



ASSESSMENT OF ERROR DUE TO ORIFICE DIAMETER MIS-MEASUREMENT AT AUSTREY

A Report for

**National Grid
Brick Kiln Street
HINCKLEY
Leicestershire
LE10 0NA**

PROJECT NO: NGR010

REPORT NO: 2010/184_Rev 1

DATE: 16 JUNE 2010



This report is issued as part of the contract under which the work has been carried out for the client.

NOTES

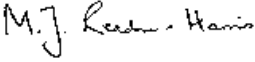
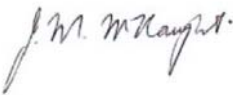
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Assessment of Error Due to Orifice Diameter Mis-Measurement at Austrey

A Report for

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HINCKLEY
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LE10 0NA

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for
Michael Valente
Managing Director

Date: 16 June 2010

EXECUTIVE SUMMARY

Owing to a mis-measurement of orifice diameters flows have been mis-measured at affected offtakes connected to the National Transmission System. This project has been undertaken to resolve these errors.

At Austrey a correction factor of 1.002348 should be applied during the period of mis-measurement.

Over the period 31/08/2007 to 24/09/2008 inclusive the flow was 381.58932 mscm and the corrected flow should be 382.48505 mscm.

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1 INTRODUCTION

Owing to a mis-measurement of orifice diameters flows have been mis-measured at affected offtakes connected to the National Transmission System. This project has been undertaken to resolve these errors. This report covers the flows through Austrey in the period of the error. The Joint Office Error Code is WM004.

2 ORIFICE DIAMETERS

The calibrations of the orifice plates in question gave the measured diameters shown in Table 1. The diameters at 20 °C have been calculated.

TABLE 1
ORIFICE DIAMETERS

Calibration Reference	Plate serial no	Declared certificate date	Orifice bore (mm)	Temperature	Value at 20 °C
					Orifice bore (mm)
OP4233	AUST3516-1-1	22/08/05	288.1395	21	288.1349
OP50203	AUST5160	31/08/06	288.159	21	288.1544
OP60165	AUST3516-1-1	07/11/06	287.87	21	287.8654
OP80054	AUST5160	19/09/08	288.1645	19	288.1691
OP80062	AUST3516-1-1	29/09/08	288.1485	20	288.1485
OP90055	AUST5160	18/12/09	288.1655	20.4	288.1637

Figure 1 shows the data from Table 1 for the orifice bores at 20°C. This figure shows that there is a reduction in measured diameter followed by a recovery. The deduction from this graph is that a plate was mis-measured.

The calibration certificates for the orifice plates are given as Appendix A.

