assembly out, will move the bottom of the stack in (away from the tape). If the back set screw is run in and the front set screw out, the bottom of the head will move out (toward the tape). Be sure both set screws remain snug. Visually check the zenith as the adjustment is being made, by lining up the head with the capstan or scrape flutter idler. When the adjustment seems correct, recheck the zenith with the grease pencil method previously described. Repeat the adjustment as required until the head zenith is correct. (There is no zenith adjustment for the erase head.)

Whenever head zenith or tape wrap is changed, check the head azimuth alignment (refer to Electronic Alignment Procedures, paragraphs 4C.3.6 and 4C.3.8).

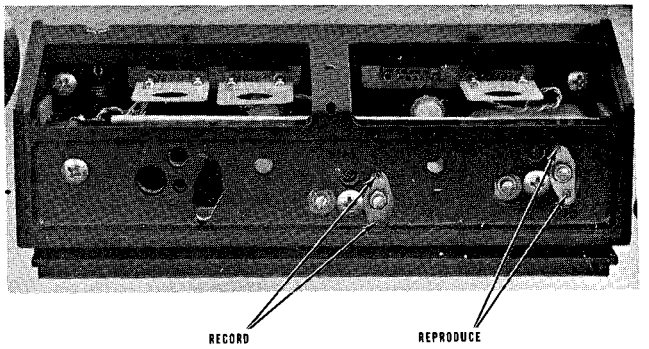

Fig. 4D—1. Head Height and Zenith Adjustment Points

4D.4 CHANGING HEAD STACKS

4D.4.1 Record or Reproduce Stack

Step 1: Remove the complete head assembly (refer to paragraph 4A.2.3).

Step 2: Remove the large cross head mounting screw (item 41, Fig. 6-1, or item 31, Fig. 6-3). This frees the shield can, which contains the head stack, from the head assembly.

NOTE

If the replacement head stack is already mounted in a shield can, simply mount that can in position. Before tightening the screw, check through the bottom of the casting that the can is aligned with the head shield, and is parallel to the top front edge of the casting.

Step 3: To remove the head stack from the shield can, use a screw driver to remove the two slot head screws and nuts (items 39-42 and 39-43, Fig. 6-1, or items 30-32 and 30-33, Fig. 6-3). Be careful not to lose the double coil lock washer. The head stack and two head springs (item 3, Fig. 6-1 and Fig. 6-3) will now be loose from the shield can. Unsolder the leads at the head stack.

Step 4: Run the leads from the connector assembly through the hole in the back of the shield can, and solder them to the terminals on the new head stack (correct connections are shown on Figs. 6-2, 6-3, and 6-5).

Step 5: Run the two hex socket head set screws out until the ends are even with the inside of the can.

Step 6: Take the two slot head screws and nuts which were removed in Step 3. Run the nuts fully on the screws, tightening them firmly against the screw head. Place the double coil lock washer over the end of the screw which has the plain hex nut (the other screw has a self-locking nut).

Step 7a: (Heads for 1/4-inch tape.) Place the two head springs in the indentations in the top of the head stack. Slip the head stack into the shield can, using care not to displace the springs.

Step 7b: (Heads for 1/2-inch tape.) Hold the shield can upside down, and place the two head springs in the indentation in the shield can. Looking through the open side of the inverted shield can, these indentations are at the right front and right rear. Being careful not to displace the springs, slide the head stack (also upside down) into the can.

Step 8: Insert the two slotted head screws through the plate and can, with the screw, plain hex nut, and double coil lock washer, in the position shown for items 39 and 42, Fig. 6-1, or items 30 and 32, Fig. 6-3. Mate the two screws with the threaded holes in the head stacks, and tighten them firmly.

Step 9: Mount the head stack and shield can in the head assembly, using the large cross head screw removed in Step 2. Refer to the note following Step 2 regarding shield can alignment.

Step 10: Run the two hex socket head set screws down, thus lowering the head stack, until head height is approximately correct.

Step 11: Run the two nuts on the cross head screws down against the plate, using the azimuth adjusting nut (see Fig. 4C-6) to set the head azimuth to the approximately correct position.

Step 12: Install the head assembly on the tape transport, being sure to plug the connectors into the correct receptacles (see Fig. 4A-1).

Step 13: Check and adjust head height (refer to paragraph 4D.2), tape wrap and zenith (refer to paragraph 4D.3), and head azimuth (refer to paragraph 4C.3.6 or 4C.3.8).

4D.4.2 Erase Head Stack

To change an erase head stack, remove the complete head assembly from the transport. Remove the large cross head mounting screw (item 40, Fig. 6-1, or 31, Fig. 6-3). The erase head stack, spacer, and shims will come free.

Place the spacer and shims on the new assembly and mount them on the casting, using the mounting screw. Check erase head height (refer to paragraph 4D.2.3) and tape wrap (refer to paragraph 4D.3).

MAINTENANCE

Part E. Transport, Corrective Maintenance

4E.1 GENERAL

Routine maintenance procedures (cleaning, lubricating, etc.) are described in part B of this section. Normal checkout and adjustment procedures for the transport are described in part C, paragraph 4C.2. The discussions herein are concerned with corrective maintenance, the replacement of parts, and special adjustment procedures required thereafter.

Practically all of the procedures described herein will require the removal of the front panel on console-mounted equipment. This panel must be removed and installed as described in Section 2, Installation, paragraph 2.3.

4E.2 SERVICING HINTS

4E.2.1 Brake Bands

Brake bands which become glazed, but are not contaminated with oil, can sometimes be renovated by sanding them with a fine grain sandpaper (4.0 or finer). Do not use emery cloth or carborundum-coated papers.

4E.2.2 Solenoids

Solenoid plungers occasionally become corroded to the point where they will not slide freely in the solenoid. Such a condition can be corrected by putting the plunger in a drill press and polishing it with crocus cloth. Do not lubricate.

4E.2.3 Relays

All plug-in relays are fitted with snap-on dust covers, which can be removed by slipping a knife blade under the cover and prying it from the base. If there is any question of whether a relay is being energized, remove the cover and observe its action. Relay contacts can be cleaned, using bond paper or a relay contact burnishing tool.

Since all relays are identical (including the record relay on the electronic assembly) it is possible that play/record operation could be continued on an emergency basis if either the play or record relay became defective and would not energize. This might be accomplished by interchanging the defective relay with the fast forward, rewind, or edit relay, depending on which of these three functions is least important at the time. Note that the fast forward, rewind, and edit relays complete the play/record circuit through normally closed contact sets, and therefore need not energize to provide emergency operation. The defective relay cannot be left out of the circuit, be sure it is plugged into the receptacle from which the good relay was removed.

4E.2.4 Capstan Idler

An arm (item 33, Fig. 6-9) is fastened to the shaft of the capstan idler by means of a rollpin (item 59, Fig. 6-9). Removing this rollpin requires special tools, as it must be pressed out (and in). Do not use a drift pin and hammer to drive this pin out or in, because pounding on the pin can easily result in irreparable distortion of the tape transport.

4E.3 REMOVING HEAD CABLE AND POWER SUPPLY BOXES

Despite the fact that the head cable box and electronic power supply assembly are mounted to the back of the tape transport, they are not considered part of the transport. Their removal is sometimes required during corrective maintenance procedures.

Removal and installation of the head cable box is discussed in Part A of this section, paragraph 4A.2.4.

To remove the electronic power supply box, disconnect all cables from receptacles J701 through J704. Disconnect the cable captive at the power supply box from its receptacle on the tape transport control box. Remove the four screws which secure the power supply box to the transport casting, and the box can be lifted off. Note that the power transistor is mounted on the side of the box which was next to the transport. Use care not to damage the transistor while the box is detached.

Installation is in the reverse order of removal. The captive cable is routed from under the power supply box out the side toward the transport control box.

4E.4 TAKEUP AND REWIND ASSEMBLIES

4E.4.1 General

The two major components in the takeup and rewind assemblies are the torque motor assembly and the brake assembly. Other parts include a turntable pad, a reel drive plate, and the 8-pin connector. The motor capacitors are mounted separately on the top plate.

On the torque motor assembly, the turntable and the brake drum are affixed to the motor shafts, and cannot be adjusted or replaced. The fixed position of the turntable also prevents removing the motor flange. If any of these components are damaged, the complete motor assembly must be ordered.

Assembly drawings of the takeup and rewind assemblies are in Figs. 6-12 and 6-13 of the Parts List and Drawings section.

Adjustment of tape tension (motor torques) and braking force are described in part C of this section, paragraphs 4C.2.3 and 4C.2.4.

4E.4.2 Replacing Entire Assembly

Both the takeup and rewind assemblies are secured, through slotted holes in the top plate, to the reel guards (this allows quick conversion to use the 11-1/2-inch CCIR reels). Note that when the assembly is removed, the reel guard will also come free.

To remove either assembly, first disconnect the applicable 8-pin connector from the receptacle on the tape transport control box. Slide the plastic sleeving from the solderless connectors in the leads to the capacitor and disconnect those wires. Manually support the assembly, and remove the three nuts and washers (items 77 and 79, Fig. 6-9) which secure the assembly to the reel guard. Remove the reel guard, and guide the turntable through the hole in the top plate to remove the entire assembly.

Replace the assembly in the reverse order of its removal. Note that if the 10-1/2-inch NAB reel is the largest which will be used, the assembly should be positioned in the slotted holes as far as possible toward the center of the transport. If the 11-1/2-inch CCIR reel is used, secure the assembly in its full outward position. Check before tightening the mounting nuts that the flat portion of the reel guard is parallel with the top edge of the transport (see Fig. 6-8) and that the turntables are centered in the guard.

See Figs. 6-12 (takeup assembly) or 6-13 (rewind assembly) when connecting the leads to the motor capacitor.

4E.4.3 Replacing Reel Drive Plate

A reel drive plate (item 4, Fig. 6-12) is located in the center of each turntable, around the spindle. The drive plate has three equal spaced extrusions which mate with the hubs on EIA reels. It is secured to the turntable by three screws.

To replace the drive plate, simply remove the three mounting screws and lift the plate from the spindle. Place the new drive plate in position, and reinstall the screws.

4E.4.4 Replacing Turntable Pad

A cork turntable pad (item 3, Fig. 6-12) covers the top surface of each turntable. To replace the pad, use a putty knife or some similar instrument to lift one edge of the pad. It can then be peeled off the turntable.

Clean all adhesive from the turntable, using lacquer thinner, MEK, etc. Peel the backing from the new pad, exposing the adhesive surface, and carefully position the pad on the turntable, being sure the reel hold down holes in the pad are aligned with those in the turntable. Press the pad firmly in position.

