# *STANDARD OUTSIDE PLANT CONSTRUCTION METHODS BOOK 1, POLE LINE CONSTRUCTION*

Kellogg's standard practice on all aspects of pole line construction. Includes open wire and sheathed cable installation. Published in 1945 and totally produced by Kellogg's engineering department.

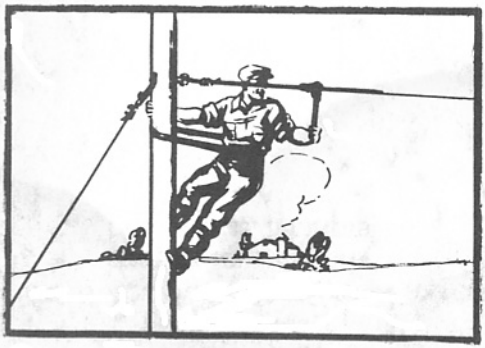
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# *Standard*
# OUTSIDE PLANT CONSTRUCTION METHODS



## BOOK 1

**Section 1 — POLE LINE CONSTRUCTION**

*Compiled, Edited, and Produced by*

**Kellogg Switchboard and Supply Co.**
**6650 S. Cicero Ave., Chicago 38, Ill.**
**Branches: Los Angeles – San Francisco – Kansas City**

# *Foreword*

*The Kellogg Switchboard and Supply Company has recognized the need of the Independent Telephone Industry for a handbook that would embody standard practices for Outside Plant Construction.*

*It is with this thought, plus a desire to aid the independent telephone company in its many problems, that this handbook has been published.*

*The information and data contained herein, will be of special benefit to all telephone companies who wish to establish and maintain standard practices.*

*Since there are, in some cases, several methods employed by operating companies in handling various phases of construction work, Kellogg engineers deemed it best to consult a number of outstanding telephone men from all parts of the country to aid them in establishing a criterion for the term—"standard practices." In several instances, where controversial discussions could not determine the advantage of one proven method over another both methods have been set down as standard practices.*

*Standard practices for Outside Plant Construction therefore, are the tested, most practical methods for this type of construction and should be adhered to as closely as possible.*

*The recommended practices as outlined in this book are based, largely on average operating conditions. No attempt has been, or can be made to cover all phases of construction under sub-average conditions. However Kellogg will gladly assist you in every way possible to overcome any problems that may arise from a sub-average operating condition, or from any sub-standard practice that is not reviewed in this handbook.*

BOOK I

# POLE LINE CONSTRUCTION

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# GENERAL

The methods and practices contained herein are designed for guidance to parties engaged in the construction, operation and maintenance of Urban and Rural Telephone Exchanges.

It is not feasible or practical to provide a standard specification for each and every field combination, problem or situation that may arise. Therefore it will be necessary to use substantial logic along with these practices when applying them to an individual problem.

**Plan all work so as to prevent**

(1) Accidents.
(2) Injury to your employees.
(3) Injury to the public.
(4) Damage to property.
(5) Traffic hazards.

Pavements, sidewalks, curbings, lawns and boulevards should be left in good condition after any work is completed.

Permits should be secured before any work is attempted.

Keep a record of all permits and have them available for future reference.

Public regulation should be obeyed at all times. Impress upon your employees the value of good public relations.

**CAUTION:**

The wire clearance and wire separation set up in these specifications are in general standard specifications throughout the country. However, where a state electrical code is in conflict with these specifications, the state requirements must be followed.

# POLE LINE

The pole line plant is the pioneer of all outside telephone property, and as such must be accorded the most careful consideration in design. The selection of the route immediately determines the future of the distribution system and also establishes any future feeder routes for subsequent types of plant construction, such as



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aerial cable and underground cable. The pole plant, therefore, should be planned in such a way as to meet initial requirements of open wire circuits as well as to provide for the possibility of future expansion through the use of aerial or underground cable.

## RIGHT-OF-WAY

Toll, exchange and rural pole lines may be built on public highways or on private right of way depending largely upon the importance and local requirements of each line. Right of way contracts or agreements should be secured from responsible public officials or private property owners before any work is started. The use of public highways may result in a lower first cost while the private right of way may result in future economies.

From a *toll* point of view, the private property location is more desirable in as much as a permanent location is established. Poles can be set in a straight line, thus eliminating costly corners and anchors. Private property routes will often have a tendency to reduce the length of the pole line thereby resulting in a saving through the use of fewer poles. This method has the further advantage of reducing power noises, and transmission troubles to a minimum.

The removal of trees and brush along the route will eliminate costly tree-trimming.

Another popular method is to set poles one to five feet back off the highway on private right of way. This method will not eliminate corners or guys but will reduce the possibility of extensive pole relocation costs, due to road relocations and highway widening projects.

*Exchange* pole routes are usually established on public streets, public alleys, public highways and on private property.

When a pole line is to be built and maintained in land developments where blocks have been laid out into building lots, it is desirable from an economic standpoint to obtain right-of-way and tree-trimming privileges before the lots are sold.

*Rural* pole routes are generally established along public highways.

The public highway right of way is more accessible to construction and maintenance crews. Consideration should be given to the possibility that relocations may be necessary due to highway changes and improvements.

Factors to be considered in obtaining right of way privileges are listed as follows:

(1) Obtain signed permits from property owners to erect and maintain poles, guys, anchors, crossarms, wire, aerial cable, underground cable and underground conduit on, across or along their properties.

(2) Obtain signed permission from private property owners to trim and remove trees or brush on their properties.

(3) Obtain signed permits from authorized officials of cities, towns or villages to erect and maintain poles, guys, anchors, crossarms, wire, aerial cable, underground cable and underground conduit in, on, across or along public streets.

(4) Obtain signed permits from authorized township and state officials to erect and maintain poles, guys, anchors, crossarms, wire, aerial cable, underground cable and underground conduit in, on, across or along town roads, county highways and state highways.

(5) Obtain consent from city, town, village or state officials to trim trees along public streets, roads or highways.

(6) Obtain signed agreements from railroad companies to cross over or locate on their property.

(7) Notify the railroad companies of plans to cross over or under their tracks within the limits of a public highway.

(8) Obtain signed permission from the Government to cross under or over a navigable stream or river.

(9) Note locations of future installations of fire hydrants, catch basins and curb lines.

(10) Obtain agreements with other utilities whose construction may interfere with safe clearance.

(11) Obtain joint use agreement with other utilities where necessary.



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# POLES

## SPECIES OF TIMBER

The species of timber most commonly used for telephone poles consist chiefly of: Northern White Cedar, Western Red Cedar, Chestnut, Southern Pine, and Douglas Fir.

Other poles are used to a small extent in territories where they are produced, such as the Hodgepole pine, Redwood, Juniper and Cypress.

## CEDAR

The two cedars which are among the most durable woods known contain powerful decay and termite-resistant toxins in their fibrous substance, particularly in the heartwood which is over 90 per cent of their volume. Cedar sapwood, while much more durable than Pine sapwood, is less toxic than Cedar heartwood. For this reason, Cedar poles are usually given a preservative butt treatment by the open tank method to secure extra protection in the region of the ground line where the pole is subjected to conditions which foster decay. The sapwood above the ground line of sound poles, free from infection when erected, has seldom been known to decay prematurely.

## CHESTNUT

Chestnut poles are durable in soil without treatment but in order to extend their durability to a maximum, they are given an open tank treatment.

## SOUTHERN PINE AND DOUGLAS FIR

Because of the very perishable nature of pine, a pine pole must be treated its entire length under pressure to insure the fullest possible penetration of the sapwood by the preservative. Framing must be done before treatment to avoid subsequent exposure of untreated sapwood or heartwood. In standard sizes the average Yellow Pine pole consists of about 80 per cent sapwood. There is no appreciable difference in strength between sapwood and heartwood. This applies to all species of wood poles. Heartwood, in

all species, while very resistant to penetration of the preservative is, at the same time, relatively more durable and resistant to decay and termite attack, than is the sapwood of the same species.

American Standards Association (A.S.A.) has adopted the numerical classification 1 to 10; each class from 1 to 7 has the same breaking load for all species. Classes 8, 9 and 10 have no guaranteed ground line circumference.

Woods Run or Top size poles guarantee no minimum ground line circumference; but are furnished with minimum tops and natural or "woods run" tapers.

## TREATMENT OF CEDAR POLES

### THE ½-INCH GUARANTEED PENETRATION SPECIFICATION

Under these specifications a half-inch penetration is guaranteed, where the sapwood is ½-inch thick. This is accomplished in the following manner: All inner bark is removed from the ground line area of the pole. It is then conveyed to an incising machine where incisions ½-inch deep are made, properly spaced to insure a uniform depth of penetration of the preservative throughout the incised area. This area is one foot above and two feet below the standard ground line—where the preservative is most needed. The pole is then immersed in hot creosote oil to the proper depth for a period of not less than eight hours, or longer if necessary to insure the proper impregnation of the sapwood.

Coal tar creosote is the most efficient wood preservative, and only No. 1 American Wood-Preservers' Association specification creosote is used. This creosote, heated to a temperature of 212 degrees to 230 degrees Fahrenheit by steam pipe coils, is kept at the proper temperature by means of accurate instruments which record the temperatures maintained during the period of treatment.

### B SPECIFICATIONS

Specify that the poles be immersed in hot oil for a period of not less than four hours. Then, the hot oil is quickly withdrawn and cold oil applied for a period of not less than two hours. While



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the "B" Treatment is superior to the "AA" specifications, experience has shown that a uniform penetration of the sapwood cannot be consistently secured so as to produce the largest possible absorption of the preservative. To overcome this, the incising process described above has been perfected.

### AA SPECIFICATIONS

The "AA" Specification calls for the poles to be immersed in hot creosote oil to the proper depth for a minimum of fifteen minutes. While this treatment will materially prolong the life of the pole it is purely superficial and no appreciable or uniform penetration of the preservative can be secured.

## TREATMENT FOR PINE AND DOUGLAS FIR POLES

### EMPTY-CELL RUEPING PROCESS

Involves the use of initial air pressure (before the introduction of the creosote into the cylinder) and a final vacuum after removing the creosote. This is the chief process now employed and is favored because of its success in eliminating bleeding.

### LOWRY PROCESS

Uses no initial air, but only a final vacuum.

### FULL-CELL BETHEL PROCESS

Leaves all free oil in the pole, using neither initial air nor a final vacuum.

Treatment is measured by the final retention of oil in pounds of oil per cubic foot of the total volume of the pole. For example, a pole of 20 cubic feet volume, into which 160 pounds of oil (approximately 9 pounds per gallon) have been injected, is said to have received an 8-pound treatment, i.e., 8 pounds of oil for every cubic foot of the entire volume of the pole. Standard treatments are 8 pounds, 10 pounds and 12 pounds.

## SHIPPING WEIGHTS—N.W.C.A. NORTHERN WHITE CEDAR POLES

WEIGHT PER POLE IN POUNDS — TABLE NO. 1

| Length | Top Diam. 4 in. | Top Diam. 4½ in. | Top Diam. 5 in. | Top Diam. 5½ in. | Top Diam. 6 in. | Top Diam. 6½ in. | Top Diam. 7 in. | Top Diam. 8 in. | Top Diam. 9 in. |
|---|---|---|---|---|---|---|---|---|---|
| 16 ft. | 85 | ... | 105 | ... | 135 | ... | 165 | 200 | 300 |
| 18 ft. | 95 | ... | 125 | ... | 155 | ... | 200 | 325 | 425 |
| 20 ft. | 100 | 100 | 130 | 130 | 190 | ... | 250 | 350 | 450 |
| 25 ft. | 150 | ... | 200 | 200 | 250 | 250 | 350 | 450 | ... |
| 30 ft. | ... | ... | 275 | 275 | 350 | 350 | 450 | 600 | ... |
| 35 ft. | ... | ... | 375 | 375 | 450 | 450 | 600 | 850 | ... |
| 40 ft. | ... | ... | ... | ... | 625 | 625 | 850 | 1100 | ... |

## SHIPPING WEIGHTS—A.S.A. NORTHERN WHITE CEDAR POLES

WEIGHT PER POLE IN POUNDS — TABLE NO. 2

| Lgth. | Class 10 | Class 9 | Class 8 | Class 7 | Class 6 | Class 5 | Class 4 | Class 3 | Class 2 | Class 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 16 ft. | 85 | 105 | 135 | 135 | 190 | 230 | ... | ... | ... | ... |
| 18 ft. | 95 | 125 | 155 | 155 | 210 | 300 | 300 | 420 | ... | ... |
| 20 ft. | 100 | 130 | 190 | 190 | 230 | 300 | 350 | 540 | 600 | 720 |
| 22 ft. | 150 | 200 | 225 | 225 | 315 | 420 | 500 | 540 | 780 | 1020 |
| 25 ft. | 150 | 200 | 250 | 250 | 300 | 420 | 515 | 600 | 780 | 1020 |
| 30 ft. | ... | 275 | 350 | 350 | 420 | 520 | 630 | 870 | 1170 | 1320 |
| 35 ft. | ... | ... | ... | 450 | 510 | 720 | 820 | 1060 | 1320 | 1620 |
| 40 ft. | ... | ... | ... | ... | 625 | 790 | 1020 | 1280 | 1675 | 2040 |

## SHIPPING WEIGHTS—W.R.C.A. WESTERN RED CEDAR POLES

WEIGHT PER POLE IN POUNDS — TABLE NO. 3

| Length | Top Diam. 4 in. | Top Diam. 5 in. | Top Diam. 6 in. | Top Diam. 7 in. | Top Diam. 8 in. |
|---|---|---|---|---|---|
| 20 ft. | 100 | 135 | 190 | 250 | 325 |
| 25 ft. | ... | 200 | 250 | 325 | 400 |

(Table No. 3 continued on page 8.)



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WEIGHT PER POLE IN POUNDS — TABLE NO. 3 (Cont'd)

| Length | Top Diam. 4 in. | Top Diam. 5 in. | Top Diam. 6 in. | Top Diam. 7 in. | Top Diam. 8 in. |
|---|---|---|---|---|---|
| 30 ft. | ... | ... | 325 | 400 | 550 |
| 35 ft. | ... | ... | 450 | 550 | 650 |
| 40 ft. | ... | ... | ... | 675 | 800 |
| 45 ft. | ... | ... | ... | ... | 1000 |
| 50 ft. | ... | ... | ... | ... | 1200 |
| 55 ft. | ... | ... | ... | ... | 1400 |

## SHIPPING WEIGHTS—A.S.A. WESTERN RED CEDAR POLES

WEIGHT PER POLE IN POUNDS — TABLE NO. 4

| Lgth. | Class 10 | Class 9 | Class 8 | Class 7 | Class 6 | Class 5 | Class 4 | Class 3 | Class 2 | Class 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 ft. | 100 | 135 | 180 | 200 | 225 | 300 | 400 | 500 | 600 | 700 |
| 25 ft. | 135 | 200 | 225 | 250 | 320 | 400 | 480 | 600 | 720 | 850 |
| 30 ft. | ... | 250 | 325 | 350 | 420 | 500 | 610 | 730 | 850 | 1000 |
| 35 ft. | ... | ... | 450 | 470 | 560 | 650 | 750 | 850 | 1000 | 1200 |
| 40 ft. | ... | ... | ... | ... | 700 | 800 | 900 | 1100 | 1300 | 1500 |
| 45 ft. | ... | ... | ... | ... | ... | 1000 | 1150 | 1300 | 1550 | 1800 |
| 50 ft. | ... | ... | ... | ... | ... | 1300 | 1400 | 1550 | 1800 | 2000 |
| 55 ft. | ... | ... | ... | ... | ... | 1600 | 1600 | 1800 | 2000 | 2300 |
| 60 ft. | ... | ... | ... | ... | ... | ... | 1900 | 2000 | 2200 | 2600 |

## SHIPPING WEIGHTS—WOODS RUN PINE POLES

### (Top Measurement—Natural Taper)

WEIGHT PER POLE IN POUNDS — TABLE NO. 5

| Length | Top Diam. 4 in. | Top Diam. 5 in. | Top Diam. 6 in. | Top Diam. 7 in. | Top Diam. 8 in. |
|---|---|---|---|---|---|
| 16 ft. | 130 | 150 | ... | ... | ... |
| 18 ft. | 150 | 200 | 280 | ... | ... |
| 20 ft. | 170 | 220 | 310 | ... | ... |
| 22 ft. | 210 | 290 | 350 | ... | ... |
| 25 ft. | 220 | 310 | 390 | 500 | 580 |
| 30 ft. | ... | 400 | 540 | 670 | 780 |
| 35 ft. | ... | ... | 670 | 870 | 1010 |

| | | | | | |
|---|---|---|---|---|---|
| 40 ft. ..... | ... | ... | 820 | 1060 | 1260 |
| 45 ft. ..... | ... | ... | 1010 | 1260 | 1500 |
| 50 ft. ..... | ... | ... | ... | 1470 | 1740 |
| 55 ft. ..... | ... | ... | ... | 1700 | 2010 |
| 60 ft. ..... | ... | ... | ... | 1900 | 2260 |

These poles have no size requirement other than top measurement as indicated above.

4-inch top poles are same as ASA Class 10.
5-inch top poles are same as ASA Class 9.
6-inch top poles are same as ASA Class 8.
7-inch top poles approximate ASA Class 5.
8-inch top poles approximate ASA Class 4.

TABLE NO. 6

## SHIPPING WEIGHT—A.S.A. POLES

8-LB. TREATMENT—WEIGHT PER POLE IN POUNDS

| Length | Class 10 | Class 9 | Class 8 | Class 7 | Class 6 | Class 5 | Class 4 | Class 3 | Class 2 |
|---|---|---|---|---|---|---|---|---|---|
| 16 ft. ..... | 130 | 150 | ... | ... | ... | ... | ... | ... | ... |
| 18 ft. ..... | 150 | 200 | 280 | ... | ... | ... | ... | ... | ... |
| 20 ft. ..... | 170 | 220 | 310 | ... | ... | ... | ... | ... | ... |
| 22 ft. ..... | 210 | 290 | 350 | ... | ... | ... | ... | ... | ... |
| 25 ft. ..... | 220 | 310 | 390 | 350 | 410 | 500 | 580 | ... | ... |
| 30 ft. ..... | ... | 400 | 540 | 480 | 570 | 670 | 780 | ... | ... |
| 35 ft. ..... | ... | ... | 670 | 590 | 710 | 870 | 1010 | 1140 | ... |
| 40 ft. ..... | ... | ... | 820 | 730 | 870 | 1060 | 1260 | 1460 | ... |
| 45 ft. ..... | ... | ... | 1010 | 900 | 1060 | 1260 | 1500 | 1740 | 1990 |
| 50 ft. ..... | ... | ... | ... | 1042 | 1254 | 1470 | 1740 | 2020 | 2340 |
| 55 ft. ..... | ... | ... | ... | ... | 1480 | 1700 | 2010 | 2300 | 2700 |
| 60 ft. ..... | ... | ... | ... | ... | 1630 | 1900 | 2260 | 2680 | 3080 |



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TABLE NO. 7

# AMERICAN STANDARDS ASSOCIATION

## DIMENSIONS OF NORTHERN WHITE CEDAR POLES

| Class | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Min. Top Circ. (in.) | 27 | 25 | 23 | 21 | 19 | 17 | 15 | 18 | 15 | 12 |
| Min. Top Dia. (in.) | 8.6 | 8.0 | 7.3 | 6.7 | 6.0 | 5.4 | 4.8 | 5.7 | 4.8 | 3.8 |
| Length of Pole | Minimum Circumference at Six Feet from Butt (Inches) | | | | | | | | | |
| 16 ft. | ... | ... | ... | ... | 26.0 | 24.0 | 22.0 | No Butt Requirement | No Butt Requirement | No Butt Requirement |
| 18 ft. | ... | ... | 32.5 | 30.0 | 28.0 | 25.5 | 23.5 | | | |
| 20 ft. | 39.5 | 37.0 | 34.0 | 31.5 | 29.0 | 27.0 | 25.0 | | | |
| 22 ft. | 41.0 | 38.5 | 36.0 | 33.0 | 30.5 | 28.0 | 26.0 | | | |
| 25 ft. | 43.5 | 41.0 | 38.0 | 35.5 | 32.5 | 30.0 | 28.0 | | | |
| 30 ft. | 47.5 | 44.5 | 41.5 | 38.5 | 35.5 | 33.0 | 30.5 | | | |
| 35 ft. | 50.5 | 47.5 | 44.0 | 41.0 | 38.0 | 35.0 | 32.5 | | | |
| 40 ft. | 53.5 | 50.0 | 46.5 | 43.5 | 40.0 | 37.0 | ... | | | |
| 45 ft. | 56.0 | 52.5 | 49.0 | 45.5 | 42.0 | ... | ... | | | |
| 50 ft. | 58.5 | 55.0 | 51.5 | 47.5 | 44.0 | ... | ... | | | |
| 55 ft. | 61.0 | 57.5 | 53.5 | 49.5 | 46.0 | ... | ... | | | |
| 60 ft. | 63.5 | 59.5 | 55.5 | 51.5 | ... | ... | ... | | | |

Circumferential Taper .63 inches per linear foot.

TABLE NO. 8

# AMERICAN STANDARDS ASSOCIATION

## DIMENSIONS OF WESTERN RED CEDAR POLES

| Class | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Min. Top Circ. (in.) | 27 | 25 | 23 | 21 | 19 | 17 | 15 | 18 | 15 | 12 |
| Min. Top Dia. (in.) | 8.6 | 8.0 | 7.3 | 6.7 | 6.0 | 5.4 | 4.8 | 5.7 | 4.8 | 3.8 |
| Length of Pole | Minimum Circumference at Six Feet from Butt (Inches) | | | | | | | | | |
| 16 ft. | ... | ... | ... | ... | 23.0 | 21.5 | 19.5 | | | |
| 18 ft. | ... | ... | 28.5 | 26.5 | 24.5 | 22.5 | 21.0 | | | |
| 20 ft. | 34.5 | 32.0 | 30.0 | 28.0 | 25.5 | 23.5 | 22.0 | | | |
| 22 ft. | 36.0 | 33.5 | 31.5 | 29.0 | 27.0 | 25.0 | 23.0 | | | |
| 25 ft. | 38.0 | 35.5 | 33.0 | 30.5 | 28.5 | 26.0 | 24.5 | | | |
| 30 ft. | 41.0 | 38.5 | 35.5 | 33.0 | 30.5 | 28.5 | 26.5 | | | |
| 35 ft. | 43.5 | 41.0 | 38.0 | 35.5 | 32.5 | 30.5 | 28.0 | | | |
| 40 ft. | 46.0 | 43.5 | 40.5 | 37.5 | 34.5 | 32.0 | ... | | | |
| 45 ft. | 48.5 | 45.5 | 42.5 | 39.5 | 36.5 | ... | ... | | | |
| 50 ft. | 50.5 | 47.5 | 44.5 | 41.0 | 38.0 | ... | ... | | | |
| 55 ft. | 52.5 | 49.5 | 46.0 | 42.5 | 39.5 | ... | ... | | | |
| 60 ft. | 54.5 | 51.0 | 47.5 | 44.0 | ... | ... | ... | | | |
| 65 ft. | 56.0 | 52.5 | 49.0 | 45.5 | ... | ... | ... | | | |
| 70 ft. | 57.5 | 54.0 | 50.5 | 47.0 | ... | ... | ... | | | |
| 75 ft. | 59.5 | 55.5 | 52.0 | 48.5 | ... | ... | ... | | | |
| 80 ft. | 61.0 | 57.0 | 53.5 | 49.5 | ... | ... | ... | No Butt Requirement | No Butt Requirement | No Butt Requirement |
| 85 ft. | 62.5 | 58.5 | 54.5 | ... | ... | ... | ... | | | |
| 90 ft. | 63.5 | 60.0 | 56.0 | ... | ... | ... | ... | | | |

Circumferential Taper .38 inches per linear foot.



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TABLE NO. 9

# AMERICAN STANDARDS ASSOCIATION

## DIMENSIONS OF CREOSOTED SOUTHERN PINE POLES

| Class | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Min. Top Circ. (in.) | 27 | 25 | 23 | 21 | 19 | 17 | 15 | 18 | 15 | 12 |
| Min. Top Dia. (in.) | 8.6 | 8.0 | 7.3 | 6.7 | 6.0 | 5.4 | 4.8 | 5.7 | 4.8 | 3.8 |
| Length of Pole | Minimum Circumference at Six Feet from Butt (Inches) | | | | | | | | | |
| 16 ft. | ... | ... | ... | ... | 21.5 | 19.5 | 18.0 | | | |
| 18 ft. | ... | ... | 26.5 | 24.5 | 22.5 | 21.0 | 19.0 | | | |
| 20 ft. | 31.5 | 29.5 | 27.5 | 25.5 | 23.5 | 22.0 | 20.0 | | | |
| 22 ft. | 33.0 | 31.0 | 29.0 | 26.5 | 24.5 | 23.0 | 21.0 | | | |
| 25 ft. | 34.5 | 32.5 | 30.0 | 28.0 | 26.0 | 24.0 | 22.0 | | | |
| 30 ft. | 37.5 | 35.0 | 32.5 | 30.0 | 28.0 | 26.0 | 24.0 | | | |
| 35 ft. | 40.0 | 37.5 | 35.0 | 32.0 | 30.0 | 27.5 | 25.5 | | | |
| 40 ft. | 42.0 | 39.5 | 37.0 | 34.0 | 31.5 | 29.0 | 27.0 | | | |
| 45 ft. | 44.0 | 41.5 | 38.5 | 36.0 | 33.0 | 30.5 | 28.5 | | | |
| 50 ft. | 46.0 | 43.0 | 40.0 | 37.5 | 34.5 | 32.0 | 29.5 | | | |
| 55 ft. | 47.5 | 44.5 | 41.5 | 39.0 | 36.0 | 33.5 | ... | | | |
| 60 ft. | 49.5 | 46.0 | 43.0 | 40.0 | 37.0 | 34.5 | ... | | | |
| 65 ft. | 51.0 | 47.5 | 44.5 | 41.5 | 38.5 | ... | ... | | | |
| 70 ft. | 52.5 | 49.0 | 46.0 | 42.5 | 39.5 | ... | ... | | | |
| 75 ft. | 54.0 | 50.5 | 47.0 | 44.0 | ... | ... | ... | | | |
| 80 ft. | 55.0 | 51.5 | 48.5 | 45.0 | ... | ... | ... | | | |
| 85 ft. | 56.5 | 53.0 | 49.5 | ... | ... | ... | ... | | | |
| 90 ft. | 57.5 | 54.0 | 50.5 | ... | ... | ... | ... | | | |

No Butt Requirement

No Butt Requirement

No Butt Requirement

Circumferential Taper .25 inches per linear foot.

TABLE NO. 10

# AMERICAN STANDARDS ASSOCIATION

## DIMENSIONS OF CREOSOTED DOUGLAS FIR POLES

| Class | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Min. Top Circ. (in.) | 27 | 25 | 23 | 21 | 19 | 17 | 15 | 18 | 15 | 12 |
| Min. Top Dia. (in.) | 8.6 | 8.0 | 7.3 | 6.7 | 6.0 | 5.4 | 4.8 | 5.7 | 4.8 | 3.8 |
| Length of Pole | Minimum Circumference at Six Feet from Butt (Inches) | | | | | | | | | |
| 16 ft. | ... | ... | ... | ... | 21.5 | 19.5 | 18.0 | | | |
| 18 ft. | ... | ... | 26.5 | 24.5 | 22.5 | 21.0 | 19.0 | | | |
| 20 ft. | 31.5 | 29.5 | 27.5 | 25.5 | 23.5 | 22.0 | 20.0 | | | |
| 22 ft. | 33.0 | 31.0 | 29.0 | 26.5 | 24.5 | 23.0 | 21.0 | | | |
| 25 ft. | 34.5 | 32.5 | 30.0 | 28.0 | 26.0 | 24.0 | 22.0 | | | |
| 30 ft. | 37.5 | 35.0 | 32.5 | 30.0 | 28.0 | 26.0 | 24.0 | | | |
| 35 ft. | 40.0 | 37.5 | 35.0 | 32.0 | 30.0 | 27.5 | 25.5 | | | |
| 40 ft. | 42.0 | 39.5 | 37.0 | 34.0 | 31.5 | 29.0 | 27.0 | | | |
| 45 ft. | 44.0 | 41.5 | 38.5 | 36.0 | 33.0 | 30.5 | 28.5 | | | |
| 50 ft. | 46.0 | 43.0 | 40.0 | 37.5 | 34.5 | 32.0 | 29.5 | | | |
| 55 ft. | 47.5 | 44.5 | 41.5 | 39.0 | 36.0 | 33.5 | ... | | | |
| 60 ft. | 49.5 | 46.0 | 43.0 | 40.0 | 37.0 | 34.5 | ... | | | |
| 65 ft. | 51.0 | 47.5 | 44.5 | 41.5 | 38.5 | ... | ... | | | |
| 70 ft. | 52.5 | 49.0 | 46.0 | 42.5 | 39.5 | ... | ... | | | |
| 75 ft. | 54.0 | 50.5 | 47.0 | 44.0 | ... | ... | ... | | | |
| 80 ft. | 55.0 | 51.5 | 48.5 | 45.0 | ... | ... | ... | | | |
| 85 ft. | 56.5 | 53.0 | 49.5 | ... | ... | ... | ... | | | |
| 90 ft. | 57.5 | 54.0 | 50.5 | ... | ... | ... | ... | | | |

No Butt Requirement

No Butt Requirement

No Butt Requirement

Circumferential Taper .25 inches per linear foot.



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# FIBRE STRENGTH

The American Standards Association has established the following fibre strength for —

Northern White Cedar ..... 3600 lbs. per sq. inch.
Western Red Cedar ..... 5600 lbs. per sq. inch.
Chestnut ..... 6000 lbs. per sq. inch.
Southern Pine (Creosoted) ..... 7400 lbs. per sq. inch.
Douglas Fir (Creosoted) ..... 7400 lbs. per sq. inch.

With these standard stress values a table was prepared to give each pole of the same class the same breaking strength regardless of length or species.

The approximate breaking loads for poles classed from 1 to 7 are indicated in the following table, assuming that the load is applied two feet from the top and that the break would occur at the ground line.

**TABLE NO. 11**

| CLASS | BREAKING LOAD (POUNDS) | CLASS | BREAKING LOAD (POUNDS) |
|---|---|---|---|
| 1 | 4500 | 5 | 1900 |
| 2 | 3700 | 6 | 1500 |
| 3 | 3000 | 7 | 1200 |
| 4 | 2400 | | |

## STAINING POLES

When it is the policy of a telephone company to set colored poles to conform with city ordinances or for various other reasons it is strongly recommended to order the poles treated with a creosoted oil stain of the desired color, instead of paint.

Paint acts as a seal over the pole surface, retards moisture evaporation and sets up an ideal condition for fungus growth and decay. Moisture will enter the broken surface of a painted pole through checks or openings made by a lineman's spur and is unable to evaporate rapidly due to this sealing effect. Fungi spores will also enter the same holes, attack the wood, cause soft spots and in time, decay.

The natural surface of a pole will afford rapid drying of the wood and thus eliminate this condition of deterioration and decay.

Stain has some preserving value and will not fill the cells of the wood, so that moisture can evaporate naturally and quickly.

## STORING POLES

The storage and care of poles is an important item and should receive careful attention and consideration in handling, sorting and stacking. The pole yard should be located on high ground with good drainage, free from fire hazards and accessible to railroad and truck transportation for future loading and hauling to various jobs.

It is important that the pole yard be kept clean and free from weeds which should be cut and removed at regular intervals. Remove all decayed wood and other rubbish from beneath and around the poles.

Poles should be piled or stacked on creosoted timber approximately 12 inches above the ground, providing plenty of ventilation, while the skids should be spaced 15 feet or less apart depending upon the length of poles to be stored.

Separate the poles into various piles for length and class and when the poles are more than two high, reverse the butts on alternate layers.



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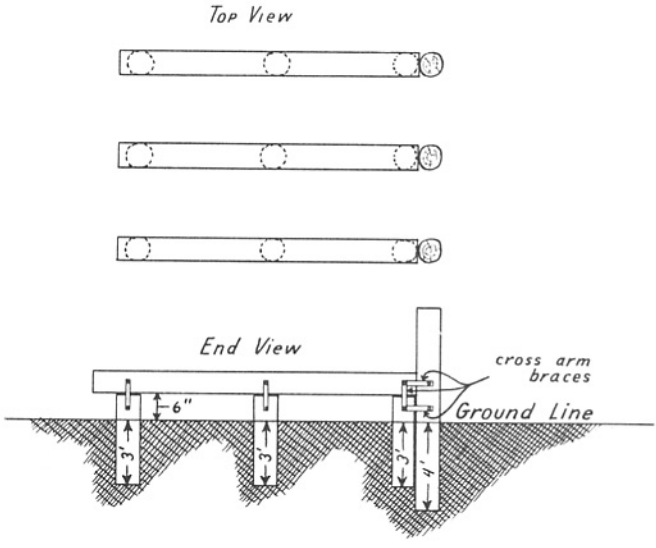



*Figure 1—Pole storage skid.*

Use salvaged poles to construct storage skids; curve out supporting poles for skid poles to rest upon and build a complete unit for each length and class of pole stored.

Material necessary for construction of one skid unit:

## STORAGE OF 20-FT. AND 25-FT. POLES

6—3-foot 6-inch logs
2—10-foot logs.
20—No. J-7020 crossarm braces.
40—No. J-8754 lag screws.

## STORAGE OF 30-FT. TO 40-FT. POLES

9—3-foot 6-inch logs.
3—10-foot logs.
30—No. J-7020 crossarm braces.
60—No. J-8754 lag screws.

## UNLOADING POLES FROM FLAT CAR

Before poles are unloaded from a car they should be carefully counted in order to check the number with the invoice. This count should be made by chalking the butt end of each pole as it is counted. If a discrepancy occurs in the count and a recheck discloses the same error, a railroad representative should be called upon to check and verify the count.

In order to insure a degree of safety to the men engaged in this work and to prevent the least amount of damage to the poles, certain precautions and rules must be adhered to.

(1) Lines, ropes and stakes should be in perfect condition.

(2) The unloading crew should preferably be small. The foreman in charge must definitely be familiar with all the details.

(3) Only one operation should be in progress at one time.

(4) No one should be allowed on top of the car of poles at any time.

(5) Check all stakes for defects. Add additional stakes if necessary.

(6) If load leans toward the back, add extra stakes.

Skids of sufficient strength should be placed against the car on the unloading side, the top of the skids being at a level with the floor. This will allow poles to roll off without interference. The lower portion of the skids should be anchored into the ground to prevent movement.

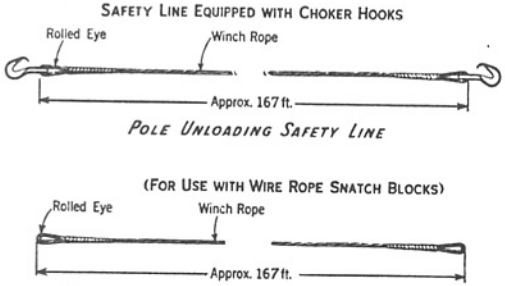



*Figure 2—Pole unloading safety line.*



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Pass the two ends of the pole unloading safety line under the flat car and above the brake rods; pull these two ends up and over the load by the use of a hand line which should be thrown over the top of the load for this purpose.

Hook two 8-inch steel snatch blocks into the eyes of the safety line and slip the bight of the line over the sheaves. If the line is equipped with hooks slip the bight over the hooks and slide into position on top of the load, approximately 12 inches back from the nearest pole.

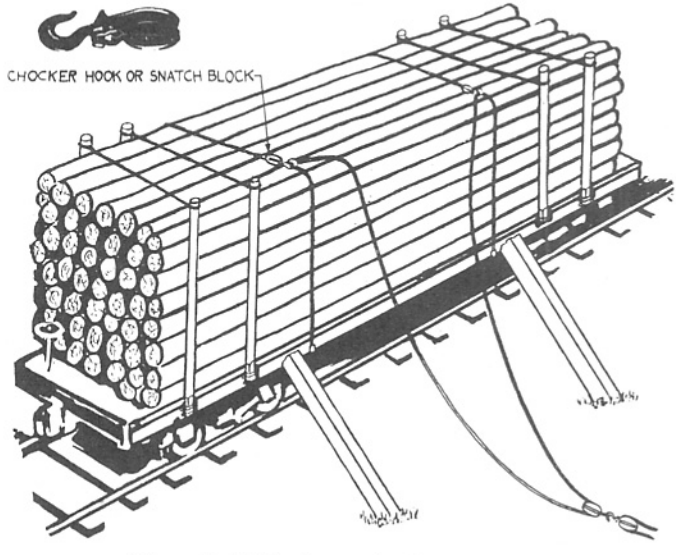



*Figure 3—Unloading poles from flatcar.*

Place one 8-inch snatch block in the bight of the safety line and pull up securely by means of a set of 3-sheave 8-inch blocks and 200 feet of 1-inch manila rope anchored to a substantial object to withstand considerable pull. A sound tree or stub with a ground

circumference of 30 inches is considered satisfactory. When the poles are pulled up and fastened securely; the blocks should be close together, to reduce the amount of stretch and to afford plenty of slack when released.

If the truck winch is used, securely fasten the eye end of the winch cable to the truck and run the line through an 8-inch snatch block. Hook this snatch block to the one on the bight of the safety line and pull up tight. The truck should be located approximately 100 feet from the car, at right angles to the track.

Be sure the anchorage is safe and the truck is blocked to avoid accidents.

After the load is securely bound the following procedure should be adhered to:

(1) Tie hand lines to stakes and tie up out of the way for further use.

(2) Cut the lower tie wires on the unloading side.

(3) Do not cut the top tie wires.

(4) Chop off the stakes close to the stake pockets. Chop off the center stakes first and the end stakes last.

(5) Precaution must be exercised when the last cut is made into the two end stakes, as the bottom of the stakes may spring out.

(6) Remove all stakes out of the way by use of the hand lines which have been previously attached.

(7) Slowly release tension in the safety line, allowing the poles to roll off the car.

(8) After the poles have settled down, remove any strain from the rear stakes by rolling additional poles forward by the use of pike poles from the ground.

(9) Remove all snatch blocks and lines.

(10) Roll and pile up poles on skids, working from the ends.

(11) The truck winch and pole derrick may also be used to great advantage in the moving and piling of poles, depending upon circumstances and local conditions.



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## UNLOADING POLES FROM GONDOLA CAR

The same general method and precautions should be used in unloading gondola cars as flat cars.

The skids must be longer in order to reach the top of the car.

Poles below the level of the sides may be rolled out by means of a rope cradle as shown in Figure No. 4. A pole derrick or gin pole may also be used, depending upon local conditions.

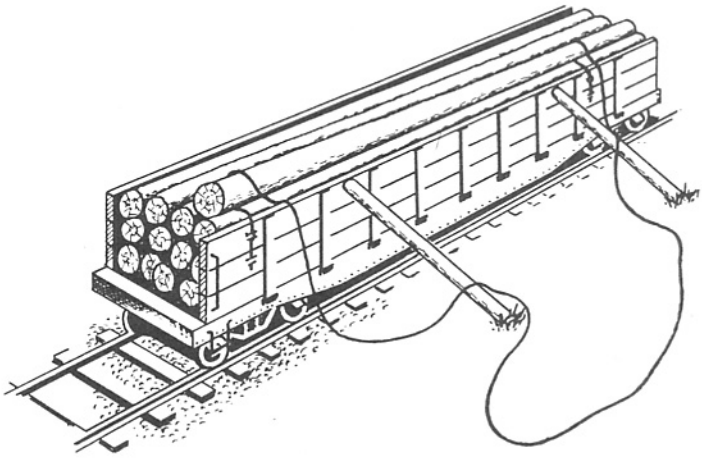


*Figure 4—Unloading poles from gondola car.*

6M-5/16-inch (utilities grade) messenger strand and 2—3-bolt guy clamps (J-1032) with eye loops or hooks may be used instead of a 7/16-inch winch line.

In order to unload poles safely and facilitate the observance of the rules set down, the following equipment is necessary.

(1) 167 feet of 7/16-inch winch line equipped with a rolled eye or hook at each end—or—

(2) 167 feet of 6M 5/16-inch (utilities grade) messenger strand. 2 (J-1032) 3-bolt guy clamps.

(3) 200 feet 1-inch manila rope.

(4) 200 feet of ½-inch manila rope—hand line.

(5) 1—No. 10 wire cutter.

(6) 1—short ladder.

(7) 2 or more skids.

(8) 2—No. 3 single bit axes.

(9) 2—T-219-818 pike poles.

(10) 2—T-104 carring hooks.

(11) When safety line is equipped with hooks and pulled up with truck winch, use 2—8-inch steel wire rope snatch blocks.

(12) When safety line is equipped with hooks and when pulled up with 1-inch manila rope by hand operation, use 1—8-inch steel wire rope snatch block and 2—8-inch sheave pulley blocks.

(13) When safety line is equipped with eyes and pulled up with truck winch, use 4—8-inch steel wire rope snatch blocks.

(14) When safety line is equipped with eyes and pulled up by hand operation, use 3—8-inch steel wire rope snatch blocks and 2—8-inch 3-sheave pulley blocks.

## JOINT USE OF POLES

The joint use of poles should be given careful consideration by the local telephone company in order that proper line clearance be obtained between the two or more utilities and to provide for future expansion to the respective aerial plants in an orderly and systematic manner.

Experience indicates that the advantage of joint use construction, where justified, is of the greatest importance in connection with the clean-up of non-standard and hazardous conditions.

In urban areas, the use of joint construction using standard



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specifications for clearance has solved many of the difficulties of pole line construction. It has eliminated duplicate pole lines in streets, alleys and on public highways.This creates a more favorable right of way. It has provided a better clearance for the telephone drop and the electric light company service wires, inasmuch as both drops leave the same pole and a good clearance can be maintained to the building.

In rural areas where comparatively short poles are used, it is generally advisable to build a separate pole line on the opposite side of the road rather than to share the cost of building a more expensive joint line with the local power company. However, a joint use study should be made to determine whether or not joint use is warranted.

(1) Determine whether future conditions will be more favorable for joint use.

(2) Future development of the telephone line.

(3) Consult local electric light company about future changes.

Joint use construction should not be considered where long spans are contemplated.

Joint use poles for toll or long distance telephone circuits, should not be considered.

Poles carrying high tension circuits should not be considered for joint use construction.

When a telephone company or electric light company is about to construct a new line or rebuild an existing line, it is desirable for both companies to consult one another regarding the requirements of each company, with the idea to establish a joint use pole line.

Care must be exercised not to give up right-of-way privileges unless satisfactory rights are secured on the foreign poles.

It is recommended that each company involved in the joint use agreement, own the full amount of a certain number of poles.

Where two telephone companies are involved in the same route, it is general practice to establish a joint use or joint owned pole line. Each company usually owns that portion of the pole necessary for their attachments or future requirements.

Proper clearance between conductors for joint use construction will be covered in another part of this book.

## STAKING LINE

Good construction of a pole line depends largely upon well-planned staking, thoroughness and competence of the men who determine the pole route. A well-built line will pay dividends, in as much, that future maintenance cost and problems will be reduced to a minimum.

It is essential that the size and class of poles, together with spacing be determined before or at the time of staking. The length, class and spacing depend upon the following:

(1) Bracket line.
(2) Cross arms and aerial wire.
(3) Aerial cable.
(4) Toll line.
(5) Rural construction. Regular, and long spans.

In preparing to stake out a line the following conditions should be kept in mind.

(1) Keep poles in alignment.
(2) Prevent unnecessary corners.
(3) Provide plenty of room for guys.
(4) Keep the line well graded.
(5) Trees, limbs and underbrush should be cleared away.
(6) Definite right of way should be secured.
(7) Clearance and grading for railroad crossings.
(8) Definite permission for crossing under railroad tracks.
(9) Grading for sudden change of ground level.
(10) Keep on or opposite lot lines.

The management of the smaller independent telephone companies no doubt will be in charge of staking or will delegate a qualified person. There are two methods. One is to predetermine and mark each stake as to size, class and type of pole. The other is to work closely with the construction forces and stake out short distances at a time and then set the poles.



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Range rods can be used to great success in staking out a line in a flat or gently rolling country. If range rods are not available, strap pattern straight handled shovels can be used. This is best accomplished where three to five range rods are placed and sighted across. If three men are available, station one at each end of the steel tape or chain and one at the rear to sight across.

The man at the front end of the steel tape measures off the distance and sets the range rod for the man at the rear to sight across. The second man, at the end of the tape or steel chain, comes up and drives the stake. This is repeated until all poles are staked.

When building over a hill use range rods as illustrated in Figure No. 5.

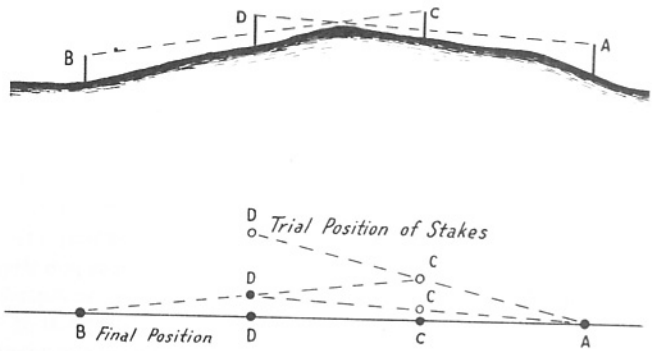



*Figure 5—Use of range rods.*

Establish a range rod at point "A" and "B," set another stake at "D" so it can be seen from "A" and set another stake at "C." Move "C" and "D" until "C" is in line with "A" and "D" and "D" is in line with "B" and "C." This process is carried on until all stakes are in line with "A" and "B."

## STAKING—RANGE RODS AND TRANSIT

The smaller independent telephone companies are not generally equipped to stake out their pole lines with the aid of a transit, but it is deemed advisable to discuss the subject as it may lead to some very valuable results.

There are times when it becomes exceedingly difficult to stake out a line over rugged and hilly country or to leave a highway and re-enter it again at some given point. It is of the utmost importance that the poles be set in line to avoid the building of unnecessary corners. It may be desirable to engage a surveyor to locate a few points along the route. From this point on the job can be completed with range stakes.

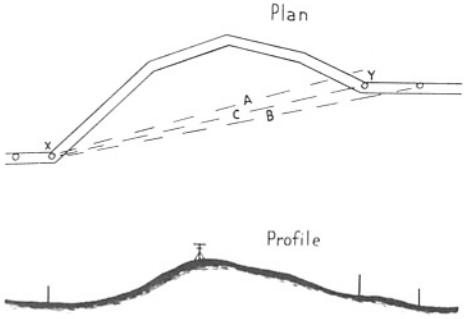



*Figure 6—Applying transit to pole-line route.*

Establish a stake at "X" where the line leaves the road and another at "Y" where the line re-enters the road. These two stakes are not visible from each other due to distance and a hill.

Set up a transit on the crest of the hill at a point visible from both "X" and "Y" and as near in line as possible. Sight the transit on "X" and turn the telescope of the transit to range stake "Y." If the sight is to the left, the transit is as illustrated in position "A". If the sight falls to the right it is in position "B." Move the transit until "C" is located and transit is in line with "X" and "Y."



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The pole locations may now be staked with rods and replaced by pole stakes as the line is advanced.

Another use for the transit is where a short cut is contemplated over considerable distance or through a heavily wooded area, where there is no visibility from "X" where the route leaves the road to "Y" where the route re-enters the road.

Refer to the Figure No. 7 and proceed as follows:

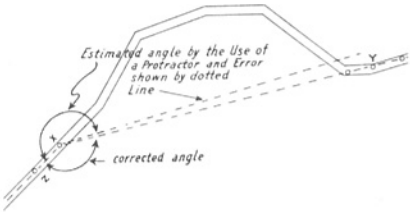



*Figure 7—Use of protractor and topographical map in locating pole line.*

(1) Obtain a topographical map of this section and locate "X" and "Y" on the map.

(2) Set a protractor on the map and determine the angle as accurately as possible the line "XY" makes the line already staked "XZ."

(3) Set the transit over stake "X" and sight back on the line for accuracy.

(4) Swing telescope to position or angle indicated by the protractor.

(5) Telescope is now in direction of "Y."

(6) Transit is now used to locate five or six range rods while the balance can be sighted through with or without the transit depending upon conditions.

(7) If line does not come out at "Y" it is in error due to plotting or sighting.

(8) Move transit to right or left as the case may be and proceed along the plan just outlined above. Repeat until stakes are lined up with "Y."

If a surveyor is engaged, the work of re-running the line several times will be eliminated due to closer calculations and mathematical corrections after the first temporarily line is established.

When new land developments are contemplated it is advisable and advantageous to secure pole and distribution right of way before the lots are sold to individuals. In cases where the lots are not staked out in each block it is merely necessary to secure a copy of the survey and re-run it with a transit or steel tape to determine the exact location of each pole.

## POLE LINE STAKING EQUIPMENT

1—No. 3150-150-foot surveyor's steel chain tape.

1—Transit.

6—8-foot staking rods (or)

6—strap pattern 8-foot straight handle shovels.

1 Bundle of laths.

1 Piece of blue marking crayon.

1—No. 801 Lineman's hand axe.

## PLANNING NEW LINES

Pole line requirements or planning should be given due consideration and cover some very definite ideas and plans, the most essential of which are listed for your guidance.

(1) Area to be served.
- (*a*) Rural
- (*b*) City
- (*c*) Residential
- (*d*) Mercantile
- (*e*) Industrial
- (*f*) New real estate development
- (*g*) Prosperous community
- (*h*) Run-down community
- (*i*) Telephone users

(2) Ultimate number of subscribers to be served.
- (*a*) Existing subscribers



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(*b*) Buildings where no service is maintained
(*c*) Vacant building lots

The items referred to as (*a*) (*b*) (*c*) should be spotted on a map in three colors or codes, (*a*) showing location and class of service for each telephone, (*b*) and (*c*) possible future service to be provided for. From this information it will be possible to determine the size and class of poles, the ultimate number of wires or size of cable required for the present and future expansion.

(3) Route, right of way and public improvements.
(4) Tree conditions.
(5) Number of open wires.
(6) Size of cable.
(7) Number of cross arms.
    (*a*) Pony
    (*b*) Standard
    (*c*) Number of pins
(8) Wood brackets.
(9) Length and class of pole.
(10) Joint use.
(11) Existing or future power lines.
(12) Storm area.
(13) Guying.
(14) Pole spacing.
(15) Long span construction.
(16) High tensile strength or BB iron wire.

The above list of items is merely a guide for planning a new pole line which will be discussed and illustrated in other parts of this handbook.

## POLE ROUTE

The route selected for a pole line is probably the most vital and important feature in its design. Consideration should be given to future adaptability and subsequent extensions to provide the best distribution system to all subscribers along the route, with the least number of poles, corners and guys.

Detailed studies and analysis of certain areas provide the necessary information to establish and designate certain routes as main feeders, to provide adequate distribution and expected real estate development of some future date. Branch routes are similarly established and built along designated points which lead into the main route and eventually into the Central Office.

Areas served by aerial street distribution include a series of half blocks on each side of the street along the route, while alley aerial distribution include a series of full blocks on each side of the route. Deviations from this practice are desirable under certain local conditions. No set of rules or specified method can be consistently adhered to as each exchange has a separate problem to face concerning the method of distribution.

A pole line built exclusively for toll use should follow the most direct route between given points with spur lines for the necessary intermediate connections.

From the above discussion it is apparent that a map should be prepared showing all existing routes together with the new proposed route with possible alternate routes.

In addition to the above mentioned facts it must be borne in mind that—

(1) Lines should be reasonably straight to reduce guying to a minimum.

(2) Maintain at least a road separation between high tension lines and telephone circuits.

(3) Poles should be so located that future extensions can be readily made.

(4) Locate poles so that they will not be subject to mechanical injury.

(5) Locate poles to minimize a fire hazard.

(6) If in doubt write to Kellogg stating your particular problems.

## RURAL POLE LINE

The design of rural lines, due to service requirements, must be given careful consideration. An exchange plant which lies close to



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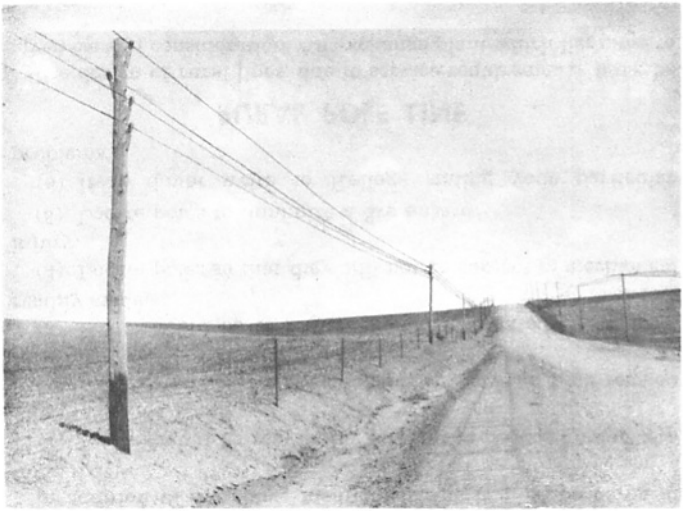


*Figure 8—A typical rural pole line.*

the central office is readily accessible to quick repair. Rural lines, on the other hand, radiate in all directions to varying lengths on roads which on occasions are impassable and are last on the list for trouble shooting. These conditions result in a need to build the line with materials and of a design to withstand more than normal service requirements.

In arriving at the proper design and route the following factors must be taken into consideration together with the subjects discussed in preceeding pages.

(1) Present subscribers to be served.

(2) Possible future subscribers.

(3) Population trends that may in the future tend to convert a portion of rural plant to exchange plant. This condition, while not frequent, will occur where new industries and Real Estate additions will be made at or near the existing corporate limits.

(4) Availability and type of right-of-way.

(5) Probable highway improvements or re-locations.

(6) Present and future tree conditions.

(7) Existing power lines and possible future extensions thereto.

(8) Public improvements.

Proper study of the factors mentioned above will result in the selection of a route which will avoid expensive re-locations at some future date and will provide a line which will meet expanding service needs.

The type of line to be built will depend upon the ultimate requirements as developed by the above notations.

## RANGE OF SPAN LENGTHS

Practical, economical long span construction has been made possible by the introduction of HTL-85 and HTL-135 high tensile, low resistance galvanized steel line wire. A comparison of the minimum breaking strengths of the three most widely used grades, reveals the construction possibilities of each. The approximate breaking strengths for No. 12 BWG wire in the three grades are as follows:

No. 12 BWG Galv. BB—476 lbs.

No. 12 BWG HTL-85—793 lbs.

No. 12 BWG HTL-135—1213 lbs.

The following ranges of span lengths are recommended for standard BB, HTL-85 and HTL-135 line wire in each loading district.

| LOADING DISTRICT | BB WIRE | HTL-85 WIRE | HTL-135 WIRE |
|---|---|---|---|
| Heavy | 0-150 ft. | 125-225 ft. | 200-350 ft. |
| Medium | 0-225 ft. | 200-325 ft. | 300-450 ft. |
| Light | 0-300 ft. | 275-375 ft. | 350-500 ft. |

The country has been divided into three storm loading districts based on the experience of various wire using companies throughout the United States. The loading map produced herewith should be referred to in determining span limitations, the proper class and spacing of poles. The boundaries of the storm

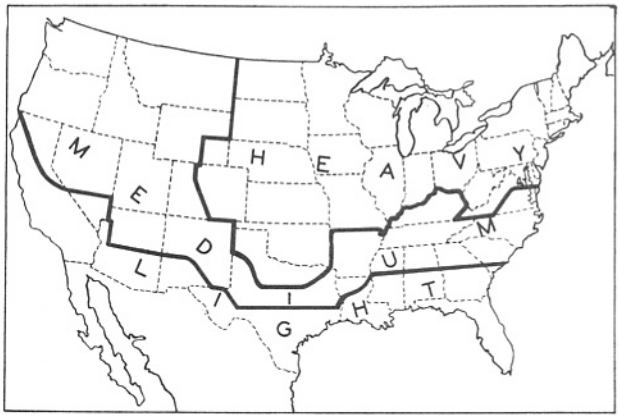


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areas shown on this map are necessarily only approximate, and some variations along the boundaries may be made where past experience indicates that changes are justified. Particular sections of line that are adequately and permanently protected from the full force of the wind by their locations in regard to wind breaks, need not be as strong as those fully exposed. Consideration may be given in such cases to using the next lighter loading area.




(From Sec. 25, pages 97 and 98, Fifth Edition, N.E.S.C., National Bureau of Standards Handbook H32.)

*Figure 9—General loading map.*

## LOCATION OF POLES

After a decision has been reached in regard to the type of wire to be used an effort should be made to hold span lengths as near as practical to the recommended maximum. This should be done in order to enjoy the most economical construction. Pole locations should be staked out ahead of actual construction to avoid expensive delays when the working force is on the ground.

The following general rules will be of considerable assistance in laying out lines.

1. Measure off the span lengths until an obstacle or a fixed pole location, such as a corner, dead-end, or crossing is reached. Locate a pole at a satisfactory distance from the obstacle or at the fixed location. If the span adjacent to this pole is 10% over or 20% under the specified length of span, relocate a sufficient number of the adjacent poles in order to make all spans come within the desired length. An alternate method is to measure the distance between fixed pole locations and divide it into an equal number of spans as near as possible to the desired span length. Stakes should be driven at the proposed pole location and the pole height indicated thereon.

2. Along highways locate pole lines five feet from fence lines to avoid, as far as possible, any "over-hang" over private property. Do not set poles between drainage ditch and traveled portion of road without approval of proper authorities.

3. Make curves in lines with a minimum number of anchors by placing as many intermediate poles as possible in a straight line.

4. Locate terminal poles to obtain the most favorable guying conditions.

5. Avoid locating poles on top of mounds or in the bottom of depressions to eliminate long and short poles for grading the line.

6. Where possible, avoid pole locations that will involve the wires in trees.

7. Avoid interference with present and probable driveways, side roads, etc.

8. Locate corner poles to obtain the best guying facilities.

9. Avoid setting poles or building a pole line near a power line.

## CLEARANCES

Minimum vertical clearances above ground. (For communication lines.)

The vertical clearances above ground for conductors, wire, guys and crossarms at 60°, and no wind, shall not be less than specified in the following table.



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These clearances do not apply to anchor-guys which do not cross over traveled spaces.

Clearances are at the lowest point of sag.

TABLE NO. 12

| SITUATION | CLEARANCE IN FEET |
|---|---|
| 1. Where line runs along side of highway, street, road or alley without overhanging the traveled way. | |
| (a) In urban areas | 18 |
| (b) In rural areas | |
| (1) In general | 15 |
| (2) Where it is unlikely that loaded vehicles will cross under line into fields | 13 |
| (c) Spaces or ways accessible only to pedestrians by reason of the location of the pole relative to fences, ditches, embankments, etc. | |
| (1) In general | 15 |
| (2) Where voltage to ground does not exceed 160 volts and the transmitted power does not exceed 50 watts | 8 |
| 2. Where parts of the line project over traveled portions of the highway | 18 |
| 3. Where line crosses over a highway, street, road or alley | 18 |
| 4. Where line crosses over private driveways and walks. | |
| (a) Private driveways | |
| (1) In general | 15 |
| (2) Over driveways to resident garages | 10 |
| (b) Walks | |
| (1) In general | 10 |
| (2) Where voltage to ground does not exceed 160 volts and the transmitted power does not exceed 50 watts | 8 |
| 5. Where line crosses over railroad tracks (from top of rails) | 27 |
| 6. Where line crosses over street railway tracks | 28 |

7. Where line crosses navigable streams and water ways, the clearance shall be as required by the War Department.

NOTE: For spans over 150 feet, increase clearance 0.1 foot for each additional 10 feet of span.

## CLEARANCE AND GRADING

The basic height of any line will be determined by normal clearance requirements with allowances, where necessary, for trees, road and highway crossings, railroad crossings, etc. In general the line should be constructed on poles of the shortest length possible to meet these requirements. The above clearances are considered standard, but in addition, construction should be governed by the requirements of the National Electrical Safety Code or by State Codes.

The following horizontal clearance shall be measured from the side of the pole to the object to be cleared.

TABLE NO. 13

| | HORIZONTAL CLEARANCE IN FEET |
|---|---|
| Nearest rail of main line railroad track | 12 |
| Nearest rail of railroad side track | 7 |
| Signal pedestal (stop & go light, railroad flasher or automatic gate, etc.) | 4 |
| Trolley feeder or power wires | 3 |

Where there is a loading siding allow enough space for a driveway.

Table 14 indicates vertical clearances to be secured between communication wires and foreign wires on separate poles.



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TABLE NO. 14

## WIRE CROSSING CLEARANCE

Vertical clearance between telephone wires and foreign wires.

| TELEPHONE WIRES CABLES AND GUYS, —AND— Electric light or Power wires and cables. | VERTICAL CLEARANCE IN FT. FOR TELEPHONE | | REMARKS Place telephone wires or cables below electric light or power wires. |
|---|---|---|---|
| | Wires & Cables | Guys | |
| (1) LINE WIRES | | | |
| 0-300 V to ground | 4′ | 2′ | Refer to Par. (a) p. 37 |
| 300 V to ground to 750 V between wires | 4′ | 2′ | Refer to Par. (b) p. 37 |
| 750-8700 Volts | 4′ | 4′ | Refer to Par. (b) p. 37 |
| 8700-50000 Volts | 6′ | 4′ | |
| SERVICE DROPS | 2′ | 2′ | Refer to Par. (c) p. 37 |
| 0-750 Volts | 4′ | 2′ | For Cables above Service drops. |
| 750-8700 Volts | 4′ | 4′ | |
| SUPPLY CABLES— Permanently grounded continuous metal Sheath (all voltage) | 4′ | 2′ | |
| OTHER SUPPLY CABLES | | | Same clearance as open power wires, of same voltage as cable. |
| (2) TROLLEY WIRE FEEDERS | | | |
| 0-750 Volts | 4′ | 2′ | Obtain greater clearance where practical. |
| 750-8700 Volts | 4′ | 4′ | |
| CONTACT WIRES | | | |
| 0-750 Volts | 10′ | 10′ | Refer to Par. (d) p. 37 |
| (3) FOREIGN COMMUNICATION WIRES (Similar construction) | 2′ | 2′ | Refer to Par. (e) Page 37 |
| Used with electric power or trolley system. | 4′ | 2′ | |
| (4) GUYS TO POWER POLES | 2′ | 2′ | |

## WIRE CROSSING CLEARANCE IN FEET

(Refer to Table 14)

(a) A clearance of 2 feet may be permitted where the power conductor is above the communication conductor. This is providing that the crossing is not within 6 feet from the pole concerned in the crossing, and the voltage to ground does not exceed 300 volts.

(b) Increase the 4 foot clearance to 6 feet where the crossing is within 6 feet of any pole concerned in the crossing. Exception to this rule is made for guys.

(c) Two foot clearance is allowable for *wires* installed above or below service drops, while *cable* must be installed below service drops.

(d) This distance may be reduced to 4 feet providing the cables or guys are protected with trolley guards or if the wires, cable or guys are so located that the trolley pole cannot contact them.

(e) May be reduced by mutual consent providing the wires and cables involved, are not Fire Alarm, railway or a telephone system of a Power Company.

For voltages greater than 50,000 volts the clearance specified shall be increased 0.5 inch for each 1000 volts of the excess.

NOTE: All clearances indicated are minimum. Greater clearances should be established wherever possible and practical; where public regulations demand it, and where special agreements are involved.

The data contained in the above wire crossing clearance table is taken from the fifth edition of the National Electrical Safety Code.

Communication wires should always be placed below power wires. In some cases, due to prior construction, it may be necessary to place communication wires above secondary wires (250 volts or less). However, this should be avoided by providing a pole that is five feet longer than normally required and permitting the Power Company to contact the upper part for clearance purposes.



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# POLE HOLE DIGGING

Pole holes should be of such size and diameter to freely permit a pole to be set at its required depth and allow space for tamping.

When large and heavy poles are to be set the pole hole should be of such size as to provide for the use of butting boards.

To facilitate the handling of large and heavy poles it is desirable to dig a trench, sloping it toward the hole to a depth of approximately one foot.

Excavations for ground braces and ground footings should be of such size as to accommodate the fixture.

Organize your work so that no holes will be left open at night or over week ends. Open or unattended holes may result in accidents to the public or injury to animals.

A wood or metal barrel with the ends removed can be used to good advantage when digging in loose sand.

If a large number of pole holes are to be excavated in loose sand, metal split cylinders should be used. These can be removed and reused again.

The preparation and blasting of a hole with dynamite is a hazardous undertaking for inexperienced men. Persons who handle dynamite are usually examined by local county authorities and issued a certificate of authority to handle this explosive. They are familiarized with local laws, ordinances and regulations governing its use and transportation.

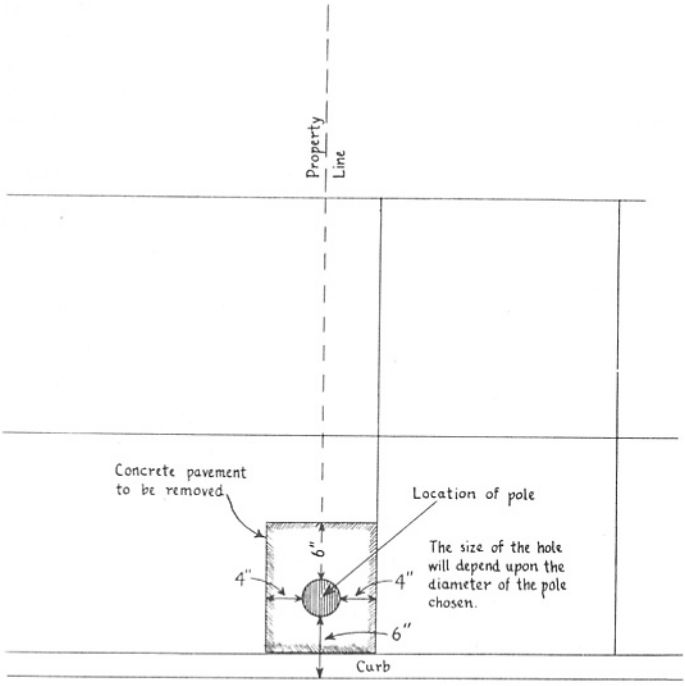



*Figure 10—Removing concrete sidewalk for pole location.*

Remove enough pavement to permit the digging of a hole of sufficient size for a particular pole assigned to the location.

Restore pavement to its original condition.



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# EARTH BORING DRILLS

Earth boring equipment should be used wherever a large number of poles are to be set or a pole moving project is contemplated. This tends to reduce the cost of digging to a minimum. The saving of man hours on two or three major pole jobs will approximate the initial cost of an earth boring machine.

A portable electric earth boring machine is complete, compact, light in weight, simple to operate, and can be transported in the rear of the truck. The outstanding feature is that it requires no extra truck or trailer for its operation and can be carried from pole to pole in areas where it is impossible to drive a truck.

The drills can also be operated by air, but this is less desirable in that the initial cost is greater and drilling must be confined to areas where air can be transported.

Holes may be readily drilled on a side hill, in a ditch and in most types of soil.

Drills may be operated very successfully through frost. The cutting edge cuts the earth into small slivers.

Drills will not cut through rock.

Dead man anchor holes are excavated by drilling holes a few inches apart and removing the surplus earth by shovel.

Holes can be drilled close to an existing pole.

The drilling equipment can be operated with or without a truck and an "A" frame.

Start the gasoline engine and regulate to a desired speed. Connect motor and generator with a flexible cord. Set the drill over the spot where the hole is to be drilled and start the drill in motion by operating a switch in the handle.

When truck and "A" frame is to be used, two men should be stationed at the drill, one at each handle. Do not apply pressure when drilling. As the required depth is reached, clear away the surplus earth, remove the motor, attach the winch line to the drill and pull up the drill.

While the truck and "A" frame are in this position, hoist pole into the hole.

When holes are drilled without the use of a truck or "A" frame, follow the same procedure as outlined above, except that three men should be stationed at the drill, one at each handle and one to clear away surplus earth and help lift out the drill.

Drills are so constructed that sections can be spliced together by inserting a pin. This in no way interferes with the blades or its operations. In some cases it may be more convenient to handle a two-foot and a four-foot section rather than one six-foot section.

Do not leave holes open over night or unguarded at any time.

Earth boring equipment required for drilling pole holes:

**POWER PLANT:**

(Choice of one)

1—110-volt, D.C., 3-K.W., spring mounted.

1—110-volt, D.C., 3-K.W., skid mounted.

1—110-volt, A.C., 2½-K.W., spring mounted.

1—110-volt, A.C., 2½-K.W., skid mounted.

1—105 cubic feet air compressor.

**MOTOR:**

(Choice of one)

1—110-volt Universal motor with special chuck.

1—45-pound air motor with special chuck.

**DRILLS:**

5 inches to 16 inches in diameter.

2 feet to 7 feet in length.

**DRIVING EXTENSION:**

3-foot extension shaft.

4-foot extension shaft.

**FLEXIBLE CORD:**

100 feet No. 10 B & S gauge copper Koiled Kordage in two 50-foot pieces complete with connections.

For further information concerning these drills and man hour savings, write for the latest bulletins.



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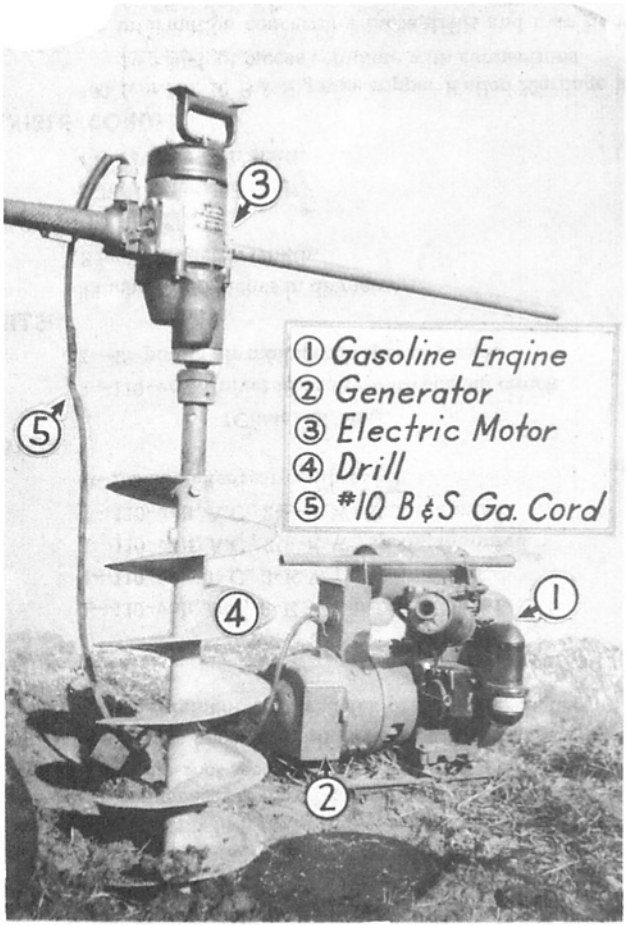



*Figure 11—Portable earth boring equipment.*

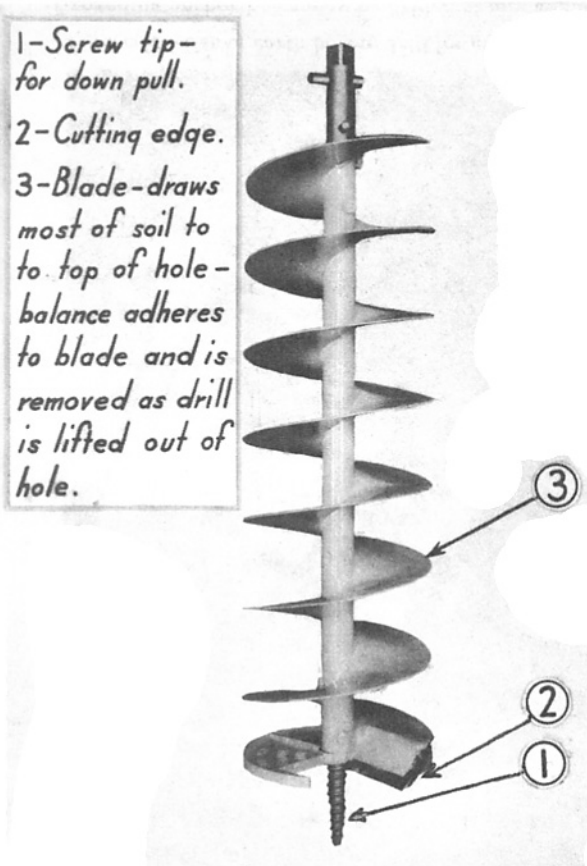



*Figure 12—Earth boring drill.*



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*Figure 13—Use of earth boring drill for anchor excavation.*

Expanding anchor holes may be drilled at any angle by directing the drill accordingly.

