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Acoustic Opinion

Dincel 110, 155, 200 and 275 mm Wall Systems

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1.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Dincel Construction System to provide Acoustic Opinions on the R_w and $R_w + C_{tr}$ ratings for a range of walls constructed using their DCS 110, 155, 200 and 275 wall system. The objective is to provide acoustical data useful to building designers for inclusion in technical publications.

Scope of Work:

- Review the previous acoustic opinion reports of systems incorporating the test results of the DCS 110, DCS 155 and DCS 200 provided by Dincel
- Model basic wall systems using acoustic modelling software
- Compare the R_w and $R_w + C_{tr}$ predictions with test results
- Provide Acoustic Opinions on the R_w and $R_w + C_{tr}$ ratings for a range of DCS 110, DCS 155 , DCS 200 and DCS 275 systems to meet the Deemed-to-Satisfy Provisions in the BCA
- Prepare an Acoustical Opinion Report.

2.0 PREDICTION OF R_W AND C_{TR}

R_w (weighted sound reduction index) provides an acoustic rating of the sound insulation of walls and partitions due to airborne sound of the human voice. Sound insulation varies with frequency and is dependent on the type of wall construction, however, the R_w provides a convenient method of rating sound insulation using a single number. The higher the R_w rating the better the sound insulation provided by the partition.

C_{tr} is a correction factor to account for the sound insulation performance in the lower frequencies. The C_{tr} factor is added to the R_w rating to get an overall $R_w + C_{tr}$ airborne rating. For masonry walls, the C_{tr} factor is typically between –5 and –3 while for plasterboard walls the factor may often be as low as –12, depending on the construction type.

The Acoustic Opinions expressed in this report are based firstly on calculations made using the Insul software and secondly by comparison with Sound Transmission Loss tests for similar wall constructions. Acoustic opinions are then provided in the light of our general acoustic experience. Factors taken into account in our calculations include: the surface mass of the plasterboard, Young's Modulus, the critical frequency and speed of sound in plasterboard, the effect of air cavities and acoustic insulation between studs.

We are of the opinion that using the Insul software and making corrections based on comparison with test results that our prediction accuracy is in the order of ± 2 dB.

Because of the complexity of such calculations, approved laboratory test results (in accordance with Australian Standard AS1191:2002 and AS/NZS1276.1:1999) are always preferred.

3.0 MATERIALS USED FOR SOUND REDUCTION

3.1 Dincel Wall Systems

The Dincel wall systems in this report have specifications as detailed in Table 1 below:

Table 1 Dincel Wall

Product Name	Thickness (mm)	Bulk Density of Concrete within Dincel framework (kg/m^3)
DCS 110	110	2,350
DCS 155	155	2,350
DCS 200	200	2,350
DCS 275	275	2,350

3.2 Plasterboard

In compiling this schedule of acoustic ratings for various plasterboard constructions Dincel has included common densities of plasterboard provided by a range of suppliers. The minimum densities used in this report is shown in Table 2 below.

Table 2 Plasterboard Densities

Product Name	Thickness (mm)	Bulk Density (kg/m^3)
Standard Plasterboard	10	650
	13	623
Fire Rated Plasterboard	13FR	808
	16	766

* Similar or higher density plasterboard may also be used.

3.3 Insulation

Acoustic insulation specified in this report has bulk densities as follows:

Table 3 Insulation Densities

Product Name	Thickness (mm)	Approx Bulk Density (kg/m^3)
Glasswool (HD)	25	24
Glasswool (LD)	50	11

