

METER ERROR REPORT**DRAFT**

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

SITE NAME	Ross	
LDZ	SW	
START DATE (actual)		
LAST GOOD DATE	14:39 on 11 th August 2008	
END DATE	09:35 on 20 th March 2009	
SIZE OF ERROR (No reconciliation required if under 0.1%)	0.704 % under-registration	
ESTIMATE – Y/N?	N	
ROOT CAUSE	Degradation of turbine meter caused under registration of flow	
ANALYSIS	Recalculation of volumes using k-factors from 'As Found' calibration	
METER TYPE	Turbine	
AUTHOR	B. Kirkman	
CHECKED BY	A. Niazi	
ACCEPTED BY WWU NETWORK		
RECONCILIATION	Distribution	Transportation

2. BACKGROUND

Ross has two turbine meter streams using a gas chromatograph for CV determination and PTZ correction.

The stream A turbine meter (serial number: 105194) was removed for calibration at 09:35 on 20th March 2009.

The meter did not pass the calibration on 17th April 2009 because of significant errors. Before the meter was calibrated a spin down test was carried out. The meter took 4 seconds to stop.

During the previous meter validation in 2008, the meter was taken out on the 11th August 2008 and inspected. The spin down time of the meter was then found to be 84 seconds. The meter was put back online at 14:39 on 11th August 2008.

3. ERROR QUANTIFICATION AND IMPACT

Stream A operated continuously from 14:39 on 11th August 2008 until 09:35 on 20th March 2009 except when the duty stream was briefly switched to stream B on two occasions on 8th January 2009.

The daily volumes were recalculated using both the used K factors, that were incorrect because of the degradation to the meter, and the 'As Found' K factors that were representative of the meter in a degraded state. Both set of K Factors are shown in Table 1.

Incorrect (Used) Values		Correct (As Found) Values	
Frequency	K factor	Frequency	K factor
(Hz)	(pulses /m ³)	(Hz)	(pulses /m ³)
61	3841.91	56	3802.671
102	3838.06	113	3831.138
327	3843.83	273	3831.138
443	3843.83	420	3672.645
820	3848.06	496	3279.875
1096	3850.76	593	3103.687

Table 1 – Frequency / K Factor pairs

The error was calculated on a daily basis as the difference between volume totals using correct and incorrect 'K factors'.

No audit data was available for 3rd October 2008 so the Relative Density was interpolated between known points.

The total error for the period 11th August 2008 to 20th March 2009 was an under-registration of 0.704 %.

4. CAUSES

The turbine meter had degraded significantly over a 6 month period.

5. RECOMMENDATIONS AND LEARNING

It is important that the manufacturer's guidance on maintenance of the turbine meter is followed to maximize the period between overhauls. If the meter is continually degrading before the scheduled overhaul or calibration then the interval should be shortened.

As the degradation is likely to have occurred over time it is recommended that half of the total error of 0.704 % under-registration should be reconciled. The table in Appendix A provides daily correction factors.

REFERENCES

HPMIS Database

Ross002_Data.xls – calculation spreadsheet

Ross002_Summary.xls – results spreadsheet

Calibration Certificate 00189 for turbine meter 105194 from Bishop Auckland Test Facility, 11th October 1999

Calibration Certificate 05360 for turbine meter 105194 from GL Flow Centre (formerly Bishop Auckland Test Facility), 21st April 2009

VERSION HISTORY

<i>Version</i>	<i>Changes</i>	<i>Author</i>	<i>Date</i>
0	<i>Original</i>	<i>B. Kirkman</i>	<i>23/04/10</i>

