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FIRE & SOUND IN MULTIFAMILY FLOORS

DESIGN CONSIDERATIONS

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FIRE & SOUND IN MULTIFAMILY FLOORS
DESIGN CONSIDERATIONS

Fire rated assemblies for multifamily floors have a number of requirements as well as options to consider. Here we present the components of fire rated UL Designs for wood framed floor/ceilings and the requirements needed for meeting sound control per Section 1207 of the International Building Code® (IBC®).

UL DESIGN OVERVIEW

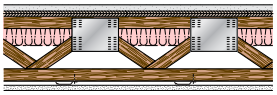
To obtain the most recent version of a fire rated UL Design, visit ul.com and enter the UL Certification (design) number in the UL Online Certifications Directory. Because UL Designs are revised on a regular basis, hard copies may be outdated even on the day they are purchased. Typically when a UL Design is revised, additional options are added. When there are a large number of options in a UL Design, it can be very confusing.

Fire rated assemblies for wood framed floor/ceilings can be found in the L500 Series and M500 Series of the UL Fire Resistance Directory. Many of these assemblies are similar to one another but have been tested (paid for) by different manufacturers and list different system options. If one manufacturer creates a unique UL Design, they will not allow their competitors to be included in that design. However, they will allow multiple manufacturers of other non-competing products to be listed. This is why when researching wood framed UL Designs you may find as many as 18 different flooring system options within that design. Each product listed in a specific UL Design creates a flooring system option that can meet the fire rating using that specified product.

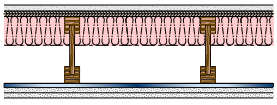
For example, if the UL fire test was performed and paid for by the truss manufacturer, you will see only that truss manufacturer approved; but there may be several approved manufacturers for floor underlayments, ceiling dampers, insulation, wallboard manufacturers, etc. The most common item in floor/ceiling assemblies that has a sole source manufacturer is the wallboard that is approved on the ceiling. This is because most of the designs in the L500 and M500 series were sponsored in whole or in part by a wallboard manufacturer such as United States Gypsum Company. You may notice the majority of these designs were created for USG Sheetrock® Brand Firecode® C Panels because these panels were the first of their kind in the industry.

There are three common types of framing for wood floors: open web trusses, I-Joists and 2x10 dimensional lumber (see below). Open web trusses are by far the most common; however, in certain parts of the U.S. such as the West Coast, I-Joists and/or dimensional lumber are more common. When using open web trusses or 2x10 dimensional lumber, a one hour fire rating is typically achieved with a single layer of 5/8 in. (16 mm) Type C wallboard. I-Joists require two layers of 5/8 in. (16 mm) Type X wallboard to achieve a one hour UL fire rating.

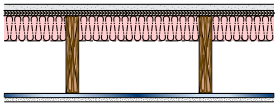
Open Web Truss



I-Joist



2x10 Dimensional Lumber



In a UL Design, the dimension that is called out is a minimum, which means you can have larger members but not smaller. For example, if the joist is a nominal 2x10 in a UL Design such as L569, a wider or deeper joist may be used and is considered better for fire resistance. Typically when a component manufacturer performs a UL fire test, they will test the dimension that is the most critical so that an architect can specify any dimension of that component that might be greater for the sake of flexibility.

Note that many components in UL Designs, such as insulation or ceiling dampers, are marked "optional." **If a component in a UL Design is not marked "optional", then that component is required in that specific UL Design.** Components in a UL Design marked with an asterisk (*) means that specific component is UL Classified and will bear the UL mark somewhere on the product.

UL DESIGN – FLOORING SYSTEM OPTIONS

The first section of a wood framed UL Design is a series of flooring system options (i.e. System 1, System 2, etc.). This section provides three choices for meeting the minimum requirement for achieving a one hour fire rating:

1. Add a second layer of plywood
2. Pour a minimum 1-1/2 in. (38 mm) of lightweight concrete
3. Pour a minimum 3/4 in. (19 mm) of gypsum underlayment

Note – floor coverings and finishes are not installed when testing a specific fire rating. Any floor covering can be added to the system noted above without changing the fire rating.

