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UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION
WASHINGTON, D.C. 20250

April 24, 1969

REPLY TO
ATTN. OF:

SUBJECT: Figure 8 Distribution Wire

TO: REA Telephone Borrowers
Consulting Engineers

We are encountering a substantial number of cases in which Figure 8 distribution wire is used on small backbone plant and feeder routes instead of the appropriate cable (shielded) type of facility.

Figure 8 distribution wire is intended for applications where its electrical characteristics should not impose transmission problems for voice or carrier frequency circuits. The absence of a shield causes this facility to be more susceptible than shielded cables to power line noise influence and interference from low frequency radio stations and other external sources of various types. The proper functioning of voice frequency repeaters may also be jeopardized by facilities of this type because of wide variations in mutual capacitance of the pairs with resultant poor structural return losses. In addition, the higher pair-to-pair capacitance unbalance of Figure 8 distribution wire may cause increased crosstalk.

REA specifications provide for shielded cable with as few as six pairs. This overlapping of cable and distribution wire in the six-pair size is deliberate, to allow the availability of a shielded facility for the construction of backbone plant and main feeders requiring only a few pairs while still permitting voice frequency repeater or carrier system operation.

Figure 8 distribution wire should not be installed as a main feeder facility which may contain trunks and/or subscriber loops of the voice frequency repeatered or carrier-derived types. Installing it for backbone plant or on poles occupied jointly with electric power circuits is also inadvisable. Backbone plant is considered to be any facility of six pairs or more which extends more than a mile.

In view of the above considerations, we urge you to make certain that the future use of Figure 8 distribution wire is restricted to the construction of short, lateral distribution leads and that the use of it instead of the appropriate cable (shielded) type of facility be avoided.

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DESIGN AND CONSTRUCTION OF FIGURE 8 DISTRIBUTION WIRE

CONTENTS

1. GENERAL

1.1 This section provides REA borrowers, consulting engineers, contractors and other interested parties with technical information for use in the design and construction of REA borrowers' telephone systems. It discusses in particular the technical considerations regarding the use of Figure 8 distribution wire.

1.2 This section is revised to: (1) Reflect changes in the combinations of sizes and gauges of Figure 8 distribution wire available in accordance with REA Specification PE-28, Multipair Figure 8 Distribution Wire; (2) Introduce an improved support wire clamp to eliminate spiral migration; (3) Emphasize the proper use of Figure 8 distribution wire; (4) Describe installation techniques which experience indicates are desirable; and (5) Correct the charts showing the final unloaded sags to reflect the latest interpretation of the National Electrical Safety Code (NESC).

1.3 This section refers to other REA publications which contain information pertinent to the design and construction of Figure 8 distribution wire plant as follows:

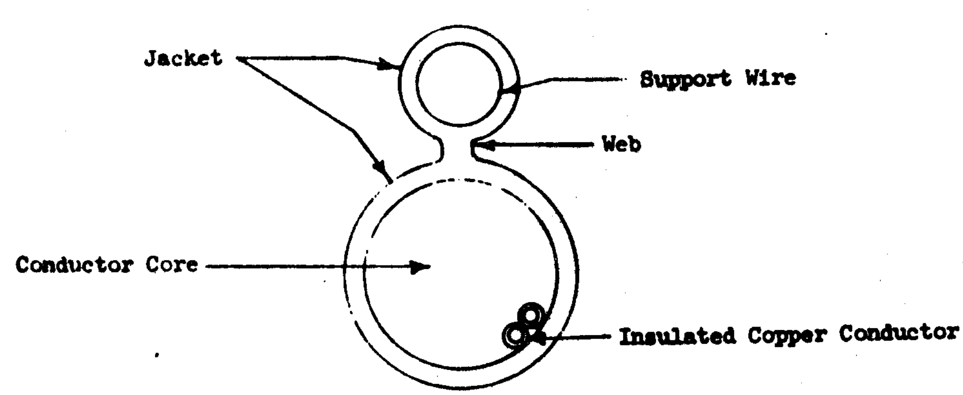
REA TE & CM Sections

- 406 - Attenuation Data
- 424 - Design of Subscriber Loop Plant
- 602 - Clearances
- 617 - Railroad Crossing Specifications
- 821 - Multipair Distribution Wire Protection

