ACOUSTICS AND AIR

WASTE WATER PIPE NOISE TESTS

ACOUSTICA GREENLAG PIPE LAGGING

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PREPARED FOR

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We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

LAE – The A Weighed Sound Exposure Level which is the noise level that would be generated if all the energy from a discreet noise event (e.g. a toilet flush) was compressed into 1 second.

1 INTRODUCTION

Wilkinson Murray Pty Ltd was engaged to conduct comparative noise testing of waste water pipe work noise to determine compliance with the requirements of the section F5 of the Building Code of Australia.

Noise levels in a complying construction scenario where measured in a test room. These tests served as reference noise levels for further comparison with alternative noise control treatment of pipework. Following reference testing the waste pipe was lagged with two Acoustica pipe lagging products being GreenLAG GL15pipe wrap and GreenLAG PL5/10 pipe wrap. The noise levels were remeasured for each of these products.

As an additional comparison a number of alterative pipe lagging products being Pyrotek 4525C, Pyrotek 4512 and Vibralag were also installed in the same test configuration and tested in the same manner.

A comparison of the results of the all tests was conducted to determine compliance with the requirements of the deemed to satisfy provisions of the BCA with respect to waste water noise in residential dwellings.

The assessment of an alternative solution has been determined in accordance with section A0.10 "Relevant Performance Requirements".

Maximum and SEL noise levels associated with toilet flushes were measured in a test room with a wall that achieves the requirements of section F5 BCA.

Noise testing was conducted in a test room with a wall separating a waste pipe that complies with the BCA's requirements.

The following sections detail the testing methodology and results.

2 PERFORMANCE REQUIREMENTS

Section F5.2 of the current Building Code Australia in section F5.6 – Sound Insulation Rating of Services" states:

(a) If a duct, soil waste or water supply pipe, including a duct or pipe that is located in a or floor cavity, serves or passes through more than one sole-occupancy unit, the pipe must be separated from the rooms of any sole-occupancy by a construction with an Rw+Ctr(air borne) not less than –

(i) 40 if the adjacent room is a habitable room (other than a kitchen); or

(ii) 25 if the adjacent room is a kitchen or a non habitable room

(b) If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (a)(i) and (ii)".

In the case of item (a)(i) a drywall construction that has been tested which achieves an acoustic Rw+Ctr rating of not less than 40. The construction that was selected consisted of the following wall construction:

- 2 x 13 mm Gyprock Fyrcheck plasterboard
- 64 mm steel studs at 600 mm maximum centres.
- 50 mm glasswool partition batts (10.8 kg/m^3)
- 2 x 13 mm Gyprock Fyrcheck plasterboard.

The above wall has been tested to achieve an acoustic rating of Rw +Ctr of 40 (Reference test HAS 067 CSR Gyprock Fire and Acoustic Design Guide). The reported transmission loss is detailed in Table 2.1 as follows

Table 2.1 Wall Transmission Loss Test Results - HAS 068

Third Octave Frequency Hertz	Transmission Loss - dB
100	22
125	30
160	31
200	37
250	42
315	44
400	47
500	49
630	52
800	53
1000	54
1250	52
1600	49
2000	50
2500	53
3150	57
4000	61
5000	63

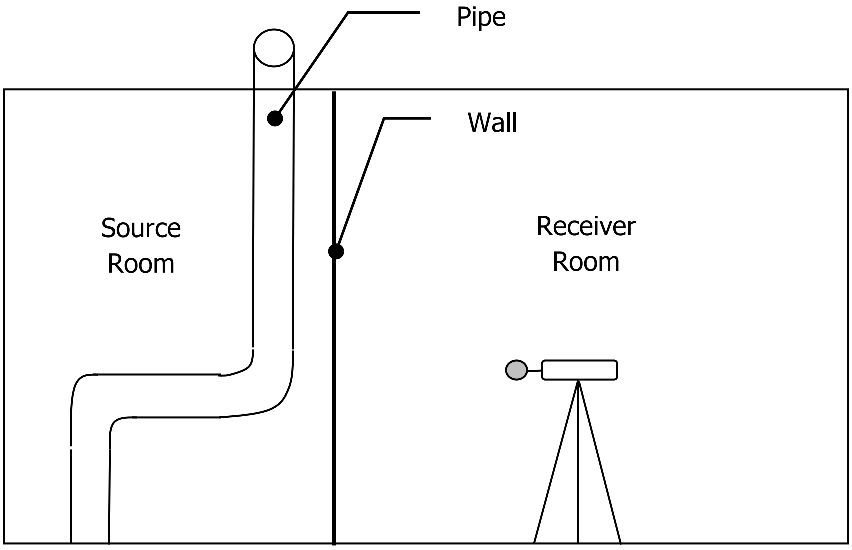
3 TEST CONFIGURATION METHODOLOGY AND CONSTRUCTION

Test configurations equipment and methodology are detailed in the following sections:

3.1 Test Construction

A test room with toilet and pipework was constructed in a room at Acoustica's factory at St Marys. Figure 3.1 shows a schematic of the test room configuration.