4E.4.5 Removing Brake Assembly

Cut the lacing twine which ties the wires to the solenoid bracket. Slide the plastic sleeving from the solderless connectors in the four leads to the two solenoids, and disconnect those wires. Remove the three screws (item 9, Fig. 6-12). Manually actuate the main brake solenoid (the one closest to the motor) and slide the entire assembly from the brake drum.

Refer to paragraph 4E.4.8 for the installation procedure, which entails proper positioning of components and setting correct clearances.

4E.4.6 Replacing Brake Bands

With the brake assembly removed from the takeup or rewind assembly (refer to paragraph 4E.4.5) proceed as follows to replace the brake band.

Step 1: Remove the brake spring (item 11, Fig. 6-14).

Step 2: Remove the two socket head cap screws and washers which secure the end of the brake band farthest from the solenoids. These two screws are shown directly below item 27, Fig. 6-14. Note that a band link clamp will also come free.

Step 3: Loosen (do not remove the other two socket head cap screws at the opposite end of the brake band. Using care not to lose the leaf spring, slide that end of the brake band from between the clamp and the screws. The brake band can now be removed.

Step 4: Position the new brake band through the holes in the housing, with the slotted end to the side next to the solenoids.

Step 5: Secure the end of the brake band farthest from the solenoids (refer to Step 2), using the band link clamp, the two socket head cap screws, and the lock washers. Tighten the cap screws.

Step 6: Slip the slotted end of the brake band between the band link clamp and the band link. Install the leaf spring between the brake band and the band link clamp (so that the spring is on the inner side of the band, on the same side as the lining). Tighten the two socket head cap screws so that they are snug but the brake band will still slip in and out of the clamp.

Step 7: Reinstall the brake spring removed in Step 1.

Further adjustments must be made when the brake assembly is reinstalled on the takeup or rewind assembly. These are explained in paragraph 4E.4.8.

4E.4.7 Removing Brake Solenoids

Cut the lacing twine which ties the wires to the solenoid bracket. Slide the plastic sleeving from the solderless connectors in the leads to the solenoids, and disconnect those wires.

To remove the edit brake solenoid (the one farthest from the motor) remove the two screws and washers (items 29 and 38, Fig. 6-14). Note that there are four places where these screws and washers are used, remove the two which secure the edit solenoid to the edit solenoid bracket (item 7 or 8, Fig. 6-14). The solenoid is now free (the plunger will slide out). If the plunger must be removed, it is accomplished by removing the self locking nut (item 37, Fig. 6-14) and the spring beneath it, and sliding the spade bolt (item 34, Fig. 6-14) out through the hole in the edit solenoid stop plate (item 18, Fig. 6-14). The plunger can be freed from the spade bolt by removing the cotter pin and clevis pin (items 24 and 25, Fig. 6-14).

To remove the main brake solenoid, remove the two screws and washers (items 29 and 38, Fig. 6-14). Note that there are six places where these screws are used, remove the two which secure the main brake solenoid to the edit solenoid bracket (item 7, Fig. 6-14). Now remove the two screws (item 31, Fig. 6-14) which secure the end of the main brake solenoid to the solenoid bracket (item 6, Fig. 6-14). Pivot the edit brake solenoid bracket so that the main brake solenoid can be removed (the plunger will slide out of the solenoid). To free the plunger, remove the cotter pin and clevis pin (items 24 and 25, Fig. 6-14).

Replacement is made in the reverse

order of the removal. Be sure to align the faces of both solenoids (the ends with the plungers) with the edit solenoid bracket. Note also that adjustment procedures described in paragraph 4E.4.8 must be performed whenever the solenoids are removed and replaced.

4E.4.8 Replacement and Adjustment, Brake Assembly

To replace the complete brake assembly on the reel motor, manually actuate the main brake solenoid and slip the brake band over the brake drum on the motor shaft. Secure the assembly in position with the three screws (item 9, Fig. 6-12).

Whenever any item on the brake assembly is removed or replaced, the adjustment procedure described in the following steps must be performed. Designations used in this description are illustrated on the takeup and supply brake adjustment portion of Fig. 6-10.

Step 1: Check that the front surface of both the main brake solenoid and the edit brake solenoid are flush with the front surface of the edit solenoid bracket. If adjustment is required, move the edit solenoid bracket so it is flush with the front surface of the main brake solenoid, then move the edit brake solenoid flush with the bracket.

Step 2: Move the edit solenoid spring anchor full forward in its slotted holes.

Step 3: Manually actuate the main brake solenoid, and measure the distance that the plunger protrudes from the solenoid in its fully bottomed position.

Step 4: Check that the brake band is square on the drum. Slide the slotted end of the band (see Brake Band Adjustment, Fig. 6-10) in its clamp until it holds the main brake solenoid plunger in a position from 5/32 to 3/16 inch out from the fully bottomed position measured in Step 3 (solenoid not actuated). Secure the band in that position by tightening the two socket head cap screws.

Step 5: Manually actuate the main brake solenoid, checking that the brake band does not buckle (any buckling will be visible near the brake band adjustment point). If any buckling is evident, slide the end of the band further into the clamp just to the point where the buckling is removed (refer to Step 6).

Step 6: Manually actuate the main brake solenoid. Rotate the motor and check that the band does not drag on the brake drum. If any dragging is noted, the band was shortened too much in Step 5, and must be lengthened by sliding it out of the clamp. The final adjustment must result in no buckling of the band (Step 5) and no drag on the drum, when the solenoid is fully bottomed.

Step 7: Position the edit solenoid spring anchor so that the edit solenoid stop plate clears the end of the main brake solenoid plunger by 1/16 inch (±1/64 inch). Secure the anchor in that position.

Step 8: Connect the leads to the solenoids at the solderless connectors. Slide the plastic sleeving over the connectors.

Step 9: Use lacing twine to tie all leads to the solenoid bracket (item 6, Fig. 6-14) so that they cannot contact any rotating parts.

Step 10: Adjust the main brake and edit brake forces as described in part C, paragraph 4C.2.4.

4E.4.9 Replacing Motor Capacitors

Removal of either the takeup or rewind motor capacitors (item 22, Fig. 6-9) requires the removal of the electronics power supply box (refer to paragraph 4E.3). Then slide the plastic sleeving from the solderless connectors in the leads to the capacitor, and disconnect those wires. Loosen the two screws on the mounting plate (item 42, Fig. 6-9) and slide the capacitor and plate from the extrusions in the casting. Remove the mounting plate and use the screws, nuts and washers to secure the new capacitor on the plate (do not tighten the screws). Slide the capacitor and plate into position and tighten the screws. Connect the leads (see Figs. 6-12, takeup, or 6-13, rewind) and replace the power supply box.

4E.5 DRIVE MOTOR ASSEMBLY

4E.5.1 General

Drive motor lubrication is explained in part B, paragraphs 4B.3.1, 4B.3.2, and 4B.3.3

4E.5.2 Removing Fan and Flywheel

Both the fan and the flywheel are secured to the drive motor shaft by set screws. To remove these components, simply loosen the set screws and slide them from the shaft.

To reinstall, slide the flywheel on the shaft, until the hub is against the shoulder on the shaft (the set screw portion of the hub should be

out, away from the motor). Tighten the set screw against the flat portion of the shaft. Slide the fan on the shaft, set screw side in (toward the motor) and bottom it against the hub on the flywheel. Tighten the set screw against the flat portion of the shaft.

4E.5.3 Removing Drive Motor Assembly

To remove the drive motor assembly, first disconnect the drive motor cable from its receptacle on the tape transport control box. At the front of the tape transport, remove the capstan idler (item 4, 5, Fig. 6-8) by loosening the set screw (item 75, Fig. 6-8) and lifting the idler from the arm (item 39, Fig. 6-8).

Manually support the drive motor, at the back of the transport. At the front of the transport remove the four screws (item 60, Fig. 6-8) which secure the motor to the top plate (the motor shield will also come free). Use care not to bump or scrape the capstan as the motor is removed.

Installation of the drive motor is performed in the reverse order of its removal. Be sure to reinstall the motor shield (item 37, Fig. 6-9), positioning it as shown. When installing the capstan idler, adjust its height so that the top surface of the rubber tire is 1/32 inch (±1/64 inch) below the top surface of the capstan shaft.

4E.5.4 Replacing Motor Capacitor

The drive motor capacitor (item 13, Fig. 6-9) is secured by two screws to the capstan solenoid mounting plate (item 43, Fig. 6-9). Slide the plastic sleeving from the solderless connectors in the leads to the capacitor, and disconnect those two wires. Free the capacitor by using a stubby screwdriver (or offset screwdriver) to remove the two screws and washers (items 69 and 80, Fig. 6-9) from the threaded holes in the plate. Use the screws and washers to mount the new capacitor in position, and reconnect the leads (see Fig. 6-10 for correct connections).

4E.6 REEL IDLER

4E.6.1 Removing Tape Guide

The tape guide can be removed from the reel idler arm by unscrewing the spring-loaded screw (item 9, Fig. 6-15). The idler, screw, spring, and flat washers used as shims will come free. When re-installing the tape guide, insert the spring and screw in the top of the guide, and be sure to install all of the washers. Then seat the slot in the bottom of the guide over the spring pin on the arm, and tighten the screw.

4E.6.2 Removing Pulley Assembly

The pulley assembly is held in the reel idler housing by the reel idler flywheel, which is secured by a set screw to the pulley shaft. Note that the set screw side of the flywheel is to the inside, toward the transport, and must be located by feel. Rotate the flywheel so that the flat portion of the pulley shaft is toward the outer edge of the rewind motor. Insert a 3/32 Allen wrench (the long-shafted type with a handle) past the outer edge of the rewind motor, manually feeling for the set screw hole. If the transport is in a face down position--such as when rotated in a console--manually support the reel idler pulley while the set screw is loosened and the flywheel removed. The pulley will then slide out of the housing.

Installation consists of sliding the pulley shaft back through the housing, and remounting the flywheel. However, an end play of from .003 to .005 inch must be provided to prevent damaging the ball bearings. This can be most accurately achieved by holding the pulley firmly down in the housing and using a feeler gauge to determine the space between the pulley and the housing, at the side opposite the arm. When this has been determined add .004 inch, and use the appropriate feeler gauge or gauges. (For example, if the clearance with the pulley fully bottomed is .021 inch, use a .025 inch gauge). Insert the gauge between the pulley and housing at the side opposite the arm. Hold the pulley firmly down on the gauge, and push the flywheel on the pulley shaft (set screw side in) so that it is in firm contact with the bottom of the housing. Tighten the flywheel set screw, and remove the feeler gauge.

4E.6.3 Adjusting Arm Tension Force

This force is not critical. However, if it becomes excessively high, and cannot be corrected by adjustment, it will indicate that some damage to the reel idler has caused a binding condition.

