TM 11-2428

WAR DEPARTMENT TECHNICAL MANUAL

AEROGRAPH CALIBRATION SET TS-407/AMQ-2

WAR DEPARTMENT 26 OCTOBER 1945

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TM 11-2428

This manual supersedes TM 11-2428, 10 September 1945

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WASHINGTON 25, D. C., 26 October 1945

TM 11-2428, Aerograph Calibration Set TS-407/AMQ-2, is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

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Acting The Adjutant General

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DESTRUCTION NOTICE

WHY – To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN – When ordered by your commander.

HOW – 1. Smash – Use sledges, axes, pickaxes, hammers, crowbars, heavy tools.

2. Cut – Use axes, handaxes, machetes.

3. Burn – Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives – Use firearms, grenades, TNT.

5. Disposal – Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT – 1. Smash – Master self-synchronous unit.

2. Cut – Cable wiring.

3. Burn – Manual, correction card, carrying case.

4. Bury or scatter – All of the above after destroying them.

DESTROY EVERYTHING

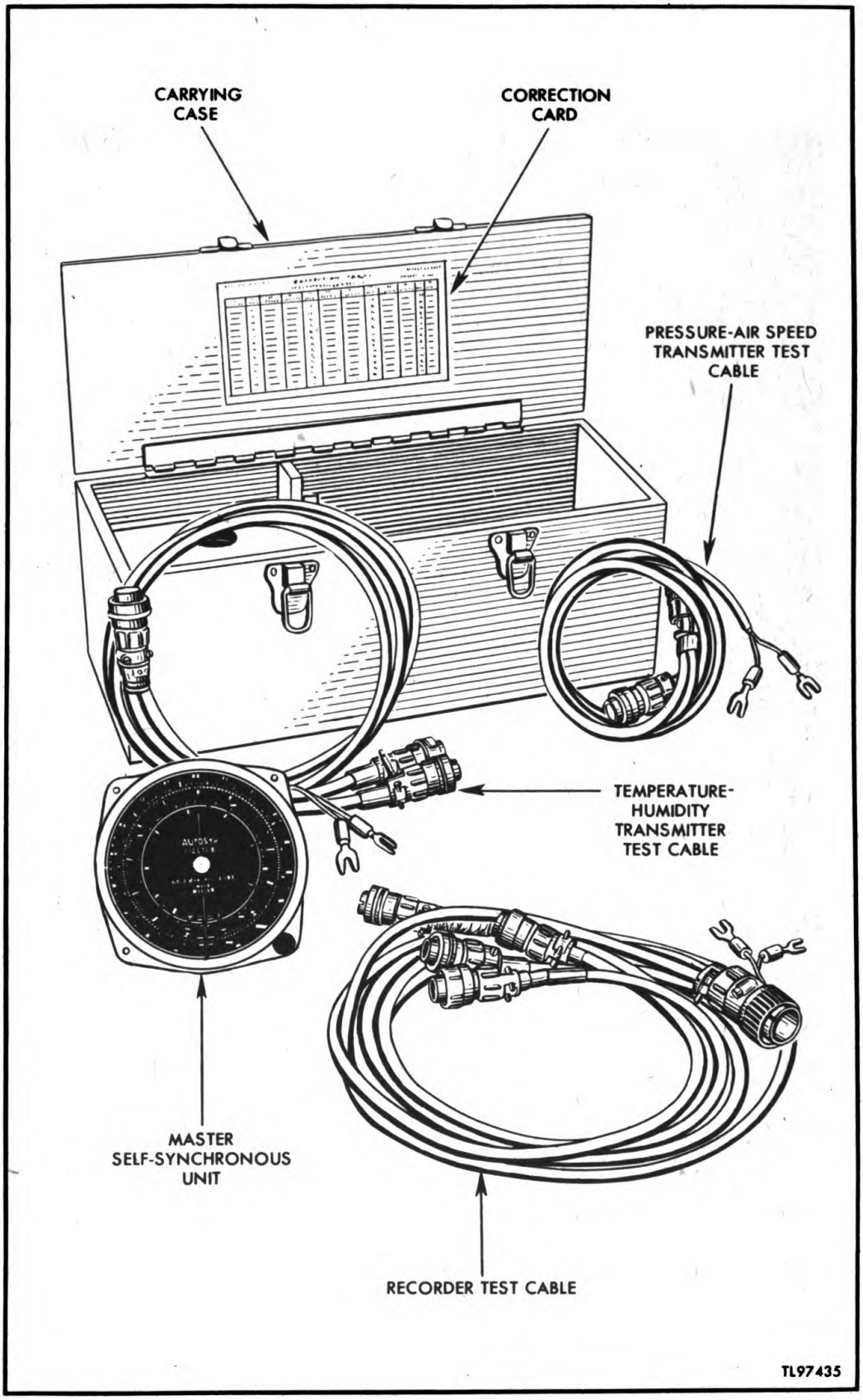


Figure 1. Calibration Set TS-407/AMQ-2, components.

This manual supersedes TM 11-2428, 10 September 1945

PART ONE

INTRODUCTION

SECTION I. DESCRIPTION

1. GENERAL.

Aerograph Calibration Set TS-407/AMQ-2 (fig. 1) contains a master self-synchronous test unit equipped with a dial having a combination of concentric scales. There are three sets of flexible cables for making electrical connections between the master self-synchronous unit and the instruments to be tested or calibrated. The equipment is contained in a wooden carrying case, and weighs a total of 9¾ pounds.

2. PURPOSE.

The aerograph calibration set is used as a standard for calibrating and testing the self-synchronous transmitter and receiver units contained in Aerograph Equipment AN/AMQ-2, which is described in TM 11-2408.

3. VOLTAGES.

The calibration set will function on either a 26-volt or 40-volt, 400-cycle supply.

4. LIST OF COMPONENTS (fig. 1).

Quantity	Name of component	Dimensions (in.)			Unit Weight (lbs)	Unit Volume (cu ft)
		Height	Width	Length		
1	Carrying case	5⅞	6½	16¼	5⅝	.36
1	Master self-synchronous unit	5⅛	5⅛	4¾	1¼	—
1	Correction card	—	5¼	10	—	—
1	Recorder test cable	—	—	36	1⅝	—
1	Temperature-humidity transmitter test cable	—	—	36	¾	—
1	Pressure-air speed transmitter test cable	—	—	36	½	—

5. CARRYING CASE (fig. 1).

a. The carrying case of Aerograph Calibration Set TS-407/AMQ-2 is a plywood box with a hinged lid held closed by two trunk catches. The top of the lid is provided with a handle for carrying the case.

b. The inside of the box is partitioned into two compartments, one for storage of the three cables of the calibration set, and the other fitted for safe storage of the master self-synchronous unit.

c. The floor of the latter compartment is elevated and has a hole to receive the clutch knob which protrudes from the face of the self-synchronous unit. The floor is provided with corner blocks and is felt-lined to receive the face of the unit. A hinged wooden clamp with a hole to fit over the receptacle at the back of the unit is provided near the top of the compartment. The under side of the clamp is felt-lined, and the clamp is fitted with a thumbscrew to lock it in the closed position.

6. MASTER SELF-SYNCHRONOUS UNIT (fig. 1).

a. The master self-synchronous unit of Aerograph Calibration Set TS-407/AMQ-2 consists of an extremely accurate self-synchronous motor contained in a metal case. The extended end of the rotor shaft bears a pointer operating over a calibrated dial which is visible behind a cover glass provided at the front of the case (fig. 2). A clutch knob labeled **PUSH TO SET** is located at the lower right-hand corner of the front of the case, and can be set to manually control the position of the rotor. The back of the case is provided with a four-prong receptacle through which electrical connections to the self-synchronous motor are made.

b. The calibrated dial (fig. 2) of the unit is provided with five concentric scales, each calibrated for a different function, as follows:

(*1*) The first (outside) scale is graduated in degrees of a circle.

