SECTION 637-225-105
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CABLE PRESSURE SYSTEMS

AIR METER AND AIR RATE INDICATORS

DESCRIPTION AND ARRANGEMENTS

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1. GENERAL

1.01 This section covers the description and arrangement of the air meter and air rate indicator, which are used to monitor the consumption and flow rate, respectively, of the dry air or nitrogen used in a ***nonpipe pressure system.*** The C or D meter-panels (Section 637-225-201) are recommended for new installations; however, the air meter and air rate indicator covered in this section can be fabricated into meter-panel arrangements to meet specific requirements.

1.02 This section is reissued to.

- Correct text and illustration covering the AT-7684X air rate indicator.
- Include the arrangement of air meters and air rate indicators to form a meter-panel assembly. This information formerly was contained in Section 637-225-200.

Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 For proper analysis of air usage in a pressure system, it is important to know the total amount of air being furnished to the system and to have a means of obtaining the instantaneous rate at which it is being supplied to each individual cable.

1.04 One principal function of air meters and air rate indicators is to indicate the presence of cable leaks within a specified distance from the office. This distance, which varies with different types of cable, is known as the monitoring range. It is the distance from the pressure source which is equivalent to a total pneumatic resistance of approximately 12 (see note). The air usage or flow rate will not show significant change if a cable leak should occur beyond the monitoring range.

> ***Note:*** This range is based on the fact that an increase in flow of 5 scfd or 0.2 scfh will result in a significant pressure drop (2.5 psi) up to 12 units of pneumatic resistance from the pressure source.

**Reprinted to comply with modified final judgment.

2. AIR METER

2.01 The air meter (Fig. 1) is a positive displacement type recording device in which the air is metered by the operation of two bellows. This meter, rated at 10 psi maximum working pressure, has a direct reading cubic foot index, and a single cubic foot proving circle.

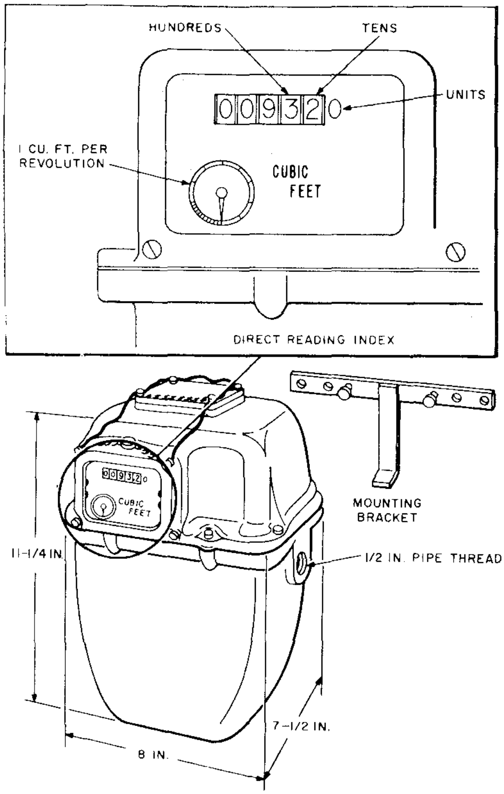


Fig. 1—Air Meter (AT-7650X)

2.02 The index on this meter records the air flow in cubic feet at the delivered pressure. For instance, if the regulator which feeds air to the meter is set at 9 psi pressure, the meter records cubic feet of air at that pressure. To determine the airflow at standard conditions (at sea-level pressure 14.7 psia and 68°F), a conversion is necessary from cubic feet at 9 psi gauge (9 + 14.7 = 23.7 psia) to standard conditions, 0 psi gauge (0 + 14.7 = 14.7 psia).

Example:

Indicated Flow—154 cubic feet
Regulator Setting—9 psi

$$\text{Flow at Standard Conditions} = \frac{9 + 14.7}{0 + 14.7} \times 154 = 248 \text{ cubic feet}$$

2.03 The air meter is used to measure the ***total amount*** of air being furnished to a cable system or to a part of a system. In general, one meter is used to measure the output to as many as ten cables. However, in some special cases, a meter is used to measure the air delivery to only one specific cable.

2.04 Periodic readings of the meter (either manually or automatically) will indicate any significant increase in air usage and therefore direct attention to a possible cable leak.

