

RECORDER

KS-19829

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-19829 recorder used with the Stored Program Control No. 1A for common systems.

1.02 The KS-19829 recorder (Fig. 1) is a magnetic tape recorder designed specifically for digital recording (writing and reading) of binary coded data; this recorder consists of a tape transport and a control unit. The recorder is available for use in two versions, identified by list numbers, differing only in power requirements as specified below.

(a) For operation from a 208-volt (± 10 percent), single-phase, 60-Hz ac power source, use the KS-19829 L1 transport and the KS-19829 L2 control unit

(b) For operation from a 117-volt (± 10 percent), single-phase, 60-Hz ac power source, use the KS-19829 L3 transport and the KS-19829 L4 control unit

The tape transport (Fig. 1 and 2) contains the tape-drive mechanism and a 9-track read-write magnetic head assembly; the control unit contains the control electronics and the dc power supplies. The dc voltage, ± 12 and ± 24 volts, necessary for the recorder electronics are developed internally. Both units are mutually dependent and function as a unit although either can be replaced independently of the other. L1 and L3 transports as well as L2 and L4 control units are *not* interchangeable because of the different operating power requirements.

1.03 The tape transport is designed to handle 1/2-inch wide, 1-1/2 mil thick, polyester base, magnetic tape on a 10-1/2 inch reel. The supply reel turntable and reel retainer assembly is arranged to accept reels with hub and flange configurations as specified by the United States of America Standards Institute (USASI). The take-up reel is

fixed and is not designed for removal during normal operation.

1.04 Provisions are made in the recorder to sense the presence of beginning-of-tape and end-of-tape markers on the tape. Use magnetic recording tape equipped with photoreflexive markers in accordance with USASI requirements.

Caution: *Use only fresh, computer-grade magnetic tape for all uses including initial tests and adjustments. An inferior grade of tape can seriously contaminate the vacuum system and tape path components.*

1.05 Section 020-010-711 covers general requirements and definitions for additional information necessary for the proper application of the requirements described in Part 2.

1.06 The requirements in Part 2 are given in the recommended sequence for a complete mechanical check of the recorder. Each procedure in Part 3 is numbered to correspond with the requirement in Part 2. Reference should be made to Part 3 when it is necessary to make adjustments.

Warning: *Hazardous voltage is supplied to recorder. Unless otherwise specified, disconnect electrical power to prevent injury to personnel or damage to the equipment.*

1.07 Before any adjustment, lubrication, or cleaning operations are performed, the equipment must be removed from service in accordance with local instructions. The recorder must be placed in the manual control condition if power is required to perform checking and adjusting operations.

1.08 Refer to Section 034-368-801 for piece-part replacement procedures when requirements in this section cannot be met due to worn, broken, or otherwise faulty parts.

TAPE TRANSPORT
KS-19829 L1 (208 VAC)
KS-19829 L3 (117 VAC)

CONTROL UNIT
KS-19829 L2 (208 VAC)
KS-19829 L4 (117 VAC)



