

AMPEX

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AG500 and AL500 Recorder/Reproducer

Operation and Maintenance Manual

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DESCRIPTION

1.1 GENERAL

Ampex Models AG-500 and AL-500 Magnetic Tape Recorders and Reproducers (See Figure 1-1) provide high quality performance for professional audio applications. Both models are housed in a compact configuration which makes them especially suitable for use as portable units; they can also be mounted directly in standard 19-inch racks.

Both the AG-500 and AL-500 consist of a two-speed tape transport assembly, a head assembly (installed on the transport), and one all solid state electronic assembly for each record/reproduce operating channel. The equipment can be provided either mounted in a specially-designed carrying case, or unmounted for installation in a custom console or in a rack.

The basic difference between the AG-500 and AL-500 equipment is in tape speed. The Model AG-500 is intended for use as a general purpose, audio recorder/reproducer; as such, optional tape speed pairs available are 3-3/4 and 7-1/2 ips (inches per second) or 7-1/2 and 15 ips. The Model AL-500 is designed for long term operation in communication logging applications; a single tape speed pair of 15/16 and 1-7/8 ips is available for this model.



Fig. 1-1. Ampex Model AG-500 Recorder/Reproducers, Portable Cases

Model AG-500 equipment is available either as a one channel or two channel equipment. The head assembly for the one channel version may provide either full track or half track recording and reproducing; for the two channel version, it may provide either conventional two track or quarter track operation.

Either two channel or four channel record/reproduce capability is available for the Model AL-500. Heads for this equipment are all of the quarter track variety.

Both models come in two basic versions, designated as Domestic and International. Domestic equipment requires a 105 to 125 volt ac power line. International equipment is provided with a switch which allows the selection of either 105 to 125 volt or 210 to 250 volt operation. Either version can be ordered for use with power line frequencies of 60 Hz or 50 Hz.

1.2 TAPE TRANSPORT ASSEMBLY

Two tape speeds are provided by the tape transport, shown on Fig. 1-2. Standard speed pairs available are 15/16 and 1-7/8 ips, 3-3/4 and 7-1/2 ips, and 7-1/2 and 15 ips. The transport accommodates 1/4-inch wide magnetic tape on reels up to 7 inches in diameter.

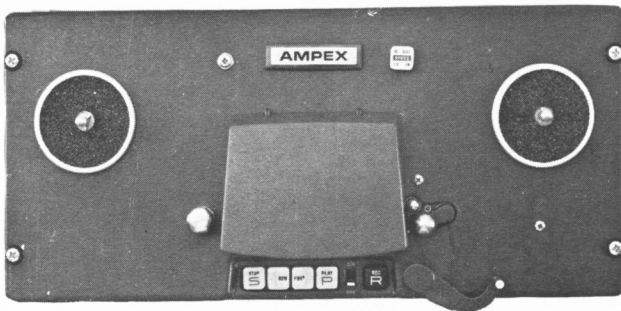


Fig. 1-2. Tape Transport

Controls on the tape transport include a speed selector lever; five pushbutton switches used to initiate the record, play, fast forward, rewind, and stop functions; and a power toggle switch.

1.3 HEAD ASSEMBLY

Individual head stacks (erase, record, or reproduce) may contain either one head (full

track) or two heads (two track or quarter track). Typical head assemblies are shown in Figure 1-3.

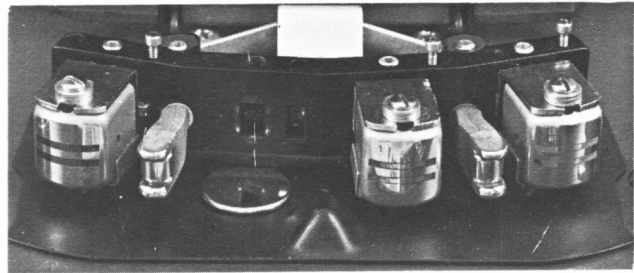


Fig. 1-3. Typical Head Assembly

NOTE

Single channel equipment ordered for half track operation, will be supplied with a complete two track head assembly.

Single channel AG-500 equipment uses a three stack head configuration, consisting of erase, record, and reproduce head stacks in that order. Two channel equipment may utilize either three or four head stacks. In the three stack version, the erase, record, and reproduce stacks are all of the same configuration (either two track or quarter track). The four stack assembly contains a two track erase, two track record, quarter track reproduce, and two track reproduce head stack; two track or quarter track reproduce operation is selected by positioning a switch on the head assembly.

All head stacks for AL-500 equipment are of the quarter track variety. No erase head is provided with the standard assembly. For two channel record/reproduce operation one record and one reproduce stack are required. A four channel equipment requires two record and two reproduce head stacks.

1.4 ELECTRONIC ASSEMBLY

Each electronic assembly (See Fig. 1-4) contains record, reproduce, and monitoring circuitry for one channel. An all solid state design is employed.

Two record inputs, with separate level controls, are provided for each channel; when both are used, the signals are mixed and recorded on one track on the tape. Adjustable equalization for both record and reproduce is provided for AG-500 recorders. On the Model AL-500, reproduce equalization is fixed (record equalization is adjustable on this equipment).

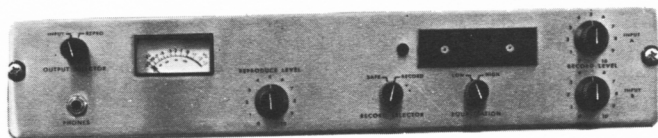


Fig. 1-4. Electronic Assembly

A vu meter, which indicates record and reproduce levels, is furnished on each electronic assembly. Operating controls include an output selector switch, a reproduce level control, an equalization switch, a record selector switch, and two record level controls.

1.5 ACCESSORIES

1.5.1 Input Transformers

Two plug-in transformers are available to allow operation with a balanced line input. One of these optional accessories (Catalog No. 4580200-01) is a balanced bridging transformer with unity gain. The other (Catalog No. 4580200-02) is a balanced matching transformer providing a gain of 14 db.

1.5.2 Microphone Preamplifier

A plug-in microphone preamplifier, Catalog No. 4010066, will allow recordings to be made from a microphone. This is a two stage preamplifier, wired so that the record level control on the electronic assembly is connected between the two stages; the preamplifier is thus used as a variable gain device which will accommodate a wide variety of microphones.

1.5.3 Remote Control Unit

Two types of remote control units are available. One, Catalog No. 01-96510, is a desk top model supplied with a 30-foot interconnecting cable. The other, Catalog No. 01-96520, is mounted on a flat panel suitable for installation in a studio console; no interconnecting cable is furnished.

1.5.4 Microphones

Two professional quality microphones are available for use with this equipment. The Ampex Model 802 has an omnidirectional pickup pattern, with a frequency response of ± 3 db from 70 to 10,000 Hz, down no more than 7 db at 50 and 20,000 Hz.

The Model 803 has a cardioid pickup pattern, with an average front-to-back discrimination of 20 db. Frequency response is approximately ± 3 db from 45 to 15,000 Hz.

Both microphones provide an output level of -55 dbm, and can be strapped for 30-50, 150-250, or 20,000 ohms impedance.

1.5.5 Head Demagnetizer

Demagnetization of the erase, record, and reproduce heads can be accomplished easily and efficiently by using the Ampex Model 820 head demagnetizer.

1.5.6 Standard Tapes

Ampex manufactures standard tapes for use in aligning the equipment and in measuring flutter. Each standard tape is individually recorded on precision equipment which is specially maintained under laboratory-controlled conditions. Catalog numbers of standard tapes are included in Sections 4 and 5, under Test Equipment Required.

1.6 SPECIFICATIONS

1.6.1 Tape Transport

Tape Width

1/4-inch

Tape Speeds

Two Speeds: 7-1/2 - 15 ips or
3-3/4 - 7-1/2 ips or
15/16 - 1-7/8 ips

Maximum Reel Size

7-inch EIA

Fast-Winding Time

60 Hz equipment: 110 seconds

(1200 foot reel)

50 Hz equipment: 128 seconds

Speed Accuracy

15 ips: $\pm 0.25\%$

7-1/2 ips: $\pm 0.25\%$

3-3/4 ips: $\pm 0.4\%$

1-7/8 ips: $\pm 0.6\%$

15/16 ips: $\pm 1.0\%$

Flutter and Wow (using flutter test tape)

15 ips: 0.1% rms

Measured according to ASA
Standard Z57.1-1954, including
all components between 0.5 and
200 Hz.

7-1/2 ips: 0.13%

3-3/4 ips: 0.175% rms

1-7/8 ips: 0.4% rms

15/16 ips: 0.5% rms

1.6.2 Electronic

Input

100,000 ohms, unbalanced.
Will accept input signal levels as
low as -18 dbm for normal
operating level.

Output

Will feed a 600 ohm line, balanced
or unbalanced, at a nominal +4 dbm
output level. Maximum reproduce
output level before clipping is +24 dbm.

Overall Frequency Response
(500 Hz reference)

15 ips: ± 2 db, 30 to 18,000 Hz

7-1/2 ips: ± 2 db, 60 to 10,000 Hz

+2-4 db, 30 to 15,000 Hz

3-3/4 ips: ± 2 db, 50 to 7,500 Hz

1-7/8 ips: ± 3 db, 100 to 6,000 Hz

15/16 ips: ± 3 db, 100 to 3,000 Hz

Overall Signal-to-Noise Ratio

Tape Speed	Equalization	HEAD		
		Full Track	Half Track	Quarter Track
15 ips	NAB	60 db	55 db	55 db
15 ips	CCIR	57 db	52 db	52 db
7-1/2 ips	NAB	60 db	55 db	55 db
7-1/2 ips	CCIR	57 db	52 db	52 db
3-3/4 ips	120 u secs	55 db	50 db	50 db
1-7/8 ips	---	---	40 db	40 db
15/16 ips	---	---	40 db	40 db

Signal-to-Noise is measured from peak record level (6 db above normal operating level) to unweighted noise. Noise is measured while erasing a 500 Hz tone which was recorded at peak level, using a filter to attenuate noise outside of audio spectrum. Signal-to-noise quoted for 3-3/4 ips is for 120 microsecond equalization, for 7-1/2 and 15 ips it is for NAB equalization. Noise is 3 db higher with CCIR equalization.

Even-Order Distortion

The second harmonic distortion of a 500 Hz signal recorded at normal operating level is less than 0.4%.

1.6.3 General

Power Line Frequency

Both Domestic and International equipment is available for use with one of two power line frequencies, either 60 Hz or 50 Hz.

Power Line Voltage

Domestic: 105-125 volts ac
International: Switch on electronic assembly can be positioned to select either 105-125 volts ac or 210-250 volts ac.

Power Consumption

At 117 volts (Domestic)
 Tape Transport: Approximately 1.5 amperes
 Each Electronic Assembly: Approximately 0.1 ampere

At 117 volts ac (International)
 Tape Transport: Approximately 1.5 amperes
 Each Electronic Assembly: Approximately 0.12 ampere

At 230 volts ac (International)
 Tape Transport: Approximately 0.75 ampere
 Each Electronic Assembly: Approximately .06 ampere

Magnetic Tape

Specifications are based on the use of professional quality magnetic tape, such as Ampex No. 631 or equivalent.

INSTALLATION

2.1 PRELIMINARY

Unpack the equipment carefully, checking it against the packing list to determine that all components have been received (if not, immediately notify your Ampex distributor). If there is any evidence that the recorder was damaged in transit, notify the responsible carrier and your Ampex distributor.

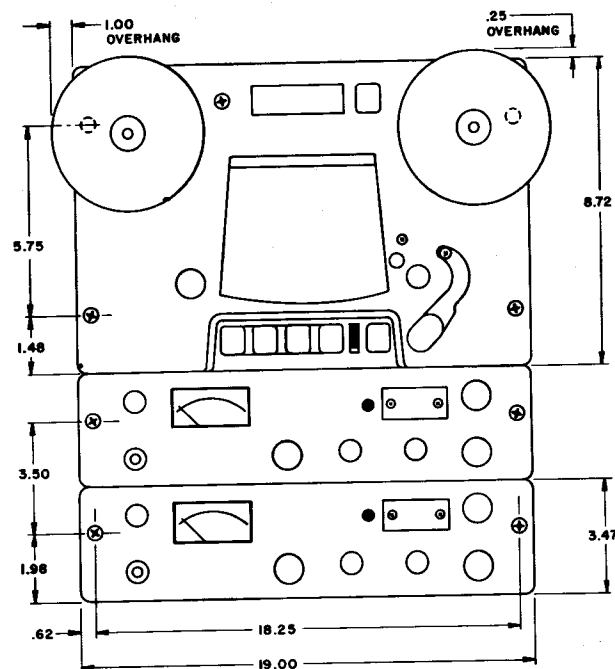
After unpacking, remove all shipping retainers (masking tape, etc.) that were used to secure components in transit.

2.2 MOUNTING

Portable equipment is shipped with the tape transport and electronic assembly mounted in the case. Unmounted models may be installed in standard 19-inch racks or in custom consoles. Mounting dimensions are included in Figure 2-1.

The major limitation in rack or console mounting is that the tape transport and electronic assembly must be positioned so that it is not necessary to lengthen the head cables (to do so would affect the frequency response of the recorder).

This equipment can be mounted and operated in either the vertical or horizontal position.



SPACE REQUIRED BEHIND MOUNTING (INCLUDING CONNECTORS)
TRANSPORT AND ELECTRONICS: 5.75

Fig. 2-1. Mounting Dimensions

2.3 CONNECTING

2.3.1 General

Portable equipment is shipped with interconnecting cables between the transport and the electronic assembly installed. It will thus be necessary only to connect the signal lines (refer to paragraphs 2.3.3 and 2.3.4) and the external power source (refer to paragraph 2.3.5) before placing the equipment in operation. If such equipment is disassembled for maintenance purposes, follow all procedures subsequently described to reconnect the assemblies.

Receptacles referenced in the following procedures are shown on Figs. 2-2 and 2-3.

2.3.2 Interconnecting Components

On single channel equipment, connect the control cable (which is captive at the tape transport) directly to receptacle J11 on the back panel of the electronic assembly. For two channel equipment use the Y interconnecting cable (provided) to connect the control lines between the transport and J11 on both electronic assemblies.

Head cables are captive at the head assembly on the tape transport. Colored plugs are used to distinguish each cable - the erase head plug is white, the record head plug is red, and the reproduce head plug is green. On two channel equipment an additional band is applied

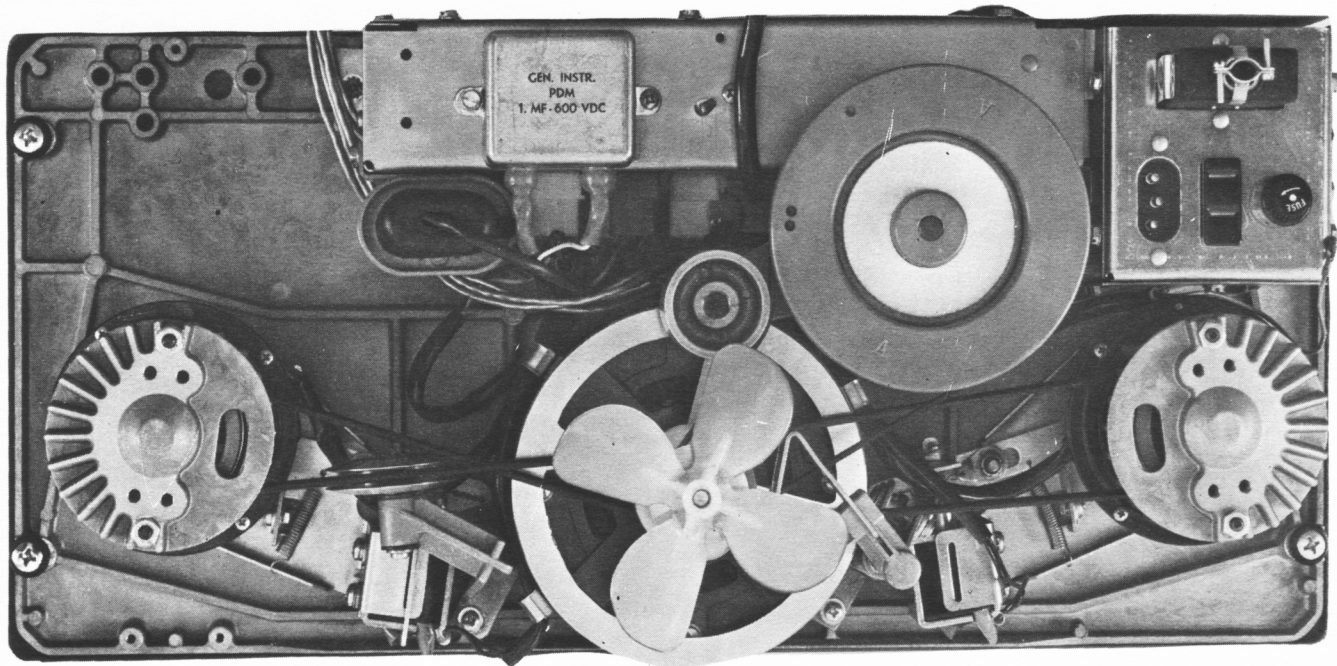


Fig. 2-2. Back View, Tape Transport

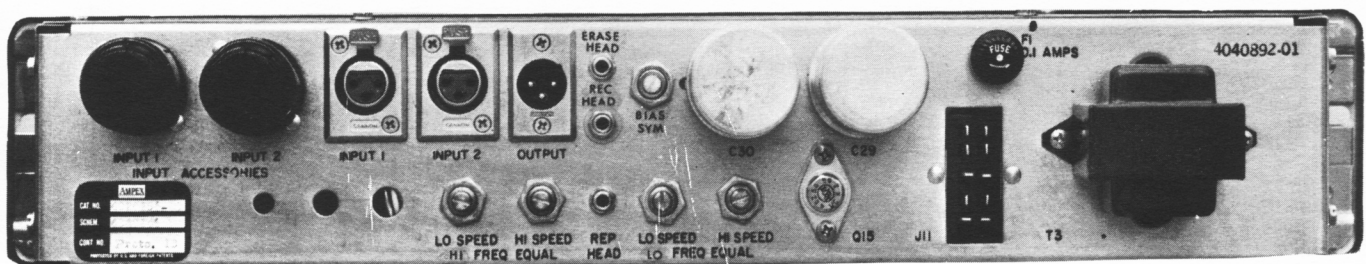


Fig. 2-3. Back View, Electronic Assembly

to the head cables for track two (the track closest to the top plate). Connect these cables to the applicable jacks on the electronic assembly.

2.3.3 Connecting Input Signal Line

Two input receptacles (designated "A" and "B") are provided on each electronic assembly. Either or both can be used to connect the input signal; if both are used (for example, when recording an orchestral group from two microphones) the signals are mixed and are then recorded on one track. Standard XL-type female receptacles are employed; mating male plugs are furnished with the equipment.

To connect an unbalanced line input, wire the signal leads to pins 3 and 2 (ground), and the shield to pin 1; then jumper pins 1 and 2. For balanced line or microphone inputs, connect the leads and shield to the same pins, but omit the jumper.

Unbalanced line inputs require that dummy plugs (furnished) be inserted in the INPUT ACCESSORY socket(s). An optional accessory input transformer or microphone preamplifier (refer to Section 1, Accessories) must be inserted in the INPUT ACCESSORY socket(s) if a balanced line or microphone input is used.

2.3.4 Connecting Output Signal Line

A standard XL-type male receptacle is used for the output connector; a mating female plug is furnished with the equipment.

To connect an unbalanced line, wire the signal leads to pins 3 and 2 (ground) and the shield to pin 1; then jumper pins 1 and 2. For a balanced line output connect the leads and shield to the same pins but omit the jumper.

2.3.5 Connecting Power

A power cable is furnished with the equipment. Connect this cable from POWER RECEPTACLE J118P, on the tape transport control box, to the a-c power source.



International version of this equipment have a 115V/230V slider switch on the back panel

of the electronic assembly. This switch must be positioned in accordance with power line voltage, or extensive damage to the equipment may result.

On domestic equipment, an a-c outlet is provided on the tape transport control box. This outlet, neither fused nor switched, provides a convenient means for connecting test equipment, accessory amplifier/loudspeakers, etc.

2.3.6 Connecting Remote Control

Two remote control units are available as optional accessories from Ampex. One (Catalog No. 01-96510-02) is a desk-top unit, enclosed in a metal case. It is furnished with an interconnecting cable, 30 feet long, which is simply plugged into REMOTE receptacle J116S on the tape transport control box (replacing the dummy plug). The other (Catalog No. 01-96520-02) is mounted on a panel. No interconnecting cable is furnished (see Fig. 2-4 for a schematic diagram of the necessary cable connections).

NOTE

If a remote control unit is not used, the dummy plug (furnished) must be inserted in REMOTE receptacle J116S or the equipment will not operate.

1	RED	1
2	WHITE	2
3	ORANGE	3
4	BROWN	4
5	YELLOW	5
6	GREY	6
7	BLACK	7
8	VIOLET	8
9	GREEN	9
10	BLUE	10

Fig. 2-4. Remote Control Cable

OPERATING INSTRUCTIONS

3.1 OPERATING CONTROLS AND INDICATORS

3.1.1 Tape Transport (See Fig. 3-1)

STOP pushbutton	Used to stop tape motion and drop out record or fast-winding modes when applicable.
REW (Rewind) pushbutton	Used to place tape in motion in fast-winding mode from takeup reel to supply reel.
FWD (Fast Forward) pushbutton	Used to place tape in motion in fast-winding mode from supply reel to takeup reel.
PLAY pushbutton	Used to place tape in motion in the reproduce mode. Must be pressed before record mode can be actuated.
Power Toggle Switch	Used to control application (ON) or removal (OFF) of power for the tape transport and electronic assembly.
REC (Record) pushbutton	Used to place equipment in the record mode. Tape motion must first be started by pressing the PLAY pushbutton, and the RECORD SELECTOR control on the electronic assembly must be in the READY position.

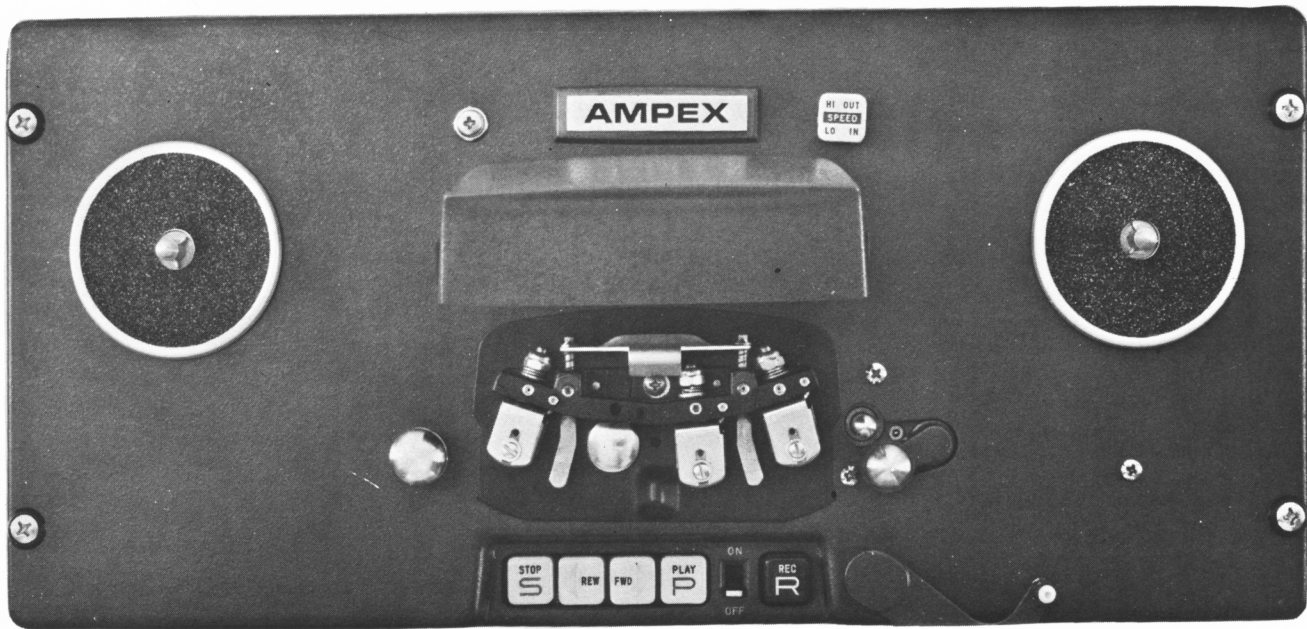


Fig. 3-1. Operating Controls and Indicators, Tape Transport

SPEED lever

Used to select high or low tape speed. Pushed in for low speed, pulled out for high speed. (Make speed selection only when the capstan is rotating.)

3.1.2 Electronic Assembly (See Fig. 3-2)

OUTPUT SELECTOR rotary switch

Used to select either the INPUT signal (signal to be recorded) or the REPRO signal (signal reproduced from the tape). The signal selected is connected to the monitor and output lines, and to the vu meter.

REPRODUCE LEVEL control

Used to adjust reproduce (playback) level.

RECORD SELECTOR rotary switch

Used to select either the SAFE condition (channel cannot be placed in the record mode) or RECORD condition (channel can be placed in the record mode).

EQUALIZATION rotary switch

Used to select appropriate record and reproduce equalization for the LOW or HIGH tape speed.

RECORD LEVEL controls
(A and B)

Are used to adjust record levels for the A and B line inputs.

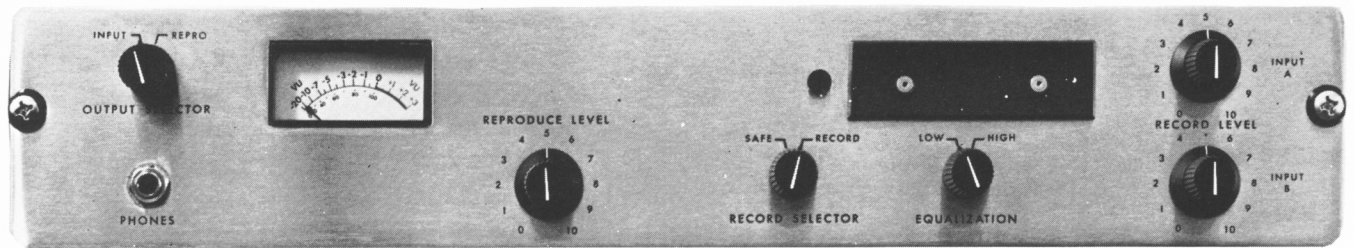


Fig. 3-2. Operating Controls and Indicators, Electronic Assembly

RECORD INDICATOR

Is illuminated whenever the equipment is operating in the record mode.

Meter

VU meter indicates record or reproduce level as selected at the OUTPUT SELECTOR switch.

3.2 MONITORING FACILITIES

The vu meter provides visual monitoring of record or reproduce signal levels. A headset can be plugged into the PHONES jack, on the front panel of the electronic assembly, for aural monitoring. Note that the signal at this jack is selected by the OUTPUT SELECTOR switch, so that either the record (input) or reproduce signal can be monitored.

3.3 TAPE THREADING

The tape threading path is shown in Fig. 3-3. When threading is completed, with the tape anchored to the takeup reel hub, man-

ually turn the takeup reel until the supply reel starts to rotate; this removes all tape slack and ensures that the takeup tension arm is not contacting the safety switch.

3.4 APPLYING POWER

To apply power to the complete system, place the power ON-OFF switch in the ON position.

3.5 SELECTING TAPE SPEED AND EQUALIZATION



Do not attempt to change tape speed until after power is applied and the capstan is rotating. The speed change mechanism may jam if this precaution is not observed.

Tape speed pairs available for this equipment are 7-1/2 - 15 ips, 3-3/4 - 7-1/2 ips, and 15/16 - 1-7/8 ips. Depending on the particular recorder and the speed desired, push the SPEED lever in to select low speed, pull it out to select high speed.

At the electronic assembly, position the EQUALIZATION switch in the HIGH or LOW position, in accordance with the tape speed selected.



Fig. 3-3. Tape Threading Path and Tape Lift Lever

3.6 RECORDING

Step 1: Thread blank tape, or tape recorded with material not necessary to save, on the tape transport (refer to paragraph 3.3).

NOTE

If a previously recorded tape was recorded on equipment using a different head configuration, the old recording might not be completely erased. Also, 15/16 and 1-7/8 ips equipment has no erase head. Bulk erasure of the tape is required in these instances.

Step 2: Apply power to the equipment.

Step 3: Select tape speed and the corresponding equalization.

Step 4: Place the RECORD SELECTOR switch in the RECORD position. If this is two-channel equipment and both channels are to record, place this switch on both electronic assemblies in the RECORD position; if only one channel is to record, place the switch on that electronic assembly in the RECORD position and the switch on the other electronic assembly in the SAFE position.

Step 5: Place the OUTPUT SELECTOR switch in the INPUT position. Using a rehearsal run or test signal, adjust the RECORD LEVEL control(s) so that the vu meter indicates 0 on most program peaks (maximum peaks can result in an indication of +2 or +3 on the meter).

NOTE

There are two record inputs available on each electronic assembly, each with a record level control. If both are used, monitor a rehearsal run and set the RECORD LEVEL controls to achieve proper balance and normal record level (as described in Step 5) for the combined inputs.

Step 6: At the tape transport, press the PLAY pushbutton and then the REC pushbutton. Tape will be placed in motion in the record mode. During the record run, the input signal can be compared with the signal being recorded and reproduced from the tape, by turning the OUTPUT SELECTOR switch from the INPUT to the REPRO position and vice versa.

Step 7: At the completion of the record run, press the STOP pushbutton to stop tape motion and remove the equipment from the record mode.

3.7 REPRODUCING

Step 1: Thread the recorded tape on the tape transport (refer to paragraph 3.3). Place the RECORD SELECTOR switch(es) in the SAFE position.

Step 2: Apply power to the equipment (refer to paragraph 3.4).

Step 3: Select the tape speed and equalization (refer to paragraph 3.5) which correspond to the speed at which the tape was recorded. If the four stack head assembly is employed, position the switch lever on the head. When the lever is full down, the two track reproduce head is connected; when it is full up, the quarter track head is connected.

Step 4: Place the OUTPUT SELECTOR switch(es) in the REPRO position.

NOTE

There will be no reproduce output if the OUTPUT SELECTOR switch is left in the INPUT position.

Step 5: Press the PLAY pushbutton. Tape will be placed in motion in the reproduce mode. Adjust the REPRODUCE LEVEL control to achieve the desired output level.

Step 6: To stop tape motion, press the STOP pushbutton.

3.8 USING FAST-WINDING MODES

It is recommended that the hinged head cover be opened and the tape lifting mechanism (see Fig. 3-4) manually actuated before entering a fast-winding mode. This removes the tape from contact with the heads, and thus minimizes head wear (and cleaning requirements).

Either fast-winding mode can be entered whenever tape is threaded and power is applied. Tape can be at a standstill or moving in any mode.

To move the tape at fast speed from the supply reel to the takeup reel, press the FWD pushbutton. To move it at fast speed from the takeup reel to the supply reel, press the REW pushbutton. Either fast-winding mode can be entered directly from the other, so in editing or cueing operations the two pushbuttons can be

pressed alternately to shuttle the tape quickly to a desired point.

To remove the equipment from a fast-winding mode, press the STOP pushbutton. (If tape is allowed to run completely off either reel, the equipment will automatically stop.)

CAUTION

When using a fast-winding mode, do not press the stop and play pushbuttons in such rapid sequence that tape motion cannot stop before the capstan idler clamps the tape to the capstan. If tape motion is not allowed to stop before the play pushbutton is pressed, the tape will probably be broken or stretched.

TRANSPORT MAINTENANCE

4.1 ROUTINE MAINTENANCE

4.1.1 Cleaning

Cleaning the heads, and other components in the tape path, is described in Section 6. It is important that such cleaning be accomplished after each eight-hour operating period, or oftener if visual inspection indicates the need.

Visually inspect all components at the back of the transport each month. Use a brush, or a small vacuum cleaner, to remove any accumulations of dirt or dust. If more comprehensive cleaning is required, Iso-Propyl alcohol may be used.



Do not use the blower action of a vacuum cleaner, or any other compressed air device, to clean the transport. Dust might be blown into bearings or other rotating parts. Also, if alcohol is used, do not allow it to drip or spray into such critical areas.

4.1.2 Head Demagnetization

Demagnetization of the heads, explained in Section 6, must be accomplished on a daily basis, or oftener if there is any suspicion that such action is necessary.

4.1.3 Lubrication

Lubrication of certain components in the tape transport is required after each 2000 hours of operation, or once a year (whichever occurs first). Use Ampex oil 4010825.

The two drive motor bearings (one at each end of the motor) require 5 or 6 drops of oil. Lubrication requires that the drive motor assembly be removed from the transport, and that the flywheel be removed from the motor assembly (refer to Disassembly, paragraph 4.3.2).

Both capstan bearings are lubricated through a spring loaded ball to the right of the capstan. Press down on this ball and insert 5 drops of oil. A hypodermic needle is ideal for this purpose.

The clutch belt separator pulley, the drive belt idler pulley, the capstan idler, and the

front bearings of the turntable clutch assemblies require lubrication at the time interval previously specified, or oftener if they become noisy. Lubrication of these components requires that they be removed from the transport. Use not more than one drop of oil or the rotating parts will throw oil. If oil should spill or be thrown on the rubber tires or belts, clean them immediately with Iso-Propyl alcohol. Any oil which contaminates the brakes will require replacement of the brake lining.

If the shaft on the speed change assembly starts to bind, lubricate it with a general purpose grease such as Ampex 4010829. Apply the grease to each end of the shaft and move the shaft back and forth several times to work the grease into the bearings. Wipe off any excess grease.

4.2 CHECKOUT AND ADJUSTMENTS

4.2.1 Test Equipment Required

Spring Scale, 0 to 32 ounces
Length of cord, approximately 30 inches, with loop tied in one end.
Empty EIA reel (2-1/4-inch hub diameter)
Feeler gauges, .015 to .045 inch extreme measurements.
Length of 1-1/2 mil magnetic tape, approximately 24 inches
Ampex Flutter Test Tapes as applicable:
15 ips: Catalog No. 01-31316-01
7-1/2 ips: Catalog No. 01-31326-01
3-3/4 ips: Catalog No. 01-31336-01
1-7/8 ips: Catalog No. 4690108-01
15/16 ips: Catalog No. 4690107-01
Flutter Meter, D and R Model FL3-d or equivalent
Normal tools used by technician

4.2.2 Tape Tension

Tape tension is measured indirectly by determining the torque supplied by the turntable clutches. This torque is adjusted by positioning sliders on two resistors -- R106 for supply, R107 for takeup -- located in the transport control box assembly. If the following procedure is performed when the equipment is cold, set the tensions on the high side of the tolerances quoted; if the recorder has been operating for 30 minutes or longer, set them on the low side.

Step 1: Place the empty 7-inch EIA reel (hub diameter 2-1/4 inches) on the supply turntable.

Step 2: Apply power to the recorder.

Step 3: Use a rubber band or piece of masking tape to hold the takeup tension arm away from its rest position, so that it does not contact the safety switch.

Step 4: Wind the length of cord on the reel in a counterclockwise direction, leaving the loop at the free end of the cord.

Step 5: Insert the hook on the spring scale in the loop on the cord. Hold the scale stationary, and press the PLAY pushbutton.

Step 6: Tap lightly on the reel, to ensure a true reading, and note the scale indication. Correct indications are shown in Table 4-1.

Step 7: If the indication in Step 6 is incorrect, remove power from the equipment and adjust the shorting slider on resistor R106 (see Fig. 4-1). Shorting more of this resistor will increase torque indication, shorting less will decrease.

Step 8: Repeat Steps 4 through 7 as required to obtain a scale indication within tolerance.

Step 9: Repeat the entire procedure at the takeup turntable, except wrap the cord on the reel in a clockwise direction. Adjustment is made at R107. Correct indications are shown on Table 4-1.

4.2.3 Brakes

Any required adjustment of braking force must be preceded by checking certain clearances. Steps 1 through 5 of the following procedure describe how to determine if brake adjustment is required; Steps through 12 describe how to check clearances and make the final adjustment.

Step 1: Place the empty EIA reel (hub diameter 2-1/4 inches) on the supply turntable.

Step 2: Wind the length of cord on the reel in a counterclockwise direction, leaving the loop in the cord at the free end.

TAPE SPEEDS AVAILABLE	SUPPLY TORQUE	TAKEUP TORQUE
15/16 - 1-7/8 ips	3-4 ozs.	4-5 ozs.
1-7/8 - 3-3/4 ips	3-4 ozs.	4-5 ozs.
3-3/4 - 7-1/2 ips	4-5 ozs.	4-6 ozs.
7-1/2 - 15 ips	4-5 ozs.	5-1/2 - 6-1/2 ozs.

Table 4-1. Correct Torque Indications

Step 3: Insert the hook on the spring scale in the loop on the cord.

Step 4: Pull on the scale, making certain that the cord does not touch either flange of the reel (the turntable will rotate counterclockwise). Note the scale indication when the turntable is rotating slowly and steadily (the initial force required to start the rotation will be excessively high). The scale should indicate from 8 ounces (minimum) to 10 ounces (maximum).

NOTE

The scale indication may vary during each rotation of the reel. Consider only the highest indication when making the measurement. (The variation will have no effect under dynamic operating conditions.)

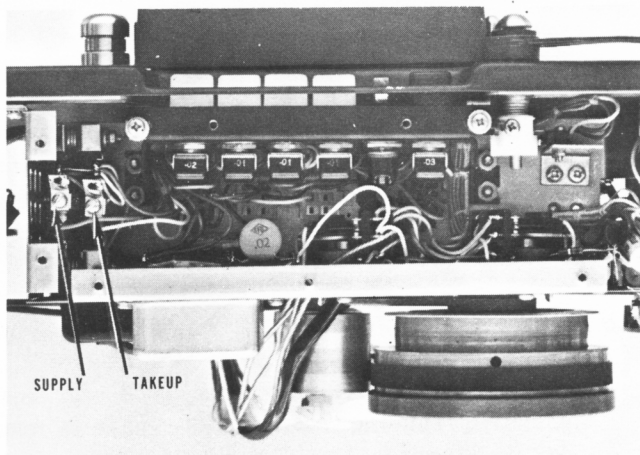


Fig. 4-1. Tension Adjusting Resistors

Step 5: Repeat Steps 1 through 4 at the takeup turntable, except wind the cord on the reel in a clockwise direction in Step 2 so that the turntable will rotate clockwise for the measurement). The scale indication should be the same as that at the supply turntable.

NOTE

If the scale indications are correct at both turntables, and brake operation has been normal, no adjustment is required. If either indication is incorrect, or if braking has been intermittent, proceed with the following steps.

Step 6: Use masking 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 7: Apply power to the equipment, and press the PLAY pushbutton. This will energize the brake solenoid.

Step 8: Using the feeler gauge, check the clearance between the brake lining (on the brake arm, see Fig. 4-2) and the brake drum. It should be from .015 to .025 inch. If necessary, adjust this clearance by moving the brake solenoid up or down on its mounting bracket. Be sure that there is clearance between the brake actuator and the solenoid if this adjustment is made.

Step 9: Press the STOP pushbutton to de-energize the brake solenoid.

Step 10: Check the clearance between the brake arm and the brake stop (see Fig. 4-2). It should be from .030 to .045 inch. If necessary, adjust this clearance by repositioning the brake stop.

Step 11: Recheck that the brake actuator is not binding against the solenoid. If any binding is noted, repeat Steps 7 through 10, positioning the components so that the actuator clears the solenoid.

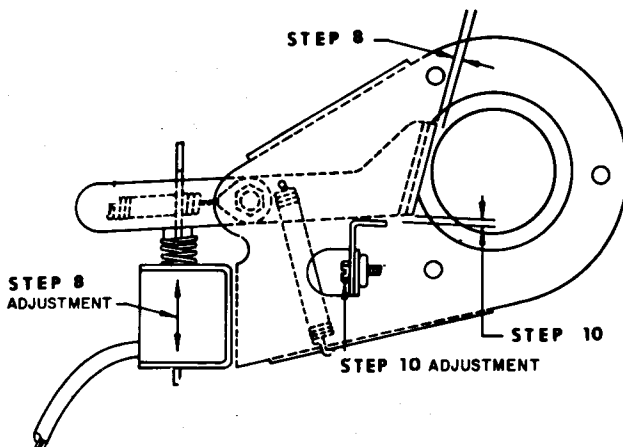


Fig. 4-2. Brake Assembly Clearances and Adjustment

Step 12: Check the braking force as described in Steps 1 through 5. If necessary, adjust this force by moving the end of the high tension spring (see Fig. 4-2) to different holes on the brake arm until proper braking force is achieved.

4.2.4 Capstan Idler Pressure

In the record or reproduce modes, the capstan idler holds the tape in firm contact with the capstan. Idler pressure is adjusted by means of a locknut on the capstan solenoid spade bolt (see Fig. 4-3). Running this nut in will increase idler pressure up to the point where the solenoid can no longer bottom. At that point, insufficient pressure is exerted and tape slippage will occur between the capstan and idler unless the nut is backed off. If the idler pressure is too high, an undue strain will be placed on the upper bearings in the capstan assembly.

An increase of temperature in the capstan solenoid will cause an increase in the d-c resistance presented by the coil. Therefore, allow a 30 minute warm-up period, with the equipment operating in the reproduce mode, before attempting any capstan idler pressure adjustment.

Step 1: Remove power from the equipment, and check the clearance between the capstan idler and the capstan. It should be 1/8 inch ($\pm 1/64$ inch). If not, the capstan solenoid stop (item 3, Fig. 7-15) must be repositioned on the solenoid to achieve this condition.

Step 2: Thoroughly clean the capstan and capstan idler (refer to Section 6).

Step 3: Remove the capstan drive belt from the drive motor pulley.

Step 4: Use masking 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 5: Thread an approximate 2 foot length of 1-1/2 mil magnetic tape between the capstan and the capstan idler, with the oxide-coated (dull) side of the tape next to the capstan.

Step 6: Apply power and press the PLAY pushbutton. The capstan will not rotate, but the capstan idler will engage.

Step 7: Form a loop, or punch a hole, in the end of the tape on the takeup side of the capstan. Insert the hook on the spring scale through this loop.

Step 8: Noting the indication, pull on the scale in the direction of normal record/reproduce tape travel. The tape should start to slip between the idler and capstan when the indication is 26 ounces (± 4 ounces).

Step 9: If the indication in Step 8 is incorrect, adjust the solenoid locknut (see Fig. 4-3) as required. Running the nut in will increase pressure; running it out will decrease pressure.

Step 10: Check that the capstan solenoid is bottomed (if not, the idler can be easily

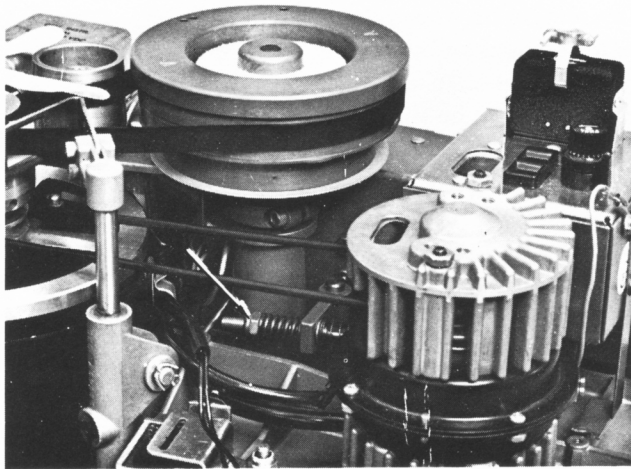


Fig. 4-3. Capstan Idler Adjustment

pushed away from the capstan). If necessary, back off the locknut until the solenoid bottoms, then recheck the idler pressure.

CAUTION

Do not leave the capstan idler pressed against the stationary capstan any longer than necessary, or a dent may be impressed in the idler. Be sure to press the STOP pushbutton when the test is concluded.

Step 11: Reinstall the drive belt removed in Step 3. Be sure that the correct face of the belt is against the drive motor pulley (see Fig. 4-4).

4.2.5 Turntable Height

In the play mode, the magnetic tape should leave the supply reel and enter the takeup reel without touching the flanges. Molded plastic reels are not precision devices, and variations sometimes occur from one to another. Tape guiding on this transport is such that the center-line of the tape is 1/2-inch from the top plate, and turntable height is adjusted for reels with an overall thickness of 0.500 inch ($\pm .005$ inch). However, this height can be adjusted to accommodate the specific type of reel being used.

