

Airflow and Acoustic Research and Development Study of Various Outlets



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Vipac Engineers & Scientists Ltd
Melbourne, Australia
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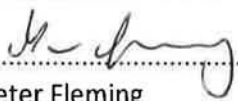



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Airflow and Acoustic Research and Development Study of Various Outlets	
FILE: 30S-12-0198-TRP-306126-0- NATA Report.doc PREPARED FOR: NE-NAN Co. Ltd. 4 Soi Suksawad 30, Suksawad Road Bangpakok, Ratburana, Bangkok THAILAND 10140 Contact Person: Kitisak Rianrungrueang Phone: +668 09666600 Fax: +662 4286131	TEST PROCEDURE LI-8850-MEL PREPARED BY: Vipac Engineers & Scientists Ltd., Victorian Technology Centre, 275 Normanby Road, Port Melbourne VIC. 3207 AUSTRALIA Phone: (613) 9647-9755 Fax: (613) 9646-4370

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1.0 INTRODUCTION

This report presents the results of various tests carried out on four (4) Diffusers and one (1) Damper supplied by "NE-NAN Co. Ltd", as described below.

2.0 TEST SPECIMEN

The units under test are detailed in Table 1 below.

Table 1: Units Under Test

Item No.	Unit Description	Neck Diameter (mm)	Face Diameter (mm)
1	Round Ceiling Diffuser	350	460
2	Round Ceiling Diffuser	295	405
3	Round Jet Diffuser	300	370
4	Round Jet Diffuser	245	330
5	Volume Damper	300	300

Photographs of the Test Units are included in Appendix A.

3.0 TEST CONDITIONS AND APPLICABLE STANDARDS

3.1 TEST CONDITIONS

The units under test were supplied with ambient temperature air at the following conditions:

Test Air Temperature	17 degrees C	± 2.0 degree C
Room Air Temperature	19 degrees C	± 2.0 degree C
Barometric Pressure	1020 millibar	± 5 millibar
Relative Humidity	50	± 10%

3.2 APPLICABLE STANDARDS

The units were tested at a range of flow conditions, as shown on the Test Certificates.

The test set ups were in general accordance with ANSI/ASHRAE 70-2006 (Diffusers) & AS 1682 (Damper – Air Leakage). Measurements were taken in general accordance with the following standards:

ACOUSTICS

AS 1217.2 Acoustics – Determination of sound power levels of noise sources
Part 2: Precision methods for broad-band sources in reverberation rooms.

AIRFLOW

ANSI/ASHRAE 70-2006 – Method of Testing the performance of Air Outlets and Air Inlets

THROW & STATIC PRESSURE DROP

ANSI/ASHRAE 70-2006 – Method of Testing the performance of Air Outlets and Air Inlets

4.0 TEST SET UP AND SPECIFICATION

Vipac's Reverberation Test Room has a volume of 170m³ has been qualified in accordance with the procedures in AS 1217.2 - 1985 for determination of sound power in octave bands with Centre Frequencies from 125 Hz to 8000 Hz.

The units under test were set up in the Air Distribution (Reverberation) Test Chamber and connected to a quiet air supply.

Following calibration checks, sound pressure levels were measured and converted to sound power levels using the comparison method of AS 1217.2 - 1985 (ie. using a reference sound source of known Sound Power to determine room correction).

Airflow rates were measured using Ø 150 mm orifice plate. Static pressure drop was recorded using a (Static Pressure) probe and a digital manometer. Throw was measured using a hotwire type anemometer. Figure 1 shows the test set up (Diffusers - Ceiling Installation).

The damper unit was set up as shown in Figure 2. The damper was fully closed during testing. An air supply was connected to the upstream side of the damper.

The static pressure immediately upstream of the damper was measured using pressure tapings connected to a manometer. By varying the supply airflow rate, the static pressure was stabilised at particular values and those values recorded against the leakage flow rate through the damper. Testing began at the lowest pressure drop of 250 Pa, and ended at the highest-pressure drop of 1250 Pa.

