

## GAS CONTRACTS MEASUREMENT LANGUAGE AND ITS EVOLUTION

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### GENERAL:

The business environment in our industry has seen tremendous change since early 1980s. This has in turn forced the industry to change its measurement technology and the process. Open access concept with multiple shippers through the same meter requires timely data to monitor nomination and allocation and to comply with commercial terms. The introduction of digital flow computer for electronic gas measurement (EGM) system has resulted in almost real time transactional information with enhanced accuracy and reliability. With respect to orifice measurement, the transition from mechanical chart recorders to EGM had an unprecedented impact on our ability to measure natural gas and adjust to market demands throughout the country. In order to realize the benefits of EGM, gas contracts had to evolve with time and include measurement provisions specific to this technology and its downstream data management requirements. Furthermore, such contract language should represent transporter and shipper or buyer and seller as the case may be in the most equitable manner possible. This paper discusses gas contract language from a measurement perspective addressing some of those challenges while recommending more up-to-date measurement provisions for gas contracts.

The traditional mechanical chart system with its inherent 45-day cycle does not lend itself to daily business environment. Transactional information is available after the fact. It worked in spite of its inadequacies, since traditionally there was one customer to one meter. Interpreting recorded variables during chart integration is often subjective, especially with painted chart caused by fluctuating flow. Few contracts addressed this matter or included any practical dispute resolution language. Measuring party had discretionary control over this important data at the metering point. Needless to say, parties involved were typically at odds over this issue. With regard to measurement accuracy, the most immediate benefit of EGM has been the elimination of interpretation of chart integration. EGM devices record the flow variables with greater resolution and accuracy than mechanical chart recorders. Obviously, the back office process and procedures must adapt to the new technology and timeliness. Once adopted efficiently, it meets today's business needs, provides additional accuracy, and allows for prompt trouble shooting, and automated archival of audit trail. All new measurement should be EGM since pros out weigh the cons.

In general, a contract has three definitive parts that relate to measurement terms and conditions in addition to other commercial and legal terms. The measurement terms can be included as an exhibit to the commercial contract, although many continue to include it in the body of the commercial language. Regardless, the three parts related to measurement are part and parcel of a contract, but may not be described to the same extent in each contract.

### Section - 1

#### Definitions of Terms

The following terms when used in any agreement incorporating these general terms and conditions, shall have the following meaning. Additional terms may be defined as required by a specific contract.

1. The term *day* shall mean a period of 24 consecutive hours beginning and ending at 7:00 a.m. local time or at such other time as may be mutually agreed to by the parties.
2. The term *month* shall mean a period of 1 calendar month beginning at a time as defined above on the first day of such month and ending at a time as defined in 1 above on the first day of the next succeeding calendar month.
3. The term *billing month* shall mean the calendar month in which deliveries were made and for which a statement or invoice is being submitted.
4. The term *year* shall mean a period of 365 consecutive days beginning and ending at 7:00 a.m. local time, provided that any such year which contains the date of February 29 shall consist of 366 consecutive days.
5. The term *cubic foot of gas*, for the purpose of measurement of the gas delivered hereunder and for all other purposes, is the amount of gas necessary to fill a cubic foot of space when the gas is at an absolute pressure of 14.73 lb/in<sup>2</sup> and at a base temperature of 60°F.
6. The term *Mscf* or *Mcf* shall mean 1000 cubic feet of gas at standard conditions.
7. The term *pipeline* shall mean this gas pipeline company and shall include the terms *seller* and *transporter* as the context indicates.
8. The term *shipper* shall include any customer that utilizes any of the pipeline's transportation services.
9. The term *customer* shall include both buyers and shippers.

The term *British thermal unit* (Btu) shall mean the quantity of heat required to raise the temperature of 11b avoirdupois of pure water from 58.5°F to 59.5°F at

