**Technical Bulletin: Penetrations in USG Powerscape® Interior Lining Noise Control Systems**
**PR-TB-AU-1010-2-31180**

## Introduction

Any penetration in a wall, floor, or ceiling (e.g. light fittings, power outlets, pipes, doors) has the potential to degrade noise control. This brochure identifies common noise control penetration problems and provides solutions for USG Powerscape® Fiberock® interior lining systems.

Construction details are provided. In addition, requirements for services in walls and floors of the May 2004 Building Code of Australian noise control provisions are listed, along with USG Powerscape® interior lining systems that may satisfy them.

## Fire Ratings

If is important to note that penetrations usually effect fire ratings. The affect on the fire rating depends on the system penetrated and the specific components involved. If in addition to noise a fire rating is required, the fire rating of the penetration details must be assessed. Refer to the USG Powerscape® publication, Technical Bulletin PR-TB-AU-1010-3-31156, on Fire penetrations.

## How Penetrations Degrade Noise Control

Common ways that penetrations degrade noise control are:-

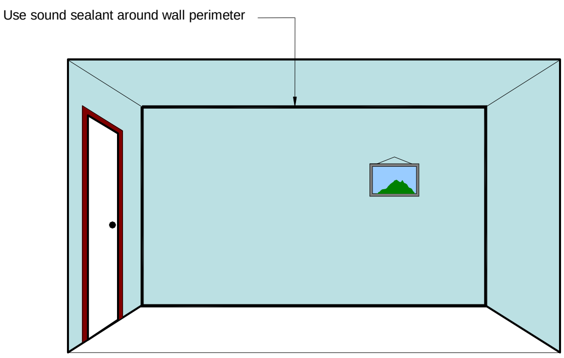
- The formation of air gaps (for example, minute air gaps through door jambs or light switches, or small gaps around pipes or in down lights)
- The replacement of interior linings with a material of a lower noise control rating (for example a flush box or a door)
- By introducing a structural connection between linings (for example a service pipe that passes through a wall)
- By introducing a sound source into a system (for example a water pipe introduces a noise source into the cavity of a wall or ceiling. Moreover, mounting it on a frame or lining causes the lining to radiate sound directly and can amplify the sound)

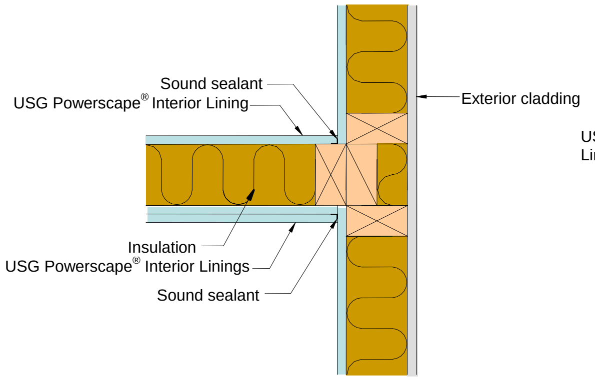
## The Importance of Sound Sealant

Even minute gaps degrade noise control. Think of filling a room with water – where water can leak, so can sound.

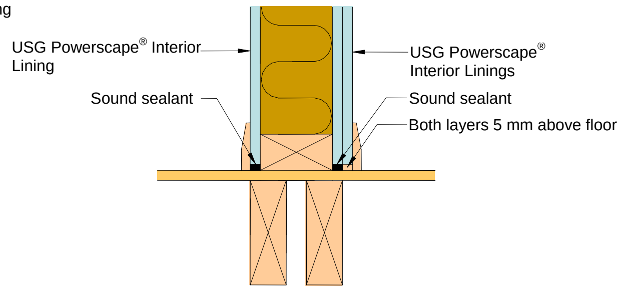
To illustrate, a wall was measured in an acoustic laboratory before and after applying sealant to the perimeter. Even though the gaps were tiny (under bottom plates or around plasterboard fixed hard against them), without sound sealant the $R_w$ rating dropped 20dB! The difference would probably be less dramatic if insulation has been in the cavity. But the point is well illustrated – use sound sealant, whether around walls, ceilings, or penetrations. Note well: mouldings (e.g. architraves), paint and wallpaper are not sufficient to stop sound leaks.

There are a variety of sound sealants on the market. A sound sealant is heavier than a general purpose sealant. It should be flexible to accommodate building movement. In some cases a fire rating may be required too.

