Sand Louvre Test

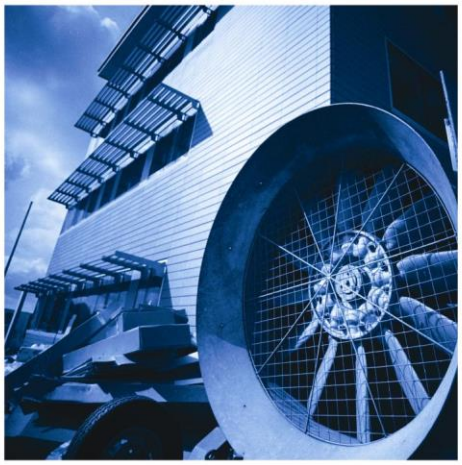
STL-A

Final Report 59314/1

Carried out for
Century Mechanical Systems Factory LLC

By Andrew Freeth

12 May 2016



Sand Louvre Test
STL-A

Carried out for:

Century Mechanical Systems Factory LLC
PO Box 60270
Dubai
UAE

Contract: **Final Report 59314/1**

Date: **12 May 2016**

Issued by: **BSRIA Limited**
Old Bracknell Lane West,
Bracknell,
Berkshire RG12 7AH UK

Telephone: +44 (0)1344 465600

Fax: +44 (0)1344 465626

E: bsria@bsria.co.uk W: www.bsria.co.uk

Compiled by:	Approved by:
Name: Andrew Freeth	**Name:** Mark Roper
Title: Senior Test Engineer	**Title:** Principal Test Engineer

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APPENDICES

FIGURES

1 INTRODUCTION

This report concerns tests conducted on a sand louvre to determine the Sand Penetration and the Pressure Drop versus Airflow Curve, with the associated Coefficient of Entry using the test methods contained within EN 13181 : 2001. The work was commissioned by Century Mechanical Systems Factory LLC and was carried out at BSRIA on 11 to 29 April 2016.

Items received for test

Test Item	BSRIA ID
STL-A	59314A1

1.1 TEST ITEM INFORMATION

Contract		59314
Date		11-4-16
Manufacturer		Century Mechanical Systems Factory LLC
Louvre Model		STL-A
Material		Aluminium
Painted		White
Core Area - Height		1008 mm
Core Area - Width		1008 mm
Blade Pack Depth		70 mm
Frame Depth		100 mm
No. of Blades		6
Blade Pitch		150 mm
Blade Angle		90º to the airflow
No. of Banks		2
Guard Type		Bird/Vermin
Guard Spacing		0 mm
Sand Catchment Tray		Yes
Blade Orientation		Vertical

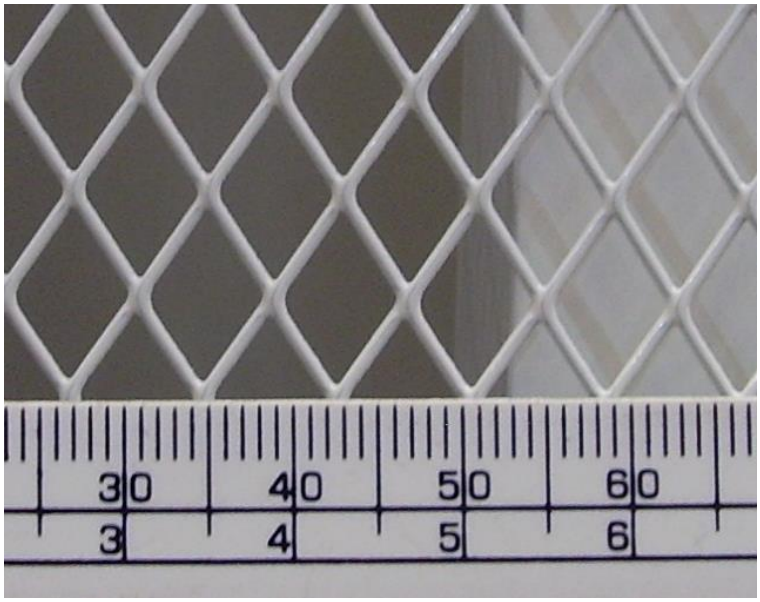
Note: Louvre core area - product of the minimum height H and minimum width W of the front opening in the weather louvre assembly with the louvre blades removed

