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PKA ACOUSTIC CONSULTING

Predicted Performance of Lorient Integrity Door Seals Applied to 35mm Solid Core Doors

Project 202 145

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1 Introduction

Lorient Australia organized an extensive testing program of door panels and door seals at the Acoustic Facilities of RMIT University Melbourne. The testing was carried out in accordance with Australian Standard AS 1191-1985 and ISO140-3-1995. The test program carried out in November 2001 included test of three single door panels and a set of double doors. The tests included each of the door panels caulked in place and in the case of the 45mm steel door and the 40mm MDF faced particleboard door with various combinations of Lorient door seals. A 35mm MDF faced door was tested as a panel but not with door seals fitted. All the tests are covered by RMIT test reports 1211/01-093PD and 094PD.

The commission is to predict the acoustic performance of the 35mm ply faced solid timber door fitted with Lorient door seal using the results determined for the 40 mm MDF faced door and the 45mm steel door Assemblies also fitted with Lorient Integrity door seals.

The overall test program provided a wealth of information that allowed not only the required prediction to be made but also indicated that predictions on other door panels would be possible. The required predictions are given in this Report.

2 Methodology

There have been attempts by Lorient in their various testing programs carried out both at Sound Research Laboratories in the United Kingdom and RMIT in Australia to establish the performance of individual door seals. As well there has been research carried out at Rosenheim to evaluate the performance of individual door seals. Whilst this is important with product development, it is the door seal combination that is essential. The performance of a single door seal does not reveal the effect of gaps that may be formed when the entire system is put together.

The test results on the 40mm door panel fully caulked in the test aperture, and then non-caulked panels fitted with various door seal combination in the same aperture showed very little deterioration of acoustic performance. It would have been easy to show the 35mm door panel and its various door seal combinations as having the same acoustic performance as the caulked panel. However careful examination of the higher performing steel door revealed that the door seal performance was having a significant control on the acoustic performance of that door system. From these tests it seemed possible that the actual acoustic performance of the door seal combination could be mathematically determined using composite transmission loss calculations and using an edging technique to clarify door seal performance. A database was established and used to predict the performance of the door seal applied to the 35mm solid core doors. These results are attached overleaf.

3 Steel Frame/Timber Frame

The original series of door tests were carried out using steel frames. Acoustic laboratory measurements carried out by this firm has revealed that providing the timber frame material is at least 600 kg/m^3 and is properly sealed within the door opening that the performance of the infill door is capable of at least Rw 40. As the results contained in the attached tables are in the order of Rw 32 then timber frames can be considered to have the same performance as a steel frame.

4 Sound Lock Doors

The combination of a double door system to provide a sound lock achieves very high acoustic insulation. The addition of acoustic absorbent linings to the sound locks can also further enhance the sound insulation achieved. Experience has shown that a sound lock arrangement is a preferable way to achieve and maintain high acoustic performance with good traffic ability compared to that of a very high performance acoustic door.

The distance between the two sets of doors influences the performance of a sound lock. Some predictions are attached overleaf for a number of door configurations. The assumption is based on the doors being approximately 1metre apart and that there is no acoustic absorption between the doors. The addition of acoustic absorbency in the form of carpet and acoustic wall linings can increase the values shown overleaf by 6 to 8 dB.

Sometimes a double set of single doors is used to provide increase in acoustic performance. These are typically used between hotel apartments. Our experience indicates that when the doors are on a common timber frame there is only limited gain in acoustic performance. It appears that the doors should be on separate frames that are not connected across the cavity wall and that the doors are at least 200mm apart. The performance of these doors is very difficult to predict.

Predictions of acoustic performance based on tests carried out at RMIT University

Double Doors

35 MDF or Ply Faced Particleboard

The following are double door systems utilising a pair of 35mm solid core doors with the following meeting stile and perimeter seal configurations :

