

TMC SPECIFICATION

NO. S 517

REV: A

COMPILED: *D.J.O*CHECKED: *D.J.O*APPD: *CFM*

SHEET 1

OF 29

TITLE:

THE TECHNICAL MATERIEL CORPORATION

QUALITY ASSURANCE DEPARTMENT

OSCILLATOR TEST PROCEDURE

MODEL: AO-100 AND AO-103

FREQUENCY RANGE: 2 MC to 4 MC

PREPARED PRINCIPALLY FOR:

TEST DEPARTMENT,

OSCILLATOR SECTION

APPROVED BY *D. Miller*

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GENERAL DESCRIPTION

- 1.1 The AO-100 unit is a high stability, tuned grid, variable frequency oscillator. The operating frequency range is limited from 2 mc to 4 mc.
- 1.2 The adjustment of the inductor, L301, establishes the 2 mc calibration point and the adjustment of the capacitor, C303 locates the 4 mc calibration point. Continuous tuning of the oscillator through limited frequency range is controlled by the mechanically coupled capacitors C301 and C302.
- 1.3 A straight line output frequency of the oscillator is accomplished by the employment of a cam whose curve is adjustable. Capacitors C301 and C302 are mechanically linked through a cam follow r arm assembly.
- 1.4 The oscillator output is taken from a cathode follower circuit which provides isolation between the oscillator and the load.
- 1.5 A 100 KC crystal oscillator is included in the AO-100 unit. The crystal oscillator provides 25 KC, 50 KC, and 100 KC calibration check points for the variable frequency oscillator. Calibration of the 100 KC crystal oscillator is performed by the adjustable capacitor C311. Capacitor C311 performs a frequency adjusting function which allows the 100 KC crystal oscillator to b cali-brated directly with WWV.
- 1.6 The calibrated 100 KC crystal oscillator serves as a transfer standard for the variable frequency oscillator. This technique provides a very high degree of accuracy in the selection of a frequency.
- 1.7 The high degree of stability is achieved princply by the very close control of the oven temperature in which the unit is installed. Of secondary importance, benefiting the excellent stability characteristic, is the regulation and filtering of the supply voltage.

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INTRODUCTION

- 2.1 This procedure describes the method the Test Department, Oscillator Section shall use to calibrate the oscillator.
- 2.2 The oscillator being calibrated will be referred to herein as the Tested Oscillator.
- 2.3 All curve data must be recorded on the oscillator Test Curve data sheet (work sheet), figure 9, page 27.
- 2.4 Read the entire procedure before attempting to start the calibration of the oscillator.
- 2.5 All instruments which comprise the calibration system must bear current calibration servicing identification labels.

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SPECIFICATIONS

3.1 The calibration of the A0-100 oscillator is considered to be accomplished only when the following specifications are achieved:

- 3.1.1 Stability - 20 cycles per megacycle per degree change in ambient temperature.
- 3.1.2 Resettability - 20 cycles per megacycle to a calibrated frequency.
- 3.1.3 Line Voltage change effects - 3 cycles per megacycle for $\pm 10\%$ change in line voltage.
- 3.1.4 Output Voltage - Sinusoidal with no spurious frequencies.

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EQUIPMENT REQUIRED(OR EQUIVALENT)LIST

4.1 The following equipment is required for the calibration of the AO-100 oscillator.

4.1.1 Oscillator, Test Fixture

4.1.2 Counter: Hewlett Packard Model 523 C

4.1.3 Wrench, Set Screw: Allen, #4

4.1.4 Wrench, Set Screw: Allen, #6

4.1.5 Wrench, Set Screw: Allen, #8

4.1.6 Wrench, Open End: 3/8"

4.1.7 Wrench : Spintite, 3/8"

4.1.8 Screwdriver, Special: Screwdriver, 2-6

4.1.9 Screwdriver, Phillips: Phillips #1

4.1.10 Screwdriver, flat blade: Flat blade, medium size

4.1.11 Side cutters: Medium size

4.1.12 Pliers, Long Nose: Medium size

4.1.13 Earphone: Headset

4.1.14 Oscilloscope: High frequency response

4.1.15 Multimeter: Simpson 260 or equivalent

4.1.16 VTVM: HP410B or equivalent

4.1.17 Receiver: General purpose

4.1.18 Oscillator Test Curve Data Work Sheet

4.1.19 Test Data (AO-100)

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TEST DATA FORMS

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- 5.1 The "Oscillator Test Curve Data Work Sheet" (figure 9), is to be used in the following, after preliminary adjustments have been made to the unit:
- 5.1.1 Complete the information regarding the Model Number, the Manufacturing Number, and the page number.
- 5.1.2 Each time a test curve is run, record the date and the time the curve is taken.
- 5.2 The "Test Data" form (figure 10) is to be completed only when the unit is to be shipped out by itself.