2.05 The meter reading (or the sum of the meter readings where more than one meter is fed from the same source) also serves to measure the total output of the air dryer or compressor-dehydrator. This is necessary in order to avoid overloading the unit, or loading the unit to the point where there is no reserve capacity for emergency conditions.

3. AIR RATE INDICATORS

3.01 Air rate indicators are devices for measuring the instantaneous rate of airflow into individual cables. Each indicator consists of a graduated glass tube mounted in a metal housing having threaded ports near the top and bottom. The glass tube contains either one or two floating ball indexes, depending on the type of indicator, and is graduated to show the airflow in standard cubic feet per hour (scfh) when the pressure is 10 psi gauge. The through port in the lower portion of the housing permits the connection of a group of indicators to form a manifold. The shutoff valve in the lower portion of the housing provides the means for disconnecting an individual cable from the air source without affecting airflow to other cables. The upper portion of the housing has one threaded port for making connection to an individual cable and a second port equipped with a pressure testing valve for measuring cable pressure or for introducing an auxiliary supply of air on a temporary basis.

3.02 ***AT-7684X Air Rate Indicator:***

(a) The AT-7684X air rate indicator (Fig. 2) is a dual-rate indicator having two floating ball indexes inside a clear glass tube and a metal marker located on the glass tube. The calibrated scale is located on the indicator housing. The upper ball (black) is read against the left-hand (black) scale in increments of 0.2 scfh, covering a flow range of 0.6 to 2.8 scfh. The lower ball (silver) is read against the right-hand (red) scale in increments of 0.5 scfh, covering a range of 2.5 to 7.5 scfh.

(b) At flows of less than 2.5 scfh, the lower ball (silver) remains at the bottom of the tube and the reading is taken from the position of the black ball against the black scale. At flows of 2.8 scfh or greater, the black ball stays at the top of the tube and the reading is taken from the position of the silver ball against the red scale.

(c) The high flow rate (red) scale is primarily useful on subscriber cable in the first stages of pressurization. With such cables, flow rates exceeding 2.5 scfh are not uncommon. The higher scale provides a means of determining the specific flow and also is helpful in indicating a significant change in flow which would result from a leak occurring close to the central office.

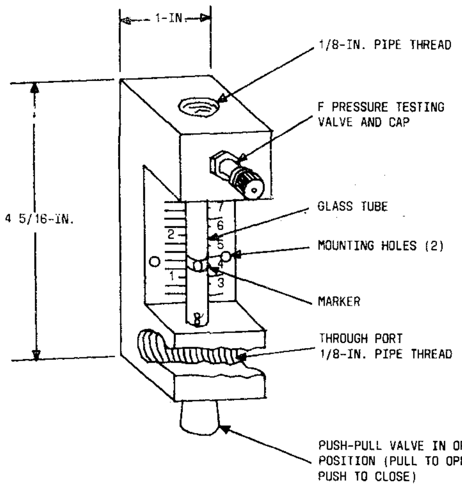


Fig. 2—Air Rate Indicator (AT-7684X)

3.03 Air rate indicators may be assembled in groups containing up to ten indicators, with each group fed from an individual air meter. The indicators are connected together by means of a 1/8-inch pipe nipple.

3.04 Indicator readings should be taken at the same time on each designated day. The readings should be taken early in the morning or late in the afternoon to minimize the effect of the sun on the air temperature in the cables.

3.05 In making comparisons among readings of several indicators (as when attempting to locate the particular cable responsible for an increase in air usage on the meter), it is important to distinguish between a cable that extends 2 or 3 miles in the underground and one of equal length which goes aerial a short distance from the office. The predominantly aerial cable will tend to show a lower rate than usual if the outdoor temperature is high, and a higher rate than usual if the outdoor temperature is low.

3.06 While it will seldom be necessary to convert the flow rate to its standard equivalent at other than 10 psi gauge, the method of converting is as follows:

$$\frac{\text{Actual Gauge Pressure} + \text{Atmospheric Pressure}}{10\text{ psi}^* + \text{Atmospheric Pressure}} \times \text{Indicated Flow} = \text{Actual Flow in scfh}$$

*Pressure at which the air rate indicator is calibrated to read standard cubic feet per hour.

