BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G10.212.7
Issue 2, March, 1955
AT&T Co Standard

TESTING MANHOLE ATMOSPHERE
CARBON MONOXIDE INDICATOR

Contents **Page**

1. GENERAL

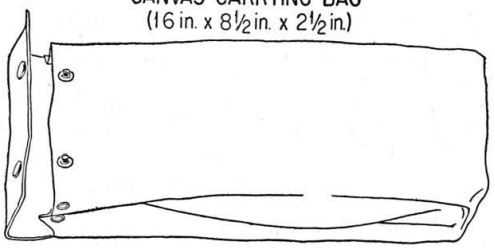
1.01 This section replaces Issue 1. It describes the Carbon Monoxide Indicator, the Carbon Monoxide Indicator Tube and the methods of using them to determine the presence of manufactured gas (carbon monoxide) and mixtures of manufactured and natural gases in manholes and cable vaults. This section has been revised to correct an error in the last sentence of Paragraph 3.02.

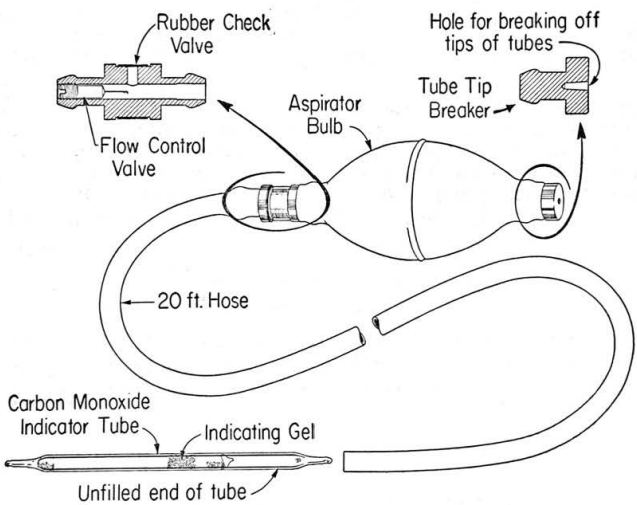
1.02 **Hydrogen Sulphide:** This indicator will not respond to hydrogen sulphide except when the concentration is high. Therefore, where it is necessary to test for low concentration of hydrogen sulphide, the **Carbon Monoxide Detector** shall be used.

1.03 The methods of ventilating manholes and cable vaults are covered in another section of the Practices.

2. CARBON MONOXIDE INDICATOR

2.01 The Carbon Monoxide Indicator, illustrated in the following sketch, consists of an aspirator bulb and a 20-foot length of hose. The indicator is supplied in a canvas carrying bag with a one-foot length of hose, a package of 12 rubber check valves and a package of 12 rubber caps. The indicator may be supplied by either the Mine Safety Appliances Company or the United States Safety Service Company. These indicators are similar in appearance and the replacement parts are interchangeable.

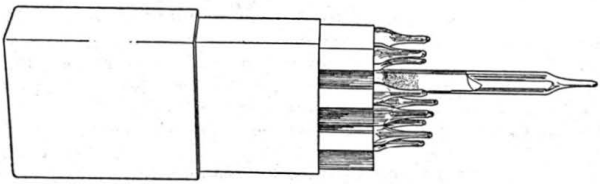




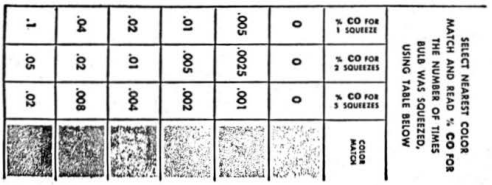
2.02 **Aspirator Bulb:** The end of the bulb to which the hose is connected is equipped with valves for regulating the flow of air through the tube and a rubber check valve. The other end of the bulb is equipped with a metal cap (Tube Tip Breaker) having a hole for breaking tips off indicator tubes.

3. CARBON MONOXIDE INDICATOR TUBE

3.01 **Tube:** The Carbon Monoxide Indicator Tube, which is the detecting element used in the indicator, is a hermetically sealed glass tube containing a yellow silica gel impregnated with a complex silico-molybdate compound catalyzed by means of palladium sulphate. The tubes are supplied in packages containing 12 tubes together with a color chart. A carton of tubes is illustrated in the following sketch. When exposed to carbon monoxide (CO) at about 70° F., the yellow silica gel turns green, the darkness of shade being directly proportional to the concentration of the carbon monoxide. At colder temperatures the tube will indicate less than the actual CO content and at higher temperatures it will indicate a slightly higher content. A tube can be used throughout the day provided no color change occurs. A tube that has changed color shall not be reused.

