Surge arrester in transformer

The mutant arrestor is used to protect electrical equipment from all kinds of over-pressure caused by lightening or switching operations. Hitachi ABB Power Grids has over 100 years of experience in the design and production of anti-spike devices. The ABB Power Grids anti-tank device is made of metal oxide resistance (MO) with no spark gaps cast directly in the silicone, grey case, and is designed and tested according to IEC 60099-4 and IEC 62848-1. Mutant Capture Ministry Major Mutant Capture Ministry A mutant arrester is a device to protect electrical equipment from transient over-pressure caused by external (lightning) or internal events (switches). Also known as a surge protection device (SPD) or transient voltage reduceer (TVSS), this type of device is used to protect the device in electrical transmission and distribution systems. (To protect consumer devices, various products called surge protection are used.) Energy criteria for different insulation can be compared according to pulse ratio. A mutant capture set should have a low pulse rate, so that a mutant incident on the mutant capture can be ignored to the ground instead of passing through the machine. To protect a unit of equipment from transient occurring on an attached conductor, a mutant arrester is connected to the conductor just before it enters the device. The transcei catcher is also connected to the ground and functions by routed energy from a transient excessive voltage to the ground if it occurs, while issy issing the conductor from the ground at a normal operating voltage. This is usually achieved through the use of a varistor, which has significantly different electrical currents at different voltages. Lightning catcher is usually not designed to protect against lightning strikes directly on the conductor, but is against electrical transients caused by lightning strikes occurring in the vicinity of the conductor. Lightning strikes the earth resulting in ground currents that can pass buried conductors and create a transient spread outward towards the end of the conductor. The same type of touch occurs in over-air and above-ground conductors that experience the passing energy of an atmospheric EMP caused by lightning flash. Surge arresters only protect against transients that cause characteristic of the rapidly rising time of a lightning bolt and will not protect against the electrolyification caused by a direct strike to the conductor. Transient similar to lightning-ins caused, such as from converting faults of high voltage systems, can also be safely redirected to the ground; however, continuous over current is not protected against these devices. The energy in a transient processing is significantly less than a lightning discharge; however it is still sufficient quantity to cause equipment damage and often requires protection. Without very thick insulation, which is usually prohibited cost, most conductors run more the distance (greater than about 50 feet) will experience transient lightning-ins caused at some point during use. Because transients are usually started at some point between the two end of the conductor, most applications install a mutant capture set just before the land conductor in each piece of equipment is protected. Each conductor must be protected, as each conductor will have its own transient cause, and each SPD must provide a path to earth to safely divert transiently away from the protected components. A notable exception when they are not installed at both ends is in high voltage distribution systems. In general, the voltage caused is not enough to do damage at the end of the power generation of the line; however, installation at the service entrance to a building is key to protecting non-powerful downstream products. Types of low voltage increase catcher: Applied in low voltage distribution system, exchange of protective electrical equipment, low voltage distribution sub-coil The ministry captures distribution: Applied in 3 kV, 6 kV, AC 10 kV power distribution system to protect the distribution sub-machine, Cable and power station equipment Common valve catcher type: Used to protect substation equipment 3~220 kV and communication system The sensor catches the valve blowing from: Use up to 35~500 kV protecting communication systems, substations and other equipment Protect the camera using the remote blow valve catcher : Used to protect AC generators and motor insulation lines The blown-from valve catcher: Used to protect neutral protection equipment 330 kV or more DC insulation communication circuit equipment or valve type blowers: Used to protect the insulation of DC system Neutral protective equipment: Applied in the engine or protector Neutral defense of fiber-tube arrester: Applied in the wire of the power plant and protects weaknesses in insulation Plug-in Signal Arrester: Used to twist pairs of transmission lines to protect communications and computer systems A gas duct commonly used in the socket of co-axis cables High frequency feeder catcher : Used to protect microwave ovens, mobile base stations for satellite collection, etc. Container type mutant capture ministry: Used to protect electronic terminal signal catchers: Applied in modems, DDN lines, faxes, telephones, process control signal circuits, etc. Network arrester: Applicable in servers, workstations, interfaces etc. Co-axis cable lightning catcher: Used on co-axis cables to protect transmission systems and receive wirelessLy See also Lightning arrester Surge protector Lightning rod Wikimedia Commons has media related surge arresters. Taking protecting substations from lightning and converting surges leading