Fig. 1—KS-19829 Recorder

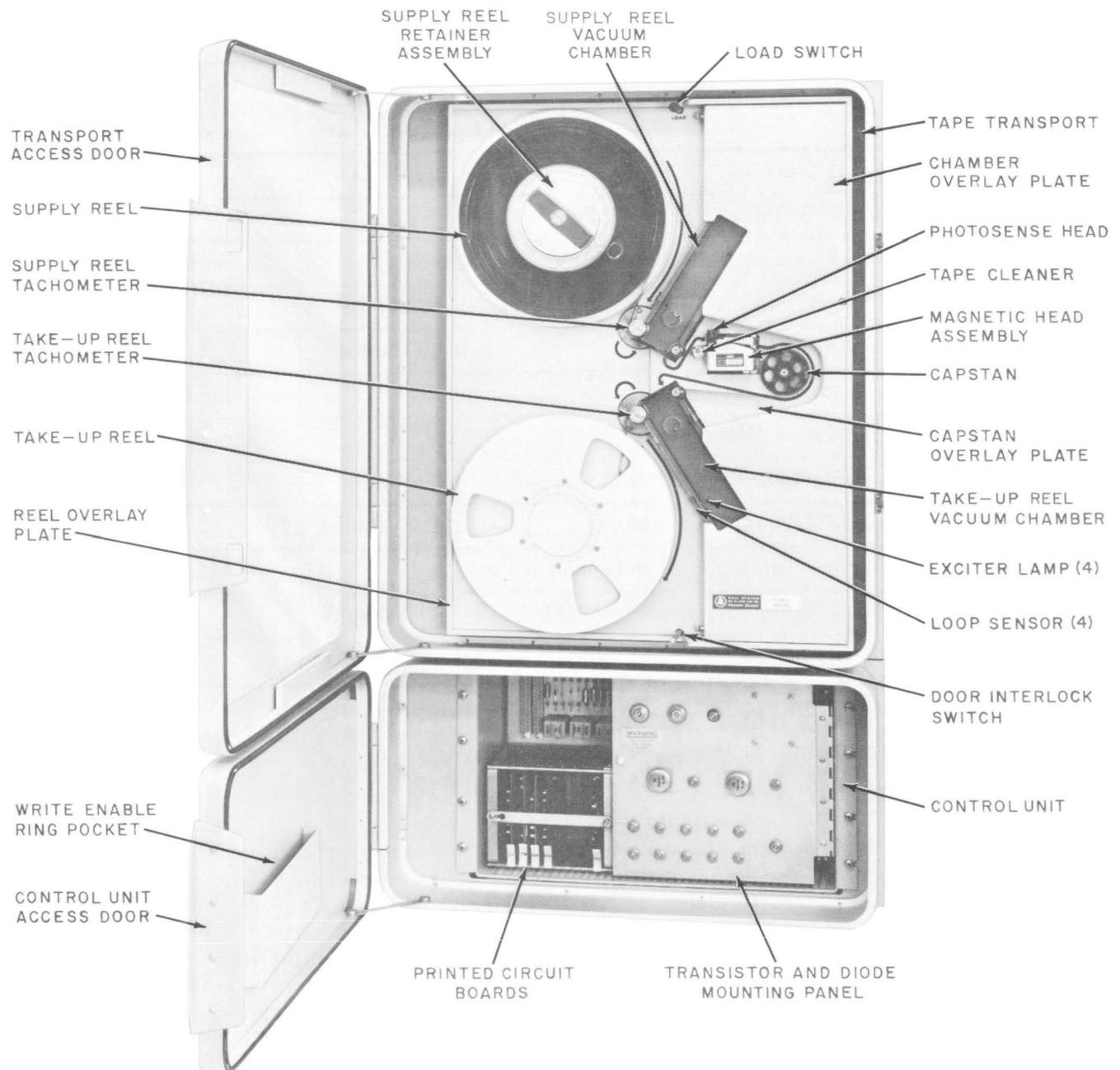


Fig. 2—KS-19829 Recorder—Front View with Access Doors Open

2. REQUIREMENTS

2.01 A program of planned preventive maintenance will help prevent unscheduled downtime. Refer to Table A for the recommended schedule of preventive maintenance.

2.02 Cleaning

(a) **General Cleaning:** The entire recorder housing should be given a general cleaning once weekly. The equipment, front and rear, shall be free of oil, grease, and dust. Oil or grease should be removed from painted surfaces

TABLE A
SCHEDULE OF PREVENTIVE MAINTENANCE

MAINTENANCE OPERATION	INTERVAL	
	STANDBY AND IN USE	TAPE IN MOTION
General Cleaning	200 hours	
Clean Tape Path		8 hours
Clean Tape-Cleaner Cartridge		120 hours
Replace Vacuum Unit Filter†	800 hours	
Check Reel Brake Tension	800 hours	
Check Reel Brake Linings†		4000 hours
Replace Reel Motor Brushes†		5000 hours
Check Vacuum Unit Motor Brushes†	800 hours	
Replace Vacuum Unit Motor†	4000 hours‡	
Replace Capstan and Reel Tachometers†		30,000 hours
Replace Photosense Head Assembly†	10,000 hours	
Replace Loop Sensor Assemblies†	10,000 hours	

† Refer to Section 034-368-801 for replacement procedures.

‡ Vacuum unit motor in use.

as soon as practical to prevent discoloration of the finish.

Caution: *When performing maintenance operations, exercise care to avoid damage to the magnetic head assembly. Gently raise and lower the head cover to prevent flattening the head cover stop.*

(b) **Tape Transport:** The magnetic head assembly (Fig. 3), capstan, tachometer pulleys, vacuum chambers (including glass covers, photocells, and exciter lamp windows), tape guides, and photosense head shall be free of dust, film, tape oxide, and all other foreign material.

(c) **Tape Cleaner:** Accumulated tape oxide shall be removed from tape cleaner after each period of 120 hours of tape running time.

(d) **Transport Access Door:** The plastic transparent window of the transport door (Fig. 2) shall be free of dust and finger smudges.

(e) **Vacuum Unit Filter:** The filter element, located inside the vacuum unit muffler (Fig. 4), shall be replaced in accordance with Table A. Ordering information for the filter is given in Section 034-368-801.

Caution: *Failure to replace a dirty filter element can cause dirt and dust to contaminate the sound proofing material in the muffler. This condition restricts the flow of air, resulting in degradation of vacuum chamber performance.*

2.03 Lubrication

(a) The tape transport and the control unit do not require lubrication.