Power pack may be located 100 feet away using No. 10 B & S gauge flexible cord.



*Figure 14—Roadside drilling with earth boring equipment. Power plant located on rear of truck.*

TABLE NO. 15

## DEPTH OF SETTING POLES

| Length of Pole (in ft.) | DEPTH OF SETTING POLES | | | | | Depth of setting in Rock |
|---|---|---|---|---|---|---|
| | Creosoted Pine | Western Red Cedar | Northern Wht. Cedar | Douglas Fir | Eastern Chestnut | |
| 16 | 3½ | 3½ | 3½ | 3½ | 3½ | 3 |
| 18 | 3½ | 3½ | 3½ | 3½ | 3½ | 3 |
| 20 | 4 | 4 | 4 | 4 | 4 | 3 |
| 22 | 4 | 4 | 4 | 4 | 4 | 3 |
| 25 | 5 | 5 | 5 | 5 | 5 | 3 |
| 30 | 5½ | 5½ | 5½ | 5½ | 5½ | 3½ |
| 35 | 6 | 6 | 6 | 6 | 6 | 4 |
| 40 | 6 | 6 | 6 | 6 | 6 | 4 |
| 45 | 6½ | 6½ | 6½ | 6½ | 6½ | 4½ |

(Table No. 15 continued on page 46.)



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**TABLE NO. 15 (Cont'd)**

| Length of Pole (in ft.) | DEPTH OF SETTING POLES | | | | | Depth of setting in Rock |
|---|---|---|---|---|---|---|
| | Creosoted Pine | Western Red Cedar | Northern Wht. Cedar | Douglas Fir | Eastern Chestnut | |
| 50 | 7 | 7 | 7 | 7 | 7 | 4½ |
| 55 | 7½ | 7½ | 7½ | 7½ | 7½ | 5 |
| 60 | 8 | 8 | 8 | 8 | 8 | 5 |
| 65 | 8½ | 8½ | 8½ | 8½ | 8½ | 6 |
| 70 | 9 | 9 | 9 | 9 | 9 | 6 |
| 75 | 9½ | 9½ | 9½ | 9½ | 9½ | 6½ |
| 80 | 10 | 10 | 10 | 10 | 10 | 7 |

Under normal conditions and where soil conditions are average, poles should be set at a standard depth as specified in the above chart; however, under varied and unusual local conditions the depth of setting a pole must be determined by the conditions that prevail.

In swampy or loose ground it is desirable to set a pole 12 inches to 24 inches deeper to obtain firm ground rather than resort to ground braces and other supports.

When ground braces and other supports are used, poles should be set at the standard depth.

Poles assigned to carry a full size cable or more, or located at a corner should be set from 6 inches to 12 inches deeper than standard recommendations.

Exchange pole line (non-joint use) consisting of 30-foot poles or taller, carrying a distribution only and set in firm earth and sheltered by buildings and so forth, may be set 6 inches less in depth.

An exchange pole of 25-foot or less carrying a distribution cable may be set to a depth of 3 feet in order to obtain clearance. This does not apply to several poles in successive order.

An exchange guyed pole (non-jointly used) assigned to carry a distribution cable or open wire may be set 1 foot less than specified. This does not mean several poles in successive order, but provides a means for individual clearance.

Poles set in a sloping bank or within five feet of the edge of a bank should be set 1 or 2 feet deeper.

Unguyed corner poles should be set 6 inches to 12 inches deeper, depending upon the soil in which the pole is to be set.

## POLE HOLE DIGGING IN ROCK

### When Solid Rock Is Encountered Set Poles at the Following Depths

TABLE NO. 16

| Depth under ground line at which Rock is encountered. | SIZE OF POLE TO BE SET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20′ | 25′ | 30′ | 35′ | 40′ | 45′ | 50′ | 55′ | 60′ |
| | Depth of Hole for Pole Setting | | | | | | | | |
| 0′0″ | 3′0″ | 3′0″ | 3′6″ | 4′0″ | 4′0″ | 4′6″ | 4′6″ | 5′0″ | 5′0″ |
| 0′6″ | 3′0″ | 3′6″ | 4′0″ | 4′0″ | 4′6″ | 5′0″ | 5′0″ | 5′0″ | 5′6″ |
| 1′0″ | 3′6″ | 4′0″ | 4′0″ | 4′6″ | 4′6″ | 5′0″ | 5′0″ | 5′6″ | 5′6″ |
| 1′6″ | 3′6″ | 4′0″ | 4′6″ | 4′6″ | 5′0″ | 5′0″ | 5′6″ | 5′6″ | 6′0″ |
| 2′0″ | 4′0″ | 4′6″ | 4′6″ | 5′0″ | 5′0″ | 5′6″ | 5′6″ | 6′0″ | 6′6″ |
| 2′6″ | 4′0″ | 4′6″ | 5′0″ | 5′6″ | 5′6″ | 5′6″ | 6′0″ | 6′6″ | 6′6″ |
| 3′0″ | 4′0″ | 5′0″ | 5′0″ | 5′6″ | 5′6″ | 6′0″ | 6′0″ | 6′6″ | 7′0″ |
| 3′6″ | 4′0″ | 5′0″ | 5′6″ | 6′0″ | 6′0″ | 6′0″ | 6′6″ | 7′0″ | 7′0″ |
| 4′0″ | 4′0″ | 5′0″ | 5′6″ | 6′0″ | 6′0″ | 6′6″ | 7′0″ | 7′0″ | 7′6″ |
| 4′6″ | .... | 5′0″ | 5′6″ | 6′0″ | 6′0″ | 6′6″ | 7′0″ | 7′0″ | 7′6″ |
| 5′0″ | .... | 5′0″ | 5′6″ | 6′0″ | 6′0″ | 6′6″ | 7′0″ | 7′6″ | 8′0″ |
| 5′6″ | .... | .... | .... | 6′0″ | 6′0″ | 6′6″ | 7′0″ | 7′6″ | 8′0″ |
| 6′0″ | .... | .... | .... | 6′0″ | 6′0″ | 6′6″ | 7′0″ | 7′6″ | 8′0″ |
| 6′6″ | .... | .... | .... | .... | .... | 6′6″ | 7′0″ | 7′6″ | 8′0″ |
| 7′0″ | .... | .... | .... | .... | .... | .... | 7′0″ | 7′6″ | 8′0″ |
| 7′6″ | .... | .... | .... | .... | .... | .... | .... | 7′6″ | 8′0″ |
| 8′0″ | .... | .... | .... | .... | .... | .... | .... | .... | 8′0″ |

## SELECTION OF POLE LENGTHS

Care should be taken to make allowance for increased sag that will be encountered in extremely hot weather. This factor is particularly important where long span construction is being used.

The grade of the line in general should follow the contour of



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the land in order that poles of uniform length may be used. Avoid (where possible) the setting of poles in the bottom of depressions or on the top of elevations.

The change of grade per span shall not exceed 5 feet where the span lengths are 150 feet or *less*, or 10 feet where the span lengths are *longer* than 150 feet.

To determine the specific height of a pole the following method may be used.

**EXAMPLE NO. 1**

| | |
|---|---|
| Top of pole to center of top cross arm | 0 ft. 10 in. |
| Center of top cross arm to center of second cross arm | 2 ft. 0 in. |
| Center of second cross arm to lowest point of wire sag | 0 ft. 10 in. |
| Wire clearance over top of railroad tracks | 27 ft. 0 in. |
| Pole located in ditch—lower than tracks | 6 ft. 0 in. |
| Depth of setting pole | 6 ft. 6 in. |
| Minimum amount of timber required | 43 ft. 2 in. |
| Length of pole selected | 45 ft. 0 in. |

**EXAMPLE NO. 2**

| | |
|---|---|
| Top of pole to lowest wire attachment | 1 ft. 3 in. |
| Sag in wire | 0 ft. 9 in. |
| Clearance over highway | 18 ft. 0 in. |
| Depth of setting pole | 5 ft. 0 in. |
| Length of pole selected | 25 ft. 0 in. |

The amount of sag is measured by sighting between targets placed on the cross arms of adjacent poles as shown in Figure 15.

The targets are graduated into inches and the horizontal cross bar can be adjusted to any sag. The correct sag for each wire for a given distance will be discussed and tabulated in the wire section.

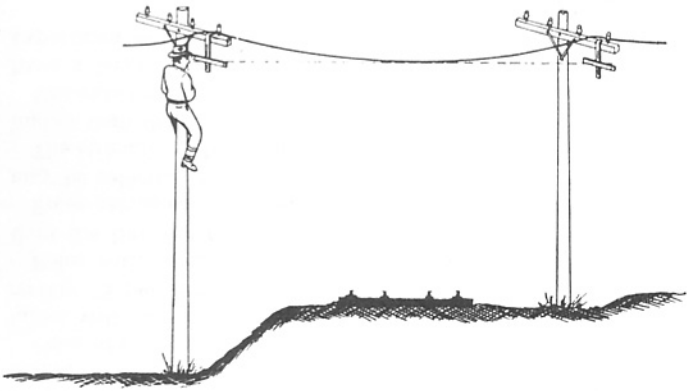


*Figure 15—Adjustable targets to determine wire sag.*

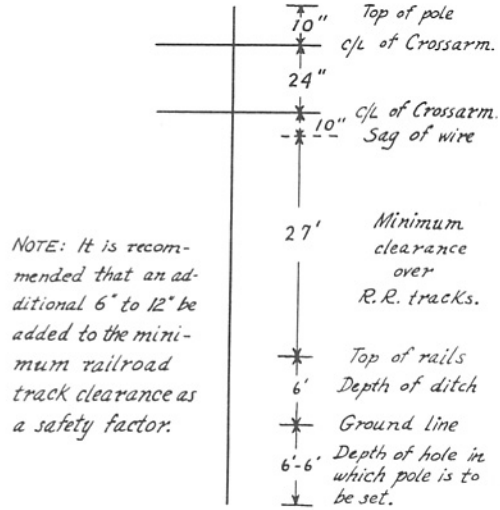



*Figure 16—Determining height of pole for railroad crossing.*



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# SELECTION OF POLES

The numerical classification of poles has been used throughout this specification. This type of classification has been generally accepted by producers and consumers.

A pole of a given class and length will have approximately the same breaking strength in any species of poles to which the numerical classification has been applied.

A storm map has been prepared showing the intensity of the storm areas of the United States, divided into heavy, medium and light loading areas. *See Figure 9, Page 32.*

When a particular pole line or section of line is permanently protected by windbreaks, buildings, trees and hills, the line need not be built as strong as those fully exposed.

When a pole line or section of line is fully exposed to the full fury of storms, special construction must be considered. The use of shorter span lengths and the increase of the strength of poles to the next higher classification is recommended.

The following tables under the heading of "Pole Selection" (for the three loading areas) are based on minimum size poles for the strongest type of construction in each area.

Poles of one class *smaller* than specified in the "Pole Selection" tables will *decrease* the strength and safety factor by approximately *20* per cent.

Poles of one class *larger* than specified in the "Pole Selection" tables will *increase* the strength and safety factor by approximately *25* per cent.

Poles with severe wind exposure should be one class larger than the line average.

Poles permanently protected from the full force of the wind may be selected one class smaller than the line average.

The strength of the corner poles must be increased to one class higher than that of the line average poles.

Untreated poles, due to their more rapid deterioration, must have a larger butt circumference than treated poles. The life expectancy of the untreated pole is thus prolonged.

# POLE SELECTION

*Based on a:* **HEAVY LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED NORTHERN WHITE CEDAR OR WESTERN RED CEDAR POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | |
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 1-2 WIRES |
| 35 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |
| 18 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 3-4 WIRES |
| 35 | 7 | 7 | 7 | 7 | 7 | |
| 40 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | |
| 18 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 6 | 5 | **5-10** |
| 35 | 7 | 7 | 7 | 6 | 5 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 5 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 6 | 5 | 4 | 4 | |
| 20 | 7 | 6 | 5 | 4 | 4 | |
| 22 | 7 | 6 | 5 | 4 | 4 | |
| 25 | 7 | 6 | 5 | 4 | 4 | |
| 30 | 7 | 6 | 5 | 4 | 4 | **11-20** |
| 35 | 7 | 6 | 5 | 4 | 4 | **WIRES** |
| 40 | 6 | 6 | 5 | 4 | 4 | |
| 45 | 5 | 5 | 5 | 4 | 4 | |
| 50 | 5 | 5 | 5 | 4 | 4 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 5 | 4 | 3 | 3 | 2 | |
| 20 | 5 | 4 | 3 | 3 | 2 | |
| 22 | 5 | 4 | 3 | 3 | 2 | |
| 25 | 5 | 4 | 3 | 3 | 2 | |
| 30 | 5 | 4 | 3 | 3 | 2 | **21-30** |
| 35 | 5 | 4 | 3 | 3 | 2 | **WIRES** |
| 40 | 5 | 4 | 3 | 3 | 2 | |
| 45 | 5 | 4 | 3 | 3 | 2 | |
| 50 | 5 | 4 | 3 | 3 | 2 | |
| 60 | 4 | 4 | 3 | 3 | 2 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | |
| 20 | 4 | 3 | 2 | 2 | 1 | |
| 22 | 4 | 3 | 2 | 2 | 1 | |
| 25 | 4 | 3 | 2 | 2 | 1 | |
| 30 | 4 | 3 | 2 | 2 | 1 | |
| 35 | 4 | 3 | 2 | 2 | 1 | **31-40 WIRES** |
| 40 | 4 | 3 | 2 | 2 | 1 | |
| 45 | 4 | 3 | 2 | 2 | 1 | |
| 50 | 4 | 3 | 2 | 2 | 1 | |
| 60 | 4 | 3 | 2 | 2 | 1 | |
| 22 | 3 | 2 | 2 | 1 | 1 | |
| 25 | 3 | 2 | 2 | 1 | 1 | |
| 30 | 3 | 2 | 2 | 1 | 1 | |
| 35 | 3 | 2 | 2 | 1 | 1 | **41-50 WIRES** |
| 40 | 3 | 2 | 2 | 1 | 1 | |
| 45 | 3 | 2 | 2 | 1 | 1 | |
| 50 | 3 | 2 | 2 | 1 | 1 | |
| 60 | 3 | 2 | 2 | 1 | 1 | |
| 25 | 3 | 2 | 1 | 1 | .. | |
| 30 | 3 | 2 | 1 | 1 | .. | |
| 35 | 3 | 2 | 1 | 1 | .. | |
| 40 | 3 | 2 | 1 | 1 | .. | **51-60 WIRES** |
| 45 | 3 | 2 | 1 | 1 | .. | |
| 50 | 3 | 2 | 1 | 1 | .. | |
| 60 | 3 | 2 | 1 | 1 | .. | |



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TABLE NO. 18

## POLE SELECTION

*Based on a:* **HEAVY LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED CHESTNUT POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 1-2 |
| 35 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 3-4 |
| 35 | 7 | 7 | 7 | 7 | 7 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 6 | 5 | **5-10** |
| 35 | 7 | 7 | 7 | 6 | 5 | **WIRES** |
| 40 | 7 | 7 | 7 | 6 | 5 | |
| 45 | 7 | 7 | 7 | 6 | 5 | |
| 50 | 7 | 7 | 7 | 6 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 6 | 5 | 4 | 4 | |
| 20 | 7 | 6 | 5 | 4 | 4 | |
| 22 | 7 | 6 | 5 | 4 | 4 | |
| 25 | 7 | 6 | 5 | 4 | 4 | |
| 30 | 7 | 6 | 5 | 4 | 4 | **11-20** |
| 35 | 7 | 6 | 5 | 4 | 4 | **WIRES** |
| 40 | 7 | 6 | 5 | 4 | 4 | |
| 45 | 7 | 6 | 5 | 4 | 4 | |
| 50 | 7 | 6 | 5 | 4 | 4 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 5 | 4 | 3 | 3 | 2 | |
| 20 | 5 | 4 | 3 | 3 | 2 | |
| 22 | 5 | 4 | 3 | 3 | 2 | **21-30 WIRES** |
| 25 | 5 | 4 | 3 | 3 | 2 | |
| 30 | 5 | 4 | 3 | 3 | 2 | |
| 35 | 5 | 4 | 3 | 3 | 2 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 40 | 5 | 4 | 3 | 3 | 2 | |
| 45 | 5 | 4 | 3 | 3 | 2 | **21-30 WIRES** |
| 50 | 5 | 4 | 3 | 3 | 2 | |
| 60 | 4 | 4 | 3 | 3 | 2 | |
| 20 | 4 | 3 | 2 | 2 | 1 | |
| 22 | 4 | 3 | 2 | 2 | 1 | |
| 25 | 4 | 3 | 2 | 2 | 1 | |
| 30 | 4 | 3 | 2 | 2 | 1 | |
| 35 | 4 | 3 | 2 | 2 | 1 | **31-40 WIRES** |
| 40 | 4 | 3 | 2 | 2 | 1 | |
| 45 | 4 | 3 | 2 | 2 | 1 | |
| 50 | 4 | 3 | 2 | 2 | 1 | |
| 60 | 4 | 3 | 2 | 2 | 1 | |
| 22 | 3 | 2 | 2 | 1 | 1 | |
| 25 | 3 | 2 | 2 | 1 | 1 | |
| 30 | 3 | 2 | 2 | 1 | 1 | |
| 35 | 3 | 2 | 2 | 1 | 1 | **41-50** |
| 40 | 3 | 2 | 2 | 1 | 1 | **WIRES** |
| 45 | 3 | 2 | 2 | 1 | 1 | |
| 50 | 3 | 2 | 2 | 1 | 1 | |
| 60 | 3 | 2 | 2 | 1 | 1 | |
| 25 | 3 | 2 | 1 | 1 | .. | |
| 30 | 3 | 2 | 1 | 1 | .. | |
| 35 | 3 | 2 | 1 | 1 | .. | |
| 40 | 3 | 2 | 1 | 1 | .. | **51-60 WIRES** |
| 45 | 3 | 2 | 1 | 1 | .. | |
| 50 | 3 | 2 | 1 | 1 | .. | |
| 60 | 3 | 2 | 1 | 1 | .. | |

# POLE SELECTION

*Based on a:* **HEAVY LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED SOUTHERN YELLOW PINE OR DOUGLAS FIR POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | **1-2** |
| 35 | 8 | 8 | 8 | 8 | 8 | **WIRES** |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | **3-4** |
| 25 | 7 | 7 | 7 | 7 | 7 | **WIRES** |
| 30 | 7 | 7 | 7 | 7 | 7 | |
| 35 | 7 | 7 | 7 | 7 | 7 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 3-4 |
| 50 | 7 | 7 | 7 | 7 | 7 | WIRES |
| 60 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 6 | 5 | 5-10 |
| 35 | 7 | 7 | 7 | 6 | 5 | WIRES |
| 40 | 7 | 7 | 7 | 6 | 5 | |
| 45 | 7 | 7 | 7 | 6 | 5 | |
| 50 | 7 | 7 | 7 | 6 | 5 | |
| 60 | 6 | 6 | 6 | 6 | 5 | |
| 18 | 7 | 6 | 5 | 4 | 4 | |
| 20 | 7 | 6 | 5 | 4 | 4 | |
| 22 | 7 | 6 | 5 | 4 | 4 | |
| 25 | 7 | 6 | 5 | 4 | 4 | |
| 30 | 7 | 6 | 5 | 4 | 4 | 11-20 |
| 35 | 7 | 6 | 5 | 4 | 4 | WIRES |
| 40 | 7 | 6 | 5 | 4 | 4 | |
| 45 | 7 | 6 | 5 | 4 | 4 | |
| 50 | 7 | 6 | 5 | 4 | 4 | |
| 60 | 6 | 6 | 5 | 4 | 4 | |
| 18 | 5 | 4 | 3 | 3 | 2 | |
| 20 | 5 | 4 | 3 | 3 | 2 | |
| 22 | 5 | 4 | 3 | 3 | 2 | 21-30 |
| 25 | 5 | 4 | 3 | 3 | 2 | WIRES |
| 30 | 5 | 4 | 3 | 3 | 2 | |
| 35 | 5 | 4 | 3 | 3 | 2 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 40 | 5 | 4 | 3 | 3 | 2 | |
| 45 | 5 | 4 | 3 | 3 | 2 | **21-30 WIRES** |
| 50 | 5 | 4 | 3 | 3 | 2 | |
| 60 | 5 | 4 | 3 | 3 | 2 | |
| 20 | 4 | 3 | 2 | 2 | 1 | |
| 22 | 4 | 3 | 2 | 2 | 1 | |
| 25 | 4 | 3 | 2 | 2 | 1 | |
| 30 | 4 | 3 | 2 | 2 | 1 | |
| 35 | 4 | 3 | 2 | 2 | 1 | **31-40 WIRES** |
| 40 | 4 | 3 | 2 | 2 | 1 | |
| 45 | 4 | 3 | 2 | 2 | 1 | |
| 50 | 4 | 3 | 2 | 2 | 1 | |
| 60 | 4 | 3 | 2 | 2 | 1 | |
| 22 | 3 | 2 | 2 | 1 | 1 | |
| 25 | 3 | 2 | 2 | 1 | 1 | |
| 30 | 3 | 2 | 2 | 1 | 1 | |
| 35 | 3 | 3 | 2 | 1 | 1 | **41-50** |
| 40 | 3 | 3 | 2 | 1 | 1 | **WIRES** |
| 45 | 3 | 3 | 2 | 1 | 1 | |
| 50 | 3 | 3 | 2 | 1 | 1 | |
| 60 | 3 | 3 | 2 | 1 | 1 | |
| 25 | 3 | 2 | 1 | 1 | .. | |
| 30 | 3 | 2 | 1 | 1 | .. | |
| 35 | 3 | 2 | 1 | 1 | .. | |
| 40 | 3 | 2 | 1 | 1 | .. | **51-60 WIRES** |
| 45 | 3 | 2 | 1 | 1 | .. | |
| 50 | 3 | 2 | 1 | 1 | .. | |
| 60 | 3 | 2 | 1 | 1 | .. | |



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## POLE SELECTION

TABLE NO. 20

*Based on a:* **MEDIUM LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED NORTHERN WHITE CEDAR OR WESTERN RED CEDAR POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 1-2 |
| 35 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 3-4 |
| 35 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | **5-6** |
| 35 | 8 | 8 | 8 | 8 | 8 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | **7-12** |
| 35 | 7 | 7 | 7 | 7 | 7 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 5 | **13-20** **WIRES** |
| 30 | 7 | 7 | 7 | 6 | 5 | |
| 35 | 7 | 7 | 7 | 6 | 5 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 40 | 6 | 6 | 6 | 6 | 5 | |
| 45 | 5 | 5 | 5 | 5 | 5 | **13-20** |
| 50 | 5 | 5 | 5 | 5 | 5 | **WIRES** |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 6 | 5 | 5 | 4 | |
| 20 | 7 | 6 | 5 | 5 | 4 | |
| 22 | 7 | 6 | 5 | 5 | 4 | |
| 25 | 7 | 6 | 5 | 5 | 4 | |
| 30 | 7 | 6 | 5 | 5 | 4 | **21-30** |
| 35 | 7 | 6 | 5 | 5 | 4 | **WIRES** |
| 40 | 6 | 6 | 5 | 5 | 4 | |
| 45 | 5 | 5 | 5 | 5 | 4 | |
| 50 | 5 | 5 | 5 | 5 | 4 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 6 | 5 | 4 | 3 | 3 | |
| 20 | 6 | 5 | 4 | 3 | 3 | |
| 22 | 6 | 5 | 4 | 3 | 3 | |
| 25 | 6 | 5 | 4 | 3 | 3 | |
| 30 | 6 | 5 | 4 | 3 | 3 | **31-40** |
| 35 | 6 | 5 | 4 | 3 | 3 | **WIRES** |
| 40 | 6 | 5 | 4 | 3 | 3 | |
| 45 | 5 | 5 | 4 | 3 | 3 | |
| 50 | 5 | 5 | 4 | 3 | 3 | |
| 60 | 4 | 4 | 4 | 3 | 3 | |
| 18 | 5 | 4 | 3 | 3 | 2 | |
| 20 | 5 | 4 | 3 | 3 | 2 | |
| 22 | 5 | 4 | 3 | 3 | 2 | **41-50** |
| 25 | 5 | 4 | 3 | 3 | 2 | **WIRES** |
| 30 | 5 | 4 | 3 | 3 | 2 | |
| 35 | 5 | 4 | 3 | 3 | 2 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 40 | 5 | 4 | 3 | 3 | 2 | |
| 45 | 5 | 4 | 3 | 3 | 2 | **41-50 WIRES** |
| 50 | 5 | 4 | 3 | 3 | 2 | |
| 60 | 4 | 4 | 3 | 3 | 2 | |
| 20 | 4 | 3 | 3 | 2 | 2 | |
| 22 | 4 | 3 | 3 | 2 | 2 | |
| 25 | 4 | 3 | 3 | 2 | 2 | |
| 30 | 4 | 3 | 3 | 2 | 2 | |
| 35 | 4 | 3 | 3 | 2 | 2 | **51-60 WIRES** |
| 40 | 4 | 3 | 3 | 2 | 2 | |
| 45 | 4 | 3 | 3 | 2 | 2 | |
| 50 | 4 | 3 | 3 | 2 | 2 | |
| 60 | 4 | 3 | 3 | 2 | 2 | |

## POLE SELECTION

TABLE NO. 21

*Based on a:* **MEDIUM LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED CHESTNUT POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | **1-2 WIRES** |
| 22 | 8 | 8 | 8 | 8 | 8 | |

(Table No. 21 continued on page 64.)



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TABLE NO. 21 (Cont'd)

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | |
| 35 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 1-2 WIRES |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | |
| 35 | 8 | 8 | 8 | 8 | 8 | 3-4 WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 5 | 5 | 5 | |
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | |
| 35 | 8 | 8 | 8 | 8 | 8 | 5-6 WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 7-12 WIRES |
| 22 | 7 | 7 | 7 | 7 | 7 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 25 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | |
| 35 | 7 | 7 | 7 | 7 | 7 | |
| | | | | | | **7-12** |
| 40 | 7 | 7 | 7 | 7 | 7 | **WIRES** |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 6 | 5 | **13-20** |
| 35 | 7 | 7 | 7 | 6 | 5 | **WIRES** |
| 40 | 7 | 7 | 7 | 6 | 5 | |
| 45 | 7 | 7 | 7 | 6 | 5 | |
| 50 | 7 | 7 | 7 | 6 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 6 | 5 | 5 | 4 | |
| 20 | 7 | 6 | 5 | 5 | 4 | |
| 22 | 7 | 6 | 5 | 5 | 4 | |
| 25 | 7 | 6 | 5 | 5 | 4 | |
| 30 | 7 | 6 | 5 | 5 | 4 | **21-30** |
| 35 | 7 | 6 | 5 | 5 | 4 | **WIRES** |
| 40 | 7 | 6 | 5 | 5 | 4 | |
| 45 | 7 | 6 | 5 | 5 | 4 | |
| 50 | 7 | 6 | 5 | 5 | 4 | |
| 60 | 4 | 4 | 4 | 4 | 4 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 6 | 5 | 4 | 3 | 3 | |
| 20 | 6 | 5 | 4 | 3 | 3 | |
| 22 | 6 | 5 | 4 | 3 | 3 | |
| 25 | 6 | 5 | 4 | 3 | 3 | |
| 30 | 6 | 5 | 4 | 3 | 3 | 31-40 |
| 35 | 6 | 5 | 4 | 3 | 3 | WIRES |
| 40 | 6 | 5 | 4 | 3 | 3 | |
| 45 | 6 | 5 | 4 | 3 | 3 | |
| 50 | 6 | 5 | 4 | 3 | 3 | |
| 60 | 4 | 4 | 4 | 3 | 3 | |
| 18 | 5 | 4 | 3 | 3 | 2 | |
| 20 | 5 | 4 | 3 | 3 | 2 | |
| 22 | 5 | 4 | 3 | 3 | 2 | |
| 25 | 5 | 4 | 3 | 3 | 2 | |
| 30 | 5 | 4 | 3 | 3 | 2 | 41-50 |
| 35 | 5 | 4 | 3 | 3 | 2 | WIRES |
| 40 | 5 | 4 | 3 | 3 | 2 | |
| 45 | 5 | 4 | 3 | 3 | 2 | |
| 50 | 5 | 4 | 3 | 3 | 2 | |
| 60 | 4 | 4 | 3 | 3 | 2 | |
| 20 | 4 | 3 | 3 | 2 | 2 | |
| 22 | 4 | 3 | 3 | 2 | 2 | |
| 25 | 4 | 3 | 3 | 2 | 2 | |
| 30 | 4 | 3 | 3 | 2 | 2 | |
| 35 | 4 | 3 | 3 | 2 | 2 | 51-60 |
| 40 | 4 | 3 | 3 | 2 | 2 | WIRES |
| 45 | 4 | 3 | 3 | 2 | 2 | |
| 50 | 4 | 3 | 3 | 2 | 2 | |
| 60 | 4 | 3 | 3 | 2 | 2 | |

## POLE SELECTION

TABLE NO. 22

*Based on a:* **MEDIUM LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED SOUTHERN YELLOW PINE OR DOUGLAS FIR POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 1-2 |
| 35 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 3-4 |
| 35 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 5 | 5 | 5 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 5-6 |
| 35 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 7-12 |
| 35 | 7 | 7 | 7 | 7 | 7 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 6 | 5 | 13-20 |
| 35 | 7 | 7 | 7 | 6 | 5 | WIRES |
| 40 | 7 | 7 | 7 | 6 | 5 | |
| 45 | 7 | 7 | 7 | 6 | 5 | |
| 50 | 7 | 7 | 7 | 6 | 5 | |
| 60 | 6 | 6 | 6 | 6 | 5 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 18 | 7 | 6 | 5 | 5 | 4 | | |
| 20 | 7 | 6 | 5 | 5 | 4 | | |
| 22 | 7 | 6 | 5 | 5 | 4 | | |
| 25 | 7 | 6 | 5 | 5 | 4 | | |
| 30 | 7 | 6 | 5 | 5 | 4 | | **21-30** |
| 35 | 7 | 6 | 5 | 5 | 4 | | **WIRES** |
| 40 | 7 | 6 | 5 | 5 | 4 | | |
| 45 | 7 | 6 | 5 | 5 | 4 | | |
| 50 | 7 | 6 | 5 | 5 | 4 | | |
| 60 | 6 | 6 | 5 | 5 | 4 | | |
| 18 | 6 | 5 | 4 | 3 | 3 | | |
| 20 | 6 | 5 | 4 | 3 | 3 | | |
| 22 | 6 | 5 | 4 | 3 | 3 | | |
| 25 | 6 | 5 | 4 | 3 | 3 | | |
| 30 | 6 | 5 | 4 | 3 | 3 | | **31-40** |
| 35 | 6 | 5 | 4 | 3 | 3 | | **WIRES** |
| 40 | 6 | 5 | 4 | 3 | 3 | | |
| 45 | 6 | 5 | 4 | 3 | 3 | | |
| 50 | 6 | 5 | 4 | 3 | 3 | | |
| 60 | 6 | 5 | 4 | 3 | 3 | | |
| 18 | 5 | 4 | 3 | 3 | 2 | | |
| 20 | 5 | 4 | 3 | 3 | 2 | | |
| 22 | 5 | 4 | 3 | 3 | 2 | | **41-50** |
| 25 | 5 | 4 | 3 | 3 | 2 | | **WIRES** |
| 30 | 5 | 4 | 3 | 3 | 2 | | |
| 35 | 5 | 4 | 3 | 3 | 2 | | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 40 | 5 | 4 | 3 | 3 | 2 | | |
| 45 | 5 | 4 | 3 | 3 | 2 | | **41-50 WIRES** |
| 50 | 5 | 4 | 3 | 3 | 2 | | |
| 60 | 5 | 4 | 3 | 3 | 2 | | |
| 20 | 4 | 3 | 3 | 2 | 2 | | |
| 22 | 4 | 3 | 3 | 2 | 2 | | |
| 25 | 4 | 3 | 3 | 2 | 2 | | |
| 30 | 4 | 3 | 3 | 2 | 2 | | **51-60 WIRES** |
| 35 | 4 | 3 | 3 | 2 | 2 | | |
| 40 | 4 | 3 | 3 | 2 | 2 | | |
| 45 | 4 | 3 | 3 | 2 | 2 | | |
| 50 | 4 | 3 | 3 | 2 | 2 | | |
| 60 | 4 | 3 | 3 | 2 | 2 | | |

Pole selection tables continued on following page

# POLE SELECTION

TABLE NO. 23

*Based on a:* **LIGHT LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED NORTHERN WHITE CEDAR OR WESTERN RED CEDAR POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | **1-4** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 8 | **5-10** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 18 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 22 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 25 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 6 | **11-30** |
| 35 | 7 | 7 | 7 | 7 | 7 | 6 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |
| 18 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 22 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 25 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 6 | **31-50** |
| 35 | 7 | 7 | 7 | 7 | 7 | 6 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |
| 25 | 6 | 6 | 6 | 5 | 5 | .. | |
| 30 | 6 | 6 | 6 | 5 | 5 | .. | |
| 35 | 6 | 6 | 6 | 5 | 5 | .. | |
| 40 | 6 | 6 | 6 | 5 | 5 | .. | **51-70** |
| 45 | 5 | 5 | 5 | 5 | 5 | .. | **WIRES** |
| 50 | 5 | 5 | 5 | 5 | 5 | .. | |
| 60 | 4 | 4 | 4 | 4 | 4 | .. | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 25 | 6 | 6 | 5 | 5 | 5 | .. | |
| 30 | 6 | 6 | 5 | 5 | 5 | .. | |
| 35 | 6 | 6 | 5 | 5 | 5 | .. | 71-80 |
| 40 | 6 | 6 | 5 | 5 | 5 | .. | WIRES |
| 45 | 5 | 5 | 5 | 5 | 5 | .. | |
| 50 | 5 | 5 | 5 | 5 | 5 | .. | |
| 60 | 4 | 4 | 4 | 4 | 4 | .. | |

## POLE SELECTION

TABLE NO. 24

*Based on a:* **LIGHT LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED CHESTNUT POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | 1-4 |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 18 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 8 | 5-10 |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | 11-30 |
| 35 | 7 | 7 | 7 | 7 | 7 | 7 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 4 | 4 | 4 | 4 | 4 | 4 | |
| 20 | 7 | 7 | 7 | 6 | 6 | .. | |
| 22 | 7 | 7 | 7 | 6 | 6 | .. | |
| 25 | 7 | 7 | 7 | 6 | 6 | .. | |
| 30 | 7 | 7 | 7 | 6 | 6 | .. | 31-50 |
| 35 | 7 | 7 | 7 | 6 | 6 | .. | WIRES |
| 40 | 7 | 7 | 7 | 6 | 6 | .. | |
| 45 | 7 | 7 | 7 | 6 | 6 | .. | |
| 50 | 7 | 7 | 7 | 6 | 6 | .. | |
| 60 | 4 | 4 | 4 | 4 | 4 | .. | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 25 | 6 | 6 | 6 | 5 | 5 | .. | |
| 30 | 6 | 6 | 6 | 5 | 5 | .. | |
| 35 | 6 | 6 | 6 | 5 | 5 | .. | |
| 40 | 6 | 6 | 6 | 5 | 5 | .. | **51-70 WIRES** |
| 45 | 6 | 6 | 6 | 5 | 5 | .. | |
| 50 | 6 | 6 | 6 | 5 | 5 | .. | |
| 60 | 4 | 4 | 4 | 4 | 4 | .. | |
| 22 | .. | .. | .. | 5 | 5 | .. | |
| 25 | 6 | 6 | 5 | 5 | 5 | .. | |
| 30 | 6 | 6 | 5 | 5 | 5 | .. | |
| 35 | 6 | 6 | 5 | 5 | 5 | .. | **71-80** |
| 40 | 6 | 6 | 5 | 5 | 5 | .. | **WIRES** |
| 45 | 6 | 6 | 5 | 5 | 5 | .. | |
| 50 | 6 | 6 | 5 | 5 | 5 | .. | |
| 60 | 4 | 4 | 4 | 4 | 4 | .. | |

## POLE SELECTION

TABLE NO. 25

*Based on a:* **LIGHT LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED SOUTHERN PINE OR DOUGLAS FIR POLES**
*In building:* **MAIN LEADS**
*To support:* **TOLL, EXCHANGE OR CABLE CONSTRUCTION**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | **1-4 WIRES** |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |

(Table No. 25 continued on page 76.)



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TABLE NO. 25 (Cont'd)

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | 1-4 WIRES |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 8 | 5-10 |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 18 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 22 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | 11-30 |
| 35 | 7 | 7 | 7 | 7 | 7 | 7 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 60 | 6 | 6 | 6 | 6 | 6 | 6 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 18 | 7 | 7 | 7 | 6 | 6 | .. | |
| 20 | 7 | 7 | 7 | 6 | 6 | .. | |
| 22 | 7 | 7 | 7 | 6 | 6 | .. | |
| 25 | 7 | 7 | 7 | 6 | 6 | .. | |
| 30 | 7 | 7 | 7 | 6 | 6 | .. | **31-50** |
| 35 | 7 | 7 | 7 | 6 | 6 | .. | **WIRES** |
| 40 | 7 | 7 | 7 | 6 | 6 | .. | |
| 45 | 7 | 7 | 7 | 6 | 6 | .. | |
| 50 | 7 | 7 | 7 | 6 | 6 | .. | |
| 60 | 6 | 6 | 6 | 6 | 5 | .. | |
| 25 | 6 | 6 | 6 | 5 | 5 | .. | |
| 30 | 6 | 6 | 6 | 5 | 5 | .. | |
| 35 | 6 | 6 | 6 | 5 | 5 | .. | |
| 40 | 6 | 6 | 6 | 5 | 5 | .. | **51-70 WIRES** |
| 45 | 6 | 6 | 6 | 5 | 5 | .. | |
| 50 | 6 | 6 | 6 | 5 | 5 | .. | |
| 60 | 6 | 6 | 6 | 5 | 5 | .. | |
| 25 | 6 | 6 | 5 | 5 | 5 | .. | |
| 30 | 6 | 6 | 5 | 5 | 5 | .. | |
| 35 | 6 | 6 | 5 | 5 | 5 | .. | |
| 40 | 6 | 6 | 5 | 5 | 5 | .. | **71-80 WIRES** |
| 45 | 6 | 6 | 5 | 5 | 5 | .. | |
| 50 | 6 | 6 | 5 | 5 | 5 | .. | |
| 60 | 6 | 5 | 5 | 4 | 4 | .. | |



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# POLE SELECTION

TABLE NO. 26

*Based on a:* **HEAVY LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED NORTHERN WHITE CEDAR OR WESTERN RED CEDAR POLES**
*In building:* **RURAL POLE LINES**
*To support:* **OPEN WIRE ONLY**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | 300 CLASS | |
| 16 | 10 | 10 | 10 | 10 | 10 | 9 | .. | |
| 18 | 10 | 10 | 10 | 10 | 10 | 9 | .. | |
| 20 | 10 | 10 | 10 | 10 | 10 | 9 | .. | |
| 22 | 10 | 10 | 10 | 10 | 10 | 9 | .. | |
| 25 | 10 | 10 | 10 | 10 | 10 | 9 | .. | **1-4** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | .. | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | .. | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | .. | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | .. | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | .. | |
| 16 | 9 | 9 | 9 | 9 | 9 | 8 | .. | |
| 18 | 9 | 9 | 9 | 9 | 9 | 8 | .. | |
| 20 | 9 | 9 | 9 | 9 | 9 | 8 | .. | |
| 22 | 9 | 9 | 9 | 9 | 9 | 8 | .. | |
| 25 | 9 | 9 | 9 | 9 | 9 | 8 | .. | **5-10** |
| 30 | 9 | 9 | 9 | 9 | 9 | 8 | .. | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | .. | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | .. | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | .. | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | .. | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | 300 CLASS | |
| 18 | 7 | 7 | 7 | 7 | 6 | 5 | .. | |
| 20 | 7 | 7 | 7 | 7 | 6 | 5 | .. | |
| 22 | 7 | 7 | 7 | 7 | 6 | 5 | .. | |
| 25 | 7 | 7 | 7 | 7 | 6 | 5 | .. | 11-20 WIRES |
| 30 | 7 | 7 | 7 | 7 | 6 | 6 | .. | |
| 35 | 7 | 7 | 7 | 7 | 6 | 5 | .. | |
| 40 | 6 | 6 | 6 | 6 | 6 | 5 | .. | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | .. | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | .. | |
| 18 | 7 | 6 | 6 | 6 | 5 | 4 | .. | |
| 20 | 7 | 6 | 6 | 6 | 5 | 4 | .. | |
| 22 | 7 | 6 | 6 | 6 | 5 | 4 | .. | |
| 25 | 7 | 7 | 7 | 6 | 5 | 4 | .. | 21-30 WIRES |
| 30 | 7 | 7 | 7 | 6 | 5 | 4 | .. | |
| 35 | 7 | 7 | 7 | 6 | 5 | 4 | .. | |
| 40 | 6 | 6 | 6 | 6 | 5 | 4 | .. | |
| 45 | 5 | 5 | 5 | 5 | 5 | 4 | .. | |
| 50 | 5 | 5 | 5 | 5 | 5 | 4 | .. | |

## POLE SELECTION

TABLE NO. 27

*Based on a:* **HEAVY LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED SOUTHERN PINE OR DOUGLAS FIR POLES**
*In building:* **RURAL POLE LINES**
*To support:* **OPEN WIRE ONLY**

(Table No. 27 continued on page 80.)



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TABLE NO. 27 (Cont'd)

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 16 | 10 | 10 | 10 | 10 | 10 | 9 | |
| 18 | 10 | 10 | 10 | 10 | 10 | 9 | |
| 20 | 10 | 10 | 10 | 10 | 10 | 9 | |
| 22 | 10 | 10 | 10 | 10 | 10 | 9 | |
| 25 | 10 | 10 | 10 | 10 | 10 | 9 | 1-4 |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | WIRES |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 16 | 9 | 9 | 9 | 9 | 9 | 8 | |
| 18 | 9 | 9 | 9 | 9 | 9 | 8 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 8 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 8 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 8 | 5-10 |
| 30 | 9 | 9 | 9 | 9 | 9 | 8 | WIRES |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 18 | 7 | 7 | 7 | 7 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 7 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 7 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 7 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 7 | 6 | 5 | 11-20 |
| 35 | 7 | 7 | 7 | 7 | 6 | 5 | WIRES |
| 40 | 7 | 7 | 7 | 7 | 6 | 5 | |
| 45 | 7 | 7 | 7 | 7 | 6 | 5 | |
| 50 | 7 | 7 | 7 | 7 | 6 | 5 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 18 | 7 | 6 | 6 | 6 | 5 | 4 | |
| 22 | 7 | 6 | 6 | 6 | 5 | 4 | |
| 22 | 7 | 6 | 6 | 6 | 5 | 4 | |
| 25 | 7 | 6 | 6 | 6 | 5 | 4 | |
| 30 | 7 | 6 | 6 | 6 | 5 | 4 | **21-30** |
| 35 | 7 | 6 | 6 | 6 | 5 | 4 | **WIRES** |
| 40 | 7 | 6 | 6 | 6 | 5 | 4 | |
| 45 | 7 | 6 | 6 | 6 | 5 | 4 | |
| 50 | 7 | 6 | 6 | 6 | 5 | 4 | |

## POLE SELECTION

TABLE NO. 28

*Based on a:* **MEDIUM LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED NORTHERN WHITE CEDAR OR WESTERN RED CEDAR POLES**
*In building:* **RURAL POLE LINES**
*To support:* **OPEN WIRE ONLY**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 16 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 18 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 20 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 22 | 10 | 10 | 10 | 10 | 10 | 10 | **1-4** |
| 25 | 10 | 10 | 10 | 10 | 10 | 10 | **WIRES** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |

(Table No. 28 continued on page 82.)



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TABLE NO. 28 (Cont'd)

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | 1-4 |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | WIRES |
| 16 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | 5-10 |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | WIRES |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 18 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 22 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 25 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 30 | 7 | 7 | 7 | 7 | 7 | 6 | 11-20 WIRES |
| 35 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 18 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 30 | 7 | 7 | 7 | 6 | 6 | 5 | 21-30 WIRES |
| 35 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 40 | 6 | 6 | 6 | 6 | 6 | 5 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |

## POLE SELECTION

TABLE NO. 29

*Based on a:* **MEDIUM LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED SOUTHERN PINE OR DOUGLAS FIR POLES**
*In building:* **RURAL POLE LINES**
*To support:* **OPEN WIRE ONLY**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 16 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 18 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 20 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 22 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 25 | 10 | 10 | 10 | 10 | 10 | 10 | **1-4** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 16 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | **5-10** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 18 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 20 | 7 | 7 | 7 | 7 | 7 | 6 | |
| 22 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 25 | 7 | 7 | 7 | 7 | 7 | 7 | 11-20 WIRES |
| 30 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 35 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 18 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 20 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 22 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 25 | 7 | 7 | 7 | 6 | 6 | 5 | 21-30 WIRES |
| 30 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 35 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 40 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 45 | 7 | 7 | 7 | 6 | 6 | 5 | |
| 50 | 7 | 7 | 7 | 6 | 6 | 5 | |

Pole Selection Tables Continued on Following Page

## POLE SELECTION

TABLE NO. 30

*Based on a:* **LIGHT LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED NORTHERN WHITE CEDAR OR WESTERN RED CEDAR POLES**
*In building:* **RURAL POLE LINES**
*To support:* **OPEN WIRE ONLY**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET | | | | | | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| | 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | |
| 16 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 18 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 20 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 22 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 25 | 10 | 10 | 10 | 10 | 10 | 10 | **1-4** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 16 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | **5-20** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |



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| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 18 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 8 | **21-30** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | **WIRES** |
| 40 | 6 | 6 | 6 | 6 | 6 | 6 | |
| 45 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 50 | 5 | 5 | 5 | 5 | 5 | 5 | |

## POLE SELECTION

TABLE NO. 31

*Based on a:* **LIGHT LOADING AREA**
*Under:* **AVERAGE CONDITIONS**
*Using:* **TREATED SOUTHERN PINE OR DOUGLAS FIR POLES**
*In building:* **RURAL POLE LINES**
*To support:* **OPEN WIRE ONLY**

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 16 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 18 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 20 | 10 | 10 | 10 | 10 | 10 | 10 | |
| 22 | 10 | 10 | 10 | 10 | 10 | 10 | **1-4** |
| 25 | 10 | 10 | 10 | 10 | 10 | 10 | **WIRES** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |

| LENGTH OF POLE IN FEET | SPAN LENGTH IN FEET 100 CLASS | 125 CLASS | 150 CLASS | 175 CLASS | 200 CLASS | 250 CLASS | ACTUAL WIRE LOAD |
|---|---|---|---|---|---|---|---|
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | **1-4** |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | **WIRES** |
| 16 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 18 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 20 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 22 | 9 | 9 | 9 | 9 | 9 | 9 | |
| 25 | 9 | 9 | 9 | 9 | 9 | 9 | **5-20** |
| 30 | 9 | 9 | 9 | 9 | 9 | 9 | **WIRES** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 18 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 20 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 22 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 25 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 30 | 8 | 8 | 8 | 8 | 8 | 8 | **21-30** |
| 35 | 8 | 8 | 8 | 8 | 8 | 8 | **WIRES** |
| 40 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 45 | 7 | 7 | 7 | 7 | 7 | 7 | |
| 50 | 7 | 7 | 7 | 7 | 7 | 7 | |

End of Pole Selection Tables



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# SELECTION AND SPACING OF POLES FOR RURAL LINE CONSTRUCTION

## HEAVY LOADING AREA — TABLE NO. 32

| No of Wires | Method of Attachment | Poles per Mile | Average Span Length | Class Pole |
|---|---|---|---|---|
| 1- 2 | Wood Brackets | 21.1 | 250 ft. | 9 |
| 3- 4 | Wood Brackets | 23.5 | 225 ft. | 9 |
| 5- 6 | 1—6-pin Pony Crossarm | 26.4 | 200 ft. | 9 |
| 5-10 | 1—10-pin Pony Crossarm | 26.4 | 200 ft. | 9 |
| 11-20 | 2—10-pin Pony Crossarms | 30.2 | 175 ft. | 7 |
| 21-30 | 3—10-pin Pony Crossarms | 30.2 | 175 ft. | 6 |
| | **MEDIUM LOADING AREA** | | | |
| 1- 2 | Wood Brackets | 21.1 | 250 ft. | 10 |
| 3- 4 | Wood Brackets | 23.5 | 225 ft. | 10 |
| 5- 6 | 1—6-pin Pony Crossarm | 26.4 | 200 ft. | 9 |
| 5-10 | 1—10-pin Pony Crossarm | 26.4 | 200 ft. | 9 |
| 11-20 | 2—10-pin Pony Crossarms | 30.2 | 175 ft. | 7 |
| 21-30 | 3—10-pin Pony Crossarms | 30.2 | 175.ft. | 6 |
| | **LIGHT LOADING AREA** | | | |
| 1- 2 | Wood Brackets | 21.1 | 250 ft. | 10 |
| 3- 4 | Wood Brackets | 21.1 | 250 ft. | 10 |
| 5- 6 | 1—6-pin Pony Crossarm | 23.5 | 225 ft. | 9 |
| 5-10 | 1—10-pin Pony Crossarm | 26.4 | 200 ft. | 9 |
| 11-20 | 2—10-pin Pony Crossarms | 26.4 | 200 ft. | 9 |
| 21-30 | 3—10-pin Pony Crossarms | 30.2 | 175 ft. | 8 |

## STANDARD POLE SPACING — TABLE NO. 33

Standard span lengths for pole lines and the number of poles per mile are specified in the following Table for urban, rural and long span construction.

| SPAN LENGTH IN FEET | NUMBER OF POLES PER MILE |
|---|---|
| 88 | 60.0 |
| 100 | 52.8 |

| | |
|---|---|
| 125 | 42.2 |
| 130 | 40.6 |
| 140 | 37.7 |
| 150 | 35.2 |
| 175 | 30.1 |
| 200 | 26.4 |
| 225 | 23.4 |
| 250 | 21.1 |
| 300 | 17.6 |
| 325 | 16.2 |
| 350 | 15.1 |
| 375 | 14.1 |
| 400 | 13.2 |
| 450 | 11.7 |

## CLASS AND SPACING OF POLES SUPPORTING AERIAL CABLE

TABLE NO. 34

| WEIGHT OF CABLES PER FT. (IN LBS.) | STORM LOADING AREA | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | EXTRA HEAVY | | HEAVY | | MEDIUM | | LIGHT | |
| | Class of Pole | Spacing of Poles (per Mile) | Class of Pole | Spacing of Poles (per Mile) | Class of Pole | Spacing of Poles (per Mile) | Class of Pole | Spacing of Poles (per Mile) |
| Less than 6 lbs. | 4 | 40 | 5 | 40 | 6 | 35 | 6 | 30 |
| 6 lbs. to 8.5 lbs. | 3 | 40 | 4 | 40 | 5 | 35 | 5 | 30 |

In partial reconstruction of a line carrying an aerial cable, the pole shall be spaced as specified in Table No. 34.

Where the existing spacing differs from that as specified, the existing spacing may be maintained, provided the class of pole used will provide a corresponding strength.

If spacing is 20% greater use the next larger class pole.

If spacing is 20% less use the next smaller class pole.

Small and branch cables may be supported on poles of the next smaller class.



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## CLASS AND SPACING OF POLES SUPPORTING OPEN WIRES AND AERIAL CABLES

Where a line is to be constructed or reconstructed to support both open wire and aerial cables, the class and spacing of poles should be maintained as specified in the table under the heading of pole selection for open wire.

The cables that are considered equivalent to open wire are specified in the following table.

TABLE NO. 35

## OPEN WIRE EQUIVALENT FOR AERIAL CABLE

| WEIGHT OF CABLES PER FOOT | EQUIVALENT NUMBER OF OPEN WIRES | | |
|---|---|---|---|
| | HEAVY | MEDIUM | LIGHT |
| Less than 6 lbs. | 10 | 10 | 20 |
| 6 lbs. to 12 lbs. | 20 | 20 | 30 |

## POLES AT RAILROAD CROSSINGS

Poles used to support track crossing spans may be of the same size as those used in the body of the line but shall not be smaller than Class 7.

Stub reinforcement of poles, spliced poles and poles supporting extension fixtures, are not permitted at railroad crossings.

## MINIMUM CLASS OF POLES AT MAJOR TRACK CROSSINGS WHERE SIDE GUYS ARE OMITTED

HEAVY LOADING AREAS TABLE NO. 36

| NUMBER OF WIRES TO BE SUPPORTED | AVERAGE LENGTH OF CROSSING AND ADJACENT SPANS | | | | |
|---|---|---|---|---|---|
| | 100 FT. MIN. CLASS | 125 FT. MIN. CLASS | 150 FT. MIN. CLASS | 175 FT. MIN. CLASS | 200 FT. MIN. CLASS |
| 1- 4..... | 7 | 7 | 7 | .. | .. |
| 5- 6..... | 7 | 6 | 5 | .. | .. |
| 7- 8..... | 6 | 5 | 4 | .. | .. |
| 9-10..... | 5 | 4 | 3 | .. | .. |
| 11-12..... | 4 | 3 | 2 | .. | .. |
| 13-20..... | 2 | 1 | .. | .. | .. |

## MEDIUM LOADING AREAS

| | | | | | |
|---|---|---|---|---|---|
| 1- 6..... | 7 | 7 | 7 | 7 | .. |
| 7- 8..... | 7 | 7 | 6 | 6 | .. |
| 9-10..... | 7 | 6 | 5 | 5 | .. |
| 11-12..... | 6 | 5 | 5 | 4 | .. |
| 13-20..... | 4 | 3 | 3 | 2 | .. |
| 21-30..... | 3 | 2 | 1 | .. | .. |
| 31-40..... | 2 | 1 | .. | .. | .. |

## LIGHT LOADING AREAS

| | | | | | |
|---|---|---|---|---|---|
| 1- 6..... | 7 | 7 | 7 | 7 | 7 |
| 7- 8..... | 7 | 7 | 7 | 6 | 6 |
| 9-10..... | 7 | 7 | 6 | 6 | 5 |
| 11-12..... | 6 | 6 | 6 | 5 | 5 |
| 13-20..... | 6 | 5 | 5 | 4 | 4 |
| 21-30..... | 5 | 4 | 3 | 3 | 2 |
| 31-40..... | 4 | 3 | 2 | 2 | 1 |
| 41-50..... | 3 | 2 | 2 | 1 | .. |
| 51-60..... | 2 | 2 | 1 | .. | .. |

# MINIMUM CLASS OF POLES AT MINOR TRACK CROSSINGS WHERE SIDE GUYS ARE OMITTED

## HEAVY LOADING AREAS

TABLE NO. 37

| NUMBER OF WIRES TO BE SUPPORTED | AVERAGE LENGTH OF CROSSING AND ADJACENT SPANS | | | | |
|---|---|---|---|---|---|
| | 100 FT. MIN. CLASS | 125 FT. MIN. CLASS | 150 FT. MIN. CLASS | 175 FT. MIN. CLASS | 200 FT. MIN. CLASS |
| 1- 4..... | 7 | 7 | 7 | 7 | 7 |
| 5- 6..... | 7 | 7 | 7 | 6 | 6 |
| 7- 8..... | 6 | 6 | 6 | 5 | 4 |
| 9-10..... | 6 | 5 | 4 | 4 | 3 |
| 11-12..... | 6 | 5 | 4 | 4 | 3 |
| 13-20..... | 5 | 4 | 4 | 3 | 2 |
| 21-30..... | 3 | 3 | 2 | 1 | .. |
| 31-40..... | 2 | 1 | .. | .. | .. |
| 41-50..... | 1 | .. | .. | .. | .. |

(Table No. 37 continued on page 92.)



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## MEDIUM LOADING AREAS

TABLE NO. 37 (Cont'd)

| | | | | | |
|---|---|---|---|---|---|
| 1- 6..... | 7 | 7 | 7 | 7 | 7 |
| 7- 8..... | 7 | 7 | 7 | 7 | 6 |
| 9-10..... | 7 | 7 | 7 | 6 | 5 |
| 11-12..... | 6 | 6 | 6 | 6 | 5 |
| 13-20..... | 6 | 6 | 6 | 5 | 5 |
| 21-30..... | 5 | 5 | 4 | 3 | 3 |
| 31-40..... | 4 | 4 | 3 | 3 | 2 |
| 41-50..... | 4 | 3 | 2 | 2 | 1 |
| 51-60..... | 3 | 2 | 2 | 1 | .. |

## LIGHT LOADING AREAS

| | | | | | |
|---|---|---|---|---|---|
| 1-10..... | 7 | 7 | 7 | 7 | 7 |
| 11-12..... | 6 | 6 | 6 | 6 | 6 |
| 13-20..... | 6 | 6 | 6 | 5 | 5 |
| 21-30..... | 5 | 5 | 5 | 4 | 4 |
| 31-40..... | 4 | 4 | 4 | 3 | 3 |
| 41-50..... | 4 | 4 | 3 | 2 | 2 |
| 51-60..... | 3 | 3 | 2 | 2 | 1 |

## TERMINAL POLES AND "H" FIXTURES

Poles one class larger than those employed in the main line should be used to terminate open wires or cables.

Where it is impracticable to terminate wires or cables on a single pole due to the great stress or where suitable guying cannot be obtained, an "H" Fixture should be used.

"H" Fixtures may be used as a substitute for a 4-way storm guyed single pole and at corners as a substitute for guyed single poles.

"H" Fixtures provide a more substantial structure in the direction of the line. In addition in some cases the use has proven to be more economical than storm guy single poles.

Poles used in the construction of an "H" Fixture may be of one class smaller than those of the main body of the line.

"H" Fixtures should be used where wires terminate at a river edge to meet a submarine cable.

"H" Fixtures may be used where a heavy toll wire lead is terminated at a point of junction with an aerial or underground cable. This will depend upon the local conditions and circumstances that may surround each installation.

The use of a double crossarm is not necessary at side guyed locations.

Use double crossarms at termination points to prevent wire slipping through the ties.

The installation of guys and crossarms to the "H" Fixtures will be discussed under their respective headings.

Each pole of an "H" Fixture is to be set in a vertical plane and shall be set 6 feet 8 inches apart. This is a center-to-center measurement.

Where 10-pin crossarms are used, pins 2 and 9 may be shifted toward the end of the arm to provide climbing space.

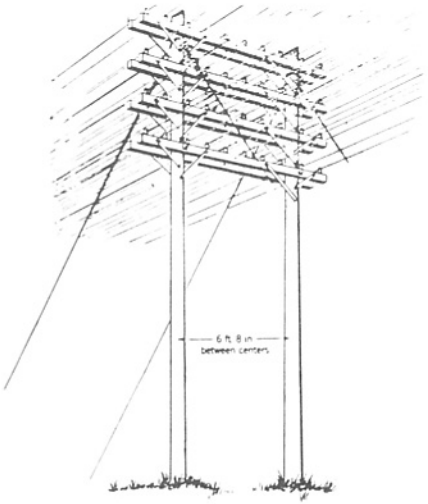



*Figure 17—"H"-Fixture.*



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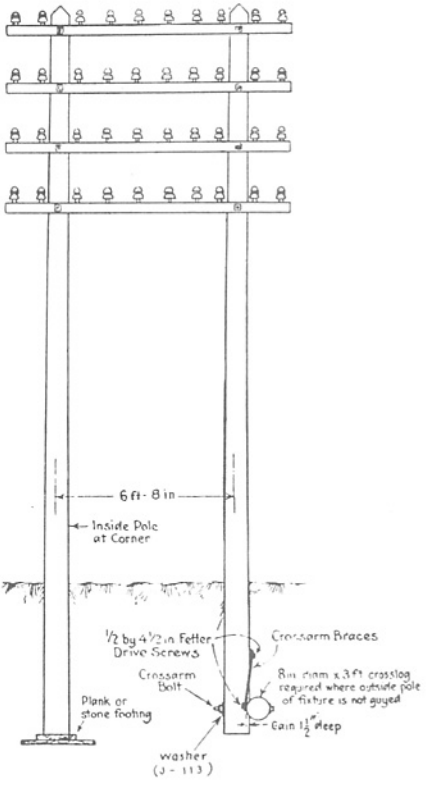



*Figure 18—"H"-Fixture at corner.*

"H" Fixtures shall be set to the same depth as single poles of the same height and class.

When an "H" Fixture is used at a corner, the inside pole shall be set on a timber or stone base while the outside pole shall be equipped with a cross log brace. This method applies only where down guys cannot be installed.

## UNGUYED POLES

When right of way conditions are such that it is impossible to guy a corner or terminal pole or to use a pole brace, it will be necessary to use a stronger pole. The strength of an unguyed corner pole will depend upon the class of poles used elsewhere in the line and upon the amount of guying it must substitute.

In general, the size of an unguyed corner pole should increase one inch in circumference for every 1000 pounds of guying required with a lead of one half.

When a pole is selected to substitute a 6-M guy in a line constructed of class 6 poles, the corner pole shall have a circumference of 6 inches more than the poles in the body of the line.

An unguyed corner pole or termination pole shall be set one foot deeper than normal specifications for a given height of pole.

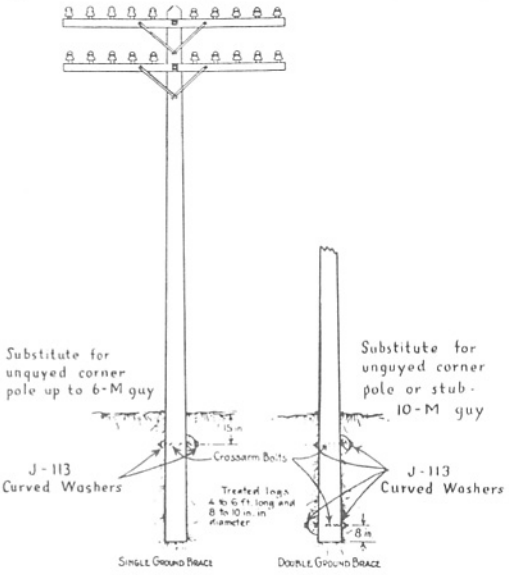



*Figure 19—Ground brace installation—(Log).*



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When a pole is substituted for a 6-M guy, a single ground brace may be used or may be set in concrete as illustrated in Figures 19 and 20.

When a pole is substituted for a 10-M guy, a double ground brace should be used or may be set in concrete as illustrated in Figures 19 and 20.

## UNGUYED GUY STUB

A guy stub that cannot be guyed shall be set one foot deeper than regulations and shall be one class larger than the pole to be guyed.

The guy stub pole shall be equipped with a double ground brace or set in concrete as shown in Figures 19 and 20.

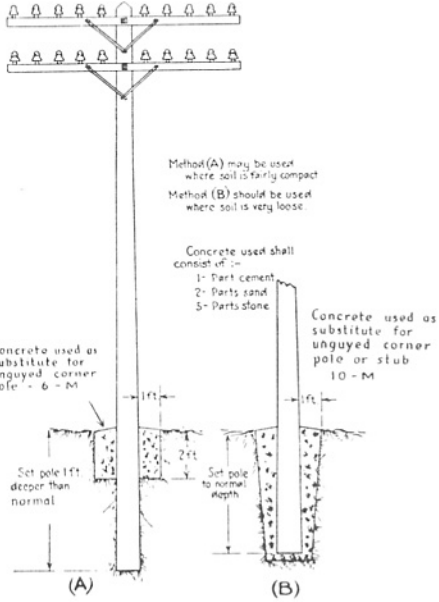



*Figure 20—Ground brace installation—(Concrete).*

## STUB REINFORCEMENT OF POLES

Poles shall be reinforced with subs only when that portion above the ground is sound and free from defects.

Poles should be reinforced where there is a large amount of attachment transferring. The transferring of cable terminals and crossarms are expensive operations and can be avoided providing the pole above the ground line is sound.

Poles at major railroad track crossings shall not be stubbed or reinforced.

Poles at minor railroad track crossings may be stubbed when approved by railroad officials of the railroad company involved.

Do not reinforce poles which are too small for their assigned load.

The "H" Fixture shall be reinforced by setting a stub alongside the pole to be reinforced. Do not use the "cut off system" as this will disturb the entire fixture when the pole is moved away from the hole to allow room for the new stub.

Reinforcing stubs may be set on the road side, field side or in line with the lead.

When a pole has decayed to such an extent that it will not support a corner or guy, it should be replaced with a new pole or be reinforced with a stub.

Cut off the decayed portion of a pole near the ground line and remove the deteriorated butt. Set the reinforcing butt in the hole previously occupied by the decayed butt and securely strap the pole to the butt.

Another method used is to set the stub alongside the pole and strap them together.

When it is necessary to obtain a greater clearance, the pole is raised out of the ground and a stub is set in the hole previously occupied by the pole. The pole is then securely strapped to the stub. The length of the stub depends upon the clearance necessary.

When heavy loads are to be supported, supplement the stubbing bands with one or two bolts passing through the pole and the stub.



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When the "cut off" method is desired proceed as follows:

1. Support the pole with pike poles or temporary guys.
2. Raise the pole approximately 18 inches out of the ground with a jack or pole derrick.
3. Saw off the pole at an angle just above the decayed point. (Low point of cut to be away from stub.)
4. Set the pole in position for strapping and bolting.
5. Remove balance of butt, clean out hole, set in new stub and back fill.
6. Place stubbing bands.

When the stub of a pole is to be left in place, dig a hole alongside of the pole to the desired depth. Set in a new reinforcing stub, back fill and securely strap the bands in place.

## LENGTH OF STUB

TABLE NO. 38

| LENGTH OF POLE TO BE REINFORCED (IN FEET) | LENGTH OF STUB | DEPTH OF SETTING STUB (IN FEET) |
|---|---|---|
| 20 | 10 | 4 |
| 25 | 10 | 5 |
| 30 | 10 | 5½ |
| 35 | 11 | 6 |
| 40 | 11 | 6 |
| 45 | 13 | 6½ |
| 50 | 13 | 7 |
| 55 | 16 | 7½ |
| 60 | 20 | 8 |

Stubs salvaged from old poles must be of sound timber and may be used on less important exchange or rural lines.

A new treated stub may be six inches less in circumference than the untreated pole to be stubbed.

A new treated stub may be two inches less in circumference than the treated pole to be stubbed.

A new untreated stub may be two inches less in circumference than the untreated pole to be stubbed.

A new untreated stub may be two inches more in circumference than the treated pole to be stubbed.

## REINFORCING STRAPS AND BOLTS

Two machine bolts passing through a pole and a stub provide a suitable support for small size poles less than 30 feet in length and supporting 20 wires or less.

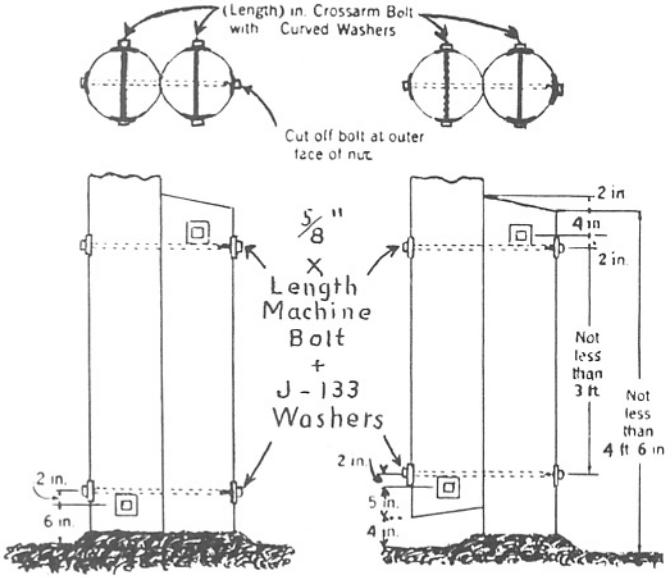



*Figure 21—Reinforcing poles with stub and bolts.*

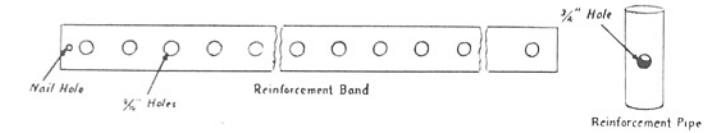



*Figure 22—Reinforcement band.*



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Stubbing bands are installed by nailing the end to the pole. Wrap the band around the pole and stub, and fasten the other end with a ½ inch lag screw through one of the end holes and one of the other holes.

The assembly is drawn up tightly by means of a ⅝ inch machine bolt and two pipe spacers.

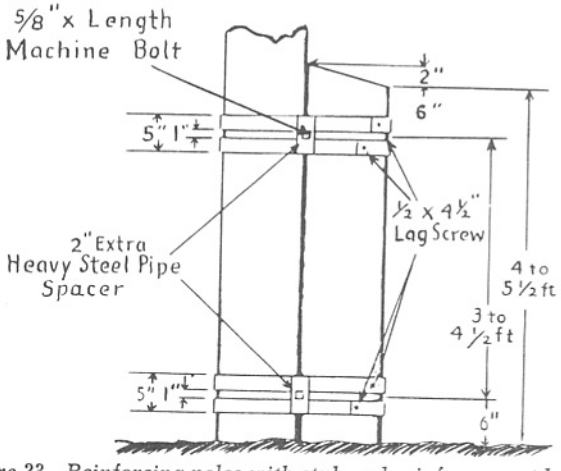



*Figure 23—Reinforcing poles with stub and reinforcement bands.*

Two stubbing bands as illustrated in Figure 23 will support a vertical load of 2000 pounds or 20 wires on poles 40 feet in length or less.

## MATERIAL REQUIRED

4—J-4850 reinforcement bands 12 ga. x 2"x68½" or

4—J-4851 reinforcement bands 12 ga. x 2"x89½"

4—J-4852 reinforcement steel pipe spacers 2"x5"

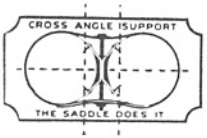
2—⅝" X length machine bolts

4—J-8754½—4½"x ½" lag screws

4—30-d galvanized wire nails.

# SADDLE STUBBING CLAMPS






Samson stubbing clamps make a stubbed pole as strong as a new line. In a test using a 40 foot pole, 11 inches in diameter at the butt with the clamps 5 feet apart, a pull of 2000 pounds was applied at the end of the pole without injury to the pole, clamps or stub.

Two stubbing clamps will support 20 wires on poles 40 feet in length or less.

*Figure 24—Stubbing installation using saddle stubbing clamps.*

## MATERIAL REQUIRED FOR SADDLE STUBBING

2—J-6850 stubbing clamps—12 ga. 2½"x 96" or
2—J-6851 stubbing clamps—12 ga. 2¼"x 60"
2—⅝"x length machine bolts
4—J-1075—2¼"x 2¼"x 3/16" square washers.



*Figure 25—Saddle stubbing wrench.*



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To simplify installation, use the Samson installing wrench. This wrench is made of forged steel. One end is used for pulling the bands tight; the other pointed end is for lining up the holes.

**Note:** Staples and saddle are included as part of the stubbing clamps.

The type of installation as shown in Figure 26 will support 20 wires on poles of 30 feet or less.

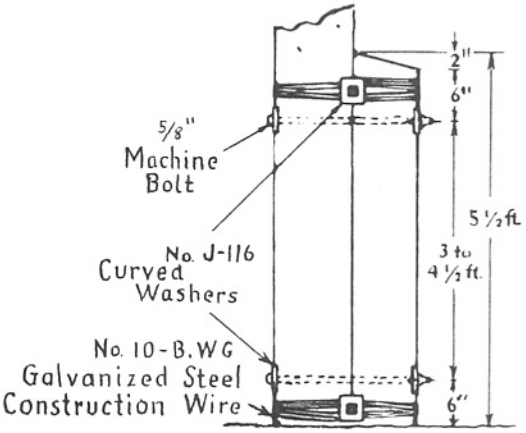



*Figure 26—Wrap-around stubbing method.*

Four band stubbing installation supplemented with two 5/8" machine bolts through the pole and stub will support the following loads:

1. Corner pole supporting one cable on 6-M strand at 130 foot spans, plus 40 wires. (The pole may be held in place with two 6-M strands to stub guy.)

2. Corner pole carrying 20 wires in the heavy loading area and held in place with a 6-M anchor guy.

3. Corner pole carrying one cable on 16-M strand at 130 foot spans with the pole held in place by 10-M anchor guys.

The "non cut off" stub installation may be used at corners and other locations without restriction to a vertical load. However, the remaining wood shall not be less than 15 inches in circumference at the greatest section of decay.

## LOCATING POLES AT CORNERS

Locating poles at sharp corners shall be avoided wherever possible. The "pull" on a single corner pole as shown in the following table shall not be over 40 feet and shall be reduced as the load is increased.

