WAR DEPARTMENT TECHNICAL MANUAL

TM 11-425

BAROGRAPHS

ML-3-A, ML-3-B

ML-3-C, ML-3-D

WAR DEPARTMENT • 20 JULY 1944

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BAROGRAPHS ML-3-A, ML-3-B ML-3-C, ML-3-D

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WASHINGTON 25, D. C., 20 July 1944.

TM 11–425, Barographs ML–3–A, ML–3–B, ML–3–C, and ML–3–D, is published for the information and guidance of all concerned.

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I Bn 1: T/O 1–627; 1–637

For explanation of symbols see FM 21–6.

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, handaxes, 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—Case and entire instrument.

2. Break—Clock mechanism, pen arm, and levers.
3. Burn—Chart and technical manual.
4. Bury or scatter—All of the above pieces after breaking.

DESTROY EVERYTHING

CONTENTS

		Paragraph	Page
SECTION I.	DESCRIPTION.		
	General	1	1
	Component parts	2	2
	Case	3	2
	Pressure-measuring mechanism	4	2
	Clock ML–145	5	5
SECTION II.	INSTALLATION AND OPERATION.		
	Unpacking	6	6
	Assembling	7	6
	Filling dash pots	8	6
	Location	9	6
	Installing chart	10	7
	Winding clock	11	7
	Replacing cylinder	12	9
	Pen adjustment	13	9
	Inking pen	14	9
	Reading chart	15	10
SECTION III.	FUNCTIONING OF PARTS.		
	Pressure-sensitive unit	16	11
	Lever system	17	12
	Clock movement	18	13
SECTION IV.	MAINTENANCE.		
	Dusting	19	15
	Cleaning pen	20	15
	Dash pots	21	15
	Lubricating	22	15
	Clock ML–145	23	16
	Moistureproofing and fungiproofing	24	16
	Recalibration	25	16
SECTION V.	SUPPLEMENTARY DATA.		
	Maintenance parts list for Barograph ML–3–(*)	26	18

SECTION I

DESCRIPTION

1. GENERAL. **a.** Barographs ML–3–A, ML–3–B, ML–3–C, and ML–3–D are portable precision instruments (also known as microbarographs) which measure and register changes in atmospheric pressure.

b. Some of the early Barographs ML–3–A have only one dash pot; the other Barographs ML–3–A and Barographs ML–3–B, ML–3–C, and ML–3–D have two dash pots. Otherwise there are no essential differences between the instruments covered in this manual. The various suffix letters result from refinements in design, the general appearance, function, and operation are the same for all.

c. Throughout this manual, basic type nomenclature followed by an asterisk within parentheses (Barograph ML–3–(*)) refers to Barographs ML–3–A, ML–3–B, ML–3–C, and ML–3–D, or any one of them.

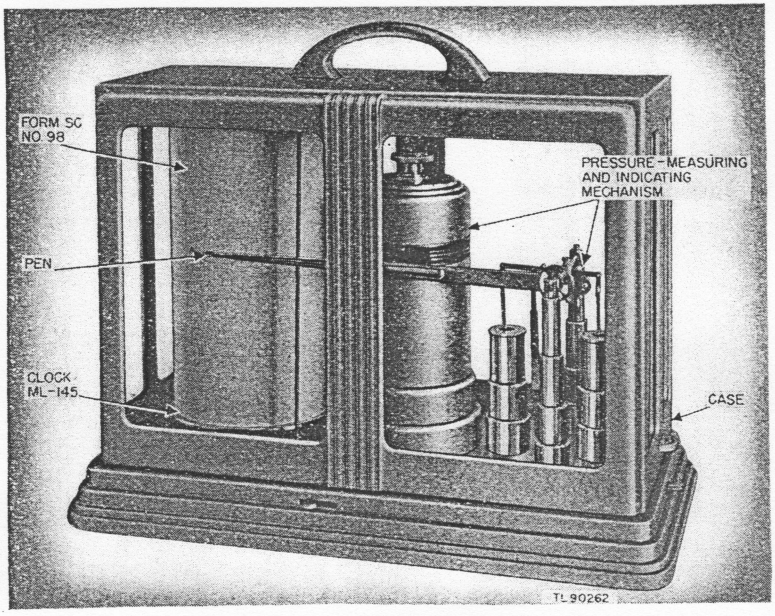

Figure 1. Barograph ML–3–(*).

2. COMPONENT PARTS. **a.** The component parts of Barograph ML–3–(*) (fig. 1) are:

1 pressure-measuring-and-registering mechanism mounted in a case.
1 pen.
1 bottle of dash-pot fluid.
1 Clock ML–145.

b. Additional items used with Barograph ML–3–(*) which must be procured separately, are—

Item	*Signal Corps stock No.*
Ink, special register, green	7A1100
purple	7A1101
red	7A1102
Oil, watch, grade No. 1	6G1339
Form SC No. 98	6D98
Mounting ML–178, special mounting to absorb shocks	7A1199–178

3. CASE (fig. 1). **a.** The case of Barograph ML–3–(*) consists of a low raised base and a high hinged cover held closed by a catch.

b. The base is metal and is approximately 13 inches long by 7 inches wide. The underside is provided with a removable cover plate, and four rubber feet.

c. The cover is a metal frame approximately 9 inches high. It has glass windows on all sides, and a carrying handle is fixed in the center of the solid top.

