



ASSESSMENT OF ERROR DUE TO ORIFICE DIAMETER MIS-MEASUREMENT AT MATCHING GREEN

A Report for

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

PROJECT NO: NGR010

REPORT NO: 2010/224

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

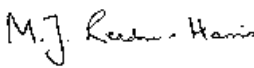
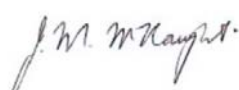
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Assessment of Error Due to Orifice Diameter Mis-Measurement at Matching Green

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: 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.

In Matching Green no orifice plates used in the line were mis-measured. Therefore no errors were made due to mis-measurement of orifice plates, and no corrections need to be made.

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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 Matching Green in the period of the error. The Joint Office Error Code is EA002.

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)
OP50250	MATC3488	24/11/2005	346.0625	21	346.0570
OP60106	4126	29/06/2006	345.9655	20	345.9655
OP70040	MATC3488	08/10/2007	346.0690	20	346.0690
OP80078	4126	10/11/2008	345.9785	19.9	345.9791
OP80084	MATC3488	21/11/2008	346.0745	20.4	346.0723
OP90054	4126	14/12/2009	345.9780	20.3	345.9763

Figure 1 shows the data from Table 1 for the orifice bores at 20°C.

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

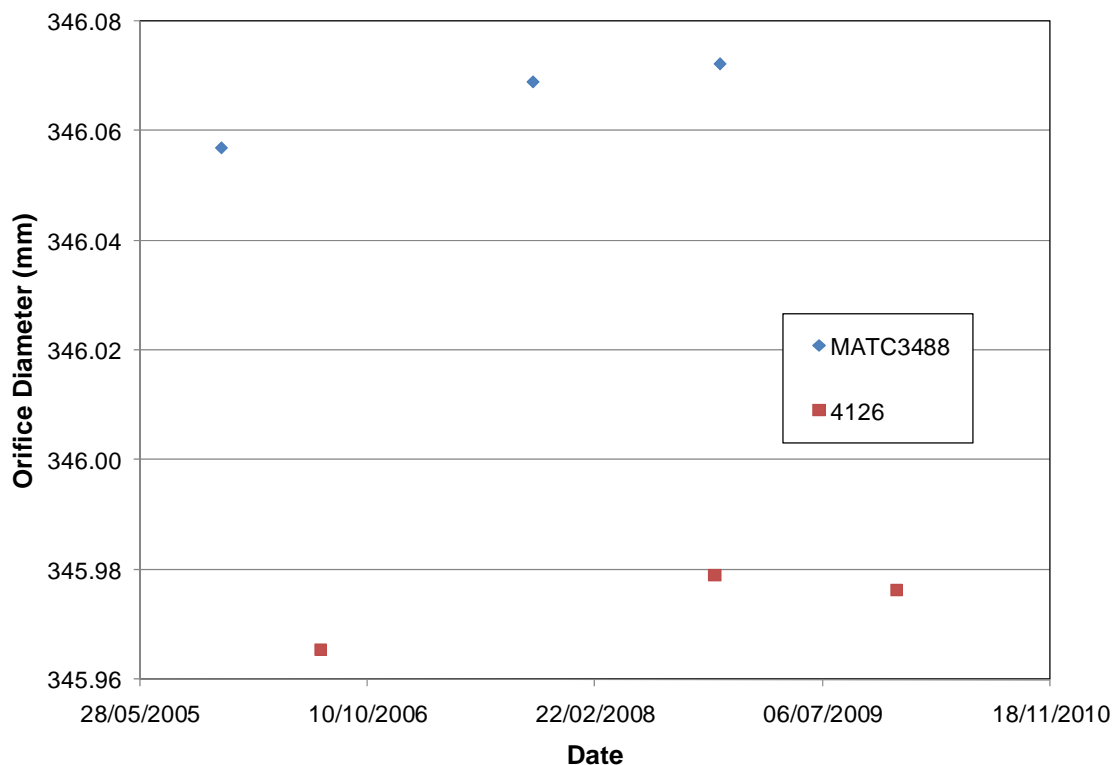


Figure 1 Orifice Diameters at 20 °C

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	omnL1116. cfg	omnL1121. cfg	omnM0625 .cfg	omnM1114 .cfg	omnM1115 .cfg	omnN0925. cfg	omnN1112. cfg
	17/11/2006 00:01	22/11/2006 00:01	25/06/2007 23:01	15/11/2007 00:01	16/11/2007 00:01	25/09/2008 23:01	13/11/2008 00:01
Orifice plate bore diameter (mm)	346.0625	345.9655	345.9655	345.9655	346.069	346.069	345.9785
Expansion coefficient of the plate (/°C)	0.000016	0.000016	0.000016	0.000016	0.000016	0.000016	0.000016
Orifice plate calibration temperature	21	21	20	20	20	20	19.9
Meter tube diameter (mm)	581.0504	581.0504	581.0504	581.0504	581.0504	581.0504	581.0504
Expansion coefficient of the meter tube (/°C)	0.000011	0.000011	0.000011	0.000011	0.000011	0.000011	0.000011
Meter tube calibration temperature	20	20	20	20	20	20	20
Isentropic Exponent	1.339	1.339	1.339	1.3465	1.3465	1.3478	1.3478
Dynamic Viscosity (Pa.s)	0.0000119	0.0000119	0.0000119	0.0000121	0.0000121	0.000012	0.000012