to flashover insulation has been an important issue for as long as there is already electrical system. But while this need Remains constant over the years, the options available to best minimize high voltage pressure have changed dramatically. This past contribution by arresting expert Jonathan Woodworth, Co-Convenor of IEC TC37 MT4 - 60099-4 and Chairman of IEEE SPD WG 3.3.11 - C62.11, considers the different scenarios, options available and the reasons behind each case. Examples of substations with people starting on lines, main arrests, second arrests and OHGW protection. CLICK TO ENLARGE Considerations in substation protection considerations in protecting the listed substation and covered below shows different performance criteria: Failure rate This is the acceptable number of insulation failures in the service life of the station. A station is usually designed according to some level of dosing performance, as outlined in Section 3.4 of IEC 60071-2 and in IEEE 1313.2. Furthermore, IEC 62305-2-2010 identifies acceptable risks for substations, where the level of risk is affected by different types of service losses. Insoker-withstand level requirements (Urw) This is given in terms of these types of mutations as fast, very fast, slow and temporary overvoltages. Safety margin The safety margin commonly used in substations is 15% for substations and 5% for air insulation. Separation Distance This is the distance between the capture device and the intended protected device. If too large, the voltage at the protected device may exceed its required insulation level due to the reflexes and travel waves. Open Breaker Protection Breakers in an open position leave the roadside candies of the breaker 100% un protected if the arrester is not installed at the line terminal. While this is a low probability issue, for critical protective stations of an open breaker can be important Altitude Surge performance of insulation at a substation is very dependent on altitude since the insulation withstands voltage reduction ~ 11% with each 1000 m increase in altitude. Because of this, longer insothiers are required at higher altitudes and the protection of the catcher becomes more important than ever. The arrestees themselves are sometimes also required to take longer due to electrical frequency requirements. Type of insulation Some insulation can withstand flashover without damage and some cannot. Air insulation is a type of self-restoration insulation that depends on the ambient air for its insulation outside the insive body. But if the stress voltage in the air exceeds its to withstandability, the inso bypass experience flashover failure. However, once the flash is cleared, the insier retains the line voltage as it did before the increase. Post insulation, stress insulation, exhaust pipes, ad tube shutdown and cable termination are all examples of different types of self-restoration insulation materials. Conversely, the variable coil and all oils/insulation paper cannot recover from a disruptive discharge and therefore considered non-self-resilient insulation. Once the failure has been in such non-self-recovery insulation, the subdier will need to be refurbished or replaced. Other types of non-self-restoration insulation including underground cables, components inside CCVT, PTs and CTs. During substation protection, the types of insulation ordering the level and mitigation costs applied to provide such proper protection without self-insive recovery are often protected with greater effort and cost. The property requires protection of the main coil mutation of the common protected power changeer at the pressure machine using the catcher. This is because the substation is usually the highest value property in a substation and usually has the lowest rising withstand voltage. It can be stated with confidence that 99% of all main electrical substations insifirmary stations are protected by the catcher. The second-class coil is the second most commonly protected insulation in a substation equipped with an electrical substation. These coil are not quite for exposure to surges and are therefore protected with the arrestees probably only about 75% of the time. High-value assets with primary and sub-protection. CLICK TO ENLARGE Transformer Bushings Both primary and primary transformer ad tubes are protected by default using the same transformer coil protection arrester. If the neutral pressure machine exits the pressure machine through a dust tube and is connected to a neutral grounding voltage, grounded voltage and dust pipe should both be considered for protection by an arrester. Cable termination cables terminated in a substation are often associated with the arrester. But the protection in this case is more for the cable since the termination itself is self-restoration type insulation while the cable is not. If the insulation cable becomes damaged from a surge, repairing that property becomes a costly task. Breaker Bushings & Vertical Insular Breaker Tubes and internal vertical insulation between contacts are also high value properties in a substation. However, these are usually not as well protected as electrical pressure machines, but should be. More on this below. Voltage measuring devices monitor high-value CCVTs and PTs and, if available in substations, their protection priority should be considered high. When designing substations, these devices are sometimes placed where they actually become part of the protection program due to their capacity. Shunt Capacitors This bank can absorb significant electricity from a lightning or switch increase without damage. So if a bank contains more MVar, it is not likely to need mutation protection. However, smaller banks may not be able to make a big surge without overcharging and flashing, so they often need protection. Whether the bank is large or small, the need to protect the system's catcher from the bank should also be assessed. Bank substation with arresting guards. CLICK TO ENLARGE Surge Sources & Mitigation Methods Methods Lightning Strike to Substation Direct attack to the substation occurs

