



INNOVATIVE SOLUTIONS

FOR LIFE SAFETY AND BUSINESS CONTINUITY

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Emergency Power Off (EPO) in IT Spaces Where Clean Agent Fire Suppression is Used

Executives responsible for the continuous operation of information technology (IT) equipment rooms spend millions of dollars annually to insure their business continuity. They evaluate their acceptable level of loss due to emergencies such as power failure, fire, and unauthorized intrusion and invest in solutions to reduce risk. The solutions they choose include uninterruptible power supplies backed with batteries, diesel generators, clean agent fire suppression systems, and access control.

One of the most important safety features of any IT equipment room is the emergency power off circuitry, more commonly known as the EPO. In fact, many local jurisdictions mandate the use of one central means of disconnecting power.

Failure to properly design, install, and manage EPO controls, can jeopardize uptime and negate the entire investment made in the business continuity solutions named above.

The EPO circuitry disconnects power to IT equipment and HVAC systems in the event of an emergency such as electrocution, fire, or flood.

EPO controls are used because power to the IT equipment and HVAC systems does not typically emanate from one conveniently located source. Disconnecting each piece of equipment individually cannot be accomplished in a timely fashion during an emergency. Often the means to disconnect power resides outside the IT space. So consolidating the EPO controls makes sense both for speed and efficiency of operation.

The activation of the EPO is typically initiated by depressing EPO button(s) located at each point of egress from the room. The EPO can also be initiated automatically by other controls serving the room such as the clean agent fire suppression control panel.

Simply put, if the EPO is activated, the IT room is down and productivity ceases. The cost of EPO activation can be substantial.

Unfortunately, the EPO is often misunderstood by the end user leading to potentially disastrous results. All too often an accidental or, stated in a more politically correct fashion, an “unplanned” shutdown occurs. To further complicate matters, if there are no written or posted procedures, restoration of power after an emergency or accidental EPO activation is very time consuming.

If you are accountable for your business' uptime do you want to explain to your management or customer that your department's lack of knowledge about your EPO controls contributed to a delay in returning the technology environment to full operation?

This article explains how EPO controls work and answers questions regarding proper application of the EPO system in technology spaces where clean agent fire suppression systems are used. This article also explains the shortcomings of many existing EPO installations. EPO systems have evolved and the innovative best practice design solution of today is illustrated.

What defines an information technology equipment area?

NFPA 70 and 75 define an information technology equipment area as rooms in a building where information technology equipment is located, including support rooms served by the same special air conditioning/air handling equipment as the information technology equipment room. Information technology equipment is any electronic digital or analog computer, along with all peripheral, support, memory, programming, or other directly associated equipment, records, storage, and activities. This includes terminals, power supplies, interconnecting wiring, and grounding systems. The information technology equipment room according to the 2002 National Electric Code shall meet the following conditions:

1. The room is separated from other occupied spaces by fire resistant-rated walls, floors, and ceilings with protected openings.
2. A separate heating/ventilating/air conditioning (HVAC) system is provided that is dedicated for information technology equipment use and is separated from other areas of occupancy. Any HVAC system that serves other occupancies shall be permitted to also serve the information technology equipment room if fire/smoke dampers are provided at the point of penetration of the room boundary. Such dampers shall operate on activation of smoke detectors and also by operation of the disconnecting means.
3. Listed information technology equipment is installed.
4. The room is occupied only by personnel needed for the maintenance and functional operation of the installed information technology equipment.

EPO and Clean Agent Fire Suppression in an Information Technology Equipment Room

Objective of a clean agent fire suppression system

To better understand EPO controls you must first appreciate the role a clean agent fire suppression system plays in most information technology spaces.

A clean agent fire suppression system can be initiated either automatically or manually via a pull station. The system uses a life safe agent to extinguish a fire. It distributes the agent or "floods" the room with the desired concentration necessary for rapid extinguishment.

The objective of any clean agent fire suppression system is to maintain business continuity. In other words, the system is designed to only discharge when absolutely required. Once discharged, the system is designed to extinguish the fire rapidly, thereby minimizing damage caused by fire and smoke. Because the suppression agent is colorless and odorless, leaves no residue and extinguishes the fire rapidly, clean up and recovery of the information technology equipment is swift. **A properly installed EPO control system must be designed in concert with the objectives and method of operation of the suppression system.**

Method of Operation

Once Smoke is Detected

Many buildings, factories, and other facilities include rooms or other zones protected by fire suppression systems. Once smoke is detected it is necessary to control the shut down of certain electrically operated equipment.

