



ASSESSMENT OF ERROR DUE TO ORIFICE DIAMETER MIS-MEASUREMENT AT PETERBOROUGH EYE

A Report for

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

PROJECT NO: NGR010

REPORT NO: 2010/223

DATE: 17 JUNE 2010



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

NOTES

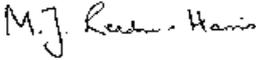
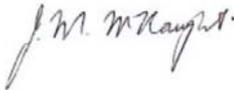
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TUV NEL Ltd
East Kilbride
GLASGOW G75 0QF
UK
Tel: +44 (0)1355 220222
Fax: +44 (0)1355 272999
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Assessment of Error Due to Orifice Diameter Mis-Measurement at Peterborough Eye

A Report for

National Grid
Brick Kiln Street
HINCKLEY
Leicestershire
LE10 0NA

Prepared by: 	Approved by: 
Dr M J Reader-Harris	J M McNaught

for
Michael Valente
Managing Director

Date: 17 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 Peterborough Eye correction factors should be applied as follows:

Meter tube	Date	Correction factor <i>$q_{m,c}/q_{m,o}$</i>
MTA	07/11/2007 to 30/10/2008	1.002606
MTB	07/11/2007 to 30/10/2008	1.002640

Over the period 07/11/2007 to 30/10/2008 inclusive the flow and corrected flow in the two tubes were as follows:

	MTA	MTB
Flow (mscm)	96.74458	135.09352
Corrected flow (mscm)	96.99513	135.44898

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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 Peterborough Eye in the period of the error. The Joint Office Error Codes are EA003 and EA004 for meter tubes MTA and MTB.

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	Values at 20 °C
					Orifice bore (mm)
OP4230	PEYE 5028	10/03/05	101.356	21	101.3544
OP4231	PEYE 5027	10/03/05	101.3615	21	101.3599
OP60023	PEYE 6014	20/02/06	101.3595	21	101.3579
OP60024	PEYE 6015	20/02/06	101.3925	21	101.3909
OP70027	PEYE 5027	29/03/07	101.259	21	101.2574
OP70028	PEYE 5028	29/03/07	101.251	21	101.2494
OP80056	PEYE 6015	24/09/08	101.3915	20	101.3915
OP80057	PEYE 6014	24/09/08	101.3625	20	101.3625
OP80079	PEYE 5027	10/11/08	101.3715	20.2	101.3712
OP80080	PEYE 5028	12/11/08	101.364	20.4	101.3634
OP90051	PEYE 6014	20/11/09	101.3575	20.6	101.3565
OP90052	PEYE 6015	20/11/09	101.3895	20.6	101.3885

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 the plates were mis-measured.

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

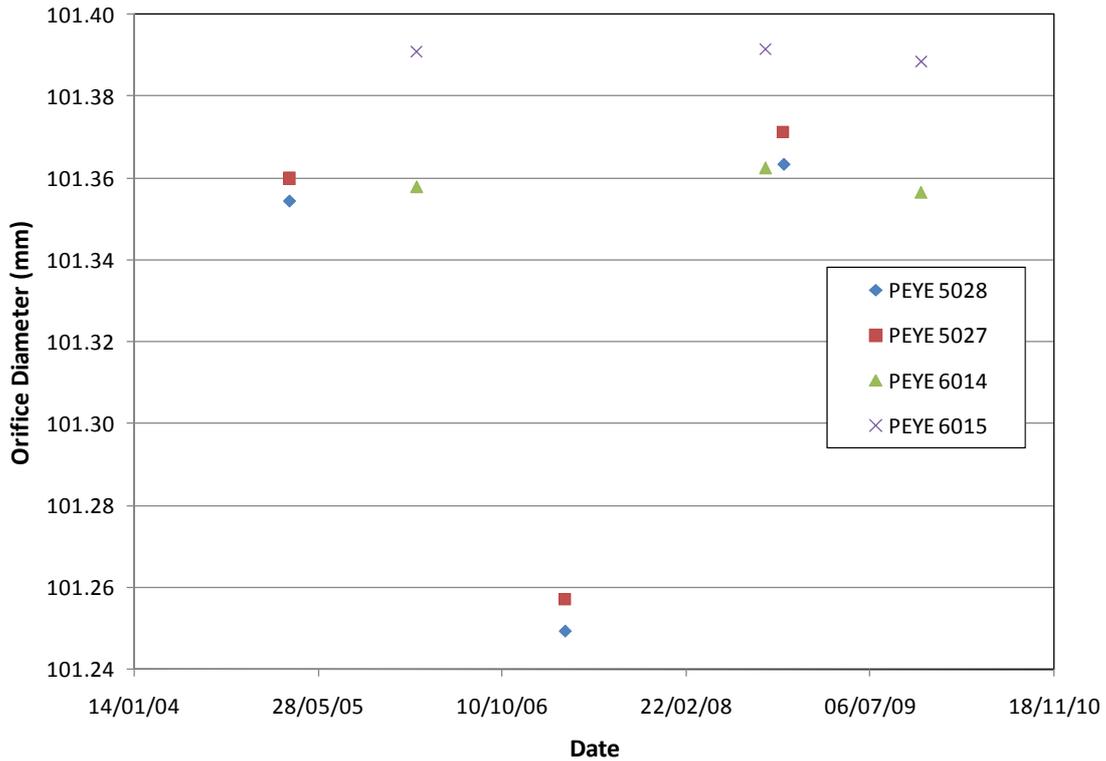


Figure 1 Orifice Diameters at 20 °C

The plates actually used in each of the two meter tubes are given in Table 2.