DISTRIBUTION

Wales & West Utilities Plc

APPENDIX A – Daily Correction Factors

Gas Day	Daily Correction Factor
11-Aug-08	1.00320635
12-Aug-08	1.00421106
13-Aug-08	1.00357952
14-Aug-08	1.00386288
15-Aug-08	1.00445101
16-Aug-08	1.00519121
17-Aug-08	1.00500155
18-Aug-08	1.00365022
19-Aug-08	1.00388219
20-Aug-08	1.00324708
21-Aug-08	1.00374552
22-Aug-08	1.00486096
23-Aug-08	1.00551883
24-Aug-08	1.00625020
25-Aug-08	1.00534921
26-Aug-08	1.00414736
27-Aug-08	1.00390076
28-Aug-08	1.00398745
29-Aug-08	1.00485394
30-Aug-08	1.00712085
31-Aug-08	1.00691927
01-Sep-08	1.00515744
02-Sep-08	1.00406404
03-Sep-08	1.00366867
04-Sep-08	1.00346834
05-Sep-08	1.00348264
06-Sep-08	1.00416032
07-Sep-08	1.00390796
08-Sep-08	1.00383928
09-Sep-08	1.00306315
10-Sep-08	1.00346852
11-Sep-08	1.00381118
12-Sep-08	1.00394737
13-Sep-08	1.00540578
14-Sep-08	1.00469088
15-Sep-08	1.00414782
16-Sep-08	1.00409585
17-Sep-08	1.00386844
18-Sep-08	1.00399772
19-Sep-08	1.00452607
20-Sep-08	1.00612539
21-Sep-08	1.00565466
22-Sep-08	1.00408793
23-Sep-08	1.00324025
24-Sep-08	1.00329571
25-Sep-08	1.00341462
26-Sep-08	1.00401438

Gas Day	Daily Correction Factor
27-Sep-08	1.00440203
28-Sep-08	1.00415420
29-Sep-08	1.00348447
30-Sep-08	1.00309658
01-Oct-08	1.00321570
02-Oct-08	1.00284911
03-Oct-08	1.00273818
04-Oct-08	1.00311461
05-Oct-08	1.00278094
06-Oct-08	1.00298132
07-Oct-08	1.00275625
08-Oct-08	1.00270615
09-Oct-08	1.00276577
10-Oct-08	1.00332071
11-Oct-08	1.00404612
12-Oct-08	1.00399361
13-Oct-08	1.00348031
14-Oct-08	1.00304034
15-Oct-08	1.00278384
16-Oct-08	1.00271855
17-Oct-08	1.00303203
18-Oct-08	1.00316009
19-Oct-08	1.00288685
20-Oct-08	1.00279957
21-Oct-08	1.00269091
22-Oct-08	1.00298609
23-Oct-08	1.00280669
24-Oct-08	1.00275370
25-Oct-08	1.00298055
26-Oct-08	1.00270111
27-Oct-08	1.00331934
28-Oct-08	1.00740352
29-Oct-08	1.00838298
30-Oct-08	1.00746279
31-Oct-08	1.00861200
01-Nov-08	1.00555306
02-Nov-08	1.00343787
03-Nov-08	1.00437082
04-Nov-08	1.00388545
05-Nov-08	1.00390723
06-Nov-08	1.00426553
07-Nov-08	1.00355398
08-Nov-08	1.00283343
09-Nov-08	1.00310307
10-Nov-08	1.00562057
11-Nov-08	1.00627512
12-Nov-08	1.00681919

