

JOINT USE OF POLES

Purpose: This addendum provides additional information for the design of cable plant in joint-use construction.

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SAG CHARTS 1 to 6 INCLUSIVE

1. SCOPE

- 1.01 The information herein is for use in the design of joint-use of cable weighing 1.5 pounds per foot or more. It supplements Addendum No. 2 to REA TE & CM-690, "Joint Use of Poles" which is limited to design where the cable weighs 1.0 pound per foot or less.

2. GENERAL

- 2.01 The design engineer must determine the clearances and points of attachment to power poles for cables which exceed 1.0 pound per foot. The solution for a specific project can be worked out graphically as explained herein. The method can be used for making rapid checks to determine whether or not the power poles will provide vertical clearances required by the NESC rules with a desired cable on them.
- 2.02 In urban areas where spans usually are 150 feet or less, it may not be necessary to use this graphic method. In such spans the power wire sags and the cable sags are considerably

less than in the long spans usually found in rural areas. In short spans the cable sags usually will exceed the power wire sags. By the use of the clearance rules stated in the following paragraphs, the required separations for these short spans can be quickly determined.

- 2.03 Reference should be made to REA TE & CM-630, "Design of Aerial Cable Plant" for information as to the grade of galvanizing or other coating on the suspension strand for use in areas where corrosive atmosphere exist.

3. JOINT USE CLEARANCE AND SEPARATION RULES

- 3.01 In joint-use construction certain clearance and separation rules are stated in the National Electrical Safety Code (NESC). A sixth edition of the Code was issued by the National Bureau of Standards, dated November 1, 1961, as Handbook 81. This can be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., priced at \$1.75 per copy. In those States where the fifth edition is in effect by law, it must be continued as a guide until the sixth edition is adopted. Certain States have rules that are more stringent than the NESC rules and these must be complied with. The NESC rules of the sixth edition are referred to herein.
- 3.02 The NESC rules make distinctions as to clearances and separations depending on whether the power line voltage is below 8700 volts to ground or above this voltage. One set of rules applies where the power line supports secondary power wires and a different set where it does not.
- 3.03 The rules applicable to cable on power poles which do not support secondary power wires are as follows: (See Figure 1 in TE & CM-690 which shows certain joint-use separation requirements).
- a. For spans exceeding 150 feet, the attachment point of the strand to power poles must be at least 40 inches (for practical purposes 3.5 feet can be assumed) below the lowest power wire attachment point, usually the power neutral wire, for power lines not exceeding 8700 volts to ground and at least 60 inches if the power voltage exceed 8,700 volts but does not exceed 15,000 volts to ground.
 - b. The minimum vertical separation required at supports between the strand and grounded non-current carrying power system equipment, such as transformer cases, is 30 inches.
 - c. The final unloaded sag of a cable at 60° F. must comply with the ground clearance rules of the NESC which are stated in REA TE & CM-602, "Clearances."

- d. NESC Rule 238 B 3(c). "For span lengths in excess of 150 feet, vertical separation at the pole between open supply conductors and communication cables or conductors shall be adjusted so that under conditions of 60° F, no wind and final unloaded sag, no supply conductor of 750 volts or less shall be lower in the span than a straight line joining the points of support of the highest communication cable or conductor, and no supply conductor of over 750 volts but less than 50,000 volts shall be lower in the span than 30 inches above such a straight line." This means the strand line of sight attachment points must be at least 30 inches below the low point in the sag of the phase wire in Figure 1, but the multi-grounded neutral wire may sag below this line of sight of the strand.
- e. The initial sag of a bare strand when installed or a cable on strand must provide at least 30 inch clearance between the lowest power wire (in this case usually the neutral wire) and the strand at 60° F. with no wind for power lines not exceeding 8700 volts to ground and 45 inch clearance if the power line exceeds 8700 volts to ground.

3.04 The rules applicable to cable on power lines which do support secondary wires are as follows: (See Figure 2 in REA TE & CM-690 which shows certain joint-use separation requirements.)

- a. Same as par. 3.03a, above.
- b. Same as par. 3.03b, above.
- c. Same as par. 3.03c, above.
- d. Same as par. 3.03d, above. However, this means in this case that the strand line of sight must be not higher than the low point of sag of the lowest secondary wire which is in the class of power wires of 750 volts or less.
- e. The initial sag of a bare strand when installed or a cable on strand must provide at least 30 inch clearance between the lowest power wire (in this case the lowest secondary wire) and the strand at 60° F. with no wind for power lines not exceeding 8700 volts to ground and 45 inch clearance if the power line exceeds 8700 volts to ground.

3.05 When suspension strand is installed, it has much less sag than after a cable is placed on it. Power wires have considerable sag in long span rural construction. Consequently,

it may be necessary to attach the strand temporarily at a point below its final attachment point to prevent contact with power wires above it on the same poles until cable is placed on the strand. The temporary means of attachment can be by driving lag bolts into the poles or by placing other suitable support hardware at proper height to give temporary clearance. Washers can be placed on the bolts and the strand can be placed on the bolts between the washers and the poles. The strand then can be secured to the poles with 0.109 inch steel line wire to hold it temporarily until after the cable is supported by the strand. The strand and cable then can be raised to the throughbolts and the strand attached by three bolt clamps in the standard manner.

