

# Difference between Unearthed Cable & Earthed Cables

## Introduction:

---

- In HT electrical distribution, the system can be earthed or unearthed. The selection of earthed/unearthed cable will depend on system. If distribution system is earthed then we have to use cable which is manufactured for earthed system. (Which the manufacturer specifies). If the system is unearthed then we need to use cable which is manufactured for unearthed system. The unearthed system requires high insulation level compared to earthed System.
- For earthed and unearthed XLPE cables, the IS 7098 part2 1985 does not give any difference in specification. The insulation level for cable for unearthed system has to be more.

## Earthed System:

---

- Earlier the generators and transformers were of small capacities and hence the fault current was less. The star point was solidly grounded. This is called earthed system.
- In Three phases earthed system, phase to earth voltage is 1.732 times less than phase to phase voltage. Therefore voltage stress on cable to armor is 1.732 times less than voltage stress between conductors to conductor.
- Where in unearthed system, (if system neutral is not grounded) phase to ground voltage can be equal to phase to phase voltage. In such case the insulation level of conductor to armor should be equal to insulation level of conductor to conductor.
- In an earthed cable, the three phase of cable are earthed to a ground. Each of the phases of system is grounded to earth. **Examples: 1.9/3.3 KV, 3.8/6.6 KV system**

## Unearthed System:

---

- Today generators of 500MVA capacities are used and therefore the fault level has increased. In case of an earth fault, heavy current flows into the fault and this lead to damage of generators and transformers. To reduce the fault current, the star point is connected to earth through a resistance. If an earth fault occurs on one phase, the voltage of the faulty phase with respect to earth appears across the resistance. Therefore, the voltage of the other two healthy phases with respect to earth rises by 1.7 times. If the insulation of these phases is not designed for these increased voltages, they may develop earth fault. This is called unearthed system.
- In an unearh system, the phases are not grounded to earth .As a result of which there are chances of getting shock by personnel who are operating it. **Examples : 6.6/6.6 KV, 3.3/3.3 KV system.**
- Unearthed cable has more insulation strength as compared to earthed cable. When fault occur phase to ground voltage is  $\sqrt{3}$  time the normal phase to ground voltage. So if we used earthed cable in unearthed System, It may be chances of insulation puncture. So unearthed cable are used. Such type of cable is used in 6.6 KV systems where resistance type earthing is used.

## Nomenclature:

---

- In simple logic the 11 KV earthed cable is suitable for use in 6.6 KV unearthed system. The process of manufacture of cable is same. The size of cable will depend on current rating and voltage level.
- Voltage Grade (Uo/U) where Uo is Phase to Earth Voltage & U is Phase to Phase Voltage.
- **Earthed system has insulation grade of KV / 1.75 x KV.**
- **For Earthed System (Uo/U): 1.9/3.3 kV, 3.8/6.6 kV, 6.35/11 kV, 12.7/22 kV and 19/33 kV.**
- **Unearthed system has insulation grade of KV / KV.**
- **For Unearthed System (Uo/U): 3.3/3.3 kV and 11/11 kV.**
- 3 phase 3 wire system has normally Unearthed grade cables and 3 phase 4 wire systems can be used earthed grade cables, insulation used is less, and cost is less.

## Thumb Rule:

---

- As a thumb rule we can say that 6.6KV unearthed cable is equal to 11kV earthed cable i.e. **6.6/6.6kV Unearthed cable can be used for 6.6/11kV earthed system**. because each core of cable have the insulation level to withstand 6.6kV so between core to core insulation level will be  $6.6\text{kV} + 6.6\text{kV} = 11\text{kV}$
- For transmission of HT, earthed cable will be more economical due to low cost where as unearthed cables are not economical but insulation will be good.
- Generally 6.6 kV and 11kV systems are earthed through a neutral grounding resistor and the shield and armor are also earthed, especially in industrial power distribution applications. Such a case is similar to an unearthed application but with earthed shield (some times called solid bonding). In such cases, unearthed cables may be used so that the core insulation will have enough strength but current rating is de-rated to the value of earthed cables. But it is always better to mention the type of system earthing in the cable specification when ordering the cables so that the cable manufacturer will take care of insulation strength and de rating.

Source: <http://electricalnotes.wordpress.com/2013/01/02/difference-between-unearthed-cable-earthed-cables/>