



33-35 Fairlight Street, Fairlight

Acoustic Design Specification

Allen Group Developments

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1 INTRODUCTION

This specification details the projects acoustic performance requirements.

The acoustic performance requirements detailed in this specification are in addition to all other non-acoustic requirements such as structural, fire protection, service requirements and the like.

The acoustic requirements of statutory requirements including the projects approvals, BCA or the like should be achieved. Where the acoustic performance requirements detailed in this specification are greater than the minimum statutory requirements then the nominated performance in this specification should be achieved.

The use of all products on the project should be installed in accordance with the requirements of the manufacturer's specifications.

The alternative use of any acoustic design elements other than those detailed in this specification are required to be approved by the projects acoustic engineer prior to use on the project.

2 INTERNAL ARCHITECTURAL ELEMENTS

All building architectural building elements are required to comply with the minimum statutory requirements including the projects Clients Requirements, Conditions of Consent and Part F5 of the BCA.

Where nominated acoustic performance is greater in this specification the acoustic performance detailed in this specification is to be achieved as a minimum.

2.1 Walls

The requirements of Part F5 of the BCA as to be used as the minimum performance criteria for the project, unless this specification includes a greater performance.

The projects minimum required acoustic performance for wall elements of the project are detailed in the table below.

Table 1 Project Minimum Acoustic Requirements for Walls

Construction Elements	Project Minimum Acoustic Performance	
	Laboratory performance requirements	Verification method*
Walls between residential sole occupancy units	$R_w + C_{tr}$ not < 50	$D_{nT,w} + C_{tr}$ not < 45
Residential walls between a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit and a habitable room (other than a kitchen) in an adjoining unit	$R_w + C_{tr}$ not < 50 And Discontinuous Construction Must have a minimum 20 mm cavity between two separate leaves ¹	$D_{nT,w} + C_{tr}$ not < 45 "Expert Judgment" Comparison to the "Deemed to satisfy" Provisions
Residential walls between sole occupancy units and a plant room or lift shaft	R_w not < 50 and Discontinuous Construction Must have a minimum 20 mm cavity between two separate leaves ¹	$D_{nT,w}$ not < 45
Residential walls between sole occupancy units and a stairway, public corridor, public lobby or the like, or parts of a different classification	R_w not < 50	$D_{nT,w}$ not < 45
Soil, waste, water supply and stormwater pipes and ductwork to residential habitable rooms	$R_w + C_{tr}$ not < 40	n/a
Soil, waste, water supply and stormwater pipes and ductwork to residential wet areas	$R_w + C_{tr}$ not < 25	n/a
Walls separating Unit areas and Basement carpark areas	R_w not < 55	$D_{nT,w}$ not < 50
<p><i>Note 1: A wall must be of "discontinuous construction" if it separates a sole occupancy unit from a plant room or lift shaft. Clause F5.3(c) defines "discontinuous construction" as a wall having a minimum 20 mm cavity between two separate leaves with no mechanical linkage except at the periphery.</i></p> <p><i>Note 2: Masonry walls must be laid with all joints filled solid, including those between the masonry and any adjoining construction</i></p>		

2.1.1 Discontinuous Construction

Where discontinuous construction is required, as detailed in Part F5 of the BCA or this specification, a minimum 20mm gap between two leaves of a wall is required. This may not include the use of impact clips or other vibration isolation without approval by the Acoustic Engineer.

2.1.2 Penetrations and Junctions

All penetrations through acoustic walls or junction of party walls are to be acoustically sealed such that the acoustic performance of the partitions is not compromised.

Where penetrations are required within acoustic walls, they are required to be acoustically treated such that the nominated acoustic performance is not reduced. The acoustic treatments of penetrations is required to be conducted using a flexible acoustic sealant in compliance with manufactures requirements.

All junctions in walls are to be sealed using an appropriate method such that the acoustic performance of walls is not compromised. The treatment of a number of wall junctions includes the following:

1. Plasterboard to plasterboard wall junctions – Junctions can be tapped and set to manufactures requirements.
2. Masonry to Masonry junctions – Junctions can be filled using a mortar or grout or a flexible acoustic sealant to manufactures requirements.
3. Masonry to concrete junctions – junction to the sealed using a flexible acoustic sealant to manufactures and other consultant (including fire) requirements.
4. Masonry to plasterboard junctions – junction to the sealed using a flexible acoustic sealant to manufactures and other consultant (including fire) requirements.
5. Aerated Concrete to concrete junctions – junction to the sealed using a flexible acoustic sealant to manufactures and other consultant (including fire) requirements.
6. Aerated Concrete to masonry junctions – junction to the sealed using a flexible acoustic sealant to manufactures and other consultant (including fire) requirements.

All acoustic sealing of vertical and horizontal junctions are to be conducted using a 10-15mm gap, sealed with a flexible acoustic (and fire where required) sealant. The use of a foam backing rod is acceptable where required. Sealants are to be an approved acoustic sealant (see following section) installed to the manufactures requirements.

All plasterboard to plasterboard junctions can be tapped and set to manufactures requirements.

The use of alternative methods of sealing penetrations or junctions on the project are required to be approved by the acoustic consultant prior to use.

2.2 Floors

The acoustic performance of all floors in the project are required to comply with minimum statutory requirements, including Part F5 of the BCA, as a minimum. In the event the nominated acoustic performance nominated in this specification are greater than the statutory requirements, then the acoustic performance nominated in this specification are to be used as a minimum.

The projects minimum required acoustic performance for floor elements of the project are detailed in the table below, including air born and impact floor performance.

Table 2 Project Minimum Acoustic Requirements for Floors

Construction Elements	Project Minimum Acoustic Performance	
	Laboratory performance requirements	Verification method*
Floors between sole-occupancy units or between a sole-occupancy unit and a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	$R_w + C_{tr}$ not < 50 $L_{n,w}$ not > 62	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w}$ not > 62
Floors of habitable areas of one sole occupancy located above other sole occupancy	$R_w + C_{tr}$ not < 50 $L_{n,w}$ not > 55	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w}$ not > 55
Floors of wet areas of one sole occupancy located above other sole occupancy	$R_w + C_{tr}$ not < 50 $L_{n,w}$ not > 62	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w}$ not > 62
<p><i>Note 1: A wall must be of "discontinuous construction" if it separates a sole occupancy unit from a plant room or lift shaft. Clause F5.3(c) defines "discontinuous construction" as a wall having a minimum 20 mm cavity between two separate leaves with no mechanical linkage except at the periphery.</i></p> <p><i>Note 2: Masonry walls must be laid with all joints filled solid, including those between the masonry and any adjoining construction.</i></p> <p><i>Note 3: Future consideration should be undertaken once future occupancies with the bae building tenancies are known. Assessments to be undertaken by the future operators if required for potentially noisy operations.</i></p>		

The installation of floors on the project should be undertaken such that the minimum acoustic requirements detailed in the table above are not achieved, this includes (but is not limited to) floor junction, set downs, installation of ceilings and the like.

Where the back filling of any floor chasing or penetrations is required, this should be conducted using a suitable non shrink grout, undertaken in compliance with the manufacture's requirements.

2.2.1 Floor Finishes, Junctions and Penetrations

The acoustic treatment of all floor junctions and penetrations is to be undertaken such that the acoustic performance of floors is not compromised. This includes (but is not limited to) the following:

1. Installation of acoustic underlays to manufactures requirements.
2. Treatment of services penetrations using an approved acoustic sealant or fire/acoustic rated collar.
3. Installation of floor finishes to manufactures specifications, and including:
 - a. No filling of gaps between hard floor finishes and surrounding building elements. Junctions can be sealed using a suitable flexible sealant.
 - b. No mechanical fixings through acoustic underlays (unless approved by the acoustic consultant).
 - c. No solid fixings, debris or junctions between skirting boards and acoustically treated floor finishes.
 - d. Prevention of other installations which will result in flanking of acoustic underlays.

2.2.2 Acoustic Underlays

Were acoustic underlays are required to achieve minimum acoustic project performance, these underlays should be installed in compliance with manufactures requirements. Suitable acoustic underlays include 100% rubber underlays to a minimum thickness of 4mm and include:

- a. Acoustic Supplies Vibramat or Vibrapads
- b. Regupol 5512, K225 615, 6010 or the like.
- c. Embelton Impactamat
- d. A1 Rubber Acoustamat
- e. 4mm Damtec Underlays

Alternative products are acceptable providing supporting acoustic technical information confirming compliance with the project requirements can be provided for approval by the acoustic engineer.

2.3 Ceilings

All ceilings are to be selected and installed to comply with the minimum statutory requirements (including Part F5 of the BCA) or the performance requirements detailed in this specification, whichever is greater.

The projects minimum required acoustic performance for ceiling elements of the project are detailed in Table 3 below (including ceiling where services are located within the ceiling cavity). The selection of ceilings for the treatment of services can include any localised treatment to services, such as the lagging of waste pipes within ceiling cavities or the like.

2.3.1 Access Panels

The use of access panels within acoustic ceilings (including ceiling used for the treatment of building services) is to include panels with a minimum performance of that which they are being installed within.

Access panels location within ceiling below building services, waste pipes, storm water pipes, FCU's or the like are to include a minimum acoustic performance of Rw 30.

Any alternative acoustic access panels proposed for the project are to be approved by the acoustic consultant prior to use on the project.

2.3.2 Penetrations and Junctions

All penetrations through acoustic ceilings or junction of ceilings are to be acoustically sealed such that the acoustic performance of the ceiling is not compromised. Where acoustic ceilings include down lights or other fittings these services should be treated using acoustic 'cans', non-gimballed lights or the like.

Where penetrations are required within acoustic ceilings, they are required to be acoustically treated such that the nominated acoustic performance is not reduced. The acoustic treatments of penetrations is required to be conducted using a flexible acoustic sealant in compliance with manufactures requirements.

All junctions in ceilings are to be sealed using an appropriate method such that the acoustic performance of ceiling is not compromised. The treatment of a number of ceiling junctions includes the following:

1. Plasterboard to plasterboard junctions – Junctions can be tapped and set to manufactures requirements.
2. Masonry to plasterboard junctions – junction to the sealed using a flexible acoustic sealant to manufactures and other consultant (including fire) requirements.

Any alternative acoustic treatments to the junctions and penetrations of acoustic ceilings should be approved by the acoustic consultant prior to installation.

2.4 Building Services Acoustic Treatments

The acoustic installation of building services are required to be acoustically treated such that the minimum requirements of Part F5 of the BCA or the nominated performance requirements of this specification are achieved, whichever is greater.

The projects minimum required acoustic treatment of building services in the project are detailed in the table below. The treatment of building services can include a number of elements such as lagging, ceilings, riser construction and the like.

Table 3 Project Minimum Acoustic Building Services Requirements

Construction Elements	Project Minimum Acoustic Performance	
	Laboratory performance requirements	Verification method*
Soil, waste, water supply and stormwater pipes and ductwork to habitable rooms	$R_w + C_{tr}$ not < 40	n/a
Soil, waste, water supply and stormwater pipes and ductwork to kitchens and other rooms	$R_w + C_{tr}$ not < 25	n/a

The installation of building services should be conducted such that the minimum acoustic requirements are not compromised. This includes but is not limited to:

1. Contact of building services installation with wall and ceiling framing.
2. Contact of building services will wall and ceiling linings including furring channels, plasterboard or the like.
3. Acoustic treatment of penetrations and junctions in building service risers with suitable acoustic sealants.
4. Installation of ceiling and risers to manufactures requirements.
5. Suitable selection of building ceilings and risers such that the minimum acoustic requirements detailed above are achieved.
6. The use of access panels within service risers should be located within wet areas of apartments only and not located within risers facing habitable areas.

2.4.1 Resiliently Suspended or Isolated Ceilings

Where/if resiliently suspended or isolated ceilings are required a suitable acoustic isolation is required to be used. Suitable acoustic isolation to ceilings include:

1. Embelton LB, LBS, LHB, CB, UB or spring isolation hangers.

The use of alternative ceiling isolation hangers is to be approved by the acoustic engineer prior to use on the project.

2.5 Doors

Doors on the project are required to be installed in compliance with the minimum requirements of Part F5 of the BCA or this specification, whichever is higher.

Minimum acoustic requirements of doors for the project are detailed in the table below.