4. STEPS IN THE PREPARATION OF FIGURE 1 - POWER LINE WITHOUT SECONDARIES
(AND NO. 4 7/1 ACSR WIRES)

4.01 Figure 1 is a graphic solution for a joint-use situation in which it is assumed that the following factors apply:

- a. Ruling span - 387 feet (Information from power company)
- b. Average span - 350 feet (Information from power company)
- c. Power line voltage - 8700 volts to ground (Information from power company)
- d. Power wires - No. 4 7/1 ACSR (Information from power company)
- e. Cable weight per foot - 1.5 lb. (Table 1 TE & CM-630, "Design of Aerial Cable Plant.") This table shows that 100-pair 19-gauge, 200-pair 22-gauge, and 300-pair 24-gauge plastic cables for aerial use weigh in the order of 1.5 lb. per foot.
- f. Power line poles - 35-foot (Information from power company)
- g. Configuration of power wires on the poles. (See RD Figure 16 in REA TE & CM-690 which is the pole head configuration drawing.)
- h. Ground clearance desired - 14 feet for the cable at final unloaded sag at 60° F.
- i. Storm loading district - heavy

4.02 Other data required in the graphic solution, available in REA documents, include:

- a. Strand size required for 1.5 lb. per foot cable for 350-foot spans in the heavy loading district. The Sag Charts 1 and 2 in REA TE & CM-630 show that a 10M strand is required for 1.5 lb. cable for 350-foot spans in the heavy storm loading district.
- b. The 10M strand stringing (initial) sag at 60° F. for 350-foot spans. This is approximately 2 feet on Sag Chart 2 herewith.

- c. The initial sag of the 1.5 lb. cable on 10M strand for 350-foot spans. This is approximately 7 feet shown on Sag Chart 5 herewith.
- d. The final unloaded sag of the 1.5 lb. cable at 60° F. on 10M strand for 350-foot spans in the heavy loading district. This is approximately 8.5 shown on Sag Chart 4 in REA TE & CM-630.
- e. The final unloaded sag of the No. 4 7/1 ACSE power wire at 60° F. for a 350-foot span in the heavy loading district. This is approximately 7 feet as shown on Figure 8 of Addendum No. 2 to REA TE & CM-690.
- f. The attachment distance in feet above ground of the power line neutral (lowest) wire. This is shown to be 25.5 feet on RD Figure No. 16 in REA TE & CM-690.

- 4.03 Figure 1 herewith is drawn using the rules and data presented in paragraphs 3.03, 4.01, and 4.02 above. It shows that the desired 14 foot ground clearance cannot be obtained on 35-foot power poles. Sag Chart 4 of REA TE & CM-630 shows that a cable weighing 0.75 lb. per foot is the heaviest that can be used in this situation on 10M strand and still comply with the required rules as it would have the 6-foot final unloaded sag. Table 1 in REA TE & CM-630 shows that 50-pair 19-gauge, 100-pair 22-gauge, and 150-pair 24-gauge plastic cables weigh in the order of 0.75 lbs. per foot.
- 4.04 Sag Chart 7 of REA TE & CM-630 shows that the 6-foot final unloaded sag of a 1.5 lb. per foot cable on a 16M strand would provide the desired 14-foot ground clearance in this situation.
- 4.05 Figure 1 shows that the strand would require temporary location when placed because it would not clear the neutral wire by 30 inches. See paragraph 3.05.
- 4.06 In joint use on 35-foot power line poles without secondaries, the maximum final unloaded sag of a cable cannot exceed eight feet if 14-foot ground clearance is required in any storm loading district for any span length. This is based on the fact that the phase wire is 29.5 feet above ground, the neutral wire is four feet below this, and the strand attachment point must be at least forty inches (3.5 feet for practical purposes) below the neutral wire which makes it 7.5 feet below the phase wire point of attachment. This means the strand cannot be placed higher than 22 feet above ground. The 14-foot ground

clearance leaves 8 feet for cable sag. This fact can be used as a check on the graphic solution of such problems as shown in Figure 1.

5. STEPS IN THE PREPARATION OF FIGURE 2 - POWER LINE WITH SECONDARIES (AND 4 7/1 ACSR WIRES)

5.01 Figure 2 is drawn using the same assumptions as used in making Figure 1 plus the fact that the lowest secondary wire is assumed to be 3 feet below the multigrounded neutral wire, and that an 8-foot ground clearance is permissible instead of 14-foot which it is evident cannot be obtained here. The line of sight rule of par. 3.04 d. applies in this situation, i.e., the line of sight must be tangent to the low point of sag of the lowest secondary wire. The other data used is the same as used in Figure 1.

5.02 The final point of strand attachment to the poles would be 7 feet below the lowest secondary (which is the final unloaded sag of this secondary wire). This would place the strand 15.5 feet above ground, which is 14 feet below the top phase wire. The final unloaded sag of the cable which is 8.5 feet will make the ground clearance 7 feet where 8 feet is desired. A cable having a final unloaded sag of 7 feet would be the heaviest permissible for the span lengths assumed. Sag Chart 4 of REA TE & CM-630 shows that a cable weighing 1.0 lb. per foot which has approximately 7 foot final unloaded sag at 350 feet would be the maximum size permissible on 10M strand in the heavy storm loading district. Table 1 in REA TE & CM-630 shows that 75-pair 19-gauge, 150-pair 22-gauge, and 200-pair 24-gauge plastic cables weigh in the order of 1.0 lb. per foot.