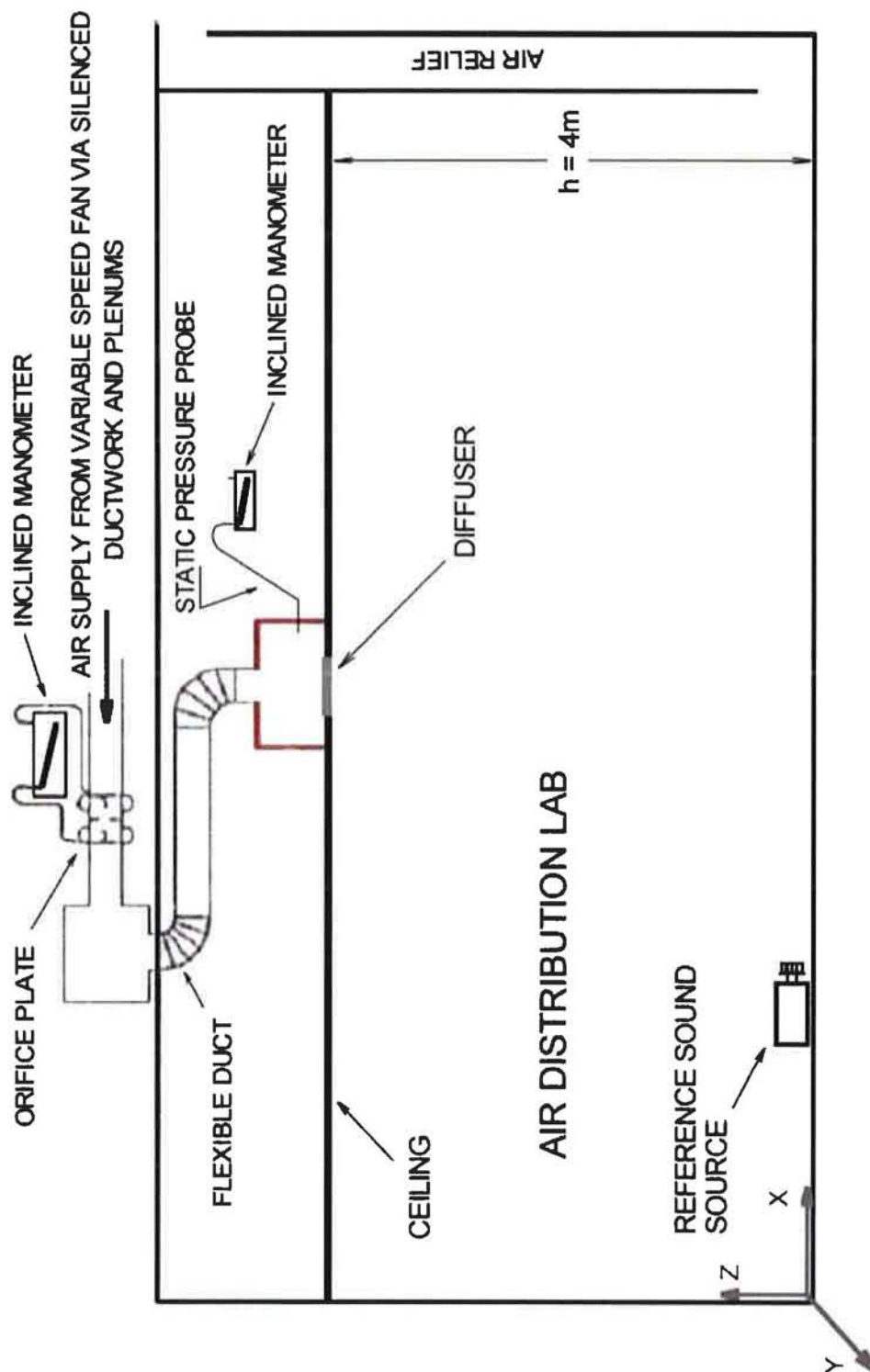


Figure 1: Test Set-up (Ceiling Diffuser)