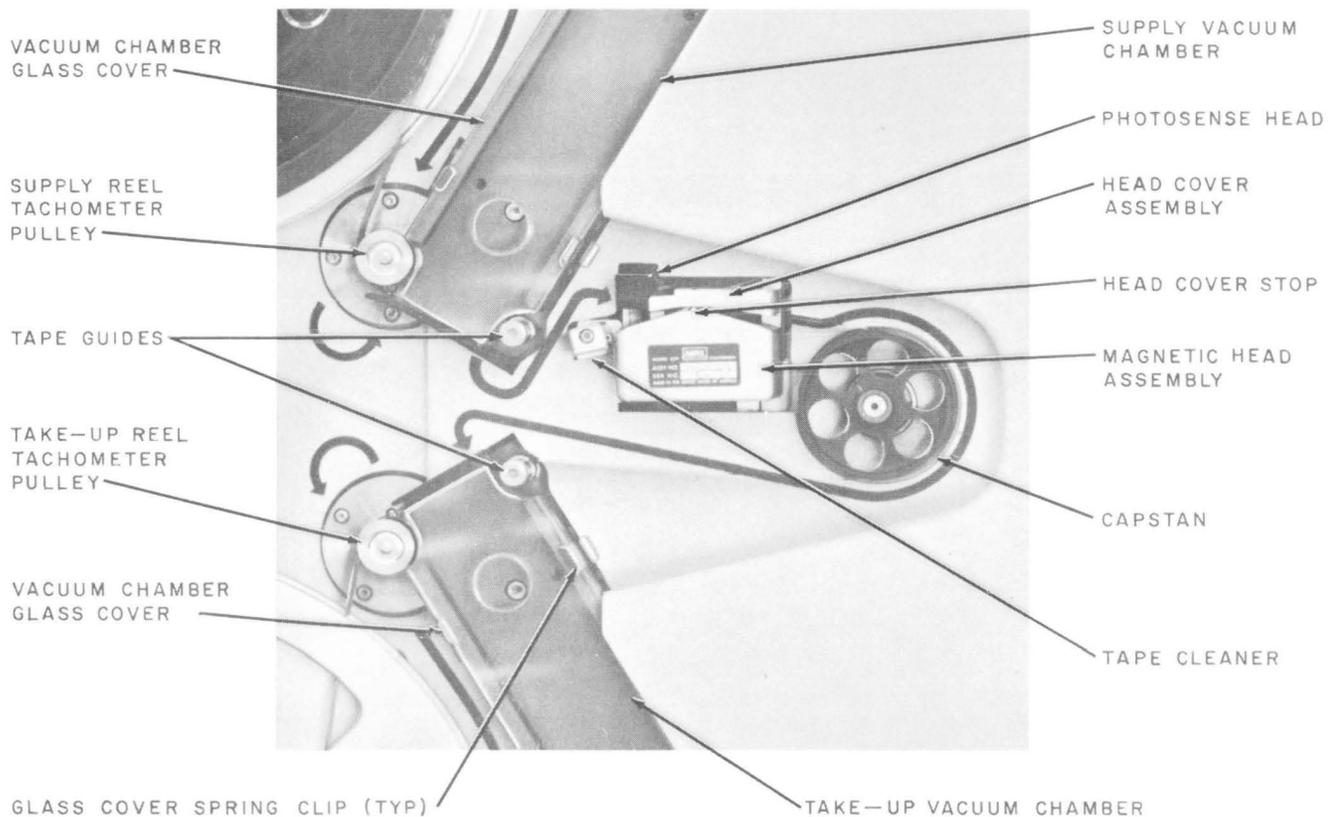


Fig. 3—Partial Front View of Tape Transport Showing Tape Path Components

(b) The transport access door hinge assembly and the mounting panel hinge should be lubricated at 6-month intervals.

2.04 Demagnetization: All ferrous parts and components in the tape path are demagnetized by the manufacturer and should require no further attention.

2.05 Reel Brake Torque (Tension) for Supply and Take-Up Reels: Braking requirements on each reel shall be measured while power is applied to the reel brake. Requirements to be met are shown in Table B. Use the 79B gauge. To check the tension requirement of either reel, proceed as follows.

(1) Wrap one end of a nylon cord several turns clockwise around the hub of the empty reel (Fig. 5).

(2) Attach the 79B gauge to a loop in the free end of the cord.

Note: Before using the 79B gauge, refer to Section 020-010-711 for information pertaining to the proper application of the gauge.

(3) Pull out LOAD switch operating rod (Fig. 2) and apply power to the recorder.

(4) Pull the tension gauge (Fig. 5) in a direction in line with the wraps of cord on the reel hub. Pull smoothly and steadily until the reel rotates and, with the reel turning smoothly, observe the gauge reading.

2.06 Control Unit Power Supply: The control unit contains a power supply which provides +12 and -12 volts of power for the control unit. Potentiometers located on printed circuit board PSD (Fig. 6) are used to regulate the voltage. Potentiometer R9 regulates +12 volts and

