Why Fire Rated Glazing?

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Glass is being designed into buildings in greater quantities, and being used more creatively than ever before. For most applications this is a relatively familiar and straight forward process with little consequence. Fire and glass don't usually mix, and incorrectly specified or installed fire rated glazing can have catastrophic effects on the safety and integrity of a building.

Where is Fire Rated Glass used.

Fire Rated Glass is used particularly in compartmentation of a building. Doors and partitions are used to protect corridors and egress ways from flames and heat for fast and safe evacuation of a building or quick access to the source of a fire by emergency personnel.

One of the key design benefits of using Fire Rated Glass is to bring natural light into the heart of a building to enhance the environment and distinctive design features while maximising the safety of its inhabitants. This leads to the use of Fire Rated Glass in walls, floors, façades, doors and roofing systems all designed to isolate and contain a fire.

All Fire Rated Glass is not created equal

The thing to remember when specifying Fire Rated Glass is that it is part of a tested system. The glass and the frame need to have supporting documentation to show they have been tested as a unit and meet certain standards. In New Zealand these standards are AS1530 part 4 and NZS4232-2. To comply in New Zealand Fire Rated Glass needs to be in either a timber or a steel frame.

There are two different types of Fire Rated Glass:

Non- insulated glass; this will be specified as -/60/-. The number represents the length of time in minutes the glass and the frame have been tested to physically stop the path of the fire.

Insulated glass; this will be specified as -/60/60. The first number in the sequence represents the length of time in minutes the glass and the frame have been tested to physically stop the path of the fire and the second number represents the length of time in minutes the glass and the frame have been tested to minimise the heat radiation through the glass.

There are a number of suppliers in New Zealand offering a myriad of different brands and specifications of Fire Rated Glass. Some are more flexible than others in their sizes and applications.

There are basically four types of non-insulated Fire Rated Glass.

Georgian wired glass; is the old wired glass that we are used to seeing in schools and buildings designed in the 60's and 70's. Today this has limited applications and has restrictions on how it can be used.

Ceramic glass; is a specific glass compound that is heat resistant. It has a very definite tint and is used as an entry level Fire Rated Glass. It is important to note this is **not** a safety glass, it can only be used where the human impact standards do not apply. Like Georgian wired glass Ceramic glass has limited applications and restrictions on how it can be used.

Coated soda lime glass; (standard glass), this is marketed under a number of brands and the fire resistance for this type of Fire Rated Glass is provided by a chemical coating on the glass. Generally it will perform better than Georgian wired or ceramic glass and can be toughened to become safety glass.

Borosilicate glass, is a specifically designed heat resistant glass that is clear and has outstanding properties when used as a Fire Rated Glass. It is a safety glass that can be used in sheets up to 1600mm x 3000mm and can also be butt jointed.

Insulated Fire Rated Glass.

The qualifying criterion for the EW glass (insulated glass) is a maximum radiant heat level measured in a standard furnace test at a distance of 1 metre of 15kW/m².
Insulated Fire Rated Glass is a laminated glass. Between each layer of glass is an intumescent material that is either in solid or gel form depending on the brand. It is this intumescent material that gives the sheet of laminated glass its fire resistance.

As the laminated glass heats up, the intumescent material will harden and when the first layer of glass in the laminate reaches approximately 120ºC the glass will shatter exposing the intumescent material. As the fire burns through this material the next layer of glass will heat and shatter exposing the next layer of laminate and so on. The higher the fire rating needed the more laminates are used, so the thicker the piece of glass will become. (Insulated fire rated glass with a -/30/30 fire rating will be 16mm thick and a -/120/120 fire rating will be 53mm thick.)

When using Fire Rated Glass it is important to remember the glass needs to be fitted into the frame in a specific way and then the frame needs to be installed into the fire rated wall correctly. With each installation, whether it is a window, door or façade; documentation is required to show the specific brand and thickness of glass and the specific frame design has been tested as a unit to AS1530 part 4 and meets the fire rating required. This glass and frame combination is then classified as a tested system.

