



ASSESSMENT OF ERROR DUE TO ORIFICE DIAMETER MIS-MEASUREMENT AT WESTON POINT MTB

A Report for

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

PROJECT NO: NGR010

REPORT NO: 2010/287

DATE: 18 AUGUST 2010



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

NOTES

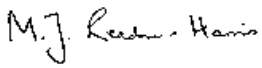
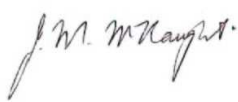
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Assessment of Error Due to Orifice Diameter Mis-Measurement at Weston Point MTB

A Report for

National Grid
Brick Kiln Street
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Leicestershire
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| | |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Prepared by:  | Approved by:  |
| Dr M J Reader-Harris | J M McNaught |

for
Michael Valente
Managing Director

Date: 18 August 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 Weston Point MTB a correction factor of 1.002371 should be applied during the period of mis-measurement.

Over the period 21/09/2007 to 26/09/2008 inclusive the flow was 111.49864 mscm and the corrected flow should be 111.76224 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 flow through Weston Point MTB in the period of the error. The Joint Office Error Code is NW008.

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. The effective bores include the effect of a drain hole to BS ISO/TR 15377:1998.

TABLE 1
ORIFICE DIAMETERS

| Calibration Reference | Plate serial no | Declared certificate date | Measured values | | | Values at 20 °C | |
|-----------------------|-----------------|---------------------------|-------------------|---------------------|-------------|-------------------|---------------------|
| | | | Orifice bore (mm) | Effective bore (mm) | Temperature | Orifice bore (mm) | Effective bore (mm) |
| OP4171 | 216-3 | 10/01/05 | 161.967 | 162.1042 | 21 | 161.9644 | 162.1016 |
| OP5061 | 216-4 | 08/04/05 | 162.265 | | 21 | 162.2624 | |
| OP60027 | 216-4 | 21/02/06 | 162.269 | | 21 | 162.2664 | |
| OP60060 | 216-3 | 11/10/06 | 161.9735 | 162.1111 | 20 | 161.9735 | 162.1111 |
| OP70056 | 216-4 | 07/06/07 | 162.095 | | 21 | 162.0924 | |
| OP80008 | 216-2 | 03/03/08 | 161.9405 | 162.0795 | 20 | 161.9405 | 162.0795 |
| OP80048 | 216-3 | 08/08/08 | 161.9765 | 162.1145 | 20 | 161.9765 | 162.1145 |
| OP80071 | 216-4 | 29/10/08 | 162.2655 | 162.1042 | 20.4 | 162.2645 | |

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.

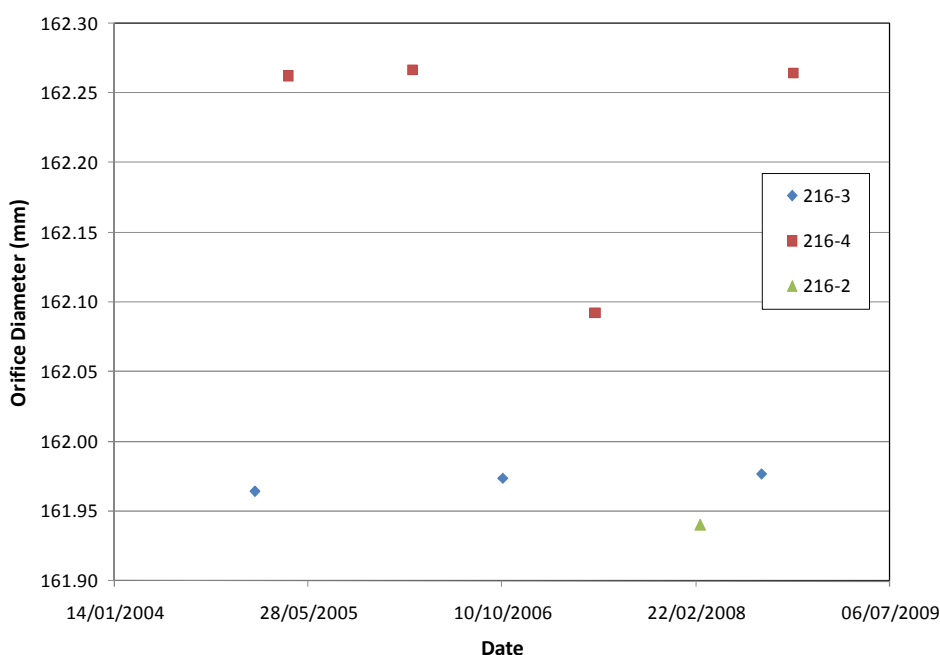


Figure 1 Orifice Diameters at 20 °C

The plates actually used in 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 | omnM0918.cfg | omnM0921.cfg | omnN0922.cfg | omnN0926.cfg |
|-----------------------------------------------|---------------------|---------------------|---------------------|---------------------|
| MTB | 18/09/2007 23:01 | 21/09/2007 23:01 | 22/09/2008 23:01 | 26/09/2008 23:01 |
| Orifice plate bore diameter (mm) | 161.9735 | 162.095 | 162.095 | 162.0795 |
| Expansion coefficient of the plate (/°C) | 0.000016 | 0.000016 | 0.000016 | 0.000016 |
| Orifice plate calibration temperature | 20 | 21 | 21 | 20 |
| Meter tube diameter (mm) | 288.7663 | 288.7663 | 288.7663 | 288.7663 |
| 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 | 1.339 | 1.339 | 1.3417 | 1.3417 |
| Dynamic Viscosity (Pa.s) | 0.000012 | 0.000012 | 0.000012 | 0.000012 |
| Orifice plate certificate number | OP60060 | OP70056 | OP70056 | OP80008 |
| Orifice plate serial number | 216-3 | 216-4 | 216-4 | 216-2 |
| Error in orifice diameter? | No | Yes | Yes | No |

On 18/09/2007 the orifice diameter in the flow computer did not include the effect of the drain hole; however, the calculations given here give the correction due to mis-measurement of the orifice diameter alone.

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 eight-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 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 56 bar a; the change in $q_{m,c}/q_{m,o}$ due to changing the static pressure by 10 bar is around 0.00002% at maximum.

Over the period from 21/09/2007 to 22/09/2008 the correction can be calculated as in Table 3. Throughout this calculation the meter tube diameter is 288.7663 mm, the isentropic exponent is 1.339 and the dynamic viscosity is 0.000012 Pa s.