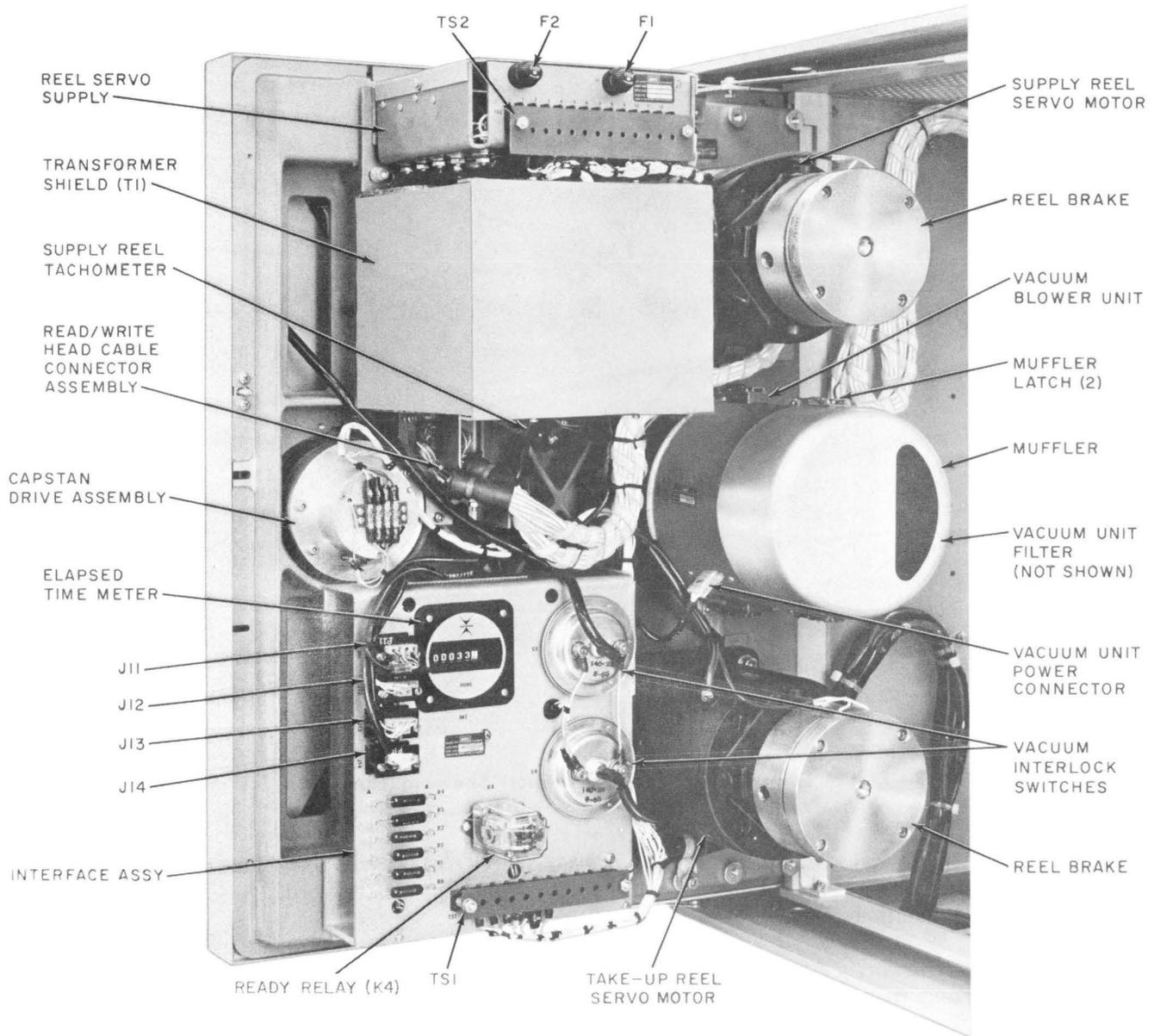


Fig. 4—Tape Transport—Rear View

TABLE B
REEL BRAKE TENSION

TYPE OF REEL	TENSION (GRAMS)		
	MIN	NOM	MAX
Take-Up Reel	350	375	425
Supply Reel	325	350	400

potentiometer R23 regulates -12 volts. These voltages, measured at TP2 as described in (a) and (b), shall be within the following limits.

+12 volts $\pm 1.0\%$ (+11.88 to +12.12)

-12 volts $\pm 1.0\%$ (-11.88 to -12.12)

Using the volt-ohm-milliammeter, check the requirements as follows.

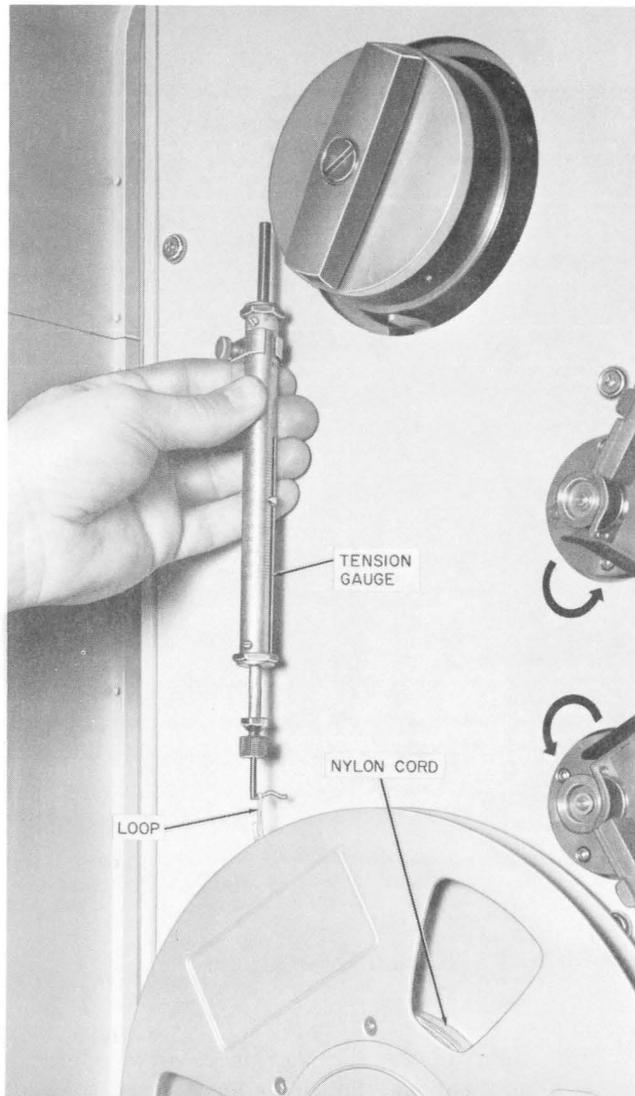


Fig. 5—Measurement of Reel Brake Tension—Typical

- (a) Using TP2-35 as the 0-volt reference, measure voltage between TP2-29 and TP2-35. This will indicate voltage as regulated by potentiometer R9.
- (b) Using TP2-35 as the 0-volt reference, measure voltage between TP2-32 and TP2-35. This will indicate voltage as regulated by potentiometer R23.

2.07 Capstan Speed and Servo Adjustments:

Tape speed across the magnetic head assembly is dependent upon the peripheral speed of the capstan. With tape loaded on the recorder, the

capstan shall rotate at 46.3 ± 0.5 rpm in both forward and reverse modes of operation. This speed corresponds to a tape speed of 5 inches per second ($\pm 1\%$). Preliminary adjustment of servo controls and checking capstan speed is accomplished by performing the following procedure.

- (1) Apply power to the recorder and install a reel of tape, looping the tape around the head assembly. **Do not place the tape around the capstan.** Provide sufficient tape within the vacuum chambers to form proper loop lengths.
- (2) Remove power from the recorder.
- (3) Using a KS-6854 screwdriver, turn adjustment screw of potentiometers 1R11 and 2R11 on reel servo printed circuit board RSA (Fig. 6) fully clockwise; then back off six turns counterclockwise.
- (4) Connect patching cords at TP2 as follows:
 - TP2-14 to TP2-15
 - TP2-21 to TP2-22
- (5) Apply power to the recorder.
- (6) Program the recorder for forward operation and permit the capstan to rotate for a few seconds.

(7) Program the recorder for stop. In this mode, the capstan shall not creep. If the capstan is creeping, adjust R33 on the capstan servo printed circuit board CSN (Fig. 6) until the creeping stops.

