RE-ORDER NO. [illegible]

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MODEL 1738 TAPE RECORDER/REPRODUCER

GENERAL TEST REQUIREMENTS

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NAS 7-100

TABLE OF CONTENTS

1.0 SCOPE

1.1 Scope. This document establishes a formal acceptance procedure for the certification of Model 1738 recorder/reproducer.

1.2 Purpose. This procedure defines functional tests and operational data on individual subassemblies to insure system compatability and formulates an evaluation sequence on the completed assembly.

2.0 APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification.

Specifications

Jet Propulsion Laboratory

30274 JPL QC Control Regulations for Mariner Program Procurement: 4 February 1963 As Amended per Contract 950105

Raymond Engineering Laboratory

General Guidelines for Quality Control Effort to be applied on Recorder Programs: 5 August 1963

Model 1738 Tape Recorder/Reproducer Operational Manual

3.0 CONDITIONS

3.1 Precedence of Specifications. Special considerations of individual assemblies may require modification of the general test procedure as outlined by this specification. Specific tests may be altered or omitted, and special tests may be added only upon approval by the REL Project Engineer.

4.0 RECORDS

4.1 Data. Data will be recorded on the reproducible forms provided for each test using a dark lead pencil or black ink pen.

Each data sheet will have the serial number of the assembly under test, the date of the test and the signature of the person performing the test.

Serial numbers of special equipment will be recorded. Where a specific piece of equipment is needed to accurately recreate a test set up, it will be considered special equipment. The test engineer or the technician will determine what is special equipment.

5.0 DATA REVIEW

5.1 Approval. On critical items, the test engineer will review data and sign the data sheet in the provided space. Where necessary, the Quality Control Department will review and sign data also.

6.0 RECORD MOTOR EVALUATION

6.1 General. The record motor is a hysteresis synchronous motor. It develops 0.20 oz-in. at 8000 rpm from a 62 volt peak-to-peak, 400 cps, square wave, single phase source.

6.2 Test Description. The record motor will be performance tested at three ambient conditions. These data will be recorded on the provided data sheet and preserved in the designated 1738 log book.

The following tests will be performed:

A. Inspection (Prior to all other items listed)

B. Motor Capacitor

C. Synchronous Torque

D. Stall Torque

E. Bearing Running Torque

F. Power Consumption

G. Winding Resistance

H. Stability

I. Thermal Stress

6.3 Test Sequence. The following defines the order of testing.

1. Motor Capacitor Test. At room temperature determine motor capacitor value.

2. Room Temperature Test. At 23° C ±5° measure synchronous torque, stall torque, power consumption, winding resistance, bearing running torque and examine for instability.

3. Cold Temperature Test. Repeat steps of test 2 at -10°C ± 5°. Do not exceed a temp. change rate >3°C/min.

4. Hot Temperature Test. Repeat steps of test 2 at +80°C ± 5°. Do not exceed a temp. change rate >3°C/min.

5. Thermal Stress. Soak motor according to section 6.4 H. Do not exceed a temperature change rate >3°C/min.

6. Final Room Temperature Test. Repeat steps of test 2 at 23°C ± 5°.

6.4 Definition. The following will define evaluation technique and limits of acceptance.

A. Inspection. The motor will be inspected by the REL inspection group. The motor shall conform physically to the REL Drawing No. 1738-101 (current issue). Upon inspection, the motor shall be delivered to the REL magnetic recorder group for evaluation.

B. Motor Capacitor. At room temperature run motor with a variable capacitor in the capacitor phase. Adjust the capacitor until maximum synchronous torque and stall torque are nearly equal. Available range of capacitor is between 0.54 and 0.58 mfd.

C. Synchronous Torque. Synchronous torque is defined as the maximum developed torque at a slip speed of 4 ± 1/2 rpm. The torque is to be measured on a REL Serial 2960 torque watch stand or equivalent. Take no less than 2 wraps around motor pulley to insure minimum down stream tension. The down stream tension, in the portion of string between the drive pulley and the fixed post, must be small enough to allow the string to support a slight arc. Measure slip speed with a Lissajous pattern on a scope, or with a stop watch and strobe. Torque readings on the watch must be corrected by the ratio of pulley diameters. Thus:

$$\text{Motor torque} = \frac{\text{Dynamometer torque} \times \text{Motor Pulley Diam.}}{\text{Dynom. Pulley Diameter}}$$

Synchronous torque should be at least 0.20 oz. in. throughout the temperature range. The motor should run counter clockwise.

D. Stall Torque. Stall torque is defined as the torque measured at a speed of 4 rpm. Take sufficient wraps around motor pulley to allow ~~a slow~~ rotation of the motor. Measure the 4 rpm speed with a stop watch. Correct torque watch reading for difference in pulley diameters. Stall torque should be at least 90% but no more than 150% of the measured synchronous torque.

E. Bearing Running Torque. Bearing running torque or more accurately described as wind and friction torque is defined as the decelerating torque measured at rated speed. Bring motor up to a speed greater than its designed synchronous speed by raising the frequency. Lower battery voltage until motor begins to slip. Disconnect power to motor and record the motor's deceleration characteristics with a sense coil and a visicorder. Measure the decelerating torque slope at the speed of interest from the visicorder record of the sense coil output. The slope is synchronous speed divided by straight line approximation of stopping time. Thus:

$$T = \frac{2\pi \times 1.03 \times 10^{-4}}{60} \times \frac{8000}{\text{stopping time}}$$

Bearing running torque should not exceed .05 oz. in. at room temperature and 0.125 oz. in. at -10°C.

F. Power Consumption. Power consumption is defined as the product of the Input Voltage times the Input current in the power transformer primary circuit minus the excitation current. In order to get the actual motor power, measure the excitation current in the power transformer (remove motor and measure current from the 50V supply, see Figure 6.3) and subtract this current from the input current when the motor is connected.

The motor should consume no more than 5 watts at any load at synchronous speed and over the temperature range. Power consumption at stall should not exceed 1.5 times the corresponding 4 rpm slip value.

Shaft power used in calculating efficiency $\left(\frac{\text{shaft power}}{\text{input power}} \times 100\right)$ may be calculated in watts using the following formula:

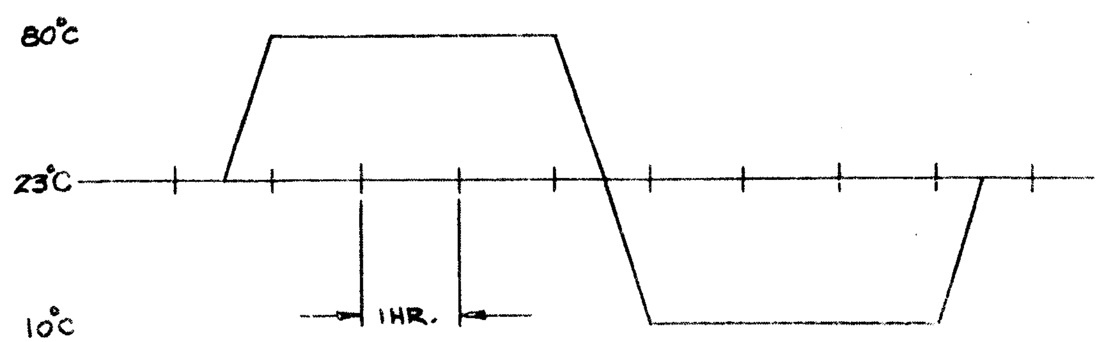
$$\text{shaft power} = \frac{.74 \times \text{speed (rpm)} \times \text{torque (oz.in.)}}{1000}$$

Pefore taking no load readings, stall motor manually.

G. Winding Resistance. Measure winding resistance with G. R. bridge type 1650-A or equivalent. Measurement must be made before operating of motor to avoid error introduced by self-heating.

H. Stability. Stability is the speed with which a motor settles to its synchronous speed. The degree of stability of a motor is to be determined at several different load levels with a strobe light. With the strobe triggered from the drive frequence observe the rotating shaft of the motor and note any oscillatory movements introduced by transients. Record magnitude and damping time of any oscillations.

I. Thermal Stress. Subject motor to 8 cycles of the temperature test described by the following graph.



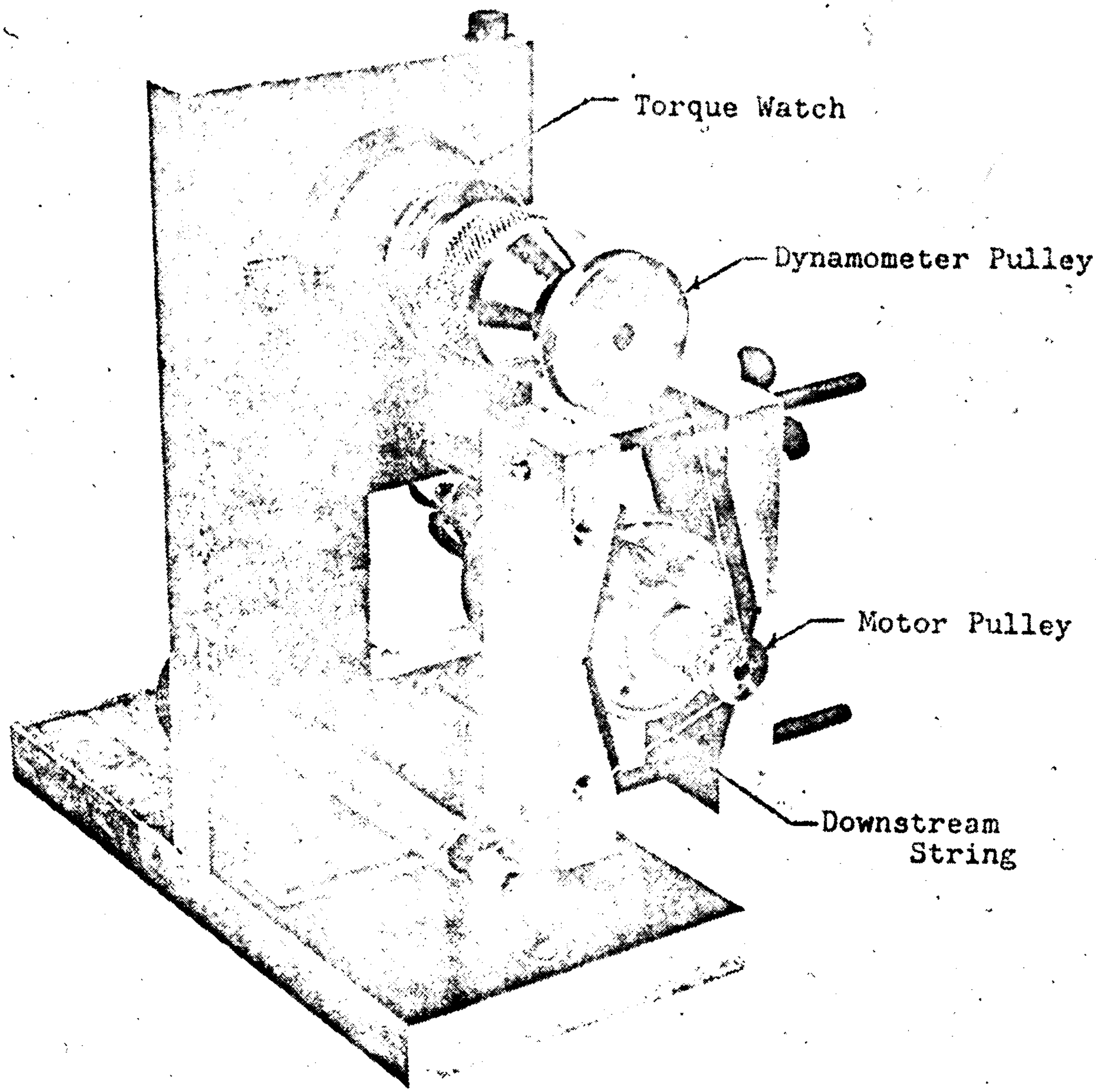


Figure 6.1
MOTOR MOUNTED IN DYNAMOMETER STAND

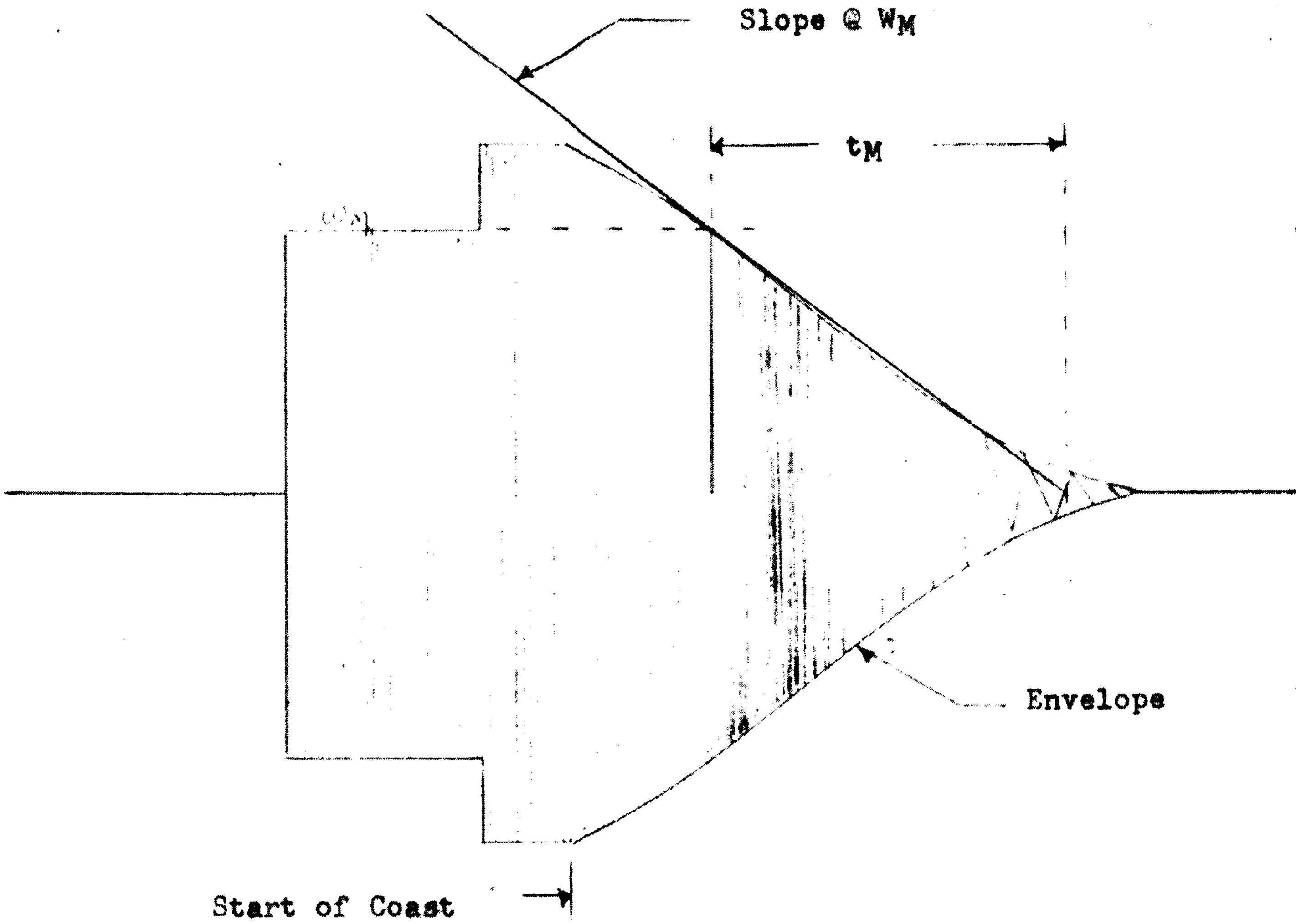


Figure 6.2

Bearing Run Down Measurement Sensor Output

$$T(\text{oz. in.}) = J\,(\text{oz. in. sec}^2)\ \frac{dW_M}{dt}\ \left(\frac{\text{Rad}}{\text{sec}^2}\right)$$

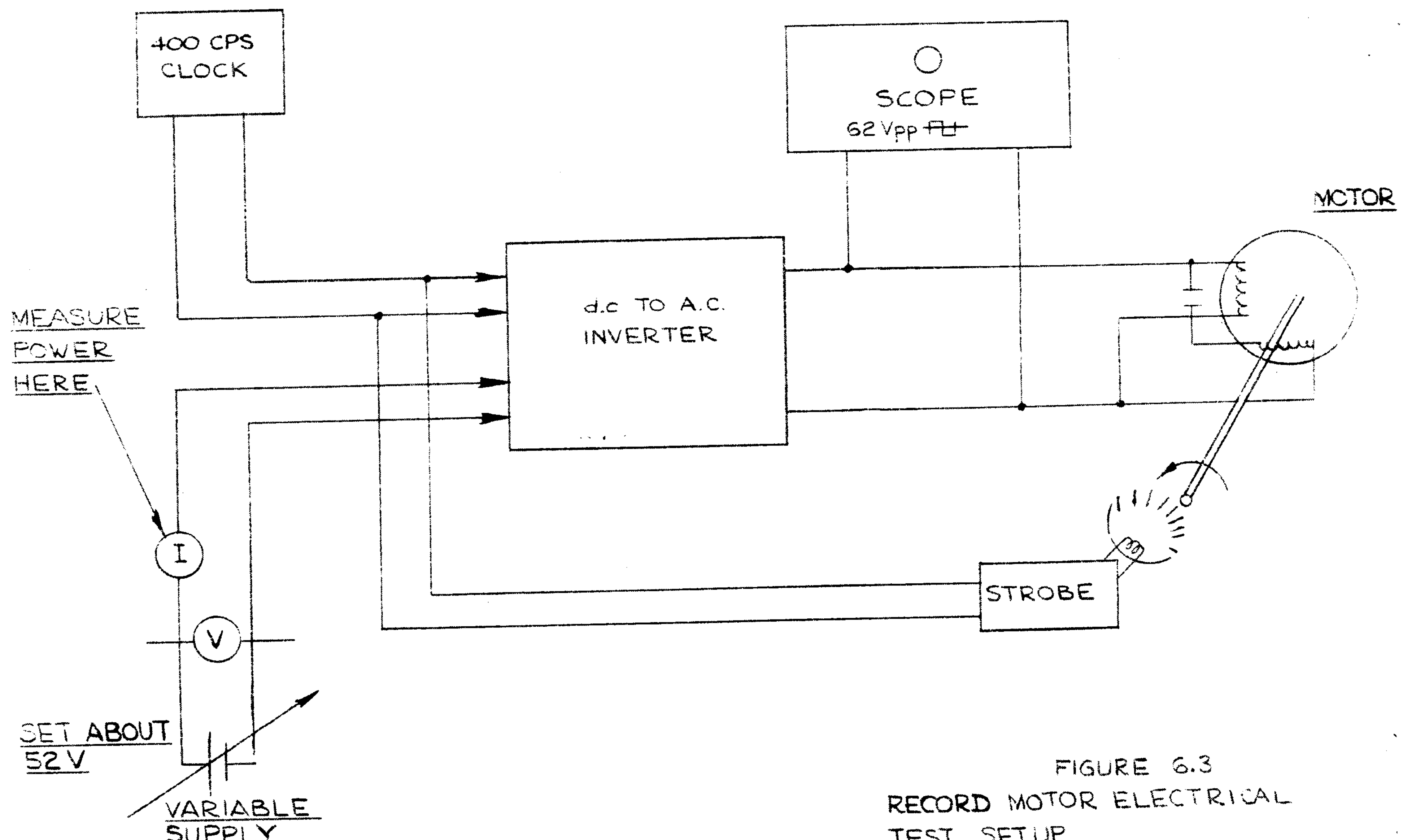


FIGURE 6.3
RECORD MOTOR ELECTRICAL
TEST SET UP

6.5 Record Motor Environmental Performance

Part Number 1738-100

Motor Serial # ______ Capacitor Value ______ mfd

Temperature	-10°C			23°C			80°C		
Input Voltage V dc									
Exc. Current MA dc									
Speed rpm	8000	7996	4	8000	7996	4	8000	7996	4
Condition	No load	Max. Sync.	Stall	No load	Max. Sync.	Stall	No load	Max. Sync.	Stall
Input Current MA									
Corr. Current MA									
Input Power W									
Dynom. Reading oz.in	0			0			0		
Shaft Torque oz. in.	0			0			0		
Shaft Eff. %	0		0	0		0	0		0
W & F Torque oz. in									
Winding Res. ohms	R-W ____ Ω G-Y Ω			R-W ____ Ω G-Y Ω			R-W ____ Ω G-Y Ω		

Stability: ______ W&F Visicorder Chart # ______

Date ______ Tested by ______

Approved by ______

Thermal stress ______ cycles

Motor Drive ______

Scope ______ Cal. exp. date ______

Ammeter ______ Cal. exp. date ______

Dynomometer ______ Cal. date ______

Voltmeter ______ Cal. exp. date ______

7.0 PLAYBACK MOTOR EVALUATION

7.1 General. The playback motor is a hysteresis synchronous motor. It develops 0.08 oz. in. at 945 rpm from a 5 volt, 47.25 cps, square wave, two phase drive.

7.2 Test Description. The playback motor will be performance tested at three ambient conditions. These data will be recorded on the provided data sheet and preserved in the designated 1738 log book.

The following tests will be performed:

A. Inspection (Prior to all other items listed)

B. Synchronous Torque

C. Stall Torque

D. Bearing Running Torque

E. Power Consumption

F. Winding Resistance

G. Power Supply Voltage

H. Stability

I. Thermal Stress

7.3 Test Sequence. The following defines the order of testing.

1. Terminal Voltage Test. Determine battery voltage according to section 7.4G.

2. Hot Temperature Test. At +80°C ± 5° measure synchronous torque, stall torque, power consumption,

winding resistance, bearing running torque and examine for instability at 850 rpm, 945 rpm, and 1040 rpm.

3. Room Temperature Test. Repeat steps of test 2 at 23°C ± 5°. Do not exceed a temp. change > 3°C/min.

4. Cold Temperature Test. Repeat steps of test 2 at -10°C ± 5°. Do not exceed a temp. change > 3°C/min.

5. Thermal Stress. Soak motor according to section 7.4I. Do not exceed a temperature change > 3°C/min.

6. Final Room Temperature Test. Repeat steps of test 2 at 23°C ± 5°.

7.4 Definition. The following defines evaluation technique and limits of acceptance.

A. Inspection. The motor will be inspected by the REL inspection group. The motor shall conform physically to the REL Drawing No. 1738-100 (current issue). Upon inspection, the motor shall be delivered to the REL magnetic recorder group for evaluation.

B. Synchronous Torque. Synchronous torque is defined as the maximum developed torque at a slip speed of 4 ± 1/2 rpm. The torque is to be measured on a REL Serial 2960 torque watch stand or equivalent. Take no less than 2 wraps around motor pulley to insure minimum down stream tension. The down stream tension, in the portion of string between the drive pulley and the fixed post, must be small enough to allow the string to support a slight arc. Measure slip speed with a Lissajous pattern on a scope, or with a stop watch and strobe. Torque reading on watch must be corrected by the ratio of pulley diameters. Thus:

$$\text{Motor torque} = \frac{\text{Dynamometer torque} \times \text{Motor Pulley Diam.}}{\text{Dynom. Pulley Diameter}}$$

Synchronous torque should be at least 0.08 oz. in. throughout the temperature range at 850 rpm, 945 rpm, and 1040 rpm.

The motor should be run counter clockwise.

C. Stall Torque. Stall torque is defined as the torque measured at a speed of 4 rpm. Take sufficient wraps around motor pulley to allow a slow rotation of the motor. Measure the 4 rpm speed with a stop watch. Correct torque watch reading for difference in pulley diameters. Stall torque should be 0.07 oz. in. or greater at nominal frequency and voltage.

D. Bearing Running Torque. Bearing running torque or more accurately described as wind and friction torque is defined as the decelerating torque measured at rated speed. Bring motor up to a speed greater than its designed synchronous speed by raising the frequency. Lower battery voltage until motor begins to slip. Disconnect power to motor and record the motor's deceleration characteristics with a sense coil and a visicorder. Measure the decelerating torque slope at the speed of interest from the visicorder record of the sense coil output. The slope is synchronous speed divided by straight line approximation of stopping time. Thus:

$$T = \frac{2\pi \times .70 \times 10^{-4}}{60} \times \frac{945}{\text{stopping time}}$$

Bearing running torque should not exceed 0.02 oz. in. at room temperature and 0.06 oz. in. at -10°C.

E. Power Consumption. Power consumption is defined as the product of the Battery Voltage times the Battery current in the bridge circuit. The motor should consume no more than .7 watts at any load at synchronous speed and over the temperature range. Power consumption at stall should not exceed 1.5 times the corresponding 4 rpm slip value.

Shaft power used in calculating efficiency $\left(\frac{\text{shaft power}}{\text{input power}} \times 100 \right)$ may be calculated in watts using the following formula.

$$\text{shaft power} = \frac{.74 \times \text{speed (rpm)} \times \text{torque (oz.in.)}}{1000}$$

Before making no load reading, stall motor manually.

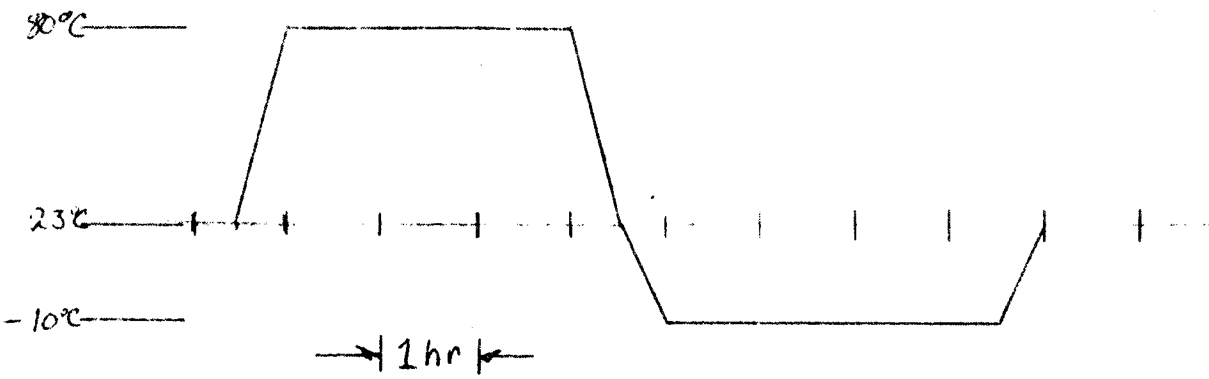
F. Winding Resistance. Measure winding resistance with G. R. bridge type 1650-A or equivalent. Measurement must be made before operating of motor to avoid error introduced by self-heating.

G. Power Supply Voltage. The power supply voltage to the bridge drive is established between 4 and 6 volts dc and must be determined at 80°C to accommodate the torque requirement.

Soak motor at 80°C for 30 minutes minimum. At a drive frequency of 52 cps, adjust battery voltage to give 0.08 oz. in. torque at 4 rpm slip. Recheck after a 10 minute non operative soak. Once determined, this voltage will become fixed and used throughout the evaluation. This voltage will also be used to set the playback voltage regulator output in the system.

H. Stability. Stability is the speed with which a motor settles to its synchronous speed. The degree of stability of a motor is to be determined at several different load levels with a strobe light. With the strobe triggered from the drive frequence observe the rotating shaft of the motor and note any oscillatory movements introduced by transients. Record magnitude and damping time of any oscillations.

I. Thermal Stress. Subject motor to 8 cycles of the temperature test described by the following graph.



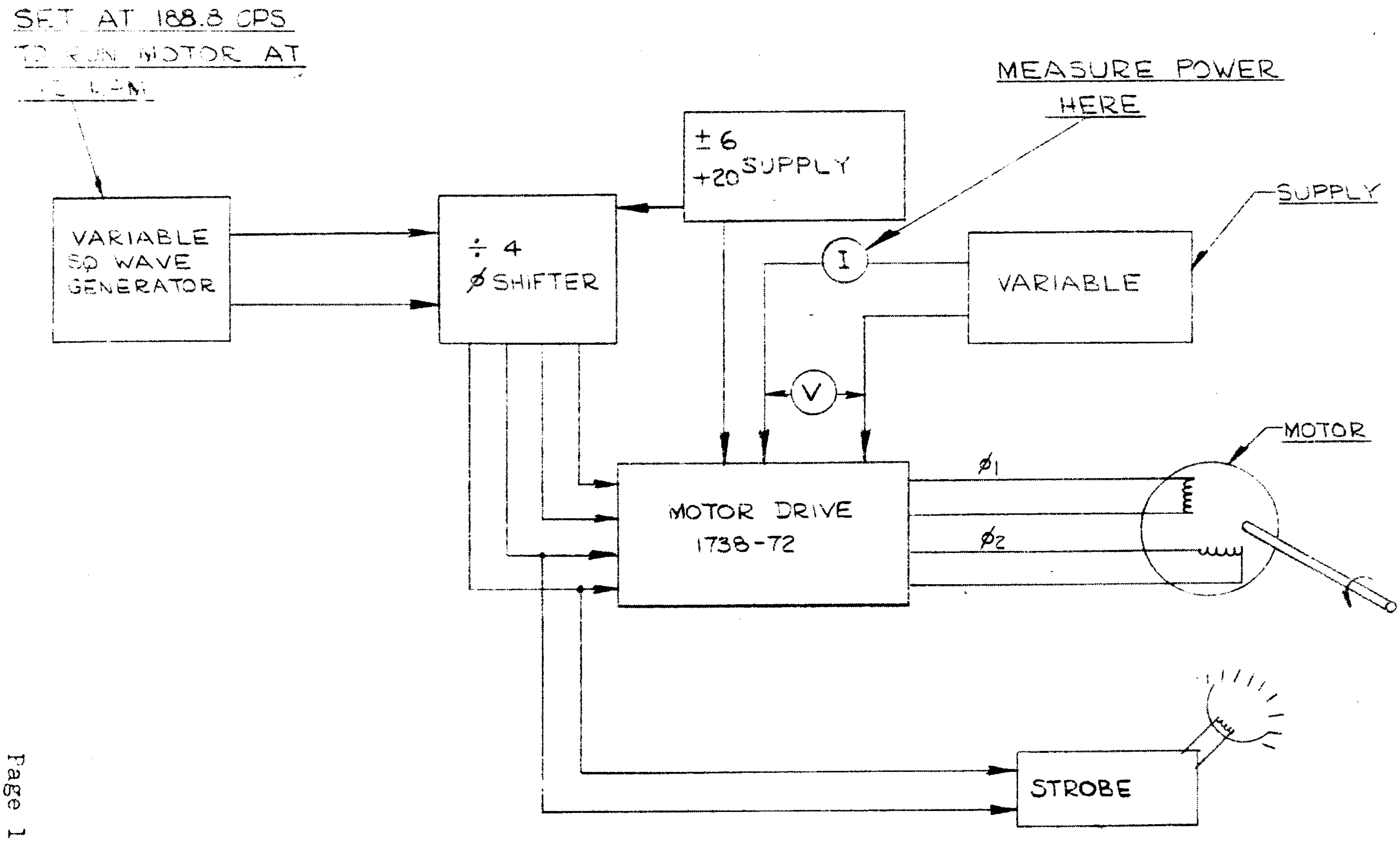


FIGURE 7.1
PLAYBACK MOTOR ELECTRICAL
TEST SETUP

7.5 Playback Motor Environmental Performance

Part Number 1738-100

Motor Serial ______ Temperature ______

Frequency cps	42.5			47.2			52.0		
Speed rpm	850	846	4	945	941	4	1040	1036	4
Condition	No load	Max. Sync.	Stall	No load	Max. Sync.	Stall	No load	Max. Sync.	Stall
Input Voltage V dc									
Input Current MA dc									
Input Power MW									
Dynom. Reading oz.in	0			0			0		
Shaft Torque oz. in.	0			0			0		
Shaft Eff. %	0		0	0		0	0		0
W & F Torque oz. in.									

Winding Resistance G - Y ______ Ω

R - W ______ Ω

Stability: ______ W&F Visicorder Chart # ______

Date ______ Tested by ______

Approved by ______

Thermal stress ______ cycles

Motor Drive ______

Scope ______ Cal. exp. date ______

Ammeter ______ Cal. exp. date ______

Dynomometer ______ Cal. date ______

Voltmeter ______ Cal. exp. date ______

8.0 COPLANAR HEAD EVALUATION

8.1 General. The coplanar head PN1738-102 is a two track record, reproduce, head module. The record section is designed to operate at 7 ma with a gap width of 250 microinches. The playback section has an output of 50 microvolts peak to peak at 0.01 inches of tape per second and a gap of 100 microinches.

8.2 Test Description. The following tests will be performed on the coplanar head:

A. Mechanical Inspection
B. Winding Resistance
C. Winding Inductance
D. Interwinding Resistance
E. DC Saturation Current
F. AC Saturation Current
G. Residual Magnetism
H. Playback Signal Amplitude
I. Visual Inspection
J. Temperature
K. Temperature Soak

8.3 Test Sequence. The following will define the order of testing.

1. Mechanical Inspection. The head shall comply with drawing 1738-102 per inspection instruction

sheet #1738-102. NOTE: Inspect head face visually only! A cotton pad is the only material that should come in contact with the head face and should be covered with such at all times except during inspection. Caution: Do not touch head face with fingers. Fingerprints can cause permanent damage.

2. Electrical Inspection. Examine wiring for proper color code and general workmanship per drawing 1738-102. Record and document on the coplanar head evaluation data sheet the following tests:

   A. Record Winding DC Resistance
   B. Record Winding Inductance
   C. Playback Winding DC Resistance
   D. Playback Winding Inductance
   E. Interwinding Resistance

3. Functional Evaluation. Determine the following:

   A. DC Saturation Current
   B. AC Saturation Current
   C. Residual Magnetism
   D. Playback Signal Amplitude

4. Temperature Soak. Soak at 180°F for 24 hours. Repeat soak at 0°F for 24 hours.

5. Visual Check. Inspect visually for effects of temperature, such as core shift and weepage. Stone

face if necessary. This step is to be performed by the Magnetic Recorder Assembly Group only.

6. Temperature Cycle. Temperature cycle heads for 9 days according to section 8.4K.

7. Visual Inspection. Check head surface for smoothness.

8. Final Electrical Inspection. Repeat step 2 parts A through E.

9. Final Functional Evaluation. Repeat step 3 parts A through D.

8.4 Definition. The following will define evaluation technique and limits of acceptance.

A. Mechanical Inspection. The coplanar head will be inspected by the REL inspection group. The head shall physically conform to the REL drawing 1738-102. Nothing, not even, fingers should come in contact with the tape path face. Investigation of the surface must be limited to visual inspection. Upon completion of mechanical inspection, the head shall be delivered to the Magnetic Recorder Group for evaluation.

B. Winding Resistance. Measure winding resistance with a General Radio impedance bridge type 1650-A only. The DC resistance of the record and playback windings should be as specified on drawing #1738-102 -1 or -2 as required.

Record data on 1738 head assembly data sheet and document with signature and date.

C. Winding Inductance. Measure winding inductance with General Radio impedance bridge type 1650-A only. Record winding inductance should be 19 mh maximum. Playback inductance should be as specified. Record and document data on the 1738 head assembly data sheet.

D. Interwinding Resistance. Measure resistance between each winding and from each winding to ground with 1862B megohm meter set on the 50 volt range only. Resistance should be 15 meg Ω minimum. Record and document data on the 1738 head assembly data sheet.

E. DC Saturation Current. The DC saturation current is the minimum DC current needed to erase a signal pre-recorded with 7.5 ma, 10.7 kc record current.

Install the head in the 1738-BB tape puller and record both tracks at 12.84 inches per second with 7.5 ma record current. Monitor the open circuit playback signal at the playback head with a Tektronics type 503 scope or equivalent.

When recording is complete, remove input signal and apply pure DC to one side of the record head while pulling the tape at $\cong$ 12.8 ips. Note the minimum direct current measured across the 10 resistor in the head driver needed to remove the pre-recorded AC signal from the tape completely. This is the DC saturation current. Write the value for each track on the data sheet.

F. AC Saturation Current. The AC saturation current is the current at 10.7 kc that saturates the tape.

Record a 10.7 kc signal at 12.84 ips. Monitor both record current and playback voltage at the head. Increase the record current from zero ma until the playback voltage ceases to grow in amplitude. The record current at this point is the AC saturation current.

Increase record current to 7.5 ma. The playback amplitude must not fall more than 5% from the value measured at saturation. Write on data sheet the values for saturation current, open circuit playback signal at saturation, and open circuit playback signal at 7.5 ma. & record current for both tracks.

G. Residual Magnetism. Residual magnetism is a permanent magnetism of the head which tends to erase the tape.

Record 10.7 kc until both tracks are full at 12.84 ips. Examine playback signal amplitude at a tape speed of 12.84 ips while recording. Remove record power and allow tape to make five complete revolutions, then re-examine the playback signal amplitude. The final signal should not have decreased in amplitude more than 10% from the original signal.

H. Playback Signal Amplitude. Record a 10.7 kc signal with 7.5 ma record current on both tracks at 12.84 ips. Feed the playback signal to a 1738-68 calibrated preamplifier. Playback at 0.01 ips with the VCO (voltage controlled oscillator) externally locked at 1512 pps. Record signal's amplitude and examine wave shape for distortion. The signal from the head must be 50 microvolts peak-to-peak or more on either track.

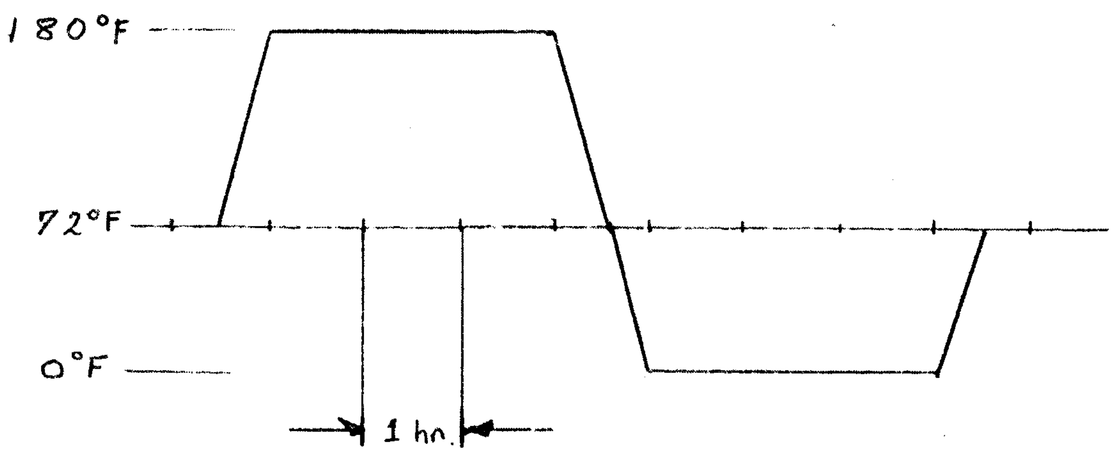
Record 21.4 kc and measure playback amplitude through a 1738-68 calibrated preamplifier as above. The signal amplitude must be 80% or greater of the 10.7 kc playback signal.

I. Visual Inspection. Visual inspection will be performed by the Magnetic Recorder Assembly Group. Under a low power microscope observe the head surface for core shift, weepage, condition of gap, and other imperfections such as scratches, oxide buildup, or finger prints. Stoning is permitted; however, a record of the operation is to be kept in the log book.

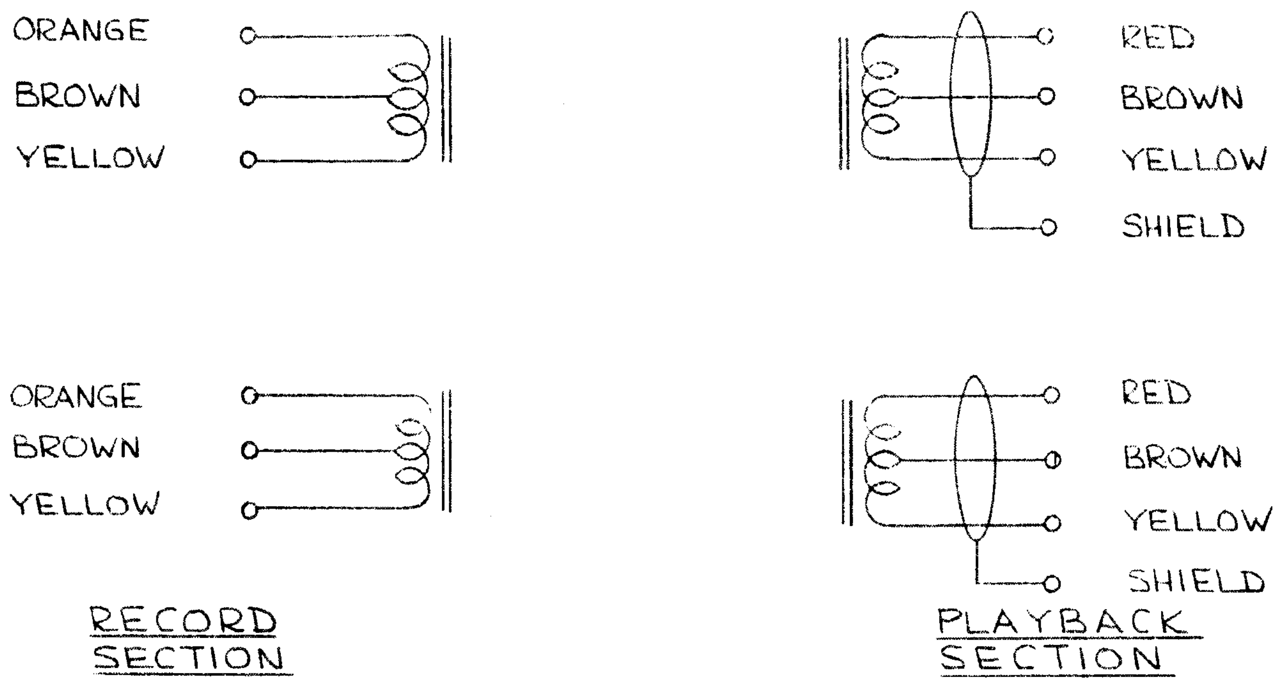
J. Temperature Soak. Heads are to be soaked at 180°F for 24 hours and 0°F for 24 hours. The chamber must be at room temperature while the head is put in or taken out of the chamber to prevent a temperature shock. The heads must not see a rate of change greater than 5°F per minute.

The head is to be placed in a sealed container that has been purged for at least one minute with dry nitrogen before placing in the environmental chamber.

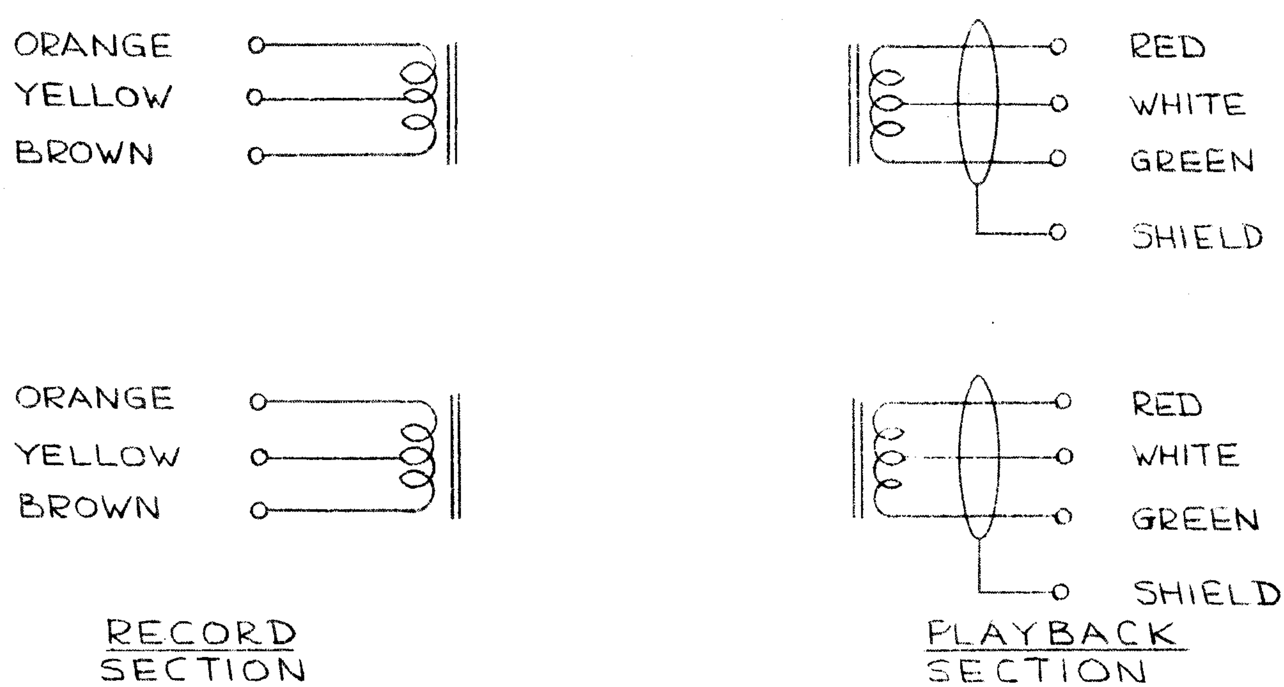
K. Temperature Cycle. The heads are to be temperature cycled eight times according to the following graph:



The coplanar head evaluation data sheets should be updated to include the color code listed below.