PLYWOOD

The first and most basic choice for achieving a one hour fire rating in most UL Designs is to add a second layer of plywood subfloor at a minimum thickness of 15/32 in. (12 mm). This layer is fastened to the 3/4 in. (19 mm) structural subfloor. This option is rarely chosen for three main reasons – it is more expensive than adding 3/4 in. (19 mm) of gypsum underlayment, it is not a suitable substrate for some floor coverings and there are no sound tests when adding an additional layer of wood to the assembly.

LIGHTWEIGHT CONCRETE

The second choice for achieving a one hour fire rating in most UL Designs is to pour lightweight concrete directly to the wood subfloor. Because lightweight concrete shrinks when it cures, a minimum of 1-1/2 in. (38 mm) is required to minimize the cracking that can be expected during the curing process. The 1-1/2 in. (38 mm) thickness also helps minimize cracking as a result of deflection created by the mass of concrete that is being poured. Despite being "lightweight," the overall load of the concrete on the assembly is greater than a plywood or gypsum underlayment solution. In addition, a lightweight concrete solution is typically double the height of a plywood or gypsum underlayment solution and negatively impacts floor-to-ceiling dimensions.

GYPSUM UNDERLAYMENT

The third and most viable choice for achieving a one hour fire rating in most UL Designs is to pour gypsum underlayment at a minimum thickness of 3/4 in. (19 mm) directly to the wood subfloor. The reason gypsum underlayment is the most common choice is that at 3/4 in. (19 mm) thick, gypsum underlayment is more economical and more crack resistant than 1-1/2 in. (38 mm) of lightweight concrete. Gypsum is a suitable underlayment for all common floor coverings and provides better sound attenuation, especially when used in conjunction with a sound mat.

Another differentiating benefit of gypsum underlayment is the fact that the gypsum molecule contains two molecules of water. The chemically combined water is released when exposed to extreme heat. The shedding of water molecules or 'sweating' of the gypsum underlayment serves as an outstanding heat sink which allows gypsum underlayment to achieve the same ratings as lightweight concrete at half the thickness. This concept is discussed again in the *Gypsum Board* section, pg. 8.

UL DESIGN – FLOORING SYSTEM OPTIONS CONT.

USG invented pourable gypsum underlayment over 50 years ago, pioneering formulations of gypsum with portland cement and other additives. These formulations provided unique installation properties allowing the contractor to place large amounts of material and achieve a smoother, more durable surface than lightweight concrete. When gypsum underlayment sets, it slightly expands and does not shrink. This creates a superior bond which means the material can be poured thinner, even over a deflecting substrate such as wood. However, for both lightweight concrete and gypsum underlayment, excessive building movement and/or deflection in the subfloor may result in cracking.

SOUND ATTENUATION

In the flooring system options there are many sound mats to choose from for placing between the gypsum underlayment and the subfloor. Typically, the thicker the sound mat the more deflection you can expect. That is why you will see the requirement to pour beyond the 3/4 in. (19 mm) thickness over most sound mats. The most common sound mat is a 1/4 in. (6 mm) mat that typically requires a 1 in. (25 mm) minimum thickness of gypsum underlayment. This additional thickness is not a UL fire issue, it is a manufacturers requirement designed to keep the floor crack resistant.

The thinnest sound mats on the market are approximately 1/8 in. (3 mm) thick. USG Levelrock® Brand SAM-N12™ Sound Attenuation Mat is a 1/8 in. (3 mm) thick mat that requires just 3/4 in. of USG Levelrock® 2500 Floor Underlayment resulting in a total profile of 7/8 in. (22 mm). Because a 1/8 in. (3 mm) thick mat deflects or compresses less than a 1/4 in. (6 mm) thick mat, less gypsum is required to create a crack-resistant system. Thinner underlayment pours ultimately offer the architect an opportunity to value engineer the system by reducing the assembly weight, and the material and labor costs associated with a thicker pour.