TABLE 3
THE CORRECTION FROM 21/09/2007 TO 22/09/2008

| | d mm | β | ε | Re_D | C | $\frac{q_{m,c}}{q_{m,o}}$ |
|----------------------------------|-----------|----------|---------------|----------|----------|---------------------------|
| Original: $\Delta p=10$ mbar | 162.0924 | 0.561327 | 0.999941 | 1550310 | 0.604207 | |
| Corrected $\Delta p=10$ mbar | 162.2644 | 0.561923 | 0.999941 | 1553987 | 0.604215 | 1.0023719 |
| Original $\Delta p=500$ mbar | 162.0924 | 0.561327 | 0.997034 | 10923624 | 0.603828 | |
| Corrected $\Delta p=500$ mbar | 162.2644 | 0.561923 | 0.997033 | 10949517 | 0.603836 | 1.0023704 |

So $q_{m,c}/q_{m,o}$ is 1.002371.

Over the period from 22/09/2008 to 26/09/2008 the correction can be calculated as in Table 4. Throughout this calculation the meter tube diameter is 288.7663 mm, the isentropic exponent is 1.3417 and the dynamic viscosity is 0.000012 Pa s.

TABLE 4
THE CORRECTION FROM 22/09/2008 TO 26/09/2008

| | d mm | β | ε | Re_D | C | $\frac{q_{m,c}}{q_{m,o}}$ |
|----------------------------------|-----------|----------|---------------|----------|----------|---------------------------|
| Original: $\Delta p=10$ mbar | 162.0924 | 0.561327 | 0.999941 | 1550310 | 0.604207 | |
| Corrected $\Delta p=10$ mbar | 162.2644 | 0.561923 | 0.999941 | 1553987 | 0.604215 | 1.0023719 |
| Original $\Delta p=500$ mbar | 162.0924 | 0.561327 | 0.997040 | 10923689 | 0.603828 | |
| Corrected $\Delta p=500$ mbar | 162.2644 | 0.561923 | 0.997039 | 10949583 | 0.603836 | 1.0023704 |

So $q_{m,c}/q_{m,o}$ is 1.002371.

4 CORRECTIONS ON A DAILY BASIS

The volume flows for each day from 21/09/2007 to 26/09/2008 are given in Table B.1 of Appendix B together with the corrected values. It has been assumed that the plates were changed at 11:00; therefore 79.8% of the flow for 21/09/2007 has to be corrected and 20.9% of that for 26/09/2008 have to be corrected based on the flow before and after 11:00. Summing the data gives the figures in Table 5.

TABLE 5

THE FLOW OVER THE PERIOD 21/09/2007 TO 26/09/2008 INCLUSIVE

| | |
|-----------------------|-----------|
| Flow (mscm) | 111.49864 |
| Correction (mscm) | 0.26360 |
| Corrected flow (mscm) | 111.76224 |
| % Change | 0.2364 |

5 CONCLUSIONS

A correction factor of 1.002371 should be applied during the period of mis-measurement.

APPENDIX A
ORIFICE PLATE CALIBRATION CERTIFICATES

TRANSCO ORIFICE PLATE CALIBRATION

DATE: 10-01-05

REF NO: OP4171

TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 161.967mm

PLATE DETAILS

| | | | | | |
|------------------|-------|-------------|-----------|-------|--------------|
| PLATE SERIAL. | 216-3 | PLATE O.D | 319.787mm | SITE | WESTON POINT |
| MANUFACTURER: | | PIPE I.D: | mm | FLOW: | |
| MATERIAL CERT.No | | DESIGN BORE | mm | | |

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 | | | | |
|----------------------------------------|-------------|--------|--------|--------|--------|-------|-------|
| FLATNESS μ | 0.172 | 0.038 | 0.076 | 0.036 | 0.008 | 0.034 | 0.061 |
| E mm | 6.428 | 6.408 | 6.430 | 6.437 | 6.433 | 6.433 | 6.434 |
| mm | 5.008 | 5.032 | 5.003 | 4.905 | 4.884 | | |
| EDGE SHARPNESS mm | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | | |
| BEVEL ANGLE | 37 DEGS | | | | | | |
| CONCENTRICITY | 0.035mm | | | | | | |
| SURFACE FINISH (Ra) | 3.0 microns | | | | | | |
| DOWNSTREAM FACE/EDGE VISUAL INSPECTION | PASS | | | | | | |
| ROUNDNESS | 0.005mm | TAPER | 0 degs | | | | |

DRAIN HOLE BORE 6.357mm CENTRE DISTANCE

COMMENTS

INSPECTED BY



G. WARDLE

TRANSCO ORIFICE PLATE CALIBRATION

DATE: 08-04-05

REF NO: OP5061

TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 162.265mm

PLATE DETAILS

| | | | | | |
|------------------|--------|-------------|-----------|------|--------------|
| PLATE SERIAL. | 216-4 | PLATE O.D | 319.604mm | SITE | WESTON POINT |
| MANUFACTURER: | | PIPE I.D: | mm | FLOW | |
| MATERIAL CERT.No | E84730 | DESIGN BORE | mm | | |

TEST EQUIPMENT

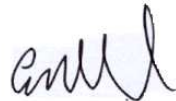
MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, CERT:- 4820 NEXT CAL DUE:- 15/10/05

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

| STATIONS: | 2 | 4 | 6 | 7 | 8 | | |
|----------------------------------------|-------------|--------|--------|--------|--------|--------|--------|
| FLATNESS % | 0.007 | 0.021 | 0.000 | 0.003 | 0.009 | 0.001 | |
| E' mm | 5.664 | 5.646 | 5.588 | 5.610 | 5.641 | 5.665 | |
| mm | 4.314 | 4.301 | | 4.317 | 4.315 | 4.322 | |
| EDGE SHARPNESS mm | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 |
| BEVEL ANGLE | 44 DEGS | | | | | | |
| CONCENTRICITY | 0.056mm | | | | | | |
| SURFACE FINISH (Ra) | 1.5 microns | | | | | | |
| DOWNSTREAM FACE/EDGE VISUAL INSPECTION | PASS | | | | | | |
| ROUNDNESS | 0.007mm | TAPER | 0 degs | | | | |

COMMENTS

INSPECTED BY



G. WARDLE

VERIFIED BY



P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 21-02-06
 REF NO: OP60027
 TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 162.269mm

