



Network Entry Gas Quality Specification

CAD/SP/GQ/1001

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Network Entry

Gas Quality Specification

Introduction

The purpose of this document is to provide information to Delivery Facility Operators (DFO), to enable full understanding of the Gas Quality Specification required for gas transportation in Cadent's distribution network.

Cadent is accountable as a gas transporter to conform to the safety and legal requirements set out by Ofgem and the HSE. DFOs will need to ensure they are working within the prescribed limits associated with Cadent's Licence to Operate and Safety Case and comply with other existing statutory and contractual obligations.

The terms for conveyance of gas in the parts of the Network operated by the Distribution Network (DN) are set out in section B of the Uniform Network Code (the "Code"). The DN and all Shippers have signed the "Code" Framework Document, which defines in precise legal detail the "Code". A section of the "Code" details the gas "Entry Requirements" and "Network Entry Provisions" which apply at each Entry Point and include the gas quality specification.

Gas entering any DN shall be compliant with GSMR (1996), GS(M)(A)R (2023) and IGEM/TD/16 and be measured in compliance with G(COTE)R.

Network Entry

The DFOs are required to have a Network Entry Agreement (NEA) that includes:

Entry pressure.

Point of delivery.

Measurement system of the gas to be delivered at a Local Distribution Zone (LDZ) System Entry Point.

The NEA is a standard document that must be signed by both the DFO and Cadent prior to the Network Entry Facility commencing delivery of gas into the distribution network.

Local Operating Procedures (LOPs), which are arrangements between Cadent and the DFO, describe the operational interface in more detail. Such details include communication routes and the arrangements for notifying the DN of a gas quality excursion outside the contractual limit. These need to be outlined alongside facility designs.

The technical assessment, design, testing and commissioning, will incorporate gas quality and measurement, mechanical and electrical requirements.

All network entry inputs which have been deemed acceptable through risk assessment, will be subject to Cadent's contractual arrangements and controls.

For more information visit www.cadentgas.com, navigate to connections and then gas producers.

Specification

For any new entry connection, the DFO should notify Cadent as soon as possible as to the likely gas composition. Cadent's ability to accept gas supplies into the system is affected by, the composition of the new gas, the location of the system entry point, volumes entered, and the quality and volumes of gas already being transported within the system.

The assessment of the acceptability of any proposed new gas supply will include:

- a) Cadent's ability to continue to meet statutory obligations, including but not limited to:
 - I. The Gas Act 1986
 - II. Gas Safety (Management) Regulations 1996 ((GS(M)R) & as amended 2023),
 - III. The Uniform Network Code (The Code) - Offtake Arrangements Document (OAD).
 - IV. The Gas (Calculation of Thermal Energy) Regulations 1996 & as Amended 1997 - (G(COTE)R).
- b) Cadent's ability to continue to meet contractual obligations.
- c) Demand requirements in the network.

Following acceptance of a connection offer, the DFO shall supply documentation which defines the design, provision, operation, validation, modification and disposal of volume and energy measurement systems at sites where the Flow Weighted Average Calorific Value (FWACV) billing methodology is applied.

Gas Safety (Management) Regulations (GS(M)R).

The gas within Cadent's network must be of the required quality for safe transport and utilisation for the consumers. The GSMR provides limits to certain components which must be adhered to for gas entering the network.

It must be noted limits on gas quality parameters shall be determined considering the uncertainty of the analytical instrument being employed.

For indicative purposes, the specification set out below is usually acceptable for most locations and encompasses but is not limited to the statutory requirements set out in the GS(M)R 1996 & 2023 Schedule 3, part I.	
1. Hydrogen Sulphide (H₂S)	Not more than 5mg/m ³
2. Total Sulphur	Not more than 50mg/m ³ .
3. Hydrogen	Not more than 0.1% (molar).
4. Oxygen*	Not more than 0.2% (molar) for pressures greater than 38 barg. Not more than 1.0% (molar) for pressures up to 38 barg.
5. Hydrocarbon Dewpoint	Not more than -2°C at any pressure up to 85 bar.
6. Water Dewpoint	Water dew temperature to be no greater than -10°C at 7 barg for injection into below 7 barg distribution systems, or Water dew temperature to be no greater than -10°C at the maximum anticipated pressure for injection onto an above 7 barg (7-16 barg) distribution system, or Water dew temperature to be no greater than -10°C at 85 barg for injection onto an above 16 barg distribution system.
7. Wobbe Number (real gross dry)	The Wobbe Number shall be in the range 46.50MJ/m ³ to 51.41MJ/m ³ .
8. Relative Density (RD)	Less than or equal to 0.700
9. Impurities	No solid or liquid which may interfere with the integrity or operation of pipes or any gas appliances
Unless stated otherwise all volumes are for the real dry gas at ISO Standard Reference conditions of 15°C and 1.01325 bar.	
Unless stated otherwise all energies are calculated using a gross calorific value for the real dry gas at ISO reference conditions of 15°C (combustion) and 15°C and 1.01325 bar (metering) also known as the reference conditions.	