REA Specification PE-27 - Figure 8 One-Pair Distribution Wire
REA Specification PE-28 - Figure 8 Multipair Distribution Wire
REA Form 511 - Telephone System Construction Contract (Labor and Materials)
REA Bulletin 344-2 - "List of Materials Acceptable for Use on Telephone Systems of REA Borrowers"

2. DESCRIPTION

2.1 Figure 8 distribution wire consists of a support wire and a conductor core laid parallel and covered with a single extrusion of black, low density polyethylene. The single extrusion provides a jacket over the support wire and core, and forms a web joining the two. A cross-section view of the facility is shown below.



2.2 The support wire may be either .109 or .134 inch Grade 190 steel. These are Class A galvanized, extra high strength steel wires having rated breaking strengths of 1800 pounds and 2680 pounds, respectively.

2.3 REA Specifications PE-27 and PE-28 provide for size and gauge combinations as follows:

No. of Pairs	Gauge	Support Wire
1	19	.109" or .134"
3	22	.109" or .134"
3	19	.109" or .134"
6	24	.109" or .134"
6	22	.109" or .134"
6	19	.109" or .134"

3. APPLICATION

3.1 Figure 8 distribution wire is an aerial facility that can be attached either to poles or crossarms. Relatively long spans are obtainable (see Tables I-X). The wire is most suitable as a distribution facility. It may be considered for short leads, laterals, branches, and as a voice frequency drop from subscriber carrier terminals. It should not be used for backbone plant or to derive main leads.

3.2 Distribution wire has a comparatively low initial cost. Therefore it is often useful for providing indefinite (short duration) service in special situations such as pole line moves, seasonal or temporary subscribers, and installations where the future service demands cannot be forecast.

3.3 The polyethylene jacket has a high degree of resistance to damage from abrasion, thus making the use of distribution wire advantageous where right-of-way clearing cannot be performed as required for open wire construction. However, prolonged exposure to abrasion may eventually damage distribution wire. Proper tree trimming and clearing will avoid abrasion after the distribution wire is installed. At points where clearance cannot be obtained, approved plastic guards should be placed around the distribution wire.

3.4 Distribution wire is preferable to open wire in corrosive atmospheres. The polyethylene jacket protects the support wire and the electrical conductors. It is also a satisfactory facility to install where Spanish moss is a problem.

3.5 The transmission criteria and considerations for Figure 8 distribution wire are discussed in REA TE & CM Sections 406 and 424.

3.51 Distribution wire does not have a metallic shield. This is an important limitation. The absence of this shield results in the wire having a greater susceptibility to power line noise level than for standard multipair cable, especially at carrier frequencies. The mutual capacitance varies widely with changes in weather conditions. Therefore, it should be avoided as a main feeder facility or in any application where there is the possibility of the use of voice frequency repeaters or carrier equipment at a later date. Because of its economy, it should be considered for telephone system applications where the electrical characteristics do not impose transmission problems.

3.52 Noise exposure may not be significant if there is no joint use with electric distribution facilities involved, especially if the telephone construction is separated several hundred feet from any power system lines along the route.

3.53 The sag and tension characteristics and the high dielectric strength make distribution wire a facility/which can be installed for joint use on electric power distribution lines. The twisted pairs make it less susceptible than open wire to noise induction.

4. DESIGN AND CONSTRUCTION CONSIDERATIONS

4.1 Pole Selection and Transverse Load

4.11 When Figure 8 distribution wire is subjected to a transverse load as defined in the Sixth Edition of National Electrical Safety Code, a transverse load is applied to the supporting poles. For purposes of pole selection this transverse load is expressed in terms of "Equivalent No. of .109 inch Steel Line Wires."

4.12 Selection of poles for Figure 8 distribution wire should be based on the criteria given in REA TE & CM Section 611, "Design of Pole Lines." The .109 inch wire equivalents shown below for the three loading districts should be used in conjunction with Section 611 for pole selection purposes:

Figure 8 DW Pair/Support Wire	Equivalent No. of .109 Steel Line Wires Heavy	Medium	Light
1/.109" or .134"	2	2	4
3/.109" or .134"	2	2	6
6/.109" or .134"	2	2	6

4.13 There are charts in Section 611 regarding margins of strength for use in pole class selection. The chart providing a margin of strength of 1.33 should be used where Figure 8 distribution wire is involved.