Orifice plate certificate number	OP50250	OP60106	OP60106	OP60106	OP70040	OP70040	OP80078
Orifice plate serial number	MATC3488	4126	4126	4126	MATC3488	MATC3488	4126
Error in orifice diameter?	No	No	No	No	No	No	No

3 CONCLUSIONS

In Matching Green no orifice plates used in the line were mis-measured. Therefore no errors were made due to mis-measurement of orifice plates, and no corrections need to be made.

APPENDIX A ORIFICE PLATE CALIBRATION CERTIFICATES

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 24-NOV-2005
REF NO: OP50250
TEMPERATURE: 21 degsC
MEASURED ORIFICE BORE: 346.0625mm

PLATE DETAILS

PLATE SERIAL.	MATC3488	PLATE O.D	623.411mm		
MANUFACTURER:	DANIEL	PIPE I.D:	582.828mm	SITE:	MATCHING GREEN
MATERIAL CERT.No.		DESIGN BORE	346.041mm	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:- 14/10/06

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS μ	0.181	0.175	0.323	0.319	0.271	0.202	0.141	0.156
IR mm	8.912	8.901	8.839	8.771	8.750	8.771	8.766	8.843
Re mm								
EDGE SHARPNESS mm	0.025	0.0125	0.0125	0.0125	0.0125	0.025	0.0125	0.0125
BEVEL ANGLE:	DEGS							
CONCENTRICITY	0.308mm							
SURFACE FINISH (Ra)	2.5 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.014mm TAPER: 0 degs

COMMENTS

INSPECTED BY:



P. KENNERSON

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 29-06-06
REF NO: OP60106
TEMPERATURE: 20 degsC
MEASURED ORIFICE BORE: 345.9655mm

PLATE DETAILS

PLATE SERIAL.	4126	PLATE O.D	622.402mm		
MANUFACTURER:	DANIEL	PIPE I.D:	582.828mm	SITE:	MATCHING GREEN
MATERIAL CERT.No.	M3781	DESIGN BORE:	346.041mm	FLOW:	12.5*10E06 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:- 14/10/06

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS	1	2	3	4	5		
FLATNESS %	0.224	0.189	0.249	0.214	0.196	0.217	0.180
'B' mm	9.328	9.320	9.275	9.299	9.162	9.285	9.267 9.264
'e' mm							
EDGE SHARPNESS mm	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	DEGS						
CONCENTRICITY	0.625mm						
SURFACE FINISH (Ra)	8.7 microns						
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS							
ROUNDNESS	0.023mm	TAPER:	01 degs				

COMMENTS:

INSPECTED BY.



P. KENNERSON / J. CHALLMAN

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 08-OCT-2007
 REF NO: OP70040
 TEMPERATURE: 20 degsC
 MEASURED ORIFICE BORE: 346.069mm

PLATE DETAILS

PLATE SERIAL: MATC3488 PLATE O.D: 622.849mm
 MANUFACTURER: DANIEL PIPE I.D: 582.828mm SITE: MATCHING GREEN
 MATERIAL CERT.No 316SS DESIGN BORE: 346.041mm 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:- 13/10/07