To check the force, use a spring scale, measuring at the outer end of the arm. It should require approximately two ounces of pressure to move the arm from its stop.

If adjustment is required, remove the pulley assembly (refer to paragraph 4E.6.2). This will reveal two screws (item 21, Fig. 6-15). Loos-

en these screws, and rotate the bushing (item 2, Fig. 6-15); clockwise rotation will increase pressure, counterclockwise rotation will decrease pressure. Tighten the two screws, and recheck the spring force. Continue until proper force is attained.

Reinstall the pulley, maintaining correct end play as explained in paragraph 4E.6.2.

4E.6.4 Removing Arm Assembly

To remove the arm assembly, first remove the pulley assembly (refer to paragraph 4E.6.2). Then remove the two screws (item 21, Fig. 6-15). The arm, bushing and idler mount (items 5, 2, and 8, Fig. 6-15) will now be free and can be lifted from the housing. Note that the arm is sandwiched between the bushing and the mount, which in turn are press-fit together to very close tolerance. They cannot therefore be ordered as separate parts. Contact Ampex Audio Technical Support Department if replacement is required. The tension spring can be replaced, it simply hooks over two pins, one on the arm and the other on the mount.

To install the arm assembly, insert it in the housing with the arm in the slot to the upper left. Insert the two screws, not tightening them completely. Check and adjust arm tension force (refer to paragraph 4E.6.3). Replace the pulley assembly, maintaining correct end play, as described in paragraph 4E.6.2.

4E.6.5 Removing Complete Assembly

To remove the complete reel idler assembly, first remove the pulley assembly (refer to paragraph 4E.6.2). At the back of the tape transport, two screws and washers (items 66 and 85, Fig. 6-9) secure the reel idler housing to the casting. Manually support the housing at the front of the transport, and remove these screws. The housing and arm assembly can now be removed from the front of the transport.

Installation is in the reverse order of removal. If the arm assembly was removed from the housing, check and adjust the arm tension force (refer to paragraph 4E.6.3). When installing the pulley assembly, provide correct end play as explained in paragraph 4E.6.2.

4E.6.6 Replacing Ball Bearings

Replacing the ball bearings (item 17, Fig. 6-15) in the reel idler assembly requires that the complete assembly be removed from the transport (refer to paragraph 4E.6.5). Then remove the arm assembly from the housing (refer to paragraph 4E.6.4). The top ball bearing can now be removed by inserting a pencil (or some similar object) up through the hole in the lower bearing, and pushing the top bearing out of the housing.

To remove the lower ball bearing, use Truarc pliers to remove the lower retaining ring. Insert the pencil or other object from the top of the housing, and push the lower bearing out.

Care must be exercised when installing the new bearings. Use no lubrication. Note that the bearings are slip fitted (not press-fitted) in the housing, and that finger pressure is all that is required to push them into position. Be very careful not to cock the bearings in the housing bore. Push only on the outer race (not toward the inside) of the bearing, applying equal pressure on the diametrally opposite sides of the bearing face. Using this procedure, install the lower bearing, pushing it into position against the retaining ring. Install the lower retaining ring below the bearing. Push the other bearing into position.

Mount the housing on the transport, and install the arm assembly. Check and adjust the arm tension force (refer to paragraph 4E.6.3). When installing the pulley assembly, maintain correct end play as described in paragraph 4E.6.2.

4E.7 TAKEUP TENSION ARM

4E.7.1 Adjusting Arm Spring Force

To check the spring force on the takeup tension arm, use a spring scale and measure at the tape guide on the outer end of the arm. Hold the arm with the scale so that the centerline of the arm is parallel to the bottom edge of the transport. The scale should indicate from 1/4 to 3/8 ounce (7 to 11 grams).

If adjustment is required, remove the cap which covers the tension arm base, by removing the socket head screw in the middle of the cap. A spring is wound around the bushing below the arm. One end of this spring is inserted in a hole in the bushing, the other end is hooked to one of two pins, located 180° apart and upright on the base. Adjustment is made by using a soldering aid, or some similar tool, to move the hook end of the scale from one pin to the other until correct force is achieved. Note that a spacer beneath the spring hook must also be moved. Winding the spring tighter around the bushing will increase the

force, allowing it to spring back to the next pin (become looser around the bushing) will decrease the force. Adjustment to the force quoted is required if the transport is changed between the vertical and horizontal position.

4E.7.2 Adjusting Safety Switch Actuation

To check the position of the takeup tension arm when it actuates the safety switch to stop tape motion, move the arm up to the tape threaded position. Now allow the arm to return slowly towards its rest position, listening closely for the click which denotes actuation of the safety switch. At that point, the tape contacting surface of the tape guide should be 3-3/4 inch (+0, -3/4 inch) up from the bottom edge of the transport.

Any adjustment required is made from the back of the transport. Remove the drive motor connector and the takeup motor connector from their receptacles on the transport control box, and hold other wires aside so that the safety switch (item 23, Fig. 6-9) is accessible. Use long nose pliers to bend the safety switch spring actuator. Bending the actuator out from the switch will result in the safety switch being actuated when the takeup tension arm is higher in position, bending it toward the switch will result in a lower position.

Replace the drive motor and takeup motor connectors when the adjustment is completed.

4E.7.3 Removing Tape Guide and Hook

Removal of the tape guide and hook from the takeup tension arm is accomplished by removing the spring loaded screw from the top of the guide. The screw, spring, guide, shim washers, and hook will come free.

To install the hook and guide, mate the locating hole on the hook and the slot at the bottom of the guide with the spring pin. Be sure to return all the shim washers to position between the guide and hook. Insert the spring and screw in the guide, and tighten the screw in the threaded hole in the arm.

4E.7.4 Replacing Tension Spring

It is difficult, but possible, to replace the tension spring around the bushing. To remove the spring, first remove the cap which covers the base, by removing the socket head screw in the middle of the cap. Unhook the end of the spring from the pin, and allow it to unwind completely. Remove the straight end of the spring from the hole in the bushing. Use long nose pliers to start the top end of the spring up over the arm, and simply unscrew the spring from the bushing.

To install the spring, start the straight end on the bushing (the hook end of the spring is up). Screw the spring on the bushing. When it is in position, insert the straight end of the spring into the hole in the base of the bushing, tighten the spring by winding the hook end two or three times around, and hook the end to one of the pins on the base. Then check and adjust the arm spring force (refer to paragraph 4E.7.1).

4E.7.5 Replacing Complete Assembly

All replaceable parts of the takeup tension arm assembly have been called out in paragraphs 4E.7.3 and 4E.7.4. If any other component becomes defective, the complete assembly must be replaced.

To remove the takeup tension arm assembly, disconnect the drive motor and takeup motor cables from their receptacles on the transport control box. Hold other wires aside so that the base of the tension arm is accessible. The assembly is secured to the top plate by one screw (item 68, Fig. 6-9). Remove this screw, and lift the assembly off from the front of the transport. Note that a drive pin, which protrudes from the inner end of the assembly, must be guided out through the hole in the top plate.

When the assembly is free from the transport, remove the set screw (item 73, Fig. 6-9) from the base. Install this set screw in the new assembly, screwing it in until it protrudes 3/16 inch. Guide the end of the new assembly through the hole in the top plate, mating the set screw with the hole to the upper left. Secure the assembly to the transport with the one screw.

After installation, check and adjust the actuation of the safety switch (refer to paragraph 4E.7.2). Reconnect the drive motor and takeup motor cables to their receptacles on the transport control box.

4E.8 CAPSTAN IDLER

4E.8.1 General

Lubrication of the capstan idler is described in part B of this section, paragraph 4B.3.3. The adjustment of idler force against the capstan is described in part C, paragraph 4C.2.5.

4E.8.2 Parts Not Removable

Note that the capstan idler arm (item 39, Fig. 6-8) and its associated components cannot be removed from the transport. This is because the solenoid arm (item 33, Fig. 6-9) is secured to the shaft of the idler arm by a rollpin. Removing and installing this rollpin requires special tools, as it must be pressed out and in. The solenoid arm will not fit through the hole in the transport, so no part between the idler arm and the solenoid arm can be removed in the field.

CAUTION

Do not use a drift pin and hammer to drive out the rollpin. Pounding on the pin can easily result in irreparable distortion of the tape transport.

It is unlikely that any of these parts will ever need replacement. If some damage should occur which requires removal, the transport should be returned to the factory for repair.

4E.8.3 Adjusting Idler Position

When the capstan solenoid is not energized, the clearance between the rubber tire of the idler and the capstan should be from 1/2 inch to 5/8 inch. Adjustment is made by moving the stop which limits the outward travel of the capstan solenoid plunger.

Loosen the two screws which secure the stop to the top of the capstan solenoid (item 9, Fig. 6-9). Slide the stop, in its slotted holes, to the position that results in the correct clearance, and tighten the screws.

If this adjustment is made, it must be followed by checking and adjusting capstan idler pressure (refer to paragraph 4C.2.5).

4E.8.4 Removing Idler

The rubber tired idler (item 4,5, Fig. 6-8) is held on the idler arm (item 39, Fig. 6-8) by a set screw (item 75, Fig. 6-8). To remove the idler, loosen the set screw and slide the idler shaft from the arm.

When installing the idler, position it so that the top surface of the rubber tire is 1/32 inch (±1/64 inch) below the top surface of the capstan.

4E.8.5 Removing Capstan Solenoid

Removal of the capstan solenoid requires that the drive motor and drive motor capacitor be previously removed (refer to paragraphs 4E.5.3 and 4E.5.4). Also, disconnect the takeup motor cable from its receptacle on the transport control box.

The capstan solenoid is item 9, Fig. 6-9. The first step in its removal is to remove the self locking nut and the adjustment spring from the end of the bolt which is inserted through the hole in the solenoid arm (item 33, Fig. 6-9). Then slide the plastic sleeving from the solderless connectors in the leads to the solenoid, and disconnect those wires.

A mounting plate is used to clamp the solenoid to extrusions on the transport casting. Loosen the four screws (items 63 and 67, Fig. 6-9). and slide the plate and solenoid from the extrusions while guiding the bolt out of the hole in the solenoid arm.

To install the solenoid, secure the mounting plate to the solenoid using the four screws and washers (do not tighten the screws). Note that the solenoid leads are fastened in a cable clamp (item 58, Fig. 6-9) which is secured by one of the four screws (item 67, Fig. 6-9). With the solenoid return spring in position on the bolt as shown in Fig. 6-9, insert the end of the bolt through the hole in the solenoid arm (item 33, Fig. 6-9), and slide the plate and the solenoid over the extrusions on the casting. Tighten the screws to clamp the solenoid in position. Install the solenoid adjusting spring and the self locking nut on the end of the bolt. Connect the leads to the solenoid.