TABLE 2

PLATES USED IN EACH LINE AS CONFIGURED BY FLOW COMPUTER

Configuration data	omnM1022.cfg	omnM1107.cfg	omnN0128.cfg	omnN1030.cfg
MTA	22/10/2007 23:01	08/11/2007 00:01	29/01/2008 00:01	31/10/2008 00:01
Orifice plate bore diameter (mm)	101.3595	101.259	101.259	101.3625
Expansion coefficient of the plate (/°C)	0.000016	0.000016	0.000016	0.000016
Orifice plate calibration temperature	21	21	21	20
Meter tube diameter (mm)	154.1494	154.1494	154.1494	154.1494
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	1.349	1.349	1.3486	1.3486
Dynamic Viscosity (Pa.s)	0.0000121	0.0000121	0.000012	0.000012
Orifice plate certificate number	OP60023	OP70027	OP70027	OP80057
Orifice plate serial number	PEYE 6014	PEYE 5027	PEYE 5027	PEYE 6014
Error in orifice diameter?	No	Yes	Yes	No
MTB				
Orifice plate bore diameter (mm)	101.3925	101.251	101.251	101.3915
Expansion coefficient of the plate (/°C)	0.000016	0.000016	0.000016	0.000016
Orifice plate calibration temperature	21	21	21	20
Meter tube diameter (mm)	154.0637	154.0637	154.0637	154.0637
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	1.349	1.349	1.3486	1.3486
Dynamic Viscosity (Pa.s)	0.0000121	0.0000121	0.000012	0.000012
Orifice plate certificate number	OP60024	OP70028	OP70028	OP80056
Orifice plate serial number	PEYE 6015	PEYE 5028	PEYE 5028	PEYE 6015
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:

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

The correct orifice 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 59 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 07/11/2007 to 28/01/2008 the correction on MTA can be calculated as in Table 3. Throughout this calculation the meter tube diameter is 154.1494 mm, the isentropic exponent is 1.349 and the dynamic viscosity is 0.0000121 Pa s.

TABLE 3

THE CORRECTION ON MTA FROM 07/11/2007 TO 28/01/2008

	d mm	β	ε	Re_D	C	$\frac{q_{m,c}}{q_{m,o}}$
Original: $\Delta p=10$ mbar	101.2574	0.656878	0.999940	1198178	0.605135	
Corrected $\Delta p=10$ mbar	101.3655	0.657580	0.999940	1201303	0.605122	1.0026077
Original $\Delta p=500$ mbar	101.2574	0.656878	0.997015	8438098	0.604454	
Corrected $\Delta p=500$ mbar	101.3655	0.657580	0.997013	8460080	0.604441	1.0026051

So $q_{m,c}/q_{m,o}$ is 1.002606.

Over the period from 07/11/2007 to 28/01/2008 the correction on MTB can be calculated as in Table 4. Throughout this calculation the meter tube diameter is 154.0637 mm, the isentropic exponent is 1.349 and the dynamic viscosity is 0.0000121 Pa s.

TABLE 4

THE CORRECTION ON MTB FROM 07/11/2007 TO 28/01/2008

	d mm	β	ε	Re_D	C	$\frac{q_{m,c}}{q_{m,o}}$
Original: $\Delta p=10$ mbar	101.2494	0.657192	0.999940	1198909	0.605131	
Corrected $\Delta p=10$ mbar	101.3589	0.657902	0.999940	1202076	0.605118	1.0026412
Original $\Delta p=500$ mbar	101.2494	0.657192	0.997014	8443232	0.604449	
Corrected $\Delta p=500$ mbar	101.3589	0.657902	0.997012	8465510	0.604436	1.0026386

So $q_{m,c}/q_{m,o}$ is 1.002640.

Over the period from 28/01/2008 to 30/10/2008 the correction on MTA can be calculated as in Table 5. Throughout this calculation the meter tube diameter is 154.1494 mm, the isentropic exponent is 1.3486 and the dynamic viscosity is 0.000012 Pa s.

TABLE 5

THE CORRECTION ON MTA FROM 28/01/2008 TO 30/10/2008

	d mm	β	ε	Re_D	C	$\frac{q_{m,c}}{q_{m,o}}$
Original: $\Delta p=10$ mbar	101.2574	0.656878	0.999940	1208152	0.605129	
Corrected $\Delta p=10$ mbar	101.3655	0.657580	0.999940	1211303	0.605117	1.0026077
Original $\Delta p=500$ mbar	101.2574	0.656878	0.997014	8508390	0.604453	
Corrected $\Delta p=500$ mbar	101.3655	0.657580	0.997012	8530556	0.604440	1.0026051

So $q_{m,c}/q_{m,o}$ is 1.002606.

Over the period from 28/01/2008 to 30/10/2008 the correction on MTB can be calculated as in Table 6. Throughout this calculation the meter tube diameter is 154.0637 mm, the isentropic exponent is 1.3486 and the dynamic viscosity is 0.000012 Pa s.

TABLE 6

THE CORRECTION ON MTB FROM 28/01/2008 TO 30/10/2008

	d mm	β	ε	Re_D	C	$\frac{q_{m,c}}{q_{m,o}}$
Original: $\Delta p=10$ mbar	101.2494	0.657192	0.999940	1208889	0.605125	
Corrected $\Delta p=10$ mbar	101.3589	0.657902	0.999940	1212082	0.605112	1.0026411
Original $\Delta p=500$ mbar	101.2494	0.657192	0.997013	8513567	0.604448	
Corrected $\Delta p=500$ mbar	101.3589	0.657902	0.997012	8536031	0.604435	1.0026386

So $q_{m,c}/q_{m,o}$ is 1.002640.

