Department of consumer and corporate affairs / Ministère de la consommation et des corporations

STANDARDS BRANCH - DIRECTION DES NORMES

NOTICE OF APPROVAL G - 33 - I

OTTAWA February 20, 1970

ROCKWELL SERIES 'G' GAS TURBO-METERS

This approval supersedes S-GA-298, dated July 17, 1964 and G-33, dated May 24, 1968

APPARATUS

	Model T-18 Mark II	Model T-30	Model T-60
Rated capacity, cu. ft./hr. at line conditions	18,000	30,000	60,000
Capacity per revolution of meter output shaft, cu. ft.	100	100	1,000
Maximum working pressure, psi	125*	125*, 720, 1440	125*, 720 1440
Meter connections, flange	4"	6"	8"
Flange rating	ASA 125	ASA 125, 300 600	ASA 125, 300 600

* All meters of this rating have cast aluminum bodies and 'Delrin' rotor blades. Meters of higher pressure rating have cast steel bodies and cast aluminum rotor blades.

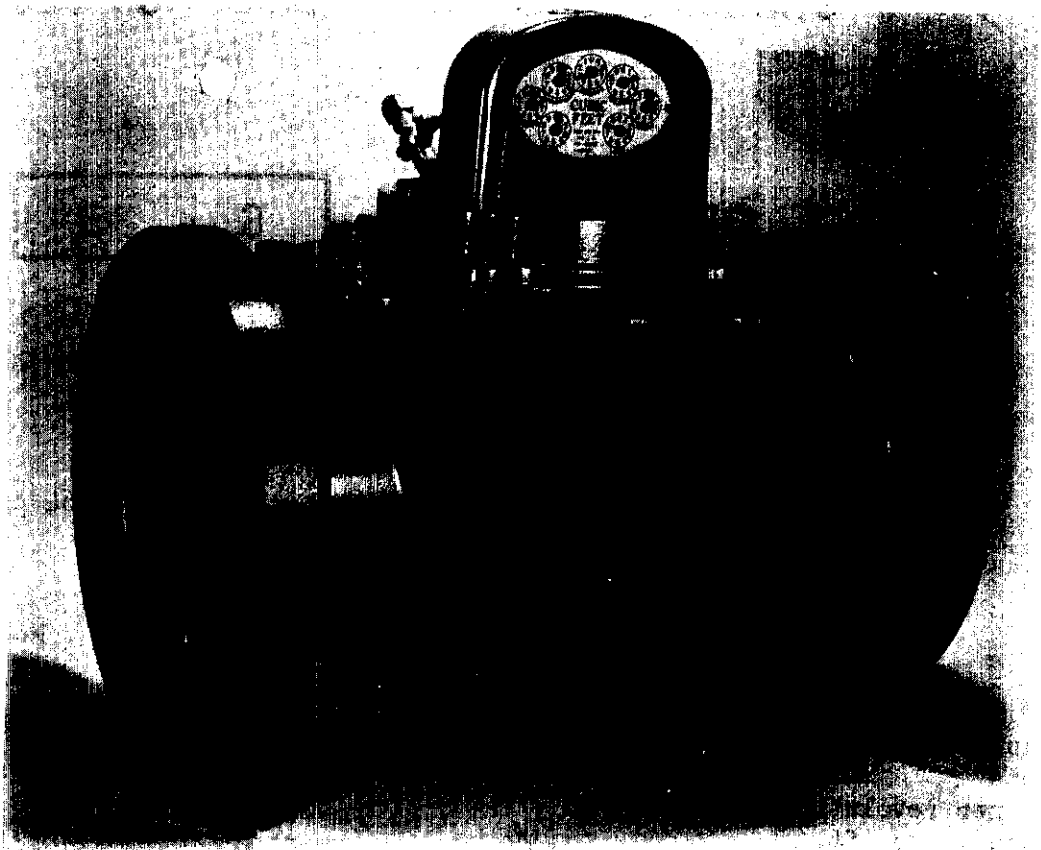
DESCRIPTION

The Rockwell, Series G, Turbo-Meter measures gas by utilizing the basic principle of a turbine.

It is an 'in-line' mounted meter consisting of two main assemblies: (1) the meter body, and (2) the removable metering assembly.

The meter body contains a nose cone, at the inlet side of the meter, and a tail assembly which may include a braking mechanism in the model T-30,

ROCKWELL SERIES 'G' GAS TURBO-METERS



125 psi meter. The brake system is intended for use on those installations where the intermittent nature of the load would cause over-registration to become an important factor. The brake consists of two spring-loaded, aluminum vanes, hinged on a common mounting shaft, and two poly-urethane brake shoes which bear against the turbine wheel and prevent its rotation when the gas flow falls below 1600 cu. ft. per hour. For higher rates of flow the turbine wheel turns normally and meter accuracy is not affected.

The internal measuring mechanism, attached to the top cover and removable with it, is composed essentially of:

(i) One-piece, molded Delrin or cast aluminum, turbine blade and rotor unit.