PLATE DETAILS

PLATE SERIAL. 216-4 PLATE O.D 319.614mm
 MANUFACTURER: PIPE I.D: mm SITE WESTON POINT
 MATERIAL CERT.No. E84730 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 |
|----------------------------------------|--------------|--------|--------|--------|--------|--------|--------|
| FLATNESS % | 0.002 | 0.027 | 0.003 | 0.033 | 0.006 | 0.002 | 0.008 |
| E mm | 5.65 | 5.636 | 5.612 | 5.582 | 5.585 | 5.617 | 5.646 |
| mm | 4.314 | 4.305 | 4.308 | 4.311 | 4.295 | 4.311 | 4.307 |
| EDGE SHARPNESS mm | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 |
| BEVEL ANGLE | 44 DEGS | | | | | | |
| CONCENTRICITY | 0.070mm | | | | | | |
| SURFACE FINISH (Ra) | 1.5 microns | | | | | | |
| DOWNSTREAM FACE/EDGE VISUAL INSPECTION | PASS | | | | | | |
| ROUNDNESS 0.005mm | TAPER 0 degs | | | | | | |

COMMENTS

INSPECTED BY  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 11-10-06
 REF NO: OP60060
 TEMPERATURE: 20 degsC

MEASURED ORIFICE BORE: 161.9735mm

PLATE DETAILS

PLATE SERIAL. 216-3 PLATE O.D. 319.800mm
 MANUFACTURER: PIPE I.D.: mm SITE: WESTERN POINT
 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 % | 0.118 | 0.092 | 0.077 | 0.039 | 0.010 | 0.021 | 0.062 | 0.125 |
| 'E' mm | 6.423 | 6.410 | 6.438 | 6.439 | 6.433 | 6.433 | 6.430 | 6.444 |
| 'R' mm | 5.008 | 5.022 | 4.974 | 4.947 | 4.941 | 5.000 | 5.071 | 5.08 |
| EDGE SHARPNESS mm | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | SQUARE |
| BEVEL ANGLE | 37 DEGS | | | | | | | |
| CONCENTRICITY | 0.041mm | | | | | | | |
| SURFACE FINISH (Ra) | 3.1 microns | | | | | | | |

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.007mm TAPER: 0 degs

DRAIN HOLE BORE 6.365mm CENTRE DISTANCE 141.404mm

COMMENTS

INSPECTED BY..  P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 07-06-07

REF NO: OP70056

TEMPERATURE: 21 degsC

MEASURED ORIFICE BORE: 162.095mm

PLATE DETAILS

PLATE SERIAL. 216-4 PLATE O.D 319.389mm
 MANUFACTURER: PIPE I.D: mm SITE WESTERN POINT
 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:- 13/10/07

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

| STATIONS | 2 | | 4 | | 8 | | 8 | |
|----------------------------------------|---------|-------|--------|--------|-------|-------|--------|--------|
| FLATNESS % | 0.004 | 0.015 | 0.009 | 0.033 | 0.000 | 0.006 | 0.004 | 0.005 |
| E mm | 5.704 | 5.630 | 5.589 | 5.646 | 5.649 | 5.582 | 5.620 | 5.700 |
| mm | 4.346 | 4.300 | 4.290 | 4.353 | 4.347 | 4.275 | 4.285 | 4.348 |
| EDGE SHARPNESS mm | 0.0125 | SQ | SQ | 0.0125 | SQ | SQ | 0.0125 | 0.0125 |
| BEVEL ANGLE | 44 DEGS | | | | | | | |
| CONCENTRICITY | 0.032mm | | | | | | | |
| SURFACE FINISH (Ra) | | | | | | | | |
| DOWNSTREAM FACE/EDGE VISUAL INSPECTION | PASS | | | | | | | |
| ROUNDNESS | 0.144mm | TAPER | 0 degs | | | | | |

COMMENTS

INSPECTED BY

 P. KENNERSTON / J. CHAMMAN

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 03-MAR-2008
 REF NO: OP80008
 TEMPERATURE: 20 degsC

MEASURED ORIFICE BORE: 161.9405mm

PLATE DETAILS

PLATE SERIAL. 216-2 PLATE O.D 319.770mm
 MANUFACTURER: PIPE I.D: 288.7663mm SITE: WESTON POINT
 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, CERT:- 6292 NEXT CAL DUE:- 05-OCTOBER-2008

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

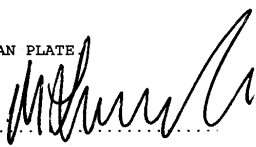
| STATIONS:- | 1 | 2 | 3 | 4 | 6 | 7 | 8 | |
|---------------------|-------------|--------|--------|--------|--------|--------|--------|--------|
| FLATNESS % | 0.089 | 0.080 | 0.186 | 0.059 | 0.158 | 0.150 | 0.132 | 0.159 |
| 'E' mm | 6.357 | 6.364 | 6.350 | 6.355 | 6.336 | 6.343 | 6.372 | 6.386 |
| | | | 4.753 | 4.851 | 4.833 | 4.819 | 4.713 | 4.663 |
| EDGE SHARPNESS mm | 0.025 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 | 0.0125 |
| BEVEL ANGLE: | 37 DEGS | | | | | | | |
| CONCENTRICITY | 0.030mm | | | | | | | |
| SURFACE FINISH (Ra) | 0.5 microns | | | | | | | |

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.008mm TAPER: 0 dege

DRAIN HOLE BORE 6.398mm CENTRE DISTANCE 141.338mm

COMMENTS: CLEAN PLATE

INSPECTED BY:  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 08-AUG-2008

REF NO: OP80048

TEMPERATURE: 20 degsC

MEASURED ORIFICE BORE: 161.9765mm

PLATE DETAILS

PLATE SERIAL. 216-3 PLATE O.D 319.783mm
 MANUFACTURER: PIPE I.D: 288.7663mm SITE: WESTON POINT
 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 % | 0.184 | 0.050 | 0.090 | 0.039 | 0.002 | 0.050 | 0.039 | 0.083 |
| 'E' mm | 6.417 | 6.414 | 6.436 | 6.424 | 6.426 | 6.441 | 6.437 | 6.429 |
| 'e' mm | 5.031 | 5.035 | 4.971 | 4.883 | 4.913 | 5.046 | 5.065 | 5.057 |
| EDGE SHARPNESS mm | 0.0125 | 0.0125 | 0.0125 | SQUARE | 0.0125 | 0.025 | 0.025 | 0.0125 |
| BEVEL ANGLE: | 37 DEGS | | | | | | | |
| CONCENTRICITY | 0.045mm | | | | | | | |
| SURFACE FINISH (Ra) | 3.0 microns | | | | | | | |

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS : 0.006mm TAPER: 0 degs

DRAIN HOLE BORE 6.375mm CENTRE DISTANCE 141.410mm

DRAINHOLE PRESENT ? (YES/NO): Yes

COMMENTS: CLEAN PLATE.