Step 1: From the back of the transport, loosen the two setscrews which hold the turntable assembly.

Step 2: Raise or lower the turntable as required, and re-tighten the two setscrews.

Step 3: Check by running tape in the play mode. Readjust turntable height as required until the tape moves from reel to reel without touching the flanges.

4.2.6 Speed Change Mechanism

Do not attempt any adjustment to this mechanism as long as it functions normally. If the speed change operation becomes intermittent, or fails, it can usually be corrected by one of the following procedures.

(a) Visually inspect the capstan drive belt. Correct positioning is shown in Fig. 4-4. If incorrect, reverse the belt (face for-face) and recheck speed change operation.

(b) Check the tracking of the capstan drive belt. It should track in the middle of the capstan flywheel and drive motor pulley. If not,

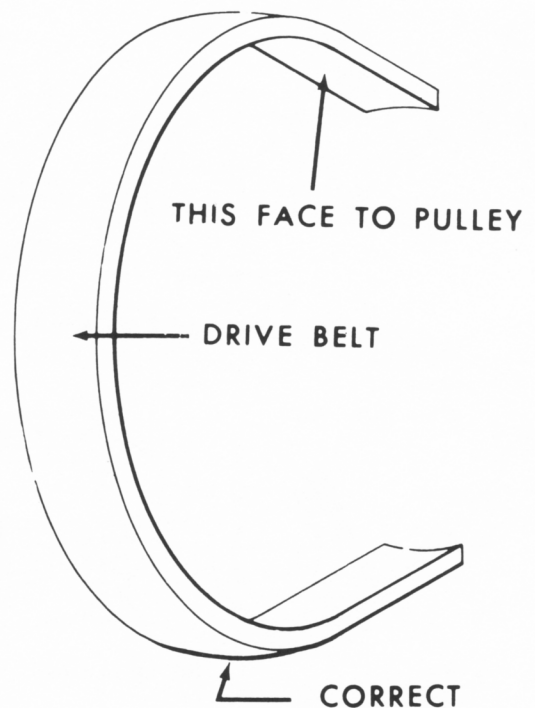


Fig. 4-4. Positioning Drive Belt

check the clearance between the inner face of the drive motor pulley and the end of the motor. It should be 1/32 inch; if not, loosen the two set screws and slide the pulley in or out on the shaft to achieve this clearance. When the clearance is correct, loosen the two setscrews on the capstan flywheel and position the flywheel for correct drive belt tracking.

NOTE

If the position of the drive motor pulley is changed, check the separation of the supply clutch belt at the crossover point. It should be approximately 1/16 inch; if not, reposition the belt separator pulley in the slotted mounting hole to achieve this separation.

(c) The edges of the drive belt should be parallel with the guide holes in the speed shift fork (item 5, Fig. 7-11) and should run through the center of those holes. The fork can be moved slightly by loosening the two socket-head screws (item 14, Fig. 7-11), repositioning the fork as required, and tightening the screws.

(d) The clearance between the shift fork and the closest part of the drive motor pulley should be approximately 1/32-inch. Clearance can be checked by pulling down on the shift fork (see Fig. 4-5a) and measuring the clearance. Adjustment can be made by loosening the nut at the base of the speed change assembly, (item 97, Fig. 7-10) moving the assembly in the slotted hole to achieve correct clearance, and tightening the nut. Check that there is no interference between the fork and the motor pulley in either position of the speed change mechanism.

NOTE

If proper fork clearance cannot be achieved as explained, it is permissible to bend the fork slightly, as shown in Fig. 4-5b).

(e) If the fork has been bent across the width (see Fig. 4-5c) it could cause the drive belt to come off the motor pulley or capstan flywheel. Check and correct if necessary.

(f) The shift fork for 15/16-1-7/8 ips and 3-3/4 - 7-1/2 ips recorders has a twist at the end of the fork (see Fig. 4-6). Check that this twist is as shown, and correct if necessary.

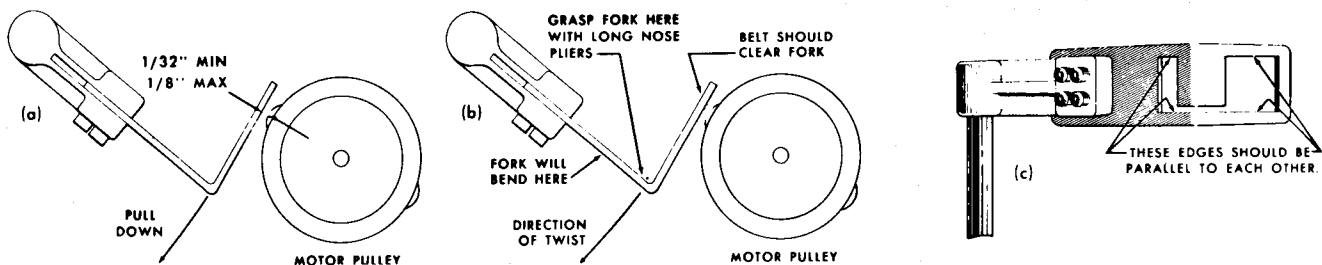
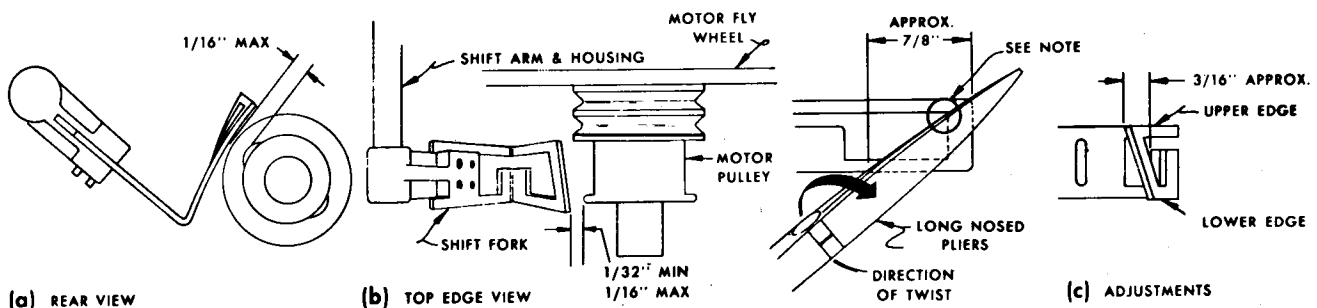


Fig. 4-5. Speed Change Mechanism



NOTE: THE EDGE OF THE LONG NOSED PLIERS MUST CROSS THE SHIFT FORK LEVER AT THIS POINT.

Fig. 4-6. Shift Fork

4.2.7 Checking Flutter and Wow

This check requires an aligned electronics, the applicable Ampex Standard Flutter tape, and a flutter meter such as the D and R Model FL3-D or equivalent.

Ampex Standard Flutter Tapes are prepared on precise equipment for each tape speed. The rms flutter content of these tapes is less than .03%, which for all practical purposes can be disregarded when flutter measurements are taken. Flutter tapes are prepared for specific tape speeds, and ---since flutter meters will accept only 3,000 cycle signals ---cannot be used at other speeds.

Flutter meters are sensitive, to some extent, to amplitude modulation, which can occur if poor head-to-tape contact exists or if drop-outs of signal occur. Heads must, therefore, be cleaned and demagnetized before flutter measurements are taken.

As a flutter tape is used over a long period of time the flutter indication will rise, although the flutter on the equipment may remain constant. This is caused by increased drop-outs, demagnetization of the signal in the repeated passes over the heads, and physical deformation of the tape by tensions, changes in temperature and humidity, etc.

Standard tapes are not to be rewound before storage, because the tape pack and tension within the reel might cause physical deformation such as edge damage, stretching, etc. Extremes in temperature and humidity must also be avoided in storage areas. Finally, standard tapes must not be stored near sources of magnetic fields, such as motors, generators, permanent magnet loudspeakers, etc., or partial erasure of the signal may result.

Flutter measurement is made as follows:

Step 1: Thread the applicable standard flutter tape on the equipment, by putting the flutter tape on the takeup turntable and rewinding to an empty reel on the supply turntable (using the tape lifters while rewinding).

CAUTION

Whenever the standard flutter tape is threaded on the equipment place the record selector switch on the electronic assembly in the safe position.

Step 2: Apply power, and select tape speed and equalization in conformance with the standard flutter tape.

Step 3: Connect the flutter meter to the OUTPUT connector.

Step 4: Start tape in motion in the reproduce mode. Adjust the REPRODUCE LEVEL control to achieve a 0 indication on the vu meter.

Step 5: Adjust the level on the flutter meter as instructed in the applicable manual.

Step 6: Switch the flutter meter to the discriminator adjustment, and adjust the trimmer for a minimum reading on the flutter meter.

Step 7: Switch the flutter meter to readout at 0.5 to 250 Hz, and read the flutter as indicated on the flutter meter.

Step 8: When the flutter measurement is completed, allow tape motion to continue in the play mode until the tape is completely wound on the takeup reel. Mark the reel "Rewind Before Using" and store it in a safe place.

Flutter can be caused by any component in the transport that affects tape motion. It is manifestly impossible in this manual, therefore, to delineate specific causes and remedies.

However, possible causes of excess flutter include:

Excessive or erratic play holdback tension.

Drivemotor not synchronized--This can be caused by low line voltage (less than 105 volts); excessive play takeup tension; a dragging belt tensioning idler; defective drive motor

starting capacitor; bearings in drive motor or in capstan in need of lubrication; or a defective drive motor.

Brakes -- the brakes may drag on the drum if they are incorrectly installed or adjusted.

Capstan Idler -- The idler tire may be dented by being allowed to engage the capstan for an extended period when the equipment is not operating. Running the recorder in the play mode for two or three hours will usually restore the tire to normal. If not, or if the bearing is defective, replace the idler.

Drive Belt -- The drive belt may be dirty or worn.

Tape Scrape -- Can be caused by warped or damaged reels, or incorrect turntable height.

If a tunable filter (e.g., General Radio Model 1564A Sound Vibration Meter) is available, excessive flutter can be isolated to certain frequencies. This is accomplished by connecting the filter to the output of the flutter meter. Starting at (for example) 2 Hz, tune both the low frequency and high frequency cutoff controls to the same frequency. Measure and make a note of the flutter. Proceed in this manner in one octave steps to 256 Hz. Comparing the results with ro-

tational periods shown in Table 4-2 may then isolate the offending assembly.

Note that if flutter disturbance is introduced by components in the supply turntable assembly, the frequency of the flutter will vary -- being low when the supply reel is full of tape and progressively increasing with reel rotation as the tape pack diminishes.

4.3 DISASSEMBLY

4.3.1 General

Disassembly of the tape transport for lubrication or replacement of parts, requires careful attention to detail. The assembly drawings in Section 7 are included to aid in disassembly and assembly procedures, and also to help in determining part numbers.

Do not attempt to disassemble components beyond the point quoted in the following procedures. In some instances, disassembly is described but part numbers are not supplied; such parts are specially fitted and, though they can be removed and reinstalled, cannot be ordered separately (the entire subassembly must be replaced).

4.3.2 Removal of Drive Motor

Individual parts of the drive motor assembly are not available as separate items (in

COMPONENT	15/16 ips	1-7/8 ips	3-3/4 ips	7-1/2 ips	15 ips
Capstan		3.8 Hz	7.6 Hz	15.3 Hz	
Capstan Idler		.68 Hz	1.35 Hz	2.7 Hz	
Drive Motor		30 Hz	30 Hz	30 Hz	
Drive Belt		2.8 Hz	4.7 Hz	9.4 Hz	
Drive Belt Tension Idler		10.9 Hz	18.2 Hz	36.3 Hz	
Clutch Belts		5.5 Hz	5.5 Hz	5.5 Hz	
Belt Separator Pulley		19.5 Hz	19.5 Hz	19.5 Hz	

Table 4-2. Rotational Periods of Components

this respect, the fan is not considered part of the assembly).

Step 1: At the back of the transport, remove the fan (item 49, Fig. 7-10) from the drive motor by loosening the setscrew and sliding the fan from the motor shaft.

Step 2: Remove the nut, flat washer, and lockwasher (items 97, 98, and 100, Fig. 7-10) at the base of the speed change assembly.

Step 3: At the front of the transport, remove the speed change knob (item 31, Fig. 7-9) by loosening the setscrew and sliding the knob off the shaft.

Step 4: At the front of the transport, remove the threaded bushing from the speed change mechanism, using long nose pliers. That mechanism will now be free and can be removed.

Step 5: Remove the capstan drive belt, and both clutch drive belts, from the drive motor pulley.

Step 6: Disconnect the drive motor connector from the receptacle on the transport control box assembly.

Step 7: Open the head cover, and remove the two motor mounting screws and washers (items 83 and 102, Fig. 7-9). The head cover will be free.

Step 8: Pry the escutcheon (item 33, Fig. 7-9) from the transport.

Step 9: Manually support the drive motor, and remove the two motor mounting screws and washers (items 83 and 102, Fig. 7-9) which were exposed when the escutcheon was removed. This frees the drive motor from the transport (the leads to the motor capacitor will still be connected).

If the drive motor was removed for lubrication, loosen the two setscrews in the flywheel and remove the flywheel. Both oil holes in the motor will now be accessible. If the drive assembly is to be replaced, disconnect the capacitor leads. Reassemble in the reverse order of disassembly.

4.3.3 Disassembly of Speed Change Mechanism

Step 1: Remove the speed change mechanism (refer to Steps 2, 3, and 4, paragraph 4.3.2).

Step 2: Remove the shift fork (item 5, Fig. 7-11) by removing the two screws (item 14, Fig. 7-11).

Step 3: To remove the speed shift arm (item 1, Fig. 7-11), grasp the roller (item 8, Fig. 7-11) with long nose pliers; pull the roller away from the slot in the speed shift arm and pivot it free from the assembly. (The spring, item 9, will also come free.) Remove the drive pin (item 13, Fig. 7-11) and the speed shift arm can be removed.



Do not remove the bearing (item 3, Fig. 7-11) from the housing. If the bearing becomes defective the entire speed change assembly must be replaced.

Step 4: To remove the bearings (item 4, Fig. 7-11), remove the cotter pin at the end of the clevis pin (item 7, Fig. 7-11) and slide the clevis pin out (the washers, items 10 and 11 will also come free). The nylon bearings can now be compressed and removed.

Reassemble in the reverse order of disassembly.

4.3.4 Removal of Clutch and Brake Assemblies

Step 1: At the back of the transport, loosen the two setscrews which secure the turntable. Slide the turntable assembly up and off from the front of the transport.

Step 2: Disconnect the clutch and brake connectors from the receptacles on the transport control box assembly.

Step 3: Remove the clutch drive belt from the drive motor pulley.

Step 4: Manually support the clutch and remove the three screws and washers (items 65 and 81, Fig. 7-9). The clutch and brake will both be free of the transport.



Do not attempt any disassembly of the clutch. If the clutch becomes defective, the entire assembly must be replaced.

Remount the clutch and brake in the reverse order of removal.

4.3.5 Disassembly of Brake

With the brake assembly removed from the transport (refer to paragraph 4.3.4), proceed as follows to replace the brake arm (which includes the brake lining as an integral part).

Step 1: Remove the low tension and high tension springs (items 10 and 11, Fig. 7-13).

Step 2: Remove the locknut (item 29, Fig. 7-13); the spring anchor and thrust washer will also come free. The brake arm (item 2, Fig. 7-13) can now be replaced.

Reassemble in the reverse order. When installing the locknut (item 29, Fig. 7-13), tighten it until it is snug, then back it off 1/4 turn. Check brake clearances and tension (refer to paragraph 4.2.3) when the assembly is remounted on the transport.

To replace the brake solenoid, proceed as follows:

Step 1: Remove the screw, washer, and locknut (items 25, 28, and 30, Fig. 7-13). The solenoid plunger and return spring will come free.

Step 2: Remove the two screws, lockwashers, and washers (items 26, 32, and 34, Fig. 7-13). This frees the solenoid.

Reassemble in the reverse order. Check brake clearances and tension (refer to

paragraph 4.2.3) when the assembly is remounted on the transport.

4.3.6 Removal of Clutch Drive Belt

To replace a clutch drive belt, simply remove the two nuts and lockwashers which secure the end bell. The clutch drive belt can then be replaced.

4.3.7 Removal of Capstan Assembly

Removal of the capstan assembly is required only when the capstan solenoid, or one of its associated parts, is to be replaced. Removal is not necessary to lubricate the capstan or to take off any other replaceable part. Note that the transport control box assembly must first be removed before it is possible to remove the capstan assembly.

Step 1: Disconnect all cables from the receptacles on the transport control box assembly.

Step 2: Remove the three nuts, lockwashers, and washers that secure the top edge of the control box to the transport.

Step 3: Remove the two screws, lockwashers, and washers which secure the lower edge of the control box to the transport. The control box assembly is now free except for the leads to the capacitor.

Step 4: Remove the capstan drive belt (item 70, Fig. 7-10).

Step 5: Manually support the capstan assembly, and remove the three screws and washers (items 65 and 85, Fig. 7-9). The capstan assembly is now free and can be removed. Replace in the reverse order of removal.

To remove the solenoid from the capstan assembly, proceed as follows:

Step 1: Remove the cotter key and clevis pin (items 5 and 4, Fig. 7-15).

Step 2: Remove the two screws and lockwashers (items 16 and 19, Fig. 7-15). This frees the solenoid stop bracket (item 3, Fig. 7-15).

Step 3: Remove the two screws, lock-washers, and washers (items 15, 35, and 18, Fig. 7-15) to free the solenoid.

Step 4: To replace the adjustment spring or eyebolt (items 8 and 6, Fig. 7-15) remove the nut (item 7, Fig. 7-15).

When reassembling, adjust the solenoid stop so that the capstan idler clears the capstan by 1/8 inch ($\pm 1/64$ inch).

There should be no need to remove the flywheel or belt tension idler; if it becomes necessary, refer to Fig. 7-15.

4.4 PRINCIPLES OF OPERATION

4.4.1 General

The tape transport mechanism provides tape motion for all modes of operation. Smooth, positive movement of the tape across the head assembly, and proper tape tension, is provided by four basic systems; the tape supply system, the tape takeup system, the tape drive system, and the control circuits.

4.4.2 Supply and Takeup Systems

Both the supply and takeup assemblies are composed of eddy current clutches, a turntable (mounted directly on each clutch shaft), and a brake assembly. The brake mountings are mirror images of each other, so the brake assemblies are not interchangeable. The brakes are solenoid operated, remaining in the braking position until the brake solenoids are energized.

The supply (rewind) and takeup eddy current clutches are so connected that if power is applied with no tape threaded, the turntables will rotate in opposite directions --the supply turntable, clockwise; and the takeup turntable, counterclockwise.

In the fast forward mode, the takeup clutch operates at full torque, and no torque is applied to the supply (rewind) clutch. The tape is held under tension by friction.

In the rewind mode, the supply clutch operates at full torque and no torque is applied

to the takeup clutch. Again, the tape is held under tension by friction.

In the reproduce or record modes, both clutches operate at reduced torque. The capstan then determines tape speed, and the tensioning system supplies tape or takes it up as metered by the capstan drive. The capstan exerts sufficient pull on the tape to overcome the opposing torque of the supply clutch, which constitutes the holdback tension. The capstan feeds the tape to the takeup turntable, under tension provided by the takeup torque.

If a tape loop is thrown, or tape breaks, the takeup tension arm actuates the safety switch (S104) and stops the equipment. The takeup tension arm is not a part of the tape tension system. Its function is to remove tape slack, especially when starting, and to operate the safety switch.

4.4.3 Tape Drive System

The tape drive system is composed of the drive motor, the capstan assembly, and the capstan idler assembly. The purpose of the drive system is to transport the tape across the heads at a uniform speed during the record and reproduce modes. A hysteresis synchronous capstan drive motor is employed.

The drive motor operates continuously whenever the POWER switch (S106) is in the ON position and tape is properly threaded. When the PLAY button is pressed, the capstan solenoid and the brake solenoids are energized. The capstan solenoid pulls the rubber tired capstan idler wheel against the tape, causing it to make firm contact with the capstan. The tape is then driven at a constant speed across the head assembly.

4.4.4 Eddy Current Clutch

A conductive disc, subjected to a normal magnetic force, has the property of resisting an applied force which tends to move the disc in its own plane. The magnitude of this resistance is directly proportional to the velocity of the conductor with respect to the magnetic field.

This resisting, or braking, effect is produced by the interaction between the applied magnetic field and a family of circulating currents

induced in the disc by conventional d-c generator action. The direction of the induced current produces a component of force opposite to the applied force, and proportional to the strength of the magnetic field. The disc is essentially an infinite number of short-circuited turns moving through a magnetic field.

The eddy current clutch makes use of the above-described braking principle, but applies the braking between a constantly moving magnetic field and a loaded current sheet. A copper cup serves as the disc. It is secured to a shaft which, in turn, drives the load. A fluted slug, made of sintered iron, is fastened directly to the drive pulley, and the slug/pulley assembly is free to rotate about the shaft. The coil, cup, and slug are assembled coaxially with the cup between the coil and the flutes of the slug.

In operation, the fluted slug is belt-driven at constant speed by the drive motor. The output shaft remains motionless, or substantially so, until a current is fed through the coil. When current is applied, the fluted slug becomes magnetized, and a constant-angular-velocity magnetic field passes through the copper cup, producing an eddy-current drag, and thus applying torque to the shaft.

4.4.5 Brake Operation

Smooth brake operation is extremely important in maintaining proper tape tension when stopping the tape. Holdback tension, supplied by the trailing turntable, is lost when the STOP button is pressed, and maintenance of tape tension then becomes a function of brake operation. The braking force acting on the turntable from which the tape is being pulled (trailing turntable) in any mode of operation must exceed the braking force acting on the turntable taking up the tape (the leading turntable) to prevent the formation of tape loops.

The brake assembly is mounted on a bracket which, in turn, is mounted between the turntable clutch and the top plate. The brake pad is affixed to the brake arm, which operates on a pivot.

A low-tension spring holds the brake pad in contact with the brake drum. One direct-

ion of rotation of the drum tends to release the brake. The spring tension holds the pad against the drum and provides the "low side" of the brake differential.

Rotation of the drum in the opposite direction causes the brake pad to exert more pressure against the drum. This moves the brake arm against the brake stop. Adjustment of this spring therefore determines the "high side" of the brake differential.

Rotation of the drum in the opposite direction causes the brake pad to exert more pressure against the drum. This moves the brake arm against the brake stop. Any further movement of the brake arm must act against the high-tension spring. Adjustment of this spring therefore determines the "high side" of the brake differential.

The ratio of the braking force in one direction to the braking force in the other--the brake differential--is approximately two to one on this equipment.

Brakes are released when the brake solenoids are energized in any operating mode.

4.4.6 Control Circuit

4.4.6.1 General

The drive motor capacitor, capstan solenoid, and brake solenoid are mounted on the assemblies which they serve. All other components of the transport control circuit are located in the control box assembly at the back of the transport.

Receptacles on the control box provide plug-in connection facilities for the drive motor, turntable clutches, brake solenoids, capstan solenoid, a-c line power, and the electronic assemblies. A receptacle and dummy plug (cable not supplied) is also supplied for connecting a remote control unit (refer to Section 1). If a remote control is not used, the dummy plug must be inserted in this receptacle or the transport will not operate.

All tape motion is controlled by five pushbuttons -- STOP, REW (rewind), FWD (fast

forward), PLAY, and REC (record) -- which are mounted on the control box (they protrude through the front of the transport). Application or removal of power is controlled by a toggle switch.

The following descriptions of circuit actions can be followed most easily by referring to the simplified schematic diagrams of Figs. 7-2 and 7-4. In these descriptions, it is assumed that tape is properly threaded and power is applied.

4.4.6.2 Play Circuit

When PLAY pushbutton S107 is pressed, capstan solenoid K105 is energized, power is applied to the takeup and supply turntable clutches, and both brake solenoids are energized.

Capstan solenoid K105 incorporates a set of contacts which is closed when that solenoid is energized. A holding circuit is formed to the capstan and brake solenoids, and to the turntable clutches, through normally closed relay contact sets K102-3, K101-3, and solenoid contact K105A in the energized position.

The capstan solenoid moves the capstan idler to clamp the tape against the capstan, the brake solenoids release the brakes, and the turntables provide correct holdback and takeup tension. Tape is thus placed in motion in the reproduce (play) mode.

Note that the play mode cannot be initiated when tape is in motion in another mode, without first pressing the STOP pushbutton.

4.4.6.3 Record Circuit

In a strict sense, this circuit does not function as a tape motion control. It becomes operative only when tape motion is started in the play mode. Thus all actions described in paragraph 4.4.6.2 must be completed before recording can begin.

After the play mode is initiated, d-c power is available (through relay contact sets K102-3, K101-3, and solenoid contact set K105A) to pin 3 of J110S, and also to RECord pushbutton S102 (which is connected to pin 4 of J110S). When the REC pushbutton is pressed, the record relay

in the electronics assembly is energized through pin 4. The potential at pin 3 then serves to hold that relay energized (a description of record relay action is provided in Section 5, paragraph 5.5.2).

4.4.6.4 Fast Forward Circuit

When FWD pushbutton S103 is pressed, fast forward relay K102 is energized. Contact set K102-1 applies full available d-c power to the takeup clutch, and opens the circuit from the d-c line to the capstan solenoid. Contact set K102-2 forms a holding circuit for the relay, in series with normally closed contact set K101-2. Contact set K102-3 applies d-c power to the brake solenoids, and opens the d-c paths to the play and the rewind circuits.

Thus, full power is applied to the take-up clutch, the brakes are released, and the capstan solenoid is deenergized. Since no power is applied to the supply clutch, tape is simply pulled at fast speed from the supply reel to the takeup reel.

Note that fast forward operation can be initiated when tape is at a standstill or in motion in any other mode (reproduce, record, or rewind modes will drop out when the FWD pushbutton is pressed).

4.4.6.5 Rewind Circuit

This circuit is similar to the fast forward circuit previously described. When the REW pushbutton S101 is pressed, rewind relay K101 is energized. Contact set K101-1 applies full available d-c power to the supply clutch, and opens the d-c line to the capstan solenoid. Contact set K101-2 applies d-c power to the brake solenoids, and opens the circuit to the fast forward relay. Contact set K101-3 forms a holding circuit for the rewind relay (in series with normally closed contact set K102-3), and opens the d-c path to the play circuit.

Full power is thus applied to the supply clutch, the brakes are released, and the capstan

4.4.6.6 Stop Circuit

STOP pushbutton switch S105 is a normally closed switch inserted in series with the negative return lead from all relays and solenoids. When this pushbutton is pressed, the negative return is opened. Any mode of operation will be dropped out, and the brakes will be applied to stop tape motion.

solenoid is deenergized. Since no power is applied to the takeup clutch, tape is pulled at fast speed from the takeup to the supply reel.

Similarly to fast forward, the record mode can be initiated when tape is at a standstill or in motion in any other mode (reproduce, record, or fast forward modes will drop out when the REW pushbutton is pressed).

ELECTRONIC MAINTENANCE**5.1 PREVENTIVE MAINTENANCE**

Preventive maintenance for the electronic assemblies consists of making the overall performance checks (refer to paragraph 5.2) at scheduled intervals to determine that the equipment is operating within specifications.

5.2 OVERALL PERFORMANCE CHECKS**5.2.1 General**

These checks should be performed at scheduled intervals to determine whether alignment is required. Alignment procedures are described in paragraphs 5.3 and 5.4.

In all of these checks, blank tape is specified. However, it is permissible to use tape that has been recorded with material not necessary to save (that material will be erased during the recording part of the check).

NOTE

Always bulk-erase tape that was prerecorded on equipment employing a head configuration different from the equipment under test. Also, bulk-erase tape for 15/16 and 1-7/8 equipment, which has no erase head.

5.2.2 Test Equipment Required

Signal Generator, Hewlett-Packard Model 200C or equivalent
Bias Filter (see Fig. 5-1)
A-C Vacuum Tube Voltmeter, Hewlett-Packard Model 400D or equivalent
Bandpass Filter (see Fig. 5-2)
Wave Analyzer (if available)

5.2.3 Test Conditions

Line output terminated in 600 ohms for all checks
Input through dummy plug (not accessory item)
Heads cleaned and demagnetized before starting
Covers installed on electronic assemblies
All checks made using professional grade magnetic tape (Ampex No. 631 or equivalent)

5.2.4 Overall Frequency Response Check

This check can be made while simultaneously recording and reproducing if a bias filter (see Fig. 5-1) is available. If this is not the case, record the tape, rewind, and then make the response run.

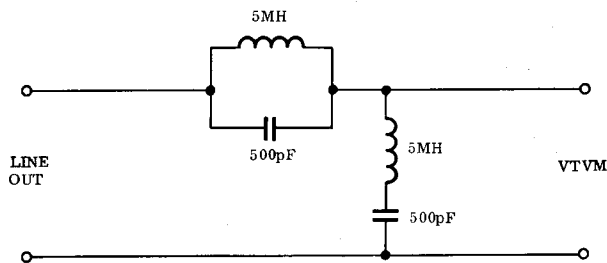


Fig. 5-1. Bias Filter

Step 1: Connect the signal generator to pins 1 and 3 of an INPUT connector (either input A or B may be used). Set the generator to 500 Hz at a nominal 1 volt level.

Step 2: Connect the bias filter to the OUTPUT connector, with the vtvm connected to the output of the filter.

Step 3: Place the OUTPUT SELECTOR switch, on the front panel of the electronic assembly, in the INPUT position. Adjust the applicable RECORD LEVEL control to achieve a -10 dbm output as indicated on the vtvm. Then turn the OUTPUT SELECTOR switch to the REPRODUCE position.

Step 4: At the tape transport, select the desired tape speed. Select the corresponding equalization at the electronic assembly.

Step 5: Thread blank tape on the equipment and place tape in motion in the record mode.

Step 6: While thus simultaneously recording and reproducing, change the frequency of the signal generator in discrete steps through the response spectrum applicable to the tape speed (refer to Section 1). Response, as indicated on the vtvm, should remain within specifications.

Step 7: Repeat Steps 4, 5, and 6 for the second speed.

Step 8: If this is two-channel equipment, repeat the entire procedure for the second channel.

Inadequate frequency response can result from any of the following causes:

- a. Heads in need of cleaning (refer to Section 6).

- b. Heads in need of demagnetization (refer to Section 6).
- c. Head azimuths incorrectly adjusted (refer to paragraphs 5.3.6 and 5.3.8).
- d. Bias level incorrectly adjusted (refer to paragraph 5.3.7).
- e. Reproduce equalization incorrectly adjusted (refer to paragraph 5.3.7).
- f. Record calibration incorrectly adjusted (refer to paragraph 5.3.7).
- g. Record equalization incorrectly adjusted (refer to paragraph 5.4.2).
- h. Play holdback tension incorrectly adjusted (refer to Section 4).
- i. Record and playback heads not adjusted to same height (refer to Section 6).
- j. Magnetic tape not professional grade.
- k. Signalgenerator output not flat over response spectrum.

5.2.5 Overall Signal-to-Noise Check

This check requires the use of an output bandpass filter, shown in schematic form on Fig. 5-2.

Step 1: Connect the signal generator to an INPUT connector (either input A or B can be used). Set the generator to 500 Hz at a nominal 1 volt level.

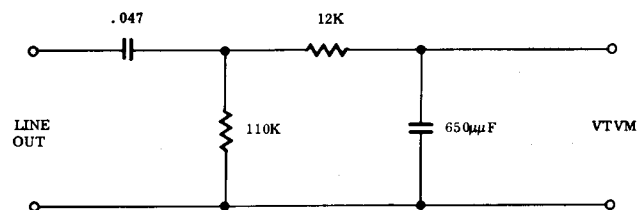


Fig. 5-2. Bandpass Filter

Step 2: Connect the bandpass filter to the OUTPUT connector, with the vtvm connected to the output of the filter.

Step 3: Place the OUTPUT SELECTOR switch in the INPUT position, and adjust the applicable RECORD LEVEL control to achieve a +10 dbm output as indicated on the vtvm.

Step 4: At the tape transport, select the desired tape speed. Select the corresponding equalization at the electronic assembly.

Step 5: Thread blank tape on the equipment, close the head gate, and start tape in motion in the record mode. Record a section of the tape with the 500 Hz signal.

Step 6: Stop tape motion and rewind the tape to the beginning of the recording made in Step 5. Close the head gate after rewinding.

Step 7: Remove the signal generator from the input. Turn the OUTPUT SELECTOR switch to the REPRODUCE position.

Step 8: Start tape in motion in the record mode with no input signal. The noise level, while thus erasing the 500 Hz signal, will be on the vtm.

NOTE

The signal-to-noise ratio is computed from peak record level, which is 6 db higher than normal record level. Therefore, 10 db must be added to the vtm indication in Step 8 to determine the actual signal-to-noise ratio, which should meet or exceed specifications (refer to Section 1).

Step 9: Repeat Steps 4 through 8 for the second speed.

Step 10: If this is two-channel equipment, repeat the entire procedure for the second channel.

An inadequate signal-to-noise ratio can result from any of the following causes:

- a. Heads in need of demagnetization (refer to Section 6).
- b. Heads in need of cleaning (refer to Section 6).
- c. Bias waveform not symmetrical (refer to paragraph 5.4.4).
- d. Fields from nearby motors, generators, etc.

- e. Head cables rubbing against moving parts on tape transport.
- f. Making noise run with head gate open.
- g. Record and playback heads not adjusted to same height (refer to Section 6).
- h. Magnetic tape not professional quality.

To check reproduce noise, remove the tape from the transport. Connect the vtm through the bandpass filter to the output connector. Hold the takeup tension arm away from its rest position (so it does not contact the safety switch) and press the PLAY pushbutton. Table 5-1 lists reproduce signal-to-noise for different speeds and track configurations.

5.2.6 Overall Distortion Check

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

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

The most common cause of high second harmonic distortion is a magnetized record head, but it could also result from a malfunctioning record or reproduce amplifier, or a non-symmetrical bias waveform.

Third harmonic distortion is dependent on the type of magnetic tape, the bias setting, and the accuracy with which the "normal recording level" is adjusted. A typical reel of tape will have a 500 Hz third harmonic content of 0.8% at operating level, but this might range as high as 1.1% or as low as 0.6%.

TAPE SPEED	HEAD	REPRODUCE SIGNAL/ NOISE (from 3% Level)
15 ips	Full Track	60 db
	Half Track	60 db
	Two Track	60 db
7-1/2 ips	Full Track	60 db
	Half Track	60 db
	Two Track	60 db
3-3/4 ips	Full Track	60 db
	Half Track	60 db
	Two Track	60 db
1-7/8	Full Track	55 db
	Half Track	55 db
	Two Track	55 db
15/16 ips	Full Track	55 db
	Half Track	55 db
	Two Track	55 db

Table 5-1. Reproduce Signal-to-Noise

5.3 NORMAL ALIGNMENT PROCEDURES

5.3.1 Standard Alignment Tapes

In aligning the equipment, the playback function is first aligned to a standard by using an Ampex Standard Alignment Tape. The record function is then aligned by using the playback circuit as a reference.

Standard 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. Heads and tape guides should be cleaned and demagnetized before the standard tape is installed on the equipment, and the tape should not be stored where temperature and humidity extremes occur. Also, the standard tape should be stored under the conditions existing after a normal play run - not after being rewound. After extensive use, the response of the standard tape will begin to fade, for example the head azimuth alignment tone may be down as much as 2 db.

When the standard tape is first run, it should be moved in the fast forward mode to the takeup side, then rewound to another reel (not the standard tape reel). The standard tape reel is then placed on the takeup turntable, and the tape is threaded. This allows storage on the original reel without the necessity of rewinding. Subsequent runs are made by putting the standard tape on the takeup turntable and rewinding to an empty reel on the supply turntable before proceeding with reproduce alignment.

5.3.2 Test Equipment Required

D-C Voltmeter, 20,000 ohms-per-volt.
A-C Vacuum Tube Voltmeter, Hewlett-Packard Model 400D or equivalent.
Signal Generator, Hewlett-Packard Model 200C or equivalent.
Wave Analyzer (if available).
Electronic Counter (if available).
Bias Filter (see Figure 5-1).
Bandpass Filter (see Figure 5-2).

Ampex Standard Alignment Tapes as applicable.

15 ips NAB: No. 01-31311-01
15 ips CCIR: No. 01-31313-01
15 ips AME: No. 01-31312-01
7-1/2 NAB: No. 01-31321-01
7-1/2 CCIR: No. 01-31323-01
3-3/4 ips (120 usec): No. 01-31331-01
3-3/4 ips (200 usec): No. 01-31334-01
1-7/8 ips: No. 01-31341-01
15/16 ips: No. 01-31351-01

Normal tools used by technician.

5.3.3 Alignment Conditions

Line output terminated in 600 ohms.
Input through dummy plug (not accessory item).
Heads cleaned and demagnetized.
Covers installed on electronics unless otherwise indicated.
Alignment made with professional grade magnetic tape (Ampex No. 631 or equivalent).

5.3.4 Introduction to Normal Alignment Procedures

Procedures described in paragraphs 5.3.5 through 5.3.8 will usually suffice to cor-

rect any deficient operation revealed by the Overall Performance Checks (refer to paragraph 5.2). Other adjustment procedures, usually not required or required only after corrective maintenance, are included in paragraph 5.4.

If the equipment will be operated most of the time at one tape speed, with the other used only infrequently, that speed should be used for the first alignment run - where bias level is set and record level is calibrated. Reproduce equalization can then be adjusted for the second speed.

When both speeds are to be used alternately, alignment should be started with the 7-1/2 ips speed for 3-3/4 - 7-1/2 and 7-1/2 - 15 ips equipment, or with the 15/16 ips speed for 15/16 - 1-7/8 ips equipment. These speeds provide optimum settings for bias and record levels.

5.3.5 Checking Power Supply Voltage

There is no adjustment for the power supply. However, its proper operation can be easily checked at an input accessory socket at the back of the electronic assembly.

Step 1: Remove one of the dummy plugs from either INPUT ACCESSORY SOCKET (J5 or J7) at the back of the electronic assembly.

Step 2: Apply power to the equipment and 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 3: Place the equipment in the record mode (it is not necessary to thread tape on the transport).

Step 4: Check the voltage from pin 5 (positive) of the accessory socket to chassis ground, using the d-c voltmeter. It should be from 22 to 24.5 volts.

5.3.6 Reproduce Head Azimuth Adjustment

For two channel equipment, this procedure will be easier if two vtm's are available, because the output of both heads in the reproduce head stack can then be measured simultaneously. Using one vtm requires that the azimuth be adjusted for one head, then the other, to arrive at

any necessary compromise setting. Of course, only one vtm is required for single channel equipment. Azimuth need be adjusted at only one tape speed.



Do not tamper with any screw on the head assembly other than the one for azimuth adjustment, or it may become necessary to adjust the head height.

Step 1: Connect the vtm to the OUTPUT connector. If this is two-channel equipment, and if two vtm's are available, connect one to each OUTPUT connector.

Step 2: Apply power to the equipment. At the tape transport, select the tape speed at which the adjustment is to be made. Select the corresponding equalization at the electronic assembly.

Step 3: Place the RECORD SELECTOR switch on the electronic assembly in the SAFE position.



To prevent accidentally entering the record mode and thus erasing the standard tape, be sure the RECORD SELECTOR switch on each electronic assembly is in the SAFE position.

Step 4: Place the OUTPUT SELECTOR on each electronic assembly in the REPRODUCE position.

Step 5: Thread the standard alignment tape applicable to the tape speed, on the tape transport (refer to paragraph 5.3.1 if this is the first run of the standard tape).

NOTE

Voice announcements on the standard tape can be monitored through headsets plugged into the PHONES jack, or through

an external amplifier/loud-speaker connected to the output of the vtvm.

Step 6: Place the standard tape in motion in the reproduce mode. As the first tone on the tape is reproduced, adjust the REPRODUCE LEVEL control(s) to achieve a convenient indication on the vtvm(s).

Step 7: The second tone on the tape is for use in setting the reproduce head azimuth. Open the head cover, and as this tone is reproduced turn the azimuth adjustment (see Figure 5-3) to achieve a maximum indication on the vtvm. If this is two channel equipment and two vtvm's are being used, adjust to the optimum setting for the two heads in the stack.

NOTE

When the head 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.

Step 8: If this is two-channel equipment, and only one vtvm is being used, rewind the tape to the first tone and repeat Steps 6 and 7 for the second channel. If the output does not peak at exactly the same setting, work back and forth between the two channels to determine the optimum adjustment point.

Leave test equipment connected and the standard tape threaded, if reproduce/record alignment is to be made.

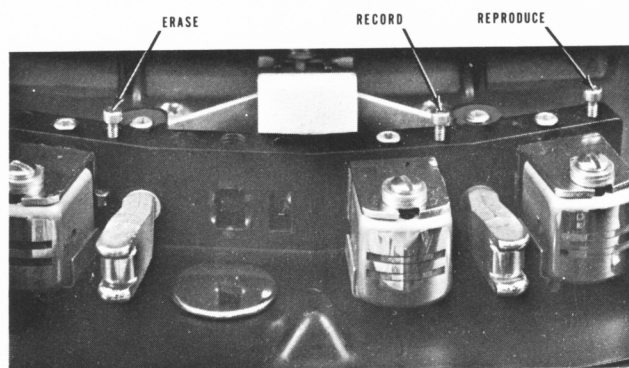


Fig. 5-3. Head Azimuth Adjustment

5.3.7 Reproduce/Record Alignment

Step 1: Repeat Steps 1 through 5 of the reproduce head azimuth adjustment procedure (refer to paragraph 5.3.6). Close the head cover.

Step 2: Start the standard tape in motion in the reproduce mode. As the first tone is reproduced adjust the REPRODUCE LEVEL control to achieve a convenient reference indication on the vtvm. (If tape speed is 15 ips adjust the record level to achieve a +4 dbm indication on the vtvm.)

NOTE

Fixed reproduce equalization is used on 15/16 and 1-7/8 ips equipment, so the adjustment described in Step 3 does not apply to that equipment.

Step 3: Following the first tone on the standard tape, there are a series of tones for use in checking reproduce high frequency equalization. As these tones are reproduced, adjust the appropriate HI FREQ EQUAL control (at the back of the electronic assembly) to achieve the flattest possible response within specifications. However, reproduce response must be within ± 2 db of the theoretical curves given in Figures 7-15, 7-16, and 7-17.

NOTE

When a standard tape is reproduced by a half track or two track head, readings below 700 Hz (7-1/2 and 15 ips) or 500 Hz (3-3/4, 1-7/8, and 15/16 ips) are invalid. The tape is recorded full track, and the "fringing" effect causes high indications at the lower frequencies. This effect does not occur when tapes are recorded and reproduced using heads of the same configuration.

Step 4: As the final tone on the tape is reproduced, adjust the REPRODUCE LEVEL control to achieve a +4 dbm indication on the vtvm

(this has already been accomplished at the 15 ips speed). The equipment vu meter should indicate 0 ($\pm 3/4$ db).

NOTE

The setting of the REPRODUCE LEVEL control in Step 4 must not be changed until record level is calibrated in Step 13.

Step 5: Allow the standard tape to continue in motion in the reproduce mode until it is completely wound on the standard tape reel. Remove the standard tape, mark it "Rewind before using", and store it in a safe place.

Step 6: Leave the vtm connected to the OUTPUT connector. Connect the signal generator to the INPUT connector (either A or B input can be used).

Step 7: Set the signal generator to provide a nominal 1 volt rms output at the appropriate frequency listed:

15 ips	1,000 Hz
7-1/2	500 Hz
3-3/4 ips	250 Hz
1-7/8 ips	250 Hz
15/16 ips	250 Hz

Step 8: Thread blank tape on the transport.

Step 9: At the electronic assembly, place the OUTPUT SELECTOR switch in the REPRODUCE position and the RECORD SELECTOR switch in the RECORD position. (If this is two-channel equipment, leave the RECORD SELECTOR on the second electronic assembly in the SAFE position so that it will not record.)

Step 10: Remove the small cover, secured by two screws, from the front of the electronic assembly.

Step 11: Start the equipment in the record mode and adjust the applicable RECORD LEVEL control to achieve a convenient indication on the vtm.

Step 12: Adjust the BIAS ADJUST control to achieve a peak indication on the vtm.

