NATURAL GAS SPECS SHEET

Fuel Providers and their large volume Customers (particularly Electric Utilities and possibly other End Users) are used to defining fuel requirements in the form of Spec Sheets. Attached, as an example, is a #6 Fuel Oil Quality Specifications table developed to conform to federal, state, and local regulations governing the generator (e.g., emissions compliance), operational requirements (e.g., type of generating and/or backend clean-up equipment), and/or any other constraints imposed on the generator. Other examples of Spec Sheets and standards lists are included. This document includes an excellent example of a Gas Quality Spec Sheet from Brazil (GasEnergia) and additionally, the regulatory standards behind it.

With other generation fuels, the quality of the delivered product is a result of an agreement between the provider and the customer (the transporter does not generally have a significant input, if any).

With Natural Gas, due to the nature of the product and the transportation mechanism, the quality of the delivered product is primarily determined by the pipeline.

Utility generators have a need to know the expected range of quality of the fuel being delivered to them and ideally to have some control over the variability of that fuel to assure compliance with regulations, to protect their investment in generating equipment, and to be able to meet the needs of their customers in the most economic manner.

Not only is there a potential for great variability in the quality of Natural Gas delivered to Customers, the standards and specs defined in pipeline tariffs tend to be vague, difficult to locate or extract from pipeline tariffs, and often difficult to comprehend. These difficulties are compounded when generators try to deal with the differences across pipelines as there is not even a standard format for describing the quality specifications.

Customers would benefit from having access to clearly defined statements of pipeline quality (even though it varies from pipeline to pipeline) in the form of Natural Gas Spec Sheets (comparable to what the folks in Brazil have) provided in screen and downloadable format under Informational Postings on U.S. pipeline websites.

APPENDIX D: NO. 6 FUEL OIL QUALITY SPECIFICATIONS *[Revised 11/06/03]*

QUALITY SPECIFICATIONS *(NOTE 1)*		TEST METHOD *(NOTE 2)*	DELIVERY LOCATIONS		
CHARACTERISTIC --OR-- PROPERTY	UNITS / CONDITIONS		MANATEE (TMT/PMT) PORT EVERGLADES (TPE/PPE) SANFORD (TJS/PSN)	MIAMI -FISHER ISLAND (TFI/PTF) CANAVERAL (TCC/PCC)	PALM BEACH (TMR/PMR/PRV)
SULFUR	WEIGHT %	D-4294 *(NOTE 3)*	1.0 MAX	1.0 MAX	MAX As Ordered (.70% -OR- 1.0%)
HEATING VALUE	MMBTU/BBL	D-240	6.340 MIN *(NOTE 4)*	6.340 MIN *(NOTE 4)*	6.340 MIN *(NOTE 4)*
WATER & SEDIMENT (W&S)	VOLUME %	D-95 & D-473	1.0 MAX *(NOTE 5)*	1.0 MAX *(NOTE 5)*	1.0 MAX *(NOTE 5)*
SEDIMENT	WEIGHT %	D-473	0.20 MAX	0.20 MAX	0.20 MAX
FLASH POINT-PENSKY	°F	D-93	150 MIN	150 MIN	150 MIN
POUR POINT	°F	D-97	60 MAX	60 MAX	60 MAX
ASH	WEIGHT %	D-482	0.10 MAX	0.10 MAX	0.05 MAX for .70% S for PMR 0.07 MAX for 1.0% S for PMR 0.10 MAX for PRV
VISCOSITY	SSF@ 122°F	D-445 *(NOTE 6)*	25 MIN / 225 MAX	75 MIN / 225 MAX	25 MIN / 140 MAX for PMR 75 MIN / 225 MAX for PRV
GRAVITY	API	D-287 or D-4052	8.0 MIN for PPE & PMT 6.0 MIN for PSN	6.0 MIN	6.0 MIN
VANADIUM	PPM	D-5863 A or B/ D-5708 A or B	200 MAX	200 MAX	200 MAX
NITROGEN	WEIGHT %	D-5762	.40 MAX for PPE & PMT .50 MAX for PSN	.40 MAX for PTF .50 MAX for PCC	.30 MAX for .70% S for PMR .40 MAX for 1.0% S for PMR .50 MAX for 1.0% S for PRV
ALUMINUM + SILICON	PPM	D-5184	120 MAX	120 MAX	120 MAX
CALCIUM	PPM	D-5863 A or B/ D-5708 A or B	50 MAX	50 MAX	50 MAX
ASPHALTENES	WEIGHT %	BRITISH STANDARD BS-4676; IP-143.	8.0 MAX	8.0 MAX	8.0 MAX
DELIVERY TEMPERATURE	°F	N/A	105 MIN / 140 MAX	105 MIN / 140 MAX	105 MIN / 140 MAX

NOTES

1. **QUALITY WARRANTY:** PRODUCT SHALL MEET THE QUALITY SPECIFICATIONS DESCRIBED HEREIN AND, ADDITIONALLY, **(a)** SHALL NOT CONTAIN PETROCHEMICAL WASTES, RESIDUES, SPENT CHEMICALS, TAR BOTTOMS, HAZARDOUS WASTE, NOR ANY OTHER EXTRANEOUS MATERIALS OR MATTER FOREIGN TO NO. 6 FUEL OIL, **(b)** SHALL HAVE A CONSISTENT, MARKETABLE ODOR CHARACTERISTIC OF NO. 6 FUEL OIL, AND **(c)** SHALL BE FREE FROM EXCESSIVE AMOUNTS OF SOLID MATTER LIKELY TO MAKE CLEANING OF SUITABLE STRAINERS NECESSARY.
2. **TEST METHODS:** THE LATEST REVISION OF TEST METHODS SHALL APPLY. IN ADDITION TO ABOVE, THE FOLLOWING TESTS SHALL BE REPORTED AS PART OF THE AS-LOADED SPECIFICATION REQUIREMENTS FOR EACH CARGO: **(a)** DI-CYCLOPENTADIENE (DCPD) CONTENT USING CURRENTLY ACCEPTED TESTING METHODS, **(b)** ZINC AND MAGNESIUM (ASTM METHOD D-5863A OR B), AND **(c)** PHOPHOROUS (ASTM METHOD D-5708A OR B.
3. **SULFUR:** NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) NO. 6 FUEL OIL STANDARDS SHALL BE USED FOR CALIBRATION OF THE SULFUR EQUIPMENT.
4. **HEATING VALUE:** A QUALITY ADJUSTMENT SHALL BE MADE TO THE UNIT PRICE FOR CARGOS WITH HEATING VALUE BELOW THE MINIMUM SPECIFIED ABOVE, WITH THE REDUCTION IN UNIT PRICE CALCULATED IN ACCORDANCE WITH THE FOLLOWING FORMULA:

   $$U_{BTU} = U \times (M - B) / M$$

   WHERE: U_{BTU} IS THE AMOUNT OF THE PRICE REDUCTION ($/BBL), **U** IS THE UNIT PRICE CALCULATED PURSUANT TO THE CONTRACT ($/BBL), **M** IS THE MINIMUM HEATING VALUE (MMBTU/BBL) SPECIFIED ABOVE, AND **B** IS THE ACTUAL HEATING VALUE (MMBTU/BBL) OF THE CARGO AS DETERMINED BY THE DELIVERY INSPECTOR.
5. **WATER & SEDIMENT:** AN ADJUSTMENT SHALL BE MADE TO THE DELIVERY QUANTITY FOR CARGOS WITH GREATER THAN 0.30% WATER & SEDIMENT (W&S), WITH THE REDUCTION IN VOLUME CALCULATED IN ACCORDANCE WITH THE FOLLOWING FORMULA:

   $$Q_{W\&S} = Q \times (A - 0.30\%)$$

   WHERE: $Q_{W\&S}$ IS THE AMOUNT OF THE VOLUME REDUCTION (BBL), **Q** IS THE DELIVERY QUANTITY AS DETERMINED BY THE DELIVERY INSPECTOR (BBL), AND **A** IS THE ACTUAL W&S AS DETERMINED BY THE DELIVERY INSPECTOR (VOLUME %).
6. **VISCOSITY:** RUN VISCOSITY TEST BY ASTM D-445 AND CONVERT THE RESULTS TO UNITS OF SSF@122°F USING THE TABLE IN ASTM D-2161.

NATGAS QUALITY SPECIFICATIONS LIST

NATGAS PHYSICAL AND CHEMICAL PROPERTIES OR CHARACTERISTICS POTENTIALLY OF INTEREST TO NATGAS USER GROUPS THAT MAY BE MONITORED, TRACKED, OR CALCULATED BY THE INDUSTRY.

PROPERTY or CHARACTERISTIC	SYMBOL	MEASUREMENT UNIT(S) –or— CONDITION	ANALYTICAL TEST METHOD	MINIMUM VALUE	MAXIMUM VALUE
HIGH HEATING VALUE	HHV	Btu/scf			
LOW HEATING VALUE	LHV	Btu/scf			
SPECIFIC GRAVITY	ρ	---			
WOBBE INDEX	W	---			
TEMPERATURE	T	°F			
WATER	H_2O	lb/MMscf			
WATER DEWPOINT	D_{H2O}	°F			
HYDROCARBON DEWPOINT	D_{HC}	°F			
METHANE	C_1	%			
ETHANE	C_2	%			
PROPANE	C_3	%			
ISOBUTANE	iC_4	%			
NORMAL BUTANE	nC_4	%			
ISOPENTANE	Ic_5	%			
NORMAL PENTANE	nC_5	%			
HEXANES (and heavier)	C_6 (C_6+)	%			
HEPTANES	C_7	%			
OCTANES	C_8	%			
NONANES	C_9	%			
DECANES	C_{10}	%			
NITROGEN	N_2	%			
CARBON DIOXIDE	CO_2	%			
OXYGEN	O_2	%			
HYDROGEN	H_2	%			
HELIUM	He	%			
OTHER GASES	?	%			
TOTAL SULFUR	S_{TOT}	Note 1			
HYDROGEN SULFIDE	H_2S	Note 1			
CARBONYL SULFIDE	COS	Note 1			
SULFUR IN MERCAPTANS	SRSH	Note 1.			
IRON SULFIDE	FeS	lbs			
OTHER SULFUR COMPOUNDS	?	Note 1			
MERCURY	Hg	ppb			
PARTICULATES	?	microns			

NOTES
(1) Sulfur measurements given in grains/100scf or in ppm or both.

-- EXAMPLE OF STANDARDS LIST --
EGYPTIAN ORGANIZATION for STANDARDIZATION and QUALITY CONTROL
NATURAL GAS MEASUREMENT STANDARDS

75.060 Natural gas

ISO 6326-1:1989 Natural gas -- Determination of sulfur compounds -- Part 1: General introduction

ISO 6326-2:1981 Gas analysis -- Determination of sulphur compounds in natural gas -- Part 2: Gas chromatographic method using an electrochemical detector for the determination of odoriferous sulphur compounds

ISO 6326-3:1989 Natural gas -- Determination of sulfur compounds -- Part 3: Determination of hydrogen sulfide, mercaptan sulfur and carbonyl sulfide sulfur by potentiometry

ISO 6326-4:1994 Natural gas -- Determination of sulfur compounds -- Part 4: Gas chromatographic method using a flame photometric detector for the determination of hydrogen sulfide, carbonyl sulfide and sulfur-containing odorants

ISO 6326-5:1989 Natural gas -- Determination of sulfur compounds -- Part 5: Lingener combustion method

ISO 6327:1981 Gas analysis -- Determination of the water dew point of natural gas -- Cooled surface condensation hygrometers

ISO 6570-1:1983 Natural gas -- Determination of potential hydrocarbon liquid content -- Part 1: Principles and general requirements

ISO 6570-2:1984 Natural gas -- Determination of potential hydrocarbon liquid content -- Part 2: Weighing method

ISO 6974-1:2000 Natural gas -- Determination of composition with defined uncertainty by gas chromatography -- Part 1: Guidelines for tailored analysis

ISO 6974-2:2001 Natural gas -- Determination of composition with defined uncertainty by gas chromatography -- Part 2: Measuring-system characteristics and statistics for processing of data

ISO 6974-3:2000 Natural gas -- Determination of composition with defined uncertainty by gas chromatography -- Part 3: Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and hydrocarbons up to C8 using two packed columns