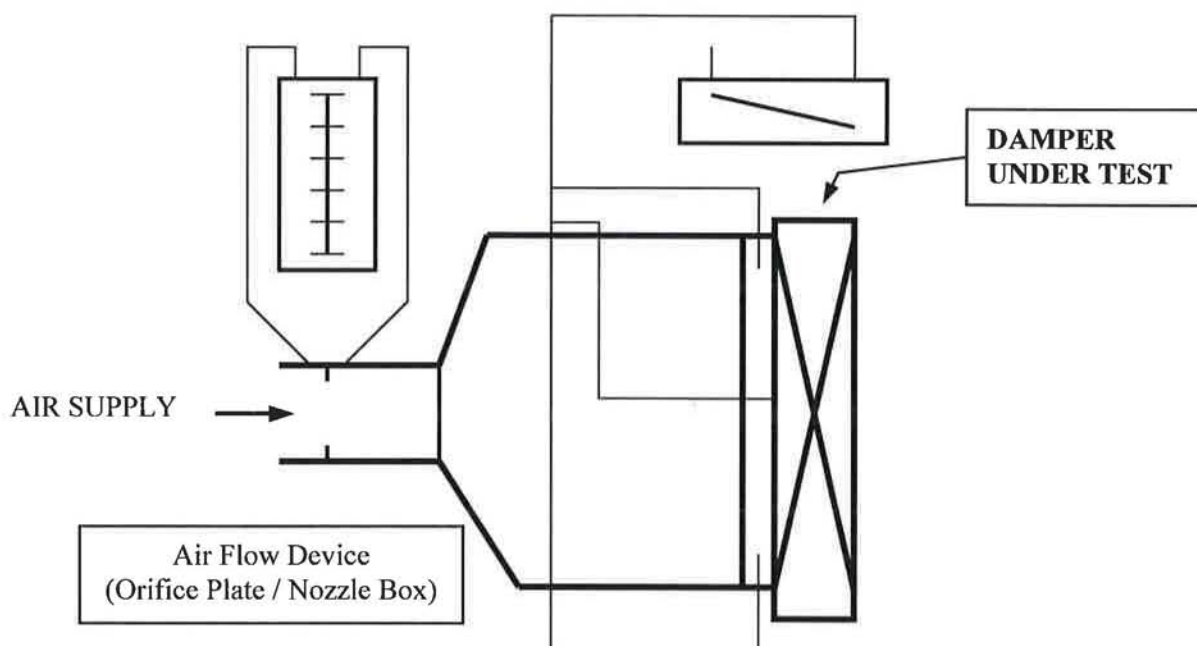


Figure 2: Test Set-up (Volume Damper – Air Leakage Test)

5.0 INSTRUMENTATION

INSTRUMENT	MAKE & MODEL	CALIBRATION		SERIAL NO.
		BY	DATE	
Sound Level Meter	ONO SOKKI LA-5570	Vipac	30 Apr 2012	47958 / 20627
Microphone	MI-3310	Vipac	30 Apr 2012	21367
Acoustic Calibrator	B&K 4230	Vipac	20 Mar 2012	831145
Manometers (2)	TSI DP-Calc PVM 610	GTS	20 Feb 2012	000010147
		UKAS	2 Mar 2012	PVM611130002
Orifice Plates	Vipac	Vipac	May 2001	-
Airflow Anemometer	TA 465P	UKAS	26 Mar 2012	TA4651210002

6.0 ORDERS OF ACCURACY

<u>Sound Pressure Level:</u>	Octave Band Centre Frequency (Hz)	Standard Deviation (1) (dB)
	125	<u>+3.0</u>
	250	<u>+2.0</u>
	500 to 4000	<u>+1.5</u>
	8000	<u>+3.0</u>


Pressure Drop: $\pm 5\%$ or 0.5 Pa whichever is greater

Airflow: $\pm 5\%$ or 10 L/s whichever is greater

7.0 RESULTS

The results obtained are shown in the attached Test Certificates.
Photographs of the Test Units are included in Appendix A. Smoke test Photographs are included in Appendix B

Report Prepared by:
VIPAC ENGINEERS AND SCIENTISTS LTD.


