Importance of Fire Compartments

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Many of the buildings you use on a daily basis, such as offices, commercial facilities, factories, and warehouses, have "fire compartments." Fire compartments are designed to prevent the spread of fire.

It is unlikely that people are aware of fire compartments on a daily basis. In this article we will reaffirm the purpose and importance of fire compartments, which play an important role in the event of a fire. In addition, we will summarize the basic points you should pay particular attention to.

1. What is Fire Compartment

Fire compartments are stipulated by the building codes and fire protection laws of each country, and are compartments within a building that are established to prevent the spread of fire in the event of a fire. They are set based on concepts such as compartments according to area, compartments by occupancies, and vertical compartments (e.g. elevators, staircases, etc.) to prevent the spread of fire between floors.

The fire compartment consists of the walls, floors, and ceilings of a building. Required fire resistance rate varies by country, and it is usually set between 1 and 4 hours.

2. Purpose of Fire Compartment

As mentioned earlier, fire compartments are established to prevent the spread of fire, heat, and smoke. Even if a fire were to break out, having measures such as fire compartments not only ensures the safety of people but also protects assets from fire. If the damage from the fire can be limited, it will be possible to shorten the recovery period for your business.

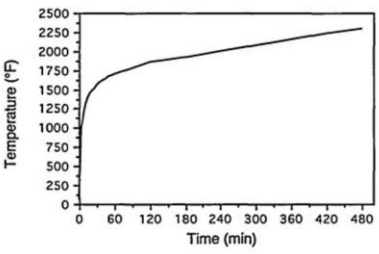
Therefore, it is important to properly maintain fire compartments in the buildings you use, and it is one of the basics of fire prevention management.

Column 1

Some countries have specifications for fire walls that are rated for two hours, for example.

The fire resistance performance of building structural materials and fire doors etc. is determined based on the results of fire tests.

There are various standards such as ASTM*1 and UL*2 regarding fire test methods, and these standards specify standard heating times and temperatures. For example, ASTM E119, which is one of the rules for standard fire tests, has established the standard time-temperature curve as shown on the right.



Time (min)	Temperature (°F)	
0	68	20°C
5	1000	538°C
10	1300	704°C
20	1462	794°C
30	1550	843°C
60	1700	927°C
90	1792	978°C
120	1850	1010°C
180	1925	1052°C
240	2000	1093°C
300	2075	1135°C
360	2150	1177°C
420	2225	1218°C
480	2300	1260°C

Figure 1: Standard time-temperature curve

Furthermore, ASTM E119 also requires that immediately after a fire test, post hose stream test be conducted on the test member to confirm the strength of the member after it has been exposed to flame.

*1 ASTM: ASTM International. The world's largest private, non-profit international standardization and standard-setting organization.
(https://www.astm.org/about/overview.html)

*2 UL: Underwriters Laboratories Inc. UL standards are product safety standards established by UL. The purpose is to standardize the functions and safety of everything from materials, equipment, parts, tools, etc. to products.
(https://www.ul.com/)

3. Control of Fire

We cannot reduce the risk of fire to "zero" in the buildings we use. Many fires occur in industrial facilities every year. Therefore, the laws of each country require that buildings be equipped with a "fire prevention system", such as fire compartments and fire extinguishing equipment.

There are two types of fire protection systems, which every building needs to have to maximize their protection: active and passive fire protection systems. The two types of systems work together to help stop and contain the threat of a fire. Alone, each one can be effective, but, together, they offer you the best type of protection you can get for your building.

1) Active Fire Protection Systems

An active fire protection system means that action of some kind is taking place. This action can be manual, meaning that a person or persons may engage in it, or it may be automatic, deploying once fire, smoke or heat is detected. This includes all fire extinguishing equipment. This includes not only equipment for extinguishing fires such as fire extinguishers, hydrants, and sprinklers, but also equipment for notifying the danger of fire, such as fire alarm system, and smoke exhaust equipment.

2) Passive Fire Protection Systems

Passive fire protection system is components or systems of a building or structure that slows or impedes the spread of the effects of fire or smoke without system activation, and usually without movement. Examples of passive systems include fire compartments and their elements such as floor-ceilings and roofs, fire doors, fire-resistant coatings etc.