Step 13: Set the signal generator to 500 Hz at a nominal 1 volt level. Adjust the RECORD LEVEL control to achieve a +4 dbm indication on the vtm.

Step 14: Turn the OUTPUT SELECTOR switch to the INPUT position. Adjust the RECORD CAL control to achieve a 0 indication on the equipment vu meter.

Step 15: Repeat Steps 1, 2, and 3 for the second tape speed, using the appropriate standard alignment tape and HI FREQ EQUAL control.

Step 16: If this is two-channel equipment, repeat the entire procedure for the second channel.

5.3.8 Record Head Azimuth Adjustments

For two-channel equipment, this procedure (similar to the one for reproduce head azimuth adjustment) will be simplified if two vtm's are available. The adjustment need be made at only one speed.

CAUTION

Do not tamper with any screw on the head assembly other than the one for azimuth adjustment, or it may become necessary to adjust head height.

Step 1: Connect the vtm to the OUTPUT connector. On two-channel equipment where two vtm's are available, connect one to each OUTPUT connector.

Step 2: Connect the signal generator to the INPUT connector (either input A or B may be used). If two vtm's are being used to adjust two-channel equipment, connect the signal generator to the input of both channels.

Step 3: Set the signal generator to a nominal 1 volt rms output level at the appropriate frequency listed:

15	ips	15,000 Hz
7-1/2	ips	15,000 Hz
3-3/4	ips	7,500 Hz
1-7/8	ips	5,000 Hz
15/16	ips	3,000 Hz

Step 4: At the electronic assembly, place the RECORD SELECTOR switch in the RECORD position and the OUTPUT SELECTOR switch in the INPUT position.

Step 5: Adjust the RECORD LEVEL control to achieve a -6 dbm indication on the vtm. Turn the OUTPUT SELECTOR switch to the REPRODUCE position.

Step 6: Thread blank tape on the transport.

Step 7: Start the equipment in the record mode (both channels of two-channel equipment when two vtm's are employed).

Step 8: While thus simultaneously recording and reproducing, open the head cover and adjust the record head azimuth (see Figure 5-3) to achieve a maximum indication on the vtm. If this is two-channel equipment and two vtm's are being used, adjust to the optimum setting for the two heads in the record stack.

NOTE

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

Step 9: If this is two-channel equipment, and only one vtm is being used, repeat the procedure for the second channel. If the azimuth does not peak at exactly the same setting, work back and forth between the two channels to determine the optimum adjustment point.

5.4 INFREQUENTLY REQUIRED ALIGNMENT PROCEDURES

5.4.1 Low Frequency Reproduce Equalization

NOTE

This adjustment requires access to the LO FREQ EQUAL controls on the back panel of the electronic assembly. Also, the adjustment does not apply to 15/16 and 1-7/8

ips equipment, where fixed equalization is employed.

Step 1: Connect the vtm to the OUTPUT connector.

Step 2: Connect the signal generator to the INPUT connector (either input A or B may be used). Set it to 500 Hz at a nominal 1 volt level.

Step 3: Apply power to the equipment. At the tape transport select the tape speed to be used. Select the corresponding equalization at the electronic assembly.

Step 4: Thread blank tape on the transport. Place the OUTPUT SELECTOR switch in the INPUT position and adjust the RECORD LEVEL control to achieve a 0 dbm indication on the vtm.

Step 5: Start the equipment in the record mode. Turn the OUTPUT SELECTOR switch to the REPRODUCE position and adjust the REPRODUCE LEVEL control for a 0 dbm indication on the vtm.

Step 6: While thus simultaneously recording and reproducing, change the frequency of the signal generator in discrete steps from 250 Hz to 30 Hz, adjusting the applicable LO FREQ EQUAL to obtain the flattest possible result within specifications. This is accomplished by adjusting for equal excursions of the positive-going and negative-going head bumps.

Step 7: Repeat Step 6 for the second tape speed.

Step 8: If this is two-channel equipment, repeat the entire procedure for the second channel.

5.4.2 Record Equalization

The adjustment will be simplified by using the bias filter, shown in schematic form on Figure 5-1. If the filter is not used, a trial-and-error method must be employed, where the tape is first recorded at different settings of the REC EQUALIZATION control and then reproduced to determine the correct setting. This will require several record and reproduce runs before the proper adjustment is finally determined.

Step 1: Repeat Steps 1, 2, and 3 of the Low Frequency Reproduce Equalization procedure. In Step 1, connect the bias filter between the OUTPUT connector and vtm.

Step 2: Remove the small cover secured by two screws to the front panel of the electronic assembly.

Step 3: Set the signal generators to provide a 1 volt rms output at the applicable frequency listed:

15	ips	18,000 Hz
7-1/2	ips	15,000 Hz
3-3/4	ips	8,000 Hz
1-7/8	ips	5,000 Hz
15/16	ips	3,000 Hz

Step 4: Thread blank tape on the equipment. Place the OUTPUT SELECTOR switch in the INPUT position and adjust the RECORD LEVEL control to achieve a -10 dbm indication on the vtm.

Step 5: Start the equipment in the record mode. Turn the OUTPUT SELECTOR switch to the REPRODUCE position.

Step 6: While thus simultaneously recording and reproducing, change the frequency of the signal generator over the top end of the response spectrum for this tape speed (refer to Specifications in Section 1). Adjust the applicable REC EQUALIZATION control (LOW speed or HIGH speed) for the flattest possible high frequency response, in reference to 500 Hz, in accordance with specifications.

Step 7: Repeat Steps 3, 4, 5, and 6 for the second speed.

Step 8: If this is two-channel equipment, repeat the entire procedure for the second channel.

5.4.3 Bias Oscillator Frequency Adjustment

This adjustment is made at the factory using an electronic counter. If such a counter is available, connect it across R41 on the record printed wiring board (with the record head connected). Place the equipment in the record mode

(on one channel only if this is two-channel equipment). Adjust the tuning slug in transformer T1 (also on the record printed wiring board) to achieve a bias frequency as close as possible to 100,000 Hz.

NOTE

If this is two-channel equipment, the frequencies of the bias oscillators in the two electronic assemblies must be identical within $\pm 1,000$ Hz.

If an electronic counter is not available, do not attempt to adjust the bias oscillator frequency, except on two-channel equipment when a beat frequency becomes noticeable. If this should occur, slowly and carefully adjust the tuning slugs, alternating between the two oscillators, until the beat frequency is eliminated.

5.4.4 Bias Symmetry Adjustment

This adjustment is made at the factory using a signal generator with a second harmonic distortion less than 0.2%, and a wave analyzer. The BIAS SYM control, on the back panel of the electronics assembly, is adjusted for minimum second harmonic distortion of a 500 Hz signal, placing only one channel at a time in the record mode.

If a wave analyzer is not available, do not change the factory setting of this control unless some component in the bias and erase oscillator requires replacement. After completing such corrective maintenance, monitor the output through a high gain amplifier and loudspeaker (or headset) while simultaneously recording and reproducing with no input signal. Adjust the BIAS SYM control for minimum popping or hissing noise.

NOTE

If the BIAS SYM control has no audible effect, simply leave it in the mid-position.

5.5 PRINCIPLES OF OPERATION

5.5.1 General

A block diagram of the record/reproduce circuits is presented in Figure 5-4. Complete

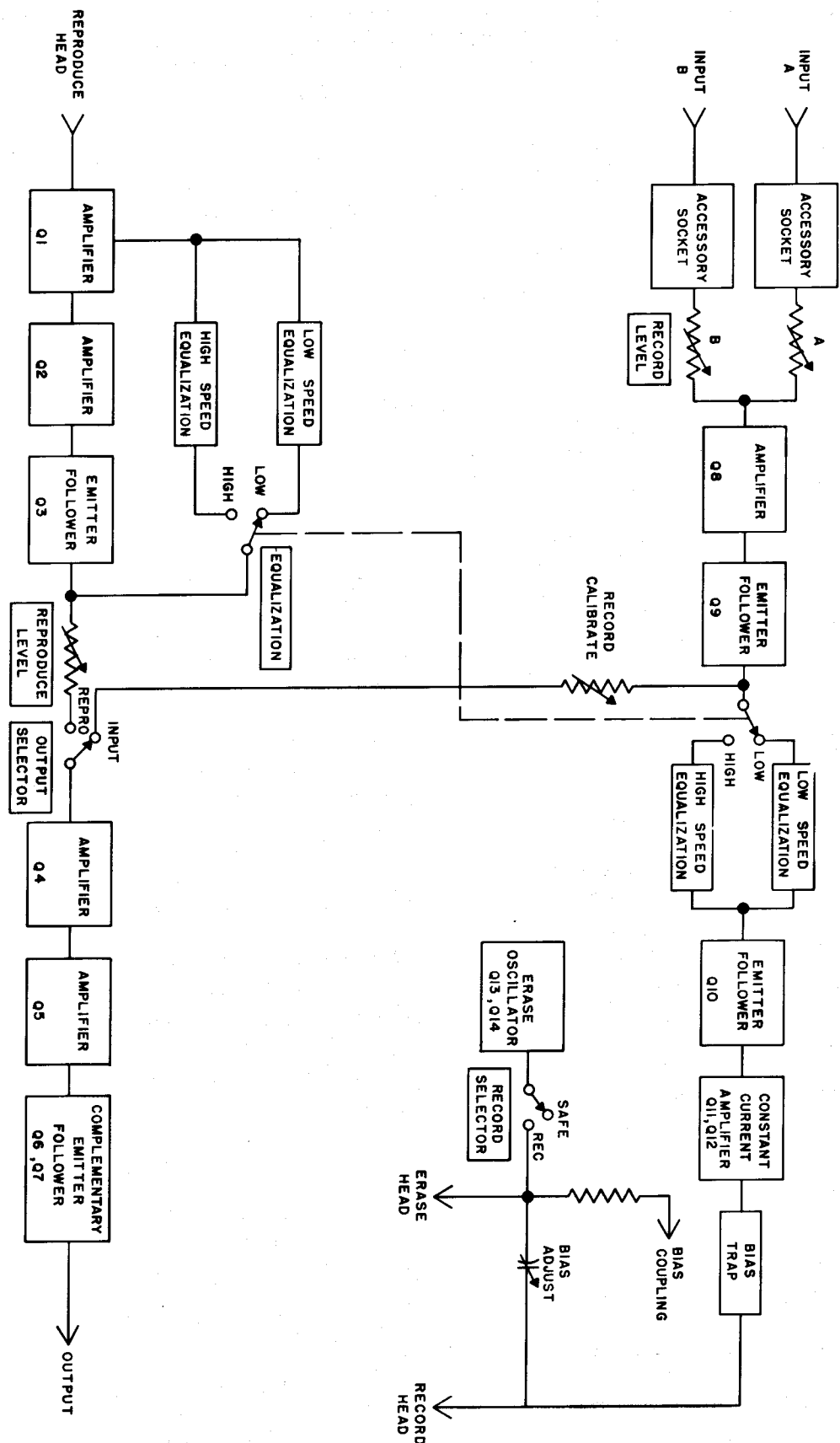


Fig. 5-4. Block Diagram, Electronic Circuit

schematic diagrams are provided in Section 7 for all available versions of the equipment.

5.5.2 Record Circuit

The signal to be recorded is connected to either or both receptacles J4 (input A) or J6 (input B), and is then routed to INPUT ACCESSORY sockets J5 or J7 respectively. Dummy plugs (provided) or optional accessory input transformers or microphone preamplifiers (refer to Section 1) must be inserted in J5 or J7 to complete the signal path.

Note that one side of the signal path is connected to the accessory sockets at pin 4, leaves the socket at pin 3 and is connected across the RECORD LEVEL control, returns to the accessory socket at pin 6, and finally leaves at pin 7. This connection allows the record level controls to be inserted between the two amplifier stages in the microphone preamplifier, when that optional accessory is used. The preamplifier can thus function as a variable gain device which will accommodate a wide variety of microphones.

Following the accessory socket and level control the two inputs are connected together through a resistive mixing circuit. The signal is then routed to the base of amplifier stage Q8. Note that the collector load for Q8 consists of the base circuit of emitter follower stage Q9.

Following Q9 there are two signal paths. The record signal is connected to contacts of EQUALIZATION switch S2, which select either the HIGH speed or LOW speed record equalization circuit. This circuit consists of resistor R29 shunted by resistor R56 and either capacitor C25 (high speed) or C26 (low speed) as selected by the switch. The record monitor signal is connected, through resistor R51 and the RECORD CAL control R50, to contacts of the OUTPUT SELECTOR switch. When that switch is in the INPUT position, the signal proceeds through the final three stages of the reproduce circuit (refer to paragraph 5.5.3) to the vu meter and output line for monitoring and calibration purposes.

Emitter follower stage Q10 follows the record equalization circuit in the record signal path. The signal is then amplified in a constant current amplifier stage formed by Q11 and Q12.

In this amplifier, Q12 acts as a bootstrap on Q11 and the circuit presents a relatively high a-c impedance (to provide a constant current signal drive) but a relatively low d-c impedance (so that the d-c operating voltage may be fully utilized). The signal then proceeds through a bias trap (L1, C15), is mixed with the a-c bias, and is delivered to the record head.

The record amplifier is made operative through contact set 6-8 of record relay K1. Closing these contacts shifts the d-c bias on transistor Q10, causing it and subsequently Q11 and Q12 to conduct, when the contacts are open the three transistors are cut off. Thus the amplifier is inoperative in any but the record mode.

Transistors Q13 and Q14 form the bias and erase oscillator. This is a conventional push-pull circuit connected as a tuned flip-flop. Operating voltage is delivered only when the equipment is in the record mode, through contact set 9-11 of record relay K1. Symmetry of the output waveform is adjustable at variable resistor R62, while the frequency is adjustable by a tuning slug in transformer T1 (nominal bias frequency is 100,000Hz).

The output of the bias and erase oscillator is taken from the secondary of T1 to RECORD SELECTOR switch S4. When that switch is in the RECORD position the bias current is delivered through capacitor C28 to the erase head, and is adjusted at capacitor C27, mixed with the record signal and delivered to the record head. Also, a bias line is run through resistor R58 to pin 7 of receptacle J11. In two channel equipment this pin is connected to the output of the bias oscillator in the second electronic assembly; the coupling locks the frequencies of the two oscillators together, so that no beat frequency is generated.

A simplified diagram of the record relay is shown in Figure 5-5. When the RECORD SELECTOR switch is in the RECORD position, and the equipment is first started in the play mode, pressing the RECORD pushbutton will energize the relay. Contact set 3-5 then forms a holding circuit for the relay, which will then remain energized until the STOP pushbutton is pressed, or tape is exhausted (safety switch opens). (Note that it is possible to drop out the record mode by returning the RECORD SELECTOR switch to the SAFE position. This, however, will cause severe

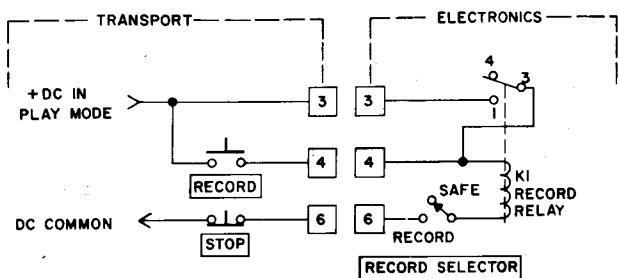


Fig. 5-5. Simplified Diagram, Record Relay

pops on the tape, and will probably magnetize the record head, so it is not a recommended practice.)

5.5.3 Reproduce Circuit

From the reproduce head, the signal from the tape is routed through two amplifier stages (Q1 and Q2) and an emitter follower stage (Q3). Reproduce equalization is connected through contacts of EQUALIZATION switch S2, from the emitter of Q3 to the emitter of Q1. Variable resistors R47 (high speed) and R48 (low speed) are used to equalize high frequencies, while R46 (high speed) and R63 (low speed) are for equalizing low frequencies.

NOTE

Fixed reproduce equalization is employed on 15/16 - 1-7/8 equipment.

Following emitter follower Q3 is the REPRODUCE LEVEL control, R49. The signal then proceeds through contacts of OUTPUT SELECTOR switch S3, which must be in the REPRODUCE position during playback. (Note that when this switch is in the INPUT position, the record monitor circuit is connected to the final three stages for calibration and monitoring of the record signal.)

After the OUTPUT SELECTOR switch, there are two amplifier stages (Q4 and Q5), and a complementary emitter follower output stage Q6/Q7. The output is transformer-coupled to the vu meter and OUTPUT connector J3. Headsets with impedances of 8 ohms or more can be used to monitor the output, either record or reproduce, at PHONES jack J2, which is connected in series with resistor R52 across the primary of the output transformer.

5.5.4 Power Supply Circuit, Domestic Equipment

The a-c power line voltage is connected

from the transport, immediately following the POWER switch, to pins 9 and 10 of the electronic assembly. One side of the line is fused by F1, and line power is then connected across the primary of power transformer T3.

Diodes CR2 and CR3 provide full wave rectification in the center tapped secondary of T3. Transistor Q15 is a series (emitter follower) power transistor. Regulation is achieved by Zener diode VR1 which holds the base, and thus the emitter, of Q15 at a constant potential (23.4 volts, $\pm 5\%$).

5.5.5 Power Supply Circuit, International Equipment

The only difference between this circuit and that in the domestic equipment is in the power input. In the international version, a selector switch on the back panel of the electronic assembly must be positioned in accordance with the a-c power line voltage - either 115 volts or 230 volts.

A simplified diagram of the international power input circuit is shown on Fig. 5-6. Line power is connected to receptacle J118P on the tape transport. Both sides of the line are switched by power switch S106 and fused by F101 and F102. The a-c power is then connected from the transport to the electronics assembly.

In the electronics assembly, the a-c power is connected across the two primary windings of power transformer T3. Note, however, that the 115V - 230V switch is connected between the two primary windings. In the 230V position of this switch the windings are connected in series across the power line. The 115 volts a-c at the junction of the two windings is returned to the transport. In the 115V position of the switch, the two windings are connected in parallel, and both sides of the line are returned to the transport.

The voltage regulator action in the electronics power supply is identical to that previously described for the domestic equipment.

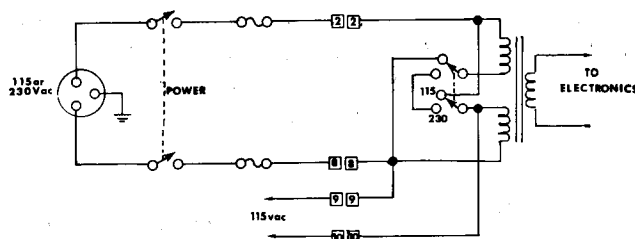


Fig. 5-6. Simplified Diagram, Power Input, International

HEAD ASSEMBLY

6.1 GENERAL

Four head stack mounting positions are provided on the head base assembly; these are designated as positions 1, 2, 3, and 4, from left to right (as viewed from the front of the assembly). Head stacks may be mounted in all positions, or certain positions may not be used, depending on the particular equipment and its application.

Erase, record, and reproduce head stacks are available in three configurations. Each may contain one head for full track operation, two heads for two track or half track operation, or two heads for quarter track operation. Note that there is no half track head as such; equipment intended for half track operation is provided with a complete two track head assembly.

On 3-3/4 - 7-1/2 ips and 7-1/2 - 15 ips equipment, the standard head assemblies can be divided into two main categories -- the three stack assembly and the four stack assembly. The three stack assembly consists of erase, record, and reproduce head stacks mounted in positions 1, 3, and 4 (respectively) on the head base; each stack is of the same configuration (full track, two track, or quarter track). In the four stack assembly, a two track erase, a two track record, a quarter track reproduce, and a two track reproduce head

stack are mounted in positions 1, 2, 3, and 4 respectively. A switch, controlled by means of a lever which protrudes through the head base, provides selection of quarter track or two track reproduce operation.

Heads for 15/16 and 1-7/8 ips equipment are of the quarter track variety. Standard assemblies for these recorders do not include an erase head, a dummy post is mounted in its position. For two-channel record and reproduce, a quarter track record head stack, and a quarter track reproduce head stack, are mounted in positions 3, and 4 respectively. On four-channel record and reproduce equipment, two quarter track record head stacks (channels 1 and 3, and 2 and 4) are mounted in positions 1 and 2. Two quarter track reproduce head stacks (channels 1 and 3, and 2 and 4) are mounted in positions 3 and 4.

6.2 ROUTINE MAINTENANCE

6.2.1 Cleaning

Oxide from the magnetic tape will be deposited on the heads. If the heads are not cleaned at frequent intervals, head-to-tape contact will be affected and equipment operation will be degraded.

Heads, tape guides, and other components in the tape threading path should be cleaned after each eight hour operating period, or oftener if visual inspection so indicates.

CAUTION

Use only the recommended solvent to clean the heads, because other solvents may damage these precise assemblies. Do not let the solution drip or spray on plastic finishes or parts, or on the tire of the capstan idler. Also, do not use metal tools, which might scratch the head assembly.

Step 1: Open the head gate.

Step 2: Moisten a cotton-tipped applicator with Ampex Head Cleaner (Catalog No. 4010823 or 087-007). Clean each head.

Step 3: Clean the tape guiding elements, the capstan, and the capstan idler with iso-propyl alcohol. Do not use the head cleaner on these elements.

6.2.2 Demagnetizing

Heads occasionally acquire a degree of permanent magnetization which can result in increased noise and distortion, and the partial erasure of high frequency signals recorded on the tape. Demagnetize the heads after each eight hour operating period, or oftener if there is any suspicion that the procedure is required.

Demagnetization is easily accomplished with an Ampex Head Demagnetizer (Catalog No. 4010820).

Step 1: Remove any tape that is on, or near, the recorder. (The demagnetizer will partially erase any tape which is in close proximity.)

Step 2: If the tips of the demagnetizer are not covered with plastic material, place pressure sensitive tape over them. This is to prevent scratching the heads.

Step 3: Plug the demagnetizer into a source of 110 - 120 volt, a-c power.

Step 4: Bring the tips of the demagnetizer into very light contact with the heads, positioned so that the tips straddle the gap in the middle of the stack.

Step 5: 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 6: Repeat Steps 3, 4, and 5 at all head stacks.

Step 7: Withdraw the demagnetizer at least three feet from the recorder before unplugging it from the a-c power source.

6.3 ADJUSTMENT PROCEDURES

6.3.1 Head Azimuth

Record and reproduce head azimuth adjustments are described as part of the normal alignment procedures in Section 5, Electronic Maintenance.

6.3.2 Tape Guides

The only adjustment which can be made on the tape guides is azimuth alignment. If the guides become tilted, so that the edges of the tape contact diagonally opposite edges of the lips of the guides, flutter and wow will be affected.

Step 1: Thread tape on the transport. Place the equipment in the reproduce mode at the high tape speed.

Step 2: Open the head gate, and visually check the tape as it moves over the guides. It should be approximately centered on the guides, horizontally parallel to the upper and lower lips of each guide.

Step 3: If misalignment is noted in Step 2, loosen the cap screw (item 16, Fig. 7-12) which secures the guide. Rotate the guide in its mounting as required to correct the misalignment, and retighten the cap screw.

Step 4: If either guide is adjusted, always check whether that adjustment has affected tape tracking at the other guide (by repeating Steps 1 and 2). When necessary, adjust the second guide as described in Step 3.

Step 5: Repeat Steps 1 through 4 until the tape tracks properly over each guide.

6.3.3 Head Height

Head heights are precisely adjusted at the factory, and there should be no necessity for readjustment unless a head stack is changed. The procedure itself is comparatively simple, but it must be performed carefully and exactly.

6.3.3.1 Full Track and Two Track Heads

Step 1: Adjust head height and azimuth until both are approximately correct, by turning the height adjusting setscrew (item 19, Fig. 7-12) and the azimuth adjusting socket head screw (item 17).

Step 2: Thread tape on the transport, and place the equipment in the reproduce mode at the high speed.

Step 3: Turn the head height adjusting setscrew clockwise until the head laminations are barely visible at the bottom edge of the tape.

Step 4: Carefully counting the precise number of turns required, turn the head height adjusting setscrew counterclockwise until the head laminations are barely visible at the top edge of the tape.

Step 5: Turn the head height adjusting setscrew clockwise exactly half the number of turns noted in Step 4. This will center the head(s) on the tape.

Step 6: Adjust the head azimuth as described in Section 5, Electronic Maintenance. Note that some interaction between height and azimuth adjustments may be encountered.

6.3.3.2 Quarter Track Record/Reproduce Heads

Step 1: Perform Steps 1 and 2 of paragraph 6.3.3.1

Step 2: Adjust the head height adjusting setscrew so that the top of the mu-metal portion of the upper head in the stack is exactly even with the top edge of the tape. (If this is a 15/16 - 1-7/8 ips recorder, and if the head assembly contains two record or two reproduce head stacks, make this adjustment at the head stacks which correspond to tracks 1 and 3 on the tape.)

Step 3: Applicable only for 15/16 - 1-7/8 ips equipment with two record or two reproduce head stacks. On the head stacks corresponding to tracks 2 and 4 on the tape, adjust the head height adjusting setscrew so that the bottom edge of the mu-metal portion of the lower head in the stack is exactly even with the bottom edge of the tape.

Step 4: Adjust the head azimuth as described in Section 5, Electronic Maintenance.

6.3.3.3 Quarter Track Erase Head

Step 1: Repeat Steps 1 and 2, paragraph 6.3.3.1.

Step 2: Repeat Step 2, paragraph 6.3.3.2.

Step 3: Turn the head height adjusting setscrew 1/8 turn (45°) in a counterclockwise direction, thus moving the top of the erase head slightly above the top edge of the tape. (This is required because the erase head is wider than the record/reproduce heads.)

6.3.4 Tape Wrap Across Heads

The heads must be positioned so that the tape wrap across each head will ensure good head-to-tape contact. There should be no need to make this adjustment unless head stacks are changed or repositioned.

Step 1: Thread tape on the tape transport.

Step 2: Open the head gate and move the tape lifter so that the tape is lifted from the heads.

Step 3: Check heads mounted in positions 2 or 3. They should be within .005 to .010 inch of the tape.

Step 4: If the head-to-tape clearance in Step 3 is incorrect, loosen the acorn nut (or the two mounting screws) which secures the head stack to the mounting. Move the head to achieve the quoted clearance, with the tape contact area centered over the gap, and retighten the acorn nut or screws.

CAUTION

To prevent damaging the head stack, tighten the nut or screws using not more than six inch-pounds of torque. This torque corresponds to two pounds of force applied to the end of an open end wrench which is three inches long.

Step 5: Retract the tape lifter. If the head stacks in positions 1 and 4 are properly positioned, the tape will clear the bottom of the tape guides by .001 to .005 inch. If adjustment is required, repeat Step 4 at the applicable head stack.

Step 6: If any adjustment is made, check the head azimuth as described in Section 5, Electronic Maintenance.

6.3.5 Checking Head Mounting

The head mounting is secured to the base by an elastic stop nut (Item 21, Fig. 7-12). This stop nut is tightened against a double coil washer (item 28) and a flat washer (item 23), to hold the head mounting in position.

From the bottom of the head base, the mounting floats on two springs (item 6, Fig. 7-12). These springs are compressed or relieved by the head height mounting setscrew and the head azimuth adjusting screw as required to achieve correct head height and azimuth. It is important, therefore, that the elastic stop nut not be tightened

to the point where the action of the springs is defeated.

To check the mounting, grasp the head mounting (and stack if one is included in that position). It should be possible to pivot the mounting slightly clockwise (viewed from the front of the assembly) against the spring action. When the mounting is released, it should immediately return to the vertical position. It should not be possible to tilt the top or bottom of the mounting away from the base in a forward or sidewise direction.

If it is not possible to pivot the mounting, or if it does not return (or returns sluggishly) to the vertical position, the elastic stop nut is too tight. If the mounting tilts away from the base, the stop nut is too loose.

To adjust the stop nut to the correct force, first loosen the nut. Then run it in, checking the pivoting action of the head mounting as previously described, until the head will not return to the vertical position. Back the nut off from that setting just to the point where the head is free to pivot and return without binding.

6.4 REPLACEMENT OF HEADS

6.4.1 Changing Head Stacks

Step 1: Disconnect the applicable head cable(s) from the electronic assembly.

Step 2: Loosen the head assembly mounting screw (item 82, Fig. 7-9). It is not necessary to remove this screw.

Step 3: Loosen the acorn nut (or the two mounting screws) which secures the head stack to the head mounting. Slip the head stack from the mounting, and guide the head cable out through the hole in the top plate. The head stack and cable will then be free; remove the acorn nut and the washer (or mounting screws) and store the head stack in a location where it will not be damaged (if it is still in good condition).

Step 4: Install the acorn nut and the washer (or the two mounting screws) on the new head stack. Guide the head cable through the hole in the top plate and slide the new head stack on the mounting, being sure both the acorn nut and washer are above the mounting.

Step 5: Adjust the head position for proper tape wrap (refer to paragraph 6.3.4) and head height (refer to paragraph 6.3.3).

Step 6: Connect the head cable to the electronic assembly, and adjust head azimuth as explained in Section 5, Electronic Maintenance.

6.4.2 Repositioning Head Stacks

Head mountings are provided in all four positions. It is therefore possible to change the position of head stacks within the assembly to any desired sequence, and to add additional stacks for special applications. Follow the same procedure described in paragraph 6.4.1 to remove and reposition head stacks, or to install new head stacks.

MODEL AL-500
15/16 & 1-7/8 ips

-01	-02	-03	-04	-05	-06	DESCRIPTION	Ampex Part No.
X						Two record/reproduce channels, 60 Hz, cased	4010062-01
	X					Two record/reproduce channels, 60 Hz, uncased	4010062-02
		X				Four record/reproduce channels, 60 Hz, uncased	4010062-03
			X			Two record/reproduce channels, 50 Hz, cased	4010062-04
				X		Two record/reproduce channels, 50 Hz, uncased	4010062-05
					X	Four record/reproduce channels, 50 Hz, uncased	4010062-06
1	1	2	1	1	2	Head assembly, reproduce, 1/4 track	1815112-04
1	1	2	1	1	2	Head assembly, record, 1/4 track	1815112-05
1	1	1				Tape Transport assembly, 60 Hz	4020061-08
			1	1	1	Tape Transport assembly, 50 Hz	4020061-09
2	2	4	1	1	3	Electronics assembly, Domestic	4020256-05
			1	1	1	Electronics assembly, International	4020256-06
	1	1	1	1	1	Guard assembly, Tape Transport	4040640-10
2	2	2	2	2	2	Knob, reel hold down	4130028-20
1			1			Case, portable	4150231-01
1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	Instruction Manual	4890169
4	4	8	4	4	8	Connector, plug, female, XL-3-11	144-003
2	2	4	2	2	4	Connector, plug, male, XL-3-12	145-009
	4	4	4	4	4	Clip, cable	302-203
1	1	1	1	1	1	Cord Set	084-027
			2	2	2	Fuse, 3/4 amp, 250V, slo-blo	070-081
1	1		1	1		Cable, Interconnecting	4050430-01
		1			1	Cable, Interconnecting	4050430-02
2	2	4	2	2	4	Transformer, input, bridging	4580200-01

MODEL AG-500
Single Channel, 60 Hz
NAB Equalization

-01	-02	-03	-04	-05	-06	-07	-08	DESCRIPTION	Ampex Part No.
X								7-1/2 & 15 ips, Full Track, cased	4010048-01
	X							7-1/2 & 15 ips, Full Track, uncased	4010048-02
		X						7-1/2 & 15 ips, Half Track, cased	4010048-03
			X					7-1/2 & 15 ips, Half Track, uncased	4010048-04
				X				3-3/4 & 7-1/2 ips, Full Track, cased	4010048-05
					X			3-3/4 & 7-1/2 ips, Full Track, uncased	4010048-06
						X		3-3/4 & 7-1/2 ips, Half Track, cased	4010048-07
							X	3-3/4 & 7-1/2 ips, Half Track, uncased	4010048-08
1	1			1	1			Head Assembly, full track, reproduce	1815108-01
1	1			1	1			Head Assembly, full track, record	1815108-02
1	1			1	1			Head Assembly, full track, erase	1815109-01
		1	1			1	1	Head Assembly, half track, reproduce	1815110-01
		1	1			1	1	Head Assembly, half track, record	1815110-02
		1	1			1	1	Head Assembly, half track, erase	1815111-01
1	1	1	1					Tape Transport Assembly, 7-1/2 & 15 ips, 60 Hz	4020061-01
				1	1	1	1	Tape Transport Assembly, 3-3/4 & 7-1/2 ips, 60 Hz	4020061-03
1	1	1	1	1	1	1	1	Electronics Assembly, Domestic, NAB	4020256-01
	1		1		1		1	Guard Assembly, Tape Transport	4040640-10
2	2	2	2	2	2	2	2	Knob, reel hold down	4130028-20
1		1		1		1		Case, portable	4150161-01
1	1	1	1	1	1	1	1	Transformer, input, bridging	4580200-01
1	1	1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	1	1	Instruction Manual	4890169
1	1	1	1	1	1	1	1	Cord Set	084-027
2	2	2	2	2	2	2	2	Connector, plug, female, XL-3-11	144-003
2	2	2	2	2	2	2	2	Connector, plug, male, XL-3-12	145-009
	4		4		4		4	Clip, cable	302-203
1	1	1	1	1	1	1	1	Tape, blank, 1200 feet, 1-1/2 mil Mylar	763-191
								Miscellaneous hardware	

MODEL AG-500
Single Channel, 50 Hz
NAB Equalization

-09	-10	-11	-12	-13	-14	-15	-16	DESCRIPTION	Ampex Part No.
X								7-1/2 & 15 ips, Full Track, cased	4010048-09
	X							7-1/2 & 15 ips, Full Track, uncased	4010048-10
		X						7-1/2 & 15 ips, Half Track, cased	4010048-11
			X					7-1/2 & 15 ips, Half Track, uncased	4010048-12
				X				3-3/4 & 7-1/2 ips, Full Track, cased	4010048-13
					X			3-3/4 & 7-1/2 ips, Full Track, uncased	4010048-14
						X		3-3/4 & 7-1/2 ips, Half Track, cased	4010048-15
							X	3-3/4 & 7-1/2 ips, Half Track, uncased	4010048-16
1	1			1	1			Head Assembly, full track, reproduce	1815108-01
1	1			1	1			Head Assembly, full track, record	1815108-02
1	1			1	1			Head Assembly, full track, erase	1815109-01
		1	1			1	1	Head Assembly, half track, reproduce	1815110-01
		1	1			1	1	Head Assembly, half track, record	1815110-02
		1	1			1	1	Head Assembly, half track, erase	1815111-01
1	1	1	1					Tape Transport Assembly, 7-1/2 & 15 ips, 50 Hz	4020061-02
				1	1	1	1	Tape Transport Assembly, 3-3/4 & 7-1/2 ips, 50 Hz	4020061-04
1	1	1	1	1	1	1	1	Electronics Assembly, International, NAB	4020256-03
		1	1	1	1	1	1	Guard Assembly, Tape Transport	4040640-10
2	2	2	2	2	2	2	2	Knob, reel hold down	4130028-20
1	1	1	1	1	1	1	1	Case, portable	4150161-01
1	1	1	1	1	1	1	1	Transformer, input, bridging	4580200-01
1	1	1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	1	1	Instruction Manual	4890169
1	1	1	1	1	1	1	1	Cord Set	084-027
2	2	2	2	2	2	2	2	Connector, plug, female, XL-3-11	144-003
2	2	2	2	2	2	2	2	Connector, plug, male, XL-3-12	145-009
	4		4		4		4	Clip, cable	302-203
1	1	1	1	1	1	1	1	Tape, blank, 1200 feet, 1-1/2 mil Mylar	763-191
2	2	2	2	2	2	2	2	Fuse, 3/4 amp, 250V, slo-blo	070-081
Miscellaneous hardware									

MODEL AG-500
Single Channel, 50 Hz
CCIR Equalization

-17	-18	-19	-20	-21	-22	-23	-24	DESCRIPTION	Ampex Part No.
X								7-1/2 & 15 ips, Full Track, cased	4010048-17
	X							7-1/2 & 15 ips, Full Track, uncased	4010048-18
		X						7-1/2 & 15 ips, Half Track, cased	4010048-19
			X					7-1/2 & 15 ips, Half Track, uncased	4010048-20
				X				3-3/4 & 7-1/2 ips, Full Track, cased	4010048-21
					X			3-3/4 & 7-1/2 ips, Full Track, uncased	4010048-22
						X		3-3/4 & 7-1/2 ips, Half Track, cased	4010048-23
							X	3-3/4 & 7-1/2 ips, Half Track, uncased	4010048-24
1	1			1	1			Head Assembly, Full Track, Reproduce	1815108-01
1	1			1	1			Head Assembly, Full Track, Record	1815108-02
1	1			1	1			Head Assembly, Full Track, Erase	1815109-01
		1	1			1	1	Head Assembly, Half Track, Reproduce	1815110-01
		1	1			1	1	Head Assembly, Half Track, Record	1815110-02
		1	1			1	1	Head Assembly, Half Track, Erase	1815111-01
1	1	1	1					Tape Transport Assembly, 7-1/2 & 15 ips, 50 Hz	4020061-02
				1	1	1	1	Tape Transport Assembly, 3-3/4 & 7-1/2 ips, 50 Hz	4020061-04
1	1	1	1	1	1	1	1	Electronics Assembly, Domestic, NAB	4020256-04
		1	1	1	1	1	1	Guard Assembly, Tape Transport	4040640-10
2	2	2	2	2	2	2	2	Knob, reel hold down	4130028-20
1	1	1	1	1	1	1	1	Case, portable	4150161-01
1	1	1	1	1	1	1	1	Transformer, input, bridging	4580200-01
1	1	1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	1	1	Instruction Manual	4890169
1	1	1	1	1	1	1	1	Cord Set	084-027
2	2	2	2	2	2	2	2	Connector, plug, female, XL-3-11	144-003
2	2	2	2	2	2	2	2	Connector, plug, male, XL-3-12	145-009
	4		4		4		4	Clip, cable	302-203
1	1	1	1	1	1	1	1	Tape, blank, 1200 feet, 1-1/2 mil Mylar	763-191
2	2	2	2	2	2	2	2	Fuse, 3/4 amp, 250 V, slo-blo	070-081
Miscellaneous hardware									

MODEL AG-500
Two Channel, 60 Hz
NAB Equalization

-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	DESCRIPTION	Ampex Part No.
X												7-1/2 & 15 ips, two track, cased	4010049-01
	X											7-1/2 & 15 ips, two track, uncased	4010049-02
		X										7-1/2 & 15 ips, two track & 4 tr., cased	(Note 1) 4010049-03
			X									7-1/2 & 15 ips, two track & 4 tr., uncased	(Note 1) 4010049-04
				X								3-3/4 & 7-1/2 ips, two track, cased	4010049-05
					X							3-3/4 & 7-1/2 ips, two track, uncased	4010049-06
						X						3-3/4 & 7-1/2 ips, four track, cased	4010049-07
							X					3-3/4 & 7-1/2 ips, four track, uncased	4010049-08
								X				3-3/4 & 7-1/2 ips, 2 tr. & 4 tr., cased	(Note 1) 4010049-09
									X			3-3/4 & 7-1/2 ips, 2 tr. & 4 tr., uncased	(Note 1) 4010049-10
										X		3-3/4 & 7-1/2 ips, 4 tr. & 2 tr., cased	(Note 2) 4010049-11
											X	3-3/4 & 7-1/2 ips, 4 tr. & 2 tr., uncased	(Note 2) 4010049-12
1	1	1	1	1	1			1	1	1	1	Head Assembly, two tr., reproduce	1815110-01
						1	1	1	1	1	1	Head Assembly, 4 tr., reproduce	1815112-01
1	1	1	1	1	1			1	1			Head Assembly, two tr., record	1815110-02
						1	1			1	1	Head Assembly, four tr., record	1815112-02
1	1	1	1	1	1			1	1			Head Assembly, two track, erase	1815111-01
						1	1			1	1	Head Assembly, four track, erase	1815112-03
1	1	1	1		1	1	1	1	1	1	1	Tape Tr. Assy, 7-1/2 & 15 ips, 60 Hz	4020261-01
						1	1	1	1	1	1	Tape Tr. Assy, 3-3/4 & 7 1/2 ips, 60 Hz	4020261-02
2	2	2	2	2	2	2	2	2	2	2	2	Electronic Assy, Domestic, NAB	4020256-01
		1	1	1	1		1		1	1	1	Guard Assembly, Tape Transport	4040640-10
								1	1	1	1	Switch Assembly, 2 & 4 Track	4050426-01
1	1	1	1	1	1	1	1	1	1	1	1	Cable, Interconnecting	4050430-01
1	1			1	1	1	1					Plug Button	4100142-01
2	2	2	2	2	2	2	2	2	2	2	2	Knob, reel hold down	4130028-20
1				1		1		1		1		Case, Portable	4150231-01
		1	1					1	1	1	1	Insulation, head switch	4170267-10
				1	1			1	1	1	1	Shaft, switch	4210216-01
				1	1			1	1	1	1	Retainer, wire	4320115-10
2	2	2	2	2	2	2	2	2	2	2	2	Transformer, input, bridging	4580200-01
1	1	1	1	1	1	1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	1	1	1	1	1	1	Instruction Manual	4890169
1	1	1	1	1	1	1	1	1	1	1	1	Cord Set	084-027
2	2	2	2	2	2	2	2	2	2	2	2	Connector, plug, female, XL-3-11	144-003
4	4	4	4	4	4	4	4	4	4	4	4	Connector, plug, male, XL-3-12	145-009
			1	1				1	1	1	1	Clamp, cable	302-049
	4		4	4				4	4		4	Clip, cable	302-203
1	1	1	1	1	1	1	1	1	1	1	1	Tape, blank, 1200 ft., 1-1/2 mil Mylar	763-191
Miscellaneous hardware													
Note 1. Records, reproduces & erases 2 tr., plus reproduces four track.													
Note 2. Records, reproduces & erases 4 tr., plus reproduces two track.													

MODEL AG-500
Two Channel, 50 Hz
NAB Equalization

-13	-14	-15	-16	-17	-18	-19	-20	-21	-22	-23	-24	DESCRIPTION	Ampex Part No.
X												7-1/2 & 15 ips, two track, cased	4010049-13
	X											7-1/2 & 15 ips, two track, uncased	4010049-14
		X										7-1/2 & 15 ips, 2 track & 4 tr., cased	(Note 1) 4010049-05
			X									7-1/2 & 15 ips, 2 track & 4 tr., uncased	(Note 1) 4010049-16
				X								3-3/4 & 7-1/2 ips, two track, cased	4010049-17
					X							3-3/4 & 7-1/2 ips, two track, uncased	4010049-18
						X						3-3/4 & 7-1/2 ips, four track, cased	4010049-19
							X					3-3/4 & 7-1/2 ips, four track, uncased	4010049-20
								X				3-3/4 & 7-1/2 ips, 2 track & 4 tr., cased	(Note 1) 4010049-21
									X			3-3/4 & 7-1/2 ips, 2 tr., & 4 tr., uncased	(Note 1) 4010049-22
										X		3-3/4 & 7-1/2 ips, 4 tr., & 2 tr., cased	(Note 2) 4010049-23
											X	3-3/4 & 7-1/2 ips, 4 tr., & 2 tr., uncased	(Note 2) 4010049-24
1	1	1	1	1	1	1	1	1	1	1	1	Head Assembly, 2 track, reproduce	1815110-01
												Head Assembly, 4 track, reproduce	1815112-01
1	1	1	1	1	1	1	1	1	1	1	1	Head Assembly, 2 track, record	1815110-02
												Head Assembly, 4 track, record	1815112-02
1	1	1	1	1	1	1	1	1	1	1	1	Head Assembly, two track, erase	1815111-01
												Head Assembly, four track, erase	1815112-03
1	1	1	1	1	1	1	1	1	1	1	1	Tape Tr. Assy, 7-1/2 & 15 ips, 50 Hz	4020261-02
												Tape Tr. Assy, 3-3/4 & 7 1/2 ips, 60 Hz	4020261-04
1	1	1	1	1	1	1	1	1	1	1	1	Electronic assembly, Domestic, NAB	4020256-01
1	1	1	1	1	1	1	1	1	1	1	1	Electronic assembly, INT'L, NAB	4020256-03
		1	1	1	1	1	1	1	1	1	1	Guard assembly, tape transport	4040640-10
												Switch assembly, 2 & 4 track	4050426-01
1	1	1	1	1	1	1	1	1	1	1	1	Cable, Interconnecting	4050430-01
1	1	1	1	1	1	1	1	1	1	1	1	Plug Button	4100142-01
2	2	2	2	2	2	2	2	2	2	2	2	Knob, reel hold down	4130028-20
1												Case, Portable	4150231-01
												Insulation, head switch	4170267-10
												Shaft, switch	4210216-01
												Retainer, wire	4320115-10
2	2	2	2	2	2	2	2	2	2	2	2	Transformer, input, bridging	4580200-01
1	1	1	1	1	1	1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	1	1	1	1	1	1	Instruction Manual	4890169
1	1	1	1	1	1	1	1	1	1	1	1	Cord Set	084-027
2	2	2	2	2	2	2	2	2	2	2	2	Connector, plug, female, XL-3-11	144-003
4	4	4	4	4	4	4	4	4	4	4	4	Connector, plug, male, XL-3-12	145-009
												Clamp, cable	302-049
		4	4	4	4	4	4	4	4	4	4	Clip, cable	302-203
1	1	1	1	1	1	1	1	1	1	1	1	Tape, blank, 1200 ft., 1-1/2 mil Mylar	763-191
2	2	2	2	2	2	2	2	2	2	2	2	Fuse, 3/4 amp, 250V, slo-blo	070-081
Miscellaneous hardware													
Note 1. Records, reproduces & erases two track, plus reproduces four track.													
Note 2. Records, reproduces & erases four track, plus reproduces two track.													