	Meeting Style	Perimeter/Bottom	100	125	160	200	250	315	400	500	630	800	1K	1.25	1.6	2K	2.5	3.15	4K	5K	STC	Rw	Ct,r	Rw+Ct,r
Double 35mm door	Single IS7061 (Batwing variant)	LE1515/IS8090si	19	23	22	26	23	25	24	24	26	27	29	32	34	35	37	38	39	40	30	30	-3	27 Predicted
Double 35mm door	Single IS7070si	LE1515/IS8090si	19	23	22	25	23	24	24	24	26	27	29	32	34	35	37	35	36	37	30	30	-3	27 Predicted
Double 35mm door	Single IS7060	LE1515/IS8090si	19	23	22	26	23	25	24	24	26	27	29	32	33	31	33	33	33	38	29	29	-2	27 Predicted
Double 35mm door	Single IS7061 (Batwing variant)	LE1212/IS8011S	20	24	22	26	23	25	24	24	26	27	29	31	33	35	36	37	39	39	30	30	-3	27 Predicted
Double 35mm door	Single IS7070si	LE1212/IS8011S	19	24	22	25	23	24	24	24	26	27	29	31	33	35	36	35	36	37	30	30	-3	27 Predicted
Double 35mm door	Single IS7060	LE1212/IS8011S	20	24	22	26	23	25	24	24	26	27	29	31	32	31	33	33	34	38	29	29	-2	27 Predicted
Double 35mm door	Single IS7061 (Batwing variant)	IS7025/IS8090si	20	24	22	26	23	25	24	24	26	27	30	32	34	35	37	37	39	39	30	30	-3	27 Predicted
Double 35mm door	Single IS7070si	IS7025/IS8090si	19	24	22	25	23	25	24	24	26	27	30	32	34	35	37	35	36	37	30	30	-3	27 Predicted
Double 35mm door	Single IS7060	IS7025/IS8090si	20	24	22	26	23	25	24	24	26	27	30	32	33	31	33	33	34	38	29	29	-2	27 Predicted

Sound Lock Doors

35 MDF or Ply Faced Particleboard

The following are Sound lock double door systems utilising a pair of 35mm solid core doors with the following meeting stile and perimeter seal configurations : The pairs of doors are 1000 apart

	Meeting Style	Perimeter/Bottom	100	125	160	200	250	315	400	500	630	800	1K	1.25	1.6	2K	2.5	3.15	4K	5K	STC	Rw	Ct,r	Rw+Ct,r
Double 35mm door	Single IS7061 (Batwing variant)	LE1515/IS8090si	21	26	27	33	31	34	35	36	40	43	48	53	57	60	63	65	66	67	42	42	-6	36 Predicted
Double 35mm door	Single IS7070si	LE1515/IS8090si	21	26	27	33	31	34	35	36	40	43	48	53	57	60	62	60	61	64	42	42	-6	36 Predicted
Double 35mm door	Single IS7060	LE1515/IS8090si	21	26	27	34	31	34	35	36	40	43	48	53	55	52	56	56	57	65	42	42	-6	36 Predicted
Double 35mm door	Single IS7061 (Batwing variant)	LE1212/IS8011S	22	28	27	33	31	34	35	36	40	43	48	51	55	59	61	64	66	67	42	42	-5	37 Predicted
Double 35mm door	Single IS7070si	LE1212/IS8011S	21	28	27	33	31	34	35	36	40	43	48	51	55	59	61	60	61	64	42	42	-5	37 Predicted
Double 35mm door	Single IS7060	LE1212/IS8011S	22	28	30	36	35	33	40	40	42	45	50	56	56	53	55	55	56	60	45	44	-6	39 Predicted
Double 35mm door	Single IS7061 (Batwing variant)	IS7025/IS8090si	22	28	27	33	31	34	35	36	40	43	49	53	57	60	63	64	67	67	42	42	-5	37 Predicted
Double 35mm door	Single IS7070si	IS7025/IS8090si	21	28	27	33	31	34	35	36	40	43	49	53	57	60	63	60	61	63	42	42	-6	36 Predicted
Double 35mm door	Single IS7060	IS7025/IS8090si	22	28	27	34	31	34	35	36	40	43	49	52	55	53	56	57	58	64	42	42	-5	37 Predicted

Single Door 35mm MDF Faced Particle Board

Predictions of acoustic performance based on tests carried out at RMIT University

Single 35mm ply faced particleboard door in steel frame. Fully caulked as tested.