While many people may infer that an active fire protection system will be the most effective way to protect a building from fire, passive fire protection systems are equally as - if not more than - effective at preventing damage and loss of life.

3) Control of Fire

Two types of fire protection systems are mentioned above, and when it comes to controlling fires, the focus tends to be on fire extinguishing equipment, that is, active fire protection systems. However, there are cases where it is not possible to properly control fires with active fire protection systems alone.

Looking back at past fire incidents, there are cases where buildings were completely destroyed. The spread of the fire could have been limited if the building had been properly fire compartmentation. Human factors are greatly involved in active fire protection systems. For example, there are cases even if fire extinguishing equipment is installed, if it cannot be operated properly, or if the fire extinguishing equipment is not functioning due to maintenance work.

On the other hand, fire compartments, which are a passive fire protection system, are a safety feature that is built into the building if properly installed. Therefore, we can expect that they can be used to suppress fires (prevent the spread of fire) without requiring any special measures in the event of a fire.

Of course, as mentioned above, fire protection can be maximized through a combination of active and passive fire protection systems. As I mentioned earlier, passive fire protection systems such as fire compartments are particularly useful in the event of a fire (emergency). This is because the involvement of human factors is limited. Hence, if they are properly maintained, it can be expected to perform its functions reliably.

Therefore, please understand that it is important to properly understand the purpose, function, and role of fire protection compartments, and to properly maintain them on a daily basis.

4. Maintenance of Fire Compartments

As mentioned above, it is important to properly maintain fire compartments within buildings. We have many opportunities to visit our customers' facilities and check them from a fire safety perspective. At that time, the following are basic points of view that are often pointed out, especially in relation to "fire walls."

1) Fire Doors / Fire Shutters

Fire walls have openings for people and objects to pass through. Fire doors and fire shutters are usually installed there.

a. Fire Doors

Many people understand that fire doors should be kept closed at all times unless they are equipped with an automatic closing mechanism linked to a fire alarm.

However, we often see cases where fire doors, which people often pass through, are secured in place with wedges, etc., as shown in the diagram. It is important not to think that “in an emergency, we will close the door and it will be okay,”" but to operate the door “always closed”.

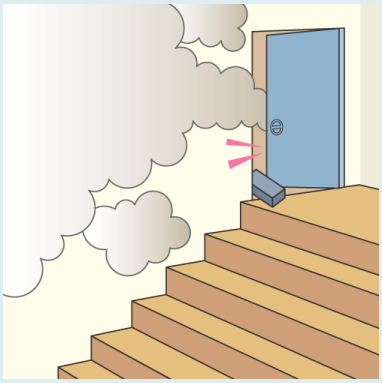


Figure 2: Fire door

Even if your fire door is equipped with a door closer, if it does not close naturally, it is important to have it repaired immediately.

b. Fire Shutters

In some warehouses and factories etc., fire shutters are installed at openings in fire walls. In order for the fire shutter to close properly, it is necessary that no objects are placed under the fire shutter and that the shutter rail is not damaged.

As for fire shutters that are not self-closing, they are basically closed at all times, just like fire doors.

Although fire shutters are fire resistant, if they are exposed to a fire for a long time, radiant heat will be transferred to the opposite side of the fire area. If combustible materials are placed close to the shutter, there is a risk of fire spreading due to radiant heat, so we usually recommend that a space of about 2 meters be maintained on both sides of the fire shutter.

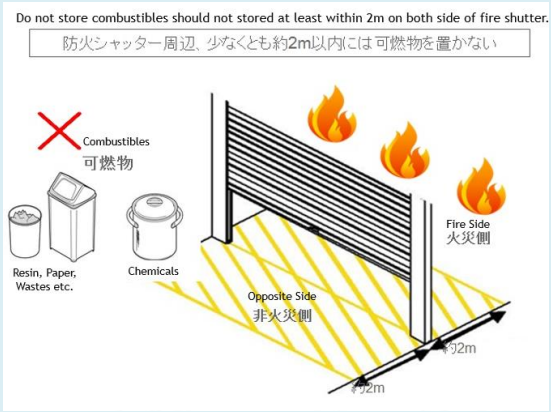


Figure 3: Fire shutter

2) Penetrating Parts such as Piping

There are parts where cables and piping penetrate through the firewall.