4. PRESSURE-MEASURING MECHANISM (figs. 2 and 3). **a.** The pressure-measuring mechanism of Barograph ML–3–(*) consists of a pressure-sensitve unit which actuates a recording pen through a system of levers.

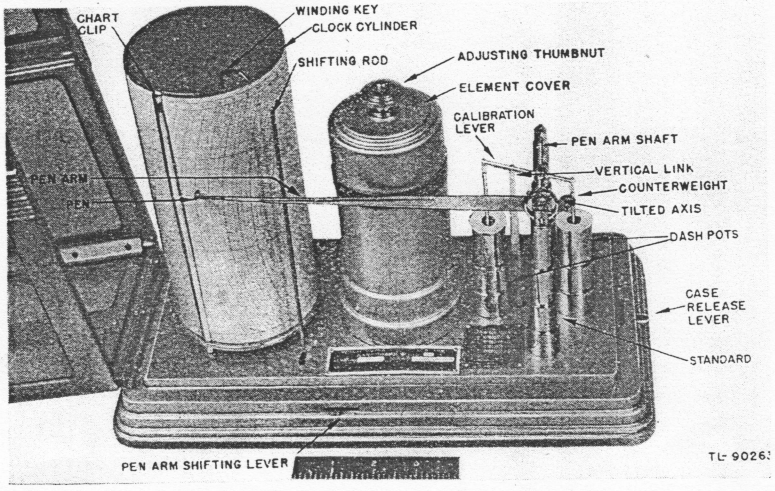

Figure 2. Barograph ML–3–(*), cover open.

b. The *pressure-sensitive unit* consists of two bellows made of very thin hard brass. The bellows are suspended inside a high dome-like cover (*element cover*) mounted over a large hole which is located approximately in the center of the base of the instrument case.

(1) The two bellows are screwed together at one end to constitute a single unit. One end of the unit is provided with a threaded bolt (*element post*) and the other end is provided with a slotted stud.

(2) The under side of the top of the pressure-sensitive unit cover is provided with a nub holding a coil spring (*element spring*). The element post of the unit extends through a hole in the nub. An *adjusting thumbnut* is screwed on the post to hold the unit, which the spring keeps firmly suspended downward within the cover. The element post is keyed to the nub to prevent the unit turning sideways. The lower end of the unit is free to move vertically.

c. The *lever system* consists of an *element link;* a *magnification lever* and *bimetal temperature compensation shaft;* a *vertical link;* a *calibration lever* and *dash pots;* a *pen arm shaft* and *standards;* and a *pen arm.*

(1) One end of the element link (fig. 3) is attached to the stud at the bottom of the pressure-sensitive unit. The other end is fitted into a slot in the magnification lever (fig. 3) which extends horizontally below

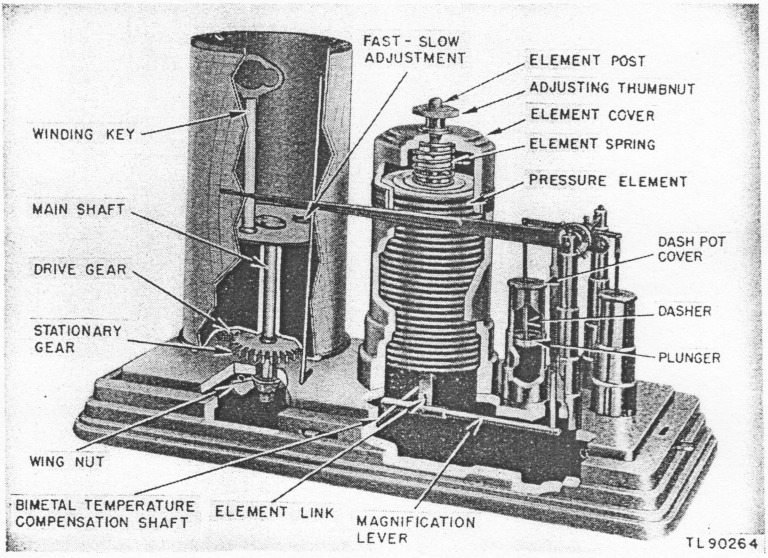

Figure 3. Barograph ML–3–(*), exposed view of mechanism.

the pressure-sensitive unit. The slotted hole in the element link is engaged by a pivot screw through the magnification lever.

(2) One end of the magnification lever (fig. 4) is clamped to the middle of the bimetal temperature compensation shaft, which has its ends fitted in bearings mounted on the under side of the case. The magnification lever extends from the shaft and across the bottom of the pressure-sensitive unit where the element link attaches to the unit, and ends below a small hole in the base.

(3) The vertical link (fig. 3) extends vertically through the small hole. The lower end of the vertical link is attached to the end of the magnification lever, and the upper end is attached about midway on one side of the calibration lever.

(4) The calibration lever (fig. 2) is inserted through the pen arm shaft. It extends at right angles on each side of that shaft, more on the side to which the vertical link is attached than on the other, and is held in position by a set screw. The ends of the calibration lever are attached to dash pots.

(*a*) Each dash pot (fig. 3) consist of a cylinder with a removable cover, a piston, and a connecting rod.

(*b*) Each dash pot cylinder is mounted immediately below an end of the calibration lever.

(*c*) Each piston is a thin sheet-metal, cone-shaped *plunger* that is fitted inside the dash pot cylinder.