4 CORRECTIONS ON A DAILY BASIS

Each (approximately four-minute) interval was considered and the flow (here and throughout this paragraph flow refers to standard volume flow) was calculated in each tube; the flowrate during the interval was taken as the average of that at the beginning and that at the end of the interval. The interval is only known to the nearest minute; so the flow in MTA during the interval was calculated by taking the product of the total flow (supplied by National Grid) during that interval and the ratio of the calculated flow in MTA to the sum of the calculated flows in the tubes. Intervals in which the calculated flow in both MTA and MTB is zero have been disregarded. Then on taking account of the effects at the beginning and end of each day the sum of the daily flow in MTA (obtained by summing the flows in each interval) and that in MTB (obtained the same way) should be equal to the total flow in that day. To ensure that the sum of the daily flows is exactly equal to the total daily flow the individual totals were scaled. Then the increase in daily flow was calculated for each of the two daily flows by using the percentage increase for each tube given above. Finally the total increase in the daily flow is the sum of the increases for the two tubes. The results are given in Table B.1 of Appendix B. The sum of the flows and the sum of the corrections have also been calculated by meter tube. It was assumed that on 07/11/2007 the orifice plates in MTA and MTB were changed at 13:45 and 12:15 respectively and that on 30/10/2008 the orifice plates in MTA and MTB were changed at 09:45 and 12:30 respectively.

5 CONCLUSIONS

Correction factors should be applied as shown in Table 7.

TABLE 7

CORRECTION FACTORS

Meter tube	Date	Correction factor $q_{m,c}/q_{m,o}$
MTA	07/11/2007 to 30/10/2008	1.002606
MTB	07/11/2007 to 30/10/2008	1.002640

These correction factors apply to both measured volume and measured energy.

On applying these corrections the corrected volumes are as shown in Appendix B.

Flows by meter tube are as shown in Table 8.

TABLE 8

FLOW IN THE PERIOD 07/11/2007 TO 30/10/2008 INCLUSIVE

	MTA	MTB
Flow (mscm)	96.74458	135.09352
Correction (mscm)	0.25055	0.35545
Corrected flow (mscm)	96.99513	135.44898
% change	0.2590	0.2631

APPENDIX A
ORIFICE PLATE CALIBRATION CERTIFICATES

TRANSCO ORIFICE PLATE CALIBRATION

DATE: 10-03-05
REF NO: OP4230
TEMPERATURE: 21 degsC
MEASURED ORIFICE BORE: 101.356mm

PLATE DETAILS

PLATE SERIAL. PEYE 5028 PLATE O.D 163.402mm
 MANUFACTURER: PIPE I.D: 154.178mm SITE EYE GREEN
 MATERIAL CERT.No. DESIGN BORE: 101.3797mm FLOW 1542455.8 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:- 15/10/05

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS %	0.013	0.205	0.041	0.046	0.020	0.122	0.081	0.019
'E' mm	3.119	3.114	3.119	3.120	3.119	3.112	3.097	3.104
e' mm	1.241	1.162	1.111	1.155	1.166	1.198	1.206	1.246
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE	44 DEGS							
CONCENTRICITY	0.094mm							
SURFACE FINISH (Ra)	0.4 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS : 0.024mm TAPER: 0 degs

COMMENTS

INSPECTED BY *G. Wardle* G. WARDLE

VERIFIED BY *P. Kennerson* P. KENNERSON

TRANSCO ORIFICE PLATE CALIBRATION

DATE: 10-03-05
 REF NO: OP4231
 TEMPERATURE: 21 degsC
 MEASURED ORIFICE BORE: 101.3615mm

PLATE DETAILS

PLATE SERIAL: PEYE 5027 PLATE O.D: 163.399mm
 MANUFACTURER: PIPE I.D: 154.178mm SITE: EYE GREEN
 MATERIAL CERT.No: DESIGN BORE: 101.3797mm FLOW: 1542455.8 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:- 15/10/05

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS %	0.008	0.047	0.109	0.037	0.009	0.013	0.115	0.158
RA mm	3.209	3.188	3.192	3.173	3.199	3.199	3.180	3.222
EDGE SHARPNESS mm	1.230	1.193	1.147	1.083	1.080	1.091	1.078	1.219
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE	44 DEGS							
CONCENTRICITY	0.069mm							
SURFACE FINISH (Ra)	0.6 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.030mm TAPER: 0 degs

COMMENTS:

INSPECTED BY:  G. WARDLE
 VERIFIED BY:  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 20-02-06
 REF NO: OP60023
 TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 101.3595mm

PLATE DETAILS

PLATE SERIAL: PEYB6014 PLATE O.D: 163.445mm
 MANUFACTURER: PIPE I.D: mm SITE: EYE GREEN
 MATERIAL CERT.No: DESIGN BORE: mm FLOW:

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	6	7	8
FLATNESS μ	0.085	0.117	0.065	0.042	0.040	0.204	0.173	0.039
E' mm	3.167	3.178	3.173	3.186	3.238	3.237	3.248	3.234
e' mm	1.968	1.929	1.996	2.057	2.079	2.075	2.081	2.038
EDGE SHARPNESS mm	0.0125	0.0125	SQUARE	0.0125	SQUARE	SQUARE	SQUARE	0.0125
BEVEL ANGLE:	45 DEGS							
CONCENTRICITY	0.070mm							
SURFACE FINISH (Ra)	1.3 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS								
ROUNDNESS	0.012mm	TAPER:		0 degs				

COMMENTS:

INSPECTED BY:  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 20-2-06
REF NO: OP60024
TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 101.3925mm

PLATE DETAILS

PLATE SERIAL. PEYE6015 PLATE O.D 163.404mm
 MANUFACTURER: PIPE I.D: mm SITE: EYE GREEN
 MATERIAL CERT.No. DESIGN BORE mm FLOW:

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	6	7	8
FLATNESS %	0.061	0.296	0.293	0.034	0.211	0.077	0.048	0.172
'B' mm	3.192	3.192	3.189	3.189	3.191	3.178	3.184	3.169
'e' mm	1.603	1.601	1.588	1.625	1.618	1.613	1.647	1.607
EDGE SHARPNESS mm	SQUARE	0.0125	SQUARE	0.0125	SQUARE	0.0125	SQUARE	SQUARE
BEVEL ANGLE	37 DEGS							
CONCENTRICITY	0.045mm							
SURFACE FINISH (Ra)	1.1 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :-	PASS							
ROUNDNESS :	0.014mm	TAPER:	0 degs					