These penetrations require that the gaps be backfilled with non-combustible material. If gaps remain, smoke and heat may spread through the gaps, and the fire may spread to adjacent areas using the cables as a combustion medium.

Cables may need to be rerouted when changing or expanding equipment.

Column 2

In 2022, a fire broke out at one of confectionery factory in Japan and six people died. In this accident, the following points, including those related to fire compartments, can be used as reference points in terms of fire prevention.

- The fire started in the drying equipment. The fire did not start from the gas or electrical equipment being used, but it was caused by an oxidation reaction of oil contained in food scraps remained in the drying equipment and the heat generated by the drying equipment.
- Polyurethane foam was installed on the ceiling where the fire started. This ignited, producing a large amount of black smoke and causing the fire to spread rapidly.
- The fire occurred at night, and there was a power outage immediately after the fire broke out. It is also speculated that a large amount of black smoke was generated, making evacuation difficult. Additionally, although the fire shutters were properly closed, some employees were not aware of the evacuation exit next to the shutters, so they were unable to evacuate, resulting in confusion.

Employees should understand the importance of fire compartments. Fire compartments also relate to evacuation routes. It is important to check both of these points during safety training for employees.

(Compiled by the writer with reference to the fire accident report released by the Fire and Disaster Management Agency of Japan's Ministry of Internal Affairs and Communications on 31 March 2023.)

It is important to make sure to fire-stop the gaps with non-combustible material after the rerouted work is complete.

Figure 4: Fire-stopping of penetrations

3) Penetrating Parts such as Conveyors

In order to transport products and raw materials etc. in warehouses and factories, fire walls may have openings for roller conveyors to pass through.

In order to protect this opening, it is important to provide a gap in the roller conveyor as shown in the diagram below, or to allow the roller conveyor to partially flip up so that fire shutters, etc. can be closed securely.

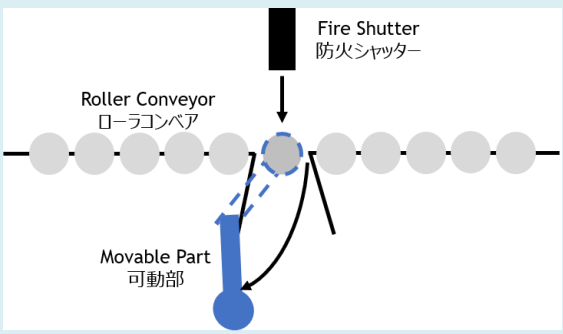


Figure 5: Example of roller conveyors
Reference: Fire and Disaster Management Agency

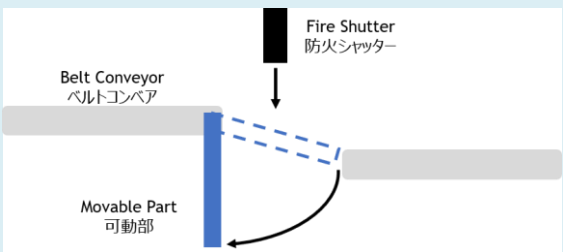


Figure 6: Example of belt conveyors
Reference: Fire and Disaster Management Agency

4) Utility Rooms

If there is a utility room such as an electrical room or AHU room, it is usually separated from the surrounding area by fire compartment. This is based on compartmentation by occupancy.

On the other hand, there are cases where fire doors with louvers are installed at the utility rooms. It is recommended that doors installed in fire walls be fire doors.

5. Conclusion

In this article, we have summarized the purpose and role of fire compartments in order to remind everyone of the importance of properly managing fire compartments in buildings that are used on a daily basis. Although the focus is on fire compartments, it goes without saying that proper maintenance of both passive and active fire protection systems in a building, along with active fire protection systems such as fire extinguishing equipment, will help reduce fire risk.

Properly maintaining the passive fire protection system, “fire compartments”, is one of the basics of fire prevention management. We would appreciate it if you would recognize this important role once again and use it as a reference for thorough safety management in your company.

Topics related to this article are covered in the following back issues of our TM-RE News. If necessary, please contact our person in charge.

- No.11 (July 2021)
  Proper Maintenance of Fire Doors
- No. 20 (April 2022)
  Management of Emergency Evacuation Routes
- No. 30 (February 2023)
  Spotting Fire Doors Failures

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