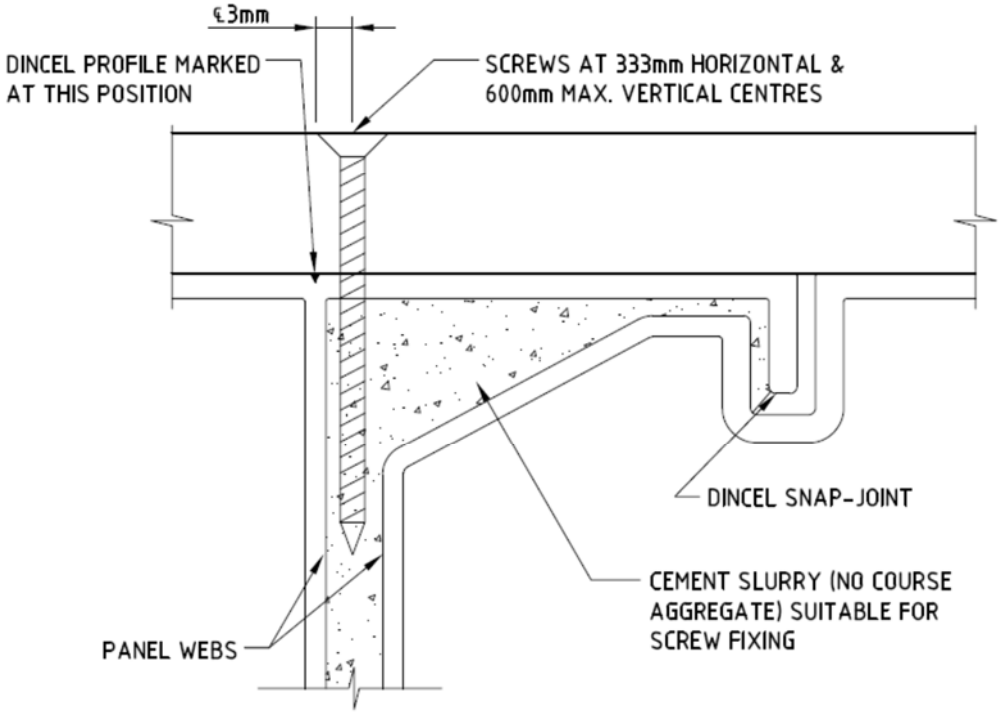
Thicker or higher density of the same bulk insulation may be substituted for wall systems in this report.

3.4 Studs

All systems in this report that detail 51 mm steel studs may be replaced with 64 mm steel studs.

3.5 Direct Fixing to Dincel

Plasterboard can be direct fixed to Dincel either by screwing or a combination of gluing and screwing. The following diagram indicates how conventional screwing can be used with Dincel wall.



DIRECT FIXING DETAIL OF PLASTERBOARD AT EACH FACE OF DINCEL

4.0 BUILDING CODE OF AUSTRALIA – ACOUSTIC REQUIREMENTS

The information in this section is extracted from the Building Code of Australia (BCA), which is now part of the National Construction Code (NCC). Volume One of the NCC contains the acoustic requirements for Class 2, 3 and 9(c) buildings in Part F5 and Volume Two contains the acoustic requirements for Class 1 buildings in Part 3.8.6.2.

The acoustic requirements and the building solutions in this report are based on the Deemed-to-Satisfy Provisions of the BCA.

NCC Volume One – Class 2, 3 and 9(c), Part F5

4.1 FP5.2 Sound transmission through walls – Class 2 and 3

The *Performance Requirements* in FP 5.2 applies to Class 2 or 3 Buildings. It states:

> *Walls separating sole-occupancy units or a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of different classification, must provide insulation against the transmission of -*
>
> *(a) airborne sound; and*
>
> *(b) impact generated sound, if the wall is separating a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit, sufficient to prevent illness or loss of amenity to the occupants.*

4.2 FP5.5 Sound transmission through walls in residential care– Class 9(c)

The *Performance Requirements* in FP 5.5 applies to Class 9(c) Building. It states:

> *Walls separating sole-occupancy units, or a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room, must provide insulation against the transmission of -*
>
> *(a) airborne sound; and*
>
> *(b) impact generated sound, if the wall separates a sole-occupancy unit from a kitchen or laundry, sufficient to prevent illness or loss of amenity to the occupants.*

4.3 F5.5 Sound insulation rating of walls – Class 2, 3 & 9(c)

(a) A wall in a Class 2 or 3 building must -

(i) have an $R_w + C_{tr}$ (airborne) not less than 50, if it separates *sole-occupancy units*; and

(ii) have an R_w (airborne) not less than 50, if it separates *sole-occupancy unit* from a plant room, lift *shaft*, stairway, *public corridor*, public lobby or the like, or parts of a different classification; and

(iii) comply with F5.3(b) if it separates -

(A) a bathroom, *sanitary* compartment, laundry or kitchen in one *sole-occupancy unit* from a *habitable room* (other than a kitchen) in an adjoining unit; or

(B) a *sole-occupancy unit* from a plant room or lift *shaft*.

(b) A door may be incorporated in a wall in a Class 2 or 3 building that separates a *sole-occupancy unit* from a stairway, *public corridor*, public lobby or the like, provided the door assembly has an R_w not less 30.