5.03 To obtain 8-foot ground clearance, the 1.5 lb. cable must not exceed 7.5-foot final unloaded sag (90 inches) or less. Use of 16M strand would be necessary. Sag Chart 7 of REA TE & CM-630 shows that with the 16M strand the final unloaded sag of 1.5 lb. cable is approximately 6 feet which would result in 9.5 foot ground clearance.

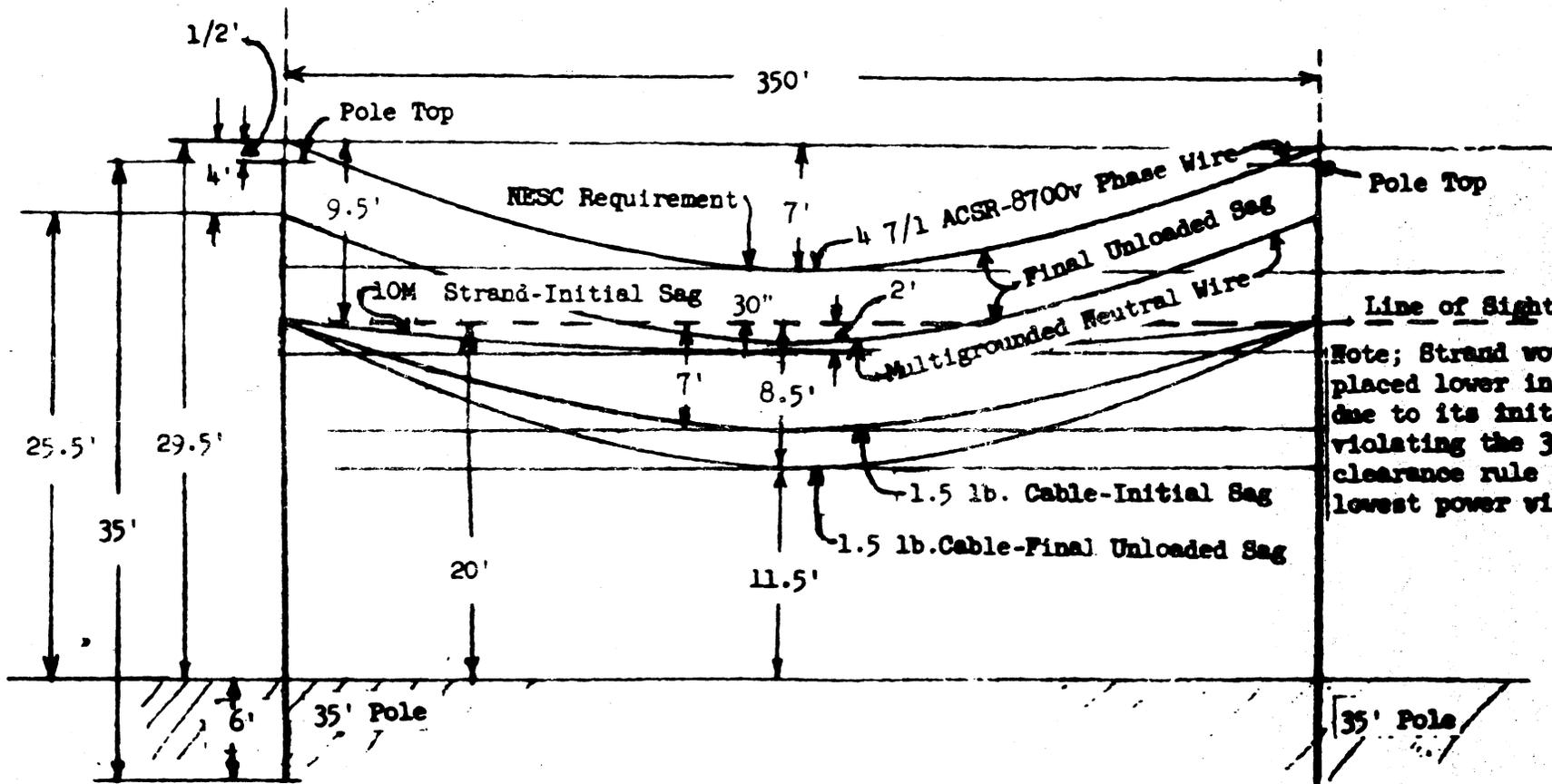
5.04 Figure 2 shows that the strand would require temporary location when placed because it would not clear the lowest secondary wire by 30 inches. See paragraph 3.05.

5.05 In joint use on 35-foot power line poles with secondaries, the sum of the final unloaded sag of any kind of power wires plus the final unloaded sag of the cable cannot exceed 8.5 feet if 14-foot ground clearance is desired in any storm loading district for any span length. The top phase wire is attached 29.5 feet above ground. The lowest secondary is attached 7 feet below it or 22.5 feet above ground. The cable must be attached tangent

to the low point of secondary sag (assuming level ground).
The ground clearance uses 14 feet of this 22.5 feet leaving
8.5 feet as the greatest possible sum of the secondary final
unloaded sag and cable unloaded sag.