NOTE: A class 9 pole provides 1.33 margin of strength for all approved sizes of Figure 8 distribution wire.

4.2 Clearances

Basic clearances should be provided in accordance with REA TE & CM Section 602, "Clearances", and REA TE & CM Section 617, "Railroad Crossing Specifications." Every effort should be made to limit crossing spans to 175 feet in the heavy loading district, 250 feet in the medium loading district, and 350 feet in the light loading district. If these limits are exceeded by a road crossing span, increased clearances should be provided in accordance with TE & CM Section 602.

4.3 Vibration

4.31 Figure 8 distribution wire is prone to low frequency wind vibration commonly referred to as "dancing." While "dancing" may not be so violent in shielded or low wind areas as to attract attention, prolonged low amplitude vibration will eventually cause open circuits and/or support wire failures. Therefore, REA recommends that all Figure 8 distribution wire be spiralled approximately one spiral for each 15 feet of span.

4.32 Spiralling of distribution wire should be done from every other pole by applying the spiralling torque to the support clamp after the two outside bolts have been properly tightened, thus keeping the spiralling torque on the support wire and not on the core. As spiralling operations proceed along a lead, spiralling at alternate poles should be in opposite directions, thereby removing and/or greatly reducing the torsion otherwise imposed on those clamps which are at the intermediate poles. The procedure to be followed in spiralling distribution wire is shown in the attached Figure 7.

4.33 If clamps are not adequately tightened the torsion developed in spiralling will cause the support wire to turn in the clamp resulting in the migration of the spirals from the spans toward the pole. Dancing of the facility and damage to it at the poles will be the final results of inadequate clamping. It is, therefore, important that only clamps included on the "List of Acceptable Materials" (REA Bulletin 344-2) be used and that they be installed in accordance with REA Form 511.

4.4 Guying and Corners

4.41 Some general notes on guying and corners of Figure 8 distribution wire follow:

THE NOTES APPLY TO ALL THREE LOADING DISTRICTS

a. A lead to height ratio of at least 1/1 should be used where possible.

b. Where a lead to height ratio of 1/1 is used with the .109" support wire, the 2.2M guy is adequate for all angles and deadends.

c. Where a lead to height ratio of 1/1 is used with the .134" support wire, the 2.2M guy is adequate for all angles up to 35°. (The 6M guy is necessary for deadends and all angles over 35°, on .134" support wire facilities.)

d. Where a lead to height ratio of 1/2 is used with the .109" support wire, the 2.2M guy is adequate for angles up to 35°. (The 6M guy is necessary for deadends and angles over 35°.)

e. Where a lead to height ratio of 1/2 is used with the .134" support wire, the 2.2M guy is adequate for angles up to 25°. (The 6M guy is necessary for deadends and angles over 25°.)

4.42 An existing guy and anchor may have adequate strength to support the additional load of Figure 8 distribution wire. The strength available in the existing guy may be evaluated by determining the type and size of strand and anchor, and then deducting the load resulting from the existing facilities. Any loss of strength in the guy or anchor caused by corrosion should also be considered.

4.43 Additional information on guying distribution wire can be found in REA TE & CM Section 650, "Guys and Anchors on Wire and Cable Lines."

4.44 The proper type support clamps should be used on all corners up to 20°. These clamps are classified in two categories: 0° to 10° and 10° to 20°. At corners between 20° and 60° the support wire should be double dead-ended in accordance with Guide Drawings. When the angle of the corner is 60° or greater, the distribution wire should be dead-ended from each direction on separate thimbleye nuts. These deadending techniques are illustrated in the attached Figures 8 and 9, and REA Form 511.

4.5 Placing

4.51 Figure 8 distribution wire should be placed along the ground from a moving reel and then lifted into place. Where obstructions make it necessary to pull the distribution wire from a stationary reel stand, suitable stringing blocks must be used at each pole or obstruction.