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	4	5	6	8		
FLATNESS %	0.275	0.239	0.300	0.411	0.379	0.288	0.245	0.254
E' mm	8.906	8.890	8.784	8.814	8.749	8.757	8.765	8.861
e'								
EDGE SHARPNESS mm	0.025	0.025	0.025	0.0125	0.0125	0.0125	0.0125	0.0125
BEVEL ANGLE:	DEGS							
CONCENTRICITY	0.270mm							
SURFACE FINISH (Ra)	2.2 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION	PASS							
ROUNDNESS	0.008mm	TAPER:		01 degs				

* COMMENTS: Plate Fails ME/2 Flatness test >0.2% across 8 points

INSPECTED BY: *M Livingstone* M LIVINGSTONE

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 10-NOV-2008
REF NO: OP80078
TEMPERATURE: 19.9 degsC
MEASURED ORIFICE BORE: 345.9785mm

PLATE DETAILS

PLATE SERIAL:	4126	PLATE O.D:	622.326mm	SITE:	MATCHING GREEN
MANUFACTURER:	DANIEL	PIPE I.D:	581.0504mm	DESIGN BORE:	346.041mm
MATERIAL CERT.No:	M3781	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:- 6822. NEXT CAL DUE:- 03-OCTOBER-2009

UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS μ	0.184	0.182	0.190	0.188	0.138	0.155	0.178	0.188
ED mm	9.300	9.263	9.248	9.272	9.279	9.289	9.275	9.298
EDGE SHARPNESS mm	0.025	0.025	0.025	0.0125	0.025	0.025	0.025	0.025
BEVEL ANGLE:	DEGS							
CONCENTRICITY	0.648mm							
SURFACE FINISH (Ra)	8.3 microns							
DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS								
ROUNDNESS	0.026mm	TAPER	01 degs					

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS

INSPECTED BY:  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 21-NOV-2008
REF NO: OP80084
TEMPERATURE: 20.4 degsC
MEASURED ORIFICE BORE: 346.0745mm

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PLATE DETAILS

PLATE SERIAL. MATC 3488 PLATE O.D 623.682mm
 MANUFACTURER: DANIEL PIPE I.D: 581.0504mm SITE: MATCHING GREEN
 MATERIAL CERT.No. 316 DESIGN BORE: 346.041mm 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:- 6822. NEXT CAL DUE:- 03-OCTOBER-2009

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UPSTREAM FACE INSPECTION RESULTS (ISO 5167)

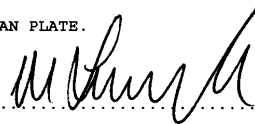
STATIONS:-	1	2	3	4	5	6	7	8
FLATNESS %	0.196	0.191	0.189	0.190	0.192	0.187	0.193	0.194
'E' mm	8.904	8.877	8.798	8.786	8.729	8.750	8.765	8.86
'e'								
EDGE SHARPNESS mm	0.0125	0.0125	0.025	0.025	0.025	0.0125	0.0125	0.0125
BEVEL ANGLE								
CONCENTRICITY	0.300mm							
SURFACE FINISH (Ra)	1.8 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.006mm TAPER: 01 degs

DRAINHOLE PRESENT ? (YES/NO): No

COMMENTS: CLEAN PLATE.

INSPECTED BY...  M Livingstone

NATIONAL GRID ORIFICE PLATE CALIBRATION

DATE: 14-DEC-2009
REF NO: OP90054
TEMPERATURE: 20.3 degsC
MEASURED ORIFICE BORE: 345.978mm

PLATE DETAILS

PLATE SERIAL:	4126	PLATE O.D:	622.387mm	SITE:	MATCHING GREEN
MANUFACTURER:	DANIEL	PIPE I.D:	581.0504mm	FLOW:	12.5 X 10E06 M ³ /DAY
MATERIAL CERT.NO.	M3871	DESIGN BORE:	346.041mm		

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			
FLATNESS %	0.176	0.183	0.186	0.188	0.152	0.176	0.154	0.180
'E mm	9.270	9.235	9.260	9.293	9.268	9.278	9.277	9.286
EDGE SHARPNESS mm	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
BEVEL ANGLE	DEGS							
CONCENTRICITY	0.581mm							
SURFACE FINISH (Ra)	8.4 microns							

DOWNSTREAM FACE/EDGE VISUAL INSPECTION :- PASS

ROUNDNESS 0.024mm TAPER: .01 degs

DRAINHOLE PRESENT ? (YES/NO) No

COMMENTS: CLEAN PLATE

INSPECTED BY:  M Livingstone