6. DATA FOR POWER LINES USING OTHER THAN 4 7/1 WIRE

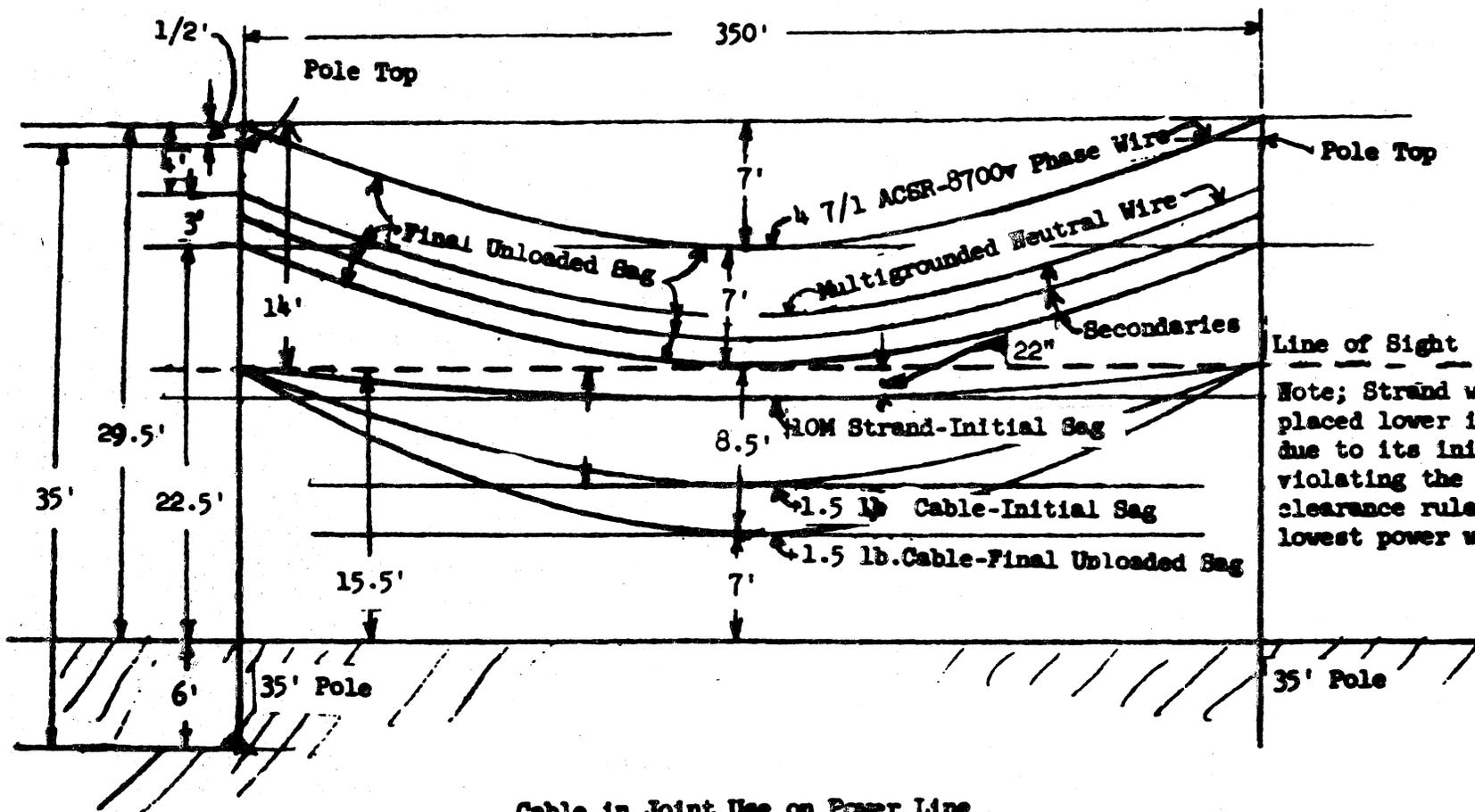
6.01 Final unloaded sag data for No. 6A and No. 8A copperweld and
No. 6 HD copper power line wire are given on Sag curves in
Addendum 2 to REA TE & CM-690.



Note; Strand would be placed lower initially due to its initial sag violating the 30 inch clearance rule (from lowest power wire).