(*d*) A connecting rod (*dasher*) is attached to the top center of each plunger, and extends through a hole in the removable cover of the dash

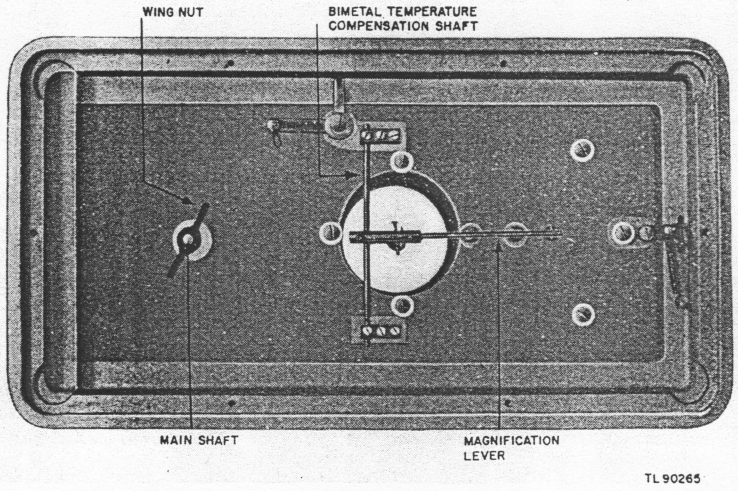

Figure 4. Barograph ML–3–(*), bottom view.

pot cylinder. The upper end of each dasher is attached to an end of the calibration lever.

(5) The ends of the pen arm shaft are supported by standards (fig. 2) mounted on the base.

(6) The pen arm has one end attached to the pen arm shaft by a *tilted-axis* arrangement (fig. 2). The other end of the long arm is free and is partially balanced by a *counterweight* attached to the opposite side of the axis.

d. The *recording pen* is a nickel-silver nib pen clamped to the free end of the pen arm. The pen arm holds the pen in position to bear against the record chart. A vertical *shifting rod* (fig. 2) is mounted on the base near the free end of the pen arm. This rod is attached to the *pen arm shifting lever* provided at the front of the base, and can be moved laterally to hold the pen arm and pen away from the chart.

5. CLOCK ML–145 (fig. 3). **a.** Clock ML–145 consists of—

(1) A clock movement housed in a high cylinder.

(2) A chart clip.

(3) A main shaft and stationary gear, with wing nut.

(4) A winding key.

b. The cylinder is metal, and is the drum for the record chart. The chart clip holds the chart on the cylinder.

c. The clock movement is the 8-day type and is fixed within the lower portion of the cylinder. The winding key attaches to the top of the clock and is reached through the open upper end of the cylinder.

d. The main shaft and gear fit into the hole provided in the base of the instrument case. The wing nut (figs. 3 and 4) screws on the threaded end of the main shaft to hold the gear stationary on top of the base.

e. The center hole in the bottom of the clock unit fits over the main shaft. The clock's drive gear engages the stationary main shaft gear and causes the chart cylinder to rotate once about every 4½ days.

SECTION II

INSTALLATION AND OPERATION

6. UNPACKING. **a.** Barograph ML–3–(*) is packed with the pen in place on the pen arm, and the pen arm tied to the shifting rod. The main shaft and stationary gear of Clock ML–145 are fastened in place in the case. The dash pot fluid and the cylinder containing the clock movement are packed separately.

b. Unpack the instrument carefully. Avoid any shock or jar. *Barograph ML–3–(*) is a delicate precision instrument and must be treated accordingly.*

c. If necessary to repack Barograph ML–3–(*) for shipment after it has been in use, proceed as follows:

(1) Turn the adjusting thumbnut of the pressure-sensitive unit counterclockwise (to the left) to move the pen to the bottom of the chart. Then lift the pen by hand to the top of the chart and tie the pen arm to the shifting lever (par. 17a(2)).

(2) Remove the clock cylinder from the instrument.

(3) Use an eyedropper to remove the fluid from the dash pots.

7. ASSEMBLING. **a.** Pull the case release lever (on the right when facing the front of the instrument) and open the hinged cover all the way over until the top left edge is resting safely on the table or shelf.

b. Untie the pen arm from the shifting rod, and make sure that the pen arm is *in front* of the rod. Push the shifting lever (at the front of the base) *to the right* to hold the pen arm as far to the front as possible.

c. Put the clock cylinder on the base by slipping the bottom center hole over the main shaft. Lower the cylinder carefully and turn it slightly until the clock drive gear is felt to engage the stationary gear on the base.

8. FILLING DASH POTS. **a.** The dash pot fluid supplied is a low-temperature oil to be used in the dash pots located below the ends of the calibration lever (fig. 2). The instrument will give an erratic record if the dash pots are not filled.

b. Fill each dash pot as follows:

(1) Use an eyedropper to extract the fluid from the shipping container.

(2) Lift the dash pot cover and put the fluid into the pot with the eyedropper. Fill it to within 3/8 inch of the top.

(3) Rock the calibration lever *slowly and carefully* to move the dash pot plungers so all air bubbles will be expelled.

(4) Lower the dash pot cover and seat it properly.

9. LOCATION. **a.** Locate Barometer ML–3–(*) on a level surface. It is important that the instrument be mounted in as level a position as

practicable because gravity is the only force that holds the pen against the chart (par. 17e).

b. The instrument must be located where it cannot be disturbed easily or jarred accidentally.

(1) If the instrument is subjected to excessive vibration when on a desk or table, provide a substantial level shelf mounted on a solid wall.

