TYPE CE RECORDER OR INDICATOR

INDEX

<table>
<thead>
<tr>
<th>Explanation of Nomenclature</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>3</td>
</tr>
<tr>
<td>Adjustment and Calibration</td>
<td>5</td>
</tr>
<tr>
<td>Replacement Parts</td>
<td>8</td>
</tr>
</tbody>
</table>

The Type CE Diaphragm Operated Air or Gas Flow Recorder or Indicator (Figure 1) measures a pressure drop across an orifice or boiler and records or indicates the measurement in terms of flow on a uniformly graduated chart or scale.

The Recorder or Indicator consists of a diaphragm mechanism connected to the pivot point of a beam by linkage. One end of the beam is attached to a yoke which is connected to the recording pen or indicating pointer. A parabolic displacer suspended from the other end of the beam extracts the square root function.

An increase in differential pressure applied to the diaphragm mechanism moves the diaphragm. This motion is transmitted thru linkage to the balance beam and causes the beam to rotate. Movement of the beam is transmitted thru linkage to position the recording pen or indicating pointer.

CROSS REFERENCE

<table>
<thead>
<tr>
<th>Instrument or Equipment</th>
<th>Instruction Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of Orifices and Flow Nozzles</td>
<td>G22 1</td>
</tr>
</tbody>
</table>
EXPLANATION OF NOMENCLATURE

TYPE
C E 3
MODEL
3 Indicator (Sector Scale)
5 Recorder
1 Small Parabolic Displacer
2 Large Parabolic Displacer

CHART
DRIVE
S A M A

TYPE
POWER
MODEL
INTERNAL ILLUMINATION
MOUNTING

F Flush Mounting
W Wall Mounting

0 No Illumination
1 Fluorescent 115v, 50 60c
3 Fluorescent 115v, 25c

E Electrical
M Mechanical
N None

Electrical
Mechanical
None
1 115v, 60c
2 115v, 50c
3 115v, 25c

Rotation
Electrical
Mechanical
None
0 None
24 Hours 0 0
1 12 Hours 1 1
2 8 Hours 2 2
4 4 Minutes 4
5 24 Minutes 5
7 7 Days 7 7

An 'X' in any Nomenclature position indicates that the variation is special. An 'X' as a suffix indicates that the Recorder or Indicator includes a special feature not covered by Nomenclature.
FIGURE 1 Typical Assembly of Type CE Air Flow Meter

INSTALLATION

The parabolic displacer assembly and air flow beam (Figure 6) are factory calibrated and marked with the Recorder or Indicator serial number before shipment. The displacer is packed in a separate carton. The air flow beam and all remaining parts are packed inside the Recorder or Indicator case. After installing the Recorder or Indicator, check calibration as outlined on page 5.

Mounting

1. Remove all parts and packing from Recorder or indicator case.

2. Mount Recorder or Indicator as shown in Figure 2. Level instrument from left to right and from front to back. Then fasten securely.

3. Assemble drop link to beam as shown in Figure 1. Moving parts must be free of friction.

4. Make certain reservoir is free from dirt or dust accumulations. Correct amount of mercury is shipped in a plastic container and tagged with Recorder or Indicator serial number. Slowly pour mercury into reservoir. Do not spill mercury during this operation.

5. Insert displacer in reservoir (see Figure 1).

Chart and Recording Pen (Type CE35 Recorder)

1. Remove chart clamp nut (Figure 9) and raise pen lifter.

2. Place chart on chart plate so edges fit under chart plate tabs. Make certain that correct chart is used. (Chart number is listed on nameplate inside Recorder case and on the Specification Sheet in front of this Instruction Book.)
3. Replace chart clamp nut and lower pen lifter

4. Make certain pen bears lightly on chart. If necessary, bend pen arm outward slightly until pen just touches chart.

Pen or Pointer Zero

1. With mercury in reservoir and beam resting at zero stop, check that recording pen (Type CE35) or indicating pointer (Type CE33) reads zero. If pen or pointer does not read zero, loosen two clamp screws (Figure 1) holding pen or pointer arm to yoke and set pen or pointer zero, tighten screws. Do not change zero stop position.