COMMENTS:

INSPECTED BY  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 29-03-07
 REF NO: OP70027
 TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 101.259mm

PLATE DETAILS

PLATE SERIAL. PEYES027 PLATE O.D 163.287mm
 MANUFACTURER: PIPE I.D: 154.178mm SITE: EYE GREEN
 MATERIAL CERT.No DESIGN BORE: 101.379mm FLOW: 1542455.8 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:- 13/10/07

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS μ	0.010	0.061	0.130	0.024	0.022	0.019	0.140	
'E' mm	3.213	3.181	3.187	3.225	3.245	3.180	3.170	
mm	1.206	1.208	1.145	1.112	1.097	1.216	1.082	
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.084mm							
SURFACE FINISH (Ra)	0.9 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.111mm TAPER: 01 degs

COMMENTS:

INSPECTED BY.  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 29-03-07
REF NO: OP70028
TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 101.251mm

PLATE DETAILS

PLATE SERIAL.	PEYE5028	PLATE O.D	163.281mm	SITE:	EYE GREEN
MANUFACTURER:		PIPE I.D:	154.178mm	FLOW:	1542455.8 M ³ /DAY
MATERIAL/ CERT.No		DESIGN BORE:	101.379mm		

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	4	5	6	7	8	
FLATNESS μ	0.021	0.331	0.047	0.045	0.018	0.104	0.092	0.014
E' mm	3.171	3.106	3.110	3.164	3.172	3.103	3.081	3.157
'e' mm	1.254	1.166	1.107	1.162	1.164	1.133	1.125	1.247
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	SQUARE	SQUARE
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.092mm							
SURFACE FINISH (Ra)	0.5 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION	PASS							
ROUNDNESS	0.110mm	TAPER:	0 dege					

COMMENTS

INSPECTED BY  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 24-SEPT-2008
 REF NO: OP80056
 TEMPERATURE: 20 degsC

MEASURED ORIFICE BORE: 101.3915mm

PLATE DETAILS

PLATE SERIAL: PEYE 6015 PLATE O.D: 163.398mm
 MANUFACTURER: PIPE I.D: 154.0637mm SITE: EYE GREEN
 MATERIAL CERT.No: DESIGN BORE: mm FLOW: 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)

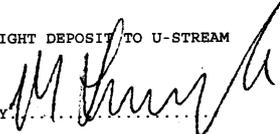
STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS %	0.128	0.095	0.128	0.152	0.123	0.150	0.076	0.123
E' mm	3.181	3.188	3.188	3.181	3.195	3.177	3.178	3.176
'e' mm	1.600	1.595	1.581	1.600	1.628	1.610	1.635	1.622
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	SQUARE	SQUARE	SQUARE	0.0125	SQUARE
BEVEL ANGLE	37 DEGS							
CONCENTRICITY	0.026mm							
SURFACE FINISH (Ra)	0.43 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.013mm TAPER: 0 degs

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS: LIGHT DEPOSIT TO U-STREAM

INSPECTED BY:  M Livingstone.

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 24-SEPT-2008

REF NO: OP80057

TEMPERATURE: 20 degsC

MEASURED ORIFICE BORE: 101.3625mm

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PLATE DETAILS

PLATE SERIAL.	PEYE 6014	PLATE O.D	163.441mm	SITE:	EYE GREEN
MANUFACTURER:		PIPE I.D:	154.1494mm	DESIGN BORE	mm
MATERIAL CERT.No.				FLOW:	M ³ /DAY

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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

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UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

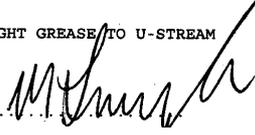
STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS %	0.123	0.155	0.088	0.080	0.033	0.184	0.172	0.025
	3.177	3.168		3.170	3.224	3.239	3.245	3.249
	1.977	1.902	1.977	2.012	2.030	2.067	2.086	2.057
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.070mm							
SURFACE FINISH (Ra)	0.21 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.006mm TAPER: 0 degs

DRAINHOLE PRESENT ? (YES/NO) No

COMMENTS: LIGHT GREASE TO U-STREAM

INSPECTED BY:  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 10-NOV-2008
REF NO: OP80079
TEMPERATURE: 20.2 degsC
MEASURED ORIFICE BORE: 101.3715mm

PLATE DETAILS

PLATE SERIAL. PEYE 5027 PLATE O.D 163.396mm
 MANUFACTURER: PIPE I.D: 154.1494mm SITE EYE GREEN
 MATERIAL CERT.No. DESIGN BORE 101.379mm FLOW 1542455.8 M³/DAY

TEST EQUIPMENT

MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS CERT:- 6822. NEXT CAL DUE:- 03-OCTOBER-2009

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS	1	2	3	4	5	7	8
FLATNESS %	0.082	0.046	0.133	0.077	0.032	0.005	
	3.200	3.188	3.196	3.174	3.198	3.191	
mm	1.218	1.209	1.159	1.088	1.068	1.085	
EDGE SHARPNESS mm	0.0125	SQUARE	0.0125	0.0125	0.0125	0.0125	0.0125 SQUARE
BEVEL ANGLE:	44 DEGS						
CONCENTRICITY	0.075mm						
SURFACE FINISH (Ra)	0.43 microns						

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.019mm TAPER: .01 degs

DRAINHOLE PRESENT ? (YES/NO) No

COMMENTS: CLEAN PLATE

INSPECTED BY.  M Livingstone.