Upon verified detection of smoke, the suppression system begins a thirty second count down to discharge. During this time, the system can be safely aborted by the user. After the beginning of the count down cycle but prior to discharge of the fire suppression system, it is desirable to shut down dedicated air handling units, fire/smoke dampers, exhaust fans, etc. (HVAC) to prevent interference with the dispersion of the suppression agent. Failure to shut down the HVAC system can result in loss of suppression agent whereby the concentration of the suppression agent falls below the level of effective extinguishment. Mechanical systems like HVAC take time to completely turn off. Squirrel cage fans and motorized fire/smoke dampers can take several seconds to wind down and seal closed. That is why it is important for the HVAC systems to be interlocked with the fire control panel and turned off or "EPO'ed" well in advance of system discharge.

Upon System Discharge

Upon discharge of the fire suppression system it is necessary to shut off all power equipment such as the uninterruptible power supply/batteries, power distribution units, etc. **While no IT manager wants to shut down power to the IT room, it is the electrical power that is often the source of fire. Removing the power enables the fire to be extinguished rapidly.**

In addition to rapid extinguishment of the fire, turning off power to the room protects firefighters and personnel against potentially serious injury caused by electrocution. The fire control panel is interlocked with these controls so automatic shut down can occur at the appropriate time.

A Traditional EPO Installation

Most emergency power off installations are afterthoughts. On many new construction projects, EPO controls are only referred to in the drawings and specifications by a general statement of desired operation. The construction documents do not include detailed specifications, standards for quality, wiring schematics, and a desired sequence of operation.

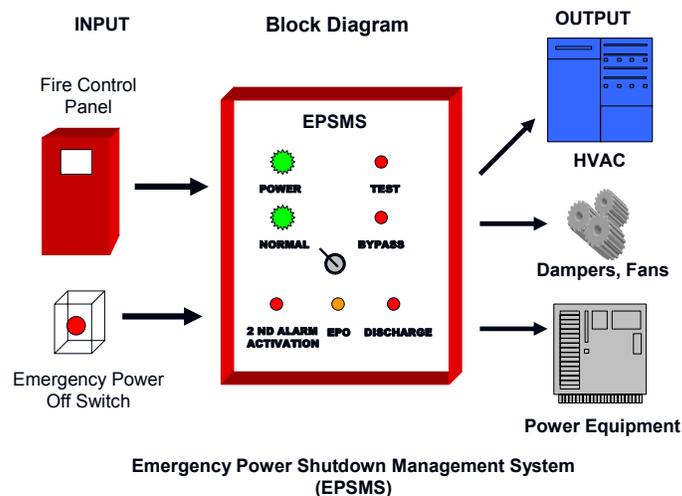
Therefore, the EPO is designed, installed, and tested in the field at the end of a project in order to meet code minimum requirements and get the job signed off by the authorities having jurisdiction. Consequently, most installations end up with a "decentralized" emergency power off system usually comprised of relays located in j-boxes scattered about the room, access floor, and/or above acoustical ceilings. Power circuits feeding shunt-trip breakers are unidentified and unmonitored. Moreover, the systems are rarely documented. There are no shop drawings showing wiring diagrams, location of devices, and intended sequence of operation. Additionally, no maintenance bypass switch is installed that would allow the EPO to be defeated during routine maintenance.

EPO controls installed in this fashion are subject to some troubling ongoing operational issues. For example, such systems can be unreliable in that wires can be disconnected or shunt-trip power circuits turned off rendering the controls useless with no trouble alarm or notification to the user. Similarly, since there is no simple way to disable the controls, accidental activation and thus accidental equipment shutdown can and does occur. Due to lack of documentation, changes or troubleshooting is time consuming and costly.

That is why an emergency power shutdown management system that overcomes these limitations is required.

Best Practice Design of Emergency Power Shutdown Management Systems

There is a need for a system that more effectively consolidates, controls, and monitors the power off circuits for a room or zone protected by a fire protection system. The EPO button(s) should be consolidated with the shutdown requirements of the clean agent suppression system to provide a simple cohesive control system. See the block diagram below.