INSPECTED BY...  M Livingstone.

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 29-OCT-2008

REF NO: OP80071

TEMPERATURE: 20.4 degsC

MEASURED ORIFICE BORE: 162.2655mm

PLATE DETAILS

| | | | | | |
|------------------|--------|------------|------------|--------------|---------------------|
| PLATE SERIAL. | 216-4 | PLATE O.D. | 319.618mm | SITE: | WESTON POINT |
| MANUFACTURER: | | PIPE I.D.: | 288.7663mm | DESIGN BORE: | mm |
| MATERIAL CERT.No | B84730 | | | FLOW: | M ³ /DAY |

TEST EQUIPMENT

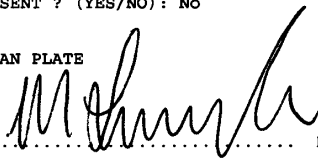
MANUFACTURER & TYPE: KEMCO 700 MANUAL 3-DIMENSIONAL MEASURING MACHINE -ASSET NO OP-A02
 CALIBRATED BY: QUALITY CONTROL TECHNOLOGY, UKAS CERT:- 6822. NEXT CAL DUE:- 03-OCTOBER-2009

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

| STATIONS:- | | 3 | 4 | 5 | 7 | 8 | | |
|----------------------------------------|-------------|--------|--------|--------|--------|-------|--------|-------|
| FLATNESS % | 0.003 | 0.017 | 0.004 | 0.025 | 0.016 | 0.007 | 0.018 | 0.017 |
| 'E' mm | 5.632 | 5.653 | 5.624 | 5.570 | 5.577 | 5.609 | 5.641 | 5.628 |
| 'e' mm | 4.303 | 4.312 | 4.319 | 4.312 | 4.307 | 4.298 | 4.322 | |
| EDGE SHARPNESS mm | 0.0125 | SQUARE | SQUARE | 0.0125 | 0.0125 | 0.025 | 0.0125 | |
| BEVEL ANGLE: | 44 DEGS | | | | | | | |
| CONCENTRICITY | 0.063mm | | | | | | | |
| SURFACE FINISH (Ra) | 0.5 microns | | | | | | | |
| DOWNSTREAM FACE/EDGE VISUAL INSPECTION | PASS | | | | | | | |
| ROUNDNESS | 0.005mm | 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 WESTON POINT MTB DURING THE PERIOD OF THE MIS-MEASUREMENT**

| | Original Values (total) | Corrected values (total) | % increase |
|-------------|--------------------------------|---------------------------------|----------------------|
| Date | Volume (mscm) | Volume (mscm) | Volume (mscm) |
| 21/9/2007 | 0.3177 | 0.31830 | 0.1893 |
| 22/9/2007 | 0.3224 | 0.32316 | 0.2371 |
| 23/9/2007 | 0.3203 | 0.32106 | 0.2371 |
| 24/9/2007 | 0.3228 | 0.32357 | 0.2371 |
| 25/9/2007 | 0.326 | 0.32677 | 0.2371 |
| 26/9/2007 | 0.331 | 0.33178 | 0.2371 |
| 27/9/2007 | 0.3325 | 0.33329 | 0.2371 |
| 28/9/2007 | 0.3369 | 0.33770 | 0.2371 |
| 29/9/2007 | 0.3289 | 0.32968 | 0.2371 |
| 30/9/2007 | 0.3294 | 0.33018 | 0.2371 |
| 1/10/2007 | 0.3265 | 0.32727 | 0.2371 |
| 2/10/2007 | 0.3154 | 0.31615 | 0.2371 |
| 3/10/2007 | 0.3109 | 0.31164 | 0.2371 |
| 4/10/2007 | 0.3168 | 0.31755 | 0.2371 |
| 5/10/2007 | 0.3199 | 0.32066 | 0.2371 |
| 6/10/2007 | 0.3223 | 0.32306 | 0.2371 |
| 7/10/2007 | 0.3205 | 0.32126 | 0.2371 |
| 8/10/2007 | 0.3288 | 0.32958 | 0.2371 |
| 9/10/2007 | 0.322 | 0.32276 | 0.2371 |
| 10/10/2007 | 0.3292 | 0.32998 | 0.2371 |
| 11/10/2007 | 0.3229 | 0.32367 | 0.2371 |
| 12/10/2007 | 0.3148 | 0.31555 | 0.2371 |
| 13/10/2007 | 0.312 | 0.31274 | 0.2371 |
| 14/10/2007 | 0.1858 | 0.18624 | 0.2371 |
| 15/10/2007 | 0 | 0.00000 | 0 |
| 16/10/2007 | 0 | 0.00000 | 0 |
| 17/10/2007 | 0.0279 | 0.02797 | 0.2371 |
| 18/10/2007 | 0.1014 | 0.10164 | 0.2371 |
| 19/10/2007 | 0.2729 | 0.27355 | 0.2371 |
| 20/10/2007 | 0.3308 | 0.33158 | 0.2371 |
| 21/10/2007 | 0.3279 | 0.32868 | 0.2371 |
| 22/10/2007 | 0.3269 | 0.32768 | 0.2371 |
| 23/10/2007 | 0.3312 | 0.33199 | 0.2371 |
| 24/10/2007 | 0.3295 | 0.33028 | 0.2371 |
| 25/10/2007 | 0.3292 | 0.32998 | 0.2371 |
| 26/10/2007 | 0.3378 | 0.33860 | 0.2371 |
| 27/10/2007 | 0.3405 | 0.34131 | 0.2371 |
| 28/10/2007 | 0.3203 | 0.32106 | 0.2371 |
| 29/10/2007 | 0.321 | 0.32176 | 0.2371 |
| 30/10/2007 | 0.3196 | 0.32036 | 0.2371 |
| 31/10/2007 | 0.3181 | 0.31885 | 0.2371 |
| 1/11/2007 | 0.2921 | 0.29279 | 0.2371 |
| 2/11/2007 | 0.3282 | 0.32898 | 0.2371 |
| 3/11/2007 | 0.3358 | 0.33660 | 0.2371 |
| 4/11/2007 | 0.3369 | 0.33770 | 0.2371 |
| 5/11/2007 | 0.3363 | 0.33710 | 0.2371 |