Table 4 Minimum Project Acoustic Requirements for Doors

Construction Elements	Project Minimum Acoustic Performance	
	Laboratory performance requirements	Verification method*
Door assemblies located in a wall between a sole-occupancy unit and a stairway, public corridor, public lobby or the like	R_w not < 30	$D_{nT,w}$ not < 25
Intra-tenancy Walls	There is no statutory requirement for airborne isolation via intra-tenancy walls.	
<i>Note 1: Clause FP5.3(b) in the 2016 BCA states that the required insulation of a floor or wall must not be compromised by a door assembly.</i>		

Where interconnecting doors are required, the acoustic performance nominated above is required to be achieved between the two sole occupancies and can include the overall performance of a double door.

The installation of doors should be undertaken in accordance with manufactures requirements and such that the acoustic requirements of the project are not compromised, including but not limited to:

1. Selection of suitable door and door hardware to achieve acoustic requirements.
2. Installation of doors and door seals to manufactures requirements.
3. Ensuring doors are not warped or have uneven surface/edge finishes.
4. Insulation of doors with minimum gaps and undercuts.
5. Installation of thresholds to doors with drop seals such that there is a flat even surface. Where drop seals are required to doors with areas including a carpet finish a aluminium or timber threshold located below the door is required to be installed.
6. Adjustment of seals such that there is a positive interaction with the adjoining surface finish.
7. Where double meeting style doors are to be used a rebate or angle is required to be include at the middle style such that a positive seal can be achieved. Where an acoustic performance is required to double meeting style doors, once leave of the door is required to include a latch such that one leave of the door can be fixed in place when not in use.



2.6 Acoustic Sealants

The use of acoustic sealants to all penetrations and wall junctions is to be conducted using an approved flexible sealant, to manufactures requirements. Suitable acoustic sealants include 100% polyurethane sealants (or equivalent). Suitable acoustic sealants include:

1. Selleys Proseries Fireblock
2. Bostick Fireban 1.
3. Bostick seal'n'flex (not fire rated)
4. CSR FireSeal
5. CSR Gyprock Fire Mastic

The use of alternative acoustic sealants is required to be approved by the acoustic engineer prior to use on the project.

3 MECHANICAL SERVICES

This section of the specification details the minimum acoustic requirements for the installation and operation of mechanical equipment associated with the project. The requirements of all other building requirements are to be achieved, including but not limited to structural, fire and architectural elements.

All mechanical services are to be installed in compliance with the requirements of the projects statutory requirements including the Conditions of Consent. Where there are multiple performance requirements detailed in this specification, Conditions of Consent or statutory standards the more stringent requirements are required to be complied with.

Where the acoustic requirements detailed in this specification exceed acoustic requirements detailed in other project documentation (such as architectural, structural or services specifications) then the requirements detailed in this specification are required to be achieved.

3.1 Project Internal Noise Levels

This section of the specification details the required internal noise levels which are required to be complied with as a result of the operation of mechanical services associated with the project. Unless otherwise stated noise levels are to be achieved with all plant and equipment operational at normal maximum operational capacities of the equipment.

Maximum internal noise level of areas within the project, which are not detailed in the table below, are required to comply with the maximum recommended noise levels detailed within the Australian and New Zealand Standard 2107:2000 'Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors'.

Internal noise levels detailed in the table below are required to be achieved, including accumulative noise levels from the operation of all equipment and including regenerated air noise from ductwork, air grills, diffusers, louvers and the like.

Table 5 Project Mechanical Services Internal Noise Level Requirements

Internal Area	Internal Noise Level Criteria dB(A)
Bedrooms and Sleeping Areas	35 from Air Conditioning equipment and toilet exhaust fans on timers. 30 from all other equipment
Living rooms, studies and all other habitable areas other than bedrooms	40 from Air Conditioning equipment and toilet exhaust fans on timers. 35 from all other equipment
Kitchens	45
Bathrooms and Laundries	45
Car Parks	65
Internal Lift Lobbies, Public Corridors and Public areas	45
Basement service areas including garbage rooms, store rooms and the like.	65
Fire Control Room	65 with all emergency equipment operational
<i>Note 1: Note: Internal noise levels during a fire emergency are required to comply with the requirements of the Australian and New Zealand Standard AS1668.</i>	

3.2 Project External Noise Levels

Noise levels generated from the operation of all plant and equipment on the site, including accumulative noise levels, are required to comply with the following:

1. Noise levels detailed in the projects conditions of consent.
2. Statutory Requirements.
3. Background Noise Levels + 5 dB(A) Leq (15min) at external open areas within the project including facades with open windows, gardens, pools, balconies, terraces and the like.



3.3 Compliance Testing

Prior to Occupational Certification and/or Practical Completion and after commissioning of all mechanical equipment the sub-contractor is responsible to ensure compliance testing of the operational plant and equipment is undertaken.

Compliance testing is required to be conducted, including the following:

1. All plant and equipment operational at maximum normal operation capacities.
2. Compliance testing to be undertaken using a Type 2 Noise Level Meter as defined in the Australian and New Zealand standard 1259.2-1990 '*Acoustics – Sound Level Meters – Integrity – Averaging*'.
3. The method used for testing should be in compliance with the requirement of the Australian and New Zealand standard 2107:2000 '*Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*'.
4. Suitable locations to ensure compliance at the potentially worst case internal and external locations within the project.
5. Suitable locations at external boundaries or affected neighbouring receivers as required to comply with the projects Conditions of Consent.
6. Noise levels should be undertaken within internal rooms at a location at least 1.5m from grills, registers or louvers or at a location where a user could be affected from the noise resulting from the operation of the mechanical services equipment.
7. Where internal spaces are can be separated by internal doors the following conditions should be used:
 - a. Wet area, bathrooms, laundries, storerooms, plantrooms or service room doors are to be closed.
 - b. Internal unit doors separating habitable areas are to be open (such as bedroom, study, living area, playroom doors).
8. Internal noise levels to be tested with all external openable windows closed.
9. The sub-contractor is required to provide the results of testing prior to certification of the building mechanical services including details of locations tested and measured internal noise levels.

In the event testing reveals internal or external noise levels which are not compliant with the required noise levels rectification works are required to be undertaken and retesting undertaken until compliance with the projects required noise levels are achieved.

3.4 Plant Vibrations

The installation of plant and equipment is required to be undertaken such that following is achieved:

1. Structure borne vibration – Noise generated from structure borne vibration is required to be treated such that the internal noise levels as detailed in Table 5 above are complied with.
2. Tactile Vibration – Tactile vibration levels within the project are required to comply with the requirements of the Australian and New Zealand standard AS2670.2-1990 '*Evaluation of Human Exposure to Whole-Body Vibration – Continuous and Shock-Inducted Vibration in Buildings (1 to 80 Hz)*'. For locations where a range or different curves are recommended the more stringent requirements of the standard are required to be achieved.

3.5 Subcontractor Requirements

It is the responsibility of the sub-contractor to ensure all noise levels detailed in this specification and all statutory requirements for internal and external noise level are achieved.

Recommended operational conditions of mechanical services are included in the following sections.

3.5.1 Regenerated Air Noise from Distribution Systems

Regenerated air noise from disruption systems is required to comply with the projects acoustic requirements. Selection of the relevant air registers is to be undertaken by the relevant mechanical services design engineers and or contractor.

Regenerated air noise from distribution systems can be minimised using the following:

1. Selection of ductwork sizes and configuration to reduce air velocities where possible. The selection of all distribution systems is required to be undertaken such that regenerated noise levels comply with project criteria based on manufactures specifications.
2. All air registers including grills, diffusers louvers, silencers dampers and the like are selected using manufactures specifications and compliant with project requirements.
3. Installation of turning veins where required.
4. Installation of flexible ductwork without kinks or restrictions in open area. Flexible ductwork should be selected such that air velocities do not exceed the following:
 - a. For 30 dB(A) - <2.4m/s
 - b. For 35 dB(A) - <2.8m/s
 - c. For 40 dB(A) - <3.3m/s
 - d. For 45 dB(A) - <4.0m/s
5. Installation of damper or balancing systems such that regenerated air noise are complied with. Alternatively, air balancing equipment is to be located with sufficient internally lined ductwork to treat regenerated air noise. Where required external wrapping of air distribution systems with loaded vinyl may be required.
6. All ductwork should be installed without open junctions or penetrations which may result in 'whistling' from air leaking from the distribution system.
7. All plenums and 'boots' behind intake or exhaust air grills are to be selected such that there is an even flow of air across the grills. Boots behind intake and exhaust air grills should be internally lined with a minimum of 18mm insulation.

3.5.2 Duct Penetrations

The penetration of mechanical services ductwork within acoustic walls is required to be undertaken such that the performance of the partition which is being penetrated achieves project requirement.

Recommended mechanical services treatments within acoustic wall elements is detailed in the table below.

Table 6 Mechanical Duct Penetration Treatments in Acoustic Partitions

Duct Type	Partition Type	Acoustic Treatment
Flexible Ductwork	Partitions up to R_w 45	600mm metal sleeve around acoustic flexible ductwork. Metal sleeve sealed to partition using flexible acoustic sealant.
	Partitions up to R_w 45	Install ductwork with a 10-15mm gap to partition sealed using a flexible acoustic sealant Seal using a suitable fire rated damper
Metal Ductwork	Partitions R 45 – 60	Install ductwork with a 10-15mm gap to partition sealed using a flexible acoustic sealant and minimum 2mm metal angle. For gaps greater than 15 an acoustic insulation is required to be installed between the ductwork and the partition. Seal using a suitable fire rated damper including a metal angle.

Note 1: Where metal angles are required the angles should be installed to the metal ductwork and sealed to the partition using a flexible acoustic sealant, such that there is not a direct connection between the partition and the metal ductwork.

3.6 Vibration Isolation

All mechanical plant and equipment (and associated services) are required to be vibration isolated from the building structure to prevent both structure borne vibration and tactile vibration such that project required noise and vibration criteria is achieved.

To ensure project noise and vibration criteria is achieved the following is recommended:

1. All plant and equipment to be vibration isolated using suitable mounts including floor mounts, vibration hangers and lateral isolation mounts as required.
2. All plant and equipment to suitably balanced such that excessive vibration is not generated.
3. Isolation of all associated connections to plant and equipment including ductwork, pipework and the like.
4. Installation of flexible connections to equipment, to manufactures specifications. Flexible connections are required to all mechanical fans, FCU's AHU's and the like. Any associated ductwork which is not separated from vibration generating equipment is required to be vibration isolated from the building.
5. Vibration isolation to be selected based on weights and operating conditions based on the manufactures specifications and isolation being used. Recommended vibration isolation suppliers include:
 - a. Embelton type mounts.
 - b. Mason type mounts.
 - c. All vibration isolation to be installed in accordance with the manufacture's specifications.
6. The selection of suitable vibration isolation is the responsibility of the mechanical services contractor.
7. The selection of suitable vibration isolation mounts are recommended in the table below.

Table 7 Recommended Vibration Isolation

Equipment Type	Vibration Isolation Type	Recommended Minimum Static Deflection
Water Pumps	Spring Isolation with inertia plinths	25mm
Condenser Units	Neoprene mounts	2mm
FCU's	Neoprene mounts	2mm
AHU's	Spring isolation to fans within AHU's	10mm
Chillers	Spring Isolation	25mm
Pipe work associated with chillers, within 25m from chillers	Spring Isolation	15mm
Cooling Towers	3 layers of neoprene pads with sheet metal spacers	8mm
Pipe work associated with cooling tower, within 25m from cooling tower	Spring Isolation	10mm
Small inline and axial fans	Spring Isolation	10mm
Large inline and axial fans	Spring Isolation	25mm
Heat Exchangers	20mm acoustic underlay below concrete plinths	2mm
Gas generators	Spring Isolation	25mm
Back up power generators	Spring Isolation	25mm
Associated pipework and ductwork to generators	Spring Isolation	15mm

Note 1: Fixing of all equipment to the building structure should be undertaken such that bridging of the vibration isolation does not occur. This should include the use of rubber gromets or the like to mechanical fixings.

3.6.1 Installation of Vibration Isolation

The installation of all vibration isolation is required to be undertaken in compliance with manufactures specifications.

Selection of vibration isolation is required to be undertaken based on the maximum normal operation of equipment and loads based on the equipment in operation.

Installation of the equipment and mounts should be undertaken such that there is no bridging of mounts including:

1. Correct installation of hanging rods within isolation mount housings.
2. Removal of all debris below equipment and inertia plinths.
3. No connection of pipes or other associated equipment bridging equipment to surrounding structure.
4. Even distribution of loads through mounts, where more than 1 mount is used to isolated equipment.
5. Installation of lateral mounts when required.



3.6.2 Acoustic Silencers and Ductwork

When required acoustic treatments including silencers and lined ductwork may be required to mechanical equipment. Where this is required all silencers and ductwork is required to be installed to manufactures requirements.