(2) A sponge-rubber pad placed under the instrument will help protect it against vibration. Mounting ML–178 (par. 2b) is a special shock mounting for Barograph ML–3–(*).

c. The temperature of the area where Barograph ML–3–(*) is located must be as constant as possible.

(1) Keep direct or reflected sunlight from the barograph.

(2) Do not locate the instrument near a stove or a radiator.

(3) Protect the instrument from drafts or sudden movements of air.

10. INSTALLING CHART. **a.** Always remove the clock cylinder from Barograph ML–3–(*) to install or change a chart.

(1) Open the case (par. 7a).

(2) Push the shifting lever to hold the pen away from the cylinder.

(3) Lift the clock cylinder vertically from the shaft and remove it from the case.

Caution. If the cylinder holds a chart on which there is a record, handle it carefully to avoid smearing the ink.

b. Remove the chart clip by pulling it vertically from the bottom slot and top notch of the cylinder. Carefully remove the used chart, if there is one, and lay it in a safe place.

c. Take a new chart and make a notation (not in the margin) of the date it is being installed, mark one of the .00 reference lines according to the local pressure range (par. 13b (2)), and install the chart as follows:

(1) Lay the left-hand side of the chart on the cylinder so the actual beginning of the chart is lined up with the right-hand sides of the bottom slot and the top notch of the cylinder, and so the lower edge of the chart is snug against the bottom flange of the cylinder (fig. 5 ①).

(2) Wrap the chart clockwise around the cylinder, taking care to keep the beginning firmly in place and the bottom edge against the flange. Lap the chart end over the beginning (fig. 5 ②).

(3) Hold the chart clip so the outside of the curve is toward the chart. Insert the straight end of the clip into the slot at the bottom of the cylinder, lay the clip flat against the lapped portions of the chart, and push the hooked top down to engage the top notch of the cylinder (fig. 5 ③).

d. Examine the pen each time the chart is changed, and clean it if necessary (par. 20b).

11. WINDING CLOCK. **a.** Wind the clock every time while the cylinder is removed from Barograph ML–3–(*) to install a chart (par. 10). *Never wind the clock while the cylinder is in place in the instrument.*

b. The winding key is reached through the open top of the cylinder.

c. Wind in the direction indicated by the arrows beside the key.

(1) Approximately 12 to 14 half-turns of the key will fully wind a run-down clock.

(2) Approximately 7 to 8 half-turns will be sufficient for the periodic winding every time the chart is changed.

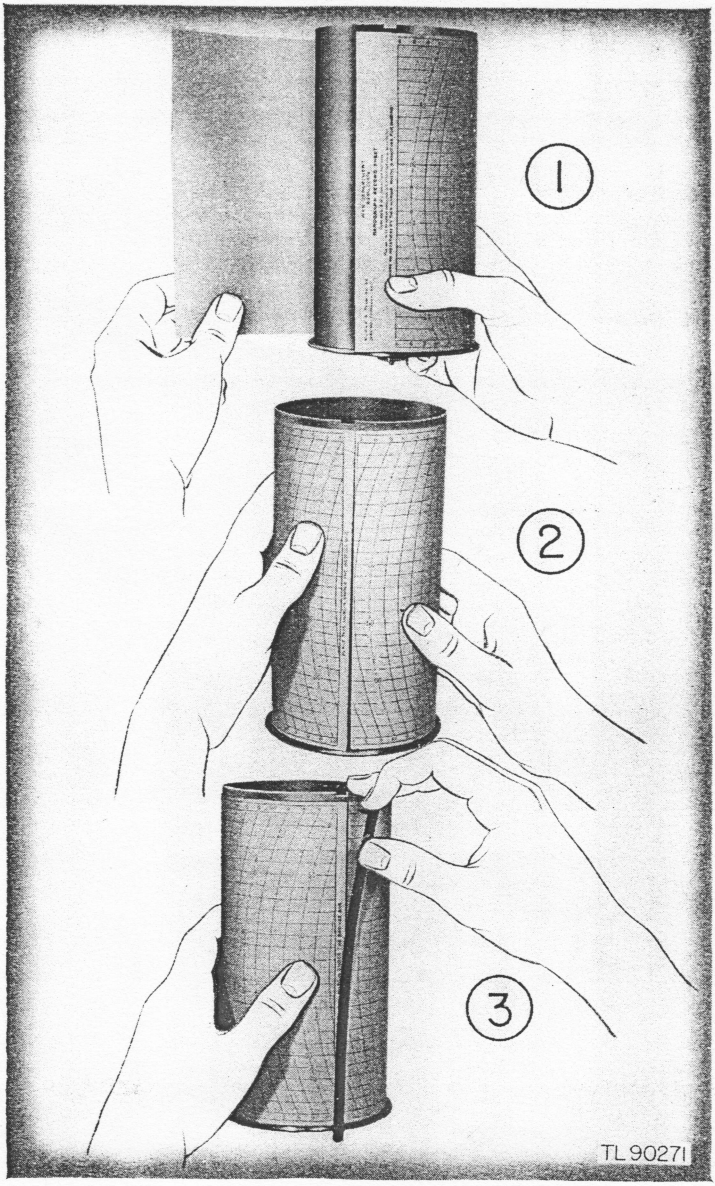

Figure 5. Installing chart on Clock ML–145.

12. REPLACING CYLINDER. **a.** After installing a chart or winding the clock, put the cylinder back on the shaft in the case.