Install the drive motor capacitor and the drive motor (refer to paragraphs 4E.5.4 and 4E.5.3, respectively). Reconnect the takeup motor cable. Check and adjust the capstan idler position (refer to paragraph 4E.8.3).

After the installation is completed, check and adjust the capstan idler pressure (refer to part C of this section, paragraph 4C.2.5).

4E.9 TAPE LIFTER

4E.9.1 Adjustment Procedure

When the equipment is operated in the play mode, the tape lifter posts must not touch the tape. In either fast-winding mode, the tape must be lifted from all of the heads; however, it must not contact the head shield covers on the headgate.

Adjustment is usually required only if damage has occurred requiring replacement of tape lifter components, or if the solenoid is replaced.

Adjustment of the tape lifter must be preceded by removing the reel idler flywheel and pulley (refer to paragraph 4E.6.2). Disconnect the rewind motor and electronic power supply cables from their receptacles on the transport control box. Remove the dummy plugs (or cables) from the 60 Hz amplifier and remote control receptacles, and remove the four plug-in relays, at the transport control box. Move the head cables to one side if they are in the way.

See the tape lifter assembly adjustment portion of Fig. 6-10 in following these instructions.

The first step is to position the tape lifter solenoid stop 21/32 inch from the face of the solenoid, by loosening the two screws which secure the stop to the solenoid, sliding the stop to the required position, and tightening the two screws. Note that it is possible that this position will have to be changed later in the procedure.

Loosen the two hex head self tapping screws, one at each end of the tape lifter bracket, and slide that bracket as far as possible toward the solenoid. Insert the end of the auto tape lifter spring (between the link on the solenoid plunger and tape lifter bracket) in the hole in the tape lifter bracket which is nearest to that end without requiring any extension of the spring. (This will usually be the third or fourth hole from the solenoid end of the bracket).

Now hold either tape lifter arm in the retracted position, so that there is a clearance of 1/16 inch between it and the back of the slot (see Fig. 6-10). Slide the tape lifter bracket away from the solenoid just to the point where all slack is removed from the auto tape lifter spring, the link to the solenoid plunger, and the plunger itself. (The plunger must be full out, against the stop.) Tighten the two hex head self tapping screws to secure the tape lifter bracket in that position. If all slack cannot be removed as described, slide the tape lifter bracket back toward the solenoid, and move the end of the auto tape lifter spring to the next hole in the bracket. Then repeat the procedure described.

Manually actuate the solenoid plunger to the fully bottomed position. The tape lifter arm should move so that there is a 1/16 inch clearance between it and the other end of the slot. If the travel of the arm is not as described, correction is made by repositioning the tape lifter solenoid stop from the 21/32 inch previously set. Moving the stop farther from the face of the solenoid will result in more travel of the arm, moving it closer will result in less travel. Note that there is a 2:1 ratio between arm travel and solenoid plunger travel (moving the solenoid stop 1/16 inch will result in changing the travel of the arm by 1/8 inch). If the solenoid stop has to be repositioned, the complete adjustment procedure must be repeated. The final adjustment must result in a tape lifter arm clearance of 1/16 inch from each end of the slot in the deenergized and energized positions.

Replace the reel idler pulley and flywheel, providing proper end play as described in paragraph 4E.6.2. Connect all cables and return the relays and dummy plugs to the receptacles on the transport control box.

4E.9.2 Removing Tape Lifter Solenoid

Removing the tape lifter solenoid requires the previous removal of the reel idler pulley and flywheel (refer to paragraph 4E.6.2). Also, disconnect the rewind motor and electronic power supply cables from their receptacles on the transport control box.

Remove the auto tape lifter spring (see Fig. 6-10). Slide the plastic sleeving from the solderless connectors in the leads to the solenoid and disconnect those two wires. The solenoid (item 10, Fig. 6-9) is clamped to extrusions on the side of the transport casting by a mounting plate (item 41, Fig. 6-9). Use an open end wrench to loosen the two hex-head screws (item 62, Fig. 6-9), and slide the solenoid and plate off the extrusions.

Installation consists of mounting the plate on the end of the solenoid, using the two screws, lockwashers, and flat washers (items 62, 84, and 88, Fig. 6-9). Slide the solenoid and plate over the extrusions on the casting, and use an open end wrench to tighten the two mounting screws, thus clamping the solenoid in position. Connect the leads to the solenoid, and return the auto tape lifter spring to its position.

Whenever the solenoid is removed and replaced, tape lifter action must be adjusted (refer to paragraph 4E.9.1). Do this before reinstalling the reel idler pulley and flywheel, or reconnecting cables.

4E.9.3 Removing Tape Lifter Assembly

Removal of the tape lifter assembly requires the previous removal of the reel idler

flywheel and pulley (refer to paragraph 4E.6.2). Disconnect the rewind motor and electronic power supply cables from their receptacles on the transport control box, remove the dummy plugs (or cables) in the 60 Hz amplifier and remote control receptacles, and remove the four plug-in relays.

Remove the tape lifter solenoid (refer to paragraph 4E.9.2). Remove the tape lifter return spring (item 35, Fig. 6-9) from between the end of the tape lifter assembly and the post on the transport. Remove the two socket head shoulder screws (item 44, Fig. 6-9) which secure the tape lifter assembly to the transport casting, and the complete assembly will come free. Note that flat washers (item 83, Fig. 6-9) are installed between the assembly and the transport.

An assembly drawing of the tape lifter assembly is provided in Fig. 6-11. Replaceable parts are listed in the tape transport parts list. Note that the spring (item 5, Fig. 6-11) is installed to take up any slack between the clevis pins which secure the tape lifter arms, and thus to prevent any backlash or rattle.

Installation of the lifter assembly on the transport is in the reverse order of its removal. Be sure to install the washers (item 83, Fig. 6-9) between the assembly and the transport. Install the tape lifter solenoid (refer to paragraph 4E.9.2). Before returning the reel idler pulley and flywheel, and connecting cables, dummy plugs, and relays, adjust the tape lifter action as described in paragraph 4E.9.1.

4E.10 SAFETY SWITCH

To remove the safety switch (item 23, Fig. 6-9) first disconnect the drive motor and takeup motor cables from their receptacles on the transport control box. Move other wiring aside.

Slide the plastic sleeving from the solderless connectors in the leads to the safety switch, and disconnect those two wires. The switch is secured to mounting posts on the transport casting, by two screws and washers, (items 70 and 82, Fig. 6-9). Remove these screws, and the switch will come free with the shield (item 30, Fig. 6-7).

Installation consists of placing the shield over the switch, and using the two screws and washers to secure them to the casting. Connect the leads to the switch (see Fig. 6-10 for correct connections).

Check and adjust safety switch actuation by the takeup tension arm assembly (refer to paragraph 4E.7.2), before connecting the drive motor and takeup motor cables to the transport control box.

4E.11 SERVICING PROCEDURES

4E.11.1 General

Power distribution to the three motors, and the six solenoids on the tape transport is controlled by components on or in the transport control box. All switches, relays, fuses, switching transistors, and power supply components for transport control are included in the control box.

A schematic diagram of the tape transport is provided on Fig. 6-20, while a simplified schematic diagram is shown on Fig. 6-21. As shown on Fig. 6-21, there are actually three control circuits. One routes the ac line power to the electronic power supply, the takeup and rewind motors, the drive motor, the 24 volt dc supply, and the 115 volt dc supply. The 24 volt dc control circuit supplies the play, edit, fast forward, rewind, and record relays (the record relay is on the electronic assembly); this circuit also provides power to the tape lifter solenoid. (The two switching transistors are in the 24 volt dc circuit). The 115 volt dc control circuit is used for power to the capstan solenoid, the two main brake solenoids, and the two edit brake solenoids.

Assembly drawings for the transport control box are provided on Figs. 6-17 and 6-18, and a power distribution and fusing diagram on Fig. 6-19.

4E.11.2 Removing Bottom Cover, Control Box

Access to components inside the control box is attained by removing the bottom cover from the box. Turn power off, and remove the cover over the tension adjusting resistors, by removing the two nuts (one at each end). Then use an open end wrench to loosen the seven hex head screws (two at each end, three on one side) around the edge of the bottom cover. Use the finger holes in the cover to pull it off (the screws will slide out of slots on the box).

WARNING

Dangerous voltages exist at many points inside the box and across the tension adjusting resistors when power

is applied. Only those who are thoroughly experienced in working with live circuits should attempt servicing when power is on.

4E.11.3 Removing Complete Control Box

To remove the complete control box from the transport, remove all cable connectors from the receptacles. Disconnect the solderless connectors in leads to the tape lifter solenoid, the capstan solenoid, the drive motor capacitor, and the safety switch.

At the front of the transport remove the two screws (item 61, Fig. 6-8) from the escutcheon over the pushbuttons; that escutcheon and the pushbuttons will come free. Remove the two screws (items 65 and 61, Fig. 6-8) from the escutcheon over the toggle switches, and remove that escutcheon.

Manually support the control box, and remove the three screws (item 71, Fig. 6-8) which secure the front of the control box to the casting. The control box can now be removed.

Note that the actuation of relays and distribution of power can be checked with the control box removed and the dummy plugs in their receptacles. To do this, connect the two leads that were connected to the safety switch, and use electrician's tape to cover the connections. Do not connect any of the other leads, but tape each solderless connector separately. Replace the cover over the tension adjusting resistors. The power cord can now be connected and power applied.

WARNING

Dangerous voltages exist in many points within the control box, and across the tension adjusting resistors. Only personnel thoroughly experienced in working with live circuits should attempt servicing procedures with the bottom cover or the resistor cover removed when power is applied.

Installing the control box is in the reverse order of its removal. Proper connections of leads to the solenoids, drive motor capacitor, and safety switch are shown on Fig. 6-10.

4E.11.4 Checking Power

4E.11.4.1 General

In this discussion, it is assumed that the power cord is properly connected to the transport and to a power source.

4E.11.4.2 Checking Input Power

When the power switch is placed in the ON position, the power indicator should light. If not, move the takeup tension arm from its rest position (so it does not contact the safety switch); if the capstan motor starts in rotation the lamp in the power indicator must be replaced (refer to paragraph 4E.11.10). If the motor does not start when the arm is moved, check line power, fuses F601 and F602, the power switch, and capacitors C606 and C607 (see Figs. 6-18 and 6-20).

Note that the fuses are located on the back panel of the control box. Power switch opening and closing can be checked by removing the two fuses, and checking with an ohmmeter across the outer contacts in the fuse posts while turning the power switch on and off. To check the capacitors, remove the bottom cover of the control box (refer to paragraph 4E.11.2). The capacitors are connected at the inner side of the power receptacle (item 28, Fig. 6-18).