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|------------|--------|----------------|--------|
| 6/11/2007 | 0.3281 | 0.32888 | 0.2371 |
| 7/11/2007 | 0.3184 | 0.31915 | 0.2371 |
| 8/11/2007 | 0.332 | 0.33279 | 0.2371 |
| 9/11/2007 | 0.3384 | 0.33920 | 0.2371 |
| 10/11/2007 | 0.3237 | 0.32447 | 0.2371 |
| 11/11/2007 | 0.3323 | 0.33309 | 0.2371 |
| 12/11/2007 | 0.3424 | 0.34321 | 0.2371 |
| 13/11/2007 | 0.3272 | 0.32798 | 0.2371 |
| 14/11/2007 | 0.3303 | 0.33108 | 0.2371 |
| 15/11/2007 | 0.3307 | 0.33148 | 0.2371 |
| 16/11/2007 | 0.3292 | 0.32998 | 0.2371 |
| 17/11/2007 | 0.3242 | 0.32497 | 0.2371 |
| 18/11/2007 | 0.3257 | 0.32647 | 0.2371 |
| 19/11/2007 | 0.3219 | 0.32266 | 0.2371 |
| 20/11/2007 | 0.3195 | 0.32026 | 0.2371 |
| 21/11/2007 | 0.3288 | 0.32958 | 0.2371 |
| 22/11/2007 | 0.3312 | 0.33199 | 0.2371 |
| 23/11/2007 | 0.5058 | 0.50700 | 0.2371 |
| 24/11/2007 | 0.377 | 0.37789 | 0.2371 |
| 25/11/2007 | 0.4452 | 0.44626 | 0.2371 |
| 26/11/2007 | 0.4426 | 0.44365 | 0.2371 |
| 27/11/2007 | 0.4503 | 0.45137 | 0.2371 |
| 28/11/2007 | 0.4108 | 0.41177 | 0.2371 |
| 29/11/2007 | 0.4713 | 0.47242 | 0.2371 |
| 30/11/2007 | 0.3285 | 0.32928 | 0.2371 |
| 1/12/2007 | 0.3292 | 0.32998 | 0.2371 |
| 2/12/2007 | 0.3174 | 0.31815 | 0.2371 |
| 3/12/2007 | 0.2953 | 0.29600 | 0.2371 |
| 4/12/2007 | 0 | 0.00000 | 0 |
| 5/12/2007 | 0.1027 | 0.10294 | 0.2371 |
| 6/12/2007 | 0.2462 | 0.24678 | 0.2371 |
| 7/12/2007 | 0.3567 | 0.35755 | 0.2371 |
| 8/12/2007 | 0.352 | 0.35283 | 0.2371 |
| 9/12/2007 | 0.362 | 0.36286 | 0.2371 |
| 10/12/2007 | 0.6086 | 0.61004 | 0.2371 |
| 11/12/2007 | 0.4646 | 0.46570 | 0.2371 |
| 12/12/2007 | 0.4532 | 0.45427 | 0.2371 |
| 13/12/2007 | 0.4427 | 0.44375 | 0.2371 |
| 14/12/2007 | 0.7873 | 0.78917 | 0.2371 |
| 15/12/2007 | 0.5857 | 0.58709 | 0.2371 |
| 16/12/2007 | 0.5923 | 0.59370 | 0.2371 |
| 17/12/2007 | 0.4278 | 0.42881 | 0.2371 |
| 18/12/2007 | 0.5876 | 0.58899 | 0.2371 |
| 19/12/2007 | 0.4393 | 0.44034 | 0.2371 |
| 20/12/2007 | 0.5443 | 0.54559 | 0.2371 |
| 21/12/2007 | 0.4713 | 0.47242 | 0.2371 |
| 22/12/2007 | 0.4554 | 0.45648 | 0.2371 |
| 23/12/2007 | 0.3258 | 0.32657 | 0.2371 |
| 24/12/2007 | 0.3611 | 0.36196 | 0.2371 |
| 25/12/2007 | 0.3136 | 0.31434 | 0.2371 |
| 26/12/2007 | 0.4793 | 0.48044 | 0.2371 |
| 27/12/2007 | 0.4074 | 0.40837 | 0.2371 |
| 28/12/2007 | 0.3654 | 0.36627 | 0.2371 |
| 29/12/2007 | 0.4601 | 0.46119 | 0.2371 |
| 30/12/2007 | 0.3188 | 0.31956 | 0.2371 |
| 31/12/2007 | 0.3625 | 0.36336 | 0.2371 |
| 1/1/2008 | 0.3186 | 0.31936 | 0.2371 |