3.07 For example, if the indicator reads 1.1 scfh and the pressure reading is 7 psi, the actual standard flow is:

$$\frac{7 + 14.7}{10 + 14.7} \times 1.1 = 0.97\text{ scfh.}$$

3.08 ***Air Rate Indicator—Superseded Type*** (Fig. 3): It is similar to the AT-7684X air rate indicator, except that it has a single-scale tube with a single floating ball index. It is calibrated to show airflow in the range of 0.2 to 2.0 scfh and has a toggle shutoff valve rather than the push-pull type.

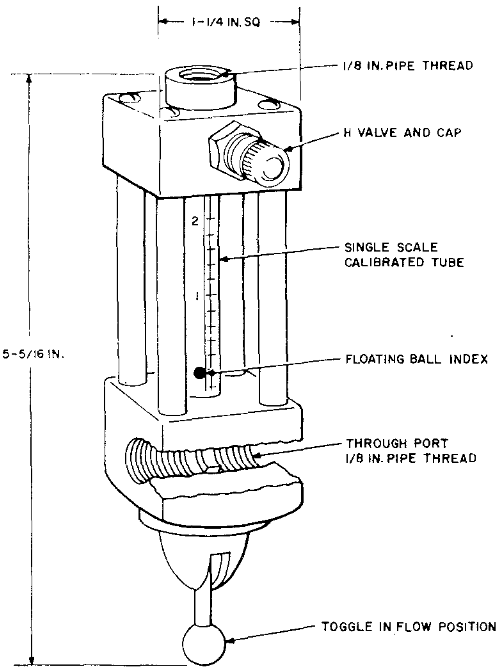
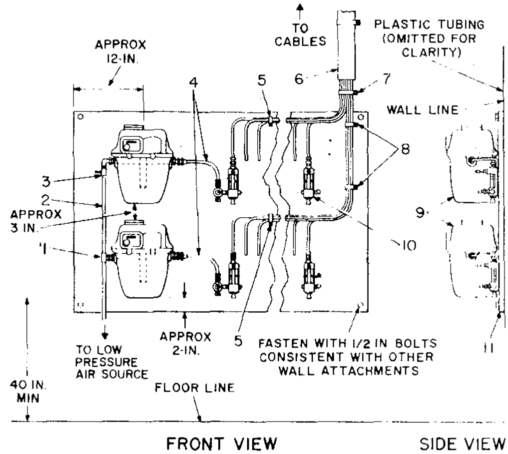


Fig. 3—Air Rate Indicator (Superseded Type)



ITEM	NAME
1	C PLASTIC PIPE FITTING
2	CA-3131 AIR PIPE
3	G PLASTIC PIPE FITTING
4	C PLASTIC TUBING (3/8 IN.)
5	NO 7 CABLE CLAMP
6	C PLASTIC TUBING GROUP
7	NO 25 CABLE CLAMP
8	NO. 13 CABLE CLAMP
9	AIR METER
10	AIR RATE INDICATORS
11	MOUNTING BOARD (3/4 IN PLYWOOD)

NOTE:
FOR DETAIL MOUNTING, REFER TO FIG. 6 AND 7 FOR AIR METER AND AIR FLOW INDICATOR, RESPECTIVELY.

Fig. 4—Meter-Panel Arrangement Using Plywood Backboard

4. AIR METER AND AIR RATE INDICATOR ARRANGEMENTS

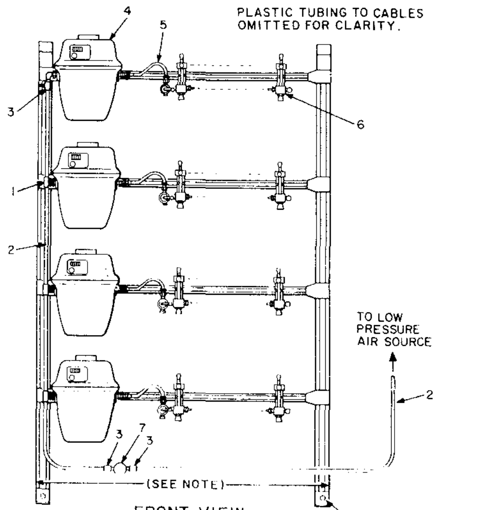
4.01 Because of the compactness, simplicity, and lower cost of installation, the C or D meter-panel (Section 637-225-201) is recommended for new installations. However, to cover additions to or modifications of existing panels, individual air meters and air rate indicators can be fabricated into meter-panel arrangements to meet specific requirements.