PETER FLEMING
AUTHOR


ZARKO DRINIC
N.A.T.A. SIGNATORY

TEST CERTIFICATE No.1

ACOUSTIC AND AIRFLOW PERFORMANCE TEST


SUPPLIED BY: NE-NAN CO. LTD.
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: November / December 2012
EXPIRY DATE: December 2015
CLIENT: NE-NAN CO. LTD.
UNIT: Round Ceiling Diffuser
FACE / NECK SIZE: Ø 460 mm / Ø 350 mm



TEST CONDITIONS				SOUND POWER LEVEL, dB re 1E-12 W						
				OCTAVE BAND CENTRE FREQUENCY (Hz)						
Qs (L/s)	Ps (Pa)	T (m)	NC	125	250	500	1000	2000	4000	8000
178	9	4	21	48.6	43.5	27.4	19.6	17.3	<13.7	<11.8
220	14	5	28	50.6	49.4	36.6	27.5	23.1	16.0	<12.1
291	26	7	35	53.8	55.0	47.8	39.4	36.6	28.2	14.9
369	43	10 *	42	56.8	60.7	56.5	48.5	46.4	39.3	25.4
412	53	11 *	47	59.2	61.8	60.3	51.8	49.6	42.7	29.7

LEGEND

- Qs - Primary Air Flow Rate (L/s)
 Ps - Supply Static Pressure (Pa)
 < - Insufficient margin above background noise to allow accurate determination
 > - Length of throw greater than that able to be measured
 NC - Noise Criterion based upon room absorption of 10 dB
 T - Horizontal Throw in meters at terminal velocity of 0.25m/s
 * - Extrapolated values are excluded from NATA's accreditation


 PETER FLEMING
 AUTHOR


 ZARKO DRINIC
 N.A.T.A. SIGNATORY

TEST CERTIFICATE No.2

ACOUSTIC AND AIRFLOW PERFORMANCE TEST


SUPPLIED BY: NE-NAN CO. LTD.
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: November / December 2012
EXPIRY DATE: December 2015
CLIENT: NE-NAN CO. LTD.
UNIT: Round Ceiling Diffuser
FACE / NECK SIZE: Ø 405 mm / Ø 295 mm



TEST CONDITIONS				SOUND POWER LEVEL, dB re 1E-12 W						
				OCTAVE BAND CENTRE FREQUENCY (Hz)						
Qs (L/s)	Ps (Pa)	T (m)	NC	125	250	500	1000	2000	4000	8000
150	13	8 *	22	48.7	44.6	31.5	21.4	17.1	<14.1	<11.7
169	17	9 *	28	50.1	49.0	36.7	27.0	21.0	<15.0	<12.1
206	25	11 *	34	53.7	54.0	44.9	35.6	29.8	22.4	15.9
261	39	15 *	39	56.4	58.6	53.3	44.1	38.3	31.7	20.5
281	45	16 *	45	58.2	60.9	58.3	48.2	43.4	36.7	24.0

LEGEND

- Qs - Primary Air Flow Rate (L/s)
 Ps - Supply Static Pressure (Pa)
 < - Insufficient margin above background noise to allow accurate determination
 > - Length of throw greater than that able to be measured
 NC - Noise Criterion based upon room absorption of 10 dB
 T - Horizontal Throw in meters at terminal velocity of 0.25m/s
 * - Extrapolated values are excluded from NATA's accreditation


 PETER FLEMING
 AUTHOR


 ZARKO DRINIC
 N.A.T.A. SIGNATORY

TEST CERTIFICATE No.3

ACOUSTIC AND AIRFLOW PERFORMANCE TEST

SUPPLIED BY: NE-NAN CO. LTD.
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: November / December 2012
EXPIRY DATE: December 2015
CLIENT: NE-NAN CO. LTD.
UNIT: Jet Ceiling Diffuser
FACE / NECK SIZE: Ø 370 mm / Ø 300 mm