4E.11.4.3 Checking 24 Volt Supply

Trouble in the 24 volt dc power supply would be indicated by the inability to actuate any of the mode relays (play, fast forward, rewind, or edit). None of these modes would therefore operate. Components in this supply are transformer T1, diodes CR601 through CR604, capacitor C609, and resistor R602. Remove the bottom cover (refer to paragraph 4E.11.2) and apply power to the equipment.

WARNING

Dangerous voltages exist at many points within the control box and across the tension adjusting resistors. Only personnel familiar with working with live circuits should perform this check.

Use a dc voltmeter to check the voltage across capacitor C609 (item 27, Fig. 6-18). Note that the 24 volts dc is a nominal voltage, varying with power line voltage and with the load applied (with no load it will be approximately 34 volts dc). If the voltage is not present, or is excessively low, check the components in the 24 volt dc supply. Note that the diodes (in the full wave bridge circuit) and R602 are mounted on a pair of two lug terminal strips located to the right of transformer T1 and just above the rewind motor receptacle (when the bottom of the control box is viewed from the side with the tension adjusting resistors). If no defective component is found, check wiring continuity from the input of the 24 volt power supply to both sides of the ac line.

4E.11.4.4 Checking 115 Volt Supply

Trouble in the 115 volt dc power supply would be indicated if none of the 115 volt solenoids (capstan, main brakes, edit brakes) would actuate in any mode of operation.

The components in this supply are resistor R609 (item 39, Fig. 6-18), capacitor C614 (item 38, Fig. 6-18), and diode CR615 (located as item 22 on the three lug terminal strip to which both C614 and C609--item 27--are connected. Remove the bottom cover of the control box (refer to paragraph 4E.11.2) and apply power to the equipment.

WARNING

Dangerous voltages exist at many points within the control box and across the tension adjusting resistors. Only personnel familiar with working with live circuits should perform this check.

Use a dc voltmeter to check the voltage across C614 (item 38, Fig. 6-18). Note that the 115 volt dc designation represents a nominal value under load. With no load it might rise as high as 150 volts dc. If the voltage is not present, or is excessively low, check the components previously listed. If no defective component is found, check wiring continuity from the input of the 115 volt dc power supply to both sides of the ac line.

4E.11.5 Checking Relay Actuation

In the following discussion, it is assumed that the power indicator illuminates when power is applied (if not, refer to paragraph 4E.11.4.2). Also, refer to the simplified schematic diagram of Fig. 6-21, which shows the interaction of the relays; if a relay does not actuate, it may be because of a malfunction in another relay.

If it is suspected that a relay is not actuating, a visual check is possible. Use a knife blade, or some similar sharp instrument, to pry the dust cover from the suspected relay. Hold the takeup tension arm so that it does not contact the safety switch. With power applied, press the pushbutton which should actuate the relay, and visually observe the relay action. If the relay actuates, check that all contacts make, then turn power off, and clean the contacts, using bond paper or a contact burnishing tool. If the relay does not actuate, proceed as follows:

(a) If the relay does not actuate, turn off power and remove the relay from its receptacle. Check with an ohmmeter across the relay coil (pins 13 and 14 on the relay). The ohmmeter should indicate approximately 650 ohms. If the coil is open (or shorted, which is more unlikely) the relay must be replaced. If a replacement is not immediately available, refer to Servicing Hints, paragraph 4E.2.3, relative to maintaining normal play/record operation on an emergency basis.

(b) If the relay does not actuate, but the coil seems in good condition, replace the relay in its receptacle. Test the other modes of operation (for example, if the fast forward relay is being tested, check the play, rewind, and edit functions). If all other functions operate normally, turn power off and interchange the suspected relay with one known to be good. Recheck all modes of operation. If the original circuit operates normally but the trouble shows up in the circuit which now contains the suspected relay, it is probable that the relay is defective despite the coil testing correctly; replace the relay. If the original circuit still does not operate, some other component is preventing relay actuation. Turn power off, and remove the bottom cover from the control box (refer to paragraph 4E.11.2).

Remove the relay, and use an ohmmeter to check wiring continuity (see Schematic diagrams Figs. 6-20, 6-21), from the 24 volt dc supply to the pushbutton switch, and thence to the relay coil. Check the diode across the relay coil.

Check switch closure when the pushbutton is pressed. Check wiring continuity to the negative side of the 24 volt dc supply.

(c) If only the play function is normal in procedure (b), and the rewind, fast forward, and edit modes are inoperative, turn power off and remove the bottom cover (refer to paragraph 4E.11.2). Check transistors Q601 and Q602, and other components in that circuit (see schematic diagrams Fig. 6-20, 6-21).

(d) If no mode of operation is available in procedure (b), check the 24 volt dc power supply (refer to paragraph 4E.11.4.3).

4E.11.6 Checking Solenoid Actuation

4E.11.6.1 General

The main brake and edit brake solenoids and the capstan solenoid are actuated by the application of the 115 volt dc power; the tape lifter solenoid is actuated by the application of the 24 volt dc power. Actuation of all solenoids can be visually checked at the back of the tape transport.

4E.11.6.2 Checking Tape Lifter Solenoid

(a) If the tape is not lifted from contact with the heads during either fast forward or rewind modes, but those modes otherwise operate normally, visually check actuation of the tape lifter solenoid. If the solenoid actuates, manually check that the plunger is fully bottomed. If these two conditions exist, it is probable that all that is required is adjustment of the tape lifter mechanism (refer to paragraph 4E.9.1).

(b) If the tape lifter solenoid does not actuate in either fast forward or rewind, but those modes otherwise operate normally, there are very few components which could be responsible. Remove the remote control dummy plug, and check the jumper from pin 12 to pin 8 on that plug. Do not replace the plug until instructed. Disconnect the solderless connectors to the tape lifter solenoid. Check resistance of the solenoid coil (across the solderless connectors in the leads to the coil), it should be approximately 30 ohms; if the coil is open or shorted, the solenoid must be replaced (refer to paragraph 4E.9.2). Check continuity from the "A" lead at the solenoid (see Fig. 6-20) to pin 12 of the remote control receptacle, little or no resistance indicates proper making of the edit switch in its up position. Check the diode across the solenoid coil by checking with the ohmmeter across the solenoid leads into the control box; if the diode is defective it must be replaced (this is the diode inside the control box which is connected from the remote control receptacle to the rewind relay receptacle).

(c) Use alligator clips to connect a dc voltmeter to the two leads into the control box (the "B" lead, see Fig. 6-20, is positive). Replace the dummy plug in its receptacle. Apply power to the equipment, and start it in the fast forward mode. The nominal 24 volt dc power should be indicated on the meter. The same should be true in the rewind mode. If power is present, it is probable that the solenoid is defective despite its coil testing correctly; replace the solenoid (refer to paragraph 4E.9.2). If power is not present, check wiring continuity to the negative and positive sides of the 24 volt power supply. Overall continuity can be easily checked by removing the dust covers on the fast forward and rewind relays. Check from the positive ("B") lead into the control box to the positive side of C609 (item 27, Fig. 6-18) manually actuating first the fast forward, then the rewind relay; little or no resistance should be encountered. Then check from the negative ("A") lead to the negative side of C609 (do not actuate the relays).

(d) If the tape lifter solenoid actuates in one fast-winding mode and not in the other but both modes otherwise operate normally, it would indicate either improper making of the relay contacts in the fast forward or rewind relays, or poor wiring connections to those contacts. Check contact set 11-3-7 and the wiring to it, on the relay indicated to be at fault.

4E.11.6.3 Checking Capstan Solenoid

(a) If the capstan idler does not move to clamp the tape to the capstan when the play pushbutton is pressed, first visually check actuation of the main brake solenoids on the takeup and rewind motors. If those solenoids are not actuating when the play pushbutton is pressed, check their actuation in fast forward and rewind; if they actuate in those modes it is probable that the trouble is in the play relay. Check that relay and its contacts (refer to paragraph 4E.11.5). Replace if necessary.

(b) If the brake solenoids do not actuate in any mode, and the capstan solenoid does not actuate in the play mode, place the equipment in the stop/edit mode and check actuation of the edit brake solenoids. If no solenoid can be actuated,

check the 115 volt dc power supply (refer to paragraph 4E.11.4.4), and the 24 volt dc power supply (refer to paragraph 4E.11.3).

(c) If the main brake solenoids are actuated when the play pushbutton is pressed in (a), the capstan solenoid and its circuit must be checked. Disconnect the solderless connectors in the leads to the capstan solenoid. Use an ohmmeter to check the resistance of the solenoid coil (across the two disconnected leads); it should be approximately 1,570 ohms. If the coil is open or shorted, the solenoid must be replaced (refer to paragraph 4E.8.5). Use alligator clips to connect a dc voltmeter to the solenoid leads into the control box (the "A" lead is positive, see Fig. 6-20), and press the play pushbutton. The nominal 115 volt power should be available across those leads. If that power is present, it is probable that the solenoid is defective despite the coil checking correctly; replace the solenoid.

(d) If power is not present in (c), remove the bottom cover of the control box (refer to paragraph 4E.11.2). Check wiring continuity from the solenoid to the negative and positive sides of the 115 volt dc power supply. Overall continuity can be easily checked by removing the dust cover from the play relay. Check with an ohmmeter from the positive ("A") lead of the solenoid into the control box to the positive side of capacitor C614 (item 38, Fig. 6-18) while manually actuating the play relay; little or no resistance should be encountered. Without actuating the relay, check from the negative ("B") lead to the negative side of C614, again little or no resistance should be encountered.

4E.11.6.4 Checking Main Brake Solenoids

(a) Main brake solenoids should be actuated in the play, fast forward, and rewind modes of operation. In the play mode, the capstan solenoid should also be actuated, so that the idler moves to clamp the tape to the capstan. If neither of the brake solenoids or the capstan solenoid are actuated in the play mode, follow the procedures described in (a) and (b) paragraph 4E.11.6.3.

(b) If the rewind main brake solenoid is actuated in the play mode, but the takeup main brake solenoid is not, check contacts in the edit relay (refer to paragraph 4E.11.5). Remove the bottom cover of the control box (refer to paragraph 4E.11.2). Remove the takeup motor cable from its receptacle on the control box. Use an ohmmeter to check the diode (CR607) which is located on the pins at the back of the rewind motor receptacle. Replace if defective. Check the resistance of the solenoid coil, across pins 5 and 6, of the rewind motor plug; it should be approximately 2,300 ohms. If the coil is opened or shorted, the main brake solenoid must be replaced (refer to paragraph 4E.4.7). Reconnect the takeup motor cable to its receptacle on the control box, and disconnect the solderless connectors to the main brake solenoid. Use alligator clips to connect a dc voltmeter to the solenoid leads from the motor plug (the lead to pin 5 of the plug is positive). Apply power, and place the equipment in the play mode. The nominal 115 volt dc voltage should be present across those leads. If the voltage is present, it is probable that the main brake solenoid is defective despite its coil testing correctly; replace the solenoid (refer to paragraph 4E.4.7). If voltage is not present, check wiring continuity from the leads to the positive and negative side of the 115 volt power supply. Overall continuity is easily checked by removing the dust covers from the play, rewind and fast forward relays. Check from the negative lead (pin 6 of the plug) to the negative side of C614 (item 38, Fig. 6-18), and manually actuate first the play relay, then the rewind relay, then the fast forward relay; little or no resistance should be encountered when any one of the relays is actuated. Without actuating any relay, check from the positive lead to the positive side of C614. Little or no resistance should be encountered.