DRAWING 1738-102-1



DRAWING 1738-102-2

8.5 Coplanar Head Evaluation Data

PN 1738-102 Date ____________ SN ____________

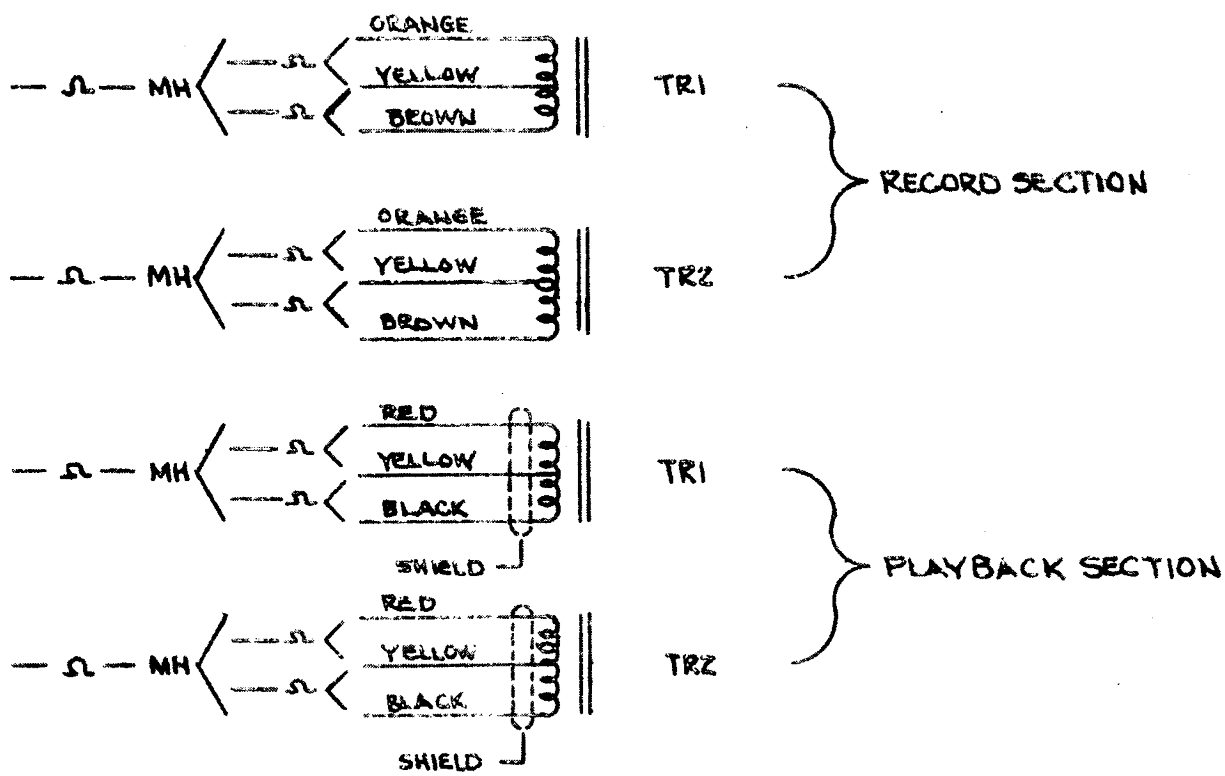
1. Mechanical Inspection.

Head accompanied with certified data from manufacturer ____________

Head meets requirement of inspection instruction sheet #1738-102 ____________

Signature of inspector and date ____________

2. Electrical Inspection.



Wind resistance and inductance in tolerance ________

Interwinding resistance:

Orange of TR1 to orange of TR2 _____ meg ohms

Orange of TR1 to red of TR1 _____ meg ohms

Orange of TR1 to red of TR2 _____ meg ohms

Orange of TR1 to case _____ meg ohms

Orange of TR2 to red of TR1 _____ meg ohms

Orange of TR2 to red of TR2 _____ meg ohms

Orange of TR2 to case _____ meg ohms

Red of TR1 to red TR2 _____ meg ohms

Red of TR1 to case _____ meg ohms

Red of TR2 to case _____ meg ohms

Signature of inspector and date ________________

3. Functional Evaluation.

A. DC saturation current____ma TR1 ___ ma TR2

B. AC saturation current____ma TR1 ___ ma TR2

Playback signal at saturation ________µvpp TR1

________µvpp TR2

Playback signal at 7.5 ma ________µvpp TR1

________µvpp TR2

C. Residual magnetism:

Playback signal amplitude while recording

_____µvpp TR1 _____µvpp TR2

Playback signal amplitude after 5 passes

_____ μvpp TR1 _____ μvpp TR2

D. Playback signal amplitude at 10.7 kc

_____ μv TR1 _____ μv TR2

Playback signal amplitude at 21.4 kc

_____ μv TR1 _____ μv TR2

Signature of operator and date ____________________

4. Temperature Soak. The head received the required soak test without receiving a temperature shock greater than 5°F/min.

Signature of operator and date ____________________

5. Visual Check.

Comment:

Signature and date ____________________

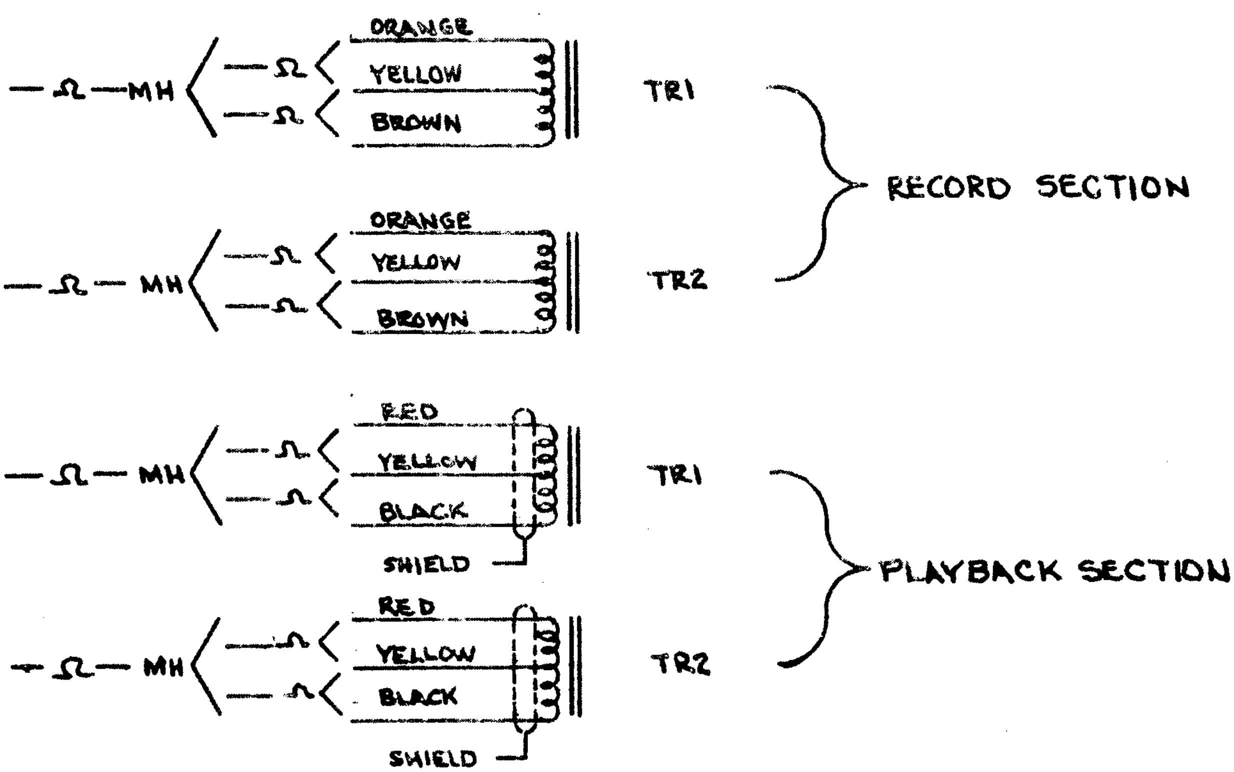
6. Temperature Cycle. Head received cycles of °F and °F for hours each. Temperature gradient____°F/min.

7. Visual Check.

Comment:

Signature and date ____________________

8. Final Electrical Inspection.



Winding resistance and inductance in tolerance ________

Interwinding resistance:

Orange of TR1 to orange of TR2 _____ meg ohms

Orange of TR1 to red of TR1 _____ meg ohms

Orange of TR1 to red of TR2 _____ meg ohms

Orange of TR1 to case _____ meg ohms

Orange of TR2 to red of TR1 _____ meg ohms

Orange of TR2 to red of TR2 _____ meg ohms

Orange of TR2 to case _____ meg ohms

Red of TR1 to red of TR2 _____ meg ohms

Red of TR1 to case _____ meg ohms

Red of TR2 to case _____ meg ohms

Signature of inspector and date ____________________

9. <u>Final Functional Evaluation</u>.

A. DC saturation current ____ ma TR1 ___ ma TR2

B. AC saturation current ____ ma TR1 ___ ma TR2

Playback signal at saturation _______µvpp TR1

_______µvpp TR2

Playback signal at 7.5 ma _______µvpp TR1

_______µvpp TR2

C. Residual magnetism:

Playback signal amplitude while recording

___µvpp TR1 ___µvpp TR2

Playback signal after 5 passes

___µvpp TR1 ___µvpp TR2

D. Playback signal amplitude at 10.7 kc

___µvpp TR1 ___µvpp TR2

Playback signal amplitude at 21.4 kc

___µvpp TR1 ___µvpp TR2

Signature and date ________________________________

Reviewed by ________________________________
Magnetic Recorder Department

Reviewed by ________________________________
Quality Control Department

9.0 BEARING EVALUATION

9.1 General. The precision bearings in the capstan, the idler, the pressure belt pulley and the tape reel are preloaded duplex pairs. They have been manufactured with care to prevent damage and contamination.

Since a thorough inspection for damage or contamination would be a destructive test, these bearings must be evaluated by the following qualitative process.

9.2 Description. The following steps will be performed on the capstan, the idler, the pressure belt pulley and the tape reel assemblies:

A. Feel Test

B. Coastdown Time

C. Temperature Cycle

D. Run-in

Identify assembly under test and record data on a vellum copy of page 35 Section 9.5 of this Test Plan and enter it into the respective 1738 Log Book.

9.3 Test Sequence. Upon completion of a bearing assembly, the respective Assembly Inspection and Test Check List will call for a bearing test. At this time the following items will be performed in order:

A. Feel Test. Record condition of bearing.

B. Coastdown Time. Record the average stopping time of three runs.

C. Hot and Cold Temperature Soak. Record temperature, duration and number of cycles of environmental exposure.

D. Post-Environmental Feel Test. Record condition of bearings after temperature soak.

E. Post-Environmental Coastdown Time. Record the average stopping time of three runs after temperature soak.

F. Run-in. Exercise bearings for two (2) hours at their prescribed speeds.

G. Post-Run-in Feel Test. Record condition of bearings after run-in.

H. Post-Run-in Coastdown Time. Record the average stopping time of three (3) runs after run-in.

9.4 Definitions. The following will define evaluation technique and limits of acceptance:

A. Feel Test. The feel test is a qualitative test to detect roughness in a bearing while rotating at a slow speed.

Rotate bearing at least three (3) times in each direction. Describe the condition of the bearing as Good or Reject.

B. Coastdown Time. Coastdown time is the time for a bearing assembly running at speed to free-wheel to a stop. The time is indicative of the wind and friction torque of the module. Windage is fixed by geometry; friction by bearing preload, lubrication, ball condition and raceway condition.

Use an 1800 RPM synchronous motor with a 2" rubber wheel on the shaft to bring the bearing assembly up to speed, then remove rubber wheel. Upon removal of rubber wheel, start a stopwatch and measure the time for the assembly to come to rest. Record the average of three (3) runs.

By applying the 2" rubber wheel to the following pulleys, make coastdown measurements from these speeds.

Drive capstan at 2400 RPM by driving it at the $1\frac{1}{2}$ inch diameter pulley.

Drive the first idler at 2400 RPM by driving it at the $1\frac{1}{2}$ inch diameter pulley.

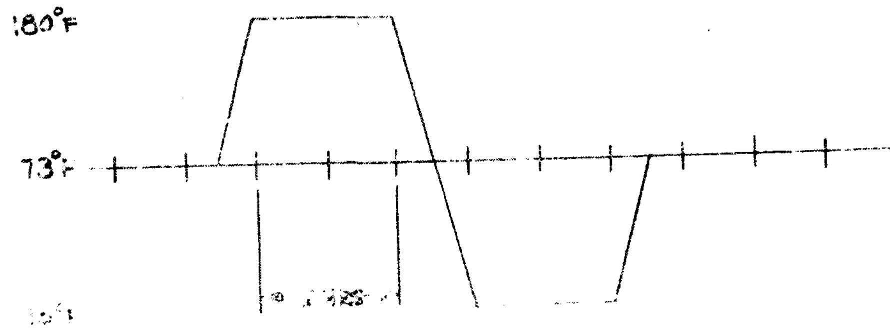
Drive the second idler at 2465 RPM by driving it at the 1.46 inch diameter pulley.

Drive pressure belt pulley at 3600 RPM by driving it at the 1 inch diameter pulley.

Drive the tape reel at 1360 RPM by driving it at the 2.65 inch diameter of the hub.

When testing the capstan, rotate the 1-1/2 inch diameter pulley clockwise viewed from the capstan end. This checks the shaft bearings. Next hold the flywheel and rotate the $1\frac{1}{2}$ inch diameter pulley counterclockwise to check clutch bearings.

C. Hot and Cold Temperature Soak. Place bearing assembly in a sealed container and purge for one (1) minute with dry nitrogen. Insert purged container in temperature chamber and cycle according to the following graph.



In the case of the capstan, cycle a minimum of 3 times prior to grinding. In no case allow the temperature gradient to exceed 5°F per minute.

D. <u>Run-in</u>. Run-in is the spinning of a bearing assembly for a length of time in order to form a bearing performance trend.

Before running-in, belt drive the bearing assembly with an REL DC Hybrid motor having a calibrated torque/current characteristic.

Record the no-load motor current, the loaded motor current, the motor speed, the module speed, the motor torque and computed input torque to module.

$$\text{Input Torque to Module} = \frac{\text{Motor Output Torque} \times \text{Motor Speed}}{\text{Module Speed}}$$

With a 4600 RPM REL Hybrid motor and the proper drive pulley, drive the respective assembly in the following manner:

Assembly	Run-in Time	Run-in Speed	Module Pulley Dia.	Drive Pulley Dia.	Direction
Capstan Assembly (Prevent the 1½" Dia. Pulley From Rotating)	2 ± ¼ hours	2300 RPM	3/4"	3/8"	CW Viewed From Capstan End
Idler Assembly	2 ± ¼ hours	2300 RPM	1½"	3/4"	CW or CCW
Pressure Belt Assembly	2 ± ¼ hours	3450 RPM	1"	3/4"	CW or CCW
Tape Reel Assembly	2 ± ¼ hours	3940 RPM	7/8"	3/4"	CW or CCW

Then repeat the torque measurements made with the calibrated REL DC Hybrid motor after run-in.

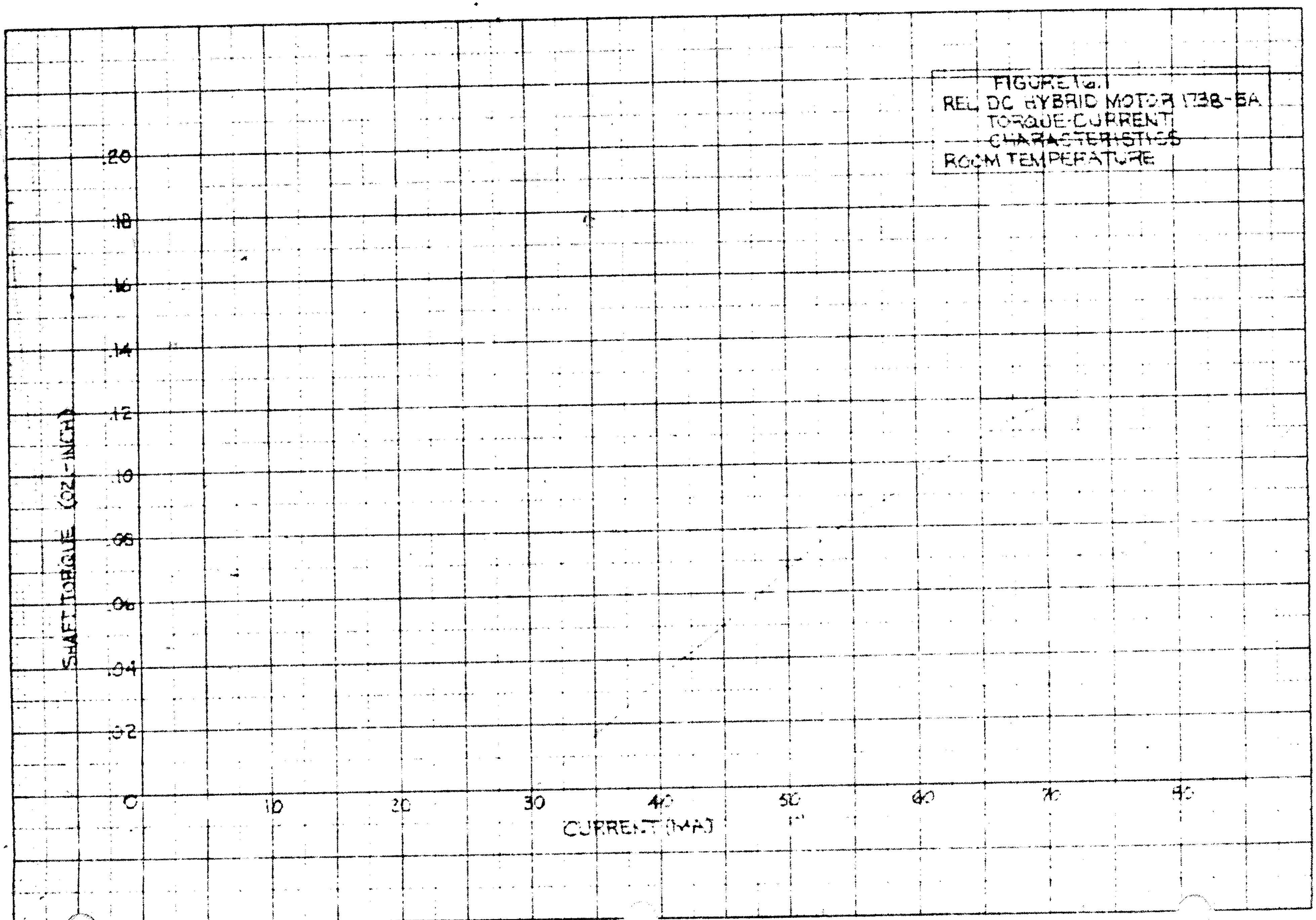


FIGURE 6.1
REL DC HYBRID MOTOR 1738-BA
TORQUE-CURRENT
~~CHARACTERISTICS~~
ROOM TEMPERATURE

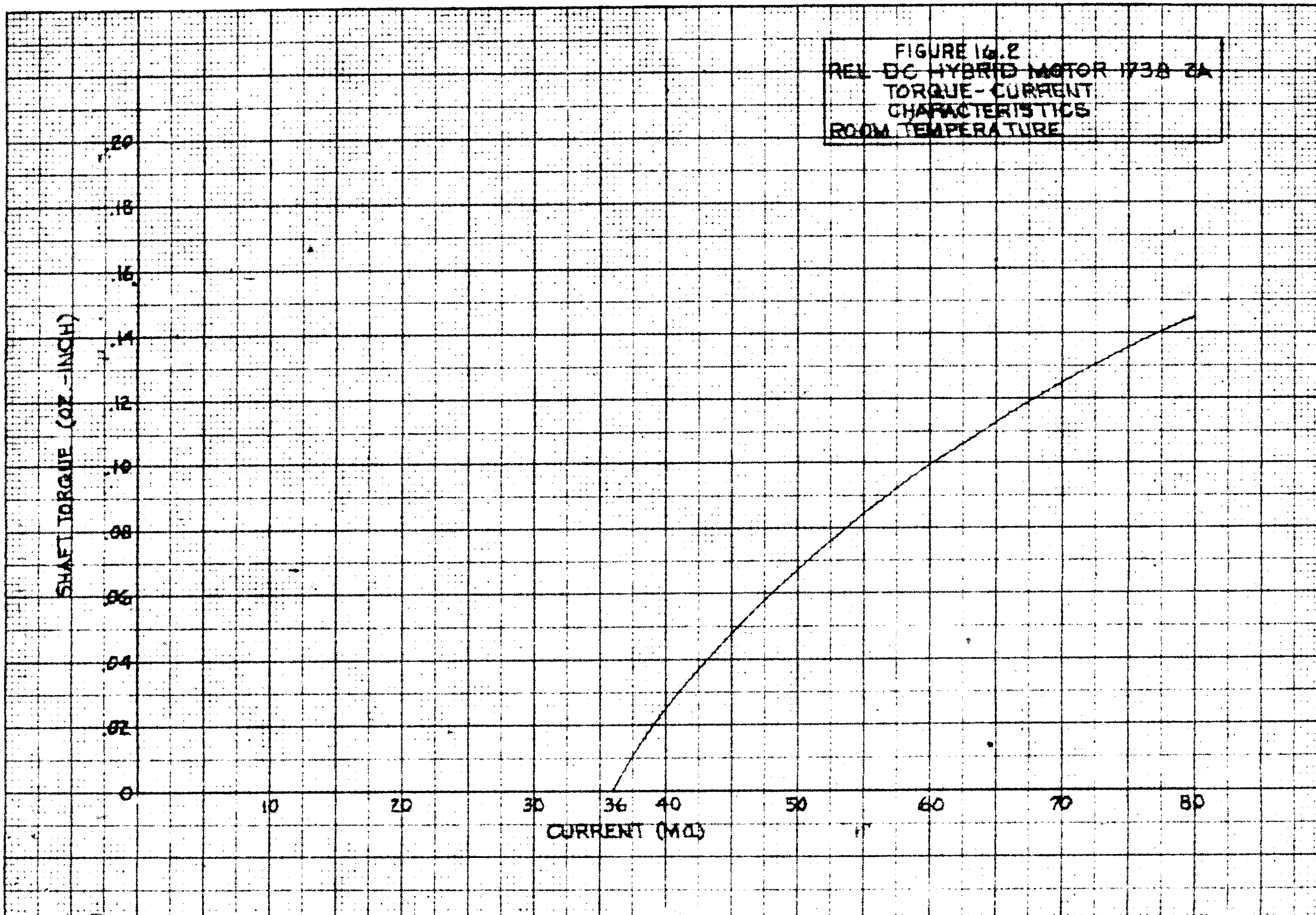


FIGURE 16.2
REL DC HYBRID MOTOR 1738 ZA
TORQUE-CURRENT
CHARACTERISTICS
ROOM TEMPERATURE

RE-ORDER No.

P34E

43

9.5 Bearing Assembly Data Sheet. This data sheet accommodates the bearing tests on the capstan, the idler, the pressure belt pulley and the tape reel. Reference to clutch is relevant to capstan assembly only.

Assembly Description: ________________ Serial No. __________

Bearing Serial No.: Shaft ______________ Clutch ____________

		Upon Assembly	Post Temperature Soak	Post Run-in	
Feel Test	Shaft				
	Clutch				
Coastdown Time	Shaft	__sec.___	__sec.___	__sec.___	RPM
	Clutch	sec.	__sec.___	__sec.___	RPM

Temperature Soak Data:

Exposed to ___°F for ____ hours and to ___°F for ___ hours for ___cycles.

Run-in Data

Duration of Run-in ___hrs. Speed _____RPM

Motor S/N ________	At Commencement of Run-in	Post-Run-in
Drive Current No Load, ma		
Drive current Loaded, ma		
Motor Speed, RPM		
Module Speed, RPM		
Motor Torque, oz-in.		
Module Torque, oz-in.		

______________________ ______________

Operator's Signature Date

10.0 CAPSTAN ASSEMBLY

10.1 General. The capstan transfers power from the drive belt to the magnetic tape and tape reel assembly. This transfer must be accomplished efficiently while isolating the section of tape crossing the head from transient influences.

The capstan is manufactured with precision bearings and is to be assembled with care.

10.2 Description. The capstan is to be assembled in the clean area by the Magnetic Recorder Group. Pages 38 and 39 of this Test Plan itemize certain critical steps in the capstan construction. Each critical step must be documented by the person performing the operation. The inspection and test results are to be reviewed by the assembly foreman and the Quality Control Department.

10.3 Sequence. Construct capstan assembly according to the REL Drawings #1738-7-1 or -7-2, filling out a vellum copy of the Inspection and Test Check List on page 38 and a vellum copy of the Bearing Assembly Data Sheet on page 35.

10.4 Definitions. The following will define evaluation technique and limits of acceptance:

A. Bearings. Only bearings rated as Good (page 31, Section 9) should be used in this assembly.

B. Bearing Protrusion. Bearing protrusion shall be 0.002 to 0.014 inches at pulley and at housing.

C. Clutch Drum Spacing. Clutch drum spacing should be 0.003 to 0.005 inches.

D. Capstan Run-out. Capstan run-out after grinding should be less than or equal to 0.00005 inches TIR max.

E. Input Pulley Diametrical Run-out. Input pulley diametrical run-out should be less than 0.0005 inches TIR.

F. Input Pulley Wobble. Input pulley wobble should be less than 0.005 inches TIR.

G. Coupling Pulley Diametral Run-out. Coupling pulley run-out should be less than 0.0005 inches TIR.

H. Coupling Pulley Wobble. Coupling pulley wobble should be less than 0.005 inches TIR.

I. Weight. Weight shall be approximately 140 grams for the upstream capstand and 140 grams for the downstream capstan.

NOTE: Should test plan and blueprint differ, print shall take precedence.

CAUTION

5X10⁶ BIT RECORDER

5X10⁶ BIT RECORDER

10.1
CAPSTAN ASSEMBLY
Page 37A

10.5 Capstan Assembly Inspection and Test Check List

Serial Number:__________ Date __________________

Operation	Done By (Initials & Date)	Data & Remarks
1. Cementing, slinger to shaft(Bonding Dept)		
2. Bearing Fit in Housing		
3. Bearing fit in Pulley		
4. Bearing fit on Shaft		
5. Alignment of Bearing Marks		
(a) in Housing		
(b) in Pulley		
6. Vent Hole Alignment		
7. Loquic, Loctite and Torque		
(a) Capstan End		
(b) Flywheel End		
(c) Flywheel to Pulley		
(d) Pulley		
8. Bearing Protrusion		inches
9. Clutch Drum Spacing		inches
10. Clutch Spring Fit		
11. Shaft Screw Loquic, Loctite, Torque		
12. Capstan Shaft Run-out		inches
13. Input Pulley Diametral Run-out		inches

10.5 (Continued)

Operation	Done By (Initials & Date)	Data & Remarks
14. Input Pulley Wobble (axial run-out)		inches
15. Coupling Pulley Diametral Run-out		inches
16. Coupling Pulley Wobble		inches
17. Temperature Cycle		Record data on vellum copy, page 35, Sec. 9 and include with these data.
18. Finish Grinding		
19. Test bearings per sec. 9. Lock $1\frac{1}{2}$" dia. Pulley & rotate in CW direction viewed from Capstan end.		Record data on vellum copy, page 35 and include with these data.
20. Visual Inspection		
21. Weight (nearest gram)		grams

Reviewed by__________________________

Assembly Foreman

Reviewed by__________________________

Quality Control Department

11.0 IDLER ASSEMBLY

11.1 General. The idler which transfers power from one belt to another is manufactured with precision parts and is to be assembled with care.

11.2 Description. The idler is to be assembled in the clean area by the Magnetic Recorder Assembly Group. Page 42 itemizes certain critical steps in the construction of the idler. Each critical step must be documented by the person performing the operation. The inspection and test results are to be reviewed by the Assembly Foreman and the Quality Control Department.

11.3 Sequence. Construct idler assembly according to the REL Drawings #1738-8 or -9, filling out a vellum copy of the Inspection and Test Check sheet on page 42 and a vellum copy of the Bearing Assembly Data Sheet on page 35.

11.4 Definitions. The following will define evaluation technique and limits of acceptance.

A. Bearings. Only bearings rated as Good (page 31, section 9) should be used in this assembly.

B. Bearing Protrusion. Bearing protrusion should be 0.002 to 0.014 inches.

C. Diametral Run-out, Pulley. Diametral runout, pulley should be less than 0.0006 inches TIR.

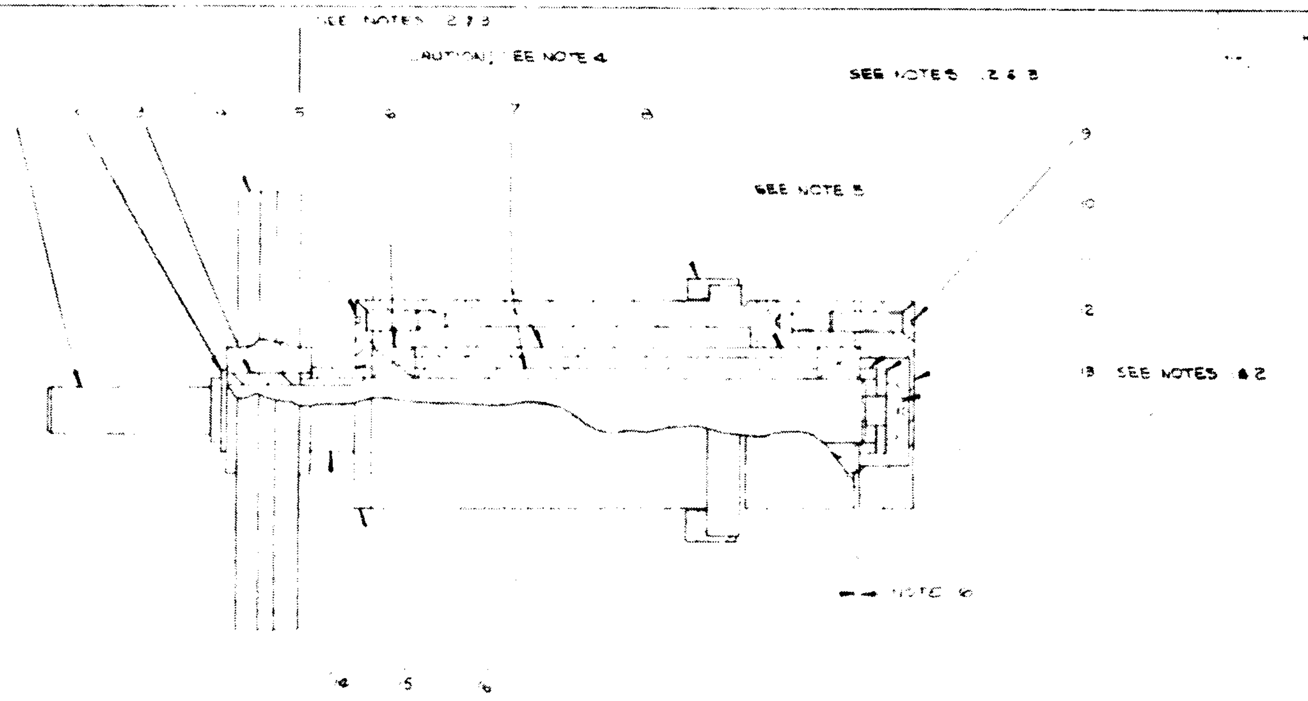
D. Pulley Wobble. Pulley wobble should be less than 0.005 inches TIR.

E. Diametral Run-out On Shaft Where Belt Runs. Diametral run-out at shaft should be less than 0.0005 inches TIR.

F. Weight. Weight shall be approximately 66 grams for the first idler and 57 grams for the second idler.

NOTE: Should test plan and blueprint differ, the print shall take precedence.

[redacted]



NOTES:
1- PRIME THREADED FASTENERS WITH 'LOQUIC' PRIMER GRADE N
2- SECURE THREADED FASTENERS WITH 'LOCTITE' GRADE 'C'
3- TIGHTEN ALL #0 SCREWS TO ONE IN LB TORQUE
4- ALIGN ECCENTRICITY MARKS ON INNER RINGS OF BEARING ITEM 6 DURING ASSEMBLY
5- ALIGN HOLES IN BEARING HOUSING ITEM 7 DURING ASSEMBLY
6- BEARING PROTRUSION .002 TO .014

[redacted]

ITEM	PART NUMBER	QTY	DESCRIPTION
16	C1738-106-2	1	HOUSING, BEARING
15	A1738-113	1	RETAINER, BEARING
14	B1738-107-1	1	SPACER (.178 TK)
13	MS35233-3	1	SCW PAN HD #2-56 x 1/4
12	A1738-124	1	RETAINER, BEARING
11	A1738-118-1	1	WASHER
10	B1738-107-3	1	SPACER (.048 TK)
9	MS35250-3	3	SCW FLT HD #0-80 x 1/4
8	B1738-128	1	CLEAT
7	B1738-105-4	M	SEPARATOR, BEARING
6	B1738-120	M	BEARING, DUPLEX
5	MS35250-2	3	SCW FL HD #0-80 x 3/16
4	B1738-127	1	PULLEY IDLER
3	A1738-108	1	KEY .32 SQ x 7/32
2	A1360-21-5	1	RING, RETAINING
1	B1738-132	1	SHAFT - SECOND IDLER

5X10 BIT RECORDER

TOLERANCES

RAYMOND ENGINEERING LABORATORY INC
MIDDLETOWN CONNECTICUT

2ND IDLER ASSY PLAYBACK

[redacted]

5X10 BIT RECORDER

FIGURE 11.1
IDLER ASSEMBLY

41A

11.4 Idler Assembly Inspection and Test Check List

Serial Number_______ Date_______________________

Operation	Done By (Initials & Date)	Data and Remarks
1. Bearing Fit In Housing		
2. Bearing Fit On Shaft		
3. Alignment of Bearing Marks		
4. [illegible] & Loctite		
(a) Shaft Screw(s)		
(b) Open Cap		
(c) Closed Cap		
5. Screw Torques		
6. Vent Hole Alignment		
7. Bearing Protrusion		inches
8. Diametral Run-out, Pulley		inches
9. Wobble (axial Mount), Pulley		inches
10. Diametral Run-out Shaft Where Belt Runs		inches
11. Test Per Sec. 9		(See page 35)
12. Visual Check		
13. Weight (nearest gram)		grams

Reviewed by_______________________
Assembly Foreman

Reviewed by_______________________
Quality Control Department

12.0 PRESSURE BELT PULLEY ASSEMBLY

12.1 General. The pressure belt pulley, which guides the belt that presses the magnetic tape against the head, is manufactured with precision parts and must be assembled with care.

12.2 Description. The pressure belt assembly is to be assembled in the clean area by the Magnetic Recorder Assembly Group. Page 44 itemizes certain critical steps in the construction of the pressure belt assembly. Each critical step must be documented by the person performing the operation. The inspection and test results are to be reviewed by the Assembly Foreman and the Quality Control Department.

12.3 Sequence. Construct pressure belt pulley according to the REL Drawing #1738-13, filling out a vellum copy of the Inspection and Test Check sheet on page 44 and a vellum copy of the Bearing Assembly Data sheet on page 35.

12.4 Definition. The following will define evaluation technique and limit of acceptance:

A. Bearings. Only bearings rated as Good (page 31, section 9) should be used in this assembly.

B. Diametral Run-Out. Diametral run-out should be less than 0.0005 inches.

C. Wobble. Wobble should be less than 0.005 inches TIR.

D. Weight. Weight should be approximately 25 grams.

12.4 Pressure Belt Pulley Assembly Inspection and Test Check List

Serial Number:_______ Date___________________

Operation	Done By (Initials & Date)	Data and Remarks
1. Bearing Fit In Pulley		
2. Bearing Fit On Shaft		
3. Alignment of Bearing Modules		
4. Loquic & Loctite		
5. Screw Torques		
6. Diametral Run-Out		inches
7. Wobble (axial Mount)		inches
8. Test Bearings per Section 9		Record data on a vellum copy of page 35 and include with these data
9. Visual Check		
10. Weight (Nearest gram)		grams

Reviewed by ______________________________
Assembly Foreman

Reviewed by ______________________________
Quality Control Department

13.0 TAPE REEL ASSEMBLY INSPECTION

13.1 General. The tape reel is the container for the endless loop of 325 feet of Mylar recording tape.

13.2. Description. The tape reel is to be assembled in the clean area by the Magnetic Recorder Assembly Group. Page 48 itemizes certain critical steps in the construction of the tape reel. Each critical step must be documented by the person performing the operation. The inspection and test results are to be reviewed by the Assembly Foreman and the Quality Control Department.

13.3 Sequence. Construct tape reel according to the REL Drawing #1738-11, filling out a vellum copy of the Inspection and Test Check Sheet on page 48 and a vellum copy of the Bearing Assembly Data Sheet on page 35.

13.4 Definitions. The following will define evaluation technique and limits of acceptance.

A. Bearings. Only bearings rated as Good should be used in this assembly. (See page 31.).

B. Diametral Run-Out. Diametral run-out should be less than 0.005 inches.

C. Wobble. Wobble should be less than 0.005 inches TIR.

D. Plate, Tape Reel Run-Out. Tape Reel run-out at plate should be less than 0.005 inches TIR.

E. Weight. Weight of tape reel with tape should be approximately 210 grams.

F. Tape Pre-run. Wind 360 feet of Minnesota Mining and manufacturing Company magnetic recording tape, part number on the REL tape puller. Run tape at 12 inches per second until the entire tape has made 150 to 175 passes.

G. Splice Tape Pre-curing. Pre-cure number 3M390 video splicing tape by baking individual strips at 200°F for four (4) hours.

H. Tape Splicing. Wind 330 feet of pre-run tape on hub. Leave approximately one (1) foot at each loose end. Remove lubricant where splice is to be made with alcohol. Butt splice the ends with one inch of Minnesota Mining and Manufacturing part number 390 video splicing tape on the lubricated side of the tape. As an added control on the materials and process, any tape splice which may possibly be the final tape splice to be put in a particular machine shall be subjected to the following test: Obtain approximately a six (6) inch sample of the tape from the region to be spliced. Make a typical splice in this sample exactly the same as the splice in the recorder tape and with a piece of the same strip of cured splicing tape. Subject the sample to an exposure at 180°F for 24 hours while under a four (4) ounce tension. Record the amount of opening of the splice at one (1) hour, two (2) hours and twenty-four (24) hours. Any non-typical results shall be considered as evidence that the splice made in the recorder is not satisfactory. Typical creep in 0.002 to 0.004 inches in a 24 hour period.

13.4 Tape Reel Assembly Inspection and Test Check List

Serial Number: ________ Date: ____________

Operation	Done By (Initials & Date)	Data and Remarks
1. Bearing Fit In Support, Hub		
2. Shaft Fit In Bearings		
3. Alignment of Bearing Marks		
4. Diametral Run-out		inches
5. Wobble (axial run-out)		inches
6. Test Bearings per Sec. 9		Record Data on a Vellum Copy of page 35 and include with these Data
7. Loquic & Loctite		
(a) Inner Bearing Retainer		
(b) Sup., hub-hub, Tape Reel		
(c) Shaft Screws (2)		
(d) Plate, Tape Reel Hub, Tape Reel		
(e) Outer Bearing Retainer		
(f) Ring-Plate, Reel		
(g) Set Screws		
8. Screw Torques		
9. Plate, Tape Reel Run-out		inches
10. Spin RPM and Coast Time		_____ RPM ___ secs.

13.4 (Continued)

Serial Number:________ Date:________________

Operation	Done By (Initials & Date)	Data & Remarks
11. Tape Length		feet
12. Attachment of Foil		
13. Tape Pre-run		________ passes
14. Splice Tape Pre-curing		Baked at _____ °F for _______ hours
15. Weight to Nearest Gram With Tape Installed		grams
16. Visual Check		

Reviewed by________________________
Assembly Foreman

Reviewed by________________________
Quality Control Department

14.0 CASE AND COVER EVALUATION

14.1 General. The transport is shock mounted within a frame called the case. The case is open on top and bottom. Covers fit over these openings to make a sealed housing for the transport to protect it from the hard vacuum of outer space.

The case and its covers are made of magnesium. To make magnesium leakproof, the metal has to be chemically treated after the final machining operation. Once treated, these parts must be protected to prevent accidental scratches or abrasions.

14.2 Test Description. The prime test on the case and covers is the leak test; however, during fabrication there are 3 in-process tests. The following type of tests will be performed on each piece:

1. Raw stock is to be X-Rayed.
2. Machined piece is to be dye-penetrant tested.
3. Piece is to be visually and dimensionally inspected.
4. Piece is to be leak tested.

Source inspection of all tests is required. The source inspector must witness all data and verify that all handling procedures are adequate to prevent scratches, nicks and burrs during all processes, tests, shipment, etc.

14.2.1 Test Sequence. The following defines the order of testing on the case, P/N 1738-167.

A. Material X-Ray. The magnesium will be X-Rayed by Parker X-Ray, East Hartford, Connecticut before machining. After the material has been X-Rayed, it is machined to dimensions at the Dean Machine Products Company, Manchester, Connecticut.

B. Dye-Penetrant Inspection. After the material is machined, the Magnaflux Corporation of East Hartford, Connecticut will perform a flourescent dye-penetration inspection.

C. Visual and Dimensional Inspection. REL will visually and dimensionally inspect after the dye-penetrant inspection. Once visually and dimensionally inspected, the pieces will be grit blasted. Within 2 hours after the grit blast, the pieces will be ultrasonically cleaned and Dow 7 finished. Then the pieces will be vacuum impregnated at American Metaseal of Hamden, Connecticut (REL source inspection is required).

After the vacuum impregnation, Raymond Engineering Laboratory, Inc., Middletown, Connecticut (REL) will purge threads, flush all debris and chips from holes, install threaded inserts, and refinish the seal surfaces. Holes receiving inserts will again be purged after the installation.

Upon completion of case, REL will rubber stamp the piece with part number and serial number.

D. Visual Inspection on Completed Case. The REL inspection group will visually inspect the completed case for finish and workmanship. When the visual inspection has been certified, the case will be turned over to the Ardel Laboratory of Glendale, California to be leak tested in the housing assembly.

14.2.2 The following will define the order of testing on the top and bottom cover P/N 1738-142, and P/N 1738-141.

A. Material X-Ray. The magnesium will be X-Rayed by Parker X-Ray before machining. After material has been X-Rayed, it is machined to dimensions at REL.

B. Dye-Penetrant Inspection. After the material is machined, the Magnaflux Corporation, East Hartford, Connecticut will perform a flourescent dye-penetrant inspection.

C. Visual and Dimensional Inspection. The REL inspection group will visually and dimensionally inspect after the dye-penetrant inspection.

When visual inspection has been certified, the covers will be turned over to Ardel Laboratory who will direct the Parker Seal Company of Los Angeles, California to machine and finish gasket grooves. All further steps in the processing and testing must be witnessed by an Ardel source inspector. Ardel is also required to seek JPL source inspection for each of the steps.

D. Gasket Groove Inspection. In-process inspection is required during machining of the gasket grooves. After the gasket groove has been inspected, the parts will be grit blasted, DOW 7 finished and vacuum impregnated.

Parker will then mold and bond Gask-O-Seals to the covers. Ardel will insure the continuity of all test and inspection records by identifying each piece by rubber stamping or silk screening part number and serial number on each cover.

E. Verification of DOW 7 Finish. Ardel and the JPL source inspector will witness the operation and verify the DOW 7 certification.

F. Verification of Vacuum Impregnation. Ardel and the JPL source inspector will witness the operation and verify the impregnation certification.

