Advances in UHV Transmission and Distribution
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Lecture - 32
Electrical hazards, minimum clearances in substation

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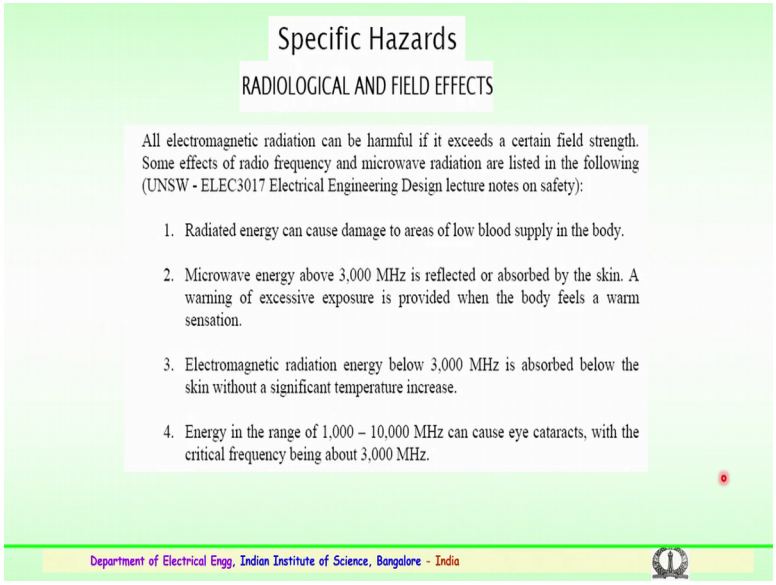

The specific hazards could also because of the radiological and the filed effects in the disk substations, which we have try to discuss earlier, all electromagnetic radiations are harmful. If it exceeds a certain field strength. So, some effects of radio frequency and particularly the microwave radiated fields which are listed in the standards and a designed lectures have to be properly looked into. But some of the important points like the radiated energy can cause damage to the areas of low blood supply in the body. So, in case of overexposure or as per the standards if the magnitudes have increased and the person experiences the more radiation energy, because of the electromagnetic effects.

So, there could be a damage for the blood supply to the body. And if the microwave energy above 3 mega 3000 megahertz is reflected or observed in by the skin. So, there could be a warning of excessive exposures are provided in body feels a warm sensation. And some cases the electromagnetic radiation energy below 3000 megahertz is absorbed below the skin without a significant temperature increase. So, the energy particularly in

the range of thousand to 10 thousand megahertz could also cause eye cataracts. So, vision problems could arise with a critical frequency between 3000 megahertz.

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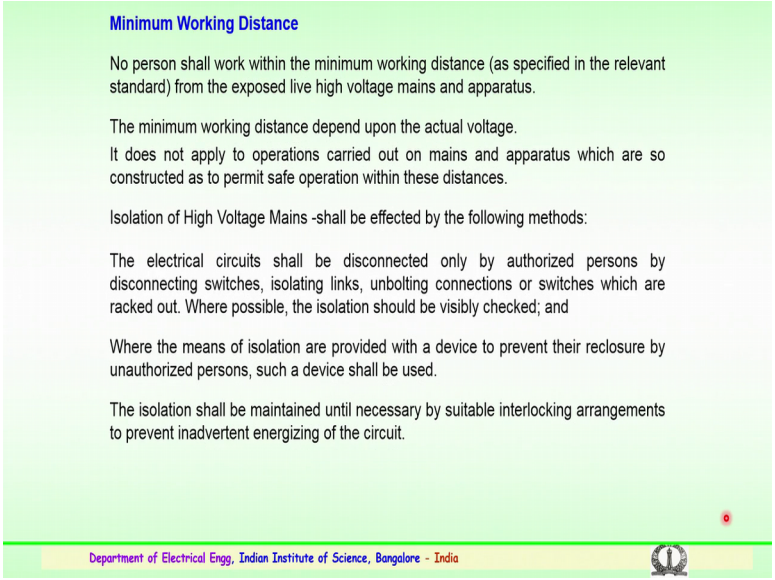

So, these are the hazards which could be effected by the radiological or the field effects, in substations very important hazards. So, what do the precautions have to be taken by the personal working in the substation or in the electrical utilities?

