Corporate Office:
1675 Chester Avenue
Fourth Floor
Bakersfield, CA 93301
USA

+1 661-771-5100
+1 661-716-5101
prosoft@prosoft-technology.com

ProSoft Technology, Inc. Summary Regarding Alberta Energy and Utilities Board Directive 017 of May 2007

Overview

ProSoft Technology's Gas and Liquid Flow Computer (AFC) products will comply with the requirements of the EUB Directive 017 of May 2007 with the release of the AFC version 2.05. These products are affected:

- MVI46-AFC
- MVI56-AFC
- MVI69-AFC
- MVI71-AFC
- PTQ-AFC

The EUB document may be downloaded from:
http://www.eub.ca/docs/documents/directives/Directive017.pdf

Details

I. Using the AFC to Implement General EUB Requirements

1. Standard or Base Conditions

The EUB base conditions of 15°C and 101.325kPaa are default for the SI System of Units.

2. Periodic Volumes

Periodic volumes may be calculated by appropriate arithmetic on recorded accumulator values from all the archive records spanning the period, which values may be specified by appropriate configuration of the archive file.

II. Notes on the EUB Directive 017 of May 2007

Chapter	**AFC ver. 2.05 Compliance**
Chapter 1 - Standards of Accuracy	**Compliant**
The AFC module is covered by adherence to requirements in subsequent sections. (See bold text in the directive, Sec 1.2, p 5)	
Chapter 2 - Calibration and Proving	**Inapplicable**
This is inapplicable in the AFC until the release of version 2.06. Furthermore, all requirements concern methods and procedures for meter physical inspection, transmitter calibration, and meter proving; applicability to v 2.06 AFC comprises only: (a) the expected prover types, and (b) the required number of runs and allowed tolerances of resulting meter factors, both of which will be accommodated in the design of the prover interface of the AFC v 2.06.	

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Chapter	AFC ver. 2.05 Compliance
Chapter 3 - Proration Factors, Allocation Factors, and Metering Differences	**Inapplicable**
This is inapplicable to the AFC, as AFC considers meter channels as independent entities only, and any such Factors or Differences belong more appropriately to a plant-balancing system; however, the AFC provides some support for API MPMS Ch 20.1 "Allocation Measurement" (distinct from EUB's "Allocation Factor") in the form of a "Shrinkage Factor" configurable for each meter channel (this appears to be related to EUB's "Metering Differences").	
Chapter 4 - Gas Measurement	**Inapplicable**
All requirements concerning design, assembly, and installation are inapplicable to the AFC, as the AFC is a calculation device only.	
Sec 4.3.1 paragraphs 3 and 4 p 63	***Inapplicable***
The AFC implements non-resettable counters (accumulators), accessible via Modbus; they can be displayed using a Modbus master such as AFC Manager, but a permanent physical display thereof is outside the scope of the AFC.	
Sec 4.3.1 paragraphs 5 p 63	***Inapplicable***
The AFC does not implement measurement using Venturi tubes or flow nozzles.	
Sec 4.3.1 paragraphs 6, 7, and 8 p 63	***Inapplicable***
The AFC can measure flow through an ultrasonic or coriolis meter, provided that it can issue a pulse train that represents gross volume or mass flow (configure the channel as "linear/pulse count"), or supply an output that represents gross volume or mass flow rate (configure the channel as "differential/flow rate integration"). The AFC can measure flow through a V-cone or wedge meter (configure the channel as "differential/orifice", set the option "V-cone/wedge device", and enter values from the device's calibration sheet or calculated therefrom by a spreadsheet supplied by ProSoft). Temperature, pressure, and compressibility corrections are calculated using AGA 8 (1992) Detail Characterization Method in conjunction with the real gas law.	
Sec 4.3.2 pp 64	***Inapplicable***
All meter types (except Venturi or flow nozzles, which are unavailable in the AFC) provide as primary input one of: • Differential pressure: Mass flow rate is calculated using the Bernoulli equation with diameter ratio "Beta", expansion factor "Y", and coefficient of discharge "Cd" determined according to meter type:	

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Chapter	AFC ver. 2.05 Compliance

- Orifice:
  - Beta calculated from entered pipe and orifice diameters.
  - Y and Cd calculated using AGA 3 (1992) or ISO 5167-2 (2003).
- V-cone and Wedge:
  - Enter pipe and cone diameters.
  - Set option "V-cone/wedge device"; this causes the AFC to use the correct "orifice-equivalent" Beta in its calculations and to use an alternate calculation for Y, resulting in a Bernoulli equation implementation consistent with that given in McCrometer's Lit# 24509-54 rev 3.0.
  - Enter the Cd from the meter's calibration sheet.
  - For a wedge device, use a ProSoft-supplied spreadsheet to calculate from data on the calibration sheet the equivalent "cone diameter" and "coefficient of discharge", and enter those values; calculation then proceeds as for a V-cone.