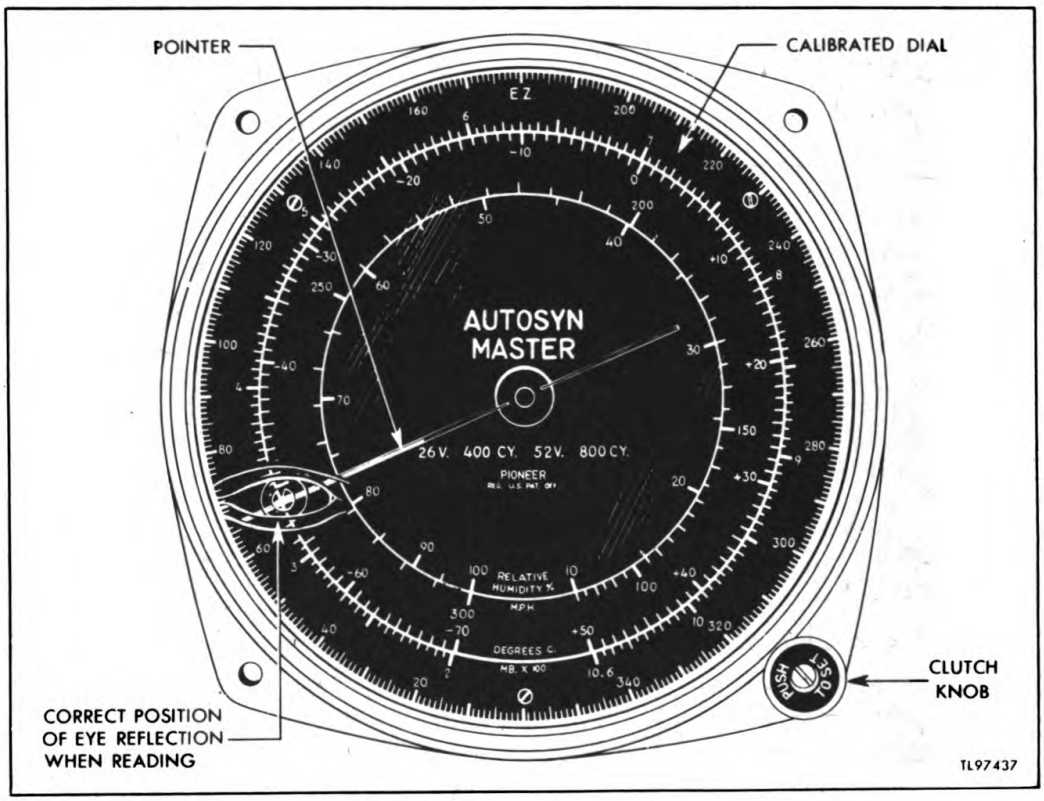


Figure 2. Master self-synchronous unit, front view.

Each division represents 1°, with numerical designations at 20° intervals. This scale is used as a reference for all the other scales.

(*2*) The second scale is graduated in millibars (from 200 to 1060) for pressure indications. The scale is labeled MB. X 100, indicating that a reading must be multiplied by 100. Consequently, each division of the scale represents 5 mb. Numerical designations are made at 100 mb intervals between the end points of the scale.

(*3*) The third scale is graduated in degrees centigrate (from −70 to +50) for temperature indications. It is labeled DEGREES C., and is calibrated along the same centerline as the MB. X 100 scale. Each division represents 1°, with numerical designations at 10° intervals.

(*4*) The fourth scale is graduated in miles per hour (mph) (from 70 to 300) for air speed indications. The scale is labeled M.P.H. Each division represents 5 mph, with numerical designations at 100-mph intervals.

(*5*) The fifth scale is graduated to indicate from 10 to 100 percent relative humidity. The scale is labeled RELATIVE HUMIDITY %, and is calibrated along the same centerline as the M.P.H. scale. Each division represents 5 percent with numerical designations at 10-percent intervals.

7. CORRECTION CARD (fig. 3).

The correction card of Aerograph Calibration Set TS-407/AMQ-2 is a filled-out printed form fastened to the inside surface of the lid of the carrying case (fig. 1). The form is a tabular listing of circular degrees at 5° intervals, with spaces provided on each side of the degrees column in which are written the corrections to apply when using the master self-synchronous unit either as a transmitter or as an indicator. The form is filled out specifically for the master self-synchronous unit having the serial number which is entered at the top of the card.

8. RECORDER TEST CABLE (fig. 1).

a. The recorder test cable of Aerograph Calibration Set TS-407/AMQ-2 consists of four 4-conductor cables, one 2-conductor cable, five connectors, and two spade lugs, assembled together to form a cable by which the master self-synchronous unit can be connected to a power supply and to any one of the four functions of an aerograph recorder.

b. One end of each of the five cables of the assembly terminates in the same 14-contact female connector, which fits the input receptacle of the aerograph recorder. The other ends of the four 4-conductor cables each terminate in a separate 4-contact female connector which fits the

AEROGRAPH - FIELD TEST

CORRECTION CARD
AUTOSYN MASTER

TYPE 5999-66C-B
SERIAL NO.

AS TRANSMITTER	POINTER READ.	AS INDICATOR	AS TRANSMITTER	POINTER READ.	AS INDICATOR	AS TRANSMITTER	POINTER READ.	AS INDICATOR	AS TRANSMITTER	POINTER READ.	AS INDICATOR
	0°			90°			180°			270°	
	5°			95°			185°			275°	
	10°			100°			190°			280°	
	15°			105°			195°			285°	
	20°			110°			200°			290°	
	25°			115°			205°			295°	
	30°			120°			210°			300°	
	35°			125°			215°			305°	
	40°			130°			220°			310°	
	45°			135°			225°			315°	
	50°			140°			230°			320°	
	55°			145°			235°			325°	
	60°			150°			240°			330°	
	65°			155°			245°			335°	
	70°			160°			250°			340°	
	75°			165°			255°			345°	
	80°			170°			260°			350°	
	85°			175°			265°			355°	

TL97438

Figure 3. Correction card form.

receptacle at the back of the self-synchronous unit. Each of these four connectors is color-coded to correspond to one of the four functions of the aerograph recorder. The other end of the 2-conductor cable terminates in a pair of spade lugs for connection to the power supply.

9. TEMPERATURE-HUMIDITY TRANSMITTER TEST CABLE (fig. 1).

a. The temperature-humidity transmitter test cable of Aerograph Calibration Set TS-407/AMQ-2 consists of two 4-conductor cables, and one 2-conductor cable, three connectors, and two spade lugs, assembled together to form a cable by which the master self-synchronous unit can be connected to a power supply and to either the temperature or the humidity element of an aerograph temperature-humidity transmitter.

b. One end of each of the three cables of the assembly terminates in the same 6-contact female connector, which fits the receptacle of the temperature-humidity transmitter. The other ends of the two 4-conductor cables each terminate in a separate 4-contact female connector which fits the receptacle at the back of the self-synchronous unit. Each of these two connectors is color-coded to identify its function. The other end of the 2-conductor cable terminates in a pair of spade lugs for connection to the power supply.