The first and foremost is to see and maintain minimum working distance. So, very important point to be considered. So, no person should work within the minimum working distance. These specifications are mentioned in the relevant standard, and what is limit is or what is the distances have to be followed or described in the standards, international and national standards from the exposed high voltage mains and also the apparatus or any high voltage equipment.

The minimum working distance depends upon the actual voltage level which the equipment is being operated or the transmission which is being operated. It does not apply to operations carried out on mains and apparatus which are constructed to permit safe operation within these distances. Isolation of high voltage mains shall be effected by the following methods. The electrical circuit is shall be disconnected only by the authorized person or persons who are in charge for the maintenance or the available for disconnecting the switches circuit breakers or isolating the links, or unbolting of the connections or switches which are to be disconnected.

So, wherever possible the isolation should be visibly checked before the work is being taken up. So, where the means of isolation are provided with a device to prevent the closure by the unauthorized person, such a device shall be used. So, it is very important only authorized persons are to be available for the connection and the disconnection of the lines. The isolation shall be maintained until necessary suitable interlocking arrangements to prevent inadvertent energizing of the circuit.

So, this minimum distances and minimum precautions have to be borne while working in the it is.

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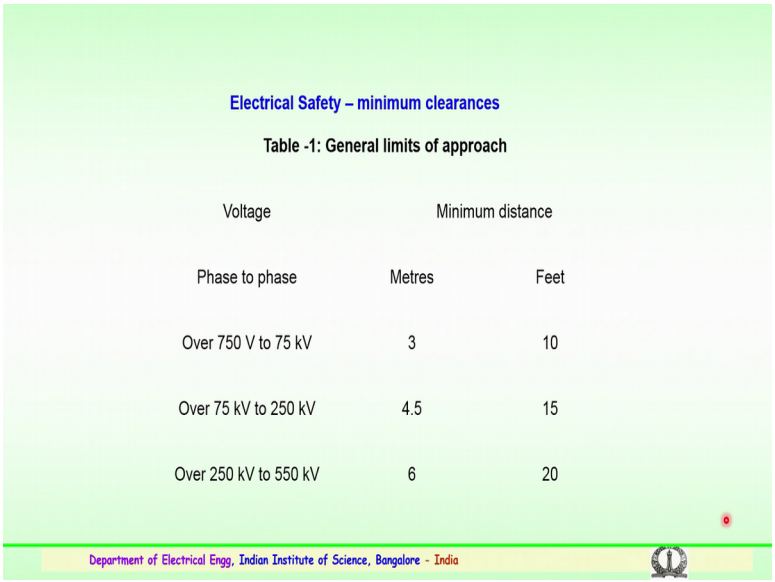

So, the safe electrical minimum clearances as per the standards the limit is of general approach for electrical safety ISBN given here you can see the voltage and the minimum distances which are mentioned. This is the phase to phase voltage levels, the distance and metres and the distance and feet. So, you can see that over 750 volts the operation of the equipment or when you the personal is trying to work in the area where up to 75 kilovolts. So, in such cases you should have a minimum clearance of a 3 metres or above 10 feet for his to be followed as per the safety rules.

So, in case the equipments or the lines are of 75 to 250 kilovolts a minimum distance of 4.5 metres or 15 feet has to be allowed and maintained. Similarly, if it is more than 250 kilovolts to 500 250 kilovolts to 550 kilovolts minimum distance of 6 metres or 20 feet has to be maintained minimum clearance has to be maintained. Further if it is more than

765 kV or 800 kV minimum clearance of 9 metres or approximately 27 feet. So, 9 metres and 27 feet in case of voltage levels of 765 or 800 kV have to be maintained, these are the standard values which are being given in the manuals or a safety standards.

