

**METER ERROR REPORT****FINAL**

Reconcile?	Y
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Safety Issue?	N
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Thesis Report No.	
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**1. EXECUTIVE SUMMARY**

SITE NAME	Maelor	
LDZ	WN	
START DATE (actual)	7 <sup>th</sup> October 2016	
LAST GOOD DATE	7 <sup>th</sup> October 2016	
END DATE	18 <sup>th</sup> October 2018	
SIZE OF ERROR (No reconciliation required if under 0.1%)	0.1477% under read / (19.5GWh / 1771346 sm <sup>3</sup> )	
ESTIMATE – Y/N?	N	
ROOT CAUSE	The meter factors in the ultrasonic meter configuration were not updated after the meter calibration.	
ANALYSIS	In the attached spreadsheets	
METER TYPE	Ultrasonic	
AUTHOR	Piers Eldridge	
CHECKED BY	Catherine Jones	
ACCEPTED BY WWU NETWORK		
RECONCILIATION	Distribution	Transportation

## 2. BACKGROUND

Gas is supplied to part of the Wales North Network at Maelor FWACV offtake. The metering system comprises two ultrasonic meters and uses a gas chromatograph for CV determination and PTZ correction.

The ultrasonic meters are configured to compensate for the error curve recorded at the calibrations using meter factors and volumetric flow rates at operating conditions. A single k-factor is used in the flow computer to convert the pulsed output from the meter to volumetric flow rates.

The two meters at Maelor offtake were calibrated at the DNVGL flow centre for calibration between September 2016 and January 2017. The meters were calibrated with the meter factors from the calibration in 2007 in the meters' configuration. The meters were installed at the offtake without updating the meter factors in their configuration.

The incorrect configuration was discovered during an external audit of the metering system carried out by METCO on 19<sup>th</sup> and 20<sup>th</sup> September 2017. The correct meter factors were entered in the meters' configuration on 18<sup>th</sup> October 2018.

The last good date is 7th October 2016 when the meter with serial number 06-490278 was installed in stream B (MT2) after the calibration on 8<sup>th</sup> September 2016. The metering system was then configured to flow through stream B.

## 3. ERROR QUANTIFICATION AND IMPACT

For each DANINT cycle, the flow rates expressed by the frequency of the pulsed output of the ultrasonic meter were corrected back to the original  $Q_{ind}$  values measured by the meter by dividing by the meter factors in table 1. The meter factors at flowrates between the calibration points were calculated by interpolating between the points.

Meter A (06-490277)			Meter B (06-490278)		
Qref (m3/h)	Qind (m3/h)	M factor	Qref (m3/h)	Qind (m3/h)	M factor
369.74	365.58	1.0020	372.48	371.74	1.0020
857.53	852.19	1.0036	829.83	826.82	1.0036
1822.86	1813.63	1.0036	1881.8	1874.97	1.0036
3221.4	3205.6	1.0034	3058.54	3048.14	1.0034
5203.38	5179.0	1.0032	5495.99	5478.48	1.0032
7833.83	7781.88	1.0043	7802.16	7768.73	1.0043

Table 1 The incorrect meter factors that were left in the ultrasonic meters' configurations.

The meter factors that should be used in the ultrasonic meters' configuration was recalculated and summarized in table 2.

The original  $Q_{ind}$  flowrates were then corrected by applying the meter factors shown in table 2. The meter factors at flowrates between the calibration points were calculated by interpolating between the points.

Meter A (06-490277)				Meter B (06-490278)			
Qref (m3/h)	Qind (m3/h)	Error (%)	M factor	Qref (m3/h)	Qind (m3/h)	Error (%)	M factor
7579.20	7554.14	-0.33	1.0033	8063.60	8025.37	-0.47	1.0048
5274.01	5258.53	-0.29	1.0029	5376.12	5349.99	-0.49	1.0049
2882.98	2875.54	-0.26	1.0026	3074.53	3059.26	-0.50	1.0050
1967.81	1961.27	-0.33	1.0033	1966.32	1956.65	-0.49	1.0049
862.93	858.54	-0.51	1.0051	808.63	804.76	-0.48	1.0048
390.23	388.01	-0.57	1.0057	367.98	365.98	-0.54	1.0055

Table 2 Recalculated calibration results for Meter A and B.