(ii) Worm and gear assembly which transmits the turbine wheel rotation, via a magnetic coupling, to the gear reduction train housed underneath the meter index, or volume correcting device. The drive train incorporates a shear pin which is designed to fail before the load torque causes the magnetic coupling to slip. Two pressure tap holes and a fitting for external lubrication of the main rotor bearings are provided on the top cover of the T-30 and T-60 meters.

The T-18, Mark II meter differs in design from the T-30 and T-60 meters in that

(1) the register and top plate (to which the internal mechanism is attached) are offset to the downstream side of the meter

(2) the only pressure tap on the meter is located on the body inlet and

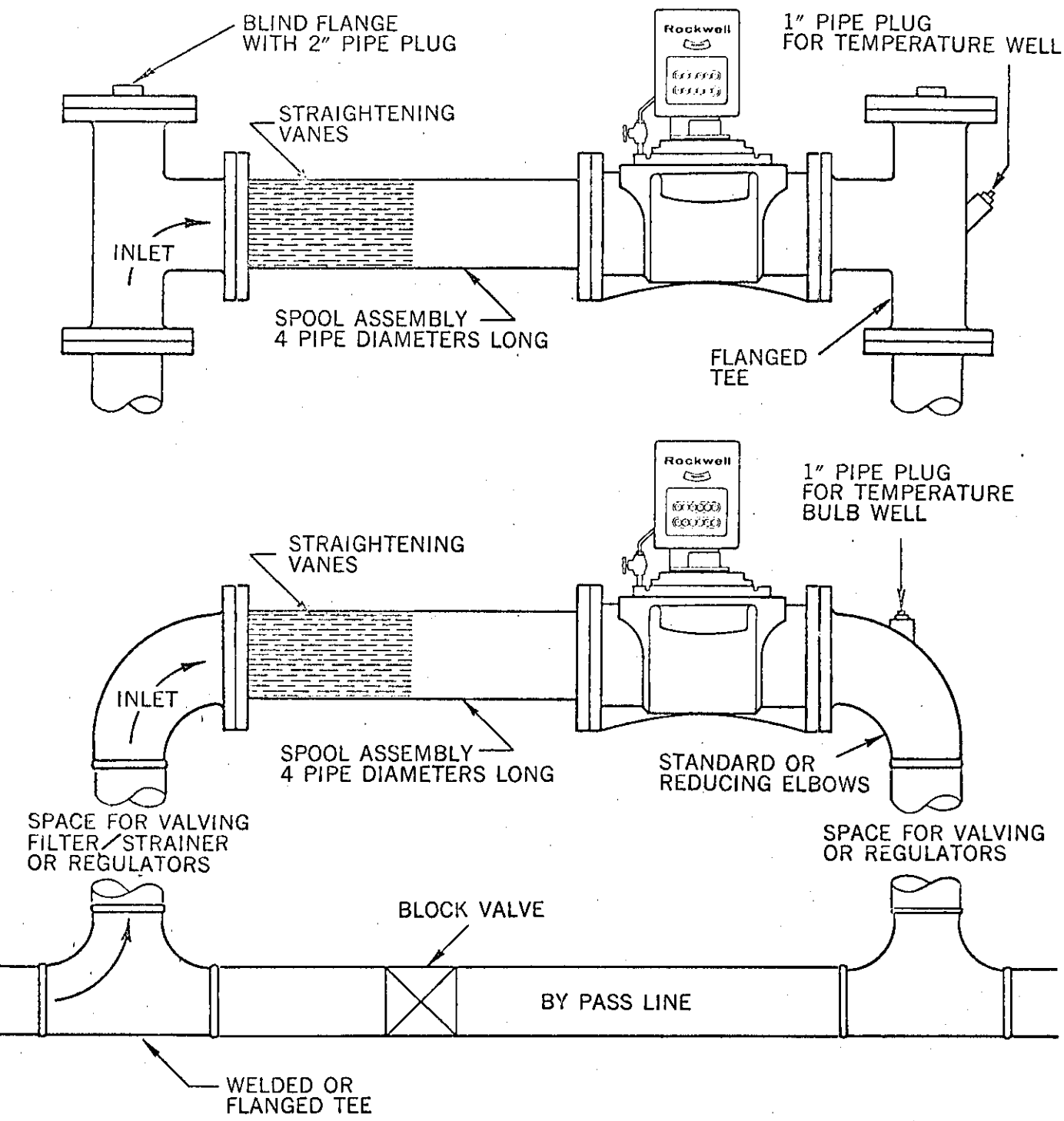
(3) there is no fitting for external lubrication of the rotor bearings.

In operation, as gas enters the meter, the nose cone immediately diverts the flow into a channel surrounding the inside periphery of the meter body. By means of this channel, the flow of the gas is directed axially towards the rotor blades and the velocity of the gas is increased. The passage of the gas stream over the rotor blades exerts a force that causes the rotor to revolve with a speed directly proportional to the rate of flow of the gas. However, should the gas stream enter the meter with a swirling motion, or have a non-uniform velocity distribution (sometimes referred to as jetting) the proportionality of the rotor speed to the flow rate may be upset and meter accuracy affected.