### RECOMMENDED "PULL" FOR SINGLE POLE CORNERS

TABLE NO. 39

| NUMBER OF WIRES | "PULL" |
|---|---|
| 1-10 | 40 ft. or less |
| 11-20 | 30 ft. or less |
| 21-30 | 25 ft. or less |
| 31-40 | 15 ft. or less |
| 41 or more | 10 ft. or less |

A single pole corner supporting small aerial cables may have a "pull" of 50 feet, while the "pull" at a single pole corner, supporting a large or full size cable shall not exceed 20 feet.

Corners where the "pull" is greater than those described above should be made on two poles and placed in such a manner that the "pull" will be equally divided on each pole.

At street corners and at other points where conditions are such



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that a single pole corner or a two pole corner cannot be built, the cable or cables may be turned on the cable suspension strand as shown in Figures 27 and 28.

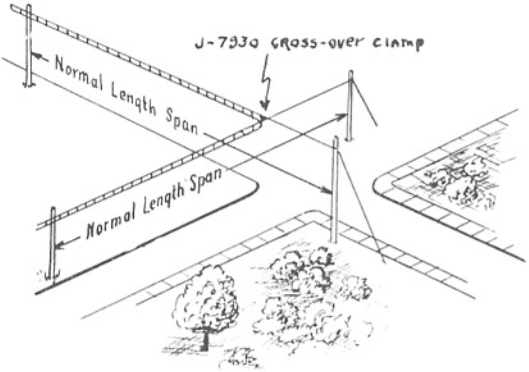



*Figure 27—Main cable turn.*

The two cable suspension strands at the point of crossing shall be securely held together with a J-7930 crossover clamp as illustrated in Figs. 27 and 28.

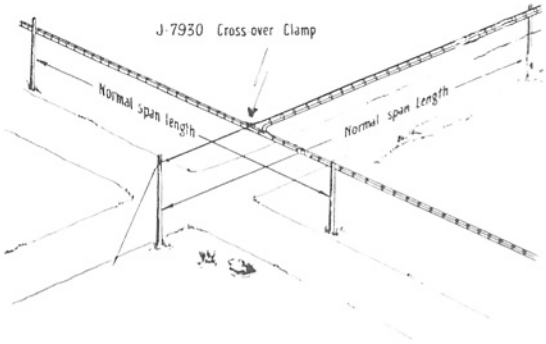



*Figure 28—Branch cable turn.*

## LOCATING POLES AT CURVES

On gradual curves it is undesirable to construct the pole line with many small "pulls" or corners. When right of way permits, the "tangent method" of setting several successive poles in a straight line to a designated point or corner is recommended. This method is shown in the following illustration.

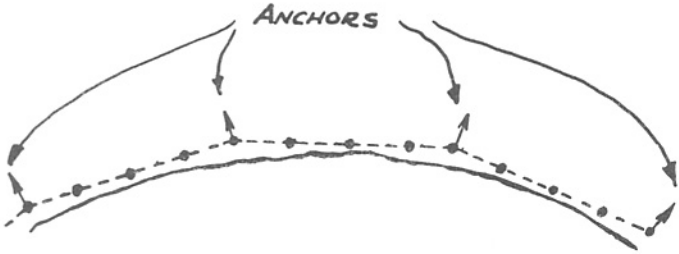



*Figure 29—Locating poles at curve.*

## LOCATING POLES AT RAILROAD CROSSINGS

A 60 degree atmospheric temperature and no wind are ideal conditions under which poles are located for all railroad clearances. Measurements for clearances shall be taken between the nearest parts of the objects concerned.

Locate poles in such a way that there will be at least an 8 foot horizontal separation between the pole and the inside of the railroad tracks.

Poles equipped with crossarms, wires, cables, guys and other fixtures shall be so located to provide a horizontal separation of at least 8 feet between the inside of the nearest railroad track and the attachment involved.

Locate crossing poles away from any inflammable structures and keep space near pole free from any inflammable material.

In the heavy loading area, the crossing span should not exceed 100 feet.

In the medium loading area the crossing span should not exceed 125 feet.



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In the light loading area the crossing span should not exceed 150 feet.

## LOCATING POLES FOR TRANSPOSITION POINTS

Poles supporting open wire phantom, carrier or repeater circuits may be shifted 10 feet ahead or 10 feet back at three transposition points per transposition sections.

Poles designated for transposition points shall be set at predetermined points with allowances made as set forth in the above paragraph.

**Note:** Additional data covering locations of poles for transposition points will be found in Book II (Open Wire Construction).

## GRADING POLE LINES

When building a pole line it must be remembered that the line should follow the contour of the earth in order that the poles may be of uniform height. However, when the contour changes rapidly the poles must be of varying heights to avoid abrupt changes in slope of the line.

The height of poles should be so selected that the upward or downward "pull" will not exceed the data contained in the following specifications:

Average span length 100 feet or less.....4 feet
Average span length 130 feet.....5 feet
Average span length 150 feet.....6 feet
Average span length 160 feet or more.....8 feet

In rugged and mountainous sections of the country it is recommended to exceed the prescribed change in grade to avoid undue construction cost.

When light lines are built on level terrain, it will be advantageous to exceed the grade change.

When the up or down "pull" on a pole is twice the amount specified, the pole should be equipped with double arms.

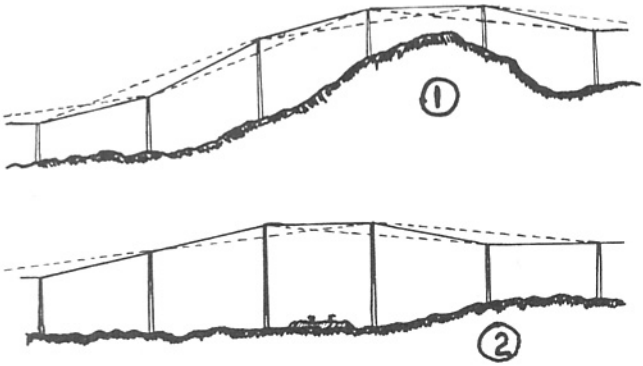



*Figure 30—Grading a pole line. (1) Grading pole line over irregular terrain. (2) Grading pole line over railroad crossing.*

## SELECTION OF JOINT POLES

When joint use poles are considered, the top and ground line circumference shall not be less than that specified by the State Electrical Code.

The National Electrical Safety Code requires that untreated poles for joint use must have an initial strength of at least 100% greater than the minimum strength permitted for the ultimate wire load. In order to meet these requirements a class 5 pole is selected with a top diameter of not less than 6 inches.

## FRAMING AND ROOFING POLES

Where creosoted pine poles are to be used, they should be roofed and gained at the treating plant or yard prior to being treated. In this connection, care should be taken in handling creosoted poles to avoid damage by carrying hooks, cant hooks or other tools, or by dragging on the ground.

Where other than creosoted pine poles are to be used, it will normally be found more economical to have them roofed and



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gained at the source. Poles should be gained for the ultimate number of crossarms. If the poles are intended to support brackets only, they should be roofed but not gained.

There are two accepted methods of roofing poles: one-way angle of roof (standard is 15 degrees) or two-way angle of roof (standard is 45 degrees). The latter method of roofing poles is generally accepted. Where framing is done on the job, turn the pole so that the face (inside of the sweep) is up and hold the pole in place by blocking or by placing the top of the pole in a gaining buck. Make two cuts with a saw at an angle of 45 degrees for a two-way roof or one cut with a saw at an angle of 15 degrees from horizontal for a one-way roof.

The 15 degree one-way roof is recommended over the two-way roof of 45 degrees is that it reduces checking and provides better drainage with less exposed roof surface. The two-way cut at 45 degrees leaves a minimum of wood along the center line. This is the natural cleavage point which invites checking while the one-way roof eliminates this disadvantage.

Where gains are required, they shall be located on the inside of the sweep on curved poles. The top of the first gain will be 8 inches from the peak of the roof. Gains shall be ½ inch deep and slightly concave. This eliminates any rocking of the arm. The width of the gain will vary with the type of arm used. Gains shall be cut so that all crossarms will be parallel to each other and at right angles to the axis of the pole. Gains will normally be spaced 24 inches apart between the tops of gains. In special cases, to secure additional clearance, the spacing may be reduced to 18 to 12 inches. A hole shall be bored with a $^{11}/_{16}$ inch bit through the center of each gain.

Poles shall be gained and roofed as illustrated in Figures 31, 32 and 33.

Drill $^{11}/_{16}$" hole for $^{5}/_{8}$" machine bolt in center of each gain.

Width of gain is $3^{3}/_{4}$" for pony arms and $4^{1}/_{4}$" for standard arms.

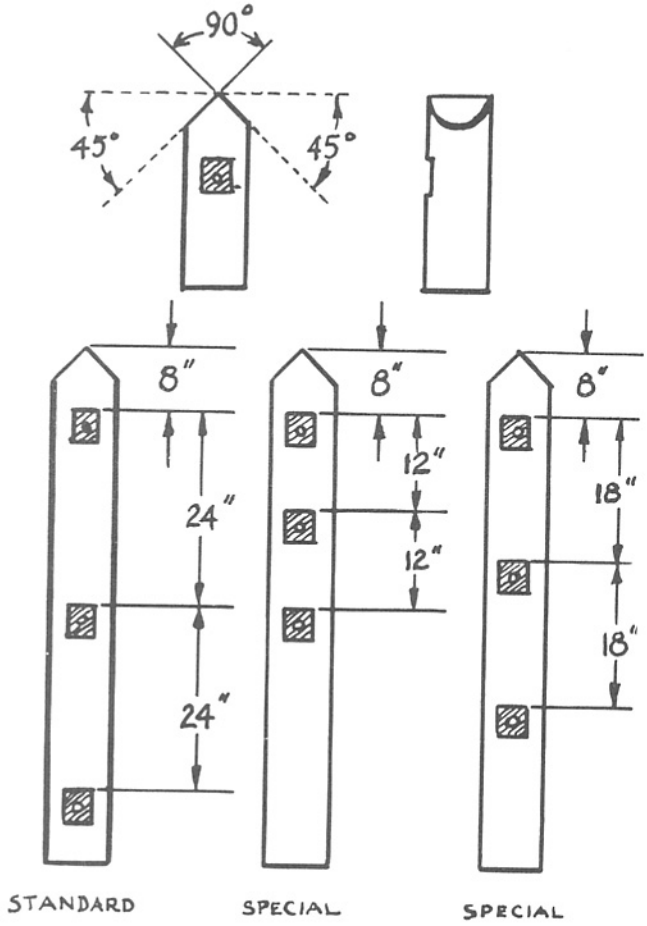


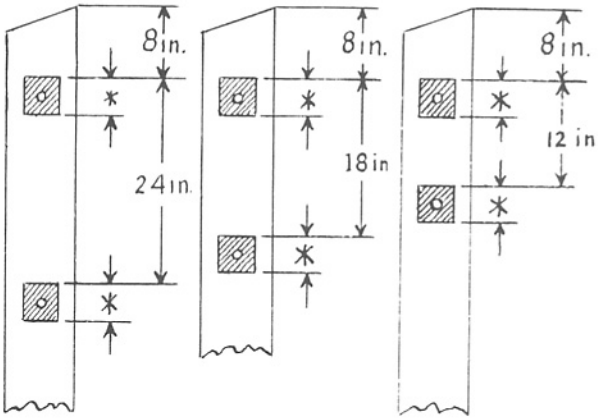

*Figure 31—Roofing and gaining poles.*



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DRILL $\frac{11}{16}$" HOLE FOR $\frac{5}{8}$" MACHINE BOLT IN THE CENTER OF EACH GAIN.

* WIDTH OF GAIN ~ $3\frac{3}{4}$" FOR PONY ARMS; $4\frac{1}{4}$ FOR STANDARD ARMS.

*Figure 32—locating gains on one-cut roof poles.*

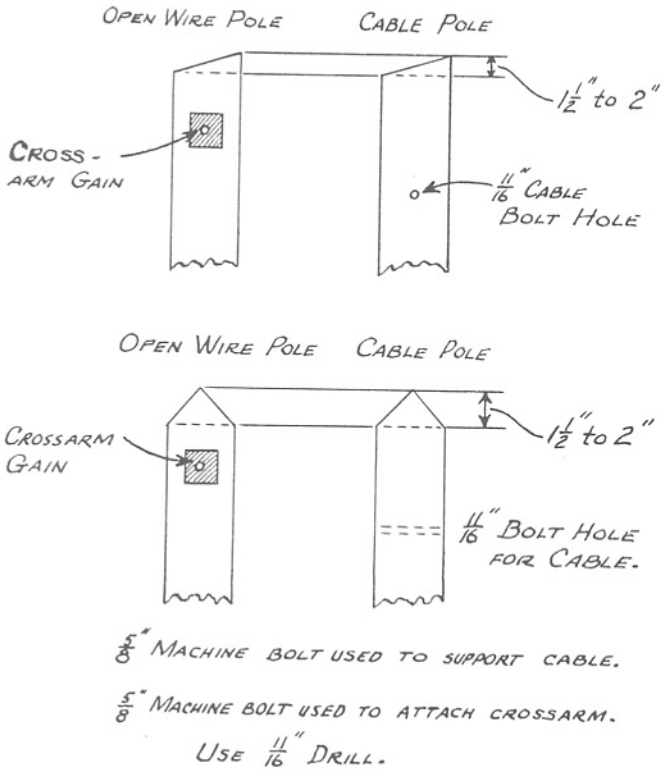



*Figure 33—Roofing poles—one and two cut methods.*



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## SLAB GAINING

Slab gaining has become popular with the larger telephone companies and it is urged that the smaller telephone companies adopt this method of gaining where crossarms are required.

The advantage of this type of gaining is the greatly improved drainage and uniform cut.

The depth of the cut is approximately ½ inch. The length varies with the number of crossarms required, and usually the cuts are from 18 inches to 11 feet. The 11 foot cuts are confined to poles of 35 feet or more. A 7 foot 6 inch cut is specified for poles 25 to 30 feet; and an 18 inch cut is designated to shorter poles where one crossarm is anticipated. However, the length of these cuts can vary to meet individual requirements.

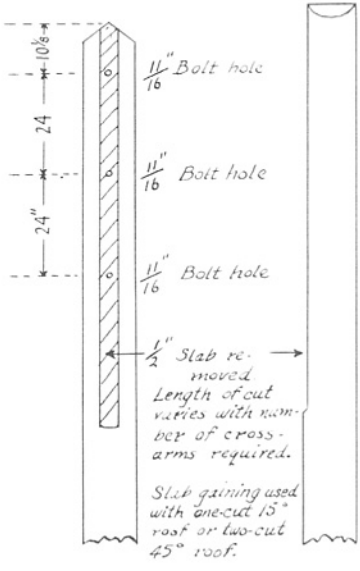



*Figure 34—Typical example of slab gaining.*

## GUYING

In order to properly determine the guying requirements of any line, certain terms must be defined.

**"Lead"** is defined as the horizontal distance from the ground line of a pole to the guy or guy rod. "Lead" is expressed as a fraction of the distance from the ground line to point of attachment on the pole.

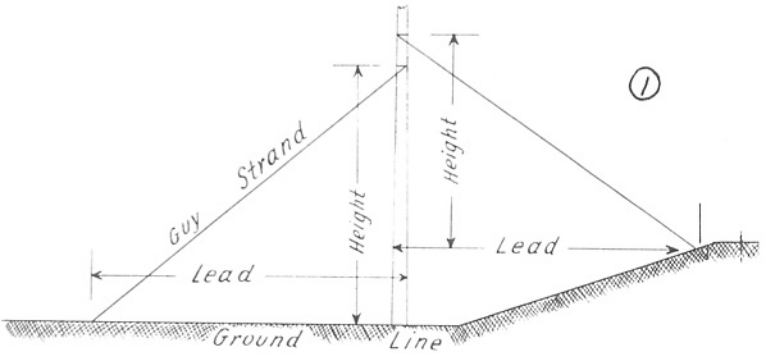
**"Height"** is defined as the vertical distance from the ground line to the point of attachment of the guy on the pole.

In order to obtain the greatest efficiency from the height-lead method of selecting guys, a ratio of 1 to 1 to 1¼ should be secured whenever possible. However, it is not always possible since it is necessary to minimize the obstructions of guys to pedestrians and to the right of way limitations.

In all cases the ratio shall be kept as high as practicable, since guys lose their efficiency rapidly as the point of anchorage approaches the base of the pole.

As the lead increases the strain on the strand and anchor becomes less, consequently the size of the strand and anchor may be reduced.

## LEADS AND HEIGHTS UNDER VARIOUS CONDITIONS

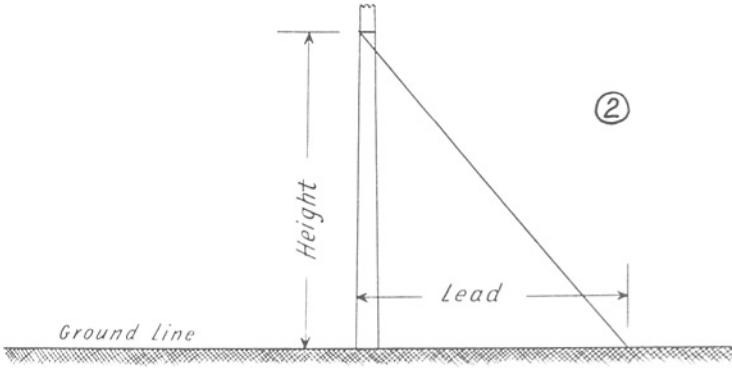




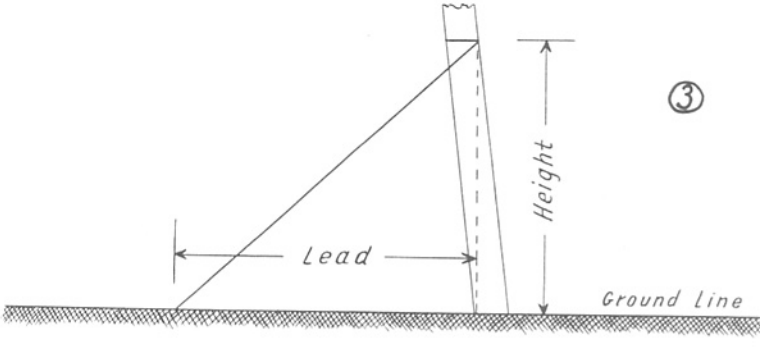

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To determine the ration of lead and height measure the lead and height in feet and write this as a fraction $\frac{\text{lead}}{\text{height}}$. Where the lead is 16 feet and the height is 32 feet, the $\frac{\text{lead}}{\text{height}} = {}^{16}\!/_{32}$ or ½ and consequently the same for any other values of lead and height.



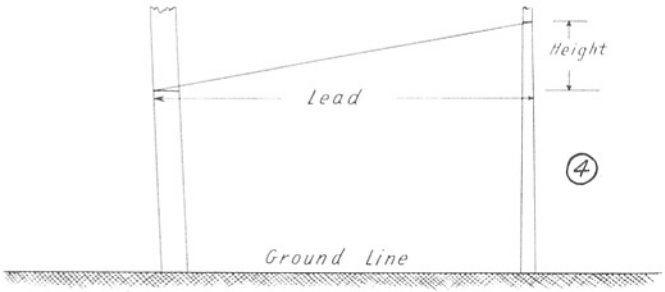



*Figure 35—(1)—(2)—(3)—(4)—"Leads and heights" for guying under various conditions.*

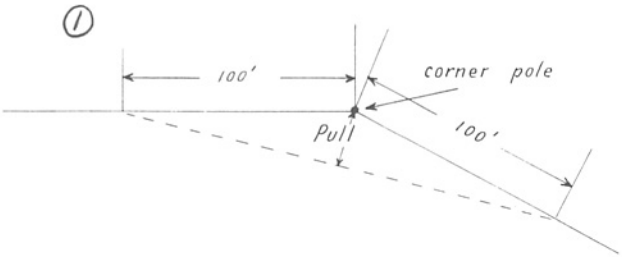
## PULL

The "pull" on a pole is defined as the distance in feet that the corner pole is out of line with two points 100 feet away on opposite sides and in line with the corner pole and its two adjacent poles.

The following five illustrations are the accepted methods of determining the "pull" on poles under various conditions.

"Pull" in all cases should be read in even feet since the guy selection tables are given within even foot limits.

## MEASURING "PULL" AT CORNER POLES

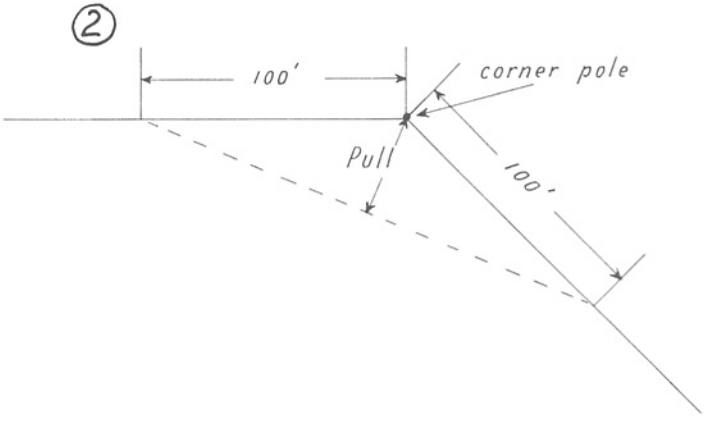


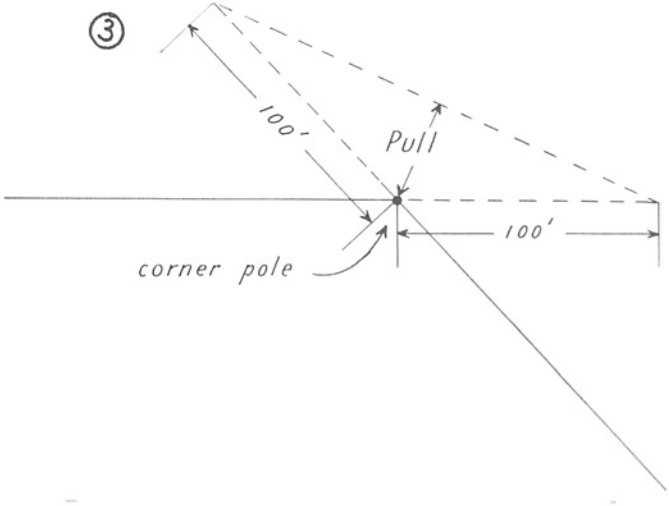



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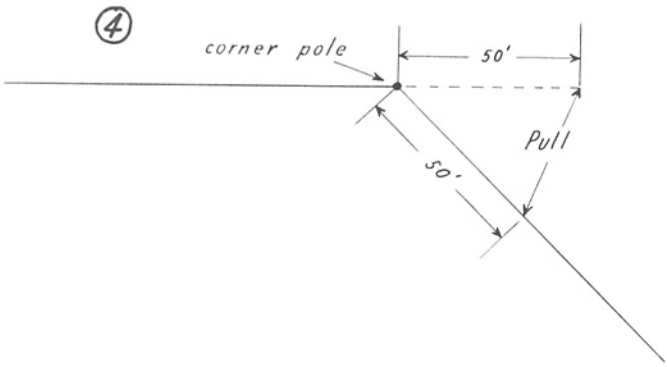



*Figure 36—(1)—(2)—(3)—(4)—Measuring "pull" at corner poles under various conditions.*

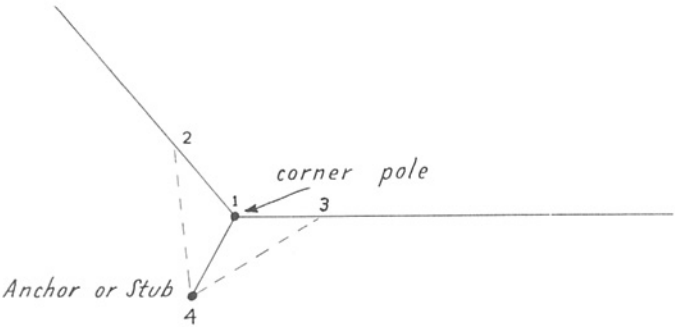



*Figure 37—Locating anchor or stub for corner pole.*

Measure off distance (1 to 2) and (1 to 3) to equal distance of "lead" 1 to 4 (anchor located from corner pole). Distance 2 to 4 and 3 to 4 are equal. Distance 1 to 2, 1 to 3 and 1 to 4 are equal. Locate anchor or stub at this point.



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## GUYS

Pole lines are guyed to meet several needs. Side guys are placed to hold the transverse stress created by the "pull" of wires or cable suspension strand at corners.

Head guys are placed to compensate and take the load where wires or cable suspension strand terminate or where an increased load is set up by long spans or steep grades.

Storm guys consist of side guys used on long straight sections of line to prevent the swaying of a line by wind. Head guys are used to prevent the collapse of a line longitudinally under extraordinary loads of wind and ice.

## OMISSION OF CORNER GUYS

Corner guys may be omitted when firm earth is encountered and when the number of wires and the "pull" on the corner does not exceed the values specified in the table below.

TABLE 40

### CORNERS — WHERE GUYS MAY BE OMITTED

| NUMBER OF WIRES TO BE ATTACHED | "PULL"—IN FEET WHERE GUY IS NOT REQUIRED | |
|---|---|---|
| | HEAVY LOADING AREA | MEDIUM AND LIGHT LOADING AREA |
| 1 - 2 | 0 ft. - 15 ft. | 0 ft. - 20 ft. |
| 3 - 6 | 0 ft. - 6 ft. | 0 ft. - 8 ft. |
| 7 - 10 | 0 ft. - 4 ft. | 0 ft. - 6 ft. |
| 11 - 20 | 0 ft. - 3 ft. | 0 ft. - 4 ft. |
| 21 - 30 | 0 ft. - 2 ft. | 0 ft. - 3 ft. |
| 31 - 50 | 0 ft. - 1 ft. | 0 ft. - 2 ft. |
| 50 - 60 | 0 ft. - 1 ft. | 0 ft. - 1 ft. |

## SIDE GUYS FOR CORNER POLES

The following tables, under the caption of Guy Selection, specify the strength of guying required at corners for open wire and aerial cable lines for each loading area.

The selection chart for corner guying as shown on the following pages specifies the required strength, in pounds, for most situations; however it must be remembered that these values must be converted to the nearest corresponding strand size.

# SIDE GUYS AT CORNERS IN HEAVY LOADING AREAS

| NO. OF WIRES | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|
| | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 1 | 1 | 33 | 25 | 18 | 13 | 11 |
| 2 | 20 | 1,300 | 1,000 | 700 | 550 | 450 |
| | 40 | 2,600 | 2,000 | 1,400 | 1,110 | 900 |
| 3-6 | 20 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 40 | 8,000 | 6,000 | 4,300 | 3,200 | 2,700 |
| 7-10 | 10 | 3,300 | 2,500 | 1,800 | 1,300 | 1,100 |
| | 15 | 4,900 | 3,800 | 2,700 | 2,000 | 1,700 |
| | 20 | 6,500 | 5,000 | 3,600 | 2,700 | 2,300 |
| | 25 | 8,000 | 6,500 | 4,500 | 3,400 | 2,800 |
| | 30 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 40 | 13,000 | 10,000 | 7,000 | 5,500 | 4,500 |
| 11-20 | 6 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 8 | 5,500 | 4,000 | 2,900 | 2,100 | 1,800 |
| | 10 | 6,500 | 5,000 | 3,600 | 2,700 | 2,300 |
| | 15 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 20 | 13,000 | 10,000 | 7,000 | 5,500 | 4,500 |
| | 25 | 16,000 | 13,000 | 9,000 | 6,500 | 5,500 |
| | 30 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| | 40 | 26,000 | 20,000 | 14,000 | 11,000 | 9,000 |
| 21-30 | 4 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 6 | 6,000 | 4,600 | 3,200 | 2,400 | 2,000 |
| | 8 | 8,000 | 6,000 | 4,300 | 3,200 | 2,700 |
| | 10 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 15 | 15,000 | 11,000 | 8,000 | 6,000 | 5,000 |
| | 20 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| | 25 | 25,000 | 19,000 | 13,000 | 10,000 | 8,500 |
| | 30 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |
| | 40 | 40,000 | 30,000 | 21,000 | 16,000 | 14,000 |



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GUY SELECTION TABLE NO. 41 (cont'd.)

# SIDE GUYS AT CORNERS IN HEAVY LOADING AREAS

| NO. OF WIRES | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|
| | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 31-40 | 4 | 5,500 | 4,000 | 2,900 | 2,100 | 1,800 |
| | 6 | 8,000 | 6,000 | 4,300 | 3,200 | 2,700 |
| | 8 | 11,000 | 8,000 | 5,500 | 4,300 | 3,600 |
| | 10 | 13,000 | 10,000 | 7,000 | 5,500 | 4,500 |
| | 15 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| | 20 | 26,000 | 20,000 | 14,000 | 11,000 | 9,000 |
| | 25 | 33,000 | 25,000 | 18,000 | 13,000 | 11,000 |
| | 30 | 40,000 | 30,000 | 21,000 | 16,000 | 14,000 |
| | 40 | ... | 40,000 | 29,000 | 21,000 | 18,000 |
| 41-50 | 4 | 6,500 | 5,000 | 3,600 | 2,700 | 2,300 |
| | 6 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 8 | 13,000 | 10,000 | 7,000 | 5,500 | 4,500 |
| | 10 | 16,000 | 13,000 | 9,000 | 6,500 | 5,500 |
| | 15 | 25,000 | 19,000 | 13,000 | 10,000 | 8,500 |
| | 20 | 33,000 | 25,000 | 18,000 | 13,000 | 11,000 |
| | 25 | ... | 32,000 | 22,000 | 17,000 | 14,000 |
| | 30 | ... | 38,000 | 27,000 | 20,000 | 17,000 |
| | 40 | ... | ... | 36,000 | 27,000 | 23,000 |
| 51-60 | 2 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 4 | 8,000 | 6,000 | 4,300 | 3,200 | 2,700 |
| | 6 | 12,000 | 9,000 | 6,500 | 4,800 | 4,100 |
| | 8 | 16,000 | 12,000 | 8,500 | 6,500 | 5,500 |
| | 10 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| | 15 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |
| | 20 | 40,000 | 30,000 | 21,000 | 16,000 | 14,000 |
| | 25 | ... | 38,000 | 27,000 | 20,000 | 17,000 |
| | 30 | ... | ... | 32,000 | 24,000 | 20,000 |
| | 40 | ... | ... | ... | 32,000 | 27,000 |

# SIDE GUYS AT CORNERS IN MEDIUM AND LIGHT LOADING AREAS

| NO. OF WIRES | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|
| | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 1 | 1 | 25 | 19 | 13 | 10 | 9 |
| 2 | 20 | 1,000 | 750 | 550 | 400 | 350 |
| | 40 | 2,000 | 1,500 | 1,100 | 800 | 700 |
| 3-6 | 20 | 3,000 | 2,300 | 1,600 | 1,200 | 1,000 |
| | 40 | 6,000 | 4,600 | 3,200 | 2,400 | 2,000 |
| 7-10 | 10 | 2,500 | 1,900 | 1,300 | 1,000 | 850 |
| | 15 | 3,700 | 2,800 | 2,000 | 1,500 | 1,300 |
| | 20 | 4,900 | 3,800 | 2,700 | 2,000 | 1,700 |
| | 25 | 6,000 | 4,700 | 3,400 | 2,500 | 2,100 |
| | 30 | 7,500 | 5,500 | 4,000 | 3,000 | 2,500 |
| | 40 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| 11-20 | 6 | 3,000 | 2,300 | 1,600 | 1,200 | 1,000 |
| | 8 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 10 | 4,900 | 3,800 | 2,700 | 2,000 | 1,700 |
| | 15 | 7,500 | 5,700 | 4,000 | 3,000 | 2,500 |
| | 20 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 25 | 12,000 | 9,500 | 6,500 | 5,000 | 4,200 |
| | 30 | 15,000 | 11,000 | 8,000 | 6,000 | 5,000 |
| | 40 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| 21-30 | 4 | 3,000 | 2,300 | 1,600 | 1,200 | 1,000 |
| | 6 | 4,500 | 3,400 | 2,400 | 1,800 | 1,500 |
| | 8 | 6,000 | 4,600 | 3,200 | 2,400 | 2,000 |
| | 10 | 7,500 | 5,500 | 4,000 | 3,000 | 2,500 |
| | 15 | 11,000 | 8,500 | 6,000 | 4,500 | 3,800 |
| | 20 | 15,000 | 11,000 | 8,000 | 6,000 | 5,000 |
| | 25 | 19,000 | 14,000 | 10,000 | 7,500 | 6,500 |
| | 30 | 22,000 | 17,000 | 12,000 | 9,000 | 7,500 |
| | 40 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |



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GUY SELECTION TABLE NO. 42 (cont'd.)

# SIDE GUYS AT CORNERS IN MEDIUM AND LIGHT LOADING AREAS

| NO. OF WIRES | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|
| | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 31-40 | 4 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 6 | 6,000 | 4,600 | 3,200 | 2,400 | 2,000 |
| | 8 | 8,000 | 6,000 | 4,300 | 3,200 | 2,700 |
| | 10 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 15 | 15,000 | 11,000 | 8,000 | 6,000 | 5,000 |
| | 20 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| | 25 | 25,000 | 19,000 | 13,000 | 10,000 | 8,500 |
| | 30 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |
| | 40 | 40,000 | 30,000 | 21,000 | 16,000 | 14,000 |
| 41-50 | 4 | 4,900 | 3,800 | 2,700 | 2,000 | 1,700 |
| | 6 | 7,500 | 5,500 | 4,000 | 3,000 | 2,500 |
| | 8 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | 10 | 12,000 | 9,500 | 6,500 | 5,000 | 4,200 |
| | 15 | 19,000 | 14,000 | 10,000 | 7,500 | 6,500 |
| | 20 | 25,000 | 19,000 | 13,000 | 10,000 | 8,500 |
| | 25 | 31,000 | 24,000 | 17,000 | 12,500 | 11,000 |
| | 30 | 37,000 | 28,000 | 20,000 | 15,000 | 13,000 |
| | 40 | ... | 38,000 | 27,000 | 20,000 | 17,000 |
| 51-60 | 2 | 3,000 | 2,300 | 1,600 | 1,200 | 1,000 |
| | 4 | 6,000 | 4,600 | 3,200 | 2,400 | 2,000 |
| | 6 | 9,000 | 7,000 | 4,800 | 3,600 | 3,100 |
| | 8 | 12,000 | 9,000 | 6,500 | 4,800 | 4,100 |
| | 10 | 15,000 | 11,000 | 8,000 | 6,000 | 5,000 |
| | 15 | 22,000 | 17,000 | 12,000 | 9,000 | 7,500 |
| | 20 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |
| | 25 | 37,000 | 28,000 | 20,000 | 15,000 | 13,000 |
| | 30 | ... | 34,000 | 24,000 | 18,000 | 15,000 |
| | 40 | ... | ... | 32,000 | 24,000 | 20,000 |

# SIDE GUYS AT CORNERS IN MEDIUM AND LIGHT LOADING AREAS

| NO. OF WIRES | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|
| | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 61-70 | 2 | 3,500 | 2,700 | 1,900 | 1,400 | 1,200 |
| | 4 | 7,000 | 5,500 | 3,800 | 2,800 | 2,400 |
| | 6 | 10,000 | 8,000 | 5,500 | 4,200 | 3,600 |
| | 8 | 14,000 | 11,000 | 7,500 | 5,500 | 4,800 |
| | 10 | 17,000 | 13,000 | 9,500 | 7,000 | 6,000 |
| | 15 | 26,000 | 20,000 | 14,000 | 11,000 | 9,000 |
| | 20 | 35,000 | 27,000 | 19,000 | 14,000 | 12,000 |
| | 25 | ... | 33,000 | 23,000 | 18,000 | 15,000 |
| | 30 | ... | 40,000 | 28,000 | 21,000 | 18,000 |
| | 40 | ... | ... | 38,000 | 28,000 | 24,000 |
| 71-80 | 2 | 4,000 | 3,000 | 2,100 | 1,600 | 1,400 |
| | 4 | 8,000 | 6,000 | 4,300 | 3,200 | 2,700 |
| | 6 | 12,000 | 9,000 | 6,500 | 4,800 | 4,000 |
| | 8 | 16,000 | 12,000 | 8,500 | 6,500 | 5,500 |
| | 10 | 20,000 | 15,000 | 11,000 | 8,000 | 7,000 |
| | 15 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |
| | 20 | 40,000 | 30,000 | 21,000 | 16,000 | 14,000 |
| | 25 | ... | 38,000 | 27,000 | 20,000 | 17,000 |
| | 30 | ... | ... | 32,000 | 24,000 | 20,000 |
| | 40 | ... | ... | ... | 32,000 | 27,000 |



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GUY SELECTION TABLE NO. 43

# CORNER GUYS FOR AERIAL CABLES

| SIZE OF SUSPENSION STRAND | WEIGHT OF CABLE PER FT. | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|---|
| | | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 6M | 0 to | 6 | 2,400 | 1,900 | 1,300 | 1,000 | 850 |
| | 2.00 | 8 | 3,300 | 2,500 | 1,800 | 1,300 | 1,100 |
| | | 10 | 4,100 | 3,100 | 2,200 | 1,700 | 1,400 |
| | | 15 | 6,000 | 4,700 | 3,300 | 2,500 | 2,100 |
| | | 20 | 8,000 | 6,500 | 4,400 | 3,300 | 2,800 |
| | | 25 | 10,000 | 8,000 | 5,500 | 4,100 | 3,500 |
| | | 30 | 12,000 | 9,500 | 6,500 | 5,000 | 4,200 |
| | | 40 | 16,000 | 13,000 | 9,000 | 6,000 | 5,500 |
| 6M | 200 | 3 | 3,000 | 2,300 | 1,700 | 1,200 | 1,000 |
| | to | 8 | 4,100 | 3,100 | 2,200 | 1,600 | 1,400 |
| | 2.25 | 10 | 5,000 | 3,900 | 2,800 | 2,100 | 1,700 |
| | | 15 | 7,500 | 6,000 | 4,100 | 3,100 | 2,600 |
| | | 20 | 10,000 | 8,000 | 5,500 | 4,100 | 3,500 |
| | | 25 | 13,000 | 9,500 | 7,000 | 5,000 | 4,400 |
| | | 30 | 15,000 | 12,000 | 8,500 | 6,000 | 5,000 |
| | | 40 | 20,000 | 16,000 | 11,000 | 8,000 | 6,000 |
| 10M | 2.26 | 2 | 3,900 | 3,000 | 2,100 | 1,600 | 1,300 |
| | to | 8 | 5,000 | 4,000 | 2,800 | 2,100 | 1,800 |
| | 4.00 | 10 | 6,000 | 5,000 | 3,600 | 2,700 | 2,200 |
| | | 15 | 10,000 | 7,500 | 5,500 | 4,000 | 3,400 |
| | | 20 | 13,000 | 10,000 | 7,000 | 5,500 | 4,500 |
| | | 25 | 16,000 | 13,000 | 9,000 | 6,000 | 5,500 |
| | | 30 | 20,000 | 15,000 | 11,000 | 8,000 | 6,000 |
| | | 40 | 26,000 | 20,000 | 14,000 | 11,000 | 9,000 |

# CORNER GUYS FOR AERIAL CABLES

| SIZE OF SUSPENSION STRAND | WEIGHT OF CABLE PER FT. | "PULL" ON POLE (FT.) | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|---|---|
| | | | Lead ¼ | Lead ⅓ | Lead ½ | Lead ¾ | Lead 1 |
| 10M | 4.01 | 2 | 5,000 | 3,900 | 2,800 | 2,100 | 1,800 |
| | to | 8 | 7,000 | 5,000 | 3,700 | 2,800 | 2,300 |
| | 5.00 | 10 | 8,500 | 6,000 | 4,600 | 3,500 | 2,900 |
| | | 15 | 13,000 | 10,000 | 7,000 | 5,000 | 4,400 |
| | | 20 | 17,000 | 13,000 | 9,500 | 7,000 | 6,000 |
| | | 25 | 21,000 | 16,000 | 12,000 | 8,500 | 7,500 |
| | | 30 | 26,000 | 20,000 | 14,000 | 10,000 | 9,000 |
| | | 40 | 34,000 | 26,000 | 19,000 | 14,000 | 12,000 |
| 16M | 5.01 | 1 | 6,000 | 4,700 | 3,000 | 2,500 | 2,100 |
| | to | 8 | 8,000 | 6,500 | 4,500 | 3,300 | 2,800 |
| | 7.00 | 10 | 10,000 | 8,000 | 5,500 | 4,200 | 3,500 |
| | | 15 | 15,000 | 12,000 | 8,500 | 6,000 | 5,500 |
| | | 20 | 21,000 | 16,000 | 11,000 | 8,500 | 7,000 |
| | | 25 | 26,000 | 20,000 | 14,000 | 10,000 | 9,000 |
| | | 30 | 31,000 | 24,000 | 17,000 | 12,000 | 11,000 |
| | | 40 | 41,000 | 32,000 | 22,000 | 17,000 | 14,000 |
| 16M | 7.01 | 1 | 4,800 | 3,600 | 2,600 | 1,900 | 1,600 |
| | to | 6 | 7,000 | 5,500 | 3,900 | 2,900 | 2,400 |
| | 8.50 | 8 | 9,500 | 7,500 | 5,000 | 3,800 | 3,300 |
| | | 10 | 12,000 | 9,000 | 6,000 | 4,800 | 4,100 |
| | | 15 | 18,000 | 14,000 | 9,500 | 7,000 | 6,000 |
| | | 20 | 24,000 | 18,000 | 13,000 | 9,500 | 8,000 |
| | | 25 | 30,000 | 23,000 | 16,000 | 12,000 | 10,000 |
| | | 30 | 36,000 | 27,000 | 19,000 | 14,000 | 12,000 |
| | | 40 | 48,000 | 36,000 | 26,000 | 19,000 | 16,000 |



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The values specified in the preceding charts are the strength required in pounds for each individual guy problem.

When the ultimate wire or cable load does not correspond with the tables, use the next larger number of wires or size of cable.

When the "pull" or the "lead" of a guy does not match with the tables, the value of the next higher "pull" or next shorter "lead" should be followed.

However, where it appears that a saving in guy strand may be effected by the actual guy requirements for an intermediate number of wires and "pulls" it may be calculated in this manner:

*Example:* — 25 wires — 12 foot "pull" — $\frac{\text{lead}}{\text{height}} = \frac{1}{2}$.

Multiply the $\frac{\text{lead}}{\text{height}}$ value given in the first line of Table 41 for one wire and one foot "pull" (18) by the actual number of wires and the "pull" involved.

$25 \times 12 \times 18 = 5{,}400$ pounds of guy. When lead is 1 use numerical value of 11 from the first line of the same table.

A corner pole supporting an open wire lead or an aerial cable should be guyed with a single guy where practicable. However, where more than one guy must be installed use the smallest number of guys of equal size and distribute their load equally.

A corner pole supporting a combined open wire lead and an aerial cable should use the combined guying values of open wire lines plus the aerial cable lines as set forth in the preceding tables.

When a corner pole supports a small aerial cable and a heavy wire lead or when a small number of wires are supported along with a large or full size aerial cable, it is not necessary to provide separate guying. However, the guy used must meet the combined requirements.

The maximum strength of a guy wire or a guy strand shall not be considered in excess of its nominal rated strength.

No. 6 BWG steel construction wire with a nominal rated strength of 1618 pounds is referred to when 203 wire or No. 6 BWG are specified.

Guy wire shall not be less than No. 6 BWG steel construction wire with a minimum breaking strength of 1618 pounds.

Guy strand shall not be less than $\frac{3}{16}$ inches in diameter with a minimum breaking strength of 1150 pounds.

## HEAD GUYS ADJACENT TO CORNERS

Pole supporting heavy loads on either side of a corner pole should be head guyed toward the corner pole as set forth in the following table:

TABLE NO. 44

| NUMBER OF WIRES SUPPORTED | "PULL" AT CORNER POLE (IN FEET) | | NUMBER AND SIZE OF GUY STRAND REQUIRED (IN POUNDS) |
|---|---|---|---|
| | HEAVY LOADING AREA | MEDIUM AND LIGHT LOADING AREA | |
| 21 - 40 | 26 ft. - 50 ft. | 31 ft. - 50 ft. | 1 — 6,000 lbs. |
| 41 - 60 | 16 ft. - 25 ft. | 26 ft. - 30 ft. | 1 — 10,000 lbs. |
| 61 - 80 | 10 ft. - 15 ft. | 15 ft. - 25 ft. | 1 — 10,000 lbs. |

## DEAD END GUYS

End poles for open wire lines and poles adjacent to them shall be guyed as indicated in the following Tables Nos. 45 and 46.

Where "H" fixtures are involved, the guy as specified shall be divided equally between the two poles of the fixture.

GUY SELECTION TABLE NO. 45

## DEAD END GUYING IN HEAVY LOADING AREAS

| NUMBER OF WIRES REQUIRED | STRENGTH OF GUYING IN LBS. | | | | | Guying for Pole Adjacent to End Terminal |
|---|---|---|---|---|---|---|
| | Lead ½ | Lead ⅔ | Lead ¾ | Lead 1 | Lead 1¼ | |
| 1 | 1,700 | 1,300 | 1,200 | 1,000 | 950 | ... |
| 2 | 3,300 | 2,600 | 2,400 | 2,000 | 1,800 | ... |
| 3-6 | 6,000 | 4,000 | 4,000 | 4,000 | 4,000 | ... |
| 7-10 | 10,000 | 10,000 | 6,000 | 6,000 | 6,000 | ... |
| 11-20 | 16,000 | 16,000 | 12,000 | 10,000 | 10,000 | ... |

(Table No. 45 continued on page 128.)



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TABLE NO. 45 (Cont'd)

| | | | | | | |
|---|---|---|---|---|---|---|
| 21-30 | 26,000 | 20,000 | 20,000 | 16,000 | 16,000 | ... |
| 31-40 | 32,000 | 26,000 | 26,000 | 20,000 | 20,000 | ... |
| 41-50 | 42,000 | 32,000 | 30,000 | 20,000 | 20,000 | 10,000 |
| 51-60 | 48,000 | 36,000 | 36,000 | 30,000 | 26,000 | 10,000 |
| 61-70 | 60,000 | 48,000 | 40,000 | 30,000 | 30,000 | 20,000 |
| 71-80 | 70,000 | 60,000 | 48,000 | 40,000 | 36,000 | 20,000 |

GUY SELECTION TABLE NO. 46

## DEAD END GUYING IN MEDIUM LOADING AREA

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN LBS. | | | | | Guying for Pole Adjacent to End Terminal |
|---|---|---|---|---|---|---|
| | Lead ½ | Lead ⅝ | Lead ¾ | Lead 1 | Lead 1¼ | |
| 1 | 1,600 | 1,300 | 1,200 | 1,000 | 900 | ... |
| 2 | 1,600 | 1,500 | 1,400 | 1,200 | 1,100 | ... |
| 3-6 | 4,000 | 4,000 | 4,000 | 4,000 | 3,600 | ... |
| 7-10 | 6,000 | 6,000 | 6,000 | 4,000 | 4,000 | ... |
| 11-20 | 12,000 | 10,000 | 10,000 | 10,000 | 6,000 | ... |
| 21-30 | 16,000 | 16,000 | 12,000 | 10,000 | 10,000 | ... |
| 31-40 | 20,000 | 16,000 | 16,000 | 16,000 | 12,000 | ... |
| 41-50 | 26,000 | 20,000 | 20,000 | 16,000 | 16,000 | ... |
| 51-60 | 30,000 | 26,000 | 26,000 | 20,000 | 20,000 | 10,000 |
| 61-70 | 36,000 | 30,000 | 26,000 | 20,000 | 20,000 | 10,000 |
| 71-80 | 40,000 | 32,000 | 30,000 | 26,000 | 26,000 | 10,000 |
| **LIGHT LOADING AREA** | | | | | | |
| 1 | 1,600 | 1,300 | 1,200 | 1,000 | 900 | ... |
| 2 | 1,600 | 1,500 | 1,400 | 1,200 | 1,100 | ... |
| 3-6 | 4,000 | 4,000 | 3,600 | 3,600 | 3,000 | ... |
| 7-10 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | ... |
| 11-20 | 10,000 | 6,000 | 6,000 | 6,000 | 4,000 | ... |
| 21-30 | 12,000 | 10,000 | 10,000 | 10,000 | 6,000 | ... |
| 31-40 | 16,000 | 12,000 | 10,000 | 10,000 | 10,000 | ... |
| 41-50 | 20,000 | 16,000 | 16,000 | 10,000 | 10,000 | ... |
| 51-60 | 20,000 | 16,000 | 16,000 | 16,000 | 12,000 | 6,000 |
| 61-70 | 26,000 | 20,000 | 20,000 | 16,000 | 16,000 | 10,000 |
| 71-80 | 30,000 | 26,000 | 20,000 | 20,000 | 16,000 | 10,000 |

## SIDE GUYING FOR END TERMINAL POLES

| NUMBER OF WIRES DEAD-ENDED | REQUIRED STRENGTH OF SIDE GUYS IN POUNDS | |
|---|---|---|
| | $\frac{L}{H}$ LESS THAN ½ | $\frac{L}{H}$ OVER ½ |
| 13 to 40 | 10,000 | 6,000 |
| 41 to 80 | 20,000 | 10,000 |

## INTERMEDIATE GUYING

Intermediate dead-end poles shall be head guyed to hold an unbalanced load due to the termination of ten wires or more. The guys required shall be determined from Tables 45 and 46.

## DEAD END GUYING FOR AERIAL CABLE TABLE NO. 48

| SIZE OF SUSPENSION STRAND DEAD ENDED (IN LBS.) | REQUIRED STRENGTH OF GUYS IN LBS. | |
|---|---|---|
| | $\frac{L}{H}$ ½ TO 1 | $\frac{L}{H}$ 1 OR MORE |
| 6,000 | 10,000 | 6,000 |
| 10,000 | 20,000 | 10,000 |
| 16,000 | 20,000 | 16,000 |

"Dead-end" poles supporting aerial cable only do not require side guys.

Where large size guys are designated it is usually desirable to install two or more guys of smaller diameter to equal the desired strength.

*Example:*

When 16,000 pound strand is designated, use one 16,000 strand or two 10,000 strands.

When 20,000 pound strand is designated, use two 10,000 pound strands.

When 30,000 pound strand is designated, use two 16,000 pound strands or three 10,000 pound strands.



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When 40,000 pound strand is designated use two 25,000 pound strands or four 10,000 pound strands.

Where an aerial cable suspension strand and an open wire lead are terminated on the same pole it will be necessary to use the combined strength of the open wire "dead end" and the aerial cable "dead end" guying as set forth in Tables 45, 46 and 48.

Where an aerial cable and an open wire lead are terminated from opposite directions, the aerial cable suspension strand shall be considered as part of the guying required to hold the open wire lead. This is providing the suspension strand is located near the center of the wire attachments.

Where aerial cable messenger strands of different strengths are terminated from opposite directions, it shall be necessary to install a head guy of the same size as the messenger strand of greater strength to hold the unbalance due to the pull of the stronger messenger strand.

Where an aerial cable messenger strand of the same size and strength terminate from opposite directions due to the change in cable size, it shall be necessary to install a head guy of one size smaller strand than the main messenger strand in order to hold the heavier cable.

## GUYS FOR RAILROAD CROSSINGS

Poles supporting a straight railroad track crossing span will require no side guys providing the poles are treated and are of such size as designated in Tables 36 and 37.

Head guys may also be omitted when the number of wires do not exceed two wires in the heavy loading area, three wires in the medium loading area and four wires in the light loading area.

Guyed poles at railroad crossing spans shall have a top circumference of not less than 15 inches.

Selection of head and side guys for poles at the crossing spans at railroad tracks will be found in Tables 49, 50, 51 and 52.

Where a 10,000 pound head guy is required, tie the two poles at the crossing spans together with a 6000 pound strand as outlined on page 137.

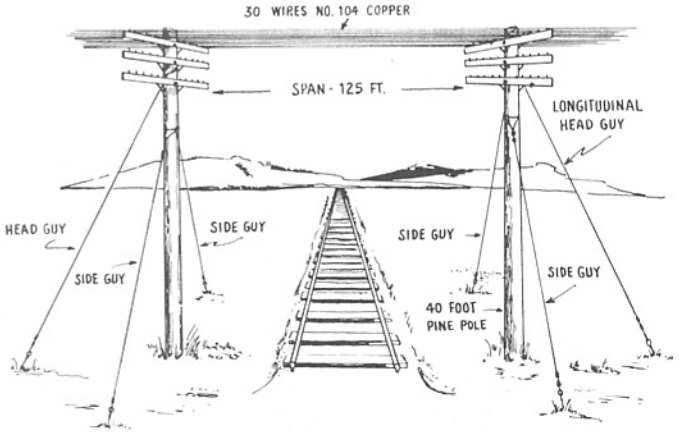



*Figure 38—Arrangement of guys at railroad crossings.*

## SIDE GUYS FOR RAILROAD TRACK CROSSING HEAVY LOADING AREAS

TABLE NO. 49

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 |
| | 100 FT. SPANS OR LESS | | | | 101 FT. TO 125 FT. SPANS | | | |
| 2-4 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 5-6 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 7-12 | 4,000 | 4,000 | 4,000 | 4,000 | 6,000 | 4,000 | 4,000 | 4,000 |
| 13-20 | 6,000 | 4,000 | 4,000 | 4,000 | 6,000 | 4,000 | 4,000 | 4,000 |
| 21-30 | 10,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 6,000 | 4,000 |
| 31-40 | 10,000 | 10,000 | 6,000 | 4,000 | 12,000 | 10,000 | 10,000 | 6,000 |
| 41-50 | 12,000 | 10,000 | 10,000 | 6,000 | 16,000 | 10,000 | 10,000 | 6,000 |
| 51-60 | 16,000 | 10,000 | 10,000 | 10,000 | 16,000 | 12,000 | 10,000 | 10,000 |
| 61-70 | 16,000 | 12,000 | 10,000 | 10,000 | 20,000 | 16,000 | 12,000 | 10,000 |
| 71-80 | 20,000 | 16,000 | 10,000 | 10,000 | 26,000 | 16,000 | 16,000 | 10,000 |



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TABLE NO. 49 (cont'd.)

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 |
| | 126 FT. TO 150 FT. SPANS | | | | 151 FT. TO 175 FT. SPANS | | | |
| 2-4 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 5-6 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 7-12 | 6,000 | 4,000 | 4,000 | 4,000 | 6,000 | 6,000 | 4,000 | 4,000 |
| 13-20 | 10,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 6,000 | 4,000 |
| 21-30 | 10,000 | 10,000 | 6,000 | 6,000 | 12,000 | 10,000 | 10,000 | 6,000 |
| 31-40 | 16,000 | 10,000 | 10,000 | 6,000 | 16,000 | 12,000 | 10,000 | 10,000 |
| 41-50 | 16,000 | 12,000 | 10,000 | 10,000 | 20,000 | 16,000 | 12,000 | 10,000 |
| 51-60 | 20,000 | 16,000 | 12,000 | 10,000 | 26,000 | 16,000 | 16,000 | 10,000 |
| 61-70 | 26,000 | 16,000 | 16,000 | 10,000 | 30,000 | 20,000 | 16,000 | 12,000 |
| 71-80 | 26,000 | 20,000 | 16,000 | 10,000 | 30,000 | 26,000 | 20,000 | 16,000 |

## SIDE GUYS FOR RAILROAD TRACK CROSSING MEDIUM LOADING AREAS TABLE NO. 50

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 |
| | 100 FT. SPANS OR LESS | | | | 101 FT. TO 125 FT. SPANS | | | |
| 2-12 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 13-20 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 21-30 | 6,000 | 4,000 | 4,000 | 4,000 | 6,000 | 4,000 | 4,000 | 4,000 |
| 31-40 | 6,000 | 4,000 | 4,000 | 4,000 | 10,000 | 6,000 | 4,000 | 4,000 |
| 41-50 | 10,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 6,000 | 4,000 |
| 51-60 | 10,000 | 6,000 | 6,000 | 4,000 | 10,000 | 10,000 | 6,000 | 6,000 |
| 61-70 | 10,000 | 10,000 | 6,000 | 4,000 | 12,000 | 10,000 | 10,000 | 6,000 |
| 71-80 | 10,000 | 10,000 | 6,000 | 6,000 | 16,000 | 10,000 | 10,000 | 6,000 |

| | 126 FT. TO 150 FT. SPANS | | | | 151 FT. TO 175 FT. SPANS | | | |
|---|---|---|---|---|---|---|---|---|
| 2-12 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 13-20 | 4,000 | 4,000 | 4,000 | 4,000 | 6,000 | 4,000 | 4,000 | 4,000 |
| 21-30 | 6,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 4,000 | 4,000 |
| 31-40 | 10,000 | 6,000 | 6,000 | 4,000 | 10,000 | 10,000 | 6,000 | 4,000 |
| 41-50 | 10,000 | 10,000 | 6,000 | 6,000 | 12,000 | 10,000 | 10,000 | 6,000 |
| 51-60 | 12,000 | 10,000 | 10,000 | 6,000 | 16,000 | 10,000 | 10,000 | 6,000 |
| 61-70 | 16,000 | 10,000 | 10,000 | 6,000 | 20,000 | 16,000 | 10,000 | 10,000 |
| 71-80 | 16,000 | 12,000 | 10,000 | 10,000 | 20,000 | 16,000 | 12,000 | 10,000 |

## SIDE GUYS FOR RAILROAD TRACK CROSSING LIGHT LOADING AREAS

TABLE NO. 51

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lead 1/3 | Lead 1/6 | Lead 2/3 | Lead 1 | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 |
| | 100 FT. SPANS OR LESS | | | | 101 FT. TO 125 FT. SPANS | | | |
| 2-12 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 13-20 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 21-30 | 6,000 | 4,000 | 4,000 | 4,000 | 6,000 | 4,000 | 4,000 | 4,000 |
| 31-40 | 6,000 | 4,000 | 4,000 | 4,000 | 6,000 | 6,000 | 4,000 | 4,000 |
| 41-50 | 6,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 6,000 | 4,000 |
| 51-60 | 10,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 6,000 | 4,000 |
| 61-70 | 10,000 | 6,000 | 6,000 | 4,000 | 10,000 | 10,000 | 6,000 | 6,000 |
| 71-80 | 10,000 | 10,000 | 6,000 | 4,000 | 12,000 | 10,000 | 6,000 | 6,000 |
| | 126 FT. TO 150 FT. SPANS | | | | 151 FT. TO 175 FT. SPANS | | | |
| 2-12 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 13-20 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| 21-30 | 6,000 | 6,000 | 4,000 | 4,000 | 6,000 | 6,000 | 4,000 | 4,000 |
| 31-40 | 10,000 | 6,000 | 4,000 | 4,000 | 10,000 | 6,000 | 6,000 | 4,000 |
| 41-50 | 10,000 | 6,000 | 6,000 | 4,000 | 10,000 | 10,000 | 6,000 | 6,000 |
| 51-60 | 10,000 | 10,000 | 6,000 | 6,000 | 12,000 | 10,000 | 10,000 | 6,000 |
| 61-70 | 12,000 | 10,000 | 10,000 | 6,000 | 16,000 | 10,000 | 10,000 | 6,000 |
| 71-80 | 16,000 | 10,000 | 10,000 | 6,000 | 16,000 | 10,000 | 10,000 | 10,000 |



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## HEAD GUYING FOR RAILROAD CROSSING

### HEAVY LOADING AREAS — TABLE NO. 52

| NO. OF WIRES | REQUIRED STRENGTH OF GUYS IN POUNDS | | | |
|---|---|---|---|---|
| | Lead ½ | Lead ⅔ | Lead ¾ | Lead 1 |
| 3 | 4,000 | 4,000 | 4,000 | 4,000 |
| 4 | 4,000 | 4,000 | 4,000 | 4,000 |
| 5-6 | 6,000 | 4,000 | 4,000 | 4,000 |
| 7-10 | 10,000 | 10,000 | 6,000 | 6,000 |
| 11-20 | 16,000 | 16,000 | 12,000 | 10,000 |
| 21-30 | 26,000 | 20,000 | 20,000 | 16,000 |
| 31-40 | 32,000 | 26,000 | 26,000 | 20,000 |
| 41-50 | 42,000 | 32,000 | 30,000 | 20,000 |
| 51-60 | 48,000 | 36,000 | 36,000 | 30,000 |
| 61-70 | 60,000 | 48,000 | 40,000 | 30,000 |
| 71-80 | 70,000 | 60,000 | 48,000 | 40,000 |

### MEDIUM LOADING AREAS

| | | | | |
|---|---|---|---|---|
| 4 | 4,000 | 4,000 | 4,000 | 4,000 |
| 5-6 | 4,000 | 4,000 | 4,000 | 4,000 |
| 7-10 | 6,000 | 6,000 | 6,000 | 4,000 |
| 11-20 | 12,000 | 10,000 | 10,000 | 10,000 |
| 21-30 | 16,000 | 16,000 | 12,000 | 10,000 |
| 31-40 | 20,000 | 16,000 | 16,000 | 16,000 |
| 41-50 | 26,000 | 20,000 | 20,000 | 16,000 |
| 51-60 | 30,000 | 26,000 | 26,000 | 20,000 |
| 61-70 | 36,000 | 30,000 | 26,000 | 20,000 |
| 71-80 | 40,000 | 32,000 | 30,000 | 26,000 |

| LIGHT LOADING AREAS | | | | |
|---|---|---|---|---|
| 5-6 | 4,000 | 4,000 | 4,000 | 4,000 |
| 7-10 | 4,000 | 4,000 | 4,000 | 4,000 |
| 11-20 | 10,000 | 6,000 | 6,000 | 6,000 |
| 21-30 | 12,000 | 10,000 | 10,000 | 10,000 |
| 31-40 | 16,000 | 12,000 | 10,000 | 10,000 |
| 41-50 | 20,000 | 16,000 | 16,000 | 10,000 |
| 51-60 | 20,000 | 16,000 | 16,000 | 16,000 |
| 61-70 | 26,000 | 20,000 | 20,000 | 16,000 |
| 71-80 | 30,000 | 26,000 | 20,000 | 20,000 |

## CABLE EQUIVALENTS FOR SIDE GUYING AT RAILROAD CROSSING

TABLE NO. 53

| WEIGHT OF CABLE | SIZE OF STRAND | EQUIVALENT NO. OF OPEN WIRES LOADING AREAS | | |
|---|---|---|---|---|
| | | HEAVY | MEDIUM | LIGHT |
| 0 to 2.24 lbs. | 6,000 lbs. | 4 | 5 | 15 |
| 2.25 lbs. to 5.00 lbs. | 10,000 lbs. | 5 | 6 | 22 |
| 5.01 lbs. to 8.50 lbs. | 16,000 lbs. | 6 | 7 | 30 |

Where an aerial cable is supported by a suspension strand and carried across a railroad track, no head guy is required.

Where an aerial cable is supported by a 6000 pound suspension strand and is combined with an open wire lead across a railroad track the crossing poles shall be head guyed as follows:

1—Refer to Table No. 52 and head guy for 10 wires less than scheduled in the heavy loading area.

2—Refer to Table No. 52 and head guy for 20 wires less than scheduled in the medium loading area.

3——Refer to Table No. 52 and head guy for 30 wires less than scheduled in the light loading area.



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Where an aerial cable is supported by a 10,000 to 16,000 pound suspension strand and is combined by an open wire lead across a railroad track, the crossing poles shall be head guyed as follows:

1—Refer to Table No. 52 and head guy for 20 wires less than scheduled in the heavy loading area.

2—Refer to Table No. 52 and head guy for 30 wires less than scheduled in the medium loading area.

3—Refer to Table No. 52 and head guy for 40 wires less than scheduled in the light loading area.

## GUYING OF CORNER POLES AT RAILROAD CROSSINGS

When one or both of the crossing poles are not in line with the crossing span, the poles shall be guyed as follows:

Where the pull on the corner poles is 10 feet or less, the guys shall be installed as shown in Figure 39.

Where the pull on the corner poles is greater than 10 feet but less than 40 feet, the guys shall be installed as shown in Figure 39.

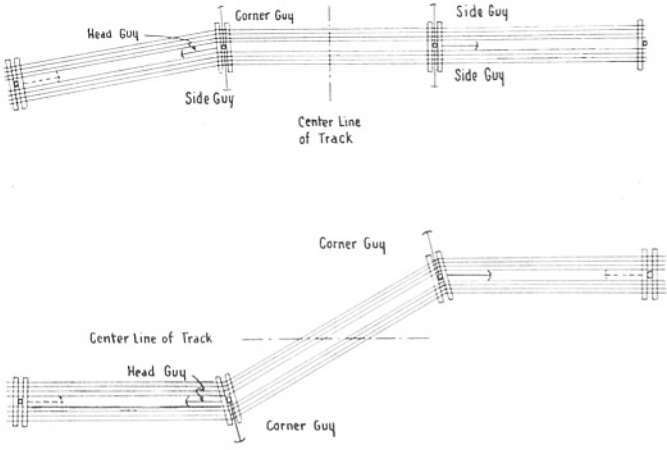



*Figure 39—Arrangement of guys at corner of major railroad crossings.*

## SPAN TIES FOR MAJOR RAILROAD CROSSING

Poles at railroad crossings that support open wire leads and require 10,000 pound head guys or more, shall be tied together with 6,000 pound strand. The strand shall be dead-ended on each pole at a point directly above the highest head guy attachment and shall maintain the standard railroad clearance of 27 ft. or more above the top of the rails.

## STORM GUYS

Storm guys shall be installed on single poles and "H" fixtures as an extra precaution against damage from wind and ice and shall be installed at corners, terminals, and on poles within greater-than-normal span lengths

The necessity of storm guying must be determined by past climatic conditions and experiences that has prevailed in the vicinity.

Normal spacing of storm guys and head guys for open wire leads are shown in the following table:

### SPACING FOR STORM GUYS TABLE NO. 54

| LOADING AREA | NO. OF WIRES | SIDE GUYS IN EACH DIRECTION | HEAD GUYS IN EACH DIRECTION |
|---|---|---|---|
| Heavy | 31-40 | Every 15th pole | Every 6th side storm guyed |
| Heavy | 41-80 | Every 8th pole | Every 10th side storm guyed |
| Medium | 31-80 | Every 15th pole | none |
| Light | 41-80 | Every 15th pole | none |

The spacing shall be considered as sections between corners and other poles where the normal installation of guys in each direction is required.

Where a pole line supports aerial cable only, no storm guying will be required.

Where a pole line supports a combination aerial cable and open wire lead, no additional side guys are required for the cable.



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## STORM GUY LOCATIONS

Table No. 54 contains data covering the spacing of storm guys. These specifications are based on normal conditions. However, it may become desirable and advisable to omit storm guys in sheltered places and to place additional guys at points where tall poles are used or where poles are set in insecure earth.

Storm guys should be installed at such points as to divide the section in equal parts.

### REQUIRED STRENGTH OF STRAND — FOR STORM GUYING — TABLE NO. 55

| LOADING AREA | NUMBER OF WIRES | L/H LESS THAN ½ | L/H OVER ½ |
|---|---|---|---|
| Heavy | 31-50 | 10,000 lbs. | 6,000 lbs. |
| | 51-80 | 20,000 lbs. | 10,000 lbs. |
| Medium | 31-50 | 10,000 lbs. | 6,000 lbs. |
| | 51-80 | 20,000 lbs. | 10,000 lbs. |
| Light | 41-60 | 10,000 lbs. | 6,000 lbs. |
| | 61-80 | 20,000 lbs. | 10,000 lbs. |

## HILL GUYING

A pole line in the heavy loading area supporting an open wire line of 20 wires or more, and built on a hill with 5 or more consecutive spans, shall be "hill-guyed."

Poles carrying 40 wires or less, shall be "hill-guyed" with 6000 pound strand.

Poles carrying more than 40 wires shall be "hill-guyed" with 10,000 pound strand.

Where the top pole on a grade is supporting an aerial cable or an open wire lead, the pole shall be guyed away from the slope. Where the length of the grade is more than 6 spans and less than 10 spans, an additional guy shall be installed on the up side of the grade on a pole nearest the middle of the grade. However, if the up grade is more than 10 spans in length, the head guy shall be installed on the up grade side of each 5th pole.

Where an aerial cable of 1⅛" or more in diameter is supported by a pole line, and where the slope is one foot in each ten feet for 5 or more consecutive spans, head guying is recommended. This is known as a 10% grade.

Guy strands for hill-guying may be one size smaller than the suspension strand used to support the aerial cable.

Where a pole line is built on a grade and supports the combined load of an aerial cable and an open wire lead, the guying shall be as specified in Table No. 48. No additional guying will be required for the open wire load.

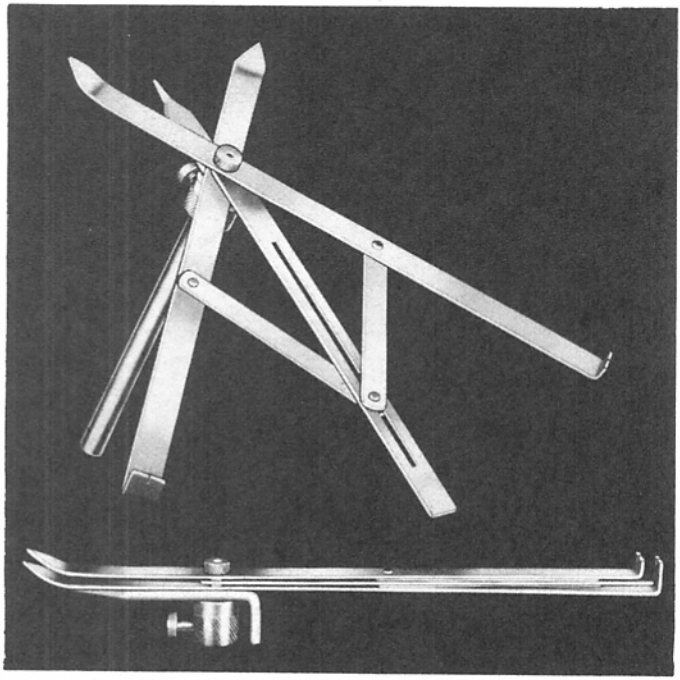


*Figure 40—Angle bisector.*



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## RURAL GUYING

In rural construction, where the load will seldom be in excess of ten wires (one arm), corner side guys will normally be installed to bisect the angle. The instrument illustrated in Figure 40 is an instrument known as a Dillon Bisector. This instrument mechanically bisects the angle. The Bisector is reasonably priced and considerable time is saved by incorporating its use; especially where new work is involved.



*Figure 41—Bisecting angle for anchor location.*

Where corners approach a right angle, it may be necessary to install head and side guys. Right angle corners should be avoided wherever possible. Where they cannot be avoided, they should be made on two poles with the pull equally divided.

The required strength of guying for various loads dealing with rural construction are set forth in Table Nos. 56, 57 and 58.

When heavier construction is under consideration or when more wires are to be guyed, use the regular guy tables.

RURAL — GUY SELECTION TABLE NO. 56

## SIDE GUYS FOR CORNER POLES

| NO. OF WIRES | "PULL" ON POLE (IN FT.) | REQUIRED STRENGTH OF GUYING IN LBS. | | | | |
|---|---|---|---|---|---|---|
| | | Lead 1/3 | Lead 1/2 | Lead 3/4 | Lead 1 | Lead OVER —1 |
| 1-4 | 1- 4 | none | none | none | none | none |
| | 5-10 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 11-20 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 21-30 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 31-40 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 41-50 | | | | | |
| 5-6 | 1- 4 | none | none | none | none | none |
| | 5-10 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 11-20 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 21-30 | 2,200 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 31-40 | 6,000 | 2,200 | 1,600 | 1,600 | 1,600 |
| | 41-50 | 6,000 | 6,000 | 2,200 | 1,600 | 1,600 |
| 7-10 | 1- 3 | none | none | none | none | none |
| | 4-10 | 1,600 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 11-20 | 2,200 | 1,600 | 1,600 | 1,600 | 1,600 |
| | 21-30 | 6,000 | 2,200 | 2,200 | 1,600 | 1,600 |
| | 31-40 | 6,000 | 6,000 | 2,200 | 2,200 | 2,200 |
| | 41-50 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |

RURAL — GUY SELECTION TABLE NO. 57

## HEAD GUYS FOR CORNER POLES

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|
| | Lead 1/3 | Lead 1/2 | Lead 2/3 | Lead 1 | Lead OVER 1 |
| 1-4 | 2,200 | 2,200 | 2,200 | 1,600 | 1,600 |
| 5-6 | 6,000 | 6,000 | 2,200 | 2,200 | 2,200 |
| 7-10 | 6,000 | 6,000 | 6,000 | 6,000 | 2,200 |



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## GUYS FOR DEAD END POLES

| NO. OF WIRES | REQUIRED STRENGTH OF GUYING IN POUNDS | | | | |
|---|---|---|---|---|---|
| | Lead ⅓ | Lead ½ | Lead ⅔ | Lead 1 | Lead OVER—1 |
| 1-4 | 6,000 | 6,000 | 6,000 | 2,200 | 2,200 |
| 5-6 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| 7-10 | 12,000 | 12,000 | 6,000 | 6,000 | 6,000 |

## TYPE OF GUYS

A side guy is installed to bisect an angle and is placed in a direction transverse to the line of the lead which it is to support.