10. PRESSURE-AIR SPEED TRANSMITTER TEST CABLE (fig. 1).

a. The pressure-air speed transmitter test cable of Aerograph Calibration Set TS-407/AMQ-2 consists of one 4-conductor cable, one 2-conductor cable, two connectors, and two spade lugs, assembled together to form a cable by which the master self-synchronous unit can be connected to a power supply and to either the pressure unit or the air speed unit of an aerograph pressure-air speed transmitter.

b. One end of each of the two cables of the assembly terminates in the same 4-contact connector, which fits either the receptacle on the master self-synchronous unit or the receptacles of the pressure-air speed transmitter. The other end of the 4-conductor cable terminates in a similar 4-contact connector. The other end of the 2-conductor cable terminates in a pair of spade lugs for connection to the power supply.

11. PACKAGING.

Packed for overseas shipment, Aerograph Calibration Set TS-407/AMQ-2 is inclosed in a fiberboard container approximately 17 inches

long, 7 inches wide, and 7 inches high (fig. 4). Shipping weight is 12 pounds. It occupies about ½ cubic foot. For unpacked weights, dimensions, and cubage, see paragraph 4.

SECTION. II. INSTALLATION

12. UNPACKING.

a. Shipping Container (fig. 4). To open the container in which Aerograph Calibration Set TS-407/AMQ-2 is packed for overseas shipment (par. 11), proceed as follows:

(*1*) Break the end seals and remove the outer container.

(*2*) Tear off waterproof paper covering.

(*3*) Break seals on top of inner container and lift out the carrying case by the handle.

(*4*) Open the carrying case and remove the bag of moisture absorbent material.

(*5*) Release the clamp of the left-hand compartment and remove the bag containing the master self-synchronous unit. Remove the unit from the protective bag.

(*6*) Check the components against the master packing slip inclosed in the case, and against the list of components in paragraph 4 of this manual. Examine each component for possible damage during shipment.

b. Carrying Case. To unpack Aerograph Calibration Set TS-407/AMQ-2 for use, proceed as follows:

(*1*) Open the carrying case.

(*2*) Remove the three cables from the right-hand compartment. Uncoil the cables.

(*3*) Release the clamp of the left-hand compartment and carefully remove the master unit. Set the unit upright on a firm surface.

13. REPACKING.

CAUTION: The master self-synchronous unit is a delicate instrument and must be handled with extreme care.

To replace the components of Aerograph Calibration Set TS-407/AMQ-2 in the carrying case, proceed as follows:

a. Check that the felt pads on the floor of the left-hand compartment and on the under side of the clamp are in place. These pads are the only protection from jolting that the master unit will have while it is stored in the case. If they have been lost, replace them with similar shock absorbent material.

b. Pull out the clutch knob of the master unit, and carefully place the unit face-down in the left-hand compartment, letting the knob extend through the hole in the floor. Close the clamp and screw it down to hold the unit firmly in place.

c. Carefully coil each of the three test cables and place them in the right-hand compartment. Avoid sharp bends when coiling the cables.

d. Close the lid of the carrying case and fasten the two trunk catches.

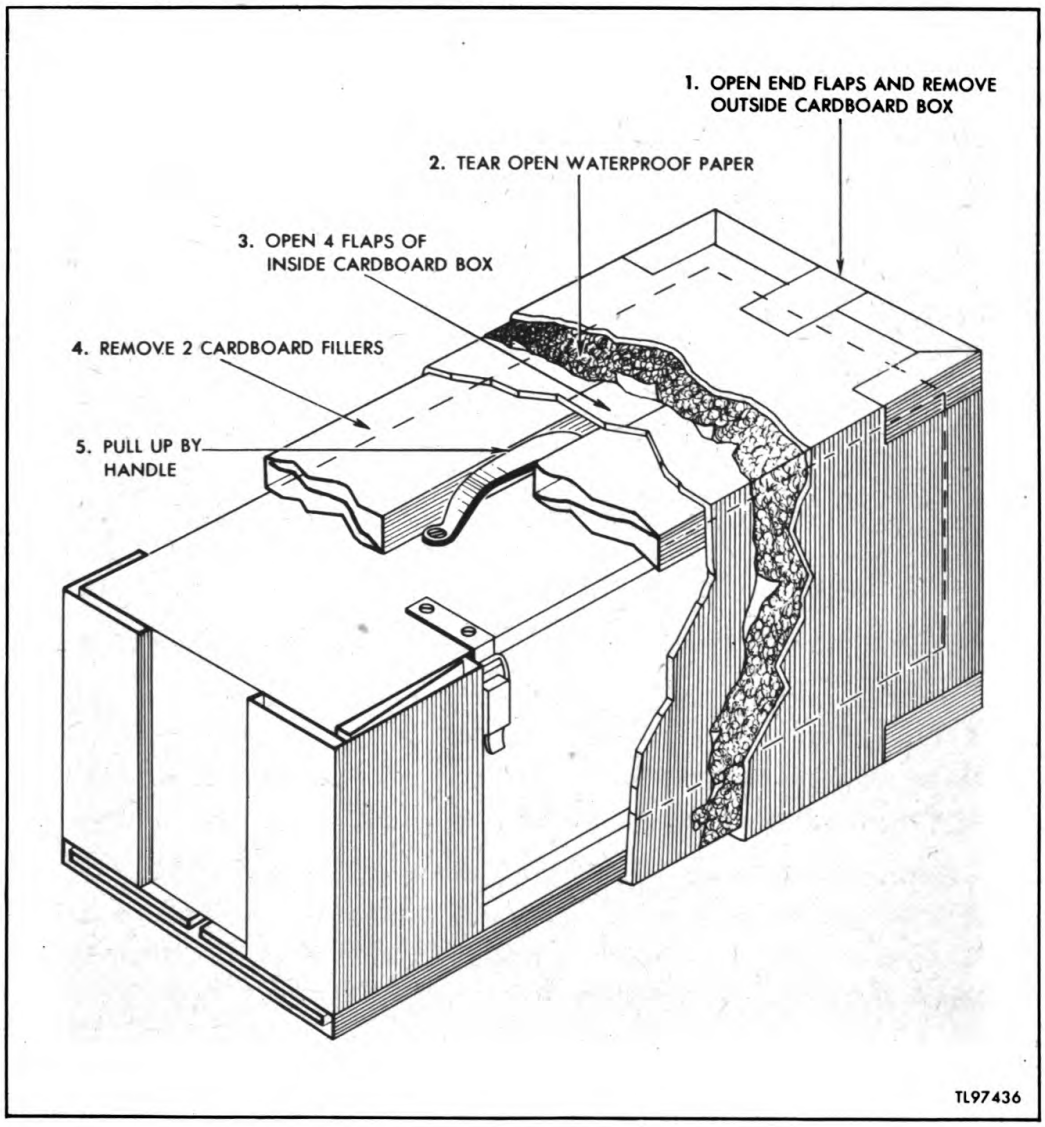


Figure 4. Opening shipping container of Aerograph Calibration Set TS-407/AMQ-2.

PART TWO

OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III. PREOPERATIONAL PROCEDURES

14. POWER SUPPLY PRECAUTIONS.

When preparing to make tests on components of the aerograph in the shop, the following precautions must be observed:

a. For testing the temperature-humidity and pressure-air speed transmitters, connect the master self-synchronous unit to a 26-volt or 40-volt, 400-cycle source only. *Under no conditions should 115-volt, 400-cycle power or direct current of any voltage be used.*

b. For testing Aerograph Recorder ML-320/AMQ-2, use the voltage for which the recorder is wired, which will be either 26-volt or 115-volt, 400 cycles. This may be determined by examination of the fuse connections within the recorder. Note the label on the fuse to which the input wire from the 14-contact receptacle is attached. When the aerograph recorder is correctly supplied, the master self-synchronous unit receives the proper supply (40 volts, 400 cycles) through the recorder transformer.