4.02 Figure 4 illustrates a typical arrangement for a small office, using a plywood backboard for mounting the various components.

4.03 C plastic tubing (3/8-inch) is adequate between the air meter and the air rate indicator, but CA-3131 pipe may be required between the air source and the air meter. In all installations, the size of the tubing generally will be specified.

4.04 The number of air rate indicators per air meter will be specified on the work plans.

4.05 The use of framing channels also provides a flexible configuration of meter-panel arrangements. A typical arrangement for a large office is illustrated in Fig. 5. Refer to Section 622-700-100 for ordering information on framing channels.



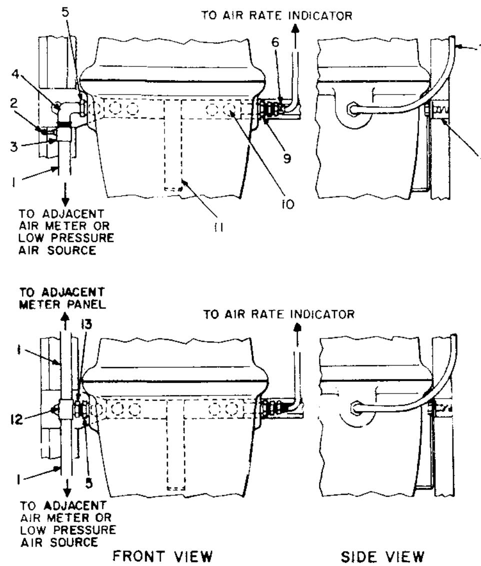
NOTE:
1. 45-IN. FOR 8 AIR RATE INDICATORS PER ROW
48-IN FOR 10 AIR RATE INDICATORS PER ROW
2. FOR DETAIL MOUNTING, REFER TO FIG. 6 AND 7 FOR AIR METER AND AIR RATE INDICATOR, RESPECTIVELY.

ITEM	NAME
1	C PLASTIC PIPE FITTING
2	CA-3131 AIR PIPE
3	G PLASTIC PIPE FITTING
4	AIR METER
5	C PLASTIC TUBING (3/8 IN.)
6	AIR RATE INDICATOR
7	3/8 IN. BALL VALVE (263B-4A IMPERIAL EASTMAN)

Fig. 5—Meter-Panel Arrangement Using Framing Channels

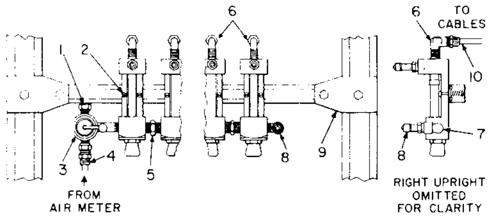
5. MOUNTING DETAILS FOR AIR METERS AND AIR RATE INDICATORS

5.01 Figures 6 and 7 illustrate the mounting details for air meter and air rate indicators, respectively, with a listing of the items required.



ITEM	NAME	BSP REFERENCE
1	CA-3131 AIR PIPE	637-050-100
2	F PRESSURE TESTING VALVE WITH CAP	637-235-100
3	G PLASTIC PIPE FITTING	637-050-100
4	1/4 IN. STREET ELBOW	
5	1/2 IN. BY 1/4 IN. BUSHING (110-B)	
6	B PLASTIC TUBING FITTING (3/8 IN.)	637-235-100
7	C PLASTIC TUBING (3/8 IN.)	
8	P-6000 CROSS MEMBER	
9	1/2 IN. BY 1/8 IN. BUSHING (110-B)	637-235-[illegible]
10	1/4 IN. BY 7/16 IN. HEX HEAD CAP SCREW P-6006-1420 NUT	
11	MOUNTING BRACKET	
12	C PLASTIC PIPE FITTING	637-050-100
13	1/4 IN. HEX NIPPLE (122-B)	637-235-100