2. Make certain beam knife edges are clean, sharp, and seat properly and that beam is free from friction at all points.

Placing Pens in Service (Type CE35 Recorder)

1. Fill recording pen with Bailey Special Recorder Ink. DO NOT USE OTHER INKS. Pen arm is enameled the color of ink to be used in pen.

2. If pen does not start inking quickly, squeeze top and bottom of ink reservoir between thumb and index finger to force ink thru spout. Another method is to work a fine wire back and forth in pen spout. A package of wire pen cleaners is furnished with the Recorder. Do not alter shape of spout to facilitate inking.

Piping Connections

1. Install unions (and shut off valves if provided) below Recorder or Indicator case (see Figure 1).

2. Make certain all air connections to the diaphragm mechanism are tight.

3. If flow is measured thru a boiler or duct, make draft and pressure connections at boiler as shown in Figure 3. If flow is measured thru a pipe line, refer to Instruction Section G22.1. Make piping connections from boiler or duct to Recorder or Indicator as shown in Figure 4.

Power Supply

1. Make power connection to Recorder (or Indicator if electrical components are included) at plug connection (on side of case shown in Figure 2).
2. Attach mating plug to a cord from power source.

3. If Recorder or Indicator is located in a damp or dusty location, remove plug and make power connection at terminal blocks inside case near conduit hole. Use 3/4-inch flexible conduit. Install a switch to turn power off and on.

**Internal Illumination**

1. If Recorder or Indicator is equipped with fluorescent lighting, the starter and lamp are packed separately. For best results, operate lighting system within voltage limits specified on ballast.

2. Insert starter in receptacle provided in lamp socket (Figure 8). Securely place lamp in holder. If lamp starts slowly, reverse starter poles.

3. If lamp fails to light, check for loose connections before replacing starter or lamp.

---

**ADJUSTMENT AND CALIBRATION**

The Type CE Diaphragm Operated Air or Gas Flow Recorder or Indicator is factory calibrated and should require no further adjustment. However, before placing in service, check calibration as outlined below. Refer to Figure 1.

**Calibration Check**

1. Close shut off valves (if provided) and disconnect unions at connections H and L. Pen or pointer should read zero chart or scale. If not, check that beam rests against zero stop.

   a. Make certain displacer does not rub against sides of reservoir.

   b. If beam rests against stop, loosen two clamp screws (Figure 1) holding pen or pointer arm to yoke and set pen or pointer on zero chart or scale line. Tighten screws.

   c. If beam is not resting against stop, check beam and linkage mechanism for friction (Do not change zero stop setting to correct pen or pointer reading.

2. Connect Recorder or Indicator H connection to a calibration outfit similar to that shown in Figure 5.

3. Check pen or pointer readings at three or four points over the given differential pressure range (such as 30, 50, 70, and 90%). To check readings between zero and 100% chart or scale, determine the applied differential pressure required to obtain desired chart or scale readings as follows:

\[
\text{\% chart or scale reading desired} \times \text{maximum differential pressure range value} = \text{applied differential pressure}
\]

**EXAMPLE**

To check pen or pointer reading at 40% chart or scale when the maximum range value is 5 in. \(H_2O\), apply 8 in. \(H_2O\).

\[
(0.4) \times 5 \text{ \(H_2O\)} = 8 \text{ \(H_2O\)}
\]

4. Apply correct differential pressure (determined in step 3) and note chart or scale readings.

   a. If average up and down readings below 50% chart or scale are incorrect, turn balance weights IN slightly to decrease reading or OUT to increase reading. Then apply zero differential and check that pen or pointer returns to zero chart or scale (refer to steps 1b and 1c)

   b. If average up and down reading at 50% chart or scale is incorrect, ADD a few drops of mercury (with eye dropper) to reservoir to increase reading or REMOVE a few drops to decrease reading. Then apply zero differential and check that pen or pointer returns to zero chart or scale (refer to step 1b and 1c).

   c. If average up and down readings between 70 and 100% chart or scale are incorrect, it is necessary to make a range adjustment using the radius arm as outlined in step 5. Then repeat entire step 4 until correct chart or scale readings are obtained.