MODEL AG-500
Two Channel, 50 Hz
CCIR Equalization

-25	-26	-27	-28	-29	-30	-31	-32	-33	-34	-35	-36	DESCRIPTION	Ampex Part No.
X												7-1/2 & 15 ips, two track, cased	4010049-25
	X											7-1/2 & 15 ips, two track, uncased	4010049-26
		X										7-1/2 & 15 ips, 2 tr., & 4 tr., cased	(Note 1) 4010049-27
			X									7-1/2 & 15 ips, 2 tr., & 4 tr., uncased	(Note 1) 4010049-28
				X								3-3/4 & 7-1/2 ips, two track, cased	4010049-29
					X							3-3/4 & 7-1/2 ips, two track, uncased	4010049-30
						X						3-3/4 & 7-1/2 ips, four track, cased	4010049-31
							X					3-3/4 & 7-1/2 ips, four track, uncased	4010049-32
								X				3-3/4 & 7-1/2 ips, 2 tr., & 4 tr., cased	(Note 1) 4010049-33
									X			3-3/4 & 7-1/2 ips, 2 tr., & 4 tr., uncased	(Note 1) 4010049-34
										X		3-3/4 & 7-1/2 ips, 4 tr., & 2 tr., cased	(Note 2) 4010049-35
											X	3-3/4 & 7-1/2 ips, 4 tr., & 2 tr., uncased	(Note 2) 4010049-36
1	1	1	1	1	1			1	1	1	1	Head Assembly, 2 track, reproduce	1815110-01
		1	1	1	1	1	1	1	1	1	1	Head Assembly, 4 track, reproduce	1815110-02
1	1	1	1	1	1	1		1	1			Head Assembly, 2 track, record	1815110-02
		1	1	1	1	1	1	1	1	1	1	Head Assembly, 4 track, record	1815111-01
1	1	1	1	1	1	1		1	1			Head Assembly, 2 track, erase	1815111-01
		1	1	1	1	1	1	1	1	1	1	Head Assembly, 4 track, erase	1815112-03
1	1	1	1		1	1	1	1	1	1	1	Tape Tr. Assy, 7-1/2 & 15 ips, 50 Hz	4020261-02
		1	1	1	1	1	1	1	1	1	1	Tape Tr. Assy, 3-3/4 & 7 1/2 ips, 50 Hz	4020261-04
1	1	1	1	1	1	1	1	1	1	1	1	Electronic Assy, Domestic, CCIR	4020256-02
		1	1	1	1	1	1	1	1	1	1	Electronic Assy, INT'L, CCIR	4020256-04
			1	1	1	1	1	1	1	1	1	Guard Assembly, Tape Transport	4040640-10
		1	1	1	1	1	1	1	1	1	1	Switch Assembly, 2 & 4 track	4050426-01
1	1	1	1	1	1	1	1	1	1	1	1	Cable, Interconnecting	4050430-01
1	1			1	1	1	1	1	1	1	1	Plug Button	4100142-01
2	2	2	2	2	2	2	2	2	2	2	2	Knob, reel hold down	4130028-20
1		1	1	1	1	1		1	1	1	1	Case, Portable	4150231-01
		1	1	1	1	1		1	1	1	1	Insulation, head switch	4170267-10
		1	1	1	1	1		1	1	1	1	Shaft, switch	4210216-01
		1	1	1	1	1		1	1	1	1	Retainer, wire	4320115-10
2	2	2	2	2	2	2	2	2	2	2	2	Transformer, input, bridging	4580200-01
1	1	1	1	1	1	1	1	1	1	1	1	Reel, 7-inch	4690069-10
1	1	1	1	1	1	1	1	1	1	1	1	Instruction Manual	4890169
1	1	1	1	1	1	1	1	1	1	1	1	Cord Set	084-027
2	2	2	2	2	2	2	2	2	2	2	2	Connector, plug, female, XL-3-11	144-003
4	4	4	4	4	4	4	4	4	4	4	4	Connector, plug, male, XL-3-12	145-009
		1	1	1	1	1	1	1	1	1	1	Clamp, cable	302-049
	4	4	4	4	4	4	4	4	4	4	4	Clip, cable	302-203
1	1	1	1	1	1	1	1	1	1	1	1	Tape, blank, 1200 ft., 1-1/2 mil Mylar	763-191
2	2	2	2	2	2	2	2	2	2	2	2	Fuse, 3/4 amp, 250V, slo-blo	070-081
Miscellaneous hardware													
Note 1. Records, reproduces & erases two tracks, plus reproduces four track.													
Note 2. Records, reproduces & erases four track, plus reproduces two track.													

TAPE TRANSPORT ASSEMBLY
Catalog No. 4020061

Item	Fig. No.	-01	-02	-03	-04	-08	-09	DESCRIPTION	Ref. No.	Ampex Part No.
		X						7-1/2 & 15 ips, 60 Hz, Domestic		4020061-01
			X					7-1/2 & 15 ips, 50 Hz, International		4020061-02
				X				3-3/4 & 7-1/2 ips, 60 Hz, Domestic		4020061-03
					X			3-3/4 & 7-1/2 ips, 50 Hz, International		4020061-04
						X		15/16 & 1-7/8 ips, 60 Hz, Domestic		4020061-08
							X	15/16 & 1-7/8 ips, 50 Hz, International		4020061-09
1	-	1	1	1	1	1	1	Oil Kit		4010825-02
2	7-40	1	1	1	1	1	1	Control Box Assembly (see separate parts list)		4020076-01
3	7-40		1		1		1	Control Box Assembly (see separate parts list)		4020076-02
4	7-40			1			1	Shift Arm Assembly (up to 7-1/2 ips, 60 Hz)		4030263-01
5	7-40	1						Shift Arm Assembly (7-1/2 & 15 ips, 60 Hz)		4030263-02
6	7-40				1		1	Shift Arm Assembly (up to 7-1/2 ips, 50 Hz)		4030263-03
7	7-40		1					Shift Arm Assembly (7-1/2 & 15 ips, 50 Hz)		4030263-04
1	7-11	1	1	1	1	1	1	Arm, speed shift		4040484-10
2	7-11	1	1	1	1	1	1	Bushing, retaining		4020137-20
3	7-11	1	1	1	1	1	1	Bushing, guide		4200138-10
4	7-11	2	2	2	2	2	2	Bearing, Snap-in		422-998
5	7-11				1		1	Fork, Shift, 3-3/4 & 7-1/2 ips, 50 Hz		4230119-10
5	7-11	1						Fork, Shift, 7-1/2 & 15 ips, 60 Hz		4230120-10
5	7-11			1			1	Fork, Shift, 3-3/4 & 7-1/2 ips, 60 Hz		4230121-10
5	7-11		1					Fork, Shift, 7-1/2 & 15 ips, 50 Hz		4230183-10
6	7-11	1	1	1	1	1	1	Housing		4290324-10
7	7-11	1	1	1	1	1	1	Clevis Pin		4160120-10
8	7-11	1	1	1	1	1	1	Roller		4040483-10
9	7-11	1	1	1	1	1	1	Spring, roller		4270183-10
-	-	2	2	2	2	2	2	Cushion		4130128-10
8	7-40	2	2	2	2	1	1	Clutch Assembly		4030077-20
-	-	1	1	1	1	1	1	End shield (bell)		4290323-10
-	-	1	1	1	1	1	1	Belt, clutch		4310052-20
-	-	1	1	1	1	1	1	Cable cap, white	J111P, J114P	169-996
-	-	2	2	2	2	2	2	Solderless connector (for cable cap)		169-993
9	7-9	1	1	1	1	1	1	Head Cover Assembly		4030104-30
-	-	1	1	1	1	1	1	Shield, head cover		4290235-20
-	-	1	1	1	1	1	1	Hinge assembly		4040371-10
-	-	2	2	2	2	2	2	Bumper, rubber		250-007
-	-	1	1	1	1	1	1	Cam, tape lift return		4230169-01
-	-	2	2	2	2	2	2	Washer, nylon		4440232-10
-	-	1	1	1	1	1	1	Head Cover		4040585-20
10	7-9	1	1	1	1	1	1	Head Base Assembly		4030105-50
1	7-42	4	4	4	4	4	4	Base Assembly, head mounting		4040692-10
2	7-42	1	1	1	1	1	1	Handle, Tape Lifter		4120051-10
3	7-42	2	2	2	2	2	2	Tape Guide		4210170-10
4	7-42	2	2	2	2	2	2	Spring, tape guide return		4270169-10
5	7-42	2	2	2	2	2	2	Spring, tape guide detent		4270170-10
6	7-42	8	8	8	8	8	8	Spring, head mounting angle		4270171-10
7	7-42	1	1	1	1	1	1	Base, Head		4330132-10
8	7-42	4	4	4	4	4	4	Plate, bottom, head base		4330133-10
12	7-40	1	1	1	1	1	1	Brake Assembly (takeup)		4030170-30
13	7-40	1	1	1	1	1	1	Brake Assembly (rewind)		4030170-40
1	7-43	1	1	1	1	1	1	Brake Stop Arm Assembly		4040336-01
2	7-43	1	1	1	1	1	1	Brake Arm (takeup)		4040485-03
3	7-43	1	1	1	1	1	1	Brake Arm (rewind)		4040485-04
4	7-43	1	1	1	1	1	1	Bracket, Mounting (takeup)		4040568-02
5	7-43	1	1	1	1	1	1	Bracket, Mounting (rewind)		4040568-01
6	7-43	1	1	1	1	1	1	Sleeve, chafing		4200139-01
8	7-43	1	1	1	1	1	1	Actuator, brake		4230182-02
9	7-43	1	1	1	1	1	1	Spring		4270058-10
10	7-43	1	1	1	1	1	1	Spring, high torque		4270184-01
11	7-43	1	1	1	1	1	1	Spring, low torque		4270185-01
12	7-43	2	2	2	2	2	2	Spring, solenoid return		4270195-01
13	7-43	2	2	2	2	2	2	Washer, thrust		4440251-01
14	7-43	1	1	1	1	1	1	Solenoid	K103, K104	4590018-10
16	7-43	1	1	1	1	1	1	Spring, anchor		4230174-02
17	7-43	1	1	1	1	1	1	Pad, self adhesive		4130167-02
22	7-43	1	1	1	1	1	1	Cable Cap, white (rewind)	J112P	169-988
23	7-43	1	1	1	1	1	1	Cable Cap, red (takeup)	J113P	169-989
24	7-43	3	3	3	3	3	3	Solderless Connector (for cable cap)		169-993
35	7-43	2	2	2	2	2	2	Disk, felt, brown		503-025

TAPE TRANSPORT ASSEMBLY (Cont.)
Catalog No. 4020061

Item	Fig. No.	-01	-02	-03	-04	-08	-09	DESCRIPTION	Ref. No.	Ampex Part No.
14	7-10	1	1	1	1	1	1	Belt Separator Assembly		4030183-10
1	7-14	1	1	1	1	1	1	Pulley, separator		4030184-01
2	7-14	2	2	2	2	2	2	Bushing, separator		4200140-01
3	7-14	1	1	1	1	1	1	Shaft, separator		4210231-01
4	7-14	1	1	1	1	1	1	Bracket, crossed belt		4260229-01
7	7-14	1	1	1	1	1	1	Washer, retainer		4440276-10
8	7-14	3	3	3	3	3	3	Washer, idler thrust		4440277-10
11	7-14	1	1	1	1	1	1	Ring, retaining		430-076
15	7-10			1	1			Capstan Assembly, 3-3/4 & 7-1/2 ips		4030261-01
16	7-10	1	1					Capstan Assembly, 7-1/2 & 15 ips		4030261-02
17	7-10						1 1	Capstan Assembly, 15/16 & 3-3/4 ips		4030261-03
1	7-15	1	1	1	1			Capstan Idler Assembly		4030141-10
1	7-15					1	1	Capstan Idler Assembly		4030191-10
2	7-15	1	1	1	1	1	1	Cap Assembly, capstan idler		4040476-10
3	7-15	1	1	1	1	1	1	Stop, solenoid		4220158-10
6	7-15	1	1	1	1	1	1	Eye Bolt		4400523-10
8	7-15	1	1	1	1	1	1	Spring, solenoid adjusting		4270162-10
9	7-15	1	1	1	1	1	1	Spring, solenoid return		4270190-10
10	7-15	1	1	1	1	1	1	Washer, felt		503-041
12	7-15	1	1	1	1	1	1	Solenoid, capstan	K105	4590090-10
J117P	7-15	1	1	1	1	1	1	Cable cap, blue	J117P	169-994
-	-	3	3	3	3	3	3	Solderless Connector (for cable cap)		169-993
13	7-15	1	1	1	1	1	1	Hub Assembly, belt idler		4030182-10
14	7-15	1	1	1	1	1	1	Shaft, belt idler		4210230-10
20	7-15	3	3	3	3	3	3	Washer, idler thrust		4440277-10
21	7-15	1	1	1	1	1	1	Washer, retainer		4440276-10
22	7-15	2	2	2	2	2	2	Ball, 0.125 dia.		420-034
23	7-15	1	1	1	1	1	1	Ring, retainer		430-076
24	7-15			1	1	1	1	Flywheel Assembly		4040331-10
24	7-15	1	1					Flywheel Assembly		4040329-10
29	7-15	1	1	1	1	1	1	Arm, belt idler		4230193-10
32	7-15	1	1	1	1	1	1	Collar, belt idler		4220184-10
33	7-15	1	1	1	1	1	1	Spring, torsion		4270182-10
34	7-15	1	1	1	1	1	1	Ring, retainer		430-157
36	7-15	1	1	1	1			Housing, capstan		4030186-10
36	7-15						1 1	Housing, capstan		4030186-20
18	7-10	1						Motor Drive Assembly (7-1/2 & 15 ips, 60 Hz)		4040326-70
19	7-10		1					Motor Drive Assembly (7-1/2 & 15 ips, 50 Hz)		4040326-80
20	7-10			1				Motor Drive Assembly (3-3/4 & 7-1/2 ips, 60 Hz)		4040326-50
21	7-10				1			Motor Drive Assembly (3-3/4 & 7-1/2 ips, 50 Hz)		4040326-60
27	7-10						1	Motor Drive Assembly (15/16 & 1-7/8 ips, 60 Hz)		4040653-30
28	7-10						1	Motor Drive Assembly (15/16 & 1-7/8 ips, 50 Hz)		4040653-40
-	-	1	1	1	1	1	1	Shield Assembly, Drive Motor		4040472-20
-	-	1	1	1	1	1	1	Capacitor Assembly, 3 mfd.,	C107	4040487-30
-	-	1	1	1	1	1	1	Safety Boot		032-082
-	-	2	2	2	2	2	2	Solderless Connector		169-993
-	-	1		1				Motor, drive, 60 Hz		4590086-60
-	-		1		1			Motor, drive, 50 Hz		4590087-60
-	-							Motor, drive, 60 Hz		4590094-60
-	-						1	Motor, drive, 50 Hz		4590095-50
-	-				1			Pulley	Note 1	4040328-40
-	-	1						Pulley	Note 1	4040327-30
-	-		1					Pulley	Note 1	4040327-40
-	-			1				Pulley	Note 1	4040328-30
-	-					1		Pulley	Note 1	4040652-30
-	-						1	Pulley	Note 1	4040652-40
-	-	1	1	1	1	1	1	Cable Cap, orange	J109P	169-995
-	-	6	6	6	6	4	4	Solderless Connectors (for cable cap)		169-993
24	7-9	1	1	1	1	1	1	Arm Assembly, tape tension		4040379-20
26	7-9	2	2	2	2	2	2	Turntable Assembly		4040481-10
30	7-10	1	1	1	1	1	1	Bracket, chassis mounting		4040989-01
31	7-9	1	1	1	1	1	1	Button, speed shift arm		4100123-40
35	7-9	2	2	2	2	2	2	Pad, turntable		4130141-10
36	7-9						1 1	Counter, four digit		4140017-10
38	7-10	1	1	1	1	1	1	Insulator, capstan solenoid		4170216-10
40	7-9	1	1	1	1	1	1	Cylinder, safety switch		4210209-10
41	7-9	1	1	1	1	1	1	Tape Guide		4210210-10

TAPE TRANSPORT ASSEMBLY (Cont.)
Catalog No. 4020061

Item	Fig. No.	-01	-02	-03	-04	-08	-09	DESCRIPTION		
42	7-9	2	2	2	2	2	2	Spacer, turntable		4220175-01
44	7-10	1	1	1	1	1	1	Cam, safety switch		4230156-20
45	7-9	2	2	2	2	2	2	Plate, turntable		4250123-10
49	7-10	1	1	1	1	1	1	Fan, motor		4250144-10
50	7-9							Pulley, position indicator		4250186-10
51	7-10	1	1	1	1	1	1	Bracket, support, control box		4260200-10
52	7-9	1	1	1	1	1	1	Spring, escutcheon		4270181-10
53	7-10	1		1		1		Spring, safety switch, 60 Hz		4270187-10
54	7-10		1		1		1	Spring, safety switch, 50 Hz		4270206-01
55	7-10	1	1	1	1	1	1	Front Panel, control box		4290243-10
56	7-9							Housing, counter		4290534-20
58	7-10							Clutch Assembly (modified)		4290536-10
63	7-9	1	1	1	1	1	1	Base Head Shield		4330101-20
64	7-9							Base Plate, position indicator		4330221-10
65	7-9	9	9	9	9	9	9	Washer		4440249-30
66	7-10	a/r	a/r	a/r	a/r	a/r	a/r	Washer, shim, 1/64 Lamicoïd		4440264-10
67	7-10	a/r	a/r	a/r	a/r	a/r	a/r	Washer, shim, 1/32 Lamicoïd		4440264-20
68	7-9	1	1	1	1	1	1	Screw		4400524-10
70	7-10	1	1	1	1	1	1	Belt, capstan drive, polyurethane		4310065-01
74	7-10	2	2	2	2	2	2	Solderless connectors		171-354
75	7-10	1	1	1	1	1	1	Pin, flat head, 0.124 dia.		408-011
76	7-10	3	3	3	3	3	3	Cable clamp		302-053
77	7-9							O-ring, position indicator		432-016
93	7-9	4	4	4	4	4	4	Screw, headless, 8-32 x 1/4		477-041
94	7-9	1	1	1	1	1	1	Screw, set, 6-32 x 3/16		477-060
95	7-9							Screw, set, 6-32 x 1/8		477-114
96	7-10	1	1	1	1	1	1	Screw, set, 10-32 x 3/16		477-127
99	7-9	a/r	a/r	a/r	a/r	a/r	a/r	Washer, shim, brass		501-114
104	7-9	1	1	1	1	1	1	Washer, nylon cup, black		503-320
109	7-10	1	1	1	1	1	1	Ring, retaining		430-218
110	7-10	a/r	a/r	a/r	a/r	a/r	a/r	Washer, .032, Lamicoïd		4440025-60

NOTE 1
Pulley and motor not available
separately.

TAPE TRANSPORT CONTROL BOX ASSEMBLY
Catalog No. 4020076

Ref. No.	-01	-02	DESCRIPTION	Ampex Part No.
	X		Domestic, 60 Hz	4020076-01
		X	International, 50 Hz	4020076-02
	1		Bracket, pushbutton, assembly	4030178-01
		1	Bracket, pushbutton, assembly	4030178-02
	1	1	Button, push, subassembly (STOP)	4030100-01
	1	1	Button, push, subassembly (PLAY)	4030100-02
	1	1	Button, push, subassembly (REWIND)	4030100-03
	1	1	Button, push, subassembly (FORWARD)	4030100-04
	1	1	Button, push, subassembly (RECORD)	4030100-11
	1	1	Bracket, pushbutton	4260153-01
	1	1	Spring, alignment	4270150-01
	3	3	Switch, pushbutton, n.o. (S101, S103, S107)	4620144-10
	1	1	Switch, pushbutton, n.c. (S105)	4620144-20
	1	1	Switch, pushbutton, n.o. (S102)	4620144-30
	1	1	Switch, toggle, dpst (S106)	120-987
	1		Switch, toggle, spst (S106)	120-999
	1		Chassis Assembly	4040359-10
		1	Chassis Assembly	4040359-20
		1	Cover Plate Assembly	4040949-01
	1		Cover Plate Assembly	4040948-01
	1	1	Connector, female, 10 contact (J116S, Remote)	146-018
	1	1	Connector, male, 3 contact (J118P, Power)	147-396
	1	1	Dummy plug (J115P)	4050101-10
	1	1	Pad, toggle switch	4130103-01
	1	1	Insulator, toggle switch	4170204-10
	1	1	Bracket, mounting, safety switch	4260156-01
	2	2	Relay (K101, K102)	4590050-10
C101	-	-	(not used)	
C102	-	-	(not used)	
C103	2	2	Capacitor, ceramic disc; .02 mfd, 500 vdcw	030-001
C104	3	3	Capacitor, mylar; 0.1 mfd, ±10%, 400 vdcw	035-999
C105	x	x	(Same as C104)	
C106	x	x	(Same as C104)	
C107			Listed with drive motor assembly, tape transport	
C108	1	1	Capacitor, electrolytic; 150 mfd, -10+100%, 180 vdcw	031-624
C109	2	2	Capacitor, paper; .0047 mfd, ±20%, 600 vdcw	035-028
C110	x	x	(Same as C109)	
C111	-	-	(not used)	
C112	1	1	Capacitor, paper; 1 mfd, -10+20%, 600 vdcw	036-023
C113	x	x	(Same as C103)	
CR101	-	-	(not used)	
CR102	8	8	Diode, rectifier, silicon; IN2363	580-027
CR103	x	x	(Same as CR102)	
CR104	x	x	(Same as CR102)	
CR105	x	x	(Same as CR102)	
CR106	x	x	(Same as CR102)	
CR107	x	x	(Same as CR102)	
CR108	x	x	(Same as CR102)	
CR109	x	x	(Same as CR102)	
F101	1	2	Fuse, slo-blo, 1-1/2 amp.	070-993
F102	-	x	(Same as F101, International unit)	
J101S	1	1	Plug, chassis, 6 way, orange	169-998
J102S	2	2	Plug, chassis, 6 way, white	169-999
J103S	x	x	(Same as J102S)	
J104S	1	1	Plug, chassis, 6 way, blue	169-997
J105S	2	2	Plug, chassis, 3 way, white	169-987
J106S	1	1	Plug, chassis, 3 way, red	169-990
J107	-	-	(not used)	
J108S	x	x	(Same as J105S)	
J109P			Listed with drive motor assembly, tape transport.	
J110S	1	1	Connector, receptacle, female; 10 sockets	144-058
J111P			Listed with clutch assembly, tape transport	
J112P			Listed with brake assembly, tape transport	
J113P			Listed with brake assembly, tape transport	
J114P			Listed with clutch assembly, tape transport	
J115P			Dummy plug (listed above)	

TAPE TRANSPORT CONTROL BOX ASSEMBLY
Catalog No. 4020076

Ref. No.	-01	-02	DESCRIPTION	Ampex Part No.
J116S			Listed with cover plate assembly above	
J117P			Listed with capstan assembly, tape transport	
J118P			Listed with cover plate assembly above	
J119S	1	-	Connector, Female, 2 sockets, AC Convenience	146-999
R101	-	-	(not used)	
R102	3	3	Resistor, fixed, comp; 100 ohms, $\pm 10\%$, 1/2W	041-038
R103	x	x	(Same as R102)	
R104	x	x	(Same as R102)	
R105	-	-	(not used)	
R106	2	2	Resistor, adjustable, wirewound; 900 ohms, $\pm 5\%$, 30W	040-045
R107	x	x	(Same as R106)	
R108	-	-	(not used)	
R109	1	1	Resistor, fixed, wirewound; 30 ohms, $\pm 5\%$, 30W	047-360
S104	1	2	Switch, safety, micro (All other switches listed with pushbutton bracket assembly, above)	120-138
	1	2	Fuse Holder	085-001
	1	2	Actuator, safety switch	094-012
	1	2	Insulator, safety switch	120-262
	13	12	Solderless contacts, for chassis plugs	169-993

ELECTRONIC ASSEMBLY
Catalog No. 4020256

Item	Fig. No.	-01	-02	-03	-04	-05	-06	DESCRIPTION	Ref. No.	Ampex Part No.
		X						Domestic, NAB Equalization, 3-3/4 & 15 ips		4020256-01
			X					Domestic, CCIR Equalization, 3-3/4 & 15 ips		4020256-02
				X				International, NAB Equalization, 3-3/4 & 15 ips		4020256-03
					X			International, CCIR Equalization, 3-3/4 & 15 ips		4020256-04
						X		Domestic, 15/16 & 1-7/8 ips		4020256-05
							X	International, 15/16 & 1-7/8 ips		4020256-06
1	7-46	1	1	1	1	1	1	Cover plate, decorative		4040932-01
2	7-46	1	1					Panel Assembly, rear, Domestic, 3-3/4 & 15 ips		4050249-01
20	7-46					1		Panel Assembly, rear, Domestic, 15/16 & 1-7/8 ips		4050249-02
3	7-46			1	1			Panel Assembly, rear, International, 3-3/4 & 15 ips		4050250-01
21	7-46						1	Panel Assembly, rear, International, 15/16 & 1-7/8 ips		4020250-02
1	7-47	1	1			1		Panel, rear, subassembly		4040892-01
1	7-48			1	1		1	Panel, rear, subassembly		4040717-01
-	-	1	1	1	1	1	1	Connector, receptacle, male, 10 pins		147-014
-	-	2	2	2	2	2	2	Socket, electron tube, octal		150-023
-	-			1	1		1	Switch, slide, DPDT		120-510
-	-			1	1		1	Bracket, transformer		4260397-01
3	7-47 & 18	1	1	1	1	1	1	Potentiometer, 25 ohms	R62	4520149-10
4	7-47 & 18	2	2	2	2			Potentiometer, 50,000 ohms	R47, R48	4520151-01
5	7-47 & 18	2	2	2	2			Potentiometer, 2.5 megohms		4520151-02
6	7-47 & 18	1	1	1	1	1	1	Capacitor, 4 sections, 500-500-200-200 mfd, 25vdcw	C30	4550147-01
7	7-47 & 18	1	1	1	1	1	1	Capacitor, 2 sections, 1000-500 mfd, 35 vdcw	C29	4550147-02
8	7-47	1	1			1		Transformer, power	T3	4580194-01
8	7-48			1	1		1	Transformer, power	T3	4580195-01
9	7-47 & 18	2	2	2	2	2	2	Diode, rectifier, large signal	CR2, CR3	013-678
10	7-47 & 18	1	1	1	1	1	1	Diode, zener	VR1	013-712
11	7-47 & 18	1	1	1	1	1	1	Transistor, NPN, silicon, 40250	Q15	014-587
12	7-47 & 18	2	2	2	2	2	2	Capacitor, electrolytic; 1 mfd, 25 vdcw	C23, C24	031-294
13	7-47 & 18	2	2	2	2	1	1	Capacitor, mylar; .01 mfd, ±5%, 100 vdcw	C21, C33	035-732
14	7-47 & 18	1	1	1	1	1	1	Resistor, fixed, comp; 120 ohms, ±10%, 1/2w	R57	041-039
15	7-47 & 18	2	2	2	2	2	2	Resistor, fixed, comp; 220 ohms, ±10%, 1/2w	R60, R61	041-040
16	7-47 & 18	2	2	2	2			Resistor, fixed, comp; 100,000 ohms, ±10%, 1/2w	R65, R66	041-072
17	7-47	1	1			1		Fuse, fast blo, 1/4 amp, 250V		070-006
18	7-47	1	1			1		Fuse Extractor Post		085-001
19	7-47									
17	7-48	3	3	3	3	3	3	Connector, telephone jack	J1, J8, J9	143-127
20	7-47									
18	7-48	2	2	2	2	2	2	Connector, audio receptacle, 3 sockets	J4, J6	146-998
21	7-47									
19	7-48	1	1	1	1	1	1	Connector, audio receptacle, 3 pins	J3	147-999
30	7-47									
28	7-48	2	2	2	2	2	2	Washer, shoulder, #8		503-013
33	7-47									
31	7-48	1	1	1	1	1	1	Washer, flat, nylon		503-030
34	7-47									
32	7-48	1	1	1	1	1	1	Washer, shoulder, fiber		503-032
47	7-47									
46	7-48					3	3	Resistor, fixed, comp; 10,000 ohms, ±5%, 1/2w	R48, R63, R66	041-014
48	7-47									
47	7-48					1	1	Resistor, fixed, comp; 15,000 ohms, ±5%, 1/2w	R65	041-254
49	7-47									
48	7-48					1	1	Resistor, fixed, comp; 1,000 ohms, ±5%, 1/2w	R47	041-245
50	7-47									
49	7-48					1	1	Resistor, fixed, comp; 220,000 ohms, ±5%, 1/2w	R46	041-027
51	7-47									
50	7-48					1	1	Capacitor, mica; 150 pfd, 500 vdcw	C33	034-213
52	7-47									
51	7-48					1	1	Capacitor, mylar; .018 mfd, 100 vdcw	C32	055-028
53	7-47									
52	7-48					4	4	Plug Button		251-013
60	7-47 & 18					1	1	Inductor, 1.2 millihenry		051-336
4	7-46	1	1	1	1			Panel Assembly, front (3-3/4 & 15 ips)		4050401-01
22	7-46					1	1	Panel Assembly, front (15/16 & 1-7/8 ips)		4050401-02
1	7-49	1	1	1	1	1	1	Panel and Bracket Assembly		4040920-01
2	7-49	1	1	1	1	1	1	Bracket Assembly, Equalization		4050121-01
-	-	1	1	1	1	1	1	Bracket		4260394-01
-	-	1	1	1	1	1	1	Shield, resistor		4600145-01
-	-	1	1	1	1	1	1	Resistor, var., comp; 50,000 ohms, ±20%, 1/4w	R50	4520151-01

ELECTRONIC ASSEMBLY (Cont.)
Catalog No. 4020256

Item	Fig. No.	-01	-02	-03	-04	-05	-06	DESCRIPTION	Ref. No.	Ampex Part No.
-	-	1	1	1	1	1	1	Capacitor, var. 25 pfd to 280 pfd, 350 vdcw	C25	4540314-01
-	-	2	2	2	2	2	2	Capacitor, var. 50 pfd to 380 pfd, 350 vdcw	C26, C27	4540314-02
4	7-19	1	1	1	1	1	1	Jewel, pilot light, red		4110258-02
5	7-19	1	1	1	1	1	1	Escutcheon, meter window		4110261-01
6	7-19	1	1	1	1	1	1	Meter, vu	M1	4140019-01
7	7-19	1	1	1	1	1	1	Panel, facing		4290609-01
8	7-19	1	1	1	1	1	1	Transformer, output	T2	4580193-01
9	7-19	1	1	1	1	1	1	Lamp, pilot	DS1	4610081-01
10	7-19	2	2	2	2	2	2	Switch, Selector	S2, S4	4620196-02
11	7-19	3	3	3	3	3	3	Knob, pointer, black		6000005-20
12	7-19	3	3	3	3	3	3	Knob, skirted, black		6000006-20
13	7-19	1	1	1	1	1	1	Capacitor, electrolytic; 500 mfd, 15 vdcw	C22	031-297
14	7-19	1	1	1	1	1	1	Capacitor, mica; 2500 pfd, ±5%, 500 vdcw	C28	034-994
15	7-19	1	1	1	1	1	1	Resistor, fixed, comp; 220 ohms, ±10%, 1/2w	R52	041-040
16	7-19	1	1	1	1	1	1	Resistor, fixed, comp; 470 ohms, ±10%, 1/2w	R58	041-044
17	7-19	1	1	1	1	1	1	Resistor, fixed, comp; 18,000 ohms, ±10%, 1/2w	R56	041-063
18	7-19	1	1	1	1	1	1	Resistor, fixed, comp; 47,000 ohms, ±10%, 1/2w	R51	041-068
19	7-19	2	2	2	2	2	2	Resistor, var, comp; 100,000 ohms, ±10%, 2w	R54, R55	044-015
20	7-19	1	1	1	1	1	1	Resistor, var, comp; 25,000 ohms, ±10%, 2w	R49	044-360
21	7-19	1	1	1	1	1	1	Switch, rotary, SPDT, non-shorting	S3	122-016
22	7-19	1	1	1	1	1	1	Jack, phone	J2	148-015
30	7-19	1	1	1	1	1	1	Speednut, push-on		497-010
48	7-19							Capacitor, mica; 100 pfd, 500 vdcw	C31	034-140
5	7-16	1	1	1	1	1	1	Printed Wiring Board Assembly, Reproduce (see Figs. 7-5 thru 7-8)		4050403-01
C1	-	1	1	1	1	1	1	Capacitor, tantalum; 10 mfd, ±20%, 6 vdcw		037-398
C2	-	1	1	1	1	1	1	Capacitor, mica; 390 pfd, ±5%, 500 vdcw		034-288
C3	-	1	1	1	1	1	1	Capacitor, electrolytic; 100 mfd, 12 vdcw		031-191
C4	-	1	1	1	1	1	1	Capacitor, mica; 100 pfd, ±5%, 500 vdcw		034-177
C5	-	4	4	4	4	4	4	Capacitor, tantalum; 15 mfd, ±20%, 15 vdcw		037-446
C6	-	x	x	x	x	x	x	(Same as C5)		
C7	-	1	1	1	1	1	1	Capacitor, tantalum; 3.9 mfd, ±20%, 25 vdcw		037-445
C8	-	x	x	x	x	x	x	(Same as C5)		
C9	-	x	x	x	x	x	x	(Same as C5)		
Q1	-	3	3	3	3	3	3	Transistor, NPN, silicon, low noise		014-698
Q2	-	x	x	x	x	x	x	(Same as Q1)		
Q3	-	2	2	2	2	2	2	Transistor, PNP, silicon		014-652
Q4	-	x	x	x	x	x	x	(Same as Q3)		
Q5	-	x	x	x	x	x	x	(Same as Q1)		
Q6	-	1	1	1	1	1	1	Transistor, NPN, silicon, 2N3706		014-585
Q7	-	1	1	1	1	1	1	Transistor, PNP, silicon, 300 mw		014-611
R1	-	1	1	1	1	1	1	Resistor, fixed, comp; 270,000 ohms, ±10%, 1/2w		041-077
R2	-	1	1	1	1	1	1	Resistor, fixed, comp; 82,000 ohms, ±10%, 1/2w		041-071
R3	-	1	1	1	1	1	1	Resistor, fixed, comp; 1,800 ohms, ±10%, 1/2w		041-051
R4	-	2	2	2	2	2	2	Resistor, fixed, comp; 100,000 ohms, ±10%, 1/2w		041-072
R5	-	1	1	1	1	1	1	Resistor, fixed, comp; 39,000 ohms, ±10%, 1/2w		041-067
R6	-	1	1	1	1	1	1	Resistor, fixed, comp; 220 ohms, ±10%, 1/2w		041-040
R7	-	x	x	x	x	x	x	(Same as R4)		
R8	-	2	2	2	2	2	2	Resistor, fixed, comp; 2,200 ohms, ±10%, 1/2w		041-052
R9	-	1	1	1	1	1	1	Resistor, fixed, comp; 22,000 ohms, ±10%, 1/2w		041-064
R10	-	1	1	1	1	1	1	Resistor, fixed, comp; 10,000 ohms, ±10%, 1/2w		041-060
R11	-	1	1	1	1	1	1	Resistor, fixed, comp; 560,000 ohms, ±10%, 1/2w		041-081
R12	-	x	x	x	x	x	x	(Same as R11)		
R13	-	1	1	1	1	1	1	Resistor, fixed, comp; 330,000 ohms, ±10%, 1/2w		041-078
R14	-	2	2	2	2	2	2	Resistor, fixed, comp; 1,000 ohms, ±10%, 1/2w		041-048
R15	-	1	1	1	1	1	1	Resistor, fixed, comp; 4,700 ohms, ±10%, 1/2w		041-056
R16	-	1	1	1	1	1	1	Resistor, fixed, comp; 15,000 ohms, ±10%, 1/2w		041-062
R17	-	x	x	x	x	x	x	(Same as R14)		
R18	-	x	x	x	x	x	x	(Same as R8)		
R19	-	1	1	1	1	1	1	Resistor, fixed, comp; 680 ohms, ±10%, 1/2w		041-046
R20	-	1	1	1	1	1	1	Resistor, fixed, comp; 430 ohms, ±5%, 1/2w		041-379
R21	-	2	2	2	2	2	2	Resistor, fixed, comp; 10 ohms, ±10%, 1/2w		041-032
R22	-	x	x	x	x	x	x	(Same as R21)		
-	-	7	7	7	7	7	7	Socket, transistor		150-103

SEMICONDUCTOR CROSS REFERENCE

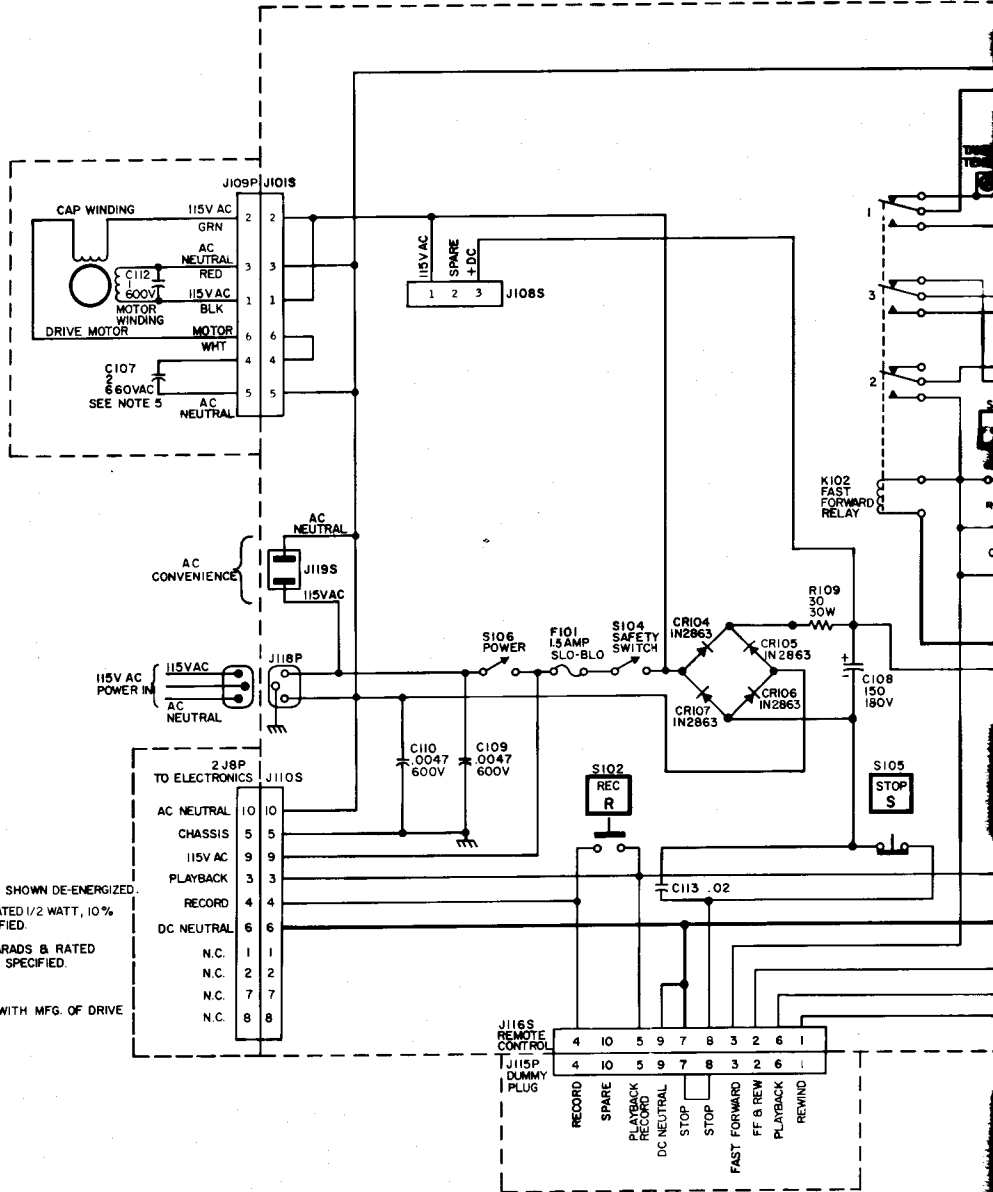
Ampex part number to JEDEC number

<u>Ampex part number</u>	<u>JEDEC number</u>
014-247 -----	2N2219
014-585 -----	2N3706
014-611 -----	2N3638
014-652 -----	*
014-658 -----	2N3565
014-698 -----	*

*Replace these parts with only the original type.