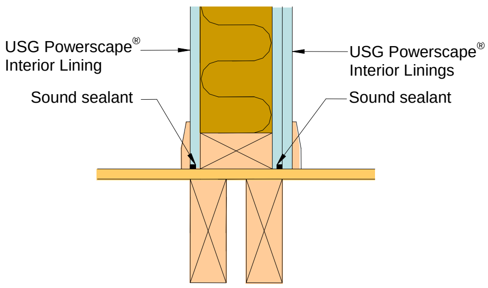



Corner Junction




Floor Junction – Boards Lifted above Flooring




Floor Junction – Boards Touching Flooring

**Figure 1**
Sound sealant must be purpose made, flexible, and may need to be fire rated

## Solutions for common penetrations

Solutions are provided for the following scenarios:-

1. Flush boxes
2. Doors
3. Down lights
4. Services

## Flush Boxes

In general, for best results offset power points in adjacent stud bays and use cavity insulation. Where this is not possible use surface mounted boxes.

General rules aside, Table 1 provides options for a variety of flush box placement, cavity insulation, and framing scenarios. These results apply for single size flush boxes, no more than four each side of a wall. Some options may slightly degrade noise control performance and are noted on the table. For single and staggered framed walls rated higher than $R_w$ 55 and double framed walls higher than $R_w$ 60 the expected degradation may be greater.

**Table 1**
**Flush Box Scenarios for Single, Staggered or Double Frame Walls**

| Cavity Insulation | Flush Box Placement | Flush Box Type | Aproximate $R_w$ loss (dB)* |
|---|---|---|---|
| - | back-to-back | standard | -10 |
| - | back-to-back | surface mount | 0 |
| yes | back-to-back | standard | -5 |
| yes | back-to-back | standard + sound sealant | -1 |
| yes | back-to-back | fire rated | 0 |
| - | adjacent bay | standard | -2 |
| yes | adjacent bay | standard | 0 |

* For single and staggered framed walls rated higher than $R_w$ 55 and double framed walls higher than $R_w$ 60 the expected degradation may be greater.

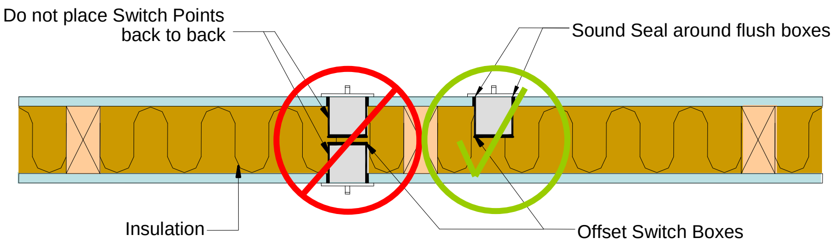



**Figure 2**
Flush Box in Wall with Sound Sealant around Perimeter

**<u>Back-to-back box remedy</u>**

Back-to-back placement is occasionally required by design to accommodate room layout, or when boxes have been installed back to back by mistake potentially compromising noise control. Remedies are,

(i) Use surface mounted flush boxes

(ii) Use fire rated flush boxes with insulation behind the box (If the wall is already constructed, stuff insulation into the wall cavity through the box hole. Ideally fill the flush box stud bay with insulation.

(iii) For double frame walls, a baffle may be use provided,
- The baffle does not bridge the two frames (a clear air gap is maintained with no risk of being closed due to normal building settlement: for example, 15mm)
- Cavity insulation is placed (a) in the box created by the baffle, and (b) between the baffle and the lining on the other wall frame.
  Extend the baffle as for a fire rated baffle.