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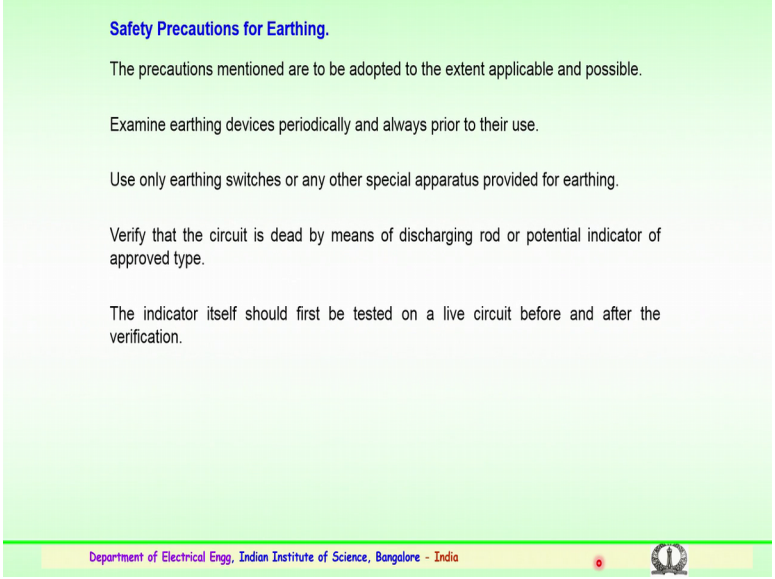

So, important aspect of the precautions is the earthing or the grounding, which we have try to discuss about this aspect. The precautions mentioned are to be adapted to the extended applicable and possible even though the substation is grounded, the equipment is grounded the safety precautions of earthing or grounding is very, very important. So, a personal should examine the earthing devices. Periodically and always prior to their use, and they have to use only earthing switches or any other special apparatus provided for earthing. There should properly verify the circuit whether it is live or dead or not partially if it is insulating the or damage the insulation, it has to be done by the means of discharging the circuit by using an earthing rod or a ground rod, or a potential indicator has to be used to see that there is no connection or there is no live end of that conductor or there is no potential seen on the circuit.

So, the indicator itself should be tested whatever the indicator is being used for that to check for live line circuit before and after the verification.

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So, these are some of the various safety devices, which are used by the utility personal or the electrical staff or technicians in the substations. This could be of insulating mats it could be insulating gauntlets or a gloves suitable helmets, which are to be used and the insulating dress which is very important for the live line maintenance personal.

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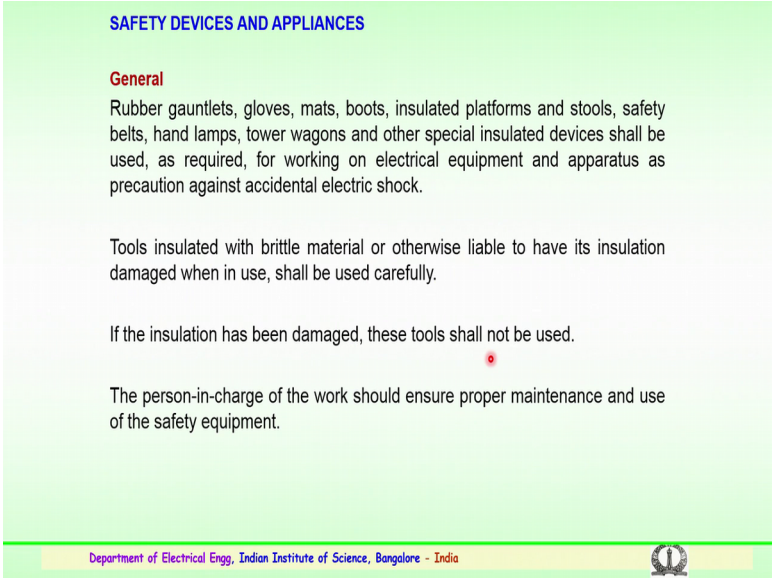

To see various safety devices and appliances are available, for the personal over working in substation. And these available devices and appliances have to be properly maintained, properly verified, and properly checked, before it is being used. So, in general you can

see in any typical substation the use of the rubber gloves or insulating gloves, or gauntlets, gauntlets are a longer type of a gloves this is a gauntlet, which extends up to the which extends above the palm. So, this gauntlets or insulating mats the insulating shoes and the insulated platforms are used for the safety aspects.