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 12-NOV-2008
 REF NO: OP80080
 TEMPERATURE: 20.4 degsC
 MEASURED ORIFICE BORE: 101.364mm

PLATE DETAILS

PLATE SERIAL. PEYE 5028 PLATE O.D 163.395mm
 MANUFACTURER: PIPE I.D: 154.0637mm SITE: EYE GREEN
 MATERIAL CERT.No DESIGN BORE: 101.379mm FLOW: 1542455.8 M³/DAY

TEST EQUIPMENT

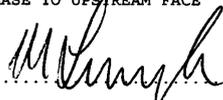
MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS CERT:- 6822. NEXT CAL DUE:- 03-OCTOBER-2009

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	2	3	4	5	6	8		
FLATNESS %	0.016	0.186	0.057	0.006	0.035	0.115	0.082	
E' mm	3.113	3.112	3.118	3.114	3.118	3.122	3.107	
e' mm	1.189	1.146	1.121	1.125	1.132	1.125		
EDGE SHARPNESS mm	0.0125	0.0125	SQUARE	0.0125	SQUARE	SQUARE	0.0125	0.0125
BEVEL ANGLE:	44 DEGS							
CONCENTRICITY	0.090mm							
SURFACE FINISH (Ra)	0.5 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION	PASS							
ROUNDNESS	0.030mm	TAPER:	0 degs					

DRAINHOLE PRESENT ? (YES/NO) No

COMMENTS: GREASE TO UPSTREAM FACE

INSPECTED BY:  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 20-NOV-2009

REF NO: OP90051

TEMPERATURE: 20.6 degsC

MEASURED ORIFICE BORE: 101.3575mm

PLATE DETAILS

PLATE SERIAL. PEYE6014 PLATE O.D. 163.446mm
 MANUFACTURER: PIPE I.D.: 154.1494mm SITE: EYE GREEN MTA
 MATERIAL CERT.No. DESIGN BORE: mm FLOW: M³/DAY

TEST EQUIPMENT

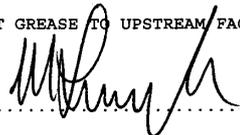
MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS TRACEABLE CERT:- 7325. NEXT CAL DUE:- 02-OCTOBER-2010

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	7	8	
FLATNESS %	0.108	0.166	0.089	0.096	0.028	0.135	0.132	0.039
'E' mm	3.179	3.163	3.188	3.167	3.218	3.240	3.247	3.256
		1.930	2.006	2.021	2.062	2.072	2.079	2.089
EDGE SHARPNESS mm	0.0125	0.025	0.025	0.025	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	45 DEGS							
CONCENTRICITY	0.073mm							
SURFACE FINISH (Ra)	0.24 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS								
ROUNDNESS	0.009mm	TAPER:		0 degs				

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS: LIGHT GREASE TO UPSTREAM FACE

INSPECTED BY:  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 20-NOV-2009
REF NO: OP90052
TEMPERATURE: 20.6 degsC

MEASURED ORIFICE BORE: 101.3895mm

PLATE DETAILS

PLATE SERIAL. PEYE 6015 PLATE O.D 163.399mm
 MANUFACTURER: PIPE I.D: 154.0637mm SITE: EYE GREEN MTB
 MATERIAL CERT.No. DESIGN BORE mm FLOW: M³/DAY

TEST EQUIPMENT

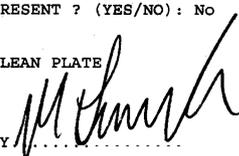
MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS TRACEABLE CERT:- 7325. NEXT CAL DUE:- 02-OCTOBER-2010

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:	1	2	3	4	5	6	7	8
FLATNESS %	0.127	0.105	0.128	0.145	0.123	0.136	0.101	0.131
'E' mm	3.194	3.189	3.191	3.181	3.183	3.189	3.184	3.188
'e' mm	1.612	1.614	1.577	1.604	1.604	1.624	1.625	1.624
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	SQUARE	SQUARE	0.0125	0.0125	0.0125
BEVEL ANGLE:	37 DEGS							
CONCENTRICITY	0.033mm							
SURFACE FINISH (Ra)	0.46 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS								
ROUNDNESS	0.012mm	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 PETERBOROUGH EYE DURING THE PERIOD OF THE MIS-MEASUREMENT

	Original Values (total)	Corrected values (total)	% increase
Date	Volume (mscm)	Volume (mscm)	Volume (mscm)
7/11/2007	0.7709	0.77219	0.1677
8/11/2007	0.8513	0.85353	0.2623
9/11/2007	0.9562	0.95871	0.2623
10/11/2007	0.7027	0.70454	0.2623
11/11/2007	0.8164	0.81854	0.2623
12/11/2007	1.1331	1.13607	0.2623
13/11/2007	1.1073	1.11020	0.2623
14/11/2007	1.0773	1.08013	0.2623
15/11/2007	1.1448	1.14780	0.2623
16/11/2007	1.2273	1.23052	0.2623
17/11/2007	1.0883	1.09115	0.2623
18/11/2007	1.1508	1.15382	0.2623
19/11/2007	1.1354	1.13838	0.2623
20/11/2007	1.0273	1.02999	0.2623
21/11/2007	0.931	0.93344	0.2623
22/11/2007	0.9888	0.99139	0.2623
23/11/2007	1.2551	1.25839	0.2623
24/11/2007	1.2521	1.25538	0.2623
25/11/2007	1.0219	1.02458	0.2623
26/11/2007	1.1337	1.13667	0.2623
27/11/2007	1.0236	1.02628	0.2623
28/11/2007	0.9486	0.95109	0.2623
29/11/2007	0.9892	0.99179	0.2623
30/11/2007	0.8727	0.87499	0.2623
1/12/2007	0.9336	0.93605	0.2623
2/12/2007	0.9447	0.94718	0.2623
3/12/2007	1.0906	1.09346	0.2623
4/12/2007	0.9774	0.97996	0.2623
5/12/2007	0.8535	0.85574	0.2623
6/12/2007	0.8436	0.84581	0.2623
7/12/2007	1.0196	1.02227	0.2623
8/12/2007	1.0817	1.08454	0.2623
9/12/2007	1.046	1.04874	0.2623
10/12/2007	1.2904	1.29378	0.2623
11/12/2007	1.3537	1.35725	0.2623
12/12/2007	1.4087	1.41240	0.2623
13/12/2007	1.5157	1.51968	0.2623
14/12/2007	1.3869	1.39054	0.2623
15/12/2007	1.3161	1.31955	0.2623
16/12/2007	1.4045	1.40818	0.2623
17/12/2007	1.5232	1.52720	0.2623
18/12/2007	1.4224	1.42613	0.2623
19/12/2007	1.4247	1.42844	0.2623
20/12/2007	1.5279	1.53191	0.2623
21/12/2007	1.4386	1.44237	0.2623
22/12/2007	1.271	1.27433	0.2623
23/12/2007	1.3012	1.30461	0.2623