(c) A wall in a Class 9c *aged care building* must have an Rw not less than 45 if it separates -

(i) sole-occupancy units; or

(ii) a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room.

(d) In addition to (c), a wall separating a *sole-occupancy unit* in a Class 9c *aged care building* from a kitchen or laundry, plant must comply with F5.3(b).

(e) Where a wall *required* to have sound insulation has a floor above, the wall must continue to -

(i) the underside of the floor above; or

(ii) a ceiling that provides the sound insulation *required* for the wall.

(f) Where a wall *required* to have sound insulation has a roof above, the wall must continue to -

(i) the underside of the roof above; or

(ii) a ceiling that provides the sound insulation *required* for the wall.

4.4 F5.3 Determination of impact sound insulation ratings – Class 2, 3 & 9(c)

(b) A wall in a building required to have an impact sound insulation rating must -

(i) for a Class 2 or 3 building be of discontinuous construction; and

(ii) for a Class 9c building, must -

(A) For other than masonry, be two or more separate leaves without rigid mechanical connection except at the periphery; or

(B) Be identical with a prototype that is no less resistant to the transmission of impact sound when tested in accordance with Specification F5.5 than a wall listed in Table 2 of Specification F5.2.

(c) For the purposes of this Part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves and -

(i) for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

(ii) for other than masonry, there is no mechanical linkage between leaves except at the periphery.

NCC Volume Two – Class 1, Part 3.8.6.2

4.5 Part 3.8.6.2 Sound insulation requirements – Class 1

(a) A *separating wall* between Class 1 buildings, or a wall that separates a Class 1 building from a Class 10a building which is not associated with the Class 1 building must -

(i) have an $R_w + C_{tr}$ (airborne) not less than 50; and

(ii) be of *discontinuous construction* if it separates a bathroom, *sanitary compartment*, laundry or kitchen in one Class 1 building from a *habitable room* (other than a kitchen) in an adjoining Class 1 building (see Figure 3.8.6.1).

(b) For the purposes of (a)(ii), *discontinuous construction* means a wall system that has two separate leaves and that is not a staggered stud wall, that complies with the following -

(i) The wall has a minimum 20 mm cavity between leaves;

(ii) For masonry walls, where wall ties are *required* to connect leaves, the ties are of the resilient type;

(iii) For walls other than masonry, there is no mechanical linkage between leaves except at the periphery.

(c) A wall *required* to have sound insulation must continue to -

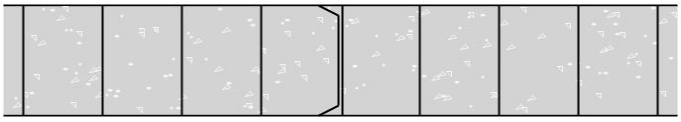
(i) the underside of the roof above; or

(ii) a ceiling that provides the sound insulation *required* for the wall.

5.0 DINCEL WALL SYSTEMS – RECOMMENDED WALL SYSTEMS

Several systems incorporating the Dincel Wall Construction have been acoustically tested. The results from the acoustic tests have been used to predict the acoustic performance of the wall systems in this Section.

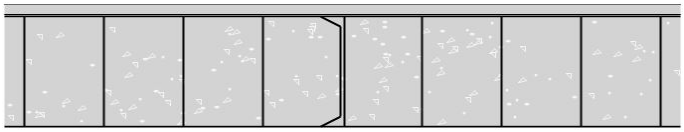
5.1 DIN-IW1



Dincel wall only

Dincel Profile	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	N/A	110	48 (43)
155	N/A	155	51 (45)
200	N/A	200	53 (48)
275	N/A	275	53 (48)[1]

5.2 DIN-IW2

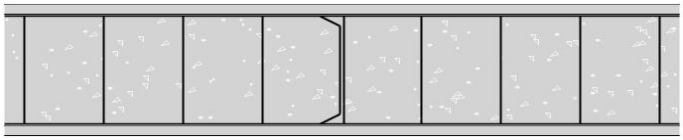


Dincel Wall
Side 1 – plasterboard, direct fix
Side 2 – left bare

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	10	120	45 (41)
155	13	168	50 (45)
200	10	210	51 (46)
275	10	285	51 (46)[1]

[1] *The acoustic rating for 275 mm Dincel is conservatively based upon the acoustic rating for 200 mm Dincel*