Apart from this proper safety belts in case of the personal operating at a higher a level, and suitable lamps hand lamps which are used for the maintenance. So, there could be tower wagons and other specially insulated devices which could be used whenever required for the maintenance or working on the electrical equipment, and apparatus as a precaution against accidental electrical shocks.

So, several of these devices or appliances are being used. Part from that several tools which are insulated with the brittle material or otherwise, liable to have it is insulation damaged when in use shall also be, used very carefully in case of the insulation has been damaged off for the tools which are being used. These tools should not be used if it is notice that the insulation of these tools have been damaged. So, the person or the engineer in charge of the work should ensure a proper maintenance.

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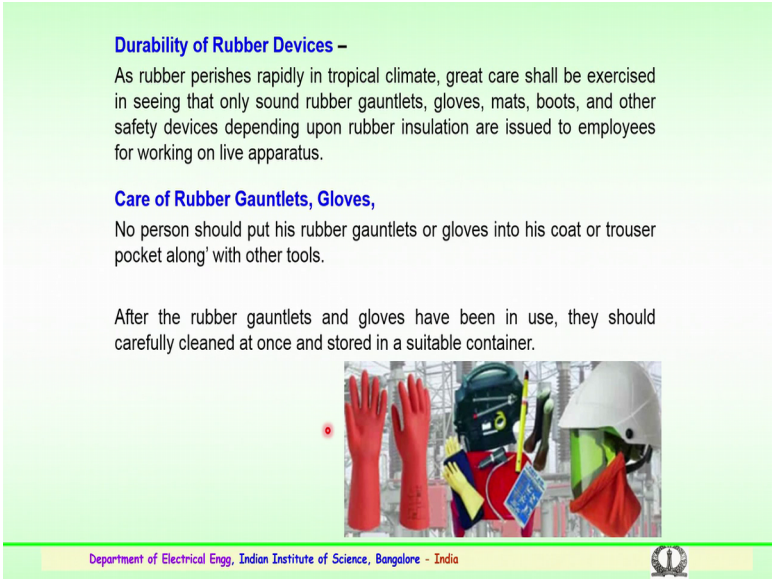

And use of the safety equipment in the substation or in the utility particularly attending the electrical maintain in works.

So, as mentioned earlier the devices have to be verified for the durability proper care has to be taken proper storage has to be done. So, example in case of a rubber devices, if we know that the rubber perishes rapidly particularly in tropical climate. So, at most care has to be exercised in seeing that these a rubber gloves or gauntlets a mats shoes and other safety devices, have to be properly checked for the insulation, which these are being used by the employees for particularly working on live line apparatus or live apparatus very important.

So, care of this rubber gloves have to be properly taken care. So, that no person should put his gloves into his coat or a trouser pocket along with tools it has to be properly maintained separately. So, after the rubber gloves or gauntlets are used, they have been in used they should be carefully cleaned and stored in a suitable container the folding have should not and they should not damage, these which could create a shock when in case it loses the insulating properties for the personal over working on live apparatus.