Insulation used on lined ductwork and silencers is required to include minimum 32kg/m³ density.

When protection of insulation is required this should be undertaken using a 30% open area sheet metal or foil.

Silencers should be constructed from 1.5mm thick metal, including a construction to prevent deformation or movement in the silencer as a result of installation or operational capacities. Recommended silencer manufactures include the following:

1. Fantech
2. Noise Control Australia
3. Kavanagh Industries
4. NAP Silentflow

Where treatment to acoustic lining is required for moisture or oil protection a Melinex lining can be used, however acoustic treatment are to be selected to ensure noise level criteria is achieved including the reduction in absorptive performance as a result of the protective lining.

3.6.3 Start Up, VSD, Controllers

The operation al all Start up, VSD and other controllers associated with the operation of the building are required to comply with the noise level criteria detailed in this specification. Where noise from equipment includes annoying, tonal or cyclic characteristic a penalty of 5 dB(A) should be applied for each characteristic.

Where possible all start up, VSD and controller equipment (or the like) should be located on walls which are not adjacent to an occupied space. Where this can not be avoided equipment should be isolated from the building structure using a suitable isolation, such as a 10mm vibration pad, with rubber grommets.

3.7 Selection of Equipment and Systems

The selection of all mechanical plant and equipment including the associated systems and acoustic treatments is required to be conducted such that the project acoustic performance requirements are achieved.

4 HYDRAULIC SERVICES

This section of the specification details the minimum acoustic requirements for the installation and operation of hydraulic service associated with the project. The requirements of all other building requirements are to be achieved, including but not limited to structural, fire and architectural elements.

All hydraulic services are to be installed in compliance with the requirements of the projects statutory requirements including the Conditions of Consent. Where there are multiple performance requirements detailed in this specification, Conditions of Consent or statutory standards the more stringent requirements are required to be complied with.

Where the acoustic requirements detailed in this specification exceed acoustic requirements detailed in other project documentation (such as architectural, structural or services specifications) then the requirements detailed in this specification are required to be achieved.

4.1 Project Internal Noise Levels

This section of the specification details the required internal noise levels which are required to be complied with as a result of the operation of hydraulic services associated with the project. Unless otherwise stated noise levels are to be achieved with all services operational at normal maximum operational capacities of the equipment.

Maximum internal noise level of areas within the project, which are not detailed in the table below, are required to comply with the maximum recommended noise levels detailed within the Australian and New Zealand Standard 2107:2000 'Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors'.

Internal noise levels detailed in the table below are required to be achieved, including accumulative noise levels from the operation of all services.

Table 8 Project Hydraulic Services Internal Noise Level Requirements

Internal Area	Internal Noise Level Criteria dB(A)
Bedrooms and Sleeping Areas	30
Living rooms, studies and all other habitable areas other than bedrooms	30
Kitchens	45
Bathrooms and Laundries	45
Car Parks	65
Internal Lift Lobbies, Public Corridors and Public areas	45
Basement service areas including garbage rooms.	65
Fire Control Room	65 with all emergency equipment operational
<i>Note 1: Note: Internal noise levels during a fire emergency are required to comply with the requirements of the Australian and New Zealand Standard AS1668.</i>	



4.2 Project External Noise Levels

Noise levels generated from the operation of all plant and equipment on the site, including accumulative noise levels, are required to comply with the following:

4. Noise levels detailed in the projects conditions of consent.
5. Statutory Requirements.
6. Background Noise Levels + 5 dB(A) Leq (15min) at external open areas within the project including facades with open windows, gardens, pools, balconies, terraces and the like.

4.3 Compliance Testing

Prior to Occupational Certification and/or Practical Completion and after commissioning of all mechanical equipment the sub-contractor is responsible to ensure compliance testing of the operational plant and equipment is undertaken.

Compliance testing is required to be conducted, including the following:

1. Period when hydraulic services, including waste discharge, are being undertaken and hydraulic plant and equipment is operating under normal conditions.
2. Compliance testing to be undertaken using a Type 2 Noise Level Meter as defined in the Australian and New Zealand standard 1259.2-1990 '*Acoustics – Sound Level Meters – Integrity – Averaging*'.
3. The method used for testing should be in compliance with the requirement of the Australian and New Zealand standard 2107:2000 '*Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*'.
4. Suitable locations to ensure compliance at the potentially worst case internal and external locations within the project.
5. Suitable locations at external boundaries or affected neighbouring receivers as required to comply with the projects Conditions of Consent.
6. Noise levels should be undertaken within internal rooms at a location at least 1.5m from grills, registers or louvers or at a location where a user could be affected from the noise resulting from the operation of the mechanical services equipment.
7. Where internal spaces are can be separated by internal doors the following conditions should be used:
 - a. Wet area, bathrooms, laundries, storerooms, plantrooms or service room doors are to be closed.
 - b. Internal unit doors separating habitable areas are to be open (such as bedroom, study, living area, playroom doors).
8. Internal noise levels to be tested with all external openable windows closed.
9. The sub-contractor is required to provide the results of testing prior to certification of the building mechanical services including details of locations tested and measured internal noise levels.

In the event testing reveals internal or external noise levels which are not compliant with the required noise levels rectification works are required to be undertaken and retesting undertaken until compliance with the projects required noise levels are achieved.



4.4 Plant Vibrations

The installation of plant and equipment is required to be undertaken such that following is achieved:

1. Structure borne vibration – Noise generated from structure borne vibration is required to be treated such that the internal noise levels as detailed in Table 8 above are complied with.
2. Tactile Vibration – Tactile vibration levels within the project are required to comply with the requirements of the Australian and New Zealand standard AS2670.2-1990 'Evaluation of Human Exposure to Whole-Body Vibration – Continuous and Shock-Inducted Vibration in Buildings (1 to 80 Hz)'. For locations where a range or different curves are recommended the more stringent requirements of the standard are required to be achieved.

4.5 Subcontractor Requirements

It is the responsibility of the sub-contractor to ensure all noise levels detailed in this specification and all statutory requirements for internal and external noise level are achieved.

Recommended operational conditions of mechanical services are included in the following sections.

4.5.1 Noise from Hydraulic Systems

Noise from hydraulic systems is required to comply with the projects acoustic requirements.

Recommended methods for the reduction of noise from hydraulic systems include the following:

1. Selection of pipework sizes and configuration to reduce velocities where possible.
2. Layout pipe work to minimise turns and bends, where possible provide bends which the greatest radius diameter as possible.
3. Select pipes with a velocity of water including the following:
 - a. For 30 dB(A) - <1.0m/s
 - b. For 35 dB(A) - <1.5m/s
 - c. For 40 dB(A) - <1.8m/s
 - d. For 45 dB(A) – <2.0m/s
4. Install piping in location which are not noise sensitive when possible.
5. Installation of all waste and storm water piping without connection or contact to building elements including wall or ceilings or associated structure/framing.
6. Installation of pipes which do not run along the head of walls. Where possible hydraulic penetrations should be installed at 90o to acoustic partitions.

4.5.2 Pipe Penetrations

The penetration of hydraulic services pipework within acoustic walls is required to be undertaken such that the performance of the partition which is being penetrated achieves project requirement.

Recommended hydraulic services treatments within acoustic wall elements is detailed in the table below.

Table 9 Hydraulic Pipe Penetration Treatments in Acoustic Partitions

Duct Type	Partition Type	Acoustic Treatment
Pipe work	Partitions up to Rw 45	<p>Install pipe work with a 10-15mm gap to partition sealed using a flexible acoustic sealant</p> <p>Seal using a suitable fire rated damper</p>
	Partitions Rw 45 – 60	<p>Install pipework with a 10-15mm gap to partition sealed using a flexible acoustic sealant. For gaps greater than 15 an acoustic insulation is required to be installed between the ductwork and the partition.</p> <p>Seal using a suitable fire rated damper including a metal angle.</p>

4.6 Vibration Isolation

All hydraulic plant and equipment (and associated services) are required to be vibration isolated from the building structure to prevent both structure borne vibration and tactile vibration such that project required noise and vibration criteria is achieved.

To ensure project noise and vibration criteria is achieved the following is recommended:

1. All plant and equipment to be vibration isolated using suitable mounts including floor mounts, vibration hangers and lateral isolation mounts as required.
2. All plant and equipment to suitably balanced such that excessive vibration is not generated.
3. Isolation of all associated connections to plant and equipment including ductwork, pipework and the like.
4. Installation of flexible pipe connections to equipment, to manufactures specifications.
5. Vibration isolation to be selected based on weights and operating conditions based on the manufactures specifications and isolation being used. Recommended vibration isolation suppliers include:
 - a. Embelton type mounts.
 - b. Mason type mounts.
 - c. All vibration isolation to be installed in accordance with the manufactures specifications.

Table 10 Recommended Vibration Isolation

Equipment Type	Vibration Isolation Type	Recommended Minimum Static Deflection
Water Pumps	Spring Isolation with inertia plinths	25mm
Condenser Units	Neoprene mounts	2mm
FCU's	Neoprene mounts	2mm
AHU's	Spring isolation to fans within AHU's	10mm
Chillers	Spring Isolation	25mm
Pipe work associated with chillers, within 25m from chillers	Spring Isolation	15mm
Cooling Towers	3 layers of neoprene pads with sheet metal spacers	8mm
Pipe work associated with cooling tower, within 25m from cooling tower	Spring Isolation	10mm
Small inline and axial fans	Spring Isolation	10mm
Large inline and axial fans	Spring Isolation	25mm
Heat Exchangers	20mm acoustic underlay below concrete plinths	2mm
Gas generators	Spring Isolation	25mm
Back up power generators	Spring Isolation	25mm
Associated pipework and ductwork to generators	Spring Isolation	15mm

Note 1: Fixing of all equipment to the building structure should be undertaken such that bridging of the vibration isolation does not occur. This should include the use of rubber gromets or the like to mechanical fixings.

4.6.1 Installation of Vibration Isolation

The installation of all vibration isolation is required to be undertaken in compliance with manufactures specifications. Selection of vibration isolation is required to be undertaken based on the maximum normal operation of equipment and loads based on the equipment in operation.

Installation of the equipment and mounts should be undertaken such that there is no bridging of mounts including:

1. Correct installation of hanging rods within isolation mount housings.
2. Removal of all debris below equipment and inertia plinths.
3. No connection of pipes or other associated equipment bridging equipment to surrounding structure.
4. Even distribution of loads through mounts, where more than 1 mount is used to isolated equipment.
5. Installation of lateral mounts when required.

4.6.2 Acoustic Treatment of Waste and Stormwater Pipes

Waste and storm water pipes are required to be acoustically treated to comply with the minimum acoustic requirements detailed in this specification.

The minimum required acoustic treatments to waste and storm water pipes is detailed in table below.

Table 11 Minimum Acoustic Treatment of Waste and Stormwater Pipes

Equipment Type	Location	Minimum Acoustic Treatment
Waste and Stormwater Pipes in risers	Riser adjacent Habitable Areas	$R_w + Ctr 40$ – See constructions included in details in Appendix B
	Riser adjacent Wet Areas	$R_w + Ctr 25$ – See constructions included in details in Appendix B
Waste and Stormwater Pipes in Ceiling Cavities	Ceilings above habitable areas	Acoustically wrap using a 4kg/m ² loaded vinyl, 25mm thick open cell foam and a band of insulation in the ceiling below pipe work.
	Ceilings above wet areas	Acoustically wrap using a 4kg/m ² loaded vinyl, 25mm thick open cell foam.
	Basement and common areas	Nil
Waste and Stormwater Pipes in Wall Cavities	Wall cavities of Residential Dwellings	Acoustically wrap using a 4kg/m ² loaded vinyl, 25mm thick open cell foam and a band of insulation in the wall cavity to a minimum of 600mm from the pipe.
	Basement and common areas	Nil

Note 1: Supply pipes including cold and hot water to units are not required to be acoustically treated.



When lagging is required this should be undertaken using 4kg/m² loaded vinyl with 25mm open cell foam. Suitable lagging includes:

1. Acoustic Supplies – Vibralag
2. Soundlag – 4525C
3. Alternatives to be approved by the acoustic consultant prior to installation on the site.

The installation of the logging should be undertaken with no pen junction, elbows or the like. All junctions should be overlapped by 10mm and tapped air tight with an aluminium tape.

Lagging is required to all main pipe runs and should be conducted for a minimum of 1m from the main pipe to vent pipes.

Where pipes abut penetrations using fire collars lagging can be stopped short by approximately 15mm as required to fire collar specifications.