The integrated EPO controls can be thought of as an **Emergency Power Shutdown Management System**, hereafter, referred to as an **EPSMS**.

The desired features of a quality **EPSMS** installation are as follows:

1. The controls should be consolidated in one location, preferably in one cabinet.
2. The control cabinet should carry an appropriate safety certification both for the application and geographic location of the installation such as Underwriter's Laboratory.
3. The power shutdown and HVAC controls should be segregated within the control cabinet.
4. The entire control system should be documented with shop drawings and a sequence of operation. All components within the control cabinet should be clearly and permanently labeled.
5. The EPO buttons should be of a locking type and should be protected by a safety cover.
6. The control cabinet should be equipped with local monitoring via illumination of indicating lights displaying pertinent functions.
7. The control cabinet should be equipped with remote monitoring capabilities via contacts or other means.
8. The power to the control cabinet should be monitored by the fire control panel as required by NFPA 75.

9. The control system should be provided with a single point means of disabling it for maintenance purposes.
10. The control system should be capable of being tested without operation of the output shutdown relays.

The advantage of the EPSMS integrated design approach over the traditional approach to EPO design is substantial. The table below clearly compares the two approaches.

Feature	Traditional EPO Design	Emergency Power Shutdown Management
Shop Drawings	No	Yes
Documented Sequence of Operation	No	Yes
Consolidated Controls	No	Yes
Single Point to Disable	No	Yes
EPO Button - Dual Action Locking Type	Not Typical	Yes
Local Monitoring	No	Yes
Remote Monitoring	No	Yes
Power to Controls Monitored by Fire Control Panel According to NFPA 75	No	Yes
System Test Capability	No	Yes
Quality Control Testing	At the Job Site	Pre-tested and Certified Prior to Installation

My EPO Activated! Now What Do I Do?

Once the EPO system is activated for whatever reason, the next question usually is “**What do I do now?**” What normally happens is that outside vendors are called in to address the problem. The vendors arrive on site and begin to diagnose what caused the EPO activation. After the cause of activation is diagnosed and addressed, the EPO system is reset. This process is very time consuming. IT managers are in the business of uptime. Any reasonable steps to increase uptime should be the IT manager’s job one. Because EPO controls are rarely activated and never routinely tested, most users and vendors are not familiar with their operation. It takes valuable time for the user or vendor to reacquaint themselves with the EPO controls so that they can be effectively reset restoring power to the IT equipment.

To expedite matters, the EPO control wiring schematics should be clearly documented including the intended sequence of operation. Moreover, the restart procedures should be clearly documented and posted for easy access.

EPO Button Design and Accidental Activation

The fact is that activation of the EPO is very disruptive and costly to an organization. IT equipment does not fare well when exposed to a hard shutdown. Frequently, restoring power is only one part of returning the room to normal operation. Damage to IT equipment caused by a hard shutdown can result in loss of data and the need for time consuming and costly repair.

Most EPO activation is accidental. The user or vendors working on site activate the EPO controls inadvertently. It is common for an EPO to be activated by janitorial staff, air conditioning maintenance vendors, electrical contractors, or fire suppression vendors unfamiliar with the EPO control location and function.

It is important to take measures to prevent accidental EPO activation from occurring in the first place. The installation of a single point EPO **maintenance bypass switch** allows the user to “safe off” the system when certain work is being conducted thus isolating the EPO system from inadvertent activation.

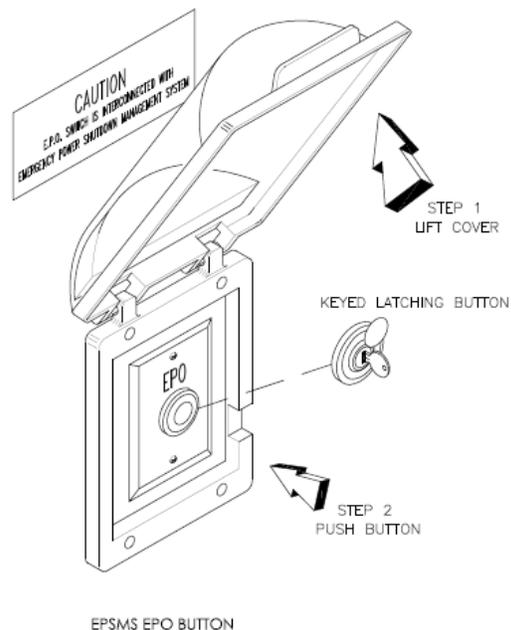
Given the amount of disruption EPO activation can cause, it is surprising that many traditional EPO controls are installed using single action buttons as shown to the right. Notice the button is unprotected and can be depressed by simply pushing in the mushroom style button.