(c) If the takeup main brake solenoid actuates in the play mode, but the rewind main brake solenoid does not, remove the rewind motor cable from the receptacle on the control box. Check the resistance of the solenoid coil, across pins 5 and 6 of the rewind motor cable plug. It should be approximately 2,300 ohms; if the coil is opened or shorted the solenoid must be replaced (refer to paragraph 4E.4.7). Remove the bottom cover of the control box, and use an ohmmeter to check the diode (CR610) which is soldered across pins 5 and 6 on the back of the rewind motor receptacle. Replace the diode if it is defective. Reconnect the rewind motor cable to its receptacle on the control box, and disconnect the solderless connectors in the leads to the solenoid. Use alligator clips to connect a dc voltmeter across the two solenoid leads to the plug. Apply power, and place the equipment in the play mode. The nominal 115 volts dc should be available across

those leads. If the voltage is present, it is probable that the solenoid is defective despite its coil checking correctly; replace the solenoid (refer to paragraph 4E.4.7). If the voltage is not present, check wiring continuity from the solenoid leads to the positive and negative sides of the 115 volt dc power supply. Overall continuity can be easily checked by removing the dust covers from the play, fast forward, and rewind relays. Connect the ohmmeter from the negative (pin 6 of the plug) lead to the negative side of C614 (item 38, Fig. 6-18). Manually actuate first the play, then the fast forward, then the rewind relays. Little or no resistance should be encountered when any one of the three relays is actuated. Without actuating any relay, check from the positive (pin 5 of the plug) lead to the positive side of C614, little or no resistance should be encountered.

4E.11.6.5 Checking Edit Brake Solenoids

(a) Edit brake solenoids on both the takeup and rewind motors should actuate in the stop/edit mode. If neither of the solenoids actuates in this mode, check actuation of the main brake solenoids in the fast forward and rewind modes, and the main brake solenoids and capstan solenoid in the play mode. If none of these solenoids can be actuated, check the 115 volt dc power supply (refer to paragraph 4E.11.4.4). If all other solenoids actuate normally, the trouble is probably in the edit relay; check relay action and contacts (refer to paragraph 4E.11.5) and replace the relay if necessary. If the relay action is normal, remove the bottom cover from the control box (refer to paragraph 4E.11.2) and disconnect both the rewind and takeup motor cables from their receptacles on the control box. Use an ohmmeter to check the diode (CR611) which is connected across pins 7 and 8 on the back of the rewind motor receptacle; replace the diode if it is defective.

(b) Probably the only other thing that could cause neither solenoid to actuate, would be the wiring to the 115 volt dc power supply. Disconnect the solderless connectors to either edit brake solenoid, and use alligator clips to connect a dc voltmeter across the leads to the plug (the lead to pin 7 is positive). Apply power to the equipment and press the edit pushbutton. The nominal 115 volt dc power should be present across the leads. If it is not present, remove the dust cover from the edit relay. Check with an ohmmeter from the positive lead to the positive side of C614 (item 38, Fig. 6-18) while manually actuating the edit relay; there should be little or no resistance. Without actuating the relay check from the negative lead to the negative side of C614, there should again be little or no resistance.

(c) If only one of the solenoids actuates in the stop/edit mode, it is probable that the non-actuating solenoid is defective, because the two are tied directly together across the rewind and takeup receptacles. Disconnect the cable from its receptacle on the control box. Check the resistance of the solenoid coil, across pins 7 and 8 on the motor cable plug; it should be approximately 2,300 ohms. If the coil is open or shorted, the solenoid must be replaced (refer to paragraph 4E.4.7). Check voltage and resistance from the non-actuating relay as explained in (b).

4E.11.7 Checking Drive Motor

(a) If the power indicator lights when power is applied, but the capstan motor does not start in rotation when tape is threaded, manually move the takeup tension arm to be sure it is not contacting the safety switch. Then, with power applied, press the edit pushbutton to place the equipment in the stop/edit mode; if braking force at the reel turntables is reduced to where the reels can easily be turned, the safety switch is all right. If not, it is probable that the actuation of the safety switch is incorrectly adjusted (refer to paragraph 4E.7.2), the spring force of the takeup tension arm is incorrectly adjusted (refer to paragraph 4E.7.1) or the safety switch is defective and must be replaced (refer to paragraph 4E.10).

(b) Next, check that the dummy plug is inserted in the 60 Hz amplifier receptacle, and check the jumpers in that plug (see P604P, Fig. 6-20). (If a 60 Hz precision amplifier is being used, check the operation of that unit.)

(c) Now remove the drive motor cable from its receptacle on the control box. If the speed switch is in the high speed position, apply power and check with an ac vtvm across receptacle pins 4 and 5, and then across receptacle pins 3 and 5. (If the speed switch is in the low speed position, check across receptacle pins 1 and 5, and 2 and 5). Full line power should be available at both positions. If so, it indicates that the speed switch is closed and that the motor capacitor is not open. If voltage is available at pins 4 and 5 (1 and 5) and not across 3 and 5 (2 and 5) the motor capacitor is probably open; check and replace if required (refer to paragraph 4E.5.4). Even if voltages are correct, check that the motor capac-

itor is not shorted; also check the connections to the motor capacitor at the solderless disconnects (see Fig. 6-10).

(d) If the motor capacitor is all right, or if power is not available across either pair of receptacle pins, turn power off, remove the bottom cover, and check the make-break action at all contacts of the speed switch (view A-A, Fig. 6-18) using an ohmmeter and placing the switch first in one position then the other. (If any capacitor C602 through C605 is shorted, voltage will appear at receptacle pin pairs for the opposite speed selected. In this case, the motor probably would always run at the slow speed--regardless of the speed selected--with very little torque).

(e) If voltages are present at both receptacle pin pairs, and if the motor capacitor is alright, it indicates that the drive motor is defective; check and replace (refer to paragraph 4E.5.3). Motor cabling connections are shown on Fig. 6-16.

4E.11.8 Checking Takeup Motor

If the power indicator does not light when power is applied refer to paragraph 4E.11.4.2. If the capstan motor does not operate when tape is threaded refer to paragraph 4E.11.7.

(a) When both of the above components operate normally, pressing the play pushbutton should result in the capstan idler clamping the tape against the rotating capstan, and the takeup motor starting in rotation to reel in the tape. If the capstan idler operates normally, but the takeup motor does not start, check deactuation of the edit relay (refer to paragraph 4E.11.5); if it does not deactuate, remove the bottom cover and use an ohmmeter to check opening and closure of the edit switch. If the edit relay does deactuate, check the actuation of the safety switch as described in paragraph 4E.7.2 (even if the safety switch is misadjusted, it would probably still leave some trouble in the takeup motor circuit.)

(b) If the capstan idler does not move to clamp the tape to the capstan, check that the dummy plug (or remote control unit) is plugged into the remote control receptacle on the control box. Check the jumpers in the dummy plug. Check if the rewind motor is applying holdback tension on the tape. If not, check actuation and contacts of the play relay (refer to paragraph 4E.11.5.).

(c) If the capstan idler clamps the tape to the capstan, and the takeup motor starts, but a tape loop allows the takeup tension arm to actuate the safety switch (thus stopping all operation) check the takeup and rewind tape tensions (refer to paragraph 4C.2.3 in part C of this section) and the spring force on the takeup tension arm (refer to paragraph 4E.7.1).

(d) If the capstan clamps the tape to the capstan and the takeup motor gives no indication of starting, it is an indication of a malfunction in the motor circuit. First, check fast forward operation. If the motor operates normally, it indicates that the motor and capacitor are alright, and that the brake solenoid is being energized. Check deactuation and contacts of the fast forward relay (refer to paragraph 4E.11.5) and takeup tension adjusting resistor R605, mounted at the back of the control box. (Note that malfunction of the play and edit relays will cause other malfunctions previously explained).

(e) If the motor does not operate in either play or fast forward, check the takeup reel switch; if it is in the small reel hub position change it to the large reel hub position. If this clears the trouble check small reel hub tensioning resistor R606 mounted on the back of the control panel. If not, or if the switch was originally in the large reel hub position, visually check actuation of the main brake solenoid. If it is not actuating, refer to paragraph 4E.11.6.4. If it is actuating, remove the takeup motor cable from its receptacle on the control box. Remove any tape threaded on the equipment, and hold the takeup tension arm from its rest position (so it does not contact the safety switch). Press the fast forward pushbutton, and use an ac vtvm to check voltage across pins 1 and 2 of the motor receptacle. Full line power should be available across those pins. If not, check wiring continuity to both sides of the ac line. Note that overall continuity can be easily checked, by removing the dummy plug from the 60 Hz amplifier receptacle. Check continuity of ac neutral by using an ohmmeter connected across pins 1 on the motor receptacle and 4 on the 60 Hz amplifier receptacle, no appreciable resistance should be present. Check the high side of the line by removing the dust caps from the play and fast forward relays. Connect the ohmmeter between pins 2 on the motor receptacle and 1 on the 60 Hz amplifier receptacle. Manually actuate the fast forward relay; no appreciable resistance should be present (reel switch in large reel hub position). Release the fast forward relay, and manually actuate the play relay. The only resistance encount-

ered should be that set at takeup tensioning resistor R605. Replace the dummy plug in the 60 Hz amplifier receptacle when checking is completed.

(f) If voltage is present as explained in (e), check the motor capacitor connections at the solderless connectors (see Fig. 6-12), then check the capacitor. If it is open or shorted, it must be replaced (refer to paragraph 4E.4.9). If voltage is present and the capacitor is alright, the takeup motor is probably defective. Check and replace the motor (refer to paragraphs 4E.4.2 and 4E.4.5). Motor cabling connections are shown on Fig. 6-12.

4E.11.9 Checking Rewind Motor

If the power indicator does not light when power is applied refer to paragraph 4E.11.4.2. If the capstan drive motor does not operate when tape is threaded, refer to paragraph 4E.11.7. If the takeup motor does not operate, refer to paragraph 4E.11.8.