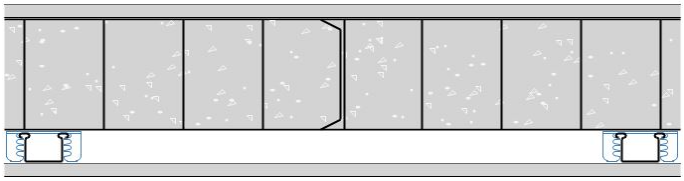
5.3 DIN-IW3



Dincel Wall
Side 1 – plasterboard, direct fix
Side 2 – plasterboard, direct fix

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	10	130	45 (41)
155	13	181	50 (45)
200	10	220	51 (46)
275	10	295	51 (46) [2]

5.4 DIN-IW4

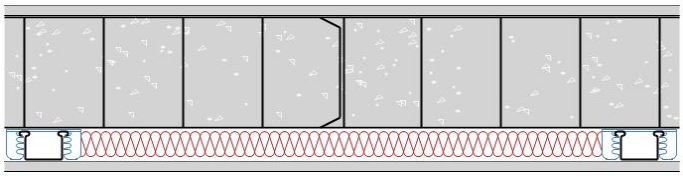


Dincel Wall
Side 1 – plasterboard, direct fix
Side 2 – 28 mm furring channels (600 c/c, 30 mm cavity), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	13	166	45 (42)
155	10	205	48 (43)
200	10	250	53 (46)
275	10	325	53 (46)[2]

[2] *The acoustic rating for 275 mm Dincel is conservatively based upon the acoustic rating for 200 mm Dincel*

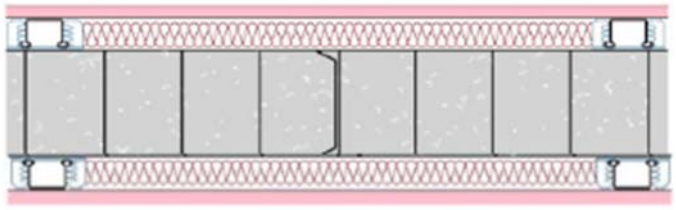
5.5 DIN-IW5



Dincel Wall
Side 1 – plasterboard, direct fix
Side 2 – 28 mm furring channels (600 c/c, 30 mm cavity), 25 mm glasswool (HD), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	10	160	53 (46)
155	10	205	55 (48)
200	10	250	57 (50)
275	10	325	57 (50) [3]

5.6 DIN-IW6

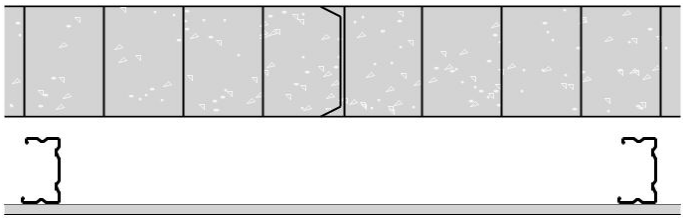


Dincel Wall
Side 1 – 28 mm furring channels (600 c/c, 45 mm cavity), 25 mm glasswool (HD), plasterboard
Side 2 – 28 mm furring channels (600 c/c, 45 mm cavity), 25 mm glasswool (HD), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	16	232	63 (50)
155	13	271	60 (52)
200	13	316	63 (54)
275	13	391	63 (54)[3]

[3] *The acoustic rating for 275 mm Dincel is conservatively based upon the acoustic rating for 200 mm Dincel*

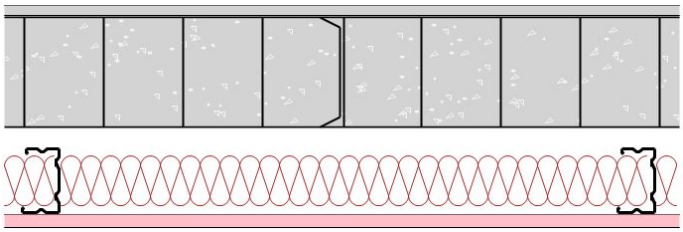
5.7 DIN-IW7



Dincel Wall
Side 1 – left bare
Side 2 – 51 mm steel studs (600 c/c, 71 mm cavity), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	10	191	51 (43)
155	10	236	54 (45)
200	10	281	57 (47)
275	10	356	57 (47) [4]