Fig. 6—Mounting Details for Air Meters



ITEM	NAME	BSP REFERENCE
1	C PRESSURE FLANGE PLUG	637 235 201
2	NO 8-32 BY 5/8-IN R.H. MACHINE SCREW AND P-6006-0832 NUT FOR FRAMING CHANNEL MOUNTING NO 8 BY 3/4-IN. R.H. WOOD SCREW FOR PLYWOOD BACKBOARD MOUNTING	
3	AT-7683 X SHUT-OFF VALVE	
4	B PLASTIC TUBING FITTING (3/8 IN.)	
5	1/8 IN HEX NIPPLE (122-B)	637-235-100
6	C PLASTIC TUBING FITTING (3/8 IN.)	
7	1/8 IN STREET ELBOW (116-B)	
8	F PRESSURE TESTING VALVE WITH CAP	
9	P-46065 TWO HOLE SPLICE PLATE	622-700-100
10	3/8 IN C PLASTIC TUBING	637-235-100

Fig. 7—Mounting Details for Air Rate Indicators

6. INSTALLATION OF PLASTIC TUBING

6.01 The plastic tubing between the meter-panel and the individual cables should be installed with consideration for the following:

(1) It should be located where physical damage is unlikely.

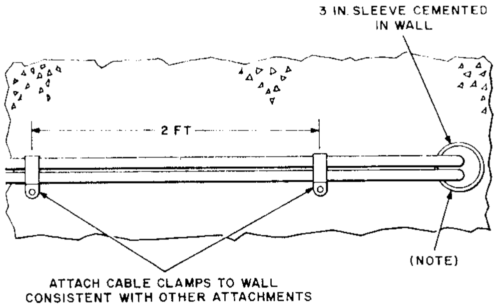
(2) It should be supported without sag, and excessive pressure at clamps should be avoided.

(3) Holes in cable vault walls should be made according to accepted practices and made airtight after tubing is installed.

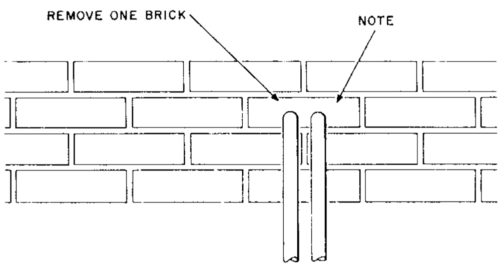
(4) Attachments inside the cable vault should not interfere with existing cables and, where possible, avoid future cable locations.

6.02 A typical entry to a cable vault is shown in Fig. 8. The size of cable clamps for each tubing configuration is shown in Table A.

6.03 The steel framework in the vault should be utilized for supporting the tubing, whenever possible.



PLASTIC TUBING THROUGH CONCRETE



PLASTIC TUBING THROUGH BRICK OR BLOCK

NOTE:
PACK FIBERGLAS AROUND TUBING AND FINISH SURFACE WITH A 1/4 IN. TO 1/2 IN. LAYER OF PLASTER OF PARIS.

Fig. 8—Plastic Tubing Entering Cable Vault

TABLE A

CABLE CLAMP SIZES

NUMBER OF HARNESSES	TUBE DIAMETER (INCHES)	NUMBER OF TUBES PER HARNESS	OUTSIDE MEASUREMENTS (INCHES)	MINIMUM BENDING RADIUS (INCHES)	AT-6933 CABLE CLAMP NUMBER
1	1/4	1	1/4 X 1/4	1.5	4
1	1/4	4	13/16 X 5/8	1.5	13
1	1/4	7	7/8 X 13/16	2.0	13
1	1/4	10	13/16 X 1-1/16	2.5	17
1	3/8	1	3/8 X 3/8	2.5	6
1	3/8	4	1-3/16 X 7/8	2.5	17
1	3/8	7	1-3/16 X 1-1/4	3.0	21
1	3/8	10	1-3/16 X 1-5/8	3.5	25
2	1/4	4	1-1/4 X 13/16	2.0	21
2	1/4	7	1-5/8 X 7/8	2.5	25
2	1/4	10	1-5/8 X 1-1/16	3.0	25
2	3/8	4	1-3/4 X 1-3/16	3.0	30
2	3/8	7	2-3/8 X 1-1/4	3.5	35
2	3/8	10	2-3/8 X 1-5/8	4.0	35