

## First Gas – Gas Measuring Systems.

First Gas supplement to BS EN 1776:2015

### Introduction:

First Gas owns and operates the Natural Gas transmission system in New Zealand.

To facilitate the operation of this system, all gas entering and leaving must be accurately accounted for.

First Gas has adopted BS EN 1776:2015 as the standard applicable to gas measuring systems accounting for gas entering and leaving its gas transmission system to ensure the necessary accuracy.

First Gas also recognises NZS5259:2015. This supplement refers to some clauses of NZS5259:2015.

This document should be read in conjunction with BS EN 1776 (2015) because it specifies specific First Gas requirements that elaborate on the general requirements of BS EN 1776 (2015). The applicable paragraphs in BS EN 1776 (2015) are identified in this supplement.

### 2 Normative references:

In addition to the Normative references referred to in BS EN 1776 (2015), First Gas recognise the following standards:

Application	Additional Normative references
Rotary meter (positive displacement)	ANSI B109.3
Turbine meter	AGA 7
Ultrasonic meter	AGA 9
Coriolis meter	AGA 11
Equations of state	AGA report No. 8 – Parts 1 & 2
Speed of Sound	AGA report No. 10

### 3 Terms and definitions:

First Gas also recognise the definitions contained in NZS5259:2015

Receipt Point: A point at which gas enters the First Gas transmission system.

Delivery Point: A point at which gas leaves the First Gas transmission system.

### 4.1 General Requirements:

The design, construction, commissioning, operation and maintenance of each Delivery Point (including any Connected Equipment) shall conform with good gas industry engineering practice and shall comply with the requirements of recognised and applicable standards as well as all current and relevant legislation (including applicable regulations and rules under any enactment), including but not limited to:

- (a) AS 2885.1: 2012 Pipelines - Gas and Liquid Petroleum, Part 1: Design and Construction;
- (b) Gas Act 1992 and the Gas Regulations;
- (c) Health and Safety at Work Act 2015;

- (d) Health and Safety in Employment (Pipelines) Regulations;
  - (e) Resource Management Act 1991;
  - (f) Electrical (Safety) Regulations;
  - (g) AS/NZS 3000 – Wiring Rules;
  - (h) AS/NZS 60079.14 - Explosive Atmospheres: Electrical Installations, Design Selection and Erection; and
- (i) mandatory Codes of Practice and Standards associated with any of the above.

#### **4.3 Quality system for gas measuring system:**

First Gas do not require the operator to have a formal quality system.

#### **5.1 General**

The output of the gas measuring system is energy (MJ). For accuracy requirements, refer to NZS 5259:2015

#### **5.2 & 5.3 Classification of the measuring system:**

All measuring systems that measure gas at receipt points shall be considered to be class A.

#### **6 Energy Determination:**

Base conditions (6.2.1): The base conditions applicable in New Zealand are

- 101.325 kPa
- 15°C

Note that these are often referred to as standard conditions.

First Gas recognise alternative methods for energy determination. See NZS 5259:2015.

First Gas recognise the method of determining gas density contained in NZS5259:2015 2.11.3.

#### **6.2.3.1 General considerations and 6.2.3.2 Calorific value determination device (CVDD):**

The gas composition shall be determined by a Gas Chromatograph.

Unless otherwise agreed by First Gas, Metering shall calculate Calorific Value, Density, Relative Density and Wobbe Index in accordance with ISO 6976. For this purpose the Hexanes-plus fraction of the gas shall be treated in one of the following ways:

- Where the analyser is a “C<sub>6</sub>+” (Hexanes-plus) type:
  - as if it were a single component, namely Normal-Hexane; or
  - as a mixture of Normal-Hexane, Normal-Heptane and Normal-Octane; where:
    - Normal-Octane represents the Octanes-plus fraction;
    - The percentages of the 3 compounds are set prior to commissioning of the Metering based on an analysis of a representative sample of gas, and are reviewed not less than annually thereafter; or

- where the analyser is a “C<sub>9</sub>+” (Nonanes-plus) type:
  - Hexanes, Heptanes and Octanes shall be determined individually and treated as Normal-Hexane, Normal-Heptane and Normal-Octane, respectively; and
  - the Nonanes-plus fraction shall be treated as if it were a single component, namely Normal-Nonane.