Cable in Joint Use on Power Line with no Secondaries

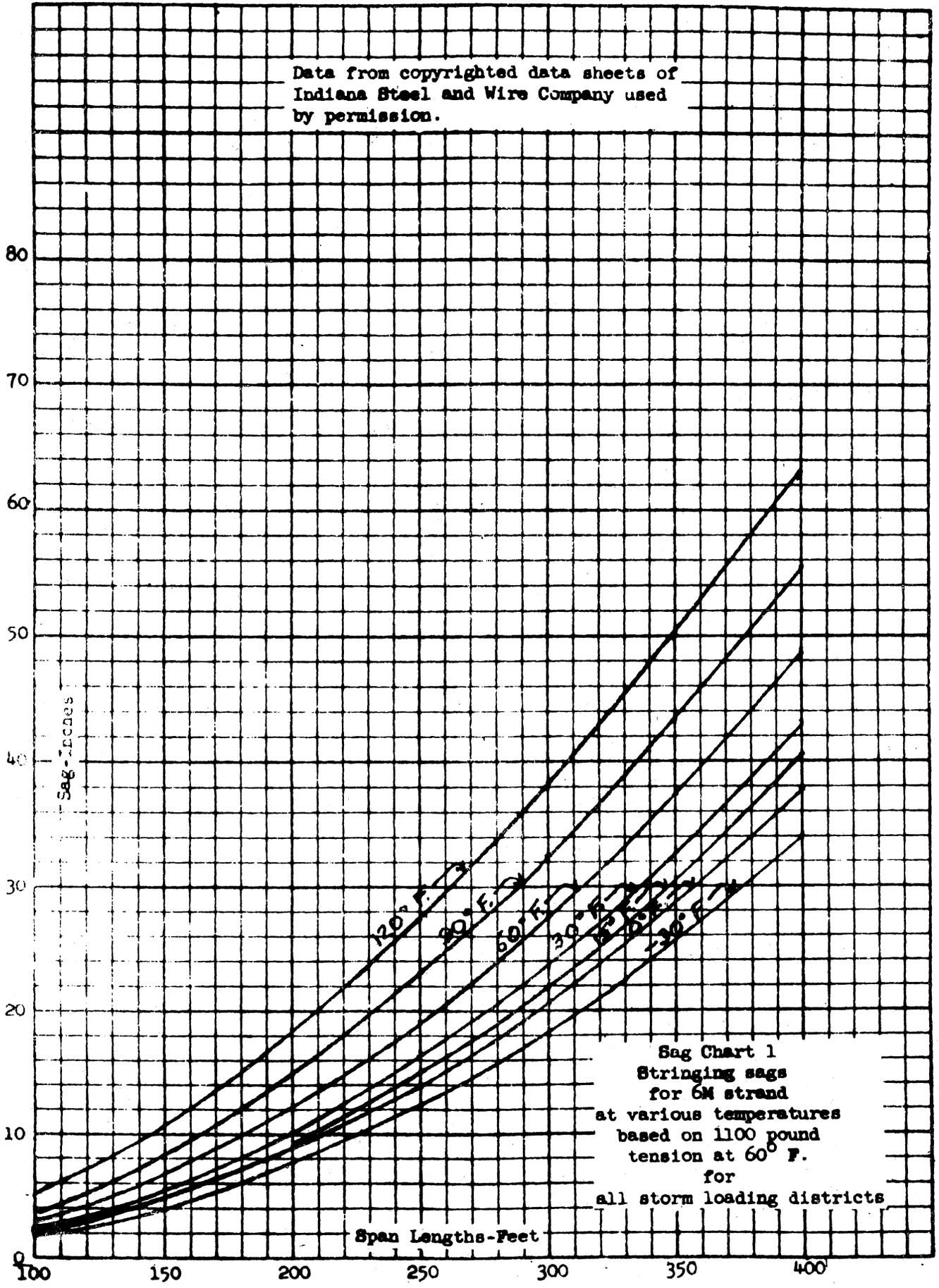
FIGURE 1



Cable in Joint Use on Power Line
with Secondaries

FIGURE 2

Data from copyrighted data sheets of
Indiana Steel and Wire Company used
by permission.