STC	R_w	$C_{t,r}$	$R_w+C_{t,r}$
31	30	-3	27

Doorset description	Seal Combination: Perimeter (head & uprights)	Door bottom	100	125	160	200	250	315	400	500	630	800	1K	1.25	1.6	2K	2.5	3.15	4K	5K	STC	R_w	$C_{t,r}$	$R_w+C_{t,r}$	
Medium Duty systems																									
Single 35mm door (steel frame)	LE1212 Batwing	IS8011si face fixed	19	24	22	26	23	25	24	24	26	27	29	31	34	35	37	38	40	40	30	30	-3	27	AM-12-11-ff
Single 35mm door (steel frame)	IS7025	IS8011si face fixed	19	24	22	26	23	25	24	24	26	27	27	29	31	34	36	39	39	40	29	29	-2	27	AM-25-11-ff
Single 35mm door (steel frame)	IS7110	IS8011si face fixed	19	24	22	26	23	25	24	24	26	27	27	29	31	34	36	39	39	40	29	29	-2	27	AM-110-11-ff
Single 35mm door (steel frame)	IS7080	IS8011si face fixed	20	24	22	26	23	25	24	24	26	26	27	28	32	34	36	38	37	40	29	29	-2	27	AM-80-11-ff
Single 35mm door (steel frame)	LE1212 Batwing	IS8011si semi mortised	19	24	22	26	23	25	24	24	26	27	29	31	34	35	37	38	40	40	30	30	-3	27	AM-12-11-sm
Single 35mm door (steel frame)	IS7025	IS8011si semi mortised	19	24	22	26	23	25	24	24	26	27	27	29	31	34	36	39	39	40	29	29	-2	27	AM-25-11-sm
Single 35mm door (steel frame)	IS7110	IS8011si semi mortised	19	24	22	26	23	25	24	24	26	27	27	29	31	34	36	39	39	40	29	29	-2	27	AM-110-11-sm
Single 35mm door (steel frame)	IS7080	IS8011si semi mortised	20	24	22	26	23	25	24	24	26	26	27	28	32	34	36	38	37	40	29	29	-2	27	AM-80-11-sm
Single 35mm door (steel frame)	LE1212 Batwing	IS8010si fully mortised	18	24	22	26	23	25	24	24	26	26	28	30	32	33	35	36	38	40	29	29	-3	26	AM-12-10
Single 36mm door (steel frame)	IS7025	IS8010si fully mortised	18	24	22	26	23	25	24	24	26	26	28	29	30	33	35	38	38	38	29	29	-2	27	AM-25-10
Single 35mm door (steel frame)	IS7110	IS8010si fully mortised	18	24	22	26	23	25	24	24	26	26	28	29	30	33	35	37	37	38	29	29	-2	27	AM-110-10
Single 35mm door (steel frame)	IS7080	IS8010si fully mortised	19	24	22	26	23	25	24	24	26	25	26	27	30	33	35	37	35	38	29	29	-2	27	AM-80-10
Heavy Duty systems																									
Single 35mm door (steel frame)	LE1515 Batwing	IS8090si face fixed	19	24	22	26	23	25	24	24	26	27	29	31	34	35	37	38	40	40	30	30	-3	27	AH-15-90
Single 35mm door (steel frame)	IS7090si	IS8090si face fixed	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-90-90
Single 35mm door (steel frame)	IS7190si	IS8090si face fixed	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-190-90
Single 35mm door (steel frame)	LE1515 Batwing	IS8090si semi mortised	19	24	22	26	23	25	24	24	26	27	29	31	34	35	37	38	40	40	30	30	-3	27	AH-15-90-sm
Single 35mm door (steel frame)	IS7120	IS8090si face fixed	18	24	22	26	23	25	24	24	26	26	29	31	33	34	37	38	39	37	30	30	-3	27	AH-20-90
Single 35mm door (steel frame)	IS7090si	IS8090si semi mortised	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-90-90-sm
Single 35mm door (steel frame)	IS7190si	IS8090si semi mortised	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-190-90-sm
Single 35mm door (steel frame)	LE1515 Batwing	IS8091si face fixed	19	24	22	26	23	25	24	24	26	27	29	31	34	35	37	38	40	40	30	30	-3	27	AH-15-91
Single 35mm door (steel frame)	IS7090si	IS8091si face fixed	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-90-91
Single 35mm door (steel frame)	IS7190si	IS8091si face fixed	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-190-91
Single 35mm door (steel frame)	LE1515 Batwing	IS8100si fully mortised	18	23	21	25	22	24	23	23	25	26	27	29	32	33	35	36	38	38	29	29	-3	26	AH-15-100
Single 35mm door (steel frame)	IS7090si	IS8100si fully mortised	18	23	21	25	22	24	23	23	25	26	27	28	30	32	35	36	32	34	28	28	-2	26	AH-90-100
Single 35mm door (steel frame)	IS7190si	IS8100si fully mortised	18	23	21	25	22	24	23	23	25	26	27	28	30	32	35	36	32	34	28	28	-2	26	AH-190-100
Single 35mm door (steel frame)	LE1515 Batwing	IS8020si faced fixed	19	24	22	26	23	25	24	24	26	27	29	31	34	35	37	38	40	40	30	30	-3	27	AH-15-20
Single 35mm door (steel frame)	IS7090si	IS8020si faced fixed	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-90-20
Single 35mm door (steel frame)	IS7190si	IS8020si faced fixed	19	24	22	26	23	25	24	24	26	26	28	29	31	34	37	38	34	36	29	29	-2	27	AH-190-20