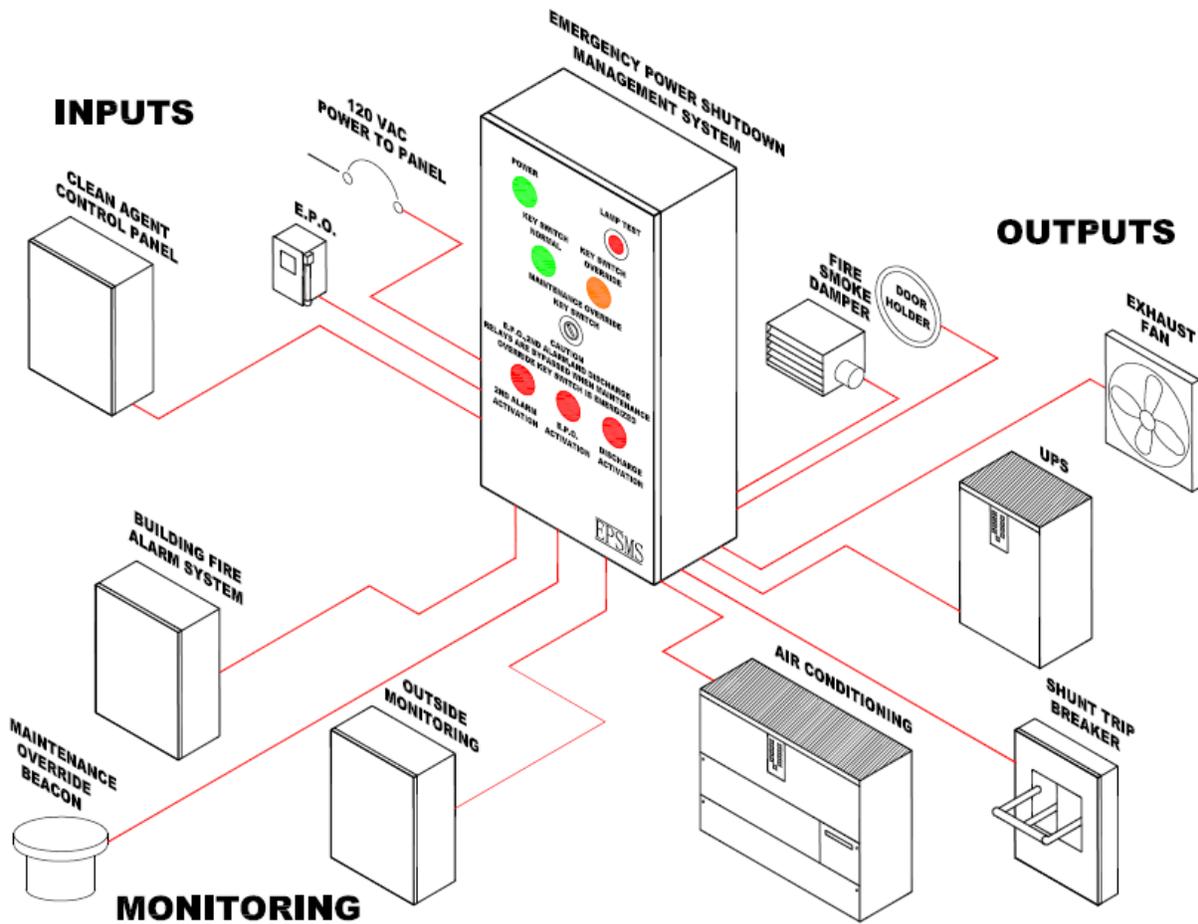
In contrast, an EPO button using best practice design requires two stages to operate. This means that two functions need to be performed in order to actuate the EPO button. The first stage of activation comes in the form of a clear protective cover. The protective cover must first be removed exposing the EPO button. In the second stage, the EPO button is pushed in. Two stage operation or “dual action” substantially reduces the possibility of accidental activation. The button should be clearly labeled for its use. See the inset below that illustrates an EPO button used in conjunction with an EPSMS.