The rated capacity of the turbo-meter indicates the maximum permissible flow rate in cubic feet per hour at actual line conditions (maximum dial rate) and this rate governs for all meter operating pressures. The minimum registration of the flow at line conditions depends on the density of the gas and decreases as the line pressure increases. The actual flow, in standard cubic feet, increases due to the pressure factor.

The differential pressure across the turbo-meter, at its rated capacity and 0.25 psig pressure of gas (sp. gr. 0.6) is approximately 2 inches w.g. As the operating pressure increases the differential pressure will increase, and at 1400 psig it reaches approximately 200 inches w.g. at maximum dial rate.

Rockwell Turbo-Meters
Models T-18, T-30, T-60 Short Coupled Sets



NOTE: Straightening vanes are required on short-coupled Turbo-Meter sets for maximum measurement accuracy

Standard construction Turbo-Meters are suitable for temperatures up to 200°F. Special construction types are available for higher temperatures.

The turbo-meter measures gas volume at line conditions and when these fluctuate and billing volume refers to other than meter conditions, suitable and approved volume correcting devices shall be used to account for changes in volume caused by the effects of temperature and pressure. The pressure connection to the correcting device shall be taken from the fitting provided on the upstream side of the meter cover.

The computation of the volume of a gas, at the contract temperature and pressure, which has been registered in cubic feet at line conditions is based on the ideal gas laws modified by a deviation factor available in the form of a Supercompressibility factor (Fpv), determined according to the A.G.A. Gas Measurement Committee Report No. 3, Orifice Metering of Natural Gas.

The general equation for converting the meter readings at line conditions to a contract base pressure and temperature is

$$Qs = Qd\ Pm\ Tm\ (Fpv)^2$$

Qs = Quantity of gas at the contract base pressure and temperature, cu. ft.

Qd = Actual (displaced) gas passed at existing meter conditions, cu. ft.

Pm = Pressure multiplier

$$= \frac{\text{Weighted average existing gauge pressure + barometric pressure}}{\text{Absolute pressure base}}$$

Tm = Temperature multiplier

$$= \frac{\text{Temperature base + 460}}{\text{Weighted average flowing gas temperature + 460}}$$

Fpv = Supercompressibility factor based upon the weighted average gas pressure and temperature and the normal composition of the gas. The composition is represented by its specific gravity, its content of nitrogen and carbon dioxide and its calorific value as used in the derivation of Fpv values.

The selection of the weighted average supercompressibility factor, Fpv, should be based on a record of the flowing gas volumes, pressures and temperatures. If no continuous record is available, the variations in pressure and temperature normally existing in the line must not introduce an error greater than ±0.5% in the selected $(Fpv)^2$ factor.

All meters accepted for service shall be effectively sealed by the field inspector to ensure that no part of the measuring unit may be tampered with. The intermediate gear train cover plate will be sealed separately from the seal on the internal mechanism assembly.

INSTALLATION

The turbo-meter is designed to operate in a horizontal line with the cover plate level. However, a variation of 5° from the horizontal is tolerable.

Turbo-meter installations must have a minumum straight run of meter size pipe, four diameters long, on the meter inlet, with standard (AGA Gas Measurement Committee Report No. 3) straightening vanes in the upstream end. This may be preceded by a reducing coupling, a long radius elbow or a tee. The meter outlet may be connected directly to the line if it is the same size as the meter, or standard or reducing elbows or tees may be used to change direction and pipe size. Attached illustration shows the arrangement of short coupled sets which should be followed exactly.

The temperature probe for the auxiliary device should not interfere with the symmetry of flow through the turbine and may be located upstream of the meter preceding the straightening vanes or downstream in a position that does not interfere with the discharge of the meter, usually about two pipe diameters downstream.

The metering station must include a by-pass and test connections for testing and servicing the meter, otherwise the customer will be shutoff on these occasions.

When maximum meter accuracy is required and space permits, it is recommended that the turbo-meter should have a straight run of meter size pipe, ten diameters long, upstream of the meter and five diameters on the downstream. Standard straightening vanes should be installed five diameters upstream of the meter.

The meter nameplate, affixed to the meter body includes the following information:

(1) Manufacturer's name or trade mark.

(2) Model and Size Designation.

(3) Capacity of meter.

(4) Maximum Working Pressure.

An additional badge, affixed to the top plate has the following information:

(1) Manufacturer's name or trade mark.

(2) Manufacturer's Serial Number.

(3) Model and Size Designation.

(4) Maximum Working Pressure.

The meter inspection number will be affixed to the top plate of the internal assembly.

The information pertinent to each meter installation shall be recorded by the Utility on a Standards Branch Gas Metering Installation Data Sheet, No. SG-1, and filed with the District Inspector of Electricity and Gas Division prior to the initial verification of the meter in the field.

Approval granted to:

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