There should be no contact between the external lagging of pipes and surrounding building elements including wall or ceilings or associated framing.

4.6.3 Start Up, VSD, Controllers

The operation of all Start up, VSD and other controllers associated with the operation of the building are required to comply with the noise level criteria detailed in this specification. Where noise from equipment includes annoying, tonal or cyclic characteristic a penalty of 5 dB(A) should be applied for each characteristic.

Where possible all start up, VSD and controller equipment (or the like) should be located on walls which are not adjacent to an occupied space. Where this can not be avoided equipment should be isolated from the building structure using a suitable isolation, such as a 10mm vibration pad, with rubber grommets.



5 ELECTRICAL SERVICES

All electrical services are required to be selected to ensure compliance with the relevant noise and vibration criteria detailed in this specification.

The installation of electrical services should be undertaken such that the acoustic performance of other building elements are not reduced. The installation of electrical services are to include the following:

1. Sealing of all penetrations within acoustic elements using a flexible acoustic sealant. Penetrations are to not to include bunched cables. Where required bunches of cables are to be installed with flat with not more than a depth of 3 cables, with the overall penetration sealed with a flexible sealant.
2. Install suitable fire rated boxes to GPO's and fittings where required.
3. Install acoustic 'cans' above gimbaled down lights within acoustic ceilings.
4. Where grouting or significant penetrations are required in floor slabs for electrical services, approval from the acoustic engineer is required prior to being undertaken on the site.
5. Alternative treatment are required to be approved by the acoustic consultant prior to installation on the site.

6 LIFT SERVICES

Lift services are required to be installed with the following acoustic performances:

1. All equipment to be vibration isolated from the building structure such that a noise level of 30dB(A) or greater is not measurable within any occupied area.
2. Noise levels within lift cars is not to exceed 55 dB(A).
3. All lift shafts adjacent to residential units are to include discontinuous construction, defined as a 20mm gap between two leaves of a wall as required by Part F5 of the BCA.

7 CARPARK LIFT, ACCESS AND ENTRY DOORS

All motorised carpark access doors are required to be vibration isolated from the building structure such that internal noise levels within any habitable areas does not exceed 30 dB(A). Where possible roller doors should include panel lift or sliding doors.

Where access doors are fixed to the building structure the access door frame should be vibration isolated from the building structure using Embelton NRD type mounts or similar. The doors mechanical motor should be supported off the isolated door frame.

Any horizontal mounts should be vibration isolated using Embelton Supershearflex and fixed using rubber gromets with no bridging contact between fixings and building structure.

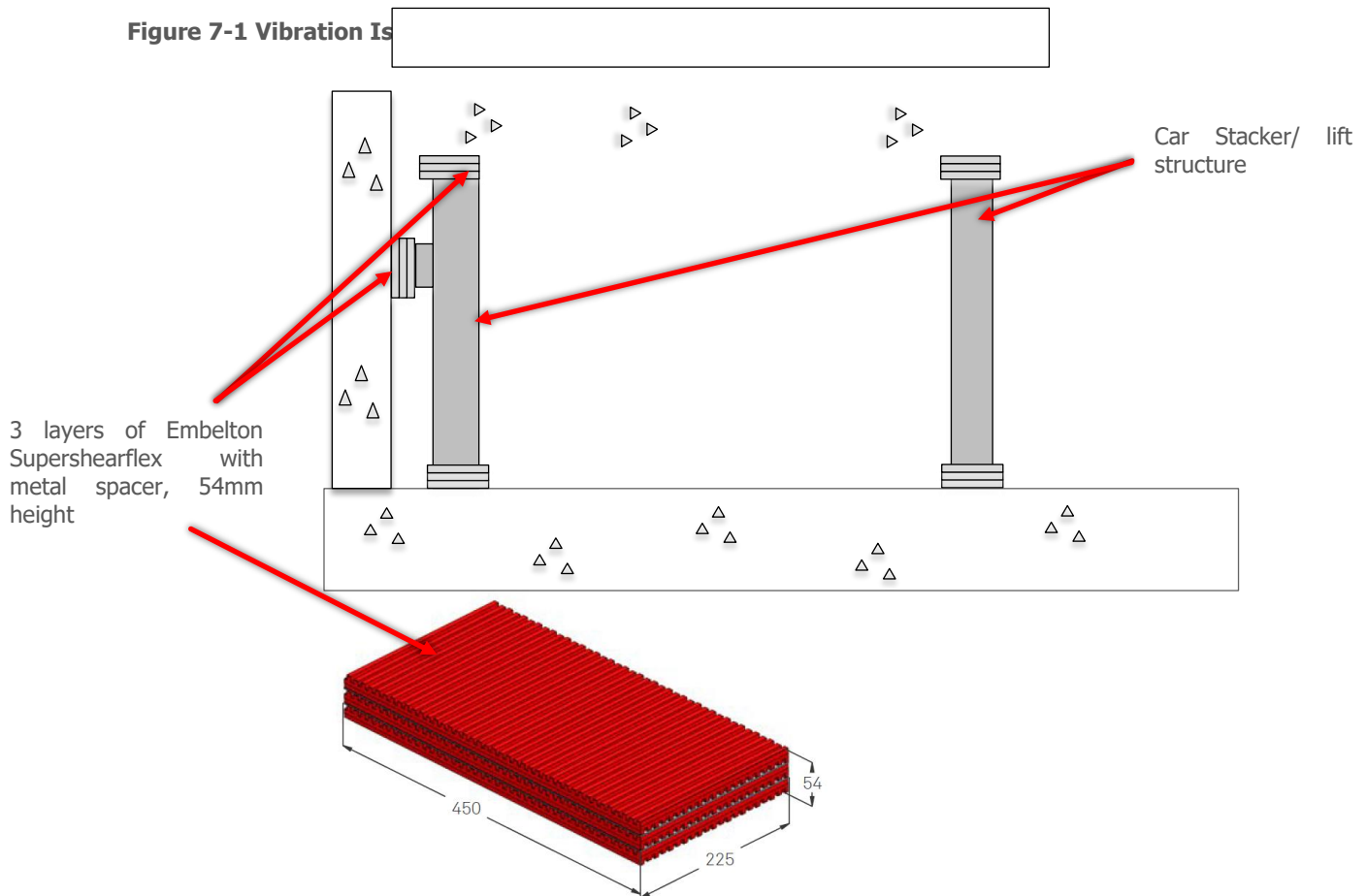
Proposed installation to be approved by the acoustic consultant prior to installation.

Car lift is required to be vibration isolated from the building structure, including details below:

1. Operation of the proposed car lift is to include smooth starting, stopping and transitions without abrupt stop starting or metal on metal contact during operation.
2. Vibration isolation – The junction of the car lift to the building structure, including the top, side and supports.

Isolation mounts should include a material similar to 3 layers of Embelton supershearflex pads, similar to those detailed in the figure below.

Figure 7-1 Vibration Is



8 GARBAGE CHUTES, REFUSE ROOM AND COMPACTORS

The installation of all garbage chutes are required to be vibration isolated at all junctions to the building structure. All junction of the garbage chute to the building are to be vibration isolated using mounts similar to Embelton NR type isolators with a static deflection of no less than 10mm.

Mounts to be correctly selected based on the weights and layouts of the garbage chute by the garbage chute provider and or installer.

The installation of any garbage compactors (or other similar equipment) within the refuse room are required to be vibration isolated from the building structure. All equipment including then compactors are to be isolated from the building using suitable vibration isolation such as Embleton NRD type mounts or equivalent to all fixing locations.

9 EXTERNAL FAÇADE

The external façade elements of the building are required to be installed such that the internal noise levels of the following:

1. Projects Conditions of Consent.
2. The Australian Standard AS2107:2016.

The required internal noise levels to be achieved within the future areas of the project, with the all openable façade elements closed, are detailed in the table below.

Table 12 Project Internal Environmental Noise Levels

Internal Area	Maximum Noise Level dB(A)
Bedrooms and Sleeping Areas	35 dB(A) LAeq (9 hour) (10pm-7am)
Living rooms, studies and all other habitable areas other than bedrooms	45 dB(A) LAeq (15 hour) (7am -10pm)
Kitchens	45 dB(A) LAeq (24 hours)
Bathrooms and Laundries	50 dB(A) LAeq (24 hours)
Internal Lift Lobbies, Public Corridors and Public areas	50 dB(A) LAeq (24 hours)

9.1 External Façade Elements

This section of the specification detailed the required acoustic performance of the external façade. The requirements detailed in this specification are to be used as a minimum and may be exceeded by other requirements of the project including (but not limited to) Structural and thermal requirements.

External façade elements are required to be installed such that the minimum acoustic performance requirements are achieved:

1. Solid façade elements minimum Rw 45.
 - a. The proposed masonry and concrete wall elements do not require additional acoustic treatments.
 - b. Any lightweight external wall elements to be selected to achieve a minimum of Rw 45.
2. Glazing elements – Details of required glazing constructions and performance are detailed in the table. The minimum acoustic performance of the installed façade systems are required to achieved the acoustic performance requirements detailed in the table below.

Table 13 Project External Glass Façade Elements Minimum Acoustic Performance

Orientation	Levels	Room Type	Typal Glass Type options	Minimum Acoustic Performance
All Orientations	All Levels	Bedrooms	6.38mm Laminated	Rw 30
		Living Rooms	6.38mm Laminated	Rw 30
		Wet Areas	6mm Float/Toughened	Rw 28
		Common Areas	6.38mm Laminated	Rw 30

The installation of the external façade, including but not limited to the glass, mullions, seals, junctions and the like should be undertaken such that the total performance of the façade system is not less than the acoustic requirements detailed in the table above.

The façade/glass contractor and/or supplier is required to provide acoustic certification of the proposed systems to be installed, including results of acoustic testing of the proposed façade systems undertaken in a suitably approved laboratory. The test data and/or certification provided should include that the overall system will be compliant with the minimum project acoustic requirements.

Any junction or penetrations in the external façade should be acoustically treated such that the acoustic performance of the façade is not compromised.