4.52 The length of a pulling section for Figure 8 distribution wire will depend on span lengths, terrain, corners, and other field conditions; however, even on straight sections usually not more than six spans should be pulled at one time. Where corners are encountered, the pulling section should be reduced accordingly.

4.53 Temporary guys and false deadends should be used when necessary to prevent subjecting the support clamps to longitudinal tensions during construction or modifications. Tangent or corner clamps must never be relied upon to support the longitudinal forces in the support messenger.

4.54 When pulling the distribution wire up to correct sag, a suitable wire grip should be used directly on the insulated support wire. The grip should be of such design as to give proper holding power and yet not damage the support wire jacket. The Crescent Tool Company #800 or an equivalent grip is acceptable. A standard line wire grip should not be used because it will damage the insulation.

4.55 If the insulation is damaged in any way, it must be repaired. Repairs should be made by applying an approved sealing compound (item "ze", REA Bulletin 344-2) or by cutting out the damaged portion and splicing the wire in accordance with the construction drawings in REA Form 511. Whether to seal or splice depends on the degree of damage. When in doubt, the splice repair should be used.

4.56 At deadends it is necessary to remove the support wire covering before applying the deadend grips. This must be done carefully to avoid damaging the support wire or core. Care should be exercised to avoid damaging the zinc coating on the support wire.

4.57 In some cases it will be necessary to cut out short lengths of support wire at corners, deadends, terminals, etc. Where this is done particular care must be used to prevent placing the core under tension.

4.58 Prior to installation, every reel of Figure 8 distribution wire should be checked to determine that the jacket does not rotate freely around the support wire. This may be done by firmly grasping the facility at the reel-end with the hands placed approximately six inches apart and rotating them in opposite directions. If there is any rotation of the jacket around the support wire when <u>reasonable torque</u> is applied, the facility should not be installed.

4.6 Terminating and Splicing (Refer to REA Form 511 and Specification PC-2).

4.61 Exposed color coded distribution wire conductors, terminals, load coils, and splices must be enclosed in approved enclosures. The enclosures are to be mounted in accordance with REA Form 511 Construction Drawings.

5. PROTECTION

5.1 Protection considerations for Figure 8 distribution wire are discussed in REA TE & CM Section 821, "Multipair Distribution Wire Protection."

5.2 The electrical continuity of the support wire must be maintained throughout the lead.

6. PRECAUTIONS

6.1 Figure 8 distribution wire must be handled with care. It should not be trampled upon, run over by vehicles, or pulled along the ground, over fences, metal support fittings, crossarms or other items which may abraid it.

6.2 Sunlight causes rapid deterioration of the colored polyethylene on conductors; therefore, the conductor insulation should not be left exposed to sunlight.

The use of test picks or other testing methods that pick pinholes in the conductor insulation should be avoided.

6.3 Ladders should not be placed against Figure 8 distribution wire nor should an attempt be made to use cable cars on this small support wire. When maintenance work in the span is required, the distribution wire may be repaired by use of a bucket or it should be lowered so it can be worked on from the ground. This facility is not to be relied upon to support personnel in any manner.

6.4 Span clamps should not be placed on distribution wire.

6.5 In corrosive atmospheres special precautions should be employed at deadends, terminals, bonding joints and other points where the jacket is removed from the support wire. Special attention should be given to restoring the insulation removed from the support wire. Resealing the bare metal from the elements is necessary. This may be done by proper application of one of the sealing compounds on the "List of Acceptable Materials" (REA Bulletin 344-2). REA Form 511 shows methods of application.

7. SAGS AND TENSIONS

7.1 In most instances adequate spans and clearances can be achieved with the .109 inch diameter support wire. There are, however, instances such as joint use of power poles which will require the span and sag characteristics of the .134 inch diameter support wire.

7.2 Figure 8 distribution wire designed on the basis of final unloaded sag data and installed on the basis of the proper initial sag data will not normally require resagging after storm loading.

7.3 Ten tables of initial stringing sags and tensions, and six figures showing final unloaded sag data for the three storm loading districts are attached. The data in the tables and figures apply only to distribution wire manufactured in accordance with PE-27 and PE-28.