The side guy as shown in Figure 43 shall be at right angles to the lead. The head guy shall be in line with the lead.

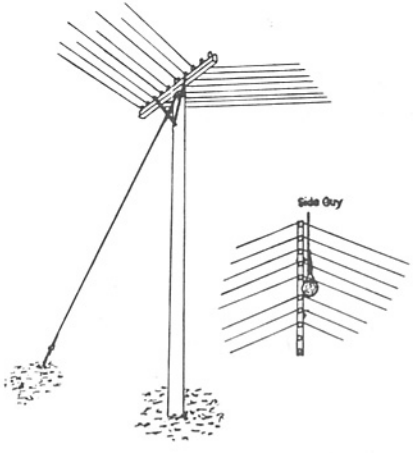



*Figure 42—Typical side guy installation.*

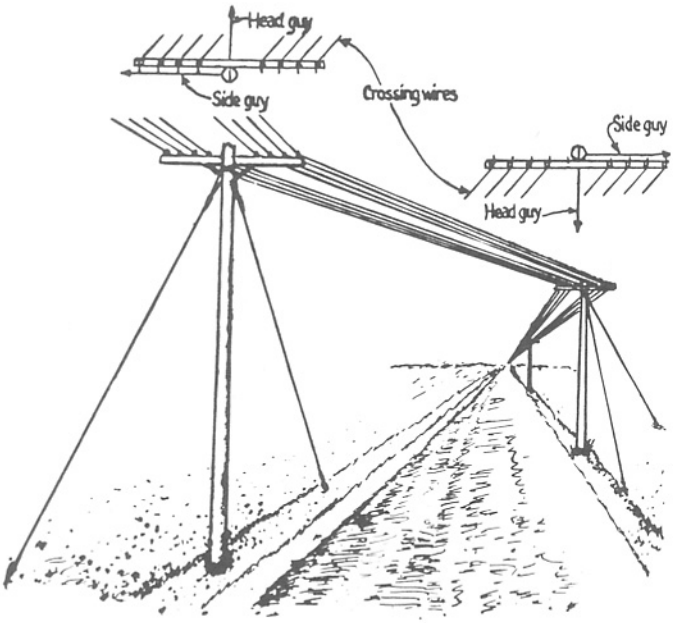



*Figure 43—Side guy combined with head guy at reverse corner.*

## HEAD GUYS

Figure 44 illustrates a typical installation of two head guys attached to a heavy corner pole. Two head guys are required when the corner pole has a pull of 30 feet or more and supports more than 20 wires.



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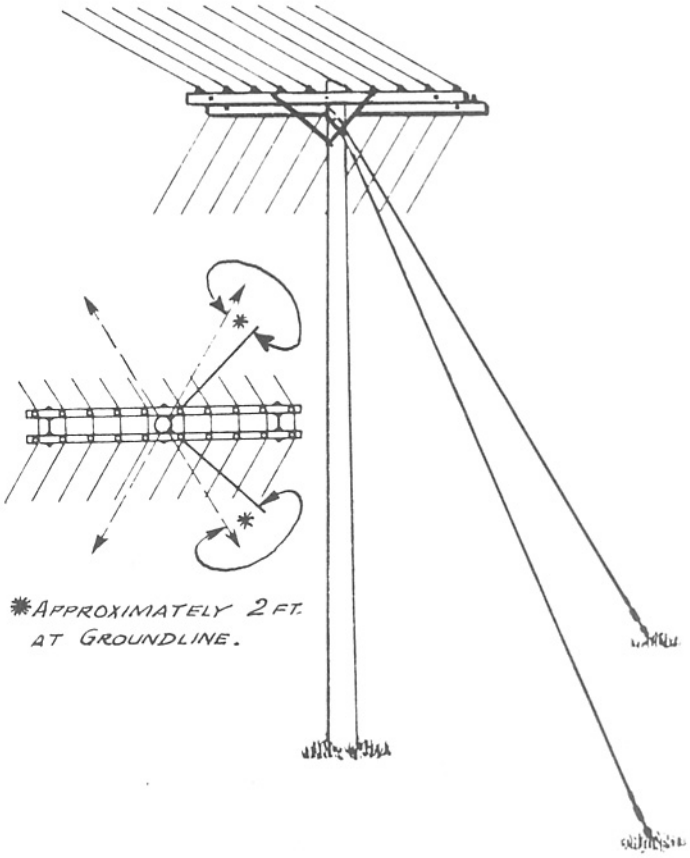



*Figure 44—Single corner—Double head guy installation.*

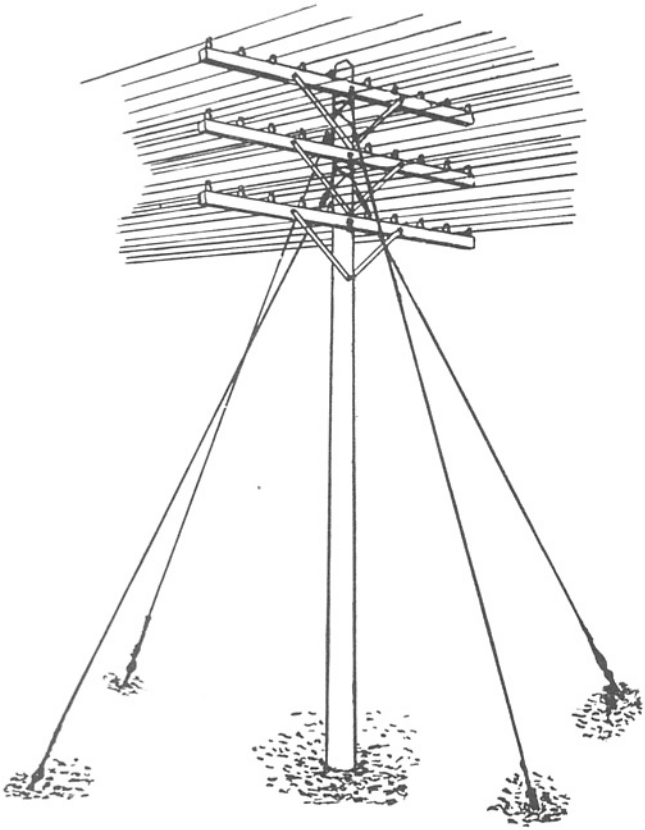


*Figure 45—Typical storm guy installation.*



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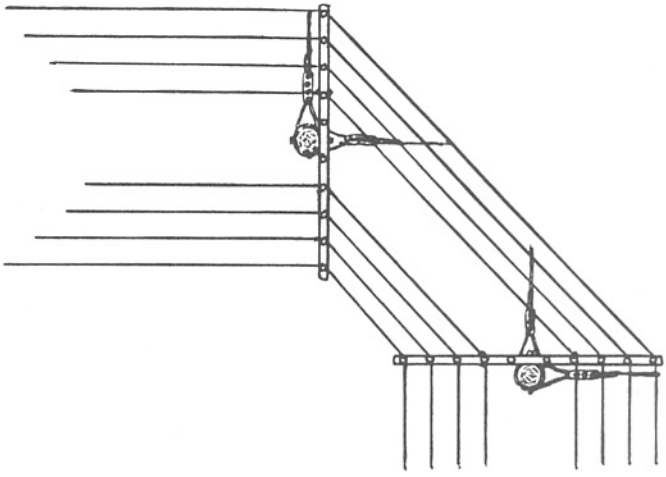


*Figure 46—Side and head guy installation at two-pole corner.*

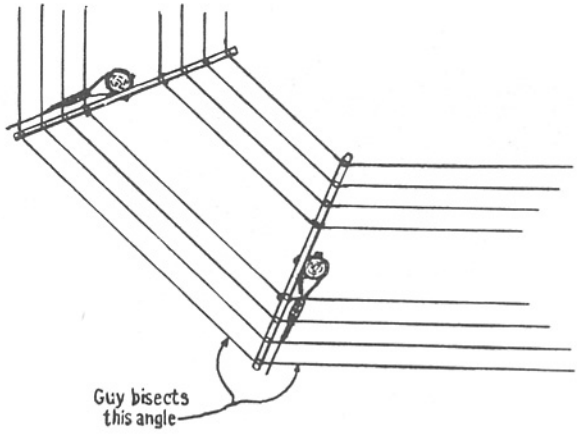



*Figure 47—Side guy installation at two-pole corner.*

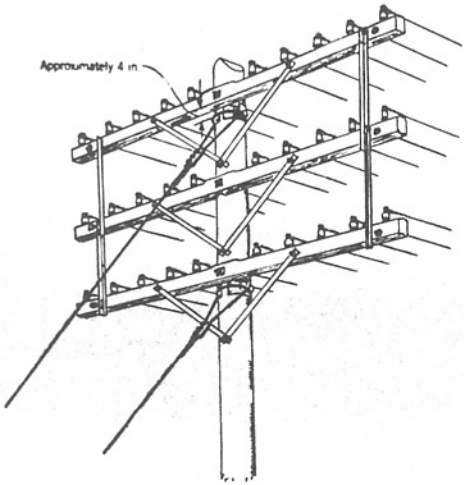



*Figure 48—Typical installation of "Dead-end" guys.*

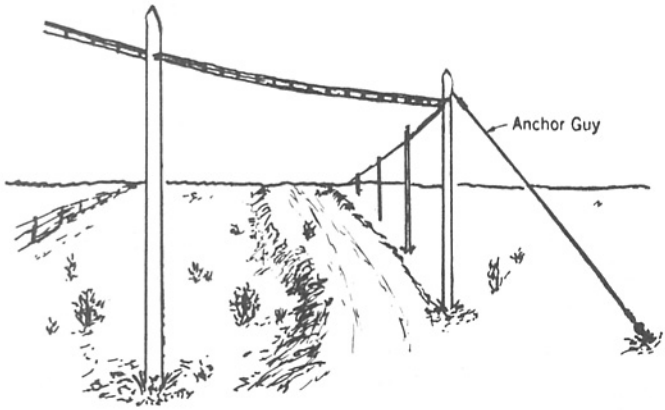



*Figure 49—Side guy on corner pole supporting aerial cable.*



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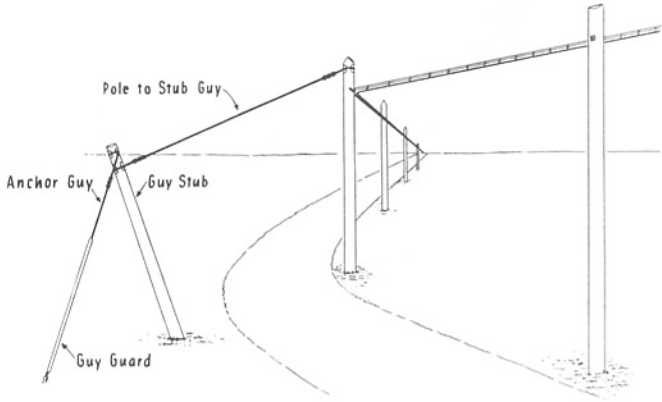



*Figure 50—Typical installation of guy stub with anchor and pole guy supporting aerial cable.*

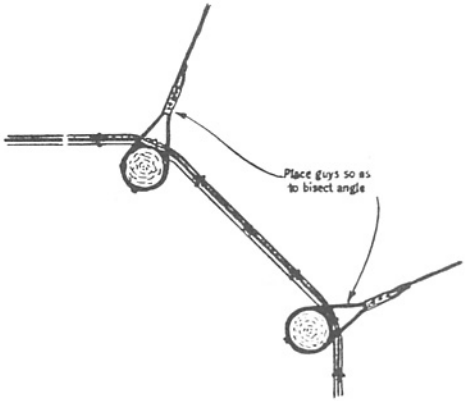



*Figure 51—Side guy installation at two-pole corner supporting aerial cable.*

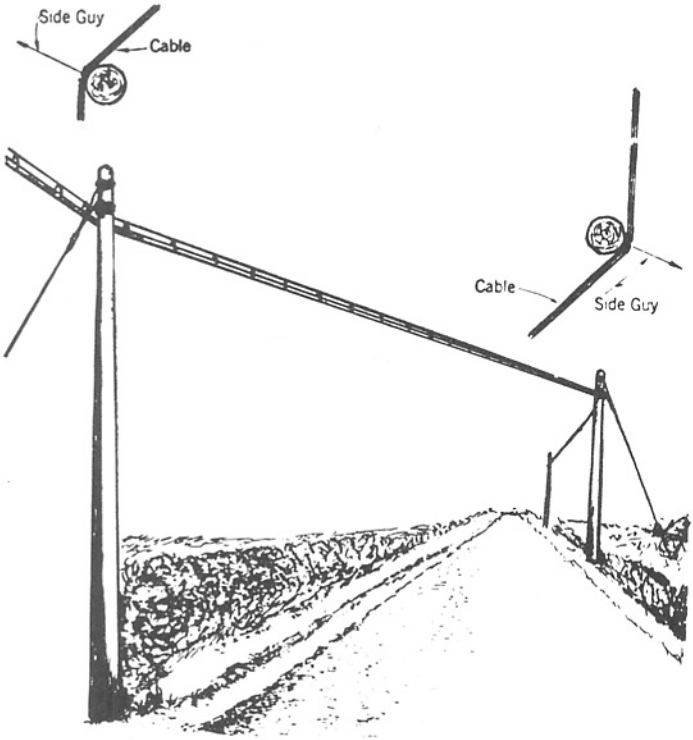



*Figure 52—Side guying reverse corner poles supporting aerial cable.*

A single guy bisecting the angle shall be used where possible. If a head guy and a side guy is required, the head guy shall be in line with the lead and the side guy shall be at right angles to the lead.



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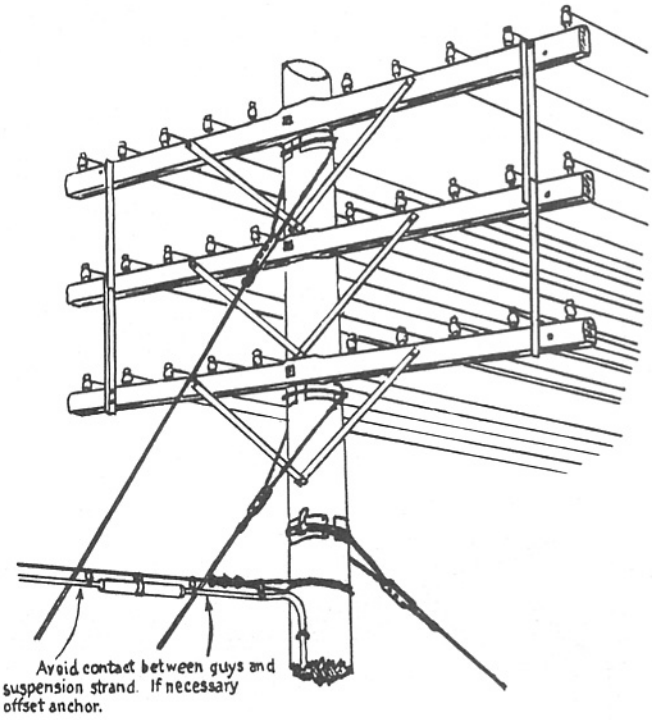



*Figure 53—"Dead-end" guying on Terminal pole supporting aerial wire and cable terminating from opposite directions.*

Figure 53 illustrates the method of guying used in connection with dead ending cable and dead ending three arms of open wire.

## WIRE FOR LIGHT GUYS AND OTHER PURPOSES

Crapo steel construction wire is especially adapted for light guys, wrapping stubbed poles and lashing of wood brackets to poles.

It is tough, flexible and has approximately the same tensile strength as B.B. Iron Wire but is more workable. However, it is not intended to meet standard electrical or transmission specifications.

The breaking strength of Crapo steel construction wire is listed in the following table.

TABLE NO. 59

### CRAPO STEEL CONSTRUCTION WIRE

| SIZE B.W.G. | DIAMETER (IN INCHES) | BREAKING STRENGTH (IN POUNDS) |
|---|---|---|
| 6 | 0.203 | 1618 |
| 8 | 0.165 | 1069 |
| 10 | 0.134 | 705 |
| 12 | 0.109 | 467 |
| 14 | 0.083 | 271 |

## STRAND GUY WIRE

The various types, sizes, weights, and minimum breaking strength of Crapo Galvanized steel suspension and guy strands are tabulated as follows:

TABLE NO. 60

### 7 WIRE, STANDARD GRADE—SINGLE GALVANIZED

| NOMINAL DIAM. OF STRAND | NOMINAL DIAMETER OF WIRE | APPROXIMATE WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|
| 3/16 in. | 0.062 in. | 72.9 lbs. | 1,150 lbs. |
| 1/4 in. | 0.080 in. | 121 lbs. | 1,900 lbs. |
| 5/16 in. | 0.104 in. | 205 lbs. | 3,200 lbs. |
| 3/8 in. | 0.120 in. | 273 lbs. | 4,250 lbs. |
| 7/16 in. | 0.145 in. | 399 lbs. | 5,700 lbs. |
| 1/2 in. | 0.165 in. | 517 lbs. | 7,400 lbs. |



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## 7 WIRE, UTILITIES GRADE—EXTRA GALVANIZED

| NOMINAL DIAM. OF STRAND | NOMINAL DIAMETER OF WIRE | APPROXIMATE WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|
| 3/16 in. | 0.062 in. | 72.9 lbs. | 1,150 lbs. |
| 1/4 in. | 0.080 in. | 121 lbs. | 1,900 lbs. |
| 5/16 in. | 0.104 in. | 205 lbs. | 3,200 lbs. |
| 3/8 in. | 0.120 in. | 273 lbs. | 4,250 lbs. |
| 7/16 in. | 0.145 in. | 399 lbs. | 5,700 lbs. |
| 1/2 in. | 0.165 in. | 517 lbs. | 7,400 lbs. |

## 7 WIRE, SIEMENS-MARTIN GRADE—EXTRA GALVANIZED

| NOMINAL DIAM. OF STRAND | NOMINAL DIAMETER OF WIRE | APPROXIMATE WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|
| 3/16 in. | 0.062 in. | 72.9 lbs. | 1,900 lbs. |
| 1/4 in. | 0.080 in. | 121 lbs. | 3,150 lbs. |
| 5/16 in. | 0.104 in. | 205 lbs. | 5,350 lbs. |
| 3/8 in. | 0.120 in. | 273 lbs. | 6,950 lbs. |
| 7/16 in. | 0.145 in. | 399 lbs. | 9,350 lbs. |
| 1/2 in. | 0.165 in. | 517 lbs. | 12,100 lbs. |

## 7 WIRE, UTILITIES GRADE—EXTRA GALVANIZED

| TRADE DESIGNATION | NOMINAL STRAND DIAMETER | NOMINAL WIRE DIAMETER | WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|---|
| 2,200-pound | 3/16 in. | 0.065 in. | 80.3 lbs. | 2,400 lbs. |
| 4,000-pound | 9/32 in. | 0.093 in. | 164 lbs. | 4,600 lbs. |
| 6,000-pound | 5/16 in. | 0.109 in. | 225 lbs. | 6,000 lbs. |
| 10,000-pound | 3/8 in. | 0.120 in. | 273 lbs. | 11,500 lbs. |
| 16,000-pound | 7/16 in. | 0.145 in. | 399 lbs. | 18,000 lbs. |
| 25,000-pound | 1/2 in. | 0.165 in. | 517 lbs. | 25,000 lbs. |

## 7 WIRE, HIGH STRENGTH—EXTRA GALVANIZED

| NOMINAL DIAM. OF STRAND | NOMINAL DIAMETER OF WIRE | APPROXIMATE WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|
| 3/16 in. | 0.062 in. | 72.9 lbs. | 2,850 lbs. |
| 1/4 in. | 0.080 in. | 121 lbs. | 4,750 lbs. |
| 5/16 in. | 0.104 in. | 205 lbs. | 8,000 lbs. |
| 3/8 in. | 0.120 in. | 273 lbs. | 10,800 lbs. |
| 7/16 in. | 0.145 in. | 399 lbs. | 14,500 lbs. |
| 1/2 in. | 0.165 in. | 517 lbs. | 18,800 lbs. |

## 7 WIRE, EXTRA HIGH STRENGTH—EXTRA GALVANIZED

| NOMINAL DIAM. OF STRAND | NOMINAL DIAMETER OF WIRE | APPROXIMATE WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|
| 3/16 in. | 0.062 in. | 72.9 lbs. | 3,990 lbs. |
| 1/4 in. | 0.080 in. | 121 lbs. | 6,650 lbs. |
| 5/16 in. | 0.104 in. | 205 lbs. | 11,200 lbs. |
| 3/8 in. | 0.120 in. | 273 lbs. | 15,400 lbs. |
| 7/16 in. | 0.145 in. | 399 lbs. | 20,800 lbs. |
| 1/2 in. | 0.165 in. | 517 lbs. | 26,900 lbs. |

## 3 WIRE, UTILITIES GRADE—EXTRA GALVANIZED

| NOMINAL DIAM. OF STRAND | NOMINAL DIAMETER OF WIRE | APPROXIMATE WEIGHT PER 1000 FEET | MINIMUM BREAK'G STR'GTH |
|---|---|---|---|
| 1/4 in. | 0.120 in. | 116.7 lbs. | 3,150 lbs. |
| 1/4 in. | 0.120 in. | 116.7 lbs. | 4,500 lbs. |
| 5/16 in. | 0.145 in. | 170.6 lbs. | 6,500 lbs. |
| 3/8 in. | 0.165 in. | 220.3 lbs. | 8,500 lbs. |

Crapo Galvanized Steel Strand is regularly furnished in the following standard lengths: 250, 500 and 1,000 foot coils; 1,000, 2,500 and 5,000 foot reels. Special lengths will be supplied if specified.



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## ANCHORS

The use of expanding, plate, cone and screw type anchors has practically replaced log or slug anchors except in swampy or loosely packed soil. A general rule is that anchors of this type should not be used in ground that caves considerably during digging operations. Listed below are tables giving the characteristics of several of the more commonly used anchors. There are many other anchors on the market which have equal holding power and other desirable features. It is not our intention to describe and illustrate all known types of anchors, but rather to give an average indication of the wide range of patent anchors in general. Size of rods for use with the various types is incorporated in Selection Table No. 61. (Selecting Anchors and Anchor Rods).

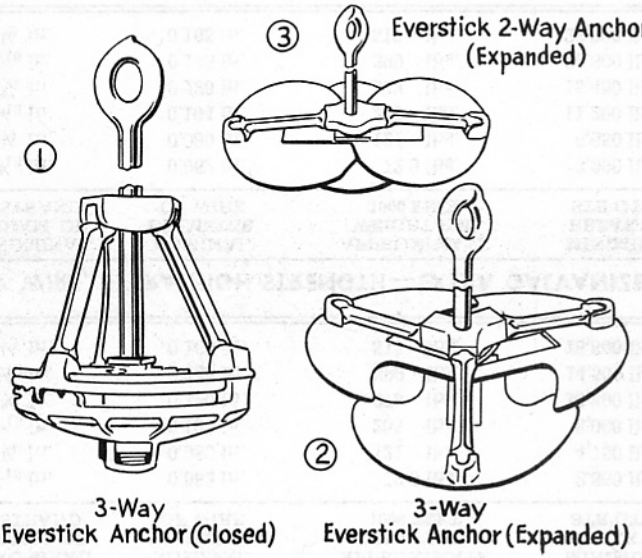



*Figure 54—Everstick expanding anchors—(1) 3-way closed—(2) 3-way expanded—(3) 2-way expanded.*

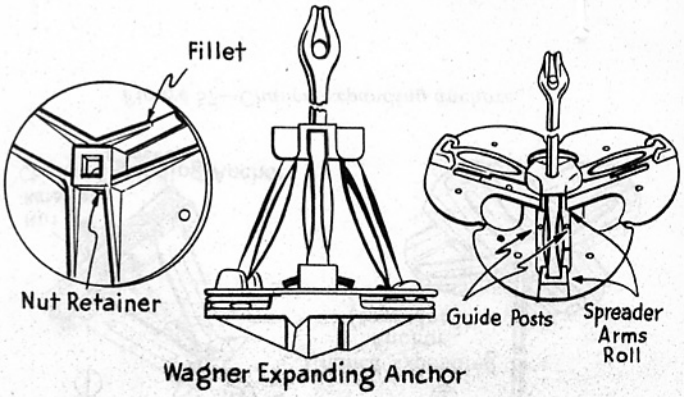



*Figure 55—Wagner expanding anchors.*

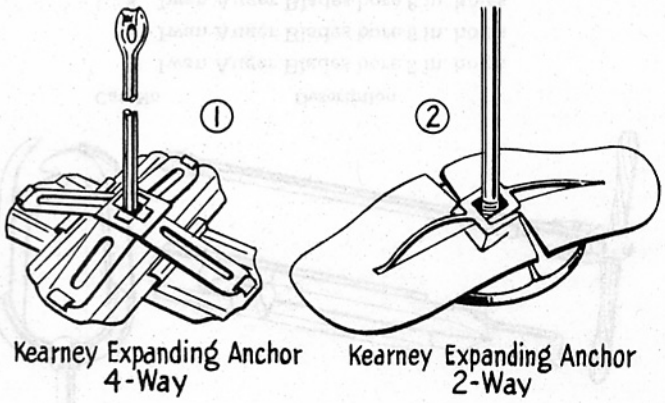



*Figure 56—Kearney expanding anchors.*

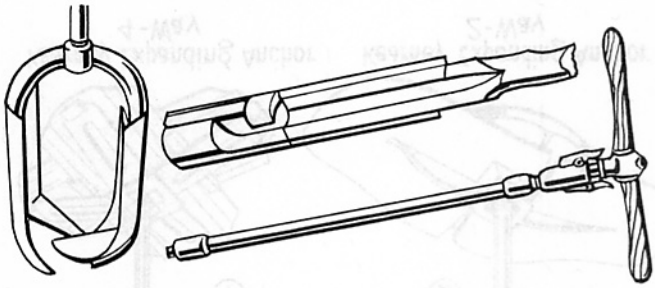


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## ANCHOR INSTALLING TOOLS



| Cat. No. | Description |
|---|---|
| 5 | Iwan Auger Blades bore 5 in. holes |
| 6 | Iwan Auger Blades bore 6 in. holes |
| 8 | Iwan Auger Blades bore 8 in. holes |
| 10 | Iwan Auger Blades bore 10 in. holes |
| 12 | Iwan Auger Blades bore 12 in. holes |
| 8 | Telescopic Handle, 8 Ft. |
| 10 | Telescopic Handle, 10 Ft. |
| | 9 Ft. Everstick Tamping Bar |

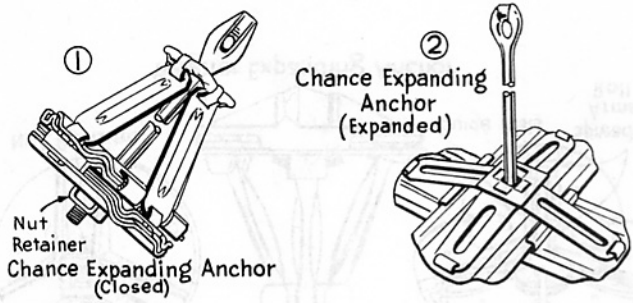



*Figure 57—Chance expanding anchors.*




*Figure 58—Typical expanding anchor installation.*



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## EVERSTICK EXPANDING ANCHORS

*For Anchor and Anchor Rod* SELECTION TABLE NO. 61

| KELLOGG CATALOG NUMBER | DESCRIPTION AND SIZE OF ANCHOR | SIZE OF GUY STRAND (IN LBS.) | RECOMMENDED SIZE OF ANCHOR ROD | HOLDING POWER (IN POUNDS) | | |
|---|---|---|---|---|---|---|
| | | | | ORDINARY SOIL | FIRM SOIL | HARD PAN |
| 52 | 5″-2-way | 1,618 | J-7406-½″x6′ | 2,000 | 3,000 | 5,000 |
| 62 | 6″-2-way | 2,200 | J-7406-½″x6′ | 3,000 | 6,000 | 7,000 |
| 82 | 8″-2-way | 6,000 | J-7418-⅝″x8′ | 7,000 | 14,000 | 16,000 |
| 633 | 6″-3-way | 2,200 | J-7406-½″x6′ | 3,000 | 6,000 | 11,000 |
| 834 | 8″-3-way | 4,000 | J-7407-½″x7′ | 4,000 | 8,000 | 14,000 |
| 836 | 8″-3-way | 6,000 | J-7418-⅝″x8′ | 6,000 | 12,000 | 18,000 |
| 8310 | 8″-3-way | 10,000 | J-7529-¾″x9′ | 10,000 | 20,000 | 24,000 |
| 8312 | 8″-3-way | 12,000 | J-7529-¾″x9′ | 12,000 | 24,000 | 24,000 |
| 103-16 | 10″-3-way | 16,000 | J-7544-1″x10′ | 20,000 | 40,000 | 45,000 |
| 64 | 6″-4-way | 4,000 | J-7407-½″x7′ | 4,000 | 8,000 | 12,000 |
| 84¾ | 8″-4-way | 6,000 | J-7418-⅝″x8′ | 12,000 | 24,000 | 24,000 |
| 84-1 | 8″-4-way | 10,000 | J-7529-¾″x9′ | 12,000 | 24,000 | 24,000 |
| 104 | 10″-4-way | 16,000 | J-7540-1″x10′ | 16,000 | 32,000 | 50,000 |
| 124 | 12″-4-way | 25,000 | J-7540-1″x10′ | 32,000 | 64,000 | 70,000 |

## WAGNER EXPANDING ANCHORS

| | | | | | | |
|---|---|---|---|---|---|---|
| 62-W | 6″-2-way | 2,200 | J-7406-½″x6′ | 3,000 | 6,000 | 7,000 |
| 82-W | 8″-2-way | 6,000 | J-7418-⅝″x8′ | 7,000 | 14,000 | 16,000 |
| 633-W | 6″-3-way | 22,000 | J-7406-½″x6′ | 3,000 | 6,000 | 11,000 |
| 834-W | 8″-3-way | 4,000 | J-7407-½″x7′ | 4,000 | 8,000 | 14,000 |
| 836-W | 8″-3-way | 6,000 | J-7418-⅝″x8′ | 6,000 | 12,000 | 18,000 |
| 8310-W | 8″-3-way | 10,000 | J-7529-¾″x9′ | 10,000 | 20,000 | 24,000 |
| 8312-W | 8″-3-way | 12,000 | J-7529-¾″x9′ | 12,000 | 24,000 | 24,000 |
| 10316-W | 10″-3-way | 16,000 | J-7544-1″x10′ | 20,000 | 40,000 | 45,000 |
| 84-W | 8″-4-way | 10,000 | J-7529-¾″x9′ | 12,000 | 24,000 | 24,000 |
| 84-1-W | 8″-4-way | 10,000 | J-7529-¾″x9′ | 12,000 | 24,000 | 24,000 |
| 104-W | 10″-4-way | 16,000 | J-7540-1″x10′ | 16,000 | 32,000 | 50,000 |

## KEARNEY EXPANDING ANCHORS

### *For Anchor and Anchor Rod* SELECTION TABLE NO. 61 (cont'd.)

| KELLOGG CATALOG NUMBER | DESCRIPTION AND SIZE OF ANCHOR | SIZE OF GUY STRAND (IN LBS.) | RECOMMENDED SIZE OF ANCHOR ROD | HOLDING POWER (IN POUNDS) | | |
|---|---|---|---|---|---|---|
| | | | | ORDINARY SOIL | FIRM SOIL | HARD PAN |
| 37533 | 3¾"-2-way | 2,200 | J-7406-½"x6' | 2,500 | 3,500 | 4,500 |
| 5053 | 5"-2-way | 2,200 | J-7407-½"x7' | 4,500 | 6,000 | 7,500 |
| 6076 | 6"-2-way | 4,000 | J-7407-½"x7' | 6,500 | 8,500 | 10,500 |
| 8120 | 8"-2-way | 6,000 | J-7418-⅝"x8' | 10,500 | 14,000 | 17,500 |
| 8136 | 8"-2-way | 10.000 | J-7529-¾"x9' | 12,000 | 16,000 | 20,000 |
| 8090 | 8"-3-way | 4,000 | J-7407-½"x7' | 6,500 | 8,500 | 10,500 |
| 8110 | 8"-3-way | 6,000 | J-7418-⅝"x8' | 8,500 | 11,500 | 14,500 |
| 8125 | 8"-3-way | 10,000 | J-7529-¾"x9' | 11,000 | 14,500 | 18,000 |
| 84090 | 8"-4-way | 4,000 | J-7407-½"x7' | 6,500 | 8,500 | 10,500 |
| 84125 | 8"-4-way | 10,000 | J-7529-¾"x9' | 11,000 | 14,500 | 18,000 |
| 84140 | 8"-4-way | 12,000 | J-7529-¾"x9' | 13,000 | 17,000 | 21,000 |

## CHANCE EXPANDING ANCHORS

| | | | | | | |
|---|---|---|---|---|---|---|
| C-62 | 6"-2-way | 2,200 | J-7406-½"x6' | 3,000 | 5,000 | 7,000 |
| C-64 | 6"-4-way | 4,000 | J-7407-½"x7' | 5,000 | 7,000 | 9,000 |
| C-745 | 7"-4-way | | | 6,000 | 10,000 | 14,000 |
| C-846 | 8"-4-way | 6,000 | J-7418-⅝"x8' | 8,000 | 12,000 | 16,000 |
| C-8410 | 8"-4-way | 10,000 | J-7529-¾"x9' | 11,000 | 17,000 | 23,000 |
| C-104 | 10"-4-way | 16,000 | J-7540-1"x10' | 16,000 | 24,000 | 32,000 |
| C-1044 | 10"-4-way | 20,000 | J-7540-1"x10' | 20,000 | 30,000 | 40,000 |
| C-124 | 12"-4-way | 25,000 | J-7340-1"x10' | 24,000 | 32,000 | 42,000 |

## INSTALLATION OF EXPANDING ANCHORS

1—Drill a hole slightly larger than the diameter of the anchor to be installed and at an angle in line with the point of attachment.

2—Place the anchor in the hole and expand the blades by striking the collar of the anchor with a tamping bar tool as shown in Fig. 58.

3—The anchor rod should extend above the ground level not less than 6 inches.



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An alternate method of installation is shown in Figure 59, which is especially suited for the large 12 inch 4-way expanding anchor. Hand augers or powered KA-MO earth boring drills may be used for the excavations.

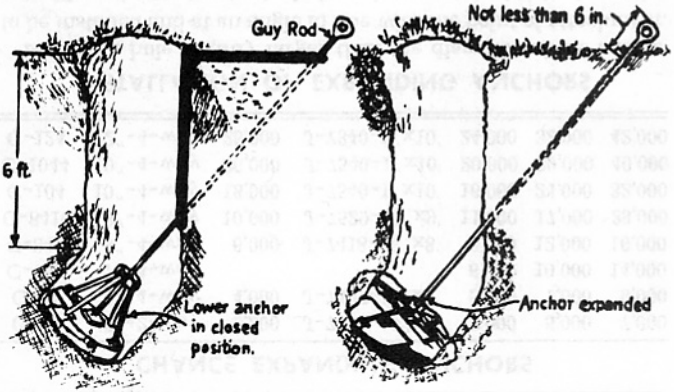



*Figure 59—Typical 4-way expanding anchor installation.*

## VERTICAL INSTALLATION OF EXPANDING ANCHORS

1—Bore a vertical hole which will be suitable for the diameter of the anchor selected (see Fig. 59).

2—Cut a slot in the earth from the vertical hole toward the pole to be guyed and in such a manner that the anchor rod will be in line with the anchor and the point of attachment.

3—Place the handle of the auger or long handle spoon into the slot and excavate the bend in the hole.

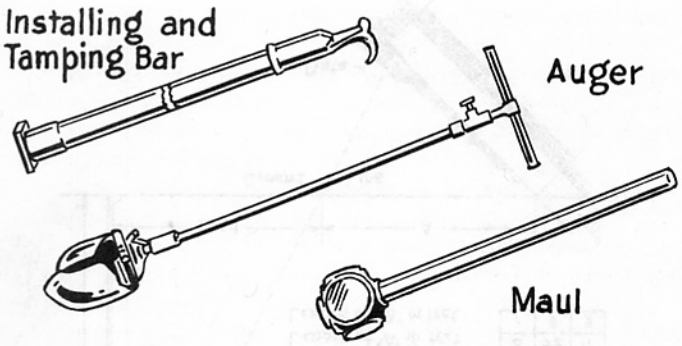
4—Place the anchor in the hole and force it into the pocket by the aid of a digging bar or any other suitable tool.

5—Expand plates to their full extent by directing blows on the collar of the anchor.

6—Anchor rods should extend at least 6 inches above the earth.

7—Back fill and tamp earth firmly.

## CHANCE INSTALLING TOOLS




| Cat. No. | Descriptions | Weight Each |
|---|---|---|
| C- 15 | 10 Ft. Never-Creep Installing and Tamping Bar | 9 lbs. |
| C- 16 | Wood Faced Maul | 12 lbs. |
| C-610 | Telegraph Auger, 5⅜ in. to 7¾ in. | 26 lbs. |
| C-812 | Heavy Telegraph Auger, 8 in. to 12¾ in. | 28 lbs. |
| C-177 | Quick Catch, Telescoping Auger Handle | 10 lbs. |

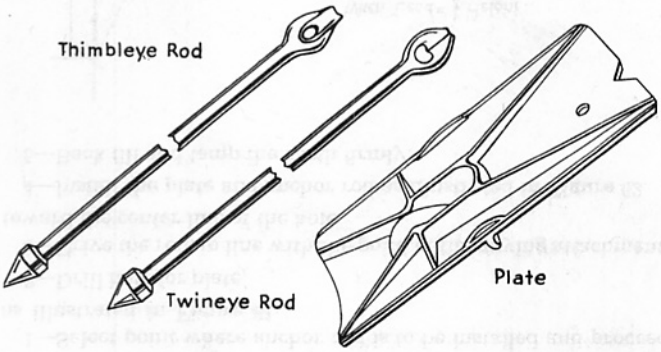



*Figure 60—Never-Creep anchor plate and rods.*



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## INSTALLATION OF PLATE ANCHORS

1—Select point where anchor rod is to be installed and proceed as illustrated in Figure 61.

2—Drill hole for plate.

3—Drive the rod, in line with the point of the guying attachment, toward the center line of the hole.

4—Install the plate and anchor rod as illustrated in Figure 62.

5—Back fill and tamp the earth firmly.

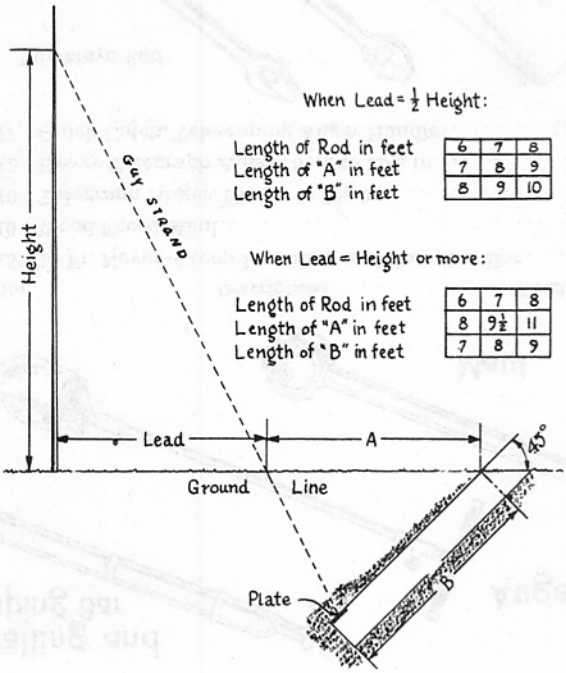



*Figure 61—Anchor rod selection for plate anchor installation.*

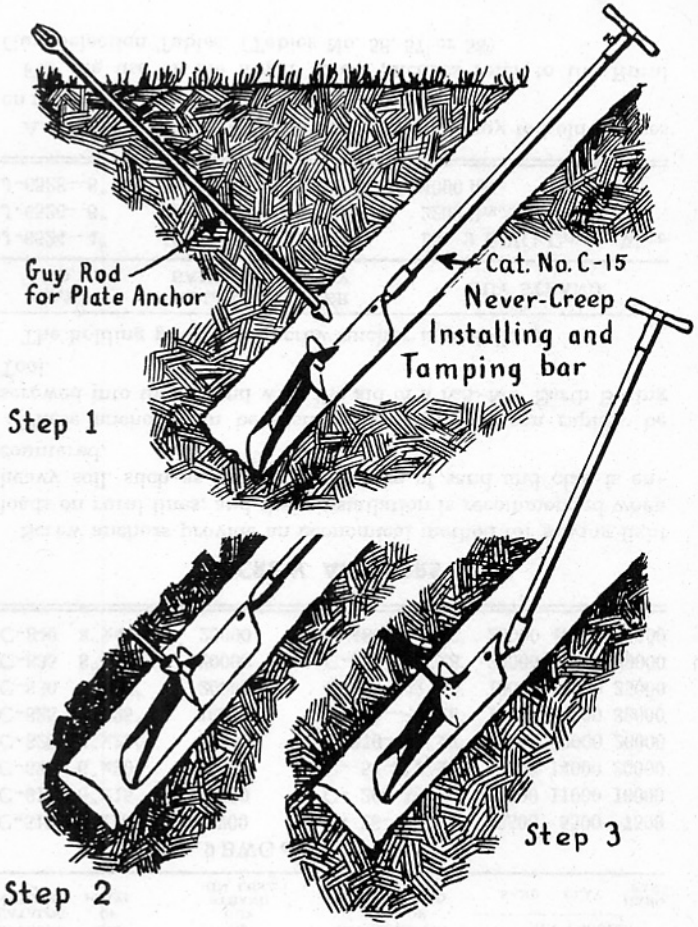



*Figure 62—Method of installing plate anchors.*



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## CHANCE—NEVER-CREEP PLATE ANCHORS

*For Anchor and Anchor Rod* SELECTION TABLE NO. 62

| KELLOGG CATALOG NUMBER | SIZE OF PLATE | SIZE OF GUY STRAND (IN LBS.) | RECOMMENDED SIZE OF ANCHOR ROD | HOLDING POWER (IN POUNDS) | | |
|---|---|---|---|---|---|---|
| | | | | SAND | CLAY | HARD PAN |
| | | No. 9 BWG or | | | | |
| C-510 | 5″x10″ | 2200 | C- 26—½″x6′ | 3500 | 5500 | 7500 |
| C-615 | 6″x15″ | 4000 | C- 26—½″x6′ | 5500 | 11000 | 16000 |
| C-620 | 6″x20″ | 6000 | C- 57—⅝″x7′ | 8000 | 14000 | 20000 |
| C-820 | 8″x20″ | 10000 | C-370—¾″x7′ | 12000 | 20000 | 26000 |
| C-825 | 8″x25″ | 16000 | C-380—¾″x8′ | 16000 | 24000 | 32000 |
| C-830 | 8″x30″ | 20000 | C-380—¾″x8′ | 18000 | 27000 | 35000 |
| C-835 | 8″x35″ | 20000 | C-380—¾″x8′ | 20000 | 31000 | 39000 |
| C-840 | 8″x40″ | 25000 | C-180— 1″x8′ | 28000 | 40000 | 50000 |

## SCREW ANCHORS

Screw anchors provide an economical method for guying light loads on rural lines; and their installation is recommended when heavy soil, such as clay or a mixture of sand and clay is encountered.

These anchors can be installed by hand or can rapidly be screwed into the ground with the aid of a KA-MO Earth Boring Tool.

The holding power of a screw anchor is as follows:

| CAT. NO. | HOLDING POWER SAND | CLAY | GUY STRAND |
|---|---|---|---|
| J-6524—4″ | 1000 lbs. | 2000 lbs. | No. 9 BWG Const. Wire |
| J-6526—6″ | 2500 lbs. | 3500 lbs. | 2200 lbs. |
| J-6528—8″ | 6000 lbs. | 7500 lbs. | 4000 lbs. |

A 4″ screw anchor will provide a suitable guy to hold 4 wires on rural lines.

For the use of the larger screw anchors refer to the Rural Guy Selection Tables. (Tables No. 56, 57 or 58).

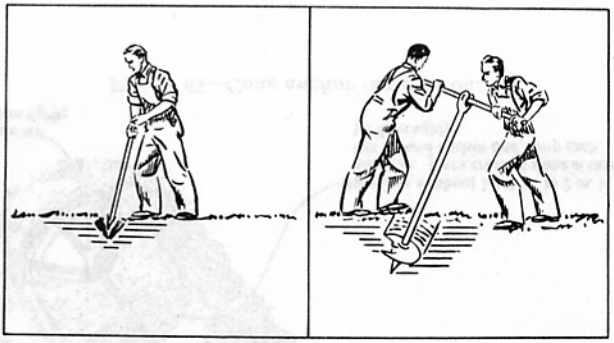


*Figure 63—Installation of screw anchor—hand method.*

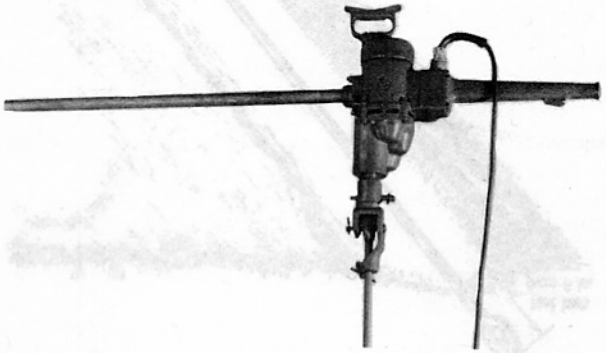


*Figure 64—Installation of screw anchors by motor.*

Remove grass roots or other vegetation and place the screw anchor in the hole, in line with the point of attachment on the pole. Proceed as shown in illustration. (Figure 63)

Turn the anchor until 6" remain above the ground line.

The eye of the rod should be at right angles to line of guying.



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## CONE ANCHORS

Where cone type anchors are placed with larger than 2200 pound strand, it is desirable to tamp stone (1½ to 2 inches in diameter) on top of the anchor for about 12 inches.

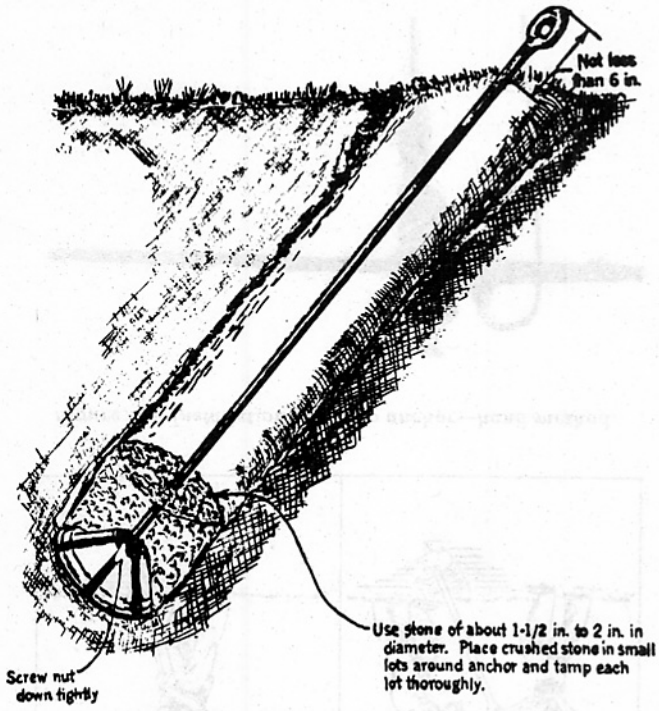



*Figure 65—Cone anchor installation.*

## ROCK ANCHORS

When rock formation is encountered, the rock-type anchor shall be installed. Figure 66 illustrates three rock-type anchors, incorporating the use of standard guy thimbles.

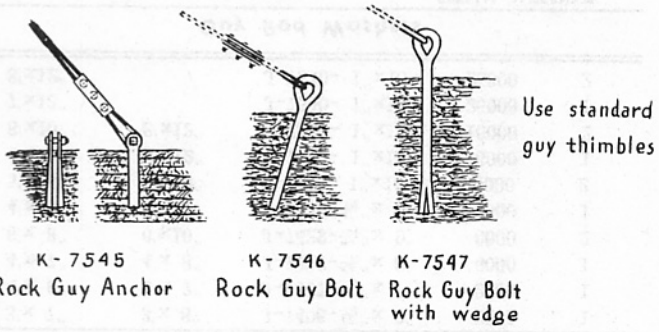



*Figure 66—Rock anchor installations.*

The K-7545 rock guy anchor is 9½" long. It is equipped with a wedge and a ¾"x2½" machine bolt.

The K-7546 rock guy bolt with drop forged eye (1½"x2" inside) is 18 inches long and 1 inch in diameter.

The K-7547 rock guy bolt is similar to the K-7546 but equipped with a wedge. The size is 18"x1" with a 1½"x2" drop forged eye.

Each of the rock anchors may be used when rock is encountered at the surface or below the surface of the earth.

The rock anchors may be installed in a vertical position or at an angle tilted away from the direction of the strain.

Because of extreme variations in soil conditions, considerable judgment must be exercised in selecting the proper anchor for individual installations.

The holding power of any of the described types of anchors will be considerably less in swampy or loose ground than in sand or ordinary soil.



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## LOG ANCHORS

Log anchors shall be used where the soil is loose, swampy, or where enormous loads are to be held.

Use durable and treated timber for logs.

Log anchors shall be set horizontally and at right angles to the guy. Trenches for the anchor rods shall be dug so that the rod will be in line with the point of attachment on the pole. Under no circumstances shall it be less than 45 degrees to the ground level.

The length and width of the excavation shall be as small as practical.

Square washers shall be placed under the nut on the rod and screwed up as far as the threads allow it to go.

The anchor rod should extend approximately 6 inches above the ground.

All excavations should be refilled with earth and tamped firmly.

## LOG ANCHORS

### *Anchor and Anchor Rod*

**SELECTION TABLE NO. 63**

| MINIMUM SIZE OF ROUND LOGS | MINIMUM SIZE OF SPLIT LOGS | SIZE OF ANCHOR RODS | SIZE OF STRAND (IN LBS.) | NUMBER OF GUYS AND RODS |
|---|---|---|---|---|
| 3'x 7" | 3'x 8" | J-7406-½"x 6' | 2200 | 1 |
| 4'x 6" | 4'x 7" | J-7407-½"x 7' | 2200 | 1 |
| 4'x 7" | 4'x 8" | J-7418-⅝"x 8' | 6000 | 1 |
| 6'x 8" | 6'x10" | J-7429-¾"x 9' | 6000 | 2 |
| 4'x10" | 4'x11" | J-7429-¾"x 9' | 10000 | 1 |
| 5'x 8" | 5'x 9" | J-7440- 1"x10' | 10000 | 2 |
| 6'x10" | 6'x12" | J-7540- 1"x10' | 16000 | 1 |
| 8'x10" | 8'x12" | J-7540- 1"x10' | 16000 | 2 |
| 7'x12" | | J-7540- 1"x10' | 25000 | 1 |
| 8'x12" | | J-7540- 1"x10' | 25000 | 2 |

### *Guy Rod Washers*

| | REGULAR SQUARE WASHERS | SPECIAL ALTERNATE TYPE OF WASHER |
|---|---|---|
| ½" rod | J-1073-2"x2"x⅛" | |
| ⅝" rod | J-1082-4"x4"x¼" | J-6860 Guy Rod Washer |
| ¾" rod | J-1082-4"x4"x¼" | J-6860 Guy Rod Washer |
| 1" rod | J-1081-4"x4"x½" | |

## DEPTH OF LOG ANCHOR TABLE NO. 64

| SIZE OF ANCHOR-HOLDING POWER (IN POUNDS) | VERTICAL DEPTH (IN FEET) ONE ROD | VERTICAL DEPTH (IN FEET) TWO RODS |
|---|---|---|
| 2200 | 4 | ... |
| 6000 | 4½ | 5 |
| 10000 | 5 | 6½ |
| 16000 | 6 | 7 |
| 25000 | 6½ | 7 |

Under ordinary conditions and in ordinary soil, the excavations for a log anchor shall be dug vertically to the depth as indicated in Table 64. However, the actual distance to the bottom of the hole may vary with the lead of the guy and the slope of the ground, but in no case shall the vertical depth be less than 4 feet.

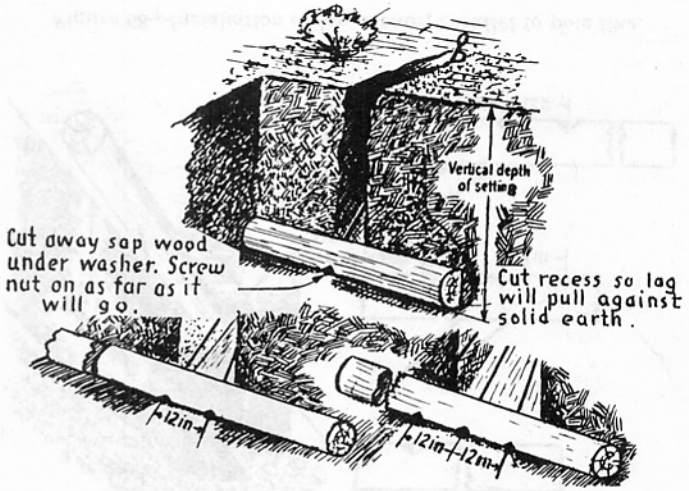



*Figure 67—Installation of log anchor at right angle to pole line.*



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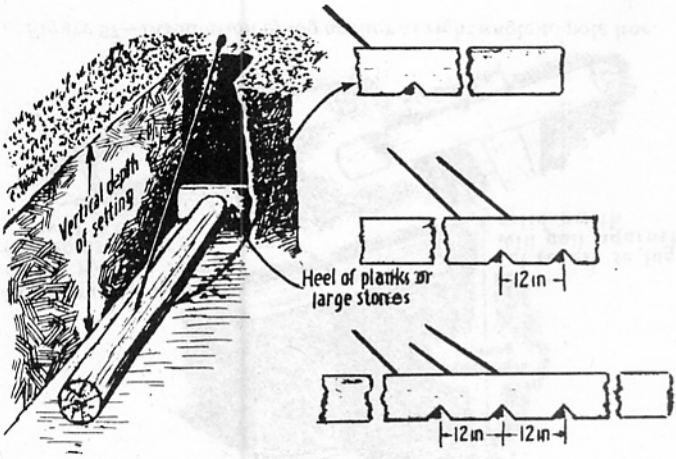



*Figure 68—Installation of log anchor, parallel to pole line.*

When a guy rod of sufficient length is used, the log may be decreased by one foot in length provided the depth of setting is increased one half foot. Locate the log in line with the guy when obstacles prevent it from being installed in a right angle position.

In soft ground or where enormous loads are to be held, additional anchorage may be obtained by placing a heavy plank or log across the anchor log as indicated in the following illustrations (Figs. 69 and 70).

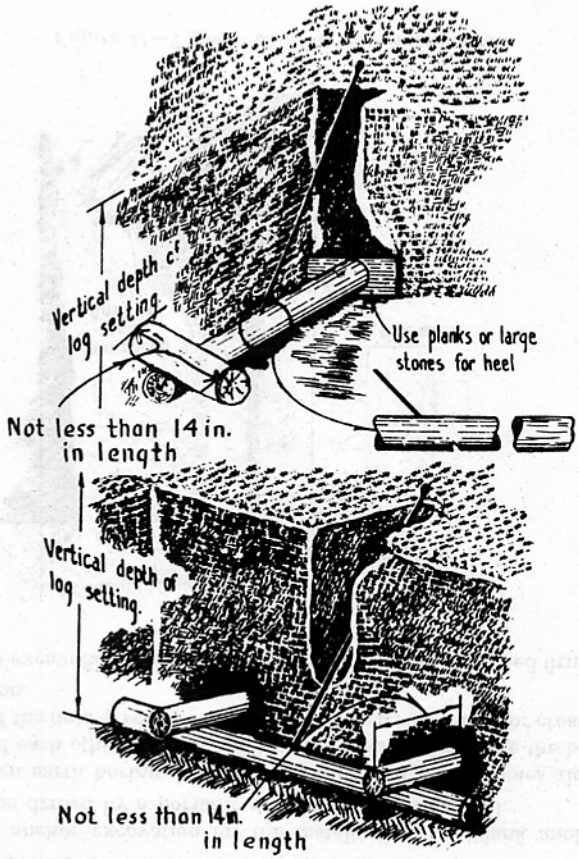



*Figure 69—Installation of log anchor, parallel to pole line with cross-log brace.*

*Figure 70—Installation of log anchor at right angle to pole line with cross-log braces.*



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## PLANK ANCHORS

Plank anchors, which have a cross section area comparable to the larger sizes of patented expanding anchors, may be used. However, their use is less desirable, due to the greater size hole necessary for the installation.

The planks must be drilled and cut before treatment.

The anchor excavation for the installation of a plank anchor may be drilled by a portable earth boring power drill.

When earth boring drills are considered, drill two holes along side of each other, remove the surplus earth and enlarge the bottom of the hole to receive the two planks in a right angle or crossed position.

The excavation should be refilled with earth and tamped firmly.

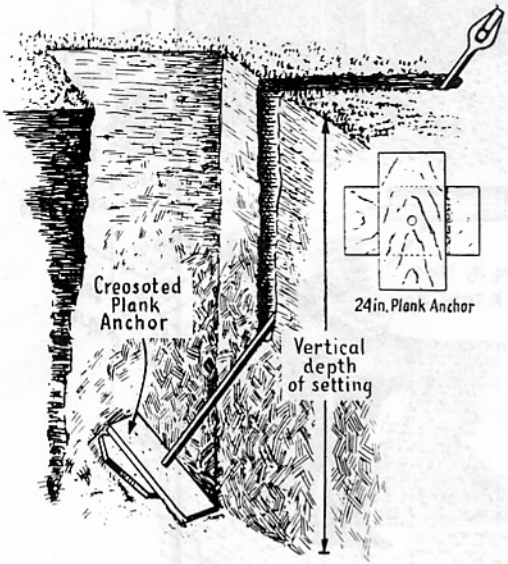



*Figure 71—Typical plank anchor installation.*

## PLANK ANCHORS

SELECTION TABLE NO. 65

| SIZE OF CREOSOTED PLANKS | SIZE OF STRAND | SIZE OF RODS | SIZE OF WASHERS |
|---|---|---|---|
| 2"x5"x24" | 2200 | J-7407—½"x7' | J-1082—4"x4"x¼" |
| 2"x5"x24" | 6000 | J-7418—⅝"x8' | J-1082—4"x4"x¼" |
| 2"x5"x24" | 10000 | J-7429—¾"x9' | J-1082—4"x4"x¼" |
| 2"x5"x24" | 16000 | J-7440— 1"x10' | J-1082—4"x4"x¼" |

**NOTE:**

Many types of guys and anchors have been discussed under this heading in order that a clear understanding may be had to meet the various conditions encountered throughout the entire country.

The guying tables as set forth on the previous pages cover most types of guying suitable for the small exchange and large exchanges, with details worked out for rural lines, heavy open wire leads (local and toll), and aerial cable.

Standardize on as few types and sizes as practicable for your exchange area.

Do not attempt to stock anchors and rods for every load change, but after careful study select anchors and rods that will cover a reasonably wide range of guying.

## STANDARD ANCHOR RODS

### *Thimbleye (Single Guy)*



| CAT. NO. | DIAMETER (INCHES) | LENGTH (FEET) | STRENGTH (POUNDS) | CAT. NO. | DIAMETER (INCHES) | LENGTH (FEET) | STRENGTH (POUNDS) |
|---|---|---|---|---|---|---|---|
| J-7406 | ½ | 6 | 10,000 | J-7429 | ¾ | 9 | 25,000 |
| J-7407 | ½ | 7 | 10,000 | J-7430 | ¾ | 10 | 25,000 |
| J-7417 | ⅝ | 7 | 16,000 | J-7437 | 1 | 7 | 40,000 |
| J-7418 | ⅝ | 8 | 16,000 | J-7438 | 1 | 8 | 40,000 |
| J-7427 | ¾ | 7 | 25,000 | J-7439 | 1 | 9 | 40,000 |
| J-7428 | ¾ | 8 | 25,000 | J-7440 | 1 | 10 | 40,000 |



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## *Twineye (Double Guy)*




| CAT. NO. | DIAMETER (INCHES) | LENGTH (FEET) | STRENGTH (POUNDS) | CAT. NO. | DIAMETER (INCHES) | LENGTH (FEET) | STRENGTH (POUNDS) |
|---|---|---|---|---|---|---|---|
| J-7517 | 5/8 | 7 | 16,000 | J-7530 | 3/4 | 10 | 25,000 |
| J-7518 | 5/8 | 8 | 16,000 | J-7538 | 1 | 8 | 40,000 |
| J-7528 | 3/4 | 8 | 25,000 | J-7539 | 1 | 9 | 40,000 |
| J-7529 | 3/4 | 9 | 25,000 | J-7540 | 1 | 10 | 40,000 |

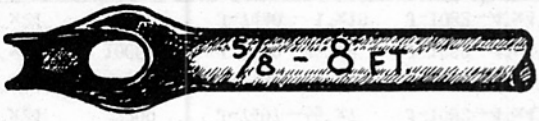
## *Tripleye (Triple Guy)*




| CAT. NO. | DIAMETER (INCHES) | LENGTH (FEET) | STRENGTH (POUNDS) | CAT. NO. | DIAMETER (INCHES) | LENGTH (FEET) | STRENGTH (POUNDS) |
|---|---|---|---|---|---|---|---|
| J-7329 | 3/4 | 9 | 25,000 | J-7340 | 1 | 10 | 40,000 |
| J-7330 | 3/4 | 10 | 25,000 | J-7350 | 1 1/4 | 10 | 54,000 |
| J-7339 | 1 | 9 | 40,000 | J-7352 | 1 1/4 | 12 | 54,000 |

## IDENTIFICATION OF ANCHORS

Rods are identified under the eye with the diameter in inches and the length in feet as shown below.




This identification should be carried further by marking with a center punch, a file or a steel stencil, so that the type of anchor may be identified at any time. These marks should be located near the eye of the rod as specified in the following table.

| IDENTIFICATION MARKS | TYPE OF ANCHOR |
|---|---|
| 1 | Patented Expanding Anchor |
| 2 | Log Anchor |
| 3 | Plank Anchor |
| 4 | Plate Anchor |
| 5 | Rock Anchor |
| 6 | Precast Concrete Anchor |
| 7 | Screw Anchor |
| 8 | Cone Anchor |

## POLE BRACES

Pole braces are divided into two types known as the "Push" Brace and the "Push-Pull" Brace. These two types may be used as a substitute for standard guying where right of way difficulties are encountered.

The "Push" brace and the "Push-Pull" brace may be one or two classes in size smaller than the pole it supports and shall be considered equivalent to a 10,000 pound guy installed in the opposite direction.

New and treated timber should generally be used. However, suitable used timber may be used on an old or existing line.

Pole braces shall be set with a lead/height of approximately ½ and never less than ⅓.

Push braces shall be set as shown in Fig. 73 and shall be supported on a timber footing (2″x12″x24″) or a large stone where exceptionally firm earth is encountered. No footing will be necessary.

"Push-Pull" braces shall be installed as illustrated in Fig. 72 with a cross log and set at a depth of 4′6″.

Braces shall be placed as high as practicable on the pole in order to prevent any tendency of the pole to "lift out."

The brace shall be framed to fit the pole and secured to the pole by a ⅝″ machine bolt. The brace should be notched to provide a flat surface for the washer. In order to prevent the brace from splitting, it is advisable to place a ⅝″ machine bolt above and at right angle to the attaching bolt.



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A "Push" brace secured to a corner pole, with a "pull" of 20 feet or more and supporting 30 wires, shall have 6 wraps of No. 8 steel construction wire, in addition to the 5/8" machine bolt.

A "Push-Pull" brace reinforcing a corner pole with a "pull" of 20 feet or more and supporting 10 wires or more shall have 6 wraps of No. 8 steel construction wire, in addition to the 5/8" machine bolt.

The wire wrapping in each case shall be located near the crotch as indicated in Fig. 72.

The wire wrapping shall be drawn up tight by the means of a 5/8" machine bolt and equipped with two 2¼"x2¼"x3/16" curved square washers.

## POINT OF ATTACHMENT FOR "PUSH" BRACES

| NUMBER OF CROSSARMS ON POLE | POINT OF ATTACHMENT ON POLE |
|---|---|
| 1 | Under first gain |
| 2 | Under second gain |
| 3 | Under third gain |
| 4 | Under fourth gain |
| 5 | Under fourth gain |

**NOTE:** Corner poles supporting 4 and 5 crossarms of wire, with a "pull" less than 20 feet may be braced as indicated above.

## SELECTION OF CROSS LOG FOR "PUSH-PULL" BRACES

| NUMBER OF WIRES | LENGTH OF LOG (IN FEET) | DIAMETER OF LOG (IN INCHES) |
|---|---|---|
| 10 or less | 4 | 7 |
| More than 10 | 5 | 8 |

## BRACED POLES REQUIRING CROSS-LOGS

| NUMBER OF WIRES | "PULL" ON CORNER POLE |
|---|---|
| 21-30 | 20 feet or more |
| 31-40 | 15 feet or more |
| 41-over | 10 feet or more |

Cross-logs for braced poles, as shown in Fig. 73 shall be not less than 7 inches in diameter and not less than 4 feet in length.

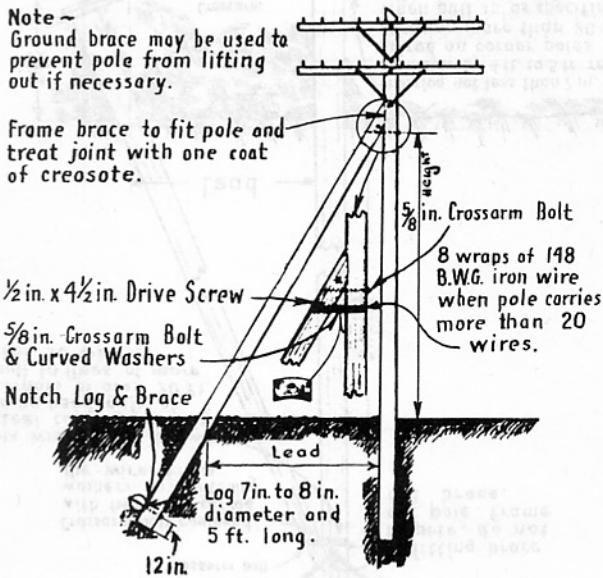



*Figure 72—Typical "push" and "pull" brace installation.*

## GROUND BRACES

Ground braces shall be used to provide stability and prevent the leaning of poles where it is impossible to install guys.

1—Ground braces shall be installed to prevent leaning in soft and swampy soil.

2—Ground braces shall be installed at corners where it is impossible to install a guy or where additional depth of setting a pole is not sufficient.



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3—Ground braces shall be installed on poles equipped with side arms. Where the poles are set in very firm earth no ground braces will be needed.

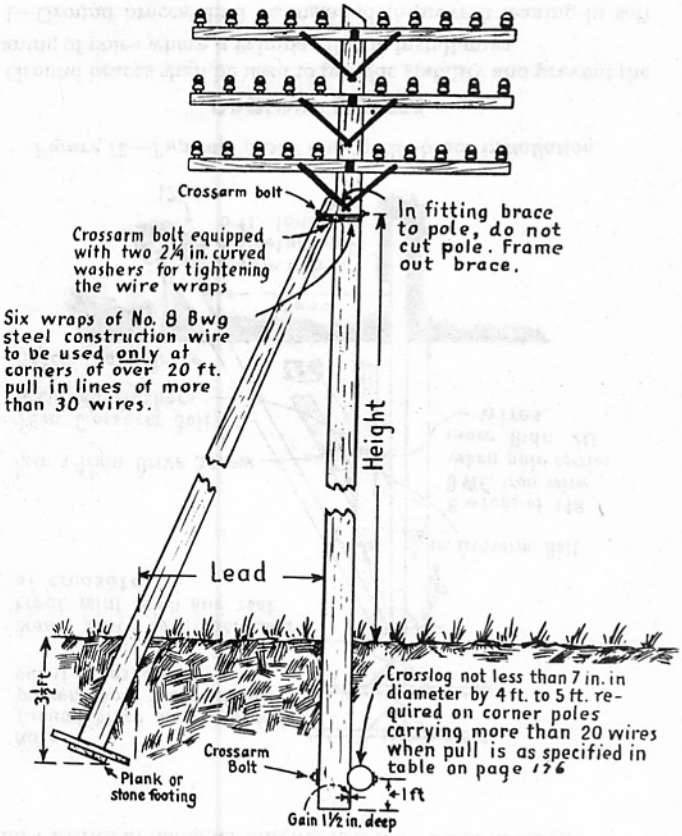



*Figure 73—Typical "push" brace installation.*

4—Extra heavy poles shall be used for this purpose and the spans between adjacent poles shall be short.

5—Ground braces may be constructed of logs, planks or concrete as illustrated in Figures 74, 75, 76, 77 and 78.

6—Guy stub poles may also be ground braced under the same conditions where the load and "pull" is not exceedingly heavy.

7—On rural lines a large rock may be used as a ground brace where the earth is firm, the line is light and the additional depth of setting the pole will not be sufficient.

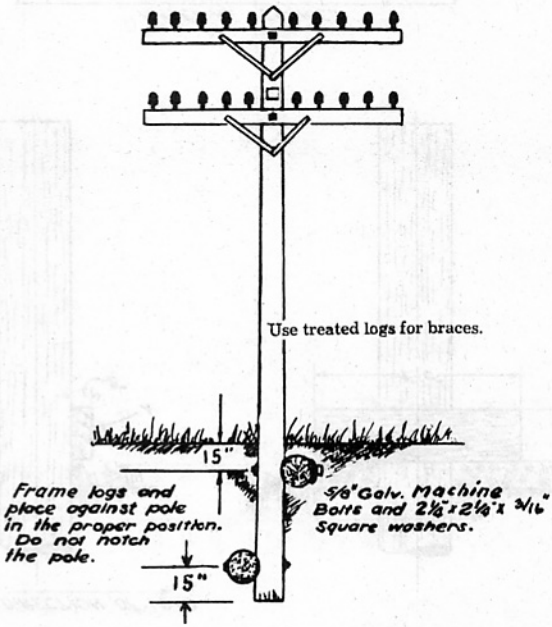


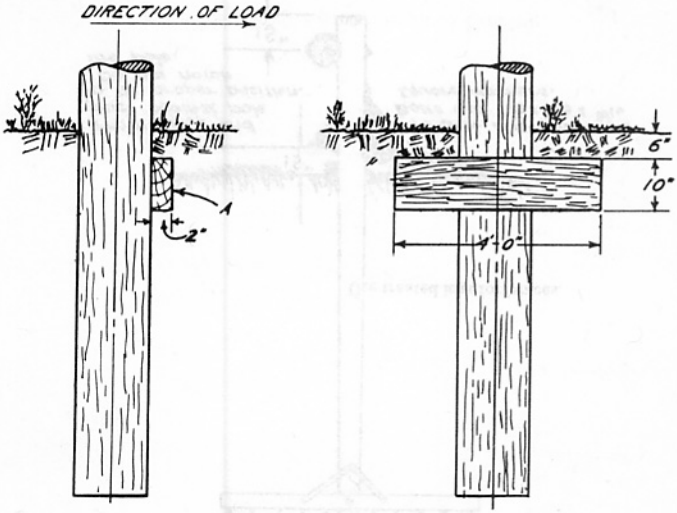

*Figure 74—Double log ground bracing.*



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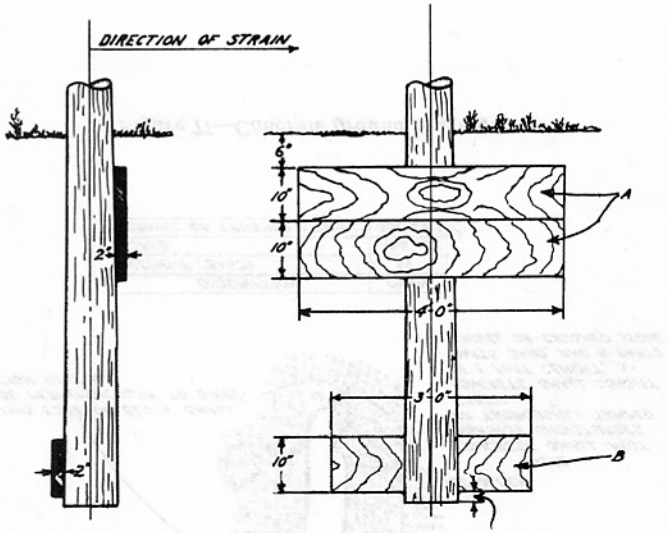



MATERIAL REQUIRED

| DESCRIPTION | QUAN. |
|---|---|
| 2"X10"X4'-0" CREOSOTED PLANK | 1 |
| | |

NOTE
PLANK SHALL REST AGAINST UNDISTURBED OR THOROUGHLY TAMPED EARTH.