The volume that flowed between each DANINT cycle was corrected by applying a correction factor calculated from the ratio between the flowrate calculated from the recorded pulse frequency and k-factor and the flowrate corrected by the meter factors in table 2.

The meter error would have no effect on the calculated gas density therefore the correction factor from the flow rate at operating conditions can be applied to the flow rate at standard conditions.

The overall error is an under-registration of 0.1477%. The error is equivalent to 1771346 sm<sup>3</sup> and 19.5 GWh.

The daily correction factors are shown in appendix A.

#### 4. CAUSES

The ultrasonic meter configuration was not configured after the calibration to correct for the errors recorded.

#### 5. RECOMMENDATIONS AND LEARNING

For future calibrations the meter factors should be removed from the ultrasonic meter configurations before the meter is calibrated.

Using k-factors in the flow computer to compensate for the errors will help prevent the issue reoccurring.

#### REFERENCES

MER Data.xls

#### VERSION HISTORY

<i>Version</i>	<i>Changes</i>	<i>Author</i>	<i>Date</i>
0	First draft	Piers Eldridge	15/03/2019

#### DISTRIBUTION

*Asset Owner*

*Energy Performance*

*Network Lead Group*

*Asset Strategy*

**Appendix A**

<b>Gas day</b>	<b>Daily correction factor</b>
07/10/2016	1.001031
08/10/2016	1.001493
09/10/2016	1.001590
10/10/2016	1.001255
11/10/2016	1.001211
12/10/2016	1.001528
13/10/2016	1.001242
14/10/2016	1.001263
15/10/2016	1.001329
16/10/2016	1.001428
17/10/2016	1.001273
18/10/2016	1.001233
19/10/2016	1.001246
20/10/2016	1.001227
21/10/2016	1.001210
22/10/2016	1.001207
23/10/2016	1.001208
24/10/2016	1.001215
25/10/2016	1.001209
26/10/2016	1.001333
27/10/2016	1.001371
28/10/2016	1.001728
29/10/2016	1.001662
30/10/2016	1.001417
31/10/2016	1.001262
01/11/2016	1.001231
02/11/2016	1.001221
03/11/2016	1.001229
04/11/2016	1.001235
05/11/2016	1.001221
06/11/2016	1.001236
07/11/2016	1.001242
08/11/2016	1.001240
09/11/2016	1.001245
10/11/2016	1.001231
11/11/2016	1.001251
12/11/2016	1.001225
13/11/2016	1.001220
14/11/2016	1.001211
15/11/2016	1.001211

16/11/2016	1.001221
17/11/2016	1.001246
18/11/2016	1.001258
19/11/2016	1.001247
20/11/2016	1.001253
21/11/2016	1.001290
22/11/2016	1.001257
23/11/2016	1.001240
24/11/2016	1.001248
25/11/2016	1.001258
26/11/2016	1.001272
27/11/2016	1.001249
28/11/2016	1.001254
29/11/2016	1.001269
30/11/2016	1.001271
01/12/2016	1.001256
02/12/2016	1.001263
03/12/2016	1.001244
04/12/2016	1.001255
05/12/2016	1.001297
06/12/2016	1.001256
07/12/2016	1.001221
08/12/2016	1.001217
09/12/2016	1.001217
10/12/2016	1.001221
11/12/2016	1.001236
12/12/2016	1.001248
13/12/2016	1.001234
14/12/2016	1.001222
15/12/2016	1.001223
16/12/2016	1.001223
17/12/2016	1.001219
18/12/2016	1.001226
19/12/2016	1.001237
20/12/2016	1.001232
21/12/2016	1.001230
22/12/2016	1.001246
23/12/2016	1.001225
24/12/2016	1.001230
25/12/2016	1.001259
26/12/2016	1.001251
27/12/2016	1.001250
28/12/2016	1.001265
29/12/2016	1.001269
30/12/2016	1.001238