ISO 6974-4:2000 Natural gas -- Determination of composition with defined uncertainty by gas chromatography -- Part 4: Determination of nitrogen, carbon dioxide and C1 to C5 and C6+ hydrocarbons for a laboratory and on-line measuring system using two columns

ISO 6974-5:2000 Natural gas -- Determination of composition with defined uncertainty by gas chromatography -- Part 5: Determination of nitrogen, carbon dioxide and C1 to C5 and C6+ hydrocarbons for a laboratory and on-line process application using three columns

ISO 6975:1997 Natural gas -- Extended analysis -- Gas-chromatographic method

ISO 6976:1995 Natural gas -- Calculation of calorific values, density, relative density and Wobbe index from composition

ISO 6976:1995/Cor 1:1997 (Applies to French version only)

ISO 6976:1995/Cor 2:1997 No title

ISO 6976:1995/Cor 3:1999 No title

ISO 6978:1992 Natural gas -- Determination of mercury

ISO 8943:1991 Refrigerated light hydrocarbon fluids -- Sampling of liquefied natural gas -- Continuous method

ISO 10101-1:1993 Natural gas -- Determination of water by the Karl Fischer method -- Part 1: Introduction

ISO 10101-2:1993 Natural gas -- Determination of water by the Karl Fischer method -- Part 2: Titration procedure

ISO 10101-3:1993 Natural gas -- Determination of water by the Karl Fischer method -- Part 3: Coulometric procedure

ISO 10715:1997 Natural gas -- Sampling guidelines

ISO 10723:1995 Natural gas -- Performance evaluation for on-line analytical systems

ISO 10723:1995/Cor 1:1998 No title

ISO 11541:1997 Natural gas -- Determination of water content at high pressure

ISO 12213-1:1997 Natural gas -- Calculation of compression factor -- Part 1: Introduction and guidelines

ISO 12213-2:1997 Natural gas -- Calculation of compression factor -- Part 2: Calculation using molar-composition analysis

ISO 12213-3:1997 Natural gas -- Calculation of compression factor -- Part 3: Calculation using physical properties

ISO 13443:1996 Natural gas -- Standard reference conditions

ISO 13443:1996/Cor 1:1997 (Applies to French version only)

ISO 13686:1998 Natural gas -- Quality designation

ISO 13734:1998 Natural gas -- Organic sulfur compounds used as odorants -- Requirements and test methods

ISO 13734:1998/Cor 1:1999 No title

ISO 14111:1997 Natural gas -- Guidelines to traceability in analysis

ISO 15403:2000 Natural gas -- Designation of the quality of natural gas for use as a compressed fuel for vehicles

Print

Chemical Composition of Natural Gas

Natural gas is a naturally occurring gas mixture, consisting mainly of methane. While most of the gas supplied to Union Gas is from western Canada, some gas is supplied from other sources, including the United States and Ontario producers. While the gas from these sources has a similar analysis, it is not entirely the same. The table below outlines the typical components of natural gas on the Union Gas system and the typical ranges for these values (allowing for the different sources).

Note that there is no guarantee of the following composition at your location or as an overall system average. Since the different gas supplies enter the Union Gas system at different locations, the exact composition at any site will vary among the different regions. The system average heating value will depend on the mix of gas supplies (which is increasingly controlled by our customers), and therefore can vary from the typical value listed below.

Component	Typical Analysis (mole %)	Range (mole %)
Methane	94.9	87.0 - 96.0
Ethane	2.5	1.8 - 5.1
Propane	0.2	0.1 - 1.5
iso - Butane	0.03	0.01 - 0.3
normal - Butane	0.03	0.01 - 0.3
iso - Pentane	0.01	trace - 0.14
normal - Pentane	0.01	trace - 0.04
Hexanes plus	0.01	trace - 0.06
Nitrogen	1.6	1.3 - 5.6
Carbon Dioxide	0.7	0.1 - 1.0
Oxygen	0.02	0.01 - 0.1
Hydrogen	trace	trace - 0.02
Specific Gravity	0.585	0.57 - 0.62
Gross Heating Value (MJ/m^3), dry basis *	37.8	36.0 - 40.2

* The gross heating value is the total heat obtained by complete combustion at constant pressure of a unit volume of gas in air, including the heat released by condensing the water vapour in the combustion products (gas, air, and combustion products taken at standard temperature and pressure).

Sulphur:

In the Union Gas system, the typical sulphur content is 5.5 mg/m^3. This includes the 4.9 mg/m^3 of sulphur in the odourant (mercaptan) added to gas for safety reasons.

Water:

The water vapour content of natural gas in the Union Gas system is less than 80 mg/m^3, and is typically 16 to 32 mg/m^3.

Typical Combustion Properties of Natural Gas

Note that there is no guarantee that the combustion properties at your location will be exactly as shown. The properties shown are an overall average on the Union Gas system.

Ignition Point:	593 ^oC *
Flammability Limits	4% - 16% (volume % in air) *
Theoretical Flame Temperature (stoichiometric air/fuel ratio)	1960 ^oC (3562 ^oF) †
Maximum Flame Velocity	0.3 m/s †
Relative density (specific gravity)	0.585 ‡
Wobbe Index (Btu/scf)	1328 ‡

† Information provided is from North American Combustion Handbook, Volume 1, 3rd edition, North American Mfg Co., 1986.
‡ Information provided is from the Chemical Composition of Natural Gas as shown on the chart above.
* Information provided is from the Union Gas Material Safety Data Sheet (WHMIS).

EXAMPLE - STATE OF WYOMING NATURAL GAS STANDARD

CHAPTER 9
STANDARDS FOR NATURAL GAS

40-9-101. Standard natural gas defined.

(a) For the purpose of this act [§§ 40-9-101 through 40-9-105] standard natural gas shall be considered to have an average standard of heating units of not less than one thousand (1,000) British thermal units per cubic foot of gas, ascertained and determined by the state chemist in accordance with standard conditions, to wit:

(i) At a temperature of sixty degrees Fahrenheit (60° F);

(ii) Under pressure of thirty (30) inches of mercury.

40-9-102. Factors to be considered in fixing rates.

The standard of heating units herein prescribed and any variations therefrom, in any gas distributed by any utility, or utilities, to users of natural gas, shall be taken into consideration by the public service commission as an additional factor to the factors provided for in W.S. 37-2-118, as a basis for fixing rates and rate schedules for the allowable charges the utility may make against the users of natural gas in any particular town, city or community, in which the question of such rates shall be presented to said commission, as provided for in W.S. 37-2-118.