Figure 3.1 Test Configuration



Five test were used in the comparative testing:

Test 1

The test set up consisted of a bare waste water pipe (Figure 3.2) installed behind the Rw +Ctr 40 plasterboard wall (Figure 3.3).

Test 2

The Rw+Ctr 40 wall was removed and the bare pipe was lagged with GreenLAG GL15 and a 10 mm plasterboard wall installed on the studs. This product has a 15 mm foam layer.

Test 3

The pipe was lagged with Acoustica GreenLAG PL5/10 pipe wrap. After the installation of the pipe wrap the 10 mm plasterboard wall was reinstalled on the studs prior to testing.

Test 4

The pipe was lagged with Pyrotek 4525C pipe wrap. After the installation of the pipe wrap the 10 mm plasterboard wall was reinstalled on the studs prior to testing.

Test 5

The pipe was lagged with Pyrotek 4512 pipe wrap. After the installation of the pipe wrap the 10 mm plasterboard wall was reinstalled on the studs prior to testing.

Test 6

The pipe was lagged with 5 kg/m^2 Vibralag pipe wrap. After the installation of the pipe wrap the 10 mm plasterboard wall was reinstalled on the studs prior to testing.

Figure 3.2 Pipework in Test Rooms

Figure 3.3 Rw+Ctr 40 Wall

Figure 3.4 Pipe Lagged with Acoustic Pipewrap

3.2 Testing Methodology

Testing was conducted utilising a Bruel and Kjaer sound level meter type 2260 located at 1 metre above the floor in the centre of the receiving room.

The cistern (see Figure 3.5) was filled and flushed 10 times and the L_{Amax} along with the A weighted Sound Exposure Level (L_{AE}) was measured for each flush. The results were then complied and average noise levels were calculated.

Following completion of tests the calibration of the meter was checked using a Brule and Kjaer calibrator type 4231 and no significant drift was observed.

Figure 3.5 Cistern and Pipe above Test Rooms

4 TEST RESULTS

The results of testing in the receiver room with ten water flushes, bare pipe and an Rw+Ctr 40 wall are detailed in Table 4.1

Table 4.1 Measured Noise Levels of Waste Water Noise in Receiver Room - Rw+Ctr 40 Wall - dBA

Test	L_{Amax}	LAE
1	39.8	45.7
2	37	45.5
3	36.9	44.5
4	37.3	44.5
5	38.3	44.5
6	38.9	44.7
7	37.3	44.4
8	36.2	43.7
9	38.1	43.9
10	36.9	44
AVERAGE NOISE LEVEL	**37.7**	**44.5**
MEAN NOISE LEVEL	**37.3**	**44.5**

The results of testing in the receiver room with ten water flushes, pipe lagged with GreenLAG GL15 on a 15mm thick and a 3.5 kg/m^2 and a 10 mm plasterboard wall are detailed in Table 4.2

Table 4.2 Measured Noise Levels of Waste Water Noise in Receiver Room - GreenLAG GL15 Pipe Lagging and 10 mm plasterboard wall – dBA

Test	L_{Amax}	LAE	L_{Aeq}
1	38.4	43.6	30.4
2	36.2	43.3	30.1
3	38	43.5	30.3
4	35.6	44.2	30.9
5	35	43.3	30
6	38.3	43.9	30.7
7	38.3	43.5	30.3
8	36.7	43.3	30.1
9	36.7	42.9	29.7
10	35.4	43.2	30
AVERAGE NOISE LEVEL	**36.9**	**43.5**	**30.3**
MEAN NOISE LEVEL	**36.7**	**43.5**	**30.3**

The results of testing in the receiver room with ten water flushes, pipe lagged with PL 5/10

'GreenLAG on a 10mm thick 24/160 grade foam - 5 kg/m^2 and a 10 mm plasterboard wall are detailed in Table 4.3