ELECTRONIC ASSEMBLY (Cont.)
Catalog No. 4020256

Item	Fig. No.	-01	-02	-03	-04	-05	-06	DESCRIPTION	Ref. No.	Ampex Part No.
6	7-16	1		1				Printed Wiring Board Assy, Record, NAB Equalization		4050404-01
7	7-16		1		1	1	1	Printed Wiring Board Assy, Record, CCIR Equalization		4050404-02
C10	-	2	2	2	2	2	2	Capacitor, tantalum; 3.9 mfd, ±20%, 25 vdcw		037-445
C11	-	1	1	1				Capacitor, mylar; .081 mfd, ±5%, 100 vdcw		055-105
C12	-	1	1	1	1	1	1	Capacitor, mylar; 0.1 mfd, ±10%, 100 vdcw		055-106
C13	-	1	1	1	1	1	1	Capacitor, mica; 20 pf, ±5%, 500 vdcw		034-944
C14	-	1	1	1	1	1	1	Capacitor, tantalum; 10 mfd, ±20%, 6 vdcw		037-398
C15	-	1	1	1	1	1	1	Capacitor, mica; 500 pf, ±5%, 300 vdcw		034-933
C16	-	x	x	x	x	x	x	(Same as C10)		
C17	-	1	1	1	1	1	1	Capacitor, mylar; 6800 pfd, ±5%, 100 vdcw		055-103
C18	-	2	2	2	2	2	2	Capacitor, mylar; 5600 pfd, ±5%, 100 vdcw		055-102
C19	-	x	x	x	x	x	x	(Same as C18)		
C20	-	1	1	1	1	1	1	Capacitor, mylar; 7500 pfd, ±5%, 50 vdcw		055-212
CR1	-	1	1	1	1	1	1	Diode, silicon, small signal		013-599
L1		1	1	1	1	1	1	Inductor, fixed; 5 millihenry, ±5%		051-342
Q8	-	1	1	1	1	1	1	Transistor, NPN, silicon, low noise, low level		014-698
Q9	-	2	2	2	2	2	2	Transistor, PNP, silicon		014-652
Q10	-	x	x	x	x	x	x	(Same as Q9)		
Q11	-	1	1	1	1	1	1	Transistor, PNP, silicon, 300 mw		014-611
Q12	-	3	3	3	3	3	3	Transistor, NPN, silicon, 800 mw		014-247
Q13	-	x	x	x	x	x	x	(Same as Q12)		
Q14	-	x	x	x	x	x	x	(Same as Q12)		
R23	-	2	2	2	2	2	2	Resistor, fixed, comp; 82,000 ohms, ±10%, 1/2w		041-071
R24	-	x	x	x	x	x	x	(Same as R23)		
R25	-	1	1	1	1	1	1	Resistor, fixed, comp; 390,000 ohms, ±10%, 1/2w		041-079
R26	-	2	2	2	2	2	2	Resistor, fixed, comp; 33,000 ohms, ±10%, 1/2w		041-066
R27	-	1	1	1	1	1	1	Resistor, fixed, comp; 15,000 ohms, ±10%, 1/2w		041-062
R28	-	1	1	1	1	1	1	Resistor, fixed, comp; 330 ohms, ±10%, 1/2w		041-042
R29	-	2	2	2	2	2	2	Resistor, fixed, comp; 270,000 ohms, ±10%, 1/2w		041-077
R30	-	2	1	2	1	1	1	Resistor, fixed, comp; 180,000 ohms, ±5%, 1/2w		041-026
R31	-	x	x	x	x	x	x	(Same as R30)		
R32	-	2	2	2	2	2	2	Resistor, fixed, comp; 10,000 ohms, ±10%, 1/2w		041-060
R33	-	3	3	3	3	3	3	Resistor, fixed, comp; 22,000 ohms, ±10%, 1/2w		041-064
R34	-	x	x	x	x	x	x	(Same as R29)		
R35	-	x	x	x	x	x	x	(Same as R26)		
R36	-	2	2	2	2	2	2	Resistor, fixed, comp; 100,000 ohms, ±10%, 1/2w		041-072
R37	-	x	x	x	x	x	x	(Same as R36)		
R38	-	x	x	x	x	x	x	(Same as R32)		
R39	-	1	1	1	1	1	1	Resistor, fixed, comp; 62 ohms, ±5%, 1/2w		041-534
R40	-	2	2	2	2	2	2	Resistor, fixed, comp; 430 ohms, ±5%, 1/2w		041-379
R41	-	x	x	x	x	x	x	(Same as R40)		
R42	-	2	2	2	2	2	2	Resistor, fixed, comp; 12 ohms, ±5%, 1/2w		041-963
R43	-	x	x	x	x	x	x	(Same as R42)		
R44	-	x	x	x	x	x	x	(Same as R33)		
R45	-	x	x	x	x	x	x	(Same as R33)		
T1	1	1	1	1	1	1	1	Coil, oscillator		4580196-01
-	-	7	7	7	7	7	7	Sockets, Transistors		150-103
8	7-16	1	1	1	1	1	1	Chassis Electronics		4290613-01
9	7-16	1	1	1	1	1	1	Cover, chassis, top		4290615-01
10	7-16	1	1	1	1	1	1	Cover, chassis, bottom		4290628-01
11	7-16	1	1	1	1	1	1	Relay	K1	4590050-10
12	7-16	1	1	1	1	1	1	Shield, switch		4600144-02
13	7-16	1	1	1	1	1	1	Lamp, indicating	DS2	4610082-01
14	7-16	2	2	2	2	2	2	Capacitor, ceramic disc; .01 mfd, 500 vdcw	C34, C35	030-002
15	7-16	1	1	1	1	1	1	Resistor, fixed, comp; 100 ohms, ±10%, 1/2w	R64	041-038
23	7-16	2	2	2	2	2	2	Dummy Plug Assembly		4030034-30
25	7-16	1	1	1	1	1	1	Shield, relay		4600147-01
36	7-16	1	1	1	1	1	1	Resistor, fixed, comp; 56 ohms, ±5%, 1w		041-565



- NOTES:
1. ALL RELAYS & SOLENOIDS SHOWN DE-ENERGIZED.
 2. ALL RESISTORS IN OHMS & RATED 1/2 WATT, 10% UNLESS OTHERWISE SPECIFIED.
 3. ALL CAPACITORS IN MICROFARADS & RATED 400V UNLESS OTHERWISE SPECIFIED.
 - 4.
 5. CAPACITOR VALUES VARY WITH MFG. OF DRIVE MOTOR.

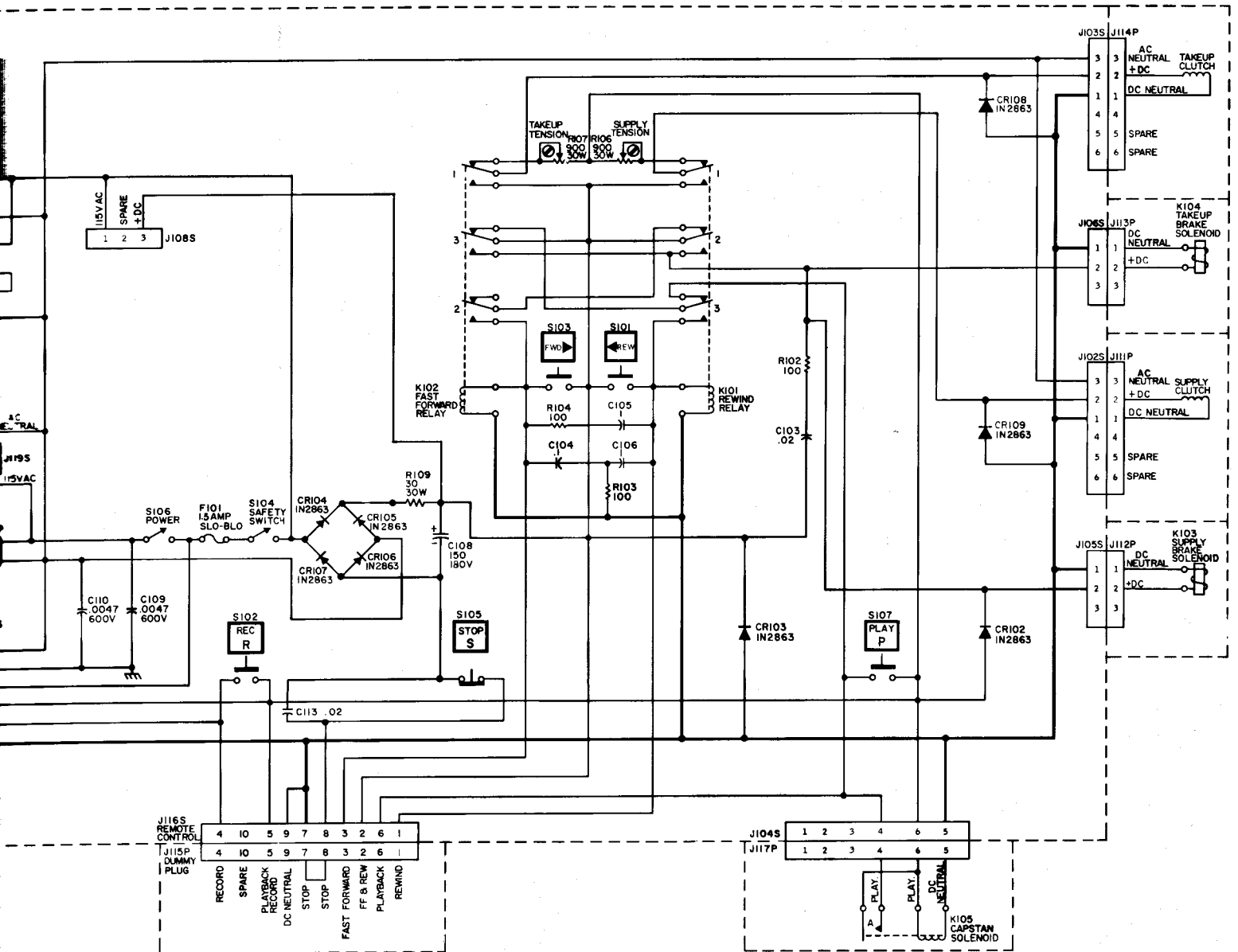
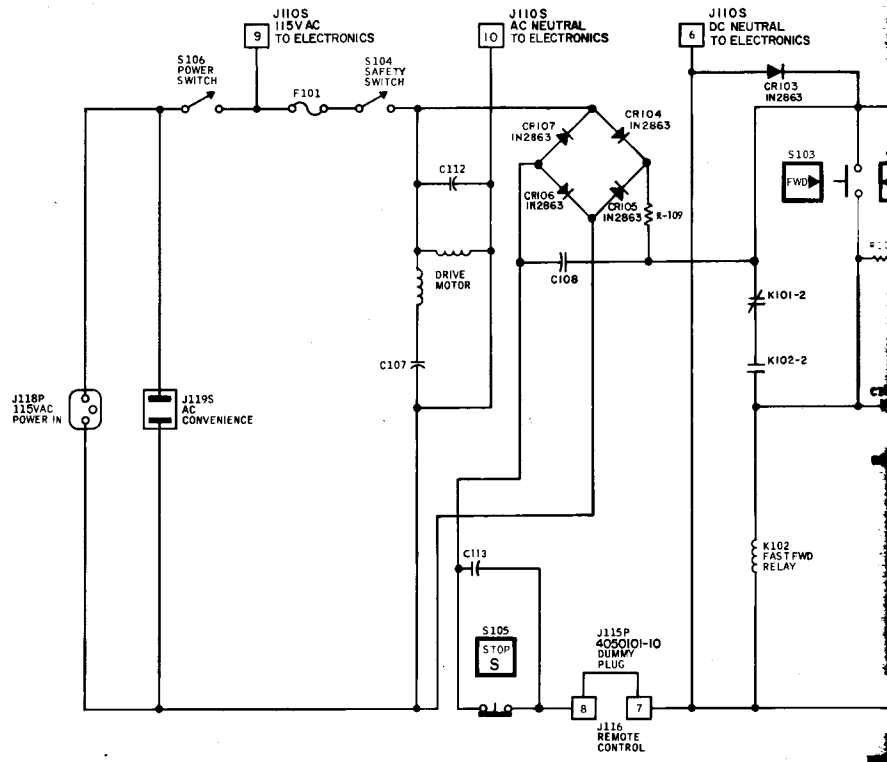


Fig. 7-1. Tape Transport Schematic Diagram, Domestic Equipment



NORMAL
 OPEN

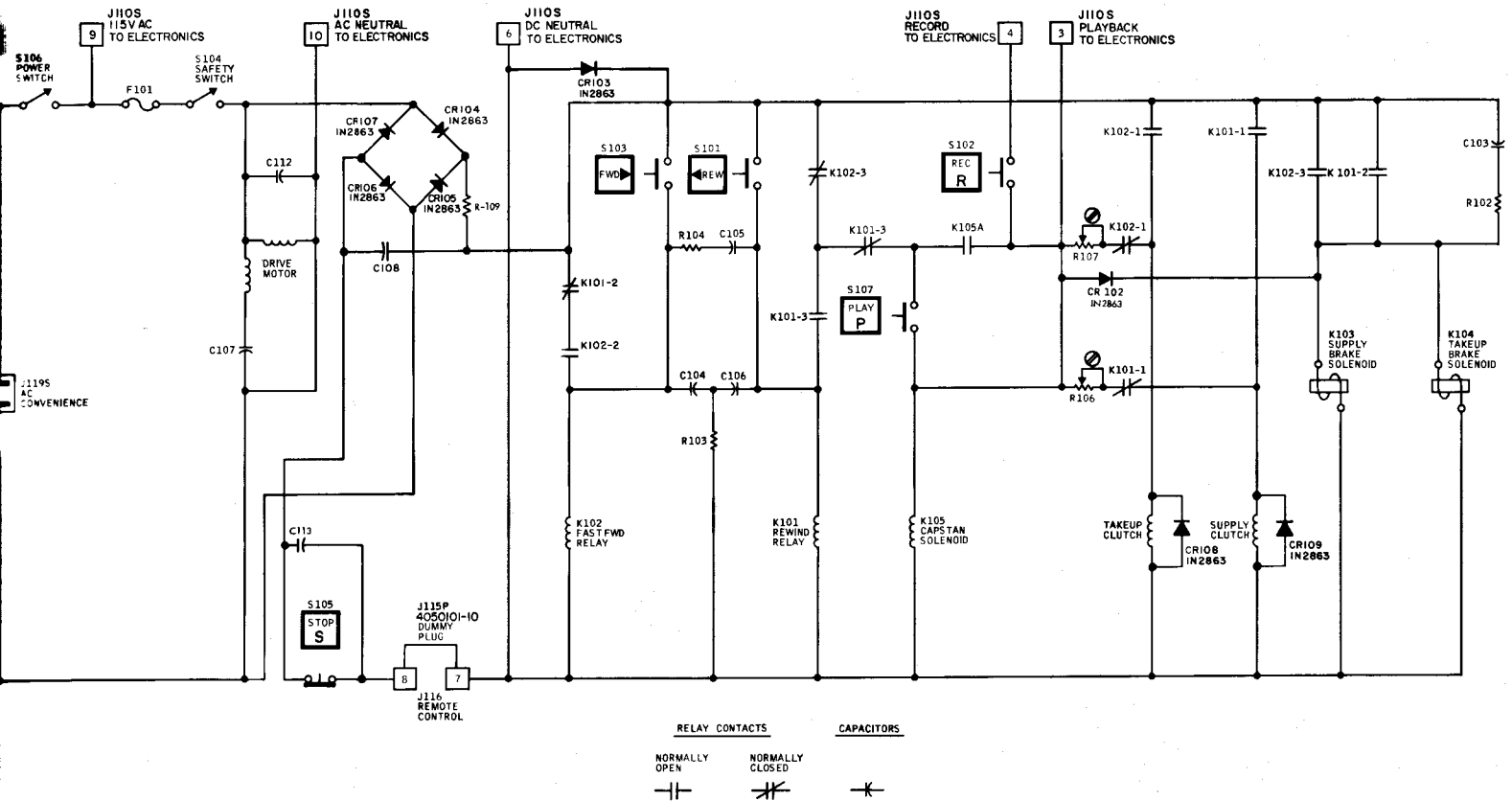
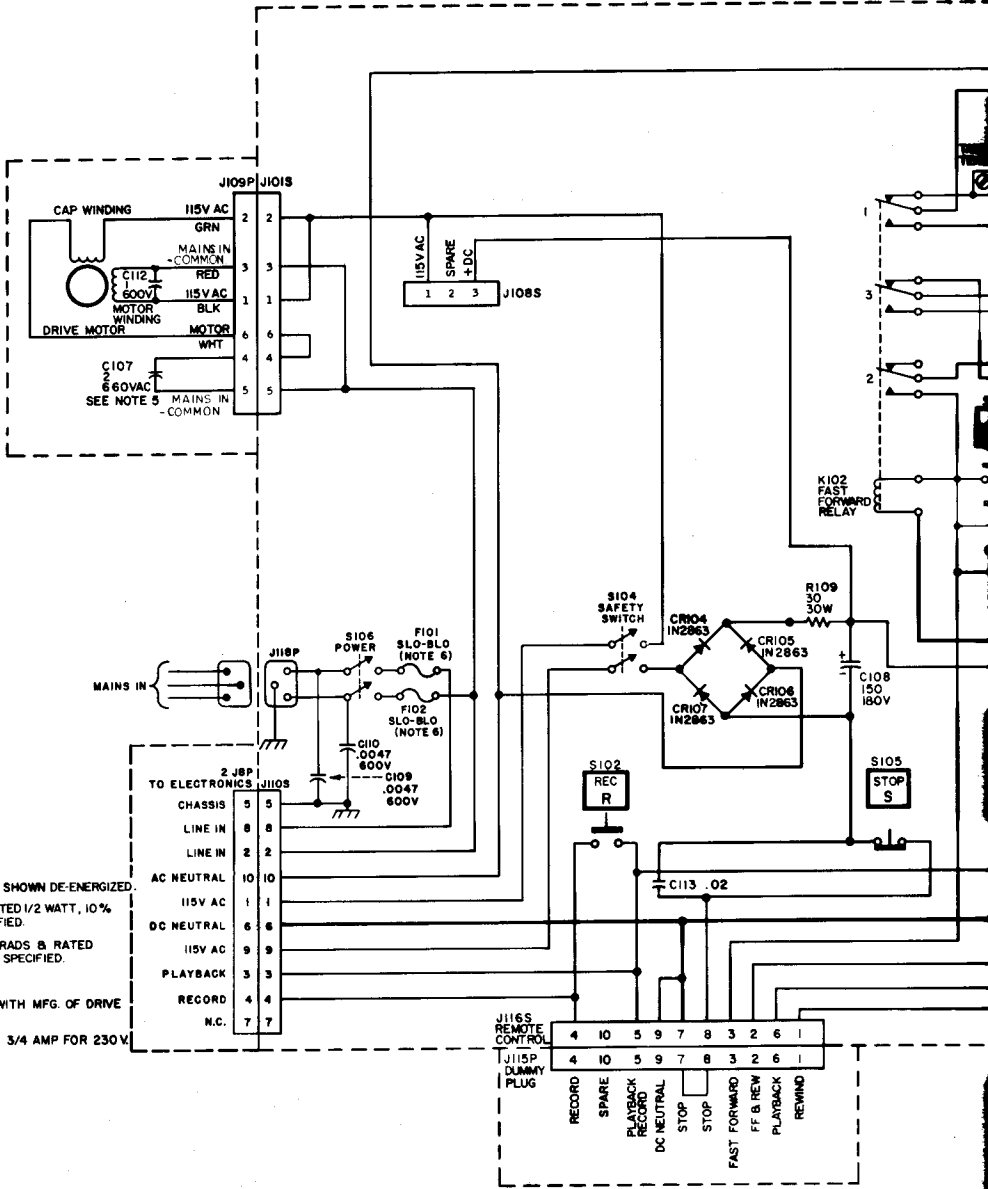


Fig. 7-2. Tape Transport Simplified Schematic Diagram, Domestic Equipment



- NOTES:**
1. ALL RELAYS & SOLENOIDS SHOWN DE-ENERGIZED.
 2. ALL RESISTORS IN OHMS & RATED 1/2 WATT, 10% UNLESS OTHERWISE SPECIFIED.
 3. ALL CAPACITORS IN MICROFARADS & RATED 400V UNLESS OTHERWISE SPECIFIED.
 - 4.
 5. CAPACITOR VALUES VARY WITH MFG. OF DRIVE MOTOR.
 6. FUSE: 1 1/2 AMP FOR 115 V, 3/4 AMP FOR 230V

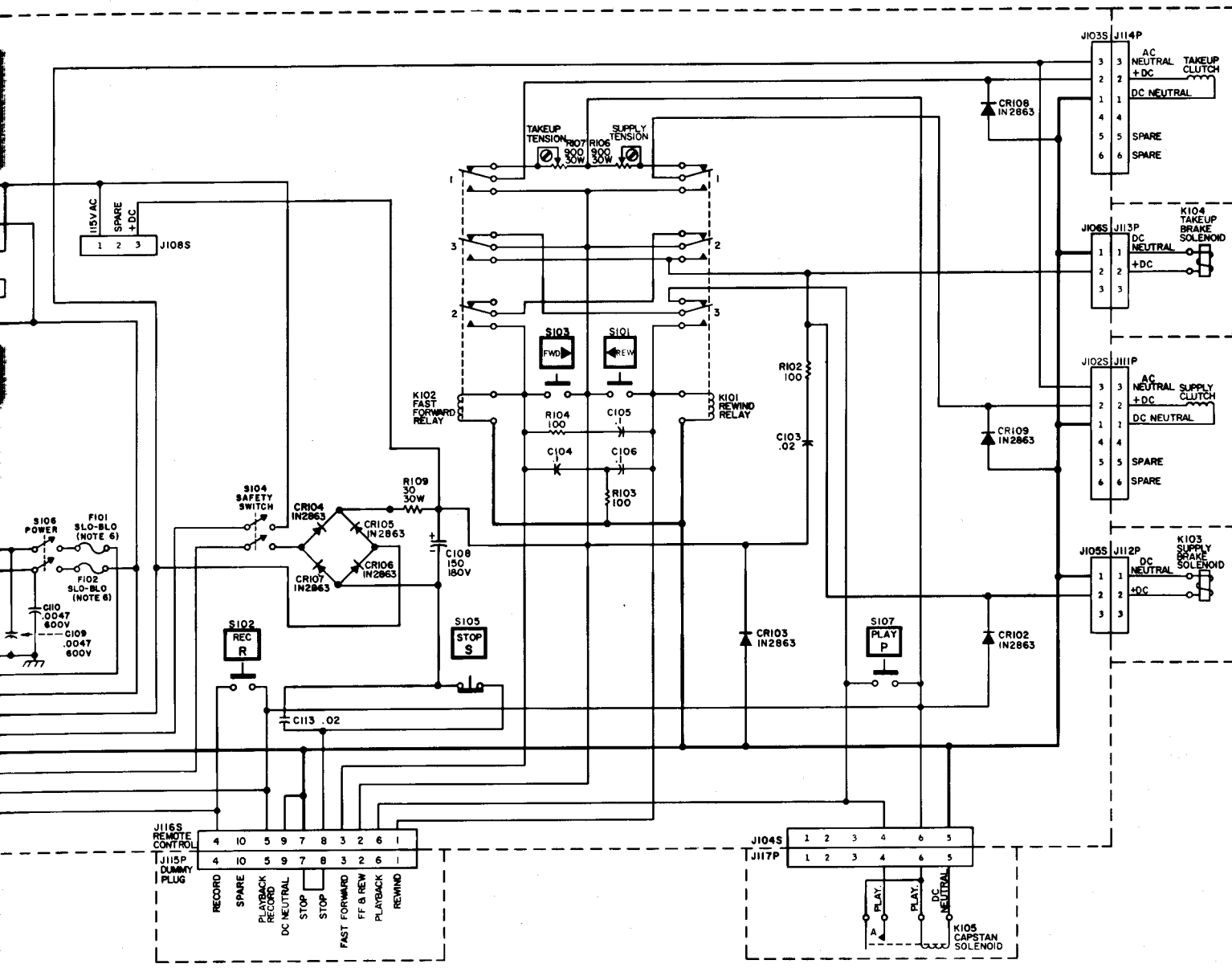
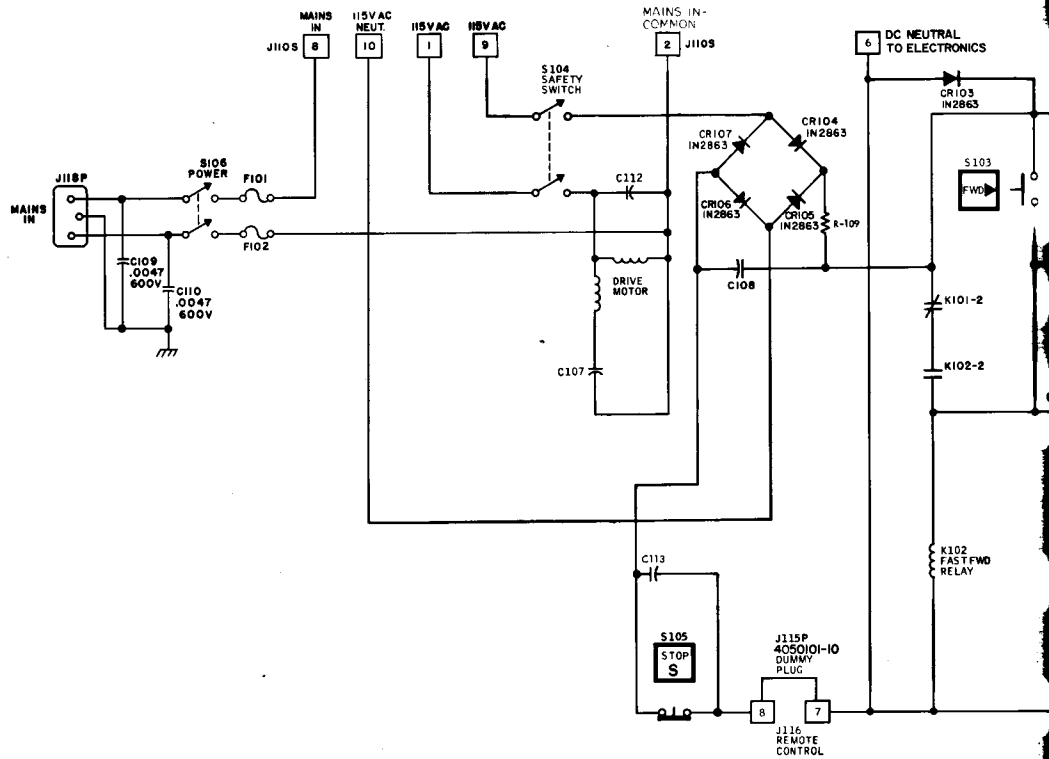


Fig. 7-3. Tape Transport Schematic Diagram, International Equipment



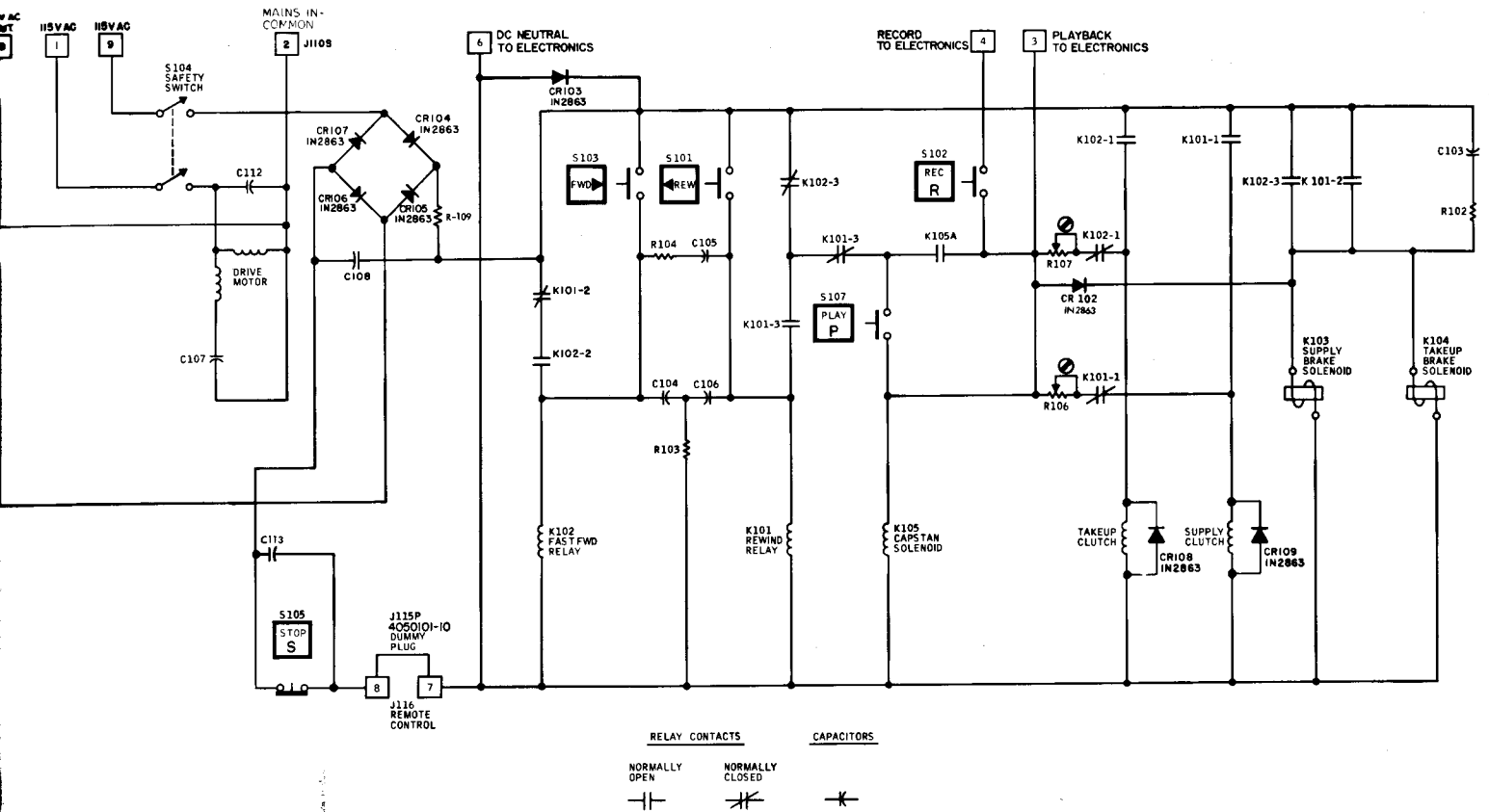
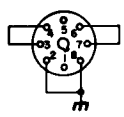
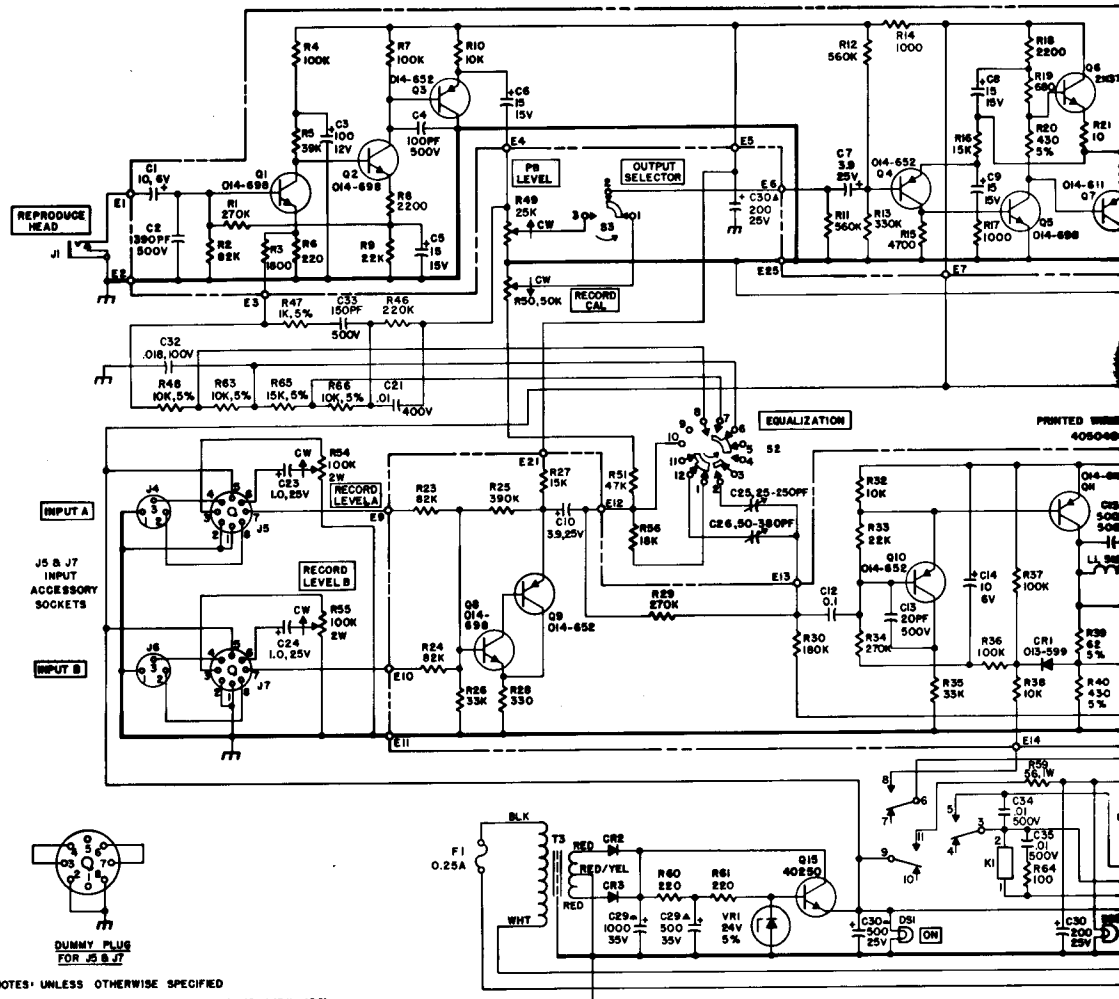


Fig. 7-4. Tape Transport Simplified Schematic Diagram, International Equipment

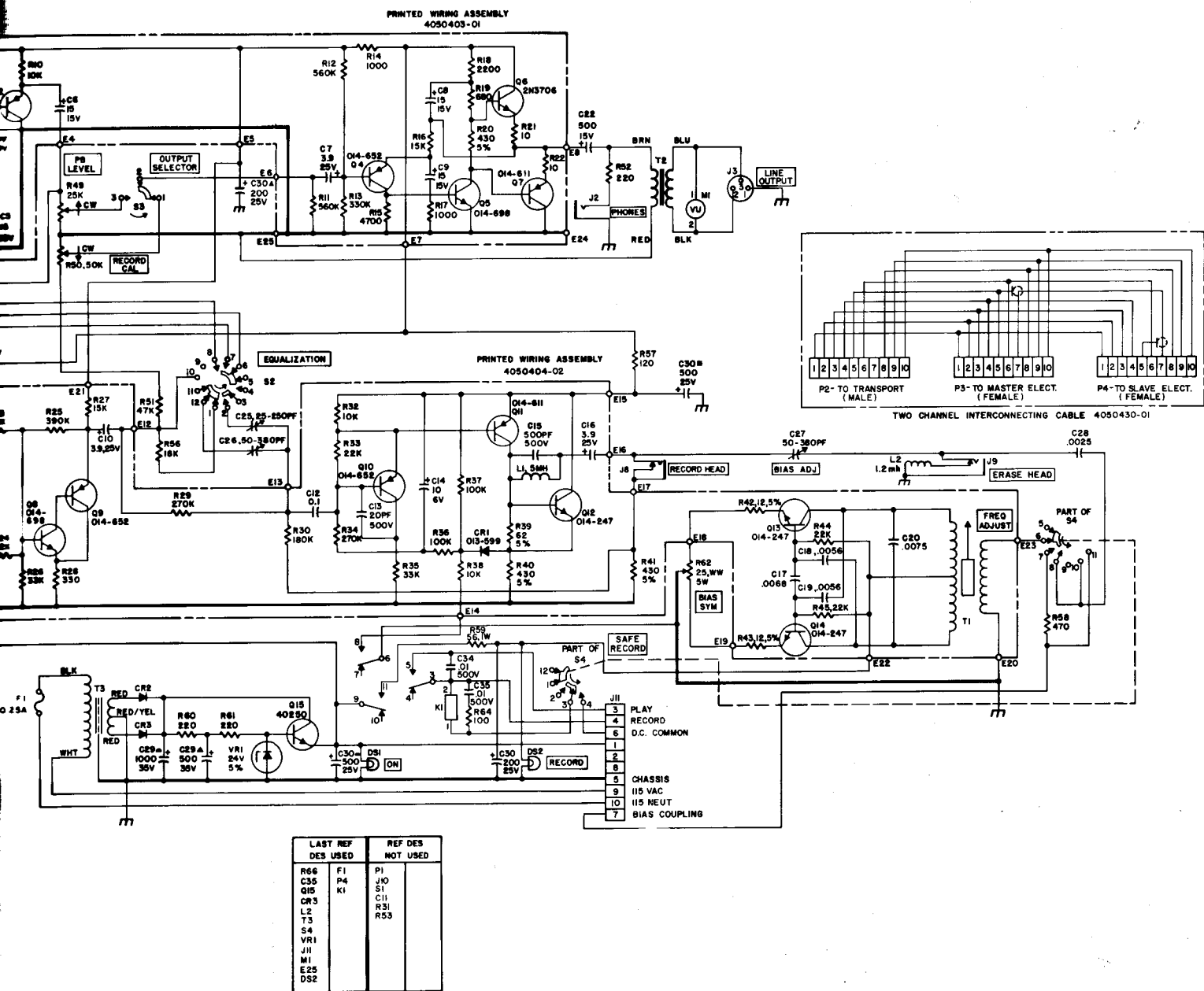


DUMMY PLUG
FOR J5 & J7

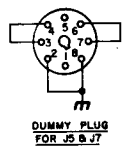
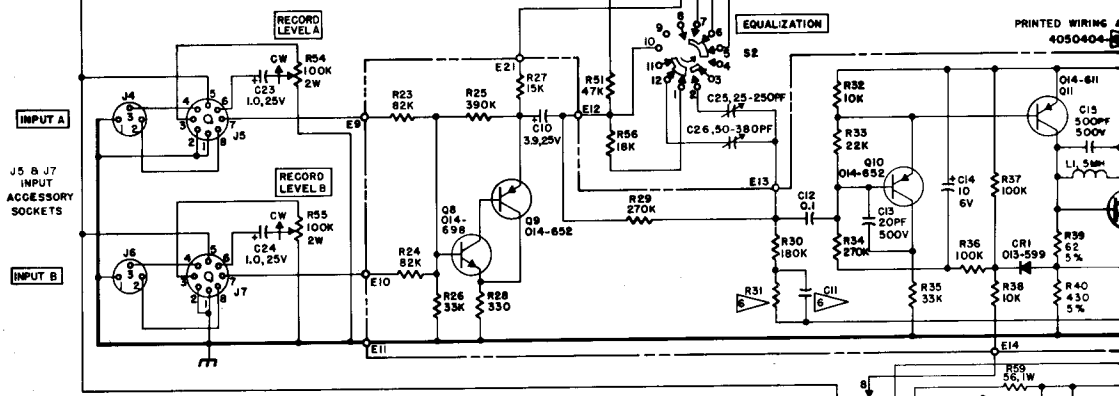
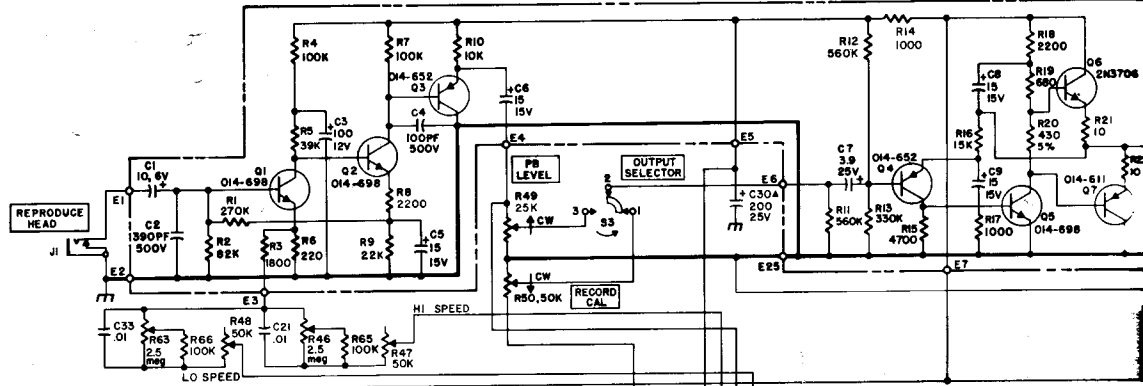
NOTES UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 100V.
3. ALL DIODES ARE TYPE O13-678.
4. ALL SWITCHES ARE IN DCW OR OFF POSITION.
5. FOR FIELD SERVICE ONLY:
 Q1, Q2, Q5, Q8 MAY BE 2N3565 OR 2N317.
 Q3, Q4, Q9, Q10 MAY BE 2N3906.
 Q7, Q11 MAY BE 2N3638.
 Q12, Q13, Q14 MAY BE 2N2219.

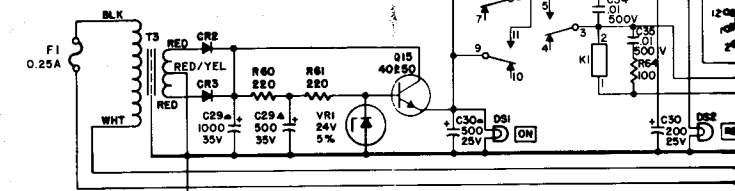
LAST REF DES USED	REF DES NOT USED
R56	P1
C35	J10
Q15	S1
CR3	C11
L2	R31
T3	R53
S4	
VR1	
M1	
E25	
DS2	



**Fig. 7-6. Record/Reproduce Schematic Diagram,
15/16 and 1-7/8 ips, Domestic Equipment**



- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 100V.
 3. ALL DIODES ARE TYPE O13-678.
 4. ALL SWITCHES ARE IN CGW OR OFF POSITION.
- FOR FIELD SERVICE ONLY:
- Q1, Q2, Q5, Q8 MAY BE 2N3565 OR 2N3117.
 - Q3, Q4, Q9, Q10 MAY BE 2N3906.
 - Q7, Q11 MAY BE 2N3638.
 - Q12, Q13, Q14 MAY BE 2N2219.