When choosing the sound mat to be used, see *Section 1207 – Sound Control* regarding sound control pursuant to Section 1207 of the International Building Code (IBC).

TRUSSES OR JOISTS

This section is usually straight forward. Some UL Designs are proprietary to specific truss or joist manufacturers, while others are generic. If no manufacturer is listed, the choice is open. If only one manufacturer is listed, they are the only manufacturer that can be used in that specific design.

CEILING DAMPERS

This section is usually straight forward as well. When ceiling dampers are allowed in a UL Design, they are always listed as optional. If a UL Design says you can achieve the fire rating with a minimum of a 12 in. (305 mm) deep truss, this section will usually say that if you use a ceiling damper the depth must be increased to 18 in. (457 mm). Because there is a fee to be listed in a UL Design as an approved component, it is common that there are specific ceiling damper manufacturers approved in each UL Design. If a manufacturer is not listed by name as an option, you will not have a fire rating if an unlisted ceiling damper is used.

BATTS AND BLANKETS

Many of the UL Designs are somewhat obsolete because they were tested without insulation in the cavity; however, to meet the sound transmission requirements of Section 1207, you must have insulation in the cavity. If insulation is not mentioned as an option in the UL Design, you can still add it, but you must also add one additional layer of wallboard to that design.

The ability to add insulation to a design that was tested without it is found in the Design Information Section of the UL Directory, Section III. **FLOOR CEILINGS**, Paragraph 17 **BLANKET INSULATION**. The additional layer of wallboard is costly; but if the design is an open web truss, you can simply switch to a design that was tested with insulation and only one layer of wallboard. Note – The original open web truss UL Designs were tested without insulation and only one layer of wallboard on the ceiling. The truss depth was only 12 in. (305 mm) and RC-1 channel at 16 in. OC. (406 mm). In UL designs that allow you to go to 12 in. (305 mm) deep, when insulation is used, the RC1 channel cannot exceed 12 in. (305 mm) OC unless USG Sheetrock® Brand EcoSmart Panels Firecode® X are used (see *Assembly Testing*, pg. 10).

USG was the first to realize that if the cavity was tested at 18 in. (457 mm) deep (which is required when using a ceiling damper), and the insulation was a maximum 3-1/2 in. (89 mm) batt attached to the subfloor, you could get an insulated assembly for sound, have enough space for a fire rated ceiling damper and only need one layer of wallboard on the ceiling with the RC-1 channel spaced at 16 in. (406 mm) OC. The first design that incorporated all of these benefits was L521 in 1997. This and several other similar UL Designs were modified in 2005 to allow different placement and thickness of the insulation.

The presence of insulation in a floor/ceiling assembly makes it more difficult to pass a UL fire test. This point is made very clear when you look at the RC-1 channel spacing requirements of many typical UL Designs in the L500 and M500 series. The more RC-1 channels, the better secured the wallboard is, and the better it can handle the stress of the fire test. For example, in most of the open web truss and 2x10 designs you have three options for the RC-1 channel spacing, which are all dependent on the placement of the insulation. See the table below for a comparison.

RC-1 Channel Spacing	Insulation Placement	OC Screw Spacing
24 in. OC (610 mm)	Only when no insulation	12 in. (300 mm)
16 in. OC (406 mm)	When a 3-1/2 in. (89 mm) maximum batt is secured to the bottom of the subfloor	12 in. (300 mm)
12 in. OC (305 mm)	When a minimum 3-1/2 in. (89 mm) batt or thicker is draped over RC-1 channels	8 in. (203 mm)

The location and insulation thickness, as well as the spacing of the RC-1 channels is critical. If you want to stay with one layer of wallboard on the ceiling, you must follow these requirements or you will not have a fire rated floor/ceiling assembly.