- Pulse count and/or frequency representing Gross Volume or Mass flow:

  Flow increments and/or rates are calculated as (pulses)/(K-factor)*(meter factor) with meter factor derivable via a five-point linearization curve. If pulse count is supplied then pulse frequency must also be supplied in order to calculate flow rate; this is to avoid instabilities in flow rate that would occur should the AFC attempt to differentiate the increment over time.

- Gross Volume or Mass flow rate: Used directly.

  The primary input thus yields either or both of a flow increment and a flow rate, measuring either Gross Volume or Mass. If the increment is not yet available (pulse count not supplied), then the increment is calculated by integrating the rate over time. Calculation of the remaining two quantities of Gross Volume or Mass, and Net Volume, is accomplished using the real gas law PV=ZNRT and the mass-volume-density relationship M=VD, with compressibilities Z and densities D calculated from molar analysis via the Detail Characterization Method of AGA 8 (1992); any gas densities available from the meter are not used. The AFC provides no facility for converting a liquid measurement to a gas equivalent; the gas equivalent volume of any condensate stream measured as a liquid must be determined off-line by the methods of Appendix E-3 of EUB Directive 46.

  Updating the physical constants used by the AFC to the latest values from the GPSA Engineering Data Book or GPA-2145 can be performed by replacing the AFC's firmware with an updated version that contains those latest values; v 2.05 AFC uses values from GPSA 2004 and GPA-2145-03.

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Chapter	**AFC ver. 2.05 Compliance**
Sec 4.3.3 pp 66	***Inapplicable***
All historical records required for compliance are or can be made available in the AFC's event log and archive files, or can be calculated from data recorded therein. The AFC does not apply an "effluent correction factor" to a gas stream. Volumetric flow rate alarms may be signaled by the PLC upon calculated flow rates returned to the PLC as a matter of course; if specific quantities are required for such alarms, they may be programmed for return. All process inputs, including the "primary input" that most directly represents flow rate (differential pressure, pulse frequency), are range-checked and alarmed when out of range; this may constitute sufficient compliance with the "volumetric flow rate alarm" requirement. Environmental alarms (communication failure, low power) are outside the scope of the AFC module.	
Test cases pp 68-77	***Test Results Coming Soon***
Compliance of the AFC's calculations with the requirements of the EUB Test Cases will be made available in a separate document upon the release of version 2.05.	
Sec 4.3.4 pp 80	***Inapplicable***
Inapplicable to the AFC	
Sec 4.3.5 pp 81	***Inapplicable***
Inapplicable to the AFC	
Chapter 5 - Site-specific Deviation from Base Requirements	**Inapplicable**
Outside the scope of the AFC.	
Chapter 6 - Conventional Oil Measurement	**Inapplicable**
• All requirements concerning design, assembly, and installation are inapplicable to the AFC, as the AFC is a calculation device only. • All requirements concerning battery balancing are outside the scope of the AFC, as the AFC treats all its meter channels as independent from each other. Battery balancing calculations belong more appropriately to a plant balancing or similar system. • The AFC does not implement tank gauging.	
Sec 6.3.2 pp 116	***Inapplicable***
Calculation and application of correction factors (CTL, CPL) can be configured for a wide range of scenarios. A Shrinkage Factor can also be configured for some liquid product groups, which is applied to the final Net Volume increment and flow rate, after all other corrections and conversions.	

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Chapter	AFC ver. 2.05 Compliance
Sec 6.8.1 pp 128	***Inapplicable***
The hydrometer correction calculated by the AFC conforms to the method specified in the superceded API MPMS Ch 11.1 (1980); the AFC does not implement any other hydrometer correction calculation. All historical records required for compliance are or can be made available in the AFC's event log and archive files, or can be calculated from data recorded therein. Volumetric flow rate alarms may be signalled by the PLC upon calculated flow rates returned to the PLC as a matter of course; if specific quantities are required for such alarms, they may be programmed for return. Environmental alarms (communication failure, low power) are outside the scope of the AFC module.	
Test cases p 129	***Test Results Coming Soon***
Compliance of the AFC's calculations with the requirements of the EUB Test Cases will be made available in a separate document upon the release of version 2.05.	
Appendix 1 - Sections Under Development	**Inapplicable**
Outside the scope of the AFC.	
Appendix 2 - EUB Documents Replaced	**Inapplicable**
Outside the scope of the AFC.	
Appendix 3 – Glossary	**Inapplicable**
Outside the scope of the AFC.	
Appendix 4 - Water-Cut (S&W) Procedures	**Inapplicable**
Outside the scope of the AFC.	