G. Inspection of Molding and Bonding of Gask-O-Seal. Ardel and the JPL source inspector will inspect the molding and bonding of the Gask-O-Seal.

H. Leak Test on Covers. Parker Seal or Ardel will leak test the covers at room temperature and at 176° F.

14.2.3 The following will define the order of testing on the housing assembly:

A. Leak Test at Ardel Laboratory. Top and bottom covers will be fastened to case, making the housing assembly, and be leak tested at Ardel at room temperature and 176° F.

B. Leak Test at REL. Housing assembly leak tested at REL (see section 16).

14.3 Definition. The following will define evaluation technique and limits of acceptance for the case, P/N 1738-167.

A. X-Rays. Each X-Ray shall be accompanied by a short, concise report describing the results. A certification of the X-Ray process is required.

B. Dye-Penetrant Inspection. Each piece shall be accompanied by a short, concise report. The process shall be source inspected and a certification that the process complied with MIL-I-6866 is required.

C. Visual and Dimensional Inspection at Dean. Inspect case per REL Inspection Instruction Sheet #1738-167. Record actual readings on an REL Inspection Record. Source inspection is required.

Word of Caution: Surfaces, top, bottom, and protruding tabs are critical surfaces and should be protected at all times to prevent scratching, damage to tabs, etc. During inspection and all subsequent handling, parts should not rest on top or bottom surfaces or tabs without first providing adequate protection sufficient to prevent any damage to surfaces.

D. Visual Inspection at REL. The REL inspection group shall inspect the completed case for finish and workmanship. They shall note that:

1. The raw material has a certification.
2. X-Ray tests are negative and accompanied by certification.
3. Dye-penetrant inspection is negative and has certification that process complied with MIL-I-6866.
4. Visual and dimensional inspection at Dean denoted that parts meet the requirement.

5. Surfaces noted 16 finish or better did not receive grit blast.
6. DOW 7 finish is complete and certified to comply with MIL-M-3171A, Type III.
7. Impregnation process is certified to comply with MIL-STD-272, 2 dip process.
8. All holes are free from debris and chips, and that threaded inserts were installed per drawing.
9. Each piece is rubber stamped with part number and serial number per JPL Specification 20002 in location described by drawing.

14.3.1 The following will define evaluation technique and limits of acceptance for the top and bottom cover P/N 1738-142 and 1738-141.

A. X-Rays. Each X-Ray shall be accompanied by a short, concise report. A certification of the X-Ray procedure is required.

B. Dye-Penetrant Inspection. Each piece shall be accompanied by a short, concise report. The process shall be source inspected and a certification that the process compled with MIL-I-6866 is required.

C. Visual and Dimensional Inspection. Inspect at REL, top and bottom cover per Inspection Instruction Sheet #1738-142 and 1738-141 respectively. Record actual readings on an REL Inspection Record. REL will verify that:

1. Raw material has a certification.
2. X-Ray tests are negative and are accompanied by certification.
3. Dye-penetrant inspection is negative and has certification that process complied with MIL-I-6866.

Word of Caution: Finished parts should be carefully handled and kept in plastic bags to protect all finishes.

D. Gasket Groove Inspection at Parker Seal. Inspect machine gasket groove according to Inspection Instruction Sheet #1738-142 for top cover and #1738-141 for bottom cover. Ardel and JPL source inspection is required.

E. Verification of DOW 7 Finish and Grit Blast. The Ardel and JPL source inspector will witness, verify, and record on the Inspection Record that the DOW 7 finish is certified to comply with MIL-M-31718A, Type III and grit blast to B/P Note 8.

F. Verification of Vacuum Impregnation. The Ardel and JPL source inspector will witness, verify and record on the Inspection Record that the vacuum impregnation is certified to comply with MIL-STD-276, two dip treatment.

G. Inspection of Molding and Bonding of Gask-O-Seal. The Ardel and JPL source inspector will witness, verify and record on the Inspection Record that the molding and bonding of the Gask-O-Seal is per B/P, and that the mating surface of the seal is free from cracks, pimples, flaws, pits or foreign material. Microscopic examination with at least 10X magnification is required. They will also examine the stamped part number and serial number and verify that they comply with the respective drawing.

H. Leak Test on Covers. See section 14.3.3.

14.3.2 The following will define evaluation techniques and limits of acceptance for the housing assembly.

A. Leak Test at Ardel. See section 14.3.3.

B. Leak Test at REL. See section 14.3.3.

14.3.3 Leak Test Procedure. The leak tests on the top and bottom cover and the housing assembly, except for tests performed at REL, will be directed by Ardel and witnessed by the JPL source inspector.

Along with the requirement set down by Ardel, REL requires the following procedure on the leak tests:

1. Use a trace gas consisting of 100% Helium.
2. Record the rating of the standard leak sample.
3. Plot the leakage readings as a function of time during the test. When it has been determined from the graph that the system has stabilized, record the final reading and compute the actual leak rate. Normally it takes at least 30 minutes to reach stability.
4. Periodically calibrate instrument by reading a standard leak sample. A calibration check must be done immediately before and after a room temperature test and immediately before and after a high temperature test.

5. Immediately before and immediately after the test run, place the standard leak sample under the bell jar in the same manner as the test specimen. Ardel may instruct that this step be eliminated if the auxiliary vacuum pumps are valved off during the actual specimen measurements.

6. Record the diatron pressure several times during the test. The pressure should remain below 0.1 microns.

7. Pressure measured at the specimen should be below 10^{-3} microns for a duration of 5 minutes or more to remove absorbed surface contaminants. This measurement should be made with a hot cathode ion gage. In the housing leak test, record the minimum pressure and the duration. This step may be omitted if leakage measurement stabilizes within 30 minutes.

8. Record the accelerator voltage; be sure this voltage is set for maximum leakage reading.

9. Record the serial number and date of the last calibration of each piece of equipment where applicable.

10. All readings that are recorded shall be actual readings; computations shall be done on a work sheet and submitted with the data.

11. Record specimen temperature with a thermocouple and potentiometer during the test. The thermocouple must be attached to the test piece in such a way as to assure actual specimen temperature.

12. Record the total length of time the specimen was in vacuum

Leak tests on the covers and housing assembly will be performed at room temperature and at 176° F ±5°. During the temperature transition, the specimen should not see a temperature change greater than 5° F per minute.

All runs will be performed with a clean, dry seal; no grease will be used on the mating surfaces of the Gask-O-Seal. Grease is permitted to seal the bell jar. When testing the covers, record the finish of the mating surface on the fixture. All surfaces of the fixture and the test piece should be clean and be free from grease, rubber, or other materials prone to contamination.

Specify the leak rate in standard cc's of helium/inch of seal x years. The leakage rate on the covers should not exceed 7 cc's/inch x year at room temperature and 60 cc's/inch x year at 176° F.

The housing assembly leakage rate should not exceed 450 cc/year at room temperature and 3700 cc/year at +176° F.

Figures 14.1, 14.2, 14.3 and 14.4 describe suggested setups for the covers and the housing.

FIG. 14.1
COVER LEAK TEST

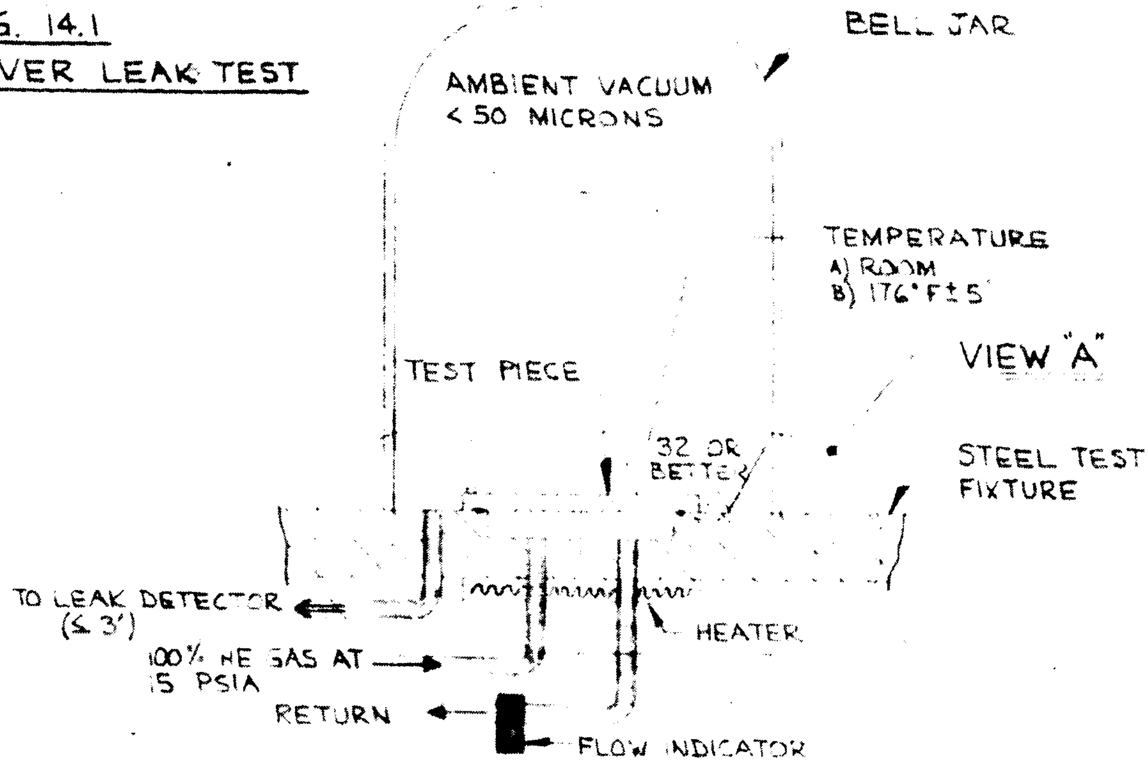


FIG 14.2
TOP COVER TEST
ENLARGED VIEW "A"

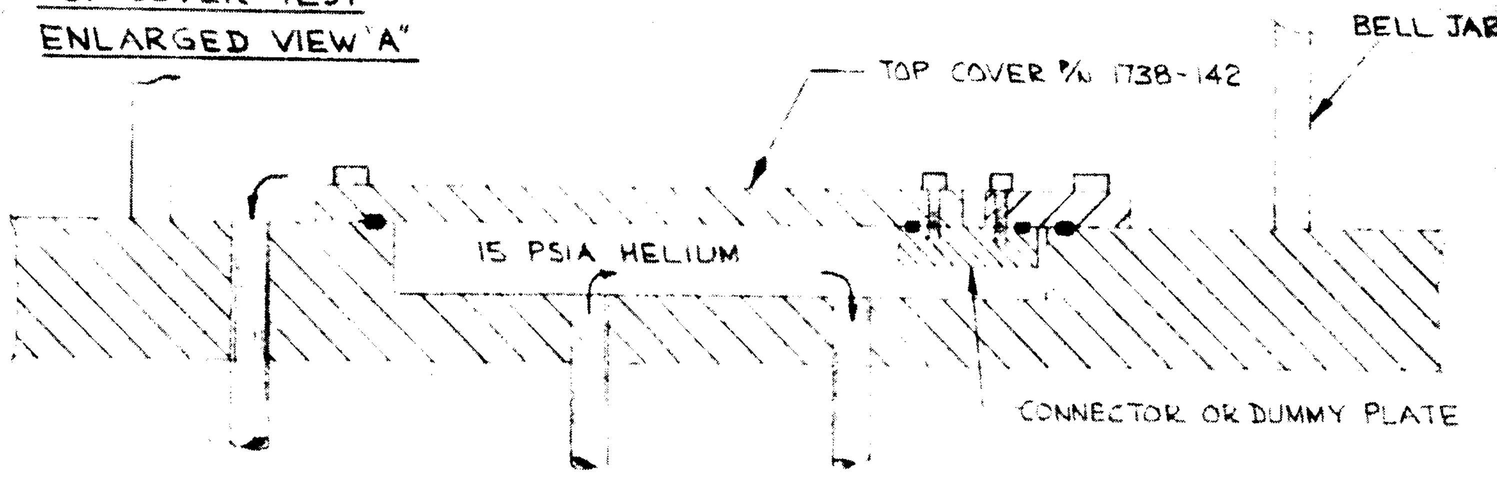
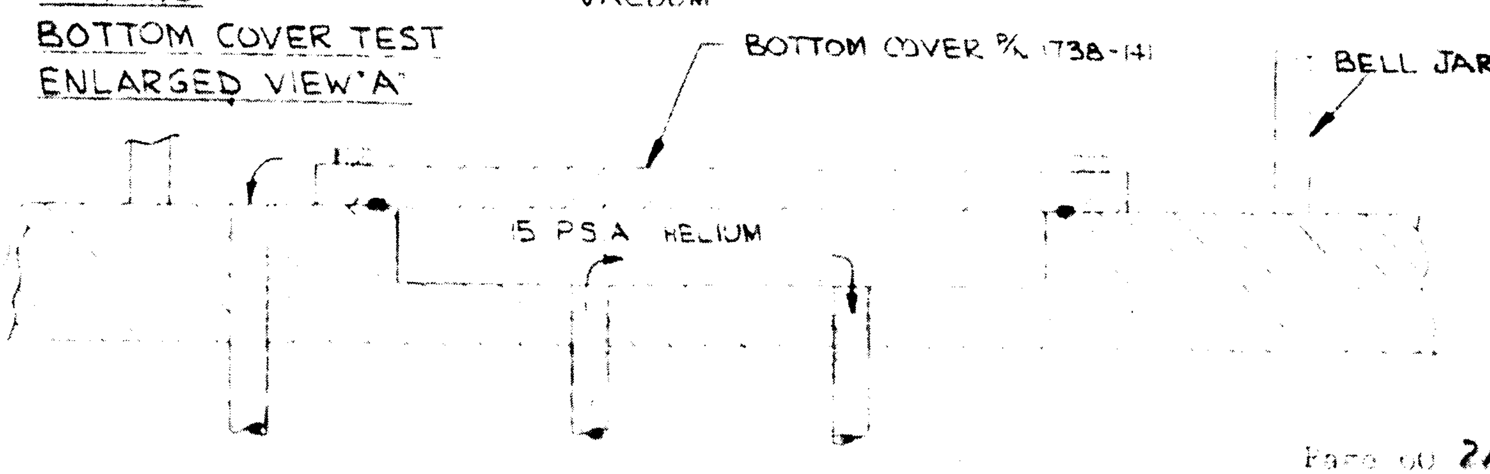


FIG. 14.3
BOTTOM COVER TEST
ENLARGED VIEW "A"



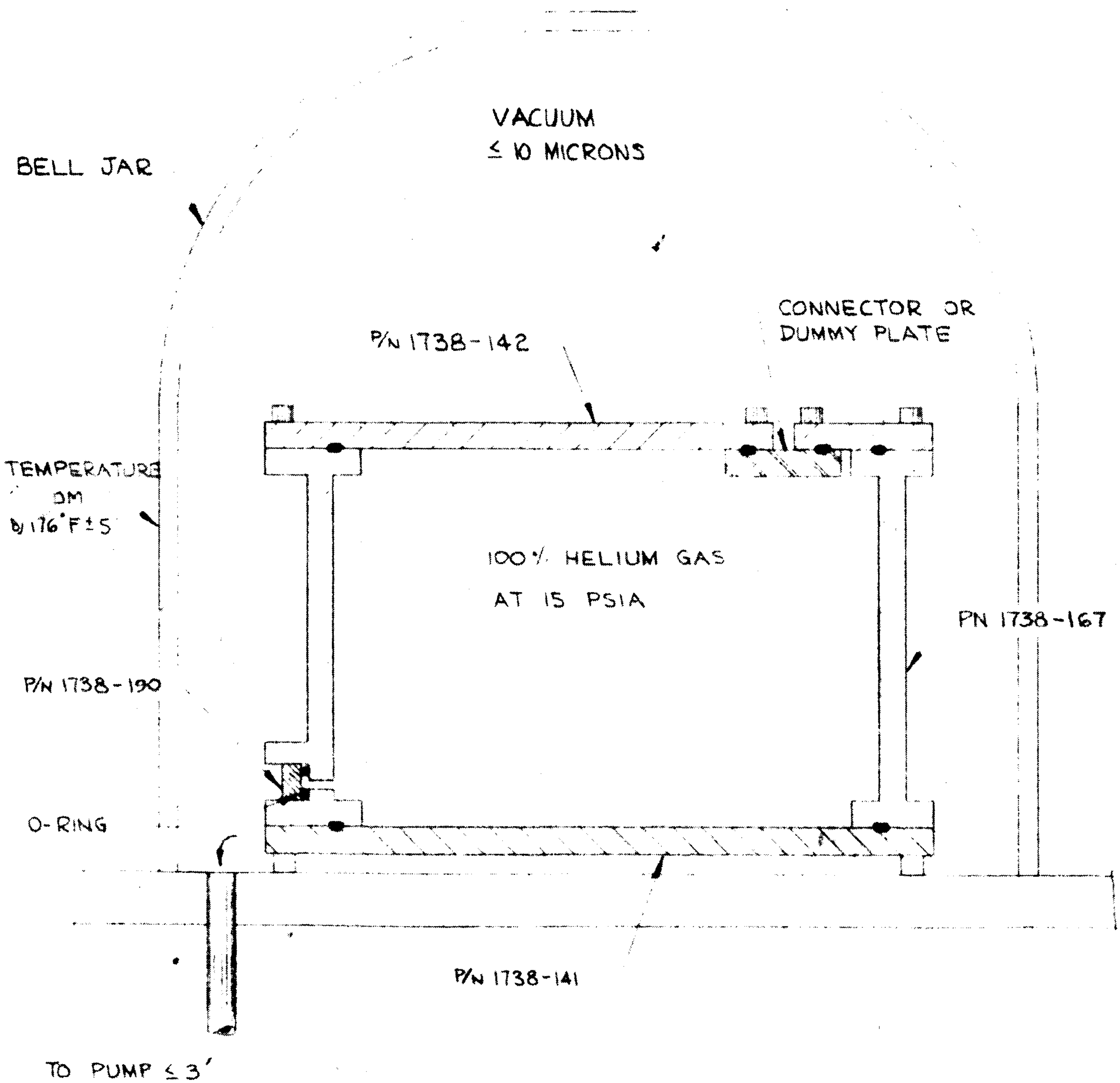


FIG 14.4

HOUSING ASSEMBLY
TEST

14.4 Suggested Leak Test Data Sheet.

Part Number____________________ S/N____________________

Date____________________ Operator____________________

---

1) Temperature________________

2) Trace Gas________________

3) Leak rate with auxiliary pump (meter)________________ at stabilization.

   Leak rate without auxiliary pump (meter________________ at stabilization

Leak Rate (meter reading)

Time

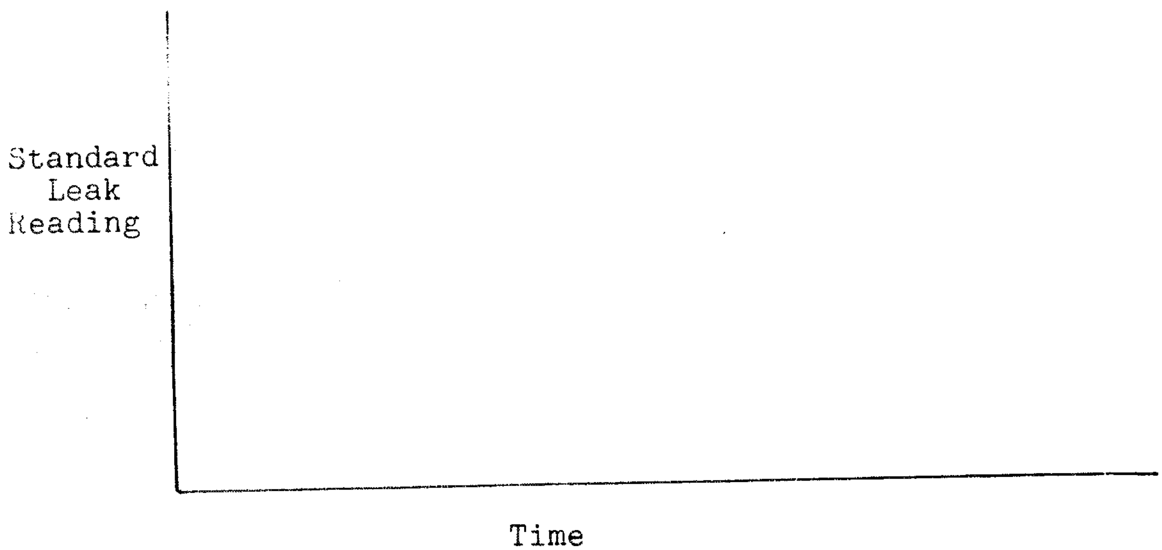
14.4 (Con't.)

Part Number ____________ S/N ____________

Date ____________ Operator ____________

4) Standard leak with auxiliary pump at stabilization ____________

Standard leak without auxiliary pump at stabilization ____________



5) Standard leak sample rate under bell jar.

Before test ____________

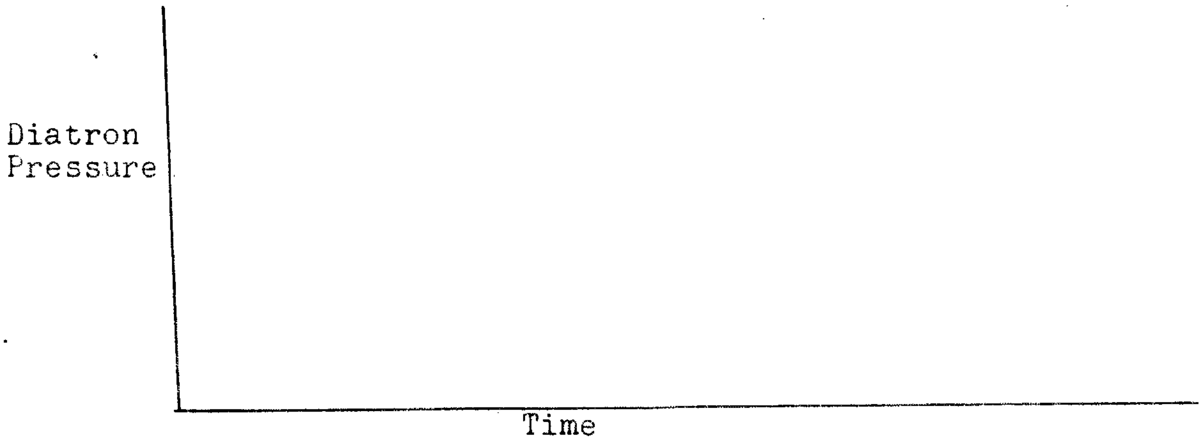
After test ____________

14.4 (Con't.)

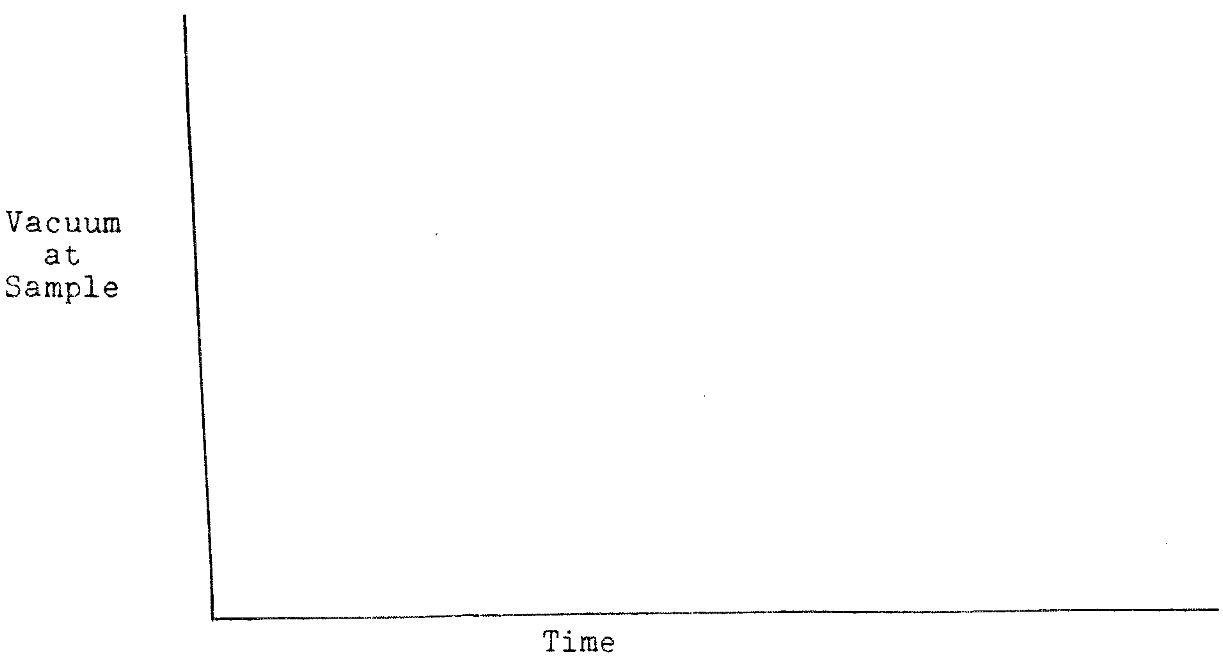
Part Number________________ S/N________________

Date________________ Operator________________

6) Pressure at Diatron



7) Vacuum at Sample



14.4 (Con't.)

Part Number____________________ S/N______________________________

Date________________________ Operator______________________________

8) Acceleration voltage____

9) Leak tester type____

Date of last calibration__________________________________

Hot cathode ion gage S/N____________________________________

Date of last calibration__________________________________

Standard leak rate____________________ S/N__________________

Date of last calibration__________________________________

10) Finish on seal mating surface_______________________________

11) Calculated leak rate of sample at stabilization______________________________ cc/in./year

Reviewed by______________________________
Engineer

Reviewed by______________________________
Source Inspection

15.0 MYLAR BELT INSPECTION

15.1 General. Mylar belts perform two tasks on the 1738 recorder. The first is to transmit power from the motors to pull the magnetic tape and the second is to press the magnetic tape against the capstans and the heads.

The power belts (clear Mylar) are 0.125" wide by one mil thick except for the 2 mil capstan coupling belts. The pressure belts (red Mylar) are 0.218" wide by 2 mils thick.

15.2 Test Description. The following inspection will be performed on all Mylar belts:

A. Visual inspection

B. Physical measurement

C. Tension in assembly.

15.3 Test Sequence. The following will define the order of testing:

1. Visual Inspection. The Mylar belt shall be free from visual flaws.

2. Physical Measurement. The Mylar belts shall comply with Inspection Instruction sheet number 1738-175 and according to the methods called out in this section.

3. Tension in Assembly. The tension of the belts in the assembled transport shall be measured by the Magnetic Recorder Assembly Group according to the method called out in Section 16.

15.4 Definition. The following will define evaluation technique and limits of acceptance.

A. Visual Inspection. The Mylar belt observed under a 5 power (or greater) eye loop shall be free from creases, pimples, pin holes, tears or necking.

B. Physical Measurement. A sample belt or pieces of identical Mylar cut from the same sheet, shall accompany the lot and be measured for thickness. The actual belts under examination should not be measured for thickness to prevent damage to their surfaces. The thickness of the sample shall be per print.

Measure each belt for width at 6 different places. Width shall be per print.

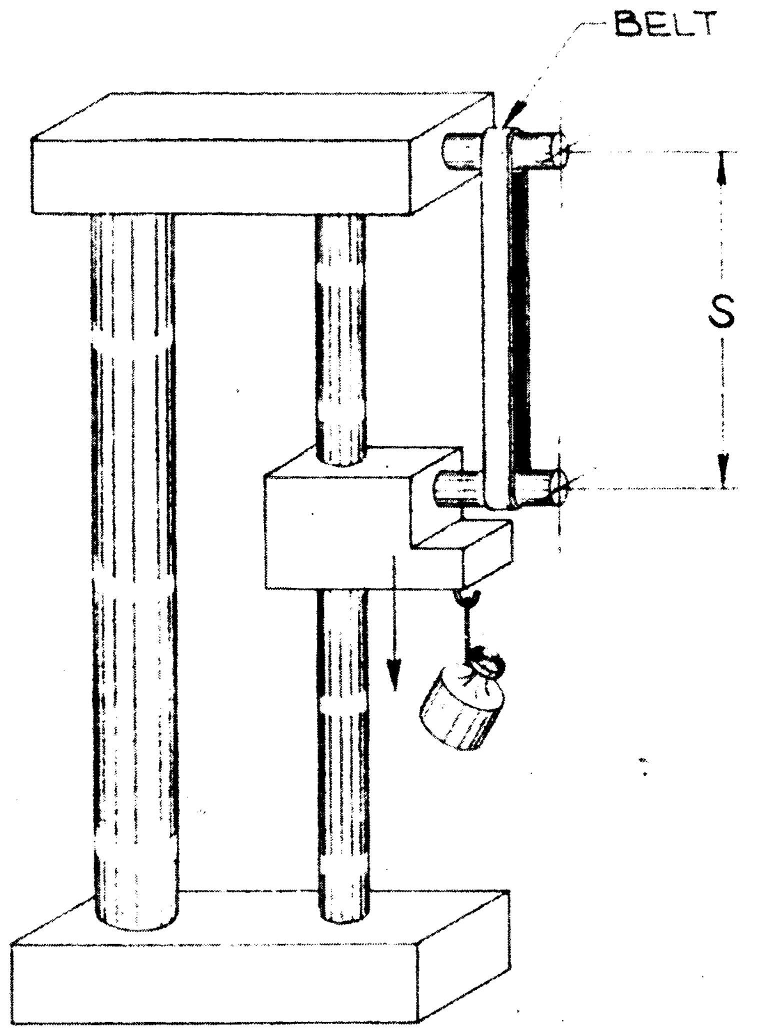
Using the test fixture number T1738-175, measure the length of each belt while the belt is supporting the following weights. See figure 15.1.

Belt Number	Weight
1738-1, 2, 3, & 4	300 grams
1738-5	1200 grams
1738-6	700 grams

Rotate belt one half revolution before making measurement. Measure 3 times and take the average.

The length of the clear belts should be per print

C. Tension in Assembly: (See Section 16.)



LENGTH = 2 (S) + 1.163

FIG 15.1
BELT MEASURING
FIXTURE

16.0 TRANSPORT EVALUATION.

16.1 General. The transport consists of the entire mechanical recorder system plus a pressure sensor, a temperature sensor, playback preamplifiers, and power decoupling modules. The completed transport is sealed in 1.5 atmospheres of dry nitrogen.

When a transport has been completely assembled and is ready for functional test, it is delivered to the Test Engineer. It must be accompanied by its Log Book, which at this point must be checked for completeness by the Test Engineer. The Log Book must contain completed data sheets and all other records pertinent to Section 1 through 15 of this plan. The Test Engineer is responsible for making all future daily entries into the Log Book after the unit has been released from assembly for evaluation. This Log shall include cumulative operating time in the record mode, cumulative operating time in the playback mode, descriptions and results of all tests, and details of any modifications.

All data should be recorded on vellum sheets for reproduction. Each sheet must have the unit serial number, date, and operator's signature.

16.2 Test Sequence. Tests and inspections should be performed in approximately the following sequence as much as possible. Where tests or inspections reveal the need for additional work or adjustment, certain steps may have to be repeated. Detailed procedures are given in section 16.3.

All data should be recorded on vellum sheets for reproduction. Each data sheet must have the unit serial number, date, and operator's signature.

16.2 Test Sequence. Tests and inspections should be performed in approximately the following sequence as much as possible. Where tests or inspections reveal the need for additional work or adjustment, certain steps may have to be repeated. Detailed procedures are given in section 16.3.

16.2.1 Screw Loctite Checklist. Maintain a checklist showing that each screw is loctited as the subassemblies are secured to the chassis plate. If any screws are loosened later, show this on the checklist; show when they are subsequently reloctited.

16.2.2 Belt Tension Measurement. Set all belts to proper tension (according to past experience). Check the settings according to the procedure of paragraph 16.3.1 and readjust if necessary.

16.2.3 Belt Wobble Measurement. Measure according to paragraph 16.3.2.

16.2.4 Head/Capstan Parallelism Measurement. Measure according to paragraph 16.3.3.

16.2.5 Tape Tension Measurement. Measure according to the procedure of paragraph 16.3.4.

16.2.6 Pressure Pad Force Measurement. Measure according to paragraph 16.3.5.

16.2.7 Preliminary Functional Check. Prior to the installation of the preamplifier and power decoupling modules, check for excessive flutter and motor hunting at -10°, +25°, and +80° C in accordance with paragraph 16.3. If no rework is indicated, proceed with installing the electronic modules. Subsequently the transport mechanism must not be subjected to temperatures below 0° or above +55° C.

16.2.8 Functional Check After Wiring. At room temperature, 0°, and +55° C, check the following:

(1) Flutter (See 16.3.6).

(2) Amplitude Modulation (See 16.3.7).

(3) Tape Time (See 16.3.8).

(4) Playback Performance (See 16.3.10).

(5) Phase-locked-loop (See 16.3.11).

(6) End-of-tape Foil and Sensor (See 16.3.9).

(7) Start-Stop Time (See 16.3.12).

(8) Check temperature and pressure transducer operation qualitatively (calibration not required).

At any temperature, especially at cold, be sure the ambient relative humidity is low enough so that the dew point is never reached.

During the temperature transition, the transport must not be subjected to a gradient of more than 5° F per minute, measured at the transport main plate. Before tests can be made, the transport must receive a minimum soak of 4 hours at each temperature.

16.2.9 Record Motor Flywheel Adjustment. Adjust in accordance with paragraphs 16.3.12 and 16.3.13.

16.2.10 Tests and Inspections Before Vibration. After completing the functional tests and correcting the record motor flywheel, perform the following steps:

(1) Inspect Tape (See 16.3.14).

(2) Install new tape, run-in, and test per 16.3.4. Maintain the graph.

(3) Install new foil, run-in, and test per 16.3.9.

(4) Check pressure pad adjustment (16.3.5).

(5) Check belt tensions according to paragraph 16.3.1 (test outer edge only).

(6) Reloctite any screws disturbed by the preceding steps.

(7) Check flutter (16.3.6), AM (16.3.7), and tape length (16.3.8 and 16.3.13).

(8) Install in case with plastic covers for vibration tests.

16.2.11 Vibration Test. Perform test per paragraph 16.3.1[illegible].

16.2.12 Tests and Inspections After Vibration. Remove from the case and perform the following steps:

(1) Check flutter (16.3.6).

(2) Check AM (16.3.7).

(3) Check foil and sensor (16.3.9) and make qualitative check of playback performance and transducer operation.

(4) Check tape tension (16.3.4).

16.2.13 Final Buttoning-up, To Be Witnessed By Resident Inspector.

(1) Check flutter (16.3.6).

(2) Check AM (16.3.7).

(3) Check foil and sensor (16.3.9) and make qualitative check of playback performance.

(4) Check tape tension (16.3.4).

NOTE: The above steps need not be repeated after the post-vibration tests if no rework was performed in the interim.

(5) Review screw loctite checklist to make certain that no screws have been forgotten.

(6) Clean up and mount transport in case. Secure mounting studs with double nuts, loctite, and lockwire.

(7) Coat seals with Dow Corning #55 vacuum grease and mount covers. Torque screws per specification. Do not use loctite on the cover mounting screws and connector mounting nuts.

16.2.14 Leak Check.

(1) After buttoning-up, perform leak test per 16.3.10.

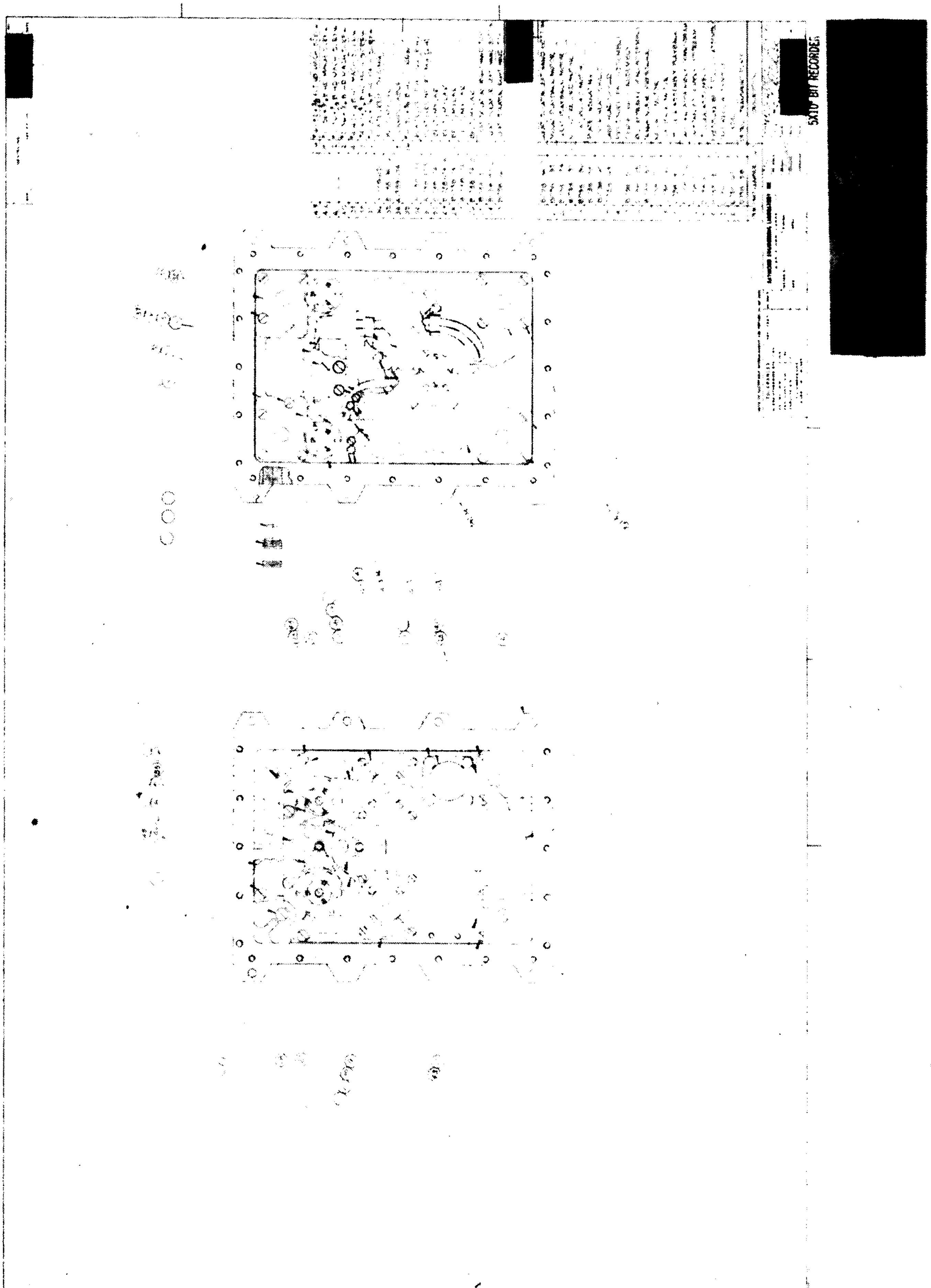
(2) Expose to one temperature cycle consisting of a soak at +55 and 0° C.

(3) Retorque cover mounting screws and connector mounting nuts.

16.2.15 Preparation For System Test. Install the transport in basic chassis with the electronic subchassis for system tests.

16.2.16 After System Test. Retorque cover mounting screws and connector mounting nuts.

RE-ORDER No. 65-492



16.3 Test Procedures.

16.3.1 Belt Tension Measurement. Excite belt in a bow-string type vibration by means of a low velocity jet of nitrogen. One half pound per square inch regulator pressure works well in most cases. Ideal pressure will vary with choice of nozzle and the belt geometry. Adjust a tone generator to the natural frequency of the belt by nulling out the beat frequency developed by the interaction of the two sound waves. The nozzle should be held an inch or less from the belt and aimed at the edge from a 20° attack angle. Gas pressure should be applied midspan as indicated in Figure 16.3. Record the maximum and minimum natural frequency of the belt when excited from the direction looking at the transport main plate. Repeat from the direction looking away from the main plate. Before making any measurements, rotate the belt twice around the pulleys to relieve any local stresses. Record the tension corresponding to the natural frequency from Figure 16.5 through 16.10 on the data sheet. The average tension should be 3,500 ±1,000 psi.

16.3.2 Belt Wobble. Estimate belt wobble by scale measurement on machine run by hand. Drive belts should not wobble more than ±0.010" and the pressure belt should not wobble more than ±0.015".

