NZ FIRE DOORS

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Acoustics 101

Acoustic protection and noise reduction are important parts of domestic and commercial building, even though they may not have the same lifesaving significance as fire and smoke resistance.
For a building element, such as a wall, floor or door, the amount of sound it lets pass through is described by its sound transmission class (STC) rating. An Rw rating if quoted, is almost identical to the STC rating

Building requirements

Noise control is just as important to living and working conditions as thermal insulation, light and ventilation. That's why everyone has a legal 'duty of care' to ensure what they build provides comfortable sound levels, particularly in a residential environment. There may also be specific privacy requirements based on a building's intended use, such as rooms for confidential client meetings.

Document G6 Airborne and Impact Sound of the NZ building code clearly explains what performance is required of walls and floors to achieve an acceptable acoustic level. The document refers to new build multi-unit dwellings such as flats, apartments or hotels including care facilities and student accommodation.. While there is no specific reference to the acoustic performance of doors (except the rare instance if inter-tenancy doors), they do form part of the system and therefore must factor in design considerations.

Understanding sound

Sound is created by a vibrating object. Sound travels through the air when the molecules move rapidly back and forth creating pressure changes. As the movement is passed from one air molecule to the next the pressure changes travel until they reach a solid surface, such as a door. The surface then reflects some of the sound energy and transmits the rest into the material. Depending on the nature of the material, it will either efficiently transmit the energy through itself and into the air on the other side or absorb some of the sound energy turning it into a small amount of heat energy. When the air vibrations reach our ear, we detect the sound.

Insulation of sound is achieved by interrupting, changing and absorbing the sound waves. The most effective materials are very dense, very thick, or a composite of differing types of materials. A double glazed window uses two dense layers of material separated by air to reduce transmitted sound

The features of a good acoustic door

A very dense door leaf is typically good at reducing sound, minimising its transmission through to the other side.

The door leaf and the edge sealing systems must work together to achieve an acceptable acoustic rating. Choosing an appropriate seal involves considering it's acoustic performance, its effect on the force required to close the door (especially when automatic closing devices will be used) and how well it stands up to wear and tear.

Because they have solid cores, our fire doors can achieve up to STC 34 (acoustic rating) if they are installed with the appropriate perimeter seals. Door sets requiring performance greater than STC 40 are a specialist product requiring bespoke engineering; we will happily work with your acoustic engineer to build a solution.

Installing acoustic doors

Installation has a direct effect on the performance of an acoustic door leaf. Hardwood, softwood and MDF jambs are all approved for acoustic doors.

The gap between the wall's sub-jamb/structural opening and the door jamb should not exceed 10 mm. It should be filled with non-combustible material and capped off with an approved acoustic fire rated mastic. Any gap is a noise path. While doors need clearance gaps between the leaf and jamb to operate without binding, these need to be as small as practical because the seals are intended to only support, not create, the sound barrier. If a single sheet of paper will pass through the gap then so will sound.

Hardware should be installed as it is for fire doors. To learn more see the hardware installation guides on this website or give us a call.

Measuring sound levels

The loudness of sound is measured in decibels (dB). For every 10 dB increase, the loudness increases by a power of ten. So a 10 dB increase is 10 times the sound energy (or twice as loud), a 20 dB increase is 100 times the energy (or four times as loud), a 30dB increase is 1000 times the energy (or eight times as loud)and so on. Here's a table of examples.