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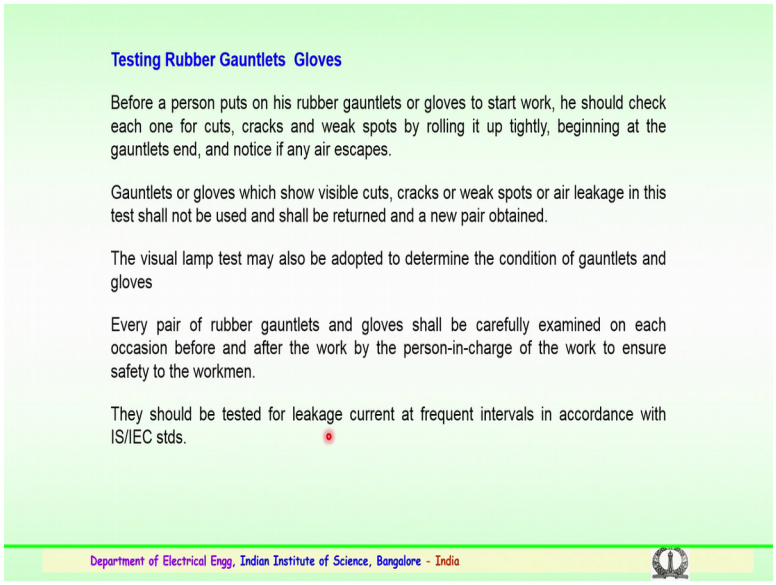

So, these have to be properly attested at regular intervals, special mentioned about the maintenance of this gloves is being given in the manual of the instructions to the personal at the substation. So, at a regular period before the person uses this rubber gloves or gauntlets to start it is it is duty to check each one in case for the cut there are cracks or a weak spots are by rolling it tightly. Beginning at the gauntlets and also notice if any air escapes that is for to verify there is a leak in the gloves or a gauntlets. If we

shows a visible cuts or a cracks, these should not be used and it should be returned and new pair to be obtained and used for the job.

Sometimes the visual lamp may be required to determine the condition of gauntlets or gloves. So, several methods are being used to check the proper functioning of this gloves or there is no damage to the gloves. So, every pair of this rubber gloves shall be carefully examined on each occasion before and after the work, by the person in charge to ensure safety of the workmen very important. And they should be tested for the leakage current or the potential at frequent intervals, in accordance with the mentioned is or international electro comic technical standardized standards.

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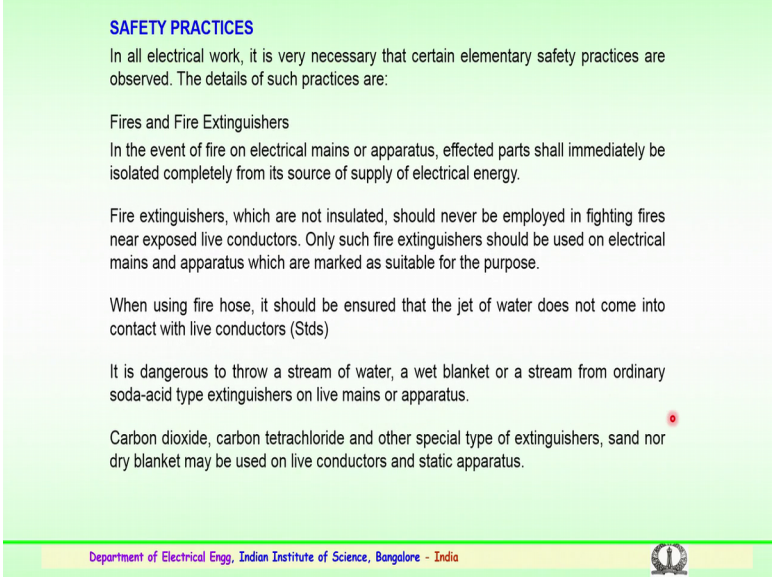

So, safety practices very important aspect in any electrical network, it is very important that certain elementary safety practices are followed. The details of such practices or adopted by the use of the necessary equipment which could help this could be to extinguish the fire or fire extinguishers, in case of any event of fire on electrical mains are operators the effected parts should immediately be isolated, completely from it source of supply of electrical energy. These fire extinguishers which are mainly not insulated should never be employed in fighting fires particularly near the exposed live conductors. Only such extinguishers should be used on the electrical mains and apparatus which are suitably marked for this purpose.