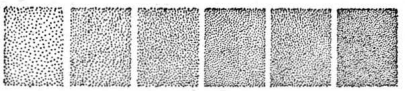


3.02 **Color Chart:** The color portion of the charts supplied by the Mine Safety Appliances Company and United States Safety Service Company are shown in the following sketches. The charts provide the means for determining the approximate concentration of the carbon monoxide in the atmosphere. This is done by comparing the color of the darkened silica gel with the colors on the chart. The atmosphere should be considered satisfactory if the color of the silica gel has not changed. ←



(MINE SAFETY APPLIANCES COMPANY)

SELECT NEAREST COLOR MATCH AND READ % CO FOR THE NUMBER OF TIMES BULB WAS SQUEEZED, USING TABLE SHOWN BELOW. ↓



% CO FOR 1 SQUEEZE	0	.005	.01	.02	.04	.1
% CO FOR 2 SQUEEZES	0	.0025	.005	.01	.02	.05
% CO FOR 5 SQUEEZES	0	.001	.002	.004	.008	.02
% CO FOR 10 SQUEEZES	0	.0005	.001	.002	.004	.01

One squeeze should be sufficient. If greater sensitivity is desired, use 2 squeezes. For extreme sensitivity, use 5 squeezes. For super sensitivity, use 10 squeezes. Read % in column showing total number of squeezes.

UNITED STATES SAFETY SERVICE COMPANY

FORM NO. 720 KANSAS CITY 6, MISSOURI PRINTED IN U.S.A.

3.03 Disregard the instructions on the color charts. Follow only those contained in this section.

4. TESTING MANHOLES

4.01 The Carbon Monoxide Indicator Tube should be prepared and used as outlined below.

(1) Break the tips off both ends of a tube in the tube tip breaker and place the unfilled end of the tube in the hose.

(2) Without entering the manhole, suspend the tube about the height of a man's head while at work and quickly and completely squeeze all air from the aspirator bulb. If a ventilating cloth is suspended in the manhole, the tube should be lowered on the sheltered side of the sail.

(3) After the bulb has inflated (about 30 seconds), raise the hose and remove the tube.

(4) Compare the color of the silica gel with the colors on the color chart. This is done by placing the tube on the chart over a color and then moving the tube from one color to another until the closest color match is obtained. If a change in color is observed, proceed to ventilate as covered in another section. The test shall then be repeated before the manhole is entered to ensure that the atmosphere is satisfactory.

4.02 **Cold Weather:** The reaction of the indicator to carbon monoxide decreases as the temperature falls. In order to compensate for the slower reaction that takes place when the temperature is 40° F. or lower, the aspirator bulb should be given **two squeezes** before the color comparison is made. A test at low temperature, even with two squeezes of the bulb may indicate less CO content than that present and therefore **any** change in color is an indication of unsatisfactory atmosphere.

4.03 In extremely cold weather, the tubes should be carried in an inside pocket so they will be kept warm by body heat. The tube used should be held in the bare hand prior to its being lowered into the manhole.

4.04 Generally it is not necessary to employ a thermometer to determine the temperature in the manhole as a satisfactory indication can be obtained by observation. When the outside temperature is 32° F. or lower, as indicated by frost or ice along the street or road, it can be assumed that the temperature in the manhole is 40° F. or lower.

4.05 **Reuse of Tube:** If a test does not discolor the silica gel, the tube may be used repeatedly throughout the day provided no discoloration takes place and the tube is sealed between tests. Seal the tube for subsequent use with the rubber caps or by slipping the ends of the one-foot length of hose over the ends of the tube. The tube shall be discarded at the end of the day. A tube that has changed color shall not be reused.

5. MAINTENANCE

5.01 **Tightness of Indicator:** Check the indicator once each week for over-all tightness as follows: With the indicator assembled, place an indicator tube with unbroken tips in the end of the hose. Completely deflate aspirator bulb and allow it to inflate. If the bulb inflates in a minimum of 5 to 10 minutes, the indicator is satisfactory.

5.02 If the bulb inflates in less than 5 minutes, remove the rubber check valve and clean around check valve opening. If cleaning does not stop the leakage, install a new rubber check valve. Then test for tightness as covered in Paragraph 5.01.

5.03 **Flow Control Valve:** When properly adjusted the bulb should inflate in 30 (± 3) seconds with the end of the hose clear (no tube in it). If proper flow cannot be obtained by cleaning the orifice or replacing the check valve, return the aspirator bulb in accordance with local routine.

5.04 The replacement parts for the indicator are listed below. These parts are interchangeable in the two makes of indicators.

Part	Manufacturer's Part No.	
	U.S. Safety Service	Mine Safety Appliances
Bag, Carrying, Canvas	WEC-47	BY-72776
Breaker, Tip, Tube	WEC-44	BY-72762
Bulb, Aspirator	WEC-40	BY-51693
Caps, Rubber, Pkg. of 12	WEC-48	BY-72768
Hose, 1 ft.	WEC-46	BY-72765
Hose, 20 ft.	WEC-45	BY-72763
Valve, Check, Rubber, Pkg. of 12	WEC-41	BY-72767