40-9-103. Tests and report of state chemist upon complaint; use of results as evidence and in fixing rates.

Whenever any complaint is made, as provided for in W.S. 37-2-118, that the heat units of the natural gas supplied by any utility to the users thereof in any town or municipality are below the standard thereof theretofore used as a factor in the basis for rates to be charged by the utility in that particular town or municipality, the public service commission shall notify the state chemist to make proper tests of the heating units of the gas furnished by such utility to the complaining municipality. The state chemist shall certify to the public service commission and to the mayor of the complaining town or municipality the result of such test, which said certificate shall be used as competent evidence by the public service commission at the hearing of said complaint, and shall be used by the commission as one (1) of the factors as a basis for any change in the rates the commission may find necessary to make.

40-9-104. Municipality may require test every 3 months.

The mayor, or city council of any town or municipality, in which natural gas is furnished by any utility is hereby given the right to require the state chemist to make a test of such gas every three (3) months and to certify the results thereof to said mayor, or city council and public service commission.

40-9-105. Expense of tests charged to state university.

Any and all expenses incurred by the state chemist in carrying out the provisions of this act [§§ 40-9-101 through 40-9-105] shall be a charge against the University of Wyoming.

http://legisweb.state.wy.us/statutes/titles/title40/chapter09.htm

Natural Gas

What it is? : History : The Route to the Distribution Utility : Advantages and Benefits : Reserves Environment : Telecommunications : Who uses Natural Gas?

What it is?

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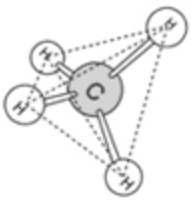
Typical Composition of Natural Gas



Its composition may vary, depending on whether the gas is associated or non-associated with oil, or has or has not been processed in industrial plants. The basic composition includes methane, ethane, propane and hydrocarbons with a heavier molecular weight (in smaller proportions). Normally it has low contaminant content, such as nitrogen, carbon dioxide, water and sulfides.

Check the composition and specifications of natural gas below.

Learn more:

» Composition of Natural Gas

» Composition of the Natural Gas in the Campos Basin (Cabiúnas Station - Macaé)

» Comparison Between Natural Gas and Other Gases

TYPICAL COMPOSITION OF NATURAL GAS

ELEMENTS	ASSOCIATED (1)	NON-ASSOCIATED (2)	PROCESSED (3)
METHANE	81,57	85,48	88,56
ETHANE	9,17	8,26	9,17
PROPANE	5,13	3,06	0,42
I-BUTANE	0,94	0,47	--
N-BUTANE	1,45	0,85	--
I-PENTANE	0,26	0,20	--
N-PENTANE	0,30	0,24	--
HEXANE	0,15	0,21	--
HEPTANE & SUPERIOR	0,12	0,06	--
NITROGEN	0,52	0,53	1,20
CARBON IOXIDE	0,39	0,64	0,65
TOTAL	100,0	100,0	100,0
DENSITY	0,71	0,69	0,61
RICHNESS (% WET C3+)	8,35	5,09	0,42
BASE CAL.VALUE (KCAL/M)	9.916	9.583	8.621
TOP CAL.VALUE (KCAL/M)	10.941	10.580	9.549

1- Gas from Garoupa field, Campos Basin
2- Gas from Miranga field in Bahia
3- Outlet from Candeias NGPU in Bahia

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NATURAL GAS SPECIFICATION (1) (2)*						
CHARACTERISTICS	UNIT	LIMIT			METHODO	
		NORTH (5)	NORTHEAST	SOUTH, SOUTHEAST, CENTRAL-WEST	ASTM	ISO
UPPER HEAT PRODUCING POWER (4)	KJ/M³ KWH/M³	34.000 TO 38.400 9,47 TO 10,67	35.000 TO 42.000 9,72 TO 11,67		D 3588	6976
WOBBE INDEX	KJ/M³ % VOL.	40.500 TO 45.000	46.500 A 52.500		-	6976
METHANE, MIN.	% VOL.	68,0	86,0		D 1945	6974
ETHANE, MAX.	% VOL.	12,0	10,0			
PROPANE, MAX.	% VOL.	3,0				
BUTANE AND HEAVIER, MAX.	% VOL.	1,5				
OXYGEN, MAX.	% VOL.	0,8	0,5			
HYDROGEN	% VOL.	NOTE				
INERT (N2 + CO2), MAX.	% VOL.	18,0	5,0	4,0		
NITROGEN, MAX.	% VOL.	NOTE	2,0			
TOTAL SULFUR, MAX.	MG/M³	70			D 5504	6326-2 6326-5
HYDRO-SULFURIC GAS (H2S), MAX.	MG/M³	10,0	15,0	10,0		
WATER DEW POINT AT 1 ATM, MÁX.	ºC	-39	-39	-45	D5454	-
LIQUID HYDROCARBONATES	MG/M³	NOTE			-	6570

Observations:

(1) Natural gas should be technically exempt, that is, there should be no visible traces of solid and liquid particles.

(2) Specification limits are values referred to as 293.15 K (20 ºC) and 101.325 kPa (1 atm) on a dry base, except at dew point.

(3) Limits for the North region are destined for different applications except vehicular, where for this purpose, limits equivalent to the Northeast region must be applied.

(4) Calorific energy of the pure reference substance used in this Technical Regulation is found under temperature and pressure conditions equivalent to 293.15 K, 101.325 kPa, respectively on a dry base.

(5) The Wobbe index is calculated by employing the Higher Calorific Energy on a dry base. When the ASTM D 3588 method is used to obtain the Higher Calorific Energy, the Wobbe index must be determined by the formula contained in the Technical Regulation.

(6) Odorized gas must not contain a sulfur content higher than70 mg/m³.

* The text was extracted from Administrative Rule #104, dated 8 July, 2002. **Click here** to see the administrative rule in its entirety.

Source: The National Petroleum Agency

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Natural Gas

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What it is?