**NOTE**

The radius \(R\) was established during factory calibration and set to give the correct pen or pointer travel for the instrument differential pressure range (see Specification Sheet in front of this Instruction Book).

5. To re-establish radius \(R'\) (Figure 1) to give correct pen or pointer travel for instrument range.
FIGURE 3  Recommended Piping Connections at Boiler Settings and Ducts
a. Loosen maximum travel stop. Apply differential corresponding to slightly more than maximum differential range value. Set stop so it just touches beam, tighten stop screw.

b. As a starting point, loosen radius screw and set radius "R" to equal 1 1/2 inches.

c. Apply differential corresponding to maximum range value. Loosen radius screw and position drive link to increase or decrease radius "R" until correct chart or scale reading is obtained at 100% chart or scale, tighten stop screw.

d. Repeat steps 4 and 5 until correct chart readings are obtained.

6. With beam resting against zero stop, the mercury depth gage should just touch surface of mercury without denting it. If not, adjust mercury depth gage (shown in Figure 1) to desired setting for a future reference point.

7. To place instrument in service, connect unions (and open shut-off valves if provided) below Recorder or Indicator case (Figure 1)

NOTES

- Connect No. Line 5: 75 feet or less - use 4 Standard Steel PPE or following size; 3/8 OD Soft Annealed Seamless Copper Tubing and suitable Fittings.
- Connect No. Line 5: longer than 75 feet - use 2 Standard Steel PPE or following size; 3/8 OD Soft Annealed Seamless Copper Tubing and suitable Fittings.
- 2 for PPE use 1 or 3/4 Tees or Plugs depending on PPE size.
- 3. Use 1 or 1/2 Unions depending on PPE size.
- 4. Use 1/2 or 5/8 Bushing depending on PPE size.
- 5. Use 7 or 3/4 Unions depending on PPE size.
- 6. Important: Slope Piping to Avoid Pockets or low Points where Condensate can Collect. If low points are unavoidable, install drip pockets at these points. Y's are suggested that a drip pocket be installed at point A.

ALL PIPING MATERIAL NOTES APPLY EQUALLY TO BOTH LINES.

FIGURE 4  Recommended Piping Connections from Boiler or Duct to Recorder or Indicator
REPLACEMENT PARTS

Spare Parts Kits

The Spare Parts Kits shown in Figures 7 and 8 should be carried in stock. Specify the Spare Parts Kit part number to order a complete kit.

Ordering Individual Parts

Figures 6, 7, 8, and 9 are Parts Drawings of the Type CE Diaphragm Operated Gas Flow Recorder mechanism and case. Normally these drawings will apply to the instrument furnished. However, there may be individual differences in specific instruments because of:

- design changes made since the printing of this Instruction Section, or
- special design of equipment furnished to make it suitable for specific application.

Therefore, when ordering parts, assure receipt of correct replacements by specifying on the order:

1. complete nomenclature and serial number (stamped on instrument nameplate) of equipment for which parts are desired, and
2. the Parts Drawing on which each part is illustrated (The Parts Drawing Number is given in the Figure caption.)

FIGURE 5 Typical Calibration Outfit
FIGURE 6 Parts Drawing M61 5, Type CE Displacer Mechanism
FIGURE 7  Parts Drawing M61-15, Type CE Diaphragm and Air Flow Beam Assembly
FIGURE 9 - Parts Drawing G92 35, Chart Plate and Chart Drive