10 APPENDIX A – GLOSSARY OF TERMS

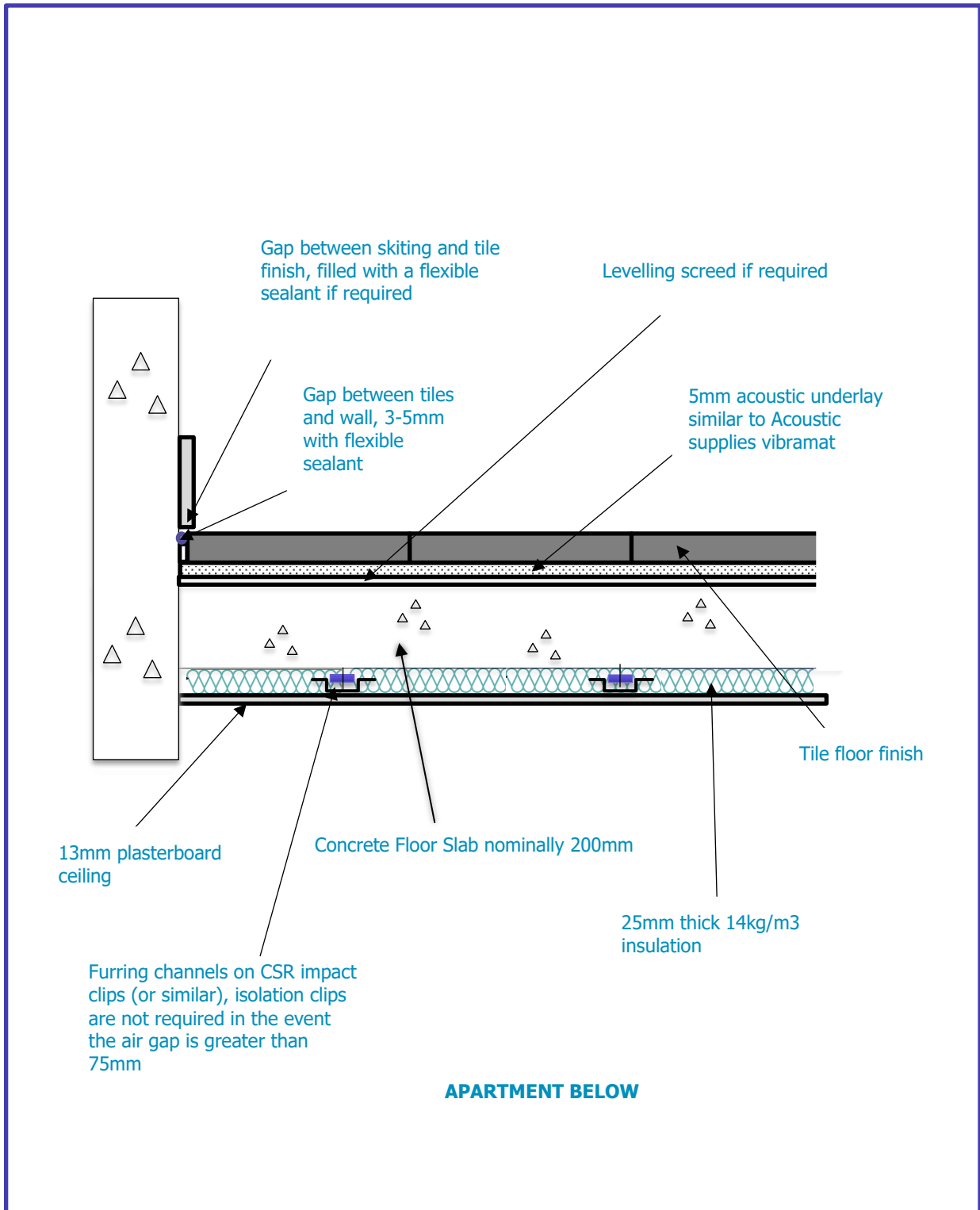
<i>Ambient Sound</i>	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.																				
<i>Audible Range</i>	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.																				
<i>Character, acoustic</i>	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.																				
<i>Decibel [dB]</i>	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; <table style="margin-left: 40px;"> <tr> <td>0dB</td> <td>the faintest sound we can hear</td> </tr> <tr> <td>30dB</td> <td>a quiet library or in a quiet location in the country</td> </tr> <tr> <td>45dB</td> <td>typical office space. Ambience in the city at night</td> </tr> <tr> <td>60dB</td> <td>Martin Place at lunch time</td> </tr> <tr> <td>70dB</td> <td>the sound of a car passing on the street</td> </tr> <tr> <td>80dB</td> <td>loud music played at home</td> </tr> <tr> <td>90dB</td> <td>the sound of a truck passing on the street</td> </tr> <tr> <td>100dB</td> <td>the sound of a rock band</td> </tr> <tr> <td>115dB</td> <td>limit of sound permitted in industry</td> </tr> <tr> <td>120dB</td> <td>deafening</td> </tr> </table>	0dB	the faintest sound we can hear	30dB	a quiet library or in a quiet location in the country	45dB	typical office space. Ambience in the city at night	60dB	Martin Place at lunch time	70dB	the sound of a car passing on the street	80dB	loud music played at home	90dB	the sound of a truck passing on the street	100dB	the sound of a rock band	115dB	limit of sound permitted in industry	120dB	deafening
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<i>dB(A)</i>	<i>A-weighted decibels</i> The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.																				
<i>Frequency</i>	Frequency is synonymous to <i>pitch</i> . Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.																				
<i>Loudness</i>	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on																				
<i>L_{Max}</i>	The maximum sound pressure level measured over a given period.																				
<i>L_{Min}</i>	The minimum sound pressure level measured over a given period.																				
<i>L₁</i>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.																				
<i>L₁₀</i>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.																				
<i>L₉₀</i>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).																				
<i>L_{eq}</i>	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.																				
<i>Background Sound Low</i>	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L _{A90} value																				



<i>Ctr</i>	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
<i>dB (A)</i>	'A' Weighted overall sound pressure level
<i>Noise Reduction</i>	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
<i>NR Noise Rating</i>	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the "A" weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
<i>R_w</i>	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for <i>R_w</i> are defined in ISO 140-2:1991 "Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data".
<i>R'_w</i>	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
<i>Sound Isolation</i>	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition
<i>Sound Pressure Level, L_p dB</i>	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
<i>Sound Power Level, L_w dB</i>	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
<i>Speech Privacy</i>	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
<i>Transmission Loss</i>	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.



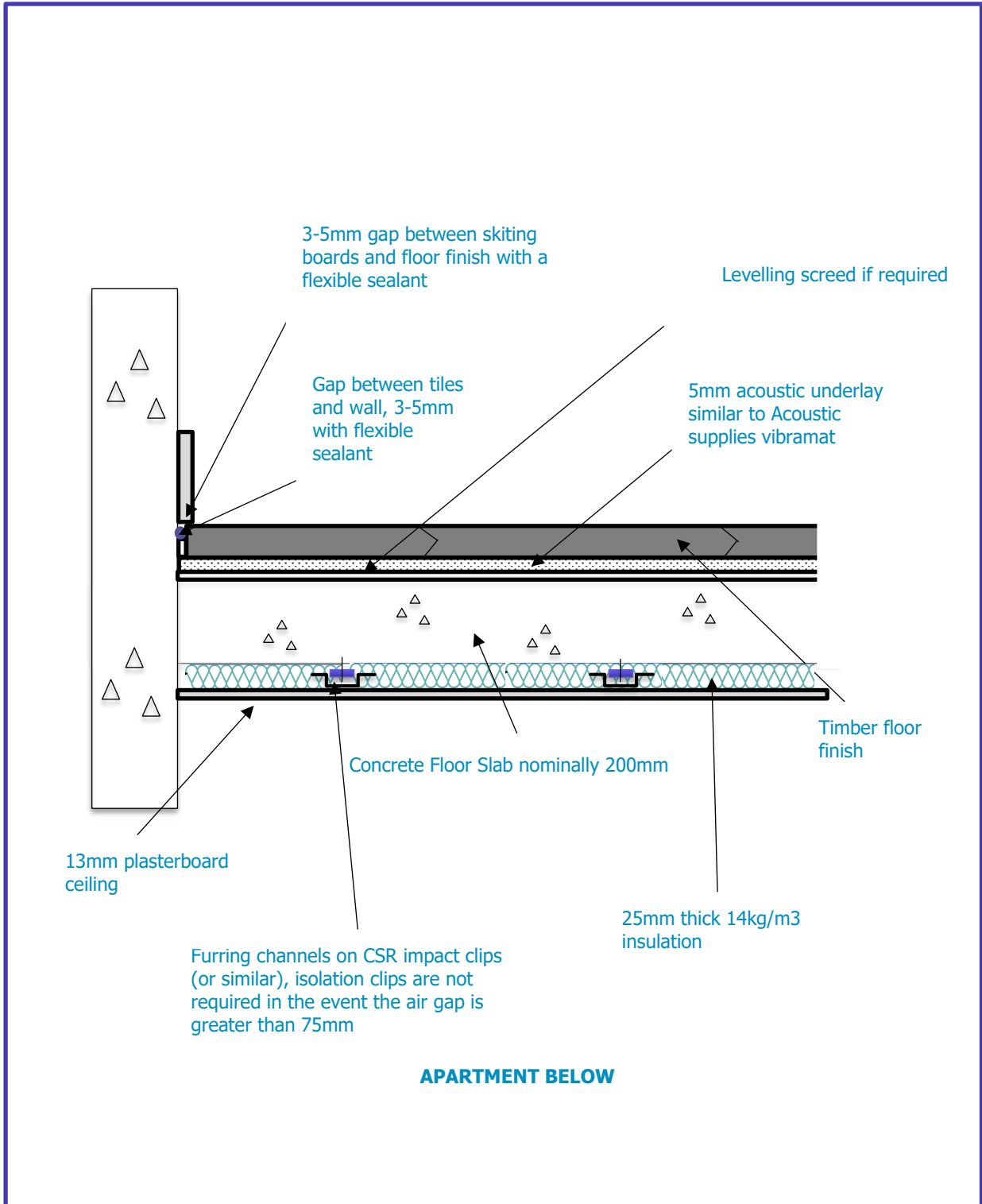
11 APPENDIX B – ACOUSTIC DETAILS



Tiled Hard Floor Finished
 within Habitable and Balconies
 above another Unit Acoustic
 Treatment
 Lntw < 55



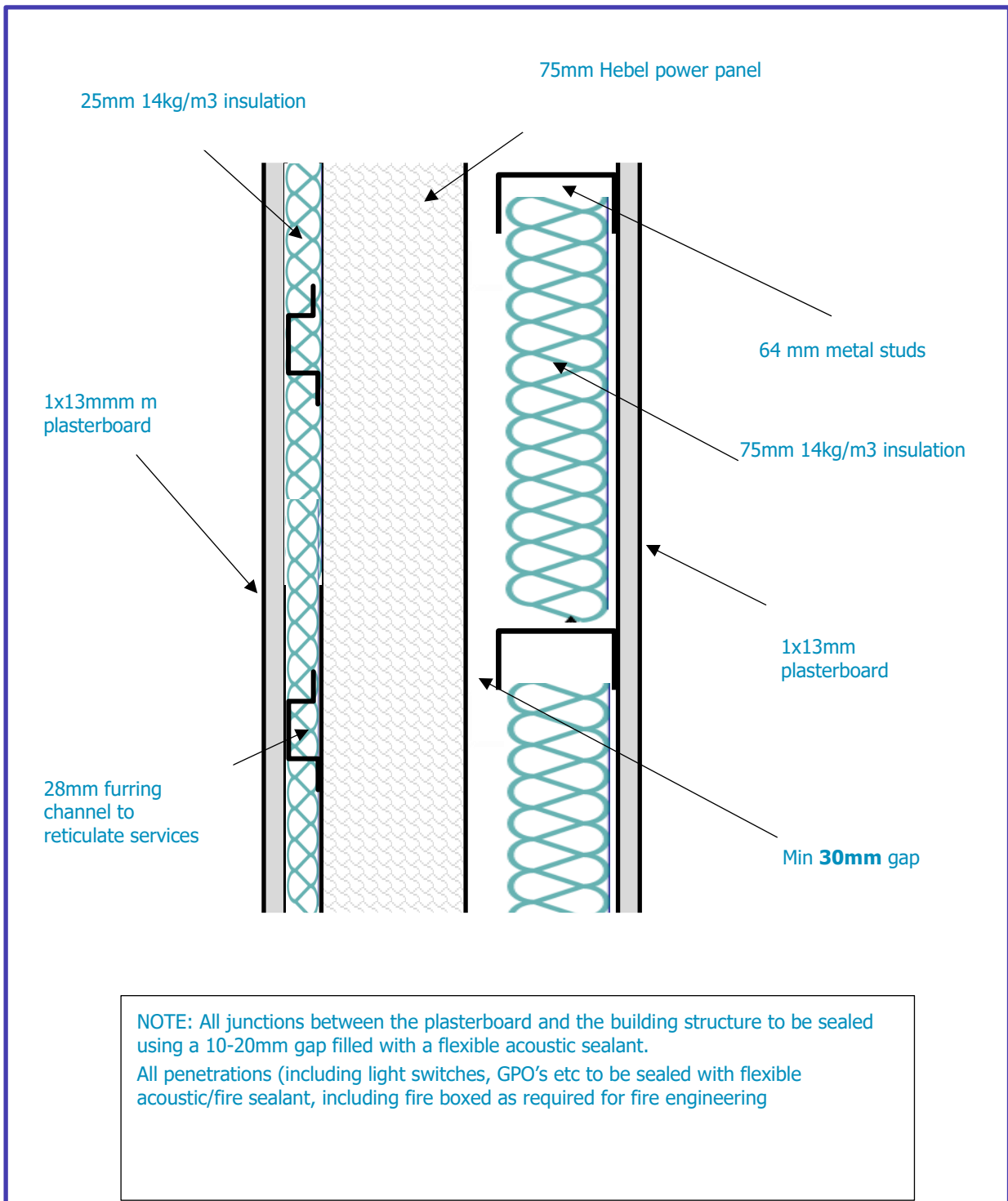
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Timber Hard Floor Finished within Habitable areas
Acoustic Treatment
Lntw < 55



