BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G85.142.3
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AT&T Co Standard

PRESSURE TESTING TOOLS
TYPE FA-176021, W. AND T. MANOMETER

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1. GENERAL

1.01 This section describes the Type FA-176021, Wallace and Tiernan Manometer, and covers the method of setting up and operating the instrument. This instrument has a range of 19 to 24 pounds per square inch (psi) absolute pressure. The dial is graduated in .005 psi divisions.

1.02 This manometer is a precision instrument to be used for accurate location of leaks after an approximate location has been obtained by other methods. It is applicable primarily to underground and buried cables which remain at constant temperature for the duration of the test.

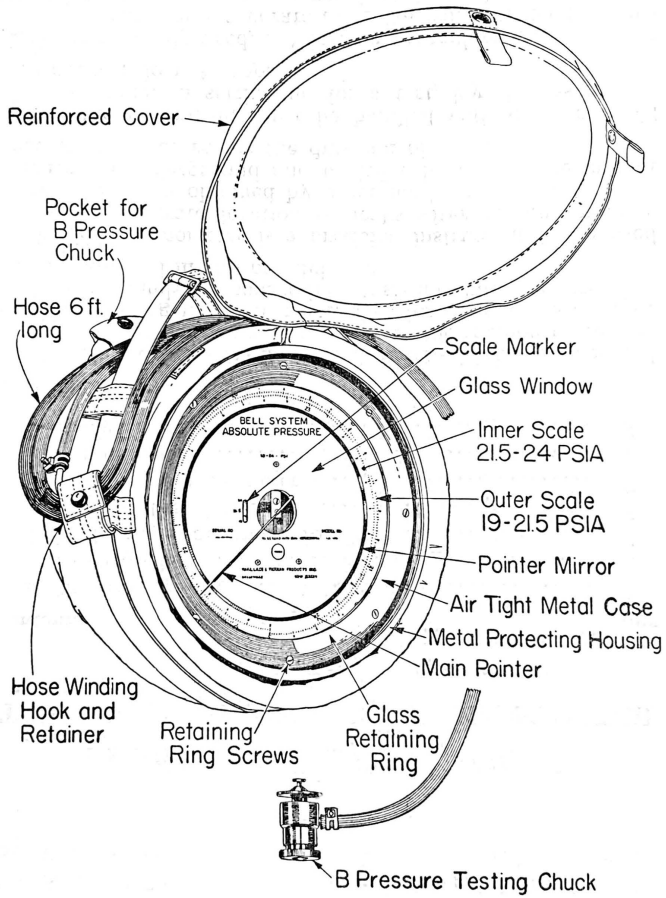
1.03 The instrument must be handled with care to avoid damage. In setting up for a test, lay the instrument down gently; do not drop.

1.04 If correctly used, the instrument will provide pressure measurements accurate to ± .001 psi. In order to facilitate making accurate pressure readings, it is advisable to use a good quality magnifying glass such as the one listed below:

Glass, Magnifying, KS-2632

2. DESCRIPTION

2.01 The following illustrates the FA-176021 Manometer in its canvas carrying case. The instrument is equipped with hose and B Pressure Chuck.

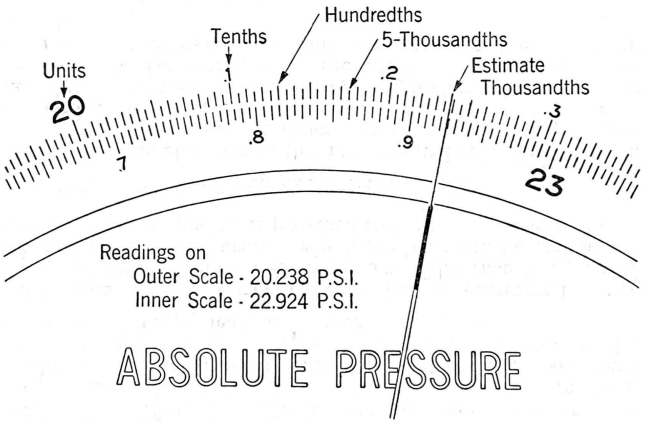


2.02 This instrument is an aneroid manometer. The gas pressure from the cable is admitted through a dust filter into the gastight case where it acts on an evacuated metal capsule. The deflection of the capsule resulting from the gas pressure in the case is transmitted by a linkage directly to a geared sector which meshes with a pinion gear on the pointer shaft. The geared sector is constructed to practically eliminate backlash, and the shaft is equipped with jewel bearings to provide free movement of the pointer.

2.03 **Scale:** The pointer makes two revolutions which provide a scale length of about 45 inches. The outer scale is calibrated from 19 to 21.5 psi (pounds per square inch) and the inner from 21.5 to 24 psi.