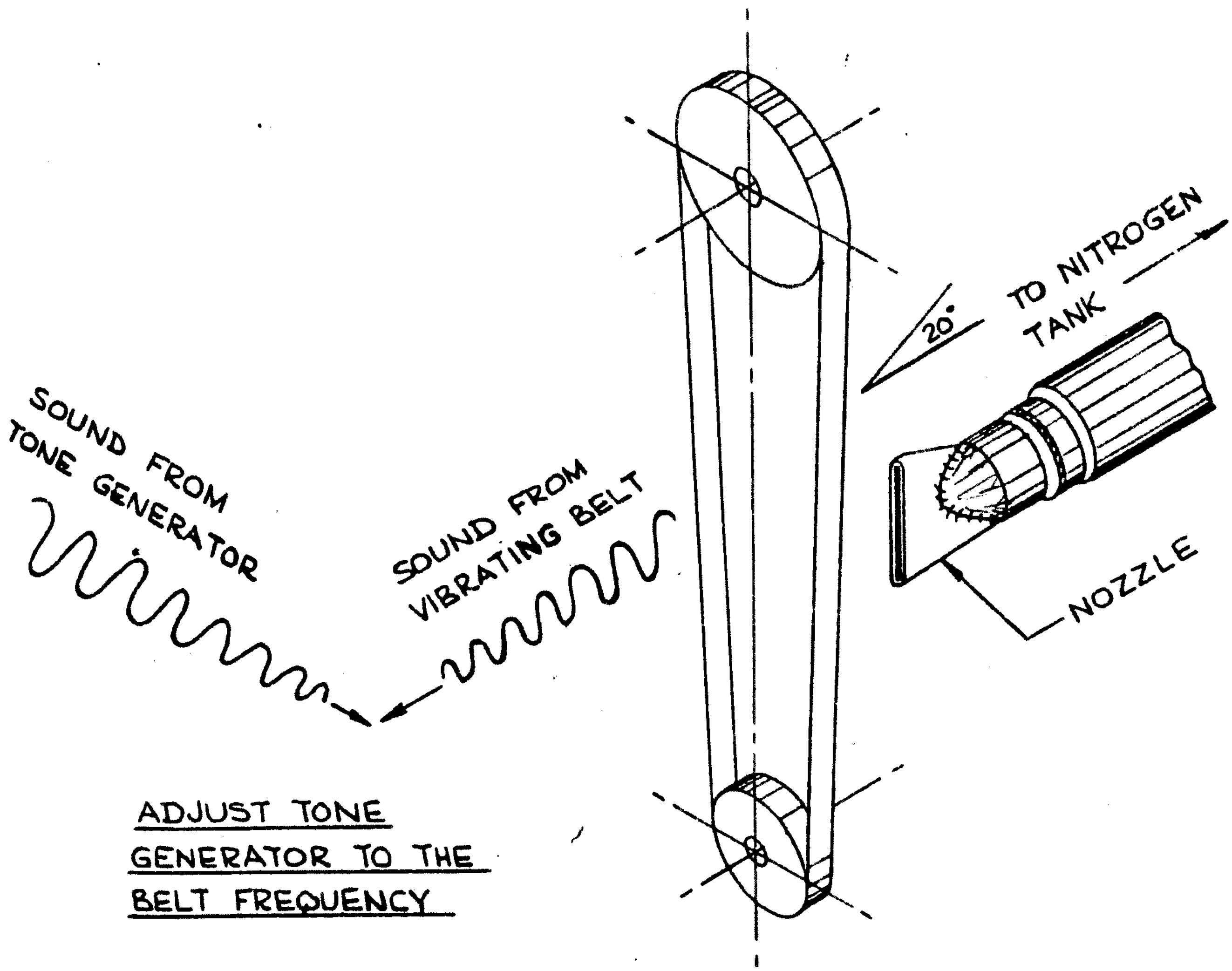


FIGURE 16.2
BELT VIBRATION

RE-ORDER No. 63 77

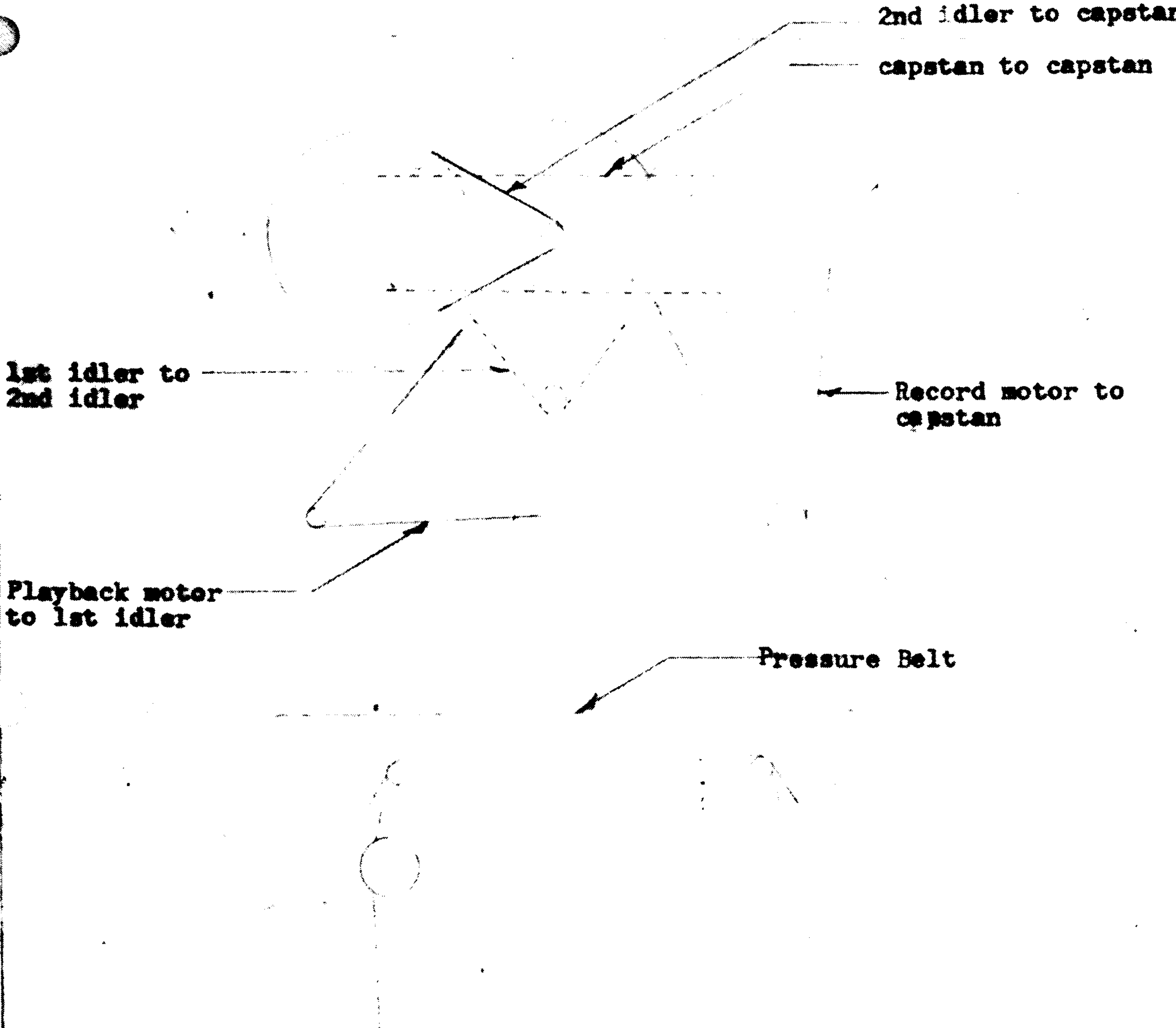


Figure 16.3

[illegible]		TITLE Belt Location 1756 Transport
		Page 76

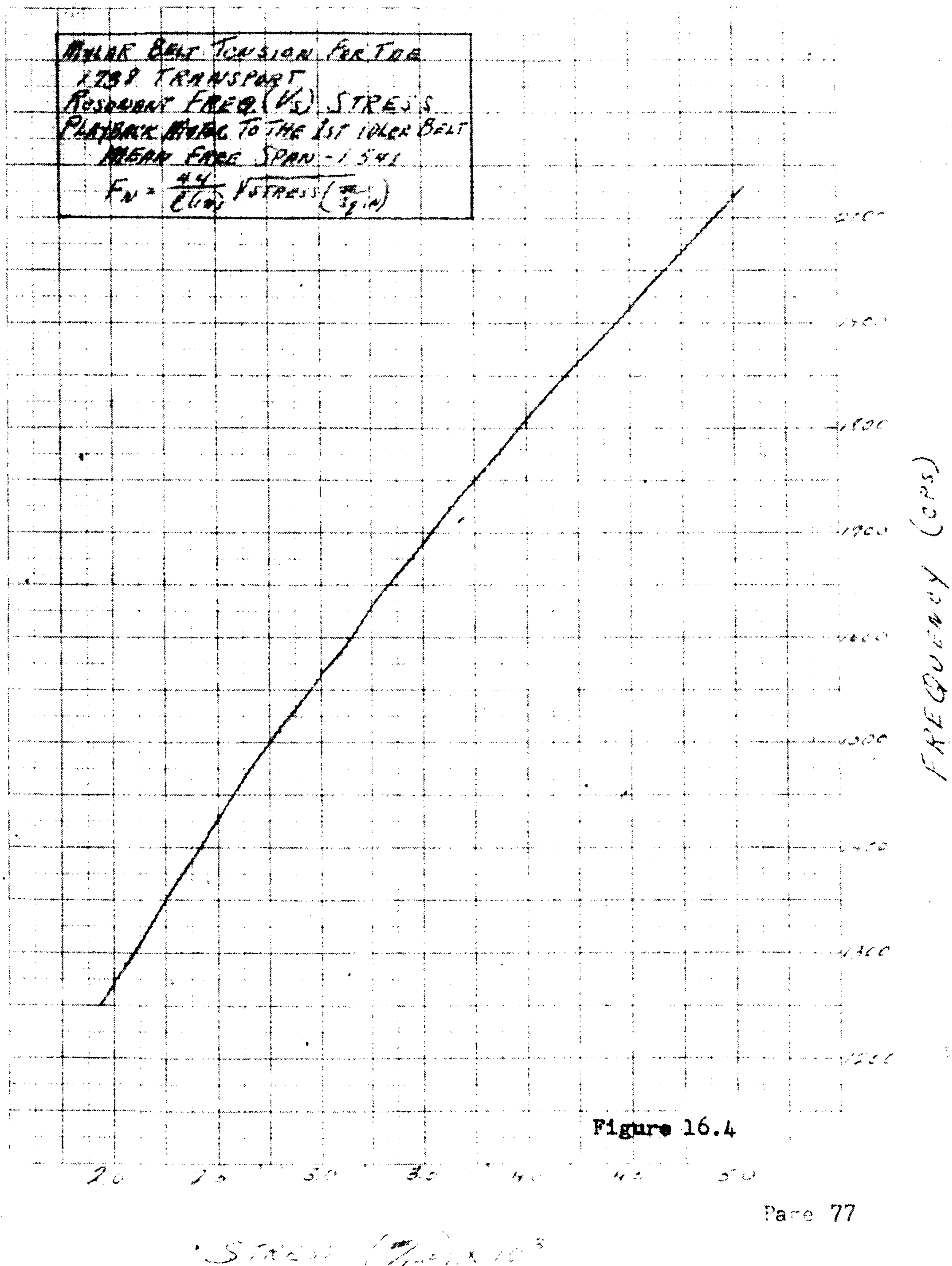

MYLAR BELT TENSION FOR THE
1238 TRANSPORT
RESONANT FREQ (VS) STRESS
PLAYBACK HEAD TO THE 1ST IDLER BELT
MEAN FREE SPAN - 1.541
FN = 44/ℓ(in) √STRESS (#/sq in)
20
25
30
35
40
45
50
STRESS (#/sq in) x 10^3
FREQUENCY (CPS)

Figure 16.4

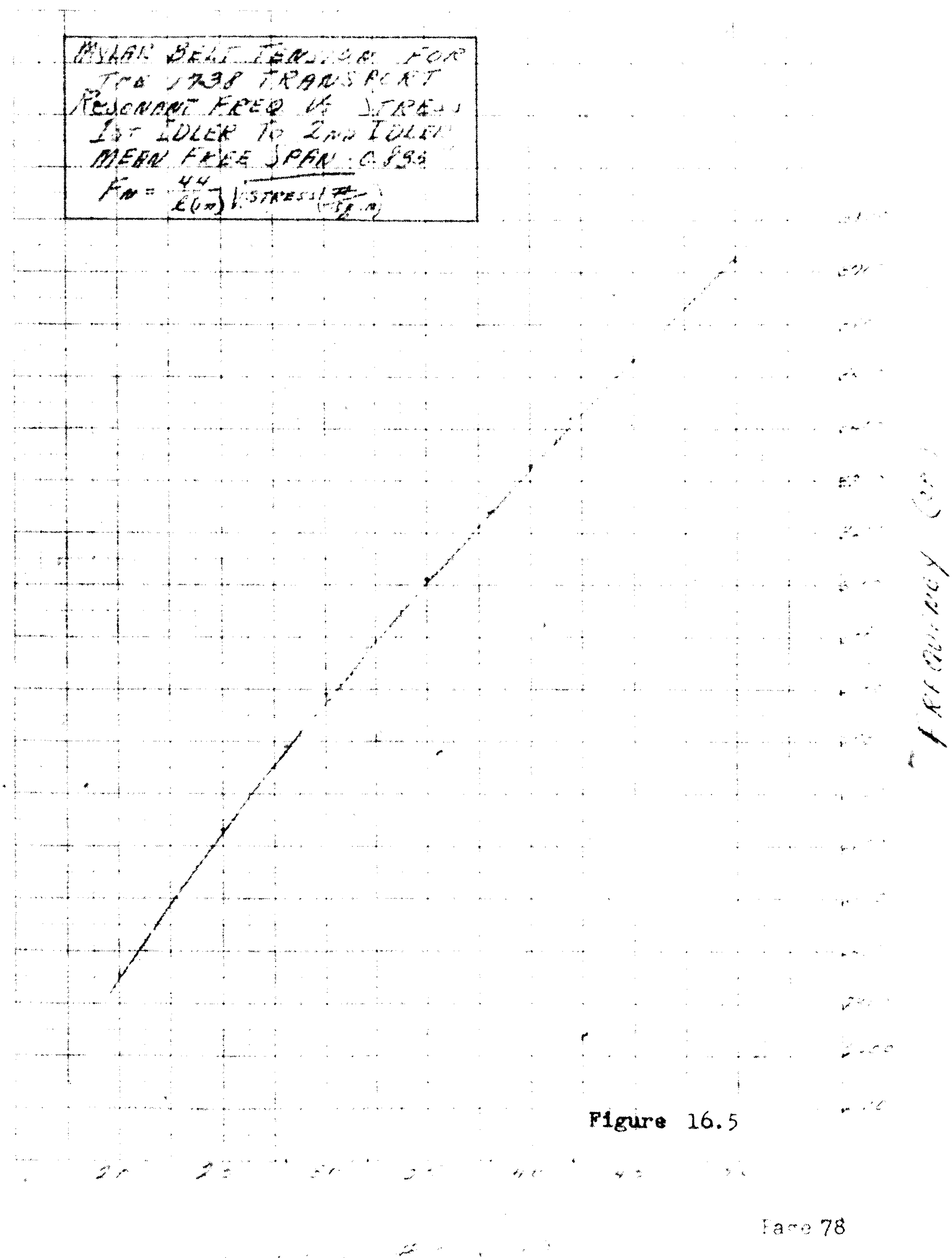
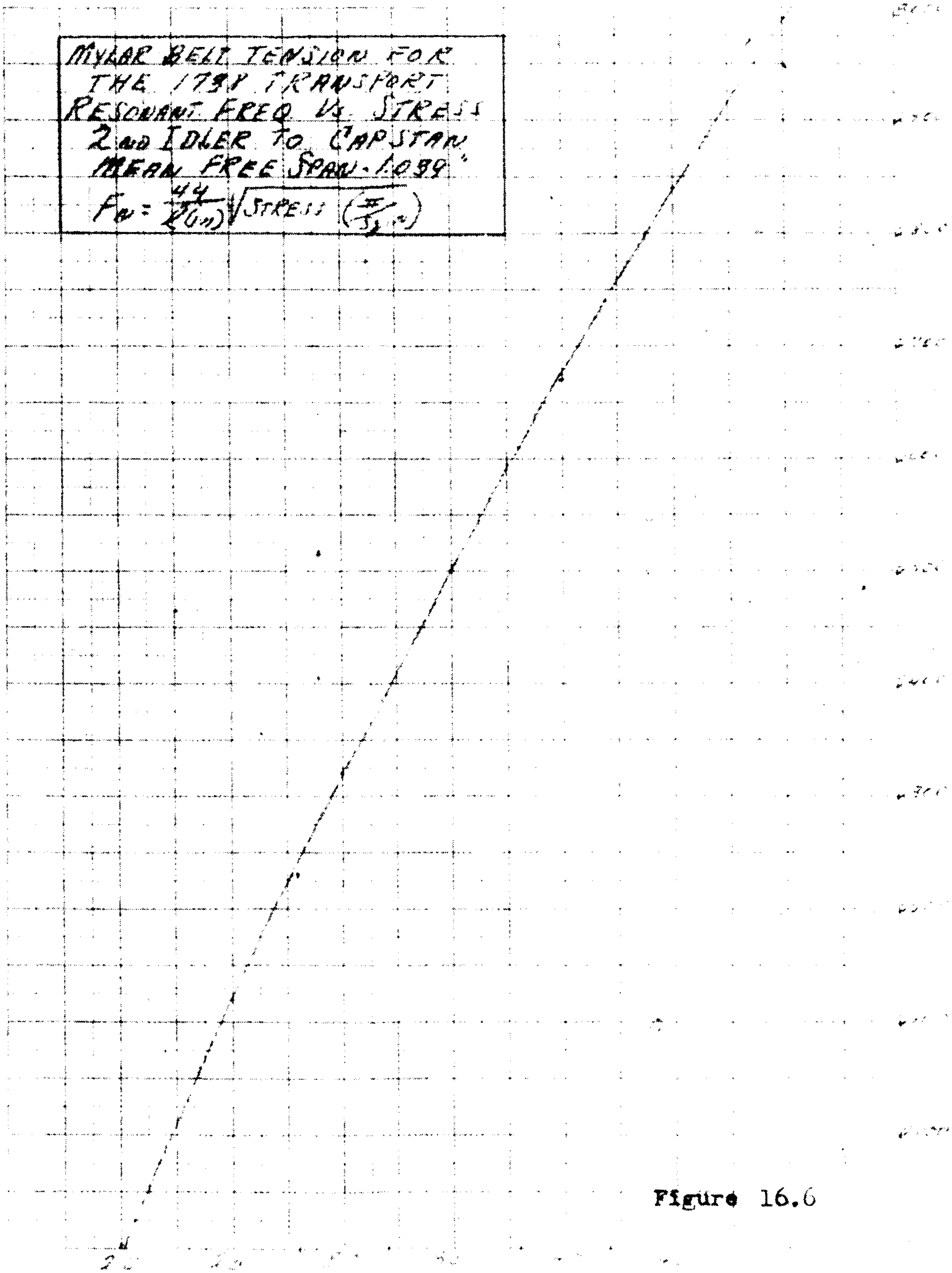

MYLAR BELT TENSION FOR
THE 1738 TRANSPORT
RESONANT FREQ VS STRESS
1ST IDLER TO 2ND IDLER
MEAN FREE SPAN 0.895
FREQUENCY
STRESS

Figure 16.5

63-497



$$F_N = \frac{44}{\ell\,(in)}\sqrt{STRESS\ \left(\frac{\#}{in^2}\right)}$$

Figure 16.6

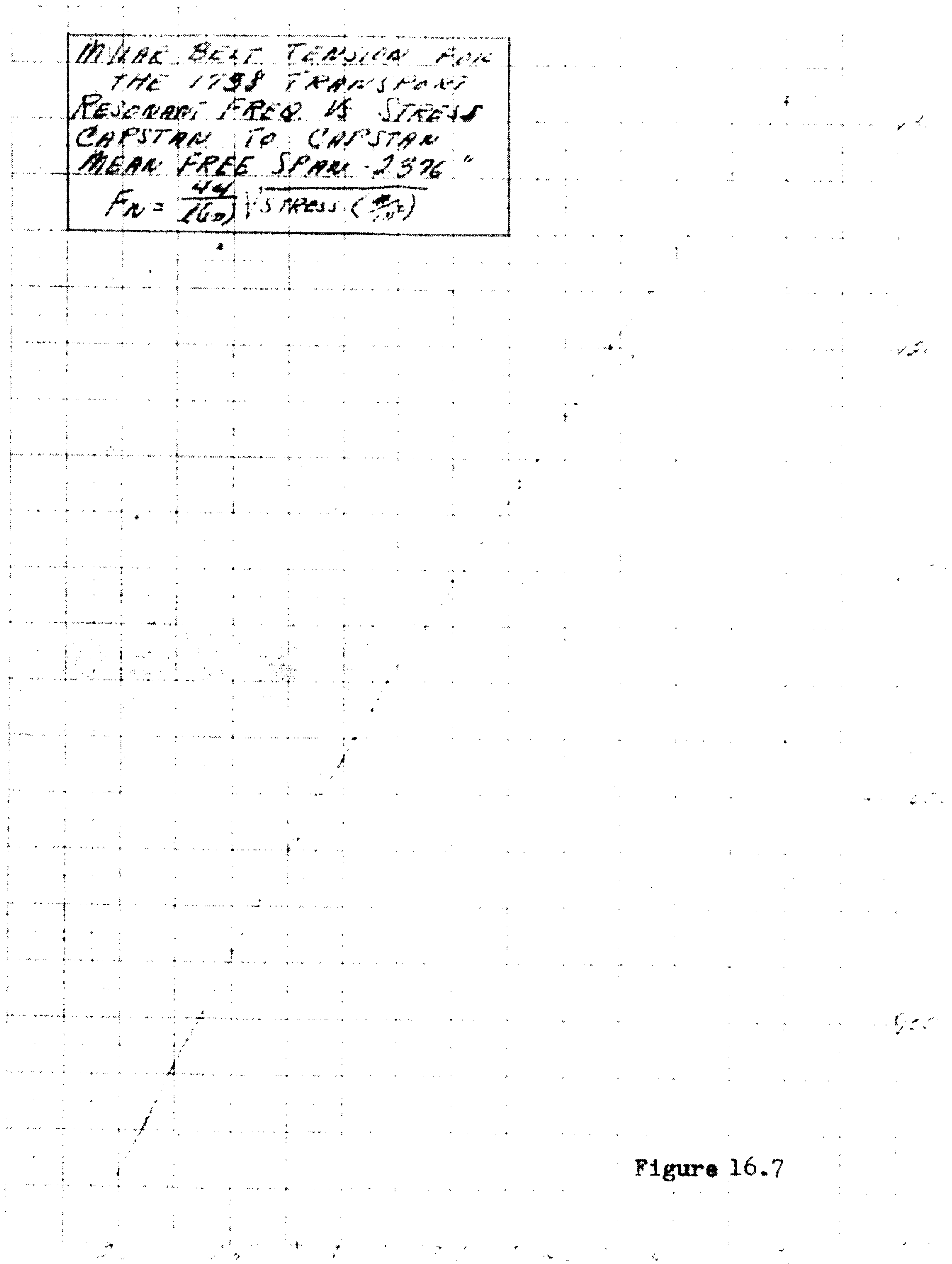

MYLAR BEST TENSION FOR
THE 1738 TRANSPORT
RESONANT FREQ. VS STRESS
CAPSTAN TO CAPSTAN
MEAN FREE SPAN - 2.376"
$F_N = \frac{44}{L(in)}\sqrt{STRESS\,(\#/in^2)}$

Figure 16.7

RE-ORDER No. 63-442

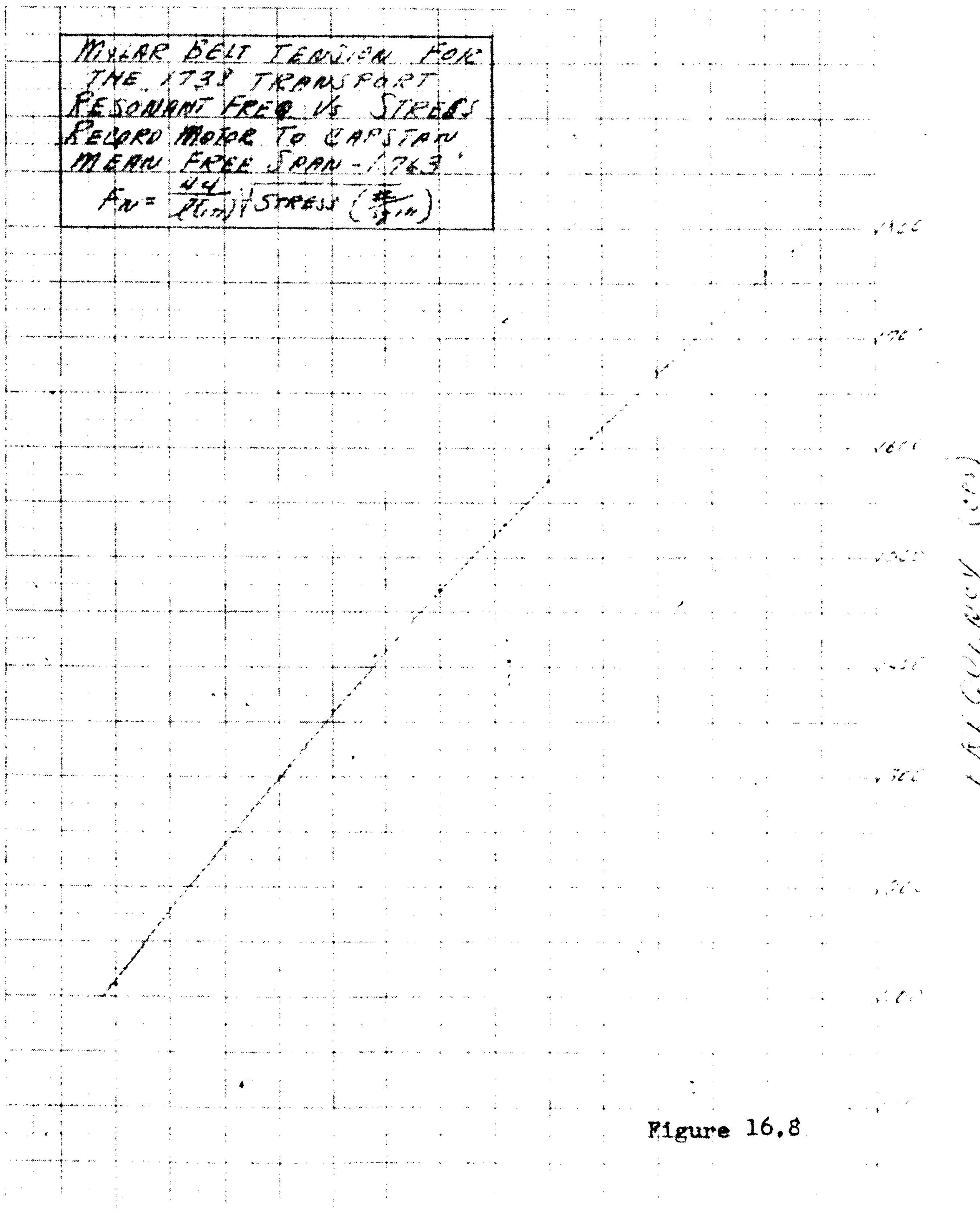


Figure 16.8

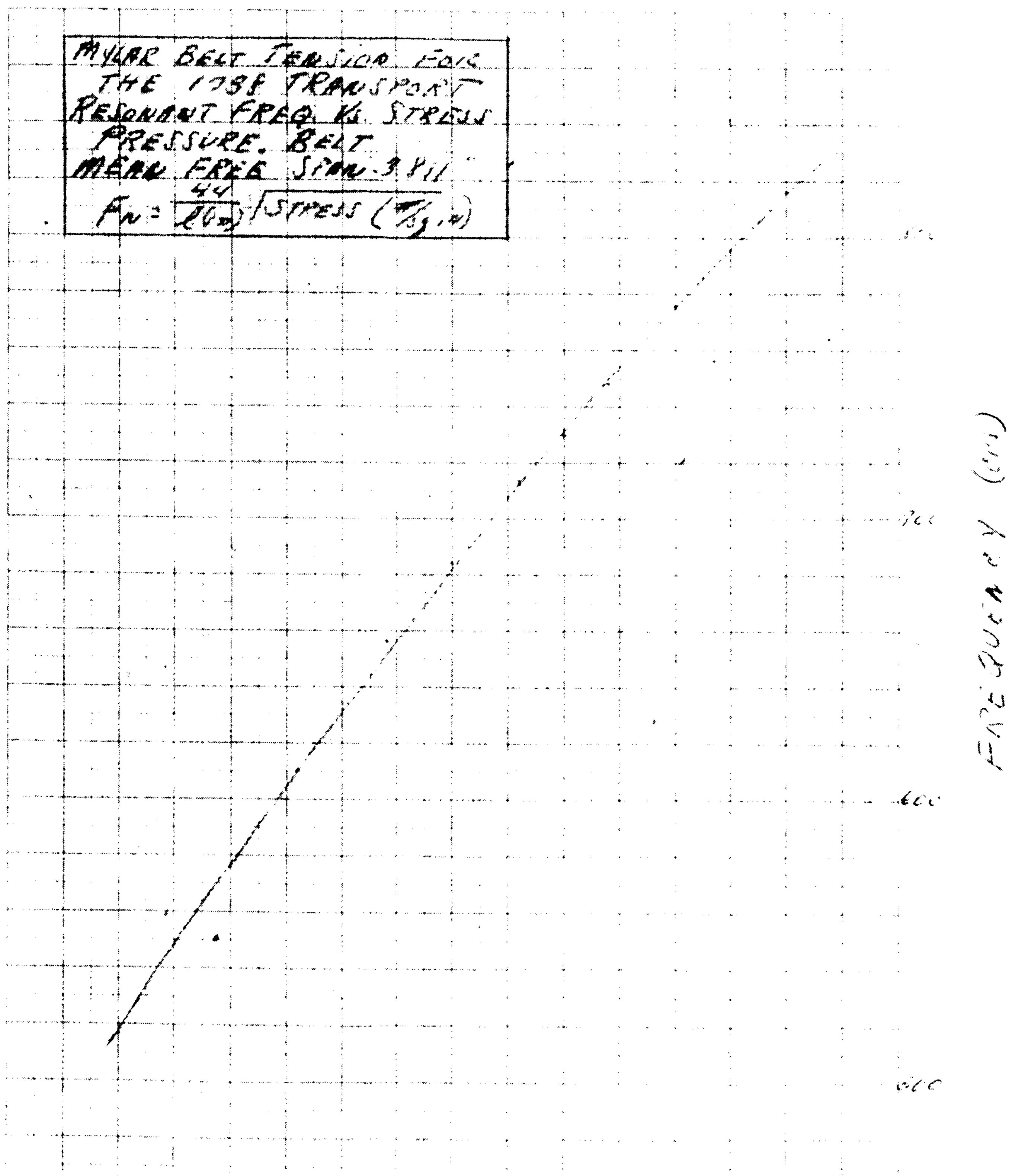

MYLAR BELT TENSION FOR
THE 1738 TRANSPORT
RESONANT FREQ. VS. STRESS
PRESSURE. BELT
MEAN FREE SPAN
FREQUENCY

Figure 16.9

16.3.3 Head/Capstan Parallelism. With an indicator, measure the position of the head with respect to the two capstans as shown in Figure 16.11. Adjust the head tuning for a tape wrap angle of approximately 5° on each section of the head.

16.3.4 Tape Tension. With the machine in the position shown in Figure 16.12, measure the distance "d" that is produced by the 50 gram weight while the machine is run. With the proper tape tension, "d" will be 2-1/4 to 3-1/2 inches.

Tape tension must be measured periodically as the machine is run. Plot a curve of "d" versus running time. Measurements should be made every few minutes during the first hour of running time with new tape, then approximately every hour after that. An actual graph of these data must be maintained on the final tape to be used in the machine.

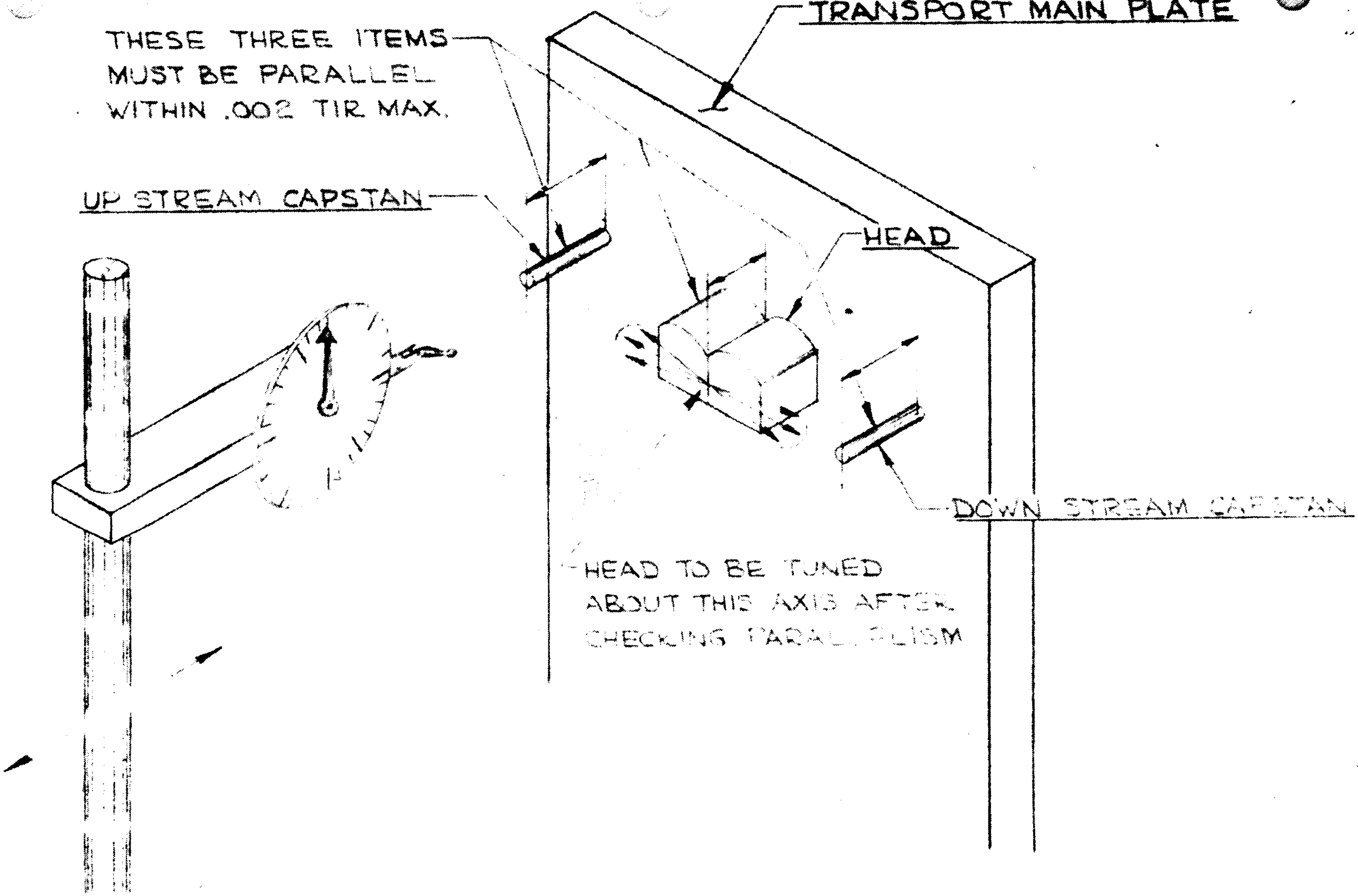


FIG 16.10
HEAD ADJUSTMENT

RE-ORDER NO

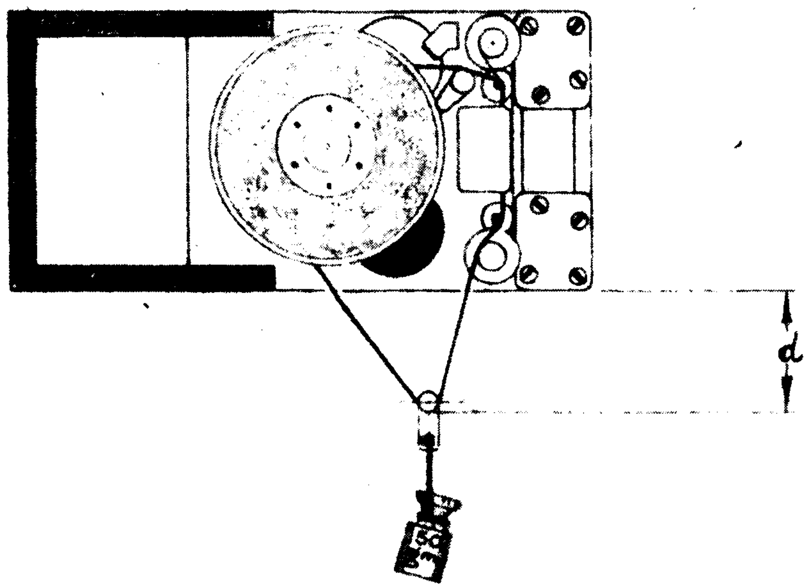
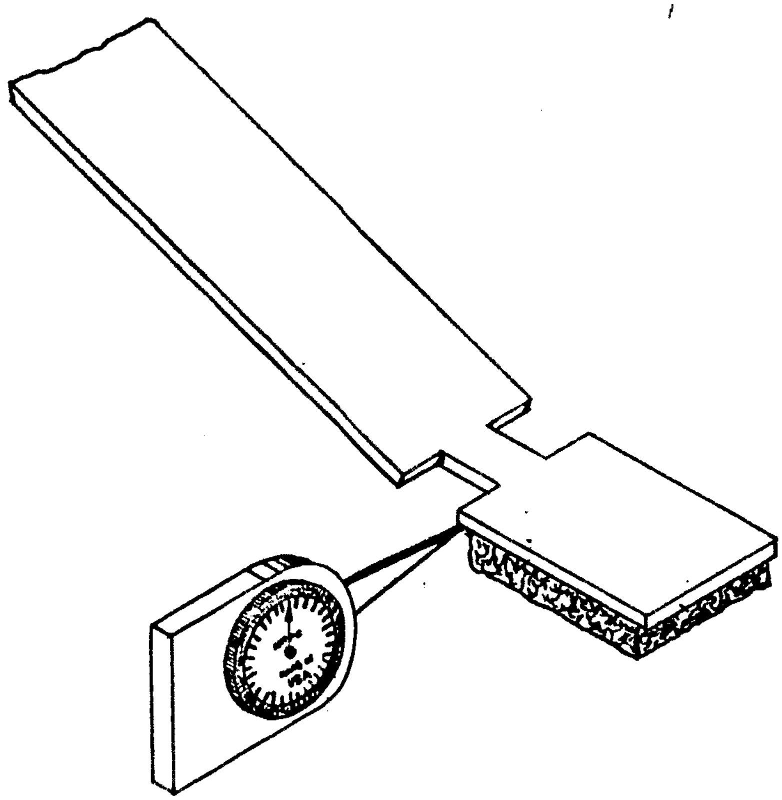


FIGURE 16.11
MEASUREMENT OF TAPE TENSION

16.3.5 Pressure Pad Force. With a force indicator, measure the pressure pad force at the base of the pad as shown in Figure 16.12. Force should be 50 ±5 grams.



With gram scale at heal of pressure pad, measure the force needed to just lift the pad off the sense head.

FIGURE 16.12
PREASURE PAD FORCE
MEASUREMENT

16.3.6 Flutter Check. Record 5 minutes of "ones" on track 1. Open circuit the record head leads and observe playback signal at record speed with a Tektronix type 531 differential scope and a 53/54 D plug-in or equivalent. Record flutter with Visicorder. Make a calibration run on the Visicorder before the test. Flutter should be no more than 1% peak-to-peak, except for electromechanical resonance of the record motor which may increase the total to 2%. See Figures 16.14 and 16.17 for the flutter measurement set-up. Note the dominant flutter frequency and compare with the following table.

TROUBLE	FLUTTER FREQUENCY (cps)	
	Playback	Record
Hub bearing outer race defect		
Hub bearing inner race defect		
Pressure belt speed	.000874 (1380 sec.)	1.22
Hub Speed	.00120 (834 sec.)	1.54
Pressure belt pulley speed	.00318 (314 sec.)	4.09
Capstan to capstan belt speed	.00666 (150 sec.)	8.56
Pressure belt pulley outer race defect	.0101 (99 sec.)	12.9
Pressure belt pulley inner race defect	.0154 (65 sec.)	19.8
Second idler to capstan speed	.0170 (58.8 sec.)	----
Upstream capstan speed	.0200 (50 sec.)	25.7
Downstream capstan speed	.0205 (48.8 sec.)	26.4
Upstream capstan bearing outer race defect	.0632 (15.8 sec.)	81.2
Downstream capstan bearing outer race defect	.0649 (15.4 sec.)	83.3
Upstream capstan bearing inner race defect	.0970 (10.3 sec.)	125.0
Downstream capstan bearing inner race defect	.0995 (10.1 sec.)	128.0
First idler to second idler belt speed	.172 (5.81 sec.)	----

TROUBLE	FLUTTER FREQUENCY (cps)	
	Playback	Record
Second idler speed	.189 (5.29 sec.)	----
Second idler outer race defect	.598 (1.67 sec.)	----
Second idler inner race defect	.918 (1.09 sec.)	----
Playback motor to first idler belt speed	1.14	----
First idler speed	1.51	----
First idler outer race defect	4.79	----
First idler inner race defect	7.35	----
Playback motor speed	15.75	----
Playback motor bearing outer race defect	49.8	----
Playback motor bearing inner race defect	76.4	----
Record motor to capstan belt speed	----	16.7
Record motor speed	----	133.33
Record motor bearing outer race defect	----	421.0
Record motor bearing inner race defect	----	646.0

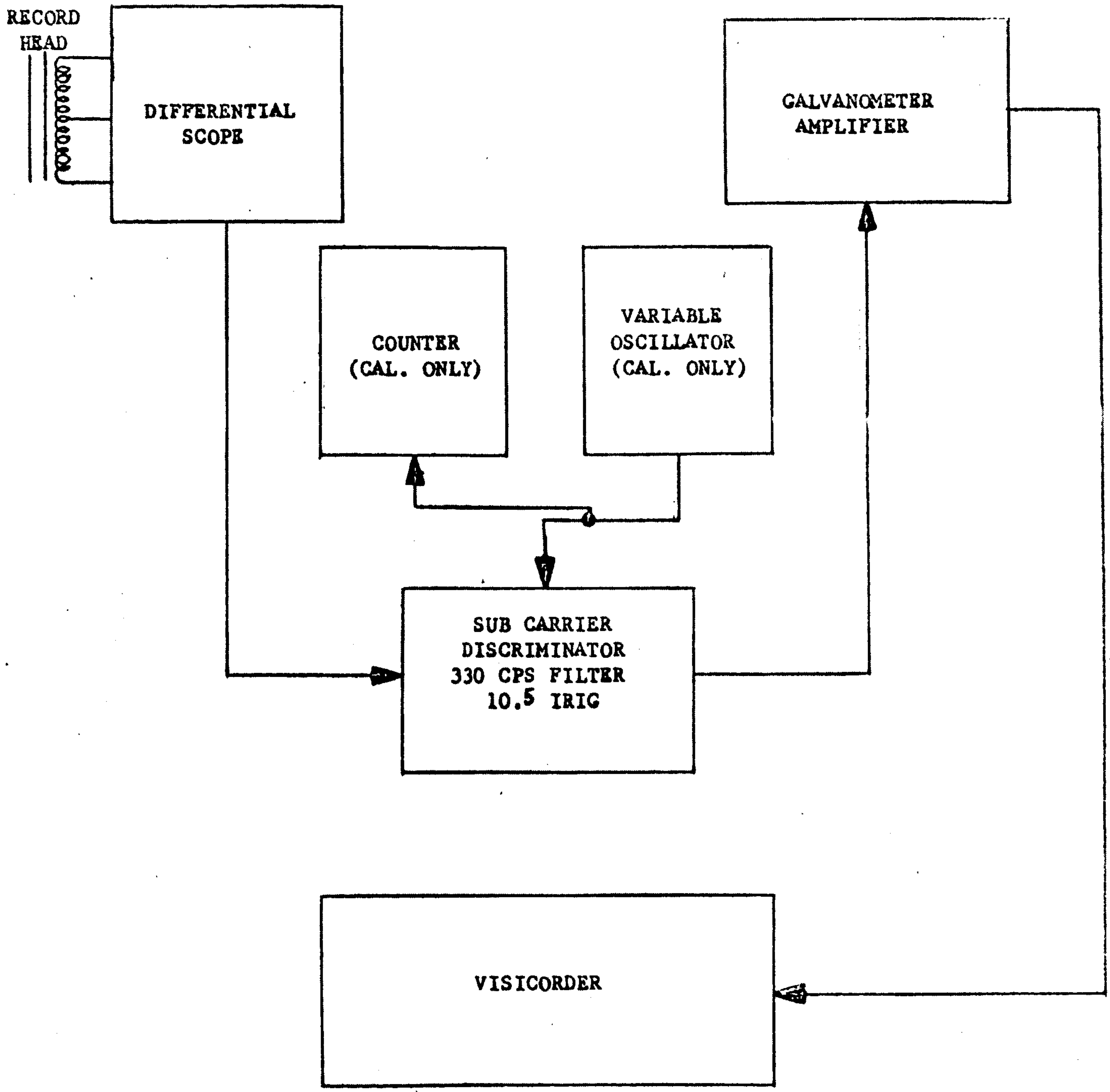


Figure 16.15
FLUTTER MEASUREMENT SETUP

16.3.7 AM Measurement. Record 5 minutes of "ones" on track 1. Open circuit the record head leads and observe the playback signal at 12.84 IPS with a Tektronix type 531 differential scope and a 53/54 D plug-in or equivalent. Feed the vertical output signal of the scope to the 1738 AM detector. Record the output of the AM detector on a Visicorder chart after making a calibration run with the Visicorder. See Figure 16.15 for test setup.

Typical AM should be less than 10% peak-to-peak. The number of dropouts, defined as a reduction of signal level by more than 50%, and the dc shift in the dc level of the peak-to-peak AM signal, should be recorded with the AM data. Check the entire tape length.

Repeat entire test on track #2.