Also during the use of the fire hose it should be ensured that the jet of water does not come in contact with the live conductors. So, this again could electrocute the personal who is operating the fire hose. So, it is dangerous always and important point to know that it is dangerous to throw a stream of water a wet blanket or a stream from ordinary soda acid type extinguishers on live mains or apparatus, because the person who these extinguisher is being used could be electrocuted because of the activity which he does. So, the carbon dioxide or a carbon tetrachloride and other special type of extinguishers are available. Sand or any blanket may be used on live conductors and the static apparatus.

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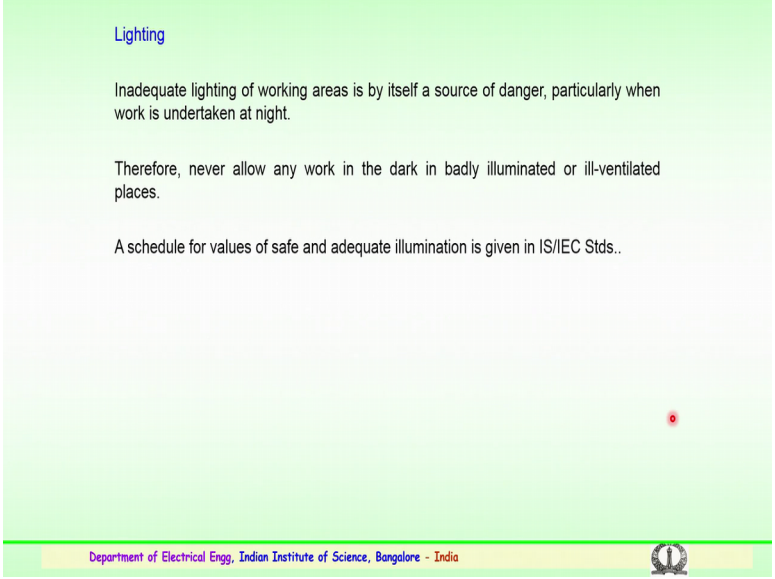

So, last important is the lighting, the lighting should be adequate very important inadequate lighting of working areas by itself is a source of danger. So, particularly work is undertaken or maintenance work is undertaken in the darkness, also adequate lighting should be ensured to the working personal also that the appropriate working is being done and necessary connections are being made.

So, therefore, it is not advisable to allow any work in the darkness or ambient dark ambient, or where there is poor illumination or ill into ventilated places. So, a schedule of a values and safe and adequate illumination is described in the standards both in a Indian standard, IS and international electro technical commission standards IEC. So,

several standards several rules and the details of the lighting requirements are specified in the standards.

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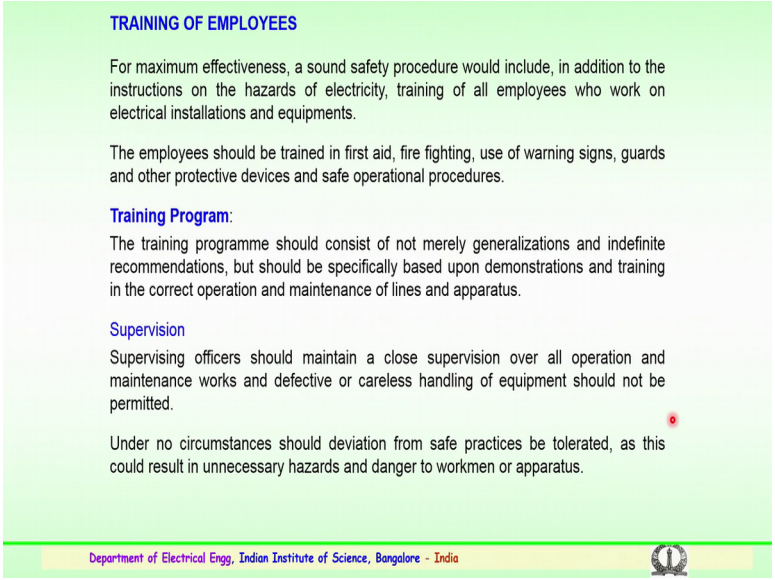