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Composition of the Natural Gas in the Campos Basin

(Cabiúnas Station - Macaé) 5/31 October 2000

Non-processed Natural Gas | Processed Natural Gas

NON-PROCESSED NATURAL GAS			
NON-PROCESSED GAS	AVERAGE	MAXIMUM	MINIMUM
O2	0.003	0.0540	0.000
N2	0.643	2.1120	0.4150
CO2	0.318	0.4100	0.2540
C1	84.266	87.2200	81.8040
C2	7.578	9.5860	5.4480
C3	4.427	5.4590	2.9480
IC4	0.663	0.7940	0.5470
NC4	1.283	1.4430	1.1170
NEO C5	0.000	0.0000	0.0000
IC5	0.238	0.3160	0.0000
NC5	0.298	0.4010	0.1860
C5+	0.281	0.5060	0.1210
RICHNESS (%)	7.189	8.1560	5.6000
P.C.S (KCAL/M³)	10502	10726	10282
DENSITY	0.687	0.7030	0.6690
H2S MG/M³	0.630	3.3961	0.0000
TOTAL SUFUR H2S MG/M³	0.746	4.1552	0.0000

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PROCESSED NATURAL GAS			
PROCESSED GAS	AVERAGE	MAXIMUM	MINIMUM
O2	0.006	0.1130	0.000
N2	0.647	1.4590	0.4740
CO2	0.293	0.3630	0.1550
C1	88.974	90.9330	85.0040
C2	6.708	8.0490	4.9590
C3	2.636	4.0860	2.0780
IC4	0.248	0.5910	0.1370
NC4	0.394	1.0520	0.2470
NEO C5	0.000	0.0000	0.0000
IC5	0.040	0.1900	0.0180
NC5	0.038	0.2280	0.0100
C5+	0.016	0.0960	0.0010
RICHNESS (%)	3.370	6.2430	2.5520
P.C.S (KCAL/M³)	9738	10359	9538
DENSITY	0.630	0.6720	0.6160

Note:
. Consider the H2O content in the non-processed natural gas natural as saturated in H2O
. Consider the H2O content in processed natural gas as 5lb/MMft3 gas

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Learn more:

» Composition of Natural Gas

» Composition of the Natural Gas in the Campos Basin (Cabiúnas Station - Macaé)

» Comparison Between Natural Gas and Other Gases

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Natural Gas » What it is?

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Comparison between Natural Gas and other Gases

	NATURAL GAS	LPG	STREET GAS (MANUFACTURED)	REFINERY GAS
ORIGIN	UNASSOCIATED PETROLEUM AND GAS RESERVOIRS	PETROLEUM DISTILLATION AND GAS PROCESSING	THERMOCATALYTIC REFORM OF NATURAL GAS OR PETROCHEMICAL NAPHTHA	OIL REFINING PROCESSES (CATALYTIC CRACKING, DISTILLATION, REFORMING AND DELAYED COKING)
MOLECULAR WEIGHT	17 TO 21	44 TO 56	16	24
SUPERIOR HEATING POWER (KCAL/M3)	RICH: 10.900 PROCESSED: 9.300	24.000 TO 32.000	4.300	10.000
RELATIVE DENSITY	0.58 TO 0.72	1.50 TO 2.0	0.55	0.82
PRINCIPLE COMPONENTS	METHANE, ETHANE	PROPANE, BUTANE	HYDROGEN, METHANE, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE	HYDROGEN, NITROGEN, METHANE, ETHANEV
PRINCIPLE USES	RESIDENTIAL, COMMERCIAL, AUTOMOTIVE AND HERMOELECTRIC GENERATION: (FUEL) INDUSTRIAL: (FUEL, PETROCHEMICAL AND METALLURGICAL)	INDUSTRIAL, RESIDENTIAL AND COMMERCIAL (FUEL)	RESIDENTIAL AND COMMERCIAL (FUEL)	INDUSTRIAL (FUEL AND PETROCHEMICAL)
STORAGE PRESSURE	200 ATM	15 ATM	- - - -	- - - -

Comments :

Origin:
There is a fundamental difference between these gases in terms of origin: natural gas is found in nature in subterranean reservoirs, whereas all the other gases originate from industrial processes.

Molecular weight (and, in consequence, density):
LPG is the only one that is heavier than air. Therefore, in the event of a leak, it concentrates at ground level, whereas the others dissipate rapidly, or in enclosed environments, they concentrate at ceiling level. This difference is fundamental in directing actions in the event of gas leaks.

Heating power:
Street gas has the least heating power, therefore, larger quantities of this gas, in relation to others, are required to liberated the same quantity of energy from burning.

Principle components:
All of these are hydrocarbon-based, but street gas and refinery gas contain inorganic components in considerable proportions.

Principle uses:
Basically, refinery gas is for industrial use as a fuel and petrochemical raw materials; street gas is used as residential and commercial fuel; LPG, in addition to its residential and commercial use, is used as an industrial fuel, and there are applications for natural gas in all sectors, including the automotive sector. Note that the use of LPG in vehicles is prohibited by law. Moreover, this application is dangerous, due to improvisations and the lack of regulations regarding the equipment used for this purpose.

Storage pressure:
LPG is sold in 13 kg canisters and in 45 kg cylinders. In either case, when the containers are full, the pressure is approximately 15 atm. At this pressure and at room temperature, 85% of its volume is in the liquid state and 15 % is in the vaporous state. When natural gas is used in vehicles (VNG - vehicular natural gas), it is sold at service stations at 200 atm pressure, which is the final pressure in the vehicle's cylinder. Under these conditions, the quantity of natural gas in the cylinder is approximately 30 kg. It is distributed through the normal gas distribution networks for all other uses.

Source: Conpet

[top]

BACK

THE NATIONAL PETROLEUM AGENCY

ADMINISTRATIVE RULE # 104, DATED 8 JULY 2002

Establishes the specification for natural gas, whether national or imported, to be used commercially throughout national territory.

The DIRECTOR GENERAL of the NATIONAL PETROLEUM AGENCY – ANP in the exercise of its legal authority and functions, as provided for by Law #9.478, dated 06 August 1997 and Board of Director Resolution #455, dated 03 July 2002, hereby publishes the following act:

Art. 1º The specification of natural gas, whether of national origin or imported, to be used commercially throughout national territory, is hereby established in terms of this Administrative Rule, in accordance with the provisions contained in Technical Regulation ANP #3/2002, which forms an integral part of this Administrative Rule.

