

# CPACL NOVA 50E RESEARCH PAPER SUMMARY

## Measurement Canada Provisional Specification PS-G-05-E – Measurement Canada

<b>Date:</b>	03/1997	<b>Forum:</b>	Canadian Government Standards
<b>Author(s):</b>	Engineering Labs Ottawa		
<b>Location:</b>	Ottawa Canada		
<b>Key Topics:</b>	Orifice metering, turbine metering, ultrasonic metering, coefficient of discharge, installation effects, design, inspection.		

This is the Canadian Government approval document which approves the use of the NOVA 50E for use in custody transfer measurement applications in Canada. With out this document, the 50E can not be used in Canada for measuring natural gas for fiscal purposes. Noteworthy is the detailed presentation of the tube bundle for inspection purposes, other type of Flow Conditioners can not be inspected due to the secrecy regarding design.

This document is quite conservative, but it can be used as a guide for typical installation design standards and inspection criteria for monthly or yearly inspections.

Provisional Specifications			
Category <b>GAS</b>	Number: <b>PS-G-05-E (rev. 1)</b>	Date: <b>1999-03-26</b>	Page <b>1 of/de 5</b>

**Subject: Provisional Specifications for the Design, Construction, Installation, Use, Verification, and Reverification of CPACL Flow Conditioners**

### 1. Scope

These specifications apply to the Canada Pipeline Accessories Company Ltd. (CPACL) K-Lab/NOVA 50E Flow Conditioner (herein referred to as the CPACL Flow Conditioner) manufactured by CPACL of Surrey, British Columbia, Canada.

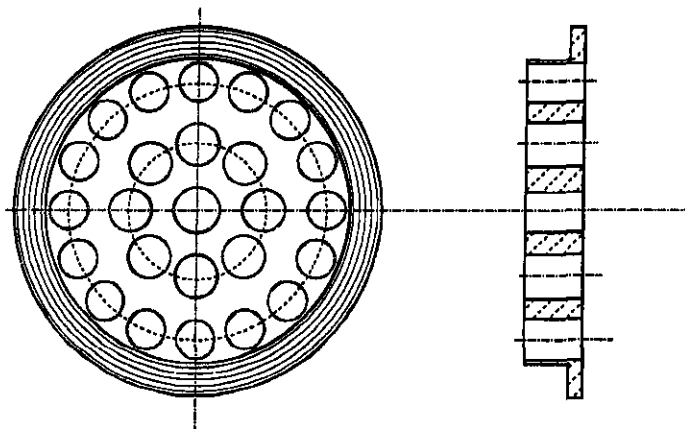
### 2. Authority

These specifications are issued under the authority of sections 12 and 18 of the *Electricity and Gas Inspection Regulations*.

### 3. Description

3.1 The CPACL Flow Conditioner is intended to reduce flow disturbances in natural gas and other related hydrocarbon fluids caused by upstream piping design configurations such as one elbow, two elbows in and out of plane, and flowing tees. The flow conditioner consists of a perforated plate with concentrically arranged holes and is illustrated in Figure 1 below.

**Figure 1 - CPACL K-Lab/NOVA 50E Flow Conditioner**



3.2 In operation, the CPACL Flow Conditioner causes the natural gas fluid pipe velocity and turbulence magnitudes with respect to the pipe radial positions to be reconfigured to reference levels. The conditioned flow profile is similar in nature to that which national orifice metering specifications require to produce metering accuracy free of bias error due to installation causing disturbances.

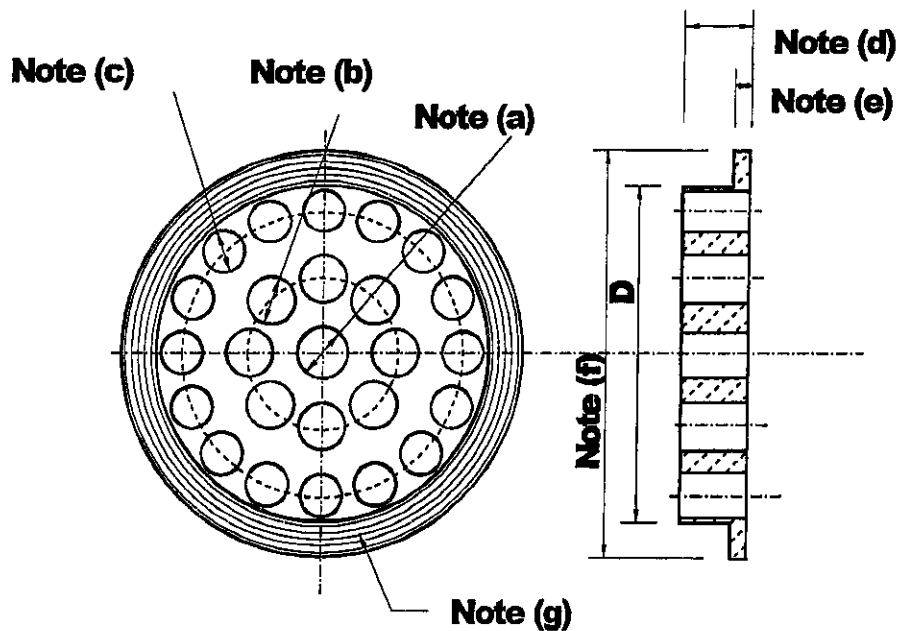
Category GAS	Number: PS-G-05-E (rev. 1)	Date: 1999-03-26	Page 3 of/de 5
-----------------	-------------------------------	---------------------	-------------------