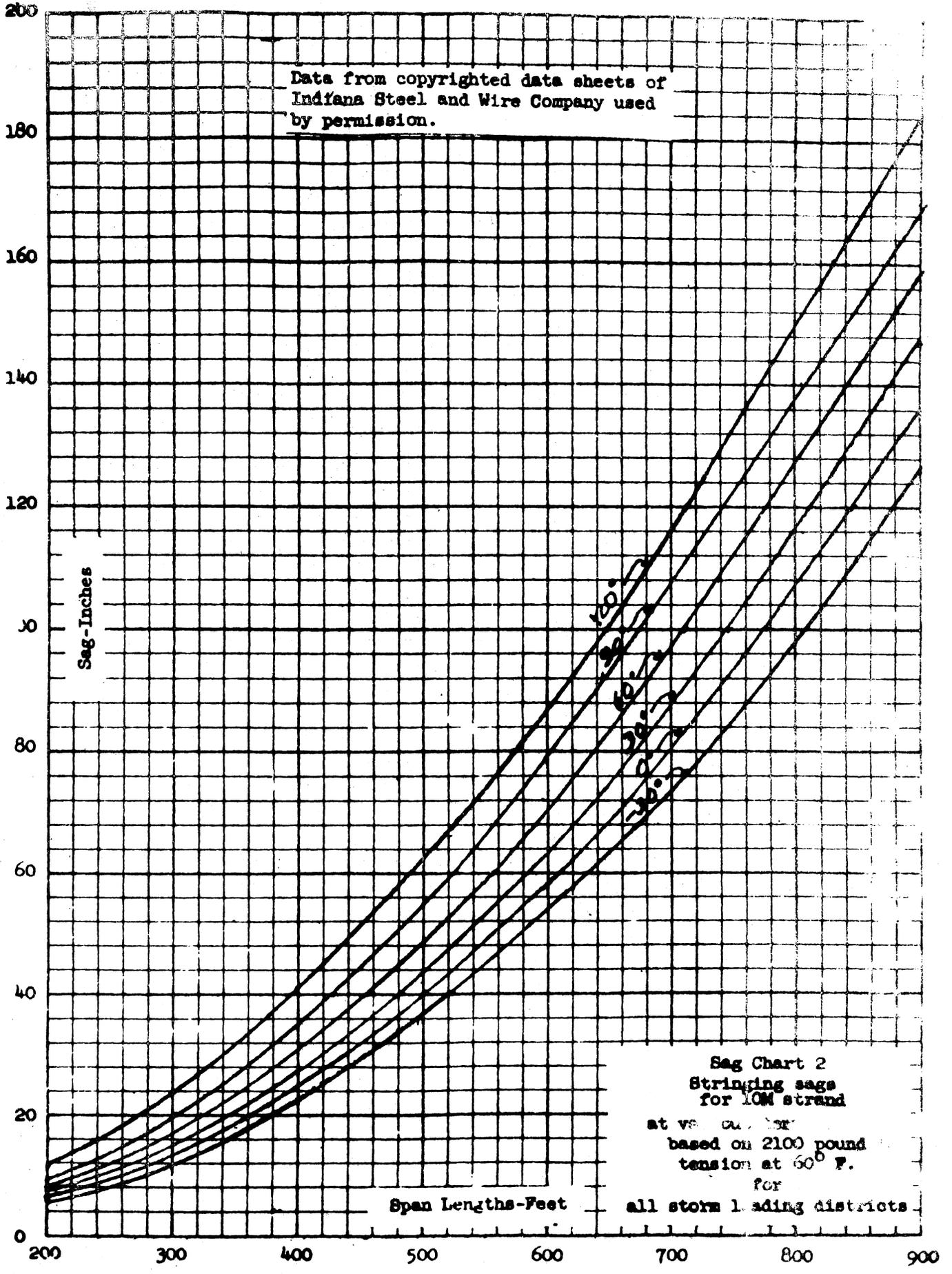


Sag Chart 1
Stringing sags
for 6M strand
at various temperatures
based on 1100 pound
tension at 60° F.
for
all storm loading districts

