

IEEE Standards Interpretation for IEEE Std 80™-1986 IEEE Guide for Safety in AC Substation Grounding

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Interpretation Request #1

As mentioned in 12.1 of IEEE Std 80-1986, the ground resistance in case of distribution substation shall be within limit of 5 ohm, where as for transmission substation the same shall be within limit of 1 ohm. Please provide information whether 33kV/11kV substation falls under the category of distribution substation with relevant IEEE code of standard and with clause number.

Interpretation Response

NOTE: IEEE Std 80-1986 has been revised as IEEE Std 80-2000. Subclause 12.1 of IEEE Std 80-1986 has been renumbered as 14.1 in the more current IEEE Std 80-2000.

It is really not essential to determine if the substation is a distribution or transmission substation to design ground grid. IEEE Std 80-2000, IEEE Guide for Safety in AC Substation Grounding is based on the safety criteria of acceptable touch and step potentials. Substations with low resistances are not an indication of safe design, nor is a substation with a high resistance necessarily an indication of an unsafe design. The resistivity of the soil, the magnitude of the available fault current, and the physical layout of the ground grid itself determines a safe design.

The statement referring to the ground resistance being usually about 1 ohm or less for a transmission substation and 1 to 5 ohms for a distribution substation came from experience. It was based on typical resistance values for transmission and distribution substations throughout the United States in the 1950s, mainly determined by the physical size of the substation area. These values of resistance provided an acceptable ground for relay and fuse protection systems. Also, since these resistance values times the available fault current for various voltage levels did not exceed the flashover capabilities of

the substation equipment. These values were not set specifically for substation safety, although it is obvious that the lower resistance may reduce the Ground Potential Rise (GPR). Before the original IEEE-80, the resistance of the ground grid was the primary concern of the design engineer. Again, that was to assure the system was effectively grounded.