

# Review of Surge Overvoltage and Protection

**Mr. Balwinder Kumar**

Principal, KC Polytechnic-Pandoga, UNA (HP)

## Abstract

Electrical power is a complex and uncertain system due to the presence of much electrical equipment like relay conductors and source mechanical equipment like generator motors. Besides the presence of the equipment like transmission line is long and comprised of inductance capacitance resistance and conductance. Hence any abnormality in the power system anywhere cause the performance of every equipment photo entire power system to get disturbed. Minor disturbance switching fault, load variation the system is built to resist change but high magnitude surge of voltage Spikes not only get affected adversely but also leads to system damage.

**Keyword** overvoltage, surge, lightning, energy storage, transient, protection

## Introduction

There are multiple situation whenever the voltage of a system is subject to overvoltage. Overvoltage may be caused due to lighting, sudden opening of circuit breaker, ground earthing wire of conductor etc. Majority of the voltages are not so large in magnitude but have major significant due to their impact on the conduction of circuit break-in and break-out equipment and circuit breaker as a protective devices. A sufficient number of voltages are of significant magnitude responsible to cause the breakdown. Power system engineer looks into limit the magnitude of overvoltage produced by operating equipment. Surge is a random shot burst of excess electrical energy to a system couch for micro or milliseconds. These are referred to as transient impulses or spike can damage or even destroy sensitive equipment. Protection devices are designed to reduce harmful energy in a system almost 80% of the transient are generated from internal sources. And remaining 20% of the transient is typically generated from external sources. Search voltage is defined as a sudden increase in line for a short duration. Search domains for a very short duration and produced overvoltage caused by a lightning strike a transmission line. Internal overvoltage caused by a system itself can and stationary overvoltage occur at the frequency and may persist for some time. External overvoltage caused by the atmospheric discharge of large magnitude causes stress on insulation. Jianshenh Li, Jun Liang in [1] use signal reactor intended to Limit large current bring new problems for measuring the lighting overvoltage the position of arrester used for calculating lighting over-voltage presented using leakage current of the arrester. A large gap electrical discharge shown in [2] under switching impulse and lighting attachment process associated with positive upward Lander progression of discharge in the long gap is attributed to intervened Physical phenomena conducted in the long Spark gap. Low voltage protection level of [3] surge applied AI single system for lighting coordination between the property of protective devices and requirement of Surge in unity for electronic equipment. Cost-effectively eliminate power disturbance due to lighting with the use of protection device at building entrance feeder branch panel critical load and communication line improve the reliability of equipment. Min Luo, Huachun Li [4] developed a new type of high Sun protective ground device for power cable lines. It includes high strength polymer copper busbar and an over-voltage protector in the EPR body protective

ground device in addition to exposed the cable line from over-voltage but also weight and volume where Lesser. In [5] developed a Fuzzy Logic technique to determine the accurate positioning of the Surge arrester in the power system to control the wrist fail you are and to permit the selection of appropriate protection steamer for each network. M A Grau [6] use the MATLAB program to determine the accurate position of the surge arrester. A protector from overvoltage is necessary to protect the circuit, like a system are very expensive, would not work in physical use. One of the most like way is to present an electrical system to minimize impact from excessive energy are energy maturity protection which ensure the efficient conduction of the energy system, prevent installation from highly sensitive energy appliances at high power. The remainder of work are- section 2 describes the reason for generation of overvoltage, protection mechanism against overvoltage presented in section 3 finally concluded in 4.

## 2. Cause of overvoltage

The power station caused either internal or external over-voltage, depending on the internal generation or atmospheric reason.

*2.1 Internal cause-* due to sudden change in operating condition, large inductance or capacitance it, short circuit current, Arc fault. When unladed line ties to a source of voltage a wave is set up travels along with line. On end point transferred to supply with same sign of voltage toys to the normal value; [5] why loaded line overvoltage produced switching operation. Current chopping used to produce High Voltage transmission touches the contact of the air blast circuit breaker. Grounding with arc the phenomena of intermittent Arc occurs towards ground shows a fault of the three-phasor system.

The internal voltage can be temporary, strong, or natural. If the voltage wave does not exceed the environment, then the frequency does not correspond to the normal frequency, and will only continue for a few cycles. Temporary power outages can be caused by the operation of circuit breakers when changing incoming or outgoing loads. These measurements can also be made with very little current interference or sudden suspension of a single phase of the program with impartial implants [7,9]. Dynamic gravity occurs at normal frequency and lasts only a few seconds. These problems can be caused by the generator disconnection or because it is suddenly discarded for a large part of the load. Dry maturation occurs at the normal frequency of the system and lasts for about an hour. Such types of voltages are created when the ground fault in a single line persists for a long time. This voltage can also be caused when neutrality is lowered by using an arc pressure coil, thus leading to maturity of the sound phase. These voltages exceed three to five times the normal range of a neutral voltage system of system and are relatively harmless to well-equipped equipment.

*2.1.1 Switching on Unloaded Line -* the line is connected to the wind power source and the travel waves are set to quickly charge the line. These waves quickly acquire a force greater than twice the force of propulsion.