Table 4.3 Measured Noise Levels of Waste Water Noise in Receiver Room – GreenLAG PL5/10 and 10 mm plasterboard wall - dBA

Test	L_{Amax}	LAE
1	34.9	41.6
2	34.9	41.7
3	35	41.4
4	34.5	40.9
5	35.1	40.9
6	34.7	41.5
7	34.6	41.2
8	35	41.2
9	34.4	41.3
10	34.3	41.7
AVERAGE NOISE LEVEL	**34.7**	**41.3**
MEAN NOISE LEVEL	**34.7**	**41.3**

The results of testing in the receiver room with ten water flushes, pipe lagged with Pyrotek 4525C pipe wrap lagging and a 10 mm plasterboard wall are detailed in Table 4.4

Table 4.4 Measured Noise Levels of Waste Water Noise in Receiver Room Pyrotek 4525C pipe wrap and 10 mm plasterboard wall - dBA

Test	L_{Amax}	LAE
1	37.6	44.5
2	37.3	43.2
3	36.8	44.2
4	36.5	42.8
5	39.5	43.6
6	36.5	43.7
7	36.2	43.7
8	37.1	43.7
9	37.7	43.4
10	35.2	42.4
AVERAGE NOISE LEVEL	**37.0**	**43.5**
MEAN NOISE LEVEL	**37.0**	**43.6**

The results of testing in the receiver room with ten water flushes, pipe lagged with Pyrotek 12/5 pipe wrap lagging and a 10 mm plasterboard wall are detailed in Table 4.5

Table 4.5 Measured Noise Levels of Waste Water Noise in Receiver Room Pyrotek 4512 pipe wrap and 10 mm plasterboard wall - dBA

Test	L_{Amax}	LAE
1	38.4	44.1
2	36.4	43.4
3	37.8	43.7
4	39.6	44.4
5	37.5	43.7
6	36.4	44.5
7	37.9	43.6
8	39.1	44.5
9	38.8	44.4
10	35.6	44
AVERAGE NOISE LEVEL	**37.8**	**44.0**
MEAN NOISE LEVEL	**37.8**	**44.0**

The results of testing in the receiver room with ten water flushes, pipe lagged with 5 kg/m^2 Vibralag pipe wrap lagging and a 10 mm plasterboard wall are detailed in Table 4.5

Table 4.5 Measured Noise Levels of Waste Water Noise in Receiver Room Vibralag pipe wrap and 10 mm plasterboard wall - dBA

Test	L_{Amax}	LAE
1	37.5	43.0
2	35.1	43.5
3	37.3	43.9
4	35.1	43.9
5	39.6	43.5
6	36.0	42.9
7	36.2	43.4
8	38.0	43.9
9	37.5	43.7
10	35.8	43.5
AVERAGE NOISE LEVEL	**36.8**	**43.5**
MEAN NOISE LEVEL	**36.8**	**43.5**

5 DISCUSSION AND CONCLUSION

A review of the results presented in Section 4 indicates that measured noise levels of waste water noise in the receiver room are lower when the Rw+Ctr 40 construction is replaced with 10 mm plasterboard and the pipe is lagged with either Acoustica's GreenLAG GL15 or GreenLAG PL5/10.

It is also noted that the use of the Pyrotek and Vibralag products in combination with a 10 mm plasterboard ceiling results in waste water noise levels similar to that measured with the Rw+Ctr 40 installed in the test room. (In the case of the Pyrotek 4512 product the small 0.1 dB exceedance is considered negligible.)

Table 5.1 summarises the results of measurements.

Table 5.1 Comparison of Measured Noise Levels - dBA

Construction	Average Noise Level	
	L_{Amax}	L_{AE}
Bare Pipe with a Rw+Ctr 40 wall	37.7	44.5
Pipe Lagged with GreenLAG GL15 and a wall of 10 mm Plasterboard	36.7	43.5
Pipe Lagged with GreenLAG PL5/10 and a wall of 10 mm Plasterboard	34.7	41.3
Pipe Lagged with Pyrotek 4525C and a wall of 10 mm Plasterboard	37.0	43.6
Pipe Lagged with Pyrotek 4512 and a wall of 10 mm Plasterboard	37.8	44.0
Pipe Lagged with 5 kg/m^2 Vibralag and a wall of 10 mm Plasterboard	36.8	43.5

Therefore, based on the comparative noise testing, the treatment with all of the pipe lagging materials tested in combination at 10 mm plasterboard ceiling comply with the provisions of section F5.2 of the Building Code of Australia.

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