(1) Before lowering the cylinder all the way so the gears mesh, note the local time and turn the cylinder so the corresponding curved vertical (time) line on the chart is lined up approximately with the pen.

(2) Lower the cylinder all the way and make certain that the drive gear of the clock meshes with the stationary gear on the base.

b. Set the pen accurately on local time (par. 13a).

13. PEN ADJUSTMENT. **a. Time Setting.** (1) Move the shifting lever to bring the pen in contact with the chart (fig. 2).

(2) Turn the clock cylinder so the *correct* curved vertical time line is immediately below the pen. When turning the cylinder, turn it counterclockwise to take up any backlash in the clock gear train. If necessary, turn the cylinder clockwise past the correct position and then return it counterclockwise.

b. Pressure Setting. This is a most important operating adjustment. Its purpose is to get the pressure-sensitive unit (par. 4b) in agreement with a local standard barometer. This is necessary so the record furnished by Barograph ML–3–(*) will be accurate.

(1) Determine the pressure indicated by the local standard barometer.

(2) Consider the local pressure *range* and select one of the chart's zero horizontal lines (marked .00) to represent *whole inches* of local pressure.

(3) Turn the knurled adjusting thumbnut at the top of the element cover (fig. 2). This nut pulls the pressure-sensitive unit up or lets it down, and thus moves the pen through the connecting system of levers. (Barograph ML–3–D has a locknut which must be released before the thumbnut can be turned.)

(4) Turn the thumbnut slowly until the pen touches the chart's horizontal line (fig. 2) that, with reference to the .00 line selected in (2) above, corresponds with the pressure indicated by the local standard barometer.

(5) Lightly tap the base of Barograph ML–3–(*) while turning the thumbnut. This will compensate for the lag in response due to the effect of the dash pots, and insures accuracy of the setting.

(6) If there is much variation between the local pressure range and the sea-level pressure range (28 to 31 inches of mercury) for which Barograph ML–3–(*) is calibrated, a calibration error will be introduced that is greater than the specified tolerance of 0.02 inch of mercury. Under such circumstances, the instrument must be sent to a depot for recalibration. *Do not attempt to recalibrate it in the field.* The procedure requires test chambers in which pressure and temperature can be controlled.

14. INKING PEN. **a.** Use a special-registering ink (par. 2b) that will remain fluid at low temperatures.

b. Ink the pen of Barograph ML–3–(*) as follows:

(1) Move the shifting lever to lift the pen from the chart.

(2) Put a drop of the ink, such as would normally cling to the end of a fine wire, between the nibs of the pen. The pen barrel never should be more than half full.

(3) Start the ink flow by drawing a piece of cellophane or lint-free paper, such as a piece of chart paper, between the nibs of the pen to wet the inside surfaces. Do not bend or deform the nibs or allow any particles of paper to remain between them.

(4) Remove any ink from the outside surfaces of the pen.

c. Move the shifting lever to place the pen in contact with the chart. Close the cover of the case; the instrument then is ready to measure and record changes in atmospheric pressure. Keep the cover tightly closed to protect the working parts against dust and dirt as much as possible (par. 19).

15. READING CHART. **a.** The chart (W. D. S. C. Form No. 98) used with Barograph ML–3–(*) is graduated in inches of mercury at 2½ times actual scale.

(1) The complete pressure range that can be measured by the barograph is 2½ inches of mercury.

(2) In order to register small changes in air pressure, the barograph is designed so a change in barometric pressure of 1 inch of mercury is expanded to cover an actual vertical distance of 2½ inches on the chart.

(3) Consequently, the complete range of the instrument requires the 6¼-inch height provided by W. D. S. C. Form No. 98.

b. The chart furnishes a record of changes in air pressure compared with time. Pressure and time are measured by the pressure-sensitive unit and Clock ML–145, respectively, of Barograph ML–3–(*).

(1) The chart is divided vertically (fig. 2) by curved lines, representing time.

(*a*) The curved lines are separated from each other by the distance that the chart is moved by the clock in 1 hour.

(*b*) Every third vertical line is identified by a particular hour designation printed in the top and bottom margins of the chart.

(*c*) The lines are curved to agree wtih the arc that must be traversed by the pen working at the end of the pivoted pen arm.

(2) The chart is divided horizontally (fig. 2) by lines representing pressure.

(*a*) The horizontal lines are separated from each other by the distance the pen moves vertically in registering a pressure change of 0.02 inch of mercury.

(*b*) Every fifth horizontal line represents 0.1 inch of mercury and is marked by its decimal number with reference to the .00 line below it (par. 13b).

c. The vertical components of the ink-trace on the chart indicate changes in pressure occurring during the time intervals indicated by the horizontal length of the trace.

(1) Pressure readings are taken to the nearest 0.01 inch of mercury, which is one-half the distance between adjacent horizontal lines of the chart.

(2) Pressure-tendency readings are estimated to the nearest 0.005 inch.

SECTION III

FUNCTIONING OF PARTS

16. PRESSURE-SENSITIVE UNIT (fig. 6). **a.** The inside of each of the two bellows of the pressure-sensitive unit (par. 4b) is partially exhausted of air and is fitted with an internal spring to prevent collapse.