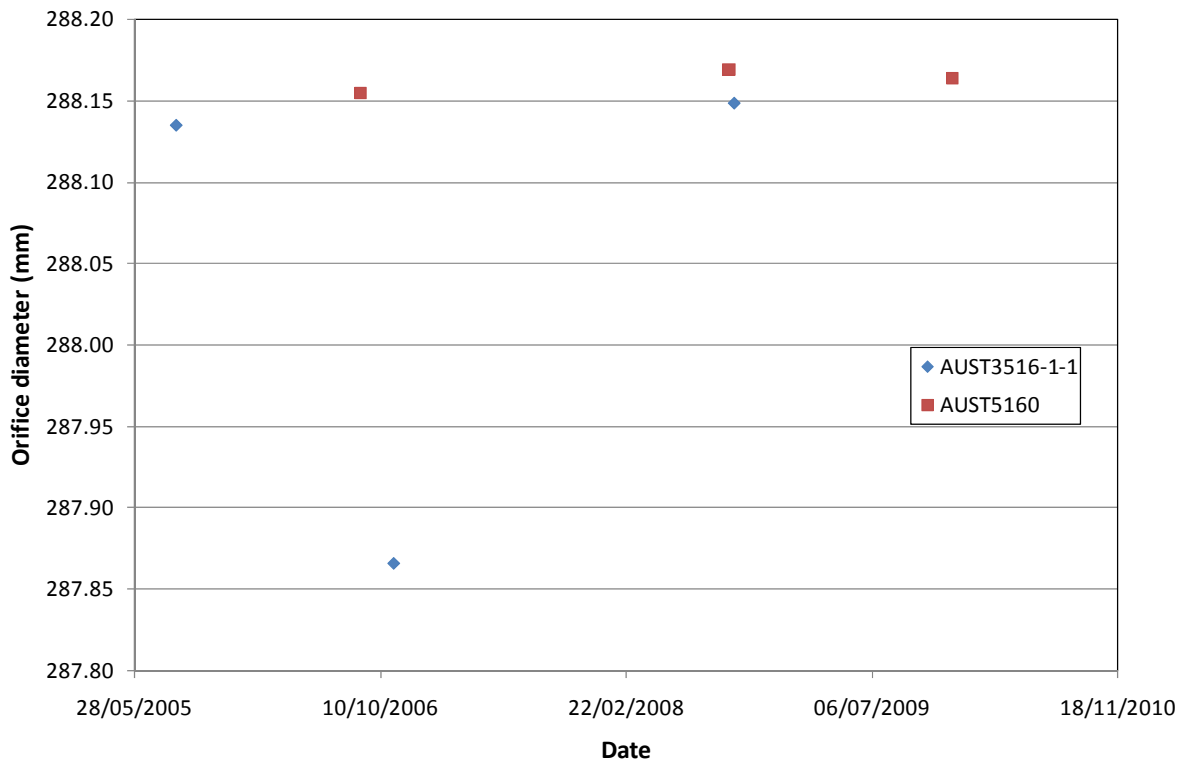


Figure 1 Orifice Diameters at 20 °C

The plates actually used in the meter tube are given in Table 2.

TABLE 2
PLATES USED IN EACH LINE AS CONFIGURED BY THE FLOW COMPUTER

Configuration	omnM0815.cfg	omnM0831.cfg	omnN0916.cfg	omnN0924.cfg
	15/08/2007 23:01	31/08/2007 23:01	16/09/2008 23:01	24/09/2008 23:01
Orifice plate bore diameter (mm)	288.159	287.87	287.87	288.1645
Expansion coefficient of the plate (°C)	0.000016	0.000016	0.000016	0.000016
Orifice plate calibration temperature	21	21	21	19
Meter tube diameter (mm)	433.3558	433.3558	433.3558	433.3558
Expansion coefficient of the meter tube (°C)	0.000011	0.000011	0.000011	0.000011
Meter tube calibration temperature	20	20	20	20
Isentropic Exponent	1.3431	1.3431	1.347	1.347
Dynamic Viscosity (Pa.s)	0.0000119	0.0000119	0.0000121	0.0000121
Orifice plate certificate number	OP50203	OP60165	OP60165	OP80054
Orifice plate serial number	AUST5160	AUST3516-1-1	AUST3516-1-1	AUST5160
Error in orifice diameter?	No	Yes	Yes	No

3 CORRECTING THE FLOWRATE

To correct the measured flowrate by replacing an incorrect diameter with the correct diameter might appear to be fairly straightforward. However, the data supplied only give time to the nearest minute and at four-minute intervals. This is inadequate for very accurate calculation. It is possible to calculate the flow over each time interval and to add the values over a day; this method can be used to check that the calculations are being done correctly, but the differences between the summed figures and the ones already given in the spreadsheet are too large to enable the correction to be calculated in this way. An alternative method has therefore been used.

The mass flowrate q_m is given by

$$q_m = \frac{\pi d^2 C \varepsilon \sqrt{2 \rho \Delta p}}{4 \sqrt{1 - \beta^4}}$$

where d is the orifice diameter, C is the discharge coefficient, ε is the expansibility, ρ is the density, Δp is the differential pressure, and β is the diameter ratio.

If the corrected and original data are described with subscripts c and o , then the following correction factor is obtained:

$$\frac{q_{m,c}}{q_{m,o}} = \left(\frac{d_c}{d_o} \right)^2 \frac{C_c \varepsilon_c}{C_o \varepsilon_o} \sqrt{\frac{1 - \beta_o^4}{1 - \beta_c^4}}$$

The correct effective diameter is taken as the average of the measurements shown in Table 1 for that plate excluding the erroneous measurement. It is then necessary to calculate C and ε in each case, and they were determined from the equations in ISO 5167-1:1991. C is a function of β and Re_D ; so there is a change in C due to β , but the change varies with Reynolds number. Throughout the calculations the upstream pressure p_1 is taken as 58 bar a; the change in $q_{m,c}/q_{m,o}$ due to changing the static pressure by 10 bar is around 0.00004% at maximum.

Over the period from 31/08/2007 to 16/09/2008 the correction can be calculated as in Table 3; throughout this calculation the meter tube diameter is 433.3558 mm, the isentropic exponent is 1.3431 and the dynamic viscosity 0.0000119 Pa s.