TEST CONDITIONS				SOUND POWER LEVEL, dB re 1E-12 W						
				OCTAVE BAND CENTRE FREQUENCY (Hz)						
Qs (L/s)	Ps (Pa)	T (m)	NC	125	250	500	1000	2000	4000	8000
205	14	14 *	20	45.6	42.4	33.4	24.9	19.0	<13.9	<12.3
250	21	17 *	25	46.1	46.3	38.4	31.0	26.8	17.9	<13.0
295	30	20 *	30	48.5	50.4	45.2	37.4	33.6	21.5	<14.3
388	52	27 *	37	53.7	55.3	51.9	47.0	44.0	34.3	23.8
477	78	34 *	44	61.5	60.9	58.2	55.0	51.7	41.7	30.6

LEGEND

- Qs - Primary Air Flow Rate (L/s)
 Ps - Supply Static Pressure (Pa)
 < - Insufficient margin above background noise to allow accurate determination
 > - Length of throw greater than that able to be measured
 NC - Noise Criterion based upon room absorption of 10 dB
 T - Horizontal Throw in meters at terminal velocity of 0.25m/s
 * - Extrapolated values are excluded from NATA's accreditation


 PETER FLEMING
 AUTHOR


 ZARKO DRINIC
 N.A.T.A. SIGNATORY

TEST CERTIFICATE No.4

ACOUSTIC AND AIRFLOW PERFORMANCE TEST


SUPPLIED BY:	NE-NAN CO. LTD.
TESTED BY:	VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE:	November / December 2012
EXPIRY DATE:	December 2015
CLIENT:	NE-NAN CO. LTD.
UNIT:	Jet Ceiling Diffuser
FACE / NECK SIZE:	Ø 330 mm / Ø 245 mm



TEST CONDITIONS				SOUND POWER LEVEL, dB re 1E-12 W						
				OCTAVE BAND CENTRE FREQUENCY (Hz)						
Qs (L/s)	Ps (Pa)	T (m)	NC	125	250	500	1000	2000	4000	8000
194	24	15 *	21	46.1	41.2	35.4	32.1	29.1	<15.9	<12.0
215	30	17 *	26	46.7	43.7	38.1	34.6	34.1	19.3	<13.2
251	41	20 *	32	47.8	46.2	42.2	38.1	40.1	26.2	15.1
323	68	26 *	38	53.7	53.5	49.0	46.6	47.0	36.1	23.4
376	98	30 *	45	57.7	57.5	54.7	52.9	53.3	44.6	31.9

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- < - Insufficient margin above background noise to allow accurate determination
- > - Length of throw greater than that able to be measured
- NC - Noise Criterion based upon room absorption of 10 dB
- T - Horizontal Throw in meters at terminal velocity of 0.25m/s
- * - Extrapolated values are excluded from NATA's accreditation


PETER FLEMING
 AUTHOR


ZARKO DRINIC
 N.A.T.A. SIGNATORY

TEST CERTIFICATE No.5

AIR LEAKAGE PERFORMANCE TEST


SUPPLIED BY:	NE-NAN CO. LTD.
TESTED BY:	VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE:	November / December 2012
EXPIRY DATE:	December 2015
CLIENT:	NE-NAN CO. LTD.
UNIT:	Volume Damper
SIZE:	300 mm x 300 mm



TEST CONDITIONS		AIR LEAKAGE	
Ps (Pa)		Qs (L/s)	
250		27	
500		37	
750		44	
1000		49	
1250		54	

LEGEND

Qs - Air Leakage Rate (L/s)
Ps - Supply Static Pressure (Pa)