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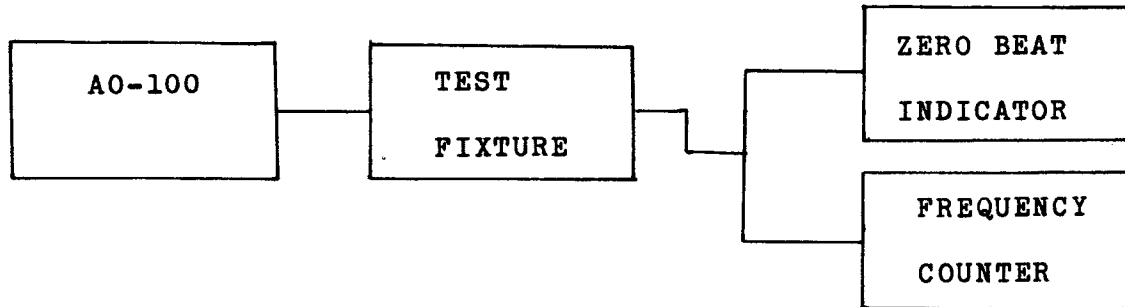
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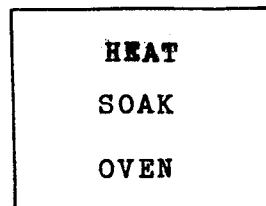
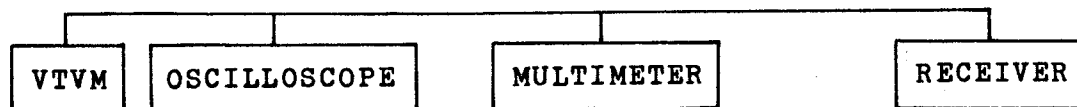
TEST SET-UP

BLOCK DIAGRAM



ASSOCIATE

TEST EQUIPMENT



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PRELIMINARY OPERATIONS

7.1 Adjust part # SL-101 (Screw, Set, Locking) in accordance with the following chart (reference figure 1), paragraph 7.1.2

7.1.1 figure 1

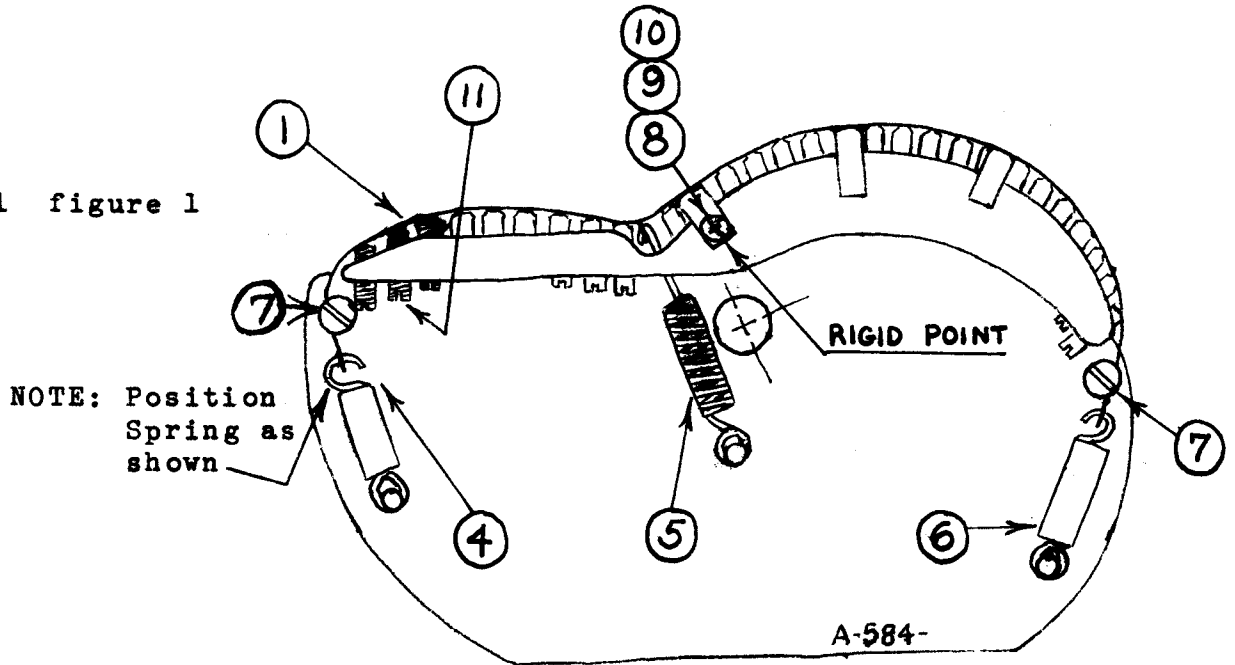


FIGURE 1

Note #1: Screw count is from left to right.