15. PRECAUTIONS IN USE OF MASTER SELF-SYNCHRONOUS UNIT.

a. Location. The master self-synchronous unit should be used at room temperatures between 60° and 90° F. Set the master unit, with its dial approximately vertical, adjacent to the equipment to be tested which should be in the same position as it occupies in actual use.

b. Setting the Pointer. It should be noted that while the range of the master self-synchronous unit is 360°, the range of the recorder is only 330°, corresponding to a range of from 15° to 345° on the degree scale of the master unit. Consequently, *when using the master unit as a transmitter, be sure that the pointer is not set between 0° and 15° or between 345° and 360°, as this will result in an off-scale indication on the recorder.*

c. Reading the Dial. For accurate reading of the dial of the master unit, the line-of-sight must be perpendicular to the pointer at the reading

point. In order to accomplish this, the reader should look for the reflection of his eye on the glass of the dial (fig. 2). When the reflection is evenly divided by the pointer, the desired position has been obtained and accurate readings will result.

d. Using Correction Card. The master unit is correct to ± ½° of arc, which is satisfactory for calibration of the air-speed and humidity functions which have expanded scales and corresponding large tolerances. When accuracy to ± ¼° of arc is required for calibration of the pressure and temperature functions, corrections must be applied. It is for this purpose that the correction card (par. 7) is supplied with the set. The corrections given on the card apply only to the 360° scale of the master unit, but may be applied to other scales as described in the examples given below:

(*1*) *Master Unit Used as a Transmitter.* Suppose that it is desired to transmit + 25° C on the temperature scale. Proceed as follows:

(*a*) Push in the clutch knob and set the pointer to + 25 on the temperature scale.

(*b*) Note the position of the pointer on the degree scale. This will be 276¼°.

(*c*) Consult the correction card column headed **POINTER READ.** and locate the value nearest to 276. This will be 275.

(*d*) Consult the correction card column headed **AS TRANSMITTER** and note the correction written in beside 275 in the **POINTER READ.** column. Suppose the correction is −¼. This indicates that a ¼° *lower* setting of the pointer along the degree scale is required.

(*e*) Carefully turn the clutch knob to reset the pointer to 276 on the degree scale, thereby positioning the rotor correctly to transmit + 25°-C.

NOTE: The same principle is used to apply corrections to the pressure scale.

(*2*) *Master Unit Used as an Indicator.* Suppose that it is desired to determine the correct value when the master unit indicates 920 mb on the pressure scale. Proceed as follows:

(*a*) Note the position of the pointer on the degree scale. This will be 291°.

(*b*) Consult the correction card column headed **POINTER READ.** and locate the value nearest to 291. This will be 290.

(*c*) Consult the correction card column headed **AS INDICATOR** and note the correction written-in beside 290 in the **POINTER READ.** column. Suppose the correction is + ½. This indicates that a ½° *higher* setting of the pointer along the degree scale is required.

(*d*) Push in and carefully turn the clutch knob to reset the pointer to 291½ on the degree scale, and read the true value of the pressure indication on the pressure scale.

NOTE: The same principle is used to correct indications of the temperature scale.

SECTION IV. OPERATION

16. CALIBRATING AEROGRAPH RECORDER ML-320/AMQ-2 (fig. 5).

a. Connect the 14-contact connector of the recorder test cable to the recorder input receptacle.

b. Push in the clutch knob of the master unit. Set the pointer to any value between 15° and 345° (par. 15b).

c. Connect the desired one of the four connectors to the master unit. These connectors are identified by distinctive color bands according to the recorder function served, as follows:

Color	*Function*
Green	Pressure
Red	Temperature
Brown	Air Speed
Purple	Relative humidity

d. Connect the spade lugs of the power lead to a 26-volt or 115-volt, 400-cycle power supply as required by the recorder (par. 14b).

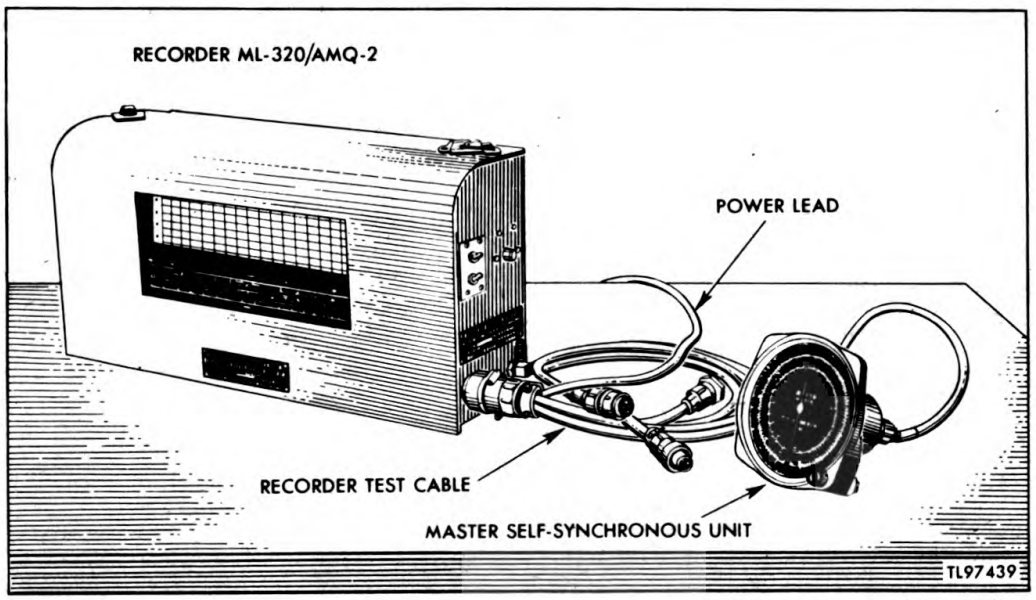


Figure 5. Master self-synchronous unit connected to Recorder ML-320/AMQ-2.

e. Prepare the recorder for operation as instructed in paragraph 19 in TM 11-2408. Turn the recorder motor ON-OFF switch to ON. The indicating pins will assume their electrical zero position. At the end of 15 seconds the pin of the function to which the master unit is connected will move to the position corresponding to the setting of the master unit.

f. Prepare a list of pointer settings for calibration use by applying corrections (par. 15d) to the appropriate one of the following sets of suggested values:

Pressure (mb)	Temperature (°C)	Air speed (mph)	Relative humidity (%)
320	− 60	100	20
400	− 50	120	30
480	− 40	140	40
560	− 30	160	50
640	− 20	180	60
720	− 10	200	70
800	0	220	80
880	+10	240	90
960	+20	260	
	+30	280	
	+40		

NOTE: The values corresponding to the ends of the recorder scale have not been used in the above sets. The recordings of these end points sometimes are affected by the recorder ribbon guides and are not indicative of the calibration of the receiving unit.

g. Calibrate a function by setting the master unit pointer carefully at each of the corrected pointer settings, allowing a 15-second record to be printed at each point. In setting the master unit at each point, move the pointer slowly (at a rate of 1° of arc per second) during the last 5 seconds of arc preceding the value. (This constitutes an important part of the friction check (subpar. i below) and simulates the condition of use where the measured function changes slowly.) As soon as a series has been completed, it should be repeated in the reverse direction.

h. Remove the printed record of the calibration from the recorder and insert it in Scale ML-319/AMQ-2 which is a component of the aerograph equipment. Adjust the margins and examine the accuracy of the printed value. These should be within the following tolerances:

Function	*Tolerance*
Pressure	± 3 mb
Temperature	± 0.4° C
Air speed	± 1 mph
Relative humidity	± ½%

If examination of the record shows that a slight shift in one direction would improve the accuracy, proceed according to the directions in paragraph 66a(3)(a) of TM 11-2408.

i. Examine the record for evidence of friction. The difference between the record of a value made when the master unit pointer has approached the point slowly from the left, and when it has approached the same point slowly from the right, is a measure of the friction of the recorder. This should not exceed 2 circular degrees (1° centigrade of Scale ML-319/AMQ-2 is equivalent to 3° of arc on the master unit). Where excessive friction is found, it should be corrected in accordance with instructions in paragraphs 68, 75, 78, and 79 in TM 11-2408.