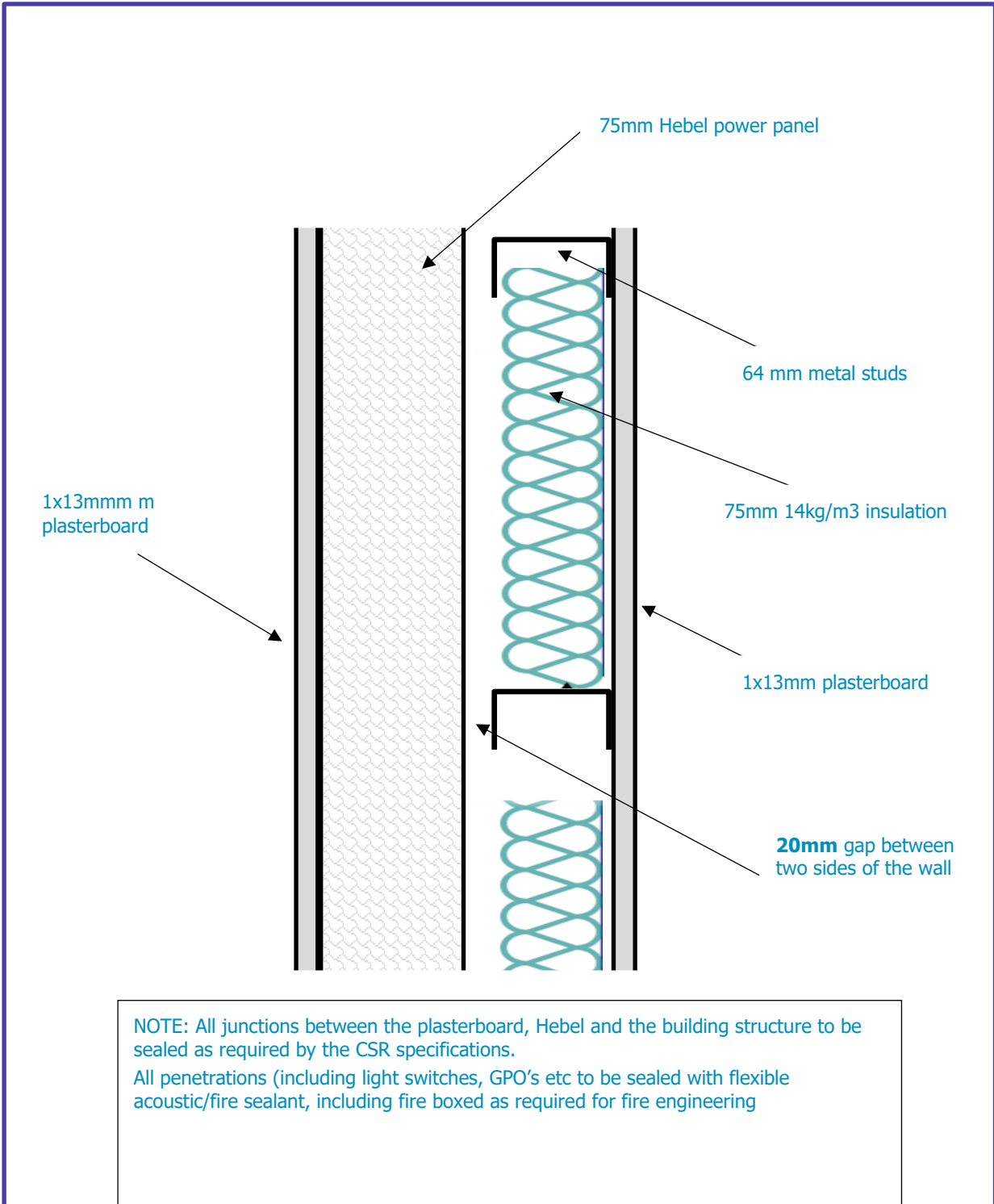
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Party Wall Construction
 Separating Units Rw + Ctr 50
 With Discontinuous
 Construction



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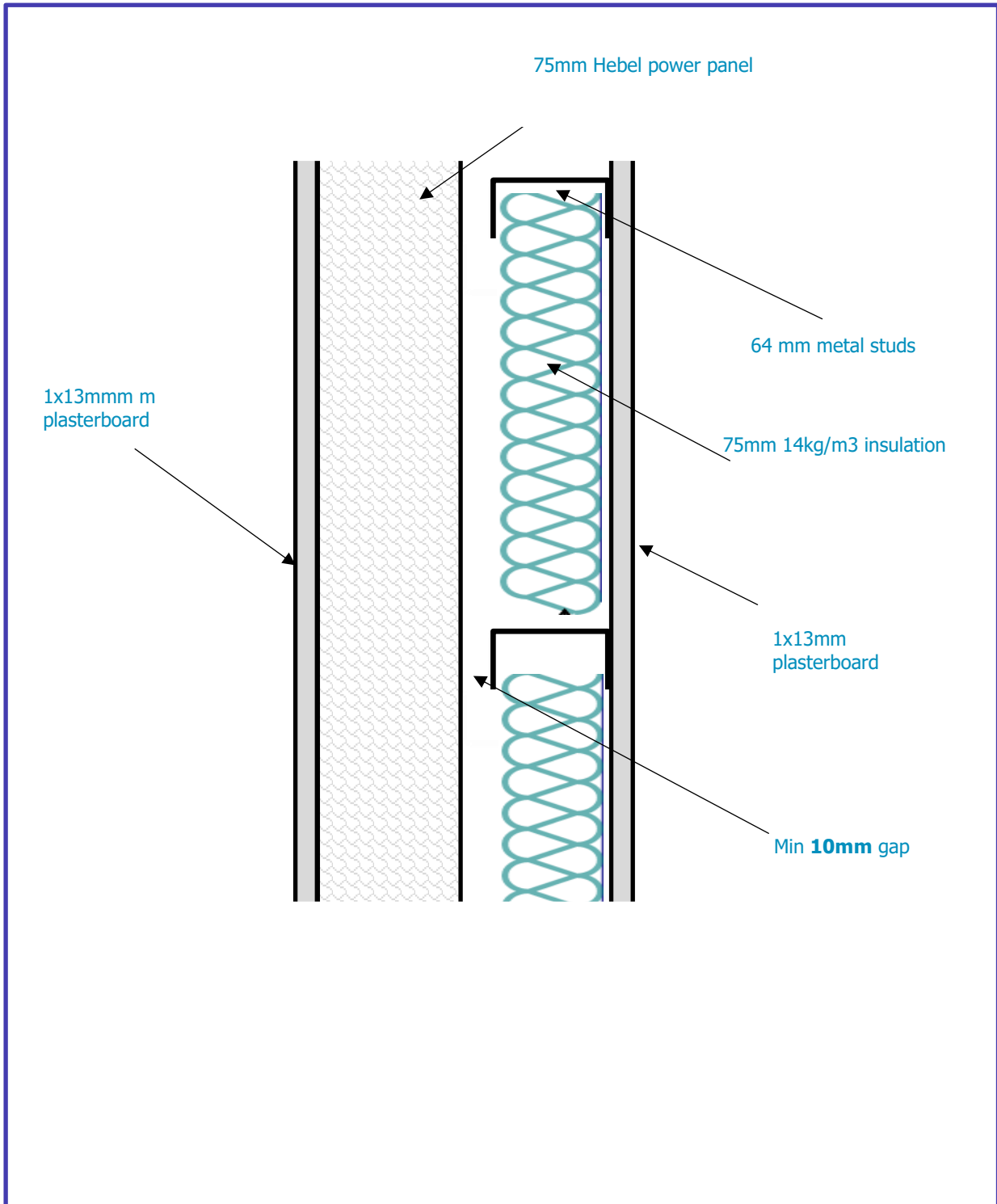
Party Wall Construction
 Separating Units Rw + Ctr 50
 With Discontinuous
 Construction
 Option 2



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Corridor Wall Construction Rw 50



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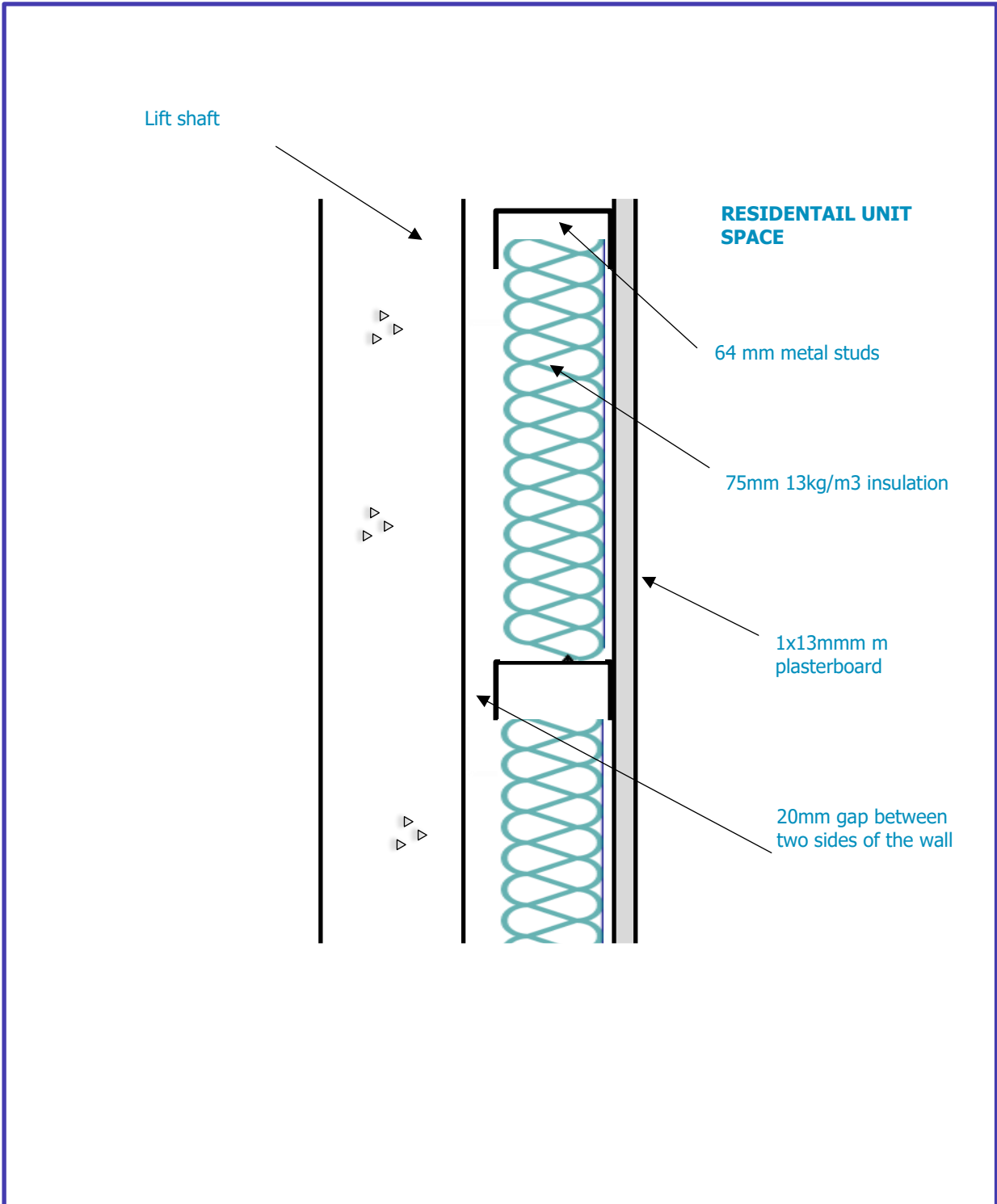
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Lift Shaft Wall Construction With Discontinuous Construction