PETER FLEMING
AUTHOR


ZARKO DRINIC
N.A.T.A. SIGNATORY

APPENDIX A

Photographs



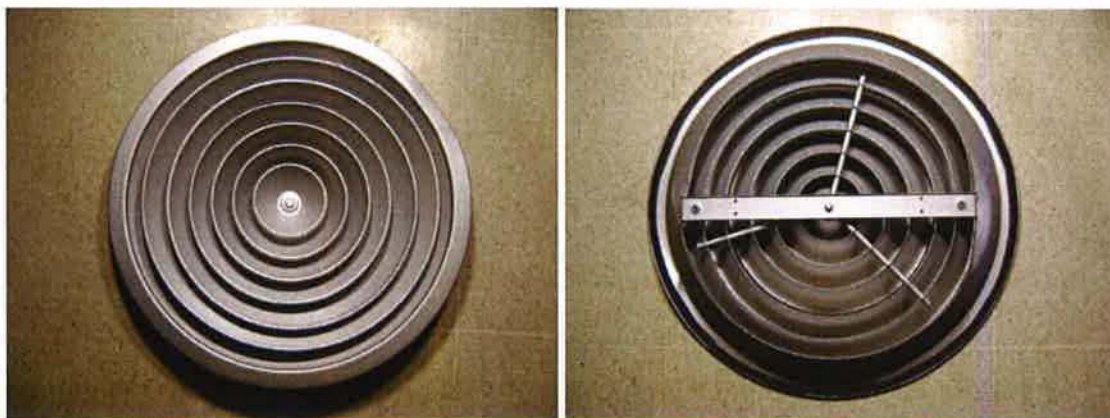


Figure 2: Round Ceiling Diffuser (Neck: Ø350mm)

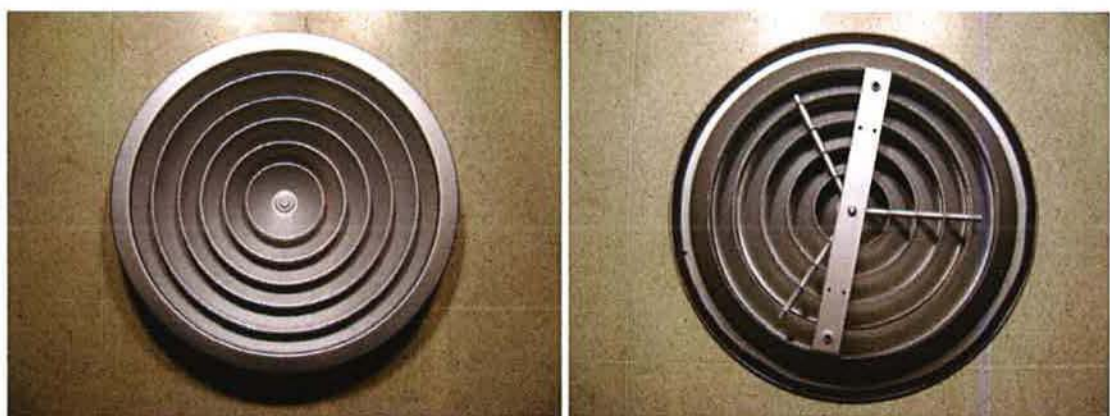


Figure 3: Round Ceiling Diffuser (Neck: Ø295mm)

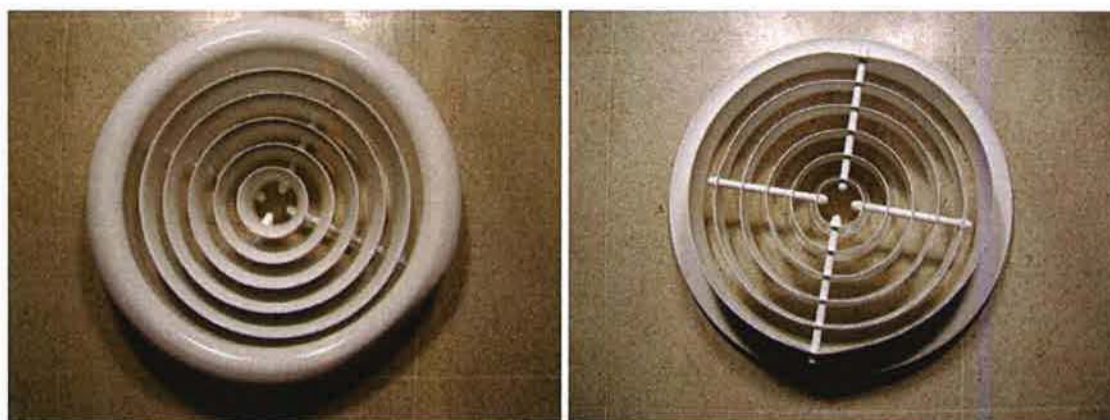


Figure 4: Jet Ceiling Diffuser (Neck: Ø245mm)