(8) Carefully grasp the capstan and turn it by hand gently. The capstan will turn easily up to a certain velocity, above which rapidly increasing resistance will be felt due to servo action. Adjust R33 until the velocity at which the servo action commences is the same both in forward and reverse. The capstan servo is then set up to be in the middle of the dead band during the standby condition of the recorder. This completes adjustments preliminary to measuring the speed of the capstan.

(9) Now finish threading the tape on the transport by placing the tape around the capstan and

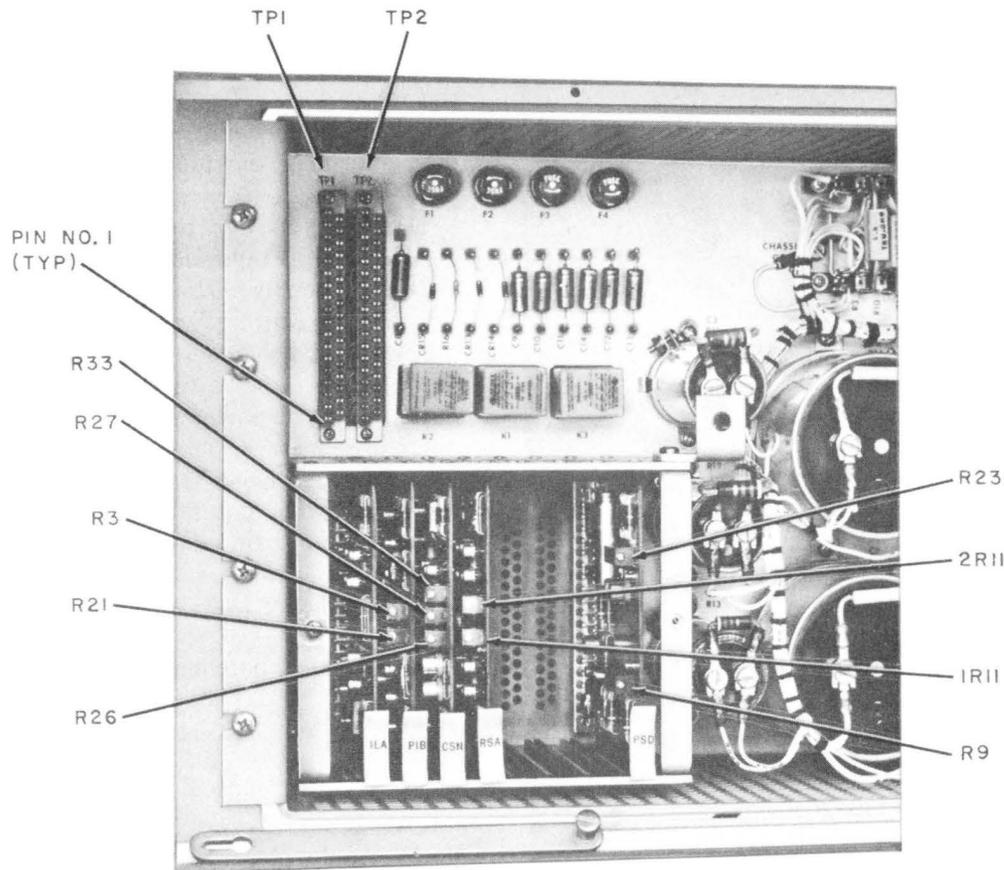


Fig. 6—Control Unit Showing Potentiometer and Test Point Locations

across the read-write heads for normal tape operations.

(10) Place a distinguishable pencil mark or a small piece of tape on the front face of the capstan for use as a reference point while using the stroboscope. The mark should be placed near the periphery of the capstan but not touching the outer rubber part.

(11) Operate the recorder in forward operation.

(12) Set the stroboscope flashing rate as closely as possible to 139 flashes per minute. With the stroboscope flashing light directed on the rotating capstan, adjust R26 on the capstan servo printed circuit board CSN (Fig. 6) until there are three essentially stationary images of the mark on the front face of the capstan. Capstan rotation should now correspond to 46.3 rpm.

(13) Operate the recorder in reverse operation and repeat the procedure in (12) except adjustment shall be made on R27 to obtain proper capstan speed in reverse.

(14) Recheck capstan speed in forward operation and readjust R26 if necessary.

(15) Remove power from the recorder and disconnect the patching cords from TP2.

2.08 Reel Servo Speed: Individual reel servo systems control the motions of the supply and the take-up reel motors which are functional in maintaining the proper amount of tape within the vacuum chambers. The amplitude of tape loop oscillations in the vacuum chambers (Fig. 2) shall not exceed 7 inches. This requirement can be checked by observing the tape loop in the take-up reel vacuum chamber during forward tape motion. Operate the recorder in reverse tape motion and

check tape loop oscillations in the supply reel vacuum chamber.

2.09 Photosense Head: The photosense head shall sense the beginning-of-tape (BOT) marker and the end-of-tape (EOT) marker. The dimensions and location of the photorefective tape markers are shown in Fig. 7. Check requirement as follows.

- (1) Apply power to the recorder and, observing the caution in 1.04, install a reel of magnetic tape with BOT and EOT photorefective markers.
- (2) Using manual controls, operate the transport for forward tape movement and run the tape through completely without interruption. The EOT lamp on the manual control panel lights when the EOT marker is sensed by the photosense head. Stop the recorder when the EOT marker passes the photosense head.
- (3) Operate the recorder in the rewind mode and allow the tape to run in rewind toward the BOT marker. Tape rewind shall overshoot the BOT marker, decelerate, and stop; tape shall immediately move in the forward direction and continue to move until the BOT marker reaches the photosense head and tape motion stops.

