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FUNDAMENTALS OF ORIFICE METER CHART RECORDERS

Class # 1180

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Introduction

There are two basic components that need to be discussed to understand the fundamentals of orifice meter measurement. One is the Primary Element, which consists of the orifice fitting, orifice plate, meter tube, and other associated components.

The other is the Secondary Element, which consists of the equipment used to measure and record the values needed to calculate a volume of gas passing through the Primary Element.

Objectives

The purpose of this session is to familiarize you with the two basic components, so that you will be able to recognize and define the parts of each, and be able to identify and use them properly.

Primary Element

1. The Components of the Primary Element are the meter tube, which is the core of the Primary Element. The meter tube contains:

Two sections of pipe one upstream and one downstream of the same diameter as the orifice fitting.

The orifice fitting. Containing two pressure taps. Each tap, one upstream and one downstream being centered 1" from surface of orifice plate.

The orifice plate holder, seal ring or gaskets, and an orifice plate.

Associated Components, such as thermowells, flow conditioners, vent valves, and isolation valves.

Secondary Element

1. The Components of the Secondary Element are the metering device and the piping from the orifice fitting to the meter.

a. Meter piping connects upstream and downstream side of orifice fitting to upstream and downstream side of the bellows unit housing on the meter device. There should be a manifold in the piping scheme containing by-pass valves, bleed-off valves, and shut-off valves.

Meter devices in this discussion will be referred to as a Differential Pressure Chart Recorders. They should contain a bellows unit, a static pressure device, chart drive, and if desired a temperature recording device.

Types of Charts

There are three main types of charts that are commonly used for chart recorders. The percentage chart is a universal chart that can be used on any type of meter set-up. The range and rotation of the meter is all the integration office needs to successfully integrate percentage charts. The linear chart should reflect the range and rotation on the chart itself. It is divided into ten major increments as is the percentage chart. The L-10 chart is calibrated for square root measurement on the chart. It is calibrated from 1 root to 10 roots. When L-10 charts are used the atmospheric zero pressure is set on the chart. When the meter is removed from service it will reflect the atmospheric zero on the chart. It will not return completely to the zero line as it will on percentage and linear charts.

Installation

There should be two valves installed in the taps on the orifice fitting. From these valves gauge lines will be piped to the manifold which is attached to the Chart Recording Device. The Chart Recording Device can be positioned upstream or downstream of the orifice fitting at a distance that will work for the surroundings. The distance from the orifice fitting is not critical, but should be as close to the orifice fitting as the surroundings will allow. The height above the orifice fitting can be critical. The Chart Recording Device should be piped so there is a slope of a 1" minimum per foot in the gauge lines that will allow moisture in the lines to drain back to the meter tube. The purpose for the slope is to prevent the lines from freezing in cold weather. Lines that are frozen will cause false pressure readings.

Operation

When the Chart Recording Device is properly installed and pressure is applied it will sense the difference in pressure from one side of the orifice plate to the other side. Hence, the term differential pressure. This pressure is applied to the upstream side of the bellows device on the back of the recorder causing fluid inside the bellows to be transferred from one side to the other side which in turn rotates a torque tube shaft that is connected to a link and lever system onto which the pens are mounted.

The static element is a metal coil of stainless steel material and is mounted in the top right corner of the chart recorder case. It is connected to the downstream side of the manifold by a 1/8th inch ss tube. When pressure is applied the static element will make an uncoiling action and the movement will be transferred to the pen by a link and lever system.

There may be a temperature system inside the chart recorder. It will be a capillary tube with a sensor bulb attached to the end of the tube. The temperature system is a coil type unit and acts much the same as the static element when temperature is applied in that it will attempt to uncoil. That action is transferred to the pen by a link and lever system.

The ranges of these three devices are determined by the application in which they will be used.

The charts used on the chart recorder should match the range of differential, static, and temperature that is installed in the recorder.

Summary

All Primary and Secondary Elements should be built and installed according to AGA Specifications. As was discussed, there are different types of orifice fittings that can be used successfully as long as they meet AGA Specs. The same can be said for orifice plates, meter tubes, associated components, and chart recording devices. Brand of parts and devices is a personal preference and is not a concern as long as AGA Specifications are not compromised.