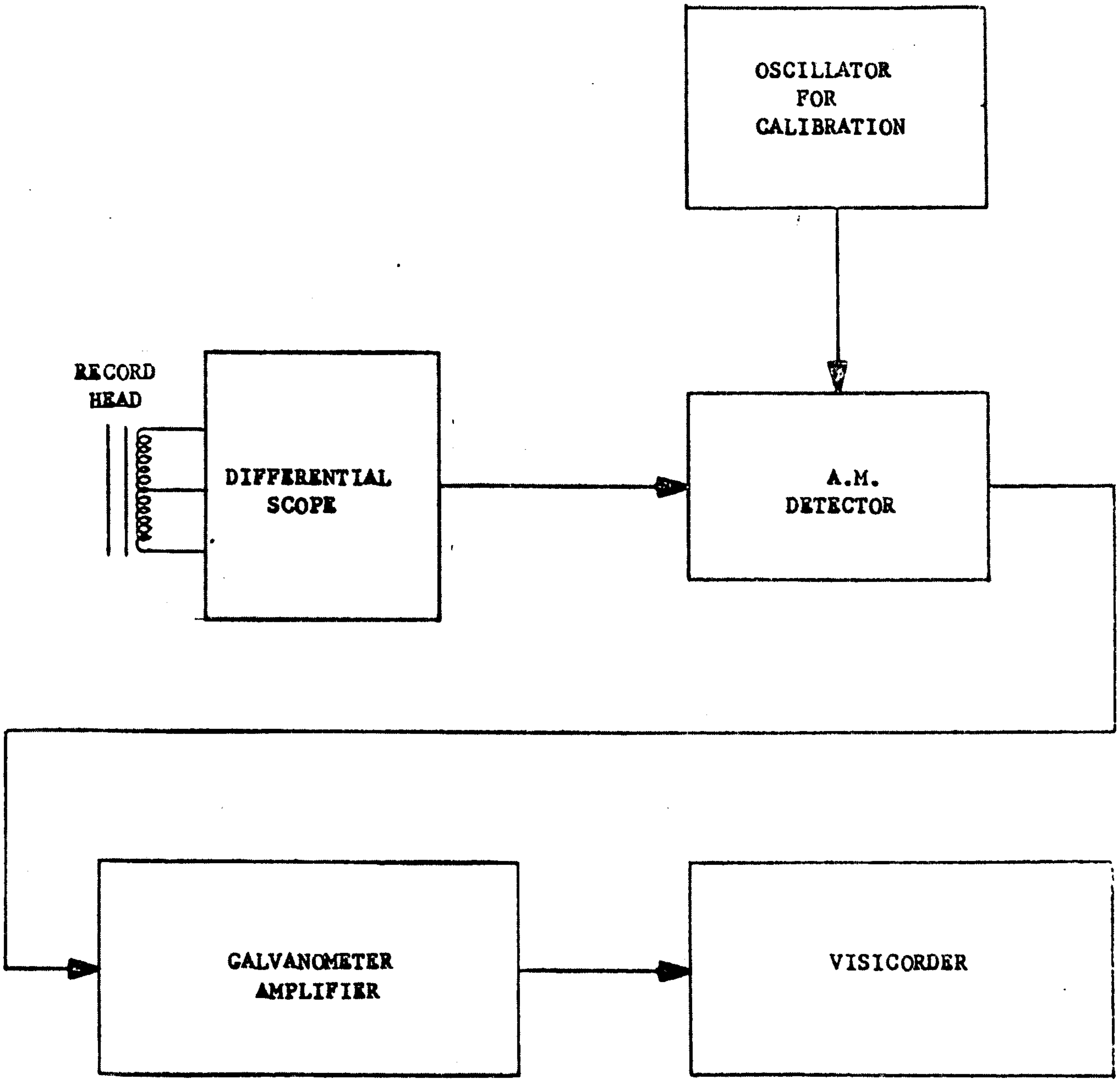


Figure 16.14
A.M. MEASUREMENT SETUP

16.3.8 Tape Time. While in record, clock the time with a stopwatch for the splice to make one complete revolution. Tape time should be 306 ±3 seconds.

$$\text{Tape Length} = \frac{\text{Time (sec.)} \times 12.84}{12}$$

It is not necessary to correct the tape length until prior to final system check.

16.3.9 Channel Change Sensor Check. Verify that contact is made when the conductive foil passes over the sense head. Make a record of the contact voltage at the sense head by obtaining a Visicorder chart with the machine operating at playback speed.

16.3.10 Playback Performance. Record 2-1/2 minutes of "zeros" and 2-1/2 minutes of "ones" on each track. Play back asynchronously by clamping the VCO control voltage at 10 V dc. Obtain Visicorder charts of different areas on each track, in each case recording the main playback amplifier output signal. Make an amplitude calibration run directly on the chart. Measure the playback pre-amplifier output signal amplitudes with a calibrated oscilloscope while the Visicorder charts are being obtained. With an all "zero" code observe the reconstructed tape bit sync signal with the scope. Measure jitter as shown in Figure 16.16.

16.3.11 Phase-Locked-Loop. Playback portions of the codes recorded per paragraph 16.3.10 synchronously)phased-locked-loop operating normally). Make Visicorder records of the Integrator Monitor signal for both codes and both tracks.

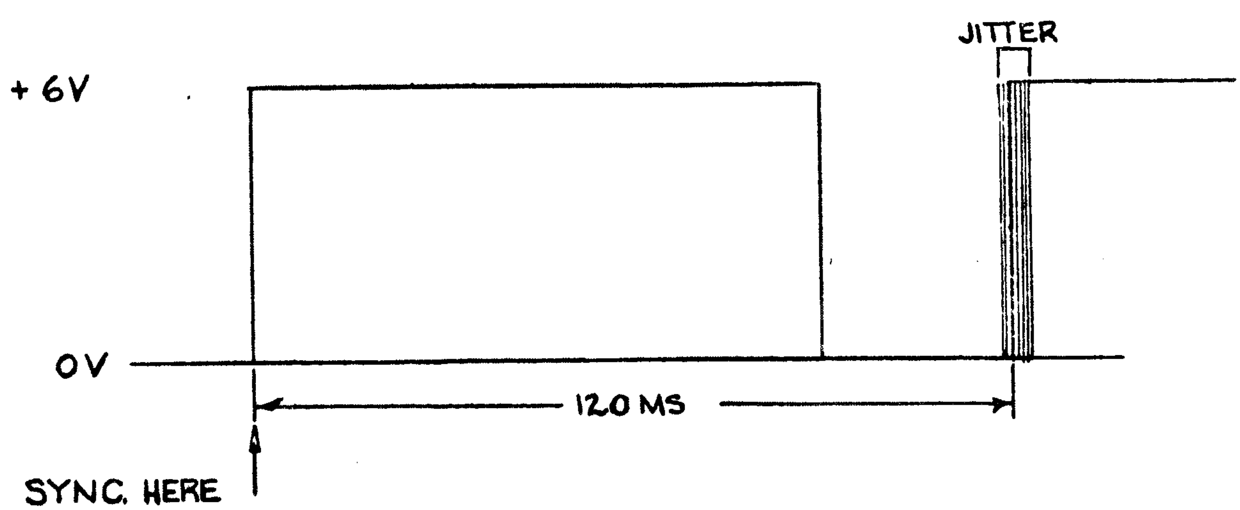


Figure 16.15 - JITTER

16.3.12 Record Mode Start-Stop Time. Acceleration and deceleration of the transport in record mode is determined by observing the record motor voltage monitor signal. Measure the start and stop periods with a stopwatch. Repeat each measurement at least four times and take an average for the two periods. The transport must come up to record speed in 3.6 seconds or less. Its deceleration should require less than 6.0 seconds.

16.3.13 Flywheel Adjustment. Based on data from 16.3.12 reduce the diameter of the record motor flywheel so that at any temperature within the operating range, the tape used up in the first 3.6 seconds after the record-start command plus the tape used up in coasting after a record-stop command is more than 33 but less than 66 inches. (For the purpose of roughly computing tape used in acceleration and deceleration, add the times measured by stopwatch and assume an average velocity of 6.5 inches per second. Add the tape length used up after record speed has been reached until a time of 3.6 seconds has elapsed after the record-start command.) To measure the tape length, record one complete track length. Stop the machine. Clamp the record amplifier so that it will cause dc erasure. Start the machine. After 3.6 seconds unclamp the record amplifier. Simultaneously clamp the record amplifier and issue a record-stop command. The sections of tape erased can be determined by playing back the entire length at record speed and timing them. The erased lengths should total 33 - 66 inches. Repeat 4 times and average.

16.3.14 Tape Inspection. Check for signs of excessive tape wear. Check the splice for creep and adhesive flow. Check the conductive foil for flaking, peeling, and adhesive flow. Examine tape guiding surfaces and the EOT sensor with a 10 power lens for accumulation of oxide, wear, sharp edges, nicks, and burrs.

16.3.15 Vibration. Place the transport in case and expose the mechanical unit to a vibration consisting of 5 to 22 cps at a 0.2 inch peak-to-peak displacement, 22 to 2,000 cps at a 5 g RMS acceleration. Make three 10 minute sweeps (5 minutes up and 5 minutes down), one for each axis. Operate the transport at record speed (launch mode) during the vibration sweeps.

16.3.16 Leak Test Procedure.

(1) Evacuate and back fill with a trace gas consisting of 10% helium, 90% nitrogen by volume at a pressure of one atmosphere.

(2) Record the rating of the standard leak sample. Multiply the stated rating by 10 in subsequent computations to compensate for the 90/10 mixture.

(3) Plot the leakage readings as a function of time during the test. When it has been determined from the graph that the system has stabilized, record the final reading and compute the actual leak rate. Show all computations. Normally it takes at least

30 minutes to reach stability.

(4) Periodically calibrate the instrument by reading the standard leak sample. A calibration check should immediately follow the final leak reading on the test assembly.

(5) Record the diatron pressure several times during the test. The pressure should remain below 0.1 microns.

(6) Record the accelerator voltage; be sure this voltage is set for maximum leakage reading.

(7) Record the serial number and date of the last calibration of each piece of equipment.

(8) All readings that are recorded shall be actual readings; computations shall be done on a work sheet and submitted with the data.

(9) Record specimen temperature during test. Test will be performed at room temperature only.

(10) Record the total length of time the specimen was in vacuum.

(11) The housing assembly leakage rate should not exceed 450 cc/year at room temperature.

(12) After completion of test, evacuate assembly and back fill with dry nitrogen at 21 psia.

16.3.17 Use Of The Chart Recorder. Make permanent records of voltage waveforms with the Minneapolis Honeywell Visicorder or equivalent strip recorder. Cut off a typical 11" strip and mark with the chart I.D. stamp including:

(1) The project number, i.e. 1738.

(2) The unit's serial number.

(3) The test description, such as playback amplitude, flutter test, AM measurement or integrator monitor.

(4) The particular configuration, such as attitude.

(5) The scale calibration.

(6) The galvonometer used.

(7) The chart speed.

(8) The date of the test.

(9) The Visicorder record number.

Make a number of Xerox copies of each Visicorder strip. Then have Visicorder strips processed through permanizing developer/fixer.

Each unit is assigned a series of Visicorder record numbers. These numbers are:

Unit	Assigned Numbers
S/N 1	100 - 199
S/N 2	200 - 299
S/N 3	300 - 399
S/N 4	400 - 499
S/N 5	500 - 599
S/N 6	600 - 699
S/N 7	700 - 799

Keep an index of the chart numbers on a copy of page 101.

For example:

Unit S/N 0

Chart Number	Date	Test Description & Results
001	9/24/63	AM Calibration run
002	9/24/63	AM Measurement, 1% Average AM No DC shift, 2 dropouts.

Where a calibration run is required, its record number should immediately precede the test record number; however, when a calibration chart is valid for more than one machine, it should receive only one record number but be referenced in the Chart Recorder Record Number Index for the second machine.

Figure 16.17 indicates the settings for the individual tests on the transport.

	Playback Performance	Flutter Test	A. M. Measurement	Integrator Monitor
Input Signal	Playback Signal	Scope Vert. Signal Output	Scope Vert. Signal Output	Integrator Monitor
Filter		330 cps L.P. IRIG 10.5 cps	1738 A.M. Detector	
Channel	any	any	any	any
Galvo. No.	M1000 or eq	M1000 or eq	M1000 or eq	M1000 or eq
Chart Speed	5 IPS	5 IPS	0.2 IPS	0.2 IPS
Chart Length	3 - 4' ea.	4 - 5' ea.	5' each	3 - 4' ea.
Calibration	2 volts/in.	1%/inch Calibrate with Oscillator & Counter	30%/inch 3%/Divis.	4 volts/in. 10 volts Center
Tolerance		≤ 1% p-p ≤ 2% p-p due to motor component	10 % p-p ____% DC Shift ____Dropouts	

Figure 16.16

Visicorder Adjustment for the

Transport Functional Test

Chart Recorder Record Number Index.

Unit Serial Number ________

Chart Number	Date	Test Description & Results

TRANSPORT EVALUATION

LIMITATION OF TAPE PASSES

	Max. number of passes
Previbration	
Flutter and tape time	3
AM	3
Vibration	6
Rm. Temp. Functional	
Flutter and tape time	3
AM	3
Playback performance and phase-locked loop	2
Foil and sensor	2
Start-stop time	3
Hot Functional	13
Cold Functional	13
Rm. Temp. Functional	13
Hot Soak	1/2
Cold Soak	1/2
Rm. Temp. Functional	13
Total	78

DATA RECORD

S/N_____ Temperature______ Date___________ Operator_____________

MECHANICAL TEST DATA

Belt Tension Measurement (3,500 ±1,000 psi)

	FRONT		BACK	
	f_N (cps)	Stress psi	f_N (cps)	Stress psi
P/B Motor/1st Idler				
1st Idler/2nd Idler				
2nd Idler/Capstan				
Rcd. Motor/Capstan				
Capstan/Capstan				
Pressure Belt				

Oscillator S/N____

Cal. Exp. Date________________

Belt Wobble

P/B Motor/1st Idler________ inches

1st Idler/2nd Idler________ inches

2nd Idler/Capstan ________ inches

Rcd. Motor ________ inches

Capstan/Capstan Drive______ inches

Pressure Belt ________ inches

Head/Capstan Parallelism

Head // Upstream Capstan _______ inches TIR

Head // Downstream Capstan______ inches TIR

Tape wrap angles_________ and ______ degrees.

DATA RECORD

(Mechanical, Con't.)

S/N_______ Temperature______ Date_______________ Operator__________

Pressure Pad Force _____________ grams (50 ±5)

Tape Tension Include data and graph in daily log section.

Preliminary Functional Check

	-10° C	+25° C	+80° C
Flutter			
Motor Stability			

Ready to Wire _________ (yes/no)

________________________ Date

Flywheel

Machined, balanced, installed,

loctited by________________________ Date________________________

DATA RECORD

S/N______ Temperature(s)________ Date(s)________ Operator____________

FUNCTIONAL TEST DATA

	0° C		25° C±		55° C	
	TR1	TR2	TR1	TR2	TR1	TR2
Flutter Chart Number						
Calibration Chart Number						
Flutter % peak-to-peak						
Dominant Flutter Frequency cps						
Probable Source of Flutter						
AM Chart Number						
Calibration Chart Number						
Average AM % peak-to-peak						
Worst Dropout % peak						
Tape Time at Record Speed						
Playback Amplifier Output Chart Number						
Playback Amplifier Output Amplitude with "0" Code V p-p						
Playback Amplifier Output Amplitude with "1" Code V p-p						
Playback Preamplifier Output With "0" Code V p-p						
Playback Preamplifier Output With "1" Code V p-p						
Bit Sync Jitter ms p-p						

(Functional Test Data, Con't.)

S/N____ Temperature(s)________ Date(s)_______ Operator__________

	0° C		25°C±		55° C	
	TR1	TR2	TR1	TR2	TR1	TR2
Phase locked loop Integrator Reset Level - V dc						
Integrator max. Hold Level With "0" Code - V dc						
Integrator min. Hold Level With "0" Code - V dc						
Integrator max. Hold Level With "1" Code - V dc						
Integrator min. Hold Level With "1" Code - V dc						
Integrator Monitor Test Chart No.						
Foil and Sensor Test Chart No.						
Number of Accummulated Tape Passes On Foil At Time of Test						
Record Mode Start Time (Average of 4 Readings)						
Record Mode Stop Time (Average of 4 Readings						
Measured Tape Length Used In 3.6 Sec. After Start Command (Average of 4 Readings)						
Measured Tape Length Used After Stop Command (Average of 4 Readings)						

(Functional Test Data, Con't.)

S/N____ Temperature(s)______ Date(s)_______ Operator__________

	0° C		25°C+		55° C	
	TR1	TR2	TR1	TR2	TR1	TR2
Temperature Transducer ohms						
Pressure Transducer ohms						

DATA RECORD

S/N _____ Temperature _______ Date __________ Operator __________

PRE-VIBRATION TEST DATA

Tape Inspection Results

New Tape Installed

Number of passes during break in up to installation of foil __________

New Foil Installed

Number of passes to break-in foil __________

Foil and sensor test chart number __________

Final tension adjustment __________ inches

Pressure Pad Setting __________ grams

Belt Tensions	F_N	PSI	READJUSTED Yes/No
P/B Motor/1st Idler			
1st Idler/2nd Idler			
2nd Idler/Capstan			
Rec. Motor/Capstan			
Capstan/Capstan			
Pressure Belt			

Flutter

	TR1	TR2
Flutter Chart No.	_____	_____
Flutter % p-p	_____	_____
Dominant Frequency	_____	_____

(Pre-Vibration Test Data, Con't.)

S/N_______ Temperature________ Date_________ Operator____________

AM	TR1	TR2
AM Chart No.	_____	_____
AM % p-p	_____	_____

Tape Time ___________ Seconds

Record Start Time ___________ Seconds

Record Stop Time ___________ Seconds

DATA RECORD

S/N______ Temperature______ Date___________ Operator_____________

VIBRATION TEST

Vibration Level __________ g rms

Unit passed/failed __________

Comments:

Accummulated Tape Passes After Foil Installation______________

DATA RECORD

S/N______ Temperature________ Date__________ Operator___________

POST VIBRATION TEST DATA

Flutter	TR1	TR2
Flutter Chart No.	_____	_____
Flutter % p-p	_____	_____
Dominant Frequency	_____	_____
AM		
AM Chart No.	_____	_____
AM % p-p	_____	_____

Foil

Foil and sensor test chart No._______

Tape Tension _______ inches

Readjusted _______ yes/no

Accummulated Tape Passes
After post vibration Tests _______

DATA RECORD

Part Number______________ S/N__________________

Date____________________________ Operator______________________

LEAK TEST

(1) Temperature_________________

(2) Trace Gas____________________________

(3) Leak rate with auxiliary pump (meter)__________________________

Leak rate without auxiliary pump (meter) at stabilization __________________________

Leak Rate (meter reading)

Time

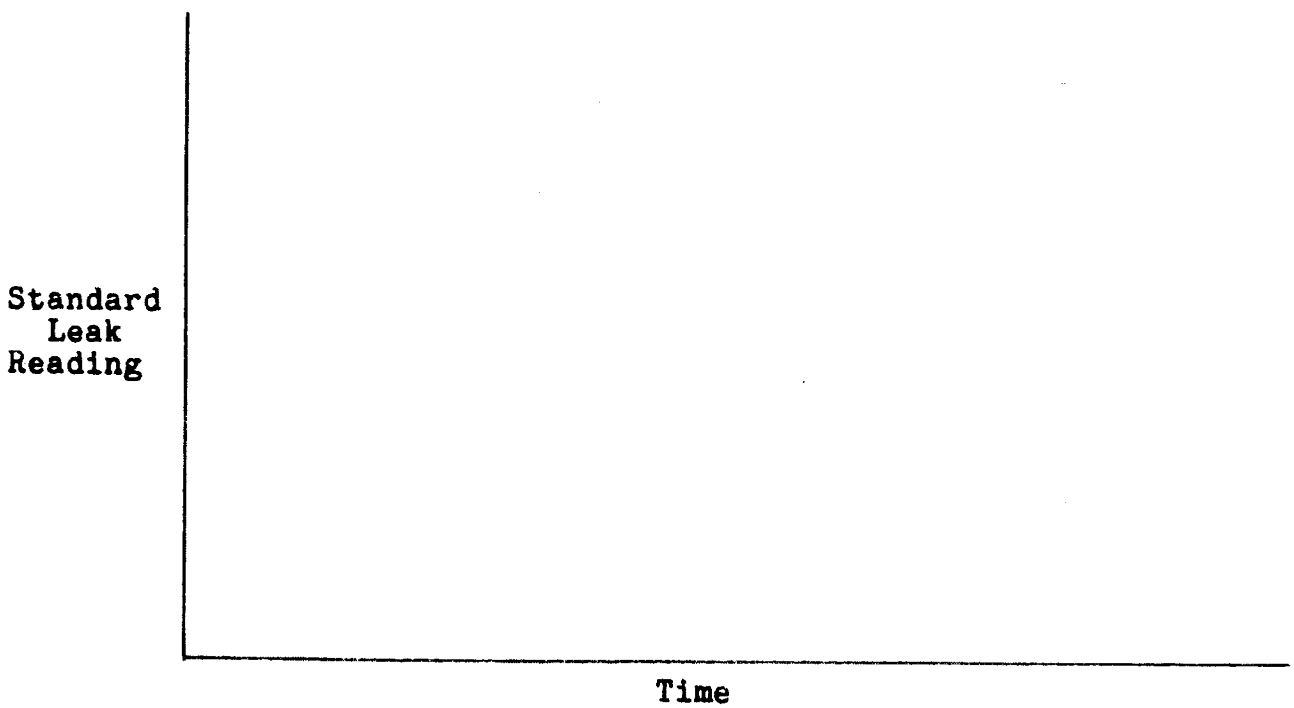
(Leak Test, Con't.)

Part Number______________ S/N______________

Date________________________ Operator____________________

(4) Standard leak with auxiliary pump at stabilization________________________

Standard leak without auxiliary pump at stabilization________________________



(5) Standard leak sample rate under Bell jar

Before test________________________

After test________________________

(Leak Test, Con't.)

Part Number________________ S/N________________

Date________________ Operator________________

(6) Pressure at Diatron

Diatron Pressure

Time

(7) Acceleration voltage________________

(8) Leak tester type________________ S/N________________

Date of last calibration________________

Standard leak rate________________ S/N________________

Date of last calibration________________

(9) Calculated leak rate of sample at stabilization ________________ cc/year.

Reviewed by________________
Engineer

Reviewed by________________
Inspector

DATA RECORD

S/N________ Date______________________ Operator____________________

PREPARATION FOR SYSTEM TEST

Backfilled with Dry Nitrogen ________________psia

Temperature cycled ________________° C to ____________° C

Cover Screws Retorqued ___________________ inch-pounds

Connector Nuts Retorqued _________________ inch-pounds

17.0 SYSTEM EVALUATION.

17.1 General. The complete tape recorder/reproducer is comprised of five (5) subassemblies. Four of the five subassemblies make up the recorder electronics; these are called subchassis. The fifth subassembly is the mechanical unit called the transport. These subassemblies go into the left half of the Spacecraft Assembly V Frame as shown in Figure 17.1.

After the four electronics subchassis and the transport have passed their individual tests, they are assembled together and tested as a system.

Supporting equipment to simulate commands and data signals originating from other parts of the spacecraft are contained in a rack called the OSE. Figure 17.2 shows the control panel of the OSE.

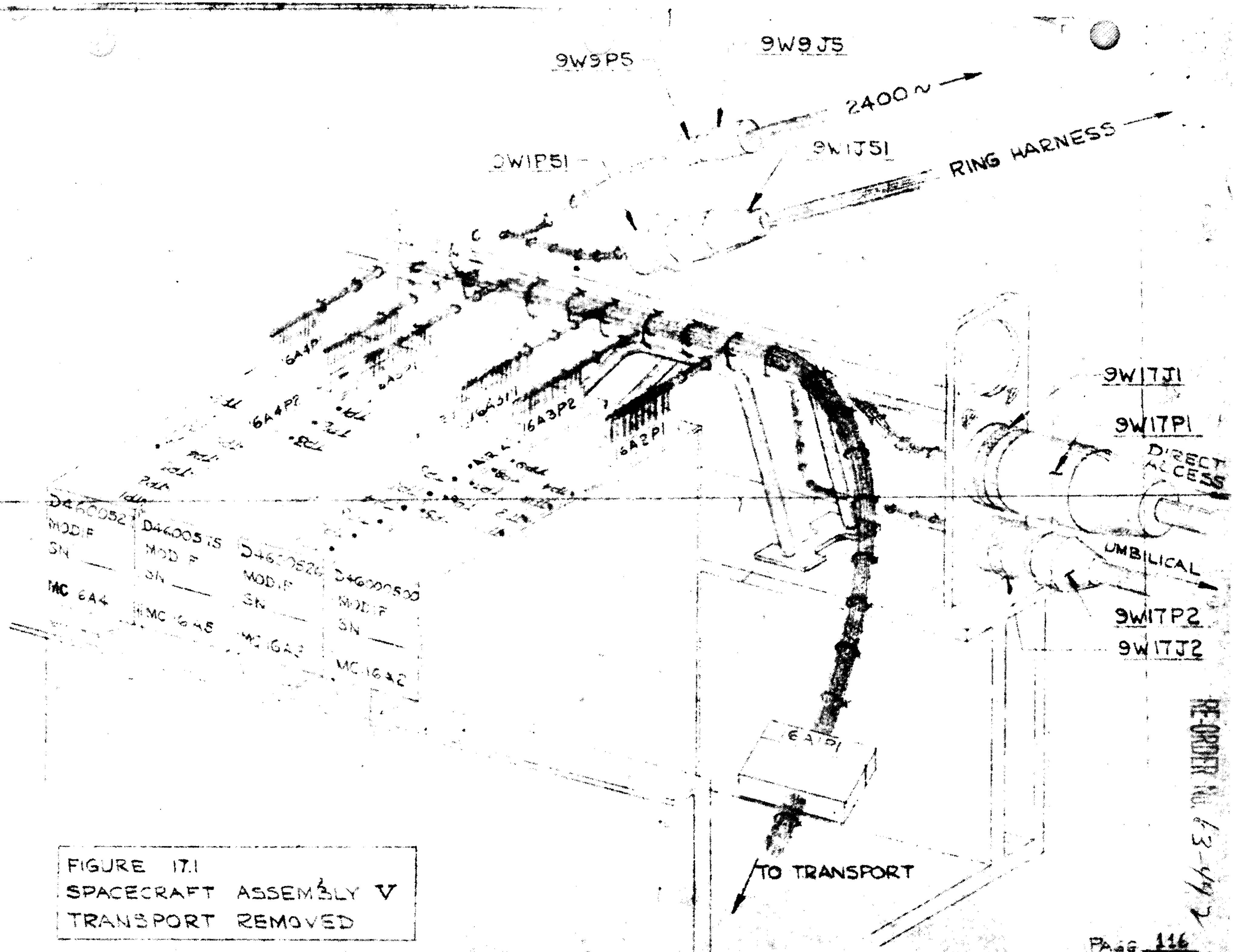


FIGURE 17.1
SPACECRAFT ASSEMBLY V
TRANSPORT REMOVED

17.2 Evaluation Description and Sequence. Make the following tests on the system, in order:

1. OSE Preparation. Preparation of the support equipment.
2. Launch Mode. Functional check of launch mode circuits.
3. Power Supplies. Basic check on supply voltages.
4. Data Record Sequences. Functional check of record circuits and insertion of data sequences for playback checks.
5. Data Playback. Functional and qualitative checks of playback circuits with varying data sequences.
6. Command and Interface Lines. Qualitative check of command functions.
7. EOT Check. Verification of the end-of-tape signal.
8. Amplitude Modulation. Qualitative check on the tape and tracking.
9. Flutter. Qualitative check on the mechanical unit.
10. Pressure Transducer. Pressure measurement in the transport.
11. Temperature Transducer. Temperature measurement in the transport.

The method for carrying out these tests is specified in Section 17.4.

17.3 The OSE. Before any tests can be performed, an operating knowledge of the OSE is necessary. The procedure for programming the OSE to allow the tape recorder/reproducer to function in record, playback, start, stop, etc., is described below. An understanding of the OSE is assumed in Section 17.4.

17.3.1 System Power. The button labeled POWER, turns on standby power in the OSE; the button labeled 2.4 kc POWER delivers dc power to the recorder electronics. The 400 CYCLE POWER button enables the power for the record motor but does not itself start the motor. The latter two voltages can be measured with the DVM built into the OSE. The AUX. 400 CYC. POWER button delivers power to the record motor and auxiliary launch mode electronics independently of the 2.4 kc POWER and 400 CYCLE POWER.

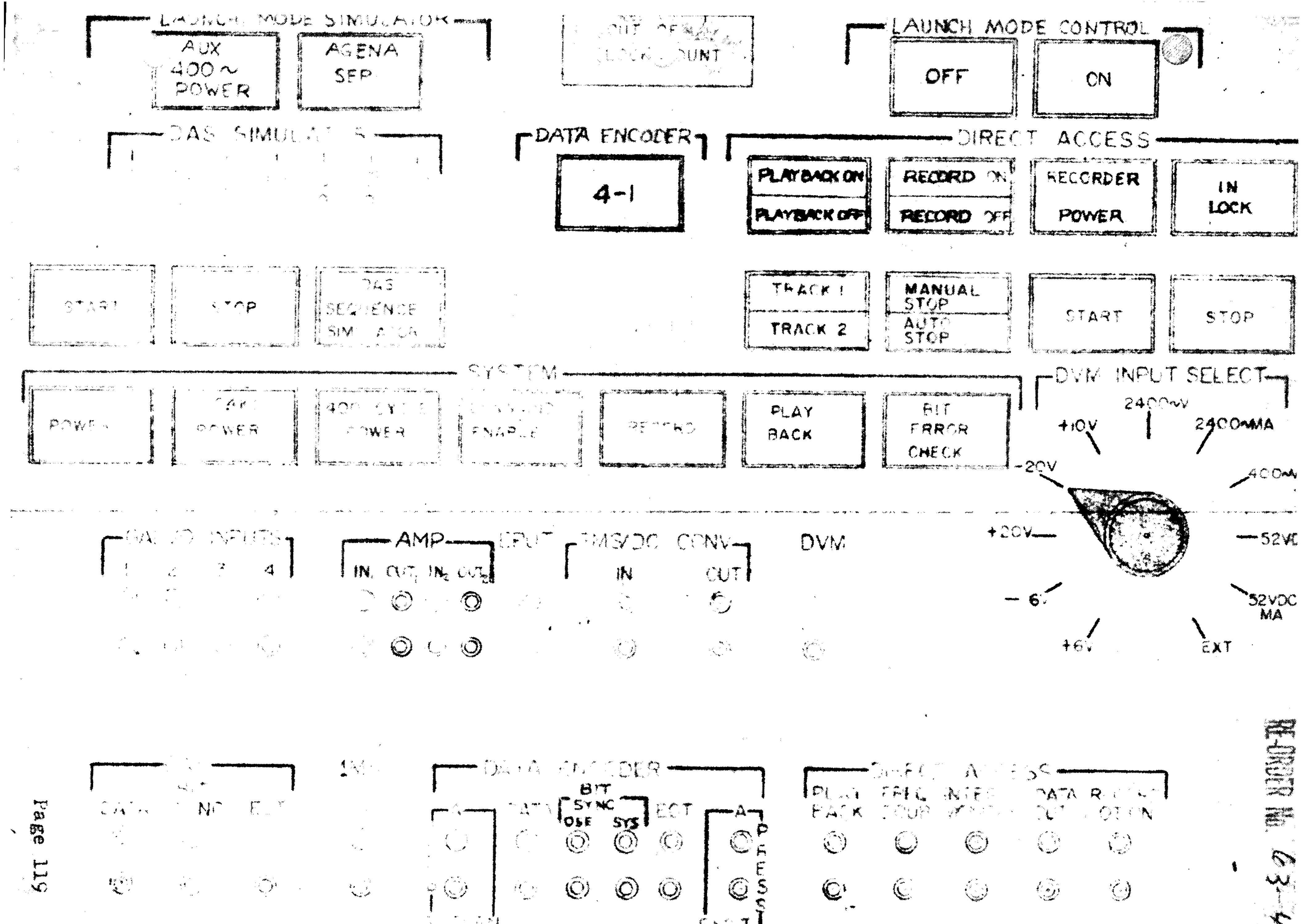


Figure 17.2
OSE Control Panel

17.3.2 <u>Necessary Conditions to Operate in Launch Mode</u>. In order to operate in launch mode, the commands shown in 17.3 must be given. Issue commands in order, reading from left to right.

17.3.3 <u>Necessary Conditions to Record</u>. In order to record, the commands shown in Figure 17.4 must be given. Issue commands in order, reading from left to right.

17.3.4 <u>Necessary Conditions to Play Back</u>. In order to play back, the commands shown in Figure 17.5 must be given. Issue commands in order, reading from left to right.

RE-ORDER No. 63-492

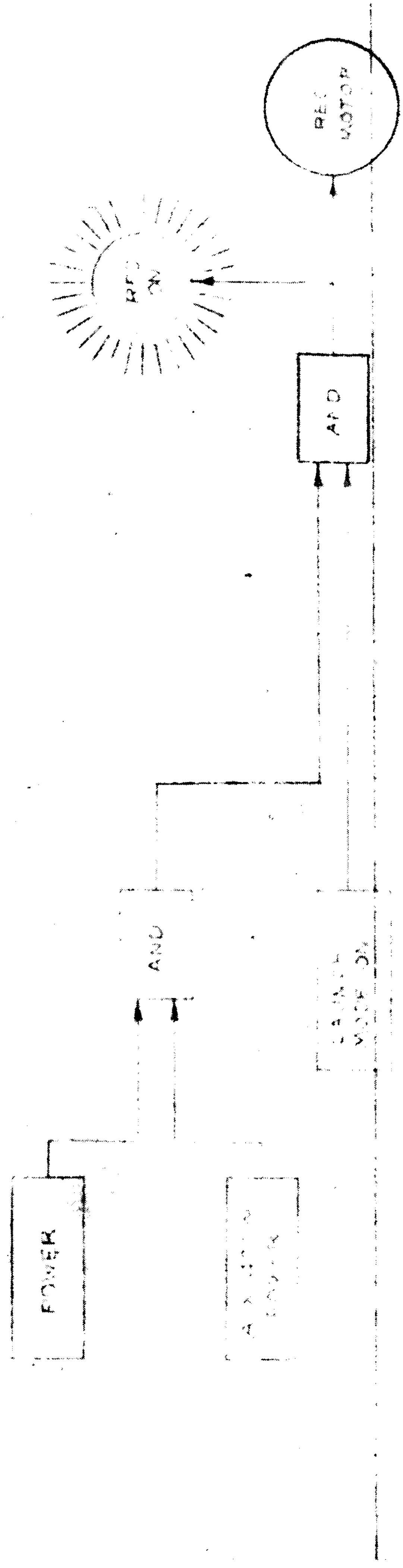


FIGURE 17.3

OSE - NECESSARY CONDITIONS FOR LAUNCH MODE

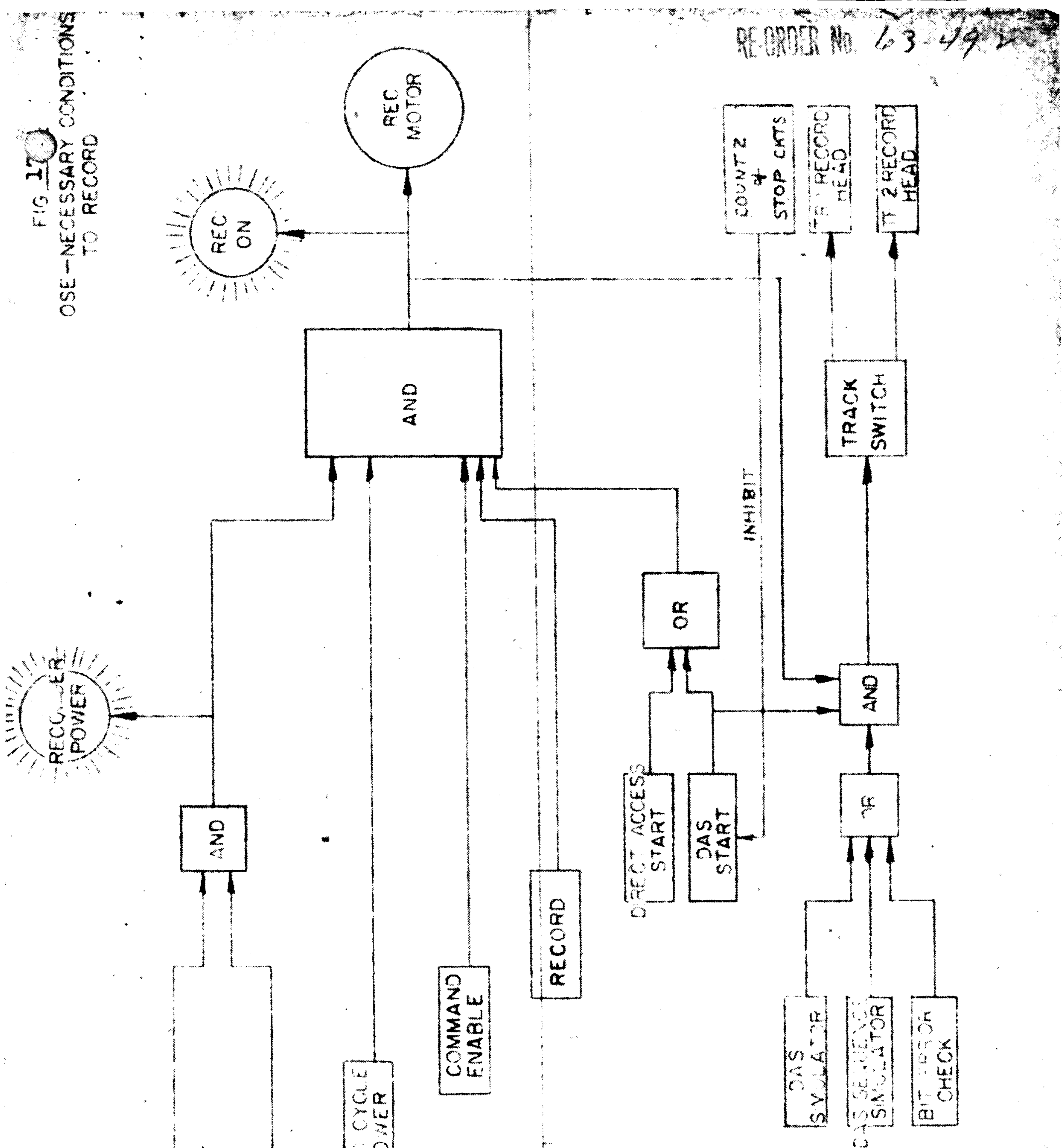


Figure 17.4

OSE Necessary Conditions To Record

RE-ORDER No. 63-492

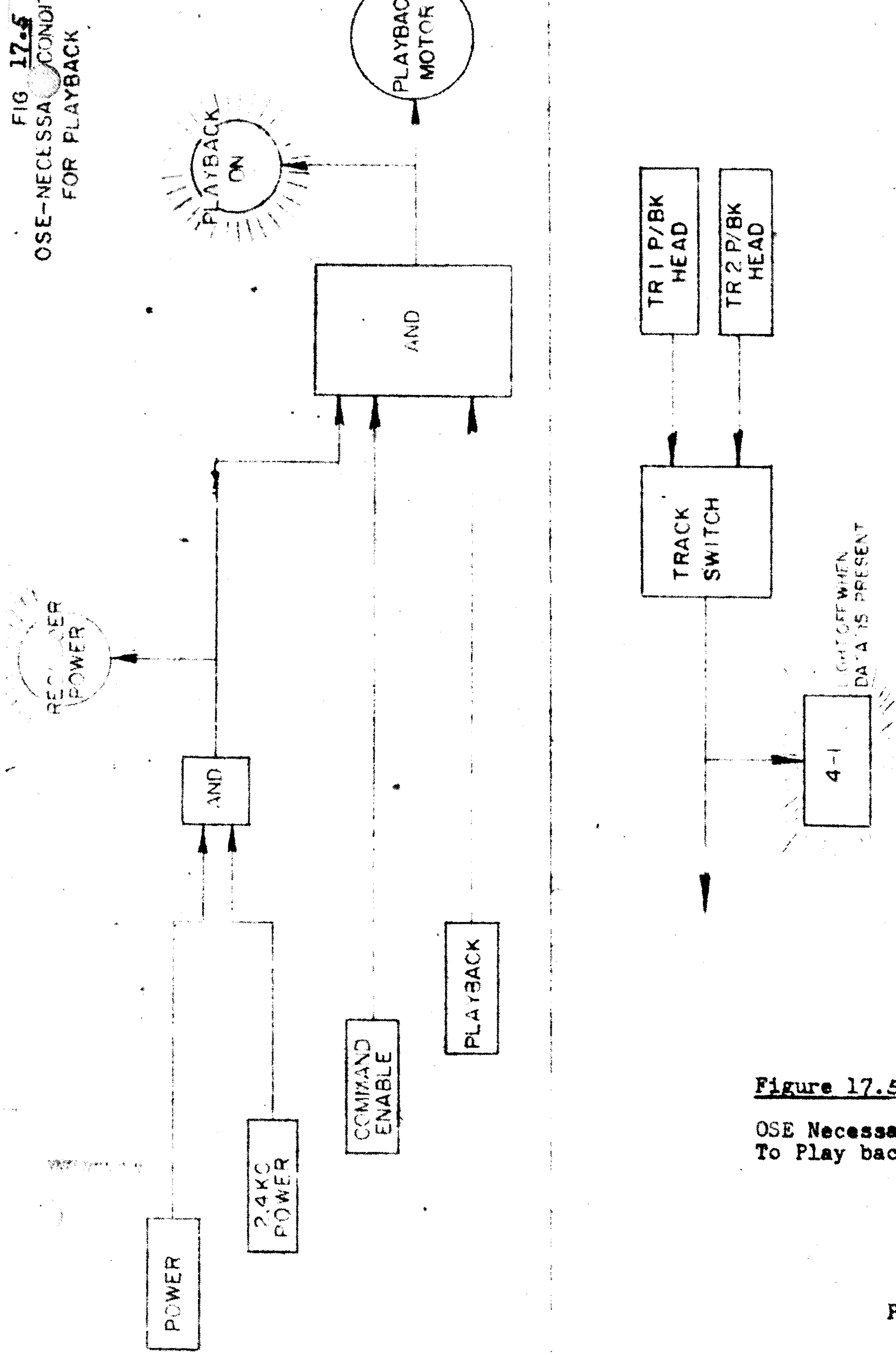


Figure 17.5

OSE Necessary Conditions To Play back

There are three sources of information for recording: the DAS SIMULATOR, DAS SEQUENCE SIMULATOR, and the BIT ERROR CHECK.

17.3.5 DAS Simulator. The toggle switches on the control panel program a seven bit word. This data is fed to the record head when the DAS START button is momentarily pressed.

17.3.6 DAS Sequence Simulator. When the DAS SEQUENCE SIMULATOR is programmed, the following events will occur when the DAS START button is pressed:

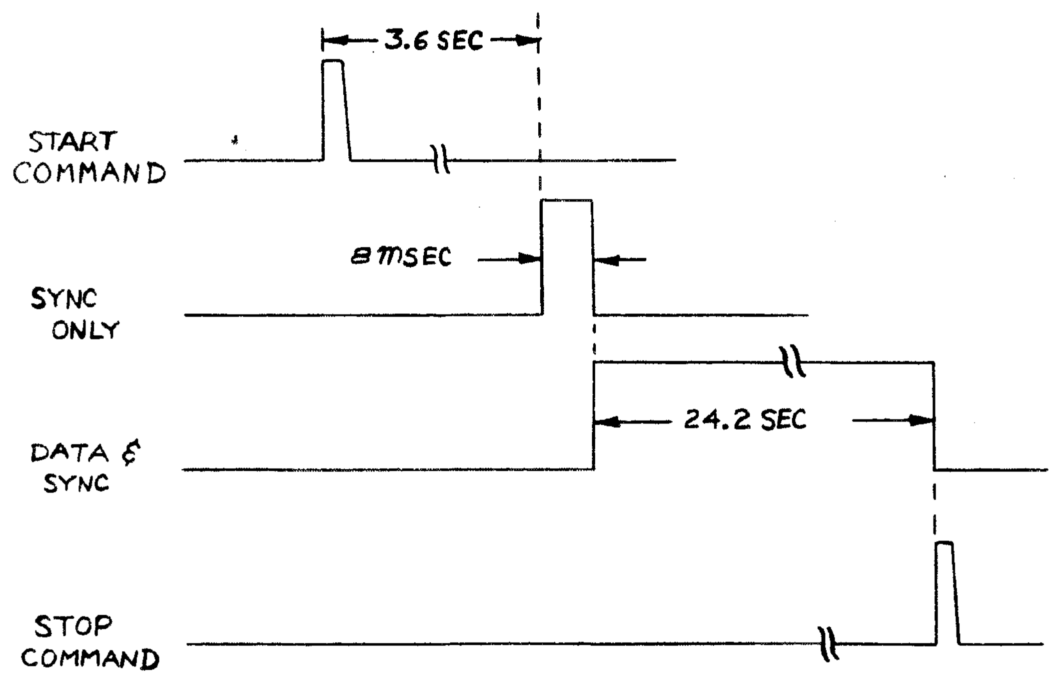


Figure 17.6 PICTURE SEQUENCE

This cycle represents one TV picture. The times in the above sketch can be changed by adjusting the controls found in the OSE junction box.

17.3.7 Bit Error. When the BIT ERROR button is lit in the record mode, the tape is being recorded with a sequence of alternate "ones" and "zeros". In the playback mode, the OSE will automatically register the number of times that the tape machine failed to deliver the proper bit of information.

17.3.8 Manual/Auto. Stop. When the AUTO. STOP button is lit, the machine, if running, will stop as the conductive foil passes over the sense head. This allows automatic indexing of a machine to the end of the tape.

17.3.9 Track Switch. The track may be changed by pressing the Track 1/Track 2 button or if the machine is allowed to run, it will change tracks automatically when the conductive foil passes the EOT sensor.