*Figure 75—Single plank ground bracing.*




MATERIAL REQUIRED

| LOC. | DESCRIPTION | QUAN. |
|---|---|---|
| A | 2"X10"X4'-0" CREOSOTED PLANK | 2 |
| B | 2"X10"X3'-0" " " | 1 |
| | | |

NOTE

PLANKS SHALL REST AGAINST UNDISTURBED OR THOROUGHLY TAMPED EARTH.

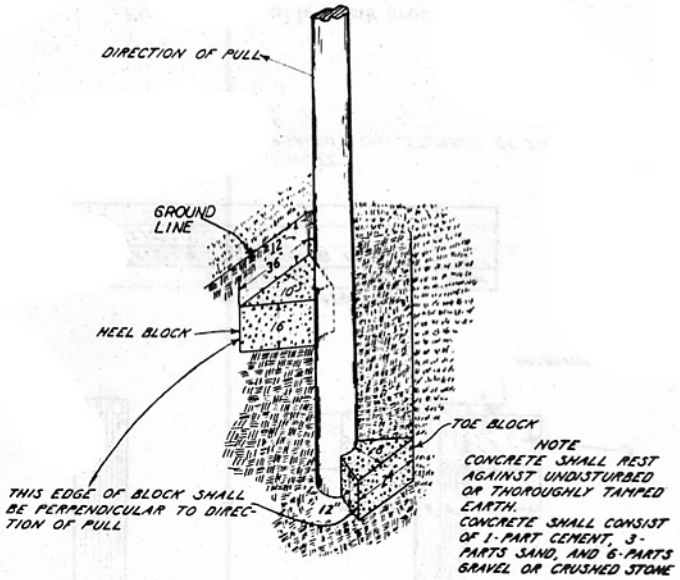
*Figure 76—Double plank ground bracing.*



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| DESCRIPTION | QUAN. |
|---|---|
| CEMENT (BAGS) | 3/4 |
| SAND | 185 LBS |
| GRAVEL OR CRUSHED STONE | 390 LBS |

Figure 77—Concrete ground bracing.

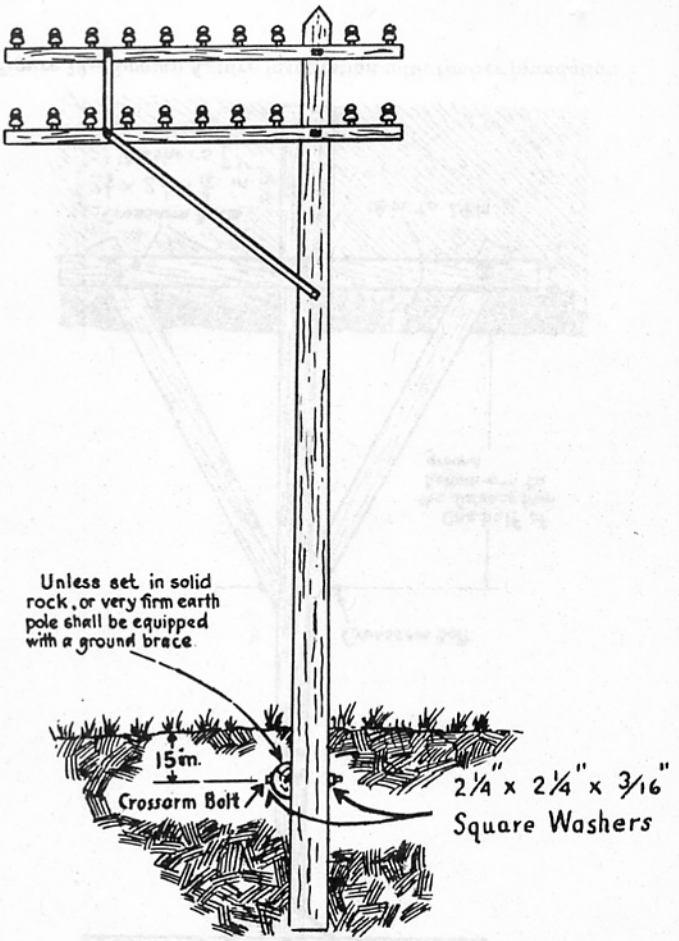



*Figure 78—Single log ground bracing.*



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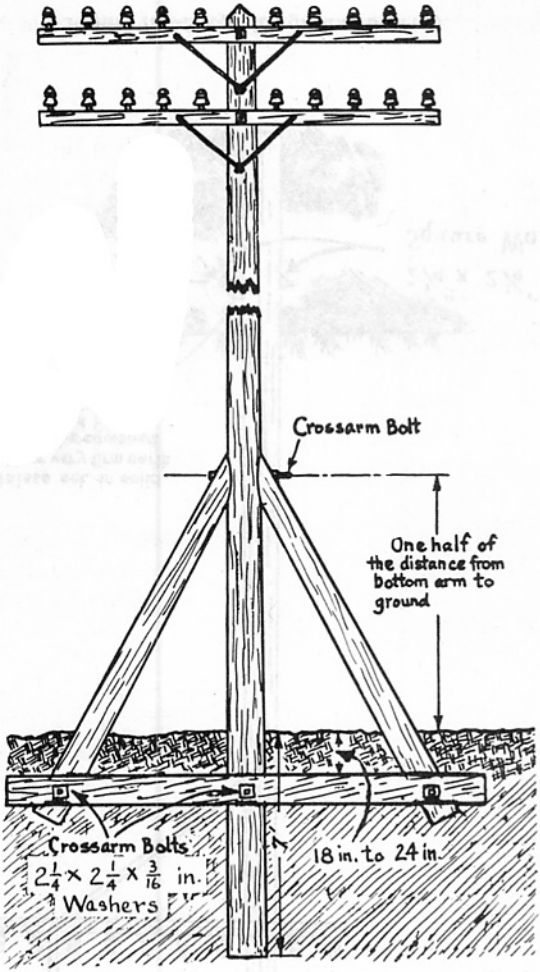



*Figure 79—Swamp fixture installation with timber foundation.*

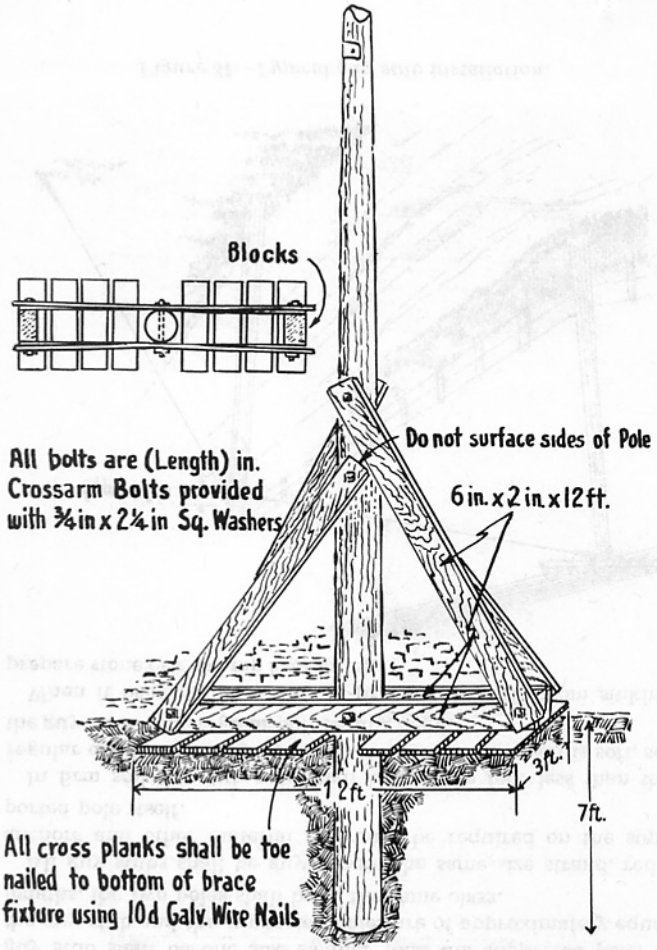



*Figure 80—Swamp fixture installation with plank foundation.*



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## GUY STUBS

Guy stubs shall be as short as practicable and still provide adequate clearance for guys over roads and other obstacles. The guy stub shall be one size smaller than the supported pole. If the guy stub and the supported poles are of approximately equal lengths, the two poles shall be of the same class.

All guy stubs shall be guyed with the same size strand, rods, anchors and other material as would be required on the supported pole itself.

In firm soil the stub pole shall be set one foot less than the regular depth of setting a pole. In areas where the soil is soft, set the guy stub at the regular pole setting depth.

When it becomes necessary to prevent the stub from sinking prepare stone or a swamp log footing.

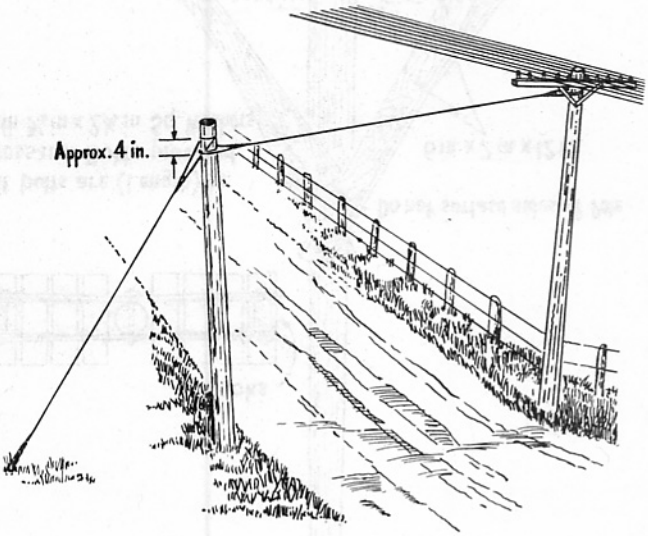



*Figure 81—Typical guy stub installation.*

## GROUND BRACE STUBS

It is better to set a ground braced pole than a ground braced stub pole. However, there may be an occasion where the load is too great for a ground brace pole, and no space exists for a down guy for the stub. Under this situation, ground brace both the main pole and the stub pole.

## TREE GUYS

When pole stubs cannot be used, guys may be attached to a tree providing the tree is of sufficient strength to hold the guyed pole. Tree guys shall not be installed unless the owner has granted permission.

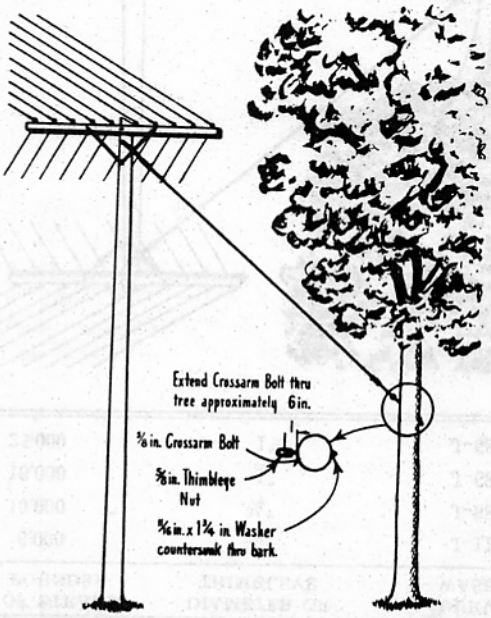



*Figure 82—Tree guy installation using thimble-eye bolt.*



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## SELECTION OF THIMBLEYE & WASHER FOR TREE GUY

| SIZE OF STRAND (IN POUNDS) | DIAMETER OF THIMBLEYE | CURVED WASHER |
|---|---|---|
| 6,000 | 5/8" | J-113 |
| 10,000 | 3/4" | J-6823 |
| 16,000 | 1" | J-6824 |
| 25,000 | 1" | J-6824 |

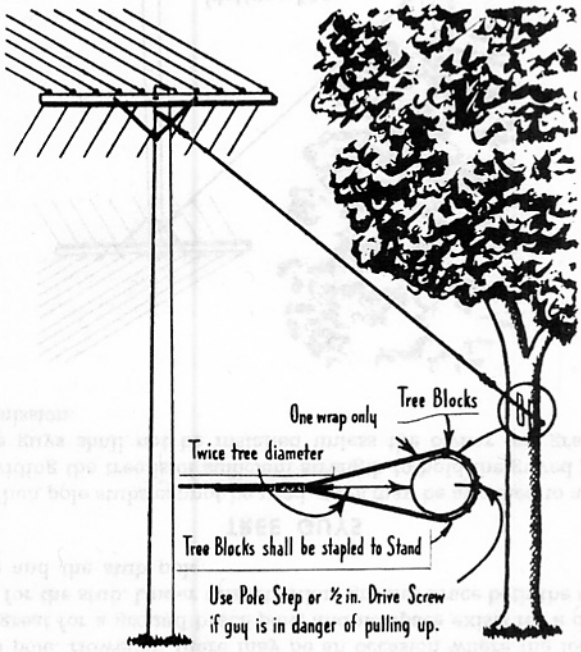



*Figure 83—Tree guy installation—wrap-around method.*

## GUYS TO FOREIGN POLES

Guys may be attached to foreign poles when other methods are impracticable and when permission is granted by the owner. The regulations governing the separation and clearances of attachments must be observed at all times. For clearances consult Table No. 14 and the state electrical code of your state. Guys may be attached to telephone company poles from Power Company poles under the same conditions mentioned above.

## STRAIN INSULATORS

Strain insulators shall be installed in guys and down guys to protect employees and the general public from electrical hazards that may arise due to contact with an electric light or power line. It is also necessary to maintain an aerial cable from incidental grounds.

A guy strand is considered exposed under following conditions:

1—Guy strand from a pole to a guy stub or from a pole to an anchor when exposed to 300 volts to ground.

2—Attaching a guy strand to a trolley pole, an electric pole or a power pole carrying more than 300 volts to ground.

3—Guy strand passing under, between or over electric circuits carrying more than 300 volts to ground.

4—Guy strand is so located that the horizontal distance between it and the nearest electrical line is less than 10 feet, except where the voltage is 300 volts or less to ground.

5—When a guy strand is attached to a telephone pole from an electric light pole, a power pole or a trolley pole.

Telephone cable is considered exposed where any portion of it is located on or crossing over a street, alley or highway. Telephone cable is not considered exposed where there are no electric light or power circuits along its entire route carrying less than 300 volts or more to ground.

## LOCATIONS OF STRAIN INSULATORS

Strain insulators shall generally be located not less than 8 feet nor more than 10 feet above the ground.

One insulator shall be used if it is sufficient to isolate the exposure.



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Except in a few cases one or more strain insulators shall be used in a guy supporting an aerial cable. Two of the exceptions are described in the following text.

1—Guys supporting unexposed cable will require no strain insulators providing the electrical separation between the suspension strand and the guy is at least 4 inches as illustrated in Figure 85.

2—Guys are not required to be equipped with strain insulators when attached to poles carrying cable, located outside the corporate limits of a village or city, provided that the guy is not exposed and that the suspension strand and the guy strand are separated by not less than 4 inches, as illustrated in Figure 85.

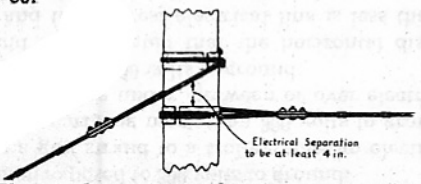



*Figure 84—Electrical separation between suspension strand and head guy*

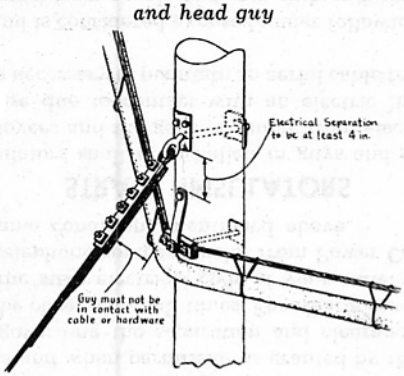
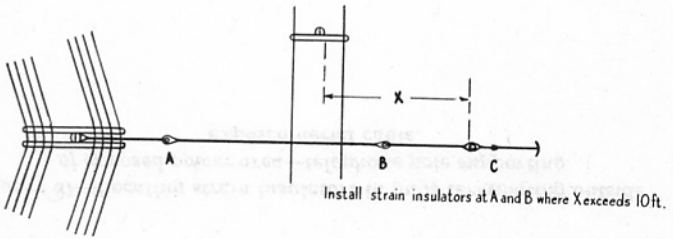



*Figure 85—Electrical separation between aerial cable and side guy.*



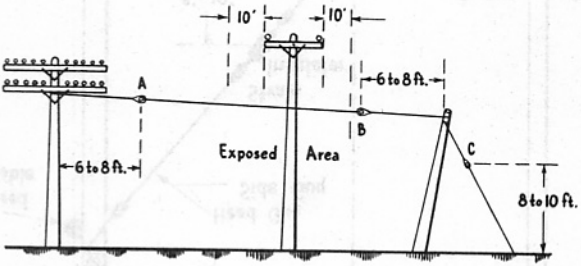




*Figure 86—Locating strain insulators in guys crossing under supply wires.*



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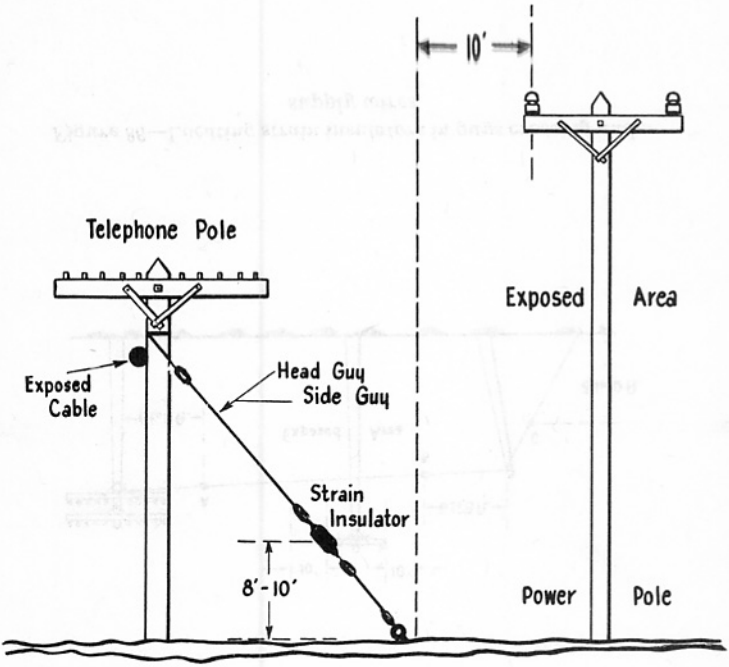



*Figure 87—Locating strain insulators in guys terminating outside of exposed power area—telephone pole supporting exposed aerial cable.*

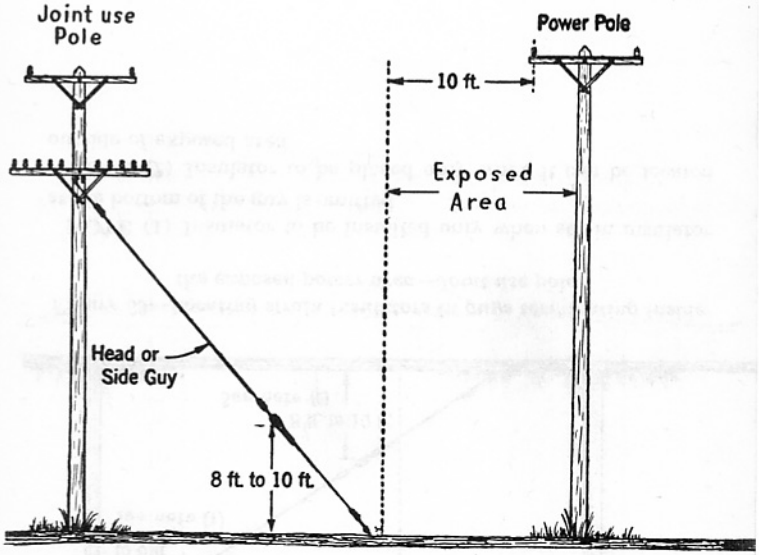



*Figure 88—Locating strain insulators in guys terminating outside of exposed power area—Joint use pole.*

Omit the strain insulator if the power circuit of the joint use pole does not exceed 300 volts to ground and the telephone cable is not exposed.



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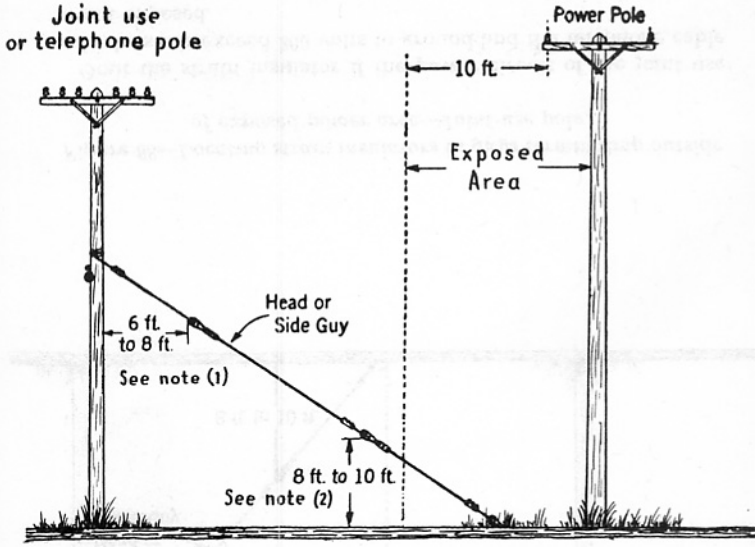



*Figure 89—Locating strain insulators in guys terminating inside the exposed power area—Joint use pole.*

NOTE (1) Insulator to be installed only when strain insulator at the bottom of the guy is omitted.

NOTE (2) Insulator to be placed only when it can be located outside of exposed area.

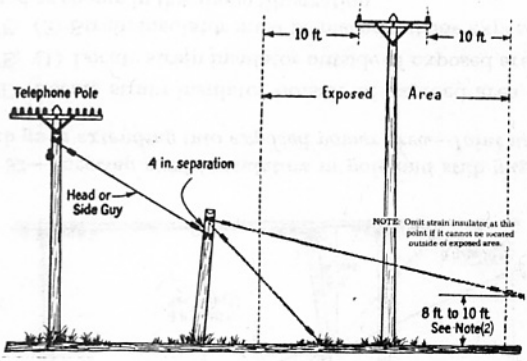



*Figure 90—Locating strain insulators in stub guys extending into exposed power area—Telephone pole.*

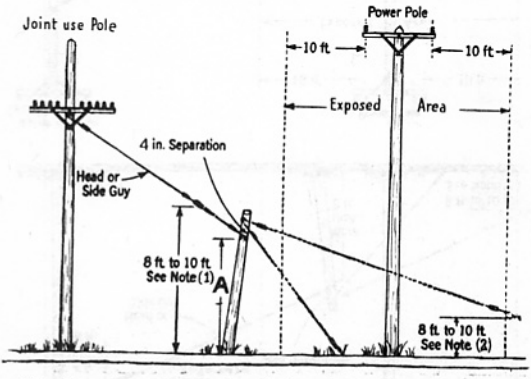



*Figure 91—Locating strain insulators in stub guys extending into exposed power area—Joint use pole.*

NOTE: (1) when "A" exceeds 8 feet, omit this strain insulator.
NOTE: (2) Install strain insulator only when it can be located outside of exposed area.



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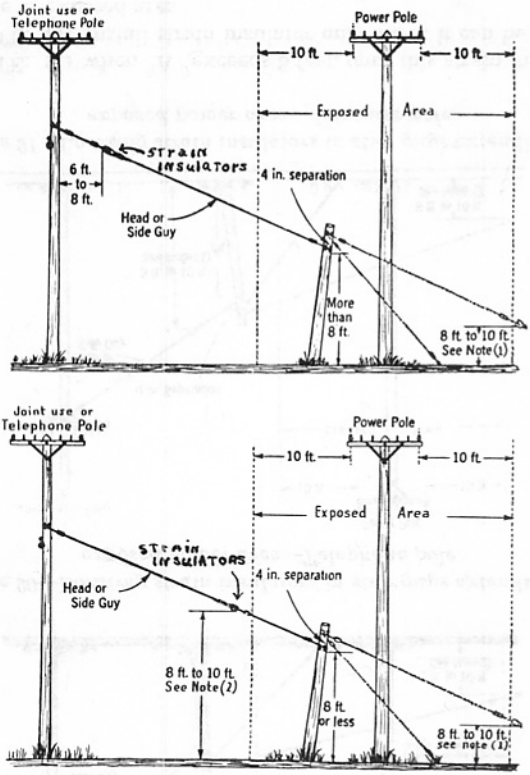



*Figure 92—Locating strain insulators in pole and stub guys. Pole and stub guys extending into exposed power area—Joint use pole.*

NOTE: Locate strain insulator outside of exposed area only.

NOTE: (1) Locate strain insulator outside of exposed area only.

NOTE: (2) Strain insulator must be placed outside exposed area or located as shown in the above illustration.

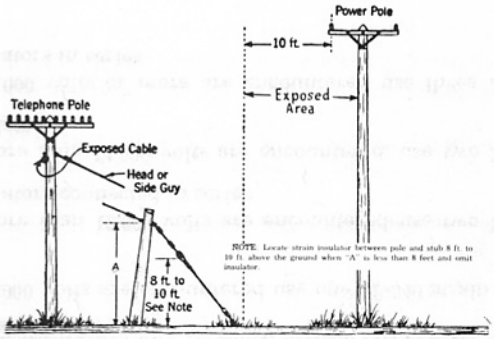



*Figure 93—Locating strain insulators in pole and stub guys. Pole and stub guys terminating outside exposed power area—Telephone pole supporting exposed aerial cable.*

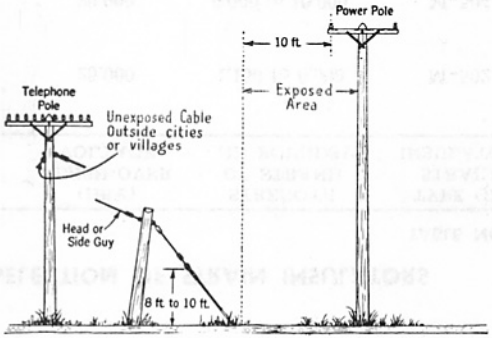



*Figure 94—Locating strain insulators in pole and stub guys. Pole and stub guys terminating outside exposed power area—Telephone pole supporting unexposed aerial cable.*

NOTE: Omit the strain insulator when there is a 4 inch electrical separation between the cable suspension strand and the guy strand.



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## STRENGTH OF STRAIN INSULATORS

Strain insulators shall have a mechanical strength at least equal to that required of the guy to which they are attached.

Strain insulators shall have a dry flash-over value double the nominal line voltage and a wet flash-over voltage as high as the nominal line voltage between conductors.

## SELECTION OF STRAIN INSULATORS

TABLE NO. 66

| LINE VOLTAGE | (DRY) FLASH-OVER VOLTAGE | STRENGTH OF STRAND (IN POUNDS)* | TYPE OF STRAIN INSULATOR |
|---|---|---|---|
| 300 volts to ground to 2200 | 25,000 | 1,150 to 6,000 | M-502 |
| 4400 | 30,000 | 6,000 to 10,000 | M-504 |
| 6600 | 35,000 | 10,000 to 20,000 | M-506 |

*No. 6 B.W.G. construction wire (breaking strength 1618 pounds) may be used where applicable.

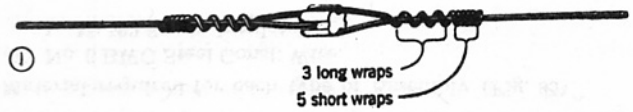
When 12,000 volts are encountered use one M-540 strain insulator.

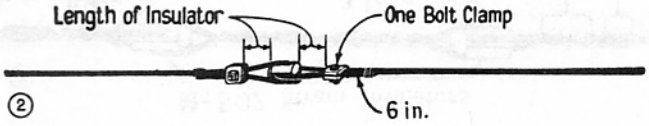
When more than 12,000 volts are encountered use two M-506 strain insulators connected in series.

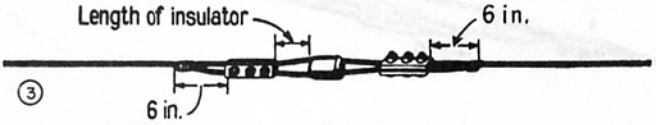
When more than 14,000 volts are encountered, use two M-540 strain insulators.

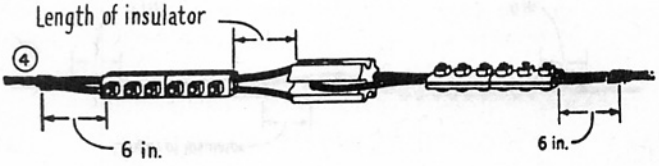
When 30,000 volts or more are encountered use three M-540 strain insulators in series.

## STRAIN INSULATOR INSTALLATIONS



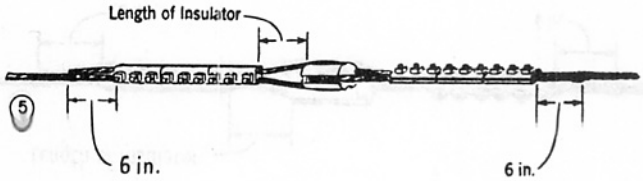





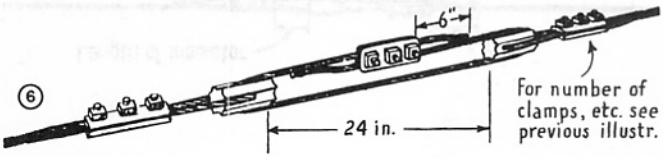

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Strain insulators in series.



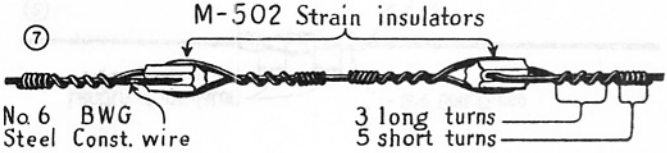




*Figure 95—Strain insulator installation methods.*

Material required for each type of Assembly (Fig. 95).

(1) No. 6 BWG Steel Const. Wire.
1—M-502 Strain Insulator.

(2) 1150 lb. to 2200 lb. Guy Strand.
1—M-502 Strain Insulator.
2—J-1061 Guy Clamps (or)
2—J-3014 Guy Clips.

(3) 6000 lb. to 10,000 lb. Guy Strand.
1—M-504 Strain Insulator
2—J-1032 3-bolt guy clamps.

(4) 10,000 lb. to 16,000 lb. Guy Strand.
1—M-506 Strain Insulator.
4—J-1121 3-bolt guy clamps.
($\frac{7}{16}$" to $\frac{1}{2}$" strand.)

(5) 25,000 lb. Guy Strand.
1—M-540 Strain Insulator.
6—J-1032 3-bolt Guy Clamps.
($\frac{7}{16}$" to $\frac{1}{2}$" strand.)

(6) Strain Insulators in Series.

(7) No. 6 BWG Steel Const. Wire.
2—M-502 Strain Insulators.

Use the same size strand for the series assembly as the main guy strand. However, when the guy strand consists of 10,000 lb., 16,000 lb., or 25,000 lb. strand, the next smaller size may be used.

Guy clamps for the series assembly shall be selected from the following table:

## GUY CLAMP SELECTION
### For Strain Insulator Assembly

TABLE 67

| SIZE OF CONNECTING STRAND (IN POUNDS) | TYPE OF GUY CLAMP | NUMBER REQUIRED |
|---|---|---|
| 1150 to 2200 | J-1061 (1-bolt) or J-3014 | 1 |
| 2200 to 4000 | J-3014 | 1 |
| 6000 to 10,000 | J-1032 (3-bolt) | 1 |
| 16,000 to 25,000 | J-1121 (3-bolt) | 2 |



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# METHOD OF ATTACHING STRAND TO GUY RODS

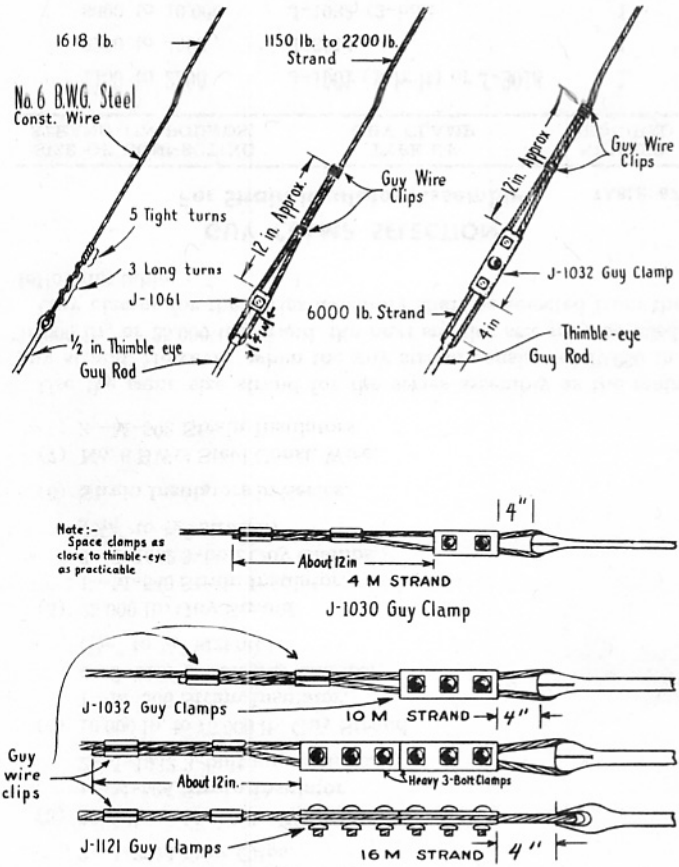



*Figure 96—Method of attaching wire and strand to guy rods.*

## SELECTION OF MATERIAL REQUIRED TO ATTACH A GUY STRAND TO A GUY ROD

| GUY CLAMPS | | NO. OF STRAND CLIPS | DIAMETER OF STRAND | STRENGTH OF STRAND (IN POUNDS) |
|---|---|---|---|---|
| REQUIRED NUMBER | TYPE OF CLAMP | | | |
| 1 | J-1061 | 2 | 3/16" to 1/4" | 1150-2200 |
| 1 | J-1030 | 2 | 1/4" to 9/32" | 3150-4000 |
| 1 | J-1032 | 2 | 5/16" to 3/8" | 3200-10,000 |
| 1 | J-1121 | 2 | 7/16" to 1/2" | 5700-12,000 |
| 2 | J-1121 | 2 | 7/16" to 1/2" | 16,000 |
| 3 | J-1121 | 2 | 7/16" to 1/2" | 25,000 |



## GUY WIRE CLIPS

Used to serve up strand ends.

Half formed to fit the strand so that, with the use of linemen's pliers, the time required for installing is approximately one-fourth that of serving the strand ends.

| CAT. NO. | MATERIAL | SIZE OF STRAND | STRAND RATING |
|---|---|---|---|
| 400 | Aluminum | 1/4 in. | 4M |
| 36 | Aluminum | 5/16 in. | 6M |
| 37 | Aluminum | 3/8 in. | 10M |
| 38 | Aluminum | 7/16 in. | 16M |
| 401 | Aluminum | 1/2 in. | 25M |
| 39 | Aluminum | 9/16 in. | .... |
| 402 | Galvanized Iron | 1/4 in. | 4M |
| 336 | Galvanized Iron | 5/16 in. | 6M |
| 337 | Galvanized Iron | 3/8 in. | 10M |
| 338 | Galvanized Iron | 7/16 in. | 16M |
| 403 | Galvanized Iron | 1/2 in. | 25M |

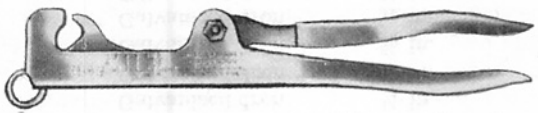


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## GUY WIRE CLIP TOOL



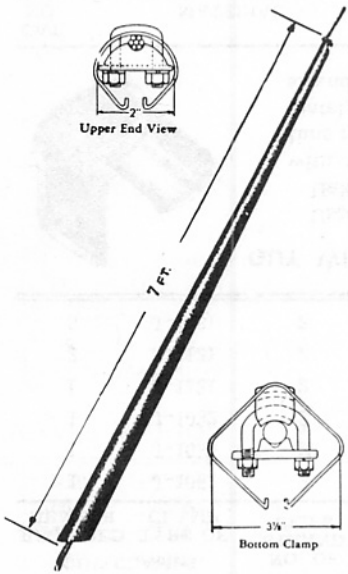
Provides an efficient means of quickly installing Guy Wire Clips. Made of stamped steel. A latch ring is provided for hanging on the lineman's belt.

## GUY GUARDS

When installing anchor guys at locations where they will become a hazard to persons or animals, guy guards should be placed on anchor guys.

A galvanized iron guy guard, as illustrated in Fig. 97, should be used in the urban districts and on all dangerous corners and curves in the rural areas.

An old cross arm or its equivalent may be lashed to the strand at other exposed points.




### INSTALLATION OF ANCHOR GUY GUARD

Clamp the bottom fitting to the guy rod, slip the guard into it, and clamp the top fitting to the strand. Guy guard should be set close to the ground to provide all protection possible.

*Figure 97—Typical guy guard installation.*

## SELECTION OF GUY GUARDS

| CAT. NO. | TYPE | LENGTH | WIDTH AT TOP | WIDTH AT BOTTOM | GAUGE STEEL |
|---|---|---|---|---|---|
| J-1617 | Light | 7 ft. | 2 in. | 3⅞ in. | 18 |
| J-1618 | Light | 8 ft. | 2 in. | 3⅞ in. | 18 |
| J-1604 | Heavy | 7 ft. | 3 in. | 3⅞ in. | 16 |
| J-1605 | Heavy | 8 ft. | 3 in. | 3⅞ in. | 16 |

## "WRAP" METHOD OF ATTACHING GUYS TO POLES AND STUBS

Strain plates shall be used on all poles except when No. 6 B.W.G. construction wire, 2200 pound strand, 4000 pound strand or storm guys are used.

When No. 6 B.W.G. construction wire is used, it should be wrapped twice around the pole and served up as illustrated in Fig. 98.

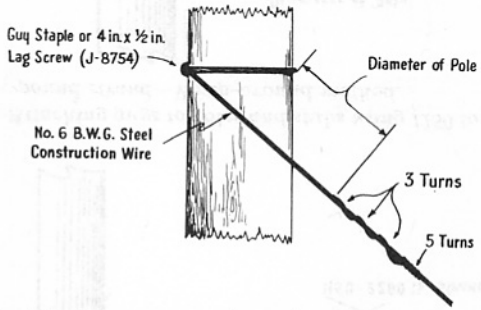



*Figure 98—Attaching guys to poles and stubs using No. 6 B.W.G. steel construction wire—Wrap-around method.*

When 1150 pound to 2200 pound strand (3/16" to ¼") is used, it should be wrapped twice around the pole and terminated as illustrated in Fig. 99.

When 3150 pound to 4000 pound strand (¼" to 9/32") is used, it should be wrapped twice around the pole and terminated as illustrated in Fig. 100.



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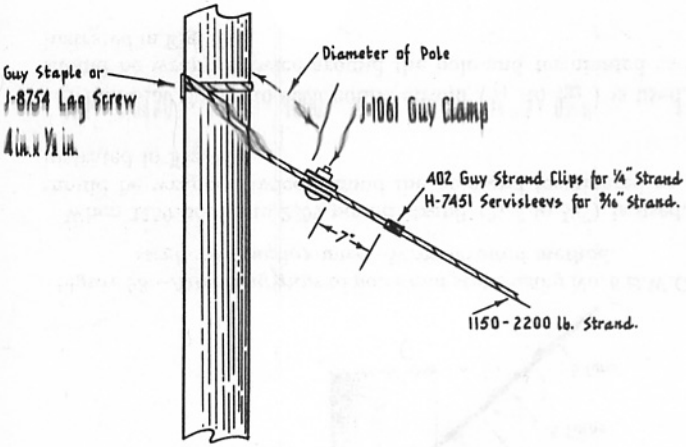



*Figure 99—Attaching guys to poles and stubs using 1150 to 2200 pound strand—Wrap-around method.*

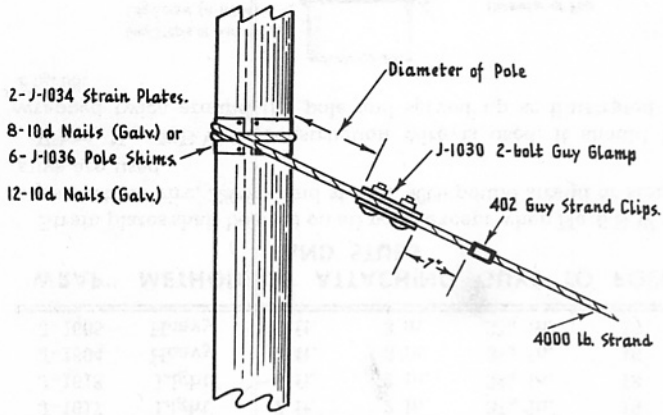



*Figure 100—Attaching guys to poles and stubs using 4,000 pound (9/32 inch Utilities Grade) messenger strand — Wrap-around method.*

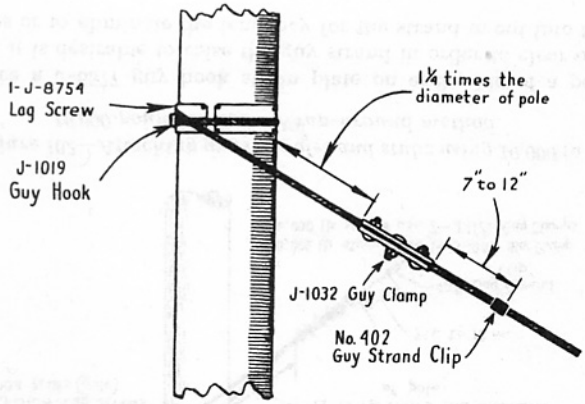



*Figure 101—Attaching guys to poles and stubs using 6,000 to 10,000 pound strand—Wrap-around method.*

Strain plates or pole shims shall be used only when soft fiber timber is encountered. Omit strain plates on the hard fiber timber.

When 6000 pound to 10,000 pound strand is to be guyed to a pole, it should be wrapped twice around the pole and terminated as shown in Fig. 101.

**Material Required for Wrap-Around Method (Fig. 101)**

2—J-1034 Strain Plates
8—10d Nails (Galv.)
1—J-1017 Guy Hook
1—J-8754 Lag Screw
1—J-1032 Guy Clamp
1—336 Guy Wire Clip or
1—337 Guy Wire Clip.

When 10,000 pound or 16,000 pound strand is used to guy a pole and where the down pull is great due to a short lead, the strand shall be terminated as illustrated (Fig. 102) using a guy hook strain plate.



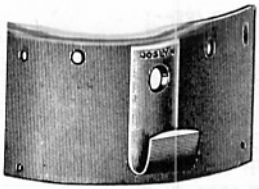
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## GUY HOOK STRAIN PLATES

***Hot Galvanized***



Serves the double function of preventing the guy strand from slipping down the pole and from biting into the pole. The guy hook is firmly welded to the plate. Has one $^{11}/_{16}$-inch hole for $^{5}/_{8}$-inch through bolt, two $^{7}/_{16}$-inch holes for $^{3}/_{8}$-inch lag screws and four $^{7}/_{32}$-inch holes for 10d nails.

| Cat. No. | Size | Std. Pkg. |
|---|---|---|
| J-6577 | 4x8 in., No. 14 Ga. | 100 |

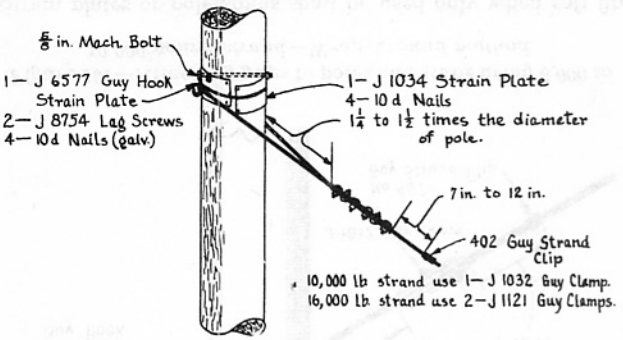



*Figure 102—Attaching guys to poles and stubs using 10,000 to 16,000 pound strand—Wrap-around method.*

Place a J-6577 guy hook strain plate on each side of a pole when it is desirable to raise the guy strand in order to clear obstacles or to eliminate the tendency for the strand to cut into the pole.

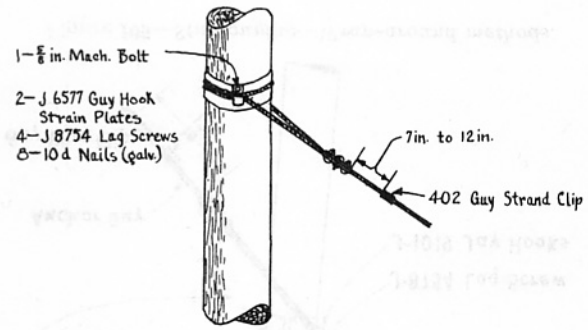



*Figure 103—Attaching guys to poles and stubs using guy hook strain plates.*

When it is desirable to use pole shims in place of standard strain plates and it is required to raise the neck of the guy, the method shown in Fig. 104 may be used.

### Material Required for Installing Pole Shims

6—J-1036 Pole Shims
12—10d Galv. Nails
2—J-1019 one-bolt Jay Hooks or
2—J-1018 two-bolt Jay Hooks.

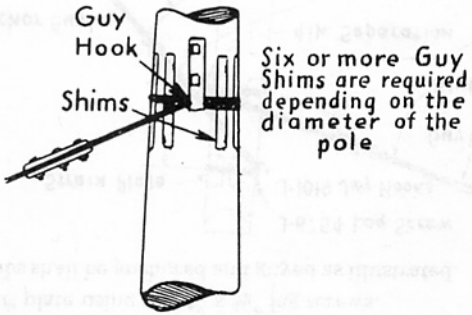



*Figure 104—Attaching guys to poles and stubs using guy hooks and pole shims.*



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The wrap around method of guying is recommended for poles of insufficient diameter at the point of guying to withstand drilling a $1\frac{1}{16}$" hole through the pole for a $\frac{5}{8}$" thimble eye bolt and to attach a lift plate using two 4" x $\frac{1}{2}$" lag screws.

Guy stubs shall be anchored and guyed as illustrated.

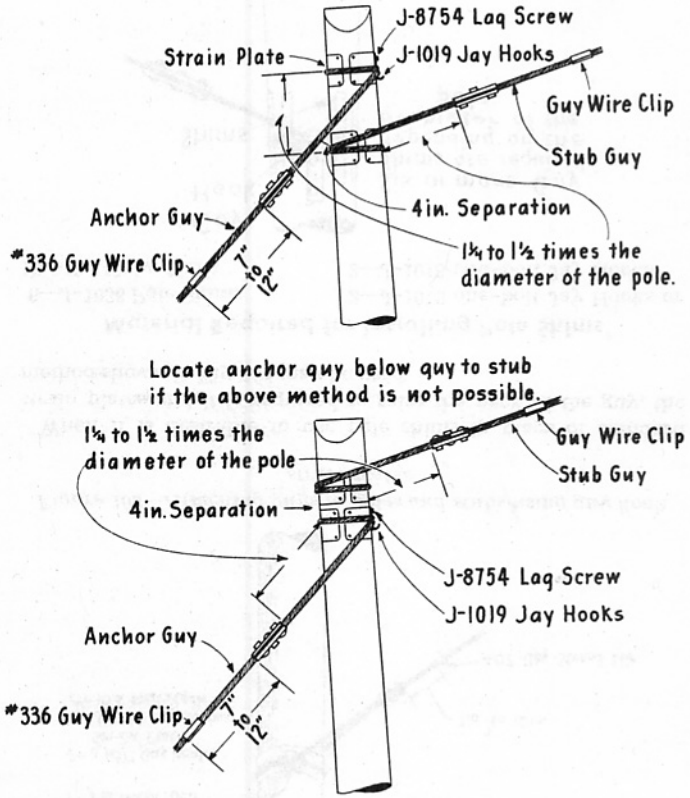



*Figure 105—Stub guying—Wrap-around methods.*

**Material required for either of the two installations. Fig. No. 105.**

4—J-1034 strain plates
16—10 d galv. nails
1—J-1019 jay hook
1—J-8754 lag screw
2—J-1032 guy clamps for 5/16" strand
2—No. 336 guy wire clips for 5/16" strand

**Material required for an alternate method using guy hook strain plates.**

3—J-1034 strain plates
16—10 d galv. nails
1—J-6577 guy hook strain plate
2—J-8754 lag screws
2—J-1032 guy clamps (5/16" strand)
2—No. 336 guy wire clips (5/16" strand)

## SERVING ENDS OF GUYS

Serve up the tail end of a 7" guy strand with one guy wire clip. When a 12" end is used, add one guy wire clip at the mid-section.

See page 203 for sizes.

## EYE BOLT METHOD OF ATTACHING GUYS

Methods of attachment of guys to poles have been vastly improved with the introduction of Thimbleye bolts, Thimbleye nuts and Thimbleyelets for use with standard through bolts. The use of this method for attaching guys to poles is strongly recommended. Such use eliminates the need of strain plates, guy hooks, lags and extra strand. Thimbleye bolts are available both straight and with angle heads, with or without a shoulder. Lift plates should be used with angle Thimbleye bolts where loads are excessive and guys are steep. These plates are curved to fit the pole and have a 1 1/16 inch hole for bolt and 9/16 inch hole for lag screw.

### Drop Forged Thimbleye Nuts
**Hot Galvanized**




Used on the threaded end of cross arm bolts, eye bolts, double arming bolts, straight and angle thimbleye bolts and other attachments where it is desired to convert a standard threaded bolt to a thimbleye bolt.



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## Thimbleye Nuts




| CAT. NO. | BOLT SIZE | MAXIMUM STRAND SIZE |
|---|---|---|
| J-6509 | ½ in. | ½ in. |
| J-6510 | ⅝ in. | ½ in. |
| J-6511 | ¾ in. | ½ in. |
| H-7512 | 1 in. | ½ in. |

## Twineye Nuts




| CAT. NO. | BOLT SIZE | MAXIMUM STRAND SIZE |
|---|---|---|
| J-6515 | ⅝ in. | ⅝ in. |
| J-6516 | ¾ in. | ⅝ in. |
| H-7562 | 1 in. | ⅝ in. |

## Drop Forged Thimbleyelets

**Hot Galvanized**

Used under the head or nut of machine bolts.




| CAT. NO. | BOLT SIZE | MAXIMUM STRAND SIZE |
|---|---|---|
| J-6550-C | ⅝ in. | ⅝ in. |
| J-6551 | ¾ in. | ⅝ in. |

## Angle Thimbleyes

**Hot Galvanized**

Used with through bolts for down guys. Eliminates the use of strain plates, guy hooks, guy thimbles, nails and lag screws and saves from 3 to 5 feet of guy strand.

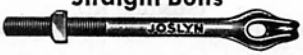


| CAT. NO. | DIAMETER BOLT | MAXIMUM STRAND SIZE |
|---|---|---|
| J-6500 | ⅝ in. | ½ in. |
| J-6501 | ¾ in. | ½ in. |
| H-1102 | 1 in. | ½ in. |

## Thimbleye Bolts Hot Galvanized

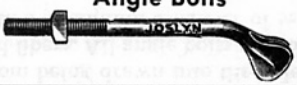
For attaching guys to poles. Eliminates strain plates, guy hooks, lag screws, nails and extra strand. Bolts 10 inches and shorter have 4 inches of thread; longer bolts have 6 inches of thread. All angle bolts are 45°. All 5/8-inch bolts have 9/16-inch eyes and 3/4-inch bolts have 11/16-inch eyes.

### Straight Bolts




| CAT. NO. | SIZE INCHES | CAT. NO. | SIZE INCHES |
|---|---|---|---|
| J-8049 | 5/8 x 6 | J-8060 | 3/4 x 8 |
| J-8050 | 5/8 x 8 | J-8061 | 3/4 x 10 |
| J-8051 | 5/8 x 10 | J-8062 | 3/4 x 12 |
| J-8052 | 5/8 x 12 | J-8063 | 3/4 x 14 |
| J-8053 | 5/8 x 14 | J-8064 | 3/4 x 16 |
| J-8054 | 5/8 x 16 | J-8065 | 3/4 x 18 |
| J-8055 | 5/8 x 18 | J-8066 | 3/4 x 20 |
| H-6688 | 1 x 8 | H-6694 | 1 x 14 |
| H-6690 | 1 x 10 | H-6696 | 1 x 16 |
| H-6692 | 1 x 12 | H-6698 | 1 x 18 |

### Angle Bolts




| CAT. NO. | SIZE INCHES | CAT. NO. | SIZE INCHES |
|---|---|---|---|
| J-8149 | 5/8 x 6 | J-8159 | 3/4 x 6 |
| J-8150 | 5/8 x 8 | J-8160 | 3/4 x 8 |
| J-8151 | 5/8 x 10 | J-8161 | 3/4 x 10 |
| J-8152 | 5/8 x 12 | J-8162 | 3/4 x 12 |
| J-8153 | 5/8 x 14 | J-8163 | 3/4 x 14 |
| J-8154 | 5/8 x 16 | J-8164 | 3/4 x 16 |
| J-8155 | 5/8 x 18 | J-8165 | 3/4 x 18 |
| H-6188 | 1 x 8 | H-6194 | 1 x 14 |
| H-6190 | 1 x 10 | H-6196 | 1 x 16 |
| H-6192 | 1 x 12 | H-6198 | 1 x 18 |

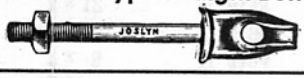


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## Shoulder Type Straight Bolts




| CAT. NO. | SIZE INCHES | CAT. NO. | SIZE INCHES |
|---|---|---|---|
| J-8406 | 5/8 x 6 | J-8414 | 5/8 x 14 |
| J-8408 | 5/8 x 8 | J-8416 | 5/8 x 16 |
| J-8410 | 5/8 x 10 | J-8418 | 5/8 x 18 |
| J-8412 | 5/8 x 12 | J-8420 | 5/8 x 20 |

The shoulder type improved eyebolt for down guys is superior mechanically to the standard type. The shoulder prevents the curved portion from being drawn into the pole and also prevents crushing the wood fibers. All angle bolts are 45°. Eye will accommodate strand with a maximum diameter of ½-inch.

## Shoulder Type Angle Bolts




| CAT. NO. | SIZE INCHES | CAT. NO. | SIZE INCHES |
|---|---|---|---|
| J-8006 | 5/8 x 6 | J-8014 | 5/8 x 14 |
| J-8008 | 5/8 x 8 | J-8016 | 5/8 x 16 |
| J-8010 | 5/8 x 10 | J-8018 | 5/8 x 18 |
| J-8012 | 5/8 x 12 | J-8020 | 5/8 x 20 |

MINIMUM BREAKING STRENGTH OF THIMBLEYE BOLTS (IN POUNDS)

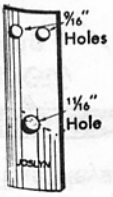
| | |
|---|---|
| 5/8-inch | 14,000 lbs. |
| 3/4-inch | 20,000 lbs. |
| 1-inch | 35,000 lbs. |

Lift plates for 5/8-inch standard thimbleye bolts have 1 1/16-inch holes and should be used on shoulder eyebolts where loads are excessive and guys are steep.

## Lift Plates for Angle Thimbleye Bolts

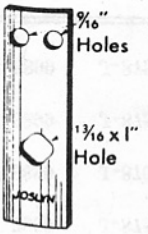
**Hot Galvanized**

Mounted with ½-inch lag screws to increase load capacity of angle thimbleye bolts. All plates are 2½ x 7 inches curved on a 3-inch radius. Plates for ⅝-inch eyebolts have 11/16-inch round holes; plates for ¾-inch eyebolts have 1 x 13/16-inch oval holes.




### 3-Hole Plates for ⅝-inch Eyebolts

| CAT. NO. | THICKNESS |
|---|---|
| J-7885 | 3/16 in. |
| J-7886 | ¼ in. |
| J-7887 | 5/16 in. |

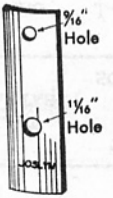



### 3-Hole Plates for ¾-inch Eyebolts

| CAT. NO. | THICKNESS |
|---|---|
| J-7889 | 3/16 in. |
| J-7890 | ¼ in. |
| J-7891 | 5/16 in. |

### 2-Hole Plates for ⅝-inch Eyebolts

| CAT. NO. | THICKNESS |
|---|---|
| J-7896 | 3/16 in. |
| J-7897 | ¼ in. |




### 3-Hole Plate for 1-inch Eyebolts

| CAT. NO. | THICKNESS |
|---|---|
| H-8899 | 5/16 in. |



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Poles and stubs shall be guyed with thimbleye bolts, washers and lift plates of the following sizes.

| REQUIRED STRENGTH OF STRAND OR GUY (IN POUNDS) | DIAMETER THIMBLEYE BOLT (IN INCHES) | CURVED SQUARE WASHER | LIFT PLATES | TYPE OF LAG SCREWS |
|---|---|---|---|---|
| 1150-4000 | ⅝ x length | J-113 | None | J-8754½ |
| 6000 | ⅝ x length | J-113 | J-7897 | J-8754½ |
| 10,000 | ¾ x length | J-6823 | J-7890 | J-8754½ |
| 16,000 | 1 x length | J-6824 | H-8899 | J-8754½ |
| 20,000 | 1 x length | J-6824 | H-8899 | J-8754½ |
| 25,000 | 1 x length | J-6824 | H-8899 | J-8754½ |

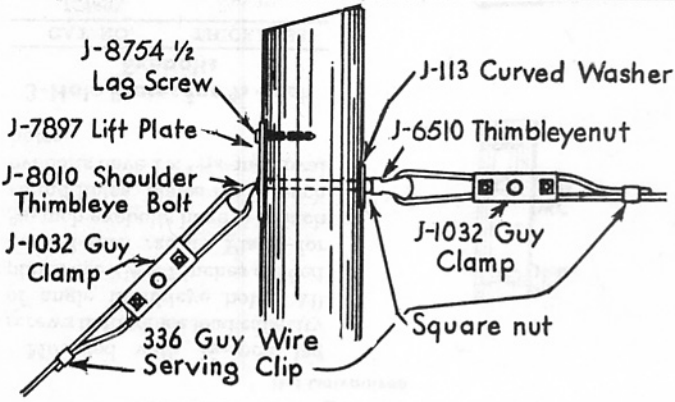



*Figure 106—Eye bolt guying method—Head and "dead-end" guys.*

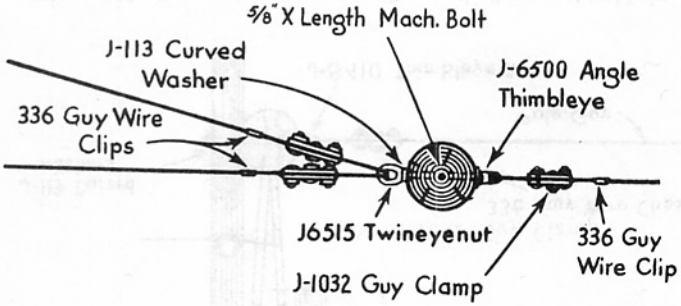



*Figure 107—Eye bolt guying method—Head and double "dead-end" guys.*

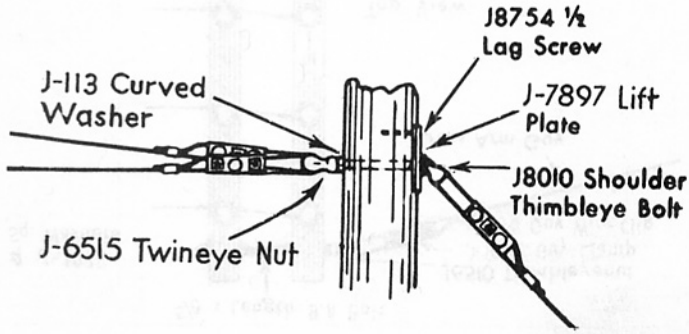



*Figure 107—Eye bolt guying method—Head and double "dead-end" guys.*



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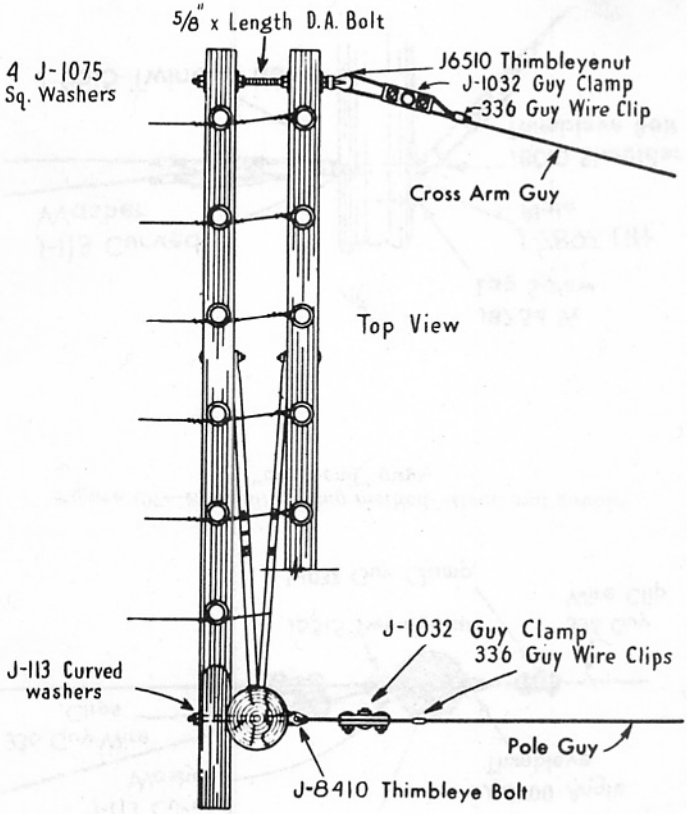



*Figure 108—Pole and cross arm guying method using thimbleye nut and thimbleye bolt.*

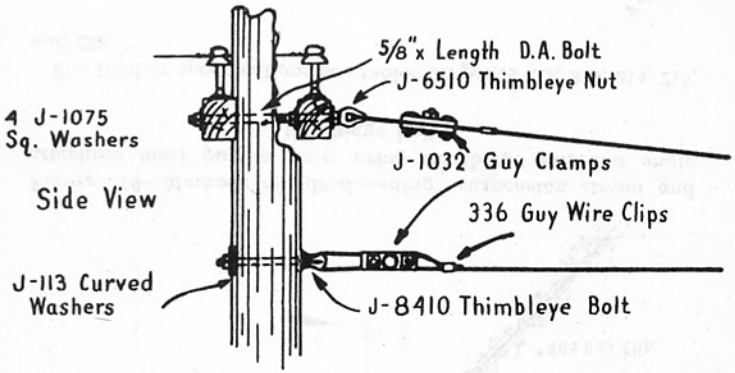



*Figure 108—Pole and cross arm guying method using thimbleye nut and thimbleye bolt.*

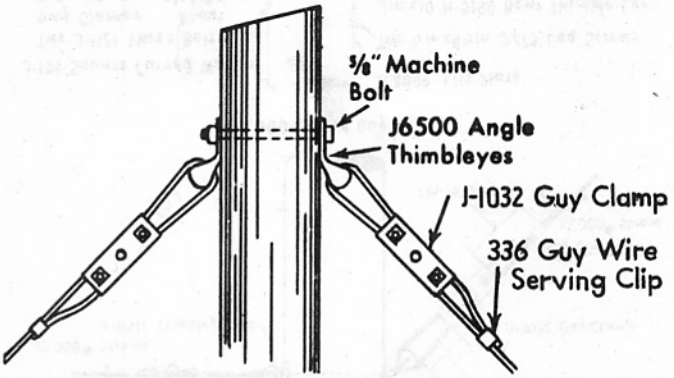



*Figure 109—Storm guy attachment using thimbleyes.*

Use the angle thimbleye bolt for attaching an anchor guy to a pole or a stub where the "lead" is less than 1¼.

Use the straight thimbleye bolt for attaching an anchor guy to a pole or a stub when the "lead" is more than 1¼.



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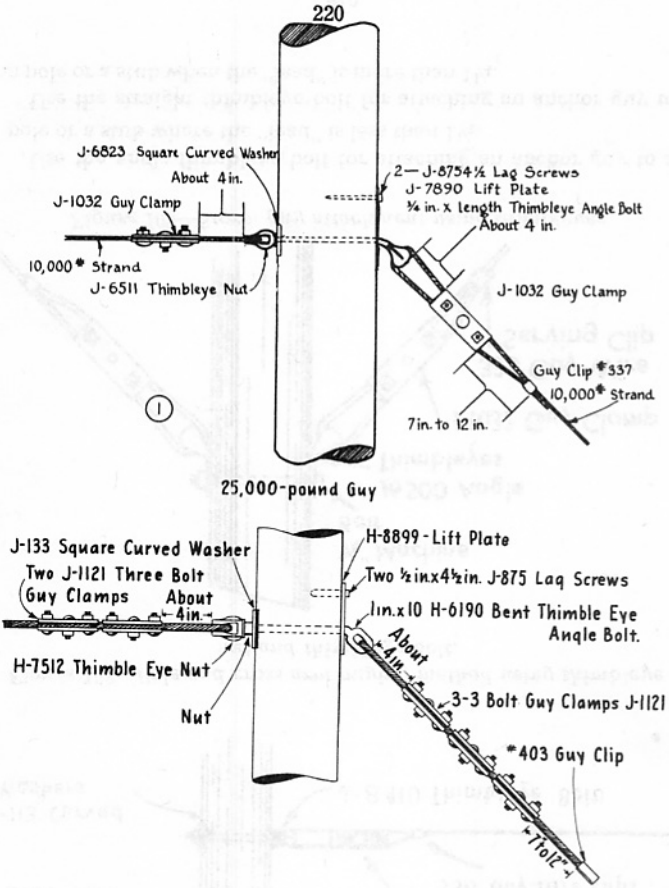



*Figure 110—Methods of "dead-ending" suspension strand and attaching head guy to pole, using thimbleye nut and angle thimbleye bolt.*

For further specifications see tables on pages 212, 213, 214, 215, and 222.

Use the straight thimbleye bolt for attaching an anchor guy to a pole or a stub where the "lead" is less than 1¼.

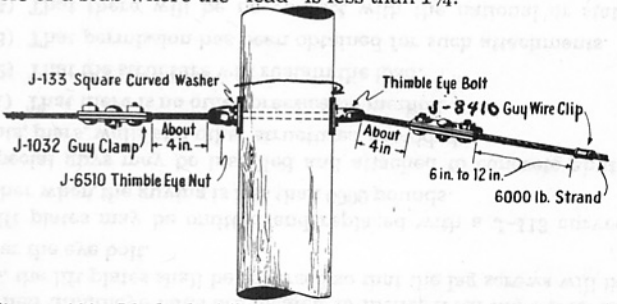



*Figure 111—Method of "dead-ending" suspension strand and attaching head guy to pole, using thimbleye nut and straight thimbleye bolt.*

For further specifications see tables on pages 212, 213, 214, 215, and 222.

Angle thimbleye bolt used in connection with No. 6 B.W.G. steel construction wire.

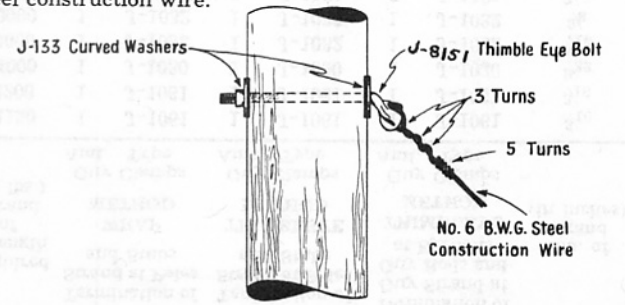



*Figure 112—Attaching guys to poles and stubs using No. 6 B.W.G. steel construction wire—Thimbleye bolt method.*

For further specifications see tables on pages 212, 213, 214, 215, and 222.



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## GUY CLAMP SELECTION

Selection and number of guy clamps required to attach guys to poles, stubs, guy rods and thimbleye bolts.

***Wrap and Thimbleye Methods*** **TABLE NO. 68**

| Required Strength of Strand (in lbs.) | Termination of Strand at Poles and Stubs WRAP METHOD | | Termination of Strand at Poles and Stubs THIMBLEYE METHOD | | Termination of Guy Strand at Guy Rods and at Eyebolts THIMBLEYE METHOD | | Dia. of Strand (in inches) |
|---|---|---|---|---|---|---|---|
| | Guy Amt. | Clamps Type | Guy Amt. | Clamps Type | Guy Amt. | Clamps Type | |
| 1150 | 1 | J-1061 | 1 | J-1061 | 1 | J-1061 | 3/16 |
| 2200 | 1 | J-1061 | 1 | J-1061 | 1 | J-1061 | 3/16 |
| 4000 | 1 | J-1030 | 1 | J-1030 | 1 | J-1030 | 9/32 |
| 6000 | 1 | J-1032 | 1 | J-1032 | 1 | J-1032 | 5/16 |
| 10000 | 1 | J-1032 | 1 | J-1032 | 1 | J-1032 | 3/8 |
| 16000 | 2 | J-1121 | 2 | J-1121 | 2 | J-1121 | 7/16 |
| 25000 | 2 | J-1121 | 3 | J-1121 | 3 | J-1121 | 1/2 |

The square nut under the thimbleye nut may be omitted when the thimbleye nut can be turned down to the curved washer so that the threaded part of the bolt does not interfere with the placing of the strand.

When thimbleye bolts are located 15 inches from the top of the pole, the lift plates shall be reversed so that the lag screws will be under the eye bolt.

Lift plates may be omitted and replaced with a J-113 curved washer when the guying is less than 6000 pounds.

Special guys may be installed and attached to concrete abutments, piers, walls and other structures, provided:

(1) That there is no other practicable method.

(2) That the structure will sustain the load.

(3) That permission has been obtained for such attachments.

(4) That there will be no conflict with the national or state Electrical Code.

**Selection of material for guying as illustrated in Figure 110.**

6000-LB. STRAND

2—No. 336 Guy Wire Clips.
2—J-1032 3-bolt guy clamps.
1—J-6510 Thimbleye nut.
1—J-113 Curved Washer.
1—⅝" shoulder thimbleye bolt.
1—J-7897 Lift Plate.
1—J-8754½ lag screw.

10,000-LB. STRAND

2—No. 337 Guy Wire Clips.
2—J-1032 3-bolt guy clamps.
1—J-6511 Thimbleye nut.
1—J-6823 Curved Washer.
1—¾" Thimbleye bolt.
1—J-7890 Lift Plate.
2—J-8754½ Lag Screws.

16,000-LB. STRAND

2—No. 338 Guy Wire Clips.
2—J-1121 3-bolt Guy Clamps.
1—H-7512 Thimbleye Nut.
1—J-6824 Curved Washer.
1—1" Thimbleye Bolt.
1—H-8899 Lift Plate.
2—8754½ Lag Screws.

25,000-LB. STRAND

2—No. 403 Guy Wire Clips.
5—J-1121 3-bolt Guy Clamps.
1—H-7512 Thimbleye Nut.
1—J-6824 Curved Washer.
1—1" Thimbleye Bolt.
1—H-8899 Lift Plate.
2—8754½ Lag Screws.



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**Selection of material for guying as illustrated in Figure 111**

6000-LB. STRAND

2—J-1032 3 bolt guy clamps.
2—No. 339 Guy Wire Clips.
1—J-6510 Thimbleye nut.
2—J-133 curved washers.
1—⅝" x length shoulder type thimbleye bolt.

10,000-LB STRAND

2—J-1032 3 bolt guy clamps.
2—No. 337 Guy Wire Clips.
1—J-6511 Thimbleye nut.
1—J-6823 curved washer.
1—¾" x length thimbleye bolt.
1—J-7890 lift plate.
2—J-8754½ — 4½" x ½" lag screws.