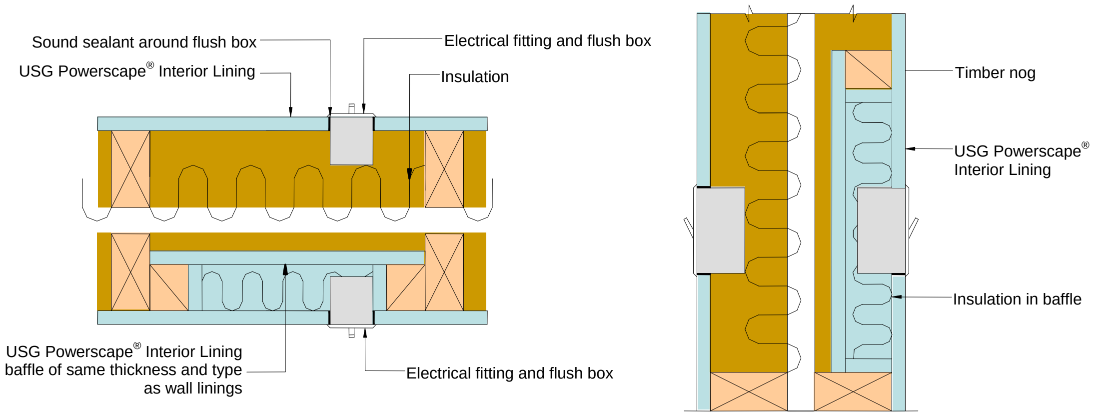



**Figure 3**
Flush Boxes in Double Stud Walls

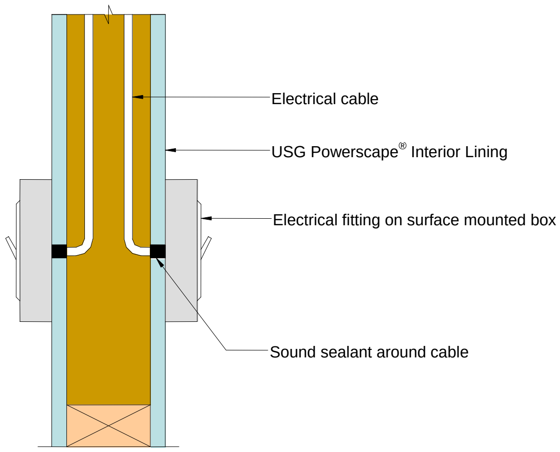



**Figure 4**
Surface Mounted Boxes Single Stud Walls

## Doors

The Building Code of Australia has two noise requirements for doors:

- Doors between occupancies and public lobbies or corridors must achieve no less than $R_w$ 30 or $D_{nTw}$ 25
- Doors within intertenancy walls must equal or exceed the minimum requirement for the wall.

For doors there are two considerations: Noise control of the door assembly, and treatment of jambs for noise control.

<u>Noise control of the door assembly</u>

A doors noise control rating will usually limit the performance of a wall with a door. For example, if a 10 $m^2$ wall is rated $R_w$ 60 (without a door) and a 1.8 $m^2$ door assembly rated $R_w$ 30 (e.g. a solid core door with perimeter seals) is installed, the expected total $R_w$ for the wall with the door is only $R_w$ 30 – the door has limited the performance.

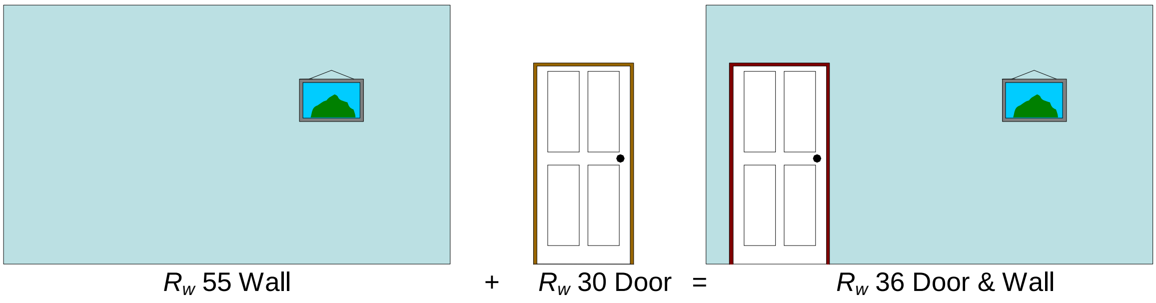



**Figure 5**
Acoustic Rated Wall System with Door

Table 2 provides examples of how combining different doors and walls affect $R_w$. The size of the wall compared to the door can make a small difference.

**Table 2**
Effect of Door Type and Door + Wall Area on $R_w$

| **Door + Wall Area ($m^2$)** | **36mm hollow core door – no seals** | | **36mm solid core door – seals** | |
|---|---|---|---|---|
| | *Door + $R_w$ 45 wall* | *Door + $R_w$ 55 wall* | *Door + $R_w$ 45 wall* | *Door + $R_w$ 55 wall* |
| **6** | ***24*** | ***24*** | ***34*** | ***34*** |
| **10** | ***25*** | ***25*** | ***36*** | ***36*** |
| **15** | ***27*** | ***27*** | ***38*** | ***38*** |
| **20** | ***28*** | ***28*** | ***39*** | ***39*** |

Therefore, it is essential to select a door assembly that matches the wall performance requirement.

A range of door options are:-

- Hollow core – no seals $R_w$ ~ 18 to 20
  Not suitable with noise control walls
- Solid core – seals $R_w$ ~ 28 to 32
  Suitable with entry level noise control walls
- Communicating doors $R_w$ ~ 40 to 45
  I.e. back-to-back doors (solid core with seals) separated by 70mm or more, with sound absorbing material on one face
- Proprietary noise control doors $R_w$ ~ 36 to 50
  Can be the same thickness as standard doors; very expensive
- Sound lobby $R_w$ ~ 50+
  Usually comprises two solid doors with seals separated by a small room. Note: Where sound passing through a door, along a corridor, and through another door there is essentially a sound lobby.