2.04 An indicator which is visible through an opening in the dial shows whether the pressure reading is to be made on the inner or outer scale.

2.05 The scale is so marked that the pressure in pounds, tenths, hundredths and 5-thousandths is read directly from the scale; the thousandths can be estimated by reading through a magnifying glass. A section of the scale illustrating the markings is shown below:



2.06 The instrument is calibrated with the dial in a horizontal position and all readings should be made in this way. However, accurate leveling is not necessary.

2.07 **Shock Mounting:** The instrument is mounted on rubber shock absorbers inside a metal shell which, in turn, is held in a padded canvas case. This protects the instrument from damage by mechanical shock and prevents vibration of the pointer which might lead to inaccurate readings.

2.08 **The Canvas Carrying Case** has a reinforced cover which protects the glass window. The case is equipped with two metal hooks around which the hose can be wound for storage. A canvas pocket is provided to house the no-loss chuck.

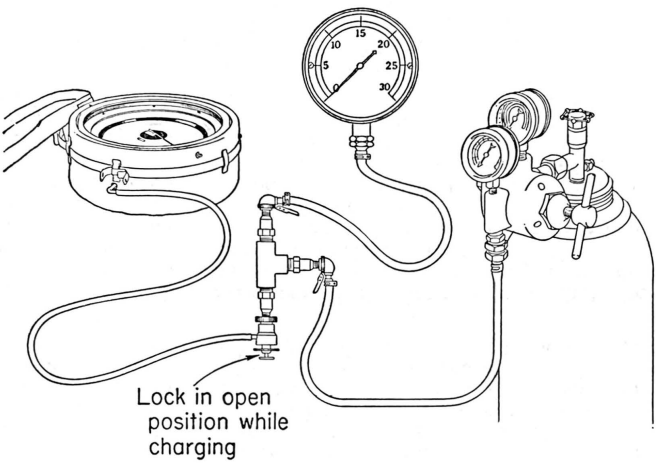
3. PREPARING MANOMETER FOR TEST

3.01 The gas chamber in this instrument holds about 150 cu. in. of nitrogen. In order not to disturb the pressure gradient in the cable, the instrument is charged to the approximate cable pressure from a nitrogen cylinder prior to taking the readings. Do not charge the instrument to a pressure above 24 psi; excessive charging may damage the operating mechanism.

3.02 This charging is done as follows, preferably about one hour in advance of making a pressure run.

(1) Measure the cable pressure at one of the end valves of the group where the gradient measurements are to be made, using a 3-1/2-inch pressure gauge that has been checked against a mercury manometer to be accurate within ± .1 lb.

(2) Connect the manometer and the 3-1/2-inch pressure gauge to a nitrogen cylinder as illustrated below. Slowly charge the manometer until the 3-1/2-inch gauge reading is about .2 to .3 lb. above the desired pressure. Then remove the regulator chuck quickly to avoid excessive loss of gas from the manometer.



(3) To adjust to the desired pressure, carefully bleed gas from the free valve by gently depressing the valve core or by loosening the valve core slightly, using a valve repair tool.

(4) Then lock the B chuck in the closed position and remove it from the 3-way fitting.

3.03 After charging the manometer, the pressure reading may rise or fall, depending on the relative temperatures of the instrument, the gas used for charging and the outdoor air. Therefore, before usable readings can be made, it is necessary to connect the charged instrument to one of the end valves of the group to be measured and allow it to remain for a period of about 30 minutes. This permits the temperature of the instrument and the charging gas to equalize with the air temperature. It also allows the manometer to adjust itself to the exact pressure of the cable.

3.04 When the instrument is in the sun, the dial should be shaded with the cover, or otherwise, so the sun does not shine directly on the mechanism through the pointer opening.

4. READING THE MANOMETER

4.01 Two men are necessary in reading the instrument; one reads the instrument and the other clocks and records the readings and makes check readings to preclude errors.

4.02 The timing should be done with a watch having a second hand.

4.03 The procedure used in reading the instrument depends on the rate at which the pressure in the cable is falling as a result of the leak.

4.04 To ensure accurate readings observe the following:

(1) Keep the glass face of the manometer clean.

(2) If it is raining, wipe the glass dry above the pointer; drops of water cause distortion of the view and may lead to error.

(3) Use the approved magnifying glass; a poor magnifying glass will cause distortion.

(4) Hold the magnifying glass horizontal at a distance that gives a sharp image of the pointer and numerals.

(5) Read the instrument through the magnifying glass. Make sure that the pointer is immediately over its image in the pointer mirror; otherwise the reading will be in error.

(6) Do not lean on the manometer while reading.

(7) Just before reading, tap the rim of the case gently with the finger to make sure that the pointer is moving freely.

