

Fire Risk and Safety Measures in General Electrical Equipment



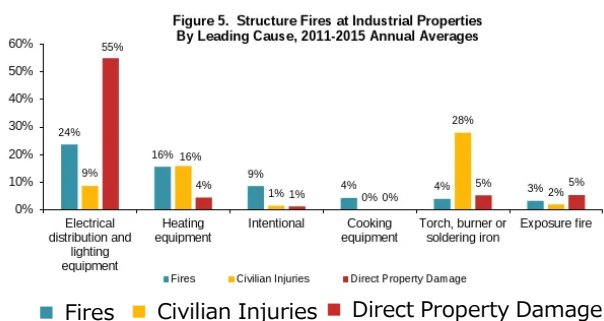
Fires arising from general electrical equipment such as lighting, air conditioner, washing machines, and refrigerators also occur in industrial buildings and factories.

In this article, we introduce fire prevention measures for fires caused by general electrical equipment, based on examples of fire accidents.

1. Fires in General Electrical Equipment

In factories and other facilities, fires can occur from production processes such as heating and burner equipment, from handling of oil and flammable liquids, and from electrical fires caused by electrical problems.

The figure below shows the sources of fires in industrial properties from 2011 to 2015, according to National Fire Protection Association (NFPA) report in 2019. The largest number of fires originated from electrical distribution and lighting, indicating that electrical equipment is a very high fire risk.



Sources of Fires in Industrial Facilities (U.S.)

Source: [NFPA report - Fire in Industrial or Manufacturing Properties](#) ^[1]

Fire preventive measures for electrical facilities, production facilities and switchboards in factories are generally maintained by conducting periodic inspections in accordance with a predetermined preventive maintenance schedule. On the other hand, general electrical equipment such as office lighting, refrigerators, air conditioner, and washing machines may not be adequately maintained.

Many fires had been reported in the past involving such general electrical equipment that was not properly managed.



Source: Tokyo Fire Department
<https://www.tfd.metro.tokyo.lg.jp/lfe/topics/range/index.html>

2. Example of Fire Accidents

The following are three examples of fire accidents that broke out in general electrical facilities.

Case 1

Fire broke out in a washer/dryer (Southeast Asia, 2020)

A part-time employee placed solvent-soaked clothes in the washer and dryer, and the washer caught fire during operation.

Initial firefighting activity failed and the fire spread to surrounding facilities.

Case 2

Fire broke out from a refrigerator (London, 2017)

At 1:20 AM, a fire broke out from a refrigerator on the 4th floor of a high-rise condominium. The fire spread to exterior materials and spread throughout the entire condominium.

It was a fire on late night, and the fire spread rapidly and it leads to delayed evacuation, resulting in the deaths of 70 people.



Refrigerator that started the fire^[2]

Source: [Phase 1 report | Grenfell Tower Inquiry](#)

Case 3

Fire broke out in a lighting cable (China, 2021)

A fire broke out from a lighting circuit above the atelier of a wedding store, spreading to decorative artificial flowers and polyurethane interior materials, destroying the building and killing 15 people.

3. Cause of Accident and Fire Risk

The following is a summary of the causes of the fires and the factors that contributed to the spread of the damage for the cases in Section 2.

❑ Case 1 (Washing machine)

- Cause of fire: Solvent components may have ignited due to high temperatures in the dryer; or sparks may have ignited due to electrical leakage or circuit shorts caused by water damage.
- Factors contributed to the spread of damage: Part-time employees were not subject to disaster training and did not know how to perform initial firefighting, causing rapid spread of damage due to delays in responding to the fire.

❑ Case 2 (Refrigerator)

- Cause of fire: The actual cause is unknown, but the fire was believed to have started from an electrical failure in the refrigerator [2] (Ignition of cables, malfunction of the refrigerator itself, etc.).
- Factors contributed to the spread of damage: The fire spread throughout the entire condominium because the exterior materials were combustibles. Victims testified that they could not find their way out[2]. It was possible that the poor visibility during the late night caused victims to delay their escape, leading to the spread of the damage.

❑ Case 3 (Lighting)

- Cause of fire: The electrical wiring was disorganized and had deteriorated, and the fire started due to poor cable contact.[3] There may have been a lack of awareness that lighting and wiring cables were one of the ignition source.
- Factors contributed to the spread of damage: The ceiling of the wedding store was covered with artificial flowers, which caused the building to burn down through combustible materials.



Wedding store ceiling lighting and ambient conditions[3]

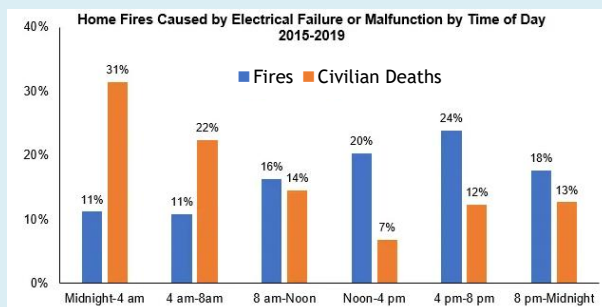
Source: [Safety | Free Full-Text | Analysis of Characteristics of Fire Incident on 24 July 2021 in Jilin Province, China \(mdpi.com\)](#)

The following are some of the key points of fire risk that can be seen from the above cases.

