УДК 537.37
Mykyta Shymko[1], Olena Syvachuk[2]
[1]student of group E-417a ZNTU
[2] teacher ZNTU

GROUNDING SYSTEMS

Grounding system is a deliberate electrical connection to earth or its equivalent of metallic non-conductive parts that may be under stress.

The purpose of protective grounding systems is to reduce to a safe value the voltage relative to the earth on the metal parts of the equipment that are not energized, but may be energized due to insulation failure of electrical installations. As a result of the circuit on the body of the grounded equipment, the voltage of the touch decreases and, as a result, the current passing through the human body when it is touched to the body. Grounding of electrical equipment, buildings and structures is also used to protect against the effects of atmospheric electricity.

Protective earthing is used in three-phase three-wire networks with voltage up to 1000 V with an insulated neutral, and in networks with a voltage of 1000 V and above - with any neutral mode. Distinguish between natural and artificial grounding. For grounding devices, natural grounding should be used first: 1) water pipes laid in the ground; 2) metal structures of buildings and structures that have 3) reliable connection to the ground; 4) metal sheaths of cables (except aluminum); 5) casing of artesian wells. It is forbidden to use pipelines with flammable liquids and gases, pipes of heating mains as grounding conductors. Natural earthing switches must be connected to the ground network at least in two different places. As artificial grounding apply: 1) steel pipes with a diameter of 3-5 cm, wall thickness

3.5 mm, 2) 2-3 m long; 3) strip steel with a thickness of at least 4 mm; 4) angle steel with a thickness of at least 4 mm; 5) bar steel with a diameter of at least 10 mm, length up to 10 m and more; 6) for artificial earthing in aggressive soils (alkaline, acidic, etc.), where they are subjected to increased corrosion, copper, copper-plated or galvanized metal is used. Aluminum sheaths of cables and bare aluminum conductors cannot be used as artificial earthing systems, since they oxidize in the soil, and aluminum oxide is an insulator. Each individual conductor that is in contact with the ground is called a single earthing, or electrode. If the ground consists of several electrodes connected in parallel, it is called a group ground. To submerge vertical electrodes into the ground, they pre-dig a trench 0.7-0.8 m deep, after which pipes or corners are driven in with the help of mechanisms. Steel rods with a diameter of 10-12 mm are buried in the ground with the help of a special device, and longer ones – with a vibrator. The upper ends of the vertical electrodes immersed in the ground are connected by a steel strip by welding. The protective grounding device can be implemented in two ways: by looping the grounding conductors and by external. In case of contour placement of earthing switches, the potentials are equalized with a single-phase short circuit to earth. In addition, due to the mutual influence of the earthing switches, the touch voltage and the step voltage in the protected area are reduced. Remote grounding do not possess these properties. But in case of a remote placement method, there is a choice of a place for deepening of earthing. Indoors, grounding conductors should be positioned so that they are accessible for inspection and reliably protected from mechanical damage. On the floor of the premises, grounding conductors are laid in special grooves. In rooms where caustic vapors and gases are released, as well as with high humidity, grounding conductors are laid along the walls with brackets 10 mm from the wall. Each electrical enclosure must be connected to a ground or to a grounding line using a separate branch. Sequential connection of several grounded electrical installation enclosures into the grounding conductor is prohibited. The resistance of the grounding device is the sum of the resistances of the grounding conductor relative to the earth and the grounding conductors. The resistance of the grounding to the ground is the ratio of the voltage on the grounding to the current passing through the grounding to the ground. The magnitude of the resistance of the earthing depends on the resistivity of the soil in which the earthing is located; type of size and location of the elements from which the grounding is made; the number and relative position of the electrodes. The resistance of the earthing can vary several times depending on the time of year. Grounding conductors have the greatest resistance in the winter when the soil freezes and during dry time. The highest permissible value of grounding resistance in installations up to 1000 V: 10 Ohms – with a total power of generators and transformers of 100 kVA or less, 4 Ohms – in all other cases. These standards are justified by the permissible amount of contact voltage, which in networks up to 1000 V should not exceed 40 V. In

installations above 1000 V, a ground resistance of R3 <= 125 / I3 Ω, but not more than 4 Ω or 10 Ω, is allowed. In installations over 1000 V with large earth-fault currents, the resistance of the grounding device should not be more than 0.5 Ohm to ensure automatic shutdown of the network section in the event of an accident. Neutral protective conductor – a conductor connecting the zeroable parts with a neutral point of the winding of the current source or its equivalent. Protective shutdown is a special case of protective zeroing. In contrast to zeroing, protective disconnection can be used in any networks regardless of the accepted neutral mode, voltage value and the presence of a neutral wire in them.