RESILIENT CHANNELS

As mentioned in the previous section, the maximum spacing of the RC-1 channels in all UL Designs is called out. The correlation between the insulation and the RC-1 channel must be followed correctly. The simple rule is this, if an architect or builder allows the insulation contractor to decide where he wants to put the insulation, the cheapest and easiest placement is draped over the RC-1 channel. Typically, an insulation contractor does not know that the insulation placement is critical for meeting the fire rating. **Therefore, in order to drape the insulation, you must specify the RC-1 channel spaced at 12 in. (305 mm) OC maximum and the screws that attach the wallboard at 8 in. (203 mm) OC, to have a fire rated floor/ceiling assembly.**

For years the description of the RC-1 channel in UL Designs was as follows:

> **Resilient Channels** — Formed from min. 0.020 in. thick galv steel, 1/2 in. deep by 2-3/8 in. wide at the base and 1-3/8 in. wide at the face.

The problem with the description above is that no RC-1 channel is manufactured to these dimensions. That description refers to an RC-1 channel that USG manufactured in the 1980s. Although USG invented RC-1 channel, we exited the steel manufacturing business over 30 years ago. Since then, the dimensions have changed slightly, but the description in the UL Designs was never modified. This caused confusion in the market place, and in some cases there was a misinterpretation as to what .020 thick steel meant. Some general contractors were requiring the RC-1 channel to be 20 gauge, but .020 thick is actually within the industry range of 25 gauge.

In February 2012, USG sponsored a revision of the RC-1 channel description in UL Designs to read:

> **Resilient Channels** — Formed from min. 25 MSG galv. steel installed perpendicular to trusses.

You can now use any RC-1 channel in a UL Design with the above description as long as the steel is 25 gauge (MSG). The description is generic so that any manufacturer of RC-1 channel can be used.

Many architects believe the specific RC-1 channel called RC Deluxe® Resilient Channel (RCSD), manufactured by ClarkDietrich® Building Systems, is required to meet the UL fire rating. Most UL designs do not call out a specific RC-1 channel for the fire rating. This specific RC-1 channel has a unique profile that makes it better for sound control than standard RC-1 channel. Because of the increased sound performance, this is the specific RC-1 channel that is used in all sound testing by USG and many other manufacturers and acousticians.

The most common problem for both fire and sound in a floor/ceiling assembly is the use of the wrong length screw when attaching the wallboard to the RC-1 channel.

All UL Designs require a 1-1/4 in. (32 mm) minimum length screw to attach the RC-1 channel to the truss or joist. A 1 in. (25 mm) maximum screw is required to attach the first layer of 5/8 in. (16 mm) wallboard to the RC-1 channel. However, the wallboard is typically fastened with a screw that exceeds the 1 in. (25 mm) maximum length. If the longer screw penetrates the RC-1 and anchors into the truss or joist, you have effectively caused the floor/ceiling assembly to fall well short of the designed STC and IIC numbers. More importantly, if the screw anchors into the truss or joist on the first layer of wallboard, you have no UL fire rating.

RESILIENT CHANNELS CONT.

A good alternative to using RC-1 channel is to suspend the ceiling with a product like USG Drywall Suspension System. This option is listed in all of the common UL Designs and will enhance the performance of both STC and IIC over the tested ratings that are published with RC-1 channel. It will also eliminate the possibility of the system being short circuited (RC-1 channel is short circuited when the screw penetrates the framing member). There is a cost to suspending the ceiling versus using RC-1 channel. The additional cost may make this option unattractive, but you would have a ceiling that cannot be short circuited and would always perform better for STC and IIC. A ceiling can be suspended using hanger wires at a depth of about 4 in. (102 mm) below the trusses.

GYPSUM BOARD

In 1917, USG invented gypsum wallboard under the brand name Sheetrock®. Since then, USG has released many variations for specialized applications. However, there are really only three basic cores when it comes to fire resistance: Regular, Type X and Type C.