(a) If all of the above components operate normally, but there is no rewind function, remove the tape from the transport. Hold the takeup tension arm from its rest position (so it does not contact the safety switch) and put the equipment in the play mode. The rewind turntable should rotate clockwise, the takeup turntable should rotate counterclockwise, and the capstan idler should move to contact the capstan. If operation is as described, press the rewind pushbutton. If this does not drop out the play mode (capstan idler does not move away from capstan) check actuation and contacts of the rewind relay (refer to paragraph 4E.11.4). If the play mode drops out, it will indicate that the rewind relay is actuating.

(b) If only the takeup motor operates in (a) check the supply reel switch. If it is in the small reel hub position, move it to the large reel hub position. If the rewind motor now operates, check small reel hub tensioning resistor R608. Also, visually check actuation of the main brake solenoid; if it does not actuate, refer to paragraph 4E.11.6.4.

(c) If changing the position of the reel switch has no effect, and if the main brake solenoid actuated in (b), remove the rewind motor cable from the receptacle on the transport control box. Hold the takeup tension arm from contacting the safety switch, and press the rewind pushbutton. Use an ac vtvm to check voltage across pins 1 and 2 of the rewind motor receptacle on the control box. Full power line voltage should be available across those pins (reel size switch in large reel position). If voltage is not as quoted, or is excessively low, check wiring continuity to the ac line. Note that overall continuity can be easily checked by removing the dummy plug from the 60 Hz amplifier receptacle. Check the neutral side of the line from pin 1 on the rewind motor receptacle to pin 4 of the 60 Hz amplifier receptacle; little or no resistance should be encountered. To check the high side of the line, remove the dust cover over the rewind and play relays, and connect the ohmmeter from pin 2 of the rewind motor receptacle to pin 1 on the 60 Hz amplifier receptacle. Manually actuate the rewind relay, little or no resistance should be encountered. Release the rewind relay, and manually actuate the play relay. The resistance set across holdback tension adjusting resistor R604 should be all that is encountered. If continuity checks are as quoted, recheck actuation and contacts on both the play and rewind relays (refer to paragraph 4E.11.5).

(d) If voltage is present as quoted in (c), check the rewind motor capacitor connections at the solderless connectors (see Fig. 6-13), then check the capacitor. If it is open or shorted, it must be replaced (refer to paragraph 4E.4.9). If voltage is present and the capacitor is alright, the rewind motor is probably defective. Check and replace the motor (refer to paragraphs 4E.4.2 and 4E.4.5). Motor cabling connections are shown on Fig. 6-13.

4E.11.10 Replacing Power Indicator Lamp

To replace the lamp in the power indicator remove the two screws (item 61, Fig.6-8) which secure the escutcheon over the pushbuttons. That escutcheon, and the pushbuttons beneath it, will come free. Remove the two screws (items 61 and 65, Fig. 6-8) which secure the escutcheon over the toggle switches, that escutcheon will come free. The lamp can now be removed from the socket if a lamp extracting tool is available. If such a tool is not available, it will be necessary to complete the removal of the control box from the transport (refer to paragraph 4E.11.3).

4E.11.11 Replacing Switches

Replacing any switch on the control box requires removing the control box from the transport (refer to paragraph 4E.11.3). Note that when new pushbutton switches are installed the protrusion of the switch from the face of the chassis is to

be set at 19/32 inch (±1/32 inch). The protrusion of any toggle switch handle from the face of the chassis is to be set at 1-5/16 inch (±1/32 inch).

4E.11.12 Checking Record Circuit

Placing the equipment in the record mode, basically speaking, consists of starting tape in the play mode at the transport and actuating the record circuits in the electronic assembly. In addition to this, on this equipment there are two switching transistors, Q601 and Q602. The purpose of these transistors is to lock out the edit, fast forward, and rewind modes while the equipment is recording. Q601 is therefore placed in the negative return lead from the edit, fast forward, and rewind relays. When the record mode is initiated, transistor Q602 is turned on, and this turns Q601 off.

If it becomes possible to start the edit, fast forward, or rewind modes of operation from the record mode, transistor Q602 (item 24, Fig. 6-18) may be open, or Q601 (item 23, Fig. 6-18) may be shorted. If it becomes impossible to start those three modes at any time, transistor Q602 may be shorted or Q601 may be open. No malfunction of either transistor will prevent entering the record mode.

Section 4

MAINTENANCE

Part F. Electronics, Corrective Maintenance

4F.1 GENERAL

Overall performance checks for the equipment are described in part B of this section, paragraph 4B.4. Normal alignment procedures are included in part C of this section, paragraphs 4C.3 and 4C.4.

Standard audio trouble shooting techniques should be used in isolating a fault to a certain stage or component. Note that dc, signal, and bias voltages are included at many points on the schematic diagram as a further aid in locating any malfunctions. The schematic diagram for record/reproduce electronic circuits are on Fig. 6-22 and 6-24, for reproduce-only equipment on Figs. 6-23 and 6-25. A power distribution and fusing diagram is on Fig. 6-19.

4F.2 USING EXTENDER BOARDS

Corrective maintenance procedures will be greatly facilitated if the optional accessory extender boards are available. The extender plugs into the circuit board receptacle in the electronic chassis (or power supply), and the circuit board then plugs into the extender. The circuit board is thus held in position outside the chassis, with all circuits connected and all components available for testing.

Catalog numbers of the extender boards are as follows:

For reproduce	4020151
For record	4020152
For bias amplifier	4020153
For power supply	4020154

4F.3 CHECKING INPUT POWER AND INDICATORS

4F.3.1 Record/Reproduce Equipment

When the power is turned on at the tape transport, the power indicator on the transport, and the vu meter lights on record/reproduce electronic assemblies should be illuminated. If the power indicator on the transport does not light, refer to paragraph 4E.11.4. A power distribution and fusing diagram is on Fig. 6-19.

(a) If the power indicator is illuminated, but the vu meter lights are not, place the record selector switch on the electronic assembly in the ready position, and check the ready indicator. If it illuminates, it is probable that one of the vu meter lights is defective (these lights are connected in series). Replace the meter light (refer to paragraph 4F.9.1.2).

(b) If the ready indicator does not illuminate in (a), check fuse 4F1 on the back panel of the electronic assembly. If that fuse is alright, check fuse F701 on the electronic power supply box mounted behind the transport. If both fuses are alright, check with a dc voltmeter at any receptacle J701 through J704 on the electronic power supply box, checking across pins 9 (positive) and 5. The 39 volt dc power should be available across those pins; if not check the power supply board (see schematic diagram, Fig. 6-22). If the voltabe is present, the trouble must be in the interconnecting cable to the electronics, or in internal wiring.

(c) If the power indicator on the transport, and the vu meter lights, are illuminated when power is applied, but the ready indicator does not light when the record selector switch is placed in the ready position, it is probable that the ready indicator light is defective. Replace the light (refer to paragraph 4F.9.1.1).

(d) If the vu meter lights and the ready indicator illuminate correctly, but the record indicator does not light when the equipment is placed in the record mode, turn the output selector switch to the bias position (while still in the record mode). If the vu meter indicates normal bias, it is probable that the record indicator light is defective; replace the light (refer to paragraph 4F.9.9.1).

(e) If no bias indication is present at the vu meter in (d) it is probable that the trouble is in the record relay. Check relay actuation, contacts, and holding circuit (refer to paragraph 4F.4).

4F.3.2 Reproduce-only Equipment

(a) There is no vu meter on reproduce-only equipment. If it is suspected that operating power is not available, check with a dc voltmeter across pins 9 and 5 on any receptacle J701 through J704 on the electronic power supply box behind the tape transport. The +39 volt dc power should be available. If not check fuse F701 on the power supply box.

(b) If no voltage is present in (a) but the fuse is alright, check the power supply printed circuit board (see schematic diagram Fig. 6-23).

(c) If voltage is present in (a) insert the reproduce board in position on an extender card and check the +39 volt voltage at any convenient point (see schematic diagram, Fig. 6-25). If no voltage is present, the fault is indicated to be in the interconnecting cable, or in internal wiring.

4F.4 CHECKING RECORD RELAY

The record relay, which plugs in at the back panel of the record/reproduce electronic assembly, is the only relay used in the record/reproduce circuit. It is identical to the four relays employed on the tape transport. (This check is not applicable to reproduce-only equipment.)

(a) If it is suspected that the record relay is not actuating, its action can be checked visually by removing the dust cover from the relay. Hold the takeup tension arm so that it does not contact the safety switch, put the record selector in the ready position, and start operation in the play mode. (Note that it is assumed here that transport operation in the play mode is normal.) Then press and release the record pushbutton. If the relay actuates and holds in the energized position, check contact closure. If contacts are dirty, clean them with bond paper or a contact burnishing tool.

(b) If the relay does not actuate and hold in (a), remove the relay from its receptacle. Check the dc resistance of the coil across relay terminals 13 and 13; it should be approximately 650 ohms. If the coil is open or shorted, the relay must be replaced. (Refer to Service Hints, paragraph 4E.2, relative to maintaining record/reproduce operation on an emergency basis if a replacement relay is not available.)

(c) If the relay coil checks correctly in (b), remove the power interconnecting cable at J11 on the electronic assembly. Place the equipment in the play mode, and use a dc voltmeter to check across pins 10 (positive) and 5 on the cable plug; the 24 volt dc holding voltage should be present across those pins. Connect the dc voltmeter across pins 4 (positive) and 8 on the cable plug; with the equipment in the play mode, press and hold the record pushbutton. The 24 volt energizing power should be available across those pins. These voltages are supplied from the 24 volt dc power supply in the tape transport control circuit, if either is not present, check wiring continuity back to that supply (through the electronic power supply box).

(d) If both the holding and energizing voltages are present in (c), remove the relay from its receptacle and leave the plug to J11 disconnected. Use an ohmmeter to check the diode across pin 4 of J11 to pin 14 of the relay receptacle. Check the other diode across pins 14 and 13 of the relay receptacle. Check resistor 4R77 across

pins 14 and 12 of the relay receptacle. Check opening and closure of the record selector switch, connecting the ohmmeter from pin 8 of J11 to pin 13 of the relay receptacle and switching the record selector from the safe (open) to the ready (closed) positions.

(e) If voltage is present in (c) and no faulty component is found in (d) the relay is probably defective despite its coil testing correctly. Replace the relay.

4F.5 CHECKING POWER SUPPLY

Adjusting the voltage regulator in the electronic power supply is described in part C of this section, paragraph 4C.3.5. Note that in this discussion it is assumed that the tape transport operates normally.