Blade Pack Depth refers to the distance from front of first bank to rear of last bank

Figure 1 Test item 59314A1 (front)

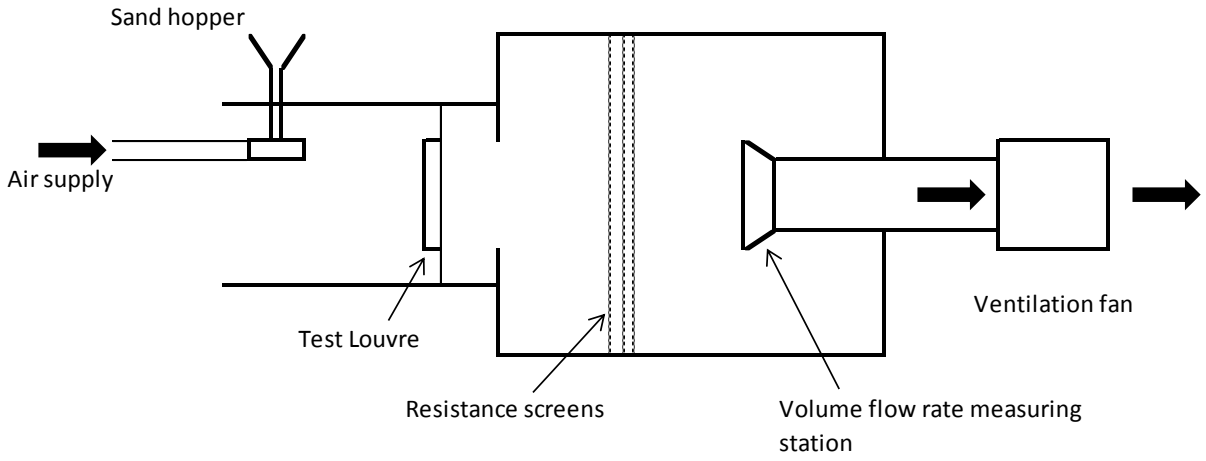
Figure 2 Test item 59314A1 (rear)

Figure 3 Close-up of mesh



2 TEST METHOD

A schematic representation of the rig used during testing



The test comprises of two parts:

2.1 SAND PENETRATION

The sand louvre is subjected to wind driven sand at an airflow speed of 20 - 25 m/s measured in the injection tube with various sand masses and delivery rates as shown in Table 1 below. In addition to the simulated wind and sand, air is drawn through the louvre at a range of velocities (0, 0.5, 1.3, 2.0, 2.8, and 3.5 m/s, or the maximum achievable). Table 2 shows the graded sand requirements for 1 Kg of standard test sand.

After each sand delivery, the fans are kept running for a further 5 minutes.

The rejected sand in the louvre and in the area in front of it, is collected, weighed and recorded. A range of measurements are taken to give the characteristic curve for the test louvre.

Table 1 Core air velocities, weights or sand and sand discharge durations

Airspeed (m/s)	Sand mass (Kg)	Discharge duration (s)
0	1	Not timed*
0.5	1	200
1.3	1	75
2.0	2	100
2.8	2	70
3.5	2	60

* Note: Although 0 m/s is not required as a test velocity, it has been included for information purposes. For 0 m/s the ventilation fan is turned off.

Table 2 Standard sand requirements

Grade size µm	Mass %	Mass required for 1kg sample (kg)
> 699	0.5	0.005
423 to 699	3.0	0.03
353 to 422	12.0	0.12
251 to 352	30.0	0.3
211 to 250	20.0	0.2
152 to 210	27.0	0.27
104 to 151	6.0	0.06
76 to 103	1.0	0.01
< 76	0.5	0.005

2.2 PRESSURE DROP

For this test, the Aerodynamic Measuring Section (AMS) is separated from the main rig. The louvre is then mounted in the upstream opening of the AMS.

Pressure tappings in the plenum walls of the AMS allow measurement of the static pressure within the plenum during testing. The airflow volume is calculated from the differential pressure at the measuring cones. The plenum has a set of settling screens within to produce even flow through the cones and therefore give accurate reading of the total volume.