Regular core is typically found in 1/2 in. (13 mm) thicknesses, and is commonly used in non-fire rated residential construction, such as single family homes.

Introduced by USG in 1952, Type X gypsum board, such as USG Sheetrock® Brand Firecode® X Panels (UL Type SCX), contain special glass fibers that are intermixed with the gypsum to reinforce the core of the panels. These fibers have the effect of reducing the size of the cracks that form as the chemically combined water is driven from the gypsum molecule (calcination); thereby extending the length of time the gypsum panels resist fire without failure. These panels are most common in one- and two-hour rated walls.

Following the introduction of Type X wallboard, USG released USG Sheetrock® Brand Firecode® C Panels (UL Type C), which is an improved Type X panel. As with the Type X panels, the core of Type C panels contain glass fibers, only in a much higher percent by weight. In addition to the greater amount of glass fiber, the core of the Type C panels also contains a shrinkage compensating additive that expands when exposed to elevated temperatures of a fire. This expansion occurs at roughly the same temperature as the calcination of the gypsum in the core. It allows the core of the Type C panels to remain dimensionally stable in the presence of fire, which in turn allows the panels to remain in place for a longer period of time even after the chemically combined water has been driven off. In today's construction, Type C panels are most common in ceilings that require a fire rating, as well as in very high fire rated walls like three and four hour assemblies.

ASSEMBLY TESTING

In a floor/ceiling fire test, the only side that is exposed to the fire is the ceiling. Therefore, the most critical component in a floor/ceiling fire test is the gypsum board. That is why it is so common that wallboard manufacturers play a big role in sponsoring the design and completion of UL fire tests.

However, a common mistake in the design of fire rated floor/ceiling assemblies is the use of the wrong type of wallboard. Even when the correct wallboard is specified by the architect, many times it is not used by the drywall contractor. The type of wallboard that is required in ceilings when using a single layer is not the same type as what is used in walls. The most common description for wallboard used in walls is 5/8 in. (16 mm) Type X, while for ceiling applications it is 5/8 in. (16 mm) Type C.

ASSEMBLY TESTING CONT.

If you use a single layer of 5/8 in. (16 mm) Type X in the ceiling, you will not meet the UL requirement for a fire rated floor/ceiling assembly. This mistake happens in more than 90% of the floor/ceilings in multifamily construction in the U.S.

Therefore, it's imperative that specifiers look closely at the wallboard type called out in the UL Design. All wallboard manufacturers use UL Type Designations when they list their approved wallboards in a UL Design. This can make the choice confusing for architects and contractors. To be sure you are specifying the correct product, you need to cross reference to the UL Type Designations. USG publishes a cross reference of UL Type Designations for all of its products at usgdesignstudio.com under System Selector/UL Type Designations, which links to the respective Submittal Sheets. Alternatively, the UL Online Certifications Directory can be referenced to verify a UL Listing, Classification or Recognition.

USG was the first in the industry to print the UL Type Designation on the face of all fire-rated wallboard 18 in. (457 mm) from the edge of the panels. Other manufacturers print their Type Designations in areas that are covered up when joint treatment is applied. By printing in the field of the panel, building officials can ensure the correct UL Classified and specified wallboard has been installed in the proper location, even after the joints are finished. This ensures the integrity of the building and the safety of its occupants.

In 2017, USG introduced a new Type X wallboard, USG Sheetrock® Brand EcoSmart Panels Firecode® X, which can be used in the most commonly specified UL Designs for wall, floor/ceiling and roof/ceiling applications, such as L500 and M500 Designs. Unlike traditional Type C panels which require RC-1 channel spacing to be 12 in. (305 mm) OC when insulation is to be draped over the channels, USG Sheetrock® Brand EcoSmart Panels Firecode® X allow for draping insulation over the RC-1 channels spaced at 16 in. (406 mm) OC. Because the most common installation of insulation in ceilings is to drape it over the RC-1 channel, the use of USG Sheetrock® Brand EcoSmart Panels Firecode® X require 25% less resilient channels to achieve a fire rating, while also reducing material cost and installation time.