17. CALIBRATING TEMPERATURE-HUMIDITY TRANSMITTER ML-317/AMQ-2 (fig. 6).

NOTE: Temperature-Humidity Transmitter ML-317/AMQ-2 must be removed from the airplane to make the following tests.

a. Temperature Transmitter.

(*1*) Remove the temperature transmitter from the housing in accordance with instructions in paragraphs 76a(1)(a) and (b) in TM 11-2408. There should be sufficient wire to permit immersion of the transmitter in a temperature bath without disconnecting it from the six-prong receptacle mounted on the housing.

(*2*) Attach the six-contact connector of the temperature-humidity transmitter test cable to the transmitter receptacle.

(*3*) Pull out the clutch knob of the master unit. Attach the *red*-banded connector to the master unit.

(*4*) Connect the spade lugs of the power lead to a 26-volt or 40-volt, 400-cycle power supply. Use 40 volts whenever it is available.

(*5*) Make tests at approximately $-60°$ C, $-35°$ C, $+25°$ C, and $+45°$ C. Allow the temperature of the bath to assume the desired test temperature. Stir the bath during the test to make sure that temperature gradients do not exist. Use an accurate centigrade thermometer or a thermocouple to measure the bath temperature. Position the thermometer bulb within ½ inch of the temperature element.

(*6*) Before taking a reading, tap or vibrate the temperature element and the master unit to remove friction. Read the master unit temperature scale to the nearest 0.2° C. Apply correction from the correction card (par. 15d). The corrected reading should be within $\pm 0.7°$ C of the test temperature.

b. Humidity Transmitter.

NOTE: Prior to calibration the humidity element should be conditioned as instructed in paragraph 20a of TM 11-2408.

(*1*) Attach the six-contact connector of the temperature-humidity transmitter test cable to the transmitter receptacle.

(*2*) Pull out the clutch knob of the master unit. Attach the *purple*-banded connector to the master unit.

(*3*) Connect the spade lugs of the power lead to a 26-volt or 40-volt 400-cycle power supply. Use 40 volts whenever it is available.

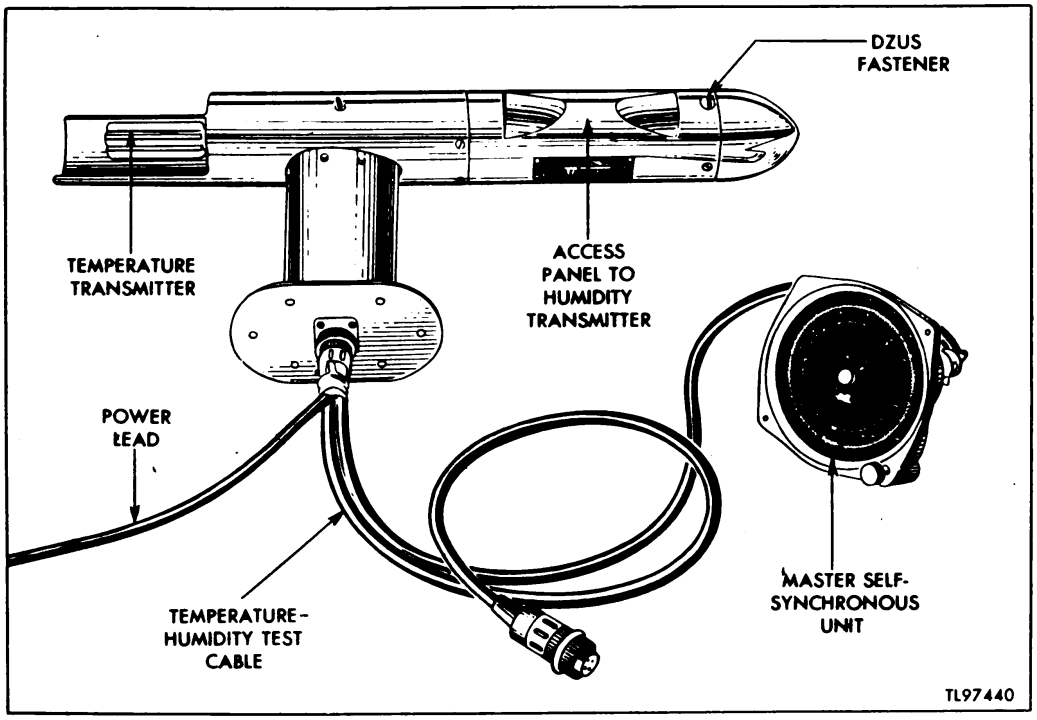


Figure 6. Master self-synchronous unit connected to Temperature-Humidity Transmitter ML-317/AMQ-2.

(*4*) Use a screwdriver to turn the Dzus fastener on the access panel of the temperature-humidity transmitter, and remove the panel. Expose the humidity element to sufficient ventilation to bring it into equilibrium with the relative humidity of the room or chamber in which it is exposed. A minimum of two tests should be made at as widely varying humidities as possible. If a humidity chamber is not available, make indoor and outdoor tests or make the tests on different days when the ambient humidity differs markedly.

(*5*) Determine the relative humidity of the room or space where the test is made. Use Psychrometer ML-24 or any other well-ventilated psychrometer of known accuracy.

(*6*) Vibrate or tap both instruments before making a reading. Read the master unit relative humidity scale to the nearest whole percent relative humidity (no correction need be applied). Accuracy of indication should be within ± 7 percent.

(*7*) If adjustments are necessary to the humidity element, consult paragraph 111b(3), (4), and (5) of TM 11-2408.

18. CALIBRATING PRESSURE-AIR SPEED TRANSMITTER ML-319/AMQ-2 (fig. 7).

NOTE: Pressure-Air Speed Transmitter ML-319/AMQ-2 must be removed from the airplane to make the following tests.

a. Pressure Transmitter.

(*1*) To measure the pressure applied when calibrating the pressure transmitter, use a standard mercury manometer (for calibrating altimeters) which is calibrated in feet of the standard atmosphere, or use a manometer calibrated in inches of mercury or millibars of pressure. Adjust the manometer scale to read atmospheric pressure at the time of the test. The master altimeter of a C-1 Instrument Test Set may be used instead of a manometer. In this case use an altimeter seting of 29.92.

(*2*) Connect the static connection of the pressure unit to the manometer and, through a tee and a needle valve, to a vacuum pump.

(*3*) Attach one of the two connectors of the pressure-air speed transmitter test cable to the pressure transmitter, and connect the other to the master unit. Pull out the clutch knob of the master unit.

(*4*) Connect the spade lugs of the power lead to a 26-volt or 40-volt, 400-cycle supply.