So, the training to these personal over working in the substation or the utilities is every important. So, proper procedure pertain in to the safety aspect in addition the instructions about the hazards of electrical contacts or the hazards of electricity, or the training to all the employees at the work and electrical installation is very important. So, all their personal should be trained using the first aid the fire fighting equipment the use of warning signals guards and other protective devices for the safe operational procedures. So, necessary training program should be conducted we should consist of not merely generalization and indefinite recommendations, is should be specifically based upon demonstration and training in the correct operation and maintenance of the transmission line the equipment which are in substation and the apparatus which the person could come in contact.

So, the supervision should be done by the supervising officers should maintain a very close activity on the operations, and maintenance works and see that any defective or demarche or careless handling of the equipment should not be permitted in the site.

Under no circumstances should deviation from the safe practices should be tolerated, as this could result in unnecessary hazards and a danger to the workmen or the apparatus

which it is being used. So, lighting as a mentioned earlier very important. So, proper lighting has to be done.

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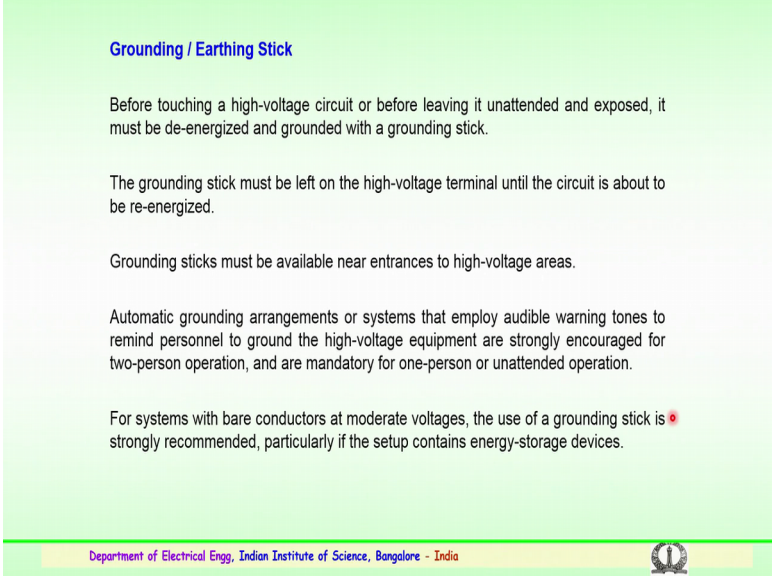

So, finally, is the grounding or the earthing stick which is very important device, where before touching high voltage circuit or before living it unattended and exposed, it must be de energized and grounded with a grounding stick or earthing stick. So, this grounding stick must be left on the high voltage terminal permanently connected until the circuit is about to be reenergized in case of maintenance.

So, during maintenance the ground stick has to be connected continuously and the work has to be carried out. So, the grounding sticks must be available in the entrances of high voltage areas and automatic grounding arrangements or the systems with necessary audible warning tones to remind personal, to the ground that the high voltage equipment are strongly encouraged for 2 person operation and are mandatory for one person to unattended operation, So very important. So, for systems particularly with bare conductors at moderate voltages. So, the use of ground stick is strongly recommended, particularly if the setup contains energy storage devices like a capacitors or other devices.

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So, these are few of the examples of how the grounding stick or the earthing stick. So, there this thing will be connected to the grounding stick, the grounding stick this is the metal thing which will be connected to the ground wire and subsequently it will be grounded connection to the ground. So, this comes in contact with the equipment which is to be grounded. So, this is an example of the substation earthing stick or the grounding stick which is used before the maintenance by the personal. So, thank you. So, that was about the importance of the grounding and the safety precautions to be employed by the substation or the personal over working in the substations.

So, thank you.