Floor/ceiling designs that require two layers of gypsum wallboard to achieve a one hour fire rating as in the I-Joist design L589, offer a little more flexibility. In the same design, you have the option to use two layers of 1/2 in. Type C or two layers of 5/8 in. Type X. The best recommendation would be to always use the two layer 5/8 in. Type X because you would now have the same wallboard on your ceiling that you have on your walls.

SECTION 1207 – SOUND CONTROL

The choice of which sound mat to use can be determined by deciding how much sound control is desired. The minimum requirements are called out in Section 1207 of the *International Building Code®* as follows:

> **1207.1 Scope.** This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between dwelling units and adjacent public areas such as halls, corridors, stairs or service areas.
> **1207.2 Air-borne sound.** Walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from public or service areas shall have a sound transmission class (STC) of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E-90. Penetrations or openings in construction assemblies for piping; electrical devises; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to dwelling unit entrance doors; however, such doors shall be tight fitting to the frame and sill.
> **1207.3 Structure-borne sound.** Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 (45 if field tested) when tested in accordance with ASTM E492.

Air-borne sound or STC is generated by things such as speech and music. In typical floor/ceiling assemblies the code minimum for STC is easily achieved. With 3/4 in. (19 mm) of USG Levelrock® 2500 Floor Underlayment and no sound mat, the STC is 55 in an open web truss design with no floor covering. The addition of a floor covering and/or a sound mat improves the STC rating.

Structure-borne sound or IIC is generated by vibration in the framing. This is caused by things such as walking on the floor. The IIC rating is easily achieved with a floor covering of carpet and pad. With carpet and pad the IIC rating with no sound mat is well above a 60. With hard surface floor coverings like sheet vinyl, VCT, vinyl plank, ceramic tile or engineered hardwood, the IIC will always fall below a 50 when there is no sound mat. The addition of a sound mat will improve the IIC rating by decoupling the underlayment from the framing. In effect, the sound mat is performing a similar function as the pad under the carpet. It is helping to reduce the vibration before it has a chance to get into the framing. While sound mats help to raise the STC, they are more effective for raising the IIC. A sound mat can make the difference between not meeting Section 1207, and exceeding Section 1207 for the IIC sound transmission of a floor/ceiling assembly.

USG has a portfolio of more than 300 laboratory sound tests per ASTM E90 (STC) and ASTM E492 (IIC) and they are cross referenced by their UL Design number (see *USG Levelrock® and USG Durock™ Brand Sound Systems Fire & Sound Rating Guide* (IG1685) for some of the most widely used fire rated floor assemblies). The building code references ASTM E90 and ASTM E492 for sound testing because they are both laboratory measurements for sound control. The reason this is required by the code is the ASTM method for laboratory testing is designed to have a test result that is as repeatable as possible by eliminating variables in the sending and receiving rooms. The only variables become what you are testing, for example, the sound mat, the underlayment and the floor covering. Different sound mats can perform differently. The thickness of the underlayment can change the result of the tests. The different types of floor coverings will also cause the results of sound tests to vary.

SECTION 1207 – SOUND CONTROL CONT.

ASTM methods are different in field sound tests because it is impossible to control the variables of the sending and receiving rooms. The variables in the sending and receiving rooms make these tests useful only in the specific dwelling units where they are tested. **Field tests should not be the basis for a specification because they do not comply with the two ASTM methods called out in Section 1207 of the building code (ASTM E90 and ASTM E492).**

The field test method for IIC is ASTM E1007. This ASTM standard clearly states:

> *"good agreement between laboratory tests and field tests on similar floor-ceiling assemblies should not be expected"*. ASTM E1007 also states *"measurements performed in accordance with this standard on nominally identical constructions and acoustical conditions may produce different results"*.