31/12/2016	1.001231
01/01/2017	1.001242
02/01/2017	1.001263
03/01/2017	1.001258
04/01/2017	1.001273
05/01/2017	1.001274
06/01/2017	1.001263
07/01/2017	1.001231
08/01/2017	1.001226
09/01/2017	1.001243
10/01/2017	1.001244
11/01/2017	1.001253
12/01/2017	1.001286
13/01/2017	1.001273
14/01/2017	1.001260
15/01/2017	1.001237
16/01/2017	1.001240
17/01/2017	1.001235
18/01/2017	1.001233
19/01/2017	1.001225
20/01/2017	1.001242
21/01/2017	1.001267
22/01/2017	1.001269
23/01/2017	1.001266
24/01/2017	1.001253
25/01/2017	1.000773
26/01/2017	1.000117
27/01/2017	1.000054
28/01/2017	1.000444
29/01/2017	1.000287
30/01/2017	1.000459
31/01/2017	1.000482
01/02/2017	1.000697
02/02/2017	1.000792
03/02/2017	1.000643
04/02/2017	1.000368
05/02/2017	1.000337
06/02/2017	0.999988
07/02/2017	1.000385
08/02/2017	1.000425
09/02/2017	0.999956
10/02/2017	0.999914
11/02/2017	1.000086
12/02/2017	1.000133
13/02/2017	1.000347

14/02/2017	1.000131
15/02/2017	1.000644
16/02/2017	1.000837
17/02/2017	1.001002
18/02/2017	1.001188
19/02/2017	1.001048
20/02/2017	1.001240
21/02/2017	1.001039
22/02/2017	1.000989
23/02/2017	1.000618
24/02/2017	1.000831
25/02/2017	1.001031
26/02/2017	1.000977
27/02/2017	1.000619
28/02/2017	1.000418
01/03/2017	1.000655
02/03/2017	1.000662
03/03/2017	1.000688
04/03/2017	1.000832
05/03/2017	1.000437
06/03/2017	1.000695
07/03/2017	1.000725
08/03/2017	1.000502
09/03/2017	1.001203
10/03/2017	1.001048
11/03/2017	1.001067
12/03/2017	1.001000
13/03/2017	1.001013
14/03/2017	1.001144
15/03/2017	1.001245
16/03/2017	1.001258
17/03/2017	1.001229
18/03/2017	1.001224
19/03/2017	1.001211
20/03/2017	1.001217
21/03/2017	1.001229
22/03/2017	1.001235
23/03/2017	1.001238
24/03/2017	1.001232
25/03/2017	1.001254
26/03/2017	1.001209
27/03/2017	1.001217
28/03/2017	1.001217
29/03/2017	1.001213
30/03/2017	1.001212

31/03/2017	1.001416
01/04/2017	1.001267
02/04/2017	1.001277
03/04/2017	1.001222
04/04/2017	1.001290
05/04/2017	1.001232
06/04/2017	1.001227
07/04/2017	1.001236
08/04/2017	1.001491
09/04/2017	1.001374
10/04/2017	1.001220
11/04/2017	1.001245
12/04/2017	1.001224
13/04/2017	1.001215
14/04/2017	1.001209
15/04/2017	1.001211
16/04/2017	1.001231
17/04/2017	1.001215
18/04/2017	1.001208
19/04/2017	1.001213
20/04/2017	1.001209
21/04/2017	1.001206
22/04/2017	1.001492
23/04/2017	1.002119
24/04/2017	1.001257
25/04/2017	1.001219
26/04/2017	1.001217
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12/05/2017	1.001847
13/05/2017	1.001877
14/05/2017	1.002131



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17/05/2017	1.001867
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08/06/2017	1.002272
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10/06/2017	1.002498
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13/06/2017	1.002559
14/06/2017	1.002723
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09/11/2017	1.001235
10/11/2017	1.001235

11/11/2017	1.001234
12/11/2017	1.001247
13/11/2017	1.001253
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18/11/2017	1.001242
19/11/2017	1.001241
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21/11/2017	1.001218
22/11/2017	1.001223
23/11/2017	1.001249
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23/12/2017	1.001240
24/12/2017	1.001220
25/12/2017	1.001224