Treatment of jambs for noise control

Sound sealant is required between linings and jambs (see figure) to block very small air gaps. Drop seals must be cut to length and aligned to fully seal the gap at the bottom of the door.

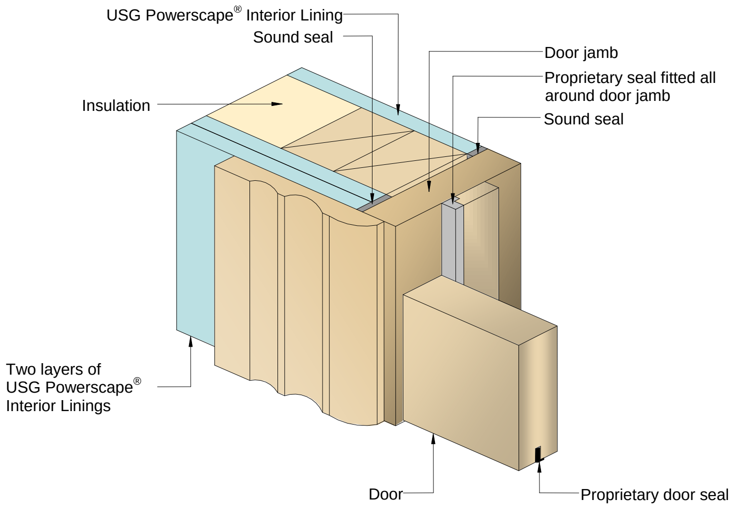



**Figure 6**
Door with Jambs Treated for Noise Control

## Down Lights

For noise control, it is good practice to avoid down lights. However, where necessary, down lights may be used with minimal impact provided:-

(i) They are positioned less than 1 every 4 $m^2$
(i) Insulation is used in the ceiling cavity.

For extra measure, use ceramic covers over fittings, or box in, observing any manufacture ventilation requirements.

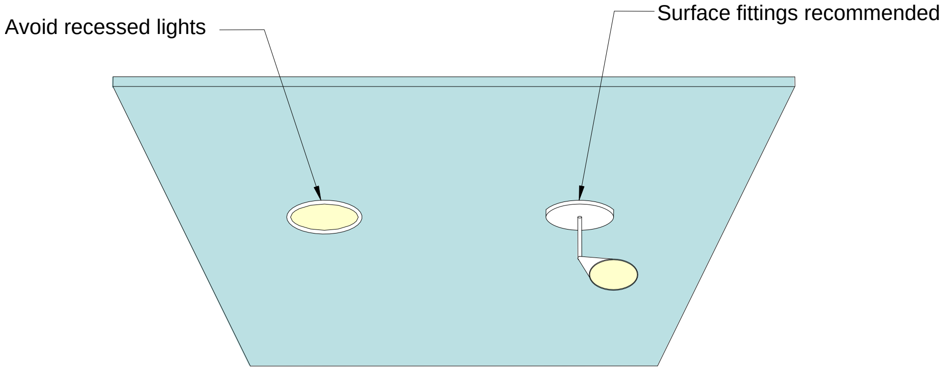



**Figure 7**
If down lights are unavoidable, for minimum degradation place 1 every 4 $m^2$.
For more protection, use ceramic hats or boxing

## Services

Ensure services do not directly contact linings or framing.

- For Rocklinings, cut holes 5 to 10mm larger than the service. When inserted, fill the gap around the service with sound sealant (and where relevant, with lagging too).
- Use resilient mounts to connect services to wall framing or Rocklinings.

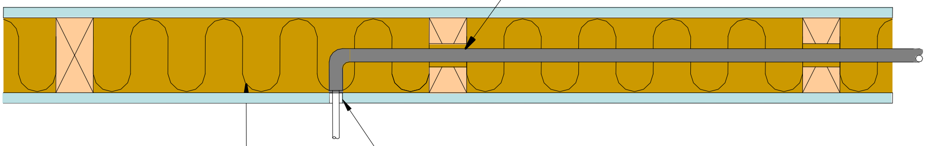



**Figure 8**
Insulating Pipe work

The Building Code of Australia sets minimum noise control standards for services that pass through wall and ceiling cavities in class 1a, 2 and 3 buildings. In summary, the BCA requirements for water and waste pipes within wall and ceilings are,

- $R_w + C_{tr}$ not less than 40 if the adjacent room is habitable, but excluding kitchens.
- $R_w + C_{tr}$ not less than 25 if the adjacent room is a kitchen or non-habitable room