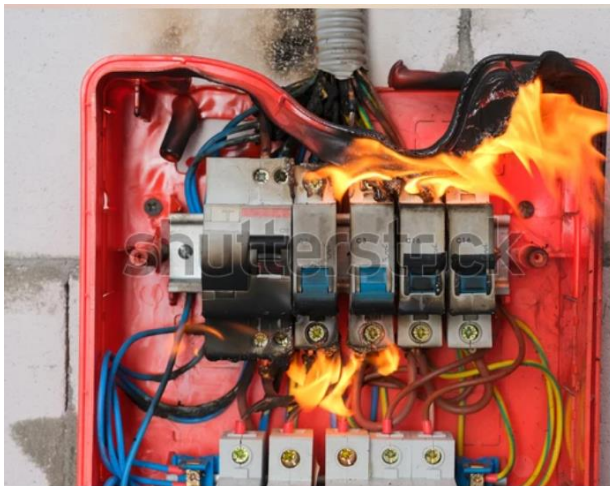


## **Short Circuit Analysis:**

Short-Circuit Currents are currents that introduce large amounts of destructive energy in the forms of heat and magnetic force into a power system. A short circuit is sometimes called a fault. It is a specific kind of current that introduces a large amount of energy into a power system. It can be in the form of heat or in the form of magnetic force. Basically, it is a low-resistance path of energy that skips part of a circuit and causes the bypassed part of the circuit to stop working. The reliability and safety of electric power distribution systems depend on accurate and thorough knowledge of short-circuit fault currents that can be present, and on the ability of protective devices to satisfactorily interrupt these currents. Knowledge of the computational methods of power system analysis is essential to engineers responsible for planning, design, operation, and troubleshooting of distribution systems.



Short circuit currents impose the most serious general hazard to power distribution system components and are the prime concerns in developing and applying protection systems. Fortunately, short circuit currents are relatively easy to calculate. The application of three or four fundamental concepts of circuit analysis will derive the basic nature of short circuit currents. These concepts will be stated and utilized in a step-by step development.

The three phase bolted short circuit currents are the basic reference quantities in a system study. In all cases, knowledge of the three phase bolted fault value is wanted and needs to be singled out for independent treatment. This will set the pattern to be used in other cases.

A device that interrupts short circuit current, is a device connected into an electric circuit to provide protection against excessive damage when a short circuit occurs. It provides this protection by automatically interrupting the large value of current flow, so the device should be rated to interrupt and stop the flow of fault current without damage

to the overcurrent protection device. The OCPD will also provide automatic interruption of overload currents.

## **Risks Associated With Short Circuit Currents**

The building/facility may not be properly protected against short-circuit currents. These currents can damage or deteriorate equipment. Improperly protected short-circuit currents can injure or kill maintenance personnel. Recently, new initiatives have been taken to require facilities to properly identify these dangerous points within the power distribution of the facility.

## **Why Is A Short Circuit Dangerous?**

A short circuit current can be very large. If unusually high currents exceed the capability of protective devices (fuses, circuit breakers, etc.) it can result in large, rapid releases of energy in the form of heat, intense magnetic fields, and even potentially as explosions known as an arc blast. The heat can damage or destroy wiring insulation and electrical components. An arc blast produces a shock wave that may carry vaporized or molten metal, and can be fatal to unprotected people who are close by.

Fault current calculations are necessary to properly select the type, interrupting rating, and tripping characteristics of power and lighting system circuit breakers and fuses. Results of the fault current calculations are also used to determine the required short-circuit ratings of power distribution system components including bus transfer switches, variable speed drives, switchboards, load centres, and panel boards. In calculating the maximum fault current, it is necessary to determine the total contribution from all generators that may be paralleled and the motor contribution from induction and synchronous motors.

Circuit Analysis is performed to determine the currents that flow in a power system under fault conditions. If the short circuit capacity of the system exceeds the capacity Short of the protective device, a dangerous situation exists. Since growth of a power system often results in increased available short-circuit current, the momentary and interrupting rating of new and existing equipment on the system must be checked to ensure the equipment can withstand the short-circuit energy (see Device Evaluation). Fault contributions for utility sources, motors and generators are taken into consideration.

A Short Circuit Analysis will help to ensure that personnel and equipment are capable of causing injury, extensive equipment damage, and costly downtime. protected by establishing proper interrupting ratings of protective devices (circuit breaker and fuses). If an electrical fault exceeds the interrupting rating of the protective device, the consequences can be devastating. It can be a serious threat to human life .

## **Ground Fault Interrupter (GFI)**

This is a device that detects when the current flow in the energized conductor does not equal the return current in the neutral conductor. The GFI protects people by quickly cutting off the current flow preventing injuries resulting from shock. Ground Fault Interrupters are typically used in homes for bathroom, kitchen, and outdoor electrical sockets. The GFI will typically be built into the electrical socket.

A GFI does not provide over-current protection, and the circuit that includes a GFI will also include a fuse or circuit breaker.

In addition to fuses, circuit breakers, and GFIs, there are electrical protection devices that:

- detect changes in current or voltage levels
- monitor the ratio of voltage to current
- provide over-voltage protection
- provide under-voltage protection
- detect reverse-current flow
- detect phase reversal

## **When are Short Circuit Analysis Needed?**

The first short-circuit analysis should be performed when a power system is originally designed, though this should not be the only time. These studies need to occur with any facility expansion or with the addition of any new electrical equipment such as circuit breakers or new transformers and cables. Without any new additions or changes, short circuit studies still need to occur on a regular basis of at least every 5-6 years.