10. a constant pressure of 14.73 lb/in<sup>2</sup> absolute.
11. The term *heating value* shall mean the number of Btu produced as determined by chromatographic analysis. The heating value so determined shall be corrected from the conditions of testing to that of the actual condition of the gas as delivered (including the conversion from saturated to dry conditions) expressed in Btu/ft<sup>3</sup> and reported at a pressure base same as used in the definition of *cubic foot of gas*, provided, however, that if the gas as delivered contains 7 lb water vapor or less per 1,000,000 ft<sup>3</sup>, such gas shall be assumed to have zero pounds of water per 1,000,000 ft<sup>3</sup> (dry gas). Heating value shall be determined to the nearest whole Btu.
12. The term *MMBtu* shall mean 1,000,000 Btu.
13. The term *natural gas* shall mean any mixture of hydrocarbons or of hydrocarbons and noncombustible gases, in gaseous state, consisting essentially of methane.
14. The term *balancing units* shall mean the measurement unit used for the purpose of balancing the amount of gas received by the transporter at the transporter's receipt points with the amount of gas delivered by the transporter for the shipper's account at the transporter's delivery points. The balancing unit shall be reported in MMBtu.
15. The term *fuel and company-used gas allowance* shall be that portion, expressed as a percent, of all gas heating value (MMBtu) received by the transporter into its system which is used in the operation of the transporter's pipeline system and which includes any lost and unaccounted-for gas.
16. The term *equivalent volumes* shall mean the sum of the volumes of gas measured in MMBtu received by the transporter for the account of the shipper at the transporter's receipt points during any given period of time adjusted for plant volume reduction (PVR), separator gas, and the then current fuel and company-used gas allowance, if applicable.
17. The *average atmospheric pressure* shall be assumed to be 14.7 lb/in<sup>2</sup>, irrespective of actual elevation or location of the point of delivery above sea level on variations in such atmospheric pressure from time to time, unless specified otherwise.

## Section - 2 Gas Quality

Unless otherwise specifically provided in the agreement, all natural gas received or delivered under the terms of the agreement shall be of pipeline quality and shall conform to the following specifications:

1. *Oxygen*: The oxygen content shall not exceed 10 ppm (parts per million) by volume, and the parties shall make reasonable efforts to maintain the gas free from oxygen.
2. *Hydrogen sulfide*: The hydrogen sulfide content shall not exceed 0.25 grains per 100 ft<sup>3</sup> of gas.
3. *Mercaptans*: The gas shall not contain more than 0.25 grains (of mercaptans) per 100 ft<sup>3</sup> of gas.
4. *Total sulfur*: The total sulfur content, including mercaptans and hydrogen sulfide, shall not exceed 2 grains per 100 ft<sup>3</sup> of gas.
5. *Carbon dioxide*: The carbon dioxide content shall not exceed 2.0 percent by volume.
6. *Liquids*: The gas shall be free of water and other objectionable liquids at the temperature and pressure at which the gas is delivered and the gas shall not contain any hydrocarbons which might condense to free liquids in the pipeline under normal pipeline conditions and shall in no event contain water vapor in excess of 7 lb per 1,000,000 ft<sup>3</sup>.
7. *Dust, gums, and solid matter*: The gas shall be commercially free of dust, gums, gum-forming constituents, and other solid matter.
8. *Heating value*: The gas delivered shall contain a daily, monthly, or yearly average heating content of neither less than 975 nor more than 1175 Btu/ft<sup>3</sup> on a dry basis.
9. *Temperature*: The gas shall not be delivered at a temperature of less than 40°F and not more than 120°F.
10. *Nitrogen*: The nitrogen content shall not exceed 3 percent by volume. In any case, total inert gas (CO<sub>2</sub> and N<sub>2</sub>) shall not exceed 4 percent by volume.
11. *Hydrogen*: The gas shall contain no carbon monoxide, halogens, or unsaturated hydrocarbons, and no more than 400 ppm hydrogen.
12. *Isopentane+*: The gas shall not contain more than 0.20 GPM i.e. gallon of isopentane or heavier hydrocarbons per Mscf.

If, at any time, gas tendered for delivery under the agreement shall fail to conform to any of the quality specifications set forth above, the receiving party may, at its option, refuse to accept delivery pending correction of the deficiency by the delivering party. Acceptance of non-spec gas shall not imply waiver of this term.

## Section - 3 Method of Measurement and Measurement Equipment

### Primary Measuring Device

Where measurement is by orifice meter, all fundamental constants, observations, records, and procedures involved in the determination and/or verification of the quantity and other characteristics of gas delivered hereunder shall, unless otherwise specified herein, be in accordance with the standards prescribed in the 2000 edition of AGA Report No. 3 (ANSI/API 2530), "Orifice Metering of Natural Gas," with any revisions, amendments, or supplements as may be mutually acceptable to the parties including any exception agreed to by the parties.

Measurement by turbine meter, unless specified otherwise, shall be in accordance with AGA Report No. 7 with any revisions, amendments or supplements as may be mutually agreeable to the parties.

Measurement by Ultrasonic meter shall be performed in accordance with AGA Report No. 9 with any revisions, amendments or supplements as may be mutually agreeable to the parties.

Measurement by Coriolis meter shall be in accordance with AGA Report No. 11 with any revisions, amendments or supplements as may be mutually agreeable to the parties.

When positive displacement meters (diaphragm or rotary type) are used for the measurement of gas, the flowing temperature of the gas may be assumed to be 60°F, and no correction shall be made for any variation there from, provided, however, that the pipeline shall have the option of installing or causing to be installed a recording thermometer and correction shall be made for each degree variation in the average flowing temperature for each meter recording.