3. PROCEDURES

3.01 List of Tools, Gauges, Test Apparatus, and Materials

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
486A	Oil Can
KS-6854	Screwdriver
R-2670	3/32-Inch Allen Wrench
R-2671	1/8-Inch Allen Wrench
R-2958	5/64-Inch Allen Wrench
R-2959	1/16-Inch Allen Wrench
R-3415	7/16-Inch Allen Wrench
—	5-Inch E Screwdriver
—	Vacuum Cleaner Equipped with a KS-14377 L30 Flexible Nozzle (or equivalent)
GAUGES	
79B	0-1000 Gram Tension Gauge

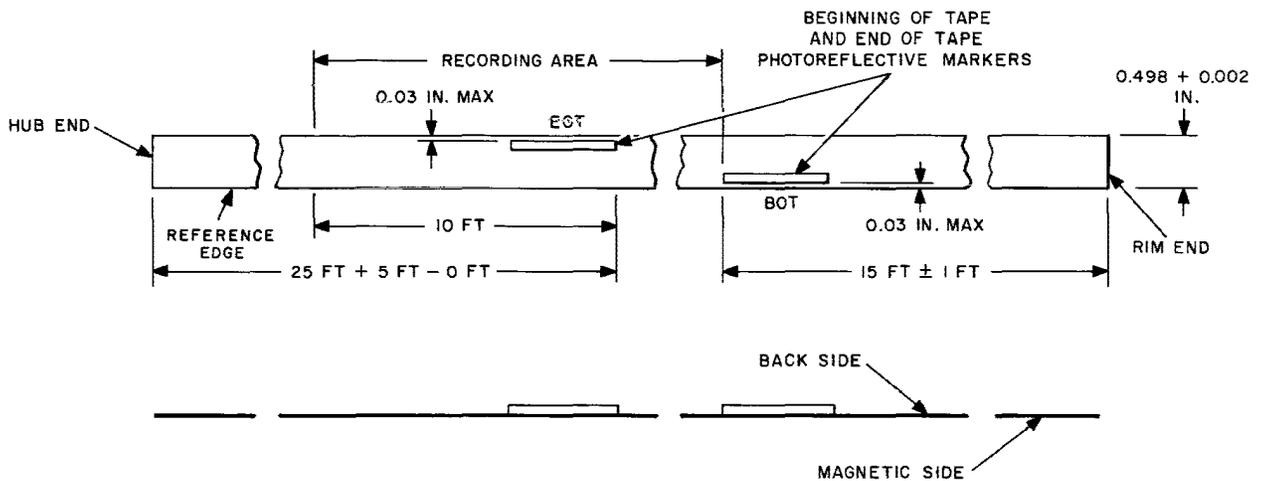


Fig. 7—Photorefective Tape Marker Placement (USASI Standard)

SECTION 034-368-701

CODE OR
SPEC NO.

DESCRIPTION

TEST APPARATUS

KS-14510 L1	Volt-Ohm-Milliammeter
—	Electronic Stroboscope, Type 1531A, 105 to 125 Volts, 50 to 60 Hz, General Radio Co., West Concord, Mass. (or equivalent)
—	Patching Cords with Tip Plugs (to be provided locally for connecting test points)
—	Reel of Magnetic Tape with BOT and EOT Markers
—	Nylon Cord (approximately 5 feet)

MATERIALS

KS-2423	Cloth
KS-6232	Oil
—	Freon (TF Grade) S-180, 16 oz. Aerosol Can, Miller Stephenson Chemical Co.

3.02 *Cleaning*

(a) **General Cleaning:** Use a vacuum cleaner equipped with a small flexible rubber nozzle, such as the KS-14377 L30 nozzle, to remove any loose dust from the inside of the recorder access door, on the tape transport face, and from the surrounding equipment frame members. Remove any remaining residue by wiping with a clean KS-2423 cloth moistened with Freon (TF grade). Follow by wiping with a clean, dry KS-2423 cloth.

(b) **Tape Transport**

Caution: Use Freon (TF grade) to clean heads, guides, capstan, vacuum chambers,

and tachometer rollers. Do not use other solvents. Freon shall not be applied directly on the parts. Use a Freon-moistened cloth to wipe the parts clean.

(1) Exercising care to avoid damage to the head assembly, use a clean KS-2423 cloth moistened with Freon (TF grade) to wipe off all oxide and dust accumulated on magnetic head assembly (Fig. 3), head cover assembly, and outer surface of tape cleaner.

(2) Carefully place a clean KS-2423 cloth moistened with Freon (TF grade) against the capstan, and rotate capstan *gently* by hand until all oxide and dirt are removed.

(3) Remove glass covers (held in place by spring clips) from vacuum chambers. If the covers are excessively dirty, use a KS-2423 cloth moistened with mild soap and water. Follow this by wiping with a KS-2423 cloth moistened with Freon (TF grade). Clean the inside of vacuum chambers and remove oxide and dust from loop sensors (Fig. 2) and exciter lamp windows. Replace vacuum chamber glass covers. Place a clean, dry KS-2423 cloth against the vacuum chamber tape guides (Fig. 3) and slowly rotate guides to remove oxide.

(4) Carefully clean the surface of photosense head using a dry KS-2423 cloth or a cloth which is slightly moistened with Freon.

(c) **Tape Cleaner:** Use the 3/32-inch Allen wrench to remove the tape-cleaner cartridge retaining screw. Do not disturb the magnetic head assembly or the tape cleaner bracket. Remove the cartridge and gently tap the cartridge body to remove accumulated tape oxide. Reinstall the cartridge and retaining screw after ensuring

that mating faces are free of particles which could upset the repositioning of the cartridge.

(d) **Transport Access Door:** Any dust attracted to the transparent window of the tape transport (Fig. 2) should be removed by lightly wiping the window panel, using a KS-2423 cloth moistened with water.

(e) **Vacuum Unit Filter:** To replace vacuum unit filter, unhook the two latches attaching the vacuum unit muffler (Fig. 4) to the blower unit; remove the muffler. Remove the used filter assembly from inside the vacuum blower unit and replace it with a new filter assembly. Reinstall the muffler on the vacuum blower unit.

