COPING WITH CHANGING FLOW REQUIREMENTS AT EXSISTING METERING STATIONS

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Introduction

In today's competitive gas market, utility companies must meet aggressive market strategies or suffer the consequences. All industries have cash registers, and gas distribution is no exception. Our measuring stations are our cash register. The problem is, these stations were designed 10, 20, 30 or even 50 years ago, and are now performing tasks they were not designed for. Therefore, changes must be made.

Measurement personnel today must be trained and taught to cope with changing flow requirements. But, modifying a station to meet today's aggressive market can be very expensive. Equipment, such as regulators and the primary element (the meter tube, the orifice plate holder, and the orifice plate), must meet A.G.A. 3 requirements. The secondary element (the recording device) can raise expenditures significantly. Sometimes modifications cannot be made to deliver the specified volume of product needed, and replacement of a complete station is even more expensive. Companies today must watch money closely, and work to reduce operating and maintenance costs.

To handle these situations effectively, technicians must be trained and taught to cope with changing flow requirements. Knowing your stations and their characteristics are an absolute. Technicians must become familiar with the kind of equipment their station has, and its proper use. The goal here is to detail the appropriate methods and equipment required to handle these tasks.

Equipment

Regulators must be sized correctly to the volume that is needed. Core sizing, spring ranges and other internal components are all adjustments that a technician can use to respond to changing flow requirements. Regulators affect several things in the flow requirement chain. Technicians must be aware of critical flow. Critical flow exceeds the high demand beyond the capacity of that specific regulator, which creates an excessive pressure drop and reduces load capacity. If the measurement device is downstream of the regulator, sometimes a simple adjustment on the regulator can assist in measuring the flow.

Reducing pressure by adjusting down a regulator will increase the velocity of the gas, and raises the differentials. When raising pressure by adjusting the regulator setting, you will decrease the velocity of the gas and reduce differential. Pressure reduction results in a roughly one degree temperature decrease for each 15 pounds of pressure cut. Excessive pressure changes upstream of an orifice meter could introduce potential measurement errors. Not applying correction factors for gas temperatures, which are any value other than 60 degrees, will also affect your measurement. An approximate one-percent measurement error occurs for every ten degrees of gas temperature. Regulator pressure reductions will also cause freezing problems if the reduction is too large.

Primary Element

The primary element (the meter tube) is the main component in the flow chain. All meter tubes must meet A.G.A. 3 requirements. Meter tube lengths can be reduced with the use of straightening vanes or flow conditioners. These vanes are smaller-diameter pipes bundled together and placed inside the inlet part of the tube. These vanes will evenly space the flow straight through the orifice plate without turbulence. The newer flow conditioners perform as well as (and in many cases better than) straightening vanes. Research indicates that they provide a higher level of accuracy, with beta ratios above 0.60. The ability to use a larger-diameter plate expands the flow capacity of a meter. The orifice plate holder must also meet A.G.A. 3 requirements. Taps on flanges and fittings are precise and cannot be deviated. Centering rings are required for high-pressure orifice flanges, and must be used to keep orifice plates precisely centered.

The orifice plate is the final piece of the primary element. Any deviation from absolutely correct usage of the orifice plate will cause major measurement errors. The orifice plate must be sized to allow the proper flow requirement. Under-sized orifice plates will cause critical flow (excessive differentials). Too large of an orifice plate will make it difficult to detect the correct pressure differences between the flange or fitting taps. Under these circumstances, low flow may not be detected or seen by the meter. Orifice plates must be clean, and free from foreign debris such as grease and dirt. Orifice plates must also be positively straight with no dishing, dents, or nicks.

When using beveled plates, the bevel must be inserted into the holder with the bevel facing the downstream tap. Improperly inserted beveled orifice plates can result in an error of as much as 15%. A rule of thumb when sizing orifice plates is: one pound pressure drop across the orifice plate will result in 27.7 inches of water column or differential on the meter.

Secondary Element

The final piece of equipment in the flow chain is the secondary element or recording device. There are several kinds on the market today. A chart recorder that uses a bellows and mechanical linkage was the mainstay in our industry for many years. When using this type of recorder, the differential must be kept at an optimal range on a chart. There are also different spring ranges, and bellows springs that will help the technician size the recorder for the operating flow.

The major problem with the chart recorder is that it has limited range ability. Any volumes that over range or under range on these devices will be lost. The electronic flow meter (EFM) was designed to assist the technician with range ability. The range of a bellows type meter is only as good as the springs installed in the meter itself. Spring ranges usually range from 0 to 20 in., 0 to 100 in., and 0 to 200 in. The range of an EFM can run as much as 0 to 700 in., but this depends on the transmitter itself. Electronic flow meters can quickly detect smaller changes in differentials. They also provide larger range options.

The EFM is also used to transmit volumes and pressures to SCADA systems and control centers. This information can be updated up to the minute, so that flow equipment changes and/or flow problems can be detected. The EFM is also linked with the chromatograph, or gas analysis equipment, allowing real-time measurement. All corrections for analytical data are made within the EFM. Just as flowing temperatures affect volume calculations, gas composition does as well. For example, a .005 change in relative density (gravity) impacts volume by an approximate 1%. EFMs are also used for pulsation problems and uneven flow characteristics. One of the most important benefits of an EFM is remote access. Data can be transferred from the meter to the measurement department via telephone, radio and microwave systems.

Turbine and ultrasonic meters are also used for measurement. Turbine meters are used at stations that require a wide range of measurements. Turbines also eliminate the use of orifice plates. The ultrasonic meter is used when measuring large volumes of gas. Straightening vanes again are needed to keep the flow straight without turbulence. The flow must be evenly spaced when it passes by the turbine modules.

When using these types of meters, the gas must be clean and free from debris. Debris will cause major problems with the modules, and cause measurement to be lost. Ultrasonic meters are very good in large capacities, but they have their faults. Debris and liquid can cause major measurement errors in these meters. The use of filters and strainers will help eliminate these types of problems. The positive quality of this meter is that there are no restrictions inside the unit, such as an orifice plate or turbine module. The ultrasonic uses transducers to measure the velocity of the product as it passes through the instrument.

Customer Demands

Dealing with customer demands and industrial requirements must be continually evaluated. Planning and engineering departments should keep this task well within reach of any goals. Communication is the one major tool a company has at its disposal to help predict future growth, or any industrial expansion projects. The lines of communication must be kept open and clear to customers. Customers must be able to communicate with any part of a company from planning and engineering, to sales and field representatives. It must be a significant goal of any company or its employees to set goals with every customer. If these goals are not maintained, then companies can be labeled as unreliable, and this could result in loss of revenues and employment opportunities.

With the onset of the deregulation, utility companies must be competitive. Industry terms such as “transportation fees,” “split contracts” and “nominations” must be understood. Companies must be diverse and adaptable to this type of market. Our meter stations designed 20 to 50 years ago are being asked to do tasks that they were never designed for. Companies must keep the measurement and pipeline capacities updated to prevent product and revenue loss.

Conclusion

Companies must cope with the changing flow requirements in today’s market. The use of technically advanced equipment is more readily available to our industry than ever before. These instruments provide customer satisfaction and company flexibility to meet market demands.

There are two major keys for fulfilling our responsibilities and our customer demands. First, we must know how to use all of the optimal ranges within the metering stations. Secondly, we must communicate with our internal and external customers throughout the entire process. If companies are to be successful in today’s volatile business environment, they must meet aggressive market strategies or suffer the consequences at the cash register. Our metering stations are our cash register. That is why technicians must know all areas of their responsibilities, and the customer requirements at our metering stations.