The reason has to do with the lack of ability to control the variables of rooms such as the size of the room, floor/wall/ceiling finishes, room shapes, etc. Therefore, the code says the test method that should be the basis of design should be a test that is performed in a laboratory.

There are many details that, if not followed, will cause the STC and IIC to fall well below the designed assembly results. Therefore, a field test is a great way to make sure an assembly is constructed properly for sound. Some jurisdictions in the US require that a series of field tests are performed prior to receiving a Certificate of Occupancy. This is something that should be done in all projects to make sure the floor/ceiling assemblies are code compliant. There are many good quality acousticians that can economically perform field tests for IIC as the equipment to perform these tests is very portable.

Typically, when a detail is missed it is not something that can be seen, but can be heard. **The most common problem in the construction of floor/ceiling assemblies for sound control has to do with the attachment of the drywall to the RC-1 channel.** In every UL Design, regardless of the number of layers of wallboard on the ceiling, the first layer of wallboard is supposed to be attached with a 1 in. (25 mm) screw as a maximum length. Per the UL Designs, if this screw exceeds 1 in. (25 mm), you do not have a fire rating and you will lose up to 10 STC and IIC points if these screws penetrate the trusses or joists.

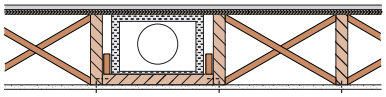
When the screw that attaches the wallboard to the ceiling penetrates through the RC-1 channel and into the framing member, the RC-1 channel is short-circuited. This has effectively eliminated the value of the RC-1 channel. When the RC-1 channel is short circuited, you are in danger of falling below a 50 IIC. An estimated 80% or more installations have short circuited RC-1 channels in floor/ceiling assemblies. It is rare that a drywall contractor knows what length screw is required by the UL Design. They will typically use a 1-1/4 in. (32 mm) length screw because that is what they usually use when attaching 5/8 in. (16 mm) wallboard to the wall studs. For this reason, see the optional method for suspending the ceiling mentioned in the *Resilient Channels* section.

DESIGN CONSIDERATIONS

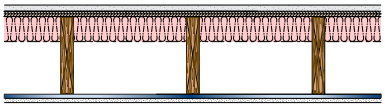
In multifamily construction, there is a cost to meet the minimum sound transmission requirements of Section 1207 of the IBC. We find in many cases there are areas that could provide cost savings.

For example, interior corridors do not have to meet Section 1207 for sound transmission, so there is no need for a sound mat or insulation in the cavity. If you have the ability to design the interior corridors with dimensional lumber as in UL Design L501 (below), you can also eliminate the cost of the RC-1 channel and attach the single layer of wallboard directly to the joist. **There are no open web truss designs or I-Joist designs that allow the elimination of RC-1 channel for fire.** The only designs that make that option available are the 2x10 dimensional lumber designs and then only when you find a design that was tested without insulation. If you add insulation to a 2x10 joist as in UL Design L569, the RC-1 channel becomes a requirement (see below).

UL Design L501



UL Design L569

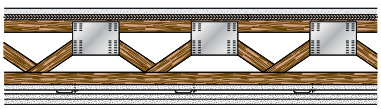


By eliminating the insulation and RC-1 channel in the interior corridors you will realize a significant cost savings. If there is no dwelling unit on either side of the assembly, there is no requirement to meet Section 1207 for sound transmission.

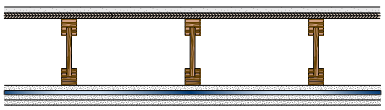
In a building where the first floor is a commercial space (not a dwelling unit), the fire rating may become two hours as opposed to one hour. This will change the UL Design that is required. For open web truss assemblies, the two hour rated assembly can be found in UL Design L577. To go from a one hour assembly to a two hour assembly you have to add two additional layers of 5/8 in. (16mm) Type C wallboard for a total of three layers on the ceiling.