FOR NAB EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	180K	4050404-01
C11	.018	4050404-01

FOR CGIR EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	SHORT	4050404-02
C11	OPEN	4050404-02

LAST REF DES USED	REF DES NOT USED
R66	F1
C35	P4
Q15	J10
CR5	S1
L1	C31
T3	C32
S4	R55
VR1	
J11	
W1	
E25	
DS2	

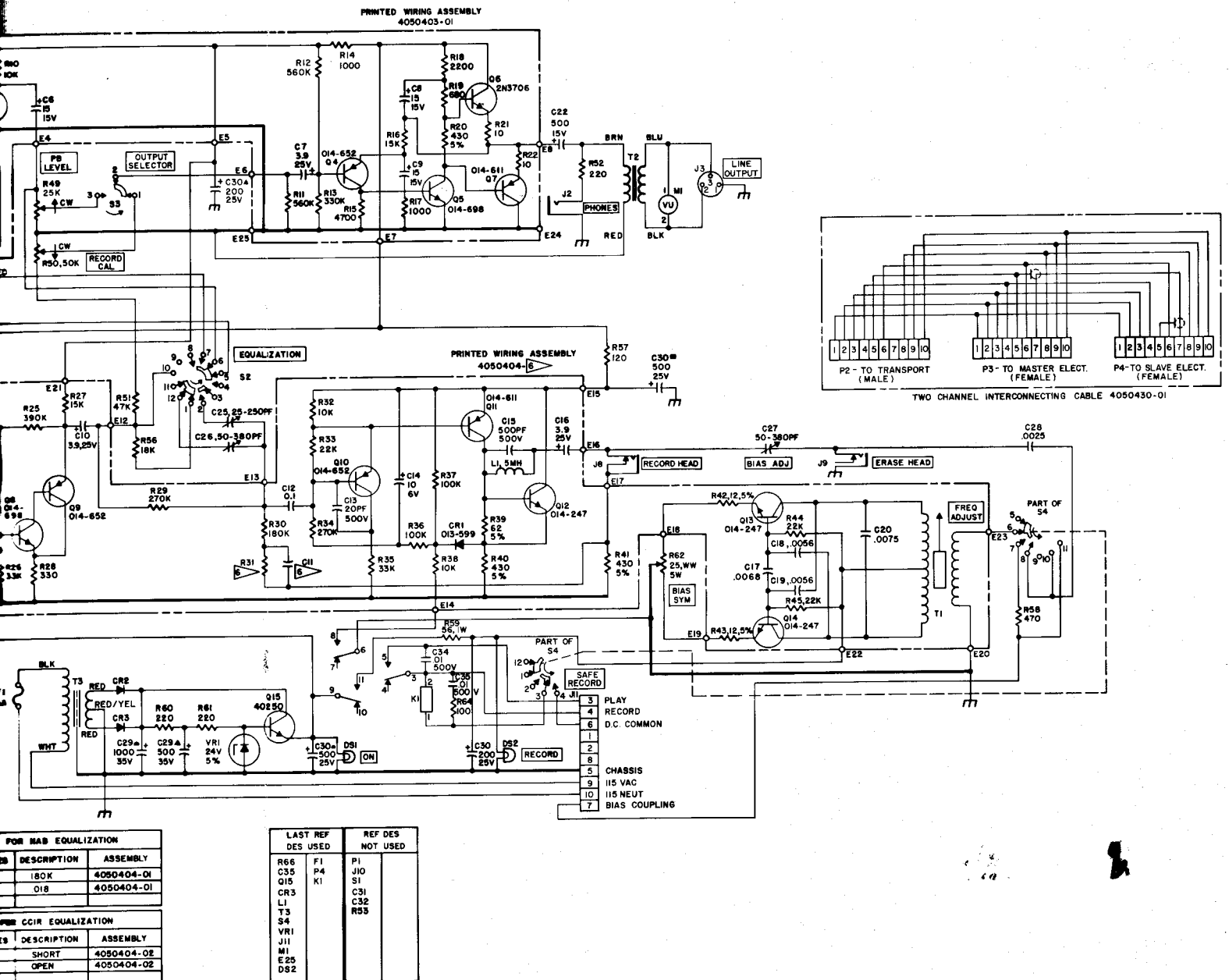
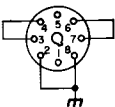
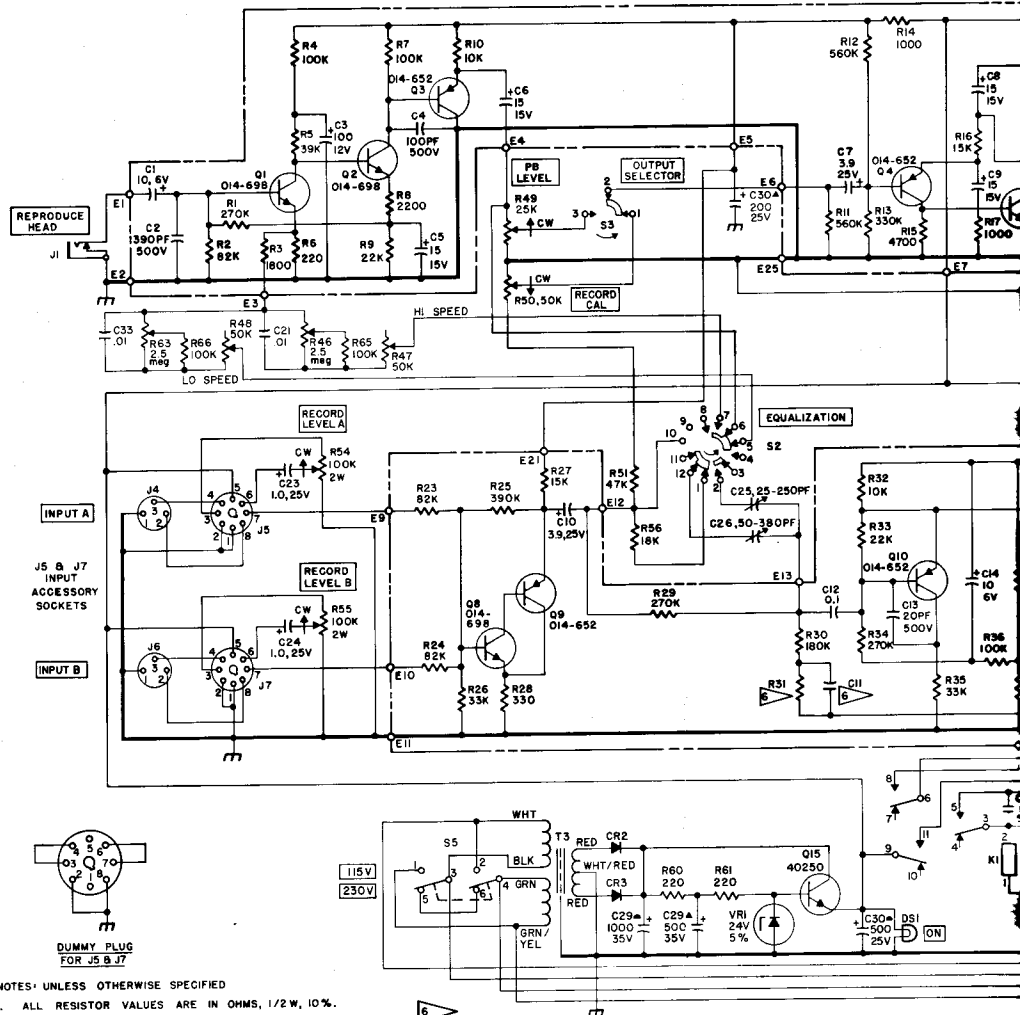


Fig. 7-5. Record/Reproduce Schematic Diagram, 3-3/4 to 15 ips, Domestic Equipment

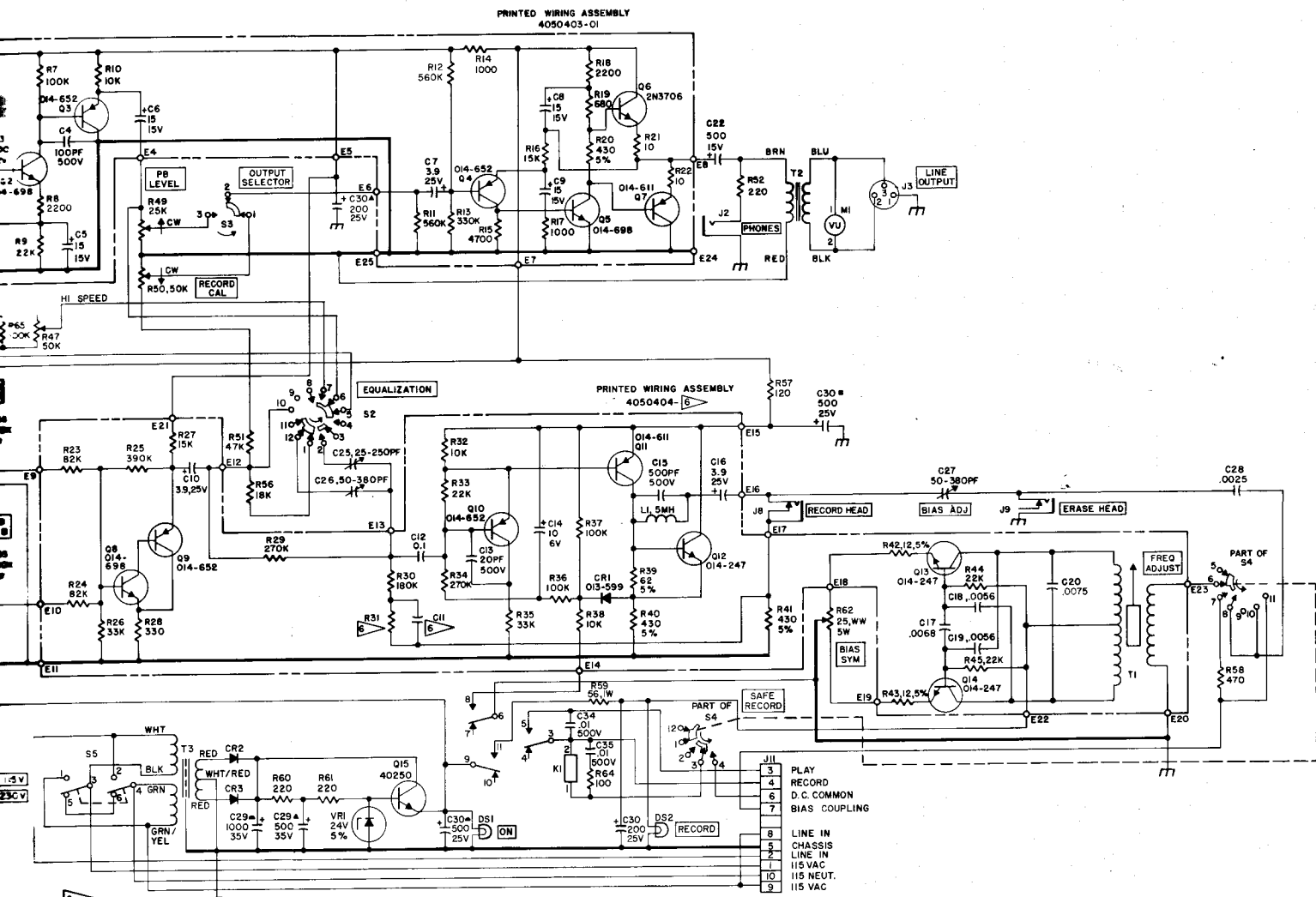


- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 100V.
 3. ALL DIODES ARE TYPE 013-678.
 4. ALL SWITCHES ARE IN CCW OR OFF POSITION.
 5. FOR FIELD SERVICE ONLY:
 - Q1, Q2, Q5, Q8 MAY BE 2N3565 OR 2N3117.
 - Q3, Q4, Q9, Q10 MAY BE 2N3906.
 - Q7, Q11 MAY BE 2N3638.
 - Q12, Q13, Q14 MAY BE 2N2219.

FOR NAB EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	180K	4050404-01
C11	.018	4050404-01

FOR CGIR EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	SHORT	4050404-02
C11	OPEN	4050404-02

LAST REF DES USED	REF DES NOT USED
R66	R53
C35	S1
Q15	C31
CR3	C32
L1	J10
T3	
S5	
VR1	
J11	
M1	
E25	
DS2	



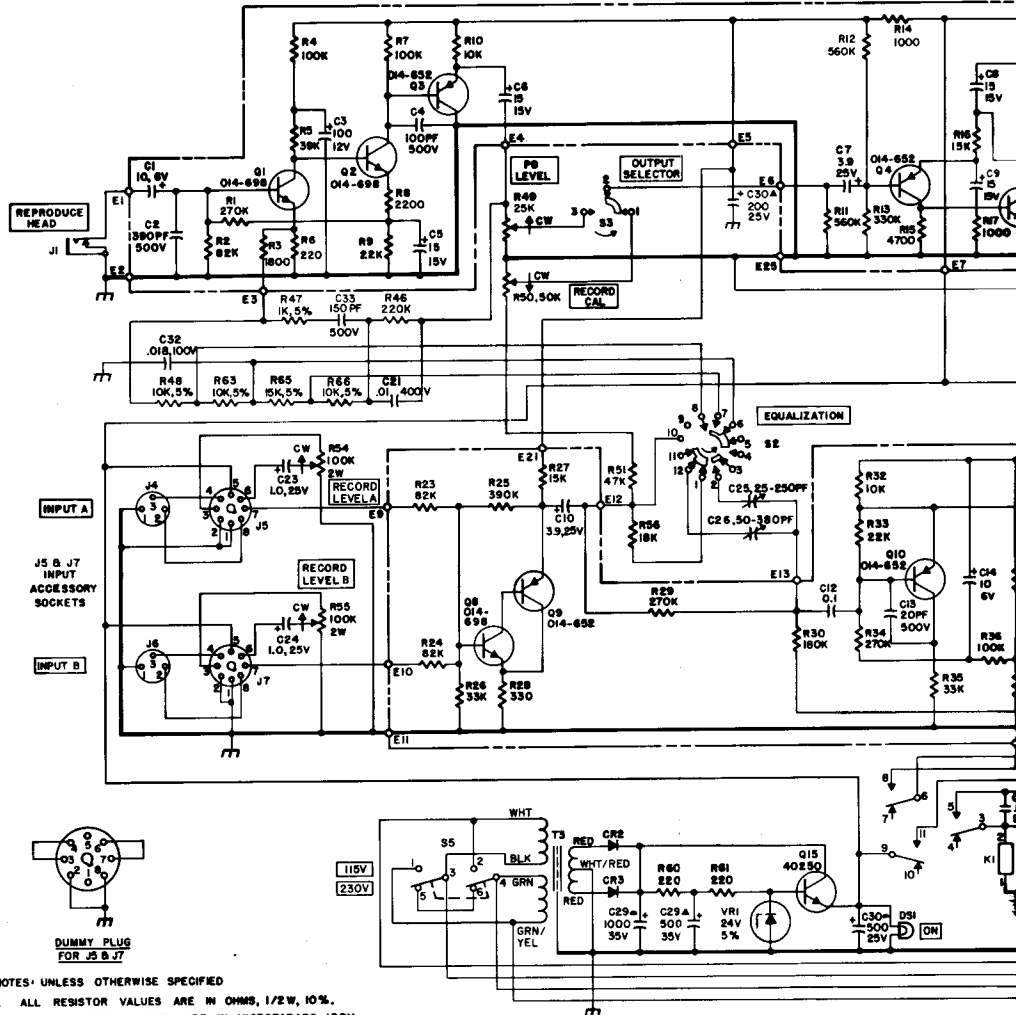
FOR NAB EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	180K	4050404-01
C11	.018	4050404-01

FOR CCIR EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	SHORT	4050404-02
C11	OPEN	4050404-02

LAST REF DES USED	REF DES NOT USED
R66 C35 Q15 CR3 LI T3 S5 VRI J11 M1 E25 DS2	R53 S1 C31 C32 J10

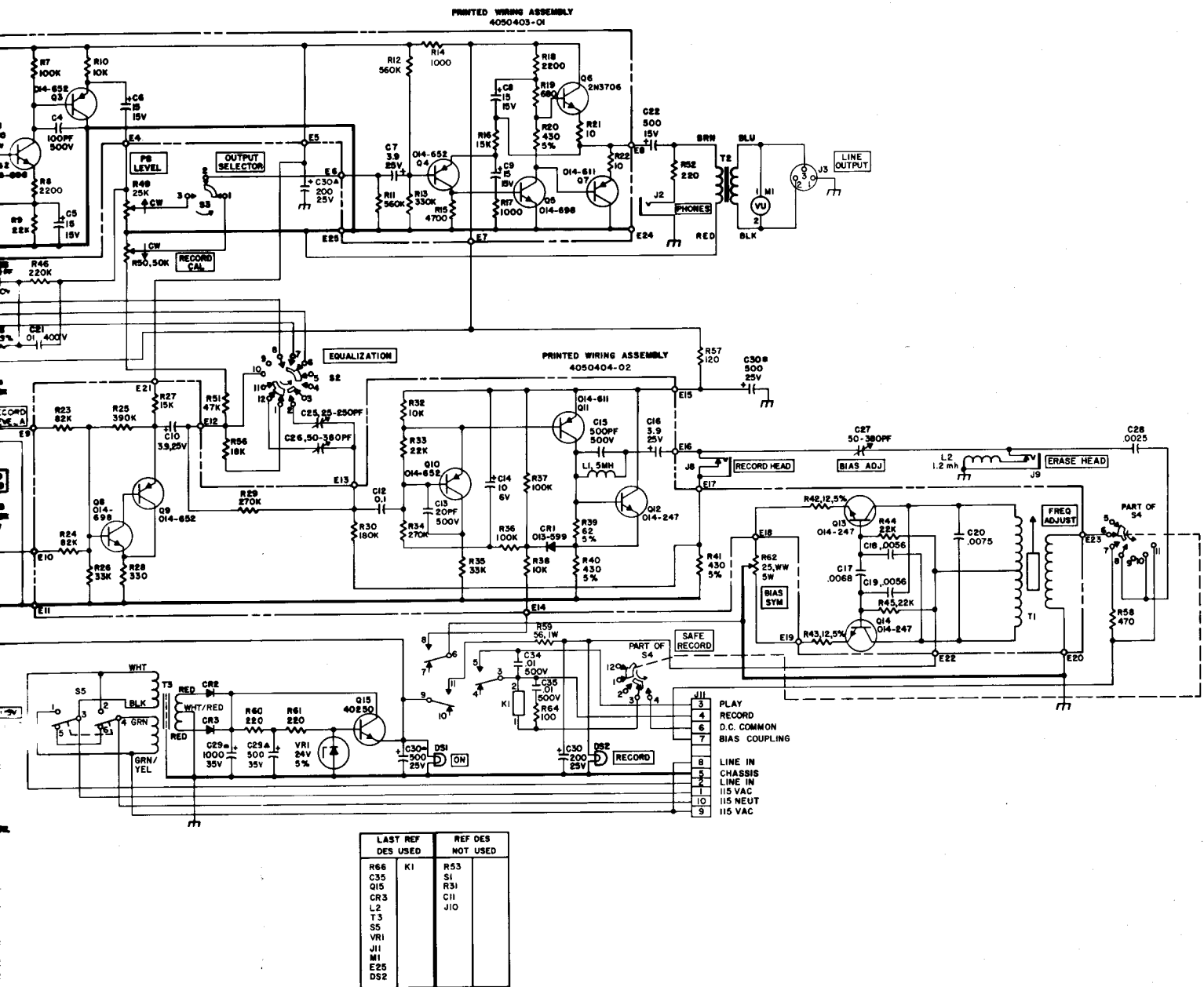
- 3 PLAY
- 4 RECORD
- 6 D.C. COMMON
- 7 BIAS COUPLING
- 8 LINE IN
- 9 CHASSIS
- 10 LINE IN
- 11 115 VAC
- 12 115 NEUT.
- 13 115 VAC
- 14 115 VAC
- 15 115 VAC

Fig. 7-7. Record/Reproduce Schematic Diagram, 3-3/4 to 15 ips, International Equipment



- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 100V.
 3. ALL DIODES ARE TYPE O13-47B.
 4. ALL SWITCHES ARE IN CCW OR OFF POSITION.
 5. FOR FIELD SERVICE ONLY:
 Q1, Q2, Q5, Q8 MAY BE 2N3565 OR 2N3117.
 Q3, Q4, Q9, Q10 MAY BE 2N3906.
 Q7, Q11 MAY BE 2N3638.
 Q12, Q13, Q14 MAY BE 2N2219.

LAST REF DES USED	REF DES NOT USED
R66	K1
C35	S1
Q15	R31
CR3	C11
L2	J10
T3	
S5	
VR1	
J11	
M1	
E25	
DS2	



**Fig. 7-8. Record/Reproduce Schematic Diagram,
15/16 and 1-7/8 ips, International Equipment**

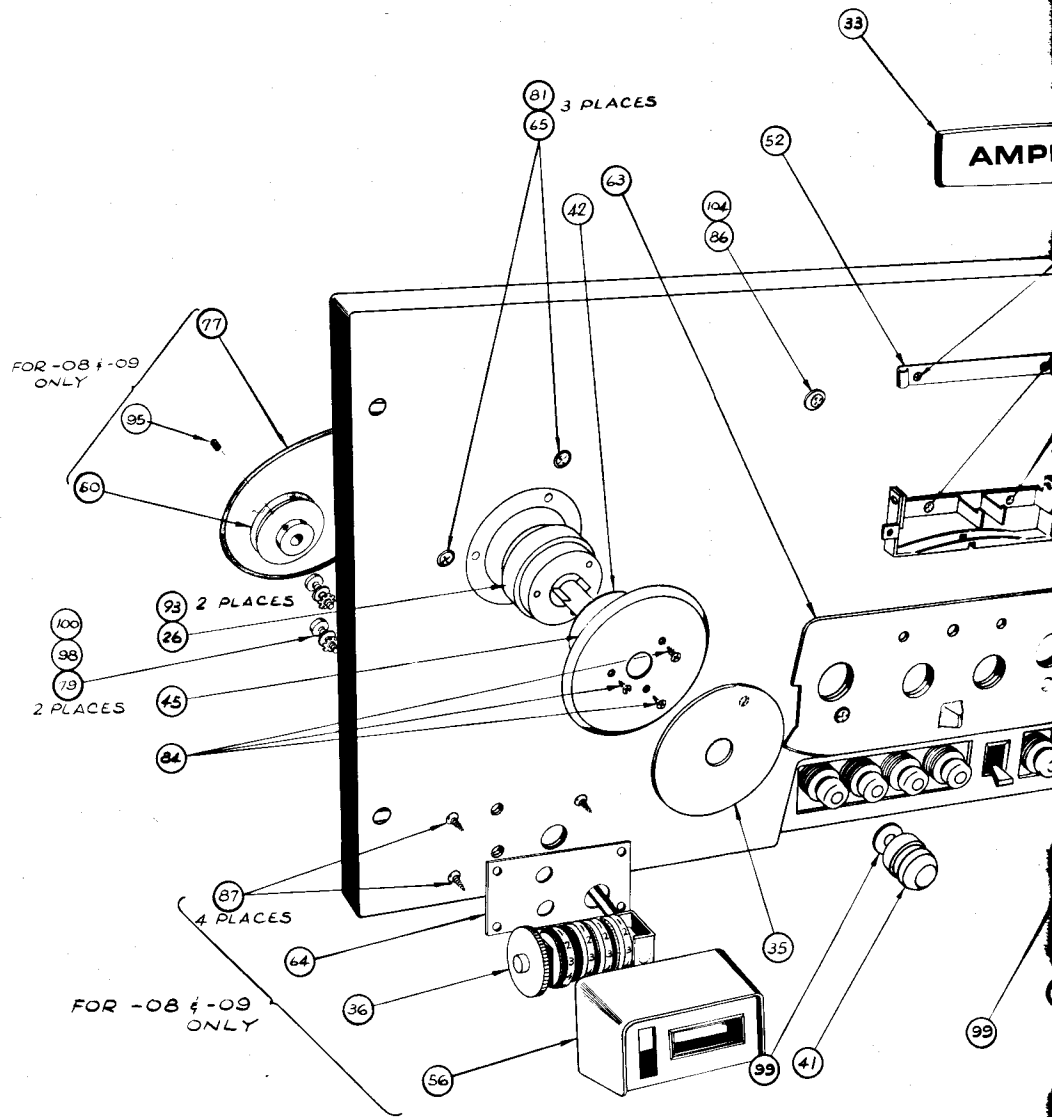


TABLE I

ASSY NO.	SPEED	CYCLE
4020061-01	7/2 ~ 15	60
4020061-02	7/2 ~ 15	50
4020061-03	3 3/4 ~ 7/2	60
4020061-04	3 3/4 ~ 7/2	50
4020061-05	7/2 ~ 15	60
4020061-06	3 3/4 ~ 7/2	60
4020061-07	1 7/8 ~ 3 3/4	60
4020061-08	1 5/16 ~ 1 7/8	60
4020061-09	1 5/16 ~ 1 7/8	50
4020061-10	7/2 ~ 15	50
4020061-11	3 3/4 ~ 7/2	50
4020061-12	7/2 ~ 15	60
4020061-13	7/2 ~ 15	50

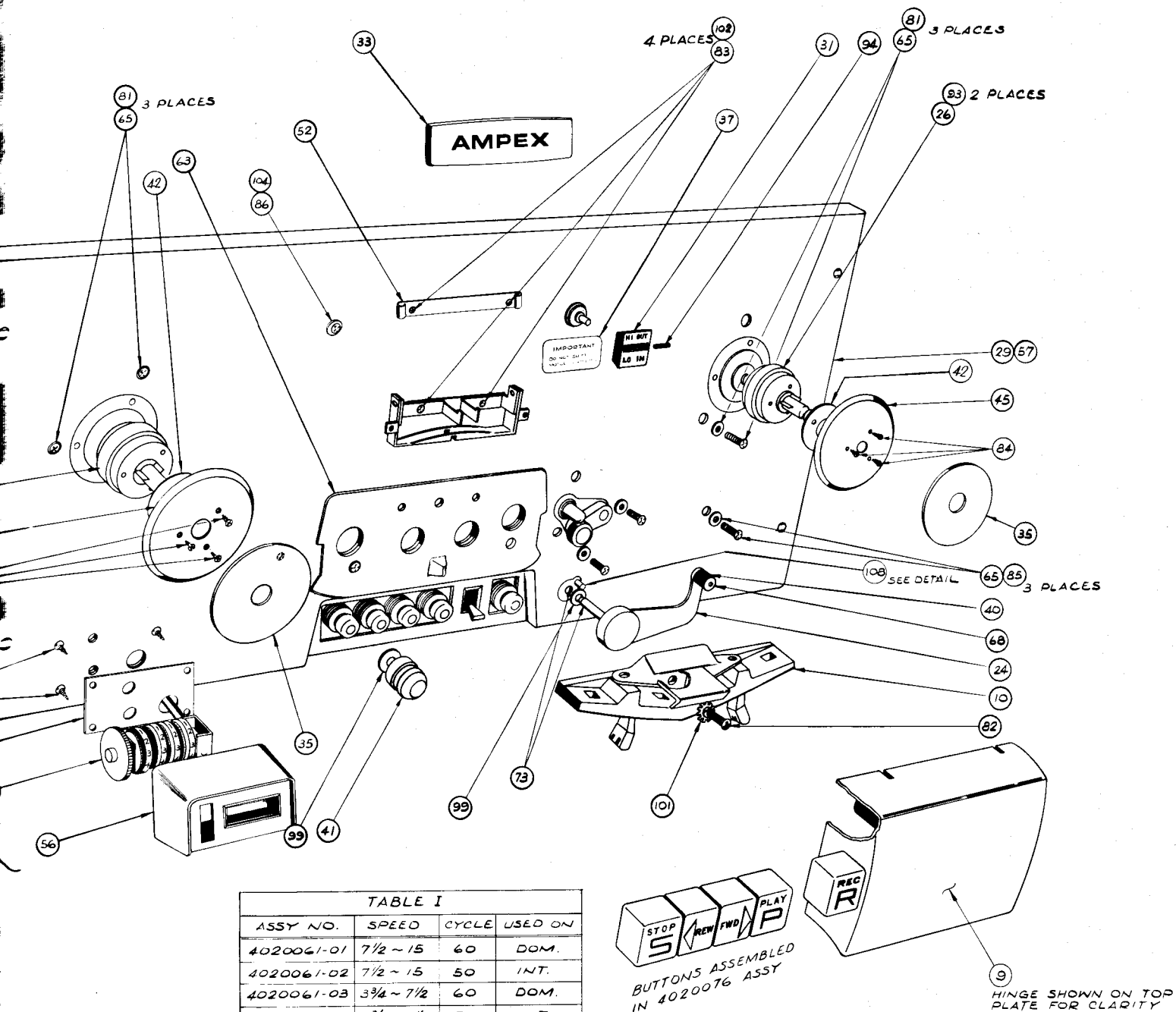


TABLE I

ASSY NO.	SPEED	CYCLE	USED ON
4020061-01	7 1/2 ~ 15	60	DOM.
4020061-02	7 1/2 ~ 15	50	INT.
4020061-03	3 3/4 ~ 7 1/2	60	DOM.
4020061-04	3 3/4 ~ 7 1/2	50	INT.
4020061-05	7 1/2 ~ 15	60	INT.
4020061-06	3 3/4 ~ 7 1/2	60	INT.
4020061-07	1 7/8 ~ 3 3/4	60	DOM.
4020061-08	15/16 ~ 1 7/8	60	DOM.
4020061-09	15/16 ~ 1 7/8	50	INT.
4020061-10	7 1/2 ~ 15	50	DOM.
4020061-11	3 3/4 ~ 7 1/2	50	DOM.
4020061-12	7 1/2 ~ 15	60	DOM. (PD-10)
4020061-13	7 1/2 ~ 15	50	DOM. (PD-10)

STOP S REW FWD P PLAY
 BUTTONS ASSEMBLED
 IN 4020076 ASSY

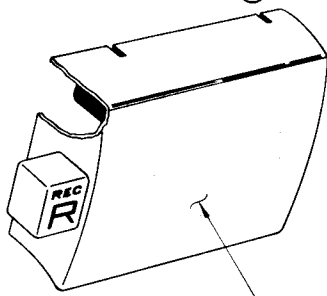


Fig. 7-9. Tape Transport Assembly, Sheet 1

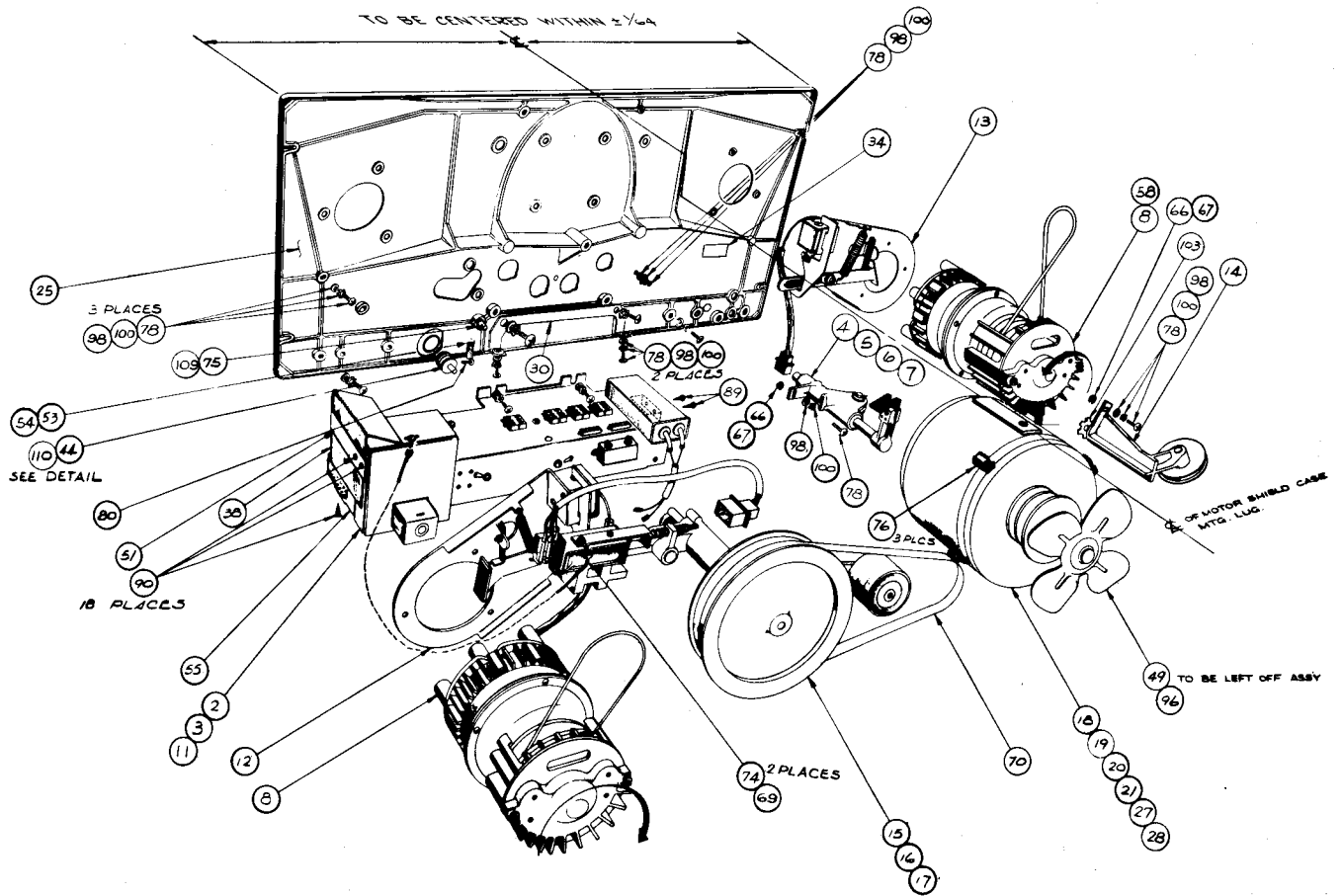
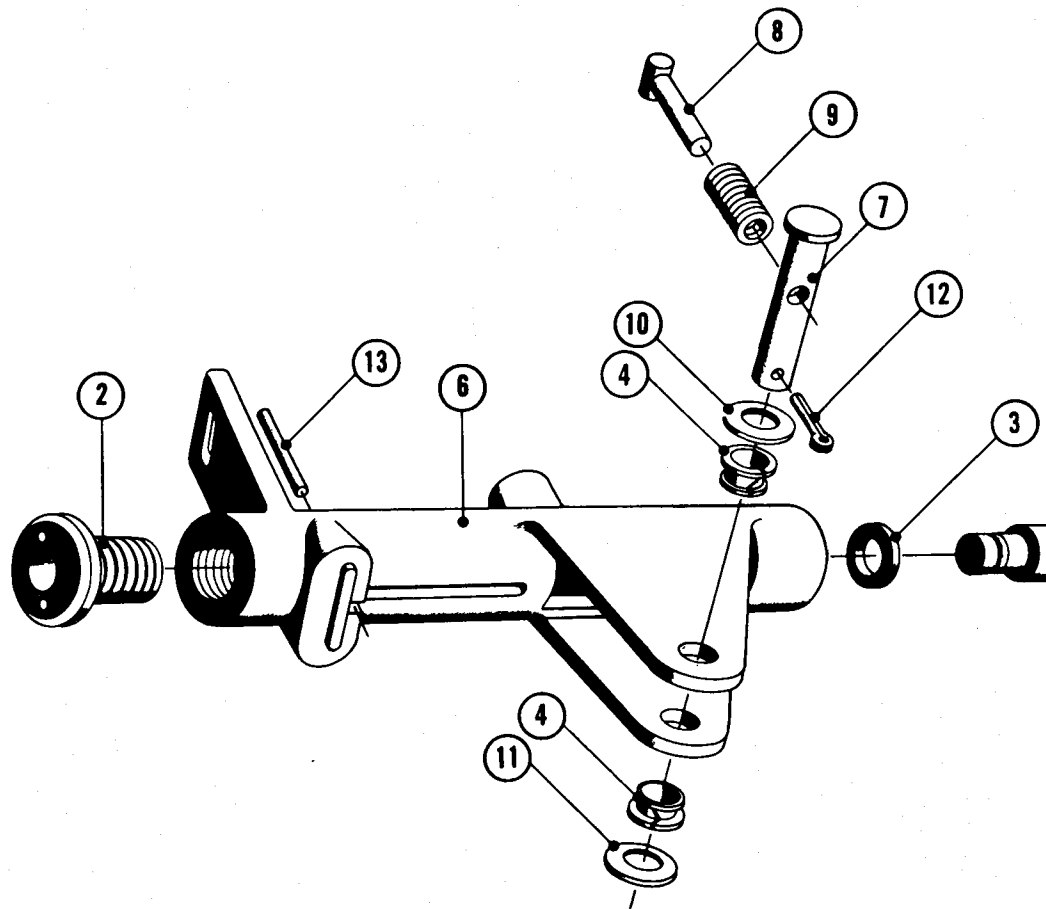
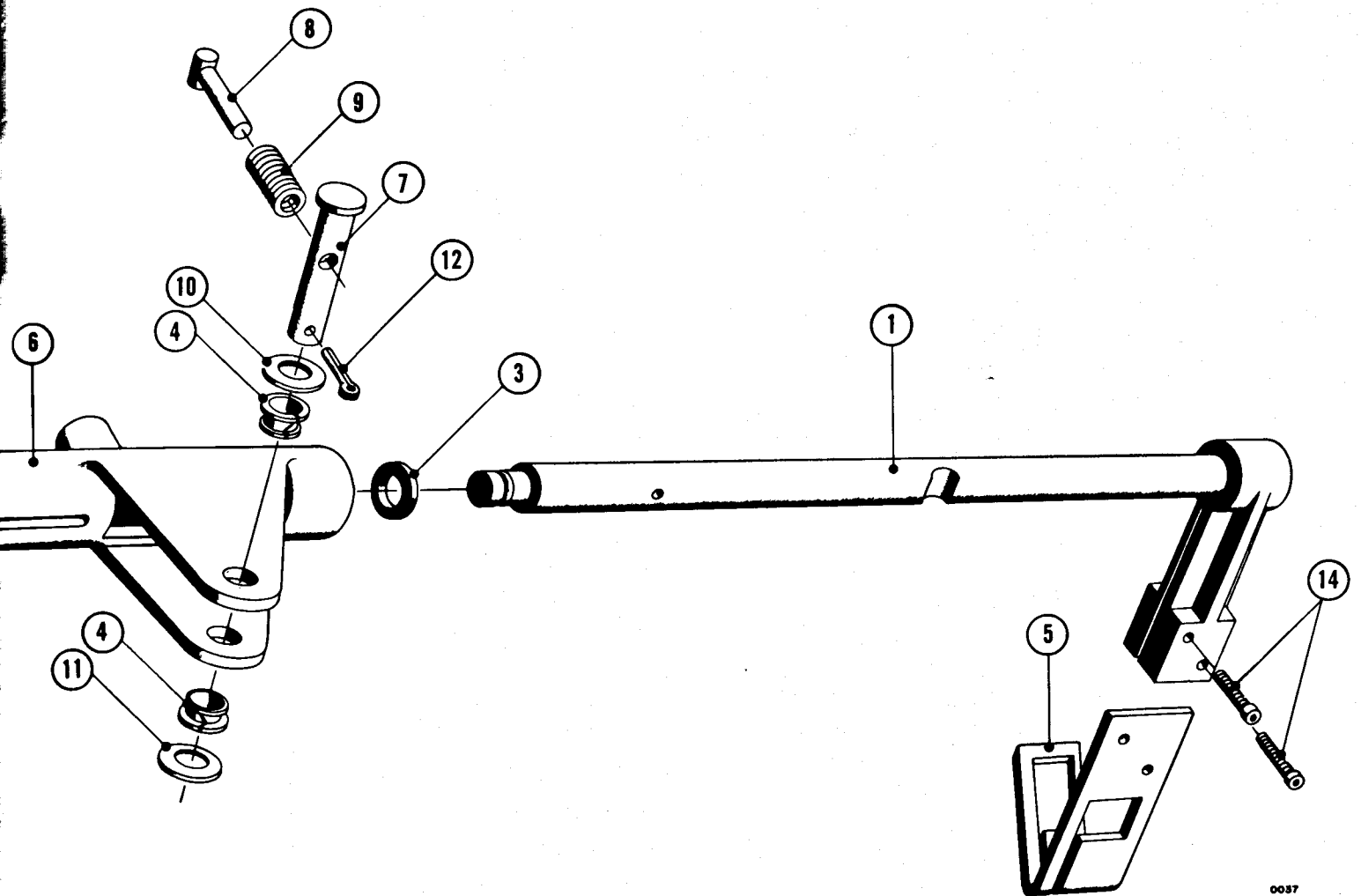


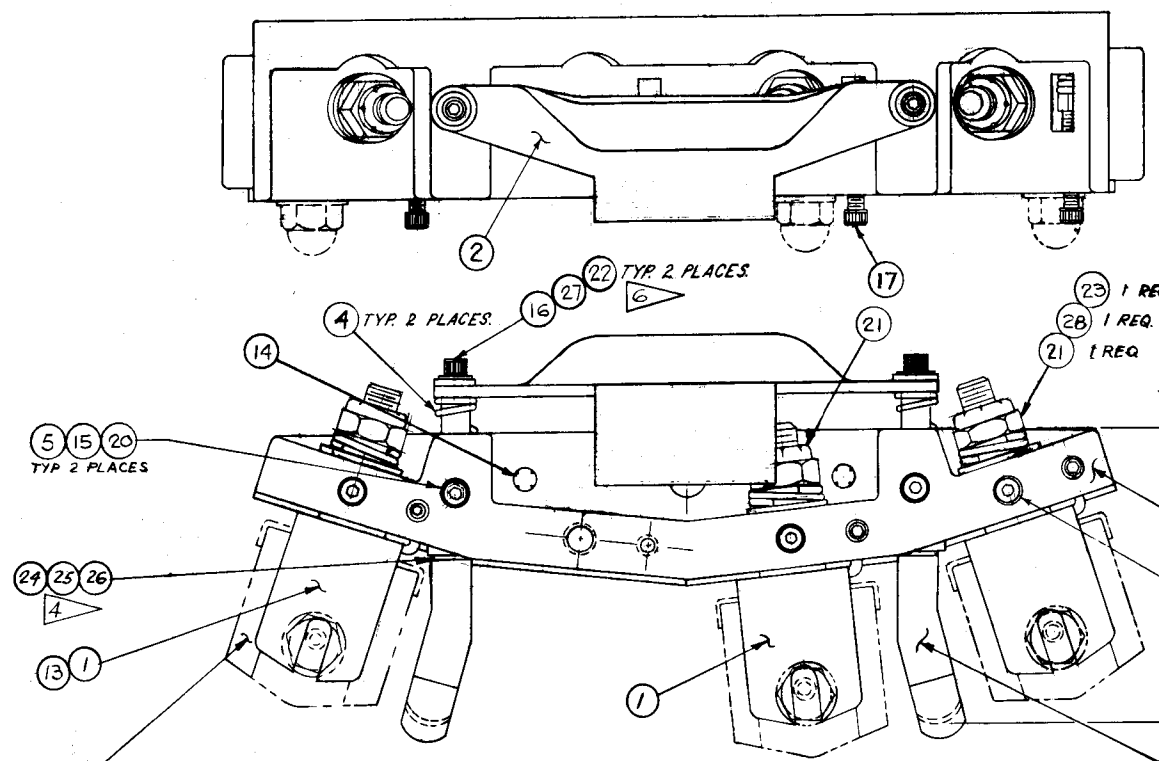
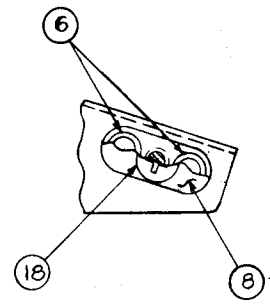
Fig. 7-10. Tape Transport Assembly, Sheet 2





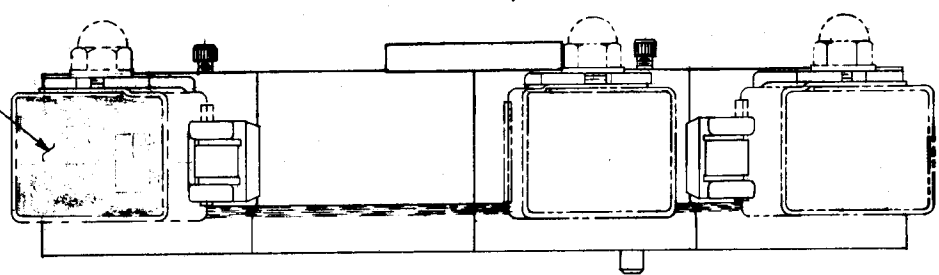
0037

Fig. 7-11. Speed Change Mechanism Assembly



1 2 3 4
MOUNTING BASE POSITIONS
(SEE TABLE 1)

LOCATION OF HEADS &
HARDWARE SHOWN FOR
CLARITY.