- A. There have been cases of fires starting from cables. Cables are a high-risk point, as there have been many cases of fires. (Case 2,3)
- B. Equipment may be used in an outdated state or inspections may not be conducted. Fires from defective equipment have also been observed. (Case 1,2,3)

C. Production equipment often operate during operating hours, whereas general electrical equipment are often in operation 24 hours a day. Damage can easily spread if evacuation is delayed due to sleeping, or initial firefighting is not possible in the late-night hours when no one is around to extinguish the fire. (Case 2, Reference figure: Number of electrical fires in homes and time of day)

D. Although the housekeeping around the production equipment and Utility equipment in the factory is basically under control, but sometimes there are large amount of combustible materials around general electrical equipment, where fires can easily spread. (Case 1,3)



Number of electrical fires in homes and time of day[4]
Source: [NFPA report - Home Electrical Fires](#)

4. Fire Prevention Measures

The Tokio Marine Group conducts fire risk surveys by visiting facilities around the world. Among the typical hazardous conditions identified through risk surveys, the following preventive measures and checkpoints effective for general electrical fires are described for the five risks listed in Section 3.

A. Risk of Cable Fires

- I. Is the cable degraded?
- II. Has the dust in the electrical outlets been cleaned?
- III. If outdoors, is the outlet waterproof type?
- IV. Are the cables clutter free and disorganized?
 - * Areas that cannot normally be checked, such as the ceiling, should be checked during periodic inspections.
- V. Is the cable completely pulled out from the cable drum before use?
 - * According to a survey by the Tokyo Fire Department, the allowable current for a wound cable drum is 1/3 of that for a pulled cable.



Case of fire ignited by reel-type cable
Source: SwindonAdvertiser.co.uk

B. Risk of Aging, Inspection, and Defective Products

- I. Is the supplier reliable?
- II. Is the product subject to recall?
- III. Are inspections being performed? (See Section 5)
- IV. Is aging equipment being properly replaced?

* For reference: One Japanese manufacturer recommends to stop using their refrigerators after 25 years^[5], and if the refrigerator is deteriorating even within 25 years, to contact the manufacturer or replace it. For reference, some of the items on the refrigerator inspection checklist provided by the manufacturer are summarized below.

- Emits burning smell.
- Abnormal sound.
- Tingling sensation of electricity leakage.
- Water leakage at the bottom.
- Scratches and burns on cables and leads.
- Dust accumulation on the plug.
- The plastic of the compressor at the rear bottom of the refrigerator is discolored.
- Dust on the lower front and rear surfaces.

C. Risk of Fires on Late Night

- I. Do you conduct nighttime evacuation drills?
* In a nighttime fire, the evacuation situation differs from that in the daytime, as the surroundings are too dark to see, and the usual passageways cannot be used due to the closing of fireproof shutters.
- II. Are there any objects left in the evacuation route?

D. Risk of Fire Spread

- I. Are there any unnecessary combustibles around the general equipment?

In addition, in electrical circuits around water, such as washing machines and outdoor units of air conditioners, it is also effective to install ground-fault circuit breakers in terms of preventing leakage and electric shock.

Under Japanese Industrial Safety and Health Act^[6], even equipment with an earth voltage of 150 V or less is obligated to install ground-fault circuit breakers in the following cases.

- Wet areas due to water or other highly conductive liquids
- Highly conductive places such as on steel plates, steel frames, surface plates, etc.

5. Reference (Maintenance Details and Frequency)

NFPA 70, Recommended Practice for Electrical Equipment Maintenance, Appendix L^[7], establishes maintenance standards for electrical equipment. The following items are organized as applicable to general electrical equipment.

Item	Check task & Interval
Power cables	<ul style="list-style-type: none"> • Visual inspection (Annually) • Electrical test (1-3 years)
Electronic equipment	<ul style="list-style-type: none"> • Inspection (Annually) • Cleaning (3 years) • Adjustment / calibration (3-5 years)
Attachment plugs, code connector bodies	<ul style="list-style-type: none"> • Inspection (Monthly, when used)
Receptacles	<ul style="list-style-type: none"> • Inspection (Monthly, when used) • Operation check (Monthly, when used)
General-use snap switches	<ul style="list-style-type: none"> • Operation check (when used)
Electric tools	<ul style="list-style-type: none"> • Inspection / Cleaning (Monthly, when used) • Lubricant (manufacturer's regulation) • Electrical tests (Quarterly)

6. Conclusion

Risks that are adequately addressed in plant facilities are often overlooked in general electrical facilities.

We would be happy if you could start by checking the general electrical equipment around you and use this information to strengthen safety management in your company.

ReferenceData

- [1] Fires in Industrial and Manufacturing Properties, NFPA Research
- [2] GRENFELL TOWER INQUIRY:PHASE 1 REPORT (Volume 4)
- [3] Analysis of Characteristics of Fire Incident on 24 July 2021 in Jilin Province, China ,Liehao Xu, Yanning Wang, Jun Chen
- [4] Home Fires caused by electrical distribution and lighting equipment, NFPA Research, Recharad Campbell
- [5] Toshiba lifestyle For the safety of long-term use of electric refrigerators
(URL:<https://www.toshiba-lifestyle.com/jp/living/attention/refrigerator.htm>)
- [6] Article 333 of the Ordinance on Industrial Safety and Health: Prevention of electric shock due to electric leakage
- [7] NFPA 70B : Recommended Practice for Electrical Equipment Maintenance, 2019 edition, National Fire Protection Association

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