Consumer and Corporate Affairs | Consommation et corporations

Consumer Standards Directorate | Direction générale des normes

SPG-244

OTTAWA, June 19, 1978

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G6635-1

SPECIAL APPROVAL

Granted to: Eurocan Pulp & Paper Co. Ltd.,
Kitimat, B.C.
V8C 2H1

Attention: Mr. J. Goel,
Instrument Superintendent.

Subject: 12" Schedule 40 Orifice Meter Run with Auxiliary Devices

The gas supply contract between Eurocan Pulp & Paper (the Buyer) and Pacific Northern Gas (the Vendor) states that in the event the Vendor's measuring system is out of service, the gas delivered during this period shall be estimated using the Buyer's check measuring equipment. As a result, it became apparent that a Special Approval for the Eurocan's measurement system is warranted.

Special Approval has been granted by the Legal Metrology Branch to Eurocan Pulp & Paper Co. Ltd. for the use of the 12" Schedule 40 orifice meter run at Kitimat, B.C. for billing purposes, based upon accumulated flow as read off the Totalizing Impulse Counter, only during the period of time that Pacific Northern Gas measuring system is out of service.

Details of the meter and auxiliary attachments for the loop number 261-152 are as follows:

1. Orifice Meter

Manufacturer	Barber Engineering & Supply Ltd.
Nominal pipe size	12"
Inside pipe diameter	11.938"
Orifice diameter	4.750"
Beta (d/D) ratio	0.3979
Pressure taps	Flange
Maximum flow	750,000 SCFH
Normal flow	450,000 SCFH

2. Auxiliary Attachments

(i) Gauge Pressure Transmitter:

Manufacturer	The Foxboro Company, Ltd.,
Model number	E11GM-1SAA2, ½" NPT
Serial number	M-288196B
Calibrated range	44.7-94.7 psia

(ii) Differential Pressure Transmitter:

Manufacturer	The Foxboro Company, Ltd.,
Model number	E13DM-1SAM2
Serial number	M-288198B
Calibrated range	0-213.75"WC

(iii) Differential Pressure Transmitter:

Manufacturer	The Foxboro Company, Ltd.,
Model number	E13DL-1SAL2
Serial number	M-288199B
Calibrated range	0-21.375"WC

(iv) Temperature Transmitter:

Manufacturer	The Foxboro Company Ltd.,
Model number	E94-N12SFN
Serial number	M-288197B
Calibrated range	460^0R-560^0R

(v) Totalizing Impulse Counter:

Manufacturer	The Foxboro Company Ltd.,
Model number PMS-4C, Hecon	G0404464-5,24VDC

(vi) Analog Recorder:

Manufacturer	The Foxboro Company, Ltd.,
Model number	6430HF-0

(vii) Printout Unit:

Manufacturer	Sodeco
Model number	KP20

The orifice meter constants shall be calculated in accordance with the AGA Gas Measurement Committee Report No. 3, (1969).

The following flow system components require government sealing:

(a) Pressure Transducers, differential and static, and Temperature Transducer.

It is required that the access covers be sealed to the body of the transducers in such a manner as to prevent access to their terminals and/or adjustments.

(b) Totalizing Counter

The counter is to be sealed in such a manner as to prevent access to its terminals.

Note: The use of a resettable type counter is not approved.

This approval is contingent upon the metering system conforming to the requirements delineated in the applicable Sections of Part VIA and Part VII of the Departmental Instructions for the Inspection of Gas Meters and Auxiliary Devices.

For field test procedure refer to the attached Appendix "A".