Note #2: Exposed threads are those threads in the area between the cam and the cam strip.

Note #3: Make sure that the tabs of the flexible cam strip are flush with the side of the cam assembly (Reference figure 1).

Note #4: It is necessary to cut away some excess material on the hook of the spring (part # SP-112), on the end attached to the flexible cam strip, so that sufficient clearance is allowed for the flexible cam strip to be pulled down to the cam assembly.

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7.1.2 SCREW ADJUSTMENT CHART

	<u>SCREW NUMBER</u>	<u>NUMBER OF EXPOSED THREADS</u>
	1	2
	2	2
	3	3
	4	4
	5	5
	6	4
	7	3
	8	2
	9	1
	10	2
<u>RIGID POINT</u>	11	1
	12	2
	13	3
	14	4
	15	4
	16	4
	17	4
	18	4
	19	4
	20	4
	21	4
	22	4
	23	3
	24	3
	25	3
	26	3
	27	3

- 7.1.3 Adjust part # SC-122 (Screw, Captive) to guide the flexible cam strip freely (see figure #1 Item 7).
- 7.1.4 Align C301 (part # A-1000) such that all of the rotor plates are uniformly contained within the stator plate area (see figure 2).
- 7.1.5 Loosen the coupling (part # MC-107) (see figure 3,item 28) and rotate the main shaft coupling, part # PM-319 to a position where the flat of the coupling is facing down and is parallel to the base (see figure 3, item 32). This position is approximately 1900 KC. Tighten the coupling(part #MC-107).

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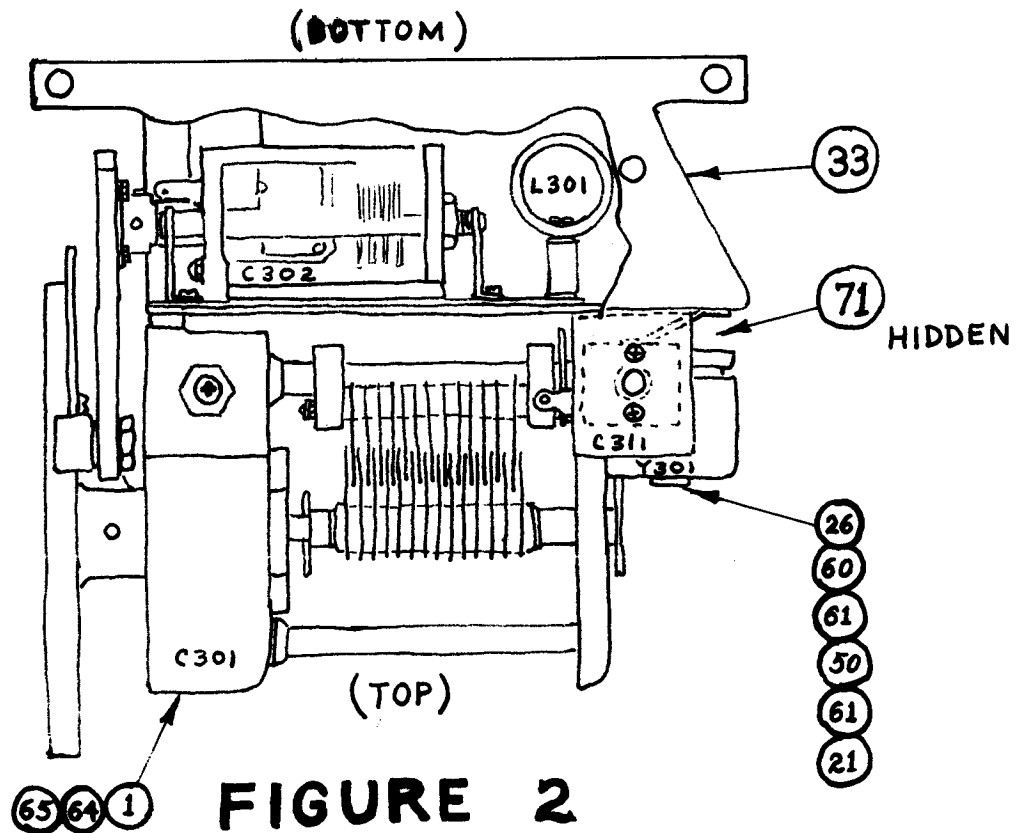


