INTRODUCTION

Rotary gas meters have been in use for over sixty years in the natural gas distribution industry. Over the years the construction has switched from heavy cast iron bodies to lighter, high strength aluminum. Advances in manufacturing techniques such as CNC machining centers have enhanced the measurement performance of the rotary meter.

Traditionally rotary meters are installed in applications requiring a flow capacity of 1,000 to 23,000 cfm.

PRINCIPLES OF OPERATION

Rotary gas meters measure the gas by positively displacing or capturing the gas in a measurement chamber. Gas entering the inlet of the rotary meter pressure body produces a differential pressure across the meter, which causes the two impellers to rotate. The timing gears synchronize the impellers to turn in opposing directions. Each rotation of the impellers measures four displaced volumes of the gas.

The meter module converts the rotation of the impellers into standard non-compensated (NC) units of volume that, depending on the module type, may also convert the NC volume to standard base temperature and/or pressure conditions. This converted or compensated volume is what is used for the measurement of the custody transfer or billing of the gas.

METER TYPES

Rotary gas meters are available in several pressure ratings and with a variety of module types to meet the diverse requirements of the gas industry. For the purposes of this paper, the most common type with a 175 psig MAOP and an ANSI 150 flange connection will be addressed.

Standard Counter (STD CTR)

Standard counter meters provide a non-compensated (NC) registration of the gas. This type of meter is typically installed in applications where the gas temperature remains near to the base temperature (60°F).

Temperature Compensated Counter (TC)

In cases where the temperature of the natural gas varies substantially from the base temperature (60°F), the measurement of the natural gas may be converted to a volumetric equivalent of this base temperature condition. The TC module measures the gas temperature with a bi-metallic probe and converts the non-compensated (NC) volume by employing a combination of a temperature cam and striker lever assembly.

Electronically Compensated Module (ECM2™)

The electronically compensated module employs a solid-state sensor to sense the rotation of the impellers and produce a high-resolution input (three pulses per impeller rotation) of the non-compensated (NC) metered gas volume. These volumetric input pulses are converted to the base temperature condition (60°F), using the programmed routines in the microprocessor and the
temperature value from the sensor, to perform the necessary calculations.

**Instrument Drive (STD ID or DCID)**

Instrument drive meters permit the mounting of a variety of mechanical or electronic (electronic volume correctors) conversion devices. The instrument drive rotation provides a specific non-compensated volume per rotation to the instrument.

**Temperature Compensated Instrument Drive (TCID)**

Temperature compensated instrument drive meters convert the non-compensated volume to a volume converted to the base temperature (60°F) condition and provide this compensated volume through the instrument drive. The instrument drive rotation provides a specific temperature compensated volume per rotation to the instrument.

**ACCURACY**

A rotary meter provides accurate gas measurement over a wide range of flow rates within its rated capacity. The enclosed graph illustrates the typical accuracy curve for a rotary meter.

**CAPACITY**

The maximum rated capacity of a rotary gas meter \(Q_{\text{max}}\) is marked on the meter. This rating is indicated in actual units of volume (acfh) since rotary meters measure gas by positive displacement. Natural gas is measured in standard units of volume (scfh). The standard unit of volume is simply the volume of gas after being converted to the base pressure condition. The following formula is employed to correctly size a rotary meter to the flow requirement.

\[
Q_{\text{max}} = \frac{\text{Flow (scfh)}}{P_F}
\]

Where the pressure factor \(P_F\) is:

\[
P_F = \frac{(P_{\text{ATM}} + P_{\text{ACT}})}{P_{\text{BASE}}}
\]

where:

- \(P_{\text{ATM}}\) = Atmospheric pressure (psia)
- \(P_{\text{ACT}}\) = Actual gas pressure (psig)
- \(P_{\text{BASE}}\) = Base pressure (psia)

Example:

The maximum flow requirement for a factory is 40,000 scfh at 40 psig.

\[
P_F = \frac{(14.4 + 40)}{14.73} = 3.69
\]

\[
Q_{\text{max}} = \frac{40,000}{3.69} = 10840 \text{ acfh}
\]

Therefore, the recommended meter would be an RM11000 with a maximum flow capacity of 11,000 acfh.

**INSTALLATION**

Remember that a rotary meter represents a substantial cash register for a gas utility. Good installation practices are the key to obtaining the accurate gas measurement.

Rotary gas meters can be installed in either a horizontal or vertical pipe. The recommended installation is in a vertical pipe to permit any contaminants in the gas to pass through the meter with a minimum of damage.

**Pre-installation Procedure**

Prior to installing a rotary meter inspect for any damage that may have occurred during transport to site. Remove the protective plugs from the inlet and outlet of the meter. Ensure that the piping manifold of the meter station is free of foreign material (dirt, tap shavings, pipe dope, weld slag, etc.) and scale. Check that the mounting flanges for the meter is level (within ±1/16” per foot), parallel to each other and the correct \(F_L\) distance apart (refer to the chart below).

**Meter Model**

<table>
<thead>
<tr>
<th>Model</th>
<th>(F_L)</th>
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<tbody>
<tr>
<td>RM1000-RM5000</td>
<td>6 15/16”</td>
</tr>
<tr>
<td>RM7000-RM23000</td>
<td>9 11/16”</td>
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</tbody>
</table>

The manufacturer’s recommended hardware specifications relating to the mounting flanges and flange bolts, washers and gaskets should be checked for compliance.
Installation procedure

Install the rotary meter with the flange gaskets. A clearance of 1/16” should remain between mounting flanges. Tighten the flange bolts to the manufacturer’s recommended torque value. Install the meter oil supplied by the manufacturer as required.

MAINTENANCE

Under normal operating conditions, the oil should be inspected every 5-10 years and changed or “topped up” as required. The change period will vary with the cleanliness of the gas being measured.