(*5*) Test at intervals of 100 mb, i.e., 900, 800, 700, etc. After evacuating the system to the desired test pressure, moderately vibrate or tap the instruments and then read the master unit to the nearest millibar. When a pressure of 200 mb has been reached, gradually let air into the system and test at the same intervals of increasing pressure.

NOTE: When using a manometer calibrated in feet of the standard atmosphere, or the master altimeter of a C-1 Instrument Test Set, use Pressure Calculator ML-323/UM, which is a component of the aerograph equipment, to determine the values in feet corresponding to the desired pressures in millibars. For this application the calculator should be set to an altimeter setting of 29.92. When using a manometer calibrated in inches of mercury, divide the desired values in millibars by 33.86 to convert to corresponding pressures in inches of mercury.

(*6*) Apply corrections (par. 15d) to the readings. The corrected readings should be within $\pm$ 5 mb of the test pressures.

(*7*) If adjustment of the pressure transmitter is necessary, consult paragraph 112b and c of TM 11-2408.

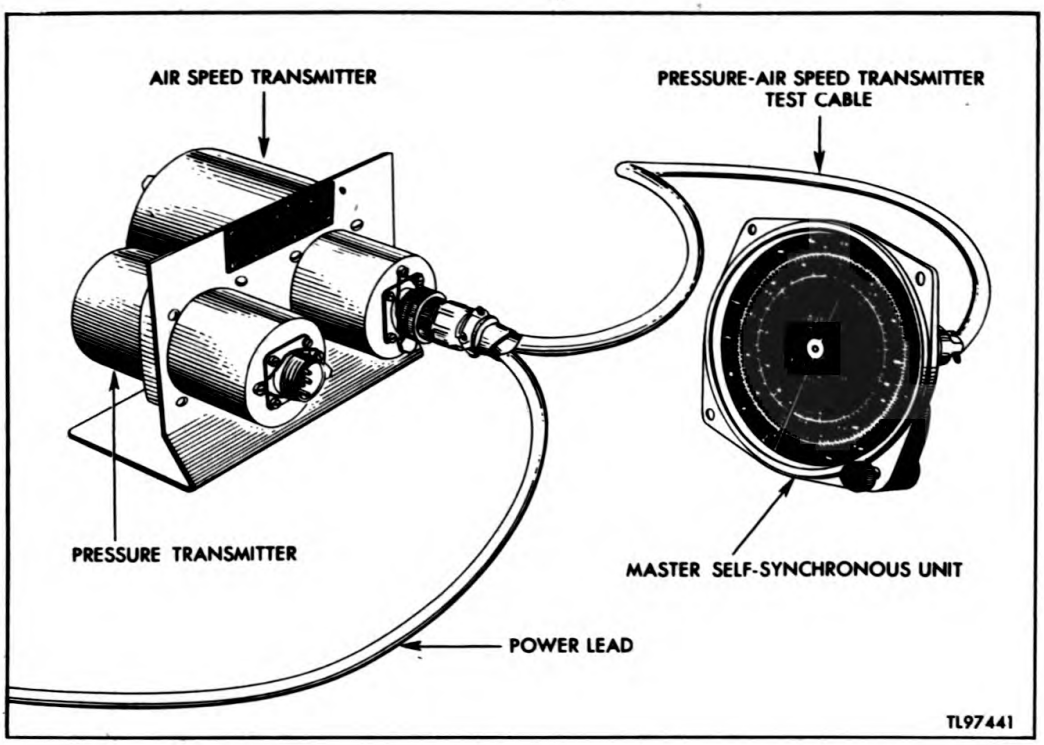


Figure 7. Master self-synchronous unit connected to Pressure-Air Speed Transmitter ML-319/AMQ-2.

b. Air Speed Transmitter.

(*1*) To measure the differential air pressure applied when calibrating the air speed transmitter, use a standard air speed manometer graduated in miles per hour, or use the master air speed indicator of a C-1 Instrument Test Set.

(*2*) Connect the manometer, or the master air speed indicator, to the pitot connection of the air speed transmitter. (The standard air speed manometer and the C-1 Instrument Test Set are equipped with a pressure source.) Leave the static connection of the air speed transmitter open to the atmosphere.

(*3*) Attach one of the two connectors of the pressure-air speed transmitter test cable to the air speed transmitter, and connect the other to the master unit. Pull out the clutch knob of the master unit.

(*4*) Connect the spade lugs of the power lead to a 26-volt or 40-volt, 400-cycle source. Use a 40-volt source whenever it is available.

(*5*) Make all tests with the air speed transmitter in the normal flight position to avoid position error. Test at intervals of 50 mph by applying pressures to give the desired manometer indication. At each point moderately vibrate or tap the air speed transmitter and the master unit to eliminate friction. Read the master unit to the nearest mile per hour (no corrections are necessary). Accuracy of indication should be within ± 3 mph.

(*6*) If adjustment of the air speed transmitter is necessary, consult paragraph 113b and c in TM 11-2408.

19. TROUBLE SHOOTING AEROGRAPH EQUIPMENT AN/AMQ-2.

Aerograph Calibration Set TS-407/AMQ-2 may be used to determine the source of faulty indication in Aerograph Equipment AN/AMQ-2 mounted in aircraft equipped with the proper power supply (par. 14). *If only 115 volts, 400 cycles is available, the voltage must be reduced to 40 volts to check the transmitters.*

a. To determine if the fault lies in one of the transmitters of the aerograph equipment, proceed as follows:

(*1*) Disconnect the transmitter from the recorder.

(*2*) Connect the transmitter to the master self-synchronous unit by means of the proper cable (par. 17 or 18).

(*3*) Check to see that the clutch knob of the master unit is pulled out, and then connect the power leads of the test cable to the 26- or 40-volt, 400-cycle source.

(*4*) Note the pointer reading on the master unit scale corresponding to the transmitter being tested. Compare this indication with the known existing condition of temperature, humidiy, pressure, or air speed. In the case of temperature or humidity, the condition may be varied slightly by breathing on the transmitter element. There should be a corresponding movement of the master unit pointer.

b. If the transmitter tests satisfactorily, proceed as follows to check the corresponding function in the recorder of the aerograph equipment:

(*1*) Connect the master unit to the recorder as instructed in paragraph 16a through e.

(*2*) Rotate the pointer of the master unit, and note the response of the indicator pin of the recorder. If accurate response is not obtained, refer to the trouble-shooting chart in paragraph 65a of TM 11-2408.

PART THREE

MAINTENANCE INSTRUCTIONS

SECTION V. PREVENTIVE MAINTENANCE TECHNIQUES

20. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment to maintain top efficiency in performance. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, and trouble shooting and repair. The primary purpose of preventive maintenance is to *prevent* break-downs and, therefore, the need for repair. The primary purpose of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized.

21. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

There are six basic operations in preventive maintenance, namely: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. The lettering system for the operations is:

F – Feel
I – Inspect
T – Tighten
C – Clean
A – Adjust
L – Lubricate

The Feel (F) and Adjust (A) operations are inapplicable to the aerograph calibration set. The Inspect (I), Tighten (T), Clean (C), and Lubricate (L) operations are applicable to certain components (par. 22)

22. INSTRUCTIONS.

a. General. Preventive maintenance work on Aerograph Calibration Set TS-407/AMQ-2 consists of inspecting the components for dirt and looseness of parts, and correcting these conditions when they exist.

b. Inspect (I).

(*1*) Inspect the master unit for dirty cover glass, and for clogged or dirty receptacle contacts.