FIGURE 2

(FRONT VIEW OF AO-100 OSCILLATOR SUB-ASSEMBLY)

- 7.1.6 Rotate the flexible shaft ten (10) turns counter clockwise (CCW) (this is approximately the 2 mc position).
- 7.1.7 Loosen the set screws and adjust the cam follower arm assembly part # A-583 (reference figure 3, item 2) on the shaft of C302, part # CB-105 (reference figure 4, item 6) such that the nut holding the roller of the cam follower arm assembly does not touch the base of the oscillator (reference figure 4) but passes as close as possible to the base of the oscillator.
 (NOTE: DO NOT tighten the set screws as this will be accomplished in paragraph 7.1.8.6 of this procedure).

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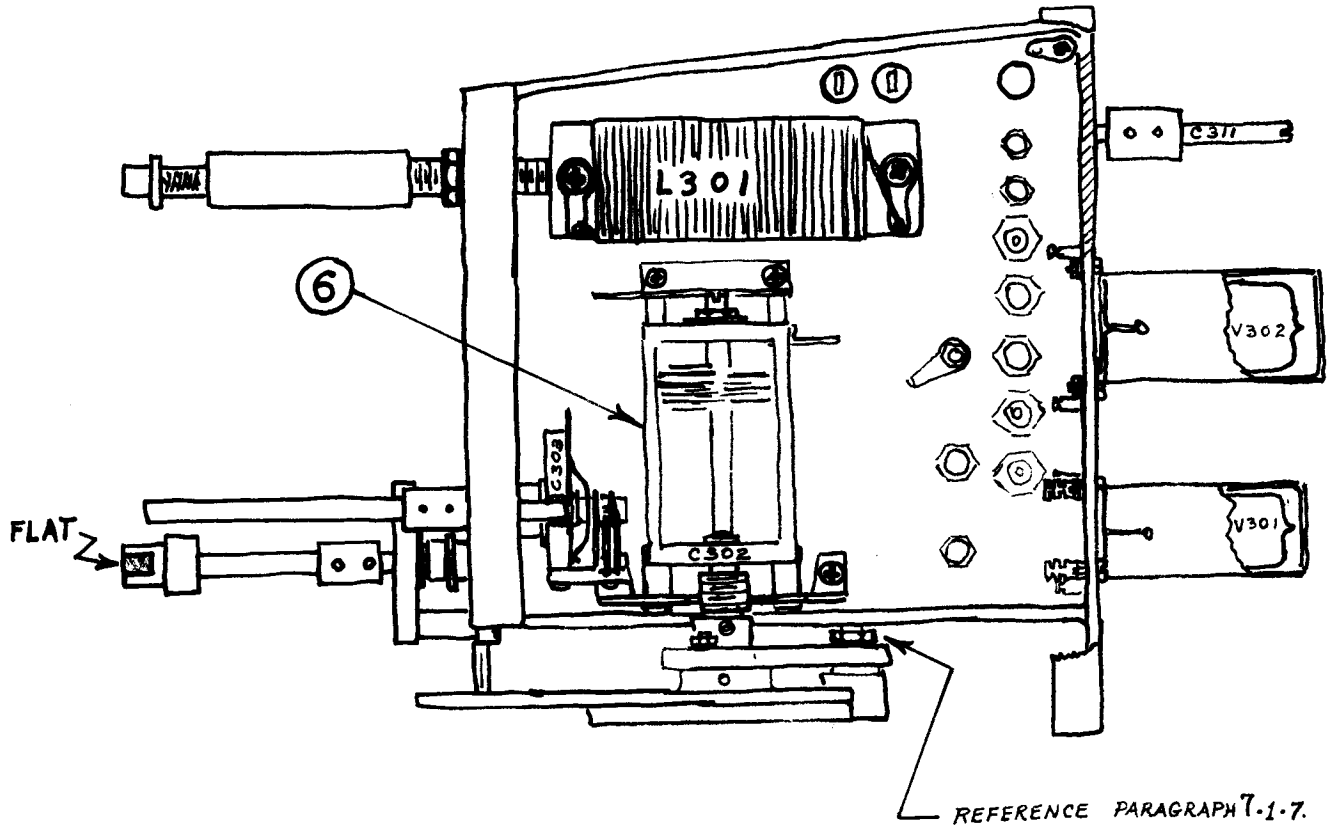