By adjusting the fan speed, the total airflow through the system varies and therefore changes the pressure on the louvre under test. A range of measurements are taken to give the characteristic curve for the test louvre.

2.3 TEST EQUIPMENT USED

Test equipment	BSRIA ID	Calibration Expiry date
Airflow cones	364	9-1-17
Micromanometer	5	16-2-17
Micromanometer	682	5-1-17
Scales	219	23-3-17
Sand injection nozzles	364	17-9-16

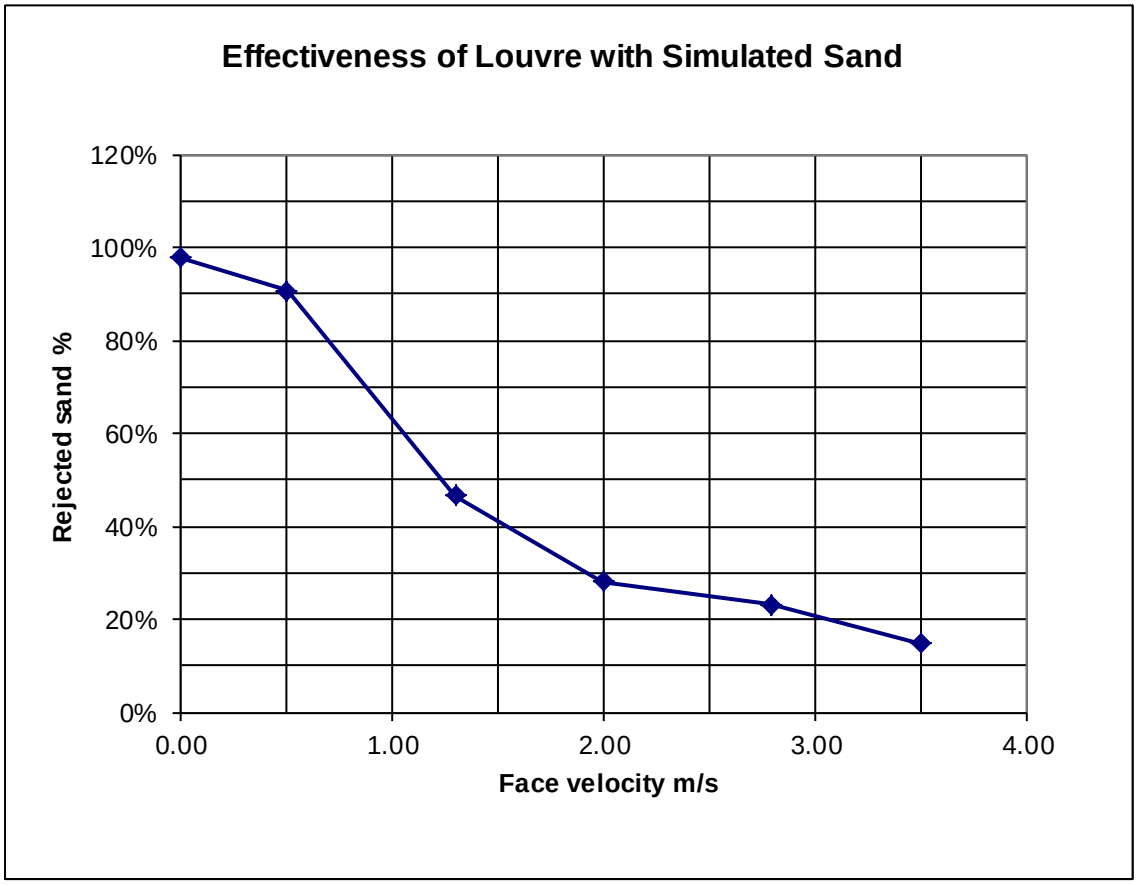
3 RESULTS

3.1 SAND PENETRATION

MANUFACTURER Century Mechanical Systems Factory LLC Date 11/04/2016
MODEL STL-A Contract 59314

louvre height	1008	mm
louvre width	1008	mm
louvre area	1.016	m^2

VENTILATION RATE		SAND MASS		Effectiveness
Volume m^3/s	Velocity m/s	Injected kg	Rejected kg	
0.00	0.00	1.00	0.98	98%
0.51	0.50	1.00	0.91	91%
1.32	1.30	1.00	0.47	47%
2.03	2.00	2.00	0.56	28%
2.84	2.79	2.00	0.46	23%
3.56	3.50	2.00	0.30	15%