Art. 2º Importers, processors, carriers, transporters and distributors of natural gas that operate in the Country must obey the provision of the Technical Regulation attached to the stages of commercialization and transport.
Sole Paragraph. The sale and transport of natural gas not specified in the Technical Regulation are hereby authorized, provided the conditions of delivery by pipeline dedicated to the said product, the agreement among the parties involved and the limits of emission of combustible products established by the environmental organ having jurisdiction in the area, are respected.

Art. 3º For the purposes of this Administrative Rule, the following definitions are hereby established:

I. Carrier: a legal entity, duly registered as such, that contracts a transporter for the service of transporting natural gas;

II. Transporter: a legal entity, duly registered as such, and authorized by the ANP (The National Petroleum Agency) to operate transport installations;

III. Processador: pessoa jurídica autorizada pela ANP a processar o gás natural;

IV. Transport Installations: natural gas pipeline transport, compression stations, as well as storage facilities necessary for the operation of the system;

V. Reception Point: the point at which the natural gas is received by the transporter from the carrier or who authorizes such reception.

VI. Point of Delivery: at which the natural gas is delivered by the transporter to the carrier or who authorizes such delivery;

Art. 4 This Administrative Rule applies to processed natural gas to be used for industrial, residential, commercial, automotive and energy generation purposes.

Sole paragraph. The attached Technical Regulation does not apply to the use of natural gas as a raw material in chemical processes.

Art. 5 The carrier is obliged to carry out analyses of the natural gas at reception points, at intervals not exceeding 24 hours, as from the first supply and forward the result to the transporter by means of a Quality certificate, which must contain an analysis of all characteristics, specification limits and the methods employed, and proof that the product satisfies the specification contained in the attached Technical Regulation.

§ 1º The Certificate of Quality must contain the name of the technician in charge, together with his/her registration number with the competent professional organ.

§ 2º Any carrier who fails to carry out an analysis of natural gas, must complete the Certificate of Quality with the data supplied by the producer/importer that acquired the product, who shall then be considered responsible for its quality.

§ 3º The carrier must forward to the ANP (The National Petroleum Agency), by not later than the 15th (fifteenth) day of the following month, the document that refers to data sent, a statistical summary of the Certificates of Quality, issued by means of the electronic address carregadorgn@anp.gov.br, in the format of an electronic worksheet, which must contain:

I - ANP carrier code;

II – month and year relative to the data certificates;

III – total volume sold for the month;

IV - ANP code for the reception point at which the analysis was carried out;

V – table of results in accordance with the model below:

CHARACTERISTIC	UNIT	Test Method	Minimum	Maximum	Considered Average	Standard Deviation	Number of Analyses
Upper Heating Capacity kJ/m³	KJ/m^3						
Wobbe Index kJ/m³							
Methane % vol.	% vol.						
Ethane % vol.	% vol.						
Propane % vol.	% vol.						
Butane and heavier % vol.	% vol.						
Inerts (N2+ CO2) % vol.	% vol.						
Nitrogen % vol.	% vol.						
Oxygen % vol.	% vol.						
Hydrosulfuric Gas mg/m3	mg/ m^3						
Dew Point of water, 1 atm (1) °C	ºC						

Note:
(1) Values referred to 20° C and 101,325 kPa except due point of water.
Where:

Minimum, Maximum – minimum and maximum value found in laboratory determinations for the month
Considered Average – considered average by volume of the object of the tests carried out during the month
Standard Deviation – standard deviation of average
Number of Analyses during the month.

Art. 6º The transporter is obliged to carry out an analysis of the product and issue a Conformity Report:

I – at all reception points after the homogenization of the mixture between gas entering and gas passing through, at maximum intervals of 24 hours from the first reception;

II – at all delivery points with an incidence of flow inversion in the transport pipeline and an outflow greater than 400 thousand m³/d during a maximum interval of 24 hours as from the first delivery.

§ 1º In cases where there is no mixture of distinct products, the transporter, who does not carry out an analysis, must complete the Conformity Report with the data contained in the Certificate of Quality sent by the carrier, who will then be held responsible for its quality.

§ 2º The transporter must send a copy of the Conformity Report, with the name of the technician in charge with his professional category number, to the carrier, proving the quality of the gas, by means of the presentation of the results, specification limits, and pertinent test methods relative to the analyses, containing the following characteristics:

I – upper heating capacity;

II- Wobbe Index;

III – contents of methane, ethane, propane, butane and heavier, inerts, nitrogen and oxygen.

§ 3º The transporter must, by not later than the 15th (fifteenth) day of the month following the data sent, a summary of Conformity Report statistics issued, via the electronic address transportadorgn@anp.gov.br, in the format of an electronic worksheet, containing the following:

I - ANP code for the transporter;

II – month and year of certified data;

III – total volume sold in the month;

IV - ANP code for analysis installation;

V – natural gas carrier code and

VI – table of results in accordance with the model below:

CHARACTERISTIC[(1)]	UNIT	Test Method	Minimum	Maximum	Considered Average	Standard Deviation	Number of Analyses
Upper Heating Capacity kJ/m³	kJ/m^3						
Wobbe Index kJ/m³	kJ/m^3						
Methane % vol.	% vol.						
Ethane % vol.	% vol.						
Propane % vol.	% vol.						
Butane and heavier % vol.	% vol.						
Inerts (N2+ CO2) % vol.	% vol.						
Nitrogen % vol.	% vol.						
Oxygen % vol.	% vol.						
Hydrosulfuric Gas mg/m3	mg/ m^3						
Dew point of water, 1 atm (1) °C	ºC						

Note:
(1) The values referred to 20° C and 101,325 kPa.
Where:
Minimum, Maximum – minimum and maximum values found in laboratory determination during the month

Considered Average – considered average by volume of the object of analyses carried out during the month

Standard Deviation – standard deviation of average

Number of Analyses – total number of analyses during the month.

Art. 7º For the purposes of identifying the carrier, transporter, reception point and analysis installation. In accordance with the provisions of articles 5 and 6, the codes that will be permanently updated on the ANP page at the electronic address www.anp.gov.brmusst be used.

Art. 8º The ANP may at any time inspect the instruments used for the preparation of the Certificate of Quality and the Conformity Bulletin relative to natural gas specified in this Administrative Rule.

Art. 9º The Certificates of Quality issued by the carrier and the Conformity Bulletins issued by the transporter must be available to ANP whenever requested, for a minimum period of 2 (two) months as from that date of issue.