TABLE 3

THE CORRECTION FROM 31/08/2007 TO 16/09/2008

	d mm	β	ε	Re_D	C	$\frac{q_{m,c}}{q_{m,o}}$
Original: $\Delta p=10$ mbar	287.8654	0.664270	0.999939	3486004	0.603245	
Corrected $\Delta p=10$ mbar	288.1417	0.664908	0.999939	3494194	0.603223	1.0023493
Original $\Delta p=500$ mbar	287.8654	0.664270	0.996931	24562819	0.602931	
Corrected $\Delta p=500$ mbar	288.1417	0.664908	0.996929	24620476	0.602908	1.0023473

So $q_{m,c}/q_{m,o}$ is 1.002348.

Over the period from 16/09/2008 to 24/09/2008 the correction can be calculated as in Table 4; throughout this calculation the meter tube diameter is 433.3558 mm, the isentropic exponent is 1.347 and the dynamic viscosity 0.0000121 Pa s.

TABLE 4

THE CORRECTION FROM 16/09/2008 TO 24/09/2008

	d mm	β	ε	Re_D	C	$\frac{q_{m,c}}{q_{m,o}}$
Original: $\Delta p=10$ mbar	287.8654	0.664270	0.999939	3428414	0.603250	
Corrected $\Delta p=10$ mbar	288.1417	0.664908	0.999939	3436469	0.603228	1.0023493
Original $\Delta p=500$ mbar	287.8654	0.664270	0.996940	24157085	0.602932	
Corrected $\Delta p=500$ mbar	288.1417	0.664908	0.996938	24213790	0.602909	1.0023473

So $q_{m,c}/q_{m,o}$ is 1.002348.

4 CORRECTIONS ON A DAILY BASIS

The volume flows for each day from 31/08/2007 to 24/09/2008 are given in Table B.1 of Appendix B together with the corrected values. It has been assumed that the plates were changed at 0930: therefore the whole flow for 31/08/2007 has to be corrected but none of that for 24/09/2008. Summing the data gives the figures in Table 5.

TABLE 5**THE FLOW OVER THE PERIOD 31/08/2007 TO 24/09/2008 INCLUSIVE**

Flow (mscm)	381.58932
Correction (mscm)	0.89573
Corrected flow (mscm)	382.48505
% change	0.2347

5 CONCLUSIONS

A correction factor of 1.002348 should be applied during the period of mis-measurement.

**APPENDIX A
ORIFICE PLATE CALIBRATION CERTIFICATES**

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 22-08-05
REF NO: OP4233
TEMPERATURE: 21 degsC
MEASURED ORIFICE BORE: 288.1395mm

PLATE DETAILS

PLATE SERIAL.	AUST 3516-1-1	PLATE O.D	507.931mm		
MANUFACTURER:		PIPE I.D:	433.374mm	SITE:	AUSTREY
MATERIAL CERT.No.		DESIGN BORE:	288.205mm	FLOW:	12.5x10E6 M ³ /DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, CERT:- 4820 NEXT CAL DUE:- 15/10/05

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

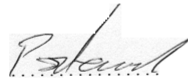
STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS μ	0.089	0.065	0.060	0.063	0.092	0.076	0.053	0.061
'E' mm	9.614	9.608	9.624	9.626	9.612	9.603	9.598	9.609
'e' mm	4.733	4.749	4.842	4.859	4.856	4.837	4.735	4.698
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.170mm							
SURFACE FINISH (Ra)	0.7 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.017mm TAPER: 0 degs

COMMENTS:

INSPECTED BY:



P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 31-08-06
REF NO: OP50203
TEMPERATURE: 21 degsC
MEASURED ORIFICE BORE: 288.159mm

PLATE DETAILS

PLATE SERIAL. AU5T5160 PLATE O.D 508.051mm
 MANUFACTURER: PERRY PIPE I.D: 433.374mm SITE: AUSTREY
 MATERIAL CERT.No. DESIGN BORE: 288.205mm FLOW: 12.5X10E06 M³/DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, CERT:- 4820 NEXT CAL DUE:- 14/10/06

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS	1	2	3	4	5			
FLATNESS μ	0.051	0.025	0.021	0.065	0.103	0.145	0.146	0.070
'E' mm	9.579	9.573	9.575	9.579	9.588	9.578	9.569	9.575
'e' mm	7.072	7.042	7.031	7.061	7.096	7.116	7.100	7.096
EDGE SHARPNESS mm	0.0125	0.0125	0.025	0.025	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.038mm							
SURFACE FINISH (Ra)	2.8 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS								
ROUNDNESS	0.013mm	TAPER:	0 degs					

COMMENTS

INSPECTED BY:



P. KENNERSON



NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 07-11-06
REF NO: OP60165
TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 287.87mm