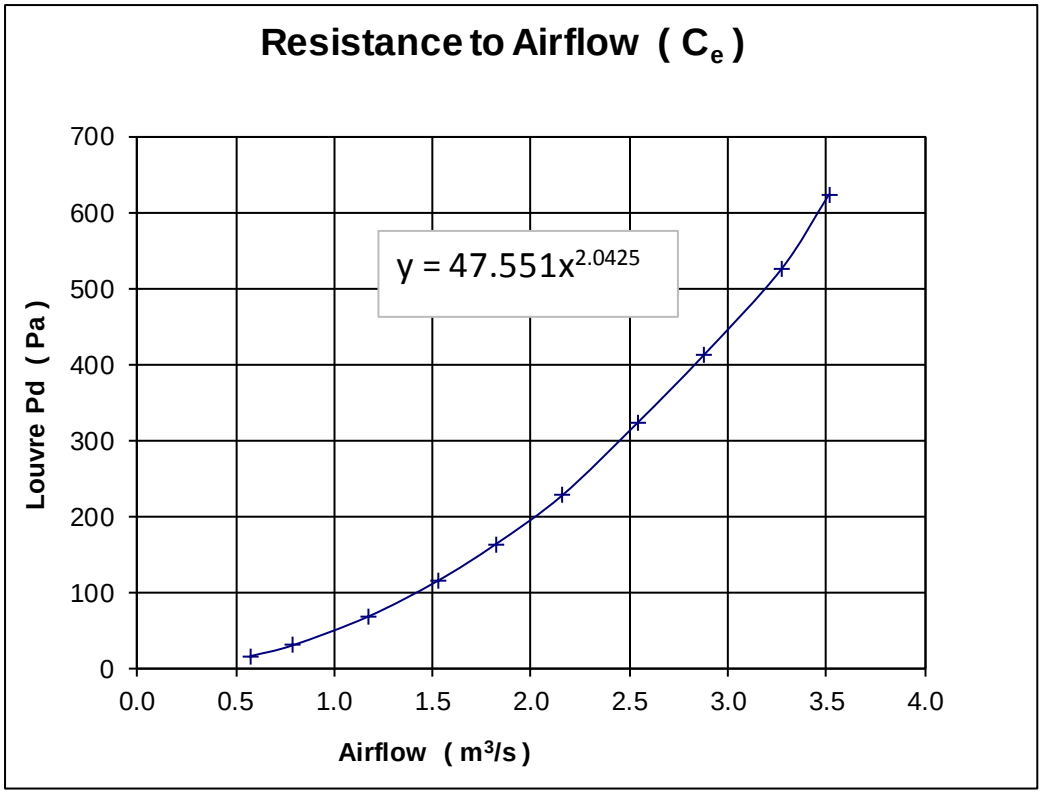


3.2 COEFFICIENT OF ENTRY

MANUFACTURER Century Mechanical Systems Factory LLC Date 29/04/2016
MODEL STL-A Contract 59314

air temperature	17.3	°C	louvre height	1008	mm
barometer	1002	mbar	louvre width	1008	mm
air density	1.197	kg/m^3	louvre area	1.016	m^2

	louvre face velocity	air flow rate		
louvre pd Pascals	m/s	test m^3/s	theoretical m^3/s	coefficient C_e
15.2	0.57	0.577	5.120	0.113
29.3	0.78	0.789	7.108	0.111
67.0	1.15	1.172	10.749	0.109
114.0	1.50	1.525	14.021	0.109
163.0	1.80	1.824	16.765	0.109
227.0	2.13	2.160	19.785	0.109
322.0	2.50	2.541	23.564	0.108
411.0	2.83	2.877	26.622	0.108
524.0	3.22	3.271	30.060	0.109
623.0	3.46	3.515	32.777	0.107
			mean C_e	0.109
			Class	4



APPENDIX: A MANUFACTURER'S DRAWING