Art. 10º The natural gas must be odorized at transport in accordance with the requirements provided for during the environmental licensing process conducted by the environmental organ having jurisdiction over the area.

Art. 11º The natural gas must be odorized at distribution so that it can be detected by human smell in the event of a leak and when there is a concentration in the atmosphere that reaches 20% of the lower limit of inflammability.

Sole Paragraph: A request for the exemption of the use of odorization of natural gas in dedicated distribution pipelines whose destination does not recommend the use of odorization and such pipelines do not pass through urban areas must be addressed to the state organ having jurisdiction over the area in which analysis is performed and authorization is granted.

Art. 12º The periods established within which the agents referred to in article 2 hereof are to satisfy the specification limits contained in the Technical Regulation attached hereto, and the period within which the specifications contained in the ANP Administrative Rules #41 and #42, dated 15 April 1998, are to met, are set out below:

I – 180 days for the northeast region and

II –90 days for the north, central-west, south and southeast regions.

Art. 13º A period of 90 days as from the date of the publication of this Administrative Rule is hereby established in which carriers must present the first statistical summary of Quality Certificates in accordance with art 5 hereof.

Art. 14º A period of 180 days is hereby established in which transporter are to present the first statistical summary of Conformity Bulletins in accordance with article 6.

Art. 15º A failure to comply with the provisions of this Administrative Rule will subject the infractor to the penalties provided for in Law #9,847 dated 26 October 1999 and any other provisions that are applicable.

Art. 16º This Administrative Rule shall come into force and effects as from the date of its publication.

Art. 17º ANP Administrative Rule #128 dated 28 August 2001, and other provisions to the contrary, are hereby revoked, subject to the terms of article 12 of this Administrative Rule.

SEBASTIÃO DO REGO BARROS

Published in the Official Gazette on 9/7/2002

ATTACHMENT

ANP TECHNICAL REGULATION # 3/2002

1. Objective

This Technical Regulation applies to natural gas, whether national or imported, to be sold throughout national territory, and includes processed fuel gas that consists of a mixture of hydrocarbonates, mainly methane, ethane and heavier hydrocarbonates in smaller quantities.

1.1 Explicatory Note

Natural gas remains in a gaseous state under temperature and ambient pressures. It is produced by processing gas extracted from reservoirs and normally consists of inert gases, such as nitrogen and carbon dioxide, as well as traces of other elements.

The natural gas processing stage reduces concentrations of potentially corrosive components such as hydrogen sulfide, carbon dioxide, besides other components such as water and heavier hydrocarbonates, condensable when natural gas is transported and distributed.

2. System of Units

The system of units to be employed in this technical regulation is SI in accordance with Brazilian Standard NBR 12230.

Therefore, the unit of energy is J and its multiples or KWh, the unit of pressure is Pa and its multiples and the unit of temperature is K (Kelvin) or ºC (degrees Celsius).
The graph to be followed is determined by NBR 12230.

3. Characteristics

The tests contained in this specification referred to their respective meanings and performance properties, as well as other relevant definitions, are listed as follows.

The reference conditions employed in this Technical Regulation are temperature and pressure reference conditions equivalent to 293,15 K and 101,325 kPa on a dry basis.

3.1 Heating Capacity

3.1.1 Upper Heating Capacity

Quantity of energy released in the form of heat, on complete combustion of a defined quantity of gas with air, at a constant pressure and with all combustion products returning to the original temperature of the reagents. The water formed during combustion is in a liquid state.

3.1.2 Lower Heating Capacity

Quantity of heat released in the form of heat, on complete combustion of a defined quantity of gas with air, at a constant pressure and with all combustion products returning to the original temperature of the reagents. All products, including the water formed during combustion, are in a gaseous state.

Upper heating capacity differs from lower heating capacity because of thermal heat caused by condensation of water.

3.1.3 Reference State

The heating capacity reference values of the pure substances employed in this Technical Regulation were extracted from ISO 6976 under temperature and pressure conditions equivalent to 293,15 K, 101,325 kPa, respectively, on a dry basis.

3.2 Relative Density

The quotient between the mass of gas contained in an arbitrary volume and the mass of dry air having an ISSO 6976 standardized composition that must occupy the same volume under normal temperature and pressure conditions.

3.3 Wobbe Index

The quotient between heating capacity and the square root of relative density under the same reference temperature and pressure conditions.

INSERIR FIGURA3.EPS

Where:

IW – Wobbe Index

PCs – Upper heating capacity

r – relative density

The Wobbe index is the quantity of energy made available in a combustion system by means of an orifice injector. The quantity of energy made available is a linear function of the Wobbe index.

Two gases that present distinct compositions, but have the same Wobbe index, will make the same quantity of energy available by means of an orifice injector at the same pressure.

3.4 Methane Number

The methane number indicates the anti-knocking capacity of natural gas resulting from its application to vehicles, its limits being subject to a comparison with the octane rating of gasoline.

Anti-knocking power is the capacity of the fuel to resist knocking in vehicles at reigning temperature and pressure levels in the engine combustion chamber, caused by compression to which the air/fuel mixture is submitted.

The anti-knocking power of liquid fuels (gasoline) is measured by means of the octane rating (MON or RON). Typical octane rating values of natural gas is between 115 and 130, where methane is 140.

In order to obtain a better picture of the anti-knocking power of gas fuels, a new scale called octane number –NM (ON) that uses pure methane as a reference (NM (ON) = 100) and hydrogen (NM (ON) = 0) was developed. The procedure contained in ISO 15403 is used to calculate the methane number based on the composition of the gas.

3.5 Composition

Mass fractions or percentages, whether volumetric or molars of the principal components, associated components, traces and other components determined by means of an analysis of natural gas. For ideal gases the volumetric fraction equals the molar fraction.

Propane and heavier hydrocarbonates have a heating capacity, on a volumetric basis that is higher than that of methane. Although adequate for combustion engines, they are undesirable when used with an elevated content for vehicles because they have a very much lower anti-knocking capacity than methane, thus reducing the methane number. In regard to the use of natural gas processed in gas turbines or industrially, these present problems in regard to the quality of combustion.

3.6 Total Sulfur

Is the sum total of sulfur compounds present in natural gas.