16,000-LB. STRAND

4—J-1121 3 bolt guy clamps.
2—No. 338 guy wire clips.
1—H-7512 Thimbleye nut.
1—J-6824 Curved washer.
1—1" x length Thimbleye Bolt.
1—H-8899 Lift Plate.
2—J-8754½—4½" x ½" lag screws.

**Selection of material for guying as illustrated in Figure 112.**

NO. 6 BWG CONS'T WIRE

2—J-133 curved washers.
1—⅝" x length thimbleye shoulder type angle bolts.

2200-LB. STRAND

2—J-133 curved washers.
1—No. 402 guy wire clip.
1—⅝" x length thimbleye shoulder type angle bolt.

4000-LB. STRAND

2—J-133 curved washers.
1—No. 402 guy wire clip.
1—⅝" x length thimbleye shoulder type angle bolt.

Consult pages 212, 213, 214, 215, and 222 for the amount and type of hardware required to terminate guying as illustrated.

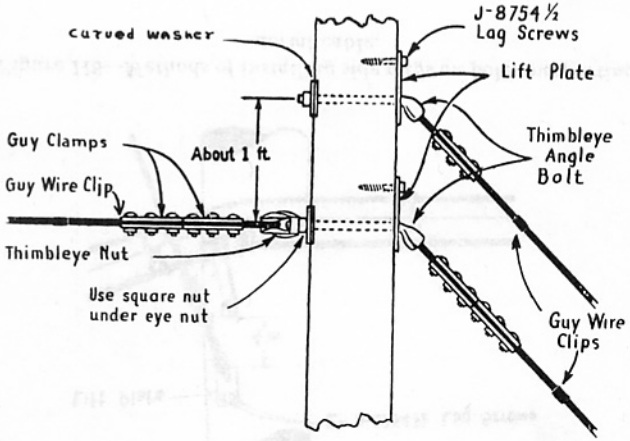



*Figure 113—Method of "dead-ending" suspension strand and attaching two pole guys, using thimbleye nuts and thimbleye bolts.*

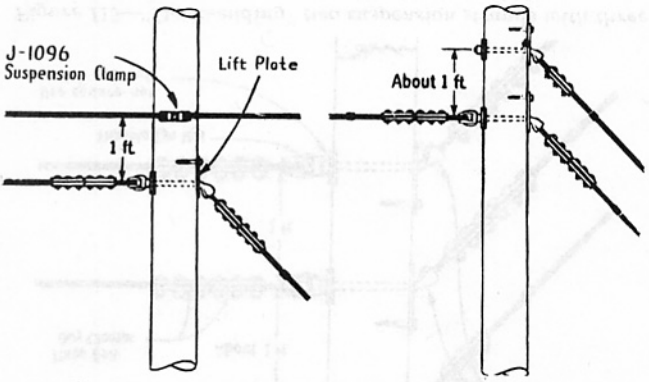



*Figure 114—Method of "dead-ending" two suspension strands between two poles using thimbleye bolts.*



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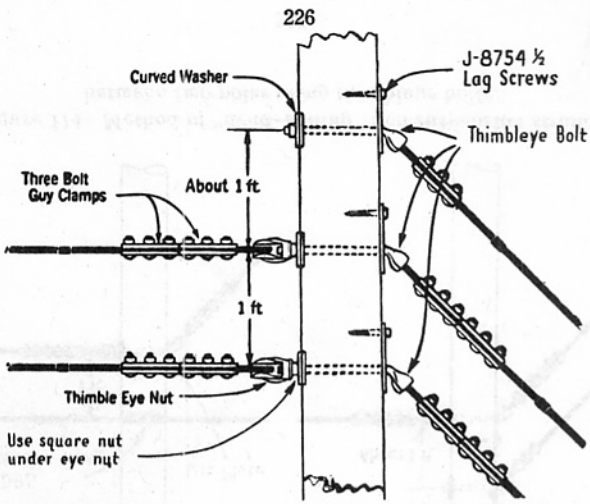



*Figure 115—"Dead-ending" two suspension strands with three anchor guys equipped with thimbleye bolts.*

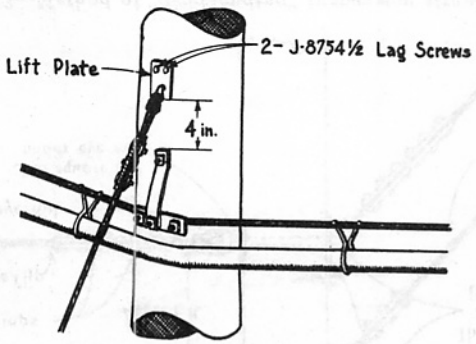



*Figure 116—Methods of installing side guys on poles supporting aerial cable.*

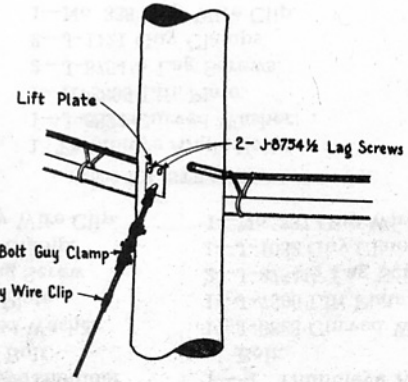



*Figure 116—Methods of installing side guys on poles supporting aerial cable.*

Refer to pages 212, 213, 214, 215, and 222 for the amount and type of hardware required to terminate guys as illustrated in Figure 116.

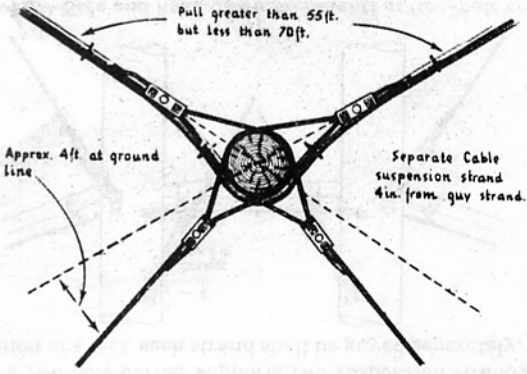



*Figure 117—"Head-guying" corner pole supporting aerial cable—Wrap-around method.*



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Where the thimbleye bolt is used as a suspension clamp bolt, the guy must be equipped with a strain insulator.

When a two pole corner supports two suspension strands, with a separation of 4 feet, each strand shall be guyed separately.

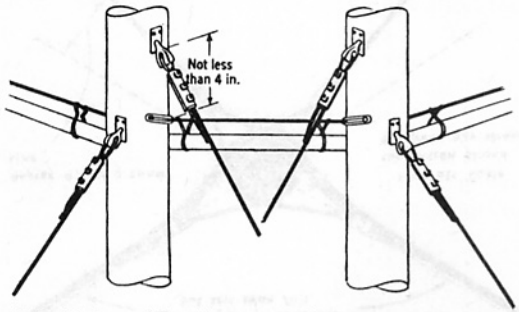



*Figure 118—Side and head guy attachments at two-pole corner supporting aerial cable—Thimbleye bolt method.*

**Selection of guy hardware material for the installation of a side guy supporting an open wire line as shown in Figure 119.**

6000-LB. STRAND

1—⅝" Thimbleye shoulder type Angle Bolt.
1—J-113 Curved Washer.
1—J-7897 Lift Plate.
1—J-8754½ Lag Screw.
1—J-1032 Guy Clamp.
1—No. 336 Guy Wire Clip.

10,000-LB. STRAND

1—¾" Thimbleye Angle Bolt.
1—J-6823 Curved Washer.
1—J-7890 Lift Plate.
2—J-8754½ Lag Screws.
1—J-1032 Guy Clamp.
1—No. 337 Guy Wire Clip.

16,000-LB. STRAND

1" Thimbleye Angle Bolt.
1—J-6824 Curved Washer.
1—H-8899 Lift Plate.
2—J-8754½ Lag Screws.
2—J-1121 Guy Clamps.
1—No. 338 Guy Wire Clip.

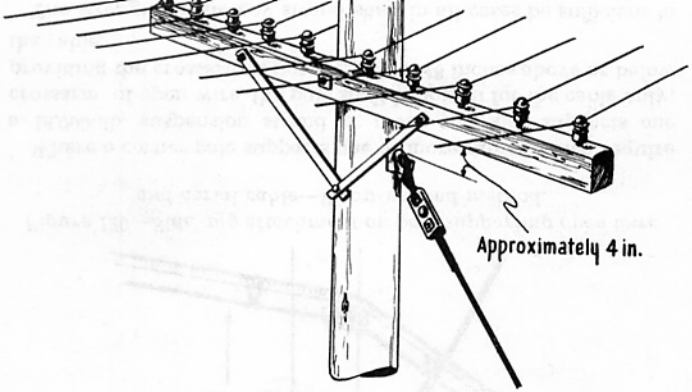



*Figure 119—Side guy attachment on pole supporting open wire—Thimbleye bolt method.*

**Position of SIDE GUYS in open wire line.**

| NUMBER OF GUYS | POSITION OF GUYS |
|---|---|
| 1 | Under 1st crossarm |
| 1 | Under 2nd crossarm |
| 2 | Under 2nd and 4th crossarm |
| 3 | Under 2nd, 4th and 6th crossarm |
| 4 | Under 2nd, 4th and 6th and 8th crossarm |

**Position of HEAD GUYS in open wire line.**

| NUMBER OF GUYS | POSITION OF GUYS |
|---|---|
| 1 | Under 1st crossarm |
| 2 | Under 1st and 3rd crossarm |
| 3 | Under 1st, 3rd and 5th crossarm |
| 4 | Under 1st, 3rd, 5th and 7th crossarm. |

In some cases where additional guys are required, the guys may be raised to the next higher position.



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**Open wire and cable supported on the same pole**

When a corner pole supports two crossarms of wire and a suspension strand up to 10,000 pounds, together with a corresponding size cable, the pole may be guyed with one guy. This can be done providing the strand and lower part of the crossarm are separated by not more than 48 inches as illustrated in Figure 120. Under all other conditions one guy shall support the open wire and the second guy shall support the aerial cable.

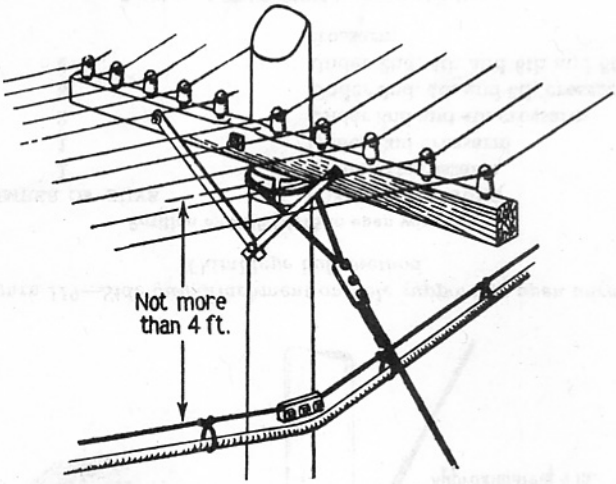



*Figure 120—Side guy attachment on pole supporting open wire and aerial cable—Wrap-around method.*

Where a corner pole supports one or more cables which require a 16,000-lb. suspension strand or more and also supports one crossarm of open wire, the pole shall be guyed for the cable only; providing the crossarm is not more than 48 inches above or below the cable.

The strength of the guy strand shall in all cases be sufficient to support the combined pull of the open wire and the aerial cables.

## THIMBLEYE BOLT AND GUY STRAP METHOD OF INSTALLING STORM GUYS

A 5/8" double arming bolt and two J-6505 guy straps may be used instead of the regular thimbleye bolt.

When a stub pole is to be guyed, a straight thimbleye bolt and a J-6505 guy strap may be used instead of the regular thimbleye angle bolt and the thimbleye nut.

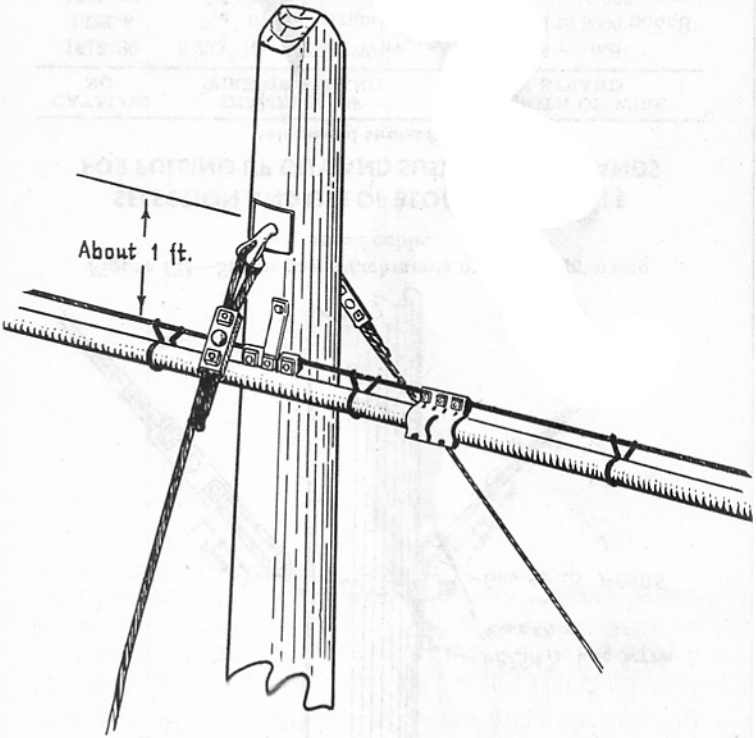



*Figure 121—Storm guy attachments on pole supporting aerial cable.*



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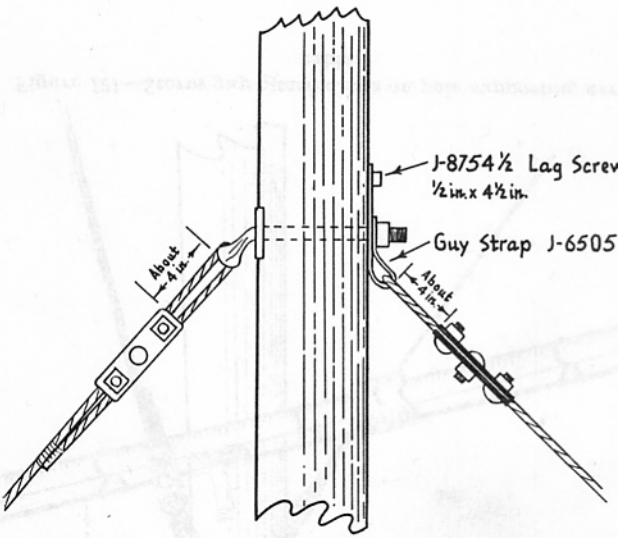



*Figure 121—Storm guy attachments on pole supporting aerial cable.*

## SELECTION AND USE OF BLOCK AND TACKLE FOR PULLING UP GUY AND SUSPENSION STRANDS

**Selection of Strand Pullers**

| CATALOG NO. | DIAMETER OF WIRE OR STRAND | STRENGTH OF WIRE OR STRAND |
|---|---|---|
| 1613-30 | 0.203" No. 6 BWG Wire | 1618 pound |
| 1628-6 | 3/16" to 7/16" strand | 1150 pound to 8000 pound |
| 1628-16 | 5/16" to 5/8" strand | 6000 pound to 16,000 pound |

**Selection of Chain Hoists**

| CATALOG NO. | TYPE | RATED CAPACITY |
|---|---|---|
| A | Coffing Safety Pull Hoist | 1500 lbs. |
| F | Coffing Safety Pull Hoist | 3000 lbs. |

NOTE: The factory tests are 100% over the rated capacity.

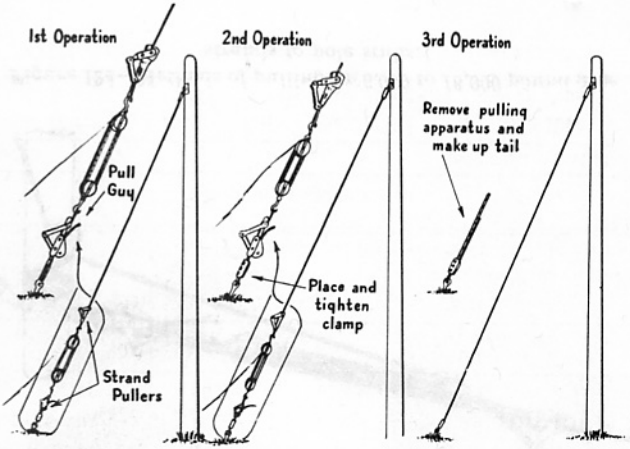



*Figure 122—Method of pulling up guy strand at anchor rod with block and tackle.*

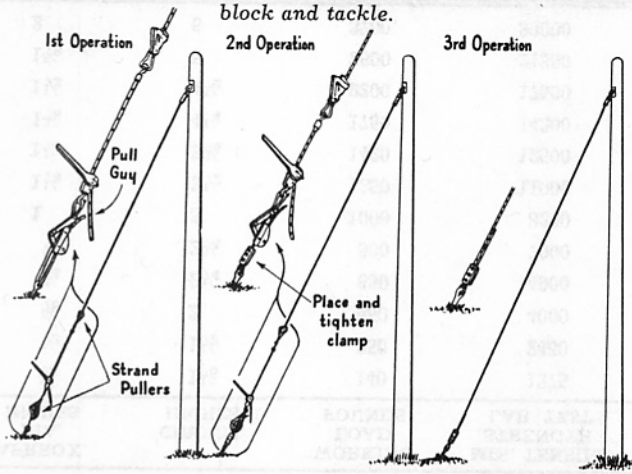



*Figure 123—Method of pulling up guy strand at anchor rod with chain hoist.*



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## APPROXIMATE WORKING CAPACITIES OF ROPES

### NEW MANILA ROPE

| APRROX. DIA. INCHES | CIRCUM. INCHES | WORKING LOAD POUNDS | MIN. TENSILE STRENGTH LAB. TEST |
|---|---|---|---|
| 3/8 | 1 1/8 | 140 | 1275 |
| 1/2 | 1 1/2 | 250 | 2450 |
| 5/8 | 2 | 450 | 4000 |
| 3/4 | 2 1/4 | 650 | 4900 |
| 7/8 | 2 3/4 | 800 | 7000 |
| 1 | 3 | 1000 | 8200 |
| 1 1/8 | 3 1/2 | 1250 | 11000 |
| 1 1/4 | 3 3/4 | 1420 | 12500 |
| 1 3/8 | 4 1/4 | 1750 | 14200 |
| 1 1/2 | 4 1/2 | 2200 | 17500 |
| 1 5/8 | 5 | 2600 | 21500 |
| 2 | 6 | 3700 | 30000 |

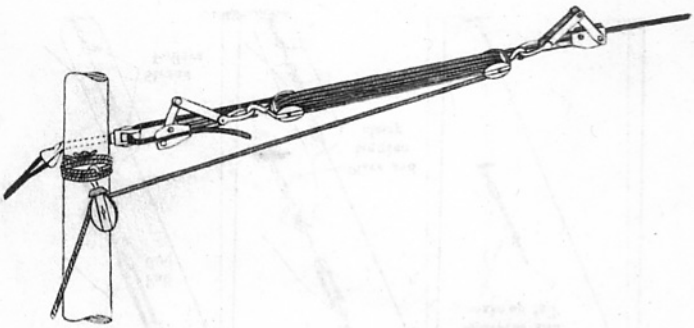


*Figure 124—Methods of pulling up 6,000 to 16,000 pound guy strands to pole stubs.*

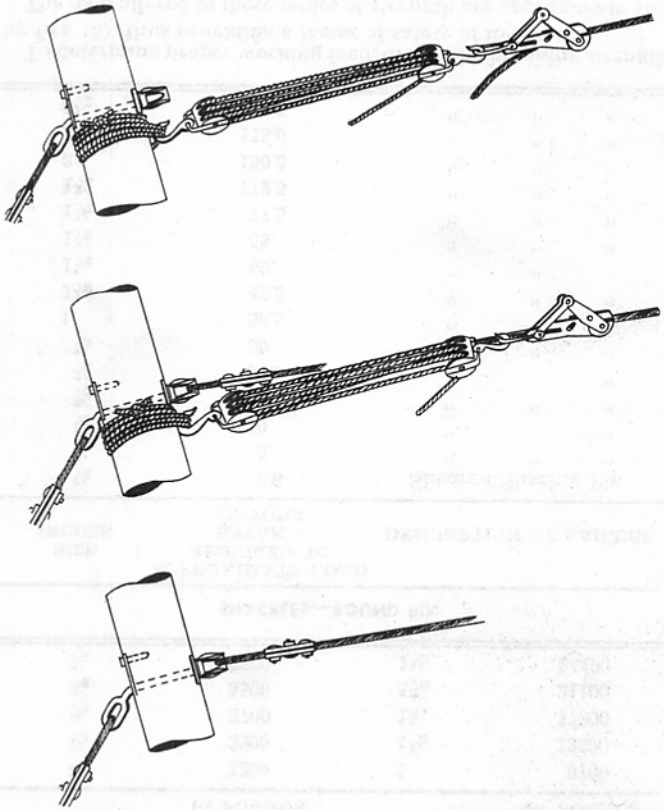


*Figure 124—Methods of pulling up 6,000 to 16,000 pound guy strands to pole stubs.*



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# APPROXIMATE STRENGTH OF HOOKS AND SHACKLES

## HOOKS—ROUND

| SIZE INCHES | APPROX. LOAD REQUIRED TO STRAIGHTEN—IN POUNDS | SIZE INCHES | APPROX. LOAD REQUIRED TO STRAIGHTEN—IN POUNDS |
|---|---|---|---|
| 3/8 | 1200 | 1 | 9700 |
| 1/2 | 2300 | 1 1/8 | 13500 |
| 5/8 | 3700 | 1 1/4 | 17000 |
| 3/4 | 5500 | 1 3/8 | 21100 |
| 7/8 | 7700 | 1 1/2 | 24400 |

## SHACKLES—ROUND PIN

| SIZE INCHES | APPROXIMATE LOAD REQUIRED TO BREAK—IN TONS | DESCRIPTION OF FAILURE |
|---|---|---|
| 1/4 | 2.6 | Sheared Shackle Pin |
| 3/8 | 5. | " " " |
| 1/2 | 10. | " " " |
| 5/8 | 15.5 | " " " |
| 3/4 | 22.5 | " " " |
| 7/8 | 30. | " " " |
| 1 | 36.5 | " " " |
| 1 1/8 | 42.5 | " " " |
| 1 1/4 | 50. | " " " |
| 1 3/8 | 65. | " " " |
| 1 1/2 | 77.5 | " " " |
| 1 3/4 | 112.5 | " " " |
| 2 | 150.0 | " " " |
| 2 1/4 | 175.0 | " " " |
| 2 1/2 | 212.5 | " " " |

To determine proper working load, divide the breaking strength by five (5), thus providing a factor of safety of five to one.

The data offered in these tables of strength are approximate and are intended to assist you in the selection of the proper types of blocks to use for your particular service.

## SUITABLE WORKING LOADS

### FOR A PAIR OF MANILA ROPE BLOCKS

| Length Shell, Inches | WITH HOOKS | | | WITH SHACKLES | | |
|---|---|---|---|---|---|---|
| | Two Singles Lbs. | Two Doubles Lbs. | Two Triples Lbs. | Two Singles Lbs. | Two Doubles Lbs. | Two Triples Lbs. |
| 3 | 200 | 300 | 400 | 400 | 800 | 1200 |
| 4 | 400 | 550 | 700 | 800 | 1400 | 1800 |
| 5 | 500 | 750 | 1000 | 1100 | 1700 | 2100 |
| 6 | 1000 | 1500 | 2000 | 1600 | 2400 | 3000 |
| 7 | 1500 | 2000 | 2500 | 2000 | 3000 | 3700 |
| 8 | 1700 | 2450 | 3200 | 2400 | 3600 | 4400 |
| 9 | 2300 | 2900 | 3600 | 2600 | 3800 | 5000 |
| 10 | 2600 | 3400 | 4200 | 4000 | 5400 | 6400 |
| 12 | 3000 | 3750 | 4500 | 5000 | 8000 | 10000 |

## Wood Pulley Blocks

### Type 1001—For Manila Rope



Single Sheave



Double Sheave



Triple Sheave

Hard wood shells, steel strapped on the inside with iron sheaves, loose side hooks and beckets. Sheaves are furnished with iron roller bushings.



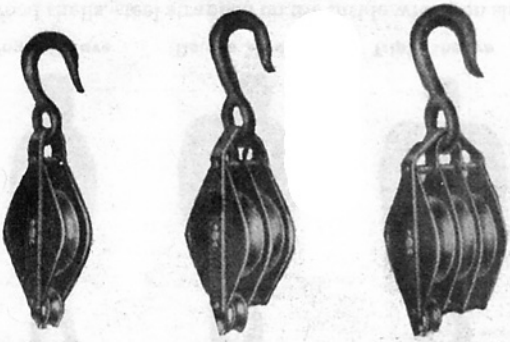
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## Steel Pulley Blocks

**Type 2001—For Manila Rope**



Single Sheave Double Sheave Triple Sheave

Shell is made of pressed steel with rounded edges to prevent chafing rope. Equipped with iron sheaves and round, loose side hook. Sheaves are furnished with iron roller bushings.

## Steel Snatch Blocks

**For Manila Rope**



Heavy steel shell with full length double steel straps, iron sheaves, steel heads and links and flat, stiff swivel hook. Rounded edges prevent chafing of rope. Sheaves are furnished with iron roller bushings.

| Cat. No. | For Rope Size | Length of Shell |
|---|---|---|
| 2706-¾ | ¾ in. | 6 in. |
| 2706-⅞ | ⅞ in. | 7 in. |
| 2706-1 | 1 in. | 8 in. |
| 2706-1¼ | 1¼ in. | 10 in. |

The tested strength of all tackle blocks is five times the working load in order to provide a safety factor of five to one.

## SELECTION OF TACKLE BLOCKS (WOOD)

| Catalog Number | Type | Number of Sheaves | Rope Diameter | Size of Shell |
|---|---|---|---|---|
| 1001-3/8 S | Wood | 1 | 3/8" | 3" |
| 1001-3/8 D | Wood | 2 | 3/8" | 3" |
| 1001-3/8 T | Wood | 3 | 3/8" | 3" |
| 1001-1/2 S | Wood | 1 | 1/2" | 4" |
| 1001-1/2 D | Wood | 2 | 1/2" | 4" |
| 1001-1/2 T | Wood | 3 | 1/2" | 4" |
| 1001-5/8 S | Wood | 1 | 5/8" | 5" |
| 1001-5/8 D | Wood | 2 | 5/8" | 5" |
| 1001-5/8 T | Wood | 3 | 5/8" | 5" |
| 1001-3/4 S | Wood | 1 | 5/8"-3/4" | 6" |
| 1001-3/4 D | Wood | 2 | 5/8"-3/4" | 6" |
| 1001-3/4 T | Wood | 3 | 5/8"-3/4" | 6" |
| 1001-7/8 S | Wood | 1 | 7/8" | 7" |
| 1001-7/8 D | Wood | 2 | 7/8" | 7" |
| 1001-7/8 T | Wood | 3 | 7/8" | 7" |
| 1001-1 S | Wood | 1 | 1" | 8" |
| 1001-1 D | Wood | 2 | 1" | 8" |
| 1001-1 T | Wood | 3 | 1" | 8" |
| 1001-1 1/8 S | Wood | 1 | 1 1/8" | 10" |
| 1001-1 1/8 D | Wood | 2 | 1 1/8" | 10" |
| 1001-1 1/8 T | Wood | 3 | 1 1/8" | 10" |
| 1001-1 1/4 S | Wood | 1 | 1 1/4" | 12" |
| 1001-1 1/4 D | Wood | 2 | 1 1/4" | 12" |
| 1001-1 1/4 T | Wood | 3 | 1 1/4" | 12" |

## SELECTION OF TACKLE BLOCKS (STEEL)

| Catalog Number | Type | Number of Sheaves | Rope Diameter | Size of Shell |
|---|---|---|---|---|
| 2001-3/8-S | Steel | 1 | 3/8" | 3" |
| 2001-3/8-D | Steel | 2 | 3/8" | 3" |
| 2001-3/8-T | Steel | 3 | 3/8" | 3" |
| 2001-1/2-S | Steel | 1 | 1/2" | 4" |
| 2001-1/2-D | Steel | 2 | 1/2" | 4" |



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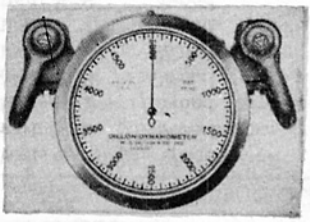
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| Catalog Number | Type | Number of Sheaves | Rope Diameter | Size of Shell |
|---|---|---|---|---|
| 2001-½-T | Steel | 3 | ½″ | 4″ |
| 2001-⅝-S | Steel | 1 | ⅝″ | 5″ |
| 2001-⅝-D | Steel | 2 | ⅝″ | 5″ |
| 2001-⅝-T | Steel | 3 | ⅝″ | 5″ |
| 2001-¾-S | Steel | 1 | ¾″ | 6″ |
| 2001-¾-D | Steel | 2 | ¾″ | 6″ |
| 2001-¾-T | Steel | 3 | ¾″ | 6″ |
| 2001-⅞-S | Steel | 1 | ⅞″ | 7″ |
| 2001-⅞-D | Steel | 2 | ⅞″ | 7″ |
| 2001-⅞-T | Steel | 3 | ⅞″ | 7″ |
| 2001-1-S | Steel | 1 | 1″ | 8″ |
| 2001-1-D | Steel | 2 | 1″ | 8″ |
| 2001-1-T | Steel | 3 | 1″ | 8″ |
| 2001-1⅛-S | Steel | 1 | 1⅛″ | 10″ |
| 2001-1⅛-D | Steel | 2 | 1⅛″ | 10″ |
| 2001-1⅛-T | Steel | 3 | 1⅛″ | 10″ |
| 2001-1¼-S | Steel | 1 | 1¼″ | 12″ |
| 2001-1¼-D | Steel | 2 | 1¼″ | 12″ |
| 2001-1¼-T | Steel | 3 | 1¼″ | 12″ |

## DILLON DYNAMOMETER

A dynamometer shall be inserted in series between the tackle block and the strand puller in order to measure the pound pull being applied to a guy.



Where two or more guys are used to hold a corner pole, a dynamometer will provide a means to measure and apply an equal tension on each guy.

The various uses of the dynamometer will be discussed under the heading of aerial cable and aerial wire installations.

# POLE FITTINGS AND ATTACHMENTS

## WOOD POLE BRACKETS

Where it is known that the ultimate wire load will not exceed 4 wires, wooden pole brackets may be used. For greater loads, crossarms should be installed, and the ultimate wire load should be provided for to avoid expensive rearrangements at a future date.

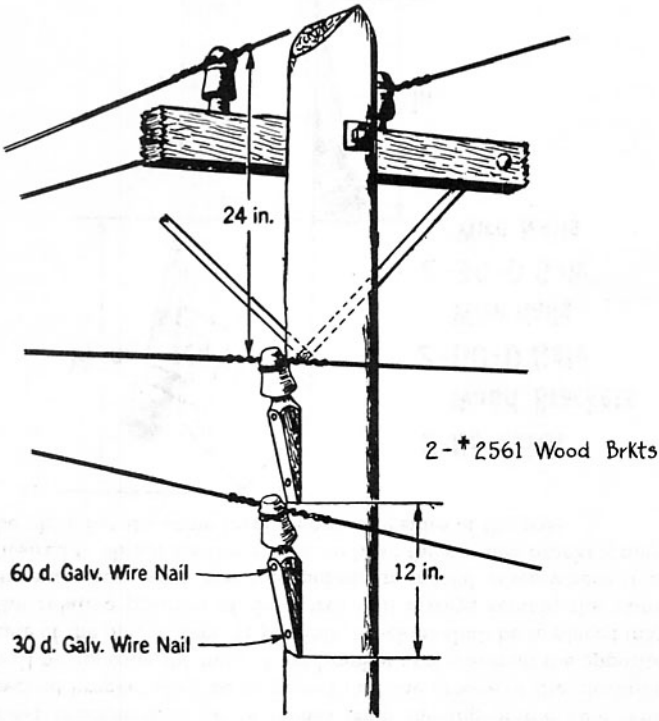



*Figure 125—Position of wood brackets on pole supporting one or more crossarms.*



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Where wood brackets are used, they shall be secured to the pole with one 30d and one 60d galvanized nail. The base of the uppermost bracket shall be 14 inches from the top of the pole. The second bracket shall be so placed that the groove of the insulator will be opposite the base of the bracket above and on the opposite side of the pole. Wherever possible, brackets shall be so placed that the relative position of the wires will always remain the same except when wires are transposed. In special cases where it is desired to obtain greater clearance from the ground, brackets may be placed at the same level on opposite sides of the pole.

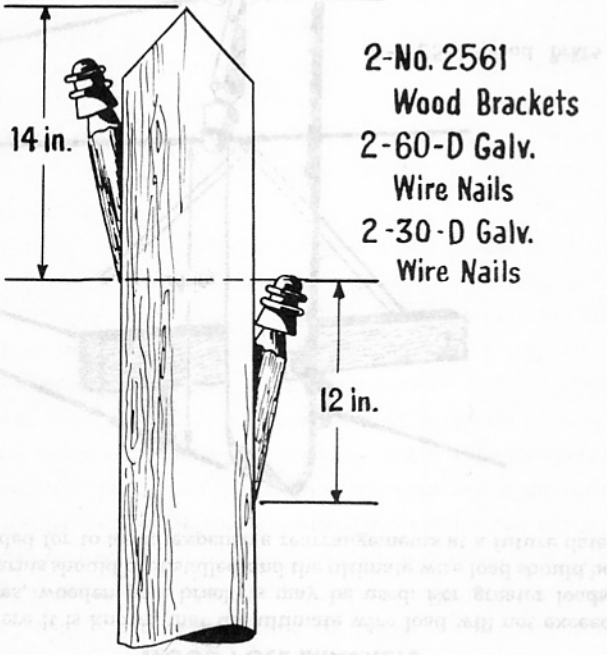



*Figure 126—Position of wood brackets on poles not equipped with crossarms.*

At small angle corner poles, bracket reinforcing straps shall be used. The bracket on the outside of the curve shall be reinforced with a bottom strap, and the inside bracket with a top strap. In the absence of straps, galvanized construction wire may be used by wrapping it twice around the pole and securing it with staples. At large angle corners, where short spans and BB Wire is used, the above method is satisfactory. However, if the corner approaches a right angle it is advisable to place the brackets on the outside of the corner. This may require two brackets for each wire in order to keep them clear of contact with the pole. In long span, corner, and "dead-end" construction where high tensile strength wire is involved, the use of fin-type insulators equipped with clevises is recommended. Pressed steel brackets may also be used. Steel brackets shall be attached to the pole with $\frac{5}{8}$ inch through bolts.

When a pair of wood brackets is attached to a pole carrying one or more crossarms, the brackets should be placed on one side of a pole, preferably the road side. However, the possible future position that the bracket line will occupy on the crossarm must be considered.

A pair of wood brackets may be attached to one side of a jointly used pole providing permission has been granted by the electric light company. Telephone wires on jointly used poles are ordinarily supported on crossarms in order to provide 30 inches of climbing space.

The position of four wood brackets on a pole may be attached to either side of a pole or if preferred the second pair of brackets may be placed on the opposite side of the pole. (Fig. 127.)



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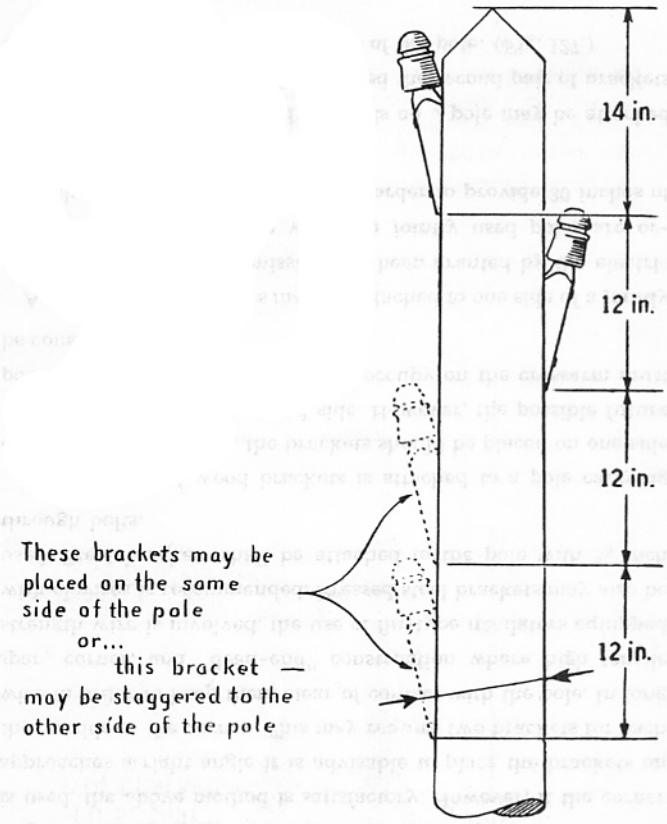



*Figure 127—Position of four wood brackets on pole.*

**Pole Line Material Required: (Fig. 127)**

4—No. 2561 Wood Brackets
4—60-d galv. Wire Nails
4—30-d galv. Wire Nails

When four wires form a phantom group, the wood brackets shall be placed as illustrated in Fig. 128.

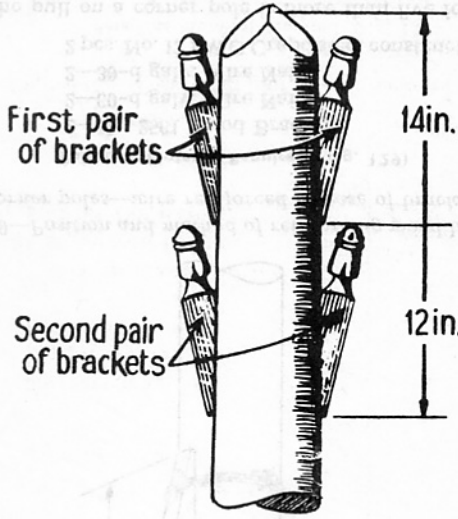



*Figure 128—Position of four brackets for a phantom group installation.*

**Pole Line Material Required: (Fig. 128)**

4—No. 2561 Wood Brackets.
4—60-d galv. Wire Nails.
4—30-d. galv. Wire Nails.

## WOOD BRACKETS ON CORNER POLES

When one or more wood brackets are attached to a corner pole and the pull is against the pole, the brackets must be reinforced with two wraps of No. 12 BWG steel construction wire at the lower part of the bracket (See Fig. 129), or must be reinforced with a J-2562 bracket strap as illustrated in Fig. 130).



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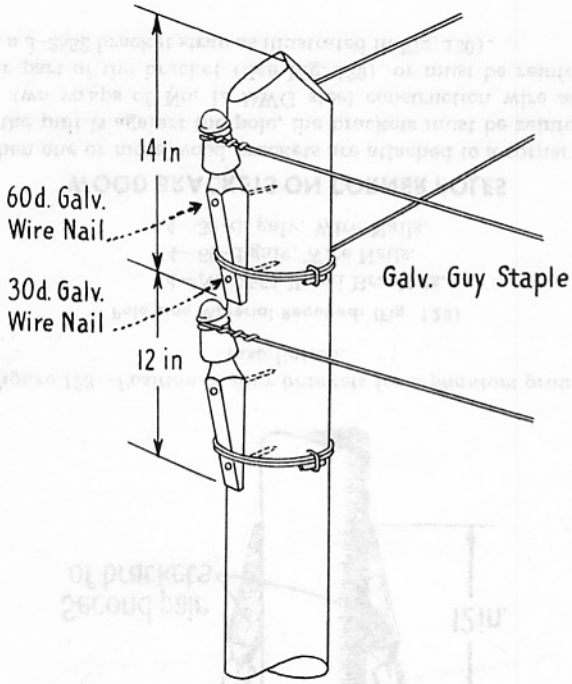



*Figure 129—Position and method of reinforcing wood brackets on corner poles—wire reinforced at base of bracket.*

**Pole Line Material Required: (Fig. 129)**

2—No. 2561 Wood Brackets
2—60-d galv. Wire Nails
2—30-d galv. Wire Nails
2 pcs. No. 12 BWG Crapo steel construction wire.

When the pull on a corner pole is more than five feet and not over 40 feet and the pull of the wires is toward the pole, reinforce the lower part of the wood bracket with a J-2562 bracket strap.

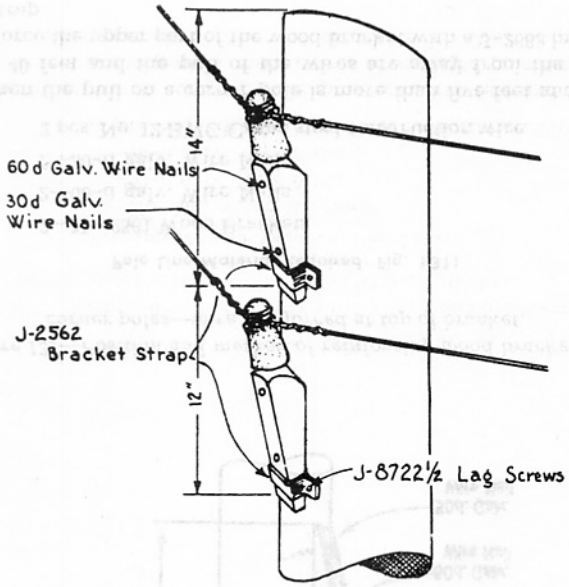



*Figure 130—Position and method of reinforcing wood brackets on corner poles—strap reinforced at base of bracket.*

**Pole Line Material Required: (Fig. 00)**

2—No. 2561 Wood Brackets.
2—J-2562 Bracket Straps.
2—60-d galv. Wire Nails.
2—30-d galv. Wire Nails.
4—J-8722½ Lag Screws.

When one or more wood brackets are attached to a pole and the wires pull away from the pole, the brackets must be reinforced with two wraps of No. 12 BWG steel construction wire at the upper part of the bracket as illustrated in Fig. 131, or must be reinforced with a J-2663 bracket strap as illustrated in Fig. 132.



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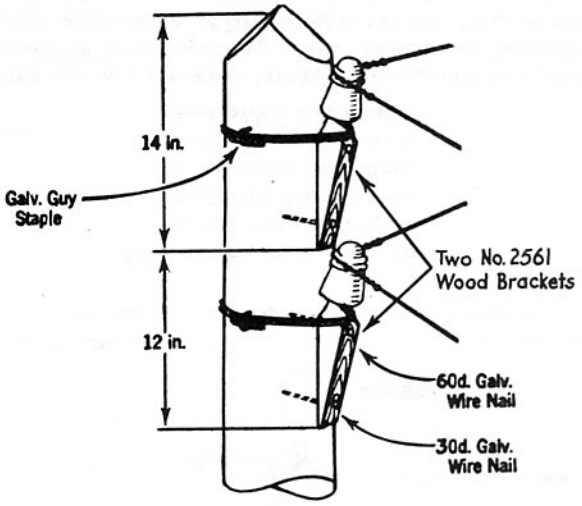



*Figure 131—Position and method of reinforcing wood brackets on corner poles—wire reinforced at top of bracket.*

**Pole Line Material Required: Fig. 131)**

2—No. 2561 Wood Brackets

2—60-d galv. Wire Nails

2—30-d galv. Wire Nails

2 pcs. No. 12 BWG Crapo steel construction wire.

When the pull on a corner pole is more than five feet and less than 40 feet and the pull of the wires are away from the pole, reinforce the upper part of the wood bracket with a J-2663 bracket strap.

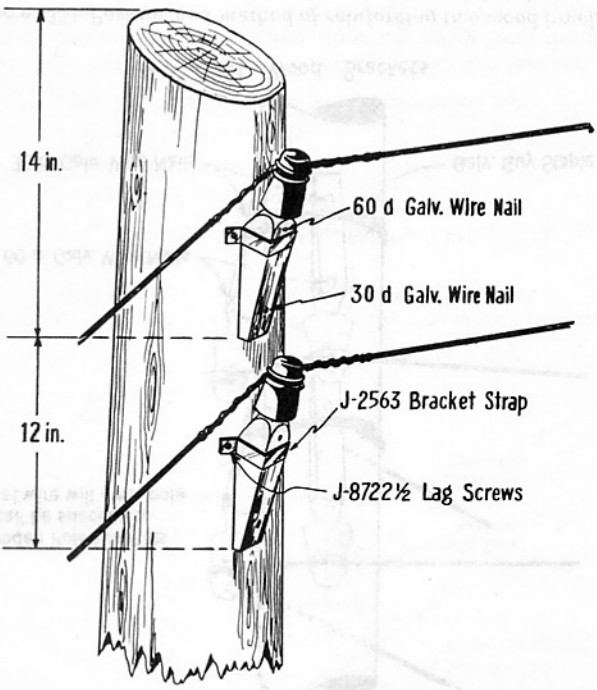



*Figure 132—Position and method of reinforcing wood brackets on corner poles—strap reinforced at top of bracket.*

**Pole Line Material Required: (Fig. 132)**

2—No. 2561 Wood Bracket
2—J-2563 Bracket Straps
2—60-d galv. Wire Nails
2—30-d galv. Wire Nails
4—J-8722½ Lag Screws



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## "TWO BRACKET CORNER" METHOD

When the pull at a corner pole exceeds 40 feet and the wires pull against the pole and where a single wood bracket will not provide wire clearance from the pole, attach and space two brackets in such a manner as to provide clearance between the wire and the pole.

Reinforce the lower part of the brackets with two wraps of No. 12 BWG steel construction wire or 4—J-2562 bracket straps as shown in Figs. 133 and 134.

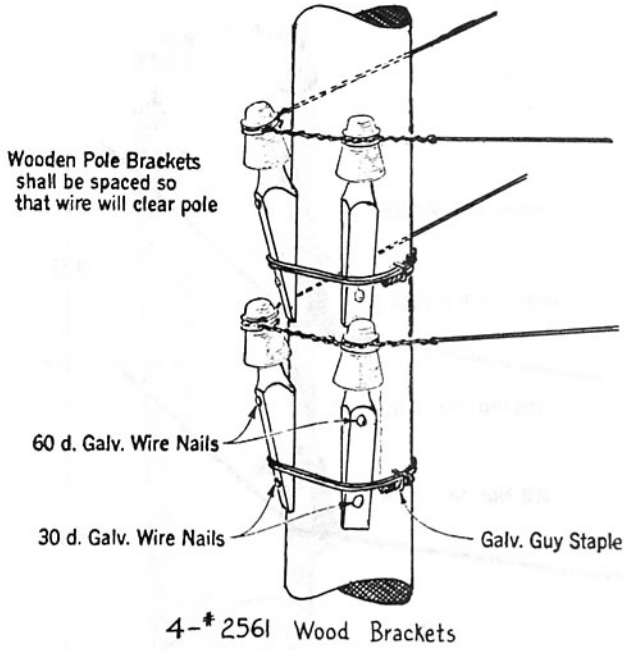



*Figure 133—Position and method of reinforcing two wood brackets on corner poles—wire reinforced at base of bracket.*

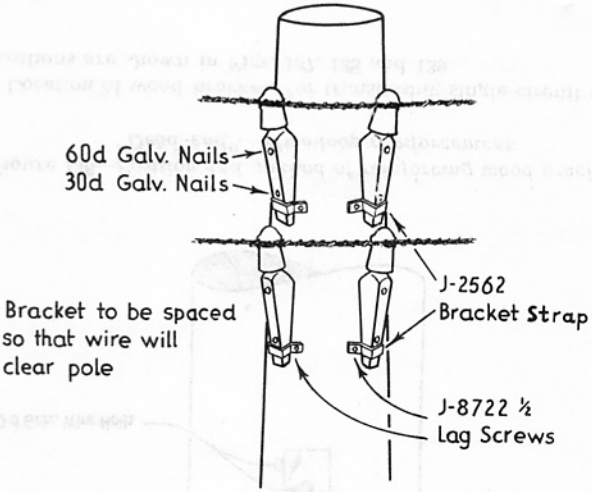



*Figure 134—Position and method of reinforcing two wood brackets on corner poles—Strap reinforced at base of bracket.*

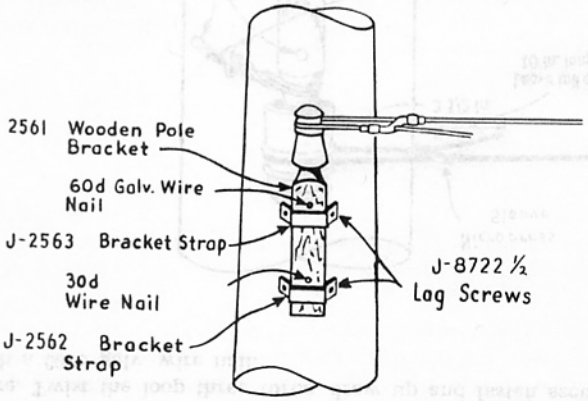



*Figure 135—Position and method of reinforcing wood bracket at "dead end"— Strap reinforced.*



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The wood brackets should be guyed with a 4-inch wire loop consisting of 2 loops of No. 12 BWG Crapo Steel Construction Wire. Twist the loop three turns, draw up and fasten securely with a 60-d galv. wire nail.

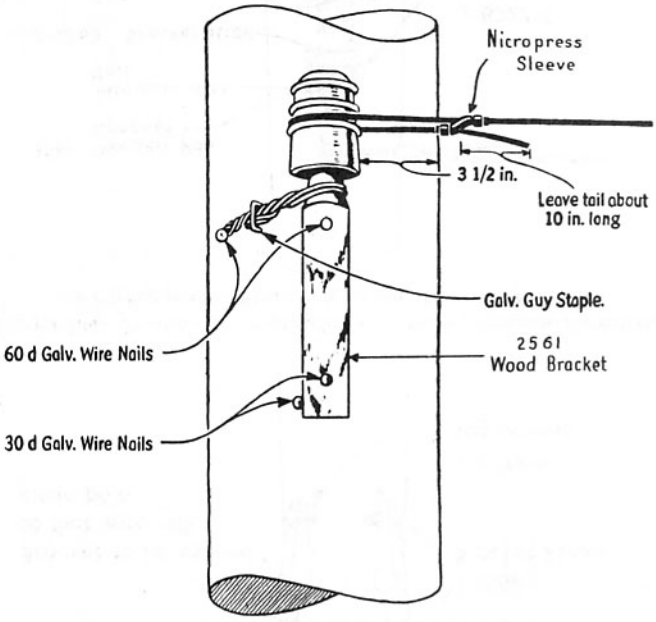



*Figure 136—Position and method of reinforcing wood bracket at "Dead-end"—Wire loop reinforcement.*

Location of wood brackets for transposing single circuit transpositions are shown in Figs. 137, 138 and 139.

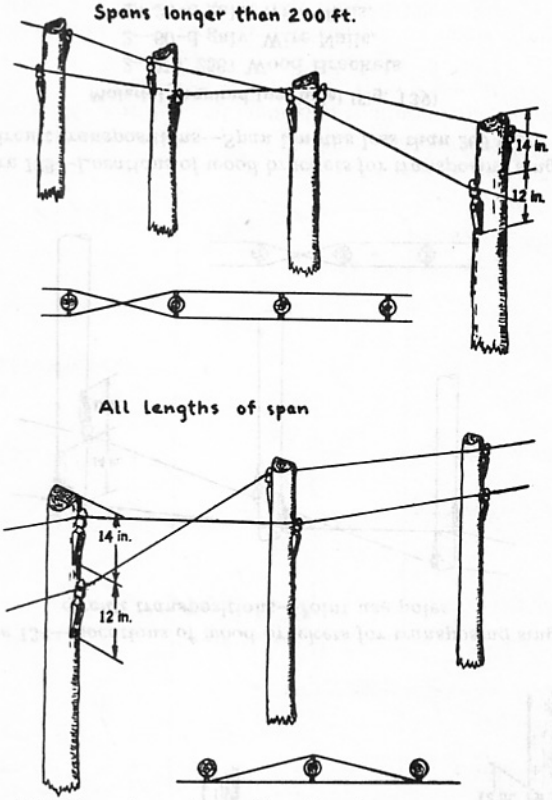



*Figure 137—Locations of wood brackets for transposing single circuit transpositions.*

**Material Required (per pole) (Fig. 137)**

2—No. 2561 Wood Bkts.
1—60-d galv. Wire Nail.
1—30-d galv. Wire Nail.



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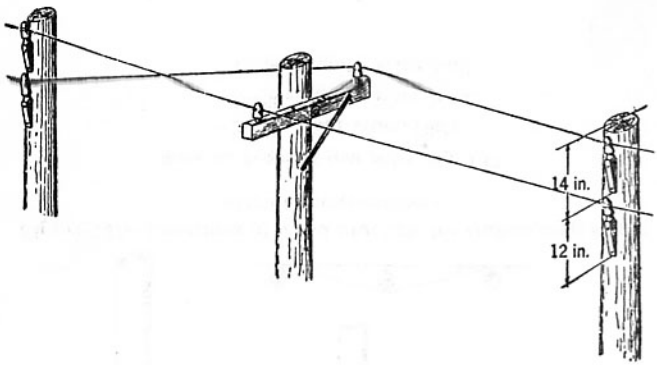



*Figure 138—Locations of wood brackets for transposing single circuit transpositions—Joint use poles.*

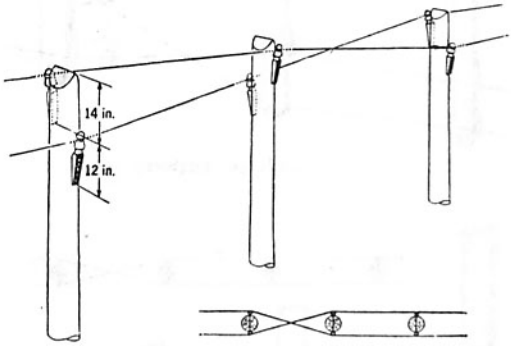



*Figure 139—Locations of wood brackets for transposing single circuit transpositions—Span lengths less than 200 feet.*

**Material Required (per pole) (Fig. 139)**

2—No. 2561 Wood Brackets.
2—60-d galv. Wire Nails.
2—30-d galv. Wire Nails.

Attach two wood brackets at long spans and at *minor* railroad crossings.

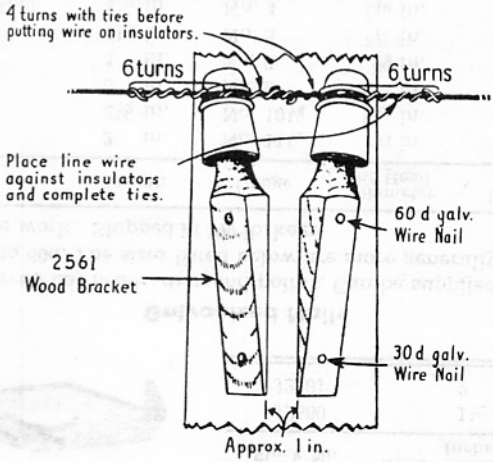



*Figure 140—Attachment of two wood brackets at long spans and at minor railroad crossings.*

**Note:** Wood pole brackets shall not be used to support wires over *major* railroad tracks.




## Bracket Straps

**Hot Dip Galvanized**

Bracket straps are used to reinforce the wood bracket when new types of high strength wire are used. Longer spans are used and therefore the strain on the fastenings is greatly increased, especially on angles. The bottom strap is used on an outside bracket and the top strap on an inside bracket.



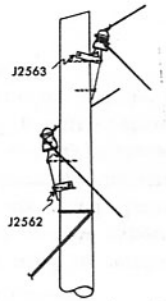
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Mounting holes are 5/16 inch. The straps are made of 1-inch x No. 14 gage steel, to fit brackets 2 inches wide.

| Stock No. | Style |
|---|---|
| J2562 | Bottom |
| J2563 | Top |




Use J-8722½-¼"x2½" Lag Screws or 30d Nails to fasten Bracket Straps

## Bracket Clips

**Hot Dip Galvanized**

Bracket clips are used under the head of the nail to prevent wood bracket from splitting. They are made of No. 14 gage steel.




| Stock No. | Width Between Legs Inches |
|---|---|
| J2560 | 1½ |
| J2561 | 2 |

## Galvanized Nails

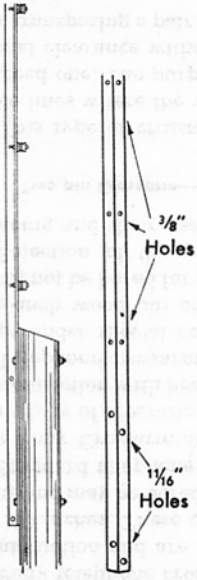
Reinforced flat heads, diamond points. Can be supplied in sizes from 6d to 60d. The sizes listed below are more generally used in telephone work. Shipped in 100 lb. kegs.

| Size | Length | Gauge | Diameter of Head | No. Per Keg |
|---|---|---|---|---|
| 6d | 2 in. | No. 11½ | ¼ in. | 18,100 |
| 8d | 2½ in. | No. 10¼ | 9/32 in. | 10,600 |
| 10d | 3 in. | No. 9 | 5/16 in. | 6,900 |
| 20d | 4 in. | No. 6 | 3/8 in. | 3,100 |
| 30d | 4½ in. | No. 5 | 7/16 in. | 2,400 |
| 30d Spcl. | 4½ in. | No. 4 | 7/16 in. | 2,000 |
| 40d | 5 in. | No. 4 | 15/32 in. | 1,800 |
| 50d | 5½ in. | No. 3 | ½ in. | 1,400 |
| 60d | 6 in. | No. 2 | 17/32 in. | 1,100 |

6d—Nailing pins to cross arms.
8d—General purposes.
10d—Fastening strain plates.
20d—Lower nail for fastening bracket No. J-2551-1 to pole.
30d—Lower nail for fastening pole steps and wood bracket to pole.
50d—Upper nail for fastening bracket No. J-2551-1 to pole.
60d—Upper nail for fastening pole step and wood bracket to pole.

## Highway Cross-Over Brackets

In rural areas it is desirable to set and maintain short and inexpensive poles wherever possible. However, in order to secure standard road clearance for an occasional subscriber drop, it is recommended to attach a highway cross-over bracket to a pole rather than replace it with a taller pole.




Cross-over Brackets
Hot Galvanized

**Material Required for a Highway Cross-over Bracket**

1—J-1207 Highway cross-over bracket or
1—M-781336 Highway cross-over bracket
2—5/8" x length machine bolts
2—J-6821—2¼"x2¼"x3/16" square washers
1—No. 6061—2-groove porcelain knob
1—J-8232—5/16"x2" flat head stove bolt

No. J-1207 consists of a 1½x1½x¼-inch steel angle 7½ feet long with six ⅜-inch holes for mounting porcelain knobs and two 11/16-inch mounting holes for ⅝-inch bolts. Holes spread 10 inches apart.

No. M-781336 consists of a galvanized steel channel, 6½ feet long.

| Cat. No. | Length |
|---|---|
| J-1207 | 90 inches |
| M-781336 | 78 inches |



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## CROSSARMS

Pony telephone crossarms are generally accepted for rural line construction and are available in various lengths from 24 inches to 120 inches. These crossarms are obtainable in fir or creosoted pine and may be bored for 2, 4, 6, 8, 10 and 12 pins.

Standard telephone crossarms have a greater cross section than the Pony Crossarm and are known as the "Electric Light Arm". This type of crossarm is used for carrying toll circuits and is used in connection with heavier construction methods.

Telephone crossarms shall be bored for 1¼-inch wood pins except under special conditions when a hole may be drilled for a 1½-inch wood pin or for a steel pin. Pony telephone crossarms shall not be bored for pins larger than 1¼ inches.

Selection of the proper crossarm, length, cross section, pin spacing and their uses are as follows:

**Two pin Crossarm—2¾" x 3¾" x 24". Catalog No. (Fir) J-5819 (Pine) No. 31**

This type of crossarm is designed for (non jointly use) rural pole lines where the ultimate number of metallic circuits will not exceed one. The purpose of the two pin crossarm is to gain additional clearance without setting a taller pole and is also valuable for transposing a pair of wires as shown in Figure 138.

**Four pin Crossarm—2¾" x 3¾" x 42". Catalog No. (Fir) J-5822 (Pine) No. 34**

This type of crossarm is designed for rural pole lines where the ultimate number of metallic circuits will not exceed two. The purpose of the four pin crossarm is to gain additional clearance without setting a taller pole. The crossarm may be also used on "joint use" poles for supporting two wires, thus providing climbing space. The two inside pins must be left vacant.

**Six pin Crossarm—2¾" x 3¾" x 62". Catalog No. (Fir) J-5823 (Pine) No. 35**

This type of crossarm is designed for rural pole lines where the ultimate number of metallic circuits will not exceed three. This crossarm is not adapted for "joint use" poles.

**Ten pin Crossarms—2 ¾" x 3 ¾" x 102". Catalog No. (Fir) J-5825 (Pine) No. 37**

This type of crossarm is designed for rural and light construction methods where the ultimate number of metallic circuits will exceed three. This crossarm is not adapted for "joint use" poles.

**Ten pin Crossarm—2 ¾" x 3 ¾" x 120". Catalog No. (Fir) K-5825 (Pine) No. 37.1**

This type of crossarm is designed for "joint use" poles and will provide 30 inches of climbing space. The crossarm is adapted to rural pole lines and other light construction methods where the ultimate number of metallic circuits will exceed three.

**Six Pin Crossarm—3 ¼" x 4 ¼" x 72". Catalog No. (Fir) K-5804 (Pine) No. 5.1**

This type of crossarm is designed to carry toll circuits and where heavy construction is required. Use this crossarm only where the ultimate number of metallic circuits will not exceed three. This crossarm is not adapted to "joint use" poles.

**Ten Pin Crossarm—3 ¼" x 4 ¼" x 120". Catalog No. (Fir) K-5809 (Pine) No. 10.1**

This type of crossarm is designed to carry toll circuits and should be used where heavy construction is required.

Use this crossarm when the ultimate number of metallic circuits will exceed three.

This crossarm is not adapted to "joint use" poles.

**Ten Pin Crossarm—3 ¼" x 4 ¼" x 120". Catalog No. (Fir) K-5809.1 (Pine) No. 10.2**

This type of crossarm is designed for "joint use" poles and will provide 30 inches of climbing space. The crossarm is adapted for heavy construction and should be used where more than three metallic circuits will be used.

NOTE: The term "joint use" signifies the pole in question is used jointly by the Telephone Company, Electric Light or Power Company.



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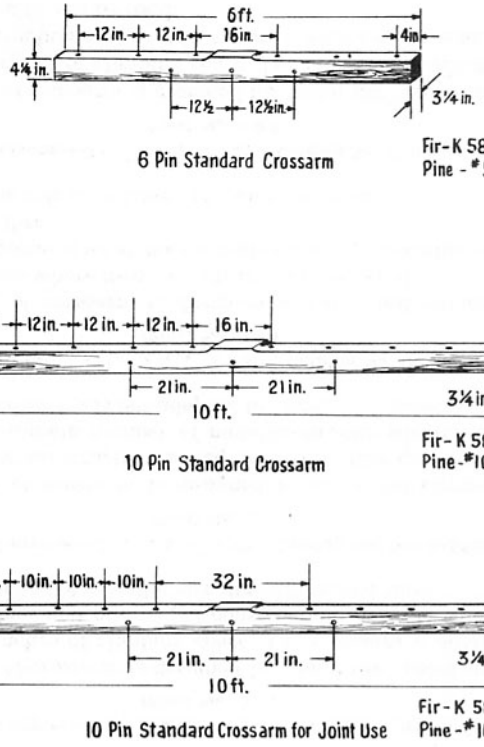



*Figure 141—Standard crossarm dimensions.*

## GENERAL STANDARD SPECIFICATIONS FOR FIR AND PINE CROSSARMS TABLE NO. 70

| SIZE OF CROSSARM | PIN HOLES SPACINGS IN INCHES CENTER | SIDES | ENDS | SIZE IN INCHES | CENTER BOLT HOLE (INCHES) | BRACE BOLT SPACING (INCHES) | LENGTH OF CROSSARM BRACE (INCHES) |
|---|---|---|---|---|---|---|---|
| **3¼"x4¼" Electric Light Arms*** | | | | | | | |
| 6 ft.— 6 pin | 16 | 12 | 4 | 1 9/32 | 5/8 | 28 | 22 |
| 10 ft.—10 pin | 16 | 12 | 4 | 1 9/32 | 5/8 | 42 | 30 |
| 10 ft.—10 pin | 32 | 10 | 4 | 1 9/32 | 5/8 | 42 | 30 |
| **2¾"x3¾" Pony Telephone Arms**** | | | | | | | |
| 24"— 2 pin | 17 | — | 3½ | 1 9/32 | 5/8 | none | none |
| 42"— 4 pin | 16 | 9½ | 3½ | 1 9/32 | 5/8 | 28 | 22 |
| 62"— 6 pin | 16 | 9¾ | 3½ | 1 9/32 | 5/8 | 28 | 22 |
| 102"—10 pin | 16 | 9¾ | 4 | 1 9/32 | 5/8 | 28 | 22 |
| 120"—10 pin | 32 | 10 | 4 | 1 9/32 | 5/8 | 42 | 30 |

*Electric Light Arms are bored 1 9/32 inch for 1¼ inch Pins or 1 17/32 inch for 1½ inch Pins. 1¼ inch Pins are considered standard for telephone work.

**Pony Telephone Arms are bored for 1¼ inch Pins only.

**Items of material required to assemble Crossarms.**

(1) 2¾"x3¾"x24" Pony Crossarm:

1—J-5819—two pin Pony Crossarm
2—J-1760—1¼" x 8" Locust Crossarm Pins
2—6d galv. Wire Nails
1—⅝" x length Machine Bolt
2—J-1075—2¼" Square Washers

(2) 2¾"x3¾"x42" Pony Crossarm:

1—J-5822 four pin Pony Crossarm
4—J-1760—1¼" x 8" Locust Crossarm Pins
4—6d galv. Wire Nails
1⅝" x length Machine Bolt
2—J-1075—2¼" Square Washers
2—J-8634—⅜" x 4" Galv. Carriage Bolts
2—J-1085—1¼" Round Washers
2—J-7122—22" Crossarm braces
1—J-8754—½"x4" Lag Screw.



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**Items of Material required to assemble crossarms (Cont'd.)**

(3) 2¾" x 3¾" x 62" Pony Crossarm:
- 1—J-5823 Six-Pin Crossarm.
- 6—J-1760—1¼" x 8" Locust Crossarm Pins.
- 6—6d galv. Wire Nails.
- 1—⅝" x length Machine Bolt.
- 2—J-1075—2¼" Square Washers.
- 2—J-8634—⅜"x4" Galv. Carriage Bolts.
- 2—J-1085—1¼" Round Washers.
- 2—J-7122—22" Crossarm Braces.
- 1—J-8754—½"x4" Lag Screw.

(4) 2¾" x 3¾" x 102" Pony Crossarm:
- 1—J-5825 Ten Pin Crossarm.
- 10—J-1760—1¼" x 8" Locust Crossarm Pins.
- 10—6d Galv. Wire Nails.
- 1—⅝" x length Machine Bolt.
- 2—J-1075—2¼" Square Washers.
- 2—J-8634—⅜" x 4" Galv. Carriage Bolts.
- 2—J-1085—1¼" Round Washers.
- 2—J-7122—22" Crossarm Braces.
- 1—J-8754—½"x4" Lag Screw.

(5) 2¾" x 3¾" x 120" Pony Crossarm:
- 1—K-5825—10-Pin Crossarm.
- 10—J-1760—1¼" x 8" Locust Crossarm Pins.
- 10—6d Galv. Wire Nails.
- 1—⅝" x length Machine Bolt.
- 2—J-1075—2¼" Square Washers.
- 2—J-8634—⅜" x 4" Galv. Carriage Bolts.
- 2—J-1085—1¼" Round Washers.
- 2—J-7130—30" Crossarm Braces.
- 1—J-8754—½" x 4" Lag Screw.

(6) 3¼" x 4¼" x 72" Standard Crossarm (Electric Light Arms):
- 1—K-5804—Six Pin Crossarm.
- 6—J-1760—1¼" x 8" Locust Crossarm Pins.
- 6—6d Galv. Wire Nails.
- 1—⅝" x Length Machine Bolt.

(6) 3¼″ x 4¼″ x 72″ Standard Crossarm (Electric Light Arms):
2—J-1075—2¼″ Square Washers.
2—J-8634—⅜″ x 4″ Galv. Carriage Bolts.
2—J-1085—1¼″ Round Washers.
2—J-7122—22″ Crossarm Braces.
1—J-8754½—½″ x 4½″ Lag Screw.

(7) 3¼″ x 4¼″ x 120″ Standard Crossarm (Electric Light Arm):
1—K-5809—Ten Pin Crossarm.
10—J-1760—1¼″ x 8″ Locust Crossarm Pins.
10—6d Galv. Wire Nails.
1—⅝″ x Length Machine Bolt.
2—J-1075—2¼″ Square Washers.
2—J-8634—⅜″ x 4″ Galv. Carriage Bolts.
2—J-1085—1¼″ Round Washers.
2—J-7130—30″ Crossarm Braces.
1—J-8754½—½″x4½″ Lag Screw.

(8) 3¼″ x 4¼″ x 120″ Standard Crossarm (Electric Light Arm):
1—K-5809.1—Ten Pin Crossarm.
10—J-1760—1¼″ x 8″ Locust Crossarm Pins.
10—6d Galv. Wire Nails.
1—⅝″x length Machine Bolt.
2—J-1075—2¼″ Square Washers.
2—J-8634—⅜″ x 4″ Galv. Carriage Bolts.
2—J-1085—1¼″ Round Washers.
2—J-7130—30″ Crossarm Braces.
1—J-8754½—½″ x 4½″ Lag Screw.

## Standard Wood Insulator Pins




The Locust Wood Pin is most popular because the hard, close-grained wood cannot be penetrated by moisture and is practically impervious to decay. Because of its great strength and uniform quality, it is well suited for making wood insulator pins where accurate turning and freedom from shrinking or warping are primary considerations.

Threaded one-inch in diameter, four threads to the inch, with 1/16-inch taper per inch of length. Length of the thread is 2¼ inches.



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**Standard Wood Insulator Pins (Cont'd)**

| Cat. No. | Pin Size Inches | Top Size |
|---|---|---|
| J-1760 | 1¼x8 | 1 in. |
| J-1761 | 1½x9 | 1 in. |

## Transposition Pins



Transposition pins conform to the above specifications but have an extra long thread for use with transposition insulators.

| Cat. No. | Pin Size Inches |
|---|---|
| J-1782 | 1¼x9 |

## Corner and Duplex Insulator Pins



Corner Pins are used principally on corners and strain points. They are reinforced with a ⅜-inch galvanized bolt which extends through the entire length of the pin. An extra large washer 2 inches in diameter is provided so that the nut may be tightened and the pin securely fastened in place.

Duplex Pins are threaded on both ends and are also used for transposition insulators.

| Cat. No. | Pin Size Inches | Description |
|---|---|---|
| J-1784 Corner | 1¼x8 | No. 1 Grade Locust |
| J-1758 Corner | 1½x9 | No. 1 Grade Locust |
| J-1786 Duplex | 1¼x11½ | No. 1 Grade Locust |

## Western Union Steel Pins




The cobs are made of the best grade of air-dried oak, boiled in paraffin to exclude all moisture. The pins are forged from stiff, high carbon open-hearth steel and are cut-threaded on the top to receive the cobs.

The Long Shank Pin is equipped with one square nut and a round washer, clipped on one side to permit locking the nut by driving a nail into the arm.

Short shank pins are furnished with nut only and are used on transposition brackets, steel crossarms, ridge irons, etc. Extra cobs can be furnished.

| Cat. No. | Diameter of Shank | Length Below Shoulder | Length Above Shoulder |
|---|---|---|---|
| J-1190 | ½ in. | 5 in. | 4¼ in. |
| J-1191 | ⅝ in. | 5 in. | 4¼ in. |
| J-1193 | ½ in. | 1 in. | 4¼ in. |
| J-1195 | ⅝ in. | 1 in. | 4¼ in. |

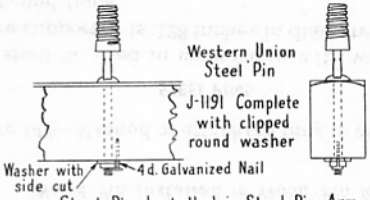
## Method of Installing Crossarm Pins

### WOOD PINS

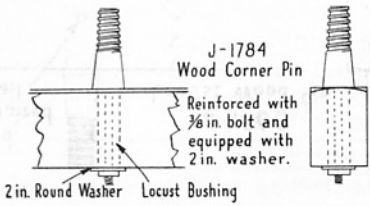
(1) Insert the lower part of the wood pin into the bored hole of a crossarm from the top.