Table 1: GSMR limits

*Gas exports >38bar you can apply for the oxygen exemption to GS(M)R through the HSE.

Contaminants and Particulates

In addition to the GS(M)R requirements outlined in the table above, it is a requirement, determined by risk assessment, to utilise online analytical systems or offline laboratory sampling to determine the presence of additional components. In addition, some feedstocks may be subject to the Environment Agency Quality Protocol.

Characteristics of gas that may cause deterioration in gas quality	
Component	
Contaminants	The gas shall not contain solid, liquid or gaseous material that may interfere with the integrity or operation of pipes or any gas appliance within the meaning of regulation 2(1) of the Gas Safety (Installation and Use) Regulations 1998 that a consumer could reasonably be expected to operate.
Organic halides	1.5 mg m ⁻³
Siloxanes	<0.23 mg ⁻³
Mercury (metallic)	10 µg m ⁻³
Micro-organisms	Must not interfere with any characteristic of the gas or Odour or cause risk to health or environment
Particulates	Must not interfere with any characteristic of the gas or Odour or cause risk to health or environment
Terpenes	Must not impact on Odour Intensity (OI)
Aldehydes, ketones, Alcohols, acetates, furans & phenols	Must not impact on OI
Ammonia	20 mg m ⁻³ (EA QP limit) And must not impact on OI
Oxygen	Total inerts shall not be more than 7.0% (molar) subject to; Carbon Dioxide: not more than 2.5% (molar).
Nitrogen	
Carbon dioxide	
Xylene	100 mg m ⁻³
Arsenic	0.1 mg m ⁻³
C7 to C12 hydrocarbons (for HC dewpoint)	Limited by HC dewpoint
Radioactivity	Not more than 5 Becquerels/g.

Table 2: Content or characteristics that may occur in biogas required to be measured for health and safety purposes as identified by risk assessment.

CV Requirements

DFOs are required to determine the CV at locations directed by Ofgem. This requirement is known as the Letter of Direction (LOD) which can only be issued by Ofgem. The LOD is only issued to locations compliant with G(COTE)R (1996, Amendment 1997 and 2023).

There are different Calorific Value Determination Devices (CVDDs) on the market, however, the installed CVDD must be approved by Ofgem, for use within a composition range specified by Ofgem. Each of these devices have been issued with a Letter of Approval (LOA) which outlines the alarm, component and characteristic ranges and limits that the instrument must comply with.

Only Ofgem approved CVDDs will be accepted in the design.

The CV specification below outlines the range that the CV must reach for network entry			
Characteristic	Unit	Range	
		min	max
Calorific Value	MJ/m ³	36.9	42.3
<ul style="list-style-type: none"> The Gross Calorific Value (real gross dry) shall be in the range 36.9 to 42.3MJ/m³, in compliance with the Wobbe Number and Relative Density described above. MJ/ m³" means megajoules per cubic metre under the reference conditions 			
Subject to gas entry location, the target CV of exported gas may change within the day but be within this range. The target CV is set by the gas received from National Gas and is not controlled by Cadent.			

Table 3: CV specification

Prerequisites for Gas transportation

Specific flow rates and injection points are determined by undertaking a Detailed Analysis Study (DAS).

Flow rate	This can vary dependant on network and entry point. This may also fluctuate with demand.
Pressure	The delivery pressure shall be the pressure required to deliver natural gas to the delivery point. Considering also, the back pressure of our System at the Delivery Point. This will vary occasionally dependant on demand and the gas network configurations. The entry pressure shall not exceed the Maximum Operating Pressure at the Delivery Point.
Delivery Temperature	Between 1°C and 38°C.*

Table 4: Gas transportation summary

*Dependant on pressure tier and pipeline material, this may have a reduced range of 1 -20°C. Deviations may be applied for in MP/IP designs.

