CANADA

DEPARTMENT OF TRADE AND COMMERCE

STANDARDS BRANCH

S-GA.304

OTTAWA, August 26, 1964.

TYPE APPROVAL

BAILEY METER COMPENSATED GAS FLOW MEASURING SYSTEMS

The apparatus specified and illustrated herein has been duly approved by the Standards Branch under the provisions of the Gas Inspection Act, Chapter 129, R.S. 1952, and may be admitted to verification in Canada.

Apparatus Approved: Pressure and/or Temperature Compensated Gas Flow Measuring Systems, Styles Nos. 1, 2 and 3, manufactured and distributed in Canada by Bailey Meter Company Limited, Montreal, Quebec.

The Style 1 Pressure and Temperature Compensated Gas Flow Measuring System comprises the following pieces of apparatus:

1. Differential Pressure Transmitter, combining the Differential Pressure Recorder Type BU and the Movable Core Transformer Electrical Retransmitter Class W1.

2. Static Pressure Transmitter

   (a) Type KP 1220A with Bourdon pressure element

   or

   (b) Type WM 53A Class 8D with bellows pressure element.

3. Temperature Resistance Element Class Q

4. Receiver Recorder Type WM 55A Model E 101, containing the following units:

   (a) Electronic Flow Receiver Class B5100-V1

   (b) Telemeter Receiver Class J1102-V1

   (c) Pyrotron Receiver Class QB102-V1A

   (d) Flow Integrator Class Y100-D

5. Calculator Box Part No. 667515A1H

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Rating of Apparatus: Differential Pressure ..... 0-53.97", 0-107.94", 0-215.88" water gauge

Working Pressure ..... 800 p.s.i.

Static Pressure Ranges

(a) Bellows element - 0-5, 0-15 and 0-30 p.s.i.
(b) Bourdon element - various ranges 0-60 to 0-800 p.s.i.

Temperature Range ..... -50°F to +150°F in various ranges

Application: Measurement in distribution service of manufactured, natural and petroleum gases, or mixtures thereof, when used in conjunction with "Primary Elements of the Orifice Meters".

Description: The differential pressure transmitter consists of the Differential Pressure Recorder Type "BU" (previously approved under Circular S-GA.224 of February 28, 1962) incorporating in its case a transformer-type retransmitter, the movable core of which is mechanically linked up with the recorder pen. The output signal of the retransmitter, proportional to the recorder pen position, is connected to a similar transformer in the Electronic Flow Receiver which functions as an A-C voltage balance circuit. An amplifier and a motor control unit in this receiver are made to reproduce, at balance conditions, transformer core and receiver pen position.

The static pressure transmitter may have either a bellows or a Bourdon tube pressure element linked up with an indicating pointer and the core of the retransmitting transformer, the output of which is connected to a slidewire circuit in the Telemeter Receiver which functions as an A-C voltage ratio balancing network. In operation an amplifier and motor control unit position the slidewire contact and also the receiver recorder pen so that pressure transmitter conditions are reproduced.

For the purpose of introducing automatic pressure compensation a retransmitting slidewire is added in this unit, its function being to multiply the differential pressure transmitter output by a suitable pressure compensating factor.

The temperature of the flowing gas is sensed by a resistance temperature element connected to the Pyrotron Receiver which functions as a self-balancing A-C Wheatstone Bridge with its amplifier and motor-driven slidewire unit. The temperature recording pen is positioned by a cam and lever arrangement included in the receiver, which also contains additional retransmitting slidewire for the purpose of automatic temperature compensation, effected in similar manner as pressure compensation.

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The compensated system also includes a unit referred to as "Calculator Box' which contains some circuit calibration components,providing proper signal proportions and interconnections between various transmitters and receivers.

In addition to the three receivers, Recorder WM55A also contains Class Y flow integrator which provides totalized compensated flow. The integrator is similar to the one described in Circular SD-GA.28 of December 12, 1952, but the escapement wheel has 300 teeth instead of 250 and the gear ratio between the cam and the wheel is such that for each revolution of the cam the escapement wheel completes only two-thirds of a revolution when rotating continuously so that for the recording pen positioned at zero on chart, 200 teeth pass the pawl during each cam revolution. For other pen positions, the wheel would advance proportionally less so that at 90% chart reading only 20 teeth would pass the pawl. The integrator has a linear scale cam and standard counter gearing, for which counter advances 100 units per hour for 100% pen position. To obtain totalized flow in units of cubic feet the counter readings must be multiplies by the integrator factor equal to the flow corresponding to 100% chart divided by 100. The maximum range of the measuring system expressed as compensated flow in Standard Cubic Feet per hour at specified base conditions will vary with range of various flow parameters and size of primary orifice elements, but shall be entered on a card located inside the Recorder case.

In operation the compensated flow measuring system functions to continuously solve the general flow equation

$$\text{Flow} = C'' F_{tf} \sqrt{h_w P_f}$$

Where C" is a flow coefficient, F_{tf} is the flowing temperature compensating factor, h_w is the differential pressure across the orifice and P_f is the static pressure in the line.

Approval is granted for three variants of the measuring systems designated by:-

Style 1 - with temperature and pressure compensation, described above.

Style 2 - with pressure compensation only. This system would include an approved flowing temperature recorder, but it would not be interconnected with the system to effect automatic temperature compensation.

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The Temperature Resistance Element and Pyrotron Receiver may still be used as the temperature recorder but it would not require to have the retransmitting slide-wire for temperature compensation and would be accordingly designated Class QB100-V1A.

Style 3 - with temperature compensation only would include an approved Static Pressure Recorder in place of the static pressure transmitter and the telemeter receiver class J.

The nomenclature of the Electronic Flow Receiver varies with the style of the system as follows:-

Class B5100-V1 - for temperature and pressure compensation

Class B4100-V1 - for temperature compensation only

Class B3100-V1 - for pressure compensation only

When the flow measuring system is partially compensated, the solution of the flow equation presumes a constant average value for the variable.

H. E. Anderson
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Ref: A-930 and A-930A

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