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|-----------|--------|----------------|--------|
| 2/1/2008 | 0.5188 | 0.52003 | 0.2371 |
| 3/1/2008 | 0.4449 | 0.44595 | 0.2371 |
| 4/1/2008 | 0.5849 | 0.58629 | 0.2371 |
| 5/1/2008 | 0.3159 | 0.31665 | 0.2371 |
| 6/1/2008 | 0.4561 | 0.45718 | 0.2371 |
| 7/1/2008 | 0.3949 | 0.39584 | 0.2371 |
| 8/1/2008 | 0.3182 | 0.31895 | 0.2371 |
| 9/1/2008 | 0.4249 | 0.42591 | 0.2371 |
| 10/1/2008 | 0.3625 | 0.36336 | 0.2371 |
| 11/1/2008 | 0.4214 | 0.42240 | 0.2371 |
| 12/1/2008 | 0.4282 | 0.42922 | 0.2371 |
| 13/1/2008 | 0.3196 | 0.32036 | 0.2371 |
| 14/1/2008 | 0.2957 | 0.29640 | 0.2371 |
| 15/1/2008 | 0.2214 | 0.22192 | 0.2371 |
| 16/1/2008 | 0.4491 | 0.45016 | 0.2371 |
| 17/1/2008 | 0.3409 | 0.34171 | 0.2371 |
| 18/1/2008 | 0.3271 | 0.32788 | 0.2371 |
| 19/1/2008 | 0.4629 | 0.46400 | 0.2371 |
| 20/1/2008 | 0.3885 | 0.38942 | 0.2371 |
| 21/1/2008 | 0.4826 | 0.48374 | 0.2371 |
| 22/1/2008 | 0.3467 | 0.34752 | 0.2371 |
| 23/1/2008 | 0.3364 | 0.33720 | 0.2371 |
| 24/1/2008 | 0.6656 | 0.66718 | 0.2371 |
| 25/1/2008 | 0.3251 | 0.32587 | 0.2371 |
| 26/1/2008 | 0.3564 | 0.35725 | 0.2371 |
| 27/1/2008 | 0.3786 | 0.37950 | 0.2371 |
| 28/1/2008 | 0.3527 | 0.35354 | 0.2371 |
| 29/1/2008 | 0.644 | 0.64553 | 0.2371 |
| 30/1/2008 | 0.3733 | 0.37419 | 0.2371 |
| 31/1/2008 | 0.5259 | 0.52715 | 0.2371 |
| 1/2/2008 | 0.326 | 0.32677 | 0.2371 |
| 2/2/2008 | 0.0004 | 0.00040 | 0.2371 |
| 3/2/2008 | 0.109 | 0.10926 | 0.2371 |
| 4/2/2008 | 0.0119 | 0.01193 | 0.2371 |
| 5/2/2008 | 0.4183 | 0.41929 | 0.2371 |
| 6/2/2008 | 0.3269 | 0.32768 | 0.2371 |
| 7/2/2008 | 0.3254 | 0.32617 | 0.2371 |
| 8/2/2008 | 0.329 | 0.32978 | 0.2371 |
| 9/2/2008 | 0.4337 | 0.43473 | 0.2371 |
| 10/2/2008 | 0.3448 | 0.34562 | 0.2371 |
| 11/2/2008 | 0.4155 | 0.41649 | 0.2371 |
| 12/2/2008 | 0.3572 | 0.35805 | 0.2371 |
| 13/2/2008 | 0.4429 | 0.44395 | 0.2371 |
| 14/2/2008 | 0.4078 | 0.40877 | 0.2371 |
| 15/2/2008 | 0.4441 | 0.44515 | 0.2371 |
| 16/2/2008 | 0.3921 | 0.39303 | 0.2371 |
| 17/2/2008 | 0.3953 | 0.39624 | 0.2371 |
| 18/2/2008 | 0.3645 | 0.36536 | 0.2371 |
| 19/2/2008 | 0.7203 | 0.72201 | 0.2371 |
| 20/2/2008 | 0.735 | 0.73674 | 0.2371 |
| 21/2/2008 | 0.32 | 0.32076 | 0.2371 |
| 22/2/2008 | 0.4708 | 0.47192 | 0.2371 |
| 23/2/2008 | 0.4688 | 0.46991 | 0.2371 |
| 24/2/2008 | 0.3577 | 0.35855 | 0.2371 |
| 25/2/2008 | 0.4832 | 0.48435 | 0.2371 |
| 26/2/2008 | 0.3786 | 0.37950 | 0.2371 |
| 27/2/2008 | 0.3307 | 0.33148 | 0.2371 |

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|-----------|---------|----------------|--------|
| 28/2/2008 | 0.393 | 0.39393 | 0.2371 |
| 29/2/2008 | 0.3475 | 0.34832 | 0.2371 |
| 1/3/2008 | 0.3871 | 0.38802 | 0.2371 |
| 2/3/2008 | 0.3465 | 0.34732 | 0.2371 |
| 3/3/2008 | 0.4663 | 0.46741 | 0.2371 |
| 4/3/2008 | 0.3996 | 0.40055 | 0.2371 |
| 5/3/2008 | 0.586 | 0.58739 | 0.2371 |
| 6/3/2008 | 0.3218 | 0.32256 | 0.2371 |
| 7/3/2008 | 0.3202 | 0.32096 | 0.2371 |
| 8/3/2008 | 0.3309 | 0.33168 | 0.2371 |
| 9/3/2008 | 0.4256 | 0.42661 | 0.2371 |
| 10/3/2008 | 0.5183 | 0.51953 | 0.2371 |
| 11/3/2008 | 0.461 | 0.46209 | 0.2371 |
| 12/3/2008 | 0.4917 | 0.49287 | 0.2371 |
| 13/3/2008 | 0.3139 | 0.31464 | 0.2371 |
| 14/3/2008 | 0.3469 | 0.34772 | 0.2371 |
| 15/3/2008 | 0.5318 | 0.53306 | 0.2371 |
| 16/3/2008 | 0.495 | 0.49617 | 0.2371 |
| 17/3/2008 | 0.3709 | 0.37178 | 0.2371 |
| 18/3/2008 | 0.3249 | 0.32567 | 0.2371 |
| 19/3/2008 | 0.4692 | 0.47031 | 0.2371 |
| 20/3/2008 | 0.6042 | 0.60563 | 0.2371 |
| 21/3/2008 | 0.3837 | 0.38461 | 0.2371 |
| 22/3/2008 | 0.3279 | 0.32868 | 0.2371 |
| 23/3/2008 | 0.3414 | 0.34221 | 0.2371 |
| 24/3/2008 | 0.4562 | 0.45728 | 0.2371 |
| 25/3/2008 | 0.6702 | 0.67179 | 0.2371 |
| 26/3/2008 | 0.33791 | 0.33871 | 0.2371 |
| 27/3/2008 | 0.5161 | 0.51732 | 0.2371 |
| 28/3/2008 | 0.5075 | 0.50870 | 0.2371 |
| 29/3/2008 | 0.3146 | 0.31535 | 0.2371 |
| 30/3/2008 | 0.3722 | 0.37308 | 0.2371 |
| 31/3/2008 | 0.3347 | 0.33549 | 0.2371 |
| 1/4/2008 | 0.3174 | 0.31815 | 0.2371 |
| 2/4/2008 | 0.3361 | 0.33690 | 0.2371 |
| 3/4/2008 | 0.4058 | 0.40676 | 0.2371 |
| 4/4/2008 | 0.316 | 0.31675 | 0.2371 |
| 5/4/2008 | 0.4468 | 0.44786 | 0.2371 |
| 6/4/2008 | 0.4521 | 0.45317 | 0.2371 |
| 7/4/2008 | 0 | 0.00000 | 0 |
| 8/4/2008 | 0 | 0.00000 | 0 |
| 9/4/2008 | 0.01 | 0.01002 | 0.2371 |
| 10/4/2008 | 0.0659 | 0.06606 | 0.2371 |
| 11/4/2008 | 0.0075 | 0.00752 | 0.2371 |
| 12/4/2008 | 0.0691 | 0.06926 | 0.2371 |
| 13/4/2008 | 0.20361 | 0.20409 | 0.2371 |
| 14/4/2008 | 0.1748 | 0.17521 | 0.2371 |
| 15/4/2008 | 0.1952 | 0.19566 | 0.2371 |
| 16/4/2008 | 0.2279 | 0.22844 | 0.2371 |
| 17/4/2008 | 0.2093 | 0.20980 | 0.2371 |
| 18/4/2008 | 0.3077 | 0.30843 | 0.2371 |
| 19/4/2008 | 0.2543 | 0.25490 | 0.2371 |
| 20/4/2008 | 0.25301 | 0.25361 | 0.2371 |
| 21/4/2008 | 0.1595 | 0.15988 | 0.2371 |
| 22/4/2008 | 0.1928 | 0.19326 | 0.2371 |
| 23/4/2008 | 0.1533 | 0.15366 | 0.2371 |
| 24/4/2008 | 0.1628 | 0.16319 | 0.2371 |