Furthermore, to assist in rapid diagnosis of the cause of EPO activation, the button should be of a locking type. When the switch is locked in place after activation it requires a key to reset the button. The EPO button activation can be monitored by the EPSMS giving the user a time and date stamp of the event. With an EPO button of this type it is very difficult for someone to claim “Mr. Nobody did it”. A switch of this type empowers IT managers and enables them to locate the source of the EPO activation more quickly.

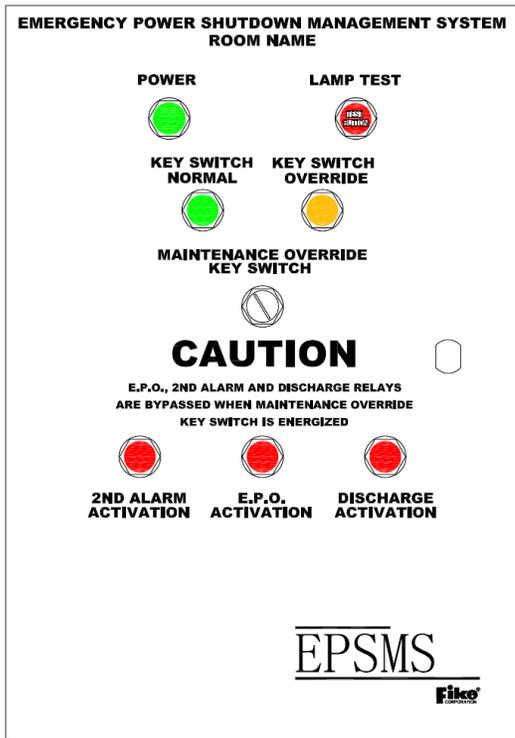
In the event of accidental or even intentional EPO activation by a disgruntled employee, the source of the EPO can be quickly diagnosed and with the use of documented restart procedures the IT space can be reenergized in a timely manner.



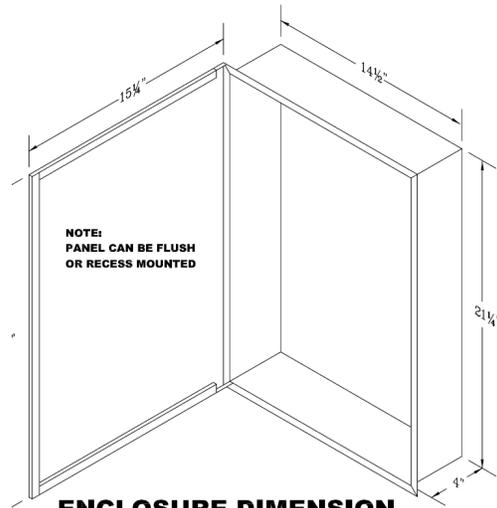
An innovative, cost effective, pre-packaged, and pre-tested solution to EPSMS is commercially available. The solution is manufactured by Fike Corporation. Fike is a world leader in the manufacture of clean agent fire suppression and life safety systems. The Fike EPSMS Model 10-1181 addresses the best practice design criteria of today's EPO controls. A general arrangement one-line of this product offering is shown below. The Fike EPSMS uses the dual action EPO button illustrated on the previous page. This product has been successfully installed on many projects in the past year since its introduction. As an expert in fire suppression applications for information technology environments, Fike is uniquely positioned to understand the necessary EPO requirements.



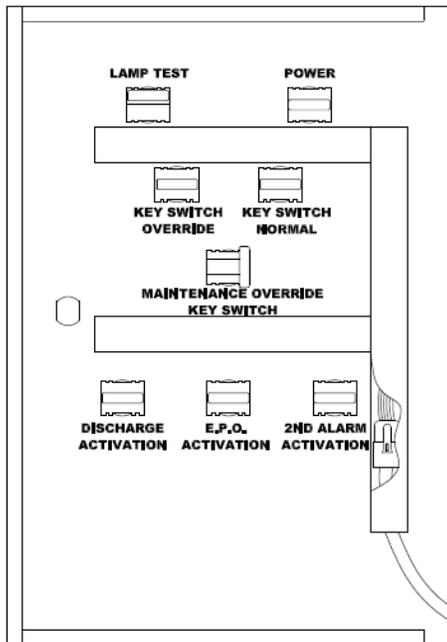
Fike CORPORATION **EPSMS** MODEL 10-1181
DETAILED GENERAL ARRANGEMENT ONE-LINE