Where measurement is by other than orifice, turbine, ultrasonic, Coriolis, or positive displacement meter, standards commonly acceptable in the industry shall be used in the determination of all factors involved in the computation of gas volumes.

### Basis

The measurement hereunder shall be corrected for deviation from Boyle's law at the pressures and temperatures under which the gas is measured hereunder in accordance with AGA Report No. 8 or as supplemented or amended from time to time, if mutually agreeable to the parties.

### Determination of heating value

The heating value of the gas may be determined by a chromatograph, continuous gas sampler, or spot gas samples. In the event a continuous gas sampler is installed, the heating value of the composite sample so taken shall be

considered as the heating value of the gas delivered during the applicable period of sampling unless agreed by the parties to apply the heating value to the month following the removal date of the composite sample.

If samples are taken, the samples shall be run or caused to be run by the measuring party at a chromatograph at another location. The result of a spot sample shall be applied to gas deliveries for the month following the day when the sample is taken and for all following month or months until a new sample is taken.

All heating value determinations made with a chromatograph shall use physical gas constants for gas compounds as outlined in the GPA Standard 2145 with any subsequent amendments or revisions to which the parties may mutually agree. Sampling of gas to obtain a true representative sample shall be done in accordance with GPA standard 2166. Fractional analysis of sample and calculation of heating value shall be done in accordance with GPA Standard 2261 and 2172 respectively. Heating value shall be determined to the nearest whole Btu.

### Determination of flowing temperature

The temperature of the gas flowing through the meter or meters shall be determined by the continuous use of a recording thermometer (should chart measurement be used) or an electronic temperature element installed so that it will properly record the temperature of the gas flowing through the meter or meters. In case of chart measurement, the average of the temperature recorded each day shall be used in computing the volumes of gas for that day. Temperature shall be determined to the nearest whole degree Fahrenheit.

### Determination of specific gravity

The specific gravity of the gas flowing through the meter or meters may be determined by the use of a recording gravitometer. The average of specific gravity recorded each day shall be used in computing the volume of gas for that day. If elected, the specific gravity of the gas flowing through the meter or meters may also be determined by a portable gravitometer or chromatograph, by spot gas samples, or by a continuous gas sampler in lieu of a recording gravitometer.

In the event spot gas samples are taken or a continuous gas sampler is installed, the samples shall be run or caused to be run by the measuring party on a gravitometer or a chromatograph at another location.

The specific gravity of the composite sample taken from a continuous gas sampler shall be considered as the specific gravity of the gas delivered during the applicable period of sampling unless agreed by the parties to apply the specific gravity

value to the month following the removal date of the composite sample.

If the specific gravity is determined as a spot gravity by a portable gravitometer or a portable chromatograph or from the taking of spot samples, the result shall apply to gas deliveries for the month following the day of the test and for all following month or months until a new test is taken.

All specific gravity determinations made with a chromatograph shall use physical gas constants for gas compounds as outlined in the GPA Standard 2145 with any subsequent amendments or revisions to which the parties may mutually agree. Specific gravity shall be determined to the nearest one-thousandth.

#### Equipment

The measuring stations shall be equipped with appropriate meter runs and accessories, or other types of meter or meters of standard make and design, commonly accepted in the industry, so as to accomplish the accurate measurement of gas delivered.

#### Electronic Gas Measurement (EGM)

An electronic flow computer (EFM-a tertiary device), transducers (secondary devices), and other associated sensing devices may be installed to accomplish the accurate measurement of gas delivered hereunder in accordance with AGA Report Nos. 3, 5, 6, 7, 8, 9, and 11 as appropriate, in lieu of mechanical devices with charts.

Static and differential Pressure transducers & transmitters installed on an orifice meter run shall utilize close-mounting. Close-mount shall mean that the distance between the orifice tap and the transmitter will not exceed 24 inches. The maximum zero-cutoff value which may be programmed for the differential transmitter reading is 0.25 inches.

If a computer and associated devices are installed, the values for gross heating value and specific gravity may be entered either manually at least once per month or as real-time data if such data are available. Values for gas components in mole per cent as required in super compressibility correction determinations using AGA 8 method shall be entered as real-time data if such data are available or shall be entered manually at intervals mutually agreed upon, but at least once every 6 months.

#### EGM Calculation and Data

The Electronic Gas Measurement (EGM) system shall be capable of establishing an audit trail (alarm,

configuration, calibration, adjustment, historical data, etc.) by compiling and retaining sufficient electronic data and information for the purpose of verifying daily and hourly quantities, and shall comply with the American Petroleum Institute - Manual of Petroleum Measurement Standards, Chapter 21, Section 1 - Electronic Gas Measurement (API Chapter 21), or other mutually agreeable standards. Pipeline shall preserve audit trail information for a minimum of 3 years or the time required by any governmental agency, whichever is greater.