26/12/2017	1.001249
27/12/2017	1.001257
28/12/2017	1.001268
29/12/2017	1.001286
30/12/2017	1.001263
31/12/2017	1.001240
01/01/2018	1.001242
02/01/2018	1.001254
03/01/2018	1.001260
04/01/2018	1.001252
05/01/2018	1.001262
06/01/2018	1.001269
07/01/2018	1.001290
08/01/2018	1.001312
09/01/2018	1.001319
10/01/2018	1.001268
11/01/2018	1.001279
12/01/2018	1.001290
13/01/2018	1.001274
14/01/2018	1.001268
15/01/2018	1.001259
16/01/2018	1.001277
17/01/2018	1.001281
18/01/2018	1.001270
19/01/2018	1.001280
20/01/2018	1.001286
21/01/2018	1.001301
22/01/2018	1.001268
23/01/2018	1.001253
24/01/2018	1.001265
25/01/2018	1.001276
26/01/2018	1.001264
27/01/2018	1.001263
28/01/2018	1.001242
29/01/2018	1.001258
30/01/2018	1.001261
31/01/2018	1.001272
01/02/2018	1.001285
02/02/2018	1.001270
03/02/2018	1.001276
04/02/2018	1.001274
05/02/2018	1.001283
06/02/2018	1.001321
07/02/2018	1.001294
08/02/2018	1.001260

09/02/2018	1.001274
10/02/2018	1.001287
11/02/2018	1.001286
12/02/2018	1.001281
13/02/2018	1.001285
14/02/2018	1.001295
15/02/2018	1.001276
16/02/2018	1.001267
17/02/2018	1.001266
18/02/2018	1.001252
19/02/2018	1.001253
20/02/2018	1.001247
21/02/2018	1.001255
22/02/2018	1.001268
23/02/2018	1.001278
24/02/2018	1.001262
25/02/2018	1.001264
26/02/2018	1.001327
27/02/2018	1.001374
28/02/2018	1.001468
01/03/2018	1.001547
02/03/2018	1.001456
03/03/2018	1.001316
04/03/2018	1.001267
05/03/2018	1.001261
06/03/2018	1.001250
07/03/2018	1.001245
08/03/2018	1.001266
09/03/2018	1.001258
10/03/2018	1.001237
11/03/2018	1.001238
12/03/2018	1.001257
13/03/2018	1.001251
14/03/2018	1.001256
15/03/2018	1.001247
16/03/2018	1.001245
17/03/2018	1.001282
18/03/2018	1.001353
19/03/2018	1.001276
20/03/2018	1.001263
21/03/2018	1.001257
22/03/2018	1.001249
23/03/2018	1.001243
24/03/2018	1.001247
25/03/2018	1.001233

26/03/2018	1.001243
27/03/2018	1.001241
28/03/2018	1.001246
29/03/2018	1.001252
30/03/2018	1.001239
31/03/2018	1.001266
01/04/2018	1.001259
02/04/2018	1.001263
03/04/2018	1.001231
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09/04/2018	1.001235
10/04/2018	1.001244
11/04/2018	1.001253
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13/04/2018	1.001249
14/04/2018	1.001364
15/04/2018	1.001243
16/04/2018	1.001225
17/04/2018	1.001218
18/04/2018	1.001398
19/04/2018	1.001921
20/04/2018	1.001564
21/04/2018	1.001909
22/04/2018	1.001595
23/04/2018	1.001244
24/04/2018	1.001215
25/04/2018	1.001317
26/04/2018	1.001240
27/04/2018	1.001218
28/04/2018	1.001219
29/04/2018	1.001216
30/04/2018	1.001311
01/05/2018	1.001217
02/05/2018	1.001343
03/05/2018	1.001225
04/05/2018	1.001639
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07/05/2018	1.002381
08/05/2018	1.002373
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15/05/2018	1.002493
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21/05/2018	1.002577
22/05/2018	1.002526
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25/05/2018	1.002355
26/05/2018	1.002480
27/05/2018	1.002768
28/05/2018	1.002784
29/05/2018	1.003024
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31/05/2018	1.002802
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13/06/2018	1.002986
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26/07/2018	1.003118
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23/08/2018	1.002551
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30/08/2018	1.002391
31/08/2018	1.002702
01/09/2018	1.002931
02/09/2018	1.002953
03/09/2018	1.002665
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06/09/2018	1.002142
07/09/2018	1.002237
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15/09/2018	1.002393
16/09/2018	1.002439
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18/09/2018	1.002601
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20/09/2018	1.001566
21/09/2018	1.001441

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26/09/2018	1.001622
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28/09/2018	1.002012
29/09/2018	1.001710
30/09/2018	1.001350
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02/10/2018	1.001269
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07/10/2018	1.001234
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13/10/2018	1.001618
14/10/2018	1.001249
15/10/2018	1.001210
16/10/2018	1.001212
17/10/2018	1.001222
18/10/2018	1.000958