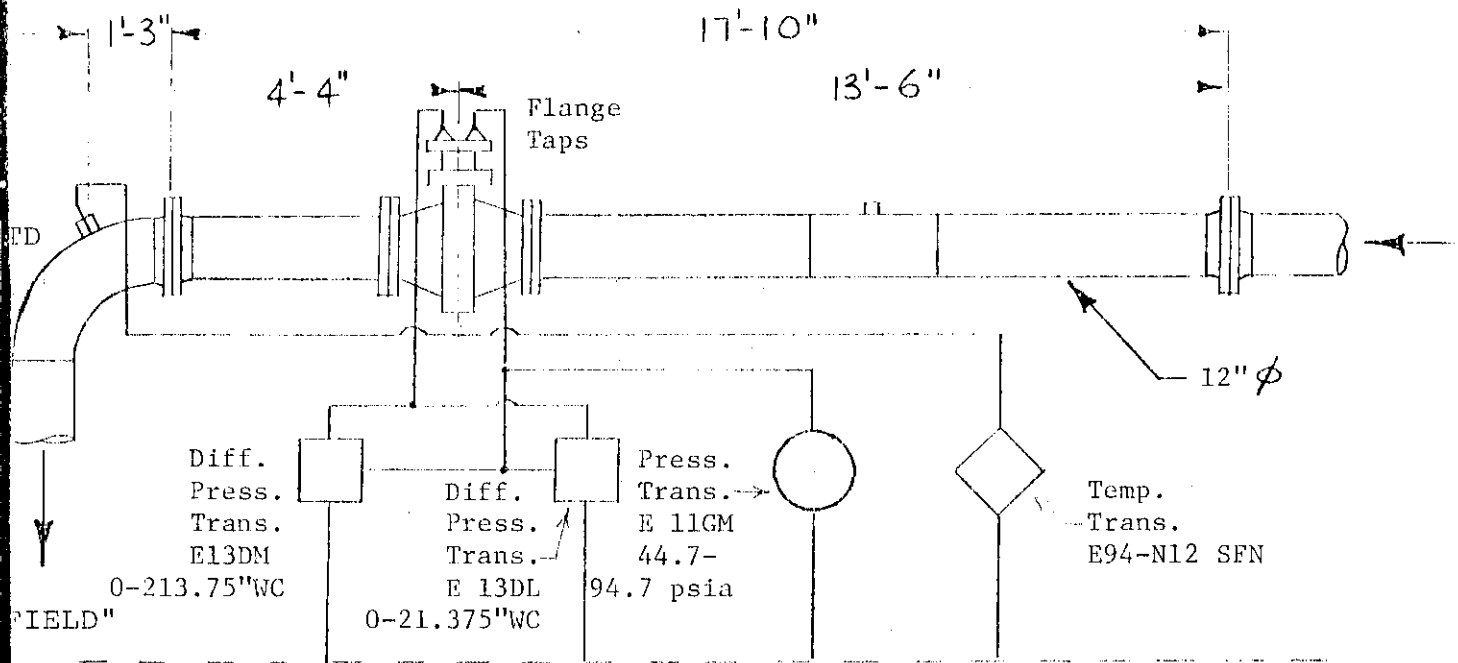
L. D. Wadman

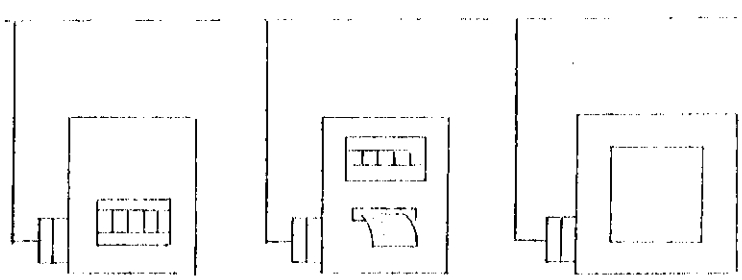
for D.L. Smith,
Chief,
Electricity & Gas Division.

c.c. Mr. W. M. Pura,
D/I, E&G, Vancouver.

EUROCAN PULP & PAPER CO. LTD.

ORIFICE METER INSTALLATION
AT KITIMAT MILLS, KITIMAT, B.C.





APPENDIX "A"

Re: Special Approval SPG-244 June 19, 1978

Field Test Procedure for Verification of Eurocan Pulp & Paper Company Ltd. Orifice Meter Installation at Kitimat, B.C.

Field Test Procedure

(A) Primary Elements:

The orifice plate and the installation shall be examined and dimensional measurement made to verify the conformity with Specification No. 7 for Approval of Type of Orifice Gas Meters and their Installation.

(B) Secondary Elements:

During the verification tests it is important for the flow conditions to be stable.

1. For verification tests simulate the flow conditions by applying appropriate temperature, and static and differential pressures, which can be held constant for the duration of the test.

2. Insert the three (3) parameters obtained above into the following orifice gas equation based upon the existing Eurocan's system. The numerical example shows the method of calculation for the average flow conditions. The same process of calculation is to be made for the parameter values, shown in Table I, at which verification tests are to be performed.