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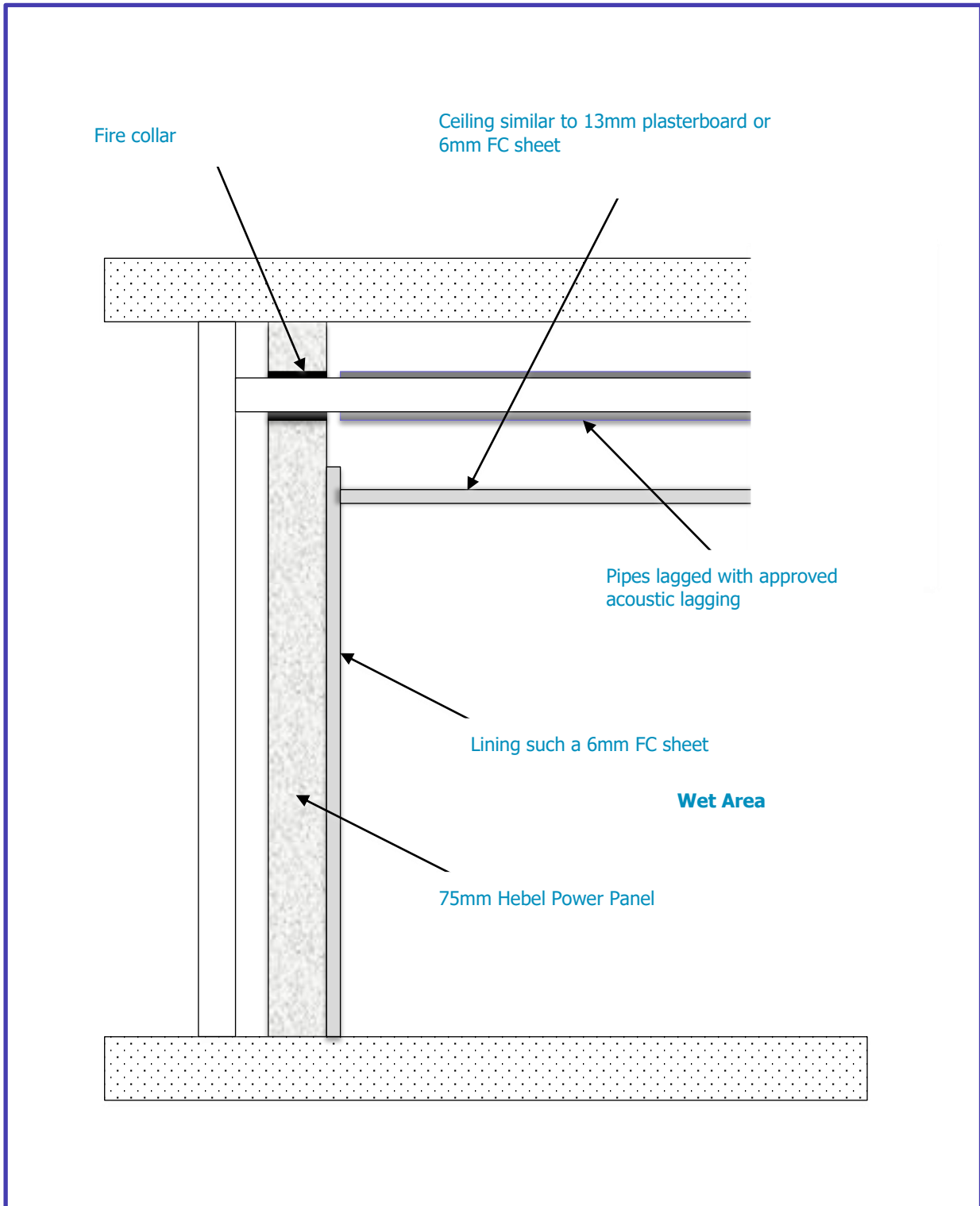
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Drawn: BW

210180

WNA006



Riser Adjacent Wet Areas
Rw +Ctr 25
Option 1



Project:

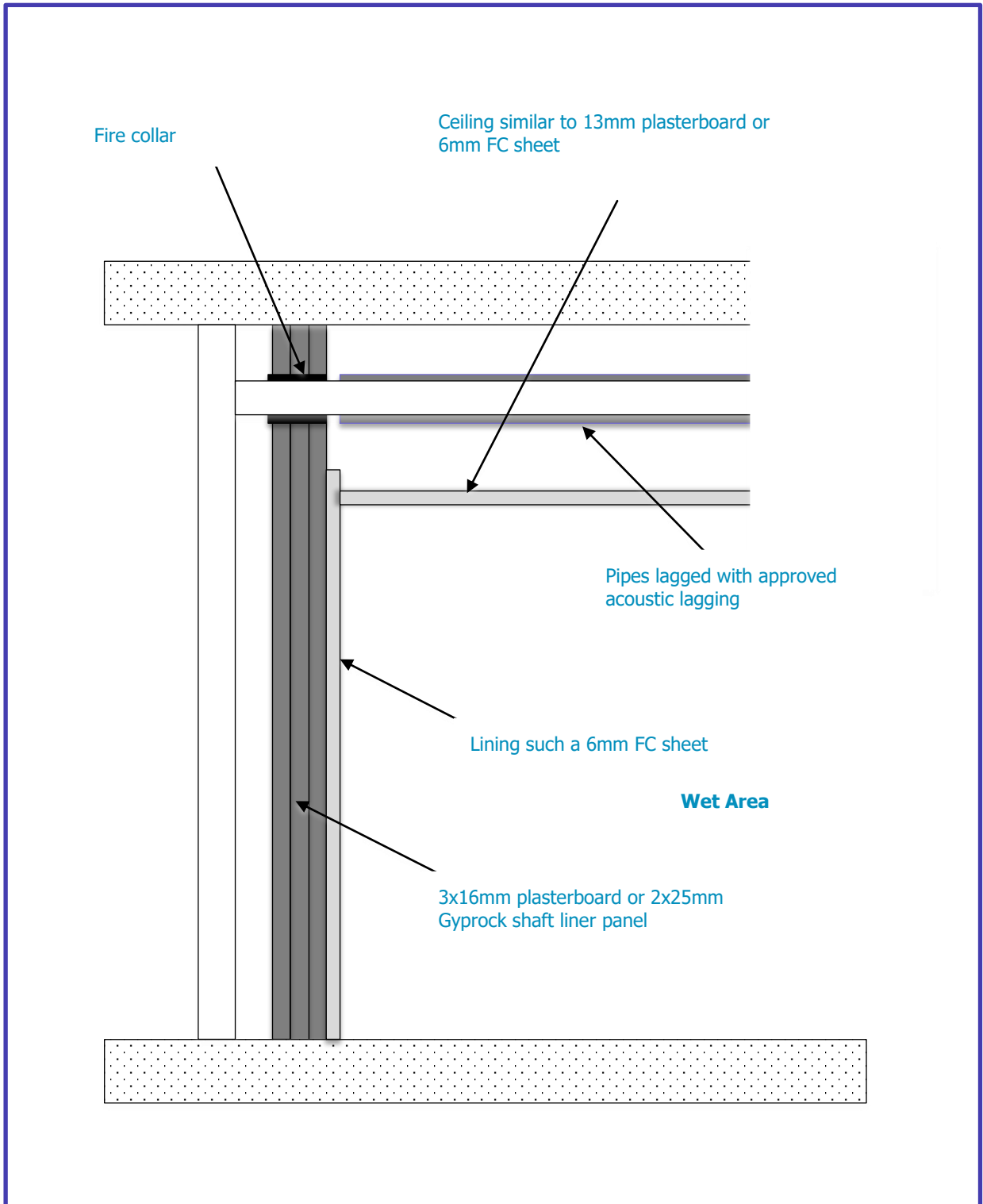
210436

Drawing Number

WNA007

Date: May 2021

Drawn: BW



Riser Adjacent Wet Areas
Rw +Ctr 25
Option 2



Project:

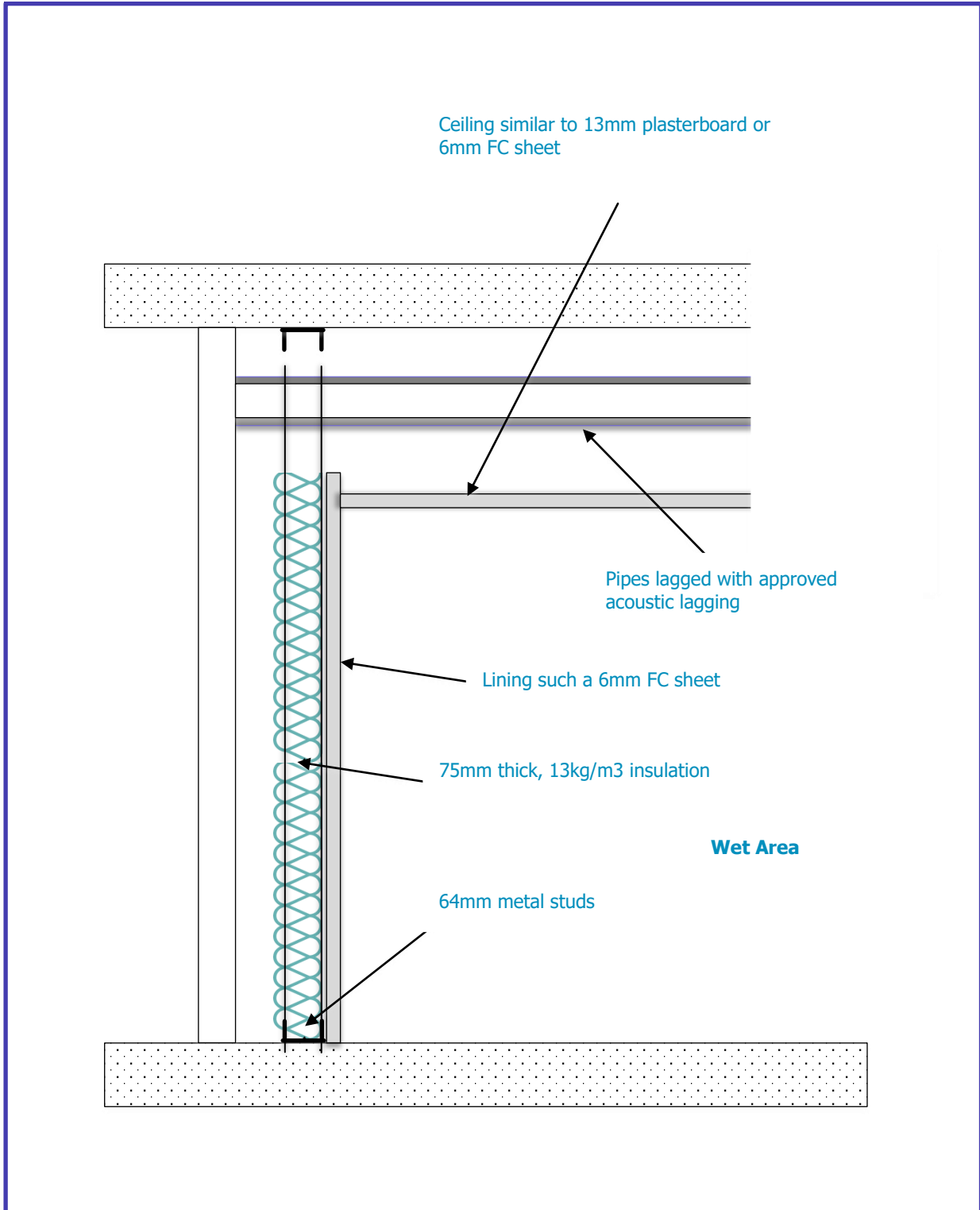
210436

Drawing Number

WNA010

Date: May 2021

Drawn: BW



Riser Adjacent Wet Areas
Rw +Ctr 25
Option 3



Project:

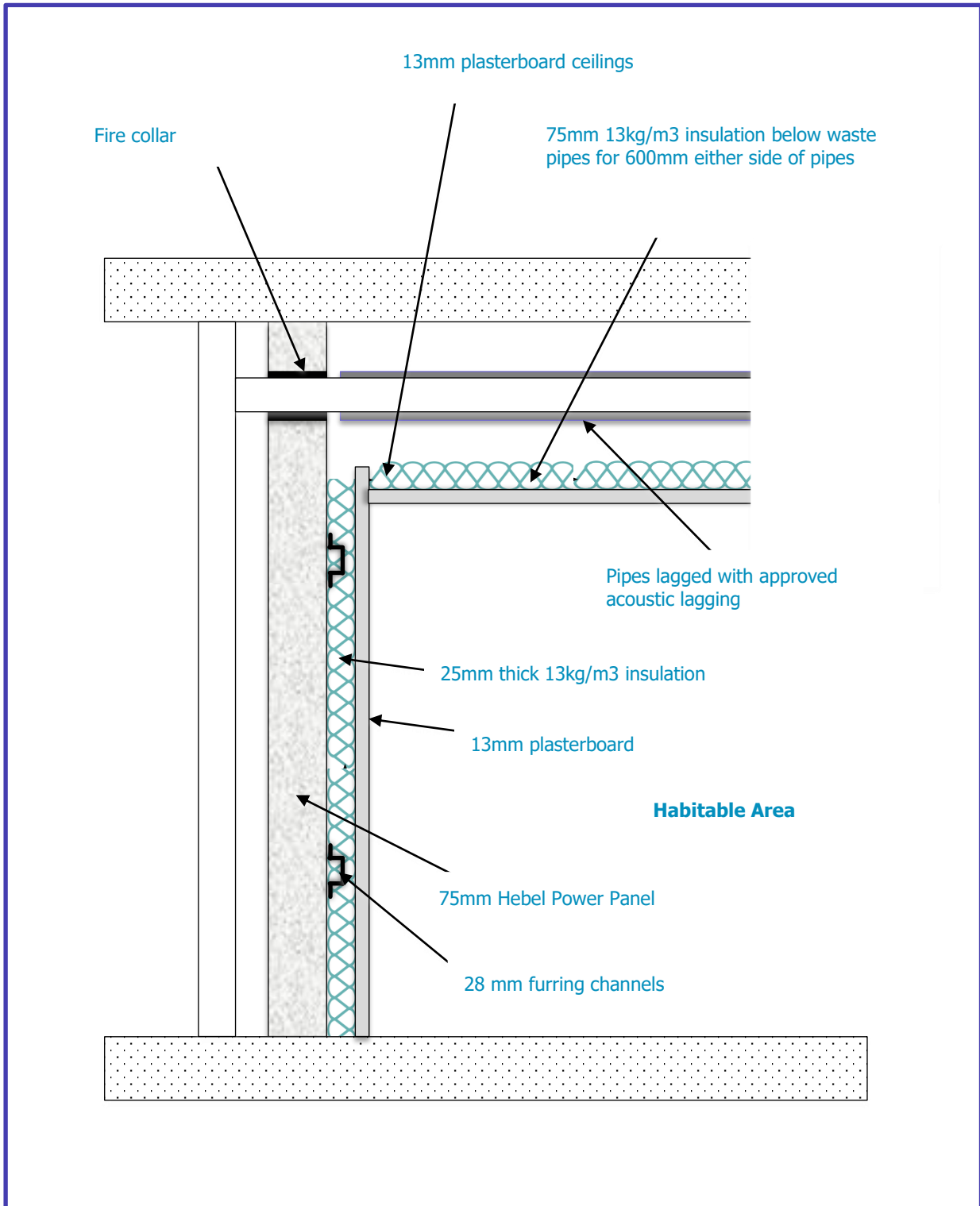
Drawing Number

Date: May 2021

Drawn: BW

210436

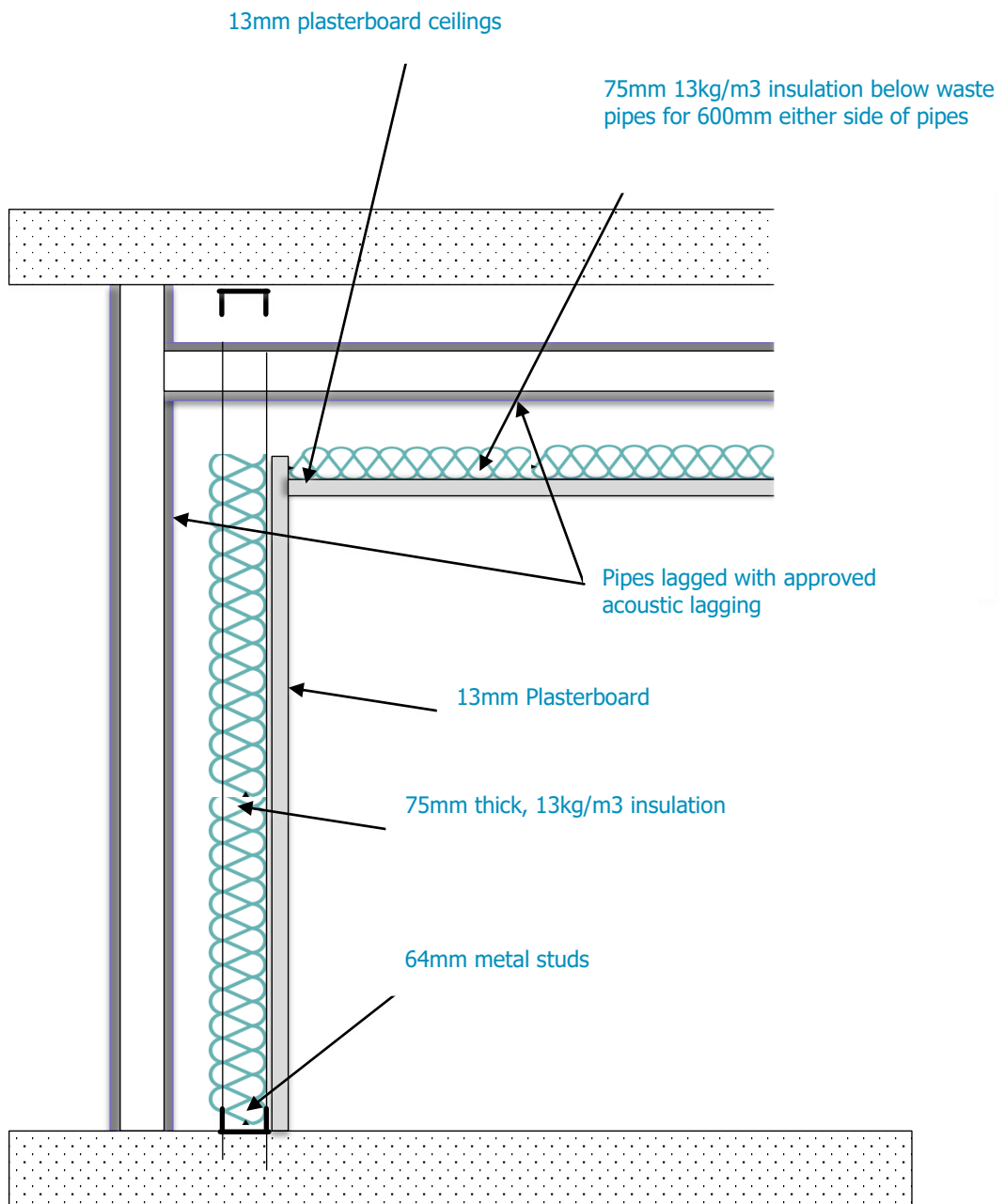
WNA009



Riser Adjacent Habitable Areas
 Rw +Ctr 40
 Option 1



		Project:	
		Drawing Number	
Date: May 2021	Drawn: BW	210436	WNA010



Riser Adjacent Wet Areas
Rw +Ctr 40
Option 2



Project:

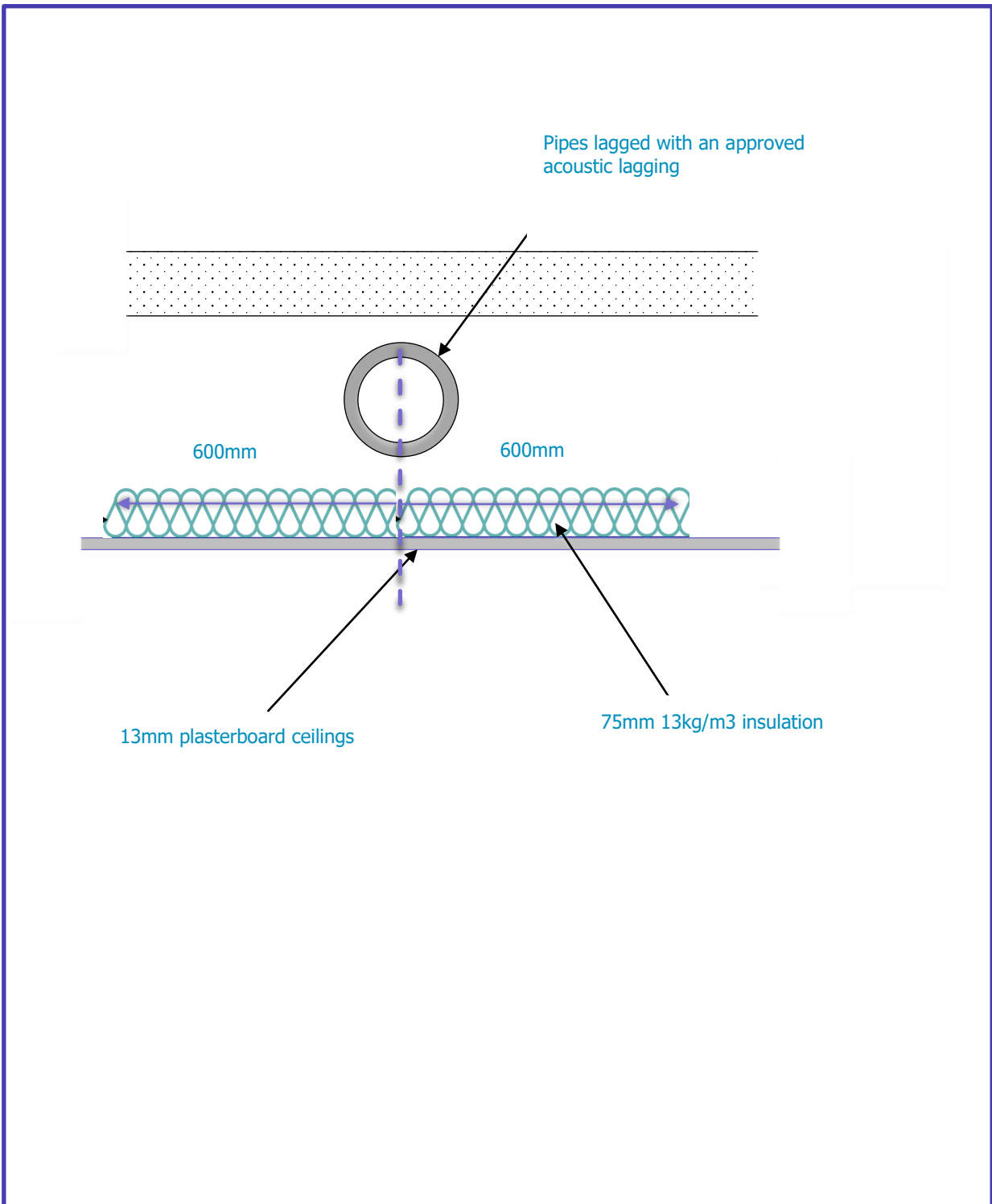
Drawing Number

Date: May 2021

Drawn: BW

210436

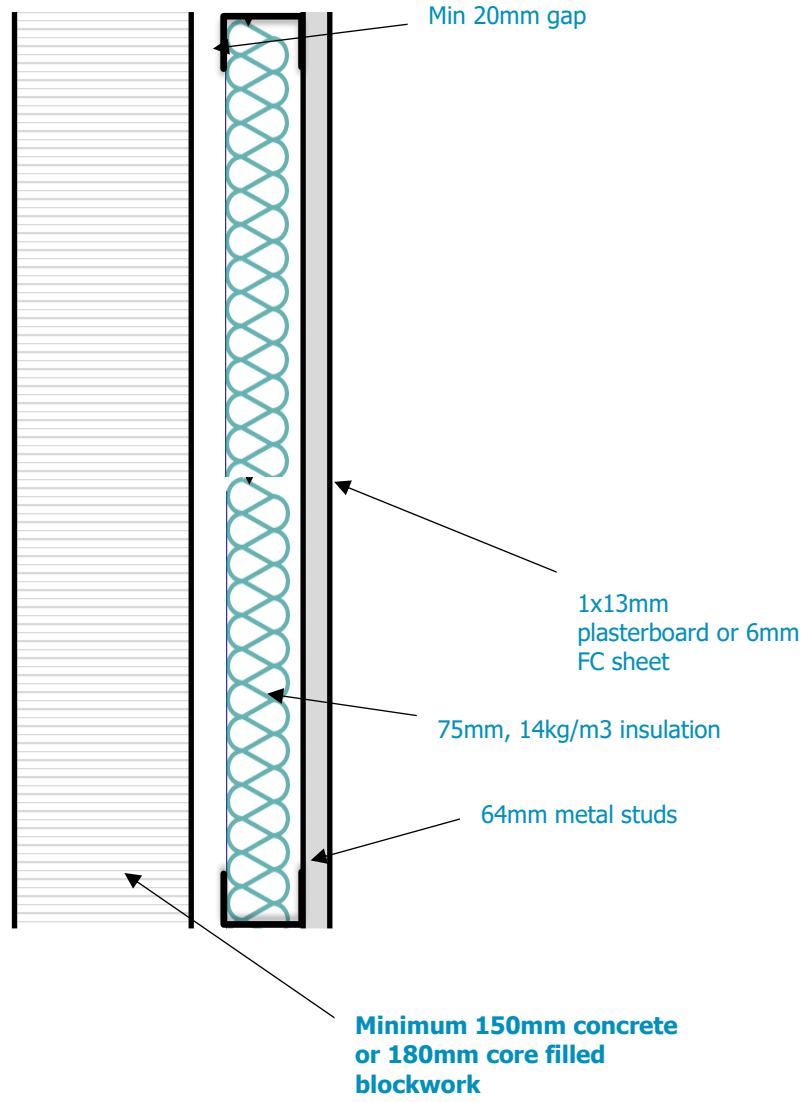
WNA011



Acoustic Treatment of Waste Pipes within Habitable Area Ceilings
Rw + Ctr 40



Date: May 2021		Drawn: BW		Project: 210436		Drawing Number: WNA012	
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Car Lift Walls



Project:

Drawing Number

Date: May 2021

Drawn: BW

210436

WNA013