17.3.10 Launch Mode Simulator - Agena Sep. Depressing the Agena Separation switch enables the EOT stop function of the launch mode circuits, and the record motor will stop as the conductive foil passes over the sense head.

17.3.11 Slew. Fast forward during playback can be achieved by operating the record motor utilizing the launch mode circuitry. No data is fed to the record heads and the tape is not erased.

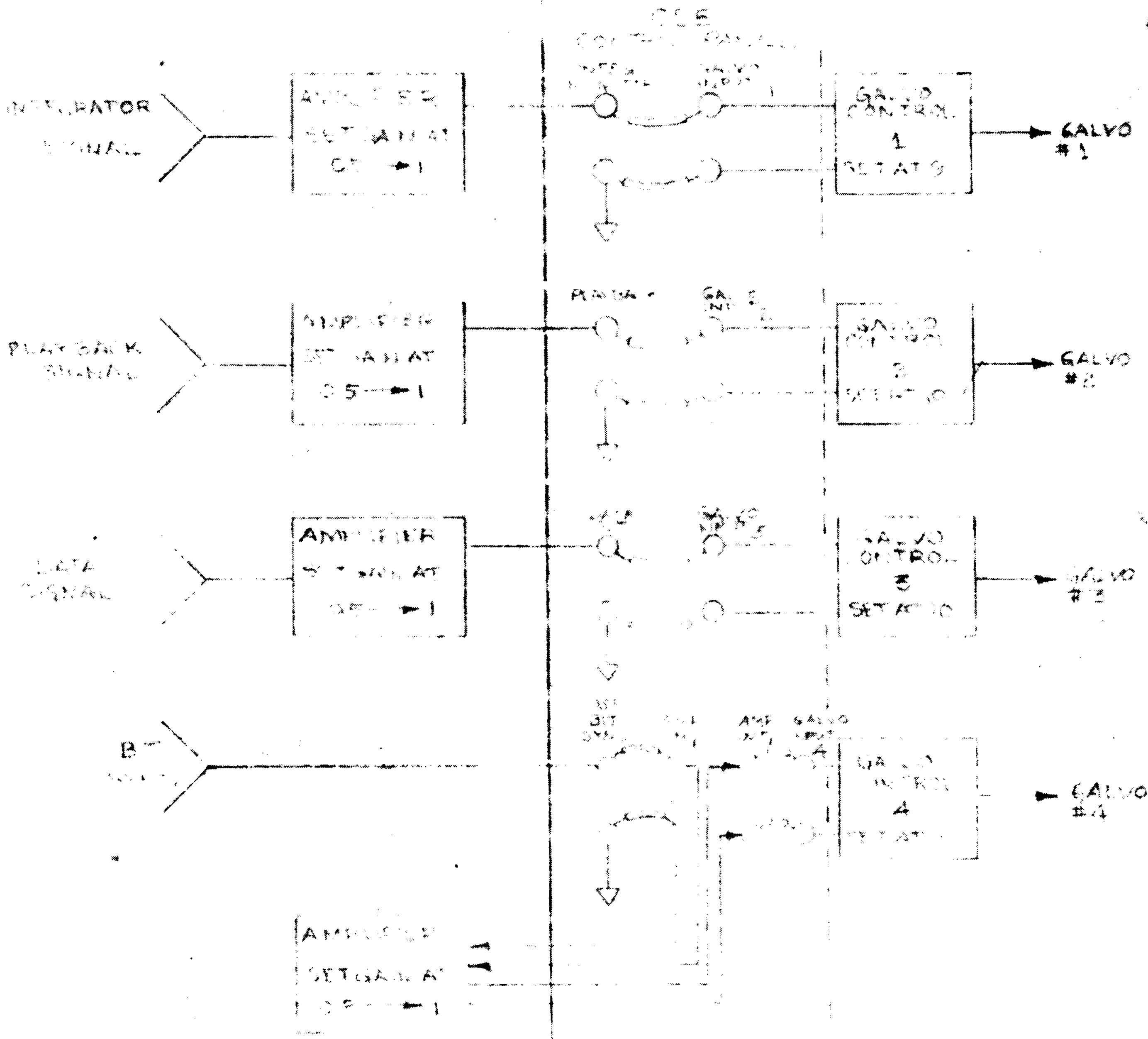
17.3.12 Instrumentation. When measuring rise times or other fast signals, use the #3A1 sensitive plug-in on the scope.

The Visicorder is internally wired and its inputs are conveniently brought out to the OSE control panel.

To standardize calibration of this instrument, four channels have been set aside for the integrator monitor, playback monitor, data out, and the bit sync, respectively.

With the Visicorder, there are five differential amplifiers. Reading from left to right on the OSE, their functions are auxiliary-1, playback amplifier, frequency doubled, integrator, and auxiliary-2.

Their outputs, and in the case of the auxiliaries, their inputs, are brought out to the OSE control panel. By patching the amplifier outputs into the galvonometer inputs, the signals arrive at the Visicorder by way of the galvonometer attenuators.


GALVO #1
GALVO #2
AMPLIFIER
GALVO #4

Identify and assign a number to every chart immediately after it is made.

The controls on the front of the Visicorder should be set as follows:

Grid on "4"

Galvo. on "4"

Timer on "ext."

Power on "lamp".

17.3.13 Transients. Line surges tend to interfere with the operation of the OSE.

17.4 Definition. The following defines the evaluation technique and limits of acceptance.

Perform these tests at the three ambient temperatures of 32° F, 75° F and 130° F (±5° F). During the temperature transition, the system must not be subjected to a gradient of more than 5 degrees Farenheit per minute measured at the transport main plate with the temperature transducer.

Plot the temperature by taking readings every 5 minutes on the DVM during the transition and every 1/2 hour, once stabilized. Continue the plotting every 5 minutes on returning back to room temperature.

The system must soak for a minimum of 4 hours, once the ambient temperature has been reached, before making any tests.

17.4.1 OSE Preparation. Before turning on any power: Place subassemblies in the left hand side of the Spacecraft Assembly V Frame and connect OSE cabling as shown in Figure 17.1.

(a) Record elapse time meter readings.

(b) Turn ON OSE main power by momentarily pressing the POWER button. Do not press any other buttons at this time. Allow a minimum of 5 minutes for warmup.

(c) Measure the 52 VDC voltage and 52 VDC-MA current with the DVM.

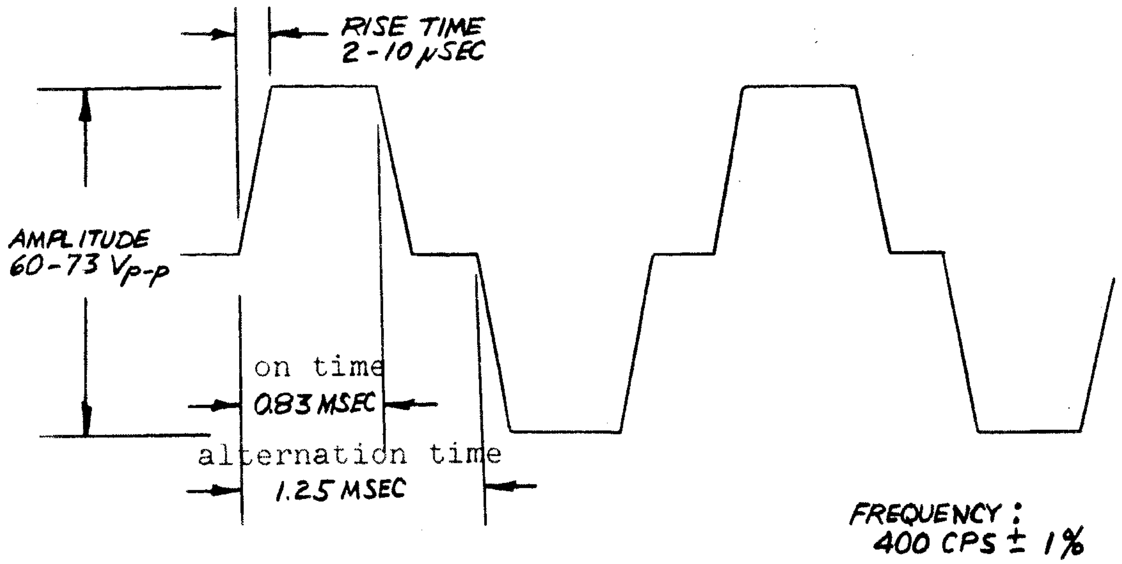
17.4.2 Launch Mode. Before applying launch mode power, check that:

(a) AGENA SEP light is OFF; 2400 CYC. POWER light is OFF; 400 CYC POWER light is OFF.

(b) LAUNCH MODE CONTROLS and indicator lights function properly by operating ON and OFF controls while observing indicator lights. Indication should be positive (OSE may need adjustment if not). Leave in OFF condition.

Apply launch mode power by momentarily depressing the AUX. 400 CYC. POWER button. The record motor should not start and monitor signal should not appear at the RECORD MOT. ON test points on the OSE panel.

(c) Measure amplitude, frequency, and waveform characteristics of the AUX. 400 CYC. signal at pins J302B11/13 with differential scope.

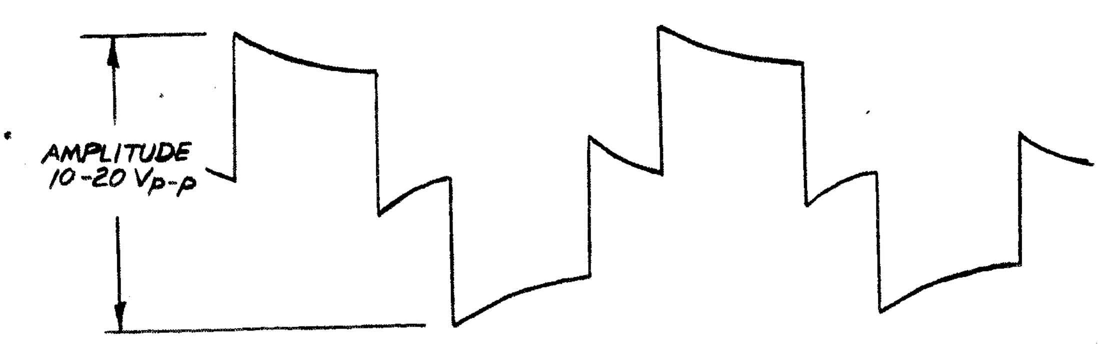


"SET" launch mode by momentarily depressing the LAUNCH MODE CONTROL-ON button.

(d) LAUNCH MODE CONTROL lights should indicate ON.

(e) Record motor should start; measure acceleration time.

(f) Monitor signal should appear at the RECORD MOT. ON test points on the OSE panel. Measure the peak-to-peak voltage.



(g) Measure the +6 VDC auxiliary supply voltage at TP-2 on subchassis 16A5 using the DVM; measure peak-to-peak ripple using scope.

(h) Measure the -6 VDC auxiliary supply voltage at TP-3 on subchassis 16A5 using the DVM; measure peak-to-peak ripple using scope.

(i) Measure the 52 VDC voltage and 52 VDC MA current with DVM.

Manually insert EOT signals using EOT TEST switch.

(j) Record motor should continue running and monitor signal should remain at test points.

Insert Agena Separation Signal by momentarily depressing AGENA SEP. button; AGENA SEP. light should indicate ON.

Manually insert EOT signal.

(k) Record motor should stop and monitor signal should disappear as EOT signal is inserted. LAUNCH MODE CONTROL lights should change to an OFF indication.

Remove Agena Separation Signal by momentarily depressing AGENA SEP. button; AGENA SEP. light should indicate OFF.

Remove launch mode power by momentarily depressing AUX. 400 CYC. POWER button.

"SET" launch mode and then re-apply launch mode power while monitoring RECORD MOT. ON test points with scope.

(l) Monitor signal should appear momentarily and LAUNCH MODE CONTROL lights should switch to an OFF indication approximately 200 milliseconds after power is applied.

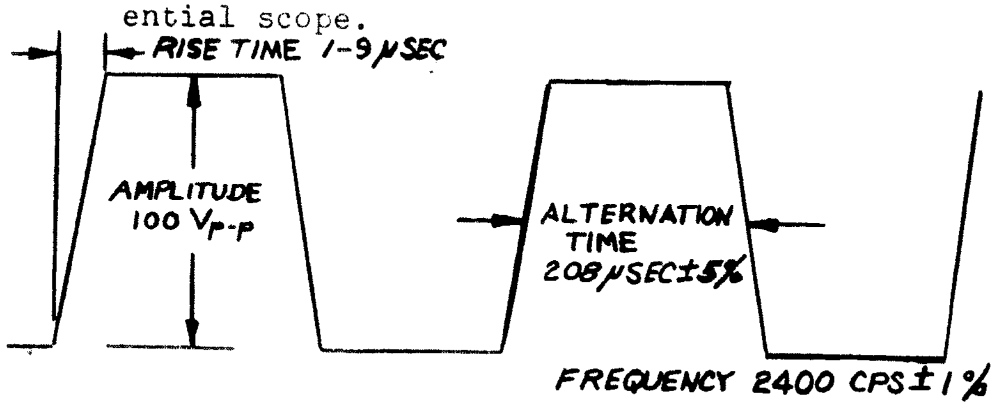
Leave auxiliary power ON and "RESET" launch mode. Insert Agena Separation Signal and allow record motor to run until conductive foil passes over the EOT sensor contacts.

(m) Record motor should stop, monitor signal should disappear, and LAUNCH MODE CONTROL lights should switch to an OFF indication as the foil passes the EOT contacts.

Remove launch mode power and Agena Separation Signal.

17.4.3 Power Supplies. Apply 2400 cps power to the recorder system by momentarily depressing the 2.4 KC POWER button.

(a) Measure amplitude, frequency, and waveform characteristics of the 2400 cps signal at pins J301-1/3 in the OSE Junction Box. Use a differential scope.



(b) Measure the system supply voltages with the DVM.

(1) +20 VDC ±1%

(2) -20 VDC ±1%

(3) +6 VDC ±5%

(4) -6 VDC ±5%

(5) +10 VDC, 4 to 6 V

The voltage measured at position +10 V on the DVM INPUT SELECTOR is the output of the playback motor regulator. This voltage must be set for each playback motor. Look up the required playback motor voltage in the Log Book for the unit under test and set the regulator output to that voltage. This adjustment is made at A2R24 on the 16A4 subchassis. See Figure 17.1.

(c) Measure peak-to-peak noise at the power supply test points on subchassis 16A4 with scope common at TP5 on subchassis 16A4.

(1) +20 VDC, TP-1

(2) -20 VDC, TP-2

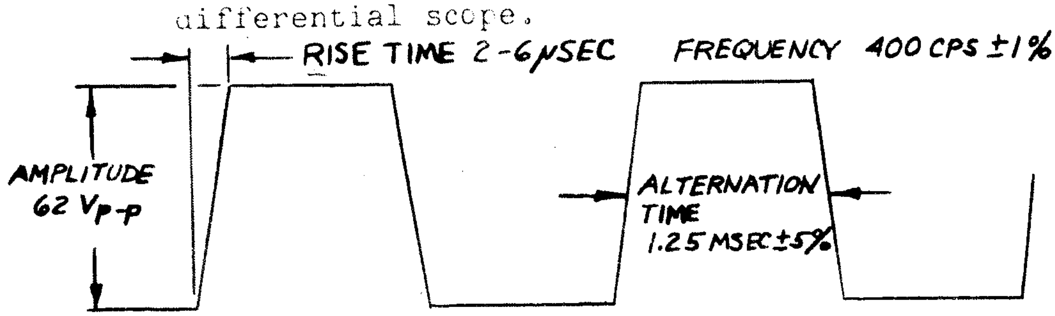
(3) +6 VDC, TP-3

(4) -6 VDC, TP-4

(d) Measure peak-to-peak noise between TP-5 (common) on subchassis 16A4 and spacecraft common on OSE panel.

Apply 400 cps power to the recorder system by momentarily depressing the 400 CYC POWER and RECORD buttons.

(e) Measure the amplitude, frequency, and waveform characteristics of the 400 cps signal at pin J302D-1/3 of the OSE Junction Box. Use a differential scope.



17.4.4 Data Record Sequences. Manually insert three EOT signals into the system, utilizing the EOT Test Switch. Track changes should occur at each signal (wait ten seconds between each EOT insertion).

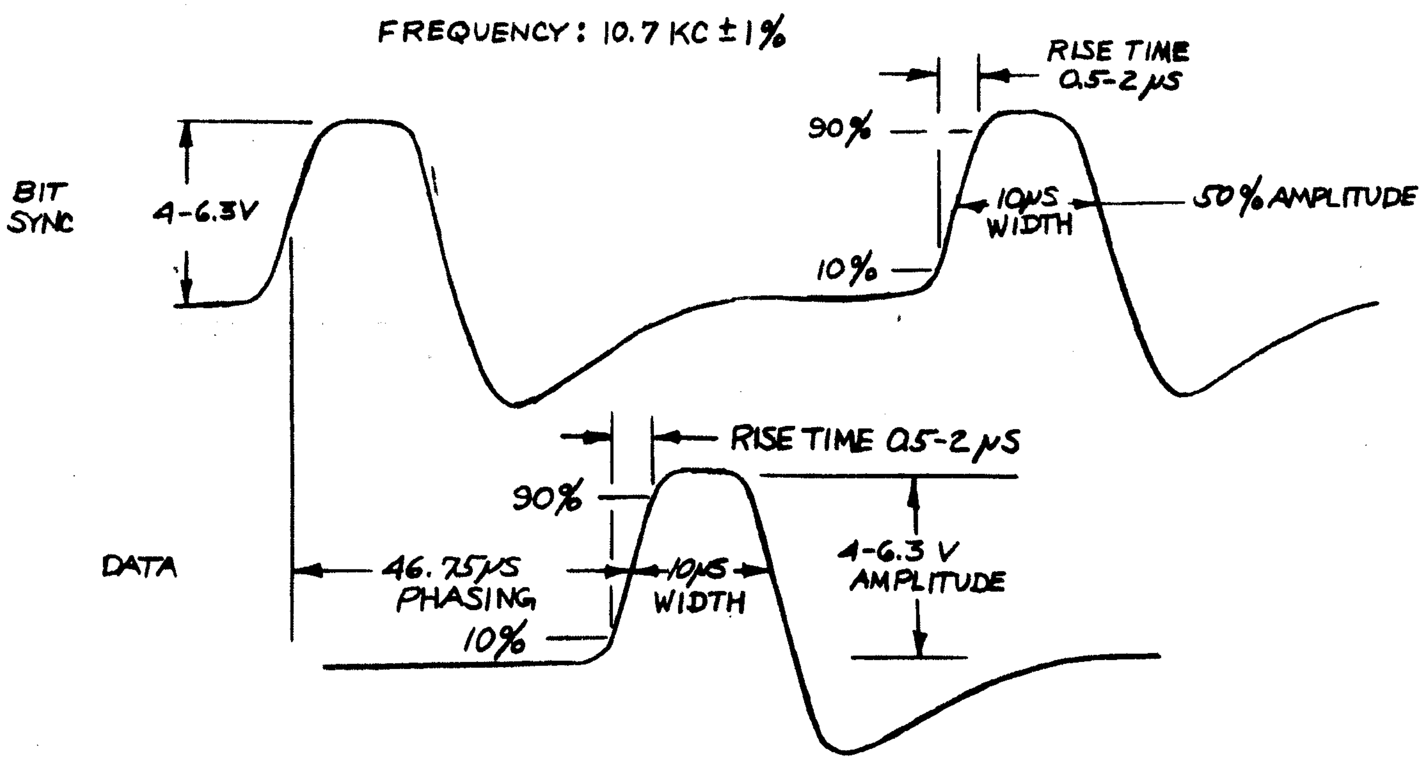
Program the OSE for AUTO. STOP operation. Enable the OSE command circuits by momentarily depressing the COMMAND ENABLE button.

Set the DAS Simulator to a 0001011 code and temporarily turn OFF the 400 CYC POWER. Make these checks after issuing a DAS COMMAND by momentarily depressing the DAS START button:

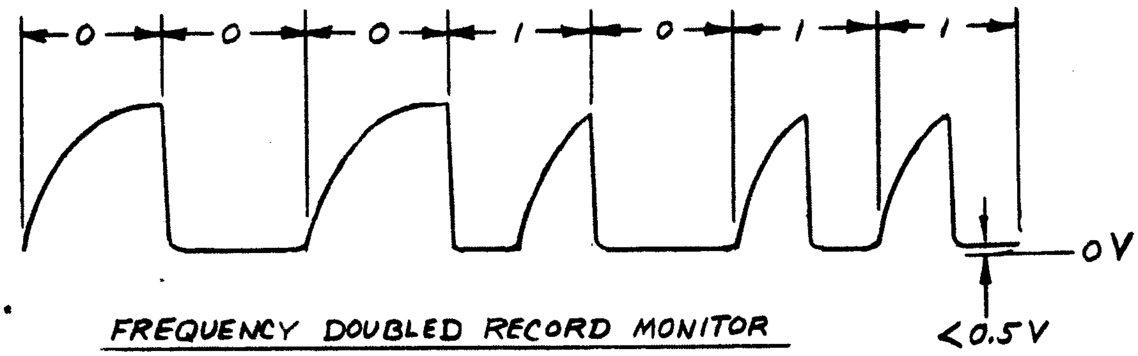
(a) Measure amplitude, width, and rise time of DAS DATA.

(b) Measure amplitude, width, and rise time of DAS BIT SYNC. Measure frequency with digital counter.

(c) Check the DAS DATA phasing in relation to the BIT SYNC with dual trace scope.



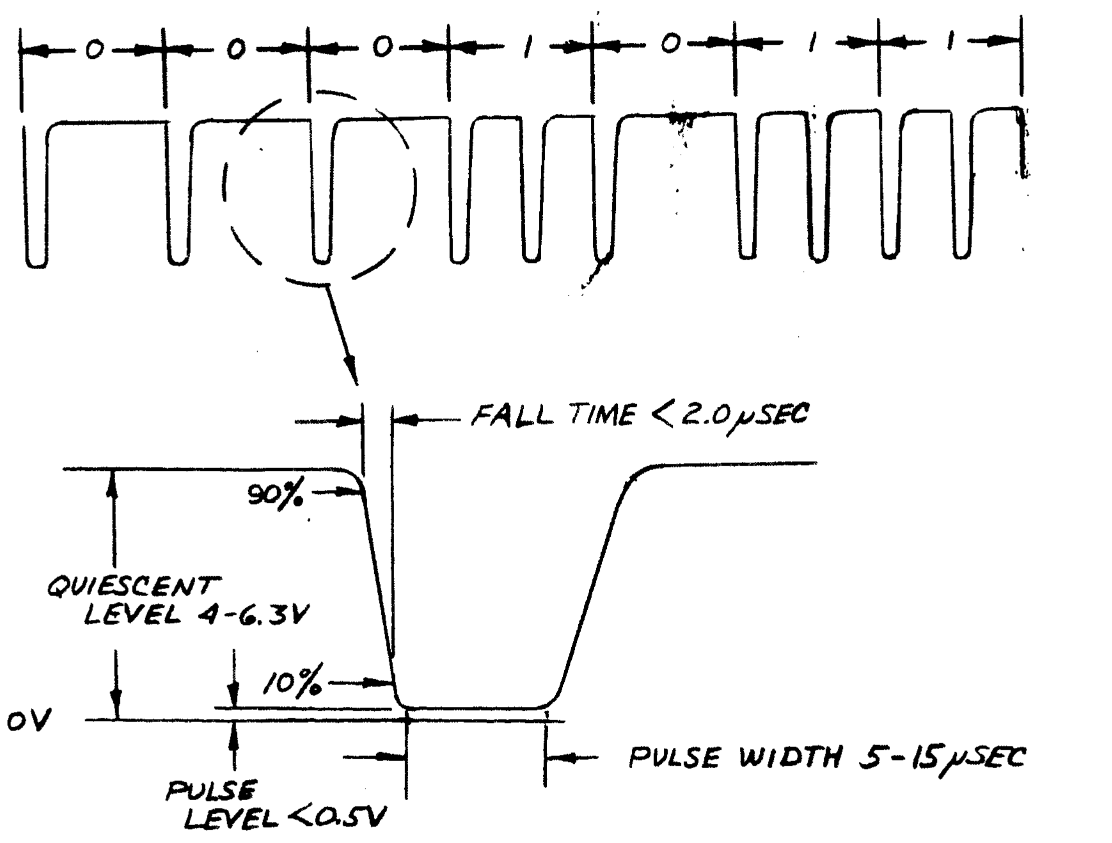
(d) Check the DIRECT ACCESS FREQUENCY DOUBLED RECORD MONITOR at pin J 305 C 19 of the OSE Junction Box.



FREQUENCY DOUBLED RECORD MONITOR

NOTE: PHASE [redacted] SHIFTED 180°

(e) Check the RZ to Frequency Doubled test point TP-1 on subchassis 16A5. Measure waveform characteristics as shown below.



(f) Check TR1 record head signal at TP-4 on subchassis 16A3. Measure DC level and head current balance as shown in Figure 17.8. AC couple the scope when making the measurement described in View A of the figure.

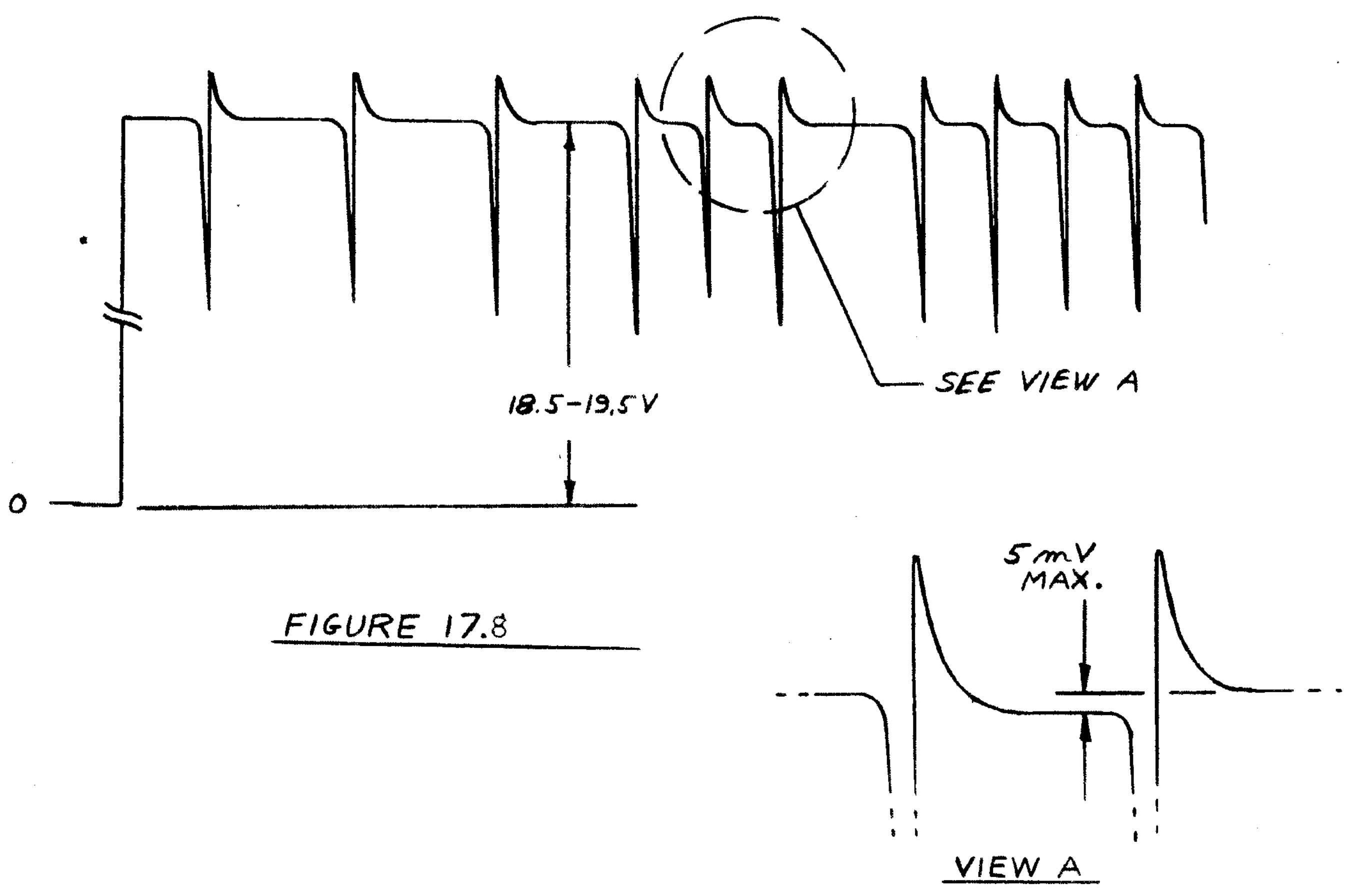


FIGURE 17.8

(g) Check TR2 record head signal at TP-3 on subchassis 16A3. Measure DC level and head current balance as shown in Figure 17.8.

Issue a DAS STOP command by momentarily depressing the DAS STOP button; re-apply 400 cps power and program the Sequence Simulator to 3.6 seconds, 0.008 seconds, and 24.2 seconds.

Set the OSE for sequence simulation by momentarily depressing the DAS SEQ. SIM. button.

(h) Record the following code sequences on TRACK 1 by issuing a DAS START command for each sequence:

(1) "0000000"

(2) "1111111"

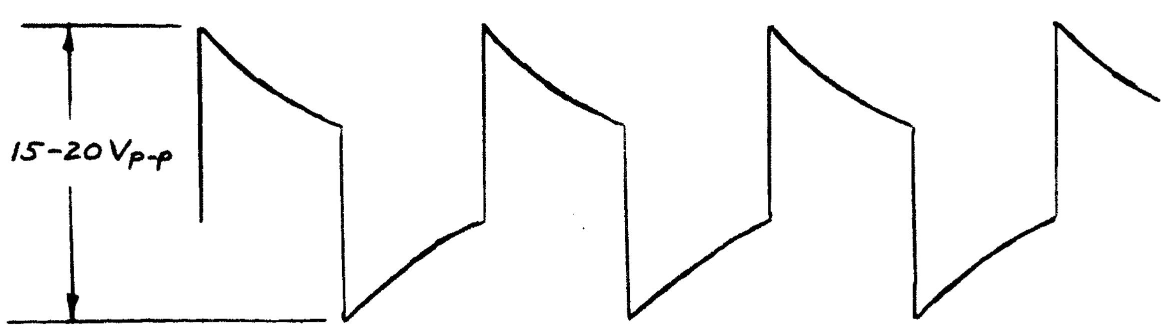
(3) "1110100"

(4) "0001011"

(5) thru (10 or 11) "10101010" (Depress BIT ERROR CHECK button for these sequences.)

(i) On the last few sequences before the EOT, monitor the DAS BIT SYNC and the RECORD MOT. ON test points. On the 11th or 12th sequence, the record motor monitor signal will decay before the bit sync. This means that the end-of-tape has been reached. Approximate the time of the partial sequence. The system must complete ten full sequences but no more than eleven full sequences.

(j) Measure the peak-to-peak voltage of the RECORD MOT. ON test points during the recording sequences.



(k) Measure the acceleration and coast down times of the record motor during the recording sequences by observing the RECORD MOT. ON test point waveform characteristics.

(l) While the record motor is running during one of the record sequences, measure the 52VDC voltage and 52VDC MA current with the DVM.

The track indicator should now indicate TRACK 2. Program the OSE for MANUAL STOP operation and turn OFF the BIT ERROR CHECK generator. The automatic stop feature of the recorder COUNT 2 & STOP circuits should stop the unit at the end of the tape.

(m) Record the following code sequence on TRACK 2 by issuing a DAS Start command for each sequence.

(1) "1111111"

(2) "0000000"

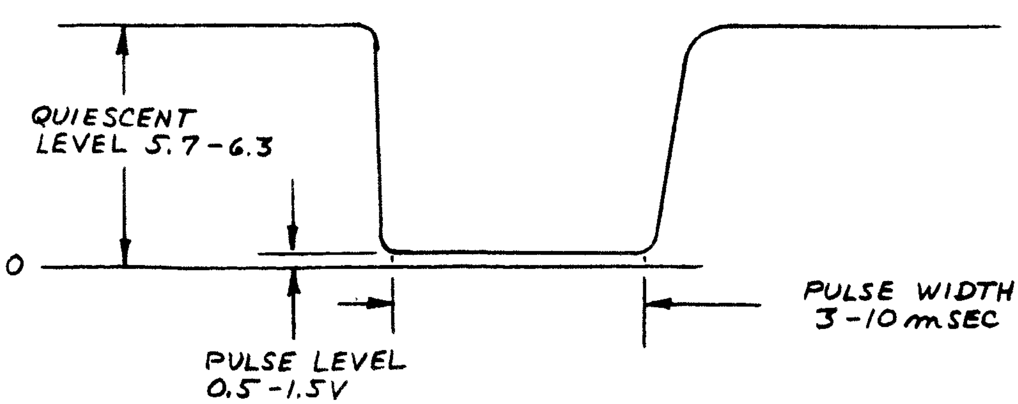
(3) "0001011"

(4) "1110100"

Turn OFF the DAS SEQUENCE SIMULATOR.

(n) Record a "0000000" code on the remainder of TRACK 2. When the EOT foil passes the sensor contacts, the unit should change tracks and stop automatically. At the same time, a negative pulse should occur on theDAS START/STOP RETURN line at pin J302A-5.

(o) Measure the quiescent level, pulse level, and width of the pulse as it occurs.



(p) Verify that the system does not respond to any further DAS Start commands.

17.4.5 Data Playback. Switch the recorder system into the playback mode by momentarily depressing the RECORD and PLAYBACK buttons. Turn OFF the 400 CYC. POWER.

17.4.5.1 First Sequences. Slew the recorder ahead for 10 seconds, utilizing the launch mode circuitry to override the playback system.

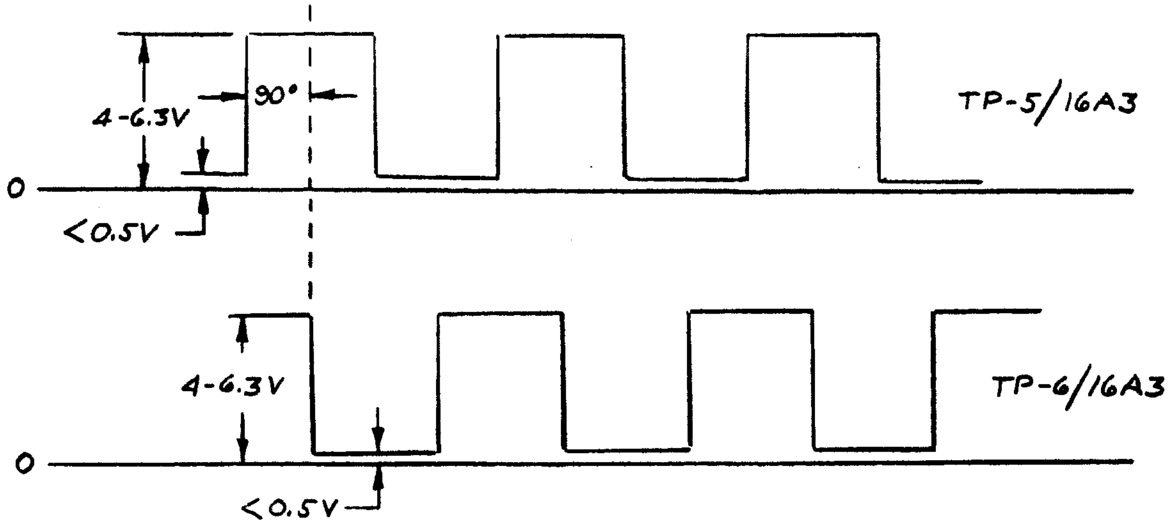
(a) Recheck the playback motor regulator voltage (DVM, +10 V position). At room temperature during initial system test, A2R24 may be reset if the value does not agree with the recommended value in the Log Book.

(1) Check the playback motor phase one drive logic signal at TP-5 on subchassis 16A3. Verify and measure voltage levels as in Figure 17.9.

(2) Check the playback motor phase two drive logic signal at TP-6 on subchassis 16A3. Verify and measure voltage levels as in Figure 17.9.

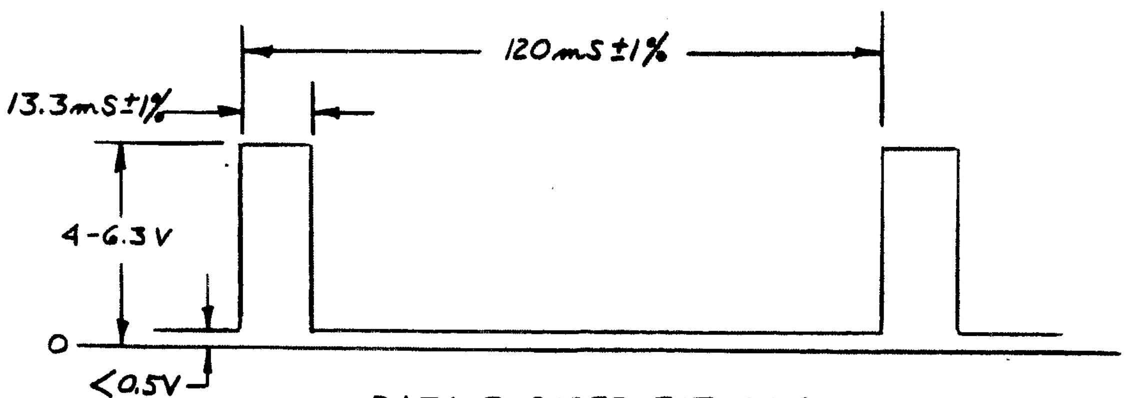
(3) Check the playback motor drive phasing (compare TP-5/16A3 with TP-6/16A3 using dual beam scope). Verify as in Figure 17.9.

(4) Check the playback motor supply ripple at pin J305A-5 of the OSE Junction Box.



PLAYBACK MOTOR DRIVE PHASING
FIGURE 17.9

(b) Examine the DATA ENCODER BIT SYNC at pin J302C-17 of the OSE Junction Box. Verify and measure pulse width, period, and levels as in Figure 17.10.



DATA ENCODER BIT SYNC
FIGURE 17.10

Switch the recorder system to TRACK 1.

(c) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "0000000" code (see Figure 17.11), and measure the peak-to-peak signal level andDC level. To obtain the DC level, turn OFF the playback motor by depressing the PLAYBACK button.

(d) Examine the integrator signal at pin J304-7 in the OSE Junction Box (see Figure 17.13) and:

(1) Measure and record the reset level.

(2) Measure and record the reset rise time.

(3) Measure and record the average rundown level (during initial systems test adjust the voltage controlled oscillator (VCO) at A1R4 on subchassis 16A3 so that the average rundown level is +10 V when the system is phase locked).

(4) Measure and record the rundown slope.

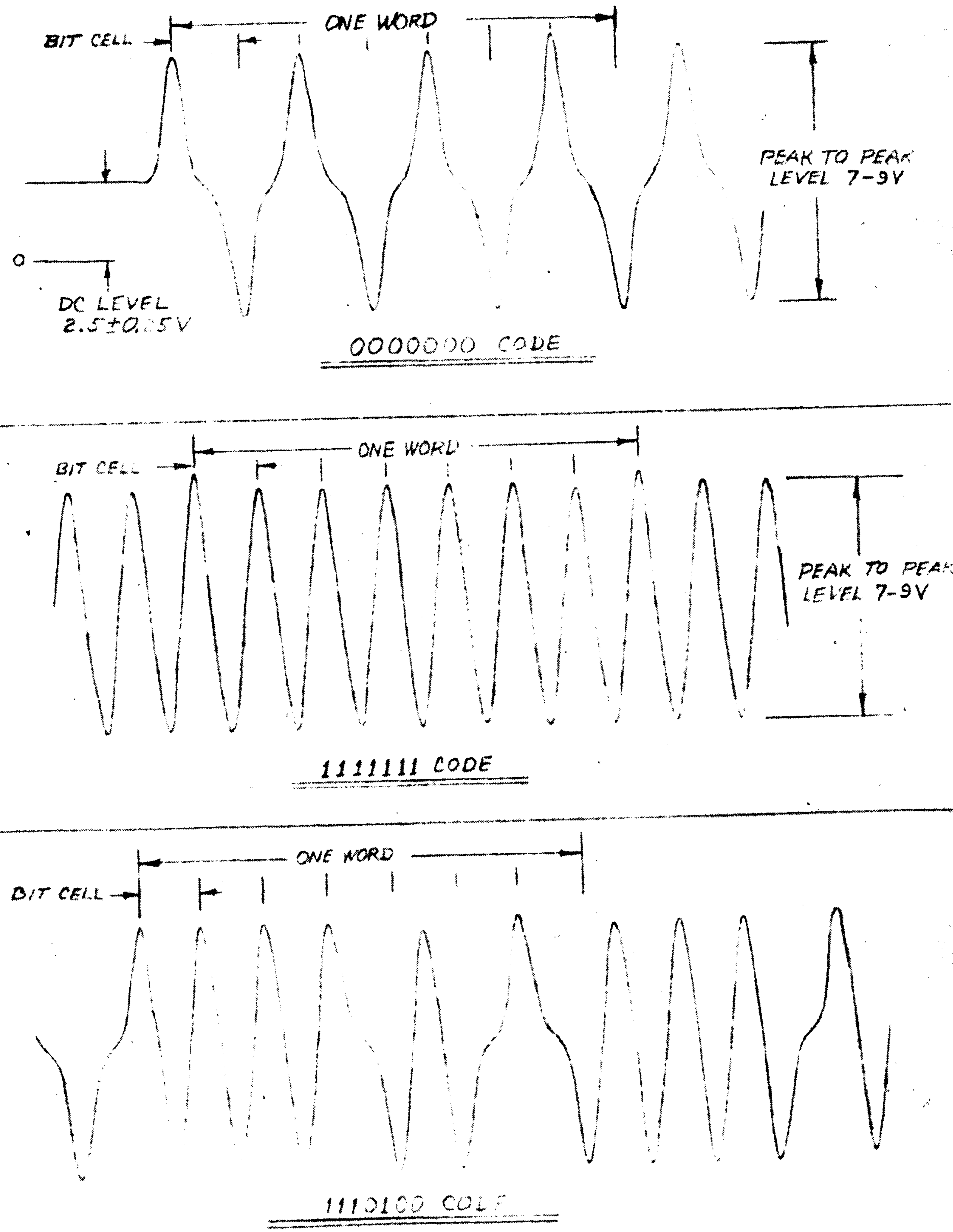
(5) Measure and record the droop.

(6) Measure and record the peak-to-peak rundown level variation.

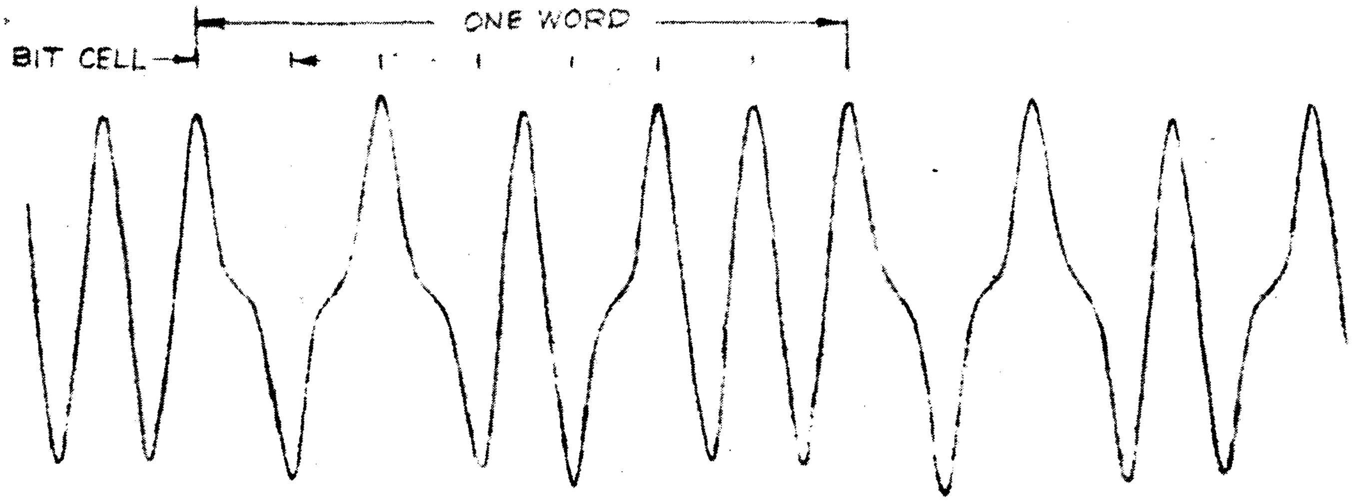
(e) Make a simultaneous Visicorder chart of the INTEGRATOR MONITOR, D/A PLAYBACK AMP. MONITOR, D/A DATA and OSE BIT SYNC. Calibrate the Integrator Monitor channel for 5 V/inch and the Playback Amp. Monitor for 4 V/inch. Use a 4 IPS chart speed. (See Figure 17.12 for a typical simultaneous chart recording.)