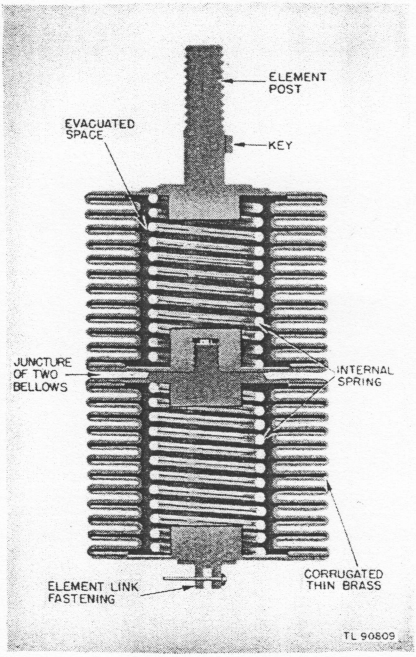

Figure 6. Pressure-sensitive unit, cross-section view.

b. The internal springs and the residual air in the bellows combine to exert a thrust equal to the atmospheric pressure on the bellows.

(1) As atmospheric pressure decreases, the springs and residual air tend to expand the bellows. The springs and air exert diminishing force as they expand, until the pressure exerted inside the bellows is in equilibrium with the reduced outside pressure.

(2) As atmospheric pressure increases, the bellows and the springs and air inside them are compressed. The springs and air exert increasing force

as they are compressed, until the pressure exerted inside the bellows is in equilibrium with the increased outside pressure.

c. The residual air inside the bellows also acts to compensate for temperature effects.

(1) The springs inside the bellows tend to become slightly weaker with increase in temperature.

(2) The residual air tends to expand and exerts a stronger pressure with increase in temperature.

(3) Thus, by controlling the amount of residual air left in the bellows during manufacutre, the weakening effect of increased temperature on the springs is compensated for.

17. LEVER SYSTEM. a. The lever system (par. 4c) has a slight overbalance which causes the pivot screw in the magnification lever to rest always in the bottom of the slot in the element link (fig. 3) when the instrument is in operation.

(1) The unbalanced portion of the weight of the pen arm is borne by the bottom of the element link slot. As the bellows expand with reduced atmospheric pressure, the free end of the pen arm drops of its own weight and the pivot screw continues to bear against the bottom of the element link slot.

(2) The slotted end of the element link prevents damage when the pen arm has dropped its limit or is tied to the shifting lever in shipment. Further expansion of the bellows in these circumstances cannot exert a pressure on the lever system because of the element link slot, which slides by the pivot screw in the magnification lever.

b. The bimetal temperature compensation shaft (fig. 4) is designed to compensate for temperature effects on the instrument.

(1) The shaft is made of a strip of invar and a strip of brass, welded together lengthwise.

(2) The coefficients of expansion of invar and brass are different; consequently the shaft bends or bows slightly under the influence of temperature.

(3) The ends of the shaft are fitted in fixed bearings which, since one end of the magnification lever is clamped to the middle of the shaft, constitute the fulcrum of that lever.

(4) As the shaft bows under the influence of temperature, it has the effect of changing the effective length of the magnification lever by varying the distance between the element link (where the *effort* is applied to the lever) and the *fulcrum* without changing the position of the latter. Thus proper adjustment of the shaft compensates for the effect of temperature.

c. The distance that the pen arm moves in response to a given movement of the magnification lever is dependent upon the distance between two points on the calibration lever (fig. 2). They are the point where the vertical link is attached to the calibration lever; the point where the lever attaches at right angles through the pen arm shaft.

(1) Shortening the distance between the two points *increases* the distance the pen arm will move in response to a given movement of the magnification lever.

(2) Lengthening the distance between the points *decreases* the motion of the pen arm relative to the magnification lever.

(3) This permits adjustment of the calibration lever for various pressure ranges. The set screw is provided on the pen arm shaft to maintain the proper adjustment.

d. The tendency of movable parts of the instrument to jump and cause the pen to register an erratic record when disturbed by external vibrations is retarded by fastening the ends of the calibration lever to plungers working in a viscous fluid (fig. 3).

(1) The apex of each cone-shaped plunger points down in the fluid. Any air trapped below the plunger will tend to rise and escape through the space between the side of the plunger and the wall of the dash pot.

(2) The clearance between the plunger and the dash pot wall also is the space through which the dash pot fluid must flow as it is displaced by the movement of the plunger.

(3) The clearance is only about 0.006 inch. Consequently the plunger can be forced down only slowly. Since each end of the calibration lever is attached to such a plunger, any rapid vertical motion transmitted to the lever system is damped.

e. The tilted axis (fig. 7) fixes the pen arm so it must move in a vertical plane in response to movements of the pen arm shaft, and at the same time causes the pen to bear against the chart or permits free motion in a curved horizontal plane.

(1) Assuming the longitudinal axis of the pen arm horizontal, the pivots of the tilted axis are inclined about 45° from the vertical in a plane perpendicular to the horizontal axis of the pen arm shaft. Thus any sidewise movement of the end of the pen arm must occur in a concave curved plane, and gravity will tend to keep the end of the pen arm at the lowest point in that curve.

(2) The chart cylinder is located so the lowest point of the theoretical concave curved path occurs *within* the chart cylinder. Consequently, the pen at the end of the pen arm bears against the chart with a pressure resulting from the pull of gravity. Correct pen pressure depends upon the barograph being level.