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|-----------|---------|----------------|--------|
| 25/4/2008 | 0.1835 | 0.18394 | 0.2371 |
| 26/4/2008 | 0.1599 | 0.16028 | 0.2371 |
| 27/4/2008 | 0.1512 | 0.15156 | 0.2371 |
| 28/4/2008 | 0.0342 | 0.03428 | 0.2371 |
| 29/4/2008 | 0.0308 | 0.03087 | 0.2371 |
| 30/4/2008 | 0.0702 | 0.07037 | 0.2371 |
| 1/5/2008 | 0.0542 | 0.05433 | 0.2371 |
| 2/5/2008 | 0.0614 | 0.06155 | 0.2371 |
| 3/5/2008 | 0.1351 | 0.13542 | 0.2371 |
| 4/5/2008 | 0.1575 | 0.15787 | 0.2371 |
| 5/5/2008 | 0.1573 | 0.15767 | 0.2371 |
| 6/5/2008 | 0.1585 | 0.15888 | 0.2371 |
| 7/5/2008 | 0.1592 | 0.15958 | 0.2371 |
| 8/5/2008 | 0.1576 | 0.15797 | 0.2371 |
| 9/5/2008 | 0.1474 | 0.14775 | 0.2371 |
| 10/5/2008 | 0.1138 | 0.11407 | 0.2371 |
| 11/5/2008 | 0.063 | 0.06315 | 0.2371 |
| 12/5/2008 | 0.0629 | 0.06305 | 0.2371 |
| 13/5/2008 | 0.0654 | 0.06556 | 0.2371 |
| 14/5/2008 | 0.0661 | 0.06626 | 0.2371 |
| 15/5/2008 | 0.0655 | 0.06566 | 0.2371 |
| 16/5/2008 | 0.0659 | 0.06606 | 0.2371 |
| 17/5/2008 | 0.0672 | 0.06736 | 0.2371 |
| 18/5/2008 | 0.0652 | 0.06535 | 0.2371 |
| 19/5/2008 | 0.0631 | 0.06325 | 0.2371 |
| 20/5/2008 | 0 | 0.00000 | 0 |
| 21/5/2008 | 0.0498 | 0.04992 | 0.2371 |
| 22/5/2008 | 0.064 | 0.06415 | 0.2371 |
| 23/5/2008 | 0.0381 | 0.03819 | 0.2371 |
| 24/5/2008 | 0.067 | 0.06716 | 0.2371 |
| 25/5/2008 | 0.0724 | 0.07257 | 0.2371 |
| 26/5/2008 | 0.0813 | 0.08149 | 0.2371 |
| 27/5/2008 | 0.1529 | 0.15326 | 0.2371 |
| 28/5/2008 | 0.0803 | 0.08049 | 0.2371 |
| 29/5/2008 | 0.0825 | 0.08270 | 0.2371 |
| 30/5/2008 | 0.0809 | 0.08109 | 0.2371 |
| 31/5/2008 | 0.0944 | 0.09462 | 0.2371 |
| 1/6/2008 | 0.0842 | 0.08440 | 0.2371 |
| 2/6/2008 | 0.0766 | 0.07678 | 0.2371 |
| 3/6/2008 | 0.078 | 0.07818 | 0.2371 |
| 4/6/2008 | 0.0776 | 0.07778 | 0.2371 |
| 5/6/2008 | 0.1233 | 0.12359 | 0.2371 |
| 6/6/2008 | 0.1582 | 0.15858 | 0.2371 |
| 7/6/2008 | 0.1556 | 0.15597 | 0.2371 |
| 8/6/2008 | 0.1573 | 0.15767 | 0.2371 |
| 9/6/2008 | 0.1228 | 0.12309 | 0.2371 |
| 10/6/2008 | 0.0299 | 0.02997 | 0.2371 |
| 11/6/2008 | 0.0871 | 0.08731 | 0.2371 |
| 12/6/2008 | 0.1588 | 0.15918 | 0.2371 |
| 13/6/2008 | 0.1614 | 0.16178 | 0.2371 |
| 14/6/2008 | 0.2142 | 0.21471 | 0.2371 |
| 15/6/2008 | 0.17271 | 0.17312 | 0.2371 |
| 16/6/2008 | 0.2697 | 0.27034 | 0.2371 |
| 17/6/2008 | 0.3418 | 0.34261 | 0.2371 |
| 18/6/2008 | 0.3349 | 0.33569 | 0.2371 |
| 19/6/2008 | 0.3233 | 0.32407 | 0.2371 |
| 20/6/2008 | 0.3279 | 0.32868 | 0.2371 |