24/12/2007	1.1259	1.12885	0.2623
25/12/2007	0.9611	0.96362	0.2623
26/12/2007	1.0319	1.03461	0.2623
27/12/2007	0.9245	0.92692	0.2623
28/12/2007	0.91769	0.92010	0.2623
29/12/2007	0.97491	0.97747	0.2623
30/12/2007	0.9347	0.93715	0.2623
31/12/2007	0.9945	0.99711	0.2623
1/1/2008	0.9759	0.97846	0.2623
2/1/2008	1.3518	1.35535	0.2623
3/1/2008	1.532	1.53602	0.2623
4/1/2008	1.2919	1.29529	0.2623
5/1/2008	1.1574	1.16044	0.2623
6/1/2008	1.1997	1.20285	0.2623
7/1/2008	1.2958	1.29920	0.2623
8/1/2008	1.2055	1.20866	0.2623
9/1/2008	1.2759	1.27925	0.2623
10/1/2008	1.1834	1.18650	0.2623
11/1/2008	1.228	1.23122	0.2623
12/1/2008	1.1702	1.17327	0.2623
13/1/2008	1.05	1.05275	0.2623
14/1/2008	1.1505	1.15352	0.2623
15/1/2008	1.07011	1.07292	0.2623
16/1/2008	1.15639	1.15942	0.2623
17/1/2008	1.2205	1.22370	0.2623
18/1/2008	1.0273	1.02999	0.2623
19/1/2008	0.7753	0.77733	0.2623
20/1/2008	0.7152	0.71708	0.2623
21/1/2008	0.9454	0.94788	0.2623
22/1/2008	1.1649	1.16796	0.2623
23/1/2008	0.9701	0.97264	0.2623
24/1/2008	1.065	1.06779	0.2623
25/1/2008	1.1523	1.15532	0.2623
26/1/2008	1.0089	1.01155	0.2623
27/1/2008	0.956	0.95851	0.2623
28/1/2008	1.151	1.15402	0.2623
29/1/2008	1.0875	1.09035	0.2623
30/1/2008	1.1725	1.17558	0.2623
31/1/2008	1.3081	1.31153	0.2623
1/2/2008	1.3697	1.37329	0.2623
2/2/2008	1.3058	1.30923	0.2623
3/2/2008	1.224	1.22721	0.2623
4/2/2008	1.1841	1.18721	0.2623
5/2/2008	1.0413	1.04403	0.2623
6/2/2008	1.1029	1.10579	0.2623
7/2/2008	1.0803	1.08313	0.2623
8/2/2008	1.0024	1.00503	0.2623
9/2/2008	0.9554	0.95791	0.2623
10/2/2008	0.9852	0.98778	0.2623
11/2/2008	1.2035	1.20666	0.2623
12/2/2008	1.2355	1.23874	0.2623
13/2/2008	1.3074	1.31083	0.2623
14/2/2008	1.3168	1.32025	0.2623
15/2/2008	1.3211	1.32457	0.2623
16/2/2008	1.3076	1.31103	0.2623
17/2/2008	1.3344	1.33790	0.2623
18/2/2008	1.5342	1.53822	0.2623

19/2/2008	1.604	1.60821	0.2623
20/2/2008	1.4658	1.46964	0.2623
21/2/2008	1.2065	1.20966	0.2623
22/2/2008	0.9759	0.97846	0.2623
23/2/2008	0.8824	0.88471	0.2623
24/2/2008	0.8975	0.89985	0.2623
25/2/2008	1.0657	1.06850	0.2623
26/2/2008	0.9432	0.94567	0.2623
27/2/2008	0.9887	0.99129	0.2623
28/2/2008	1.0305	1.03320	0.2623
29/2/2008	1.1712	1.17427	0.2623
1/3/2008	0.8672	0.86947	0.2623
2/3/2008	0.8079	0.81002	0.2623
3/3/2008	1.1064	1.10930	0.2623
4/3/2008	1.2619	1.26521	0.2623
5/3/2008	1.1629	1.16595	0.2623
6/3/2008	0.9204	0.92281	0.2623
7/3/2008	0.8977	0.90005	0.2623
8/3/2008	0.9154	0.91780	0.2623
9/3/2008	0.8694	0.87168	0.2623
10/3/2008	1.1306	1.13357	0.2623
11/3/2008	1.0356	1.03832	0.2623
12/3/2008	1.1066	1.10950	0.2623
13/3/2008	1.0384	1.04112	0.2623
14/3/2008	0.8078	0.80992	0.2623
15/3/2008	0.7074	0.70926	0.2623
16/3/2008	1.0034	1.00603	0.2623
17/3/2008	1.1593	1.16234	0.2623
18/3/2008	1.2392	1.24245	0.2623
19/3/2008	1.1934	1.19653	0.2623
20/3/2008	1.1565	1.15953	0.2623
21/3/2008	1.0578	1.06057	0.2623
22/3/2008	1.1816	1.18470	0.2623
23/3/2008	1.201	1.20415	0.2623
24/3/2008	1.2084	1.21157	0.2623
25/3/2008	1.2142	1.21738	0.2623
26/3/2008	1.1232	1.12615	0.2623
27/3/2008	0.9282	0.93063	0.2623
28/3/2008	1.0762	1.07902	0.2623
29/3/2008	0.8569	0.85915	0.2623
30/3/2008	0.636	0.63767	0.2623
31/3/2008	0.7604	0.76239	0.2623
1/4/2008	0.7023	0.70414	0.2623
2/4/2008	0.6921	0.69392	0.2623
3/4/2008	0.6246	0.62624	0.2623
4/4/2008	0.5775	0.57901	0.2623
5/4/2008	0.7668	0.76881	0.2623
6/4/2008	0.9633	0.96583	0.2623
7/4/2008	1.1137	1.11662	0.2623
8/4/2008	0.968	0.97054	0.2623
9/4/2008	0.8847	0.88702	0.2623
10/4/2008	0.7567	0.75868	0.2623
11/4/2008	0.8334	0.83559	0.2623
12/4/2008	0.7562	0.75818	0.2623
13/4/2008	0.7692	0.77122	0.2623
14/4/2008	0.9031	0.90547	0.2623
15/4/2008	0.9168	0.91920	0.2623