3.03 Lubrication

(a) Lubrication of recorder is not necessary except as prescribed in (b).

(b) Use the 486A oil can to apply one or two drops of KS-6232 oil to each hinge joint of transport access door (Fig. 2) and to hinges of panels on both the transport and the control unit. Operate doors back and forth to work oil into hinges. Any excess oil should be removed immediately to prevent discoloration of equipment finish.

3.04 Demagnetization: No procedure is required.

3.05 Reel Brake Torque (Tension) for Supply and Take-Up Reels

(1) Use appropriate Allen wrench to loosen the setscrew which locks drag torque adjusting nut (Fig. 8) located at the rear of reel motor brake. Use the 5-inch E screwdriver to rotate the drag torque adjusting nut to increase or decrease tension as required to meet the requirements of Table B.

(2) Tighten the locking setscrew and recheck the requirements. If brake tension requirements of Table B cannot be met, replace the reel brake lining as described in Section 034-368-801.

3.06 Control Unit Power Supply: Use the KS-6854 screwdriver for making the following potentiometer adjustments.

(1) Using the volt-ohm-milliammeter between TP2-29 (Fig. 6) and TP2-35 (with TP2-35 as the 0-volt reference), adjust potentiometer R9 on printed circuit board PSD to obtain a reading of +12 volts ± 1.0 percent (+11.88 to +12.12).

(2) Using the volt-ohm-milliammeter between TP2-32 and TP2-35 (with TP2-35 as the 0-volt reference), adjust potentiometer R23 on printed circuit board PSD to obtain a reading of -12 volts ± 1.0 percent (-11.88 to -12.12).

3.07 Capstan Speed and Servo Adjustments:

The procedure for adjusting capstan speed and servo control is included with the requirements covered in 2.07.

3.08 Reel Servo Speed: Use the KS-6854 screwdriver for making potentiometer adjustments in the following procedure.

(1) Connect patching cords at TP2 (Fig. 6) as follows:

TP2-14 to TP2-15

TP2-21 to TP2-22

(2) Using manual controls, operate the transport for forward tape movement. With the tape in forward motion, adjust potentiometer 2R11 (Fig. 6) on the reel servo printed circuit board RSA counterclockwise while observing the tape loop in the take-up vacuum chamber (Fig. 9). Tape loop oscillations about the forward loop sense photocell will decrease in amplitude as 2R11 is rotated counterclockwise. Adjust 2R11 until tape oscillation becomes minimal and the loop just starts to decrease in length.

(3) Stop the recorder and remove patching cord between TP2-14 and TP2-15.

(4) Operate the recorder for reverse tape movement. Adjust potentiometer 1R11 (Fig. 6) counterclockwise while observing tape loop oscillations about the forward loop sense photocell in the supply vacuum chamber. Adjust 1R11 until tape oscillation becomes minimal and the loop just starts to decrease in length.

(5) Stop the recorder and remove the patching cord between TP2-21 and TP2-22.