The CVDD shall determine both spot values (i.e. values for the last gas sample analysed) and daily average values of the following parameters:

- (a) the concentrations of gas constituents (expressed in mole %), including:
  - (i) Carbon Dioxide;
  - (ii) Nitrogen;
  - (iii) Methane;
  - (iv) Ethane;
  - (v) Propane;
  - (vi) Iso-Butane;
  - (vii) Normal Butane;
  - (viii) Iso-Pentane, including Neo-Pentane if detectable and < 10% of total Pentanes;
  - (ix) Neo-Pentane, if detectable and ≥ 10% of total Pentanes;
  - (x) Normal-Pentane; and
  - (xi) Hexanes-plus fraction, (see above information relating to the treatment of the C<sub>6</sub>+ fraction)
- (b) Calorific Value (expressed in MJ/scm on a dry gas basis);
- (c) Nett Calorific Value (expressed in MJ/scm on a dry gas basis);
- (d) density at Standard Conditions (expressed in kg/m<sup>3</sup>);
- (e) Relative Density; and
- (f) Wobbe Index (expressed in MJ/scm),

and all values so determined must be both stored by the analyser and transmitted to the flow computer.

**Data acceptance criteria recognised by First Gas:**

Un-normalised molar concentrations:

- The un-normalised total of all components is within the range 98% to 102% for sample gas and
- 99% to 101% for calibration gas.

Comparing characteristics of certified Calibration gas:

Density +/- 0.1%

Calorific Value (Superior) +/- 0.1%

The CVDD shall be programmed to send an error message to the conversion device and the First Gas SCADA RTU if:

- The data acceptance criteria is not met
- The CVDD self-diagnoses a malfunction. Since CVDD's are constantly evolving, the self-diagnostic functions shall be subject to discussion and agreement with First Gas during the design phase.

When this error situation occurs, the conversion device shall utilise a "fall-back" gas composition, and the gas quantities calculated shall be flagged accordingly. The "fall-back" gas composition shall be agreed by First Gas.

#### **6.9 Gas pressure conversion and 7.8.2 Gas pressure measurement Class A:**

First Gas has traditionally recorded gauge pressure, and utilises gauge pressure in its SCADA system. For metering purposes, gauge pressure shall be converted to absolute pressure by employing an agreed altitude factor. See NZS 5259:2015.

#### **6.10 Compressibility conversion:**

First gas recognise all methods documented in NZS5259:2015 3.8.2.4.

#### **7.6.1 Gas measuring installation, General:**

All measuring systems that measure gas at receipt points shall allow for in-service verification of meters. This shall be achieved by installing two meters (a primary meter and a verification meter) which can be run in series when required.

The measuring values shall be safeguarded for a minimum of 30 days.

Where the gas measurement system incorporates a meter which can be damaged by operating above Q (max) (e.g. turbine and rotary meters), it shall incorporate a flow restricting device that limits the gas flow rate to 120% of Q (max).

All measuring systems that measure gas at receipt points shall incorporate an uninterruptible power supply system capable of operating the measuring system for a minimum of 4 hours in the event of a power failure.

#### **7.6.3 Gas Meters**

All gas meters shall record the uncorrected reading and make this available for reading. Rotary and Turbine meters shall incorporate a mechanical totaliser. Other meter technologies shall electronically store the uncorrected reading in a way that can be transferred to the conversion device or downloaded.

All turbine meters shall incorporate an external oiler.

Accuracy testing of gas meters shall comply with NZS5259:2015.

#### **7.17 Filter:**

All gas entering the First Gas Transmission system shall pass through a filter / separator immediately upstream of the meter. This filter / separator shall incorporate filter elements which will remove 99.9% of contaminants larger than 3 microns.

**7.23 Documented provisions, 11.7 Calibration / verification and maintenance records, & Annex F:**

The owner of the measuring system shall comply with clause 7.23 and maintain the archive described in annex F. This shall be available for First Gas inspection at any time.

Where the measuring system is not owned by First Gas, the measuring system owner shall obtain First Gas approval of the following items prior to commissioning.

- The measuring system design
- The calibration certificates for all major measuring system components
- The maintenance plan for all major measuring system components
- The plan for measurement system fault detection and rectification.

**11.3. Gas Meters (Operations and Maintenance):**

Coriolis meters shall be specified to include self-diagnostic capability. This shall be checked at intervals of no more than 1 year compared with the results obtained during commissioning.

All gas measuring systems shall be designed to cause an alarm signal to be generated when a malfunction occurs. This alarm signal shall be automatically transmitted to the gas measurement system owner and First Gas. The details of what issues represent a malfunction shall be discussed and agreed between the gas measuring system owner and First Gas.

**11.5 Calorific value determination device:**

Verification of the performance of the CVDD by comparing the process gas composition determined by the CVDD with the gas composition determined by a calibration laboratory shall be carried out at intervals of no more than 6 months. The acceptance criteria for this check shall be Calorific Value (Superior) +/- 0.5%.

The CVDD shall be programmed to auto-calibrate at least weekly.