FIGURE 4

(BOTTOM VIEW OF AO-100 OSCILLATOR SUB-ASSEMBLY)

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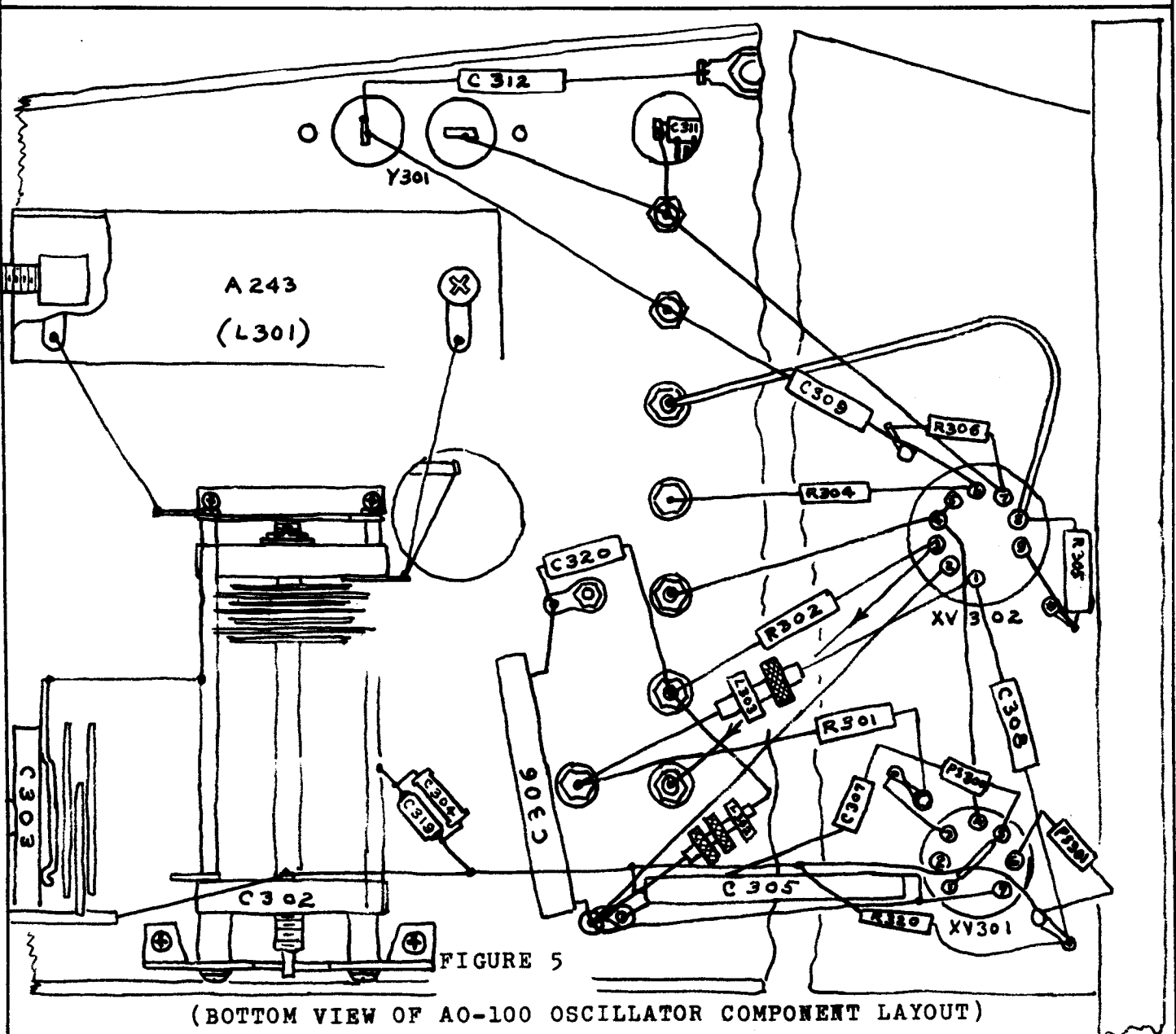
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- 7.1.8 Loosen the set screws and adjust the cam sub-assembly, part # A-584, on the shaft of C301, allowing for the position of the roller of the cam follower arm sub-assembly (part # A-583) with respect to the cam to be aligned as follows (Note: Under no circumstances is the position of the rotor of C301 to be disturbed during these adjustments):