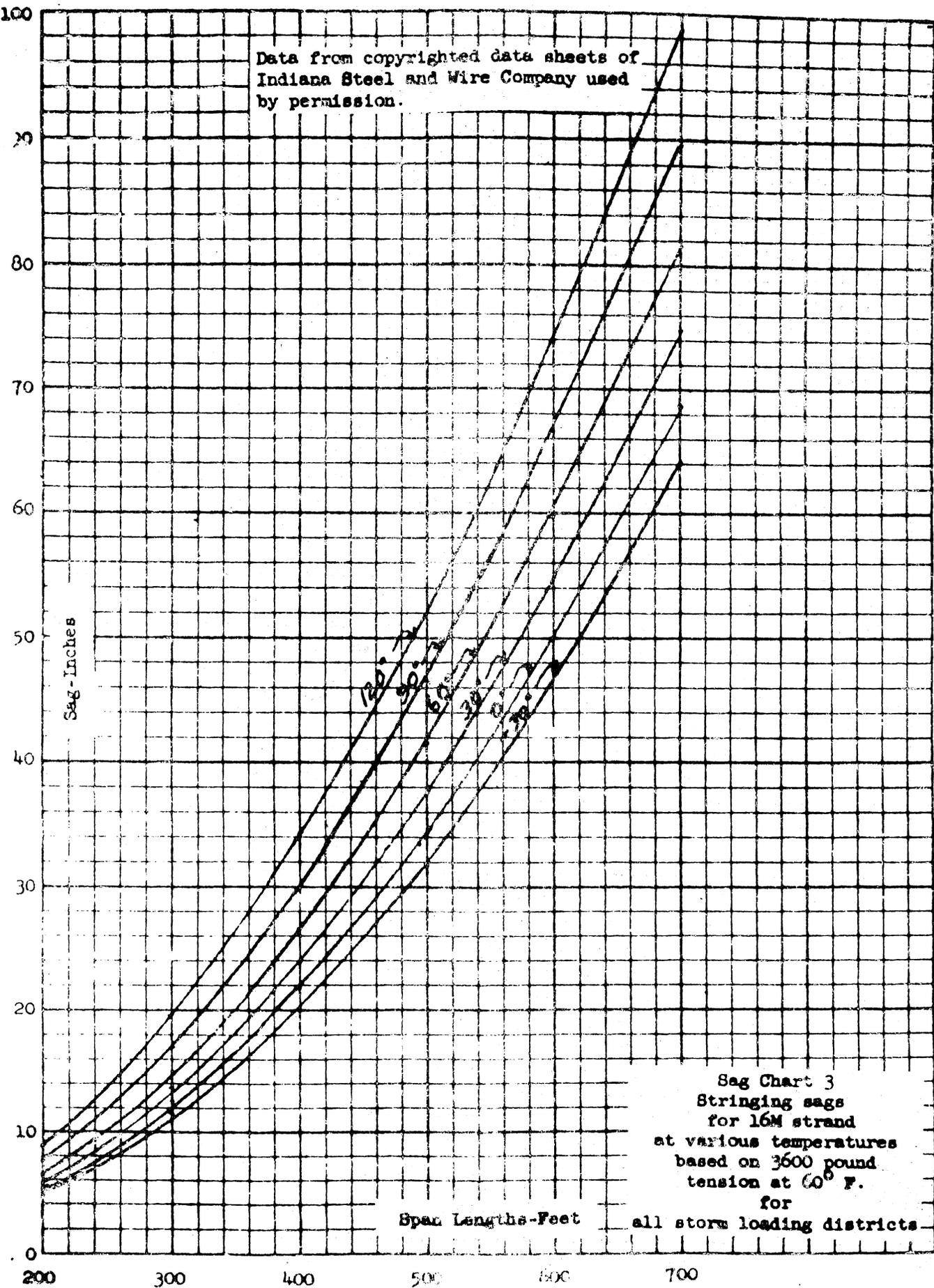
Span Lengths-Feet

Sag-Inches

100 150 200 250 300 350 400



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Sag Chart 3
Stringing sags
for 16M strand
at various temperatures
based on 3600 pound
tension at 60° F.
for
all store loading districts

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140

120

100

80

60

40

20

0

Sag-Inches

Span Length Limits
for Light Loading

Span Length Limits
for Medium Loading

Cable weights shown
are pounds per foot

Span Length Limits
for Heavy Loading

1.5 lb

1.25 lb

Span Lengths-Feet

Sag Chart 4
Initial sags

for
1.5 and 1.25 lb. cable
on 6M strand at 60° F.
for
all storm loading districts

100

150

200

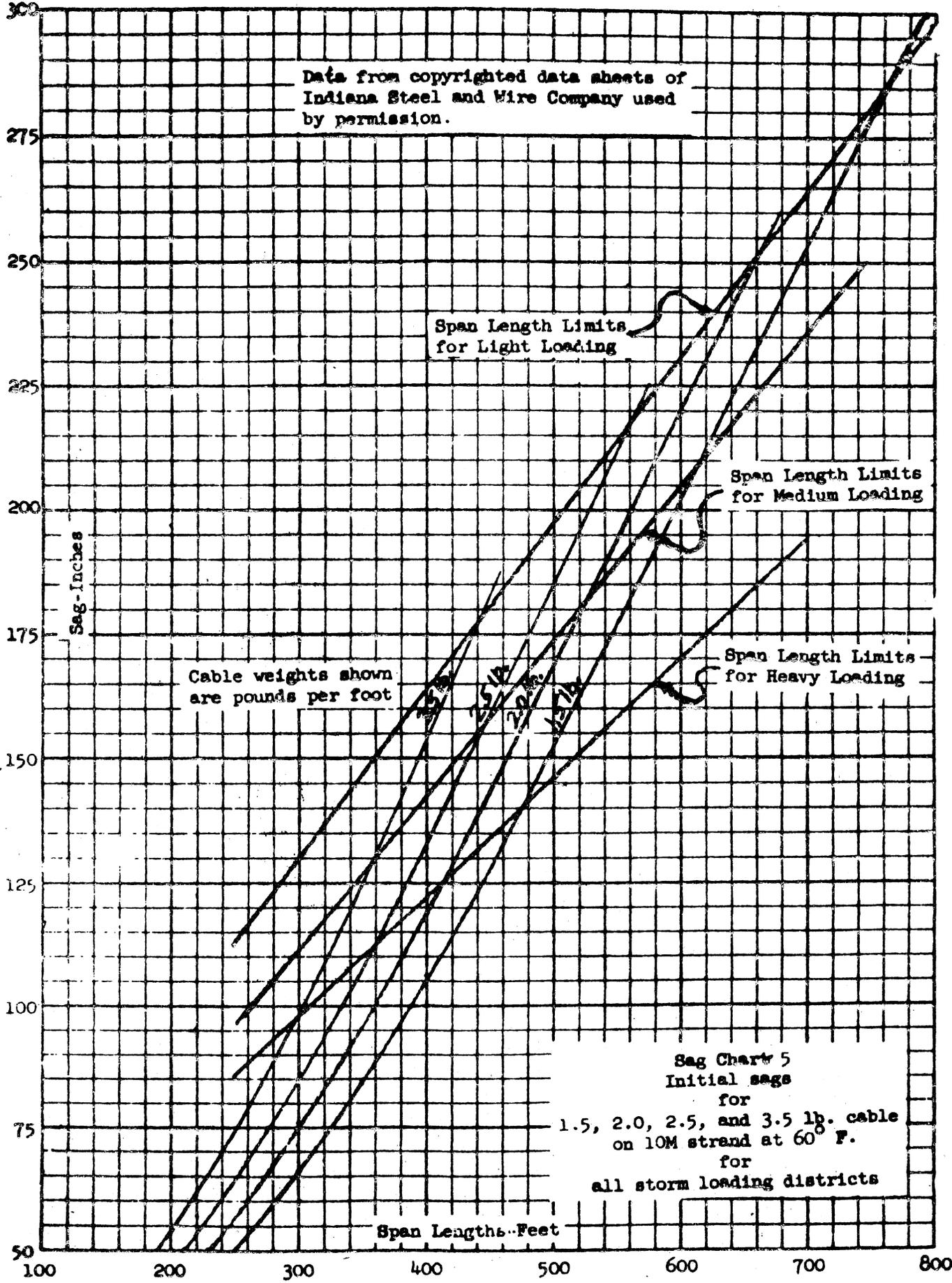
250

300

350

400

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Span Length Limits
for Light Loading