(a) The power supply provides 39 volts dc, regulated to -1/2+1 volt. This voltage should be available at three pins of any of the power to electronics receptacles (J701 through J704) on the power supply box. Place the equipment in the reproduce mode. Check with a dc voltmeter between pins 9 (positive) and 5 of the receptacle (if this is four channel equipment remove one of the electronic cables for this test). Select high speed, with the equipment still in the reproduce mode, check with the dc voltmeter across pins 7 (positive) and 5 (this is the high speed equalization switching voltage). Select low speed and check across pins 6 (positive) and 5 (this is low speed equalization switching voltage). The regulated dc voltage should be present at all three points as checked. Note that if it is present across pins 9 and 5, and not present at either one or both of the other points, the trouble is probably in the speed switch on the tape transport, or in the cabling or internal wiring.

(b) If no voltage is present, first check fuse F701 on the power supply box. If that fuse is alright, open the power supply box and use the extender card to hold the printed circuit board in position outside of the box. If voltage is present but is excessively high, proceed to (f).

WARNING

Dangerous voltage exists across the fuse post and across the transformer leads. Use special care when making the following checks which require application of power.

(c) With all electronic assemblies connected, place all channels in the record mode. Use the dc voltmeter to check across CR706, CR705, and R707 (as the board is positioned in the extender, the positive lead of the voltmeter is to be placed at the end of CR706 which is nearest the extender, the negative lead to the end of R707 farthest from the extender). Voltage present at this point is dependent on load, and component tolerances, and can only be given in approximate terms. For one channel of electronics it should be approximately 72 volts, for two channels approximately 66 volts, for three channels approximately 60 volts, and for four channels approximately 54 volts.

(d) If voltage is not present, or is excessively low, in (c) remove power from the equipment and use an ohmmeter to check CR706, CR705, and R707 on the printed circuit board. If those components check correctly, remove the power supply box from the transport (refer to part E of this section, paragraph 4E.3). On the side which was next to the transport, capacitor C707, resistor R706, and the diodes (CR701 through CR704) which make up the full wave bridge rectifier are available. Check each of those components. If they are alright, remove the heat sink panel on which the power transistor (Q705) is mounted. Apply power (connect the box to the transport) and use an ac vtvm to check primary (white/black leads) and secondary (red/red leads) voltages to check the power transformer (T702). See warning after (b).

(e) If the voltage seems correct in (c) check transistors Q706 (shorted), Q704 (open), and Q703 (open). Then check all other components associated with those stages (all are mounted on the printed circuit board). Check capacitor C706 (shorted) on the printed circuit board. Finally check power transistor Q705 (open) which is mounted on the heat sink.

(f) If voltage is present in (a) but is excessively high, try adjusting the regulator to bring it within tolerance (refer to paragraph 4C.3.5). If adjustment cannot be made, remove the printed circuit board from the power supply box. Check transistors Q706 (open), Q704 (shorted), and Q703 (shorted). Check all components associated

with those stages. Finally check power transistor Q705 (shorted), which is mounted on the heat sink on the side of the box next to the transport.

4F.6 CHECKING BIAS

This check is applicable to record/reproduce equipment only.

If trouble is experienced in the bias or erase circuit, the malfunction could be in either the master bias oscillator (on the same printed circuit board as the power supply), or the bias amplifier module. On multi-channel equipment if the trouble is present on all channels, it can be assumed that the master bias oscillator is at fault; if the trouble is on only one channel, it is probable that the bias amplifier for that channel is at fault.

Trouble can also be easily isolated to one circuit or the other by inserting the bias amplifier extender card in the amplifier receptacle, plugging the bias amplifier module into the extender, and measuring the bias input with an ac vtvm across resistors 3R90 and 3R91. Correct bias voltage at those points is shown on the schematic diagram, Fig. 6-24. If this input voltage is correct, the trouble is probably in the bias amplifier module; if it is incorrect, the master bias oscillator is probably at fault.

Bias and dc voltages under correct operating conditions are shown on the schematic diagram, Fig. 6-24, at key points on the bias amplifier module. Placing the equipment in the record mode and checking these voltages should quickly isolate any trouble to a particular stage and component. Note that dc voltage is applied to the bias amplifier only in the record mode. There should be no difficulty in checking the very simple push-pull master bias oscillator. Use an extender card to position the power supply and oscillator printed circuit board so that all components are available.

WARNING

Dangerous voltages exist across the fuse post and at the transformer leads inside the power supply box. Use special care when checking the master bias oscillator with power applied.

4F.7 CHECKING RECORD/REPRODUCE

4F.7.1 General

On record/reproduce equipment, if a tape does not play back correctly on the same machine on which it was recorded, the fault can be in either the record circuit or the reproduce circuit. This can be quickly checked by playing back a tape known to be properly recorded. If that tape reproduces normally, the trouble is in the record circuit; if it does not, the trouble is in the reproduce circuit.

Whenever any trouble is experienced, check power indications (refer to paragraph 4F.3). Also check the high speed and low speed equalization switching voltages from the power supply (refer to paragraph 4F.5).

The schematic diagram is on Fig. 6-24.

4F.7.2 Checking Record

If the trouble is indicated to be in the record circuit, check that the signal input is properly connected and that the dummy plug (or accessory) is plugged into the input accessory socket on the back panel of the electronic assembly. Check the bias by placing the equipment in the record mode and turning the output selector to the bias position; if the bias is not normal refer to paragraph 4F.6. Check the actuation and contacts of the record relay (refer to paragraph 4F.4). Check that the record head is properly connected.

Signal voltages and dc voltages are given on the schematic diagram, Fig. 6-24. Using the extender card and checking these voltages should quickly isolate the fault to a specific stage and component.

Following are some servicing hints which might be helpful.

(a) With the equipment in the record mode and the output selector in the input position, check if the vu meter indication is normal with a signal input. If not, the trouble is indicated to be in stage 2Q9 or in the plug-in equalizer board; if the vu meter indication is normal, the trouble is in stages 2Q10 through 2Q15.

(b) Transistor 2Q10 conducts only when the low tape speed is selected; 2Q11 conducts only when the high tape speed is selected.

(c) DC voltage is applied to stages 2Q9 through 2Q11 whenever power is on. It is applied to stages 2Q12 through 2Q15 only when the equipment is operating in the record mode.

Signal voltages and dc voltages are shown on the schematic diagram, Fig. 6-24. Use the extender card and check these voltages. This should quickly isolate the fault to a specific stage and component.

Note that if the output selector is put in the input position, and the vu meter indication seems normal when a signal is applied to the record line input, the fault is indicated to be in stages 1Q1 through 1Q4. If the indication is not normal the fault is indicated to be in stages 1Q5 through 1Q8.

4F.7.3 Checking Reproduce

If trouble is indicated in the reproduce circuit, check that the reproduce head and the output line are connected. Check with head sets at the phones jack on the front of the assembly; if the signal is normal at that point the fault is probably in the output transformer or output line.

4F.8 CHECKING REPRODUCE-ONLY

Check signal and dc voltages as shown on the schematic diagram, Fig. 6-25. Note that the same reproduce extender card is used as that for the reproduce circuit in record/reproduce equipment.

4F.9 REPLACEMENT OF PARTS

4F.9.1 Indicator Lamps

4F.9.1.1 Ready/Record Lamps

The ready and the record indicator lamps are held in position by a spring clip. Remove the top cover from the electronic assembly. Pull off the wired sockets from the lamps. Then, using long nose pliers, press the two extrusions on the clip together and remove the clip--being careful not to let it slip from the pliers. The lamp is now free and can be removed through the front of the assembly. When installing the new lamp, press the clip against the panel, so that the lamp is held firmly in position.

4F.9.1.2 VU Meter Lamps

To remove the vu meter lamps, remove the bottom cover of the electronic assembly. Pull off the wired sockets from the lamps then simply pull the lamps out of the meter housing. Replace the lamps in the reverse order of removal.

4F.9.2 Components on Printed Circuit Boards

Removing components from printed circuit boards requires proper tools and correct procedures. Required tools are a low-wattage (50 watts or less) pencil-type soldering iron, noncorrosive soldering flux (rosin alcohol base), and a length of small diameter shielding braid. (If a plunger type solder remover is available, use it instead of the soldering flux and shielding braid).

To remove a component from a board, dip the length of shielding braid in the soldering flux. Heat the solder junction with the soldering pencil (do not use a soldering gun or high wattage iron), and dip the braid into the molten solder. The solder will be drawn up into the braid. When solder has been removed in this fashion from all component leads, the part can be removed without exerting excessive force. Be sure not to overheat any of the soldering junctions during this procedure.

To install the replacement part, bend its leads to fit through the mounting holes. Bend the leads down against the foil path, and use the soldering pencil, and low melting point rosin core solder to solder the junctions. Avoid overheating the junction. Remove any excess rosin from the joint by cleaning it with alcohol.

If a diode or transistor is replaced, allow the board to cool for approximately five minutes before reinserting it in the housing and applying power. This is to prevent thermal runaway which might result from the soldering operation if power is applied immediately after replacing a semiconductor device.

4F.9.3 Other Components

All other components are accessible if either the top or bottom cover is removed. On the schematic diagram of Fig. 6-24, component location is indicated by the number preceding the identification letter. A table on the diagrams shows the prefixes used and the indicated locations. Assembly drawings, Fig. 6-26 through 6-29, are also provided to help in locating parts.

4F.10 ACHIEVING RESPONSE CURVES

Response curves for record and reproduce are provided on Figs. 6-32 and 6-33. To achieve these curves, disconnect the head cables, input cable, and output cable from their receptacles at the back of the electronic assembly. Connect the signal generator and the vtvm as shown in

Fig. 4F-1 (record) and Fig. 4F-2 (reproduce), using the resistor networks shown. Set the generator to provide a 0.78 volt (0 dbm) output. To check the record amplifier curve, remove the bias amplifier plug-in circuit board. Hold the takeup tension arm from its rest position, so that it does not contact the safety switch, and place the equipment in the record mode. Simply apply power to check the reproduce amplifier curve.

Run the generator in discrete steps over the frequency range specified for the tape speed involved, and adjust the equalization controls to place the amplifiers on curve.

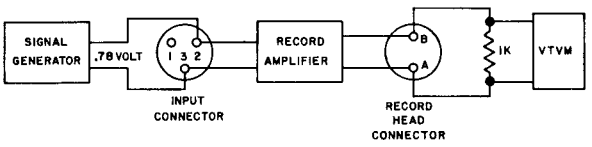

Fig. 4F—1. Connections, Record Response Curves

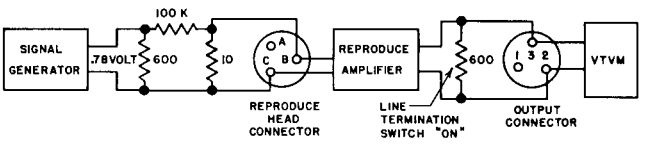

Fig. 4F—2. Connections, Reproduce Response Curves