18. CLOCK MOVEMENT. **a.** The clock movement rotates itself and the chart cylinder in which it is mounted around on the main shaft fastened to the base of the barograph.

b. The large spur gear on the main shaft remains stationary with the shaft when the shaft is fastened properly to the base.

c. The off-center drive gear of the clock engages the stationary gear when the chart cylinder is in position on the main shaft.

d. The spring mechanism of the clock rotates the drive gear, which revolves itself around the circumference of the stationary gear.

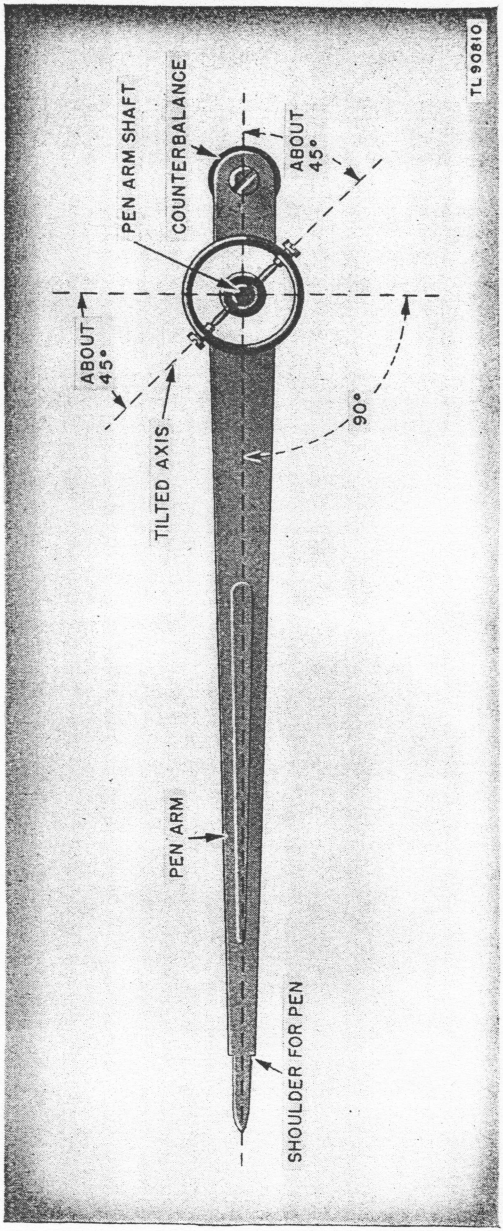

Figure 7. Tilted axis of pen arm.

SECTION IV

MAINTENANCE

NOTE. Unsatisfactory performance of this equipment will be reported immediately on W. D., A. G. O. Form No. 468. If form is not available, see TM 38–250.

19. DUSTING. Keep the working parts of Barograph ML–3–(*) free of dust. Carefully use a clean camel's hair brush for the purpose.

20. CLEANING PEN. **a.** Whenever the pen is not making a fine line on the chart, draw a piece of cellophane or lint-free paper between the nibs (par. 14b (3)).

b. If that does not improve the line, wash the pen with alcohol or water. (1) Hold the pen arm with one hand to relieve the tilted axis of strain, and slide the pen from the end of the pen arm with the other hand. Be careful not to bend the pen arm.

(2) Lightly scrape off any dried ink from the outside of the pen before washing it.

(3) Dry the outside of the pen with a clean cloth. Dry the inside by drawing clean lint-free paper between the nibs.

(4) Replace the pen and seat it against the shoulder provided on the pen arm, again holding the pen arm with the other hand to protect the tilted axis from strain.

(5) Ink the pen (par. 14).

c. The ink in the pen will tend to absorb moisture in humid weather (par. 21a) and may completely fill the pen barrel and run down the pen arm. Use a small piece of blotting paper and remove *all* the ink from the pen. Then refill it (par. 14).

21. DASH POTS. **a.** Watch the level of the fluid in the dash pots. It is hygroscopic and will tend to absorb moisture in periods of high relative humidity, such as foggy weather or prolonged periods of mist or light rain.

b. Keep the level of the fluid about ⅜ inch below the top of the dash pot. Remove excess fluid with an eyedropper, and add new fluid whenever the level falls below ⅜ inch from the top. Completely empty the dash pot whenever the fluid becomes excessively diluted by absorption of moisture, and replace with new fluid.

22. LUBRICATING. **a.** Barograph ML–3–(*) requires little lubrication. Be sparing in the use of oil. Too much oil tends to collect dust and consequently increases friction of the moving parts, which defeats the purpose of lubrication.

b. Use grade No. 1 watch oil (par. 2b) or special preservative lubricating oil (specification AXS–777). Apply the amount that clings to the end of a very fine wire to the following parts:

(1) The three pivots on the calibration lever (fig. 2).

(2) The bearings at the ends of the bimetal temperature compensation shaft (fig. 4).

(3) The element link and the vertical link pivots on the magnification lever (fig. 3).

Caution. Remove the clock cylinder from the case and use an eyedropper to remove the fluid from the dash pots before turning the instrument upside down to reach parts to be lubricated.

23. CLOCK ML–145. a. FAST-SLOW Adjustment. If Clock ML–145 runs fast or slow, adjust it by the regulator provided near the winding key on the top of the clock case.

(1) Open the sliding window of the regulator.

(2) Move the regulator arm toward FAST if the clock has been running slow, or toward SLOW if it has been running fast.

(3) Each graduation of the regulator represents 42 seconds in 24 hours.

(*a*) The clock will *speed up* 42 seconds per day, or about 5 minutes per week, for *each* graduation that the regulator is moved toward FAST.