PLATE DETAILS

PLATE SERIAL.	AUST3516-1-1	PLATE O.D	507.528mm	SITE:	AUSTREY
MANUFACTURER:		PIPE I.D:	433.374mm	DESIGN BORE:	288.205mm
MATERIAL CERT.No.				FLOW:	12.5X10E06 M ³ /DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, CERT:- 4820 NEXT CAL DUE:- 13/10/07

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5			
FLATNESS μ	0.057	0.037	0.055	0.044	0.058	0.098	0.065	0.064
IR mm	9.649	9.589	9.607	9.695	9.677	9.588	9.575	9.648
'e' mm	4.745	4.720	4.828	4.918	4.912	4.828	4.709	4.731
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.025	0.025	0.025	0.0125
BEVEL ANGLE	44 DEGS							
CONCENTRICITY	0.183mm							
SURFACE FINISH (Ra)	0.8 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS : 0.265mm TAPER 0 degs

COMMENTS

INSPECTED BY:



P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 19-SEPT-2008
REF NO: OP80054
TEMPERATURE: 19 degsC
MEASURED ORIFICE BORE: 288.1645mm

PLATE DETAILS

PLATE SERIAL.	AUST5160	PLATE O.D	508.046mm		
MANUFACTURER:	PERRY	PIPE I.D:	433.3558mm	SITE:	AUSTREY
MATERIAL CERT.No.	861028	DESIGN BORE:	288.205mm	FLOW:	12.5X10E06 M ³ /DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS CERT:- 6292. NEXT CAL DUE:- 05-OCTOBER-2008

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:	1	2	3	5	6	7	8	
FLATNESS %	0.052	0.007	0.017	0.063	0.113	0.159	0.142	0.117
	9.578	9.582	9.579	9.577	9.585	9.578	9.577	9.573
'e' mm	7.072	7.039	7.024	7.047	7.097	7.111	7.115	7.100
EDGE SHARPNESS mm	SQUARE	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	SQUARE
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.021mm							
SURFACE FINISH (Ra)	2.3 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :	PASS							
ROUNDNESS :	0.006mm	TAPER:	0 degs					

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS: CLEAN PLATE.

INSPECTED BY...  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 29-SEPT-2008
REF NO: OP80062
TEMPERATURE: 20 degsC
MEASURED ORIFICE BORE: 288.1485mm

PLATE DETAILS

PLATE SERIAL. AUST3516-1-1 PLATE O.D 507.932mm
 MANUFACTURER: PIPE I.D: 433.3558mm SITE: AUSTREY
 MATERIAL CERT.No DESIGN BORE: 288.205mm FLOW: 12.5X10E06 M³/DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS CERT:- 6292. NEXT CAL DUE:- 05-OCTOBER-2008

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	6	7	8	
FLATNESS %	0.053	0.078	0.066	0.088	0.071	0.084	0.062	0.066	
	9.594	9.606	9.624	9.620	9.603	9.614	9.605	9.591	
	4.707	4.726	4.831	4.868	4.853	4.848	4.730	4.702	
EDGE SHARPNESS mm	0.0125	0.0125	0.025	0.025	0.025	0.025	0.0125	0.0125	
BEVEL ANGLE	44 DEGS								
CONCENTRICITY	0.175mm								
SURFACE FINISH (Ra)	0.35 microns								
DOWNSTREAM FACE/EDGE VISUAL INSPECTION	PASS								
ROUNDNESS	0.015mm	TAPER:	0 degs						

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS: CLEAN PLATE

INSPECTED BY:  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 18-DEC-2009
 REF NO: OP90055
 TEMPERATURE: 20.4 degsC
 MEASURED ORIFICE BORE: 288.1655mm

PLATE DETAILS

PLATE SERIAL: AUST5160 PLATE O.D: 508.055mm
 MANUFACTURER: PERRY PIPE I.D: 433.3558mm SITE: AUSTREY
 MATERIAL CERT.No. 861028 DESIGN BORE: 288.205mm FLOW: 12.5 X 10E06 M³/DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS TRACEABLE CERT:- 7325. NEXT CAL DUE:- 02-OCTOBER-2010

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)


STATIONS:-	1	2	4	5	6	7	
FLATNESS %	0.058	0.032	0.012	0.064	0.101	0.149	0.146 0.069
'E' mm	9.581	9.578	9.582	9.574	9.573	9.581	9.577
'e' mm	7.067	7.037	7.025	7.053	7.090	7.115	7.113
EDGE SHARPNESS mm	SQUARE	SQUARE	0.0125	0.0125	0.0125	0.0125	0.025 0.0125
BEVEL ANGLE:	44 DEGS						
CONCENTRICITY	0.264mm						
SURFACE FINISH (Ra)	2.2 microns						