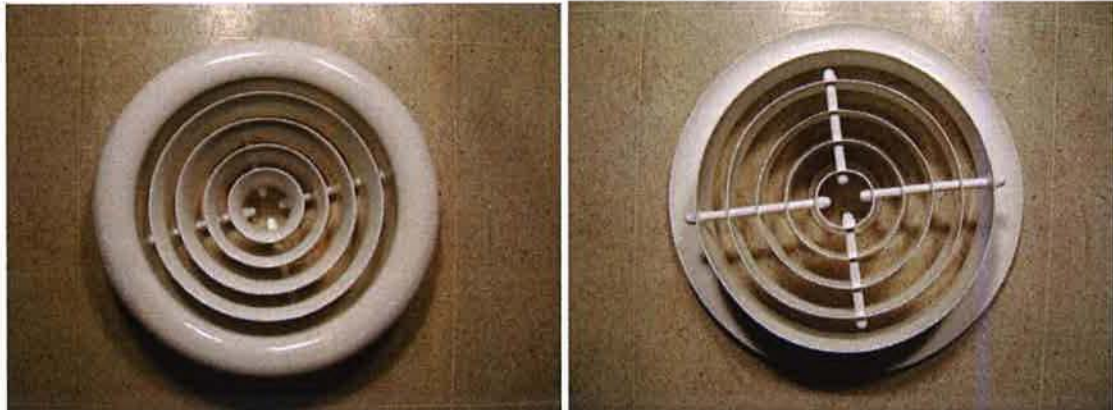


Figure 5: Round Ceiling Diffuser (Neck: Ø300mm)

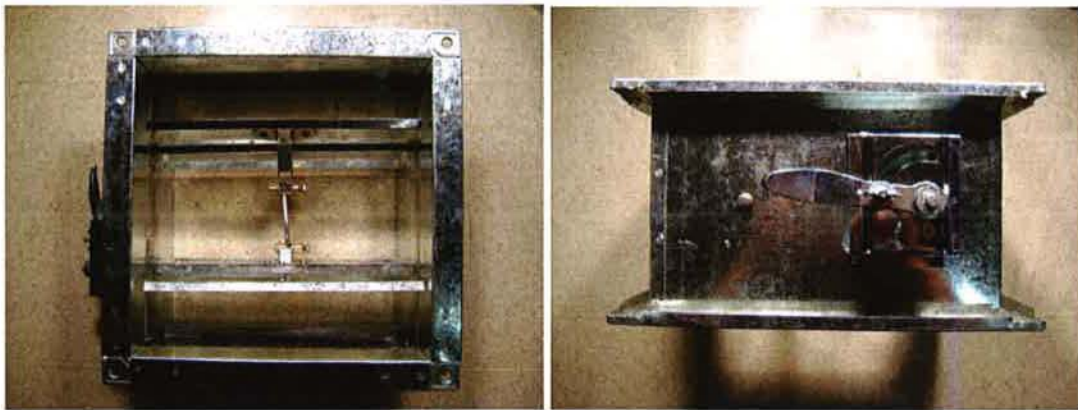


Figure 6: Volume Damper (300mm x 300mm)

APPENDIX B

Smoke Photographs





Figure 7: Round Ceiling Diffuser (Neck: Ø350mm)



Figure 8: Round Ceiling Diffuser (Neck: Ø295mm)



Figure 9: Jet Ceiling Diffuser (Neck: Ø245mm).



Figure 10: Jet Ceiling Diffuser (Neck: Ø300mm).