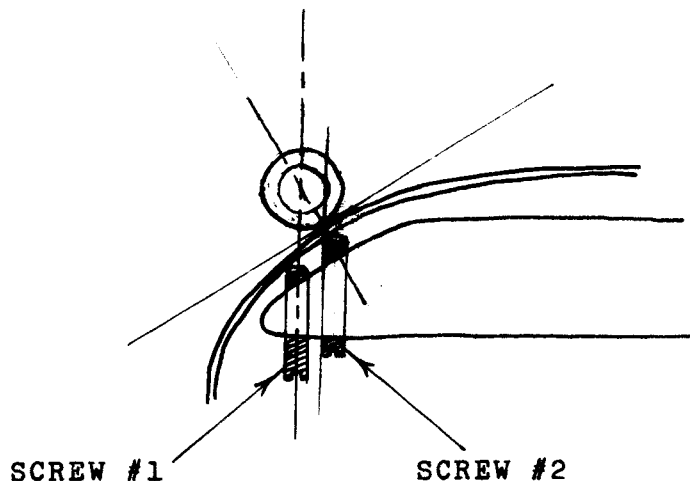


FIGURE 6

(POSITIONING ROLLER TO CAM)

- 7.1.8.1 The axis of the first cam adjustment screw is to be aligned to the axis of the roller (reference figure 6).
- 7.1.8.2 The tangent point of the roller must be at the axis of the imaginary line of the second adjustment screws leading edge (reference figure 6).
- 7.1.8.3 The roller must roll on the entire flexible cam strip area—having the edge of the roller even with the edge of the flexible cam strip.
- 7.1.8.4 Tighten the set screws of the cam sub-assembly to the shaft of C301.
- 7.1.8.5 Adjust the rotor angle of the variable capacitor, C302, (part # CB-105), to a position where the rotor plates are in mesh with the stator plates by approximately sixty degrees (60°). The correct angle is obtained when an imaginary line is continued from the straight edge of the rotor bisecting line of "AB" of the stator as indicated in figure 7.

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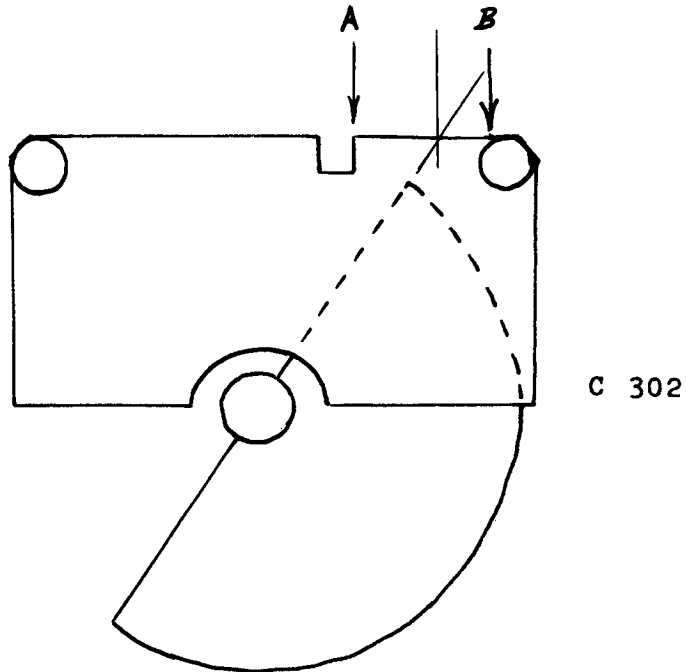


FIGURE 7

(ADJUSTMENT OF ROTOR ANGLE -- C302)

- 7.1.8.6 Tighten the cam follower arm sub-assembly set screws to the shaft of the variable capacitor, C302.
- 7.1.9 Rotate the main shaft (flexible shaft) 60 turns in the counter clockwise (CCW) direction. This will result in a position that is approximately 2.6 mc.
- 7.1.10 Adjust the rigid point on the flexible cam strip, part # MS-318, such that the edges of the tab are tangent to the edges of the inner hole of the roller (reference figure 8).