(2) Shoulder should be flush with the top of the crossarm.

(3) Drive a 6d. galv. wire nail through the crossarm into the wooden pin at a point midway between the top and the bottom of the crossarm.



Steel Pin Installed in Steel Pin Arm



Steel Pin Installed in Wood Pin Arm



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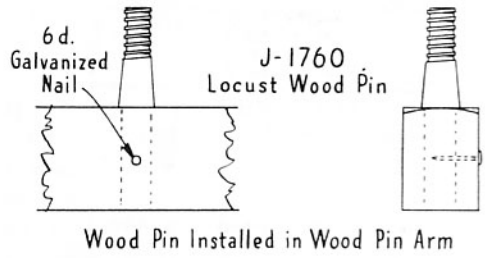



*Figure 142—Method of attaching pins to crossarms.*

### STEEL PINS

Steel pins shall be used in connection with wooden crossarms when the wire supported is .128 inches in diameter or larger under the following conditions:

(1) Corner Poles where the pull is in excess of 20 feet.

(2) Only one crossarm to be equipped with steel pins where the corner pole is double armed.

(3) Crossarms shall be equipped with steel pins at terminal or dead end poles.

(4) On long spans where the double crossarms are used, equip the arm facing the long span with steel pins. The remaining arm shall be equipped with wood pins.

### Break Irons

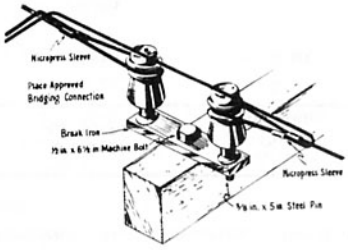



*Figure 143—Typical break iron installation.*

Break irons are used at test points and terminal poles. Break irons are assembled and installed as shown in Figure 143.

**Material Required for a Break Iron.**

1—H-9280—Break Iron Bracket.
1—H-5660—Top Centering Washer.
1—H-5680—Bottom Centering Washer.

## ATTACHING CROSSARMS TO POLES

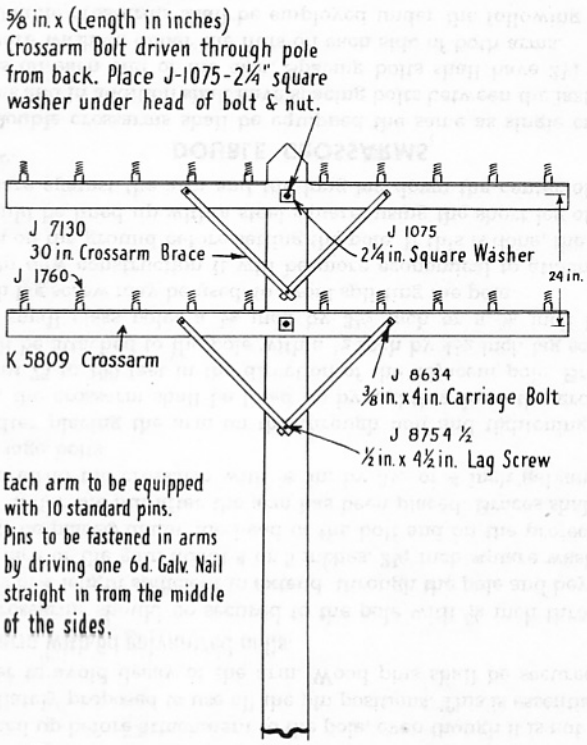



*Figure 144—Method of attaching crossarms to pole.*



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Where crossarms are bored for wood pins, they shall be entirely pinned up before attachment to the pole, even though it is not immediately proposed to use all the pin positions. This is essential in order to avoid decay of the arm. Wood pins shall be secured in the arm with 6d galvanized nails.

Crossarms should be secured to the pole with ⅝ inch through bolts of a length sufficient to extend through the pole and beyond the face of the gain about 4 or 5 inches. 2¼ inch square washers shall be placed under the head of the bolt and on the projecting end under the nut after the arm has been placed. Braces shall be secured to the crossarm with ⅜ in. by 3½ or 4 inch galvanized carriage bolts.

After placing the arm on the through bolt and tightening the nut, the crossarm shall be lined up by sighting from the ground about 75 to 100 feet in the direction of the adjacent pole. Braces shall be attached to the pole with a ½ inch by 4½ inch lag screw. On small class poles a ½ inch by 3½ inch or a ⅜ inch by 4 inch lag screw may be used, to avoid splitting the pole.

On new construction it will be more economical to attach the arm on the ground before setting the pole. If this is done, the arm should be lined up with a steel square, using the short leg of the square against the arm and the long leg down the center of the pole.

## DOUBLE CROSSARMS

Double crossarms shall be equipped the same as single crossarms and in addition shall have spacing bolts between the last two pins on each end of the arm. Spacing bolts shall have 2¼ inch square washers under the nuts on each side of both arms.

Double crossarms shall be employed under the following conditions.

(1) Attached to poles at railroad crossings.
(2) On corner poles having a pull of 20 feet or more.
(3) On head-guyed poles adjacent to corner poles.
(4) On terminal poles.
(5) On "H" fixture poles.
(6) On head-guyed poles adjacent to end terminal.
(7) On intermediate terminal poles where five or more wires terminate on a crossarm from one direction.

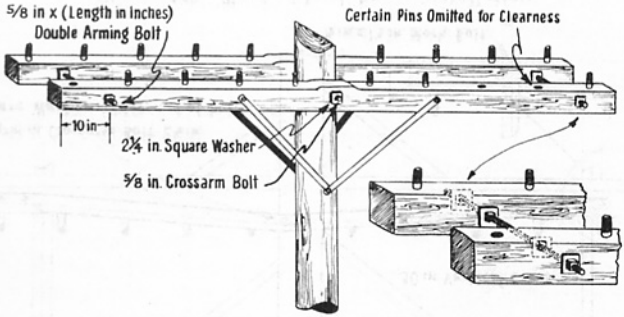



*Figure 145—Method of attaching double crossarms to pole.*

## SIDE ARM FIXTURES

Sidearm construction may be necessary at some locations in order to clear trees or other obstacles. When such construction is necessary, diagonal and back braces shall be used. Diagonal braces shall be fastened to the pole by the use of a ½ inch drive screw and to the arm with a ½ by 4½ inch machine bolt. The back brace will be secured to the pole by placing it under the head of the through bolt and to the arm by the same machine bolt that secures the diagonal brace. Where the line consists of more than one crossarm, vertical braces shall be used in side arm construction and secured by the use of ½ inch by 3½ to 4½ inch machine bolts.

Spacing blocks cut from old crossarms may be used if desired. The block may be held in place by driving a 30d galv. wire nail through each arm or by drilling a hole through the block and driving the double arm bolts through the arm and the block.

### Back Bracing Corner Poles

This type of back bracing is designed for corner poles where the pull is more than 12 feet and less than 40 feet. Standard 30-inch crossarm braces are used. (Fig. 146.)



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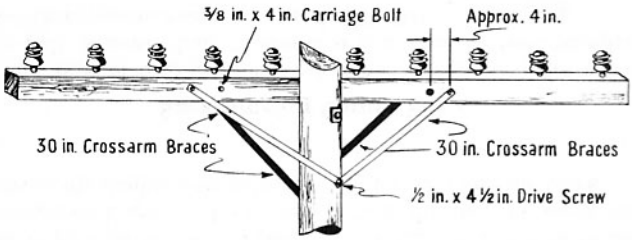



*Figure 146—Crossarm back bracing using 30-inch braces.*

## BACK BRACE

A nine-foot one-inch horizontal back brace (J-6969) shall be used on a ten-foot crossarm under the following conditions:

(1) Back brace crossarm where two or more wires terminate on a ten foot crossarm.

(2) Back braces may be used instead of double crossarms However, double cross-arming is recommended.

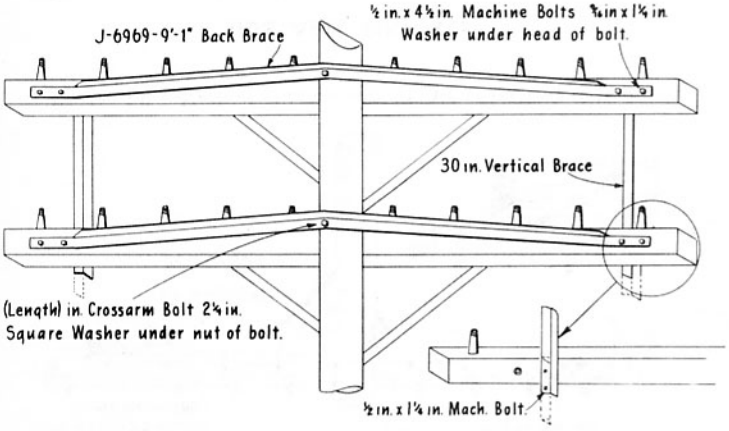



*Figure 147—Typical back brace installation.*

**Material Required for Back Braces (Fig. 147)**

2—J-6969 Back Braces.
8—J-8704½ Mach. Bolts.
4—J-1086 Round Washers.
2—J-7054 Vertical Braces.
4—J-8644½ Carriage Bolts.

## Short Spacing of Crossarms

To gain additional clearance over roads, or for other reasons, crossarms may be spaced 12 inches or 18 inches apart.

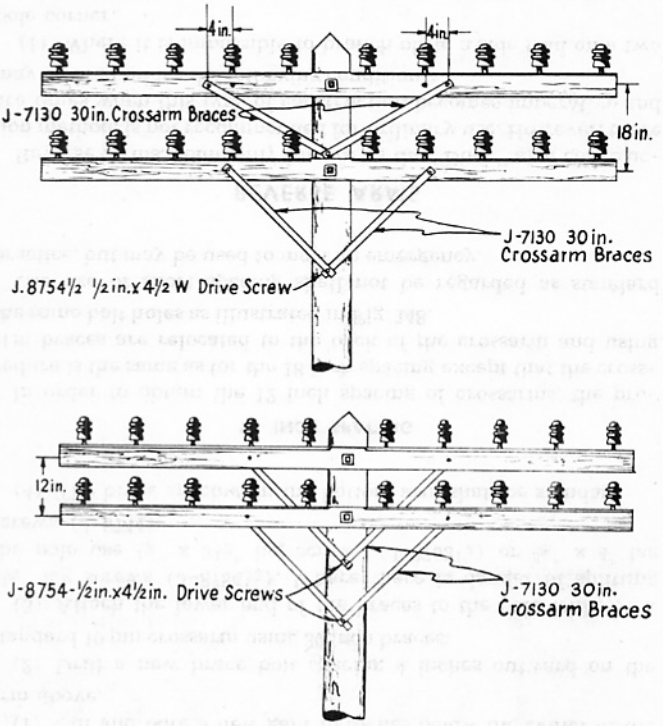



*Figure 148—Attaching crossarms to pole—Short spacing.*



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### 18 INCH SPACING

(1) Cut and bore a new gain 18 inches below the center of the arm above.

(2) Drill a new brace bolt spacing 4 inches outward on the standard 10 pin crossarm using 30 inch braces.

(3) Attach the lower end of the braces to the pole with ½" x 4½" lag screws (J-8754½). Where there is danger of splitting the pole use ½" x 3½" lag screws (J-8753½) or ⅜" x 4" lag screws (J-8744).

(4) The brace spacing on the bottom arm shall be standard.

### 12 INCH SPACING

In order to obtain the 12 inch spacing of crossarms, the procedure is the same as for the 18 inch spacing except that the crossarm braces are relocated to the back of the crossarm and using the same bolt holes as illustrated in Fig. 148.

The use of short spacing shall not be regarded as standard practice, but may be used to meet an emergency.

## REVERSE ARMS

Reverse Arms, commonly known as the "Buck" arm construction method, is not recommended for ordinary use. However, there are times when this type of construction becomes imperative and may be used under the following conditions:

(1) Where it is impossible to branch off to a side lead on a two pole corner.

(2) Where it is impossible to construct a two pole right angle corner.

When installing reverse arms, the double crossarm construction method is preferable; but the nine-foot, one-inch (J-6969) backbrace may be used on lighter loads.

When reverse arms are attached to a "joint use" pole or where there is more than one crossarm, the pin positions must be respaced to provide 30 inches of climbing space.

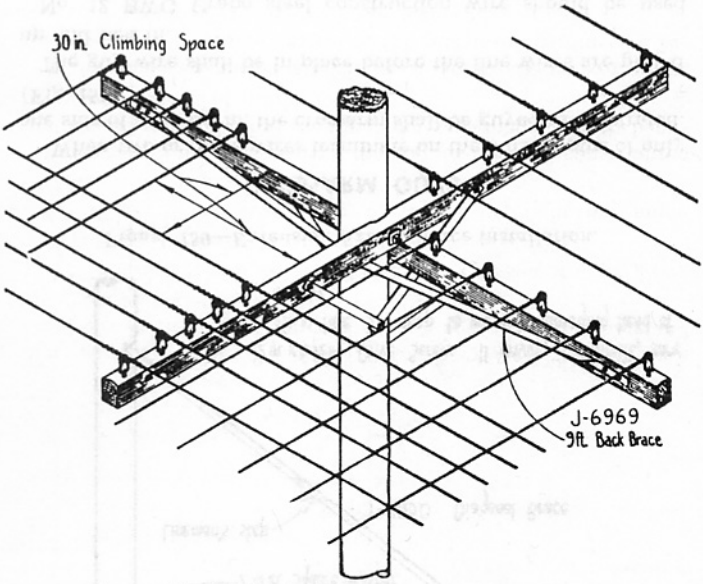



*Figure 149—Method of attaching reverse crossarms.*

## EXTENSION FIXTURE BRACE

Extension fixture braces are sometimes known as alley arm braces and should be used in order to clear obstacles. Installing this type of fixture is recommended when the pole is offset. This permits the wires to keep in line with the lead.

**Material Required for Installing Extension Fixture Brace (Fig. 150)**

2—K-5809—10 Pin Crossarms.
20—J-1760—Standard Wood Pins 1¼" x 8".
20—6d. Galv. Wire Nails.
2—⅝" x length Machine Bolts.
2—J-1075—2¼" Square Washers.
2—J-7050—Diagonal Brace and Step.



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1—J-1536 Vertical Brace.
1—J-7052 Back Brace.
1—J-8756½—½" x 6" Lag Screw.
4—J-8704½—½" x 4½" Machine Bolts.

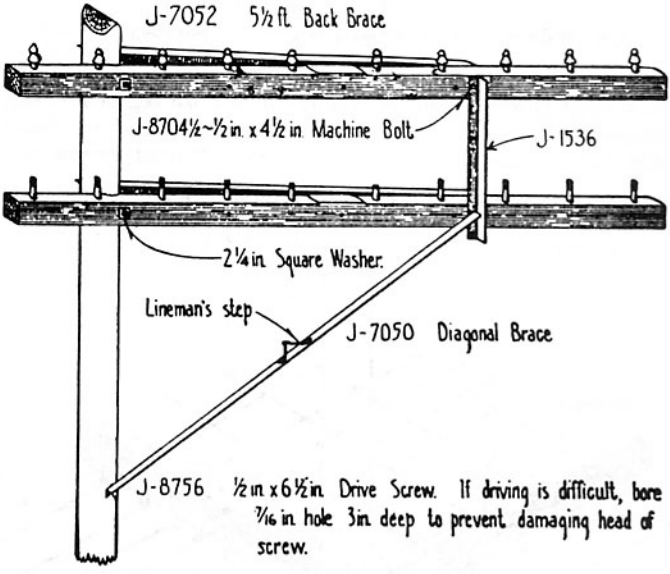



*Figure 150—Extension fixture brace installation.*

## CROSSARM GUYS

When two or more wires terminate on the outside pins of only one side of a crossarm, the crossarm shall be guyed as illustrated. (Fig. 151.)

The guy wire shall be in place before the line wires are pulled up and tied in.

No. 12 BWG Crapo steel construction wire should be used

where less than three wires are terminated, and No. 10 BWG Crapo steel construction wire should be used where more than three wires are terminated.

The guy wire shall be wrapped twice around the pole or crossarm, and the end of the wire shall be served up with 2 short turns and 3 long turns around the guy wire.

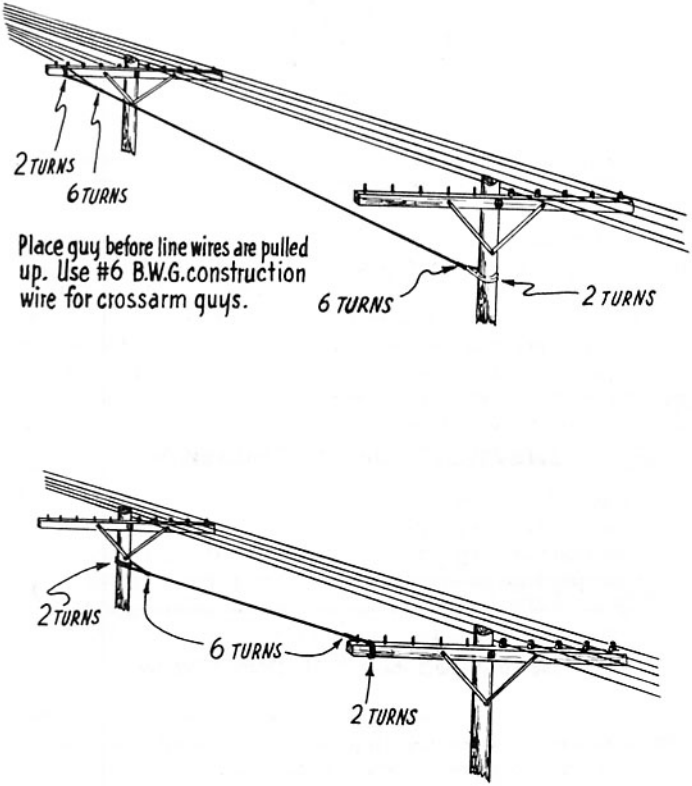



*Figure 151—Crossarm guying.*



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## NUMBERING OF PIN POSITIONS

Pin positions are numbered consecutively from left to right, starting with the top crossarm which is known as the first crossarm and facing in the direction of the line.

## NUMBERING TEN PIN CROSSARMS

Pin No. 1—Top crossarm—first left hand pin position.
Pin No. 10—Top crossarm—last right hand pin position.
Pin No. 11—2nd crossarm—first left hand pin position.
Pin No. 20—2nd crossarm—last right hand pin position.
Pin No. 21—3rd crossarm—first left hand pin position.
Pin No. 30—3rd crossarm—last right hand pin position.

## NUMBERING SIX PIN CROSSARMS

When a six pin crossarm is employed, the left hand pin on the top crossarm shall be pin No. 3, while the right hand pin shall be pin No. 8. Pins No. 1-2 and 9-10 are reserved so that when the six pin crossarm is replaced with a ten pin crossarm, the pin positions 3, 4, 5, 6, 7 and 8 can be transferred to the same positions on the new ten pin crossarm.

Figure 152 illustrates the method used to add two additional brackets where a ten pin crossarm carries five circuits, or where

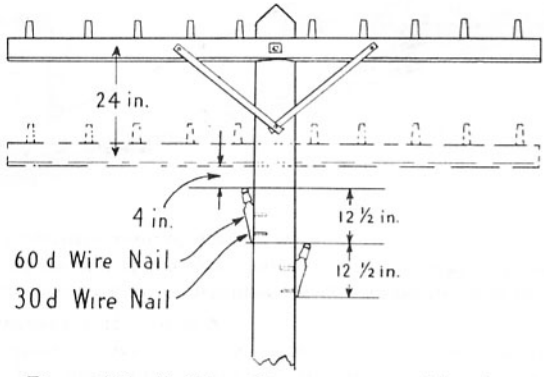



*Figure 152—Position of temporary wood brackets.*

two ten pin crossarms carry ten circuits and the addition of a second or third crossarm is contemplated.

The bracket circuit as shown should be intended to occupy pin positions 15 and 16 on the second arm or pin positions 25 and 26 on the third arm.

Place brackets on the left side of the pole for future pin positions 13 and 14 (second arm) or pin position 23 and 24 (third arm).

Place brackets on the right side of the pole for future pin positions 17 and 18 (second arm) or pin position 27 and 28 (third arm).

A ten pin crossarm, having five circuits, is shown above. An additional circuit, which will ultimately be transferred to the second crossarm, position of 15-16, is shown on the brackets. Attach brackets as illustrated (Fig. 152).

## GUARD ARMS

### 3¼" x 4¼" x 48"

Guard Arms are bored for ⅝" machine bolts and ⅜" carriage bolts and shall be attached to a "jointly used" pole where the separation of the electric light wires or fixtures and the telephone cable suspension strand is less than six feet.

The position of the guard arm shall be above and shall parallel the cable suspension strand, with a separation of 4 inches between the center of the guard arm and the center of the suspension bolt.

Guard arms are also valuable in order to provide a means to distribute drop wires and to maintain 30 inches of climbing space. This will be covered in another part of the hand book under the heading of Block and Drop Wires.

## ATTACHING GUARD ARM

The pole to which a guard arm is to be attached shall be gained in the same manner as recommended for crossarms. Refer to Figures 119 and 120.

The guard arm shall be securely fastened to the pole by the use of a ⅝" machine bolt and a guard arm brace. The details of this installation is shown in Figure 153 on the following page.



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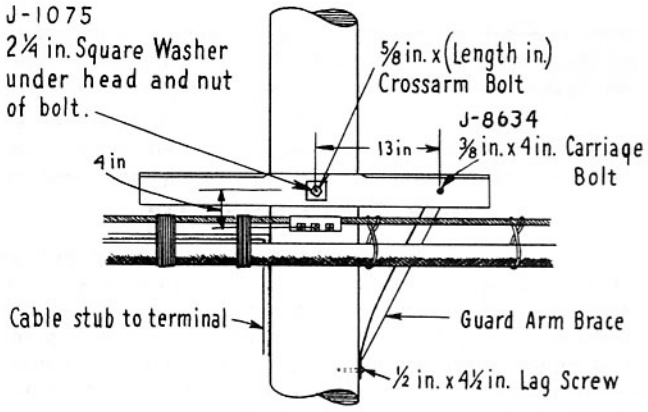



*Figure 153—Position of guard arm attachment.*

**Material required to install a Guard Arm**

1—G—3¼" x 4¼" x 48" Guard Arm.
1—⅝" x length Machine Bolt.
2—J-1075—2¼" Square Washers.
1—J-8634—⅜" x 4" Carriage Bolt.
1—H-9240—Guard Arm Brace.
1—J-8754½—½" x 4½" Lag Screw.

## FACING OF POLES AND CROSSARMS

The face of a pole is that side on which one or more crossarms are attached under the following conditions:

(1) Crossarms may be placed on either side of a straight pole and designated as the face.

(2) On a curved pole the concave side shall be the face of the pole.

(3) The face of the pole shall be in line with the pole lead.

When a straight section of pole line is designated to carry only a cable, set the poles so that the face is in line with the pole lead.

When poles are designated for strand dead end, place the pole with the face away from the last span.

Corner poles shall be placed in such a manner that the face of the pole will be away from the inside of the corner.

Where a pole line is located on level ground and under ordinary conditions, the crossarms shall face in opposite directions on adjacent poles as indicated in Figure 154.

Where a pole line is located on an up-grade section of land, face the poles and crossarms toward the top of the grade as indicated in Figure 155.

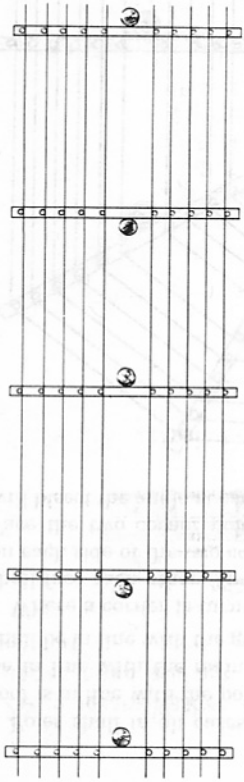


*Figure 154—Facing crossarms—Pole line on level ground.*

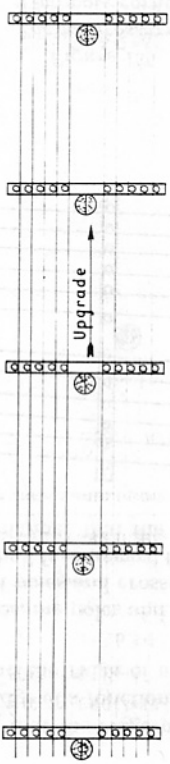



*Figure 155—Facing crossarms—Pole line on upgrade.*



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Poles shall in all cases be so placed that the ridge of the pole roof is in line with the pole lead. The ridge of a junction pole shall be in line with the main pole lead; and the ridge of a stub pole shall be in line with the guy strand.

Where a corner is turned on two poles, the poles and crossarms shall face each other. The two adjacent poles and crossarms (one on each side of the two corner poles) shall face toward the corner. Face the two corner poles in such a manner that the crossarms will bisect the angle at each pole.

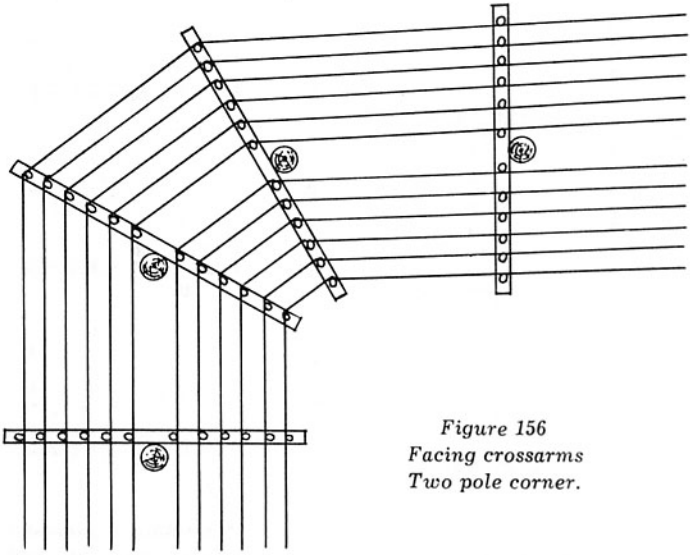


*Figure 156*
*Facing crossarms*
*Two pole corner.*

Where circumstances are such that a pole line must be built across a highway, the crossing poles shall be set in such a manner that the crossarms will face toward each other.

The adjacent poles, one on each side of the crossing pole shall be set so that the crossarms will face toward the crossing pole (Fig. 157).

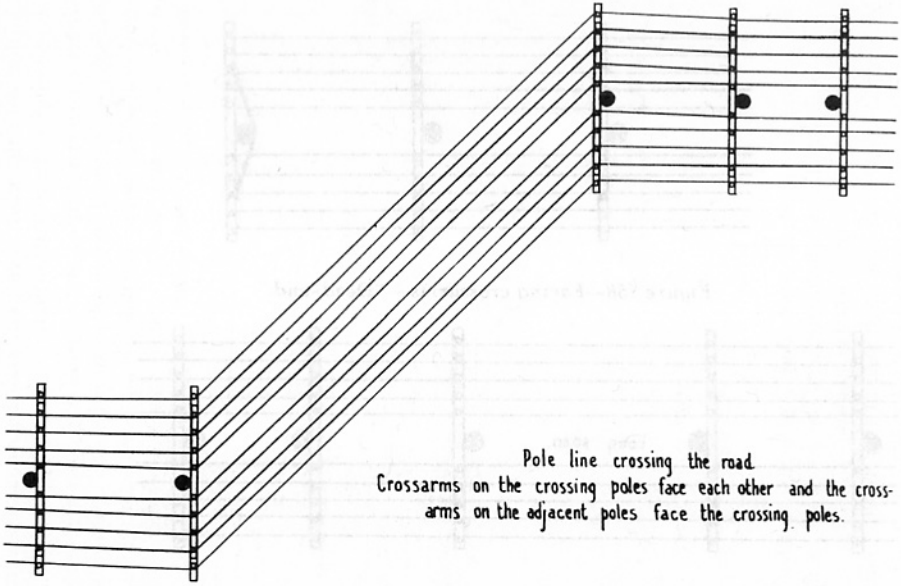



*Figure 157—Facing crossarms—Road crossing.*



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The last two poles and crossarms at the end of a line shall face in the direction of the "dead end" (Fig. 158).

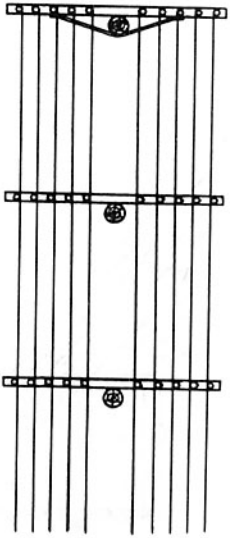


*Figure 158—Facing crossarms—"Dead-end."*

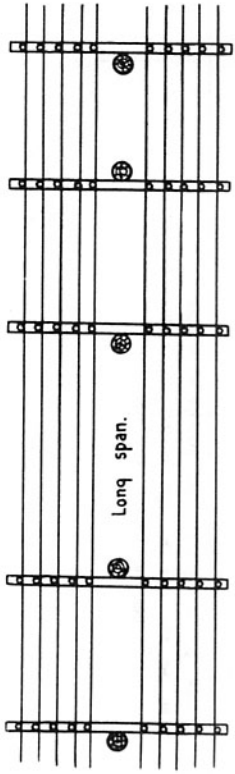



*Figure 159—Facing crossarms—Long span.*

When a long span is encountered the poles are set so that the crossarms will face away from the long span, thereby placing the strain against the poles.

The face of the pole on a curved pole line must be so set that the crossarms will face toward the middle of the curve and that each crossarm will bisect the angle at each pole as illustrated (Fig. 160).

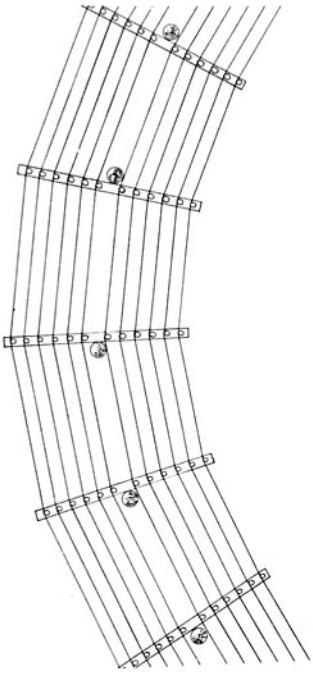


*Figure 160—Facing crossarms—On curves.*



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Where a single corner is encountered the pole and crossarm at the corner shall face away from the longer straight section while one pole on each side of the corner pole shall face toward the corner.

The corner pole shall be so faced that the crossarm will bisect the angle.

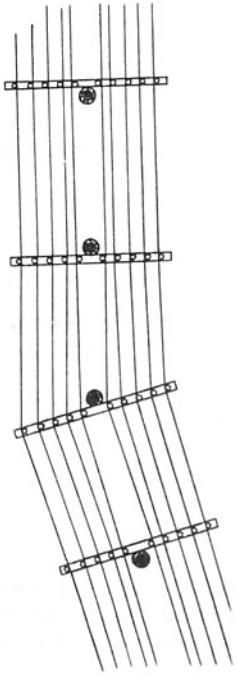


*Figure 161—Facing crossarms—Single corner.*

## BISECTING THE ANGLE

Figure 162 illustrates a method used in determining the correct angle of a crossarm and where it should be placed on a corner pole.

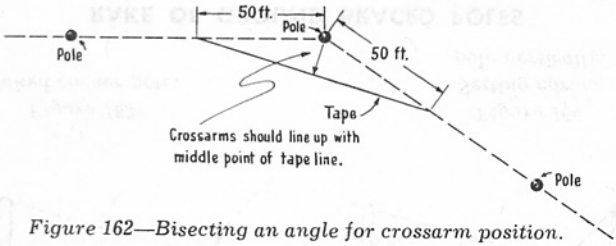



*Figure 162—Bisecting an angle for crossarm position.*

## RAKE OF CORNER POLES

Corner poles having a "pull" of five feet or more shall be raked by setting the butt out of line and inside the corner. When attaching guys, pull the top of the pole over so that when the load is put on the corner and the anchors and guys have settled, the top of the pole will be back in line.

Under average conditions the pole shall be raked approximately 8 to 12 inches (or to an amount equal) to the expected "give" when the load is applied and the anchors have settled.

This may be modified under local conditions. Care should be exercised to avoid buckling the pole.

The following table may be used to determine the distance that the butt of a pole may be offset to obtain the desired rake.

### OFFSET FOR CORNER POLES TABLE NO. 71

| "PULL" ON POLE (IN FT.) | 16 TO 25 FT. POLES | 30 TO 35 FT. POLES | 40 FT. POLES AND TALLER (IN INCHES) |
|---|---|---|---|
| | OFF SET FOR CORNER POLES (IN INCHES) | | |
| 5-10 | 9 | 12 | 15 |
| 11-20 | 12 | 16 | 18 |
| 21-30 | 14 | 20 | 23 |
| 31-40 | 18 | 24 | 28 |



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Fig. 163 illustrates a corner pole offset, raked and guyed but with no load. After the load is added and the guys settle into place, the top of the pole must be in line with the true corner.

Figure 164 illustrates a corner pole where the pull is less than five feet, or where it is necessary to set the pole in the line. It shall be raked away from the corner approximately 8 inches to 12 inches or to the amount of "give" expected to take place when the load is applied and the anchors have settled. The pole shall be in a vertical position as illustrated.

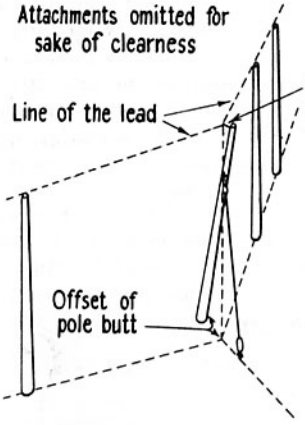



*Figure 163*
*Raked corner pole.*

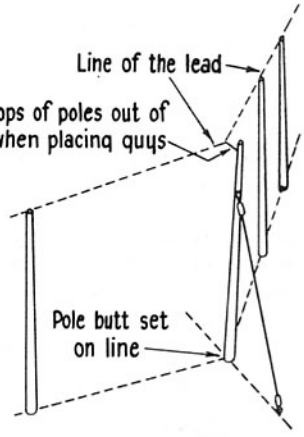



*Figure 164*
*Setting corner pole vertically.*

## RAKE OF GROUND BRACED POLES

Ground braced corner poles shall be set with the butt of the pole in line while the top shall be set out of line, away from the "pull," to an amount equal to the expected "give" when the load is applied.

## RAKE OF PUSH BRACED POLE

A pole supported by a push brace shall be set with the butt of the pole in line and the top raked to an amount equal to the expected "give" of the structure after the load is applied.

## RAKE OF GUYED STUBS

The rake of guy stubs may be raked up to four feet.

## RAKE OF "DEAD END" POLES

"Dead End" poles shall be set vertically.

## POLE STEPPING

All terminal poles, office poles, test poles, junction poles, painted poles or any other poles that are frequently climbed should be "stepped" in the manner illustrated. This stepping provides greater safety and convenience to the climbers, and eliminates spur holes; thus prolonging the life of the pole.

Place the steps in line with the lead, keep clear of any cable. If conditions require shifting of a step, place it where it is useful.

## STEPPING OPEN WIRE POLES

To Step a crossarm or open wire pole, proceed in the following manner:

(1) Drill ½" holes 2" to 3" deep in cedar poles, and 4" deep in chestnut and creosoted pine poles.

(2) Place two iron pole steps 6'-6" from the ground and opposite each other.

(3) Place one wood pole step and the remaining iron pole steps as illustrated (Fig. 165).

(4) Do not place steps at or above the lowest crossarm. Remove steps as additional arms are added.

(5) Fasten wood pole step with one 30 d and one 60 d galvanized wire nail.

### Material required to step a 30 pole as indicated in Figure 165:

| | |
|---|---|
| 10—J-1118—⅝" x 10" Pole Steps. | 1—30 d Galvanized Wire Nail. |
| 1—J-2662—Wood Pole Step. | 1—60 d Galvanized Wire Nail. |



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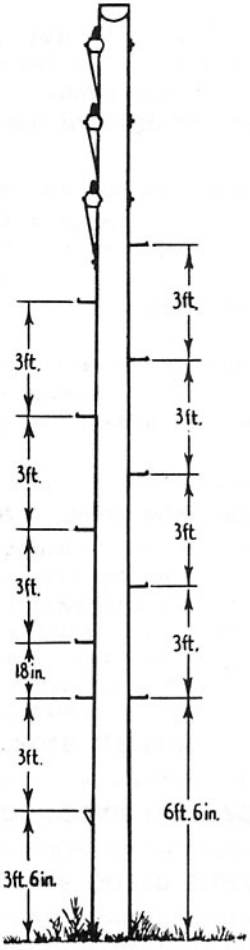



*Figure 165—Stepping poles equipped with crossarms and open wire.*

## STEPPING TERMINAL POLES

### (Terminal located on face or back of pole)

(1) Do not place any steps above the suspension strand where a guard arm is required.

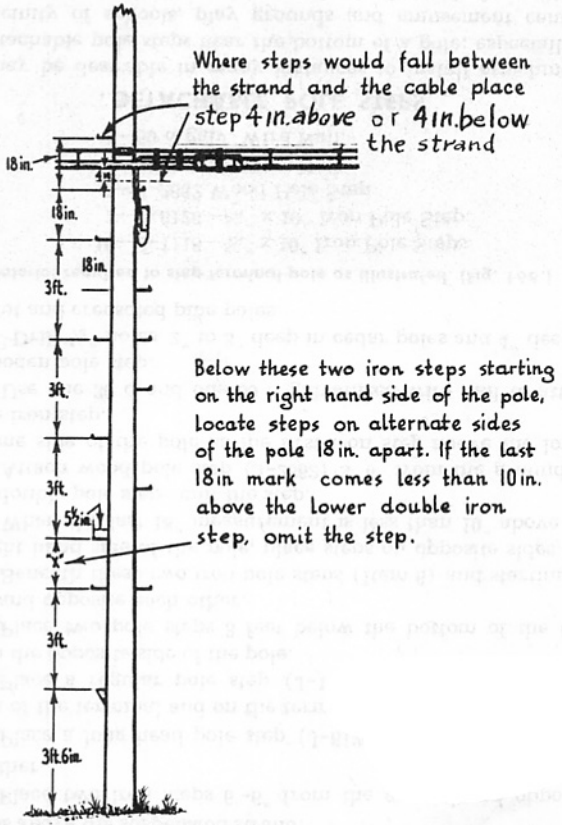



*Figure 166—Method of stepping terminal pole supporting aerial cable.*



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(2) When measurements indicate that a step would be placed between the strand and 4 inches below the cable, place the step 4 inches above the suspension strand.

(3) Place two iron steps 6′-6″ from the ground and opposite each other.

(4) Place a long head pole step (J-6126) 18 inches below the bottom of the terminal and on the terminal side of the pole.

(5) Place a regular pole step (J-1118) 18 inches above this step on the opposite side of the pole.

(6) Place two pole steps 3 feet below the bottom of the terminal and opposite each other.

(7) Beneath these two iron pole steps (Item 6) and starting on the right hand side of the pole, place steps on opposite sides, 18″ apart. When the last 18″ measurement is less than 10″ above the lower double pole step, omit the step.

(8) Attach wood pole step (J-2662) 3′ 6″ from the ground on the same side of the pole as the first iron step above the lower double iron step.

(9) Use one 30 d and one 60 d galvanized wire nail to attach the wooden pole step.

(10) Drill ½″ holes, 2″ to 3″ deep in cedar poles and 4″ deep in chestnut and creosoted pine poles.

**Material required to step terminal pole as illustrated. (Fig. 166.)**

10—J-1118—⅝″ x 10″ Iron Pole Steps.
1—J-6126—⅝″ x 10″ Iron Pole Step.
1—J-2662 Wood Pole Step.
1—30 d galv. Wire Nail.
1—60 d galv. Wire Nail.

## DETACHABLE POLE STEPS

It may be desirable in many instances to install attachments for detachable pole steps near the bottom of a pole; especially in the vicinity of schools, play grounds and amusement centers. This will prevent children and unauthorized people from climbing the poles. In addition to the hazards involved, the cable terminals may be tampered with; the cover left open and exposed to the rains or the aerial cable may be injured.

The distance from the last permanent pole step to the ground can be adjusted to meet local requirements and conditions. It is recommended, however, the space be confined to 6'-6" to 7'-6" and that not more than three detachable pole steps be used for each pole.

It must be kept in mind that the steps should be removed when not in use.

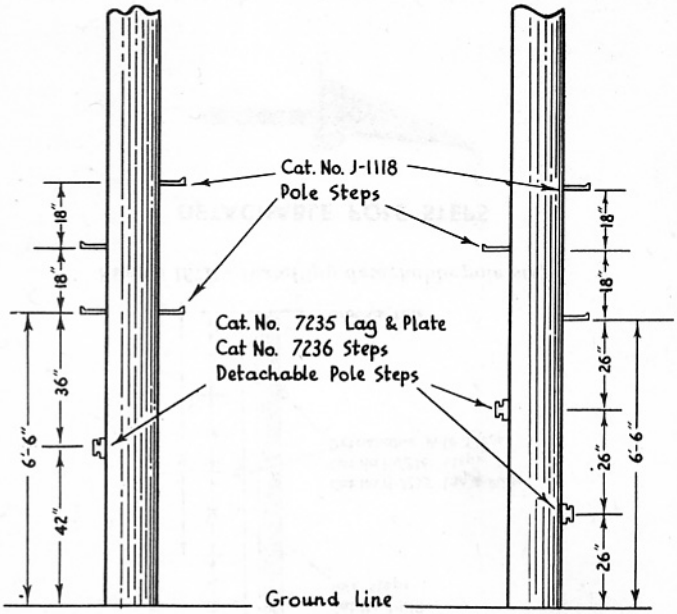



*Figure 167A—Installing detachable pole steps.*



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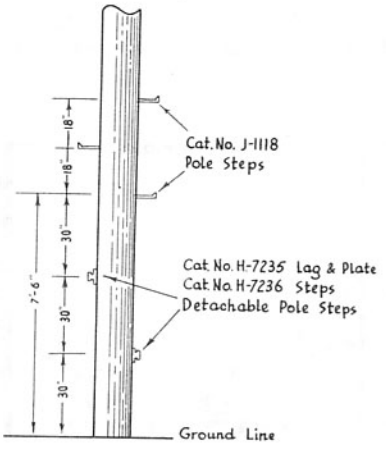



*Figure 167B—Installing detachable pole steps.*

## DETACHABLE POLE STEPS



To install, slip the plate on the lag and drive in the pole until the plate bites into the wood. The step slides down in a groove on each side of the head of the lag and bears against the plate. When the step is removed nothing but the rounded head of the lag extends from the pole.

| STOCK NO. | DESCRIPTION | EXTENSION FROM POLE (INCHES) | APPROXIMATE SHIPPING WEIGHT, LBS. PER 100 |
|---|---|---|---|
| H 7235 | Lag and Plate | | 65 |
| H 7236 | Step | 5 | 50 |

## TRANSPOSITION BRACKETS

Single point transposition brackets are mounted on a cross-arm and are used to transpose a single circuit, utilizing the existing wood pin.

The single point transposition bracket and the method of attaching it to a crossarm is illustrated in Fig. 168.

The four point transposition brackets are mounted on a crossarm and in utilizing the regular crossarm pin, a transposition of two circuits of a phantom group may be preformed.

The method of installing wood brackets for a transposition of a single circuit, is described on page 253, and illustrated in Figures 137, 138 and 139.

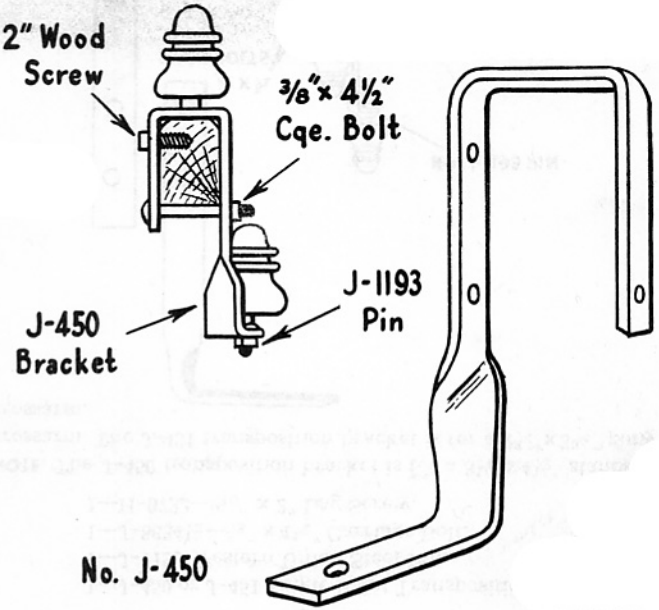



*Figure 168—Single point transposition bracket installation.*



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**Material required to assemble a complete single point transposition bracket (Fig. 168).**

1—J-450 or J-451 Single Point Transposition Bracket.
1—J-1193 Western Union Steel Pin.
1—J-8634½—⅜" x 4½" Carriage Bolt.
1—H-9732—5/16" x 2" Lag Screw.

**NOTE:** The J-450 transposition bracket is for a 3¼"x4½" standard crossarm. The J-451 transposition bracket is for a 2¾"x3¾" pony crossarm.

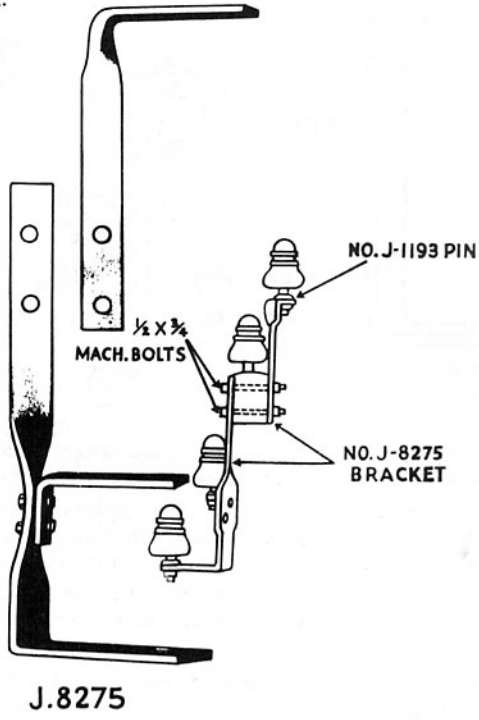



*Figure 169—Four point transposition bracket installation.*

**Material required to make up a four point transposition bracket (Fig. 169).**

1—J-8275 Four Point Transposition Bracket (3¼"x4¼" Standard Crossarm).

2—H-9704¾—½" x 4¾" Machine Bolts.

3—J-1193 Western Union Steel Pins.

## LOCATION OF SINGLE POINT TRANSPOSITION BRACKETS

It is preferable that the single point transposition bracket (J-450 or J-451) shall be installed in a straight section of a line, however, if it is necessary that the fixture be placed on a corner pole, the "pull" shall not be more than 12 feet.

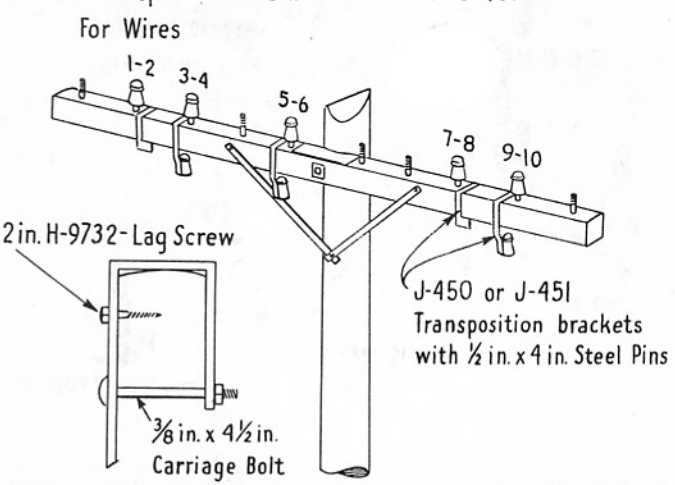



*Figure 170—Location of single point transposition brackets.*

## LOCATION OF FOUR POINT TRANSPOSITION BRACKETS

It is preferable that the four point transposition brackets (J-8275) shall be installed in a straight section of a line, however, if it is necessary to locate the fixture on a corner pole, the "pull" shall not be more than 12 feet.



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When a pole line supports several crossarms carrying phantom groups, the phantom brackets shall be located as illustrated in Fig. 171.

The phantom group fixtures on arms 1, 3, 5 and 7 shall have the same relative position while the fixtures on crossarms 2, 4, 6 and 8 shall be located in an intervening staggered position. This staggering position of fixtures is necessary in order to provide a clearance for fixtures and wires.

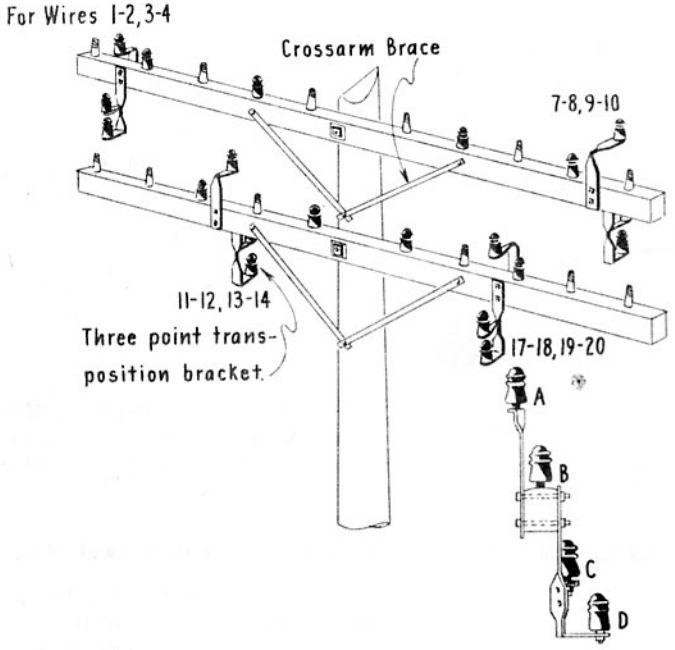



*Figure 171—Location of four point transposition brackets.*

When a four point phantom bracket (J-8275) is placed at pin position 4 or 7 on crossarms 1, 3 or 5, it may be necessary to relocate the 30 inch crossarm brace, or make adjustments in bracing, in order to provide clearance between the fixture and the crossarm braces. (Fig. 172.)

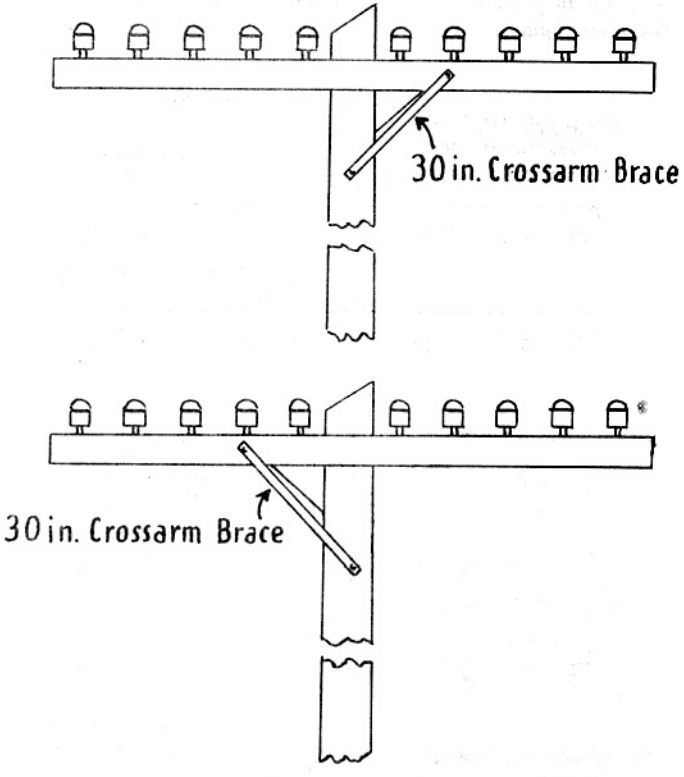



*Figure 172 — Relocating crossarm braces to provide mounting space for four point transposition brackets located at pin 4 and 7.*



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When a four point phantom bracekt (J-8275) is placed at pin position 5 or 6 on crossarms 2, 4, or 6, it may be necessary to relocate the 30 inch crossarm brace or make adjustments in bracing in order to provide clearance between the fixture and the crossarm braces. (Fig. 173.)

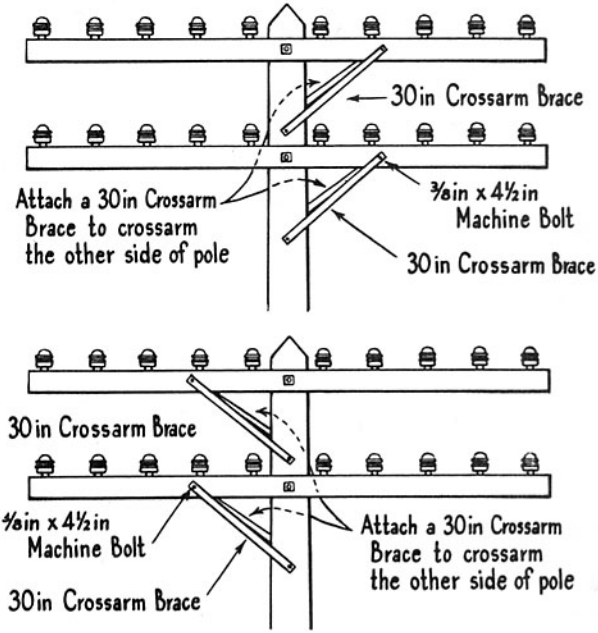



*Figure 173 — Relocating crossarm braces to provide mounting space for four point transposition brackets located at pin 5, 6, 15 and 16.*

**NOTE:** The various types of transpositions, their uses and points of transposing will be described and illustrated in Book No. 2 (Aerial Wire Construction).

# LONG SPAN CONSTRUCTION

The greater strength of Crapo HTL-85 and HTL-135 line wire has made it possible to construct exchange and rural lines of longer span lengths with fewer poles per mile.

A decided advantage of these high strength steel wires is that they will withstand greater loads of ice with wind than B.B. telephone wire of comparable size. No. 12 Crapo HTL-85 Line Wire has 60% greater strength than B.B., while HTL-135 has approximately two and one-half times the tensile strength of the older grade of wire. Experience has shown that the use of these high strength wires will result in fewer wire failures, less stretching, less increase in sag, reduced service interruptions and greater reliability.

To take full advantage of the long spans made possible by the superior strength of these wires, care should be taken in designing and building the pole line. Sound practice dictates the use of somewhat stronger guys and slighly heavier hardware with long-span construction, but the increased cost of these items is nominal in comparison with the over-all savings.

In building long-span lines it may be found desirable to space the poles so that the span lengths may be reduced by one-half should it become necessary to carry increased wire or cable loads requiring shorter pole-spacing. This then may be accomplished by setting one pole midway between each existing pole.

When crossing over railroad tracks, the crossing span and adjacent poles should be reduced to standard span lengths or otherwise an underground crossing must be installed. When an over head crossing is desirable, the 27 foot clearance from the top of the rails to the lowest wire must be maintained.

Long spans may be maintained over highways provided that standard clearance is adhered to. However, each crossing should be given individual consideration and study in order to prevent a hazard to the public.

When the crossing span is over a main-traveled highway, it is recommended to shorten the crossing span or install an underground crossing.



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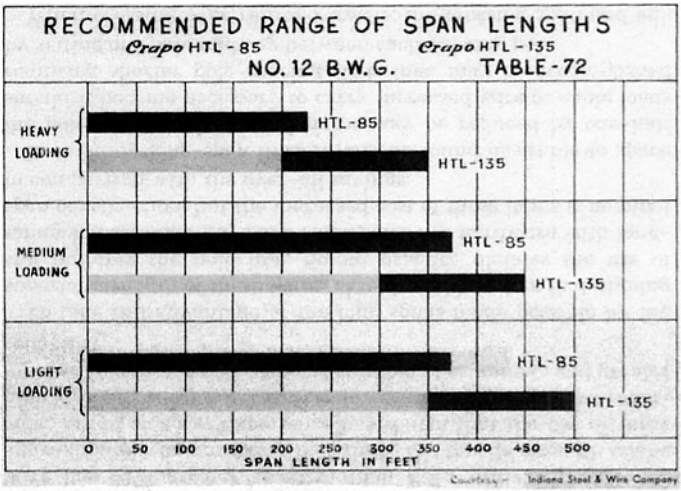


Long spans may be maintained over secondary roads provided standard clearance can be maintained.

## RANGE OF RECOMMENDED SPAN LENGTHS

The following ranges of span lengths are recommended for standard high strength Crapo HTL-85 and HTL-135 line wire in each loading zone.

**TABLE NO. 72**



Occasional spans of greater lengths, such as river and ravine crossings will require individual consideration. Recommendations for spans of greater length than that covered in table No. 72 are described on pages 319 to 324 (River Crossing Strand).

## SAFETY CODE REQUIREMENTS

There are various special situations in which the construction of telephone lines are governed by requirements of the National Electrical Safety Code, or State Codes. Where communication lines are in hazardous proximity with power lines, as in the case of crossings, conflicts, over-building, and joint use, the rules of the National Electrical Safety Code and the State Electrical Code shall always be adhered to. The local state Electrical Code shall have priority where there is a conflict in rules. These rules are also applicable to crossings at highways and railroad track.

## SAG CHARTS

Stringing Sags for HTL-85 and HTL-135 high tensile strength wire are furnished in the following tables in order to predetermine the height of an individual pole or a section of pole line.

**Stringing sags for Crapo HTL-85 telephone wire (No. 12 B.W.G.)**

**TABLE NO. 73—Heavy Loading Districts—Long spans from 125 to 225 Feet**

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 100° | 90° | 80° | 70° | 60° | 50° |
| 125 | 13.0 | 12.0 | 11.0 | 10.0 | 9.5 | 8.5 |
| 130 | 14.0 | 13.0 | 12.0 | 11.0 | 10.0 | 9.0 |
| 140 | 16.0 | 15.0 | 14.0 | 12.5 | 11.5 | 10.5 |
| 150 | 18.5 | 17.0 | 16.0 | 14.5 | 13.0 | 12.0 |
| 160 | 21.0 | 19.5 | 18.0 | 16.0 | 15.0 | 14.0 |
| 170 | 23.5 | 22.0 | 20.5 | 18.5 | 17.0 | 15.5 |
| 180 | 26.5 | 24.5 | 23.0 | 20.5 | 19.0 | 17.5 |
| 190 | 29.5 | 27.0 | 25.5 | 23.0 | 21.0 | 19.5 |
| 200 | 33.0 | 30.0 | 28.5 | 25.5 | 23.5 | 21.5 |
| 210 | 36.0 | 33.0 | 31.5 | 28.0 | 26.0 | 23.5 |
| 220 | 39.5 | 36.5 | 34.0 | 30.5 | 28.5 | 26.0 |
| 225 | 41.5 | 38.0 | 35.5 | 32.5 | 30.0 | 27.0 |

TABLE NO. 73 CONTINUED ON FOLLOWING PAGE



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| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 40° | 30° | 20° | 10° | 0° | -10° |
| 125 | 7.5 | 7.0 | 6.5 | 6.0 | 5.5 | 5.0 |
| 130 | 8.0 | 7.5 | 7.0 | 6.5 | 6.0 | 5.5 |
| 140 | 9.5 | 9.0 | 8.0 | 7.5 | 7.0 | 6.5 |
| 150 | 11.0 | 10.0 | 9.0 | 8.5 | 7.5 | 7.0 |
| 160 | 12.5 | 11.5 | 10.5 | 9.5 | 9.0 | 8.0 |
| 170 | 14.0 | 13.0 | 12.0 | 11.0 | 10.0 | 9.5 |
| 180 | 15.5 | 14.5 | 13.0 | 12.0 | 11.0 | 10.5 |
| 190 | 17.0 | 16.0 | 14.5 | 13.5 | 12.0 | 11.5 |
| 200 | 19.0 | 18.0 | 16.0 | 15.0 | 13.5 | 13.0 |
| 210 | 21.0 | 19.5 | 17.5 | 16.5 | 15.0 | 14.5 |
| 220 | 23.5 | 21.5 | 19.5 | 18.0 | 16.5 | 15.5 |
| 225 | 25.0 | 23.0 | 21.0 | 19.0 | 17.5 | 16.5 |

These sags are such that the unloaded tensions at minus 10 degrees fahrenheit equal approximately one-fifth of the rated breaking strength of Crapo HTL-85 wire, for all span lengths shown above.

**Medium Loading Districts—Long Spans from 200 to 325 Feet—HTL-85**

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 100° | 90° | 80° | 70° | 60° | 50° |
| 200 | 25.0 | 23.5 | 22.0 | 20.5 | 19.0 | 17.5 |
| 210 | 27.5 | 26.0 | 24.0 | 22.5 | 21.0 | 19.5 |
| 220 | 30.0 | 28.5 | 26.5 | 25.0 | 23.0 | 21.5 |
| 230 | 33.0 | 31.0 | 29.0 | 27.0 | 25.0 | 23.5 |
| 240 | 36.0 | 33.5 | 31.5 | 29.5 | 27.0 | 25.5 |
| 250 | 39.0 | 36.5 | 34.0 | 32.0 | 29.5 | 27.5 |
| 260 | 42.0 | 39.5 | 37.0 | 34.5 | 32.0 | 29.5 |
| 270 | 45.5 | 42.5 | 39.5 | 37.5 | 34.5 | 32.0 |
| 280 | 49.0 | 45.5 | 42.5 | 40.0 | 37.0 | 34.5 |
| 290 | 52.5 | 49.0 | 46.0 | 43.0 | 39.5 | 37.0 |
| 300 | 56.0 | 52.5 | 49.0 | 46.0 | 42.5 | 39.5 |
| 310 | 60.0 | 56.0 | 52.5 | 49.5 | 45.5 | 42.5 |
| 320 | 64.0 | 60.0 | 56.0 | 52.5 | 49.5 | 45.0 |
| 325 | 66.0 | 62.0 | 58.0 | 54.5 | 51.5 | 47.5 |

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 40° | 30° | 20° | 10° | 0° | -10° |
| 200 | 16.5 | 15.0 | 14.0 | 13.0 | 12.0 | 11.5 |
| 210 | 18.0 | 16.5 | 15.5 | 14.5 | 13.5 | 13.0 |
| 220 | 20.0 | 18.5 | 17.0 | 16.0 | 15.0 | 14.0 |
| 230 | 21.5 | 20.0 | 18.5 | 17.5 | 16.0 | 15.0 |
| 240 | 23.5 | 21.5 | 20.5 | 19.0 | 17.5 | 16.5 |
| 250 | 25.5 | 23.5 | 22.0 | 20.5 | 19.0 | 18.0 |
| 260 | 27.5 | 25.5 | 24.0 | 22.0 | 20.5 | 19.5 |
| 270 | 30.0 | 27.5 | 25.5 | 24.0 | 22.0 | 21.0 |
| 280 | 32.0 | 29.5 | 27.5 | 25.5 | 24.0 | 22.5 |
| 290 | 34.5 | 32.0 | 29.5 | 27.5 | 25.5 | 24.0 |
| 300 | 36.5 | 33.5 | 32.0 | 29.5 | 27.5 | 26.0 |
| 310 | 39.0 | 36.0 | 34.0 | 31.5 | 29.0 | 27.5 |
| 320 | 42.0 | 38.5 | 36.0 | 33.5 | 31.0 | 29.5 |
| 325 | 44.0 | 40.5 | 37.0 | 34.5 | 32.0 | 30.5 |

These sags are such that the unloaded tensions at minus 10 degrees fahrenheit equal approximately one-fifth of the rated breaking strength of Crapo HTL-85 wire, for all span lengths shown above.

**Light Loading Districts — Long Spans from 275 to 375 Feet — HTL-85**

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 100° | 90° | 80° | 70° | 60° | 50° |
| 275 | 40.0 | 37.5 | 35.0 | 32.0 | 30.5 | 28.0 |
| 280 | 41.5 | 39.0 | 36.5 | 33.5 | 31.5 | 29.0 |
| 290 | 44.5 | 41.5 | 39.0 | 36.5 | 34.0 | 31.5 |
| 300 | 47.5 | 44.5 | 41.5 | 38.5 | 36.0 | 33.5 |
| 310 | 51.0 | 47.5 | 44.5 | 41.5 | 38.5 | 36.0 |
| 320 | 54.0 | 50.5 | 47.5 | 44.5 | 41.5 | 38.5 |
| 330 | 57.5 | 54.0 | 50.5 | 47.0 | 44.0 | 41.0 |
| 340 | 61.0 | 57.5 | 53.5 | 50.0 | 46.5 | 43.5 |
| 350 | 64.5 | 60.5 | 56.5 | 53.0 | 49.0 | 46.0 |
| 360 | 68.5 | 64.0 | 60.0 | 56.0 | 52.0 | 48.5 |
| 370 | 72.0 | 67.5 | 63.5 | 59.0 | 55.0 | 51.0 |
| 375 | 74.0 | 69.5 | 65.0 | 60.5 | 56.5 | 52.5 |

TABLE NO. 73 CONTINUED ON FOLLOWING PAGE



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| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 40° | 30° | 20° | 10° | 0° | -10° |
| 275 | 26.0 | 24.0 | 22.5 | 21.0 | 19.5 | 18.5 |
| 280 | 27.0 | 25.0 | 23.5 | 22.0 | 20.5 | 19.0 |
| 290 | 29.0 | 27.0 | 25.0 | 23.5 | 22.0 | 20.5 |
| 300 | 31.0 | 29.0 | 27.0 | 25.0 | 23.5 | 22.0 |
| 310 | 33.0 | 31.0 | 28.5 | 26.5 | 25.0 | 23.5 |
| 320 | 35.5 | 33.0 | 30.5 | 28.5 | 26.5 | 25.0 |
| 330 | 37.5 | 35.0 | 32.5 | 30.5 | 28.5 | 26.5 |
| 340 | 40.0 | 37.0 | 34.5 | 32.0 | 30.0 | 28.0 |
| 350 | 42.5 | 39.5 | 36.5 | 34.0 | 32.0 | 30.0 |
| 360 | 45.0 | 42.0 | 39.0 | 36.5 | 34.0 | 32.0 |
| 370 | 47.5 | 44.5 | 41.0 | 38.5 | 36.0 | 33.5 |
| 375 | 48.5 | 45.5 | 42.0 | 39.0 | 36.5 | 34.0 |

These sags are such that the unloaded tensions at minus 10 degrees fahrenheit equal approximately one-fourth of the rated breaking strength of Crapo HTL-85 wire, for all span lengths shown above.

**Stringing sags for Crapo HTL-135 telephone wire (No. 12 B.W.G.)**

**TABLE NO. 74—Long Spans in Heavy Loading Districts**

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 100° | 90° | 80° | 70° | 60° | 50° |
| 200 | 15.0 | 14.0 | 13.0 | 12.5 | 11.5 | 11.0 |
| 210 | 16.5 | 15.5 | 14.5 | 13.5 | 12.5 | 12.0 |
| 220 | 18.0 | 17.0 | 16.0 | 15.0 | 14.0 | 13.0 |
| 230 | 19.5 | 18.5 | 17.5 | 16.0 | 15.0 | 14.0 |
| 240 | 21.5 | 20.0 | 19.0 | 17.5 | 16.5 | 15.5 |
| 250 | 23.0 | 21.5 | 20.5 | 19.0 | 18.0 | 16.5 |
| 260 | 25.0 | 23.5 | 22.0 | 21.0 | 19.5 | 18.0 |
| 270 | 27.0 | 25.5 | 24.0 | 22.5 | 21.0 | 19.5 |
| 280 | 29.0 | 27.5 | 25.5 | 24.0 | 22.5 | 21.0 |
| 290 | 31.5 | 29.5 | 27.5 | 26.0 | 24.0 | 22.5 |
| 300 | 33.5 | 31.5 | 29.5 | 28.0 | 26.0 | 24.0 |
| 310 | 35.5 | 33.5 | 31.5 | 29.5 | 27.5 | 26.0 |
| 320 | 38.0 | 35.5 | 33.5 | 31.5 | 29.5 | 27.5 |
| 330 | 40.5 | 38.0 | 35.5 | 33.0 | 31.0 | 28.5 |
| 340 | 43.0 | 40.5 | 37.5 | 35.0 | 33.0 | 31.0 |
| 350 | 45.5 | 43.0 | 40.0 | 37.5 | 35.0 | 33.0 |

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 40° | 30° | 20° | 10° | 0° | -10° |
| 200 | 10.0 | 9.5 | 9.5 | 9.0 | 8.0 | 7.5 |
| 210 | 11.0 | 10.5 | 10.0 | 9.5 | 9.0 | 8.5 |
| 220 | 12.0 | 11.5 | 11.0 | 10.5 | 10.0 | 9.5 |
| 230 | 13.5 | 13.0 | 12.0 | 11.5 | 10.5 | 10.0 |
| 240 | 14.5 | 14.0 | 13.0 | 12.5 | 11.5 | 11.0 |
| 250 | 15.5 | 15.0 | 14.0 | 13.5 | 12.5 | 12.0 |
| 260 | 17.0 | 16.0 | 15.0 | 14.5 | 13.5 | 13.0 |
| 270 | 18.5 | 17.5 | 16.5 | 15.5 | 15.0 | 14.0 |
| 280 | 19.5 | 18.5 | 17.5 | 16.5 | 16.0 | 15.0 |
| 290 | 21.0 | 20.0 | 19.0 | 18.0 | 17.0 | 16.0 |
| 300 | 22.5 | 21.5 | 20.5 | 19.5 | 18.5 | 17.5 |
| 310 | 24.0 | 23.0 | 21.5 | 20.5 | 19.5 | 18.5 |
| 320 | 26.0 | 24.5 | 23.0 | 22.0 | 20.5 | 19.5 |
| 330 | 27.5 | 26.0 | 24.5 | 23.5 | 22.0 | 21.0 |
| 340 | 29.0 | 27.5 | 26.0 | 24.5 | 23.5 | 22.0 |
| 350 | 31.0 | 29.0 | 27.5 | 26.0 | 25.0 | 23.5 |

These sags are such that the unloaded tensions at minus 10 degrees Fahrenheit equal approximately one-fifth of the rated breaking strength of Crapo HTL-135 Wire, for all span lengths shown above.

**Long Spans in Medium Loading Districts—HTL-135**

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 110° | 100° | 90° | 80° | 70° | 60° |
| 300 | 28.0 | 25.5 | 24.5 | 22.5 | 21.5 | 20.0 |
| 310 | 30.0 | 27.5 | 26.0 | 24.0 | 23.0 | 21.5 |
| 320 | 32.0 | 29.0 | 27.5 | 26.0 | 24.0 | 23.0 |
| 330 | 34.0 | 31.0 | 29.5 | 27.5 | 26.0 | 24.5 |
| 340 | 36.0 | 33.0 | 31.0 | 29.0 | 27.5 | 26.0 |
| 350 | 38.0 | 35.0 | 33.0 | 31.0 | 29.0 | 27.5 |
| 360 | 40.5 | 37.0 | 35.0 | 33.0 | 31.0 | 29.0 |
| 370 | 43.0 | 39.0 | 37.0 | 34.5 | 32.5 | 31.0 |
| 380 | 45.0 | 41.0 | 39.0 | 36.5 | 34.0 | 32.5 |



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**TABLE NO. 74 (CONT'D)**

| Span Length (Feet) | Temperature in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 110° | 100° | 90° | 80° | 70° | 60° |
| 390 | 47.5 | 43.5 | 41.0 | 38.5 | 36.0 | 34.0 |
| 400 | 50.0 | 45.5 | 43.0 | 40.5 | 38.0 | 36.0 |
| 410 | 52.5 | 48.0 | 45.0 | 42.5 | 40.0 | 38.0 |
| 420 | 55.0 | 50.0 | 47.5 | 44.5 | 42.0 | 40.0 |
| 430 | 58.0 | 52.5 | 50.0 | 47.0 | 44.0 | 42.0 |
| 440 | 60.5 | 55.0 | 52.0 | 49.0 | 46.0 | 43.5 |
| 450 | 63.0 | 57.5 | 54.5 | 51.0 | 48.0 | 45.5 |
| | 50° | 40° | 30° | 20° | 10° | 0° |
| 300 | 19.0 | 18.0 | 17.0 | 16.0 | 15.5 | 15.0 |
| 310 | 20.5 | 19.0 | 18.5 | 17.5 | 17.0 | 16.0 |
| 320 | 21.5 | 20.5 | 19.5 | 18.5 | 18.0 | 17.0 |
| 330 | 23.0 | 21.5 | 20.5 | 19.5 | 19.0 | 18.5 |
| 340 | 24.5 | 23.0 | 22.0 | 21.0 | 20.0 | 19.5 |
| 350 | 26.0 | 24.5 | 23.5 | 22.0 | 21.5 | 20.5 |
| 360 | 27.5 | 26.0 | 24.5 | 23.5 | 22.5 | 21.5 |
| 370 | 29.0 | 27.5 | 26.0 | 25.0 | 24.0 | 23.0 |
| 380 | 30.5 | 29.0 | 27.5 | 26.0 | 25.5 | 24.5 |
| 390 | 32.0 | 30.5 | 29.0 | 27.5 | 26.5 | 25.5 |
| 400 | 34.0 | 32.0 | 30.5 | 29.0 | 28.0 | 27.0 |
| 410 | 36.0 | 33.5 | 32.0 | 30.5 | 29.5 | 28.5 |
| 420 | 37.5 | 35.5 | 33.5 | 32.0 | 31.0 | 30.0 |
| 430 | 39.5 | 37.0 | 35.5 | 33.5 | 32.5 | 31.0 |
| 440 | 41.0 | 39.0 | 37.0 | 35.0 | 34.0 | 32.5 |
| 450 | 43.0 | 40.5 | 38.5 | 36.5 | 35.5 | 34.0 |

These sags are such that the unloaded tensions at zero degrees Fahrenheit equal approximately one-fifth of the rated breaking strength of Crapo HTL-135 wire, for all span lengths shown above.