5.8 DIN-IW8

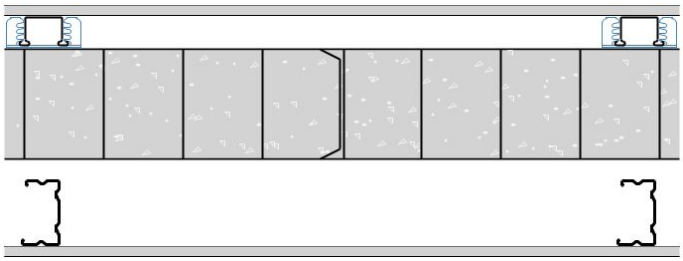


Dincel Wall
Side 1 – plasterboard, direct fix
Side 2 – 51 mm steel studs (600 c/c, 71 mm cavity), 50 mm glasswool (LD), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	13	207	57 (50)
155	13	252	63 (51)
200	10	291	61 (53)
275	10	366	61 (53)[4]

[4] *The acoustic rating for 275 mm Dincel is conservatively based upon the acoustic rating for 200 mm Dincel*

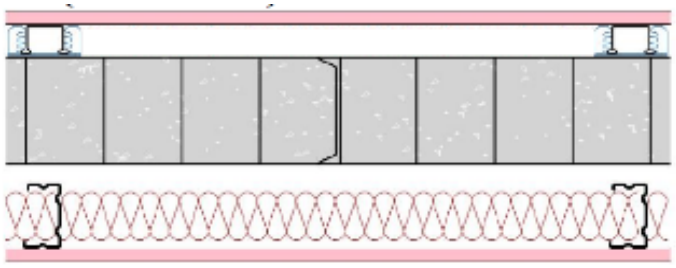
5.9 DIN-IW9



Dincel Wall
Side 1 – 28 mm furring channels (600 c/c, 30 mm cavity), plasterboard
Side 2 – 51 mm steel studs (600 c/c, 71 mm cavity) plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	10	231	47 (41)
155	10	276	51 (43)
200	10	321	55 (46)
275	10	396	55 (46) [5]

5.10 DIN-IW10

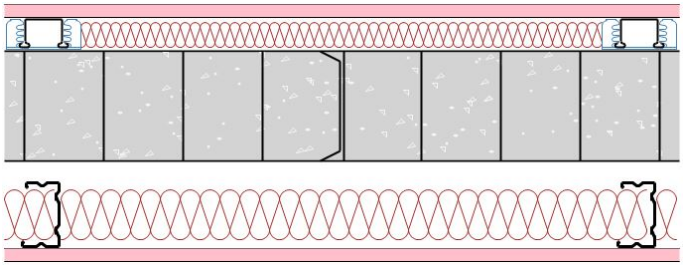


Dincel Wall
Side 1 – 28 mm furring channels (600 c/c, 30 mm cavity), plasterboard
Side 2 – 51 mm steel studs (600 c/c, 71 mm cavity), 50 mm glasswool (LD), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	13	237	57 (50)
155	13	282	63 (51)
200	13	327	61 (53)
275	13	402	61 (53)[5]

[5] *The acoustic rating for 275 mm Dincel is conservatively based upon the acoustic rating for 200 mm Dincel*

5.11 DIN-IW11



Dincel Wall
Side 1 – 28 mm furring channels (600 c/c, 30 mm cavity), 25 mm glasswool (HD), plasterboard
Side 2 – 51 mm steel studs (600 c/c, 71 mm cavity), 50 mm glasswool (LD), plasterboard

Wall Width (mm)	Minimum Plasterboard Thickness (mm)	Total Wall Width (mm)	Acoustic Opinion R_w (R_w + C_{tr})
110	13FR	237	62 (50)
155	13FR	282	67 (52)
200	13FR	327	68 (53)
275	13FR	402	68 (53) [6]

[6] *The acoustic rating for 275 mm Dincel is conservatively based upon the acoustic rating for 200 mm Dincel*

6.0 STATEMENT OF EFFECT

We are confident that provided the walls are built of the materials specified in a workmanlike manner in accordance with the manufacturer's instructions (taking due care to seal all joints and use constructions that will avoid flanking transmission problems), they will provide the sound insulation ratings listed in the Acoustic Opinions section of this report.



Stephen Gauld, BE (Mech), MEngSc (Noise and Vibration), MIEAust, MAAS
Principal Acoustical Engineer
for and on behalf of Day Design Pty Ltd

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