16/4/2008	0.9437	0.94618	0.2623
17/4/2008	0.9034	0.90577	0.2623
18/4/2008	0.9383	0.94076	0.2623
19/4/2008	0.8627	0.86496	0.2623
20/4/2008	0.8366	0.83879	0.2623
21/4/2008	0.7207	0.72259	0.2623
22/4/2008	0.5775	0.57901	0.2623
23/4/2008	0.6463	0.64800	0.2623
24/4/2008	0.6664	0.66815	0.2623
25/4/2008	0.5805	0.58202	0.2623
26/4/2008	0.3281	0.32896	0.2623
27/4/2008	0.3062	0.30700	0.2623
28/4/2008	0.4441	0.44526	0.2623
29/4/2008	0.6026	0.60418	0.2623
30/4/2008	0.7154	0.71728	0.2623
1/5/2008	0.6172	0.61882	0.2625
2/5/2008	0.5084	0.50974	0.2640
3/5/2008	0.3664	0.36737	0.2640
4/5/2008	0.2673	0.26801	0.2640
5/5/2008	0.2385	0.23913	0.2640
6/5/2008	0.2547	0.25537	0.2640
7/5/2008	0.2334	0.23402	0.2640
8/5/2008	0.2167	0.21727	0.2640
9/5/2008	0.1932	0.19371	0.2640
10/5/2008	0.1445	0.14488	0.2640
11/5/2008	0.1438	0.14418	0.2640
12/5/2008	0.2102	0.21075	0.2640
13/5/2008	0.3299	0.33077	0.2640
14/5/2008	0.325	0.32586	0.2640
15/5/2008	0.3949	0.39594	0.2640
16/5/2008	0.5231	0.52448	0.2640
17/5/2008	0.4698	0.47104	0.2640
18/5/2008	0.4	0.40106	0.2640
19/5/2008	0.5008	0.50212	0.2640
20/5/2008	0.4801	0.48137	0.2640
21/5/2008	0.3974	0.39845	0.2640
22/5/2008	0.3189	0.31974	0.2640
23/5/2008	0.291	0.29177	0.2640
24/5/2008	0.2521	0.25277	0.2640
25/5/2008	0.4109	0.41198	0.2640
26/5/2008	0.4917	0.49300	0.2640
27/5/2008	0.4406	0.44176	0.2640
28/5/2008	0.3311	0.33197	0.2640
29/5/2008	0.3082	0.30901	0.2640
30/5/2008	0.2875	0.28826	0.2640
31/5/2008	0.1832	0.18368	0.2640
1/6/2008	0.3004	0.30119	0.2640
2/6/2008	0.2819	0.28264	0.2640
3/6/2008	0.3884	0.38943	0.2640
4/6/2008	0.2831	0.28385	0.2640
5/6/2008	0.2296	0.23021	0.2640
6/6/2008	0.2653	0.26600	0.2640
7/6/2008	0.2502	0.25086	0.2640
8/6/2008	0.1883	0.18880	0.2640
9/6/2008	0.1806	0.18108	0.2640
10/6/2008	0.1961	0.19662	0.2640
11/6/2008	0.2199	0.22048	0.2640

12/6/2008	0.3192	0.32004	0.2640
13/6/2008	0.3148	0.31563	0.2640
14/6/2008	0.2168	0.21737	0.2640
15/6/2008	0.237	0.23763	0.2640
16/6/2008	0.2604	0.26109	0.2640
17/6/2008	0.2338	0.23442	0.2640
18/6/2008	0.2567	0.25738	0.2640
19/6/2008	0.21339	0.21395	0.2640
20/6/2008	0.1938	0.19431	0.2640
21/6/2008	0.2008	0.20133	0.2640
22/6/2008	0.1646	0.16503	0.2640
23/6/2008	0.2072	0.20775	0.2640
24/6/2008	0.1882	0.18870	0.2640
25/6/2008	0.1695	0.16995	0.2640
26/6/2008	0.1847	0.18519	0.2640
27/6/2008	0.17551	0.17597	0.2640
28/6/2008	0.1326	0.13295	0.2640
29/6/2008	0.1352	0.13556	0.2640
30/6/2008	0.1491	0.14949	0.2640
1/7/2008	0.1366	0.13696	0.2640
2/7/2008	0.1455	0.14588	0.2640
3/7/2008	0.1495	0.14989	0.2640
4/7/2008	0.1357	0.13606	0.2640
5/7/2008	0.1214	0.12172	0.2640
6/7/2008	0.1352	0.13556	0.2640
7/7/2008	0.1631	0.16353	0.2640
8/7/2008	0.16579	0.16623	0.2640
9/7/2008	0.1898	0.19030	0.2640
10/7/2008	0.1568	0.15721	0.2640
11/7/2008	0.1546	0.15501	0.2640
12/7/2008	0.1478	0.14819	0.2640
13/7/2008	0.1363	0.13666	0.2640
14/7/2008	0.1487	0.14909	0.2640
15/7/2008	0.13699	0.13735	0.2640
16/7/2008	0.1417	0.14207	0.2640
17/7/2008	0.17001	0.17046	0.2640
18/7/2008	0.1553	0.15571	0.2640
19/7/2008	0.1252	0.12553	0.2640
20/7/2008	0.1474	0.14779	0.2640
21/7/2008	0.1548	0.15521	0.2640
22/7/2008	0.1417	0.14207	0.2640
23/7/2008	0.1308	0.13115	0.2640
24/7/2008	0.1302	0.13054	0.2640
25/7/2008	0.1167	0.11701	0.2640
26/7/2008	0.0972	0.09746	0.2640
27/7/2008	0.0976	0.09786	0.2640
28/7/2008	0.1125	0.11280	0.2640
29/7/2008	0.1144	0.11470	0.2640
30/7/2008	0.1167	0.11701	0.2640
31/7/2008	0.1094	0.10969	0.2640
1/8/2008	0.11391	0.11421	0.2640
2/8/2008	0.1019	0.10217	0.2640
3/8/2008	0.1079	0.10818	0.2640
4/8/2008	0.1266	0.12693	0.2640
5/8/2008	0.1313	0.13165	0.2640
6/8/2008	0.1221	0.12242	0.2640
7/8/2008	0.1229	0.12322	0.2640