4.05 **Slow Falling Pressure:** If the leak is such that the pressure at the valve falls no more than .001-.002 psi in a period of one or two minutes, proceed as follows: The instrument reader connects the B chuck to the valve and tells the timer when the core depressor is locked open. The timer then allows a lapse of one or two minutes, as agreed upon, and gives the reader a "get-ready" signal about 10 seconds before the "read" signal.

4.06 **Fast Falling Pressure:** If the leak is such that the pressure falls as much as .002 to .003 psi per minute, the instrument reader should connect the B chuck to the valve and tell the timer when the core depressor is locked open. The timer will indicate when one minute has elapsed. The reader then observes the pointer closely and gives the timer a "get-ready" signal a few seconds before the pointer is directly over one of the calibration lines. When the pointer is on the line, he signals "read" and the timer notes the time. The pressure reading is then recorded.

4.07 **Recording Time and Pressure:** The time is recorded in hours, minutes and seconds, to the nearest second. The pressure is recorded to the nearest .001 psi. The even pounds, tenths and 5-hundredths are read directly and the

thousandths are interpolated using the magnifying glass to facilitate reading.

5. STORING THE MANOMETER

5.01 To prevent accumulation of moisture in the manometer case, observe the following:

(1) Always charge the manometer to a pressure of 22 to 23 psi before storing.

(2) Make sure the chuck is closed and that the locking wheel is tight before placing the chuck in the canvas pocket.

(3) Do not kink the hose in looping it around the hose winding hooks.

6. MAINTENANCE

6.01 **Testing for Gastightness:** The instrument can be checked for gastightness as follows:

(1) Charge the manometer to approximately 22 lbs. psi. Place instrument indoors, out of the direct sun, and allow one or two hours for the instrument temperature to equalize with room temperature.

(2) Read and record the pressure indicated by the instrument as well as the room temperature near the instrument.

(3) After approximately 24 hours, again read the instrument and the thermometer.

(4) Convert each of the pressure readings to the equivalent pressure at 60° F. using the following formula:

$$P = \frac{(520)}{(t + 460)} P_t$$

P_t = Pressure at temperature t.

t = Fahrenheit temperature.

P = Equivalent pressure at 60° F.

(5) The overnight pressure loss, based on the corrected readings, should not exceed .10 psi in 24 hours.

6.02 If the pressure loss is greater than the permissible loss, check the external hose connections with soap solution and tighten the clamps if necessary. Also test the chuck as covered in the practices.

6.03 If the gas loss cannot otherwise be accounted for, check the seal of the glass window as follows:

(1) Charge the instrument to a pressure of about 22 psi.

(2) Carefully remove the instrument from the canvas carrying case.

(3) Lower the instrument and the hose into a container of clear water and observe for the presence of bubbles.

(4) If bubbles are seen adjacent to the glass retaining ring, carefully tighten the retaining ring screws with an appropriate screwdriver. If moderate tightening does not stop the leak, the instrument should be returned for repair in accordance with local routine.

(5) If bubbles develop at the hose connections, tighten the clamps.

(6) If bubbles develop in the hose itself, it should be replaced.

6.04 **Pointer Mechanism:** The pointer should move smoothly and without backlash. This can be checked as follows:

(1) Charge the instrument to 24 psi and then discharge the gas by operating the valve core depressor on the chuck. Observe the pointer to see that it moves smoothly. When the instrument is discharged, the pointer should come to rest at a position equivalent to a reading of 21.5 psi; the scale marker should be near the numeral 19.

(2) Then begin charging the instrument slowly. Stop charging at approximately 19 psi and carefully note the position of the pointer. Tap the instrument to make the pointer flutter. The pointer should come to rest at the position noted above.

(3) Continue charging in about 1/2-pound steps to 24 psi and repeat the tapping test to make sure that the pointer mechanism is functioning smoothly.

6.05 Abrupt stopping or jerky movement of the pointer on falling or rising pressure is an indication that the mechanism may have been damaged by dropping or other abnormal shock. In this event, the instrument should be returned for repair.

6.06 **Hose Replacement:** If the hose develops a leak near the hose connections due to bending, it can be repaired by cutting off a 2 to 3 inch section and reclamping. If the hose develops a leak at some other point or if the outer surface is cracked due to aging or otherwise damaged, it should be replaced.

6.07 Examine the replacing hose to see that the rubber is lively and does not tend to crack when it is stretched over the hose fittings.

6.08 Before placing the new hose, blow it out well with nitrogen to get rid of dirt particles that may tend to lodge in the chuck. The manometer is equipped with a filter to keep out dust.

6.09 After the new hose is installed, test the connections with a pressure testing solution to ensure gastightness.

7. REPLACEMENT PARTS

7.01 The standard listing for the replacement hose and clamp is as follows:

Hose, 6 ft., for 3/16-in. Pressure Testing Hose—Assembly
Clamp, Hose, 3/16-inch