*2.1.2 Sudden Opening of Load Line-* When the load on the line is suddenly turned on the short-term setting voltage. Temporary power outages do not depend on line power so the low power transmission system is responsible for dissipating power of the same magnitude as compared to the high power system.

2.1.3 Insulation Failure - failure of separation between line and land is very common. When a possible deterioration in the separation occurs a sudden decrease in magnitude to zero and therefore a negative wave of the frontal force is very steep in the form of pipes produced in both directions.

2.2 *External cause*- Following external causes for overvoltage

2.2.1 Lighting - arc discharge between cloud and earth. An immense Spark occurs when the cloud is charged higher potential concerning earth during the oppressed of War most air-earth abrading in between air-tiny particle of water cause form accumulation of charges. When water drop created large drop becomes a positive charge and a smaller drop becomes a negative charge. Cloud became rich with charge it made recharge to another cloud or called lighting. Lighting surges damage the equipment in the generation and transmission line. Lighting discharge writes zero to peak voltage about 100 microseconds and decays to half of the voltage about 500 microseconds [10]. Voltage waves traveling a long line in both directions depending on the inductance and capacitance of the line. These effects May shutter insulator, winding of transformer damage and pile up against transformer. To protect against lighting discharge necessary protection required most common protection are earthling screen, overhead ground wire, and lighting arrester.

2.2.2 Earthling screen - power station is a house with expensive component/equipment should be kept safe against lightning directly. Strike screen consisting of a network of copper conductors mounted over electrical equipment is sealed properly connected to earth along with low impedance. Whenever a direct-strike, screen assistant Spark by which lighting, etc are connected to ground and equipment remain protected

2.2.3 Overhead ground wire - this method is expensive to protect the transmission line. Above the line conductor ground wires are placed. In such a position lighting stock is caught by them. Did wire are grounded at each pole true resistance path. When a direct lighting strike occurs taken up by ground wire keep protecting voltage line from the harmful effect of lighting.

2.2.4 Lighting arrester- a protective device starts conduction when high-voltage search power system consist of gab in series with a Nonlinear resistor is used for safety purposes in line with direct stroke. Operation the lightning arrester is of an occurrence of overvoltage insulation of the breakdown gap and formation of arc it provides low resistance to searches towards ground. Due to search time of conducted arrester to ground excess charge on the voltage line.

### **3. Over Voltage protection**

Excessive amounts can be temporary or permanent, classified into two group internal and external. This overheating can destroy cushioning and speed controlling devices. Therefore, it is necessary to built up resources to keep safe them from power damage injuries [6]. The methodology of shielding electrical equipment from getting damage caused overvoltage. Usage of component such as folded metal near transmission line and Zener diodes. Various methodology employed to prevent overvoltage and its special features. Ouput, process, functionality and mode of operation must need to be included to define.

### 3.1 SCR Crowbar

A crowbar switch circuit presented in figure 1, creates a short circuit path across output in case of overvoltage. A feature of thyristors is focused on because change of large currents and waits till continue to wait for charged charges. The thyristor frequency is connected to the back by a fuse that separates the controller from excess power.

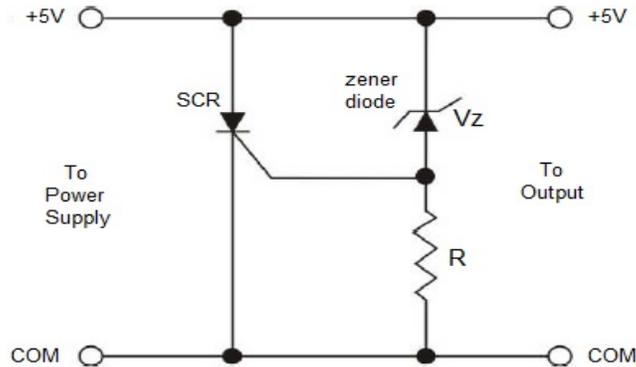


Figure 1. Crowbar circuit [7]

### 3.2 Voltage Clamping

A defense system, can be in a situation where you have used the Zener dial kept in parallel to output shown in Figure 2. Along with zener diode capacity chosen must above the file a fixed voltage. With normal conditions is not limited to operating. Whenever voltage rises greatly, then it begin to conduct, pressing voltage a certain price above the voltage line.

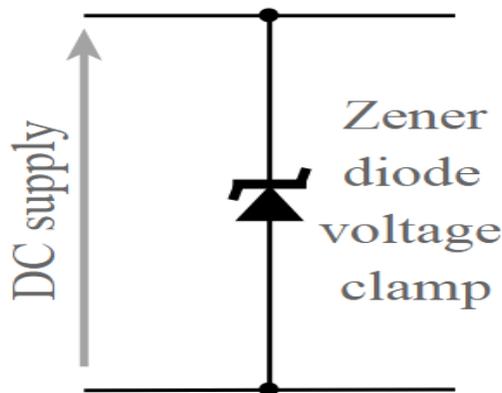


Figure 2 Zener clamping circuit [8]

## 4. Conclusion

Excessive overcrowding can be a reason to damage the installation of electrical component/equipment. Thus, it become important to select the causes of energy depletion wisely so that they are not unexpected damage and can be avoided. A variety of over-the-counter power protection features provide security concerning the operation of electrical systems such as power grip, SCR bolt, and power grip.

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