although it is very rare for the flash to fire directly at the device. This is because stations are commonly protected from them by over-the-top shield wires or masts. For example, the shield wire is located above the device and around the perimeter so that they intercept any attack and transfer it to earth. However, although a direct strike is prevented, the possibility exists that a surge caused will make its way to the device. In the event that the insion voltage is greater than 350 kV, it is unlikely that the flash will occur from a caused mutation. But if the insufferable voltage is less than 350 kV catch is necessary to protect the device from surges caused. CLICK TO ENLARGE Masts at HVDC Converter Station in Western Canada.CLICK TO ENLARGE If masts are used, these are strategic lies so that all direct strikes will hit them instead of equipment or buses. The most suitable standard for efficient design and dosing of substation shielding is IEEE 998. The distribution substation only protects the mast. CLICK TO ENLARGE Lightning Surges on Incoming Lines The only way for a potentially damaging lightning surge to challenge a substation is by entering an incoming line. If the line arrives to be shielded, there needs to be a backflash not too much span from the substation to a phase conductor for the surge to poses a problem. When a backflash occurs at a tower, it creates a rapid surge. But when the surge comes down the line, the corona on the line reduces the front-wave travel so steep that by the time it reaches the station it has become manageed. CLICK TO ENLARGE CLICK TO ENLARGE But if the backflash occurs only a span or two away, the wave-front steepness of the entering surge is extremely high and will significantly stress insulators in the substation – even when arresters are installed. Fortunately, substation catcher rarely sees more than 10-15 kA of current from a backflash on an arrival line. As a result they are not under heat stress by lightning, only under electrical stress. Switch surges on the line to Conversion Increase on the arrival line is the most common type of surge to achieve in a substation and can travel hundreds of kilometers due to their low frequency associated with lightning. When these types of surges enter, the entire main side of the substation sees a similar increase in voltage and catches at the substation can protect the entire station. Converting energy mutations dissipated by capture sets on systems with voltages greater than 240 kV can sometimes be significant and challenge the arrester's ability to handle energy. Conversion surges created in surge conversion substations are also generated in the station from the operation of overpasses or other switches. For both external and internal switches, the point on the AC wave where the device operates has a profound effect on the increased amp amp great margin. For when transferred to peak voltage, it is possible to generate the initial voltage from 2 to 3 times. In some cases, the breaker may attack first or re-attack during operation. For internally generated insemsions, the front of the rising waves can increase very quickly and will pose a serious threat to nearby insulation. For this type of switching increase, special mitigation with capacitors and arrests may be necessary. If a capacitors bank is converted in a substation, a significant surge can be created that will need mitigation. Types of substations & special protection transmission substations There are several different types of transmission substations, such as substations with and without substations, transmission and distribution stations combined, those with large voltage control equipment such as capacitors banks Etc. In any case, the arrester is applied to minimize lightning and possible surge conversion. In stations equipped only with overpasses but without substations, the arrestees may or may not be installed. For example, they may not be necessary if no end point can be important or open point. Moreover, if the line resistance remains unchanged, the arrester is not required. In transmission stations where there is a step up or step down the substation, the catcher should be used on both the high and low sides of the substation if the surge can enter from either direction. If the breaker is present, the person arresting the entrance to the line should be considered for protection if the breaker is open at any time. At critical substations with breakers, if they are used to clear bugs, it is possible that during such an error clearing event, a second surge can affect the roadside liner while the breaker is in an open state. Now, the person arrested at the machine can not protect the dust tube and double voltage can occur with the next flash tube flash. To protect the roadside liner of the breaker, an arrester should be installed at the entrance to the line. Examples of people arresting line entrances on the 500 kV system. CLICK TO ENLARGE Distribution Substation A distribution substation is one step one voltage transmission down to 34.5 kV or less and has feeders going to urban, industrial, or commercial areas. Such substations can become quite complex, with many types of equipment that need to be protected. The road surface of