(*b*) The clock will *slow down* 42 seconds per day, or about 5 minutes per week, for *each* graduation that the regulator is moved toward SLOW.

(4) Since the chart cylinder cannot be set as close as 5 minutes to local time (par. 13a), an adjustment of the clock regulator within one graduation of correct time will be satisfactory.

b. Repair. Do not attempt to repair the clock movement or to adjust it in *any way* except as instructed in a above. *Never remove the clock movement from the chart cylinder in which it is mounted.* Send the complete unit, including the shaft and gear on the instrument base, to a depot for repair.

(1) Move the shifting lever to the right to hold the pen away from the chart.

(2) Lift the cylinder from the shaft.

(3) Unscrew the wing nut (figs. 3 and 4) and remove the shaft and gear from the base. Screw the wing nut and washer back on the removed shaft.

(4) Pack the cylinder and the shaft and gear very carefully. The shaft and gear will be necessary to test the clock after repair.

24. MOISTUREPROOFING AND FUNGIPROOFING. Barograph ML–3–(*) does not require moistureproofing or fungiproofing.

25. RECALIBRATION (FOR DEPOT USE ONLY). a. Purpose. Barograph ML–3–(*) requires recalibration for use at a pressure range that varies considerably from the range for which the instrument was calibrated originally (par. 13b (6)).

b. Equipment. Recalibration of Barograph ML–3–(*) can be accomplished *only* with special test chambers in which the temperature and pressure can be controlled.

c. Preliminary pressure calibration. Put the instrument in a pressure chamber in which a pressure range of 2½ inches of mercury within the limits prescribed by the intended location is available. Adjust the instrument to that range, as follows:

(1) Loosen the set screw that holds the calibration lever in position through the pen arm shaft.

(2) Slide the calibration lever to increase or decrease the recording range to agree with the pressure range in the test chamber (par. 17c).

(*a*) This preliminary adjustment may be approximate since it will be necessary to calibrate again for pressure after compensating for temperature.

(*b*) Tighten the set screw.

d. Temperature compensation. (1) Check the instrument for temperature effects, as follows:

(*a*) Subject the instrument to a temperature of 100° F. for 1 hour. Observe the position of the pen and note the pressure as indicated by a standard barometer.

(*b*) Place the instrument in a cold chamber at 32° F. for 1 hour, again observing the pen position and noting the pressure.

(2) If the two positions of the pen differ by more than 0.04 inch of mercury after taking into consideration any change in pressure indicated by the standard barometer, the instrument must be adjusted for temperature (par. 17b).

(3) Loosen the screw that clamps the magnification lever to the bimetal temperature compensation shaft (fig. 4).

(4) Rotate the bimetal temperature compensation shaft enough to compensate for the error. Turning the shaft through 90° compensates for an error of 0.1 inch of mercury.

(*a*) If the pen indicates a higher pressure at 32° F. than at 100° F., turn the shaft clockwise, as viewed in figure 3.

(*b*) If the pen indicates a lower pressure at 32° F. than at 100° F., turn the shaft counterclockwise.

(5) Tighten the clamping screw, and retest as instructed in (1) above. Repeat procedure in (3) and (4) above if necessary.

e. Final pressure calibration. (1) Return the instrument to the pressure chamber.

(2) Repeat the procedure described in c above, this time sliding the calibration lever to the *exact* position through the pen arm shaft to make the recording range of the instrument agree with the pressure range in the test chamber.

(3) Finally, tighten the set screw to hold the calibration lever in the correct position.

SECTION V

SUPPLEMENTARY DATA

26. MAINTENANCE PARTS LIST FOR BAROGRAPH ML–3–(*).

NOTE. Order maintenance parts by stock number, name, and description. Only maintenance parts can be requisitioned.

Signal Corps stock No.	Name of part and description	3d echelon	4th echelon	5th echelon	Field depot	Depot	Station	Region	Quan. per major unit
7A203( )	Barograph ML–3–(*): 2½–1 microbarograph; 4-day movement.	----	----	----	----	----	----	(*)	1
7A203/A1	Arm, pen	(*)	(*)	(*)	----	(*)	---	(*)	1
7A1208	Pen, nib type with ink space.	(*)	(*)	(*)	----	(*)	(*)	(*)	1
7A857	Fluid, dash pot (bottle sufficient for one renewal).	----	----	----	----	----	(*)	(*)	1
7A585	Clock ML–145, with shaft, gears, wing nut, and winding key.	(*)	(*)	(*)	----	(*)	(*)	(*)	1
7A203/C1	Clip, chart	----	----	----	----	----	----	(*)	1
7A302A/2	Glass, 4¾ by 7½ by approximately 0.090″ thick.	(*)	(*)	(*)	----	(*)	----	----	4
7A1100	Ink, special register, green, ¼-oz bottle.	----	----	----	----	----	(*)	(*)	1
7A1101	Ink, special register, red, ¼-oz bottle.	(*)	(*)	(*)	----	(*)	(*)	(*)	1
7A1102	Ink, special register, purple, ¼-oz bottle.	----	----	----	----	----	(*)	(*)	1
6D98	W. D. S. C. Form No. 98, 4-day, box of 100.	(*)	(*)	(*)	----	(*)	(*)	(*)	1
6G1339	Oil, watch, grade A1, nongum 1-oz bottle.	(*)	(*)	(*)	---	(*)	(*)	(*)	1

*Indicates availability.

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