The Decibel Scale

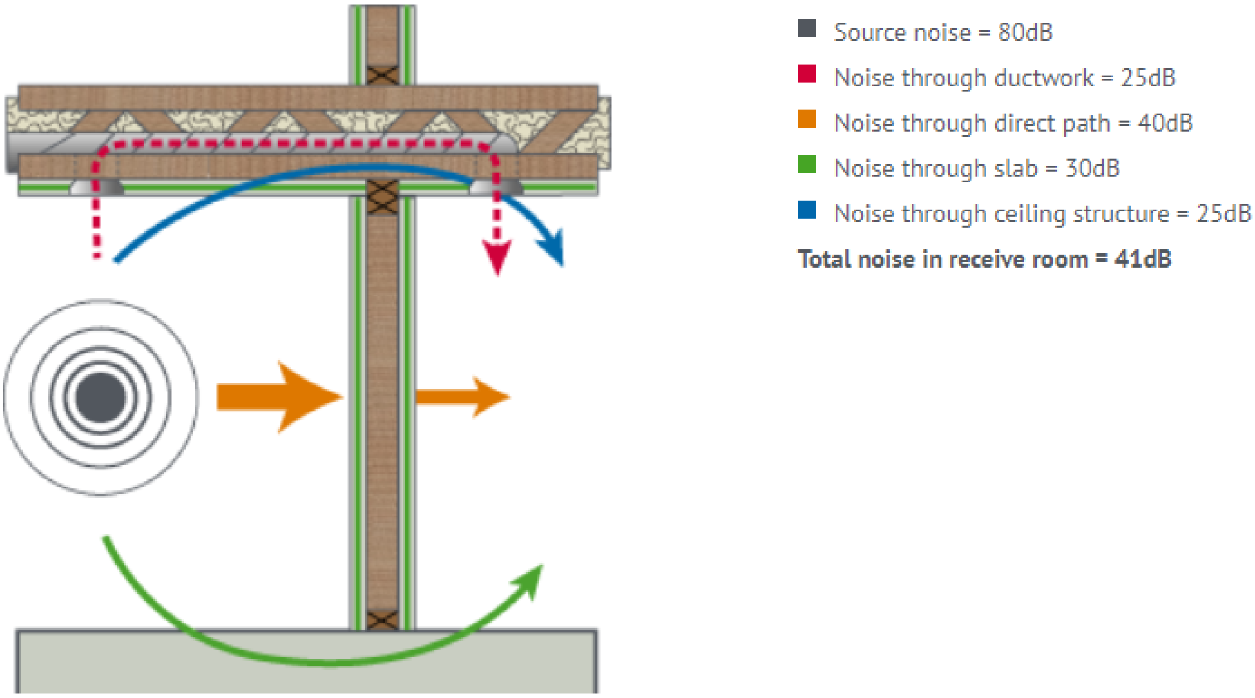
Level in decibels	Typical everyday example	Times louder than 10dB
10dB	Rustling or falling leaves	1
20dB	Watch ticking	10
30dB	Birds flying by	100
40dB	Quiet conversation	1,000
50dB	Louder conversation	10,000
60dB	Quiet traffic noise	100,000
70dB+	Louder traffic	1,000,000
80dB+	Loud highway noise at close range	10,000,000
85dB	Hearing damage after approximately 8 hours.	
100dB	Jackhammer (pneumatic drill) at close range	1,000,000,000
100dB	Hearing damage after about 15 minutes.	
110dB+	Jet engine at about 100m	10,000,000,000
120dB	Threshold of pain. Hearing damage after very brief exposure	

Acoustic testing

When acoustic door systems are laboratory tested they're set into a standard wall between two rooms. There's a sound generator in one room and a sensitive microphone in the other, so the sound reduction can be measured. Solid surfaces respond differently to different frequencies (wavelengths), so the test is repeated at specific frequencies. The measured sound levels are fitted to a graph using an international standard known as ASTM E413 to produce the door's standard transmission class or STC value. The laboratory test values are known as the STC (Design).

Onsite performance

The transmission of sound through structural paths, rather than through the air, is often called ‘flanking sound’. This is sound going to the next room through the floor or ceiling, rather than the walls or doors.



This diagram illustrates the importance of considering the entire system by showing some simple flanking noise paths that bypass a door or wall. The red arrow is direct sound – what you would measure in a lab test of a door or wall to arrive at an STC rating. The green, orange and blue paths are some simple “flanking paths”. These paths are often more important than the direct, red, path because of the effect they have on the system performance.

Because the onsite conditions are rarely the same as the standard testing rooms, the potential STC value of a door set is almost never achieved in reality. Any field test results will depend on things like the quality of construction, acoustic performance of the various building elements, and the accuracy of the door installation. This different result achieved in a site test is called the STC (Field). It is acknowledged in Section G6 of the Building Code that an STC (Field) may be up to 5 STC units lower than the STC (Design) achieved in the laboratory test. Because a door must have clearance gaps to operate, and gaps are a sound path, it is also generally accepted that the wall rating should be a minimum of 10-15 STC units greater than the door in order to achieve the desired system STC rating.

The intended use and specification of the door should also be carefully considered. For example, high performance acoustic requirements need specialist sealing and door leaf construction. These can create their own issues, such as fire alarms not being heard, self-closing mechanisms not working fully and the inability of young or infirm people to operate the door.

Our acoustic doors

The physical properties of a fire door are closely related to its acoustic performance, so we’ve kept things simple by providing the fire rating and standard acoustic rating for each of the doors in our 30+, 60+ and 90+ ranges. If you need a fire door that has a higher acoustic rating, give us a call and we’ll walk you through the options. The data sheet for each of our doors details its performance levels and you should follow the door’s installation guide.