Some sulfur compounds when in the presence of water cause the corrosion of steel and aluminum alloys. Sulfuric gas (H2S) is the most critical compound in respect to corrosion and will be dealt with separately.

3.7 Hydrosulfuric Gas

Its presence depends on origin as well as the process employed in the treatment of the gas and can cause problems in piping and the end use of natural gas.

Hydrosulfuric gas in the presence of oxygen can cause corrosion when under pressure, especially in respect to copper, and can also be harmful to transport systems and the use of natural gas.

3.8 Dew Point

Dew point is the temperature at which the first drop of liquid occurs when gas undergoes cooling or compression. Liquids normally found are water, hydrocarbonates or glycol, which have distinct dew points. The most important safety requirement in respect to natural gas is the temperature of dew point in order to avoid the formation of liquid. Water in a liquid state is the precursor of the formation of corrosive compounds by means of the combination of natural gas components, specifically CO2 and H2S. The combination of corrosive agents and variable pressure during transport of the fuel may result in cracks in the metal and cause obstructions in the gas system.

Hydrates, formed when free water reacts with hydrocarbonates can obstruct instrumentation lines, control valves and filters.

3.9 Inert Gases

The principal inert components present in natural gas are carbon dioxide (CO2) and nitrogen (N2). Their presence in gaseous mixtures reduce heating capacity, besides increasing the resistance to knocking in the case of vehicles, and, consequently, the methane number

The presence of carbon dioxide is due to the natural gas extraction technique employed or because of the natural occurrence of this element in the origin of the product. Carbon dioxide has a corrosive action when in the presence of water.

3.10 Oxygen

Is present in low concentrations. Under these conditions it dilutes the fuel and is critical in the presence of water, even in low concentrations, because it could cause corrosion of metallic surfaces.

3.11 Solid particles

Causes contamination, obstruction and erosion of vehicle feed systems and industrial burner injector openings. When natural gas is destined for use as a turbine fuel, the solid particles can cause erosion of the parts that circulate the hot gas.

3.12 Liquid particles

Cause sharp alterations to flame temperature and in the gas turbine load, drawback of flame from pre-mixed flames and can nuclear the condensation of heavier natural gas fractions. When the presence of liquid is identified in the gas to be employed in gas turbines, separators are used and the flow is heated in order to vaporize the liquid phase.

4. Applicable standards

The definition of product characteristics is obtained by means of the use of American Society for Testing and Materials standards (ASTM), issued by the International Organization for Standardization” (ISO) and the Brazilian Association of Technical Standards (Associação Brasileira de Normas Técnicas) (ABNT).

Uncertainty, repetitivity and reproducibility data supplied within the methods related to this regulation, must only be used as guidelines for the acceptance of duplicate test results and must not be considered as a tolerance applied to the limits specified in this Regulation.

Product analysis must be conducted on a representative sample of the product obtained in accordance with the ISO 10715 method – Natural Gas: Sampling Guidelines.

Test Standards and Methods:

The characteristics contained in Table I, attached hereto, must be determined according to the most recent publication of the following test methods:

4.1 ABNT Standard

METHOD	TITLE
NBR 12230	SI – Prescriptions for its application

4.2 ASTM Standards

METHOD	TITLE
ASTM D 1945	Standard Test Method for Analysis of Natural Gas by Gas Chromatography
ASTM D 3588	Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density (Specific Gravity) of Gaseous Fuels
ASTM D 5454	Standard Test Method for Water Vapor Content of Gaseous Fuels Using Electronic Moisture Analyzers
ASTM D 5504	Standard Test Method for Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence

4.3 ISSO Standards

METHOD	TITLE
ISSO 6326	Natural Gas – Determination of Sulfur Compounds, Parts 1 to 5
ISO 6570	Natural Gas – Determination of Potential Hydrocarbon Liquid Content, Parts 1 to 2
ISO 6974	Natural Gas – Determination of composition with defined uncertainty by gas chromatography, Parts 1 to 5
ISO 6976	Natural Gas – Calculation of calorific values, density, relative density and Wobbe index from composition
ISO 10715	Natural Gas – Sampling Guidelines
ISO 13686	Natural Gas – Quality Designation
ISO 15403	Natural Gas – Designation of the quality of natural gas for use as a compressed fuel for vehicles

Table I: Specification of Natural Gas (1)

CHARACTERISTIC	UNIT	LIMIT			METHOD	
Upper heating capacity(4)	kJ/m3 kWh/m3	North	Northeast	South, Southeast, Central-West	ASTM	ISO
Wobbe Index (5)	kJ/m3	34.000 a 38.400 9,47 a 10,67	35.000 a 42.000 9,72 a 11,67		D3588	6976
Methane, min	% vol.	40.500 a 45.000	46.500 a 52.500		-	6976

Ethane, max	% vol.	68,0		86,0	D1945	6974
Propane, max.	% vol.	12,0		10,0		
Butane and heavier, max	% vol.	3,0				
Oxygen, max.	% vol.	1,5				
Inerts (N2+CO2), max.	% vol.	0,8	5,0	4,0		
Nitrogen	% vol.	anotar	2,0			
Total Sulfur, max.	mg/m3	70			D5504	6326-2 6326-5
Hydrosulfuric Gas (H2S), max.	mg/m3	10,0	15,0	10,0	D5504	6326-2 6326-5
Dew point of water at 1atm, max.	ºC	-39	-39	-45	D5454	-

Comments:
(1) O gás natural deve estar tecnicamente isento, ou seja, não deve haver traços visíveis de partículas sólidas e partículas líquidas.

(2) Specified limits are values referred to 293,15 K (20 ºC) and 101,325 kPa (1 atm) on a dry basis, except for dew point.

(3) Limits related to the North region are destined for a variety of uses except for use in vehicles, and for this specific use, must meet the limits equivalent to those set for the Northeast region.

(4) The heating capacity reference of pure substance employed in this Technical Regulation is found under temperature and pressure conditions equal to 293,15 K, 101,325 kPa, respectively on a dry basis.

(5) The Wobbe index is calculated by employing Upper Heating Capacity on a dry basis. When the ASTM D 3588 method is employed in order to obtain Upper Heating Capacity, the Wobbe index must be determined by means of the formula contained in the Technical Regulation.

(6) Odorized gas must not have a total sulfur content that exceeds70 mg/m³.