Any volume recalculation shall utilize a mutually agreeable technique to compensate for the inherent inaccuracy associated with calculating volumes from averages of the flowing parameters as opposed to the actual instantaneous values used by the original flow computing device.

#### Calibration and tests of meters

Chromatographs, if used, shall be calibrated by the measuring party not less frequently than once per month against a standard gas sample. All other measuring equipment shall be calibrated and adjusted as necessary but no more than once each month. The other party may, at its option, be present for such calibration and adjustment. The measuring party shall give the other party notice of the time of all tests sufficiently in advance of conducting them that both parties may conveniently have their representatives present. Following any test, any measuring equipment found to be inaccurate to any degree shall be adjusted immediately to measure accurately.

Each party shall have the right, at any time, to challenge the accuracy of any measuring equipment used hereunder and may request additional tests. If, upon testing, the challenged equipment is found to be in error, then it shall be repaired and calibrated. The cost of any such special testing, repair, and calibration shall be borne by the party requiring the special test if the percentage of inaccuracy is found to be 1 percent (0.5% for EGM) or less; otherwise, the cost shall be borne by the party operating the challenged measuring equipment.

#### Access to meters, charts, and records

The non-measuring party shall have access at all reasonable times to the measuring equipment and all other instruments used by the measuring party in determining the measurement and quality of the gas delivered under the agreement, but the reading, calibrating, programming, data collecting, and adjusting thereof shall be done only by employees, agents, or representatives of the measuring party. All records shall be kept on file by the measuring party for a period of 2 years or any time required by governmental agencies, whichever is greater for mutual use of the parties hereto. The measuring party shall, upon request, submit to

the other party records from such equipment, subject to return by that party within 30 days after receipt thereof.

Upon request, the electronic measurement data and calculated by the EGM shall be preserved and provided for auditing purposes in a mutually agreeable standard format. Standard format shall mean the API Chapter 21 compliant electronic format provided by the manufacturer of the flow computer or another format for which commercially available EGM Review and Recalculation software exists and is mutually agreed upon by the parties hereto. Printed paper data is not acceptable for audit purposes. In addition, the final custody transfer volumes and MMBtus and a log of the changes made between the amounts calculated by the meter and the settlement amounts shall be provided. Unless a currently unresolved exception exists, all volumes shall be considered final after 2 years.

#### Correction of metering errors

If, upon any test, the measuring equipment in the aggregate is found to be inaccurate by more than 1 percent, registration thereof and any payments based on such registration shall be corrected at the rate of such inaccuracy for any period of inaccuracy which is definitely known or agreed upon, but in case the period is not definitely known or agreed upon, then for a period extending back one-half the time elapsed since the last day of calibration.

#### Failure of meters

If, for any reason, the measuring equipment is out of service or out of repair so that the quantity of gas delivered through such measuring equipment cannot be ascertained or computed from the readings thereof, the quantity of gas so delivered during the out-of-service or out-of-repair period shall be estimated and agreed upon by the parties hereto on the basis of the best available data, using the first of the following methods that is feasible:

1. By using the registration of any duplicate measuring equipment installed by the measuring party if installed and registering correctly.
2. By correcting the error if the percentage of error is ascertainable by calibration, test, or mathematical calculation.
3. By using the registration of any check measuring equipment of the other party if installed and registering accurately.
4. By estimating the quantity of deliveries by deliveries during preceding periods under similar conditions when the measuring equipment was registering accurately.

#### Check measuring equipment

Either party may install, maintain, and operate at its own expense, at or near each pipeline receipt point and/or each pipeline delivery point, such check measuring equipment as desired, provided that such equipment is installed so as not to interfere with the operation of any other measuring equipment. Whenever any receipt or delivery point is on the premises of the delivering party, the receiving party shall have the right of free use and ingress and egress at all reasonable times for the purpose of installation, operation, repair, or removal of such check measuring equipment. In the event check measuring equipment is installed by either party, the other party shall have access to the same at all reasonable times, but the reading, calibration, and adjusting thereof and operation and maintenance shall be done only by the party installing the checking equipment.

#### New measurement techniques

If, at any time during the term of the agreement, a new method or technique is developed with respect to gas measurement, or the determination of the factors used in such gas measurement, such new-method or technique may be substituted for the method set forth in this section when, in the opinion of the parties, employing such new method or technique is advisable.

#### Bibliography:

1. "Natural Gas Measurement and Control-A Guide to Operators and Engineers.", by Lohit Datta-Barua, McGraw-Hill Publishing, Dec. 1991
2. "Gas Contracts: Then and Now", by Mark B. Fillman and Gary P. Menzel, published in the proceedings of the American School of Gas Measurement Technology, 2006