(f) As above, make a simultaneous Visicorder chart but at 0.1 IPS chart speed.

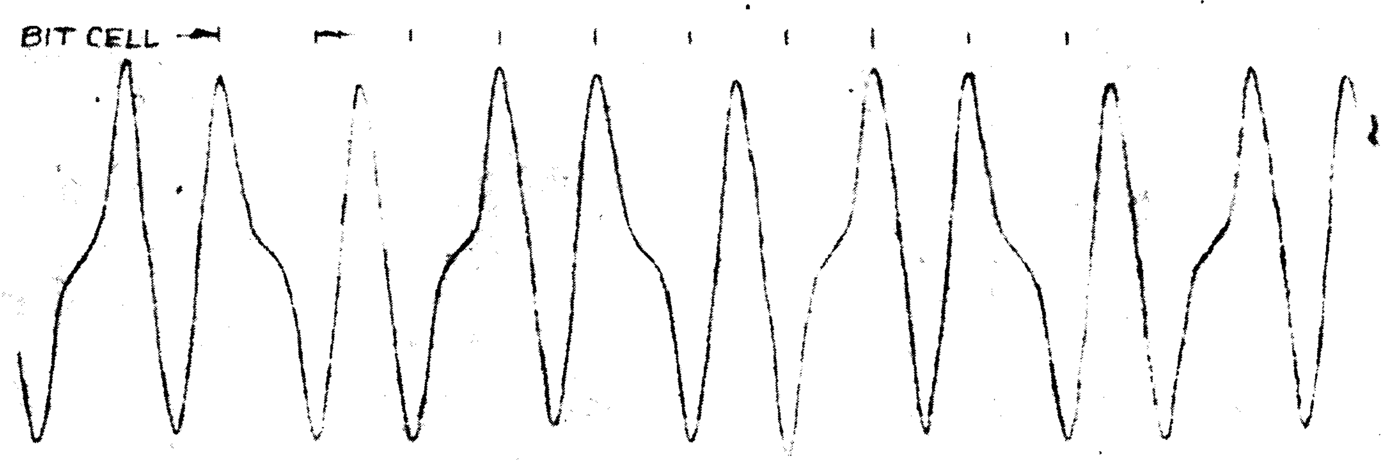
(1) Check that the D/A DATA output remains at a "zero" logic level throughout the recording.



PLAYBACK SIGNALS
FIGURE 17.11

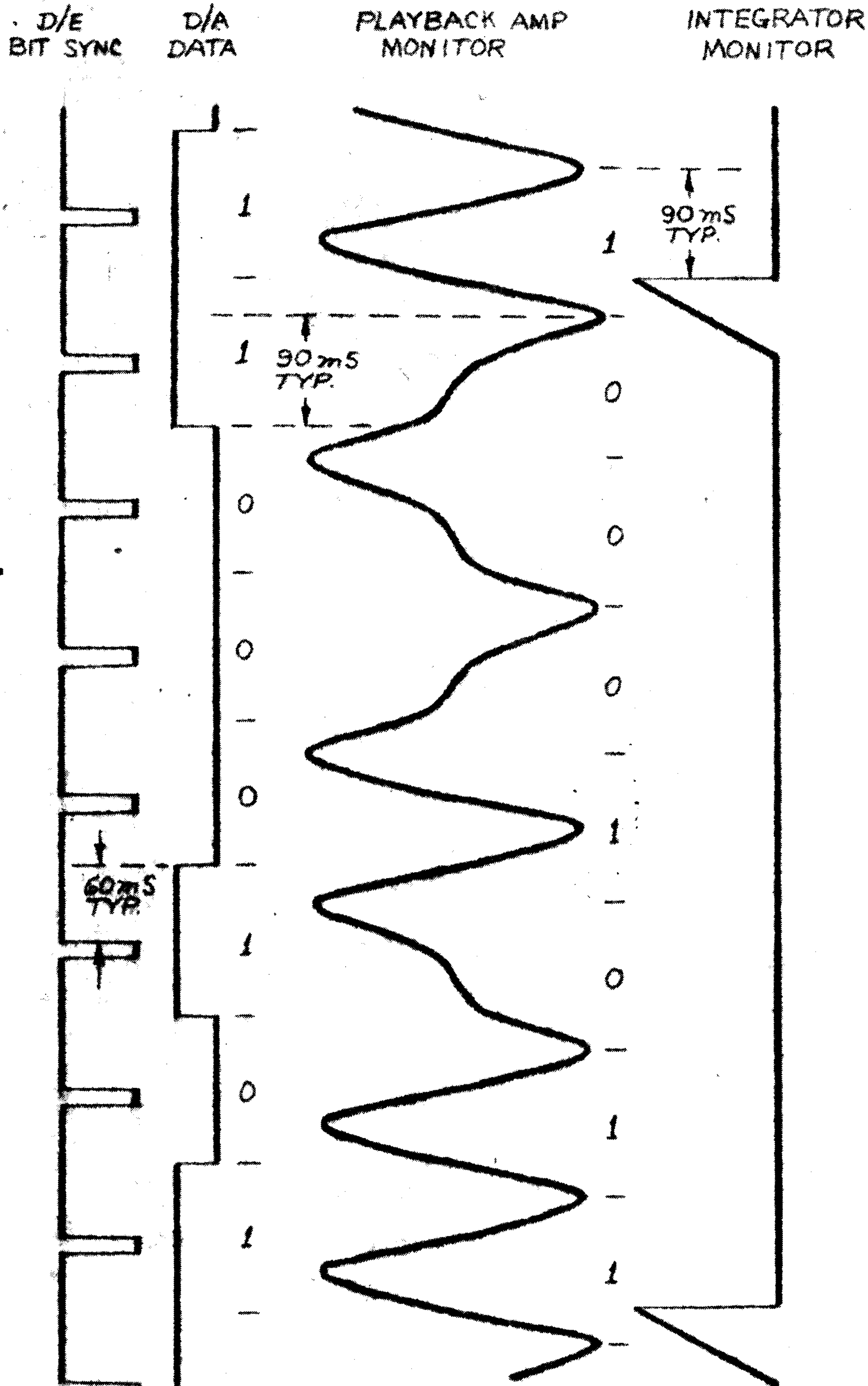


0001011 CODE



10101010--- CODE

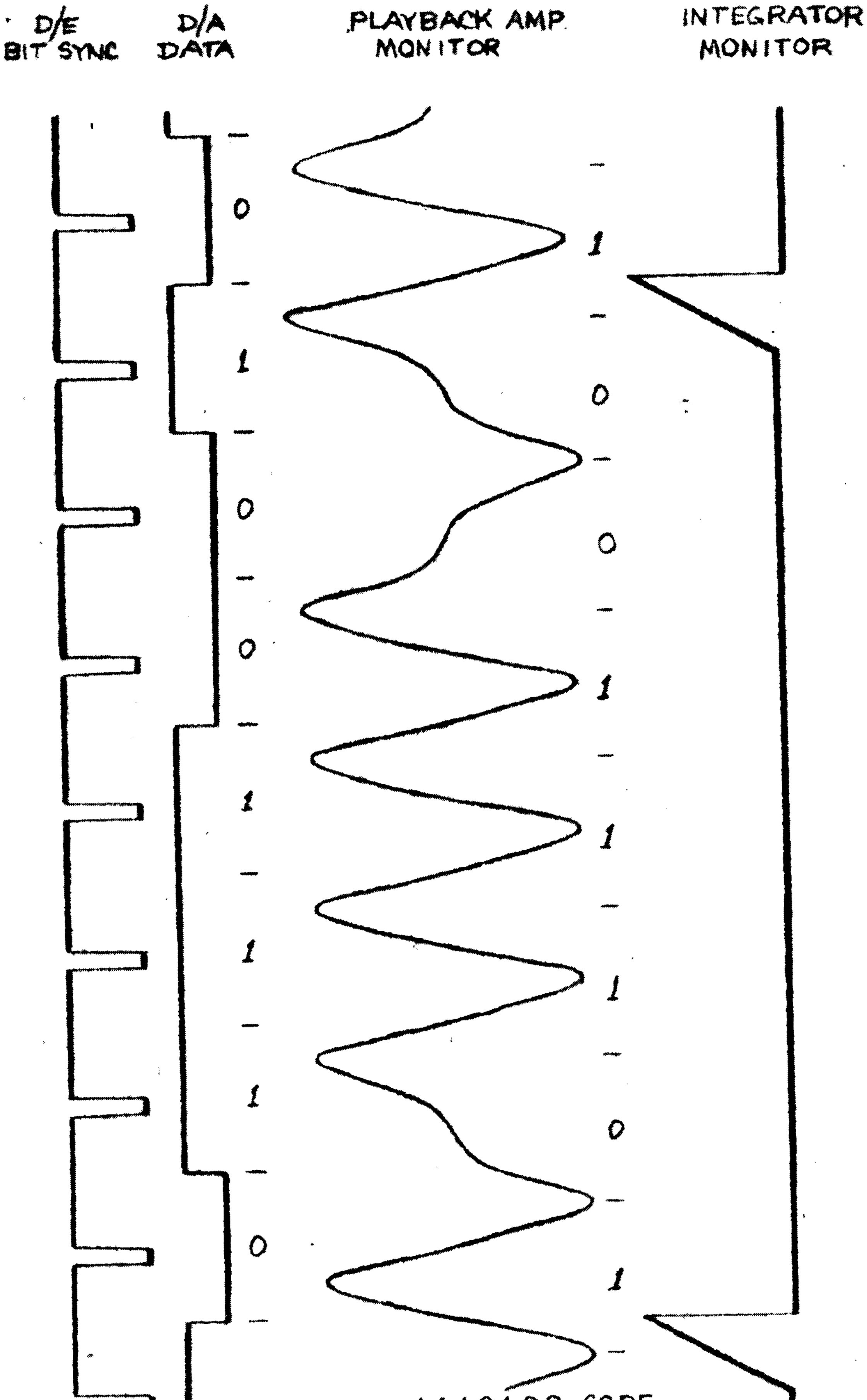
PLAYBACK SIGNALS
FIGURE 17.11 CONT'D



0001011 CODE

TYPICAL SIMULTANEOUS RECORDING

FIGURE 17.12

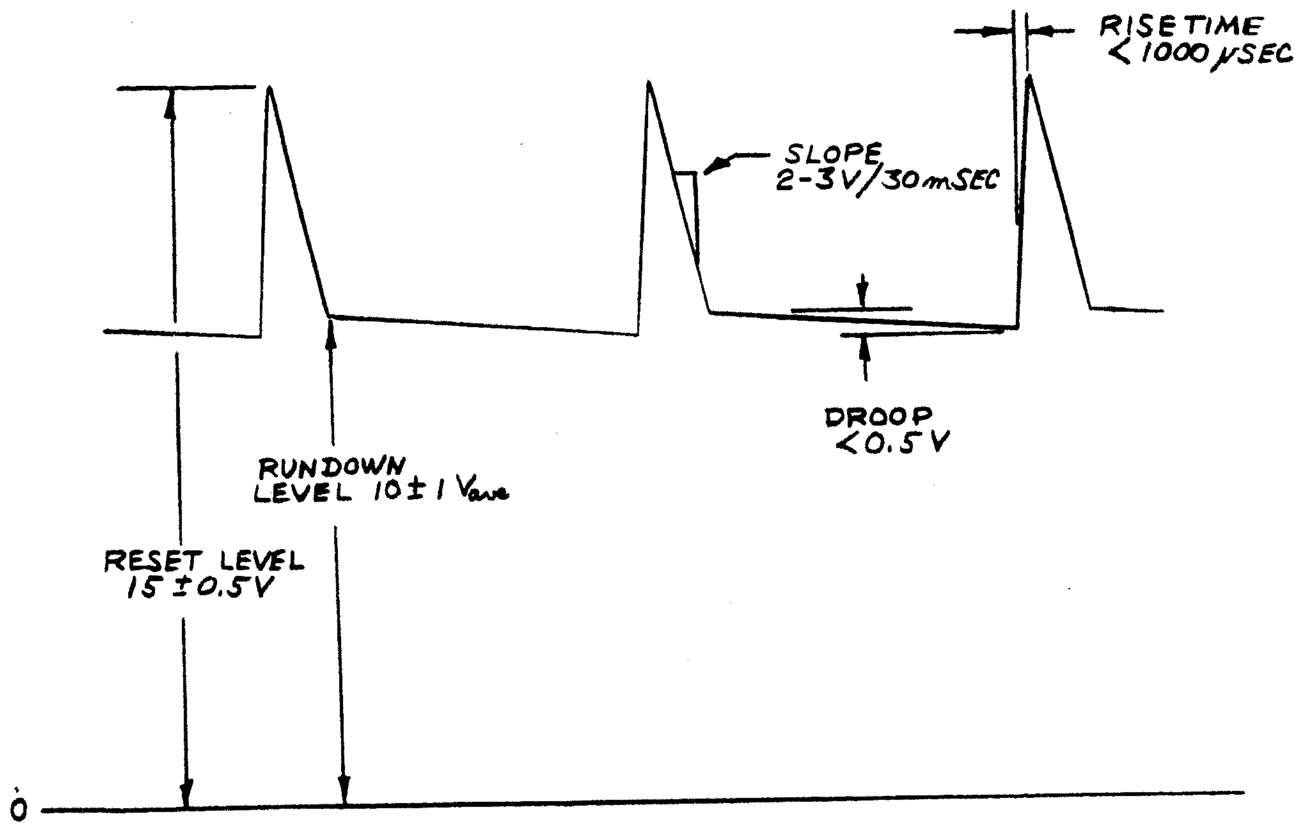


1110100 CODE

TYPICAL SIMULTANEOUS RECORDING

FIGURE 17.12 cont'd

(2) Check that the D/E $\overline{\text{Data}}$ output remains at a "one" logic level throughout the recording (use scope).

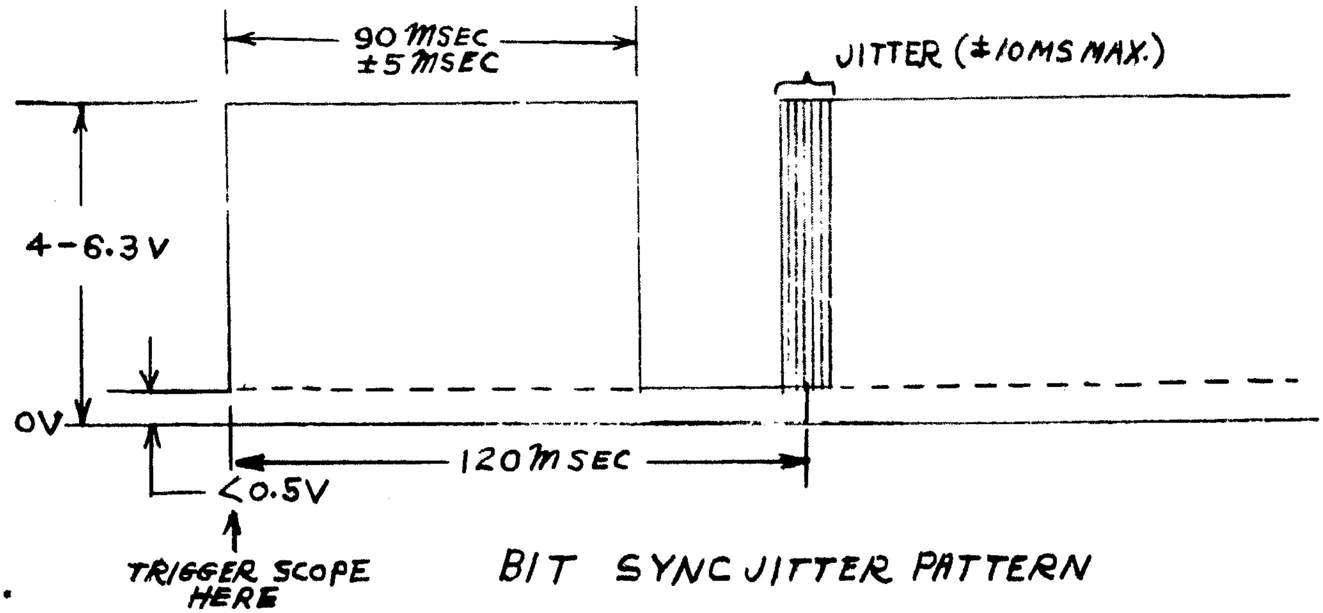


INTEGRATOR PATTERN

FIGURE 17.13

(g) Verify the playback bit sync signal at TP-7 on subchassis 16A2. Measure the signal levels, pulse length, and peak-to-peak jitter (see Figure 17.14

(1) Check to see that no "ones gate" pulse is present at TP-4 on subchassis 16A2.



BIT SYNC JITTER PATTERN

FIGURE 17.14

(h) Verify the differentiator waveform at TP-3 on subchassis 16A2 (see Figure 17.15).

(1) Measure the peak-to-peak signal level and DC level (turn OFF playback motor for DC level).

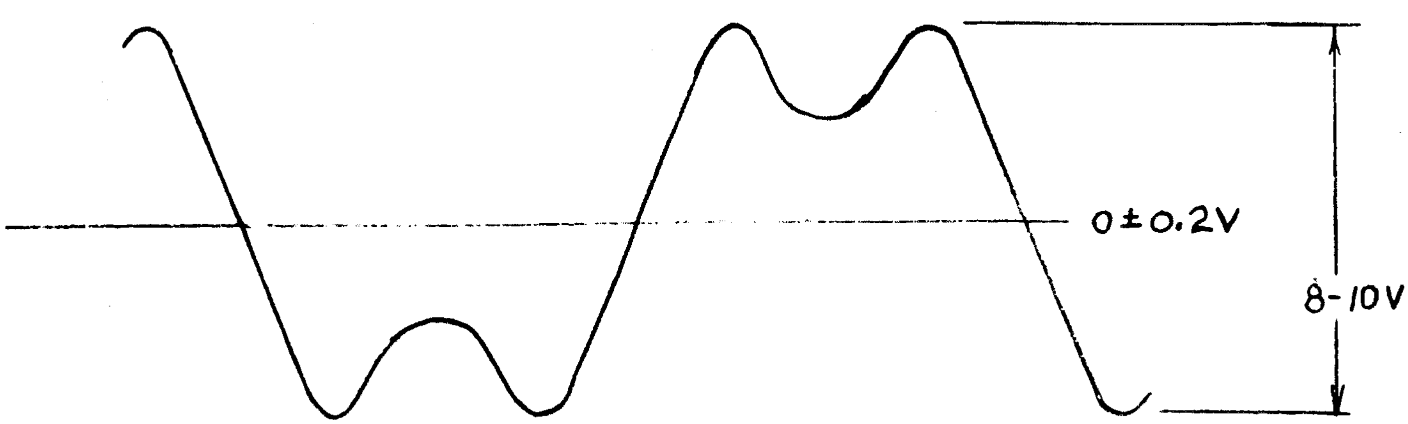


FIGURE 17.15

DIFFERENTIATOR TRACK #1 0000000 CODE

(i) Verify the frequency doubled code waveform at TP-1 on subchassis 16A2 (see Figure 17.16).

(1) Measure the voltage levels as indicated.

(2) Verify the frequency doubled code waveform at TP-2 on subchassis 16A2 and measure voltage levels.

(3) Check phasing with dual beam scope.

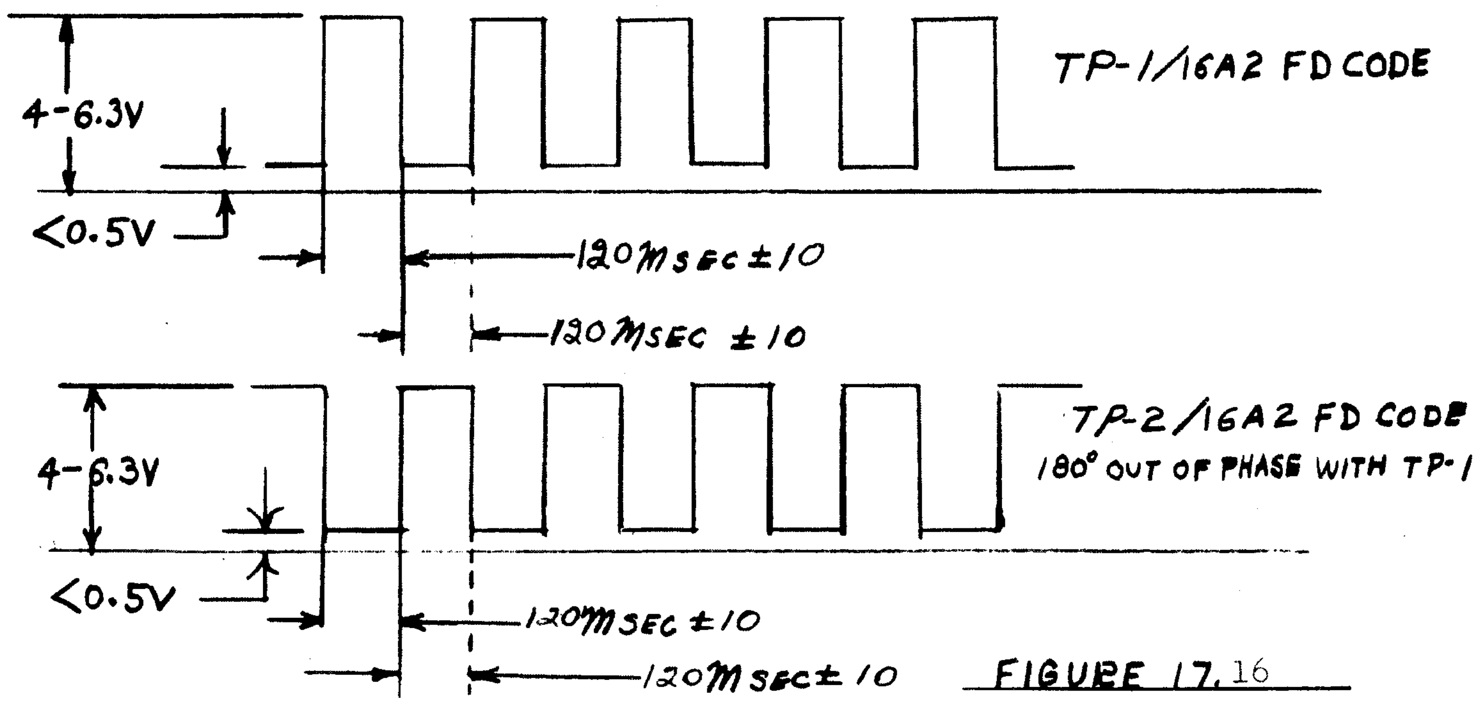


FIGURE 17.16

(j) Check the Mode 4 - 1 logic signal at pin J302C-3 of the OSE Junction Box.

(1) Verify that voltage level is 4 to 6.3 V when playback motor is ON and less than 1/2 V when playback motor is OFF; record voltages.

(2) Check that same signal exists at TP-5 on sub-chassis 16A2.

(k) Verify the phase comparator inputs at TP-6 and TP-8 on subchassis 16A2 (see Figure 17.17).

(1) Measure voltage levels and pulse timing of the tape input at TP-6 as indicated.

(2) Measure voltage levels and pulse timing of the reference input at TP-8 as indicated.

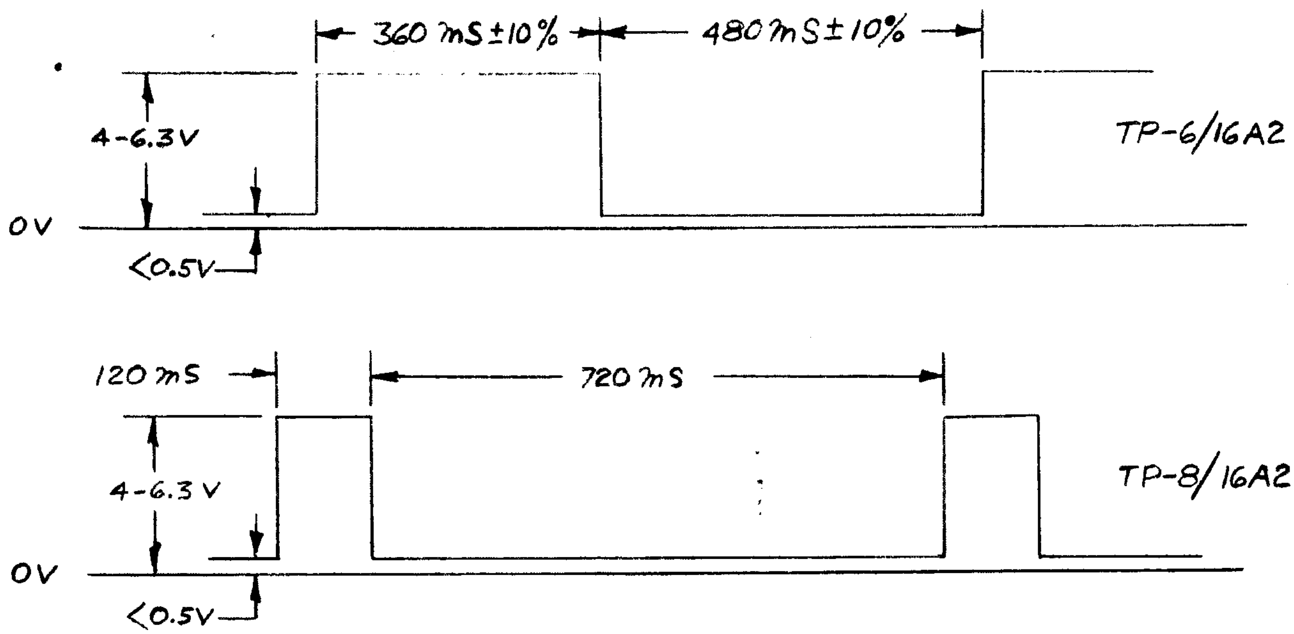
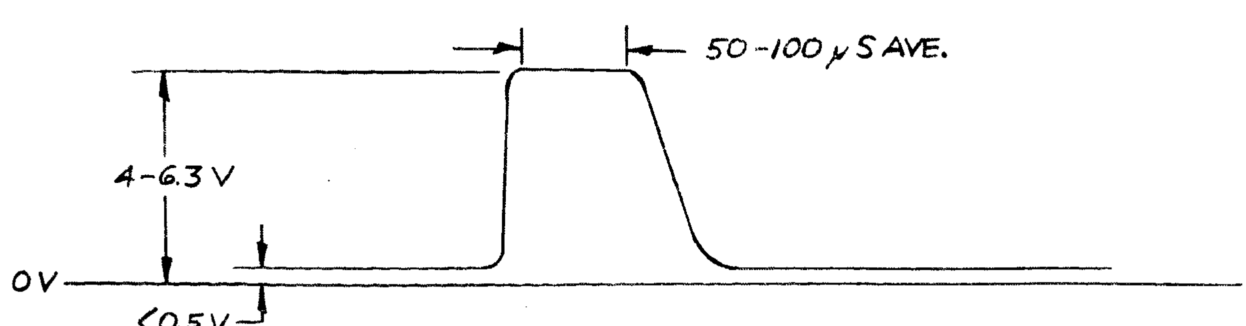


Figure 17.17

(l) Verify the differentiator and full wave rectifier at TP-9 on subchassis 16A2 (see Figure 17.18).

(1) Measure voltage levels and pulse width as indicated.



DIFFERENTIATOR & FULL WAVE RECTIFIER
Figure 17.18

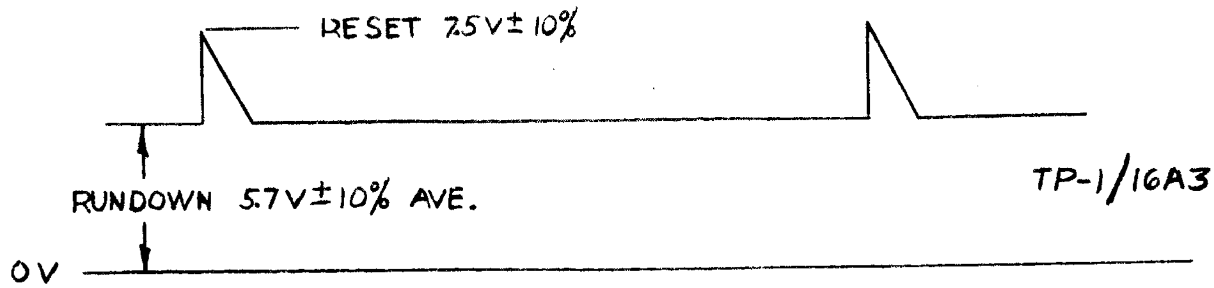


Figure 17.19

(m) Verify the VCO input and output signals at TP-1 and TP-2 on subchassis 16A3.

(1) Measure input reset and average rundown levels at TP-1 as indicated (see Figure 17.19).

(2) Measure output voltage levels and pulse width at TP-2 as indicated (see Figure 17.20).

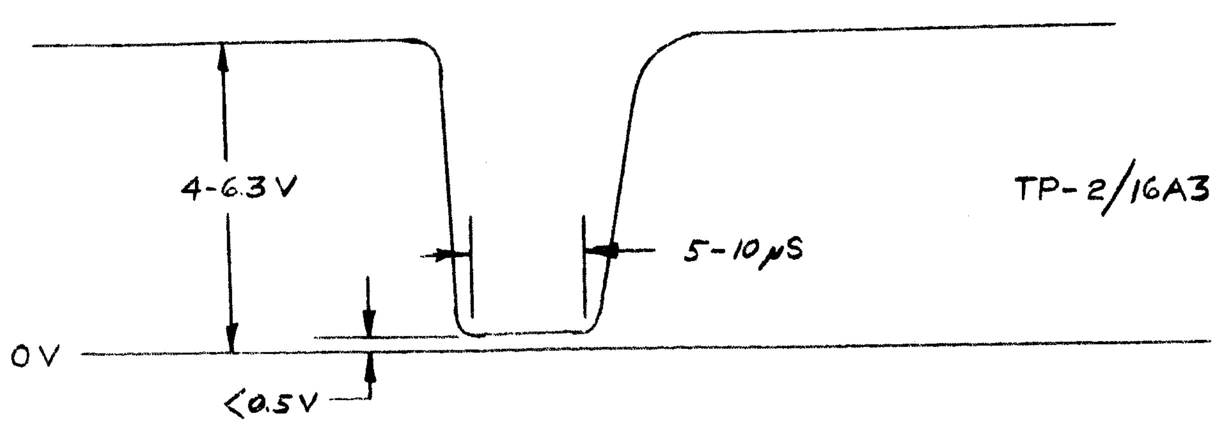


Figure 17.20

Switch recorder system to TRACK 2.

(n) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "1111111" code (see Figure 17.11 and measure the peak-to-peak signal level and DC level.

(o) Examine the integrator signal at pin J304A-7 of the OSE Junction Box (see Figure 17.13).

(1) Measure and record the average rundown level.

(2) Measure and record the peak-to-peak rundown level variation.

(p) As in paragraph 17.4.5.1(e) make a simultaneous Visicorder chart at 4 IPS.

(q) As above, make a simultaneous Visicorder chart at 0.1 IPS.

(1) Check that the D/A DATA output remains at a "one" logic level throughout the recording.

(2) Check that the D/E DATA output remains at a "zero" logic level throughout the recording (use scope).

(r) Measure the playback bit sync jitter at TP-7 on subchassis 16A2 (see Figure 17.14).

(s) Verify the "ones gate" signal at TP-4 on subchassis 16A2.

(1) Measure the signal levels, pulse length, and peak-to-peak jitter (see Figure 17.14).

(2) Compare phasing of the playback bit sync at TP-7/16A2 and the "ones gate" at TP-4/16A2 and

measure the average time delay in milliseconds and the peak-to-peak variation in time delay (see Figure 17.21).

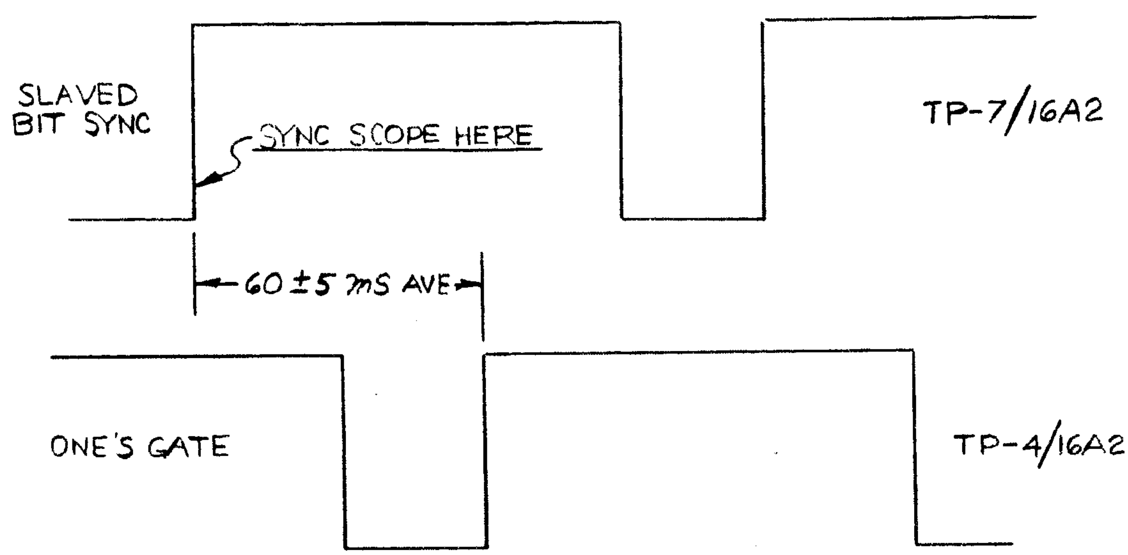


Figure 17.21

(t) Verify the frequency doubled code at TP-1 on sub-chassis 16A2. (see Figure 17.22).

(1) Verify the frequency doubled code at TP-2 on subchassis 16A2.

(2) Check phasing with dual beam scope.

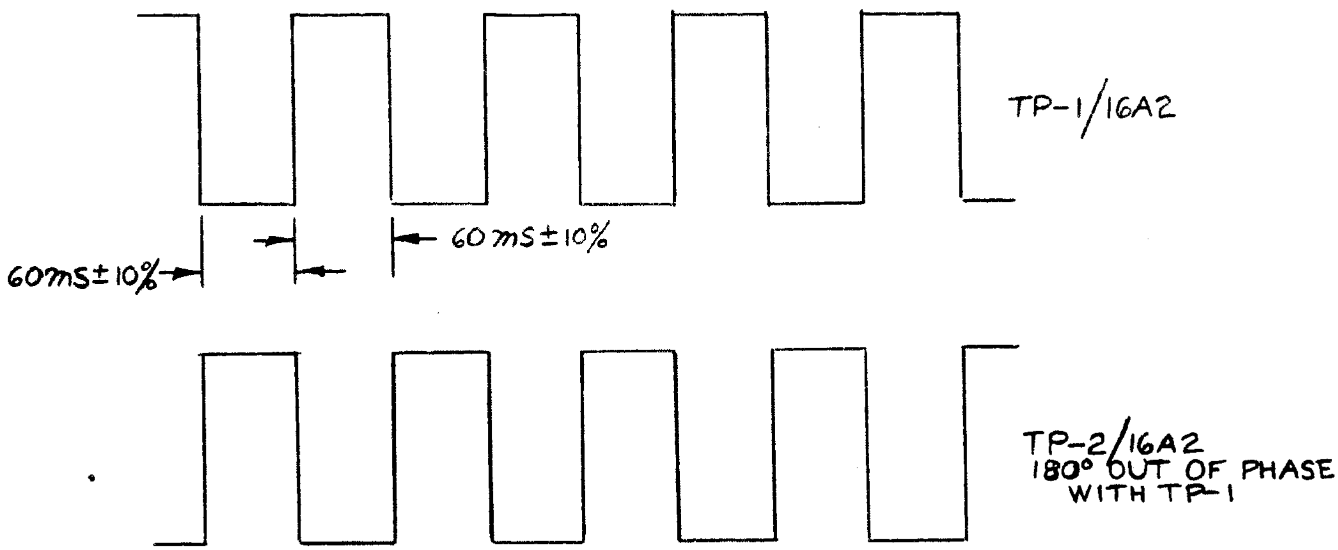


Figure 17.22

17.4.5.2 Second Sequences. Slew the recorder ahead for 29 seconds, utilizing the launch mode circuitry to override the playback motor.

Switch the recorder system to TRACK 1.

(a) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "1111111" code (see Figure 17.11), and measure the peak-to-peak signal level.

(b) Examine the integrator signal at pin J304A-7 of the OSE Junction Box (see Figure 17.13).

(1) Measure and record the average rundown level.

(2) Measure and record the peak-to-peak rundown level variation.

(c) As in paragraph 17.4.5.1 (e) make a simultaneous Visicorder chart at 4 IPS.

(d) As above, make a simultaneous Visicorder chart, but at 0.1 IPS.

(1) Check that the D/A DATA output remains at a "one" logic level throughout recording.

Switch the recorder system to TRACK 2.

(e) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "0000000" code (see Figure 17.11) and measure the peak-to-peak signal level.

(f) Examine the integrator signal at pin J304A-7 of the OSE Junction Box (see Figure 17.13).

(1) Measure and record the average rundown level.

(2) Measure and record the peak-to-peak rundown level variation.

(g) As in paragraph 17.4.5.1 (e) make a simultaneous Visicorder chart at 4 IPS.

(h) As above, make a simultaneous Visicorder chart, but at 0.1 IPS.

(1) Check that D/A DATA output remains at a "zero" logic level throughout recording.

17.4.5.3 Third Sequences. Slew the recorder ahead for 29 seconds, utilizing the launch mode circuitry to override the playback motor.

Switch the recorder system to TRACK 1.

(a) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "1110100" code (see Figure 17.11).

(b) Verify the D/A DATA signal at pin J305D-1 of the OSE Junction Box. Measure the signal levels (see Figure 17.23).

<u>NOTE</u>: Visicorder galvanometer must be removed from line for this measurement.

(c) Verify the D/E $\overline{\text{DATA}}$ signal at pin J302C-19 of the OSE Junction Box. Measure the signal levels (see Figure 17.23).

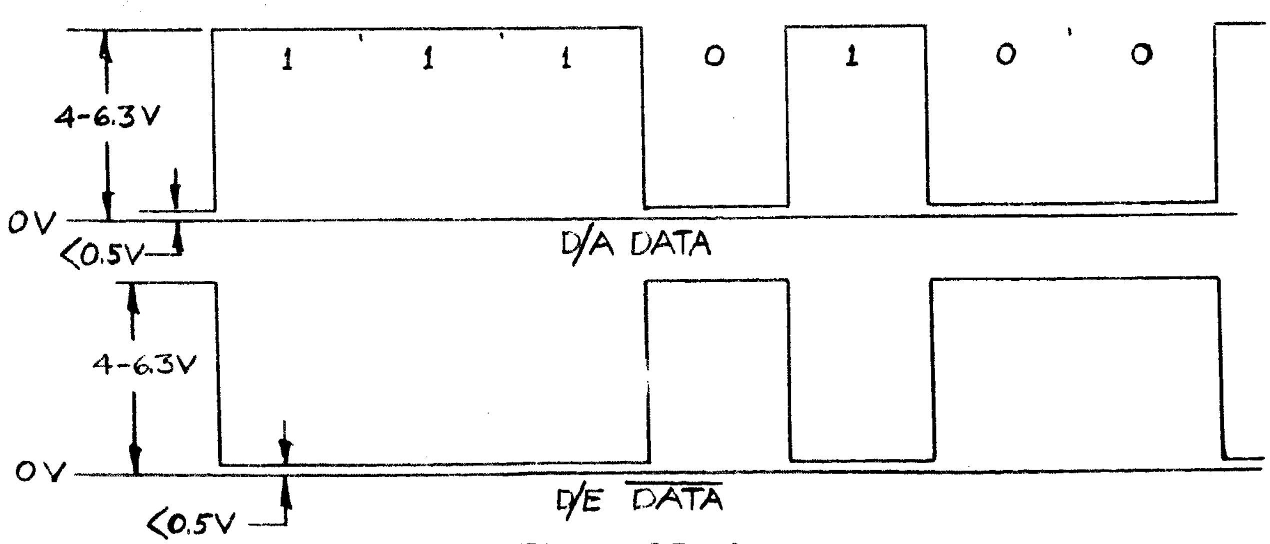


Figure 17.23

(d) As in paragraph 17.4.5.1(e) make a simultaneous Visicorder chart at 8 IPS.

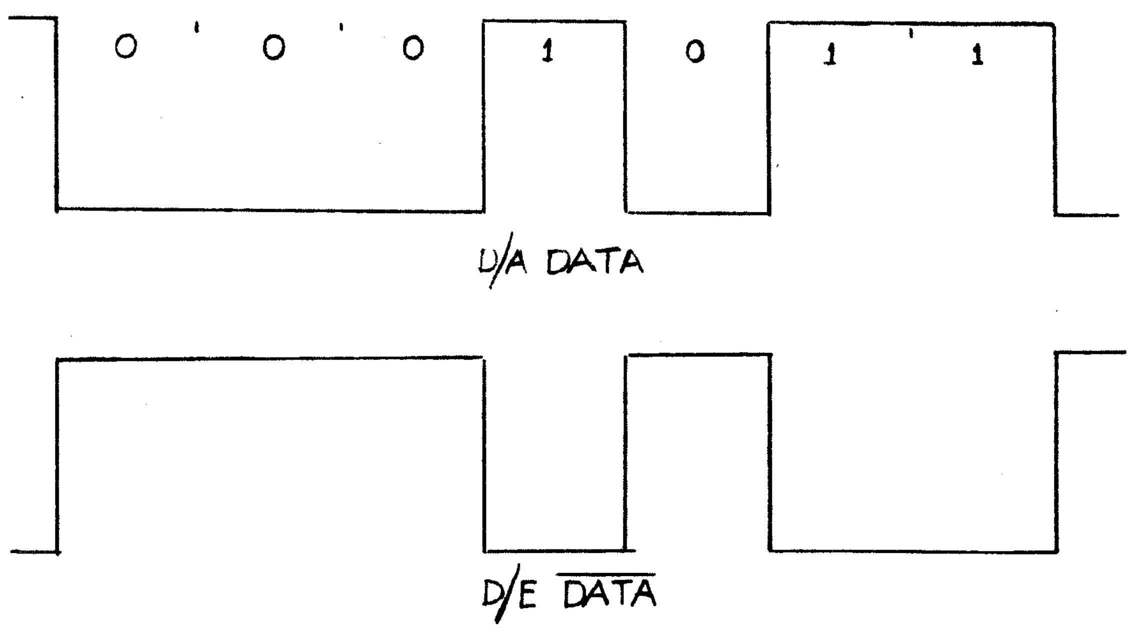
(1) Check phasing of signals (see Figure 17.12).

Switch the recorder system to TRACK 2.

(e) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "0001011" code (see Figure 17.11).

(f) Verify the D/A DATA Signal at pin J305D-1 of the OSE Junction Box (see Figure 17.24).

(g) Verify the D/E $\overline{\text{DATA}}$ Signal at pin J302C-19 of the OSE Junction Box (see Figure 17.24).



D/E $\overline{\text{DATA}}$

Figure 17.24

(h) As in paragraph 17.4.5.1(e) make a simultaneous Visicorder chart at 8 IPS.

(1) Check phasing of signals (see Figure 17.12).

17.4.5.4 Fourth Sequences. Slew the recorder ahead for 29 seconds, utilizing the launch mode circuitry to override the playback motor.

Switch the recorder system to TRACK 1.

(a) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "0001011" code (see Figure 17.11).

Switch the recorder system to TRACK 2.

(b) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "1110100" code (see Figure 17.11).

17.4.5.5 <u>Fifth Sequences</u>. Slew the recorder ahead for 29 seconds, utilizing the launch mode circuitry to override the playback motor.

Switch the recorder system to TRACK 1.

(a) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "10101010" code (see Figure 17.11).

(b) Verify the "10101010" code at the D/E $\overline{\text{DATA}}$ output on pin J302C-19 of the OSE Junction Box (see Figure 17.25).