3. Re-verification period for secondary elements is six years.

Table I

Test No.	ΔP_1	ΔP_2	Temp.	Static Pressure P
1	180" W.C.		Av. Flowing	Av. Existing Line
2	100" W.C.		32°F	Line -20% of Line Press.
3		18"W.C.	Av. Flowing	Line +20% of Line Press.
4		10"W.C.	Av. Flowing	Av. Line Pressure

EXAMPLE:

CONDITIONS AT METER	VALUE OF FACTOR
Meter equipped with Flange Taps.	
d = diameter of orifice = 4.750 in.	
D = internal dia, of meter tube = 11.938 in.	F_b = 4637.2
Static pressure obtained upstream of meter.	
Average differential (at normal flow), h_w = 74.77 in. W.C.	
Average static pressure, p_f = 74.73 psia (60.0 psig)	
Standard atmospheric pressure = 14.73 psia	
β = 4.750 ÷ 11.938 = 0.3979	
$\sqrt{h_w p_f}$ = pressure extension (average) = $(74.77 \times 74.73)^{\frac{1}{2}}$ = 74.75	
For β = 0.3979 and D = 11.938; b = 0.0196	
$F_r = 1 + (0.0196 \div 74.75) = 1.00026$	F_r = 1.00026
Differential ratio, $h_w \div p_f$ = 74.77 ÷ 74.73 = 1.0	Y_1 = 0.9884
p_b = base pressure = 14.73 psia	F_{pb} = 1.0000
T_b = temperature base = 60^0F	F_{tb} = 1.0000
T_f = flowing temperature = 45^0F; $\left(F_{tf} = \sqrt{\frac{60+460}{T_f+460}}\right)$	F_{tf} = 1.0147
G = specific gravity = 0.585	F_g = 1.3074
Supercompressibility factor for 60.0 psig and 45^0F:	F_{pv} = 1.0052
Manometer factor:	F_m = 1.0000
Area factor, F_a and Location factor, F_ℓ are assumed to be unity (1.0000)	F_a = 1.0000
	F_ℓ = 1.0000

Orifice constant, C', corresponds to expression:

$$C' = F_b \times F_r \times Y \times F_{pb} \times F_{tb} \times F_{tf} \times F_g \times F_{pv} \times F_m \times F_a \times F_\ell$$

Then, C' = 4637.2 x 1.00026 x 0.9884 x 1.0000 x 1.0000 x 1.0147 x 1.3074 x 1.0052 x 1.0000 x 1.0000 x 1.0000 = 6113.643

For an average pressure extension, $\sqrt{h_w p_f} = (74.772 \times 74.73)^{\frac{1}{2}} = 74.75$, the flow rate would be

$$Q_h = C' \sqrt{h_w p_f} = 6113.6432 \times 74.75 = 456{,}994.8 \text{ cu. ft. per hr.}$$

The above equation, $Q_h = C' \sqrt{h_w p_f}$ can be converted to an equation where all three parameters are included in the solution of the flow equation, namely,

$$Q_h = C'' \sqrt{h_w p_f} \times F_{tf} \qquad \text{.....(1)}$$

where Q_h = rate of flow in cu. ft. per hr. at base conditions,

C' = orifice flow constant as designated in AGA Report No. 3

$$C'' = \frac{C'}{F_{tf}}$$

F_{tf} = gas flowing temperature factor

p_f = absolute static pressure in psia

h_w = differential pressure in inches of water.

The equation (1), above, can be adapted to include the measured period of test time during which the difference in readings of the integrating register between the start and finish of the test is utilized.

$$\text{Thus, } Q = C'' \sqrt{h_w p_f} \times F_{tf} \times t, \qquad \text{.....(2)}$$

where Q = accumulated flow in cu. ft. at base conditions.

t = time duration of test in hours.

Note: Pacific Northern's base temperature and pressure is 60^0F and 14.73 psia, respectively.

3. Obtain reading of accumulated flow in cu. ft. off the totalizing impulse counter for an accurately measured period of time. The magnitude of the accumulated flow shall be sufficiently large so that precision of reading of this volume would not contribute more than 0.1% error to the overall test result.

4. Compare this observed result with the calculated flow (para. 2) over the same time duration, t, as in para. 3, namely,

$$Q = C'' \sqrt{h_w p_f} \times F_{tf} \times t \qquad \text{cu. ft.}$$

5. The error of the counter- obtained quantity shall not exceed 2% of the calculated quantity in para. 4.

This verification tolerance appears in the Departmental Instructions, Part VIA, section 4.