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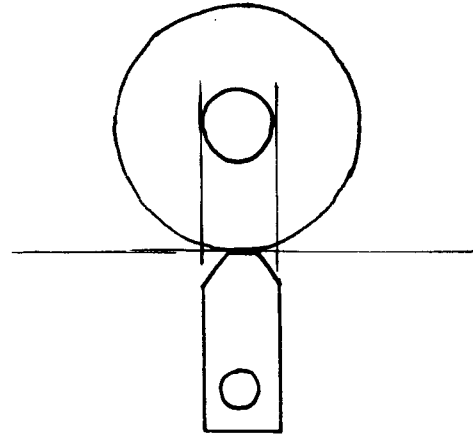


FIGURE 8

(ADJUSTMENT OF THE FLEXIBLE CAM STRIP RIGID POINT)

- 7.1.11 Return the main tuning capacitor, C301, to 1900 KC.
- 7.1.12 Set the variable capacitor, C303 (part # CB-121), to half mesh.
- 7.1.13 Set the variable capacitor, C311 (part # CT-103-1), to half mesh.
- 7.1.14 Set the tuning slug, L301 (part # A-3127), out to the mechanical stop by rotating the tuning slug shaft fully counter clockwise (CCW).

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8 OSCILLATOR CALIBRATION PROCEDURE

- 8.1 Check the frequency reading on the dial of the counter on the test fixture - the dial should read 1900 KC - Set dial lock.
- 8.1.1 Install the oscillator into the test fixture - secure all connections.
- 8.1.2 Turn the oscillator on - determine that no malfunction exists in the oscillator (short circuit, open circuit, or some other type circuit malfunction).
- 8.1.3 Allow at least four hours warm-up time before proceeding to the next step.
- 8.2 Adjust the frequency reading on the dial of the counter in the test fixture to 2000 KC.
- 8.2.1 Plug the head phones into the oscillator test fixture, to monitor audibly, the zero beats.
- 8.2.2 Determine the frequency of the 100 KC crystal calibrator using the test frequency counter. Adjustment of the 100 KC ~~Crystal~~ calibrator frequency is accomplished by adjusting C311 (part # CT-103-1).
- 8.2.3 Adjust the slug of L301 for a zero beat.
- 8.2.4 Rotate the counter nineteen (19) zero beats and stop - the twentieth (20) zero beat will be 4000 KC.
- 8.2.5 Adjust C303 to achieve the 4000 KC zero beat when the dial indicator of the counter in the test fixture is at the 4000 KC position.
- 8.2.6 Rotate the counter back to the 2000 KC position and readjust L301 for a zero beat.
- NOTE: It is important to remember that the desired frequency should be dialed in only from a lower frequency. The reason that this procedure must be followed is due to the backlash condition which is inherent in mechanical gear train assemblies.
- 8.2.7 Rotate the counter to the 4000 KC position and readjust C303 for the 4000 KC zero beat.
- 8.2.8 Repeat steps 8.2.6 and 8.2.7 until a zero beat is achieved when the counter is at the 2000 KC position without any further adjustment to either C303 or L301.

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- 8.2.9 Rotate the counter to the 2.5993 KC position (reference the 9300 curve) and adjust C303 for a zero beat.
- 8.2.10 Rotate the counter to the 4000 KC Position and adjust the plates of C302 for a zero beat.
- 8.2.11 Check the 2000 KC, 2599.3 KC, and the 4000 KC points for a zero beat. (Note: Remember to always come on to the desired frequency from a lower frequency).
- 8.2.11.1 Readjust L301 at the 2000 KC point as required.
- 8.2.11.2 Readjust C303 at the 4000 KC point as required.
- 8.2.11.3 Readjust C303 at the 2599.3 KC point as required.
- 8.2.11.4 Readjust C302 at the 4000 KC Point as required.

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9.1.4 Remove the oscillator from the test fixture and plac the oscillator into the baking oven. Allow at least ninty six hours before establishing a 9600 calibration curve.

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**11 ESTABLISH A 9900 CALIBRATION CURVE
(Final Calibration Curve)**

11.1 The following chart indicates the test fixture counter frequency and identifies the associated set screw on the cam assembly to be adjusted (reference figure 1) for a zero beat.

11.1.1	COUNTER DIAL SETTING (FREQUENCY KC)	SET SCREW NUMBER (REF.PARA. .1.2,SCREW ADJUSTMENT CHART)	SET SCREW NUMBER TO THE RIGHT OF THE RIGID POINT
	2699.9	11	1
	2799.9	12	2
	2899.9	13	3
	2999.9	14	4
	3099.9	15	5
	3199.9	16	6
	3299.9	17 & 18	7 & 8
	3399.9	18 & 19	8 & 9
	3499.9	20	10
	3599.9	21	11
	3699.9	22 & 23	12 & 13
	3799.9	24	14
	3899.9	25 & 26	15 & 16
	4000.0	27	17
	2000.0	1	--
	2099.9	2 & 3	--
	2199.9	4 & 5	--
	2299.9	6 & 7	--
	2399.9	8	--
	2499.9	9	--
	2599.9	10	--

11.1.2 Using the "oscillator test curve" data sheet, record the indicated dial frequency on the counter for each frequency zero beat from 2000 KC to 4000 KC.

