



Title: **Terms and Conditions for the Approval of Electronic APC Incorporated into Electronic Registers**

Effective Date: **2006-03-16**

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Revision:

1.0 Application

These terms and conditions apply in respect of electronic registers incorporating APCs and ATC of the electronic type that provide the registration of volumes measured by a meter in units converted to a reference temperature and pressure. These terms and conditions apply to devices which incorporate the pressure measuring equipment and to devices which are to be used in conjunction with approved pressure transducers¹.

2.0 Definitions

In this document:

APC – means a device which incorporates the necessary components and software to automatically determine a conversion factor for pressure (Cpl) from a pressure measurement and other programmed or measured liquid characteristics as required;

ATC – means automatic temperature compensator (CAT);

Cpl – means the pressure conversion factor for the liquid being measured which, when multiplied by the uncompensated volume, will result in a registration of volume at reference pressure;

Theoretical Cpl – means the conversion factor for pressure as determined by approved algorithms and/or tables, these include the *API Manual of Petroleum Standards Chapter 11.2.2M, Compressibility Factors for Hydrocarbons: 350-637 Kilograms per cubic Meter Density (15 °C) and -46 °C to 60 °C Metering Temperature* (1986) (*Cpl théorique*);

Reference pressure – means

- (a) in the case of a liquid that has an equilibrium vapour pressure of less than 101.325 kPa at measurement temperature,
 - (i) in metric units, an absolute pressure equal to 101.325 kPa, and
 - (ii) in Canadian units, an absolute pressure equal to 14.73 pounds per square inch;
- (b) in the case of a liquid that has an equilibrium vapour pressure of 101.325 kPa or more at measurement temperature, the equilibrium vapour pressure at the temperature of the liquid as it is being measured (*pression de référence*);

¹ The requirements of these terms and conditions were included in draft specifications related to Electronic APCs Incorporated into Electronic Registers.

Equilibrium vapour pressure – means equilibrium vapour pressure as determined by approved algorithms and/or tables or as measured on a representative liquid-gas two phase sample maintained at metering temperature. The approved tables include the *API Manual of Petroleum Standards Chapter 11, addendum to section 2, part2*;

GSP or gross volume at standard pressure – is the volume, at metering conditions, registered by a register and converted from the liquid's measured pressure to the reference pressure;

Net volume – is the volume registered by a register after applied corrections which has been converted to reference conditions;

Regulations – means the *Weights and Measures Regulations (Règlement)*;

Specifications – means *Weights and Measures Ministerial Specifications*.

All other words and expressions used in this document have the same meaning as in the *Specifications and Regulations*.

3.0 Exception

Notwithstanding section 236 of the Regulations, the meter equipped with an APC in a metering assembly may register the volume of liquid in units corrected to a temperature of 15 °C and to the reference pressure.

4.0 Design, Composition and Construction

4.1 Marking

In addition to the marking requirements of the regulations, a system shall be marked with the following information:

- (a) manufacturer's name;
- (b) model number designation;
- (c) serial number;
- (d) Notice of Approval number;
- (e) design pressure range;
- (f) operating pressure range;
- (g) type and range of input signal required; and
- (h) special application or limitations as applicable.

5.0 Performance

5.1 General Accuracy

(1) The limit of error of the APC function is +/- 0.2 % for the approved products and their associated range of pressure, temperature, product densities and other significant characteristics.

(2) The calculation of the Cpl factor by the APC shall be within 0.05% of the theoretical Cpl as determined from the APC indicated parameters for the range of products and associated pressure, temperature and densities, and other significant characteristics for which the APC feature is set.

5.2 Pressure Measurement Accuracy

For those APC devices which incorporate pressure measuring element:

(1) the indicated pressure shall be within the following limit of errors:

Column I Indicated Pressure	Column II Limits of Error
1 less than 1 MPa	+ 50 kPa
2 between 1 and 4 MPa	+ 5 % of known pressure
3 more than 4 MPa	+ 200 kPa

(2) Other than the limit of errors, the performance, installation and use requirement specified in *Terms and Conditions for the Approval of Pressure Transducers* shall apply to the pressure measurement function.

For those APC devices to be used in conjunction with an approved pressure transducers, the pressure signal measurement and indication by the APC shall be within the following limit of errors:

Column I Indicated Pressure	Column II Limits of Error
1 less than 1 MPa	+ 20 kPa
2 between 1 and 4 MPa	+ 2% of known pressure
3 more than 4 MPa	+ 80 kPa

5.3 Registrations Provided for Inspections

(1) A system incorporating an APC in a metering assembly shall be designed to provide on demand for inspection purposes, the instantaneous measured liquid temperature and pressure and, as required, the vapour pressure of the liquid, the density of the liquid and other significant product characteristics.

(2) A system incorporating an APC in a metering assembly shall be designed to provide, for inspection purposes, the Cpl or the gross volume at standard pressure.

(3) The minimum increment of registration of pressure shall not exceed 10 kPa.

5.4 Price Calculation

A system that continuously registers both net and gross volume and is equipped with unit price and total price displays shall be designed to calculate the total price as the product of the unit price displayed and the net volume delivered.

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5.5 Interlocks

An APC that may be used for more than one liquid shall incorporate an interlocking mechanism that ensures that the pressure correction factors corresponding to the liquid chosen are automatically selected.

When the pressure of a liquid is outside the pressure range of an APC, the APC shall be designed to automatically prevent further deliveries.

5.6 Printed Information

In addition to showing the information required by section 27 of the *Electronic Register and Ancillary Equipment Incorporated in Metering Assemblies Specifications and Metering Assemblies Incorporating ATCs Specifications*, an electronic printer forming part of a metering assembly that indicates the amount of a delivery from a bulk meter, receiving meter or aircraft refueller equipped with an APC shall provide a ticket that shows the net volume and gross volume, and the density and temperature and pressure used to determine the VCF and Ctl. The registration of the corrected volume shall bear the statement "Volume Corrected to Vapour Pressure at 15 °C".

6.0 Installation and Use

An APC shall be installed and used with an ATC meeting the requirements of the *Weights and Measures Ministerial Specifications, Metering Assemblies Incorporating Electronic ATCs Specifications*. Product temperature used for the calculation of the Cpl will be provided by the ATC function.

Only approved pressure transducers meeting the requirements of the *Terms and Conditions for the Approval of Pressure Transducers* of compatible type and range of signal shall be used for pressure measurement input to an APC.

The average or nominal metering pressure shall be less than 3/4 of the associated pressure transducer operating pressure range and design pressure.

Density of product at reference conditions shall be determined by fixed programmed factor or from an online densitometer.

Vapour pressure shall be obtained by:

- a) use of approved product tables or algorithm; and
- b) instantaneous pressure measurement from a representative gas/liquid two phase sample maintained at metering temperature. Tolerances relating to pressure measurement shall apply.

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