The gas exported into Cadent's network must be odourised in accordance with GS(M)R 1996 Schedule 3 part I paragraph 2 and Cadent safety case.

Odour	Gas shall be odourised with odorant NB (80% tertiarybutyl mercaptan, 20% dimethyl sulphide) at an odorant injection rate which may be varied at the DN Operator's request to meet operational circumstances. This will also be determined by gas volume/ flow rate.
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Table 5: Gas Odour summary

Blending

Where blending possibilities have been identified in a Cadent issued DAS, gas entry specifications must be adhered to and measured at the Grid Entry Unit (GEU). Measurement of the CV value must be undertaken in accordance with G(COTE)R and Cadent's blending specification.

Appendix A – Definitions

Term	Description
Billing methodology	Set out by the government to ensure all customers are billed fairly for their gas use.
Blending	The mixing of biomethane and natural gas.
CVDD	Calorific Determination Device- measure cv value for Ofgem purpose etc
Calibration Certificates	Document supplied to verify the quality, accuracy, content and margins of error of the equipment, vessels or gases used for measuring gas composition.
Calorific Value (CV)	The CV of a fuel is the quantity of heat produced by its combustion, at constant pressure and under the conditions known as “normal” of temperature and pressure (i.e., to 0°C and under a pressure of 1 013 mbar). The CV of natural gas is expressed in kWh per cubic meter.
Characteristics of gas	Relates to natural gas composition, compressibility, density, pressure, temperature, energy value, combustion
Calorific Value Determination Devices (CVDDs)	Devise for measuring Calorific value of a gaseous substance. Must be Ofgem approved in this instance for use in the FWACV system.
Delivery Facility Operators (DFO)	The company and or persons operating the gas generation facility. They are the responsible persons to ensure all Safety and network criteria are met, maintained and logged.
Distribution Network (DN)	Distribution Network- Geographical area consisting of 5 divided areas within Cadent distribution. This consists of North West, East Anglia, East Midlands, West Midlands, North London
Flow Weighted Average Calorific Value (FWACV) system	Assets that form the system in order to measure CV values and flow through a directed site in accordance with Ofgem regulations. This includes approved Chromatographs, fiscal flow meters, Industrial PC and software, certified gas bottles plus associated equipment.
Grid Entry Unit (GEU)	The facility housing the assets where gas enters the Cadent network via relevant pipework
Letter of Approval (LOA)	Letter of approval from Ofgem to outline the agreed parameters of an approved piece of equipment for CV or flow measurement.
Local Distribution Zone (LDZ)	Zone for HP,MP, LP pipe work for gas distribution owned by a distribution network. Cadent zones are north west, west midlands, north London, east midlands, east anglia.
Local Operating Procedures (LOP)	The DFO needs to provide to Cadent the operating procedure for each task associated with the design and operation of plant, to show maintenance of plant and compliance with GSMR, G(COTE)R, the “Code” and manufacturers guidelines for instruments and assets.
Network Entry Agreement (NEA)	The legal agreement between Cadent and the DFO which specifies the requirements and outlines the responsibilities of both parties to enable alternative gas to be transported by Cadent.
Ofgem	The Office of Gas and Electricity Markets
Uncertainty	The difference between the indication and the ideal value of a measured signal (error).

Appendix B – References

Statutory References

Reference	Title
Environment Agency Quality Protocol	This quality protocol sets out end of waste criteria for the production and use of biomethane arising from the degradation of organic wastes in a landfill site or anaerobic digestion plant, for injection into the gas grid or use in an appliance suitably designed and operated for natural gas - Available on the UK government website
GS(M)R	The Gas Safety (Management) Regulations 1996 – Available on the HSE webpage
GS(M)(A)R	The Gas Safety (Management) (Amended) Regulations 2023 – Available on the HSE webpage
G(COTE)R	The Gas (Calculation of Thermal Energy) Regulations 1996, as amended 1997. – Available on Joint Office of Gas Transporters website
Uniform Network Code	Uniform Network Code 2023 – Available on Joint Office of Gas Transporters website