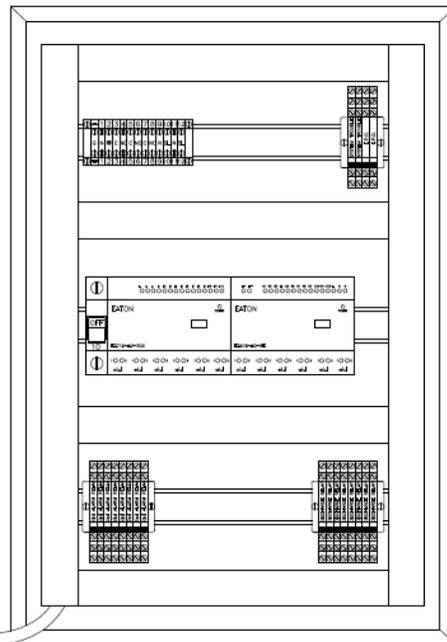
FRONT PANEL DOOR



ENCLOSURE DIMENSION



BACK OF PANEL DOOR



ENCLOSURE FRONT VIEW (NO DOOR)

DOOR WIRING HARNESS

Summary

In summary, the EPO controls of today should be consolidated, controlled, and monitored from one location. EPO systems effectively documented for both installation and post EPO activation enabling rapid recovery can vastly improve overall end user uptime. EPO controls have evolved using an integrated design approach. Cost effective, packaged, listed, and pre-tested **Emergency Power Shutdown Management Systems (EPSMS)** are now commercially available. It is now very easy for engineers to specify and end users to implement this innovative solution to EPO controls.

For technical information or to purchase a **Fike** CORPORATION EPSMS contact:



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Codes, Standards and Requirements

This section defines standards and requirements that apply to both EPO installations and equipment. Local authorities vary by jurisdiction but generally adhere to the following:

National Fire Protection Agency 2003 Edition -NFPA 70 also known as the National Electric Code NEC Article 645.2, 645.10, and 645.11:

A means shall be provided to disconnect power to all electrical equipment in the information technology equipment room. There shall also be similar means to disconnect the power to all dedicated HVAC systems serving the room and cause all required fire/smoke dampers to close. The control for these disconnecting means shall be grouped and identified and shall be readily accessible at the principal exit doors. A single means to control both the electronic equipment and the HVAC systems shall be permitted. Where a pushbutton is used as a means to disconnect power, pushing the button in shall disconnect the power.

Two separate disconnecting means are required, but a single control, such as one pushbutton, is permitted to electrically operate both disconnecting means. The disconnecting means is required to disconnect the conductors of each circuit from their power source, turn off dedicated HVAC equipment and close all required fire/smoke dampers. The disconnecting means is permitted to be remotely-controlled switching devices, such as relays, with pushbutton stations located at the principal exit doors.

National Fire Protection Agency 2003 Edition – NFPA 75 Standards for the Protection of Information Technology Equipment:

This standard incorporates the requirements of NFPA 70 and introduces an additional requirement (See Chapter 8 Fire Protection and Detection Equipment 8.2.2). Where interlock and shutdown devices are provided, the electrical power to the interlocks and shutdown devices shall be supervised by the fire control panel.

Underwriters Laboratory – UL 1778:

A disconnection device shall be provided for the output AC and DC power circuits for a fixed UPS, and remote battery supply/cabinet assembly.

EN50091:

This European UPS standard requires EPO on any hardwired UPS. However, the EPO may be integral to the UPS and not required to be activated at the exit doors.

IEC 364-4-46:

This international standard titled: “Electrical installations of building part 4: protection for safety” requires that “means shall be provided for emergency switching of any part of an installation where it may be necessary to control the supply to remove unexpected danger”. Although not specifically referenced, information technology spaces are considered such an installation. Furthermore, “the arrangement of the emergency switching shall be such that its operation does not introduce a further danger or interfere with the complete operation necessary to remove the danger.”