**Stringing sags for Crapo HTL-135 telephone wire (No. 12 B.W.G.)**

**Long Spans in Light Loading Districts**

| Span Length (Feet) | Temperatures in Fahrenheit Degrees —Sags in Inches— | | | | | |
|---|---|---|---|---|---|---|
| | 110° | 100° | 90° | 80° | 70° | 60° |
| 350 | 35.0 | 32.0 | 30.0 | 28.0 | 26.5 | 25.0 |
| 360 | 37.0 | 33.5 | 31.5 | 30.0 | 28.0 | 26.5 |
| 370 | 39.0 | 35.5 | 33.5 | 31.5 | 29.5 | 28.0 |
| 380 | 41.0 | 37.5 | 35.0 | 33.0 | 31.0 | 29.5 |
| 390 | 43.0 | 39.5 | 37.0 | 35.0 | 33.0 | 31.0 |
| 400 | 45.5 | 41.5 | 39.0 | 36.5 | 34.5 | 32.5 |
| 410 | 47.5 | 43.5 | 41.0 | 38.5 | 36.5 | 34.5 |
| 420 | 50.0 | 46.0 | 43.0 | 40.5 | 38.0 | 36.0 |
| 430 | 52.5 | 48.0 | 45.0 | 42.5 | 40.0 | 38.0 |
| 440 | 55.0 | 50.0 | 47.0 | 44.5 | 42.0 | 40.0 |
| 450 | 57.5 | 52.5 | 49.5 | 46.5 | 44.0 | 41.5 |
| 460 | 60.0 | 55.0 | 51.5 | 48.5 | 46.0 | 43.5 |
| 470 | 62.5 | 57.5 | 54.0 | 50.5 | 48.5 | 45.5 |
| 480 | 65.5 | 60.0 | 56.0 | 53.0 | 50.0 | 47.5 |
| 490 | 68.0 | 62.5 | 58.5 | 55.0 | 52.0 | 49.5 |
| 500 | 71.0 | 65.0 | 61.0 | 57.5 | 54.5 | 51.5 |
| | 50° | 40° | 30° | 20° | 10° | 0° |
| 350 | 23.5 | 22.5 | 21.0 | 20.0 | 19.5 | 19.0 |
| 360 | 25.0 | 23.5 | 22.5 | 21.5 | 21.0 | 20.0 |
| 370 | 26.5 | 24.5 | 23.5 | 22.5 | 22.0 | 21.0 |
| 380 | 28.0 | 26.5 | 25.0 | 24.0 | 23.0 | 22.0 |
| 390 | 29.5 | 27.5 | 26.0 | 25.0 | 24.0 | 23.5 |
| 400 | 31.0 | 29.0 | 27.5 | 26.5 | 25.5 | 24.5 |
| 410 | 32.5 | 30.5 | 29.0 | 28.0 | 27.0 | 26.0 |
| 420 | 34.0 | 32.0 | 30.5 | 29.0 | 28.0 | 27.0 |
| 430 | 35.5 | 33.5 | 32.0 | 30.5 | 29.5 | 28.5 |
| 440 | 37.5 | 35.5 | 33.5 | 32.0 | 30.5 | 29.5 |
| 450 | 39.0 | 37.0 | 35.5 | 33.5 | 32.0 | 31.0 |
| 460 | 41.0 | 38.5 | 37.0 | 35.0 | 33.5 | 32.5 |
| 470 | 43.0 | 40.5 | 38.5 | 36.5 | 35.0 | 34.0 |
| 480 | 44.5 | 42.0 | 40.0 | 38.0 | 36.5 | 35.5 |
| 490 | 46.5 | 44.0 | 42.0 | 39.5 | 38.0 | 37.0 |
| 500 | 48.5 | 45.5 | 43.5 | 41.0 | 39.5 | 38.5 |

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These sags are such that the unloaded tensions at zero degrees Fahrenheit equal approximately one-fourth of the rated breaking strength of Crapo HTL-135 wire, for all span lengths shown above.

## TANGENT POLE ATTACHMENTS FOR LONG SPAN RURAL LINES

Where straight sections of pole lines support one to four wires; the wires shall be attached to poles with heavy wood brackets. The brackets shall be spaced (whenever possible) 18 inches to 24 inches apart.

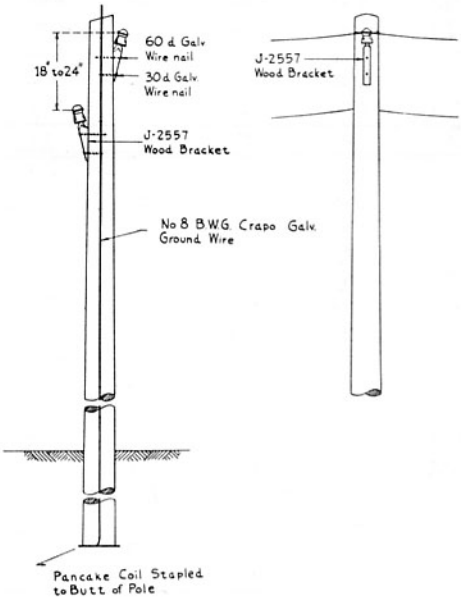



*Figure 174—Location of wood brackets and ground wire on poles used in long span construction.*

## POLE ATTACHMENTS FOR SMALL-ANGLE POLE

The use of wood brackets on corner poles for long span construction shall be slightly heavier than the wood brackets used on corner poles of standard span construction. The wood brackets on corner poles for long span construction shall be spaced, 18 inches to 24 inches apart, wherever possible.

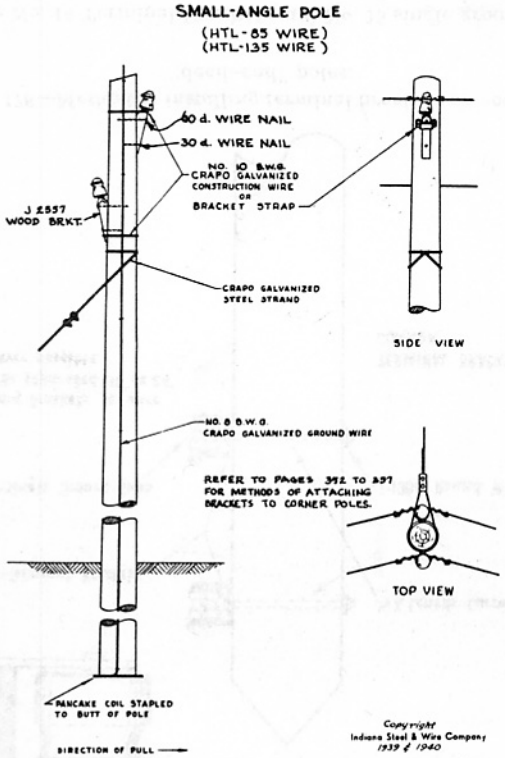



*Figure 175—Location and method of installing and reinforcing wood brackets and ground wire on small angle poles.*



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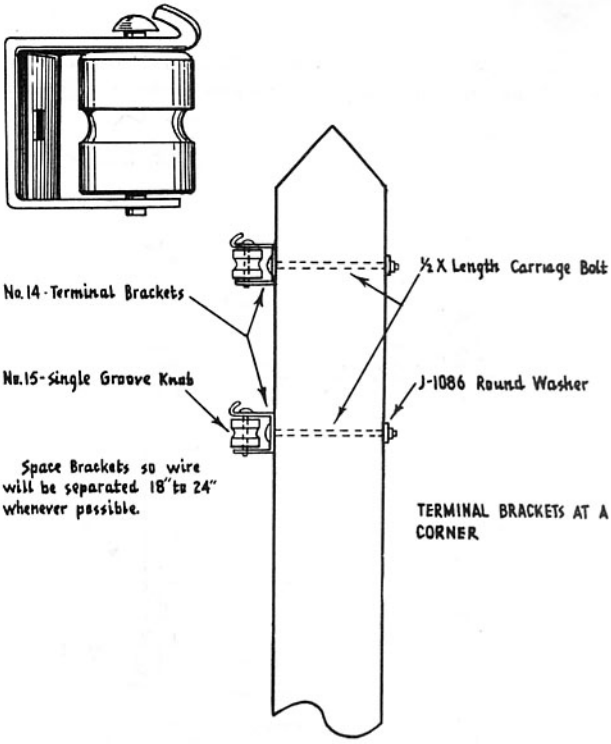



*Figure 176—Method of installing terminal brackets on corner and "dead-end" poles.*

Place No. 14 Terminal Brackets and No. 15 single groove knobs on the face of a pole to terminate wires with span lengths up to 500 ft.

Place No. 14 Terminal Brackets and No. 15 single groove knobs on the side of a pole for angles with span lengths up to 500 ft.

Terminal brackets can be used as an alternate for wood brackets and may be installed on corner and "dead-end" poles.

## POLE ATTACHMENTS FOR LARGE ANGLES AND DEAD ENDS

Small and large angle poles with spare lengths up to 500 feet in length and using H.T.L.—135 high tensile strength wire, shall be dead-ended from each direction on heavy steel brackets as illustrated in Figure 177, or may be dead-ended on Strain insulators as shown in Figure 178. The corner may approach an angle of 90 degrees.

Wire at "dead end" poles shall be terminated in the same manner as described in the above paragraph; except that the wires terminate from only one direction.

The brackets or strain insulator fixtures should be mounted to provide 18 inches to 24 inches of space between the wires.

DEAD-END AND LARGE-ANGLE POLE

(HIGH TENSILE STRENGTH WIRE)

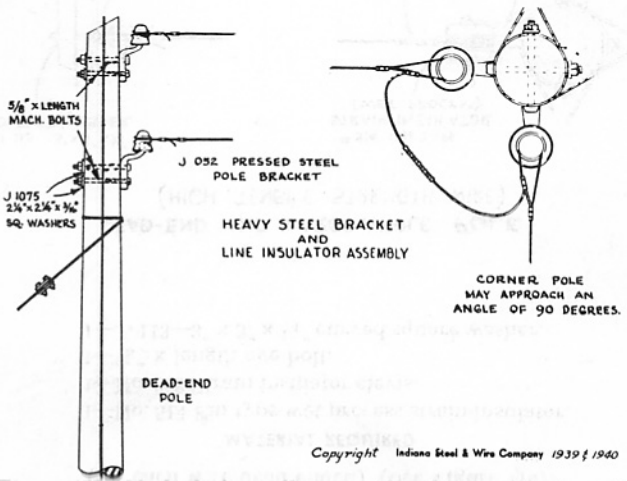



*Figure 177—Method of installing steel brackets on "dead-end" and large angle poles.*



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## STRAIN INSULATOR ASSEMBLY

(for each wire dead ended) (See Figure 178).

**MATERIAL REQUIRED**

1—No. 514 Fin type wet process strain insulator.
1—No. 808 Strain insulator clevis.
1—5/8" x length eye bolt.
1—J-113--3" x 3" x 1/4" curved square washer.

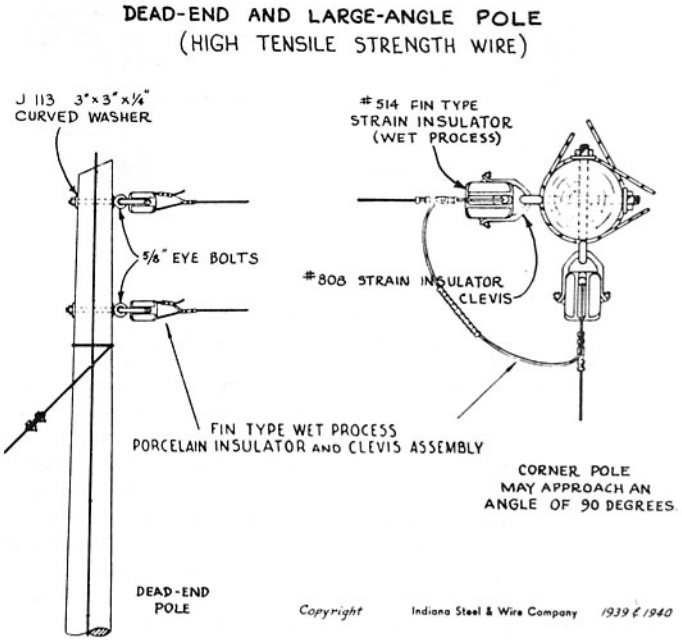



*Figure 178—Method of attaching fin type strain insulators to "dead-end" and large angle poles.*

## LONG SPANS TERMINATED ON SINGLE BACK BRACED CROSSARM

When more than four wires are used in long span construction (up to 300 feet) the wires shall be attached to crossarms and "Dead Ended" on a single back-braced crossarm equipped with steel pins.

### BACK BRACE ASSEMBLY (FIG. 147)

A ten pin, 10 foot standard crossarm 3¼" x 4¼" will require a J-6969—9 ft. 1 inch back brace.

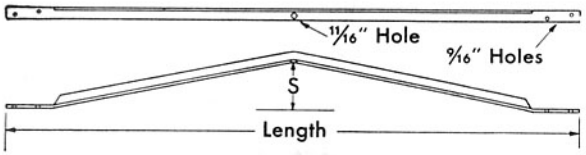
A six pin, 6 foot standard crossarm 3¼" x 4¼" will require a J-6966, 6 ft. back brace.

**Material Required for Attaching a Back Brace To a Crossarm**

1—⅝" x length machine bolt.
1—J-1075--2¼" x 2¼" x 3/16" square washer.
4—J-8644½—½" x 4½" carriage bolts.
4—J-1086—1⅜" round washers.

Methods of attaching crossarms to poles are described and illustrated on pages 258 to 276.

## CROSSARM BACK BRACES




| Cat. No. | Length | Inches | Size Angle Inches |
|---|---|---|---|
| J-6966 | 6 ft. | 6 | 1½x1½x3/16 |
| J-6967 | 7 ft., 10 in. | 6 | 1¾x1¾x3/16 |
| J-6969 | 9 ft., 1 in. | 6½ | 1¾x1¾x3/16 |

Crossarm back braces are used to reinforce crossarms at corners and terminal poles. The crossarm brace is drilled with a 11/16" center hole for a ⅝ inch machine bolt and two 9/16 inch holes at each end for ½ inch carriage bolts.

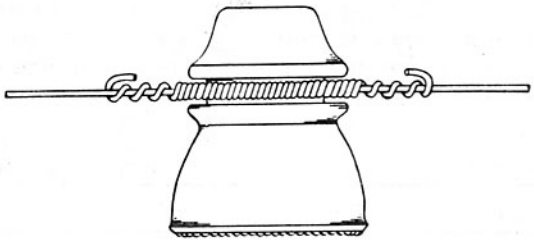


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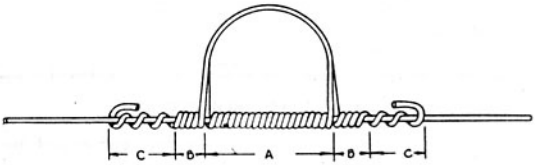
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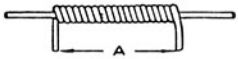
## ARMOR TIE



SIDE VIEW




A- CLOSE WRAPS EQUAL TO DIAMETER OF INSULATOR GROOVE.
B- 3 TO 4 CLOSE WRAPS.
C- 2 TO 3 OPEN WRAPS (TRIPLE SPACED).




| LINE WIRE SIZE B.W.G. | TIE WIRE SIZE B.W.G. | TIE WIRE LENGTHS IN INCHES |
|---|---|---|
| 9 | 10 | 48 |
| 10 | 10 | 46 |
| 12 | 12 | 44 |
| 14 | 14 | 40 |

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*Figure 179—Typical armored tie.*

## STRAIGHT SECTIONS OF POLE LINE—LONG SPAN CONSTRUCTION

When six or more high tensile strength wires are strung in a straight section of a pole line, they shall be attached to a standard crossarm 3¼"x4¼" with the standard pin spacing.

For spans of 200 feet to 500 feet, it is recommended that consideration be given to reinforcing the line wire at the supports with Crapo Armor tie wire. This method of reinforcing the line wire will stiffen the wire in the groove of the insulator and will provide improved distribution of line wire stresses at the supports.

This tie wire acts as an armor over the line wire and protects it against abrasion caused by vibration and swaying.

During periods of ice and wind loading, the armor tie secures the line wire firmly to the insulator.

## DEAD-ENDING OF LONG SPANS ON CROSSARMS

When spans of 300 foot to 500 foot of high tensile strength wire is dead-ended; the wire shall be attached to a No. 514 strain insulator equipped with a No. 808 clevis which shall be bolted through a double crossarm fixture. A ⅝" double arming eye bolt is required in order to distribute the stress equally between the two crossarms. (See figure 180.)

Where more than one crossarm is used, the arms should be spaced approximately 30 inches apart.

Under this arrangement the crossarms should not be drilled for wood pins.

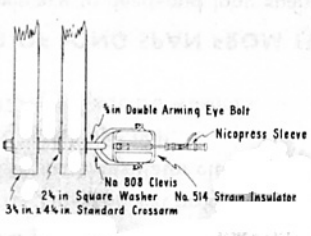



*Figure 180—Method of "dead-ending" high tensile strength wire on a double crossarm using strain insulator and clevis.*



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**Material required for dead-ending wire on double crossarm. (For each wire dead-ended) (Fig. 180)**

1—No. 514 Tin-type wet process strain insulator.

1—No. 808 strain insulator clevis.

1—⅝" x length eye bolt.

4—J-1075—2¼" square washers.

## DEAD-ENDING OF LONG SPAN FROM TWO DIRECTIONS

When it is necessary to dead-end long spans from both directions, use the same method as described on Page 315 (Dead-ending of long spans on crossarms). However it will be necessary to use a strain insulator and clevis on each side of the double arm fixture. In place of the ⅝" double arming eye bolt use a standard ⅝" double arm bolt of sufficient length to allow a No. 7052 eye nut to be attached at each end. This eye nut will provide a means for holding the clevis and strain insulator in place.

**Material required for dead-ending wires from two directions on a double crossarm fixture. (For each wire dead-ended).**

1—No. 514 Fin-type wet process strain insulator.

1—No. 808 strain insulator clevis.

1—⅝" x length double arm bolt.

4—J-1075—2¼" square washers.

2—7502 eye nuts.

Another favorable method of "dead-ending" long spans of H.T.L.—85 wire, of 300 feet or less, and where more than four wires are involved; is to incorporate the use of No. 14 terminal brackets that are securely bolted to a 3¼" x 4¼" x 6' or 10' standard cross arm.

**NOTE:** Crossarm shall not be drilled for pins. The spacing for terminal brackets shall be the same as that of standard pin spacing *(see figure 141)—Cross-arm dimensions and pin spacing.*

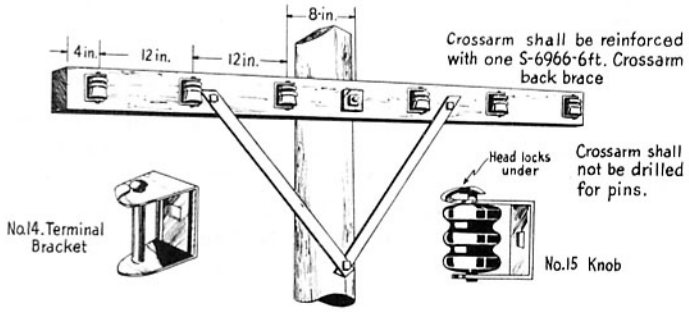



*Figure 181—Location of terminal brackets on crossarm for terminating high tensile strength wire.*

**Material required for "deadending" long spans on terminal brackets using 6′ or 10′ standard crossarms (Figure 181).**

1—3¼″ x 4¼″ x 6′ crossarm (less driling for pins)

2—J-7122—22 inch cross arm braces (30 inch braces on 10 pin crossarm).

2—J-8634½—⅜″ x 4½″ carriage bolts.

2—J-1085—1¼″ round washers.

1—J-8754½—½″x4½″ lag screw.

1—⅝″ x length machine bolt.

2—J-1075—2¼″x2¼″x$\frac{3}{16}$″ square washers.

6—No. 14 Terminal brackets. (Use 10 brackets on ten foot crossarm).

6—No. 15 knobs. (Use 10 knobs on ten foot crossarm).

6—J-8644½—½″x4½″ carriage bolts. (Use 10 bolts on ten foot crossarm).

6—J-1086—1⅜″ round washers. (Use 10 washers on ten foot crossarm).

**NOTE:** Crossarms shall be drilled for terminal brackets and hardware mounting only. No drilling for pins.



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## JUNCTION POLE

A typical junction pole installation of a bracket line, leaving a main pole line is illustrated below.

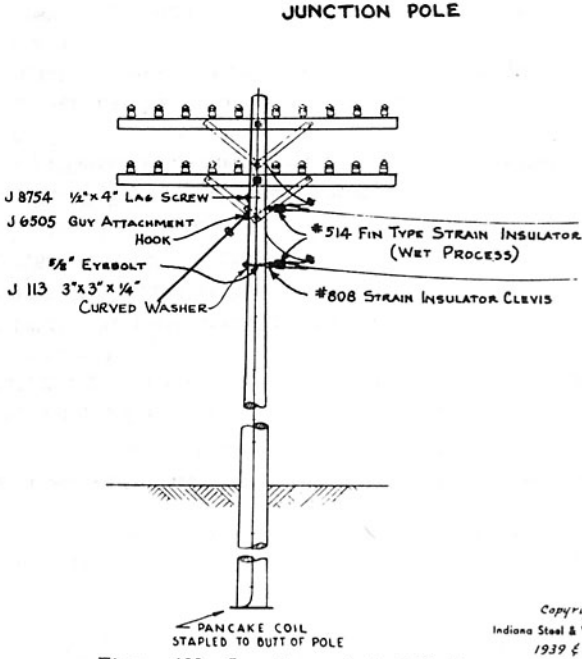



*Figure 182—Junction pole installation*

## TERMINATE HIGH TENSILE STRENGTH WIRE

Note: It is recommended to terminate long spans of H.T.L.-85 and H.T.L.-135 high tensile strength wire on large diameter strain insulators whenever possible.

Do not terminate long spans of H.T.L.-85 or H.T.L.-135 on small diameter knobs and insulators as this may have a tendency to injure the wire due to the sharp turn.

## RIVER CROSSING STRAND

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River crossings of open-wire communication lines are often of such width that exceptionally long spans are required. In many instances these crossings also are in relatively exposed locations, and sometimes are not readily accessible. Consequently it is considered good practice to build and maintain them with sufficient strength to withstand relatively heavy ice and/or wind loading.

To meet the requirements of this severe type of service, the Indiana Steel & Wire Company offers *Crapo* River Crossing Strand made of seven individual wires stranded into one compact conductor. This river crossing strand is furnished in two sizes: 3/16-inch and 5/16-inch. Physical properties are given below:

**Physical Properties of *Crapo* River Crossing Strand** **TABLE NO. 75**

| STRAND SIZE INCHES | TYPE OF CONSTRUCTION | WIRE DIAMETER (INCHES) | OUTSIDE DIAMETER OF STRAND (INCHES) | APPROX. WT. IN LBS. PER 1000 FT. | MINIMUM BREAKING LOAD (POUNDS) |
|---|---|---|---|---|---|
| 3/16 | 7-wire | 0.065 | 0.195 | 80.2 | 4,000 |
| 5/16 | 7-wire | 0.104 | 0.312 | 205 | 11,200 |

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### Recommended Grade of Strength

The strength of a given overhead wire span can be expressed in terms of the ice and/or wind loading which it will sustain at a specified temperature without exceeding safe limits of tension in the conductor. Because of the severe exposures involved, the assumptions relating to climatic loading and conductor strength set forth in the fifth edition of the National Electrical Safety Code, for overhead conductors of grades B, C and D construction, are recommended for long-span river crossings of communication lines. The term "overhead conductors" as used in the Code is understood, for present purposes, to include *Crapo* River Crossing Strand.



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### Climatic Loading

Three general degrees of loading due to weather conditions are recognized under the National Electrical Safety Code and are designated as Heavy, Medium and Light. The map showing the districts in the United States in which these loadings are normally applicable accompanies rule 250 of the Code.

The assumed loadings on conductors are defined in rule 251 of the Code. Those provisions of this rule applicable to steel conductors have been assembled in Table 76 herein. The results of the application of these loading specifications to *Crapo* River Crossing Strand are shown in Table 77.

### Sags and Tensions

In the following sag and tension tables for *Crapo* River Crossing Strand, the maximum tensions are those permitted under rule 261F4 of the fifth edition of the Code, for Grades B and C construction. The highest grade required by the Code is grade B, under which the maximum tensions are limited to 60 per cent of the minimum breaking strength of the conductor, as shown in Table 78 which follows:

Rule 261F4 also prescribes that initial tensions at 60 degrees fahrenheit before application of external load shall not exceed 35 per cent of the ultimate strength and that final tensions at that temperature (after application of maximum loading) shall not exceed 25 per cent. For design purposes the ultimate strength of *Crapo* River Crossing Strand is taken as the minimum breaking strength shown in Table 75.

The foregoing limitations in design also are predicated on the use of recognized methods for avoiding fatigue failures by minimizing stress concentrations and chafing in wires and fastenings.

### Initial and Final Sags

When overhead spans first are subjected to maximum loading for a considerable period of time, a slight permanent stretch or "set" occurs, which in turn causes a small increase in sag. Tables 79, 80 and 81 show initial sags before application of external load and final sags after maximum load (See Table 76) has been imposed for a considerable period. The final sags always should be used in computing final clearances above ground or other objects.

**Definition of Loading on Bare Steel Strand**

**From Rule 251 in Fifth Edition of N.E.S.C. TABLE NO. 76**

| LOADING DISTRICT | RADIAL THICKNESS OF ICE (INCHES) | HORIZONTAL WIND PRESSURE (LBS. PER SQ. FT.) | TEMPERATURE IN FAHRENHEIT DEGREES | CONSTANT TO BE ADDED TO THE RESULTANT IN LB. PER FT. |
|---|---|---|---|---|
| Heavy | 0.50 | 4 | 0 | 0.29 |
| Medium | 0.25 | 4 | 15 | 0.19 |
| Light | None | 9 | 30 | 0.05 |

### Sag-Tension Tables

Tables 79, 80 and 81 have been prepared for the guidance of engineers in designing, constructing and maintaining river crossings and other spans of unusual length involving the use of *Crapo* River Crossing Strand. The key to design limits referred to in the Sag-Tension Tables is given in Table 78.

### Standard Lengths

*Crapo* River Crossing Strand in $\frac{5}{16}$-inch size is furnished on reels in optional lengths of 1000 feet, 2500 feet, or 5000 feet, as ordered. It cannot be furnished in coils.

This strand in $\frac{3}{16}$-inch size is furnished either in coils of 500 feet or 1000 feet in length, or on reels in lengths of 2500 feet, or 5000 feet, as ordered.



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**TABLE NO. 77—Ice and Wind Loadings on *Crapo* River Crossing Strands**

| Strand Size (in.) | Type of Construction | Diameter of Wire (in.) | Outside Diameter of Strand (in.) | Weight (lb. per ft.) | Loading District | Loading in Pounds Per Linear Foot | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Total Vertical | Total Horizontal | Resultant of Vertical and Horizontal | Constant to Be Added to the Resultant | Total Strand Loading |
| 3/16 | 7-wire | 0.065 | 0.195 | 0.0803 | Heavy | 0.512 | 0.398 | 0.649 | 0.29 | 0.939 |
| | | | | | Medium | 0.219 | 0.232 | 0.319 | 0.19 | 0.509 |
| 5/16 | 7-wire | 0.104 | 0.312 | 0.205 | Heavy | 0.710 | 0.437 | 0.834 | 0.29 | 1.124 |

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**TABLE NO. 78—Key to Design Limits Referred to in Sag-Tension Tables**

| Design Limit | Load Condition | Loading District | Maximum Tension in Per Cent of Minimum Breaking Strength |
|---|---|---|---|
| 1 | Maximum Load | Heavy | 60% |
| | | Medium | 60% |
| 2 | Initial Unloaded | All | 35% |
| 3 | Final Unloaded | All | 25% |

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## TABLE NO. 79—3/8-Inch *Crapo* River Crossing Strand—Sags and Tensions

### Heavy Loading District

| Span Lgth. Feet | Design Limit | Maximum Loading | | Ice Load Only | | WITHOUT ICE OR WIND | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | At —30° F. | | At 0° F. | | At 30° F. | | At 60° F. | | At 90° F. | | At 120° F. | |
| | | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. |
| **Initial Sags and Tensions** | | | | | | | | | | | | | | | | | |
| 400 | 3 | | | 6.26 | 1649 | 1.07 | 1497 | 1.13 | 1420 | 1.20 | 1337 | 1.29 | 1244 | 1.40 | 1149 | 1.52 | 1057 |
| 500 | 3 | | | 8.82 | 1821 | 1.58 | 1590 | 1.66 | 1516 | 1.75 | 1438 | 1.86 | 1346 | 2.00 | 1253 | 2.16 | 1161 |
| 600 | 1 | | | 12.63 | 1829 | 2.52 | 1429 | 2.66 | 1356 | 2.82 | 1276 | 3.04 | 1183 | 3.31 | 1092 | 3.61 | 999 |
| 800 | 1 | | | 25.35 | 1641 | 10.40 | 621 | 11.15 | 577 | 12.00 | 534 | 13.00 | 496 | 14.00 | 461 | 15.00 | 430 |
| 1000 | 1 | | | 42.75 | 1528 | 30.00 | 338 | 30.85 | 328 | 31.70 | 322 | 32.60 | 312 | 33.50 | 303 | 34.45 | 296 |
| 1200 | 1 | | | 65.35 | 1457 | 54.15 | 273 | 54.90 | 269 | 55.65 | 266 | 56.40 | 261 | 57.25 | 258 | 58.00 | 254 |
| 1400 | 1 | | | 92.50 | 1413 | 82.40 | 246 | 83.00 | 244 | 83.75 | 242 | 84.50 | 240 | 85.25 | 238 | 86.00 | 236 |
| **Final Sags and Tensions** | | | | | | | | | | | | | | | | | |
| 400 | 3 | 9.15 | 2067 | 6.69 | 1544 | 1.24 | 1292 | 1.34 | 1198 | 1.46 | 1104 | 1.61 | 1000 | 1.80 | 894 | 2.03 | 792 |
| 500 | 3 | 12.90 | 2299 | 9.60 | 1680 | 1.95 | 1285 | 2.10 | 1196 | 2.27 | 1105 | 2.51 | 1000 | 2.80 | 894 | 3.18 | 791 |
| 600 | 1 | 17.81 | 2400 | 13.76 | 1681 | 3.45 | 1046 | 3.76 | 960 | 4.12 | 873 | 4.66 | 781 | 5.26 | 697 | 5.96 | 615 |
| 800 | 1 | 31.70 | 2400 | 27.05 | 1536 | 15.25 | 421 | 16.10 | 399 | 17.00 | 380 | 18.00 | 358 | 18.95 | 340 | 19.95 | 324 |
| 1000 | 1 | 50.00 | 2400 | 44.90 | 1454 | 34.75 | 293 | 35.50 | 288 | 36.30 | 280 | 37.05 | 273 | 37.95 | 267 | 38.80 | 261 |
| 1200 | 1 | 72.90 | 2400 | 67.50 | 1411 | 58.40 | 253 | 59.00 | 251 | 59.80 | 248 | 60.50 | 245 | 61.30 | 242 | 62.00 | 239 |
| 1400 | 1 | 100.45 | 2400 | 94.85 | 1378 | 86.25 | 234 | 86.90 | 233 | 87.50 | 232 | 88.20 | 230 | 88.95 | 229 | 89.65 | 227 |

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## TABLE NO. 80—3/16-Inc. Crapo River Crossing Strand—Sags and Tensions

### Medium Loading District

| Span Length Feet | Design Limit | Maximum Loading | | Ice Load Only | | WITHOUT ICE OR WIND | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | At 0° F. | | At 30° F. | | At 60° F. | | At 90° F. | | At 120° F. | |
| | | Sag ft. | Tension lb. | Sag ft. | Tension ft. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. |
| **Initial Sags and Tensions** | | | | | | | | | | | | | | | |
| 500 | 3 | | | 5.20 | 1334 | 1.98 | 1295 | 2.09 | 1211 | 2.24 | 1125 | 2.43 | 1032 | 2.68 | 939 |
| 600 | 3 | | | 7.00 | 1404 | 2.61 | 1332 | 2.66 | 1247 | 2.73 | 1160 | 2.82 | 1071 | 2.96 | 976 |
| 800 | 3 | | | 11.48 | 1534 | 4.62 | 1389 | 4.96 | 1310 | 5.34 | 1221 | 5.74 | 1138 | 6.20 | 1051 |
| 1000 | 3 | | | 16.45 | 1663 | 7.00 | 1454 | 7.45 | 1378 | 7.90 | 1295 | 8.45 | 1211 | 9.00 | 1129 |
| 1200 | 1 | | | 24.30 | 1628 | 11.45 | 1277 | 12.00 | 1208 | 12.85 | 1132 | 13.70 | 1061 | 14.70 | 988 |
| 1400 | 1 | | | 36.50 | 1476 | 21.40 | 921 | 22.60 | 871 | 23.95 | 824 | 25.40 | 779 | 26.80 | 737 |
| 1600 | 1 | | | 51.70 | 1368 | 36.70 | 702 | 38.15 | 675 | 39.75 | 650 | 41.35 | 626 | 43.00 | 603 |
| **Final Sags and Tensions** | | | | | | | | | | | | | | | |
| 500 | 3 | 9.38 | 1707 | 5.52 | 1256 | 2.12 | 1197 | 2.28 | 1109 | 2.51 | 1000 | 2.80 | 896 | 3.16 | 794 |
| 600 | 3 | 12.55 | 1838 | 7.57 | 1305 | 2.70 | 1192 | 2.79 | 1101 | 2.91 | 1000 | 3.09 | 902 | 3.33 | 805 |
| 800 | 3 | 19.72 | 2079 | 12.56 | 1403 | 5.56 | 1173 | 5.97 | 1091 | 6.52 | 1000 | 7.18 | 910 | 7.90 | 823 |
| 1000 | 3 | 27.85 | 2299 | 18.30 | 1496 | 8.90 | 1158 | 9.50 | 1075 | 10.10 | 1000 | 11.00 | 916 | 12.00 | 834 |
| 1200 | 1 | 38.50 | 2400 | 27.20 | 1453 | 15.05 | 958 | 16.15 | 895 | 17.45 | 834 | 18.60 | 777 | 20.00 | 722 |
| 1400 | 1 | 52.55 | 2400 | 40.50 | 1336 | 27.95 | 708 | 29 30 | 675 | 30.65 | 644 | 32.25 | 614 | 33.75 | 585 |
| 1600 | 1 | 69.15 | 2400 | 56.10 | 1263 | 44.45 | 583 | 45.95 | 565 | 47.45 | 548 | 48.90 | 533 | 50.40 | 519 |

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## TABLE NO. 81—5/16-Inch *Crapo* River Crossing Strand—Sags and Tensions

### Heavy Loading District

| Span Lgth. Feet | Design Limit | Maximum Loading | | Ice Load Only | | WITHOUT ICE OR WIND | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | At −30° F. | | At 0° F. | | At 30° F. | | At 60° F. | | At 90° F. | | At 120° F. | |
| | | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. | Sag ft. | Tension lb. |
| **Initial Sags and Tensions** | | | | | | | | | | | | | | | | | |
| 800 | 3 | | | 13.20 | 4344 | 4.36 | 3954 | 4.52 | 3761 | 4.70 | 3559 | 4.94 | 3330 | 5.22 | 3113 | 5.62 | 2881 |
| 1000 | 3 | | | 18.90 | 4701 | 6.30 | 4070 | 6.60 | 3889 | 6.93 | 3702 | 7.37 | 3488 | 7.82 | 3274 | 8.39 | 3057 |
| 1200 | 3 | | | 26.30 | 5179 | 9.05 | 4228 | 9.35 | 4044 | 9.75 | 3865 | 10.20 | 3654 | 10.80 | 3446 | 11.45 | 3229 |
| 1400 | 3 | | | 32.35 | 5417 | 11.90 | 4344 | 12.25 | 4177 | 12.80 | 4005 | 13.50 | 3806 | 14.15 | 3604 | 15.05 | 3407 |
| 1600 | 1 | | | 42.40 | 5405 | 16.85 | 3901 | 17.50 | 3737 | 18.45 | 3568 | 19.45 | 3390 | 20.50 | 3208 | 21.70 | 3030 |
| 1800 | 1 | | | 55.72 | 5218 | 26.55 | 3125 | 27.90 | 2994 | 29.10 | 2857 | 30.60 | 2712 | 32.25 | 2581 | 34.00 | 2453 |
| 2000 | 1 | | | 70.85 | 5075 | 40.60 | 2554 | 42.35 | 2459 | 43.95 | 2370 | 45.75 | 2272 | 47.50 | 2182 | 49.40 | 2099 |
| **Final Sags and Tensions** | | | | | | | | | | | | | | | | | |
| 800 | 3 | 17.40 | 5203 | 13.80 | 4133 | 4.80 | 3523 | 5.02 | 3277 | 5.40 | 3056 | 5.80 | 2800 | 6.38 | 2578 | 7.10 | 2319 |
| 1000 | 3 | 25.00 | 5682 | 20.10 | 4460 | 7.40 | 3473 | 7.90 | 3241 | 8.46 | 3033 | 9.15 | 2800 | 9.93 | 2581 | 10.88 | 2538 |
| 1200 | 3 | 33.10 | 6158 | 27.35 | 4811 | 10.94 | 3422 | 11.62 | 3214 | 12.38 | 3024 | 13.30 | 2800 | 14.20 | 2605 | 15.30 | 2411 |
| 1400 | 3 | 42.10 | 6595 | 34.75 | 5046 | 15.25 | 3363 | 16.00 | 3178 | 17.00 | 2982 | 18.15 | 2800 | 19.50 | 2611 | 20.85 | 2426 |
| 1600 | 1 | 54.00 | 6720 | 45.75 | 5010 | 22.95 | 2869 | 24.05 | 2718 | 25.45 | 2575 | 27.00 | 2426 | 28.60 | 2289 | 30.40 | 2170 |
| 1800 | 1 | 68.75 | 6720 | 59.75 | 4870 | 36.00 | 2319 | 37.55 | 2227 | 39.25 | 2135 | 41.00 | 2046 | 42.80 | 1959 | 44.60 | 1876 |
| 2000 | 1 | 84.55 | 6720 | 75.35 | 4760 | 51.90 | 1992 | 53.50 | 1930 | 55.05 | 1870 | 57.00 | 1811 | 58.65 | 1751 | 60.50 | 1695 |

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# SELECTION AND SPACING OF POLES
## FOR LONG SPAN CONSTRUCTION

Poles selected to support long spans shall be as short as possible and still maintain standard clearances.

All corner poles and dead-end poles shall be the next size larger than the poles used in the straight section of a line.

The following pole selection tables for long span construction are based on average conditions. When local sub-average conditions are encountered, it will be necessary to select a pole, larger or smaller in diameter.

**HEAVY LOADING AREA** — **TABLE NO. 82**

| Number of Wires | Poles per Mile | Average Span Length (in feet) | Class of Pole |
|---|---|---|---|
| 1 - 2 | 15.0 | 350 | 7 |
| 1 - 2 | 17.6 | 300 | 8 |
| 1 - 2 | 21.1 | 250 | 9 |
| 1 - 2 | 26.4 | 200 | 9 |
| 3 - 4 | 15.0 | 350 | 7 |
| 3 - 4 | 17.6 | 300 | 7 |
| 3 - 4 | 21.1 | 250 | 8 |
| 3 - 4 | 26.4 | 200 | 9 |
| 5 - 6 | 15.0 | 350 | 6 |
| 5 - 6 | 17.6 | 300 | 7 |
| 5 - 6 | 21.1 | 250 | 7 |
| 5 - 6 | 26.4 | 200 | 9 |
| 7 - 10 | 15.0 | 350 | 6 |
| 7 - 10 | 17.6 | 300 | 6 |
| 7 - 10 | 21.1 | 250 | 7 |
| 7 - 10 | 26.4 | 200 | 9 |

# SELECTION AND SPACING OF POLES FOR LONG SPAN CONSTRUCTION

**MEDIUM LOADING AREA** **TABLE NO. 83**

| Number of Wires | Poles per Mile | Average Span Length (in feet) | Class of Pole |
|---|---|---|---|
| 1 - 2 | 11.7 | 450 | 6 |
| 1 - 2 | 13.2 | 400 | 7 |
| 1 - 2 | 15.0 | 350 | 8 |
| 1 - 2 | 17.6 | 300 | 9 |
| 1 - 2 | 21.1 | 250 | 10 |
| 1 - 2 | 26.4 | 200 | 10 |
| 3 - 4 | 11.7 | 450 | 6 |
| 3 - 4 | 13.2 | 400 | 6 |
| 3 - 4 | 15.0 | 350 | 7 |
| 3 - 4 | 17.6 | 300 | 8 |
| 3 - 4 | 21.1 | 250 | 9 |
| 3 - 4 | 26.4 | 200 | 10 |
| 5 - 6 | 11.7 | 450 | 6 |
| 5 - 6 | 13.2 | 400 | 6 |
| 5 - 6 | 15.0 | 350 | 6 |
| 5 - 6 | 17.6 | 300 | 7 |
| 5 - 6 | 21.1 | 250 | 8 |
| 5 - 6 | 26.4 | 200 | 9 |
| 7 - 10 | 11.7 | 450 | 6 |
| 7 - 10 | 13.2 | 400 | 6 |
| 7 - 10 | 15.0 | 350 | 6 |
| 7 - 10 | 17.6 | 300 | 7 |
| 7 - 10 | 21.1 | 250 | 8 |
| 7 - 10 | 26.4 | 200 | 9 |



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# SELECTION AND SPACING OF POLES FOR LONG SPAN CONSTRUCTION

**LIGHT LOADING AREA** — **TABLE NO. 84**

| Number of Wires | Poles per Mile | Average Span Length (in feet) | Class of Pole |
|---|---|---|---|
| 1 - 2 | 10.5 | 500 | 6 |
| 1 - 2 | 11.7 | 450 | 6 |
| 1 - 2 | 13.2 | 400 | 7 |
| 1 - 2 | 15.0 | 350 | 8 |
| 1 - 2 | 17.6 | 300 | 9 |
| 1 - 2 | 21.1 | 250 | 10 |
| 1 - 2 | 26.4 | 200 | 10 |
| 3 - 4 | 10.5 | 500 | 6 |
| 3 - 4 | 11.7 | 450 | 6 |
| 3 - 4 | 13.2 | 400 | 7 |
| 3 - 4 | 15.0 | 350 | 8 |
| 3 - 4 | 17.6 | 300 | 9 |
| 3 - 4 | 21.1 | 250 | 10 |
| 3 - 4 | 26.4 | 200 | 10 |
| 5 - 6 | 10.5 | 500 | 5 |
| 5 - 6 | 11.7 | 450 | 6 |
| 5 - 6 | 13.2 | 400 | 6 |
| 5 - 6 | 15.0 | 350 | 7 |
| 5 - 6 | 17.6 | 300 | 7 |
| 5 - 6 | 21.1 | 250 | 8 |
| 5 - 6 | 26.4 | 200 | 9 |
| 7 - 10 | 10.5 | 500 | 5 |
| 7 - 10 | 11.7 | 450 | 5 |
| 7 - 10 | 13.2 | 400 | 6 |
| 7 - 10 | 15.0 | 350 | 7 |
| 7 - 10 | 17.6 | 300 | 7 |
| 7 - 10 | 21.1 | 250 | 8 |
| 7 - 10 | 26.4 | 200 | 9 |

## SIDE GUYS FOR LONG SPANS — TABLE NO. 85

| Number of Wires | Heavy Loading Area | Medium Loading Area | Light Loading Area |
|---|---|---|---|
| | REQUIRED STRENGTH OF STRAND (in pounds) | (in pounds) | (in pounds) |
| 1 - 2 | 2200 | 2200 | 2200 |
| 3 - 4 | 4000 | 4000 | 2200 |
| 5 - 6 | 4000 | 4000 | 4000 |
| 7 - 10 | 6000 | 6000 | 4000 |

Side guys shall be installed with a lead and weight ratio of approximately 1 to 1.

## HEAD GUYS FOR LONG SPANS — TABLE NO. 86

| Number of Wires | Heavy Loading Area | Medium Loading Area | Light Loading Area |
|---|---|---|---|
| | REQUIRED STRENGTH OF STRAND (in pounds) | (in pounds) | (in pounds) |
| 1 - 2 | 4000 | 4000 | 4000 |
| 3 - 4 | 4000 | 4000 | 4000 |
| 5 - 6 | 6000 | 6000 | 6000 |
| 7 - 10 | 6000 | 6000 | 6000 |

Head guys shall be installed with a lead and height ratio approximately 1 to 1.

## POSITION OF ATTACHMENTS ON "JOINT USE" POLE

The data contained herein concerning the vertical separation of crossarms and other attachments on "joint use" poles are based on information contained in the Fifth Edition of the National Electrical safety code. (Table 11, page 74.) However, the local state Electrical Code must receive priority and must be adhered to at all times.

It has been found from practical operating experiences that the most popular and the best suited voltages for joint use construction in urban areas are voltages of 5,000 volts or less between conductors.



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### Climbing Space

All telephone crossarms attached to a joint use pole shall provide a 30 inch climbing space.

### Clearance and separation of foreign wires

Figure 183 illustrates a 10 pin crossarm attached to a joint use pole that provides a 30 inch climbing space. The crossarm shall be attached to the pole at a point not less than 40 inches from the lowest part of a secondary supply rack. The secondary supply circuit shall not exceed 750 volts.

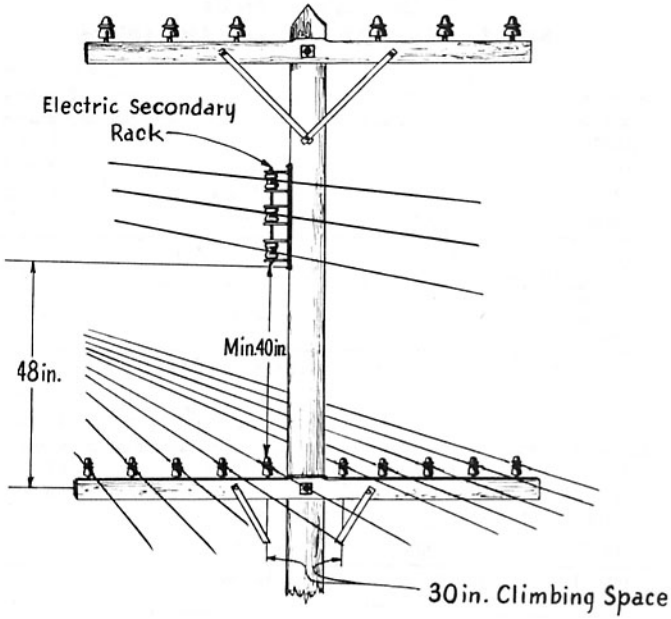
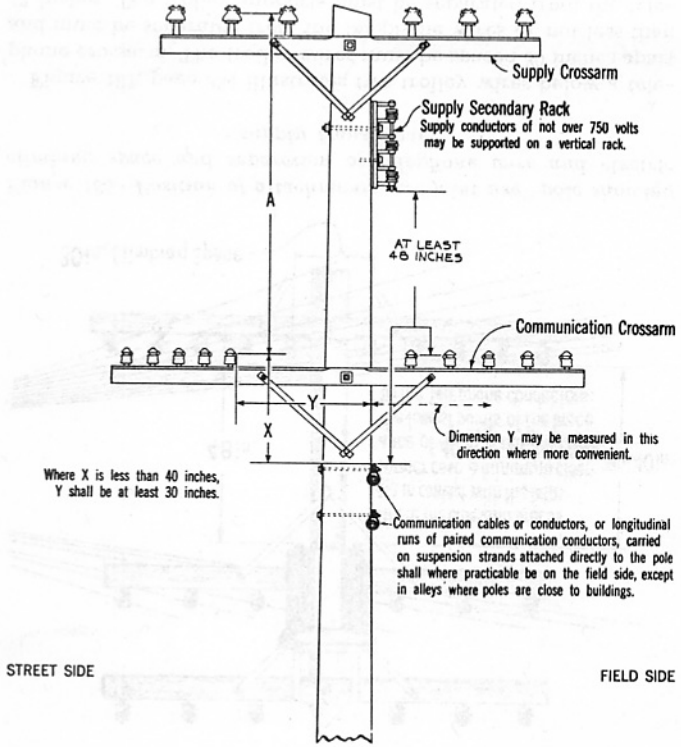



*Figure 183—Position of attachments on "joint use" pole showing climbing space and separation of telephone wires and electric secondary rack.*

SUPPLY SECONDARY RACK AND COMMUNICATION CROSSARM AND CABLES, SHOWING ARRANGEMENT OF ATTACHMENTS, CLEARANCES AND CLIMBING SPACE




| Dimension | Voltages of Supply Circuit Concerned | Minimum Clearances (Inches) |
|---|---|---|
| A | 0 TO 5000 | 40 |
| | | |

*Figure 184—Position of attachments on "joint use" pole.*



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Figure 185 illustrates a 10 pin crossarm attached to a joint use pole that provides a 30 inch climbing space. The crossarm shall be attached to the pole at a point where a separation of at least 48 inches can be maintained between the telephone wires and the lowest point of a transformer. However when the transformer case is effectively grounded the separation may be reduced to 40 inches.

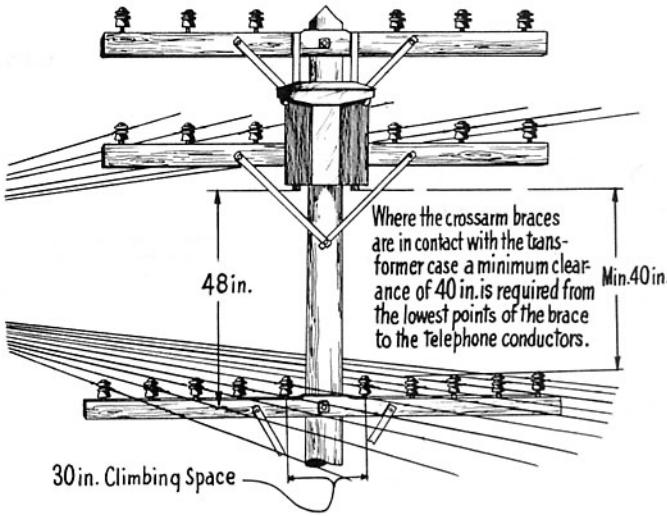



*Figure 185—Position of attachments on "joint use" pole showing climbing space and separation of telephone wire and electric supply transformer.*

Figure 187, page 334 illustrates two trolley wires below a telephone crossarm. The trolley wires must be spaced 30 inches apart and must be separated from the telephone wires by not less than 48 inches. The trolley supports must be separated from the telephone wires by 24 inches.

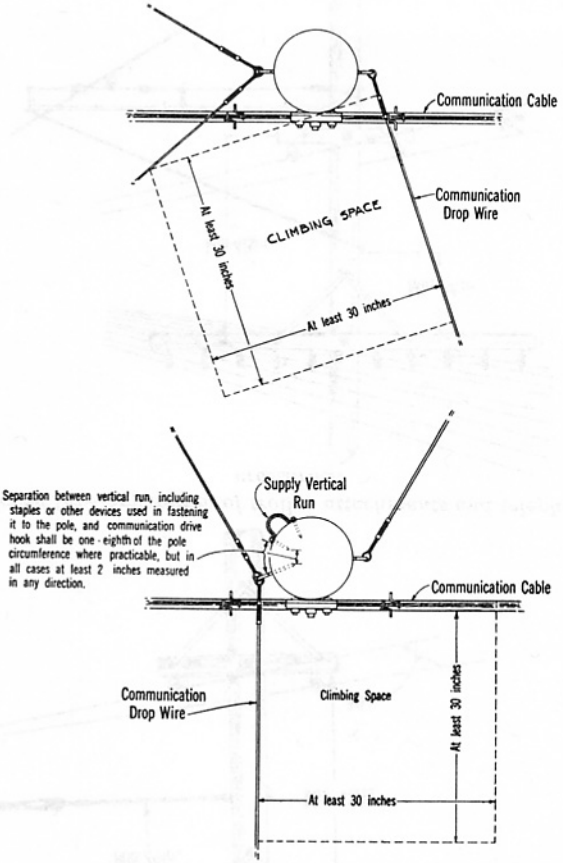



*Figure 186—Climbing space through communication drop wires.*



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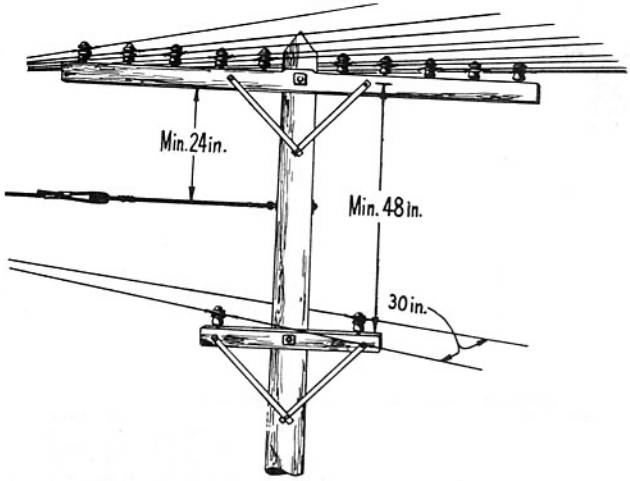



*Figure 187—Separation of trolley attachments and telephone crossarms.*

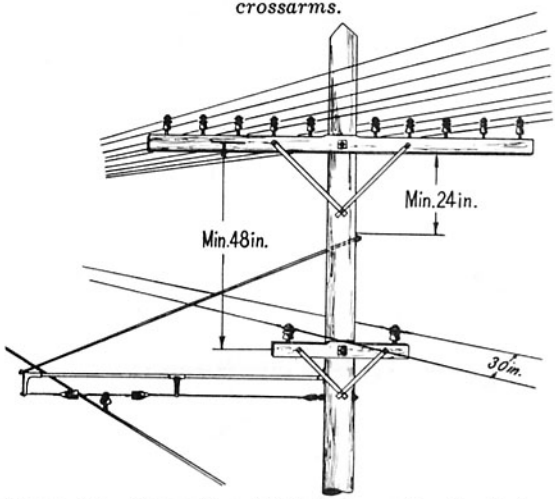



*Figure 188—Separation of telephone and trolley fixtures.*

Figure 188 illustrates a situation where the two top gains are reserved for the telephone company attachments. The second gain is occupied by a standard 10 pin telephone crossarm with regular pin spacing. The third gain is used to support a trolley fixture, while the fourth gain is occupied by a trolley wire crossarm. Immediately below the fourth gain is attached a trolley supporting arm. All separations are clearly indicated.

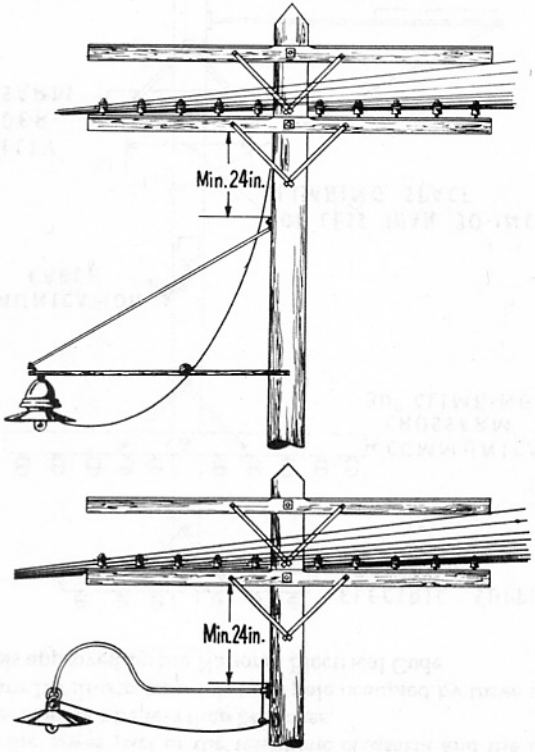



*Figure 189—Separation of telephone crossarms and street lighting fixtures.*



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Figure 189 is an illustration of two joint use poles where two types of street lighting brackets are attached. The separation between the lower part of the telephone crossarm and the lighting fixtures shall not be less than 24 inches.

Figure 190 illustrates a joint use pole occupied by three utilities at levels approved by the National Electrical Code.

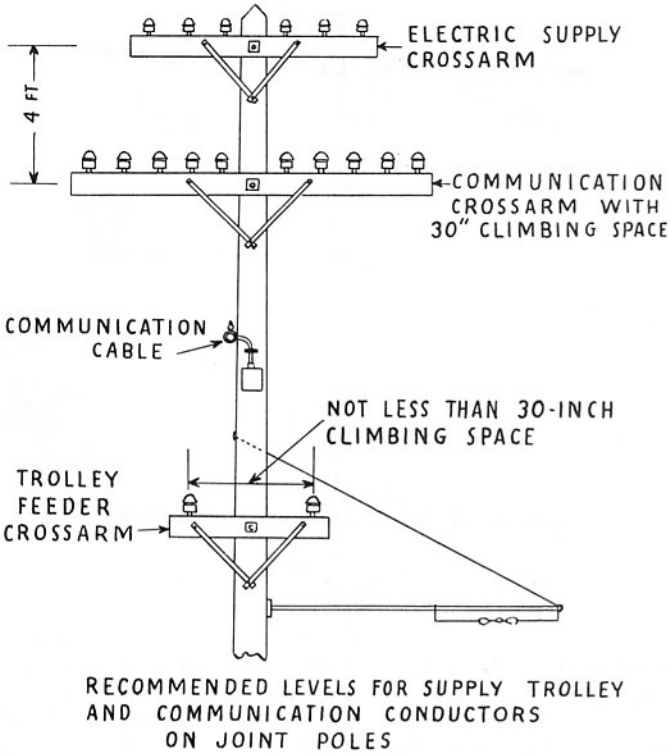



*Figure 190—Relative position of power, telephone and trolley attachments.*

Example: The crossarm in the top gain shall be reserved for electrical supply conductors carrying 5,000 volts or less. The second gain is vacant in order to provide 48 inches of separation between the electrical supply conductors and the telephone crossarm in the third gain. The telephone crossarm must have 30 inches of climbing space.

The 3rd, 4th, 5th and 6th gains are reserved for the telephone attachments.

The 7th, 8th and 9th gains are reserved for the trolley cables and fixtures.

**Vertical separation between Horizontal crossarms.**

**All Voltages are between Conductors.**

**TABLE NO. 87**

| Communication conductors at lower levels | Open wires 0-750 volts. Cables (all voltages) having effectively grounded, continuous metal sheath or messenger | 750 to 5,000 volts |
|---|---|---|
| | (in feet) | (in feet) |
| Communication conductors | 4 | 4 |

**NOTE:** The above data taken from the fifth edition of the National Electrical Safety Code.

Vertical separation between crossarms shall be measured from center to center.

Figure 192 illustrates the position and separation of horizontal crossarms on the same pole. The electric light or power company is assigned to a space in the top gain and the telephone or communication company is assigned to a space in the third gain. The separation of the crossarms shall conform with the data contained in the above table.



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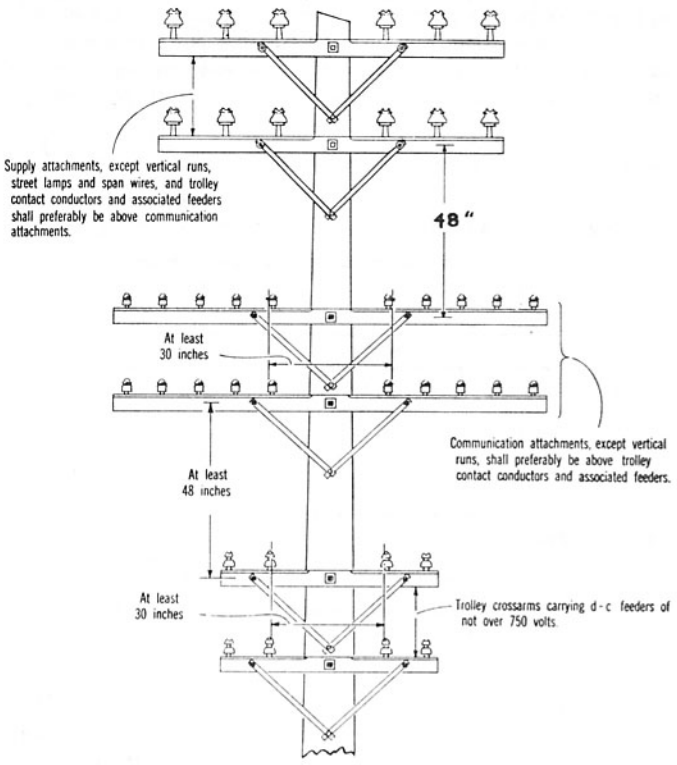



*Figure 191—Relative position of power, telephone and trolley crossarm attachments, showing vertical clearances.*

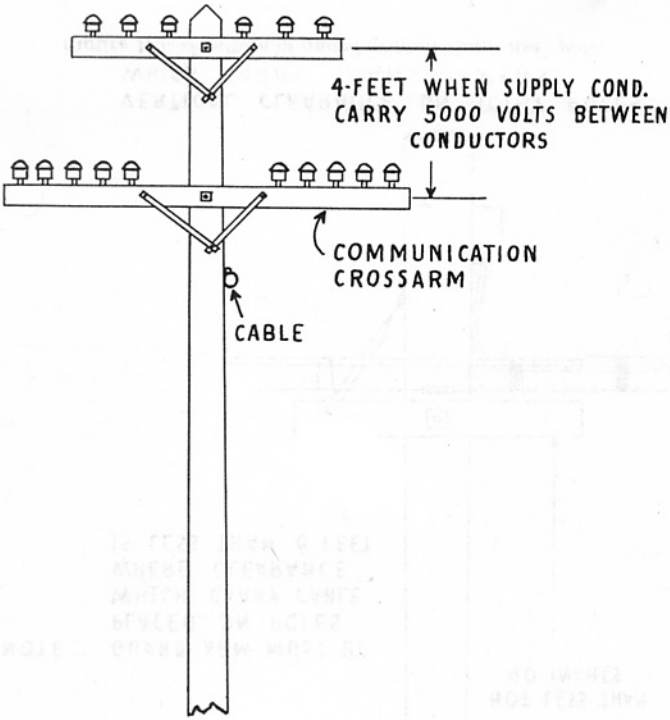



*Figure 192—Vertical separation of power and telephone crossarms.*

## POSITION OF GUARD ARM

Guard arms must be placed on a joint use pole directly above the messenger strand supporting an aerial cable when the clearance is less than 72 inches.



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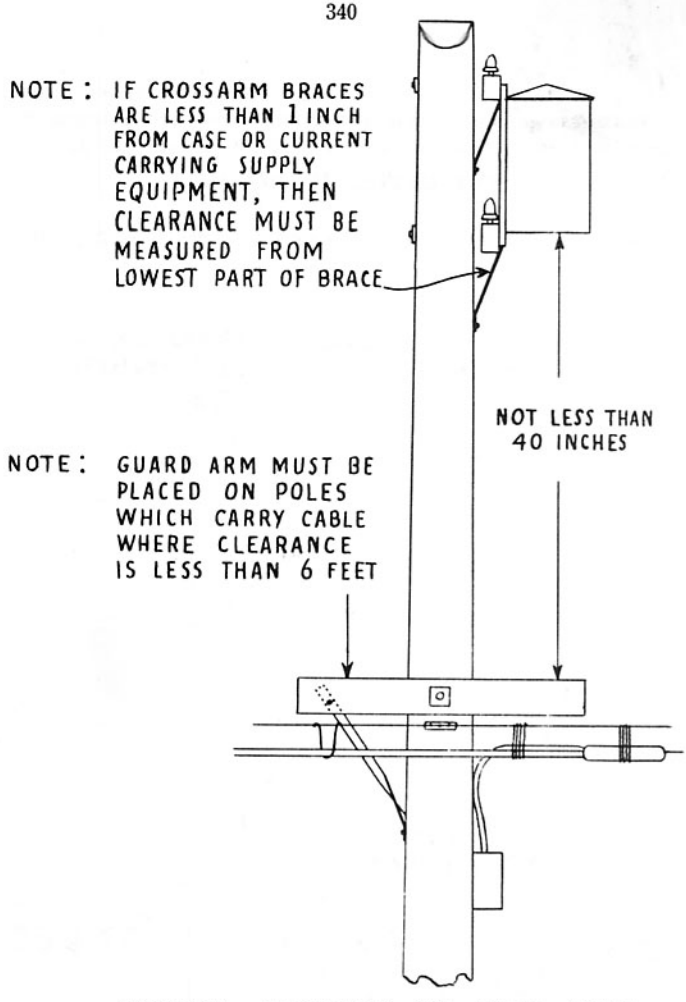
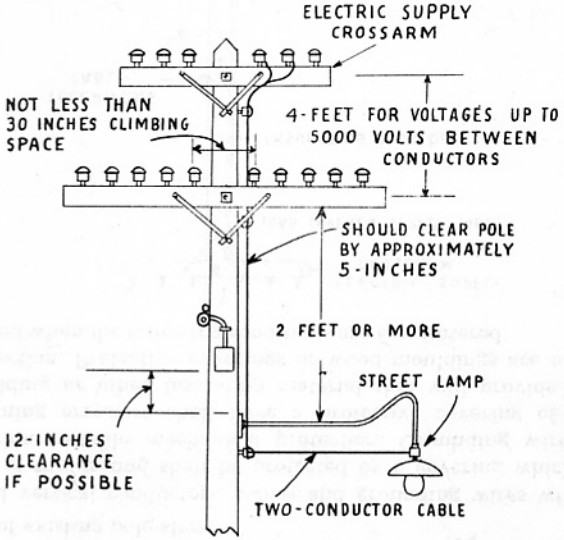



*Figure 193—Position of guard arm on "joint use" pole.*

Figure 194 illustrates a pole jointly used by an electric light or power company and a telephone or communication company. The top gain is alloted to the electric supply conductors with voltages up to 5,000 volts.

Where the electric supply voltage is less than 5,000 volts, the telephone or communication crossarm shall be placed in the third gain, which will provide a separation of 48 inches.

The telephone cable and terminal may be located in the gain below the telephone crossarm or may be moved up depending upon the space required. However the street lighting fixture must be located at a point not less than 12 inches below the lowest part of the cable terminal and 24 inches or more below the bottom of the telephone crossarm.




VERTICAL CLEARANCE ON JOINT POLES WHICH CARRY STREET LAMPS

*Figure 194—Vertical separation of electric supply circuits, telephone circuits and street lighting brackets.*



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## LOCATION OF VERTICAL OR LATERAL CONDUCTORS

Vertical or lateral conductors shall be located so that they do not obstruct climbing spaces or lateral working spaces between line conductors at different pole levels, or interfere with the safe use of existing pole steps.

All vertical conductors, cables and grounding wires within 8 feet of the ground shall be protected by a covering which will provide suitable mechanical protection. Grounding wires for lightning arresters shall have a protective covering of wood moulding or other insulating material that will provide equal protection. Protective coverings or wood mouldings are not required when the following conditions are encountered:

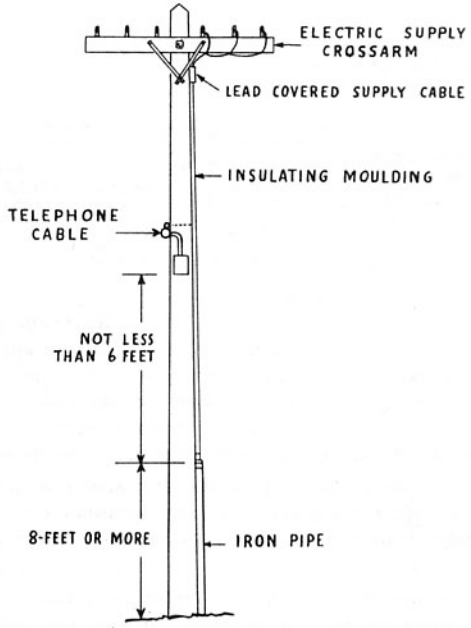



*Figure 195—Protection of vertical runs.*

(1) The covering may be omitted from armored cables or cables installed in a grounded metal conduit.

(2) The covering may be omitted from lead-sheathed cables in rural districts.

(3) This covering may be omitted from vertical runs of communication cables or conductors.

(4) This covering may be omitted from grounding wires in rural districts having a triple braid, weather-proof covering, or where such grounding wire is one of a number of grounding wires used to provide multiple grounds.

(5) This covering may be omitted from wires which are used solely to protect poles from lightning.

## VERTICAL SUPPLY CONDUCTORS PASSING THROUGH COMMUNICATION SPACE ON JOINT USE POLES

Metal sheathed supply cables passing through a communication space on a joint use pole shall be covered with wood molding or other suitable insulating material from the lowest point of such cable to a point 40 inches above the highest communication conductor, except under the following situations:

(1) Metal pipe may be used on poles where there are no trolley attachments and the metal pipe is effectively grounded.

On poles where there are trolley attachments or where the metal pipe is not effectively grounded, the pipe shall be covered with wood molding or other suitable insulating material from a point 6 feet below the lowest communication wire or trolley attachment to a point 40 inches above the highest communication wire or trolley attachment.

(2) Secondary supply conductors of not more than 300 volts to ground may be run in multiple conductor cables, attached directly to the surface of a pole in such a manner as to avoid abrasion at the point of attachment. In the case of aerial service, the point where such cables leave the pole shall be at least 40 inches above the highest, or 40 inches below the lowest communication attachment. Each conductor of such cable which is not effectively grounded shall be insulated for a potential of at least 1,000 volts.



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(3) Where there are no trolley attachments on a pole, no insulating covering is required over supply cables having effectively grounded lead sheath, or supply cables having effectively grounded metal sheath of other types where it is mutually agreed to by the parties concerned.

## SUPPLY GROUNDING WIRES

Supply grounding wires shall be covered with wood molding or other suitable insulating covering.

## VERTICAL COMMUNICATION CONDUCTORS ON JOINT USE POLES

Vertical runs of metal sheath communication cables shall be covered with wood molding or other suitable insulating material where they pass trolley feeders or other supply-line conductors. This insulating covering shall extend from a point 40 inches above the highest trolley feeder, or other supply conductors, to a point 6 feet below the lowest trolley feeder or other supply conductors, but need not extend below the top of any mechanical protection which may be provided near the ground.

## COMMUNICATION GROUNDING CONDUCTORS

Vertical communication grounding conductors shall be covered with wood molding or other insulating material between points at least 6 feet below and 40 inches above any trolley feeders or other supply line conductors which they pass.

## VERTICAL SEPARATION OF SUPPLY CONDUCTORS AND COMMUNICATION CONDUCTORS FROM THROUGH BOLTS

Vertical runs of supply conductors shall be separated from the ends of through bolts when associated with communication line equipment by one-eighth of the circumference of the pole where practicable, but in no case less than 2 inches.

Vertical runs of communications conductors shall be separated from the ends of through bolts when associated with supply line equipment by one-eighth of the circumference of the pole where practicable, but in no case less than 2 inches.