Gas Day	Daily Correction Factor
13-Nov-08	1.00623548
14-Nov-08	1.00363594
15-Nov-08	1.00285387
16-Nov-08	1.00270030
17-Nov-08	1.00361346
18-Nov-08	1.00393889
19-Nov-08	1.00430845
20-Nov-08	1.00296071
21-Nov-08	1.00422528
22-Nov-08	1.00455601
23-Nov-08	1.00462550
24-Nov-08	1.00830122
25-Nov-08	1.01068795
26-Nov-08	1.00769058
27-Nov-08	1.00604034
28-Nov-08	1.00850339
29-Nov-08	1.00728037
30-Nov-08	1.00931400
01-Dec-08	1.01160653
02-Dec-08	1.01183132
03-Dec-08	1.01282193
04-Dec-08	1.00992996
05-Dec-08	1.00865699
06-Dec-08	1.00689279
07-Dec-08	1.00882210
08-Dec-08	1.00992947
09-Dec-08	1.01026668
10-Dec-08	1.01183995
11-Dec-08	1.01292180
12-Dec-08	1.01027956
13-Dec-08	1.00564927
14-Dec-08	1.00586751
15-Dec-08	1.01154219
16-Dec-08	1.01043414
17-Dec-08	1.00919119
18-Dec-08	1.00597812
19-Dec-08	1.00816685
20-Dec-08	1.00322827
21-Dec-08	1.00278338
22-Dec-08	1.00298829
23-Dec-08	1.00316594
24-Dec-08	1.00288487
25-Dec-08	1.00278983
26-Dec-08	1.00484796
27-Dec-08	1.00798155
28-Dec-08	1.00907986
29-Dec-08	1.00922661
30-Dec-08	1.01088347
31-Dec-08	1.01459802
01-Jan-09	1.01339388

Gas Day	Daily Correction Factor
02-Jan-09	1.01114888
03-Jan-09	1.01197388
04-Jan-09	1.01464103
05-Jan-09	1.01462867
06-Jan-09	1.01737757
07-Jan-09	1.01517966
08-Jan-09	1.01290716
09-Jan-09	1.01327935
10-Jan-09	1.01325760
11-Jan-09	1.00853359
12-Jan-09	1.00614321
13-Jan-09	1.00687669
14-Jan-09	1.01027471
15-Jan-09	1.00800679
16-Jan-09	1.00627437
17-Jan-09	1.00401860
18-Jan-09	1.00587584
19-Jan-09	1.00920350
20-Jan-09	1.01017877
21-Jan-09	1.01045259
22-Jan-09	1.00782507
23-Jan-09	1.00888333
24-Jan-09	1.00825352
25-Jan-09	1.00519863
26-Jan-09	1.00837041
27-Jan-09	1.01004189
28-Jan-09	1.00730394
29-Jan-09	1.00920537
30-Jan-09	1.00892286
31-Jan-09	1.00776179
01-Feb-09	1.01267688
02-Feb-09	1.01823702
03-Feb-09	1.01382696
04-Feb-09	1.01295819
05-Feb-09	1.01402311
06-Feb-09	1.01489637
07-Feb-09	1.01026592
08-Feb-09	1.01041828
09-Feb-09	1.01310116
10-Feb-09	1.01024838
11-Feb-09	1.00957089
12-Feb-09	1.01290821
13-Feb-09	1.00854713
14-Feb-09	1.00675450
15-Feb-09	1.00477033
16-Feb-09	1.00604263
17-Feb-09	1.00512720
18-Feb-09	1.00391449
19-Feb-09	1.00424651
20-Feb-09	1.00439459

Gas Day	Daily Correction Factor
21-Feb-09	1.00288814
22-Feb-09	1.00291879
23-Feb-09	1.00431937
24-Feb-09	1.00352945
25-Feb-09	1.00419879
26-Feb-09	1.00533379
27-Feb-09	1.00429354
28-Feb-09	1.00312602
01-Mar-09	1.00258919
02-Mar-09	1.00565895
03-Mar-09	1.00675189
04-Mar-09	1.00869139
05-Mar-09	1.00886214
06-Mar-09	1.00781151
07-Mar-09	1.00362483
08-Mar-09	1.00414774
09-Mar-09	1.00692810
10-Mar-09	1.00495949
11-Mar-09	1.00622208
12-Mar-09	1.00389503
13-Mar-09	1.00435574
14-Mar-09	1.00261476
15-Mar-09	1.00249169
16-Mar-09	1.00342906
17-Mar-09	1.00383681
18-Mar-09	1.00291156
19-Mar-09	1.00359364
20-Mar-09	1.00149677