Span Length Limits
for Medium Loading

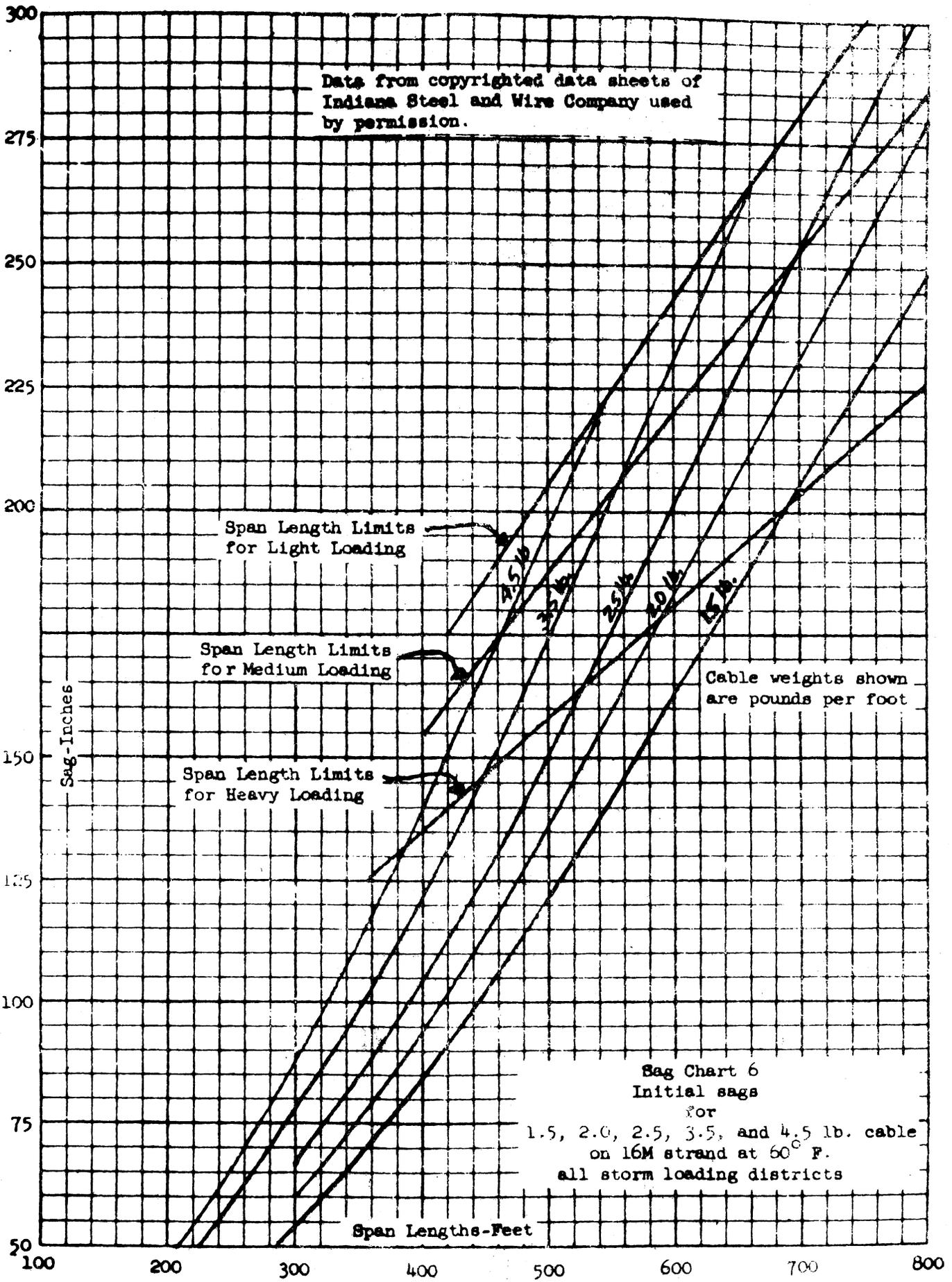
Span Length Limits
for Heavy Loading

Cable weights shown
are pounds per foot

Sag Chart 5
Initial sags
for
1.5, 2.0, 2.5, and 3.5 lb. cable
on 10M strand at 60° F.
for
all storm loading districts

Span Lengths - Feet

Sag - Inches



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Span Length Limits
for Light Loading

Span Length Limits
for Medium Loading

Span Length Limits
for Heavy Loading

Cable weights shown
are pounds per foot

Sag Chart 6
Initial sags

for
1.5, 2.0, 2.5, 3.5, and 4.5 lb. cable
on 16M strand at 60° F.
all storm loading districts

Span Lengths-Feet

Sag-Inches