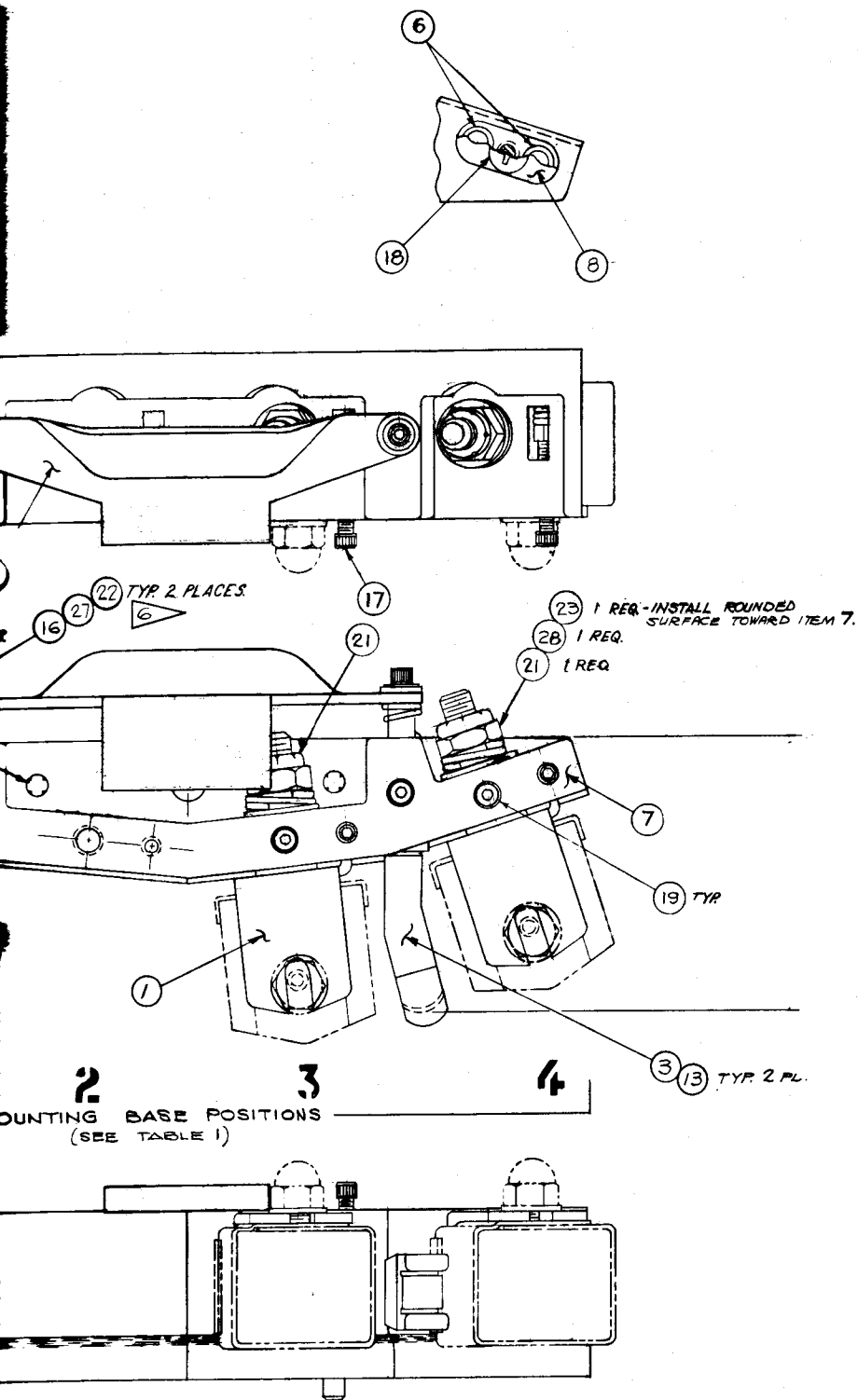


TABLE II

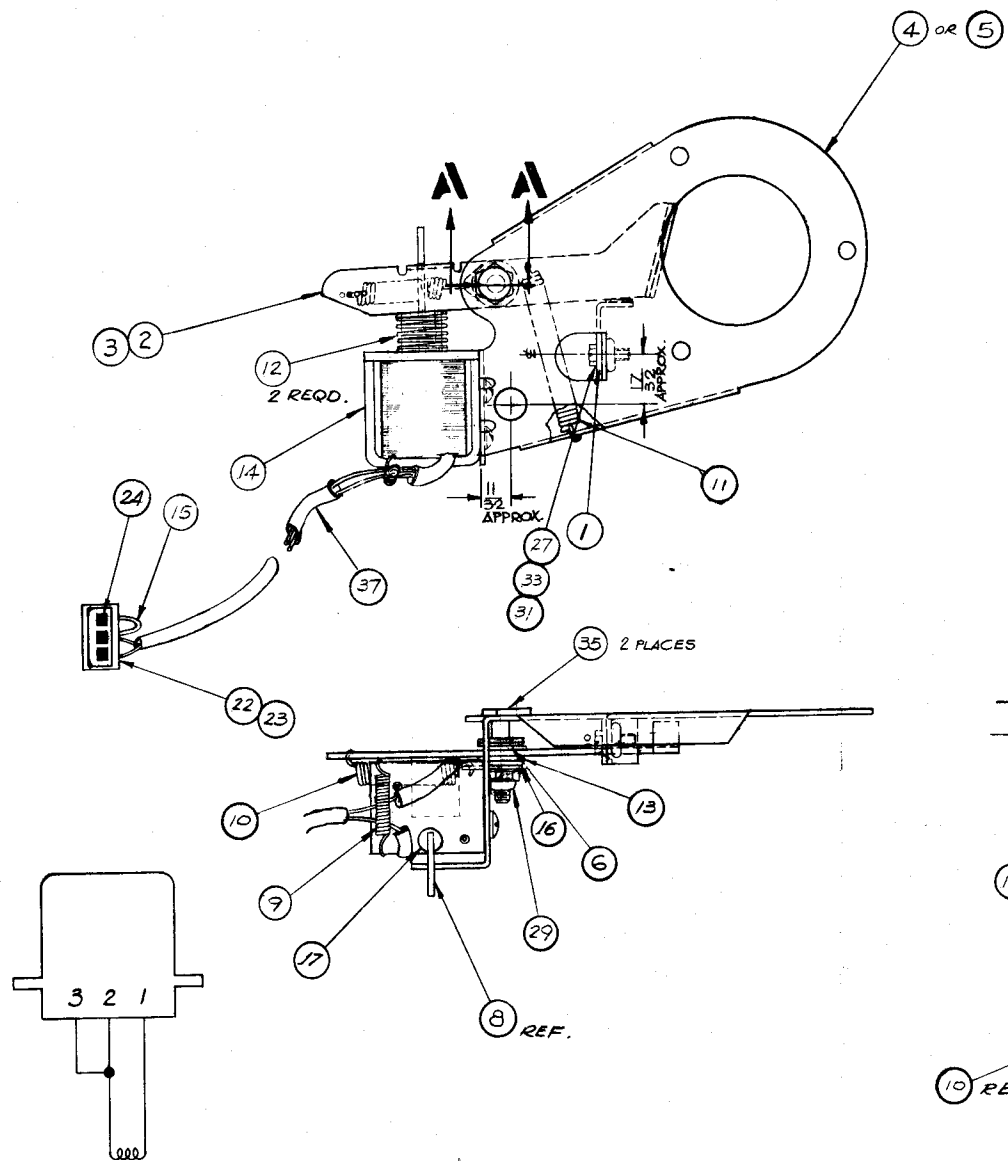
MODEL	NEXT ASSEMBLY
PR-10 CL-10	02-96200
AG-500 AL-500	4020061
GS-80	4020238
AG-300 HEAD 364 HEAD	02-96620

TABLE I

DASH NO.	POSITIONS			
	1	2	3	4
-40	x	-	x	x
-50	x	x	x	x
-60	-	x	x	-

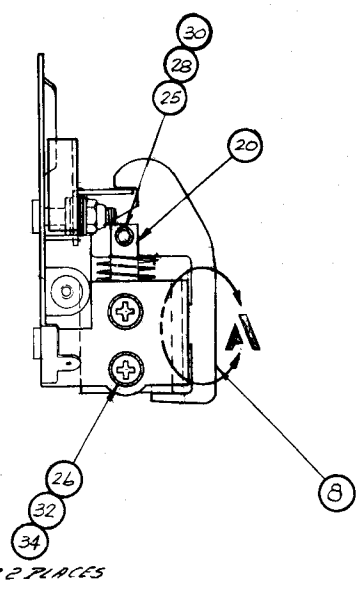
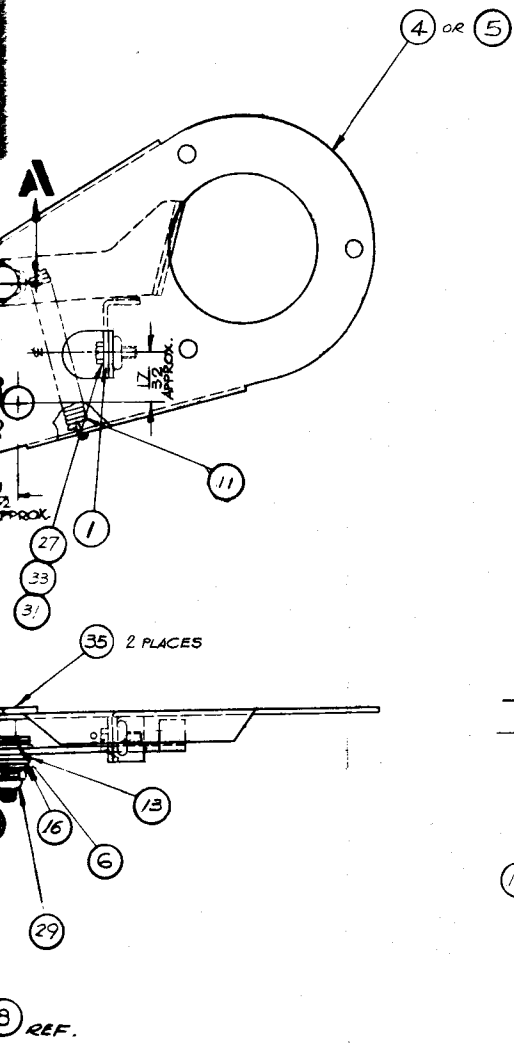
'X' INDICATES INSTALLATION, IN THIS POSITION OF ITEMS 1, 6 (2 PL.), 8, 13, 19, 17, 21, 23 & 28.

Fig. 7-12. Head Base Assembly



SCHMATIC

SECTION



-40 SUPPLY BRAKE ASSY SHOWN
 -30 TAKE UP BRAKE ASSY OPPOSITE

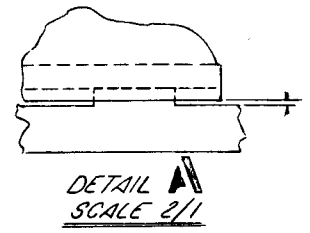
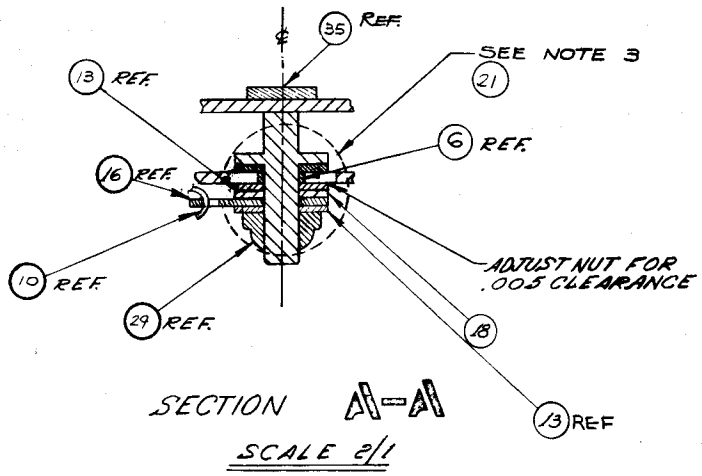


Fig. 7-13. Brake Assembly.

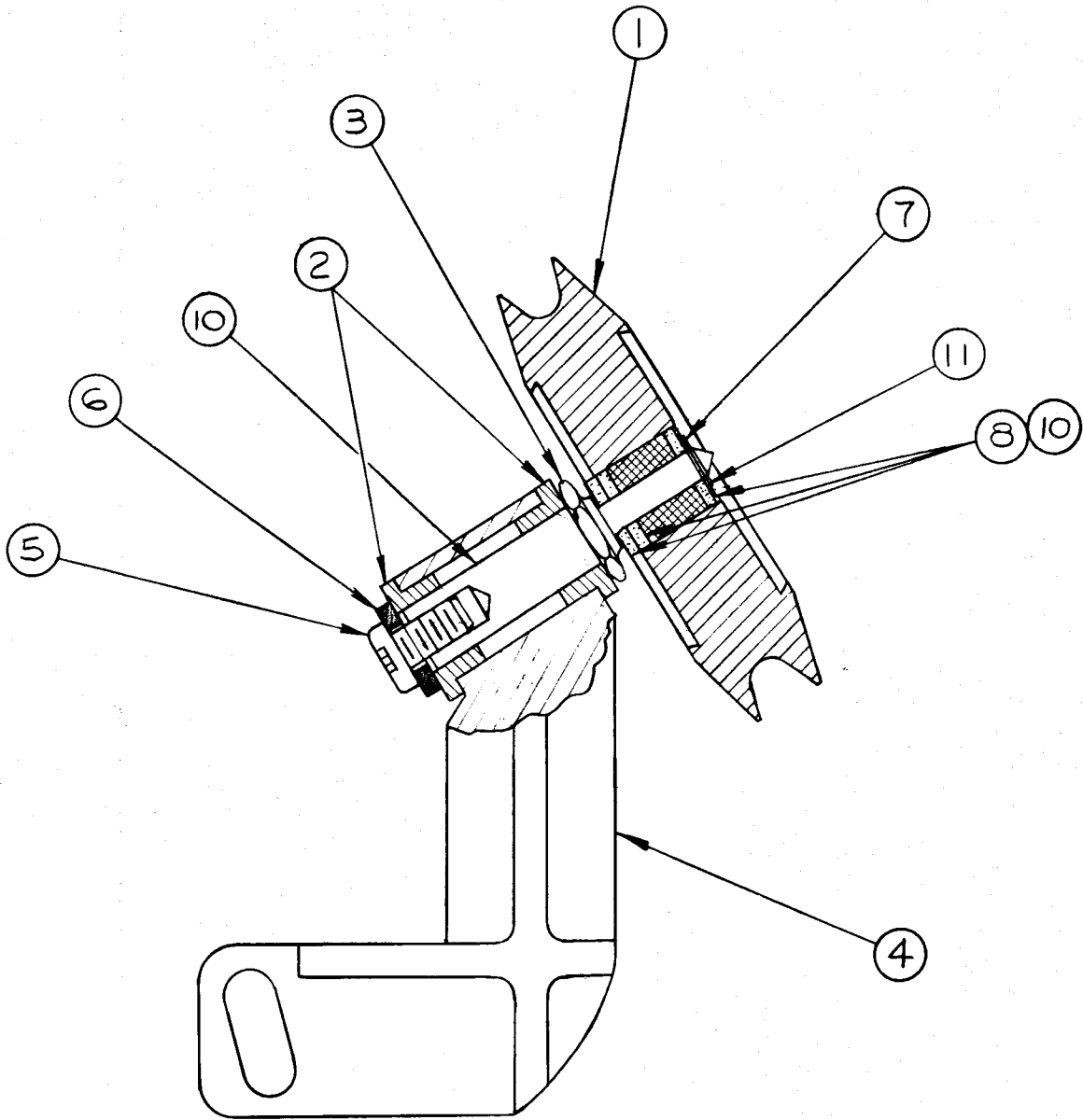


Fig. 7-14. Belt Separator Assembly

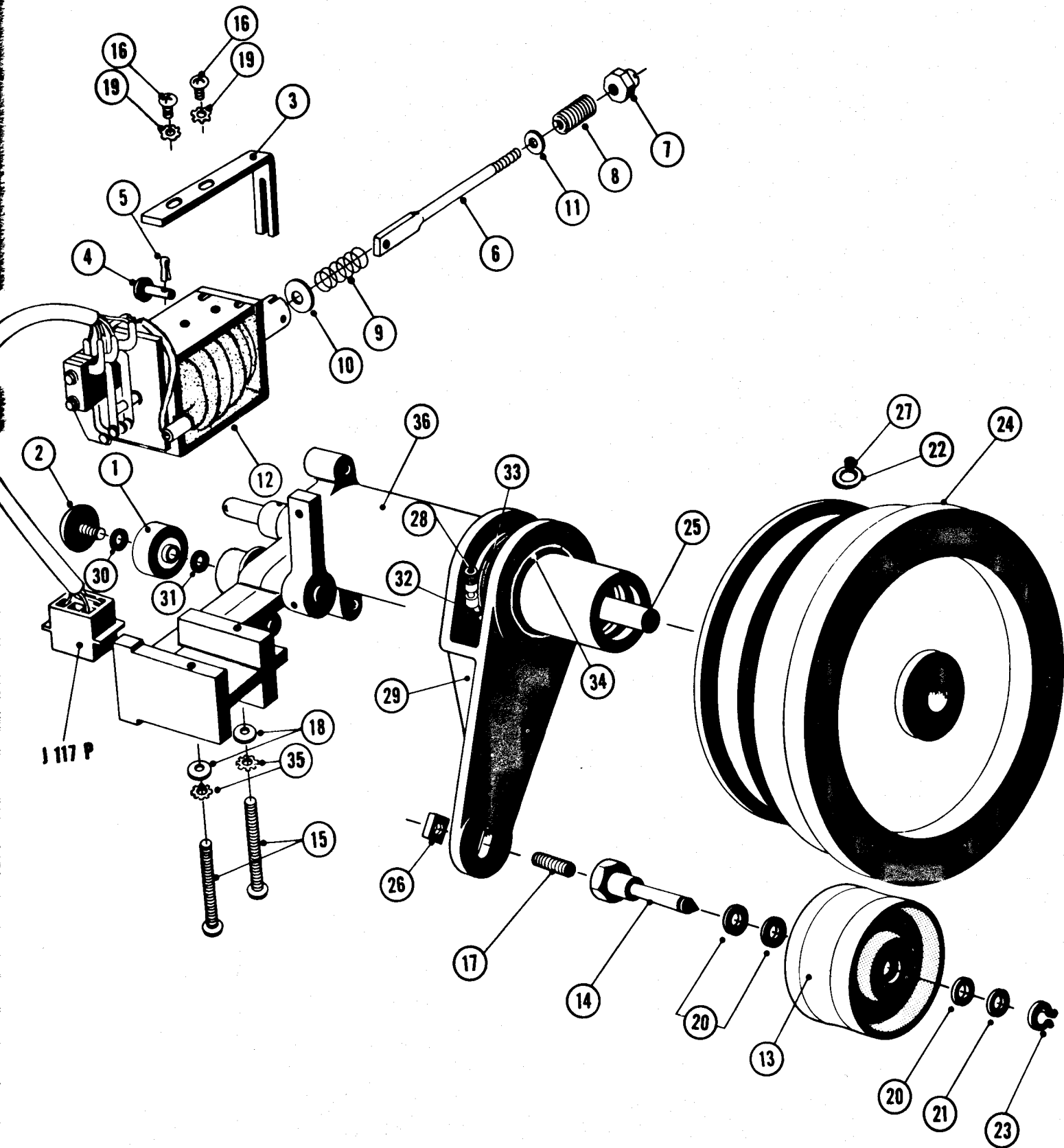
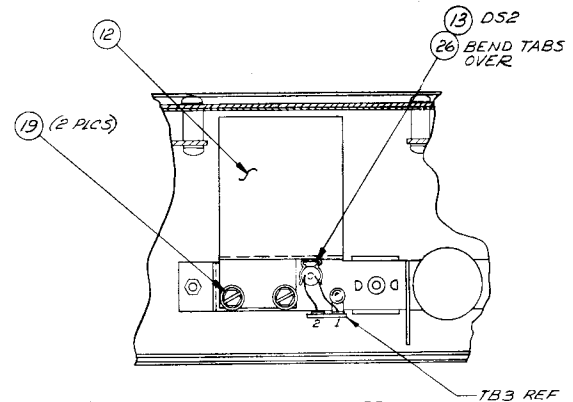
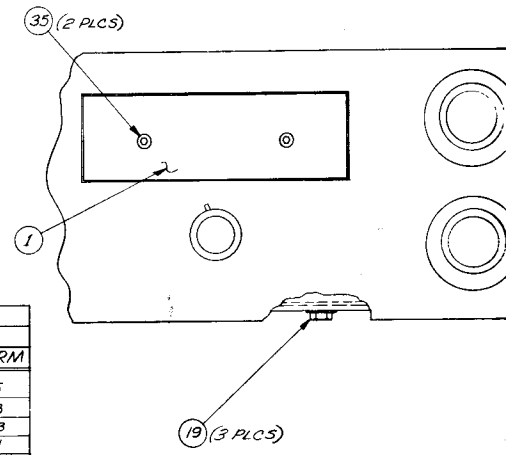
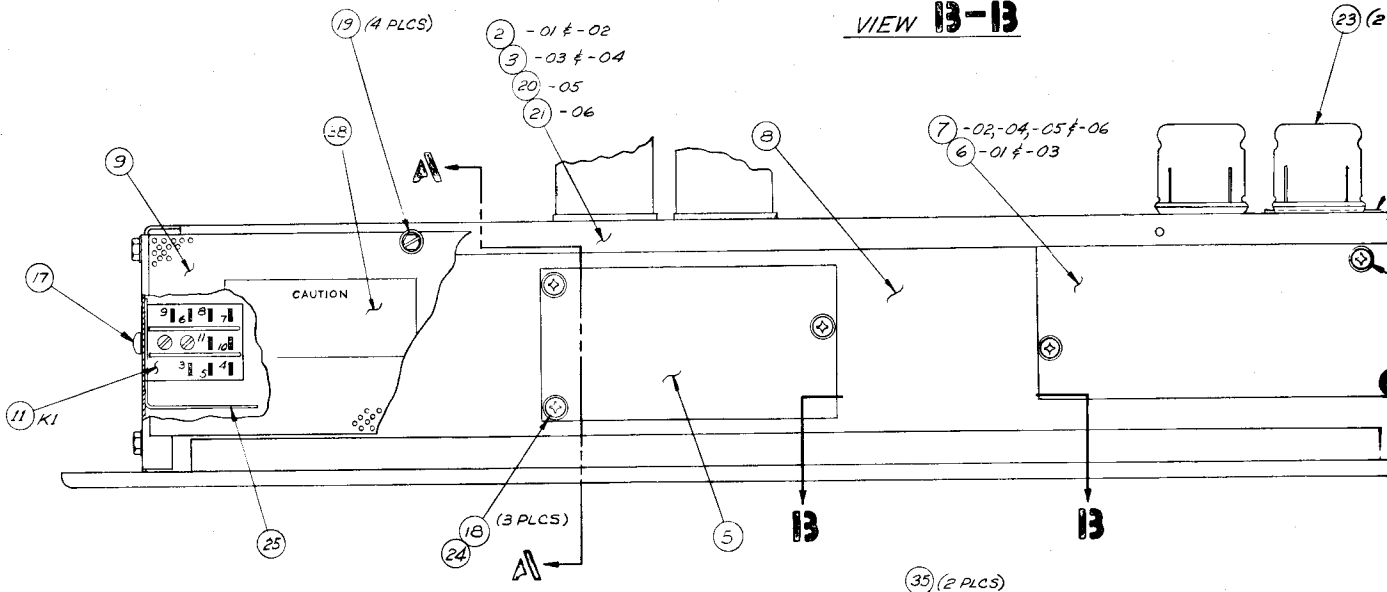


Fig. 7-15. Capstan Assembly

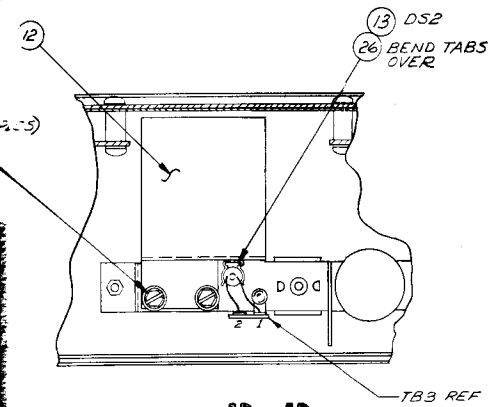
PART NO.
4020256-01
4020256-02
4020256-03
4020256-04
4020256-05
4020256-06



VIEW 13-13

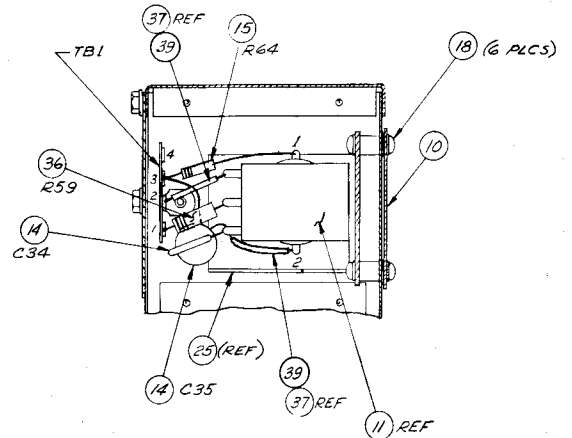
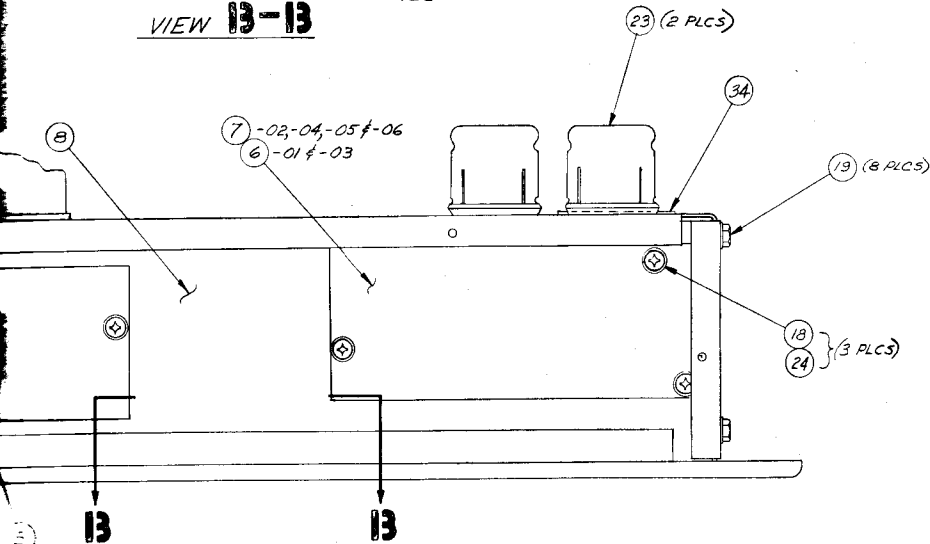


ITEM NO.	SCHEM. REF	CONNECTION TABLE			
		FROM COMPON. TERM	TO COMPON. TERM		
14	C34	KI 3	KI 5		
14	C35	KI 3	TB1 3		
15	R64	KI 1	TB1 3		
36	R59	KI 11	TB1 1		
37	JUMPER	KI 2	KI 3		
37	JUMPER	KI 6	TB1 2		



PART NO.	DESCRIPTION
4020256-01	DOMESTIC NAB 3 3/4 TO 15 I.P.S.
4020256-02	DOMESTIC CCIR " "
4020256-03	INT'L NAB " "
4020256-04	INT'L CCIR " "
4020256-05	DOMESTIC 15/16 - 1 7/8 IPS
4020256-06	INT'L 15/16 - 1 7/8 IPS

VIEW 13-13



SEC A-A

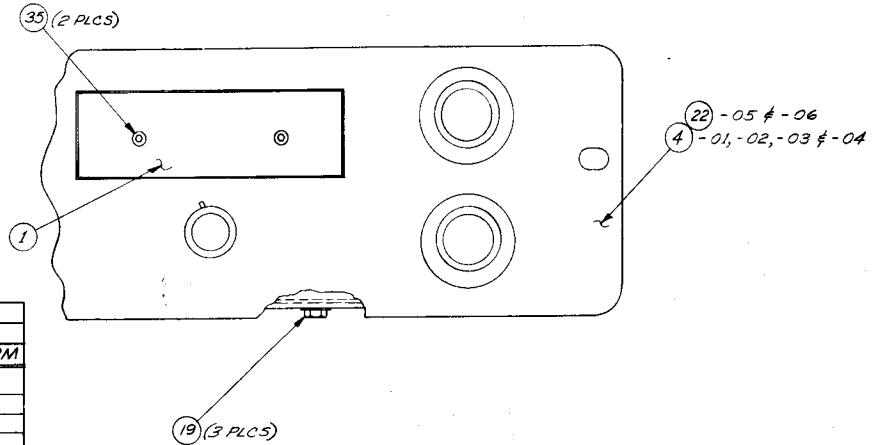
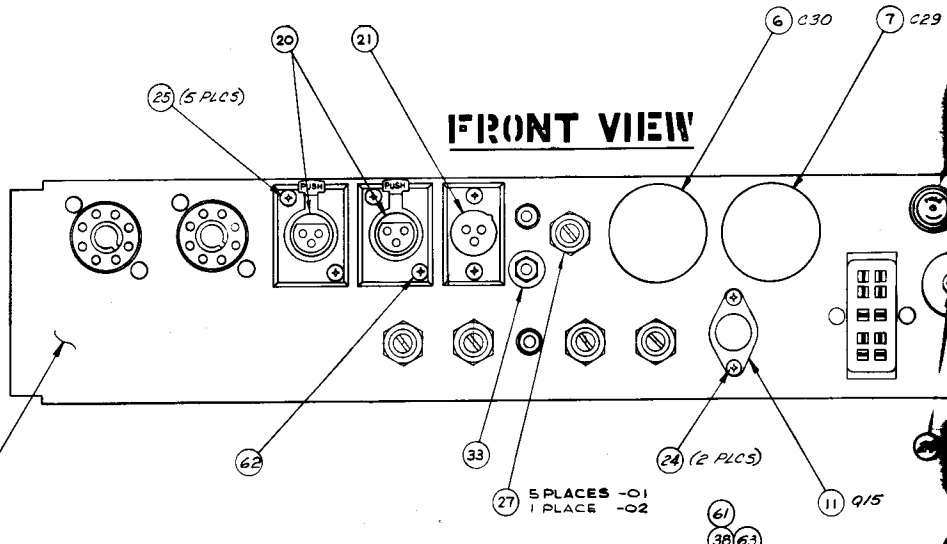
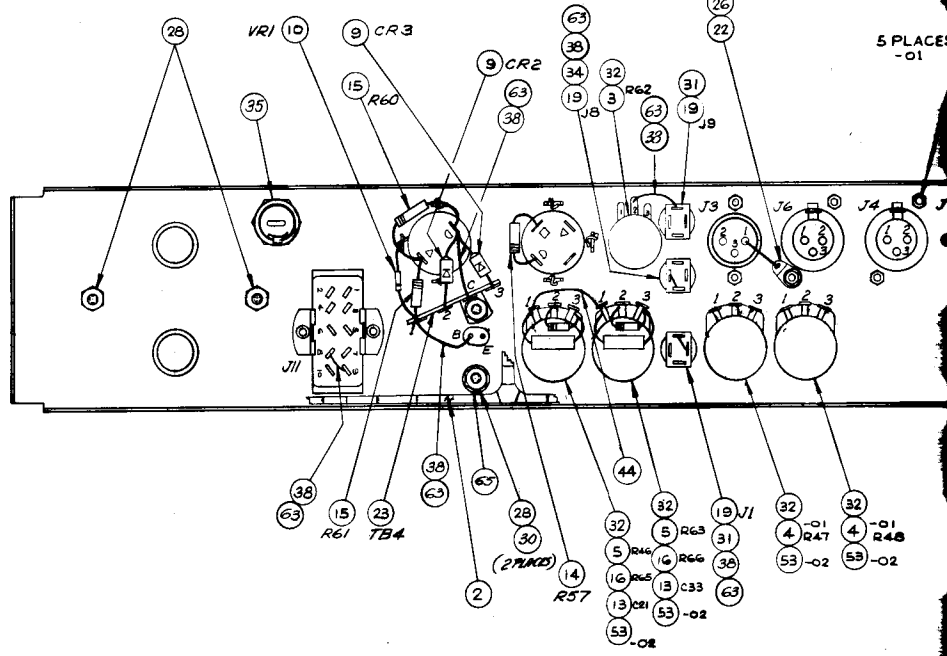


TABLE		
FROM	TO	
TERM	COMPON.	TERM
3	K1	5
3	TBI	3
1	TBI	3
11	TBI	1
2	K1	3
6	TBI	2

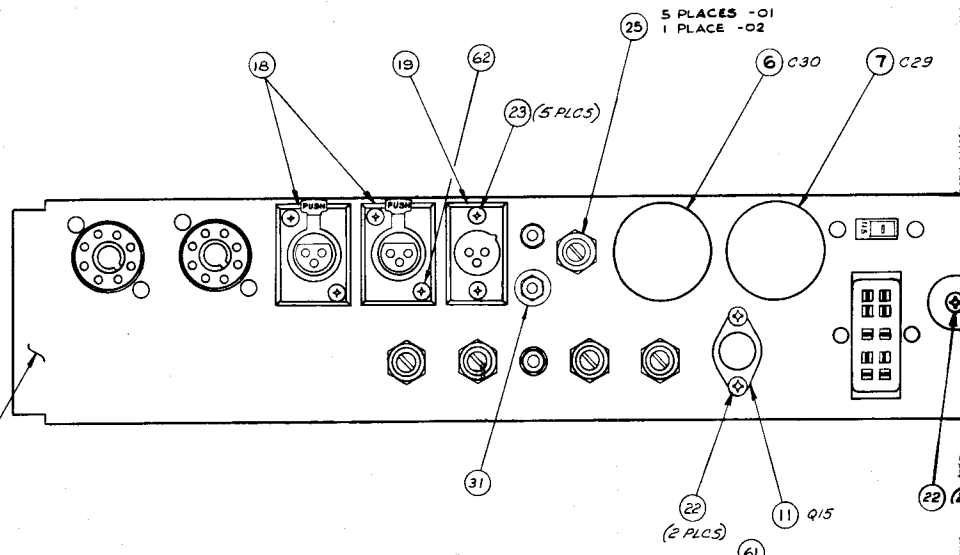
Fig. 7-16. Electronic Assembly



-01 SHOWN
3 3/4 TO 15 I.P.S.



FRONT VIEW

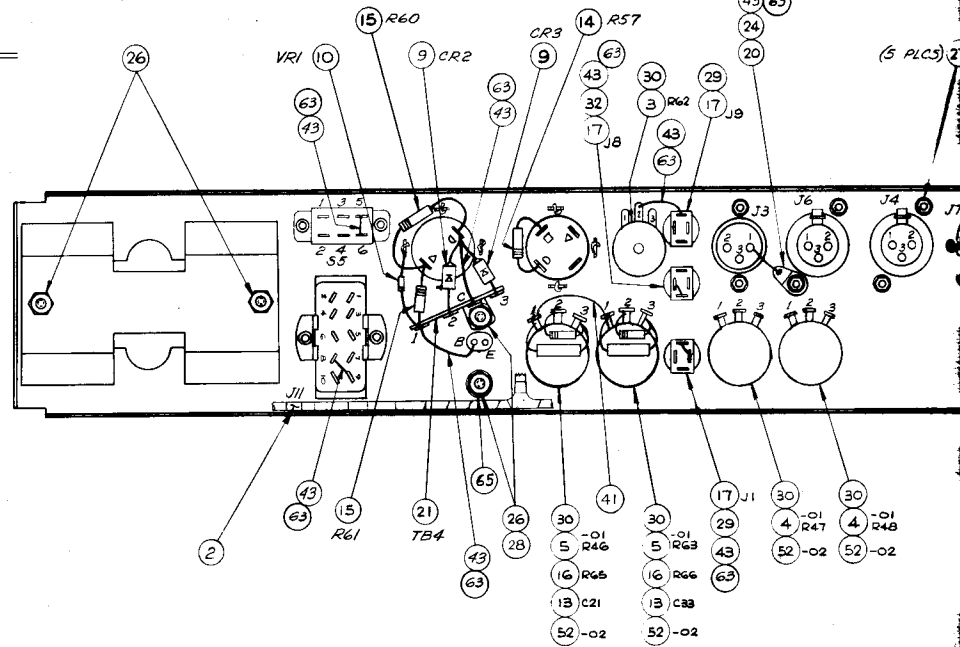


-01 SHOWN

3 3/4 TO 15 I.P.S.

REAR VIEW

ROTATED 180°



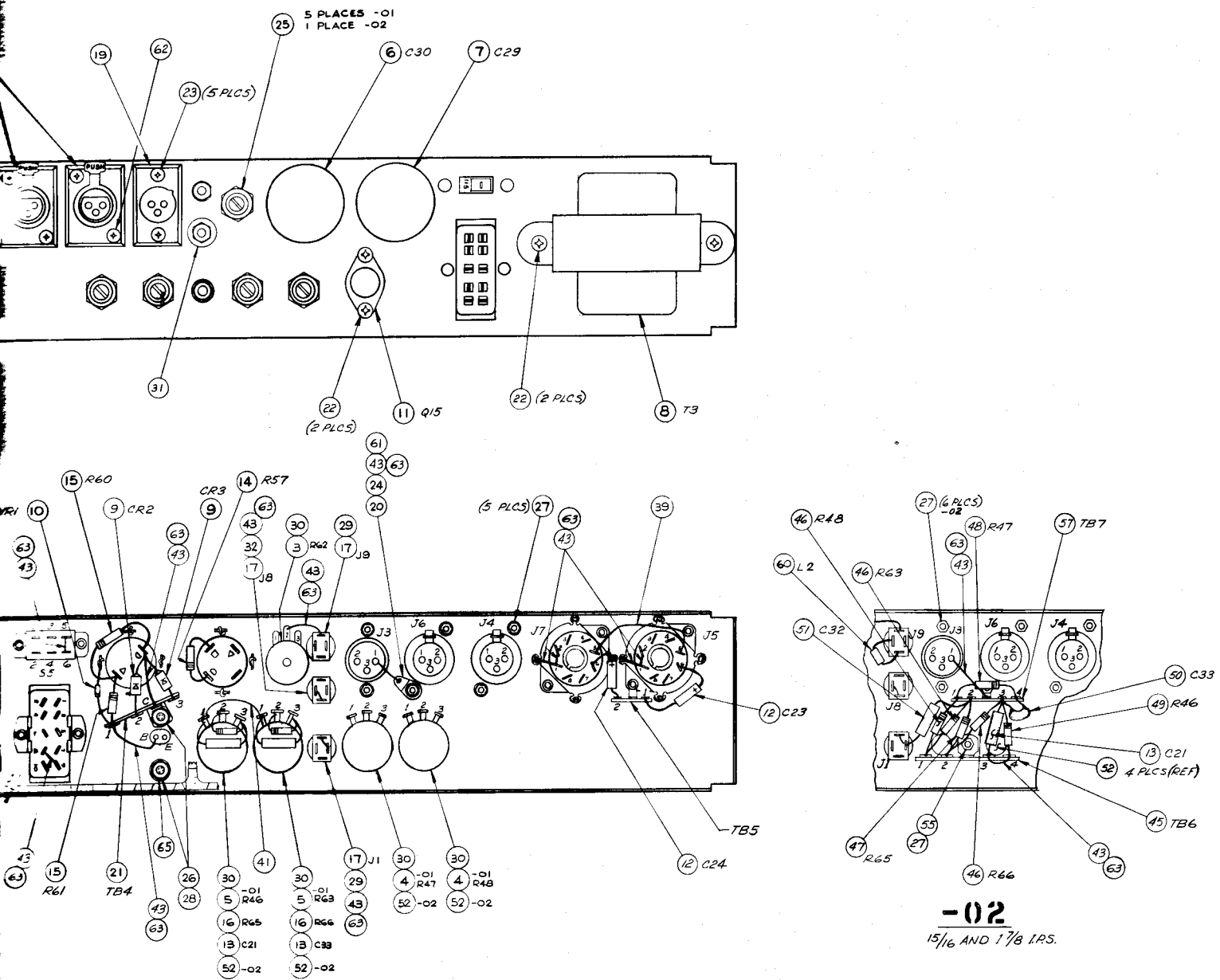
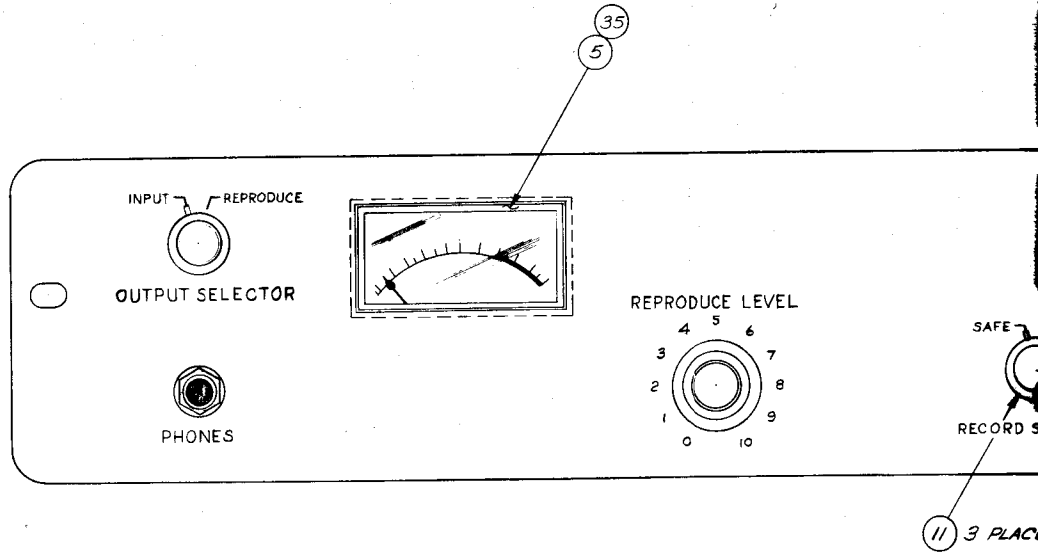
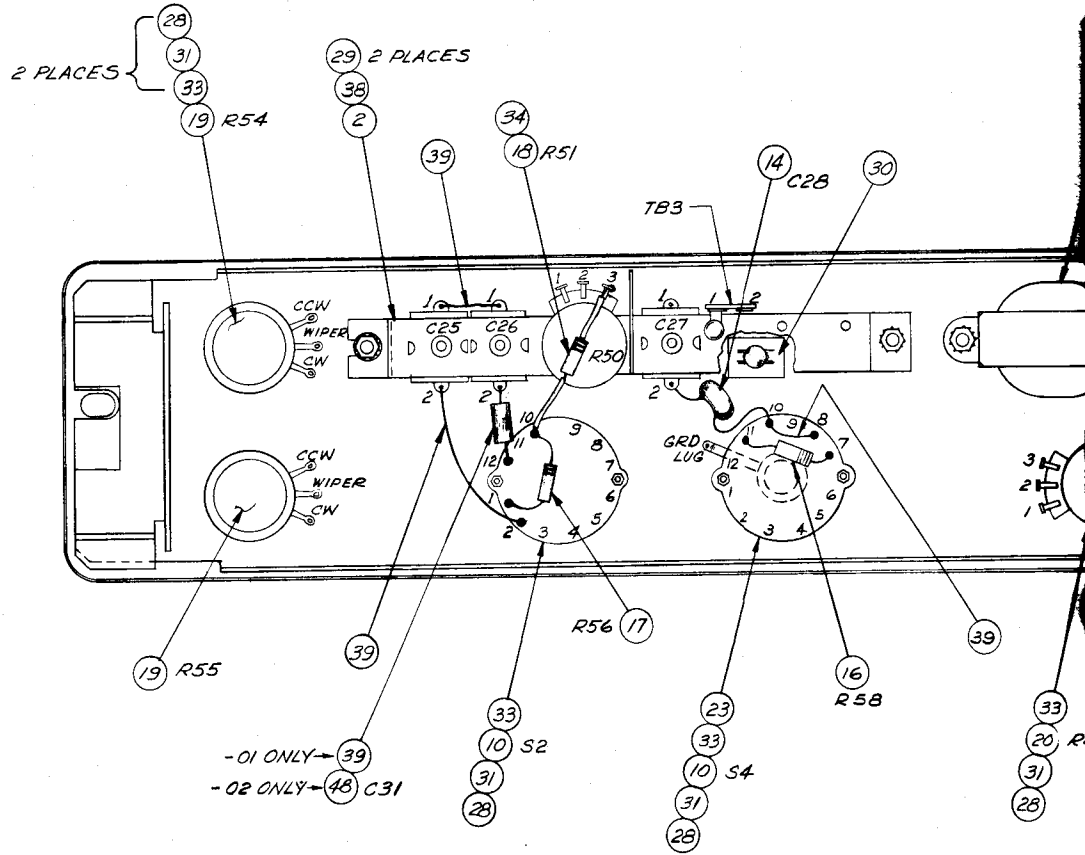


Fig. 7-18. Panel Assembly, rear (International)

FRONT

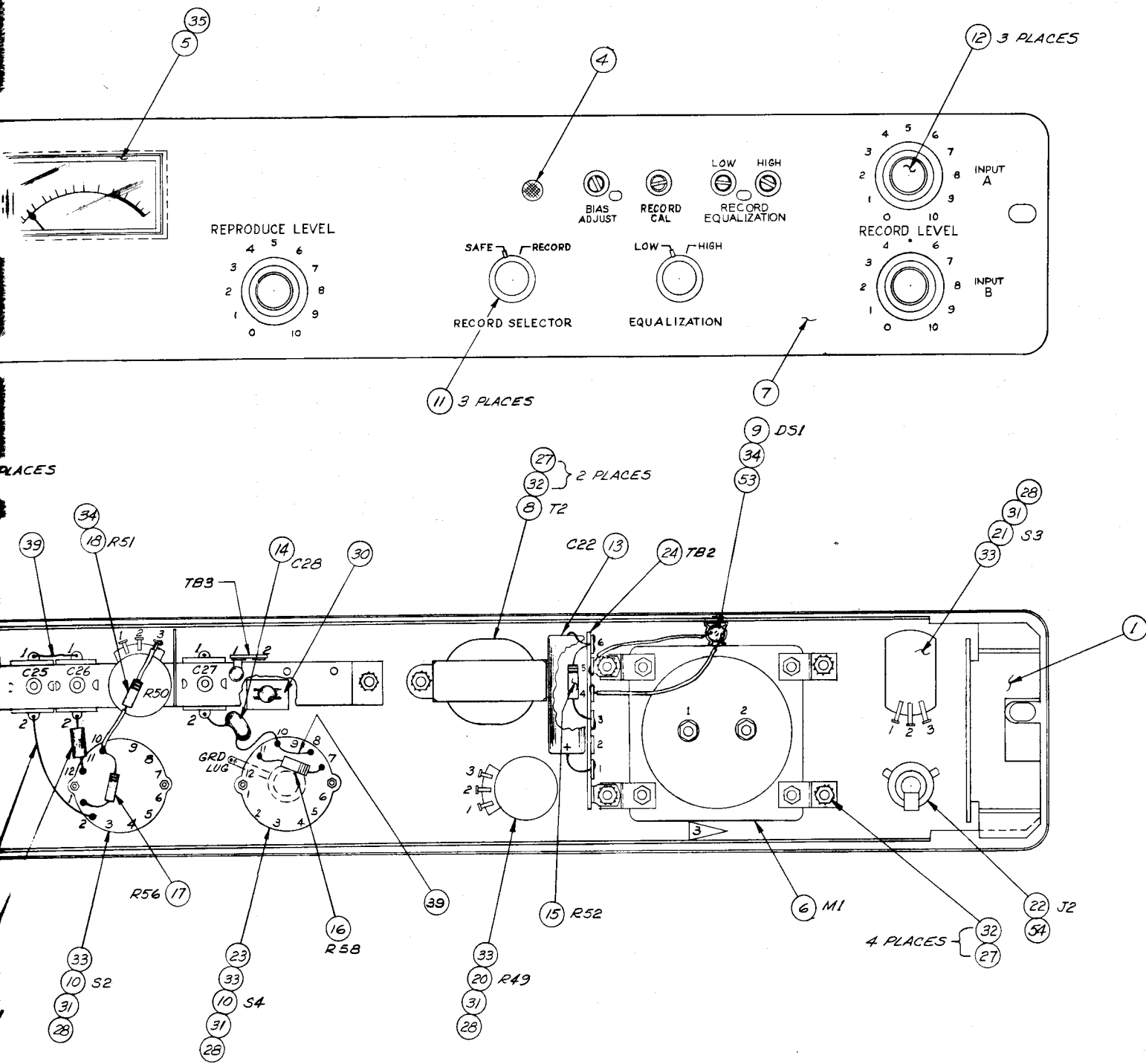


REAR
ROTATED 180°



-02 SHOWN

15/16 - 1 7/8 I.R.S.