the electric changeer, for example, must always be protected. However if the low side can not see a surge, arrest on that side is not necessary. The exception to this rule occurs when a break is on the low side. In this case, the catcher should be installed between the sensitive coil and the potentially dangerous rapid surge that a breaker can create. At distributed transfer exits, where lightning strikes can enter the station, the arrestees should always be applied to minimize these increases that will always arrive sooner or later. If these arrestees are sufficient LV side of power they can also be used as protection for the transformer. Another common condition that arises in distribution stations is the use of neutral grounding return (NGR) to limit faulty currents to the system. When NGRs are used, UC ratings and MCOV arrests need to be increased to take into light of the long and high-margin overc pressures that are likely to occur. Indoor air insulation substation The enclosed substation can vary from just a few components to the entire building full of electrical equipment. Industrial parks, for example, often contain multiple internal stations and should be treated just like any outdoor air insulation substation. One problem that can arise with this type of station is that the visibility of the arrestees is often buried in cabinets, making easy access to them difficult. This only becomes a concern if there becomes a need to verify the health of the arrestees using an infrared camera or by other means. It is therefore suggested that enclosures arrester has at least one party that is inadequately attached and allows the arrestees to be assessed if necessary arises. One problem that arises in this type of station more often in other types, is that long cables run with open points. The voltage doubles the problems arising in this configuration and the person arrested at the open point should be considered. Indoor air insulation substation in New Zealand.CLICK TO ENLARGE Examples of indoor substations where all the arrestees hide from view. CLICK TO ENLARGE Full & Partial GIS Substations A GIS station entirely with gis arresters is quite different from other substations and the mutation protection here is usually specially designed. Arrester reviews are usually quite high in voltage to process significant energy in any surge. If a station instruds part of the air and is exposed to lightning, lightning protection is obviously necessary. But if the station is partly ins cooled but inside a building, mutant protection becomes less of a concern. When all inputs and outs are underground, mutation protection design studies should be carried out to determine whether and where to install the capture set. Gis catch and dust tube air insulation. CLICK TO ENLARGE Generator Stations Generator Stations are the hardest to protect because generators withstand voltage for very fast front surges that are actually lower than bil. If a station is a small unit where the lines come only a few hundred meters from the generator, special protection is needed. Not only can the tanks get through the step up the voltage, they can be generated at low voltages (e.g. 15 kV) by the breaker in the system. Very fast increases and high energy increases can be found on bus generators. This is where the increased capacitors are just as important as the mutant catcher. The generator of the winding stator here failed due to lack of adequate protection. CLICK TO ENLARGE Types of Arresters Used in Substations Station The latest issue of IEC 60099-4 now refers to pre-Class 2,3 and 4 arresters as 'station' stations arrestees, classified according to their test parameters. They usually have a lower residual voltage as well as withstand the highest errors and energy processing ratings. While such arrestees are used at most substations, they may not always be the only type used. The main reason for using the station layer capture device at the substation lies in their ability to withstand faulty currents. Since the current error in a substation usually comes from multiple directions, the available fault stream can be easily reached above the 20 kA limit of the distribution catcher. Therefore, the default capture set is the station layer. The Distribution Class Catcher distribution class, formerly known as The Type 1 Arrester, can be used in substations with fault lines below 20 kA. Here, the remaining voltage of the distribution layer catcher can often meet the performance requirements of the station. Moreover, for stations below 260 kV, the energy processing capacity of the distribution catcher is often also adequate. Before assumptions that a station class arrester must always be assigned, it is best to consider whether a person who arrests distribution more flexibly, the lower cost is really enough. The distribution arrester is installed at the exit of the distribution substation. CLICK TO ENLARGE Arrester Selection Considerations MCOV UC There are no special considerations required when choosing UC of an arrester in a substation. If the catcher is designed to protect the variable coil, this should be as low as possible to provide the best protection. Energy Assessment If an arrester is applied to lines with a system voltage of 345 kV or more, an energy rating should be assessed. If the system voltage is below 345 kV, energy rating is not an issue, except when there is a large capacitors bank on the system. The current error withstands this evaluation rating which is particularly important in substation protection since, as stated earlier, high fault lines may be available. If so, the choice of catcher must take this into mind. Account.