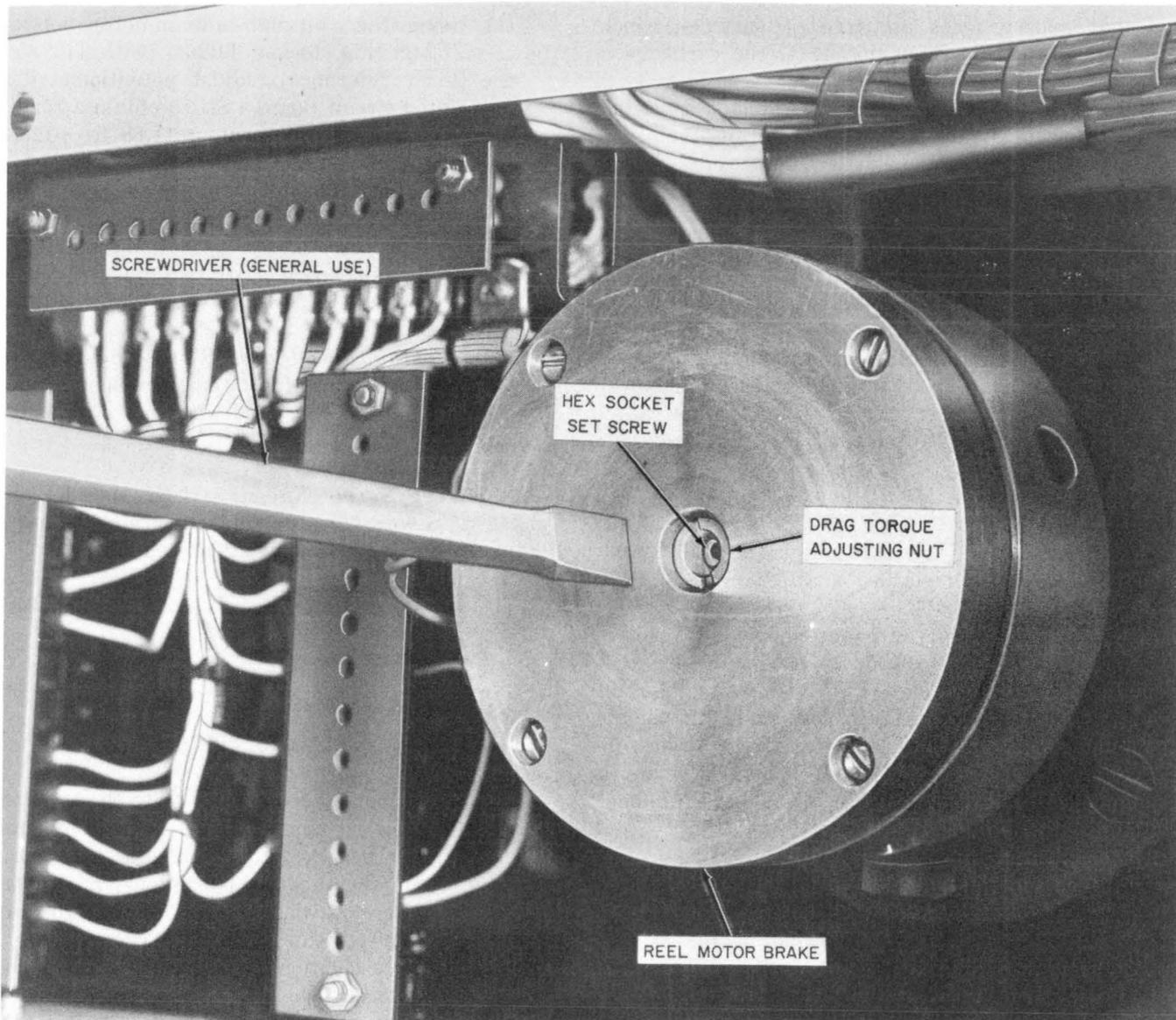


Fig. 8—Reel Motor Brake Showing the Drag Torque Adjusting Nut

(6) Operate the recorder in the rewind mode and observe tape loops in both vacuum chambers (Fig. 9). Both loops should oscillate about the reverse (rear) loop sense photocells. Minor readjustment of 1R11 for the supply vacuum chamber or 2R11 for the take-up vacuum chamber may be necessary.

3.09 *Photosense Head*

(1) Using TP2-35 (Fig. 6) as the 0-volt reference, connect the KS-14510 L1 voltmeter between TP2-35 and TP1-20.

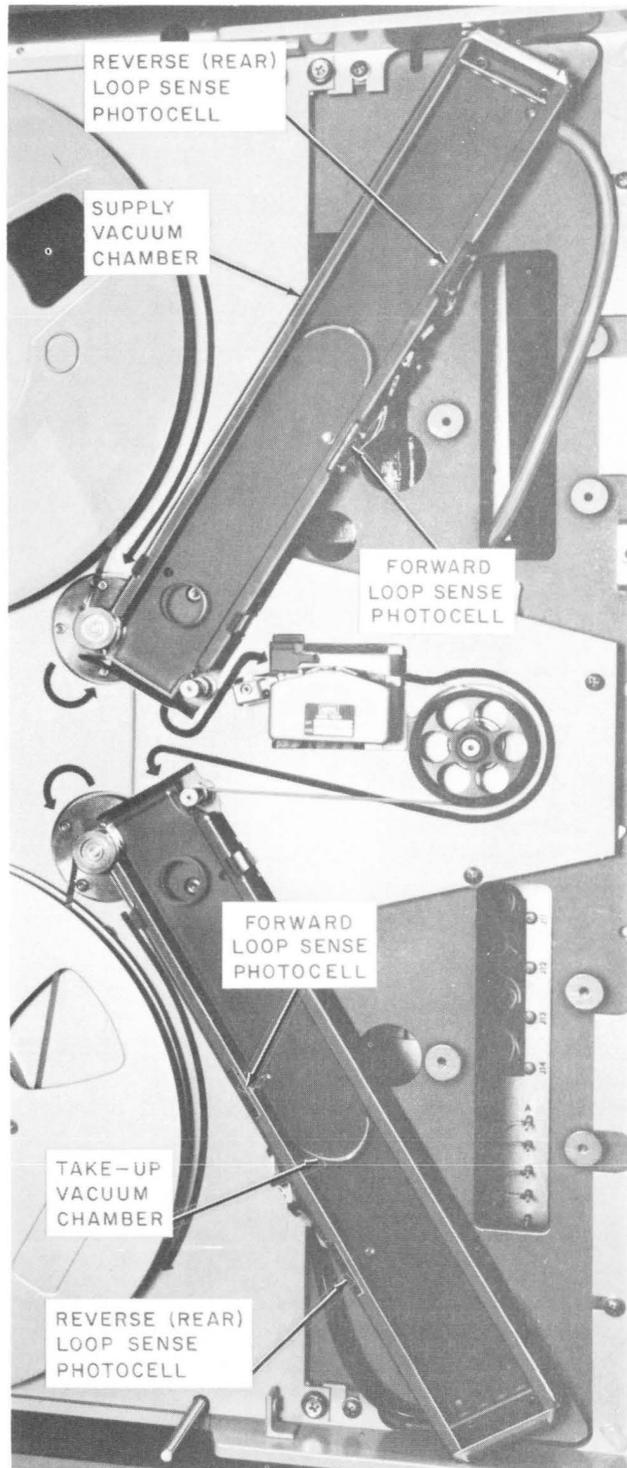


Fig. 9—Vacuum Chambers—Shown with Chamber Area Overlay Plate Removed

- (2) Install a reel of magnetic tape and stop the tape with the BOT marker positioned *away* from the photosense head (Fig. 3).
- (3) Adjust potentiometer R3 (Fig. 6) on the photosense and interlock printed circuit board PIB. Adjust R3 until the voltmeter indicates a transition from a high state (+12 volts) to a low state (0 volts).
- (4) Move the tape until the BOT marker is beneath the photosense head. Counting the number of turns, adjust R3 in a counterclockwise direction until the voltmeter indicates a transition from a low state (0 volts) to a high state (+12 volts). The potentiometer adjustment should require approximately three turns before the transition occurs.
- (5) Readjust R3 in a clockwise direction halfway back to the transition point of (3).
- (6) Connect the voltmeter to TP1-21 using TP2-35 as the 0-volt reference. Repeat the procedure in (2), (3), (4), and (5), adjusting potentiometer R21 on printed circuit board PIB and placing the EOT marker under the photosense head during (4).