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS : 0.007mm TAPER: 0 degs

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS: CLEAN PLATE

INSPECTED BY:  M Livingstone

APPENDIX B CORRECTED DAILY VOLUME FLOWS

TABLE B.1

FLOWS AT AUSTREY DURING THE PERIOD OF THE MIS-MEASUREMENT

	Original Values (total)	Corrected values (total)	% increase
Date	Volume (mscm)	Volume (mscm)	Volume (mscm)
31/08/2007	0.1926	0.19305	0.2348
01/09/2007	0	0.00000	0
02/09/2007	0	0.00000	0
03/09/2007	0	0.00000	0
04/09/2007	0	0.00000	0
05/09/2007	0	0.00000	0
06/09/2007	0	0.00000	0
07/09/2007	0	0.00000	0
08/09/2007	0	0.00000	0
09/09/2007	0	0.00000	0
10/09/2007	0.04301	0.04311	0.2348
11/09/2007	0.0296	0.02967	0.2348
12/09/2007	0	0.00000	0
13/09/2007	0	0.00000	0
14/09/2007	0	0.00000	0
15/09/2007	0	0.00000	0
16/09/2007	0	0.00000	0
17/09/2007	0	0.00000	0
18/09/2007	2.9843	2.99131	0.2348
19/09/2007	3.2981	3.30584	0.2348
20/09/2007	2.5788	2.58486	0.2348
21/09/2007	0.0331	0.03318	0.2348
22/09/2007	0	0.00000	0
23/09/2007	0	0.00000	0
24/09/2007	0.7825	0.78434	0.2348
25/09/2007	2.2474	2.25268	0.2348
26/09/2007	0	0.00000	0
27/09/2007	0.44241	0.44345	0.2348
28/09/2007	0	0.00000	0
29/09/2007	0	0.00000	0
30/09/2007	0	0.00000	0
01/10/2007	0	0.00000	0
02/10/2007	0.1419	0.14223	0.2348
03/10/2007	0	0.00000	0
04/10/2007	0	0.00000	0
05/10/2007	0	0.00000	0
06/10/2007	0	0.00000	0
07/10/2007	0.0001	0.00010	0.2348

08/10/2007	0	0.00000	0
09/10/2007	0	0.00000	0
10/10/2007	0	0.00000	0
11/10/2007	0	0.00000	0
12/10/2007	0	0.00000	0
13/10/2007	0	0.00000	0
14/10/2007	0	0.00000	0
15/10/2007	0	0.00000	0
16/10/2007	0	0.00000	0
17/10/2007	0	0.00000	0
18/10/2007	0	0.00000	0
19/10/2007	0	0.00000	0
20/10/2007	0	0.00000	0
21/10/2007	0	0.00000	0
22/10/2007	0	0.00000	0
23/10/2007	0	0.00000	0
24/10/2007	0	0.00000	0
25/10/2007	0	0.00000	0
26/10/2007	0	0.00000	0
27/10/2007	0	0.00000	0
28/10/2007	0	0.00000	0
29/10/2007	0	0.00000	0
30/10/2007	0.8934	0.89550	0.2348
31/10/2007	0	0.00000	0
01/11/2007	0	0.00000	0
02/11/2007	0.6289	0.63038	0.2348
03/11/2007	0.5166	0.51781	0.2348
04/11/2007	0.3529	0.35373	0.2348
05/11/2007	0	0.00000	0
06/11/2007	3.5699	3.57828	0.2348
07/11/2007	2.6352	2.64139	0.2348
08/11/2007	2.4337	2.43941	0.2348
09/11/2007	2.3826	2.38819	0.2348
10/11/2007	2.9337	2.94059	0.2348
11/11/2007	3.7	3.70869	0.2348
12/11/2007	4.6864	4.69740	0.2348
13/11/2007	5.0934	5.10536	0.2348
14/11/2007	5.1889	5.20108	0.2348
15/11/2007	5.6952	5.70857	0.2348
16/11/2007	7.0377	7.05422	0.2348
17/11/2007	4.3718	4.38206	0.2348
18/11/2007	5.5972	5.61034	0.2348
19/11/2007	4.3825	4.39279	0.2348
20/11/2007	4.2585	4.26850	0.2348
21/11/2007	3.4337	3.44176	0.2348
22/11/2007	3.2911	3.29883	0.2348
23/11/2007	1.2147	1.21755	0.2348
24/11/2007	0	0.00000	0

