

# CERTIFICATE OF CALIBRATION

ISSUED BY

**ANTECH**

DATE OF ISSUE 3 January 2003      CERTIFICATE NUMBER : N0000-02



0489

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APPROVED SIGNATORY

## Antech Calibration Services

Hewett Road  
Gapton Hall Industrial Estate  
Great Yarmouth  
Norfolk NR31 0NN  
Telephone: +44 (0) 1493 440600  
E-mail: sales@antech.org.uk

Facsimile: +44 (0) 1493 440606

### CUSTOMER DETAILS

ANTECH REF : SAMPLE

Company : Antech Calibration Services Ltd  
Address : Hewett Road  
Gapton Hall Industrial Estate  
Great Yarmouth  
Norfolk NR31 0NN  
Order Number : n/a

### UNIT CALIBRATED

Manufacturer : Daniel Industries  
Description : 16" sharp, square edged orifice plate  
Plate Identification No. : 104165  
Basis of Test : EN ISO 5167-1:1997  
Measured Bore ( $d_m$ ) : 228.7844 mm  
Nominal Tube Bore (D) : 356.4430 mm  
Beta Ratio ( $\beta$ ) : 0.6419  
Date Inst. Received : 2 January 2003  
Date Calibrated : 3 January 2003  
Outer Diameter : 16.1 inches (see note)

AMBIENT TEMPERATURE : 20.2 °C ± 0.5 °C

CALIBRATION PROCEDURE : PROC5003

The measured results are within the specified tolerances of EN ISO 5167-1 1997.

Approved Signatory : D. Highton ( )      D. Read ( )

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ISO REF.	FEATURE AND TOLERANCES	MEASURED VALUE
8.1.1.1	<b>CONCENTRICITY</b> 1.8172 mm MAX	0.0310 mm
	Uncertainty of Measurement : $\pm 0.020$ mm	
8.1.2.1	<b>PLATE FLATNESS OF UPSTREAM FACE</b>	1 0.0600 mm
	D-d/2	2 0.0033 mm
	Maximum Allowable Error: 0.3191 mm (0.5%)	3 0.0360 mm
		4 0.0347 mm
		5 0.0200 mm
		6 0.0353 mm
		7 0.0593 mm
	Uncertainty of Measurement : $\pm 0.005$ mm	8 0.0343 mm
	DIRECTION OF PLASTIC DEFORMATION:	Indeterminate
8.1.2.2	<b>PLATE SMOOTHNESS OF UPSTREAM FACE</b>	0.28 $\mu\text{m}$ R <sub>a</sub>
	Maximum Allowable Error: 0.0001 d = 22.88 $\mu\text{m}$	
	Uncertainty of Measurement : $\pm 10\%$	
8.1.3.1	<b>FLATNESS OF DOWNSTREAM FACE</b>	
	Visual Examination	Satisfactory
8.1.3.3	<b>SURFACE CONDITION OF DOWNSTREAM FACE</b>	
	Visual Examination	Satisfactory
8.1.4	<b>PLATE &amp; EDGE THICKNESS e &amp; E</b>	1 6.8280 mm
		2 6.8330 mm
8.1.4.1	e > 0.005D and < 0.02D= 1.7822 mm / 7.1289 mm	3 6.8230 mm
		4 6.8310 mm
8.1.4.2	Maximum Allowable Variation 0.001 D = 0.3564 mm	5 6.8380 mm
		6 6.8410 mm
		7 6.8310 mm
		8 6.8260 mm
	Measured Variation	0.0180 mm
	Uncertainty of Measurement : $\pm 0.040$ mm	

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ISO REF.	FEATURE AND TOLERANCES	MEASURED VALUE	
		OUTER 'E'	INNER 'E'
8.1.4.3	E > e and < 0.050 D = 6.8314 mm / 17.8222 mm	1 9.6413 mm 2 9.6000 mm 3 9.5750 mm 4 9.6250 mm 5 9.5750 mm 6 9.5590 mm 7 9.6037 mm 8 9.5637 mm	9.6710 mm 9.6723 mm 9.7130 mm 9.6993 mm 9.6473 mm 9.6650 mm 9.7203 mm 9.5933 mm
8.1.4.4	Maximum Allowable Variation 0.001 D = 0.3564 mm  Measured Variation  Uncertainty of Measurement : ± 0.010 mm		0.1613 mm
8.1.5	<b>ANGLE OF BEVEL (F)</b>		
8.1.5.1	If thickness E > thickness e then a bevel will be present on the downstream side.		A bevel was present
8.1.5.2	Angle of Bevel F shall be between 30° and 60°  Uncertainty of Measurement : ± 1°		44.0°
8.1.6.1	<b>EDGE (G)</b>  Visual examination revealed that edge G was free from wire edges, burrs or any other peculiarities.		Free From Defects
8.1.6.2	Radius of edge G <= 0.0004 d = 0.0915 mm  Uncertainty of Measurement : ± 0.020 mm	1 0.0000 mm 2 0.0000 mm 3 0.0000 mm 4 0.0000 mm 5 0.0000 mm 6 0.0000 mm 7 0.0000 mm 8 0.0000 mm	
8.1.6.3	<b>DOWNSTREAM EDGES H &amp; I</b>  Visual examination revealed that edges H & I were free from any significant defects.		Free From Defects

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ISO REF.	FEATURE AND TOLERANCES	MEASURED VALUE	
8.1.7.2	<b>DIAMETER OF ORIFICE d</b>  The value d of the diameter of the orifice = the mean of at least four diameters distributed in axial planes at approximately equal angles to each other.  Mean =	1-5	228.7863 mm
		2-6	228.7823 mm
		3-7	228.7827 mm
		4-8	228.7863 mm
			228.7844 mm
	Uncertainty of Measurement : $\pm 0.005$ mm		
8.1.7.3	No diameter shall differ by more than 0.05% from the value of the mean diameter = $\pm 0.1144$ mm  Perpendicularity of bore to upstream face. Uncertainty of Measurement : $\pm 0.005$ mm		+ 0.0019 mm
			- 0.0021 mm
			0.0005 mm

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

## NOTE

This measurement is supplied for additional information purposes only. It is intended to be used as a guide to the actual outer diameter of the artefact and not the size of the pipeline into which it will be installed.

**END OF CERTIFICATE**