#### 4. Design and Construction

4.1 *Design.* The CPACL Flow Conditioner shall consist of a plate with 25 bore holes arranged in a symmetrical, circular pattern as pictorially represented in Figure 2 below. The dimensions of the bore holes are a function of the actual pipe inside diameter (D). The characteristics of importance and their associated quality criteria shall be as follows, corresponding to the letter labellings within Figure 2:

- (a) a central hole of dimension  $0.18629 D \pm 0.077\% D$ ;
- (b) a center ring of 8 holes of dimension  $0.163 D \pm 0.077\% D$  holes on a  $0.5 D \pm 0.020$  inch bolt circle;
- (c) an outer ring of 16 holes of  $0.1203 D \pm 0.077\% D$  holes on a  $0.85 D \pm 0.020$  inch bolt circle;
- (d) perforated plate thickness of  $0.125 D$  to  $1.5 D$ ;
- (e) flange thickness based on service application requirements;
- (f) outer diameter to match flange type and service application; and
- (g) flange face surface to match flange type and service application.

Figure 2 - Dimensions of CPACL Flow Conditioner



4.2 *Construction Material.* CPACL Flow Conditioners are constructed of the following metallic materials:

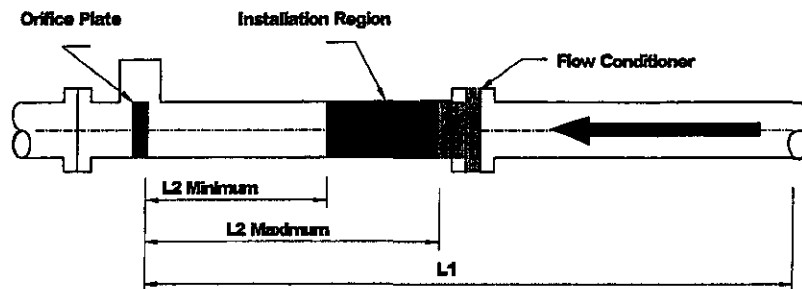
- (a) ASME Grade 517-70,65,60,55 and other machineable Carbon Steels;

Category <b>GAS</b>	Number: <b>PS-G-05-E (rev. 1)</b>	Date: <b>1999-03-26</b>	Page <b>4 of/de 5</b>
------------------------	--------------------------------------	----------------------------	--------------------------

- (b) ASME Grade A 213-304, 316, Stainless Steels and other machineable Stainless Steels such as 17-4 PH;
- (c) Mild Steel based on engineering design application;
- (d) 41xx and 43xx series machine steels; and
- (e) other metallic specialized applications such as Monel or Titanium.

Category GAS	Number: PS-G-05-E (rev. 1)	Date: 1999-03-26	Page 5 of/de 5
-----------------	-------------------------------	---------------------	-------------------

Figure 3 - Installation Details



5.2 For orifice meter and ultrasonic meter applications, the CPACL Flow Conditioner shall be installed upstream of the orifice plate or meter within a straight length of pipe such that:

- (a) the total length (L1) of straight pipe shall be at least
  - (i) 12 nominal pipe diameters for installations involving a single elbow or two or three elbows in and out of plane, or
  - (ii) 16 nominal pipe diameters for installations involving flowing tees; and
- (b) the length (L2) of straight pipe between the CPACL Flow Conditioner and the orifice plate or meter shall be
  - (i) at least 7 nominal pipe diameters and at most 14 nominal pipe diameters for installations involving a single elbow or two and three elbows in and out of plane, or
  - (ii) at least 11 nominal pipe diameters and at most 14 nominal pipe diameters for installations involving flowing tees.
- (c) Notwithstanding subsections (a) and (b), the difference between the total length (L1) and length (L2) shall not be less than 3 pipe diameters.