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|-----------|---------|----------------|--------|
| 21/6/2008 | 0.3283 | 0.32908 | 0.2371 |
| 22/6/2008 | 0.3241 | 0.32487 | 0.2371 |
| 23/6/2008 | 0.3285 | 0.32928 | 0.2371 |
| 24/6/2008 | 0.3224 | 0.32316 | 0.2371 |
| 25/6/2008 | 0.2898 | 0.29049 | 0.2371 |
| 26/6/2008 | 0.0974 | 0.09763 | 0.2371 |
| 27/6/2008 | 0.3086 | 0.30933 | 0.2371 |
| 28/6/2008 | 0.3224 | 0.32316 | 0.2371 |
| 29/6/2008 | 0.3257 | 0.32647 | 0.2371 |
| 30/6/2008 | 0.3241 | 0.32487 | 0.2371 |
| 1/7/2008 | 0.3191 | 0.31986 | 0.2371 |
| 2/7/2008 | 0.31731 | 0.31806 | 0.2371 |
| 3/7/2008 | 0.31789 | 0.31864 | 0.2371 |
| 4/7/2008 | 0.3163 | 0.31705 | 0.2371 |
| 5/7/2008 | 0.3123 | 0.31304 | 0.2371 |
| 6/7/2008 | 0.3094 | 0.31013 | 0.2371 |
| 7/7/2008 | 0.3094 | 0.31013 | 0.2371 |
| 8/7/2008 | 0.3405 | 0.34131 | 0.2371 |
| 9/7/2008 | 0.3141 | 0.31484 | 0.2371 |
| 10/7/2008 | 0.33701 | 0.33781 | 0.2371 |
| 11/7/2008 | 0.31609 | 0.31684 | 0.2371 |
| 12/7/2008 | 0.31641 | 0.31716 | 0.2371 |
| 13/7/2008 | 0.3177 | 0.31845 | 0.2371 |
| 14/7/2008 | 0.3137 | 0.31444 | 0.2371 |
| 15/7/2008 | 0.3136 | 0.31434 | 0.2371 |
| 16/7/2008 | 0.3154 | 0.31615 | 0.2371 |
| 17/7/2008 | 0.3132 | 0.31394 | 0.2371 |
| 18/7/2008 | 0.24709 | 0.24768 | 0.2371 |
| 19/7/2008 | 0.1928 | 0.19326 | 0.2371 |
| 20/7/2008 | 0.1786 | 0.17902 | 0.2371 |
| 21/7/2008 | 0.2067 | 0.20719 | 0.2371 |
| 22/7/2008 | 0.2103 | 0.21080 | 0.2371 |
| 23/7/2008 | 0.29279 | 0.29348 | 0.2371 |
| 24/7/2008 | 0.3074 | 0.30813 | 0.2371 |
| 25/7/2008 | 0.3049 | 0.30562 | 0.2371 |
| 26/7/2008 | 0.3083 | 0.30903 | 0.2371 |
| 27/7/2008 | 0.23341 | 0.23396 | 0.2371 |
| 28/7/2008 | 0.1051 | 0.10535 | 0.2371 |
| 29/7/2008 | 0.1807 | 0.18113 | 0.2371 |
| 30/7/2008 | 0.1784 | 0.17882 | 0.2371 |
| 31/7/2008 | 0.179 | 0.17942 | 0.2371 |
| 1/8/2008 | 0.181 | 0.18143 | 0.2371 |
| 2/8/2008 | 0.2611 | 0.26172 | 0.2371 |
| 3/8/2008 | 0.3132 | 0.31394 | 0.2371 |
| 4/8/2008 | 0.3135 | 0.31424 | 0.2371 |
| 5/8/2008 | 0.3128 | 0.31354 | 0.2371 |
| 6/8/2008 | 0.3127 | 0.31344 | 0.2371 |
| 7/8/2008 | 0.3145 | 0.31525 | 0.2371 |
| 8/8/2008 | 0.3144 | 0.31515 | 0.2371 |
| 9/8/2008 | 0.3128 | 0.31354 | 0.2371 |
| 10/8/2008 | 0.3129 | 0.31364 | 0.2371 |
| 11/8/2008 | 0.3134 | 0.31414 | 0.2371 |
| 12/8/2008 | 0.3121 | 0.31284 | 0.2371 |
| 13/8/2008 | 0.3132 | 0.31394 | 0.2371 |
| 14/8/2008 | 0.3156 | 0.31635 | 0.2371 |
| 15/8/2008 | 0.3175 | 0.31825 | 0.2371 |
| 16/8/2008 | 0.3185 | 0.31926 | 0.2371 |

| | | | |
|-----------|--------|----------------|--------|
| 17/8/2008 | 0.317 | 0.31775 | 0.2371 |
| 18/8/2008 | 0.315 | 0.31575 | 0.2371 |
| 19/8/2008 | 0.3147 | 0.31545 | 0.2371 |
| 20/8/2008 | 0.3072 | 0.30793 | 0.2371 |
| 21/8/2008 | 0.3148 | 0.31555 | 0.2371 |
| 22/8/2008 | 0.3174 | 0.31815 | 0.2371 |
| 23/8/2008 | 0.3167 | 0.31745 | 0.2371 |
| 24/8/2008 | 0.3124 | 0.31314 | 0.2371 |
| 25/8/2008 | 0.311 | 0.31174 | 0.2371 |
| 26/8/2008 | 0.1763 | 0.17672 | 0.2371 |
| 27/8/2008 | 0.0047 | 0.00471 | 0.2371 |
| 28/8/2008 | 0.1586 | 0.15898 | 0.2371 |
| 29/8/2008 | 0.2565 | 0.25711 | 0.2371 |
| 30/8/2008 | 0.3139 | 0.31464 | 0.2371 |
| 31/8/2008 | 0.3183 | 0.31905 | 0.2371 |
| 1/9/2008 | 0.3187 | 0.31946 | 0.2371 |
| 2/9/2008 | 0.3202 | 0.32096 | 0.2371 |
| 3/9/2008 | 0.3204 | 0.32116 | 0.2371 |
| 4/9/2008 | 0.3239 | 0.32467 | 0.2371 |
| 5/9/2008 | 0.3179 | 0.31865 | 0.2371 |
| 6/9/2008 | 0.3114 | 0.31214 | 0.2371 |
| 7/9/2008 | 0.3145 | 0.31525 | 0.2371 |
| 8/9/2008 | 0.3188 | 0.31956 | 0.2371 |
| 9/9/2008 | 0.3177 | 0.31845 | 0.2371 |
| 10/9/2008 | 0.3118 | 0.31254 | 0.2371 |
| 11/9/2008 | 0.3123 | 0.31304 | 0.2371 |
| 12/9/2008 | 0.3209 | 0.32166 | 0.2371 |
| 13/9/2008 | 0.3171 | 0.31785 | 0.2371 |
| 14/9/2008 | 0.3189 | 0.31966 | 0.2371 |
| 15/9/2008 | 0.1274 | 0.12770 | 0.2371 |
| 16/9/2008 | 0 | 0.00000 | 0 |
| 17/9/2008 | 0.1318 | 0.13211 | 0.2371 |
| 18/9/2008 | 0.3299 | 0.33068 | 0.2371 |
| 19/9/2008 | 0.3209 | 0.32166 | 0.2371 |
| 20/9/2008 | 0.322 | 0.32276 | 0.2371 |
| 21/9/2008 | 0.3231 | 0.32387 | 0.2371 |
| 22/9/2008 | 0.3259 | 0.32667 | 0.2371 |
| 23/9/2008 | 0.335 | 0.33579 | 0.2371 |
| 24/9/2008 | 0.324 | 0.32477 | 0.2371 |
| 25/9/2008 | 0.3239 | 0.32467 | 0.2371 |
| 26/9/2008 | 0.3269 | 0.32706 | 0.0497 |