(*2*) Inspect the test cables for cut or frayed insulation, broken strands of wire, and loose or corroded connectors or connector contacts. Use an ohmmeter to check all conductors for continuity. *This check is important since the self-synchronous units will function, although not correctly, even if one or more of the lead wires are loose or broken.*

(*3*) Inspect the carrying case for dirt, and for loose or rusty hardware.

c. Clean (C).

(*1*) Clean dirty glass or painted wood surfaces with a soft cloth, dampened with water if necessary.

(*2*) Clean electrical contacts with #000 sandpaper, and then wipe with a clean, dry cloth.

d. Tighten (T).

(*1*) Resolder loose electrical connections.

(*2*) Tighten loose cable clamps.

(*3*) Tighten loose screws of the carrying case hardware.

e. Lubricate (L). Lubricate rusty hinges and trunk fasteners of the carrying case with Oil, Engine (OE). *Do not attempt to lubricate any parts of the master self-synchronous unit.*

SECTION VI. LUBRICATION

NOTE: Lubrication is not required for any component of Aerograph Calibration Set TS-407/AMQ-2, except occasionally for carrying case hardware (par. 22e).

SECTION VII. MOISTUREPROOFING AND FUNGIPROOFING

NOTE: Moistureproofing and fungiproofing treatment is not required for Aerograph Calibration Set TS-407/AMQ-2.

PART FOUR

AUXILIARY EQUIPMENT

(NOT USED)

PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Air Forces, will be reported on Army Air Forces Form No. 54 (Unsatisfactory Report).

SECTION VIII. THEORY OF EQUIPMENT

23. AEROGRAPH CALIBRATION SET TS-407/AMQ-2.

The major component of Aerograph Calibration Set TS-407/AMQ-2 is the master self-synchronous unit. It contains an extremely accurate self-synchronous motor with a calibrated dial and a mechanical clutch which permits its use as a master transmitter or a master indicator to test another self-synchronous unit to which it is electrically connected. The theory of operation of the remote indicating system thus formed is discussed in paragraph 57 of TM 11-2408. The dial of the master unit is designed specifically for calibrating the self-synchronous transmitting and receiving units of Aerograph Equipment AN/AMQ-2.

SECTION IX. REPAIRS

24. GENERAL REPAIR.

a. Master Self-synchronous Unit. The master unit of Aerograph Calibration Set TS-407/AMQ-2 *must not be overhauled in the field.* When trouble develops, replace the unit with a new one and send the old one to a depot.

b. Test Cables. Replace any test cable through which continuity (par. 22b(2)) cannot be obtained after remedying loose connections. As a temporary expedient, the cable can be rewired with new wire, following the appropriate wiring diagram in figure 8.

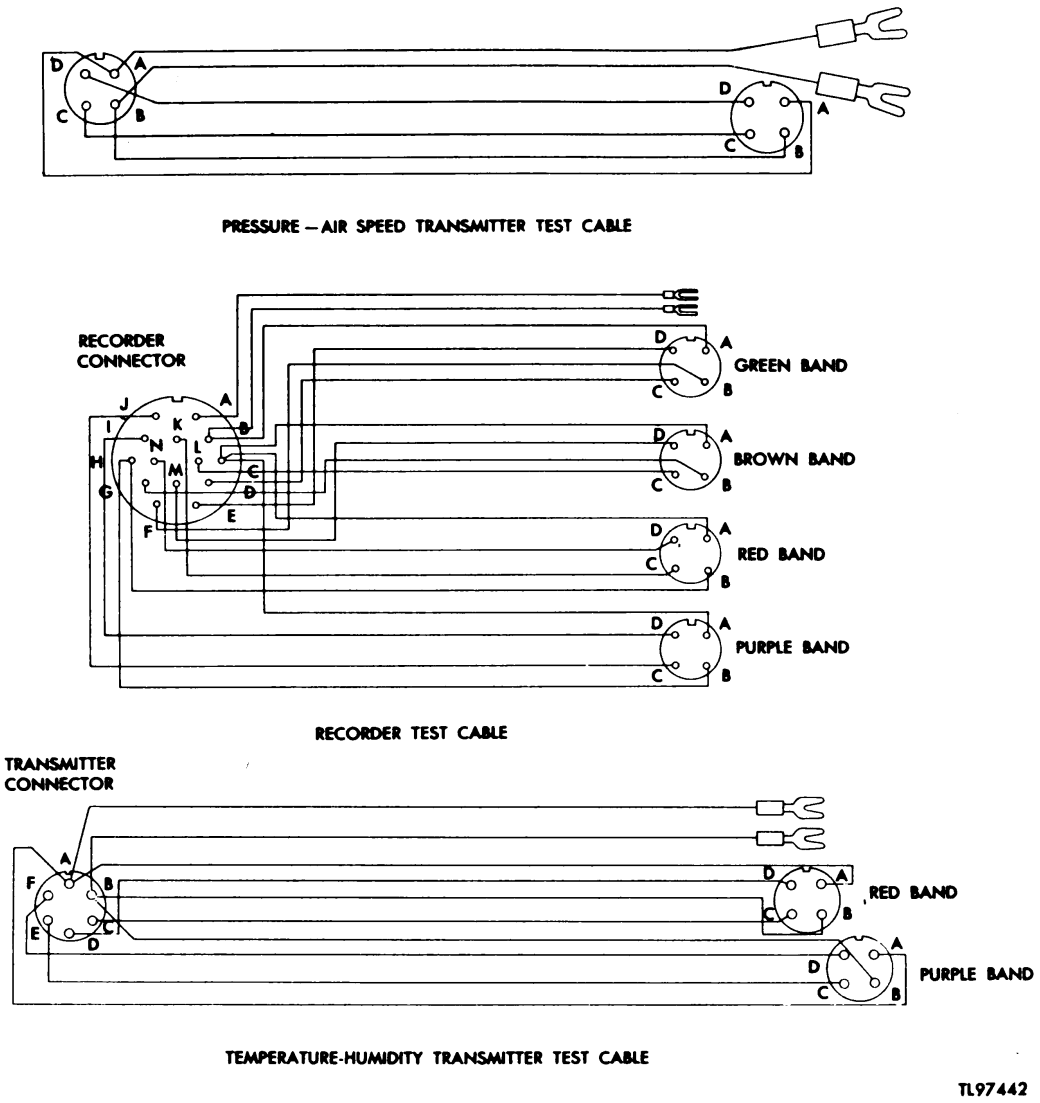
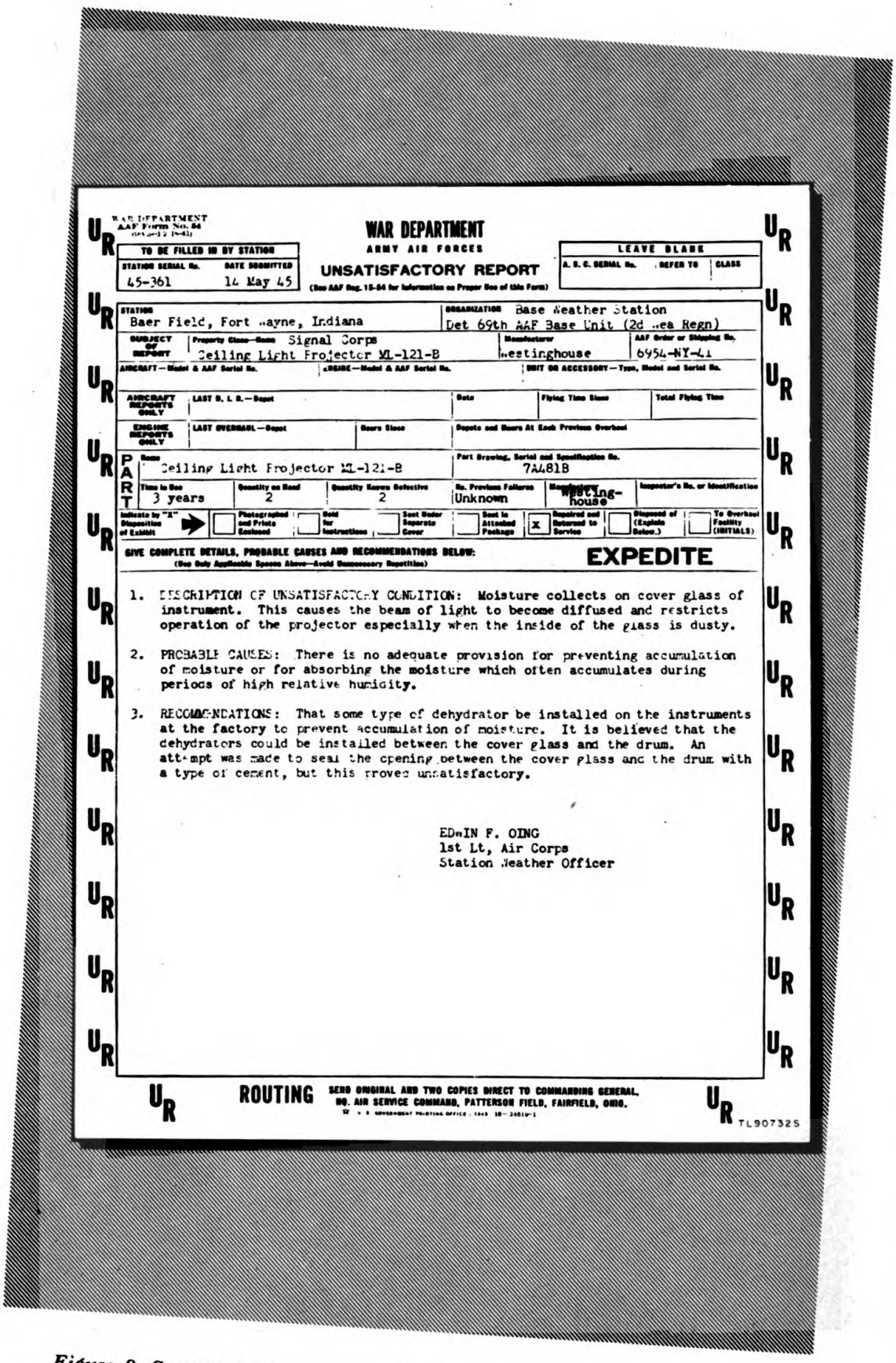


