Measurement Error Investigation

Cadent Gas Limited

Null Report Dunstall Green

Document Reference: NK3217-009-001
Client Reference: MER/CAD/205/21

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1 Revision Control

Rev	Issue date	Description	Prep.	App.
1	22/03/2021	Issued for comment	IR	BK
2	05/05/2021	Final	IR	BK
2.1	10/06/2021	Revised Final	IR	BK
2.2	13/07/2021	Revised Final	IR	BK

2 Executive Summary

Site Name	Dunstall Green
DNO	Cadent Gas Limited
LDZ	North London
Error Start Date	Installation C.2004
(Or) Last Good Date	
Error Corrected Date	8th February 2021
Size of Error (over or under read)	<0.005% over-registration
Error Description	Incorrect meter linearisation curve
Methodology	Comparison of correct and incorrect meter linearisation curve errors and review of 2018 to 2020 data to find maximum gross volume for each year
Meter Type	Turbine meter
MER Unique Reference Number	N/A
Cadent Internal Reference	MER/CAD/205/21

3 Error Description

Dunstall Green is an HP to LP site in the south east of the North London LDZ, fed by a 750mm pipeline from Winkfield (South) Offtake. The current site capacity is 30,000 Sm3/h. Dunstall Green Inter-LDZ Offtake has a single 12" turbine metering stream for measurement of gas.

A review of the turbine meter linearisation table held within the Omni flow computer took place in November 2020 and discrepancies were noted between the Omni linearisation table and the values in the calibration certificate. This incorrect data is likely to have been resident in the flow computer since meter installation in approximately 2004.

The incorrect linearization data held in the Omni is shown in Table 1, with the correct values shown in Table 2. The corresponding errors for each frequency in the linearisation table are shown in Table 3.

The reason for the error is that there are two repeat flow points performed for each point on the calibration curve and only the first point was entered instead of the average % error for both points.

Frequency (Hz)	K-Factors
59	645.5819
234	646.4224
349	646.2284
466	646.0345
586	645.7759
0	645.9698

Table 1 – Incorrect Linearisation Table held in Omni flow computer.

Frequency (Hz)	K-Factors
59	645.6149
234	646.4223
349	646.2610
466	646.0343
586	645.8090
699	645.9694

Table 2 – Correct Linearisation Table using both flow points from meter calibration certificate.

Frequency (Hz)	Error (%)
59	0.0051
234	0.0000
349	0.0050
466	0.0000
586	0.0051
699	100.0000

Table 3 – % Errors in linearisation curve.

The meter calibration certificate is shown in Appendix A.

4 Methodology

The correct meter calibration flow points were entered into a spreadsheet with the errors averaged over both flow points, this showed that the error due to use of the incorrect linearisation curve was a <+0.005% error on K-Factor.

MARQUIS data files for years 2018, 2019 and 2020 were compiled into yearly spreadsheets (4-minute data). The maximum LGT Standard volume flowrate was established. A line density and standard density was calculated for each 4-minute period using an AGA 8 calculation. The gross volume flow was calculated by using the standard density to convert the maximum LGT flowrate to mass and then dividing by the line density to get the gross volume flowrate.

Error Period	Maximum LGT flowrate (Sm^3/h)	Maximum Calculated Gross Volume (m^3/h)	Maximum Frequency (Hz)
2018	14905	2106	366
2019	15924	2236	389
2020	23174	3240	561

Table 1 – Review of 6th Point on Linearisation Curve

5 Error Quantification

As the metering error of <0.005% is less than the measurement error reconciliation threshold of ±0.1% there is no requirement for reconciliation in this instance.

The potential error of using the 6th flow point frequency of 0 Hz instead of 699 Hz was reviewed and it was found that the turbine frequency never exceeded 561 Hz during the 3-year review period, so there was no measurement impact.

6 Learning

It is recommended that any new meter calibration certificates contain the relevant data in the format required by the flow computer so it can be entered directly without having to perform intermediate calculations.

7 References

Dunstall Green Site Data Files (.V03 and .Z03)
Omni Flow computer configuration (DUNQ0607.OMI)

8 Appendix A – Turbine Meter Calibration Certificate

Public acknowledged inspection office GA 3
for gas meters
at the EnBW

The test results listed base on the unified German - Dutch reference values for the volume unit of high-pressure natural gas, which were agreed to be used in Germany and the Netherlands by Agreement between the Federal Institute of Physics and Metrology (PTB) and the Netherlands Meetinstitut (NMI).

Verification certificate

Customer	vemm tec Messtechnik GmbH	
Adress	Gartenstr. 20 14482 Potsdam	
Manufacturer / Type	vemm tec / Turbinenz.	
Size	G 4000	
Qmax / Qmin	4000 / 320	m³/h
Serial number	031346	
Year of construction	2003	
Pressure	16	bar
Nominal size	300	mm
1 tr =	10	m³
Installed pulsers HF1	646.487	Imp/m³
Installed pulsers HF2	646.487	Imp/m³
Installed pulsers NF	0.1	Imp/m³
Calibration gear	37/46	

Gasanalysis

CO2 (%):	0.0083	H2 (%):	0.0000
dV:	0.5710	Ho (kwh/m³):	11.1250
natural gas:	H-Gas		

Flowrate m³/h	Reynoldsnumber	Error %
3897.45	1.54E+06	-0.08
3896.65	1.54E+06	-0.08
3268.24	1.31E+06	-0.11
3269.56	1.31E+06	-0.10
2595.81	1.03E+06	-0.07
2596.70	1.03E+06	-0.07
1944.95	7.76E+05	-0.04
1945.40	7.75E+05	-0.03
1303.31	5.18E+05	-0.01
1303.27	5.17E+05	-0.01
328.17	1.31E+05	-0.14
328.30	1.31E+05	-0.13

Error in % (WME): -0.07

Temperature in °C 8.9 Pressure in bar (abs.): 5 Density in kg/m³: 3.54

Remarks:

Signature: calibration rig manager

STAATLICH ANERKANNTE PRÜFSTELLE GA 3 STUTTGART

27.04.04