25/11/2007	0	0.00000	0
26/11/2007	0.9713	0.97358	0.2348
27/11/2007	2.8335	2.84015	0.2348
28/11/2007	0.9527	0.95494	0.2348
29/11/2007	0.7827	0.78454	0.2348
30/11/2007	0.9679	0.97017	0.2348
01/12/2007	1.4583	1.46172	0.2348
02/12/2007	3.872	3.88109	0.2348
03/12/2007	4.064	4.07354	0.2348
04/12/2007	3.8695	3.87859	0.2348
05/12/2007	2.024	2.02875	0.2348
06/12/2007	0.0009	0.00090	0.2348
07/12/2007	0	0.00000	0
08/12/2007	0.0001	0.00010	0.2348
09/12/2007	0	0.00000	0
10/12/2007	3.7448	3.75359	0.2348
11/12/2007	5.3946	5.40727	0.2348
12/12/2007	5.7158	5.72922	0.2348
13/12/2007	4.5696	4.58033	0.2348
14/12/2007	5.1417	5.15377	0.2348
15/12/2007	4.601	4.61180	0.2348
16/12/2007	5.5626	5.57566	0.2348
17/12/2007	3.4252	3.43324	0.2348
18/12/2007	7.55021	7.56794	0.2348
19/12/2007	6.9033	6.91951	0.2348
20/12/2007	5.877	5.89080	0.2348
21/12/2007	5.0403	5.05213	0.2348
22/12/2007	3.4438	3.45189	0.2348
23/12/2007	4.9967	5.00843	0.2348
24/12/2007	3.7952	3.80411	0.2348
25/12/2007	3.3853	3.39325	0.2348
26/12/2007	2.1486	2.15364	0.2348
27/12/2007	2.2432	2.24847	0.2348
28/12/2007	2.4413	2.44703	0.2348
29/12/2007	0	0.00000	0
30/12/2007	0	0.00000	0
31/12/2007	0	0.00000	0
01/01/2008	0	0.00000	0
02/01/2008	2.7764	2.78292	0.2348
03/01/2008	4.7267	4.73780	0.2348
04/01/2008	4.3731	4.38337	0.2348
05/01/2008	2.0019	2.00660	0.2348
06/01/2008	0	0.00000	0
07/01/2008	0.9537	0.95594	0.2348
08/01/2008	0.1683	0.16870	0.2348
09/01/2008	3.4054	3.41340	0.2348
10/01/2008	4.0279	4.03736	0.2348
11/01/2008	4.5901	4.60088	0.2348

12/01/2008	4.0554	4.06492	0.2348
13/01/2008	3.6376	3.64614	0.2348
14/01/2008	3.9368	3.94604	0.2348
15/01/2008	3.9071	3.91627	0.2348
16/01/2008	4.5115	4.52209	0.2348
17/01/2008	4.3759	4.38617	0.2348
18/01/2008	0.0779	0.07808	0.2348
19/01/2008	0	0.00000	0
20/01/2008	0	0.00000	0
21/01/2008	0	0.00000	0
22/01/2008	1.0726	1.07512	0.2348
23/01/2008	0.0499	0.05002	0.2348
24/01/2008	0	0.00000	0
25/01/2008	1.1533	1.15601	0.2348
26/01/2008	1.05161	1.05408	0.2348
27/01/2008	0.81519	0.81710	0.2348
28/01/2008	0	0.00000	0
29/01/2008	2.8345	2.84116	0.2348
30/01/2008	4.8653	4.87672	0.2348
31/01/2008	4.80479	4.81607	0.2348
01/02/2008	3.6049	3.61336	0.2348
02/02/2008	0	0.00000	0
03/02/2008	0	0.00000	0
04/02/2008	0.885	0.88708	0.2348
05/02/2008	1.7103	1.71432	0.2348
06/02/2008	0.3384	0.33919	0.2348
07/02/2008	1.263	1.26597	0.2348
08/02/2008	0.0172	0.01724	0.2348
09/02/2008	0	0.00000	0
10/02/2008	0	0.00000	0
11/02/2008	0	0.00000	0
12/02/2008	0	0.00000	0
13/02/2008	0.1289	0.12920	0.2348
14/02/2008	0	0.00000	0
15/02/2008	2.3272	2.33266	0.2348
16/02/2008	3.1307	3.13805	0.2348
17/02/2008	4.1879	4.19773	0.2348
18/02/2008	4.9122	4.92373	0.2348
19/02/2008	5.2267	5.23897	0.2348
20/02/2008	1.3527	1.35588	0.2348
21/02/2008	0	0.00000	0
22/02/2008	0	0.00000	0
23/02/2008	0	0.00000	0
24/02/2008	0.8046	0.80649	0.2348
25/02/2008	2.4977	2.50356	0.2348
26/02/2008	0.6003	0.60171	0.2348
27/02/2008	3.1867	3.19418	0.2348
28/02/2008	3.6022	3.61066	0.2348