For I-Joist assemblies, the two hour rated assembly can be found in UL Design L538. To go from a one hour assembly (two layers of 5/8 in. (16 mm) Type X wallboard) to a two hour assembly you will instead need three layers of 5/8 in. (16 mm) Type C wallboard on the ceiling. Because the RC-1 channel cannot handle the weight of three layers of wallboard, the RC-1 channel is installed between the first and second layers. This detail works for fire but is a poor design for sound. **Therefore, you will not be able to meet Section 1207 for sound in a two hour fire rated wood framed floor/ceiling assembly with either the open web trusses or I-Joist designs below:**

UL Design L577



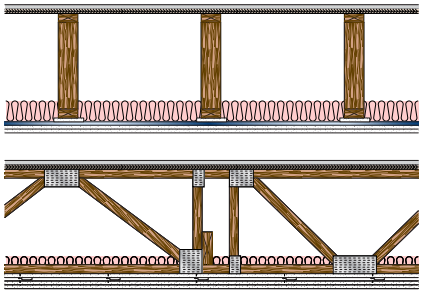
UL Design L538



DESIGN CONSIDERATIONS CONT.

The newest two hour open web truss UL Design is M521. UL design M521 is by far the most economical way to get a two-hour fire rating with an open web truss and is the only design that can meet Section 1207 for STC and IIC. This unique new design was developed in 2014 and can be found in the 2015 UL Directory. This design is great for sound and eliminates the third layer of wallboard by placing a 6 in. (152 mm) strip of USG Sheetrock® Brand Firecode® C Panels (UL Type C) along the bottom of each truss as follows:

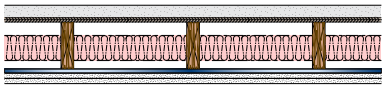
UL Design M521



The above design is proprietary to USG Levelrock® Floor Underlayment above the subfloor and USG Sheetrock® Brand Firecode® C Panels (UL Type C) on the ceiling. UL design M521 is by far the most economical way to get a two hour fire rating with an open web truss and it is the only design that can meet Section 1207 for STC and IIC.

There is a two hour design that works for fire and sound with a 2x10 dimensional lumber joist. The assembly can be found in UL Design L541. This design only requires two layers of wallboard that are attached to the RC-1 channel as follows:

UL Design L541



If the two hour floor is a dwelling unit above a commercial space, the only area that must meet Section 1207 for sound is the dwelling unit. Because IIC only travels from the top down, you may not need a sound mat between the first and second floor. The only type of sound that travels from the first floor to the second floor is air-borne sound (STC) and it is much easier to achieve a minimum STC-50 than an IIC-50.

CONTACT

For more information see *Resources* on pages 14-15, visit usgperformanceflooring.com or contact your local USG representative at 800 USG.4YOU (874-4968).

RESOURCES

RC Deluxe® Resilient Channel (RCSD)

UL Design Information Section

UL Design L501

UL Design L521

UL Design L538

UL Design L541

UL Design L569

UL Design L577

UL Design L589

UL Design M521

UL Online Certifications Directory

UL.com

RESOURCES CONT.

USG Design Studio
usgdesignstudio.com

USG Drywall Suspension System

USG Levelrock® 2500 Floor Underlayment

USG Levelrock® and Durock™ Brand Sound Systems Fire & Sound Rating Guide (IG1685)

USG Levelrock® Brand SAM-N12™ Sound Attenuation Mat

USG Sheetrock® Brand EcoSmart Panels Firecode® X

USG Sheetrock® Brand Firecode® C Panels

USG UL Type Designations

USG Corporation
usg.com

CONTACT INFORMATION

United States Gypsum Company
550 West Adams Street
Chicago, IL 60661

PRODUCT INFORMATION

See usgperformanceflooring.com for the most up-to-date product information.

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TECHNICAL SERVICE

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WEBSITES

usgperformanceflooring.com

usg.com/floorprep

CONTENT

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