5.3 For short-coupled turbine meter applications, the CPACL Flow Conditioner shall be installed upstream of the meter within a straight length of pipe such that:

- (a) the total length (L1) of straight pipe shall be at least 12 nominal pipe diameters for installations involving a single elbow or two or three elbows in and out of plane and flowing tees; and
- (b) the length (L2) of straight pipe between the CPACL Flow Conditioner and the turbine meter shall be at least 7 nominal pipe diameters and at most 14 nominal pipe diameters for installations involving a single elbow or two and three elbows in and out of plane, and flowing tees.

Category GAS	Number: PS-G-05-E (rev. 1)	Date: 1999-03-26	Page 6 of/de 5
-----------------	-------------------------------	---------------------	-------------------

(c) (c) Notwithstanding subsections (a) and (b), the difference between the total length (L1) and length (L2) shall not be less than 3 pipe diameters.

Category <b>GAS</b>	Number: <b>PS-G-05-E (rev. 1)</b>	Date: <b>1999-03-26</b>	Page <b>7 of/de 5</b>
------------------------	--------------------------------------	----------------------------	--------------------------

## 6. Verification and Reverification

6.1 Before being installed for use in the measurement installations referred to in section 4.0, the CPACL flow conditioner shall be verified to ensure that all design and construction requirements specified in section 3.0 of this specification have been met. Acceptance shall be indicated by placing a verification mark on downstream face of the flow conditioner.

6.2 For orifice meter applications, the installation of the CPACL flow conditioner in accordance with section 5 of this specification shall be verified before the meter assembly is installed or reinstalled for use.

6.3 For turbine meter and ultrasonic meter applications, the owner of the meter shall be responsible for ensuring that the CPACL flow conditioner is installed in accordance with the installation requirements of section 5 of this specification and for providing evidence of compliance to Measurement Canada on request.

6.4 CPACL flow conditioners shall be reverified for compliance with the requirements of this specification at intervals corresponding to the reverification period of the orifice meter, turbine meter, or ultrasonic meter, as the case may be.

### NOTES:

1. The CPACL flow conditioner is a licensed product, complying with UK patent No. GB 2 235 064B, European Patent No. 0483206, US Patent No. 5.341.848, Canadian Patent Application No. 2063820, and Norwegian Patent No. 174859.
2. Reference information is contained in Measurement Canada file O26635-AP-AG-97-0005.

Alan E. Johnston  
President  
Measurement Canada

**Appendix: Dimensional Information for Selected CPACL Flow Conditioners**

NPS	Schedule	Pipe ID (in)	Flange OD (in)	Flange Thickness (in)	Total Thickness (in)	Weight (lbs)
4	40, S	4.026	6.1875	0.250	0.625	1.0
4	80, XS	3.826	6.1875	0.250	0.625	0.9
6	40, S	6.065	8.500	0.250	1.000	3.7
6	80, XS	5.761	8.500	0.250	1.000	3.5
8	40, S	7.981	10.625	0.250	1.1875	4.0
8	80, XS	7.625	10.625	0.250	1.1875	3.8
10	40, S	10.020	12.750	0.375	1.500	15.0
10	XS	9.750	12.750	0.375	1.500	14.0
10	80	9.562	12.750	0.375	1.500	13.0
12	S	12.000	15.000	0.375	1.875	27.0
12	40	11.938	15.000	0.375	1.875	25.0
12	80	11.374	15.000	0.375	1.875	23.0
14	S	13.250	16.250	0.375	2.000	35.0
14	40	13.124	16.250	0.375	2.000	32.0
14	80	12.500	16.250	0.375	2.000	30.0
16	S	15.250	18.500	0.375	2.375	55.0
16	40	15.000	18.500	0.375	2.375	51.0
16	80	14.312	18.500	0.375	2.375	47.0
18	S	17.250	21.000	0.375	2.500	75.0
18	40	16.876	21.000	0.375	2.500	70.0
18	80	16.124	21.000	0.375	2.500	65.0
20	S	19.250	23.000	0.500	2.875	107.0
20	40	18.812	23.000	0.500	2.875	101.0
20	80	17.938	23.000	0.500	2.875	95.0
24	S	23.250	27.250	0.500	3.500	190.0
24	40	22.624	27.250	0.500	3.500	108.0
24	80	21.562	27.250	0.500	3.500	172.0
30	S	29.250	33.750	0.500	4.375	377.0
30	40	28.500	33.750	0.500	4.375	360.0
36	S	32.250	40.250	0.500	5.250	858.0
36	40	34.500	40.250	0.500	5.250	825.0

**Note:** All Flow Conditioners manufactured to ANSI, ASME, or CSA pressure requirements for high pressure service.