(1) Measure the average time delay of the D/E $\overline{\text{DATA}}$ transition from the leading edge of the D/E BIT SYNC as indicated.

(2) Measure the peak-to-peak variation in time delay as indicated.

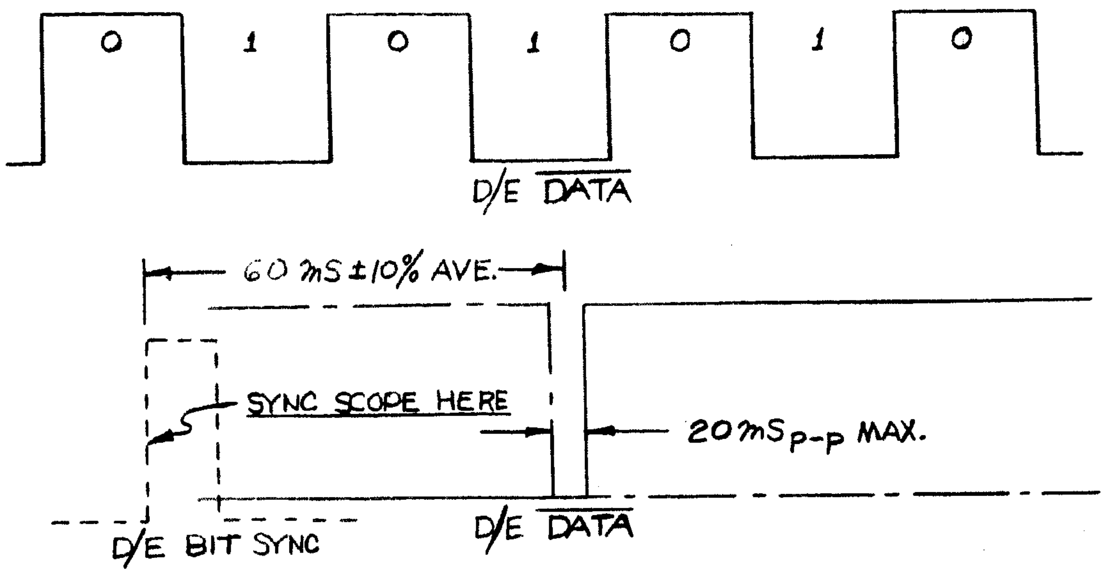


Figure 17.19

(c) Examine the integrator signal at pin J304A-7 of the OSE Junction Box (see Figure 17.13).

(1) Measure and record the average rundown level.

(2) Measure and record the peak-to-peak rundown level variation.

(d) As in paragraph 17.4.5.1(e), make a simultaneous Visicorder chart at 4 IPS.

(e) As above, make a simultaneous Visicorder chart, but at 0.1 IPS.

Switch the recorder system to TRACK 2.

(f) Examine the playback signal at pin J305C-11 of the OSE Junction Box. Verify the "0000000" code (see Figure 17.11).

(g) With the DVM, measure the system supply voltages while operating in the PLAYBACK mode.

(1) +20 VDC ±1%

(2) -20 VDC ±1%

(3) +6 VDC ±5%

(4) -6 VDC ±5%

Turn the playback motor OFF, program the OSE for AUTO STOP and operate in the RECORD mode until the system stops as the EOT foil passes the sensor contacts. (Record "0000000" code).

17.4.6 Command and Interface Lines. Operate the recorder system in the RECORD mode with the 400 CYC POWER OFF and with AUX. 400 CYC. POWER OFF.

(a) Verify the DAS START command by observing the pulse at pin J302A-1 of the OSE Junction Box as the DAS START button is depressed (see Figure 17.26).

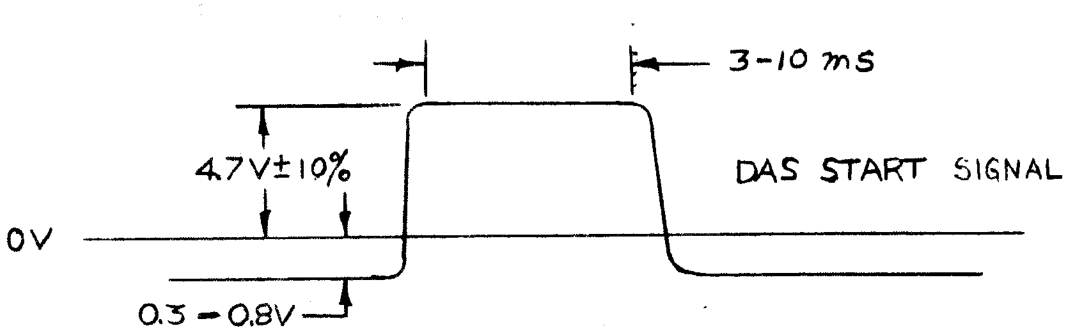


Figure 17.26

(b) Verify the DAS STOP command by observing the pulse at pin J302A-3 of the OSE Junction Box as the DAS STOP button is depressed (see Figure 17.27).

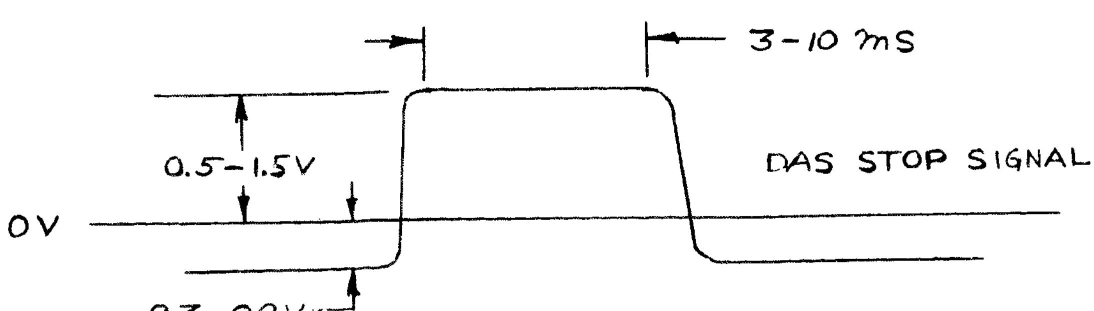
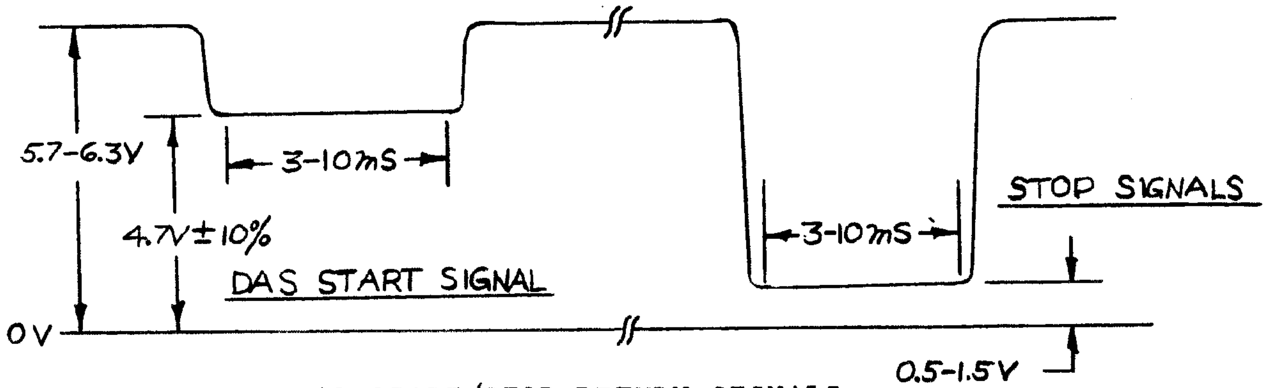


Figure 17.27

(1) Measure the quiescent level, pulse level, and pulse width as indicated.



DAS START/STOP RETURN SIGNALS

Figure 17.28

(c) Verify the DAS START/STOP RETURN signals by observing the pulse at pin J302A-5 as the DAS START, DAS STOP, D/A START, and D/A STOP buttons are depressed (see Figure 17.28).

(1) Measure the quiescent level, pulse level, and pulse width as the DAS START button is depressed.

(2) Measure the pulse level and pulse width as the DAS STOP button is depressed.

(3) Measure the pulse level and pulse width as the D/A START button is depressed.

(4) Measure the pulse level and pulse width as the D/A STOP button is depressed.

(d) Verify the D/A START command by observing the pulse at pin J305C-9 as the D/A START button is depressed (see Figure 17.29).

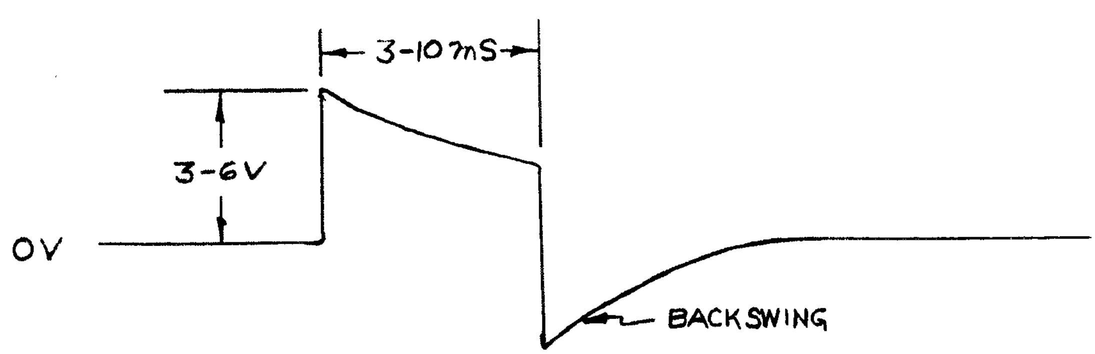
(1) Measure the pulse level and pulse width as indicated.

(e) Verify the D/A STOP command by observing the pulse at pin J305C-7 as the D/A STOP button is depressed (see Figure 17.29).

(1) Measure the pulse level and pulse width as indicated.

(f) Verify that the D/A START/STOP commands are operating the start/stop relay by observing the effect on the integrator monitor test point at pin J304A-7 of the OSE Junction Box as the D/A START and STOP buttons are depressed.

(1) Voltage level should be +16 to +18 V after START command and less than +15 V after STOP command.



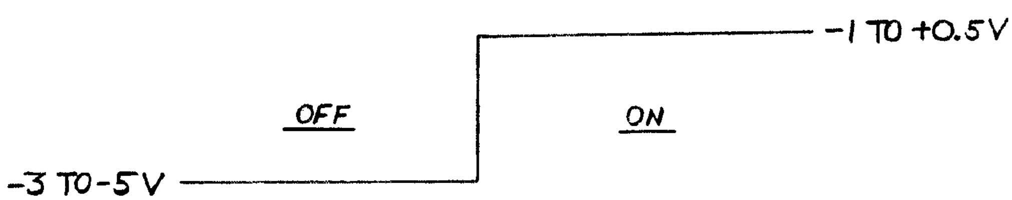
D/A START & STOP SIGNAL

Figure 17.29

Operate the recorder system in the PLAYBACK mode.

(g) Verify that when the playback motor is switched from ON to OFF, the PLAYBACK MOTOR ON signal at pin J305C-13 of the OSE Junction Box changes levels as indicated in Figure 17.30.

(1) Measure the ON and OFF voltage levels.

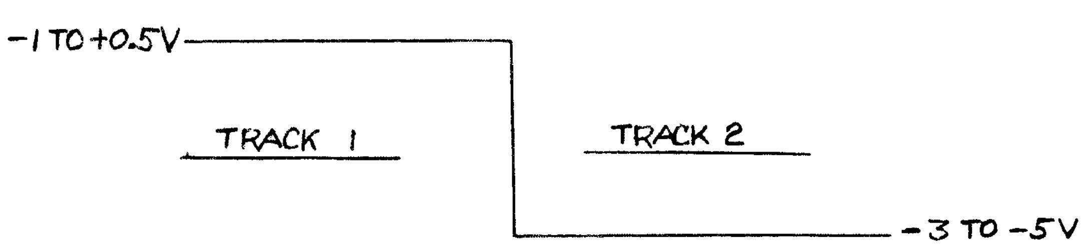


PLAYBACK MOTOR ON SIGNAL

Figure 17.30

(h) Verify that when a TRACK STEP command is issued, the TRACK INDICATOR signal at pin J305C-15 changes levels as indicated in Figure 17.31.

(1) Measure the TRACK 1 and TRACK 2 voltage levels.

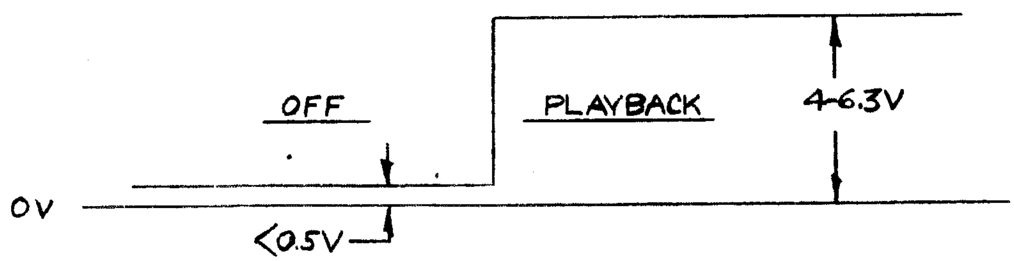


TRACK INDICATOR SIGNAL

Figure 17.31

(i) Verify that when a PLAYBACK command is issued, the D/E PLAYBACK command signal at pin J302C-15 changes level as indicated in Figure 17.32.

(1) Measure the OFF and PLAYBACK levels.

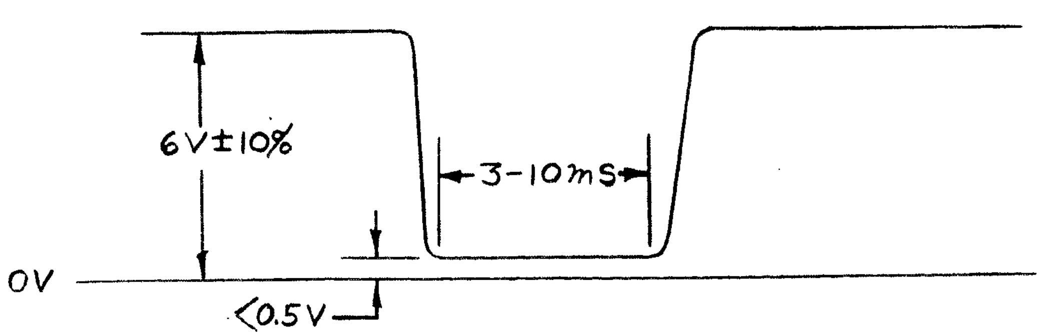


PLAYBACK COMMAND SIGNAL

Figure 17.32

(j) Verify the Umbilical Track Step command by observing the pulse at pin J304A-1 and A-3 as the Track Step button is depressed (see Figure 17.33). Allow 10 seconds minimum between pulses. Pulse level and quiescent level may vary depending on OSE adaptation.

(1) Measure the quiescent level, pulse level, and pulse width as indicated. Use differential scope for this measurement.

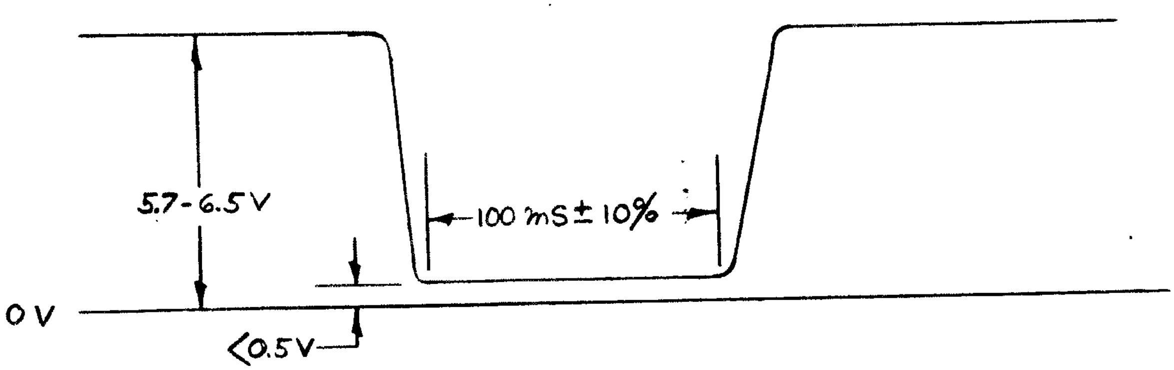


TRACK STEP COMMAND SIGNAL

Figure 17.33

(k) Verify the Flight Track Step Command by observing the pulse at pin   as the Flight Track Step button is depressed (see Figure 17.34). Allow 10 seconds minimum between pulses.

(1) Measure the quiescent level, pulse level, and pulse width as indicated.



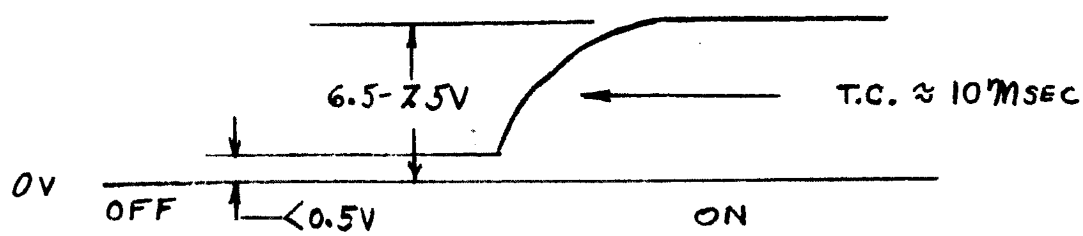
FLIGHT TRACK STEP COMMAND

Figure 17.34

Turn ON the AUX. 400 CYC. POWER and:

(l) Verify the Agena Separate signal by observing the waveform at pin J304A-11 as the AGENA SEP button is depressed (see Figure 17.35).

(1) Measure the "OFF" and "ON" DC levels as indicated.

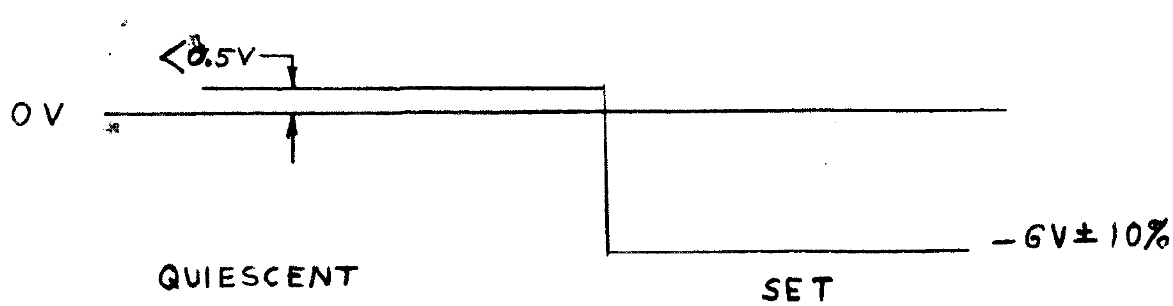


AGENA SEPARATE SIGNAL

FIGURE 17.35

Turn OFF the AUX. 400 CYC. POWER and:

(m) Verify the Launch Mode "Set" signal by observing the waveform at pin J304A-15 as the LAUNCH MODE ON button is depressed (see Figure 17.36).



LAUNCH MODE "SET" SIGNAL

FIGURE 17.36

(n) Verify the Launch Mode "Reset" signal by observing the pulse at pin J304A-15 as the LAUNCH MODE OFF button is depressed (see Figure 17.37).

(1) Measure the pulse amplitude and width as indicated.

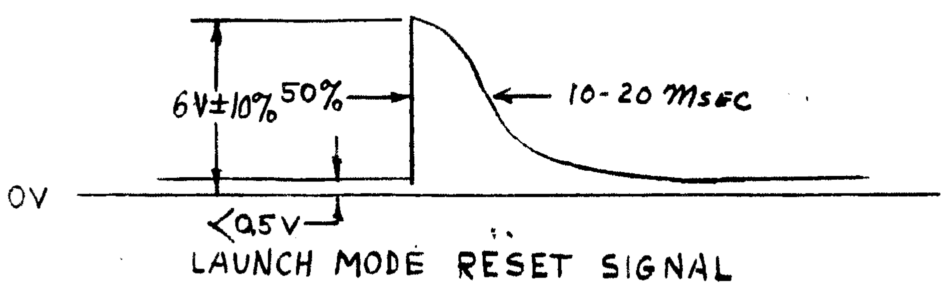


FIGURE 17.37

17.4.7 EOT Check. Operate the recorder system in the RECORD mode with the 400 CYC POWER off and with AUX. 400 CYC. POWER off.

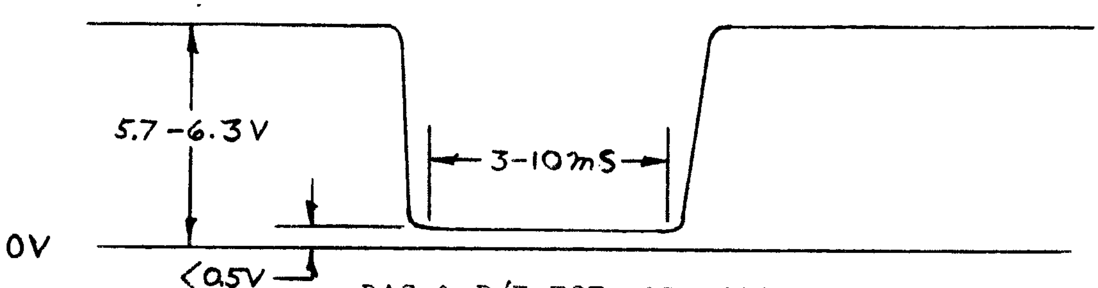
NOTE: Always allow 10 seconds minimum between EOT insertions.

(a) Verify the DAS EOT signal by observing the pulse at pin J302A-7 as the EOT TEST switch is depressed and then released (see Figure 17.38).

(1) Measure the quiescent level, pulse level, and pulse width as indicated.

(b) Verify the D/E EOT signal by observing the pulse at pin J302C-1 as the EOT TEST switch is depressed and then released (see Figure 17.38).

(1) Measure the quiescent level, pulse level, and pulse width as indicated.

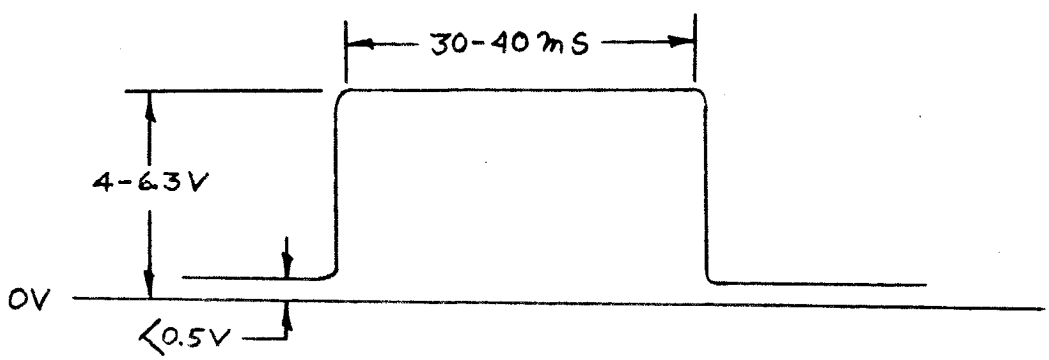


DAS & D/E EOT SIGNALS

Figure 17.38

(c) Verify the D/A EOT signal by observing the pulse at pin J305C-17 as the EOT TEST switch is depressed and then released (see Figure 17.39).

(1) Measure the pulse level and pulse width as indicated.



D/A EOT SIGNAL

Figure 17.39

Turn on 400 CYC. POWER and program the OSE for AUTO. STOP operation. RECORD TRACK 1 with a "1111111" code.

(d) Measure the time from the issuance of the START command to the automatic stop (approximately 306 seconds).

The recorder system should have switched to TRACK 2 as EOT foil passed the sensor contacts. RECORD TRACK 2 also with a "1111111" code.

(e) Issue a STOP command _____ seconds (approximately 3.0) before the automatic stop should occur.

NOTE: To calculate time before auto. stop use the following formula:

$$\text{time in seconds} = \frac{4.6 \times \text{coastdown time in seconds}}{12.9} + 0.7$$

Switch the recorder system into PLAYBACK mode.

(f) Make a simultaneous Visicorder chart of the INTEGRATOR MONITOR, D/A PLAYBACK AMP. MONITOR, D/A DATA and D/E EOT signal. Use a 0.1 IPS chart speed.

(1) Continue recording for 2 minutes after EOT and track change occur.

(2) Verify that one and only one EOT signal has occurred.

17.5.8 A.M. Measurement. Remove all power to the system; then disconnect the record head leads of both tracks at the transport patch cable Junction Box.

Re-apply power and operate in the RECORD mode after inserting three EOT signals with the EOT TEST SWITCH. Use the D/A START command to start the recorder; be sure the DAS Simulator is turned OFF. Program the OSE for MANUAL STOP operation.

(a) Examine the signal on the TRACK 1 record head leads using a Tektronix Type 531 Differential Scope with a 53/54D plug-in or equivalent setup. Apply the vertical output of the scope to the 1738 A.M. detector. Make a Visicorder chart of the A.M. detector output at 0.2 IPS. Calibrate the Visicorder so that 4 inches equals 100% amplitude.

(1) From the chart, record the peak-to-peak A.M.

(2) From the chart, record the number of dropouts.

(3) From the chart, record the DC shift.

(4) Preserve a representative 11 inch length of the A.M. chart.

See Section 16.3.7 for more details.

(b) As above, examine the signal on the TRACK 2 record head leads and make a Visicorder chart of the A.M. detector output at 0.2 IPS.

(1) From the chart, record thepeak-to-peak A.M.

(2) From the chart, record the number of dropouts.

(3) From the chart, record the D.C. shift.

(4) Preserve a representative 11 inch length of the A.M. chart.

17.4.9 Flutter. Remove the A.M. detector and connect the vertical output of the scope to a subcarrier discriminator with a 10.5 KC IRIG channel and a 330 cps (Gaussian) filter. Connect the discriminator to a Visicorder. Calibrate the first part of the Visicorder chart with a 10.7 KC center

(a) Measure the voltage across the temperature transducer.

(b) Compute the apparent resistance.

$$\text{Resistance} = V_A \times 1000$$

(c) From the temperature transducer data filed in the Log Book, find the main plate temperature.

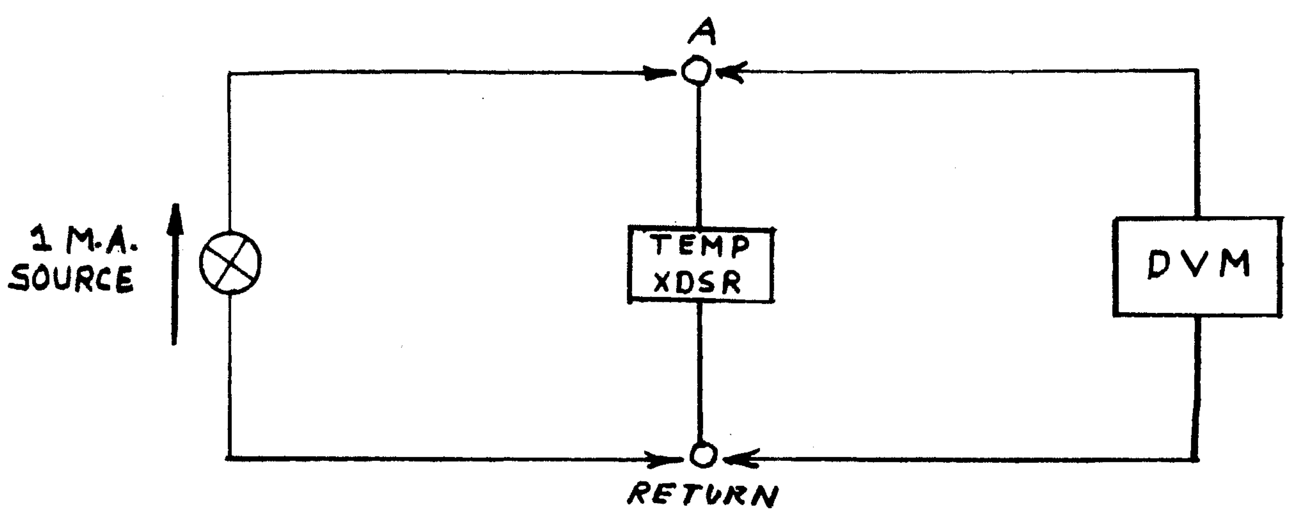


Figure 17.41

and ±1% of 10.7 KC calibration marks. Then make a 5 foot chart of the actual flutter, running the chart at 5 IPS.

(a) Measure the peak-to-peak flutter and comment on the cause.

See Section 16.3.7 for more details.

17.4.10 Pressure Transducer. Connect the one ma source to the pressure transducer as shown below, in Figure 17.40.

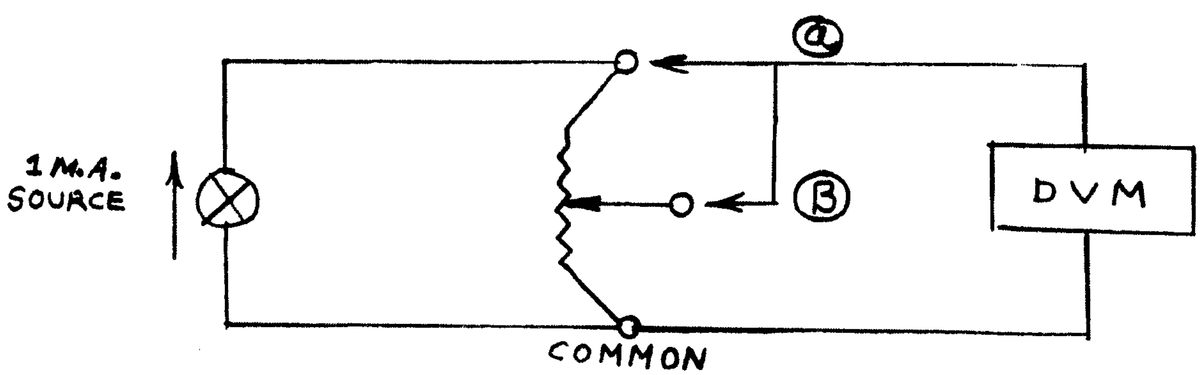


Figure 17.40

(a) With the DVM, measure the voltage between EXC and Common.

(b) With the DVM, measure the voltage between A and Common.

(c) Compute the pressure in transport.

$$\text{Pressure}_{(\text{PSIA})} = \frac{V_A}{V_{EXC}} \times 40$$

17.4.11 Temperature Transducer. Connect the one ma source to the temperature transducer as shown in Figure 17.41.

17.5 System Evaluation Data.

System S/N_____ Subchassis S/N 16A1_____
16A2_____
16A3_____
16A4_____
16A5_____

Temperature(s)_______ Date(s)_______ Operator(s)___________________

17.5.1 OSE Preparation.

TEMPERATURE	+25° C	+55° C	0° C	+25° C
a. Elapsed Time Meter Readings				
Record Motor-Min.				
P/B Motor-Hrs.				
Total Time-Hrs.				
OSE Time-Hrs.				
b. Warm-up Time-Minutes				
c. 52 VDC-volts				
52 VDC-MA-ma.				
17.5.2 Launch Mode.				
a. Pre-Power Check-OK				
b. Controls & Indicators-OK				
c. Aux. 400 Cyc. Amplitude-Vp-p				
Frequency-cps				
Rise Time-usec				
Alternation Time-msec				
On Time-msec				
d. Launch Mode Control ON-OK				
e. Acceleration Time-sec				
f. Motor Monitor-Vp-p				
g. TP-2/16A5 Aux. +6 Vdc-volts				
Ripple-Vp-p				
h. TP-3/16A5 Aux. -6 Vdc-volts				
Ripple-Vp-p				
i. 52 Vdc-volts				
52 Vdc-MA-ma				

17.5 (Con't.) System Evaluation Data. Sheet 2 of 9.

TEMPERATURE	+25° C	+55° C	0° C	+25° C
j. EOT Inhibited-OK				
k. EOT Agena Sep-OK				
l. Launch Mode Auto. Reset-OK				
m. Normal EOT-OK				
17.5.3 Power Supplies				
a. 2400 Cyc. Amplitude-V p-p				
Frequency-cps				
Rise Time-usec				
Alternation Time-usec				
b. (1) +20 VDC-volts				
(2) -20 VDC-volts				
(3) +6 VDC-volts				
(4) -6 VDC-volts				
(5) +10 VDC-volts				
Motor S/N_____ Voltage_____		X	X	X
A2R24/16A4 Motor Voltage Adj.-OK		X	X	
c. (1) +20 VDC Noise-Vp-p		X	X	
(2) -20 VDC Noise-Vp-p		X	X	
(3) +6 VDC Noise-Vp-p		X	X	
(4) -6 VDC Noise-Vp-p		X	X	
d. Common-to-Common Noise-Vp-p		X	X	
e. 400 Cyc. Amplitude-Vp-p				
Frequency-cps				
Rise Time-usec				
Alternation Time-msec				
17.5.4 Data Record Sequences				
Three EOT's-OK				
a. DAS Data Pulse Amplitude-volts				
DAS Data Pulse Rise Time-usec				
DAS Data Pulse Width-usec				
b. DAS Bit Sync Amplitude-volts				
DAS Bit Sync Rise Time-usec				
DAS Bit Sync Pulse Width-usec				
DAS Bit Sync Frequency-cps				
c. DAS Data/Bit Sync Phasing-usec				

17.5 (Con't.)System Evaluation Data

TEMPERATURE	+25° C	+55° C	0° C	+25° C
d. Frequency Doub. Record Mon.-OK				
e. TP-1/16A5 RZ to FD Waveform-OK				
Quiescent Level-volts				
Pulse Level-volts				
Pulse Width-usec				
Fall Time-usec				
f. TP-4/16A3 TR1Record Head-volts				
Head Current Balance-mv				
g. TP-3/16A3 TR2Record Head-volts				
Head Current Balance-mv				
h. TR1 Sequences-OK				
i. Number of Sequences____				
Partial Sequence-sec				
j. Record Motor Mon.-Vp-p				
k. Acceleration Time-sec				
Coast Down Time-sec				
l. 52 VDC Voltage-volts				
52 VDC-MA Current-ma				
Track 2 Indication-OK				
m. TR2 Sequences-OK				
n. TR2 "0000000"-OK				
Count 2 & Stop Verification-OK				
o. Quiescent Level-volts				
Pulse Level-volts				
Pulse Width-msec				
p. DAS Start Inhibited-OK				
17.5.5 Data Playback				
17.5.5.1 First Seq.-Slew Ahead				
a. Playback Motor Voltage-volts				
(1) TP-5/16A3 Motor Drive Ø1-OK				
Logic "1" Level-volts				
Logic "0" Level-volts				
(2) TP-6/16A3 Motor Drive Ø2-OK				
Logic "1" Level-volts				
Logic "0" Level-volts				

17.5 (Con't.) System Evaluation Data

TEMPERATURE	+25° C	+55° C	0° C	+25° C
(3) Playback Motor Drive Ø-OK				
(4) Motor Supply Ripple-Vp-p				
b. D/E Bit Sync Width-msec				
Period-msec				
"1" Logic Level-volts				
"0" Logic Level-volts				
c. TR1 Playback Signal 0000000-OK				
Playback Amplitude-Vp-p				
Playback Amp. DC Level-volts				
d. (1) Integrator Reset-volts				
(2) Reset Rise Time-usec				
(3) Rundown Level-V_{ave}				
A1R4/16A3 VCO Adjust-OK				
(4) Rundown Slope-V/30ms				
(5) Droop-Vp-p				
(6) Rundown Variation-Vp-p				
e. Visicorder Chart # 4IPS				
f. Visicorder Chart # 0.1IPS				
(1) D/A Data "0"-OK				
(2) D/E Data "1"-OK				
g. TP-7/16A2 "1" Logic Level-V				
"0" Logic Level-V				
Pulse Length-msec				
Jitter-msec p-p				
(1) No "Ones" Gate-OK				
h. TP-3/16A2 Diff. Waveform-Vp-p				
(1) Diff. DC Level-volts				
i. TP-1/16A2 F.D. Code 0000000-OK				
(1) "1" Logic Level-volts				
"0" Logic Level-volts				
(2) TP-2/16A2 F.D. Code 0000000-OK				
"1" Logic Level-volts				
"0" Logic Level-volts				
(3) TP-1/TP-2/16A2 Phasing-OK				

17.5 (Con't.) System Evaluation Data

TEMPERATURE	+25° C	+55° C	0° C	+25° C
j.(1) Mode 4-1 P/B Motor On-volts				
Mode 4-1 P/B Motor Off-volts				
(2) TP-5/16A2 Mode 4-1 Logic-OK				
k.(1) TP-6/16A2 Tape Ø Comp. Input-OK				
"1" Logic Timing-$msec_{ave}$				
"0" Logic Timing-$msec_{ave}$				
"1" Logic Level-volts				
"0" Logic Level-volts				
(2) TP-8/16A2 Ref. Ø Comp. Input-OK				
"1" Logic Timing-msec				
"0" Logic Timing-msec				
"1" Logic Level-volts				
"0" Logic Level-volts				
l.(1) TP-9/16A2 Diff.&F.W.Rect.-OK				
Pulse Level-volts				
Quiescent Level-volts				
Pulse Width-usec				
m.(1) TP-1/16A3 VCO Input Signal-OK				
Reset Level-volts				
Rundown Level-V_{ave}				
(2) TP-2/16A3 VCO Output Signal-OK				
Pulse Level-volts				
Quiescent Level-volts				
Pulse Width-usec				
n. TR2 Playback Signal 1111111-OK				
Playback Amplitude-Vp-p				
Playback Amp. DC Level-volts				
o.(1) Integrator Rundown Level-V_{ave}				
(2) Rundown Level Variation-Vp-p				
p. Visicorder Chart # 4 IPS				
q. Visicorder Chart # 0.1 IPS				
(1) D/A Data "1"-OK				
(2) D/E Data "0"-OK				
r. TP-7/16A2 Bit Sync Jitter-$msec_{p-p}$				
s. TP-4/16A2 Ones Gate "1" Level-volts				
"0" Level-volts				

17.5 (Con't.) System Evaluation Data

TEMPERATURE	+25° C	+55° C	0° C	+25° C
s.(1) Con't. Pulse Length-msec				
Pulse Jitter-msec$_{p-p}$				
(2) TP-7/TP-4/16A2 Phasing-OK				
Average Time Delay-msec				
Time Delay Variation-msec$_{p-p}$				
t. TP-1/16A2 F.D. Code 1111111-OK				
(1) TP-2/16A2 F.D. Code 1111111-OK				
(2) TP-1/TP-2/16A2 Phasing-OK				
17.5.5.2 Second Seq.-Slew Ahead				
a. TR1 Playback Signal 1111111-OK				
Playback Amplitude-V$_{p-p}$				
b.(1) Integrator Rundown-V$_{ave}$				
(2) Rundown Variation-V$_{p-p}$				
c. Visicorder Chart # 4 IPS				
d. Visicorder Chart # 0.1 IPS				
(1) D/A Data-OK				
e. TR2 Playback Signal 0000000-OK				
Playback Amplitude-V$_{p-p}$				
f. Integrator Rundown-V$_{ave}$				
Rundown Variation-V$_{p-p}$				
g. Visicorder Chart #-4 IPS				
h. Visicorder Chart #-0.1 IPS				
(1) D/A Data-OK				
17.5.5.3 Third Seq. - Slew Ahead				
a. TR1 Playback Signal 1110100-OK				
b. D/A Data 1110100-OK				
"1" Logic Level-volts				
"0" Logic Level-volts				
c. D/E $\overline{\text{Data}}$ 1110100-OK				
"1" Logic Level-volts				
"0" Logic Level-volts				
d. Visicorder Chart #-8 IPS				
(1) Signal Phasing-OK				
e. TR2 Playback Signal 0001011-OK				
f. D/A Data 0001011-OK				
g. D/E $\overline{\text{Data}}$ 0001011-OK				

17.5 (Con't.) System Evaluation Data

TEMPERATURE	+25° C	+55° C	0° C	+25° C
h. Visicorder Chart # - 8 IPS				
(1) Signal Phasing-OK				
17.5.5.4 Fourth Seq. - Slew Ahead.				
a. TR1 Playback Signal 0001011-OK				
b. TR2 Playback Signal 1110100-OK				
17.5.5.5 Fifth Seq. - Slew Ahead.				
a. TR1 Playback Signal 10101010-OK				
b. D/E Data 10101010-OK				
(1) Average Time Delay-msec				
(2) Time Delay Variation-$msec_{p-p}$				
c.(1) Integrator Rundown-V_{ave}				
(2) Rundown Variation-V_{p-p}				
d. Visicorder Chart #-4 IPS				
e. Visicorder Chart #-0.1 IPS				
f. TR2 Playback Signal 0000000-OK				
g.(1) +20 VDC-volts				
(2) -20 VDC-volts				
(3) +6 VDC-volts				
(4) -6 VDC-volts				
17.5.6 Command & Interface Lines.				
a(1) DAS START Quiescent Level-volts				
Pulse Level-volts				
Pulse Width-msec				
b(1) DAS STOP Quiescent Level-volts				
Pulse Level-volts				
Pulse Width-msec				
c. DAS START/STOP RETURN				
(1) DAS START Quiescent Level-volts				
Pulse Level-volts				
Pulse Width-msec				
(2) DAS STOP Pulse Level-volts				
Pulse Width-msec				
(3) D/A START Pulse Level-volts				
Pulse Width-msec				
(4) D/A STOP Pulse Level-volts				
Pulse Width-msec				

17.5 (Con't.) System Evaluation Data

	TEMPERATURE	+25° C	+55° C	0° C	+25° C
d(1)	D/A START Pulse Level-volts				
	Pulse Width-msec				
e(1)	D/A STOP Pulse Level-volts				
	Pulse Width-msec				
f(1)	Start/Stop Relay-OK				
	After START Level-volts				
g(1)	Playback Motor On Level-volts				
	Off Level-volts				
h(1)	Track Indicator Level TR1-volts				
	TR2-volts				
i(1)	Playback Command Level-volts				
	Off Level-volts				
j(1)	Tr.Step Comm. Quies.Level-volts				
	Pulse Level-volts				
	Pulse Width-msec				
k(1)	Fl.Tr.Step Comm.Qis.Level-volts				
	Pulse Level-volts				
	Pulse Width-msec				
l(1)	Agena Separate Waveform-OK				
	Off Level-volts				
	On Level-volts				
m(1)	Launch Mode"Set"Quiescent-volts				
	Set Command-volts				
n(1)	Launch Mode"Reset"Pulse Lv-volts				
	Pulse Width-msec				
17.5.7	EOT Check.				
a(1)	DAS EOT Quiescent Level-volts				
	Pulse Level-volts				
	Pulse Width-msec				
b(1)	D/E EOT Quiescent Level-volts				
	Pulse Level-volts				
	Pulse Width-msec				
c(1)	D/A EOT Quiescent Level-volts				
	Pulse Level-volts				
	Pulse Width msec				
d.	Tape Time, Start-to-Stop-sec				
e.	Computed Start-to-Stop-sec				
f(1)	Visicorder Chart #-0.1 IPS				
(2)	Number of EOT Signals				

17.5 (Con't.) System Evaluation Data

TEMPERATURE	+25°	+55° C	0° C	+25° C
17.5.8 A.M. Measurement.				
a.(1) TR1 Amplitude Modulation-% p-p				
(2) Number of Dropouts				
(3) DC Shift-%p-p				
(4) Visicorder Chart # 0.2 IPS				
b.(1) TR2 Amplitude Modulation-%p-p				
(2) Number of Dropouts				
(3) DC Shift-%p-p				
(4) Visicorder Chart # 0.2 IPS				
17.5.9 Flutter.				
a. Flutter-%p-p				
• Visicorder Chart # ____				
Comment				
17.5.10 Pressure Transducer				
a. EXC and Common-volts				
A and Common-volts				
Transport Pressure-PSIA				
17.5.11 Temperature Transducer.				
a. A and Return-volts				
b. Resistance-ohms				
c. Transport Temperature-°F				
Shut Down				
a. Elapsed Time Meter Readings				
Record Motor-Min.				
Playback Motor-Hrs.				
Total Time-Hrs.				
OSE Time-Hrs.				
b. Tape Passes-Accumulated				