11.1.3 Make all the necessary corrections to the cam set screws to achieve a zero beat for each required frequency on the oscillator test curve data sheet. A tolerance of \pm 300 cycles is allowed for each frequency as taken from the adjusted frequency chart (reference is made here to the calibration curve used).

NOTE: It may be necessary to reset C302, C303 and L301 to bring the overall operation of the unit to within the specified limits.

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11.1.4 The calibrated oscillator, meeting all the specifications is now ready for installation into a unit. If a unit is not ready for a calibrated oscillator to be installed into it, the calibrated oscillator should be stored in an area where, ideally, it would not be moved until it is to be directly installed into a unit. The calibrated oscillator stored environment should be free from shock, vibration and dust. The atmosphere should be at a constant temperature with a low relative humidity.

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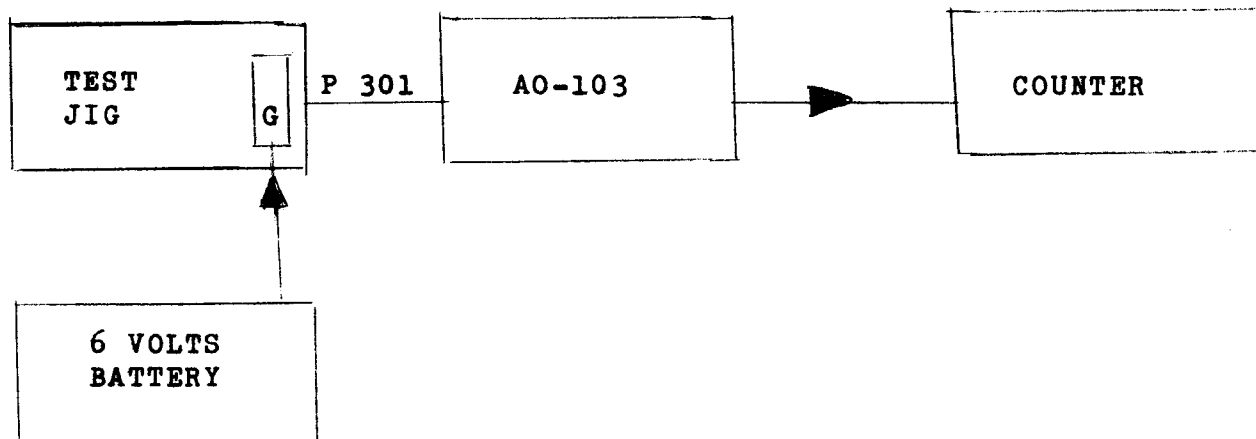
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5. REACTANCE TUBE CHECK OUT

- a. Set up equipment as shown in figures below.



- b. Function switch in operate position. This is effectively removing Pin G on P 301 from ground.
- c. Connect DC supply on Pin G of P 301 and MO set on 2000 kcs.
- d. Plus one volt should increase the frequency at least .01% of the predetermined frequency.
- Minus one volt should decrease the frequency at least .01% of the predetermined frequency.
- e. Repeat step D at 3000 kc and 4000 kc. This completes checkout of the reactance tube.

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TITLE: **SAMPLE OF THE OUTLINE TO BE USED FOR THE FORM "TEST CURVE DATA SHEET"**

OSCILLATOR TEST CURVE
(DATA WORK SHEET)

PAGE _____ OF _____

MODEL # _____

MANUFACTURING # _____

	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME
FREQ.	TEST-1	TEST-2	TEST-3	TEST-4	TEST-5	TEST-6	TEST-7	TEST-8	TEST-9	TEST-10								
2000																		
100																		
200																		
300																		
400																		
500																		
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400																		
500																		
600																		
700																		
800																		
900																		
4000																		

FIGURE 9

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TITLE: SAMPLE OF THE OUTLINE TO BE USED FOR THE FORM "TEST DATA AO-100 AND AO-103" (NOTE: THIS FORM IS USED ONLY WHEN THE AO-100 AND AO-103 IS SHIPPED SEPERATELY)

TEST DATA SHEET

AO-100 & AO-103

MECHANICAL CHECK

ELECTRICAL CHECK

CALIBRATION CHECK

REACTANCE TUBE CHECK

DATE _____

TESTER _____

MFG. NO. _____

APPROVED _____

FIGURE 10