29/02/2008	3.5588	3.56716	0.2348
01/03/2008	0	0.00000	0
02/03/2008	0	0.00000	0
03/03/2008	3.3507	3.35857	0.2348
04/03/2008	3.3551	3.36298	0.2348
05/03/2008	3.9333	3.94254	0.2348
06/03/2008	3.3814	3.38934	0.2348
07/03/2008	0	0.00000	0
08/03/2008	0	0.00000	0
09/03/2008	0	0.00000	0
10/03/2008	4.1028	4.11243	0.2348
11/03/2008	3.4585	3.46662	0.2348
12/03/2008	2.9289	2.93578	0.2348
13/03/2008	2.1593	2.16437	0.2348
14/03/2008	1.8854	1.88983	0.2348
15/03/2008	0	0.00000	0
16/03/2008	0	0.00000	0
17/03/2008	3.236	3.24360	0.2348
18/03/2008	2.8947	2.90150	0.2348
19/03/2008	0.4572	0.45827	0.2348
20/03/2008	0	0.00000	0
21/03/2008	0	0.00000	0
22/03/2008	0	0.00000	0
23/03/2008	2.701	2.70734	0.2348
24/03/2008	3.2181	3.22566	0.2348
25/03/2008	3.0851	3.09234	0.2348
26/03/2008	3.006	3.01306	0.2348
27/03/2008	2.3749	2.38048	0.2348
28/03/2008	0.6201	0.62156	0.2348
29/03/2008	2.8619	2.86862	0.2348
30/03/2008	0	0.00000	0
31/03/2008	0	0.00000	0
01/04/2008	0	0.00000	0
02/04/2008	0	0.00000	0
03/04/2008	0	0.00000	0
04/04/2008	0.0001	0.00010	0.2348
05/04/2008	0	0.00000	0
06/04/2008	0.0865	0.08670	0.2348
07/04/2008	0	0.00000	0
08/04/2008	0	0.00000	0
09/04/2008	0	0.00000	0
10/04/2008	0	0.00000	0
11/04/2008	0	0.00000	0
12/04/2008	0	0.00000	0
13/04/2008	0	0.00000	0
14/04/2008	0	0.00000	0
15/04/2008	1.9411	1.94566	0.2348
16/04/2008	0.3111	0.31183	0.2348

17/04/2008	0	0.00000	0
18/04/2008	0.4755	0.47662	0.2348
19/04/2008	0.0037	0.00371	0.2348
20/04/2008	0.7728	0.77461	0.2348
21/04/2008	0	0.00000	0
22/04/2008	0	0.00000	0
23/04/2008	0	0.00000	0
24/04/2008	0	0.00000	0
25/04/2008	0.6677	0.66927	0.2348
26/04/2008	1.7425	1.74659	0.2348
27/04/2008	0	0.00000	0
28/04/2008	0	0.00000	0
29/04/2008	0.4514	0.45246	0.2348
30/04/2008	1.892	1.89644	0.2348
01/05/2008	0.0247	0.02476	0.2348
02/05/2008	0	0.00000	0
03/05/2008	0	0.00000	0
04/05/2008	0.6014	0.60281	0.2348
05/05/2008	2.5382	2.54416	0.2348
06/05/2008	1.5723	1.57599	0.2348
07/05/2008	0.2044	0.20488	0.2348
08/05/2008	0	0.00000	0
09/05/2008	0	0.00000	0
10/05/2008	0	0.00000	0
11/05/2008	0	0.00000	0
12/05/2008	1.4851	1.48859	0.2348
13/05/2008	0	0.00000	0
14/05/2008	0	0.00000	0
15/05/2008	0	0.00000	0
16/05/2008	0	0.00000	0
17/05/2008	0	0.00000	0
18/05/2008	0	0.00000	0
19/05/2008	0	0.00000	0
20/05/2008	0	0.00000	0
21/05/2008	0	0.00000	0
22/05/2008	0	0.00000	0
23/05/2008	0	0.00000	0
24/05/2008	0	0.00000	0
25/05/2008	0	0.00000	0
26/05/2008	0	0.00000	0
27/05/2008	0	0.00000	0
28/05/2008	0	0.00000	0
29/05/2008	0	0.00000	0
30/05/2008	0	0.00000	0
31/05/2008	0	0.00000	0
01/06/2008	0	0.00000	0
02/06/2008	0	0.00000	0
03/06/2008	0.5094	0.51060	0.2348