Figure 8. Wiring diagrams of test cables.

25. UNSATISFACTORY REPORT.

When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels. A sample filled-out form is shown in figure 9.



WAR DEPARTMENT
AAF Form No. 54

WAR DEPARTMENT
ARMY AIR FORCES
UNSATISFACTORY REPORT
(See AAF Reg. 15-54 for Information on Proper Use of this Form)

TO BE FILLED IN BY STATION	
STATION SERIAL No.	DATE SUBMITTED
45-361	14 May 45

LEAVE BLANK		
A. S. C. SERIAL No.	REFER TO	CLASS

STATION: Baer Field, Fort Wayne, Indiana		ORGANIZATION: Base Weather Station Det 69th AAF Base Unit (2d Wea Regn)	
SUBJECT OF REPORT — Property Class—Name: Signal Corps Ceiling Light Projector ML-121-B		Manufacturer: Westinghouse	AAF Order or Shipping No.: 6454-NY-41
AIRCRAFT—Model & AAF Serial No.	ENGINE—Model & AAF Serial No.	UNIT OR ACCESSORY—Type, Model and Serial No.	

AIRCRAFT REPORTS ONLY: LAST D. I. S.—Depot		Date	Flying Time Since	Total Flying Time
ENGINE REPORTS ONLY: LAST OVERHAUL—Depot	Hours Since	Depots and Hours At Each Previous Overhaul		

PART						
Name: Ceiling Light Projector ML-121-B			Part Drawing, Serial and Specification No.: 7A481B			
Time in Use: 3 years	Quantity on Hand: 2	Quantity Known Defective: 2	No. Previous Failures: Unknown	Manufacturer: Westinghouse	Inspector's No. or Identification	

Indicate by "X" Disposition of Exhibit	Photographed and Prints Enclosed	Held for Instructions	Sent Under Separate Cover	Sent in Attached Package	Repaired and Returned to Service: X	Disposed of (Explain Below.)	To Overhaul Facility (INITIALS)
➔							

GIVE COMPLETE DETAILS, PROBABLE CAUSES AND RECOMMENDATIONS BELOW:
(Use Only Applicable Spaces Above—Avoid Unnecessary Repetition)

EXPEDITE

1. DESCRIPTION OF UNSATISFACTORY CONDITION: Moisture collects on cover glass of instrument. This causes the beam of light to become diffused and restricts operation of the projector especially when the inside of the glass is dusty.

2. PROBABLE CAUSES: There is no adequate provision for preventing accumulation of moisture or for absorbing the moisture which often accumulates during periods of high relative humidity.

3. RECOMMENDATIONS: That some type of dehydrator be installed on the instruments at the factory to prevent accumulation of moisture. It is believed that the dehydrators could be installed between the cover glass and the drum. An attempt was made to seal the opening between the cover glass and the drum with a type of cement, but this proved unsatisfactory.

EDWIN F. OING
1st Lt, Air Corps
Station Weather Officer

ROUTING SEND ORIGINAL AND TWO COPIES DIRECT TO COMMANDING GENERAL, HQ. AIR SERVICE COMMAND, PATTERSON FIELD, FAIRFIELD, OHIO.

TL907325

Figure 9. Sample filled-out Unsatisfactory Report (AAF Form No. 54).

APPENDIX

SECTION X. MAINTENANCE PARTS

26. MAINTENANCE PARTS FOR AEROGRAPH CALIBRATION SET TS-407/AMQ-2.

The following information was compiled on 10 October 1945. The appropriate pamphlet of the ASF Signal Supply Catalog for Aerograph Calibration Set TS-407/AMQ-2 is:

SIG 10-922.2, Aerograph Calibration Set TS-407/AMQ-2, Fixed Plant Maintenance List (when published).

For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG-2.

Ref symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
Fig. 1	7A8114-407	AEROGRAPH CALIBRATION SET TS-407/AMQ-2: used for calibrating Aerograph Equipment AN/AMQ-2( ); u/ with but not p/o Aerograph Equipment AN/AMQ-2( ). Utilizes Autosyn Master Indicator type 5999-66C-B, selsyn, 26 volt 400 cycle, single phase, dial graduated 360° in increments of 1°, figures every 20°; contained in plywood carrying case, dimen., 16¼ in. long, 6½ in. wide, 5⅞ in. deep.	
Fig. 1	3E7316	CABLE, assembly: recorder test; cord, rubber sheathed; 36 in. long.	QD-70753-1 (P47)*
Fig. 1	3E7316-2	CABLE, assembly: temperature - humidity transmitter test; cord, rubber sheathed; 36 in. long.	QD-70754-1 (P47)*
Fig. 1	3E7316-1	CABLE, assembly: pressure-air speed transmitter; cord, rubber sheathed; 36 in. long.	QD-70755-1 (P47)*

*(P47)—Eclipse—Pioneer Division, Bendix Aviation Corp.

55444—P-45-09; 1300; Oct. 45.