All fire rated systems should carry a tag indicating;

1) Who the manufacturer is.
2) The fire rating the system has been tested to.
3) The date the system was installed.
4) The standard the system has been tested to.

Responsibility lies with the manufacturer of the system (fire rated glass and frame) to ensure these details are present and correct.

Options in Design

The designer has three levels of fire rating protection to choose from.

1. *Insulated Fire Rated Glass*, offers the highest degree of confidence in effective fire protection. This ensures reliable integrity and insulation performance to areas of a building where prolonged evacuation is expected or a safe path is needed for emergency personnel. This option offers the **greatest protection and peace of mind** of the three options because radiant heat levels on the non-fire side of the Fire Rated Glass at 1 metre distance are typically less than 1kW/m² at the standard test times defined in the test standards.

2. *Non-insulated Fire Rated Glass*, also known as integrity only Fire Rated Glass are designed and tested to halt the path of the fire for a defined time. There can be issues with the levels of transmitted heat through the glass to the protected side being too high for both people and materials. This will generally be used where rapid evacuation of a building is expected.

These first two options are both tested systems.

Exceptions to the rule of *"a tested fire rated system."* are known as alternative solutions. Alternative solutions usually involve non Fire Rated Glass and either a sprinkler or drenching set up. A designer

can ask for an opinion from a fire engineer as to the likelihood of such a set up working effectively as a fire barrier. When a designer has that opinion it needs to be reviewed and passed by the local authorities before being installed into a building. It is important to realise this type of solution will not have been tested, the responsibility for its success or failure rest with the designer, fire engineer and the local authority.

An alternative solution, a non tested variation to fire rated glass, usually involving toughened or laminated standard soda lime glass. The success of this solution depends on a fire starting and spreading in a predictable way with the sprinklers operating immediately and a constant and even stream of water being applied to the glass. There is little margin for safety and chance may very well determine the outcome. This is a very **high risk** option.

Tempered glass and water don't mix well under fire conditions. Tempered or toughened glass is approximately five times stronger than standard annealed glass. It is designed for use where physical impact is a concern and it will shatter into small pieces without any sharp edges. There is no way of accurately predicting how heat from a fire will transfer through the glass prior to the water being applied; also there are other conditions to take into account such as:

- How the wind or sprinkler operation will affect water flow over the glass, especially as the building ages?
- Will the water flow be even and constant or will there be areas where the flow will not be sufficient to control the glass temperature?
- Will the glass temperature be too high when the water is applied, what will happen to the glass once the water is applied?

The effective function of an alternative solution in each case depends on the particular glass panel under consideration. It is impossible to know precisely the stress field generated by a range of possible fire conditions. The way the glass is designed to break also means that failure is unpredictable and without warning. When heat and water are added to the equation, **failure can be sudden and catastrophic.**

Annealed laminated glass with a plastic interlayer is designed for impact and security purposes. When used in an alternative solution this type of glass presents its own particular issues. When exposed to fire the glass will crack within a few minutes, at relatively low temperatures. The glass will fall out of the frame in 5 to 12 minutes. A rise in temperature of as little 80ºC may be enough to cause cracking. Under fire conditions the plastic interlayer quickly turns to liquid, smoking and then igniting. In fire tests, such laminates fail in 5 to 8 minutes with cracking and flaming of the interlayer.

The thing to remember with alternative solutions is they are an untested solution, where chance may substantially determine the outcome. This is the **highest risk option** a designer has.

Today, through extensive modelling and testing, we have a very good understanding of how a fire will behave within a modern building envelope. We also can predict how a glazed fire rated system will react in a fire. Designers incorporate fire cells and safe paths in buildings to maximise the safety of its occupants, yet there is still a great void of knowledge at all levels of the design and construction process when it comes to the fire rating requirements for glass within a building.

I hope this article has gone some way to clarifying what is needed and required when specifying Fire Rated Glass and gives you a better understanding of why and how we use it.