

## JOINT USE OF POLES

**Purpose:** The purpose of this addendum is to include joint use by telephone borrowers of poles carrying 14.4/24.9 kv multigrounded neutral type of power distribution circuits. This addendum supplements Section 690 by expanding its scope.

### **Additions:**

#### **1. Scope**

1.1 This addendum discusses considerations involved in joint use of poles for rural power and telephone circuits under conditions where:

1.11 Telephone circuits are open wire.

1.12 Electric power circuits are of the multigrounded neutral type whose voltage from phase to ground exceeds 8700 volts but does not exceed 15,000 volts.

#### **2. General**

2.1 Joint use by telephone borrowers of poles carrying 14.4/24.9 kv multigrounded neutral type of power distribution circuits is recommended, if all requirements for such joint use as set forth below can be met and if, after careful consideration of all factors involved, joint use appears to be economically and technically desirable, or if it is the best engineering solution to difficult right-of-way or construction problems.

2.2 Section 690 of the TE & CM discusses the considerations involved in joint use of poles for rural power and telephone circuits involving open wire telephone circuits and multigrounded neutral power circuits whose voltage to ground does not exceed 8700 volts. It is the purpose of this addendum to set forth the considerations involved in joint use of poles involving open wire telephone circuits and multigrounded neutral power circuits whose voltage to ground exceeds 8700 volts, but does not exceed 15,000 volts. Joint use with a multigrounded neutral power system is assumed throughout the discussion that follows.

2.3 The omission of cable construction from Issue No. 1 of Section 690 was to expedite issuance of the section and in no way implies that such joint use is not desirable. Joint use of poles for electric power circuits and telephone cables will be covered in a later addendum to this section.

2.4 The requirements of this addendum to the manual are based on conformity with the applicable provisions of the National Electrical Safety Code and the "Joint Pole Practices for Supply and Communication Circuits" as were the requirements described indicated for lower voltage in Paragraphs 2.2 and 2.3 of Section 690, lower voltage joint use.

2.5 Strength, ground clearance and climbing space requirements for 14.4 kv joint use will be the same as now required by Section 690 for lower voltage joint use.

### 3. Separation Requirements Between Electric and Telephone Circuits

3.1 For voltages between phase wire and neutral of 15 kv or less, the multigrounded neutral is classified as being a 0-750 volt conductor. Therefore for single phase lines of 14.4/24.9 kv systems, the minimum separations between neutral or lowest secondary conductors and telephone conductors within-span and at the pole are the same for single phase 14.4 kv as for single phase 7.2 kv; namely, 40 inches at the pole and 30 inches within span. Therefore the "Vertical Separation Tables" now included in Section 690 can be used for single phase 14.4 kv joint use. In Montana, South Dakota and Arizona, state laws have been passed which classify the neutral as being from 0-750 volts regardless of the number of phases. This permits the separation tables of Section 690 to be used on "V" phase and 3-phase lines having a potential of 24.9 kv between phases, in these three states. In other states, at the present time basic separations from the multigrounded neutral or lowest secondary wire of 60 inches at the pole and 45 inches within-span must be maintained on "V" and 3-phase 14.4/24.9 kv lines.

### 4. Electrical Protection Requirements

4.1 Electrical protection in this instance as in the case of joint use with power circuits not exceeding 8700 volts to ground, is based on coordinated electrical protection schemes on the power and telephone systems. The definition of "coordinated electrical protection" is given in Paragraph 6.1, Section 690.

4.2 The basic telephone protection devices for 14.4 kv joint use are the same as are now used in 7.2 kv joint use. The short circuit currents, recloser, characteristics, and fusing of each 14.4 kv distribution line which is being considered for joint use must be checked against the time-current characteristics of the power contact protectors which would be used on the telephone circuits. This is necessary in order to determine if they are capable of handling the probable amount of energy to which they might be subjected in the event of a contact between a power phase conductor and a telephone conductor. The time-current characteristic of a typical power contact protector is shown in Figure 2 of Section 820, Issue No. 2.

4.3 The short circuit current of a 14.4 kv line as compared with an equivalent 7.2 kv line supplied by substations having equal kva ratings is roughly half that of the 7.2 kv line at, or near the substation. A cross-over point is usually reached some distance out on the line, beyond which the short circuit current of the 14.4 kv line would be greater than that of the 7.2 kv line, but less than the value at the substation. On the substation side of the cross-over point, there is usually an adequate difference between the maximum normal load currents and fault current to make it easy to obtain reliable and positive operation of reclosers on fault currents, without false operation on unusually high nonfault load currents. The duty on the power contact protectors on the substation side of the cross-over point would be less at 14.4 kv than on the equivalent 7.2 kv line. Therefore it is possible to handle somewhat higher kva ratings with 14.4 kv systems without exceeding the safe current-carrying capacity of the power contact protectors. Beyond the cross-over point, the higher short circuit currents of the 14.4 kv system insure more positive operation of reclosers than is possible in an equivalent 7.2 kv system and there is little danger of burning out the power contact protectors. Although in some instances, as indicated above, the duty on the power contact protectors would be less in a 14.4 kv system than in a 7.2 kv system of the same kva rating, it is recommended that they be installed at intervals of 20 ohms of telephone conductor (one wire) as now specified in Section 820 of the TE & CM.

## 5. Electric Induction at Fundamental Frequency

5.1 For the same average cross section configuration of wires, the open circuit electrically induced voltage in telephone circuits on a joint use power line would be almost twice as high in a 14.4 kv system as in a 7.2 kv system. Therefore approximately twice as many drains would be required on telephone circuits on a 14.4 kv line in order to reduce the induced voltage to the same level as that from the 7.2 kv line. While it is desirable to hold the induced voltage on all lines to the practicable minimum, there is no hard and fast limiting value of voltage that would be considered tolerable. Ringing, personnel, and economic considerations are also involved. Drainage units should therefore be installed in accordance with the requirements of Section 820.

## 6. Magnetic Induction at Fundamental Frequency - Short-Circuit Conditions

6.1 The current in a power fault to neutral or to ground not involving the telephone wires would still impress voltage

on the telephone wires by magnetic induction. The magnitudes of these longitudinally-induced voltages may first be compared for the 14.4 kv and the 7.2 kv cases on the assumption that the short-circuit currents are the same and similarly divided between neutral and ground. If the neutral is at the same vertical spacing from the telephone conductors at 14.4 and at 7.2 kv as will normally be the case, the induced voltage will be the same in either case.

- 6.2 If any fault location such that the fault current is smaller at 14.4 kv, the situation would thus favor the 14.4 kv system as against the 7.2 kv system. For faults at great distances from the substation (for which the induced voltage may still be relatively large in spite of the lowered magnitude of the fault current), the induced voltage will be higher at 14.4 kv. Local conditions will be the determining factor here. But, as a general statement, it is unlikely that abnormal magnetic induction would significantly influence the choice between joint use at 7.2 and at 14.4 kv.

## 7. Noise

- 7.1 There are many factors that affect noise in circuits on a joint use line. Some of these factors are dependent on voltage, others are dependent on current. Therefore, for the same system kva rating, an increase in noise from some sources would be expected with a 14.4 kv system as compared with an equivalent 7.2 kv system, while a decrease would be expected from other sources. The net effect of an increase in voltage would be entirely different in different situations. Therefore there is no reason to suppose that noise conditions would be materially worse in joint use at 14.4 than at 7.2 kv.