7.31 The tables of initial sags and tensions appear as follows:

For use with .109 support wire:

Table I	1 Pr. - 19 Ga.
Table II	3 Pr. - 22 Ga.
Table III	3 Pr. - 19 Ga. and 6 Pr. - 22 Ga.
Table IV	6 Pr. - 24 Ga.
Table V	6 Pr. - 19 Ga.

For use with .134 support wire:

Table VI	1 Pr. - 19 Ga.
Table VII	3 Pr. - 22 Ga.
Table VIII	3 Pr. - 19 Ga. and 6 Pr. - 22 Ga.
Table IX	6 Pr. - 24 Ga.
Table X	6 Pr. - 19 Ga.

7.32 Curves giving final unloaded sags are included in the following figures:

Figure	Loading District	Support Wire Size	NESC Assumed Loading* Horizontal Wind Pressure (lbs/sq. ft.)	Radial Thickness of Ice (Inch)
1	Heavy	.109"	8	0.50
2	Heavy	.134"	8	0.50
3	Medium	.109"	8	0.25
4	Medium	.134"	8	0.25
5	Light	.109"	12	0
6	Light	.134"	12	0

*The Fourth Edition of the National Electrical Safety Code made relatively severe assumptions concerning transverse loading with the result that the pole strengths necessary were considerably out of line with designs using the same materials in other fields of engineering. Studies made since its issuance indicated that the wind pressures assumed for transverse loading seldom occur concurrently with the assumed ice conditions and then only in restricted areas. The Fifth and Sixth Editions of the Code reduced this assumed transverse wind loading. Therefore, constants were added to the resultant loading calculated in accordance with these editions to make the loading in the Fourth, Fifth and Sixth Editions effectively equivalent for round conductors.

Figure 8 distribution wire does not develop the same amount of loading as would be developed by a round conductor. The Sixth Edition of the NESC requires that a "double constant" be added to the calculated resultant load. This addition represents a substantial over-design for Figure 8 distribution wire. For sag and tension purposes, the NESC Committee on Interpretations has permitted Figure 8 facilities to have loads calculated in accordance with the Fourth Edition.

Transverse loads for pole strength are calculated according to the assumptions in the Sixth Edition.

7.4 The initial stringing tension for Figure 8 distribution wire depends upon the size of the supporting wire, the size of the core, the storm loading district, the maximum span length and the temperature at the time of tensioning. Tables I thru V show stringing sags and tensions for distribution wires supported by a .109 inch solid galvanized steel wire. Tables VI thru X should be referred to if the support wire diameter is .134 inch.

7.5 Each table contains a different tension for each 100-foot interval of span length. The tension to be used is shown below the sag at a given temperature for the maximum span in the pulling section. For example, assume that a 6 pair, 19 gauge distribution wire having a .134 inch EHS solid galvanized steel wire is to be used in the medium loading district.

Table X should be used to determine the initial sag and tension. In addition, assume that the temperature during the tensioning operation is 75° F., and that the span lengths in the pulling section range from 350 feet to 450 feet. From Table X, the stringing tension to be applied for this pulling section is 464 pounds.

7.6 The following example is offered to illustrate the use of Figures 1 thru 6. Assume a 3 pair, 19 gauge Figure 8 distribution wire having a .134 inch EHS support wire is to be used in the Heavy Loading District. A 14-foot final unloaded ground clearance is required and the terrain is level. What is the maximum span length allowable if 25-foot poles are used? From Figure 4, the maximum span allowable is 370 feet.

SAG TABLE I

Initial Stringing Sag and Tension Data
For
1/19/.109 Figure 8 Distribution Wire

Temperature °F.

Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	2	3	3	4	5	6
125	4	4	5	6	7	9
150	5	6	7	8	10	12
175	7	8	9	11	13	16
200	9	11	12	14	17	20
	(360)	(319)	(278)	(239)	(201)	(167)
225	12	13	15	18	21	25
250	15	16	19	22	25	30
275	18	20	23	26	30	35
300	21	24	27	31	35	40
	(356)	(319)	(282)	(248)	(217)	(189)
325	25	28	32	36	40	46
350	29	32	36	41	46	52
375	34	37	42	46	52	58
400	38	42	47	52	58	65
	(351)	(319)	(287)	(258)	(231)	(207)
425*	43	48	53	59	65	72
450	49	54	59	66	73	79
475	54	60	66	73	80	87
500	60	66	73	80	88	95
	(349)	(319)	(291)	(265)	(241)	(223)
525	67	73	80	87	95	103
550	73	80	87	95	103	111
575	81	87	95	103	112	120
600**	88	95	103	112	121	129
	(345)	(319)	(294)	(272)	(252)	(236)

*Max. Span Heavy Loading District (Will develop 75% tension)
**Will develop 65% tension in Medium Loading District and 46% tension in Light Loading District.