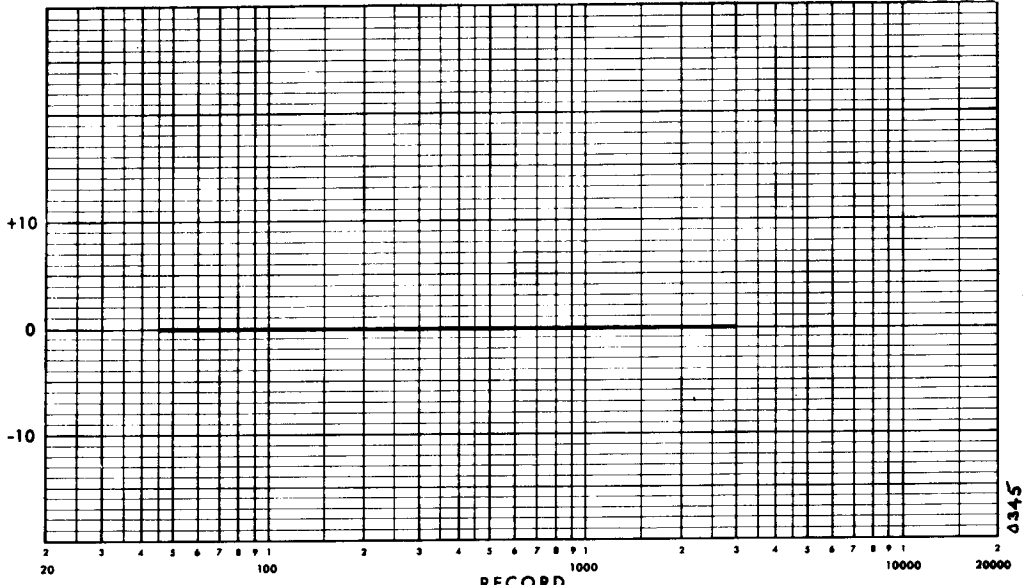


-02 SHOWN

15/16 - 1 7/8 I.P.S.

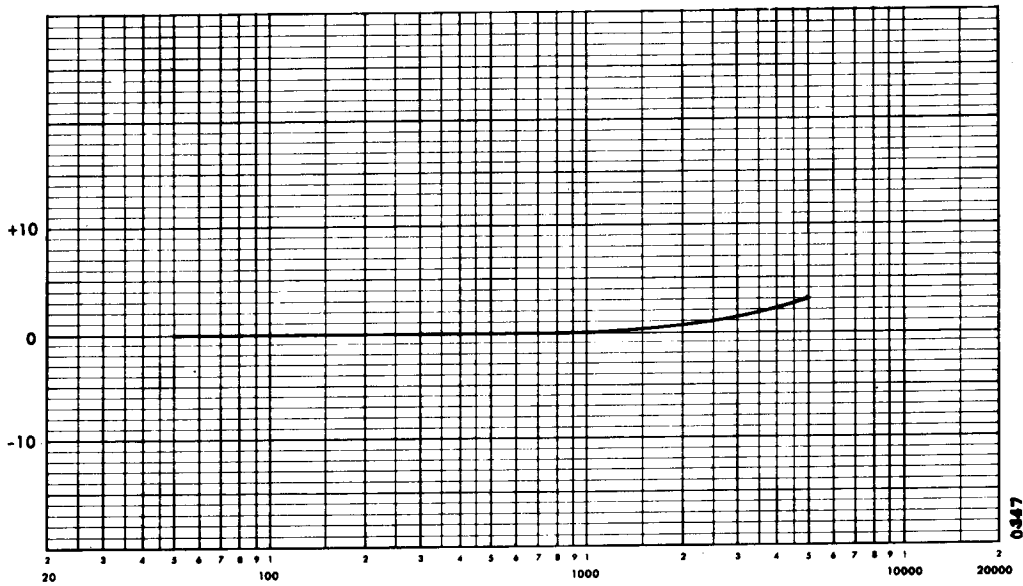
Fig. 7-19. Panel Assembly, front

RECORD



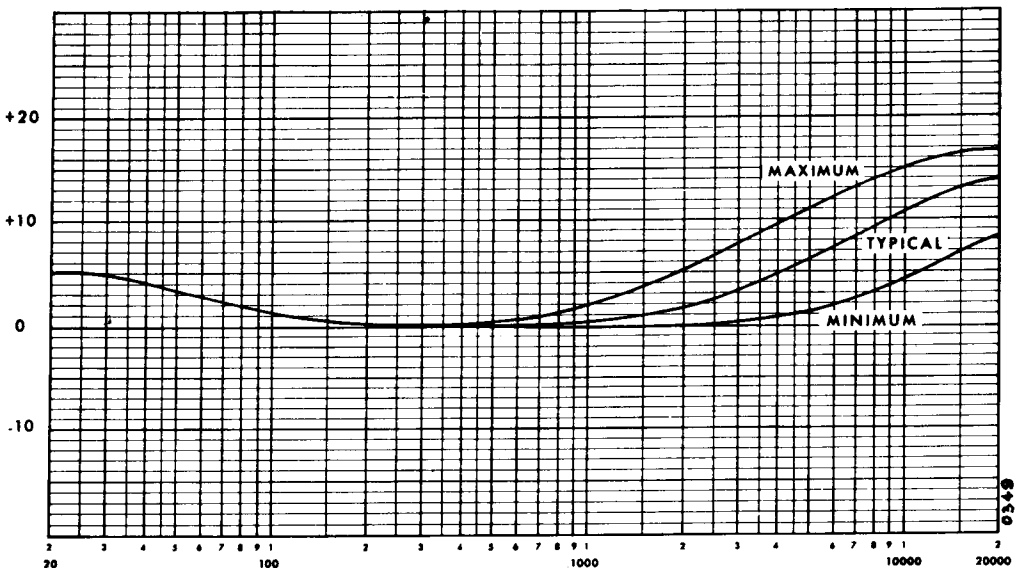
15/16 ips

RECORD

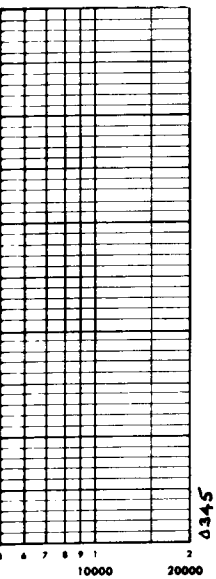


1-7/8 ips

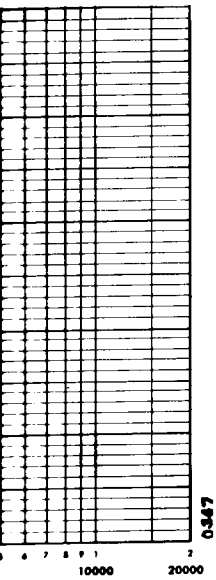
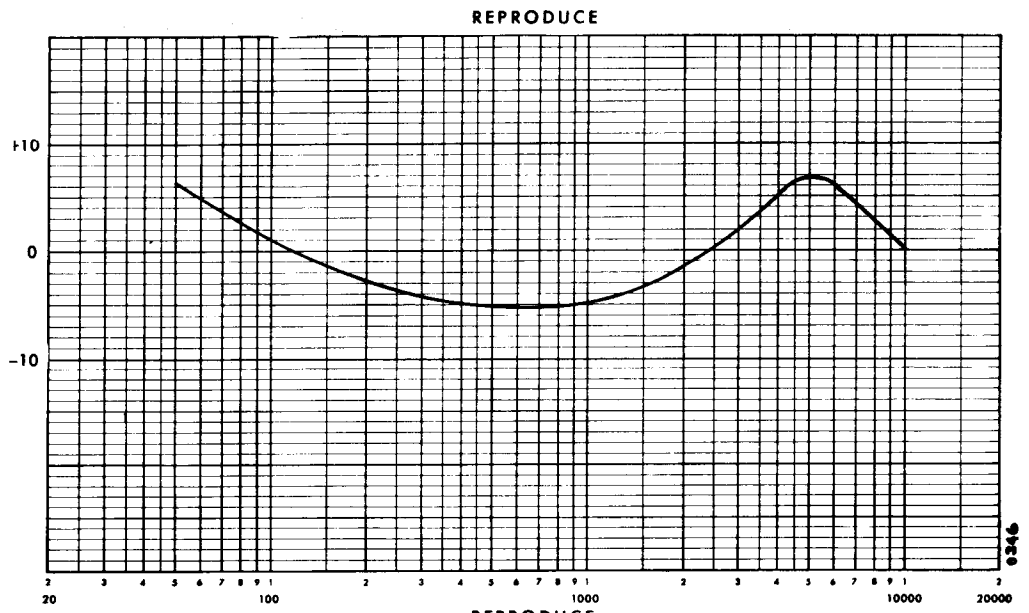
RECORD



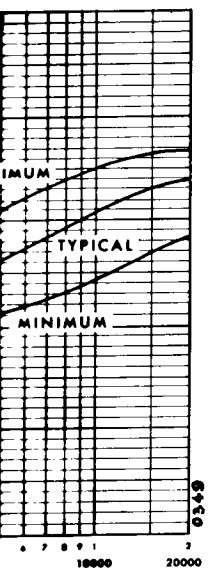
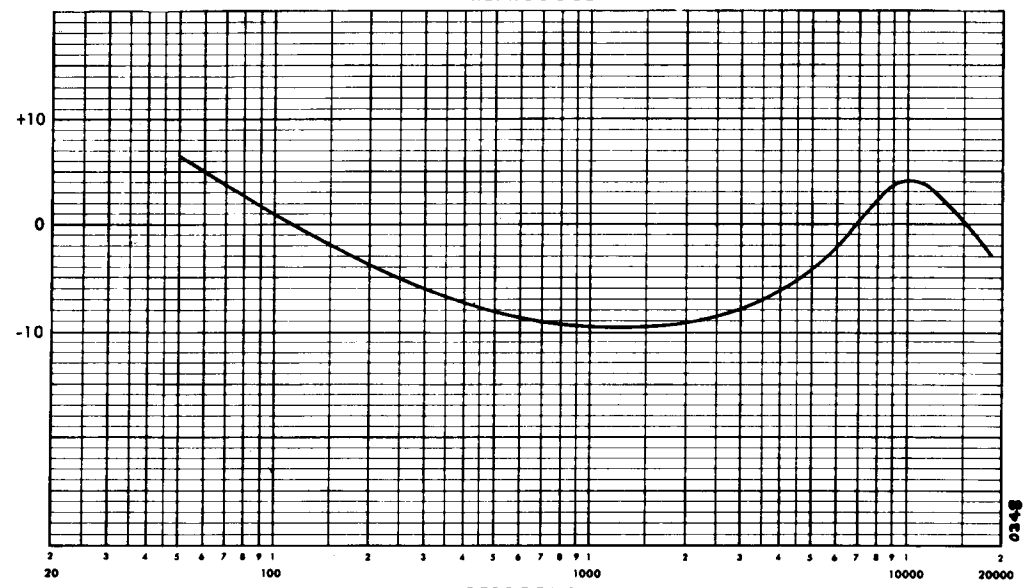
3 3/4 ips (200 usec)



15/16 ips



1-7/8 ips



3 3/4 ips (200 usec)

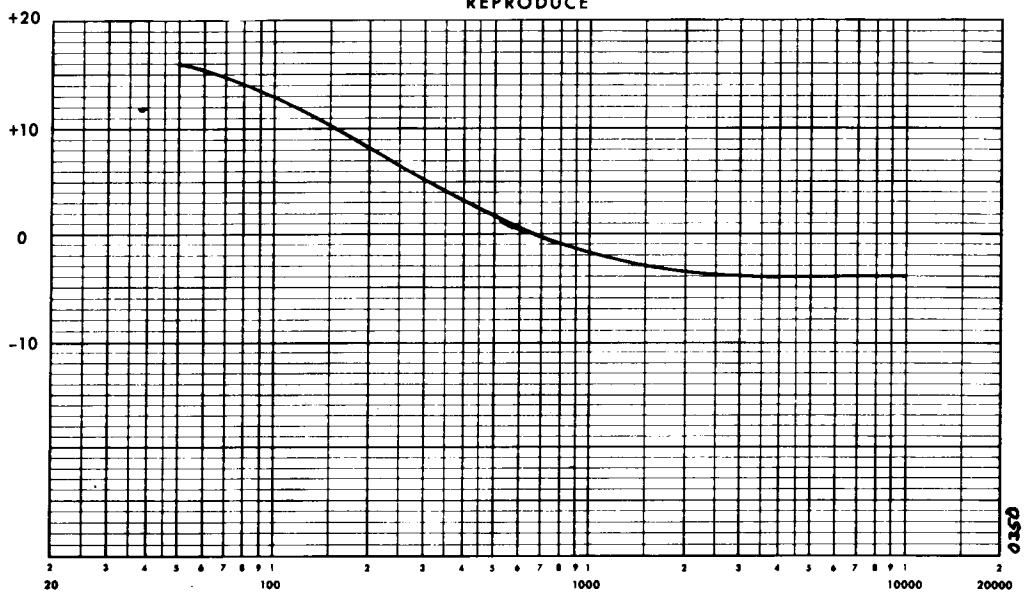
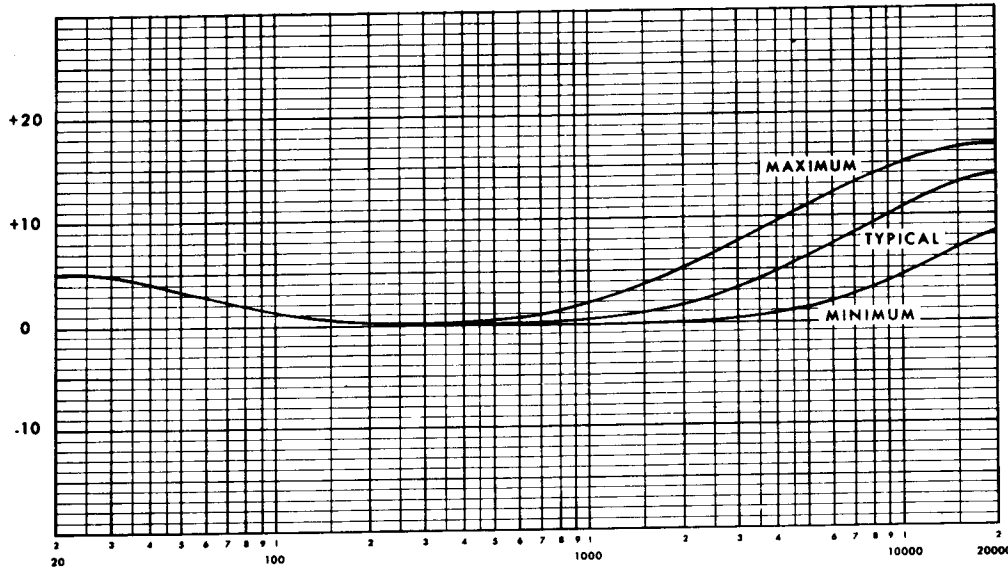


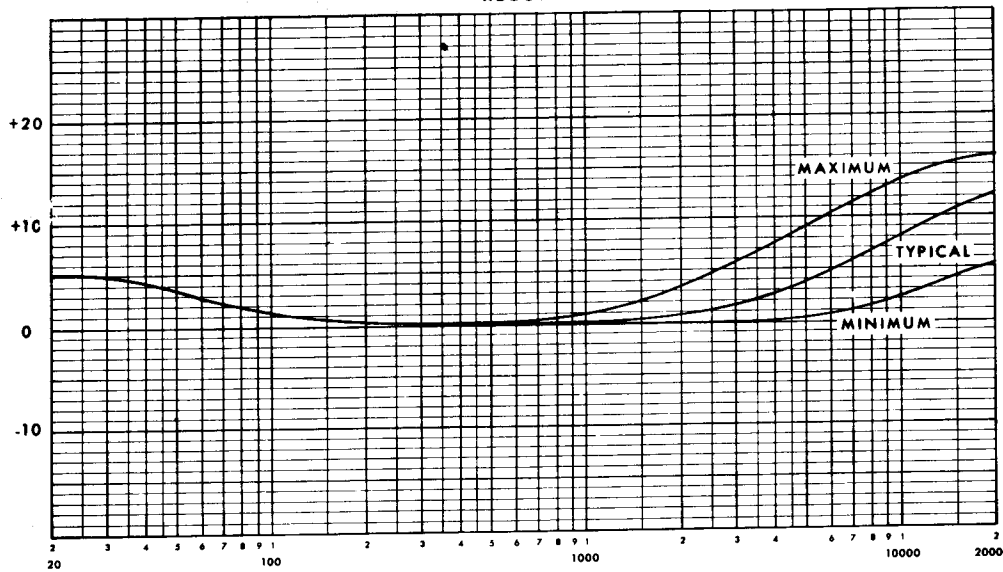
Fig. 7-20. Response Curves, Sheet 1

RECORD



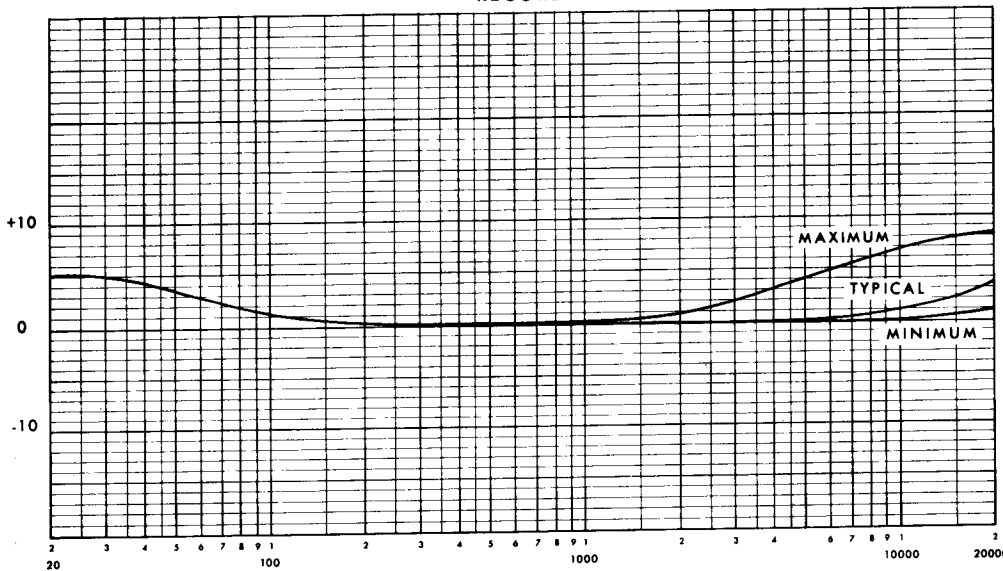
3 1/2 ips (120 usec)

RECORD

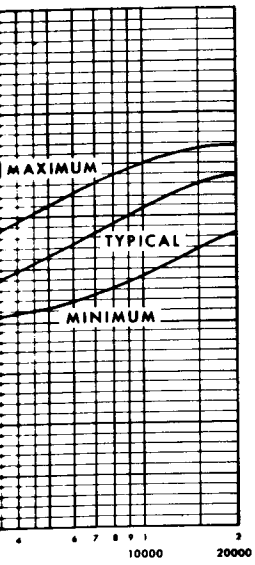


7 1/2 ips NAB

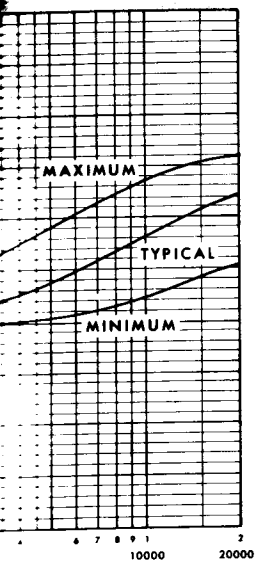
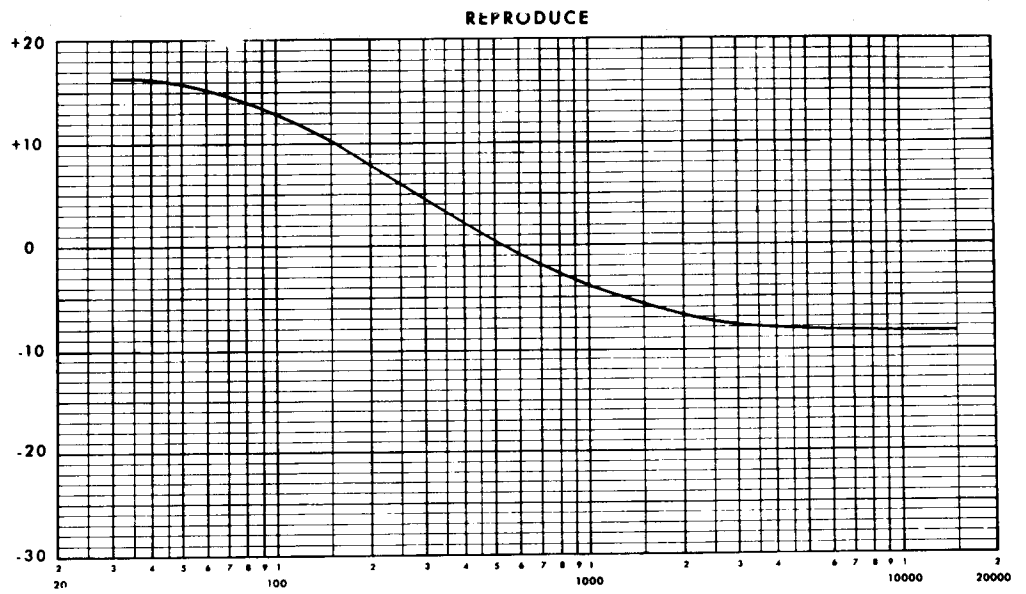
RECORD



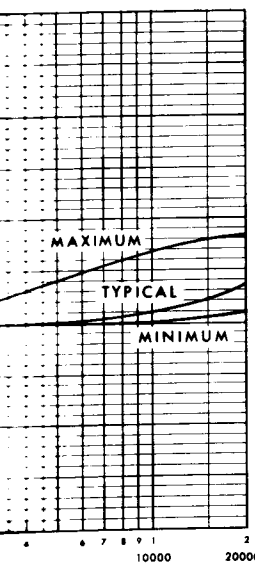
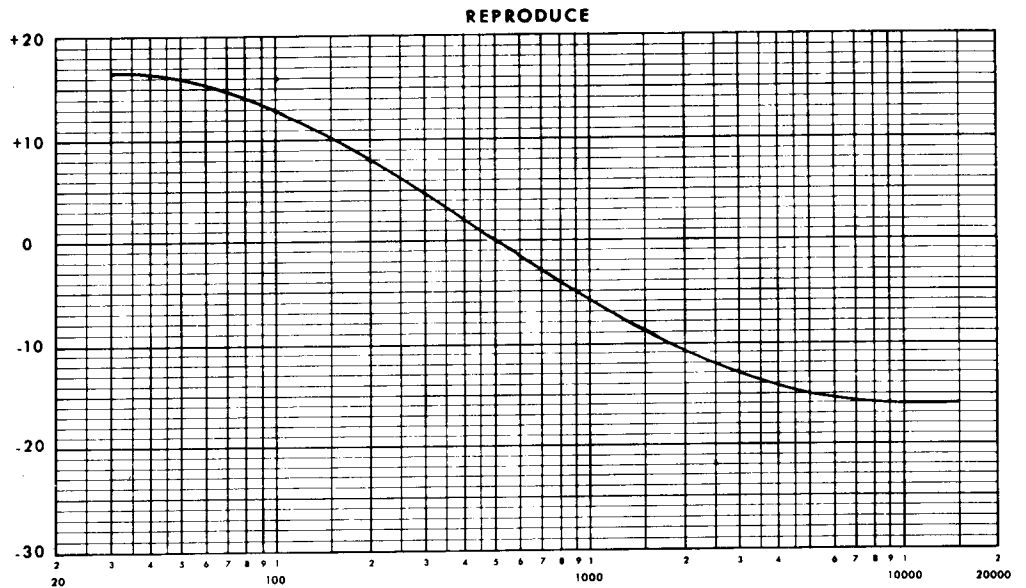
15 ips NAB



3 3/4 ips (120 usec)



7 1/2 ips NAB



15 ips NAB

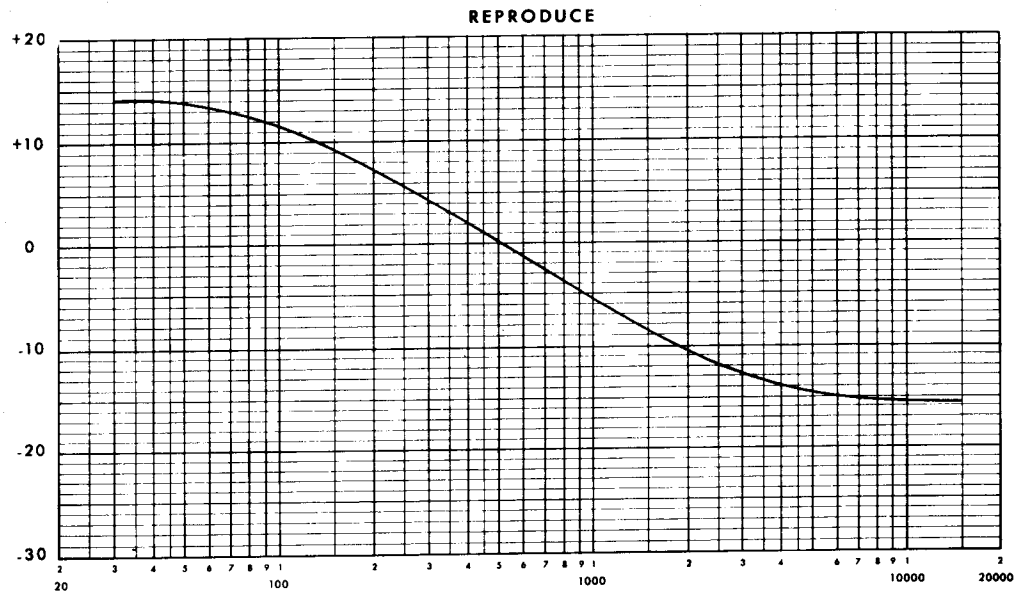
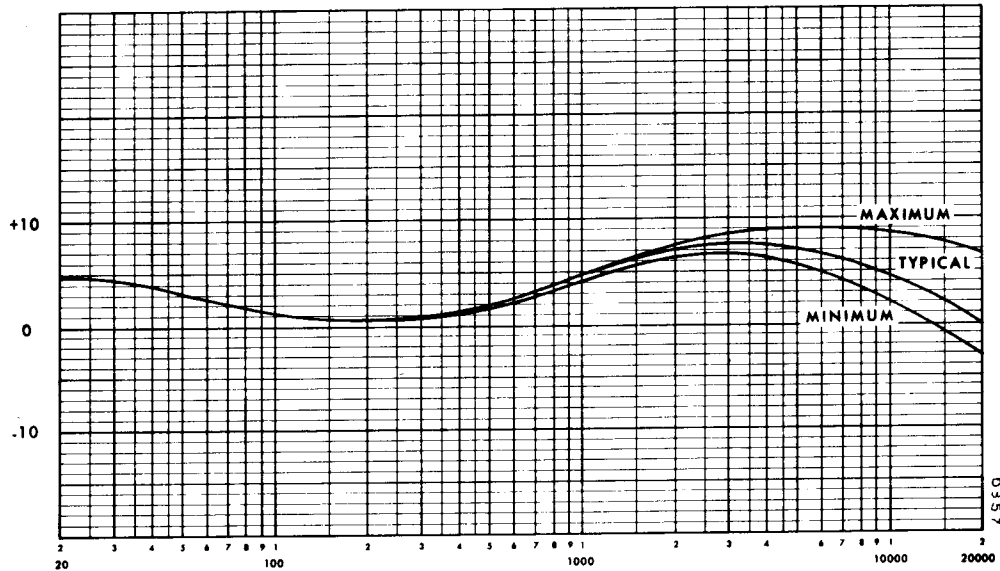
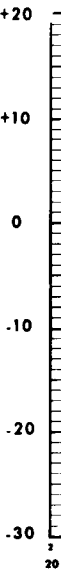


Fig. 7-21. Response Curves, Sheet 2

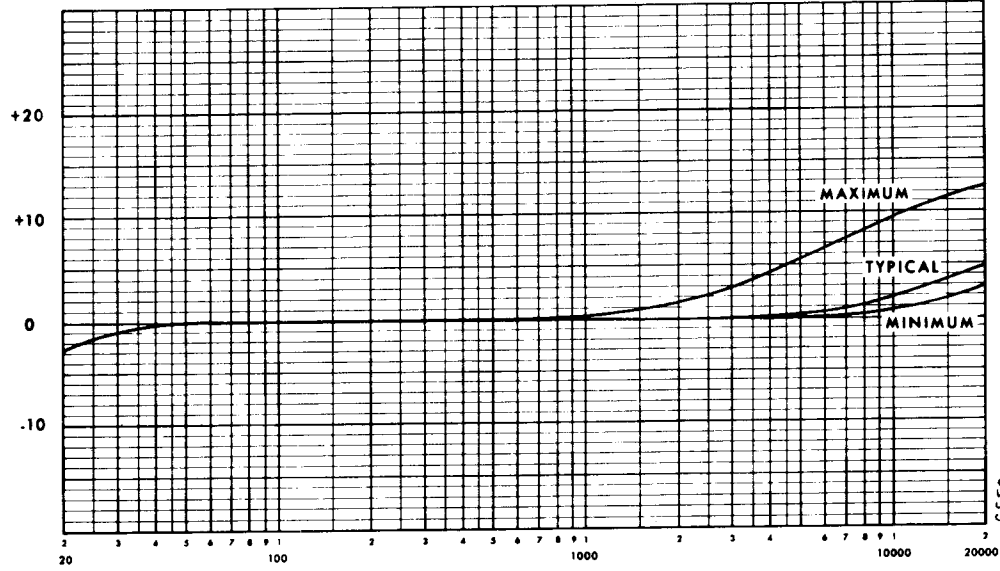
RECORD



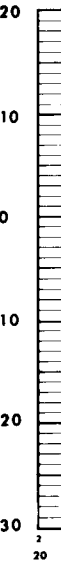
15 ips AME



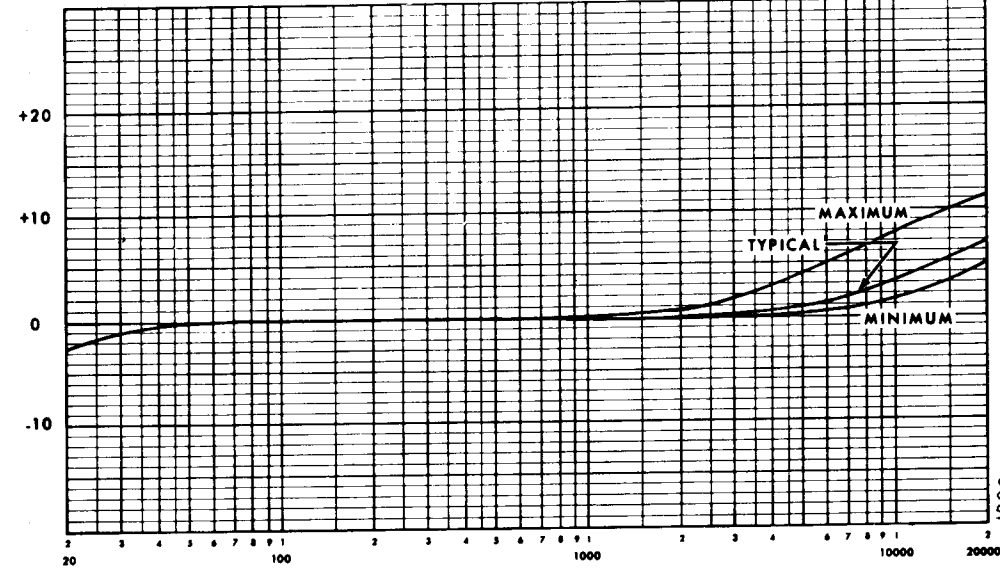
RECORD



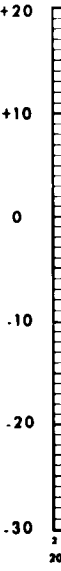
7 1/2 ips CCIR

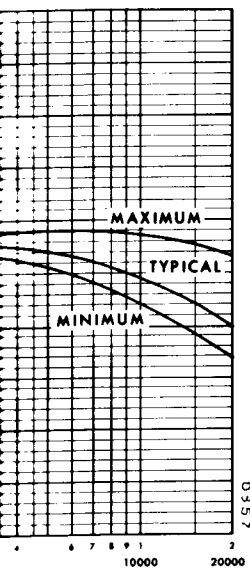


RECORD

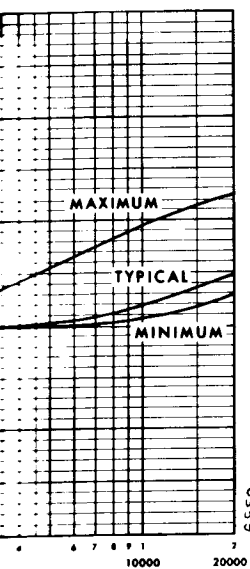
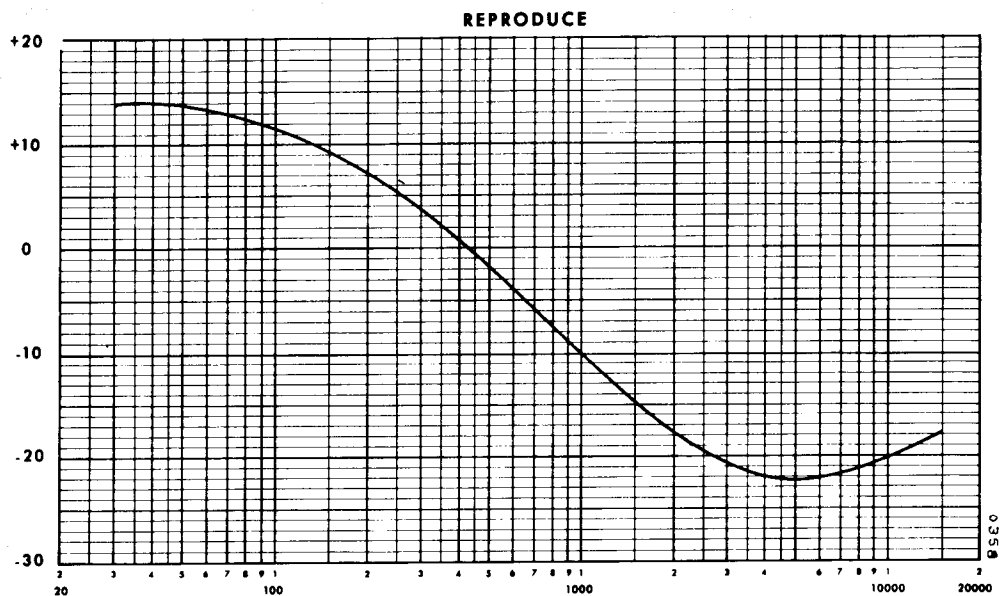


15 ips CCIR

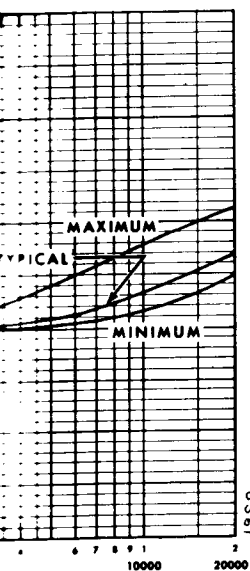
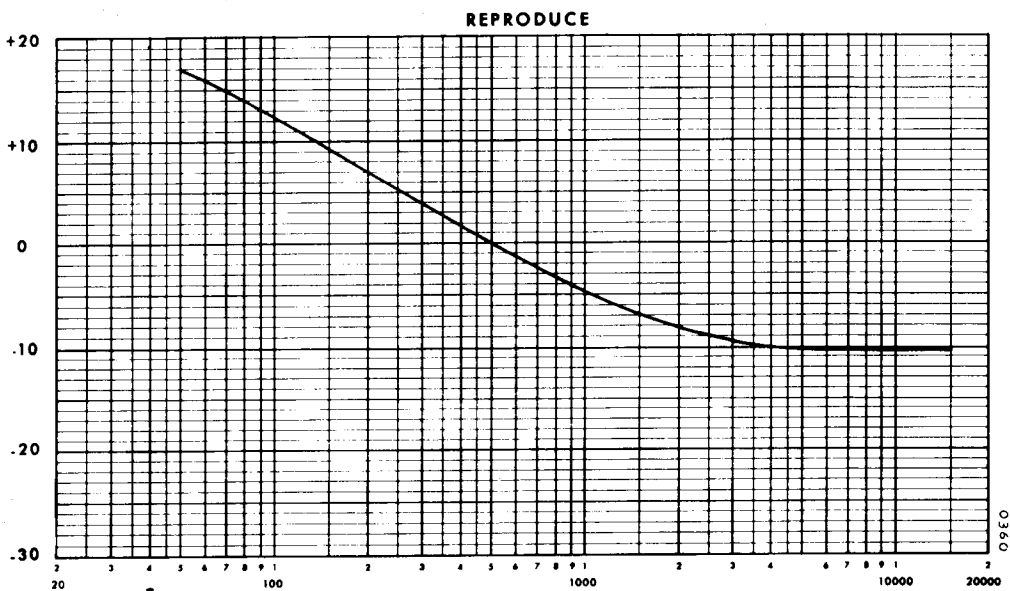




15 ips AME



7½ ips CCIR



15 ips CCIR

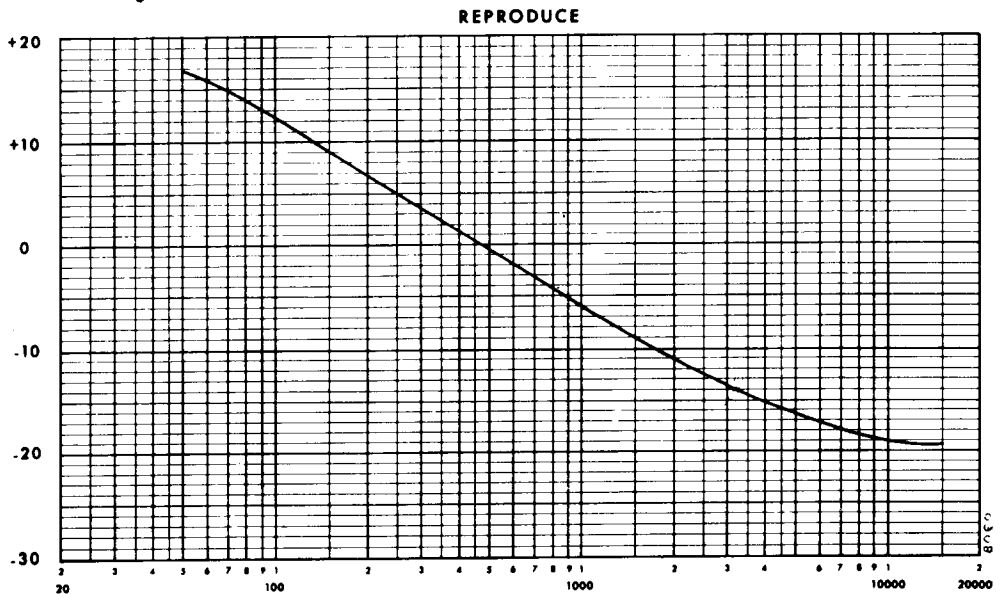


Fig. 7-22. Response Curves, Sheet 3

Rec'd 1/7/71 - No warranty card enclosed
AMPEX PROFESSIONAL AUDIO EQUIPMENT *File*

ONE YEAR WARRANTY

Congratulations and thanks. You now own the finest instrument of its kind in the world today. This equipment meets standards of performance, durability and reliability that surpass anything in its market. The warranty covering this equipment is valuable to you.

This warranty is effective when the warranty-registration card is fully and properly filled and returned to the factory within ten (10) days of delivery.

Before your unit left the factory, all phases of its performance were carefully checked by sensitive test instruments. This individual Ampex unit equalled or exceeded all current specifications for its model. Hence, if properly used, it should meet your most exacting requirements.

Should you experience difficulty in the operation of this equipment or should servicing of any kind be necessary, please contact the distributor from whom it was purchased.

If the equipment has been damaged in transit, you should report the fact immediately to your distributor.

Ampex reserves the right to modify or change the equipment, in whole or in part, at any time prior to delivery thereof, in order to include therein electrical or mechanical refinements deemed appropriate by Ampex, but without incurring any liability to modify or change any equipment previously delivered, or to supply new equipment in accordance with earlier specifications.

WARRANTY

Ampex warrants to the original using purchaser that all new Professional Audio Equipment shall be free from defects in workmanship and material under normal and proper use and service for a period of one year from date of delivery to original using purchaser and agrees to repair or replace all parts (except tubes, transistors, diodes, fuses, lamps and tape) thereof showing such defects, subject to all of the following provisions.

Ampex Warranty Obligation

- (a) Parts returned within 0-90 Days from Date Equipment Delivered to Original Using Purchaser - All such defective parts will be repaired or replaced at no charge for labor or materials;
- (b) Parts returned within 91-365 Days from Date Equipment Delivered to Original Using Purchaser - All such defective parts will be repaired or replaced at no charge for material and a labor charge equal to actual labor costs incurred in such repair or replacement.
- (c) In all warranty transactions the responsibility of Ampex shall be limited to making a new or factory-reconditioned replacement part available to the distributor; it is the responsibility of the distributor to repair or replace defective parts.

Conditions of Ampex Warranty

- (a) Defective equipment shall be returned, transportation prepaid, to the Ampex distributor from whom the equipment was originally purchased unless such distributor agrees to inspect or repair at purchaser's premises; and
- (b) For warranty service, purchaser must provide Ampex Distributor from whom equipment was bought, with purchase date along with model and serial number of equipment; and

- (c) Purchaser shall not have used or allowed to have been used in the equipment any parts not supplied by Ampex through its distributors (tape, vacuum tubes, transistors, diodes, fuses, and lamps excepted); and
- (d) Inspection shall disclose to Ampex's satisfaction that the defects are as above specified and that the equipment has not been altered or repaired by other than factory approved procedures, subjected to negligence, misuse or accident, or damaged by excessive current or otherwise, or had its serial number or any part thereof altered, defaced or removed.

Exceptions to Ampex Warranty

- (a) Tubes, transistors, diodes, fuses, lamps, and tapes are hereby excluded from the provisions of this warranty (as to these items, no warranty, expressed or implied, is made by Ampex);
- (b) Replacement parts supplied under this warranty carry only the unexpired portion of the original warranty.

Sole Warranty

This warranty is expressly in lieu of all other warranties, expressed or implied, and all other obligations or liabilities on the part of Ampex. No person, including any distributor, agent or representative of Ampex, is authorized to assume for Ampex any liability on its behalf or in its name except to refer purchasers to this warranty. In no event shall Ampex be liable for claims, demands or damages of any nature, however denominated; Ampex's sole warranty liability shall be to repair defective items or to supply replacement parts in accordance with the terms of this warranty.

AMPEX

AMPEX CORPORATION, 401 BROADWAY, REDWOOD CITY, CALIFORNIA