04/06/2008	0	0.00000	0
05/06/2008	0	0.00000	0
06/06/2008	0	0.00000	0
07/06/2008	0	0.00000	0
08/06/2008	0	0.00000	0
09/06/2008	0.1468	0.14714	0.2348
10/06/2008	0	0.00000	0
11/06/2008	0	0.00000	0
12/06/2008	0.4694	0.47050	0.2348
13/06/2008	0	0.00000	0
14/06/2008	0	0.00000	0
15/06/2008	0	0.00000	0
16/06/2008	0	0.00000	0
17/06/2008	0	0.00000	0
18/06/2008	0	0.00000	0
19/06/2008	0	0.00000	0
20/06/2008	0	0.00000	0
21/06/2008	0	0.00000	0
22/06/2008	0	0.00000	0
23/06/2008	0	0.00000	0
24/06/2008	0	0.00000	0
25/06/2008	0.1999	0.20037	0.2348
26/06/2008	0.1997	0.20017	0.2348
27/06/2008	0	0.00000	0
28/06/2008	0	0.00000	0
29/06/2008	0	0.00000	0
30/06/2008	0.0177	0.01774	0.2348
01/07/2008	0.1622	0.16258	0.2348
02/07/2008	0	0.00000	0
03/07/2008	0	0.00000	0
04/07/2008	0	0.00000	0
05/07/2008	0	0.00000	0
06/07/2008	0	0.00000	0
07/07/2008	0	0.00000	0
08/07/2008	0	0.00000	0
09/07/2008	0.963	0.96526	0.2348
10/07/2008	0	0.00000	0
11/07/2008	0	0.00000	0
12/07/2008	0	0.00000	0
13/07/2008	0	0.00000	0
14/07/2008	0	0.00000	0
15/07/2008	0	0.00000	0
16/07/2008	0.7344	0.73612	0.2348
17/07/2008	0	0.00000	0
18/07/2008	0	0.00000	0
19/07/2008	0	0.00000	0
20/07/2008	0	0.00000	0
21/07/2008	0.8743	0.87635	0.2348

22/07/2008	0	0.00000	0
23/07/2008	0	0.00000	0
24/07/2008	0	0.00000	0
25/07/2008	0	0.00000	0
26/07/2008	0	0.00000	0
27/07/2008	0	0.00000	0
28/07/2008	0	0.00000	0
29/07/2008	0	0.00000	0
30/07/2008	0	0.00000	0
31/07/2008	0	0.00000	0
01/08/2008	0	0.00000	0
02/08/2008	0	0.00000	0
03/08/2008	0	0.00000	0
04/08/2008	0	0.00000	0
05/08/2008	0	0.00000	0
06/08/2008	0	0.00000	0
07/08/2008	0	0.00000	0
08/08/2008	0	0.00000	0
09/08/2008	0	0.00000	0
10/08/2008	0	0.00000	0
11/08/2008	0	0.00000	0
12/08/2008	0	0.00000	0
13/08/2008	0	0.00000	0
14/08/2008	0	0.00000	0
15/08/2008	0	0.00000	0
16/08/2008	0	0.00000	0
17/08/2008	0	0.00000	0
18/08/2008	0	0.00000	0
19/08/2008	0	0.00000	0
20/08/2008	0	0.00000	0
21/08/2008	0	0.00000	0
22/08/2008	0	0.00000	0
23/08/2008	0	0.00000	0
24/08/2008	0	0.00000	0
25/08/2008	0	0.00000	0
26/08/2008	0	0.00000	0
27/08/2008	0	0.00000	0
28/08/2008	0	0.00000	0
29/08/2008	0	0.00000	0
30/08/2008	0	0.00000	0
31/08/2008	0	0.00000	0
01/09/2008	0	0.00000	0
02/09/2008	0	0.00000	0
03/09/2008	0	0.00000	0
04/09/2008	0	0.00000	0
05/09/2008	0	0.00000	0
06/09/2008	0	0.00000	0
07/09/2008	0	0.00000	0

08/09/2008	0.0835	0.08370	0.2348
09/09/2008	0.0975	0.09773	0.2348
10/09/2008	0	0.00000	0
11/09/2008	0	0.00000	0
12/09/2008	0	0.00000	0
13/09/2008	0	0.00000	0
14/09/2008	0	0.00000	0
15/09/2008	0	0.00000	0
16/09/2008	0.0664	0.06656	0.2348
17/09/2008	2.4072	2.41285	0.2348
18/09/2008	0.4166	0.41758	0.2348
19/09/2008	0	0.00000	0
20/09/2008	0	0.00000	0
21/09/2008	0	0.00000	0
22/09/2008	0	0.00000	0
23/09/2008	0	0.00000	0
24/09/2008	0.1032	0.10320	0