8/8/2008	0.1343	0.13465	0.2640
9/8/2008	0.1255	0.12583	0.2640
10/8/2008	0.1229	0.12322	0.2640
11/8/2008	0.1328	0.13315	0.2640
12/8/2008	0.1425	0.14288	0.2640
13/8/2008	0.1646	0.16503	0.2640
14/8/2008	0.14851	0.14890	0.2640
15/8/2008	0.1322	0.13255	0.2640
16/8/2008	0.1166	0.11691	0.2640
17/8/2008	0.1179	0.11821	0.2640
18/8/2008	0.1363	0.13666	0.2640
19/8/2008	0.1453	0.14568	0.2640
20/8/2008	0.1421	0.14248	0.2640
21/8/2008	0.1354	0.13576	0.2640
22/8/2008	0.1293	0.12964	0.2640
23/8/2008	0.1154	0.11570	0.2640
24/8/2008	0.1138	0.11410	0.2640
25/8/2008	0.1119	0.11220	0.2640
26/8/2008	0.1285	0.12884	0.2640
27/8/2008	0.1409	0.14127	0.2640
28/8/2008	0.1301	0.13044	0.2640
29/8/2008	0.1224	0.12272	0.2640
30/8/2008	0.1054	0.10568	0.2640
31/8/2008	0.1164	0.11671	0.2640
1/9/2008	0.1412	0.14157	0.2640
2/9/2008	0.1631	0.16353	0.2640
3/9/2008	0.1752	0.17566	0.2640
4/9/2008	0.1917	0.19221	0.2640
5/9/2008	0.2106	0.21116	0.2640
6/9/2008	0.1632	0.16363	0.2640
7/9/2008	0.1633	0.16373	0.2640
8/9/2008	0.1769	0.17737	0.2640
9/9/2008	0.20039	0.20092	0.2638
10/9/2008	0.18121	0.18169	0.2640
11/9/2008	0.1712	0.17165	0.2640
12/9/2008	0.2067	0.20725	0.2640
13/9/2008	0.1689	0.16935	0.2640
14/9/2008	0.15739	0.15781	0.2640
15/9/2008	0.2068	0.20735	0.2640
16/9/2008	0.2417	0.24234	0.2640
17/9/2008	0.2556	0.25627	0.2640
18/9/2008	0.2334	0.23402	0.2640
19/9/2008	0.1841	0.18459	0.2640
20/9/2008	0.1546	0.15501	0.2640
21/9/2008	0.1738	0.17426	0.2640
22/9/2008	0.2354	0.23602	0.2640
23/9/2008	0.2882	0.28896	0.2640
24/9/2008	0.2699	0.27061	0.2640
25/9/2008	0.2421	0.24274	0.2640
26/9/2008	0.2449	0.24555	0.2640
27/9/2008	0.2373	0.23793	0.2640
28/9/2008	0.2515	0.25216	0.2640
29/9/2008	0.32819	0.32906	0.2640
30/9/2008	0.36121	0.36216	0.2640
1/10/2008	0.4146	0.41569	0.2640
2/10/2008	0.515	0.51636	0.2640
3/10/2008	0.6695	0.67127	0.2640

4/10/2008	0.6207	0.62234	0.2640
5/10/2008	0.525	0.52639	0.2640
6/10/2008	0.578	0.57953	0.2640
7/10/2008	0.4134	0.41449	0.2640
8/10/2008	0.4501	0.45129	0.2640
9/10/2008	0.4322	0.43334	0.2640
10/10/2008	0.342	0.34290	0.2640
11/10/2008	0.2736	0.27432	0.2640
12/10/2008	0.2492	0.24986	0.2640
13/10/2008	0.296	0.29678	0.2640
14/10/2008	0.3388	0.33969	0.2640
15/10/2008	0.3911	0.39213	0.2640
16/10/2008	0.4938	0.49510	0.2640
17/10/2008	0.5202	0.52157	0.2640
18/10/2008	0.4333	0.43444	0.2640
19/10/2008	0.4591	0.46031	0.2640
20/10/2008	0.4808	0.48207	0.2640
21/10/2008	0.5898	0.59136	0.2640
22/10/2008	0.6702	0.67196	0.2623
23/10/2008	0.6072	0.60878	0.2606
24/10/2008	0.5416	0.54301	0.2606
25/10/2008	0.6294	0.63104	0.2606
26/10/2008	0.4875	0.48877	0.2606
27/10/2008	0.7655	0.76749	0.2606
28/10/2008	0.9615	0.96403	0.2627
29/10/2008	0.9726	0.97516	0.2635
30/10/2008	1.0097	1.01031	0.0608