SAG TABLE II

Initial Stringing Sag and Tension Data
For
3/22/.109 Figure 8 Distribution Wire

	Temperature °F.					
Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	3	3	4	4	5	7
125	4	5	6	7	8	10
150	6	7	8	10	11	14
175	8	10	12	13	15	18
200	11	12	14	16	19	22
	(367)	(327)	(287)	(249)	(214)	(181)
225	14	16	18	20	23	27
250	17	19	22	24	28	32
275	21	23	26	29	33	38
300	25	27	31	34	39	44
	(362)	(327)	(293)	(261)	(231)	(204)
325	29	32	36	40	45	50
350	34	37	41	46	51	57
375*	39	43	47	52	58	64
400	44	49	53	59	65	71
	(358)	(327)	(298)	(271)	(246)	(224)
425	50	55	60	66	72	79
450	57	62	67	73	80	87
475	63	69	74	81	88	95
500	70	76	82	89	96	104
	(353)	(327)	(30[illegible])	(280)	(259)	(240)
525	78	84	[illegible]	97	105	113
550	86	92	[illegible]	106	114	122
575	94	100	10[illegible]	115	123	132
600**	102	109	117	125	133	142
	(349)	(327)	(306)	(287)	(269)	(253)

*Max. Span Heavy Loading District (Will develop 75% Tension)
**Will develop 68% Tension in Medium Loading District and 51% Tension in Light Loading District.

SAG TABLE III

Initial Stringing Sag and Tension Data
For
3/19/.109 and 6/22/.109 Figure 8 Distribution Wire

	Temperature °F.					
Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	3	4	4	5	6	7
125	5	6	7	8	9	11
150	7	8	10	11	13	15
175	10	12	13	15	17	20
200	14	15	17	19	22	25
	(373)	(337)	(299)	(263)	(230)	(199)
225	17	19	21	24	27	31
250	21	23	26	29	33	37
275	26	28	31	35	39	43
300	31	34	37	41	45	50
	(369)	(337)	(305)	(276)	(249)	(225)
325	36	39	43	47	52	57
350	42	46	50	54	59	65
375*	48	52	57	62	67	73
400	55	60	64	70	75	81
	(363)	(337)	(311)	(287)	(266)	(246)
425	62	67	73	78	85	90
450	70	75	81	87	94	100
475	78	84	90	96	103	109
500	87	93	99	106	113	119
	(360)	(337)	(315)	(295)	(277)	(262)
525	96	102	109	116	123	130
550	106	112	119	126	134	141
575	116	123	130	137	145	152
600*	127	134	141	149	157	164
	(355)	(337)	(319)	(302)	(287)	(275)

*Max. Span Heavy Loading District (Will develop 75% Tension)
**Will develop 70% tension in Medium Loading District and 55% tension in Light Loading District.

SAG TABLE IV

Initial Stringing Sag and Tension Data For 6/24/.109 Figure 8 Distribution Wire

Temperature °F.

Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	3	4	4	5	5	7
[illegible]	5	6	6	7	9	11
[illegible]	7	8	9	10	12	15
[illegible]	9	11	12	14	16	19
	12	14	15	18	20	24
	(368)	(331)	(292)	(256)	(221)	(189)
	16	17	19	22	25	29
[illegible]	19	21	24	27	30	35
[illegible]	23	26	29	32	36	41
300	28	30	34	37	42	47
	(365)	(331)	(298)	(267)	(239)	(214)
325	33	36	39	44	49	54
350	[illegible]	41	46	50	55	61
375*	[illegible]	47	52	57	62	68
400	[illegible]	54	59	64	70	76
	(360)	(331)	(304)	(278)	(255)	(234)
425	56	61	66	72	78	84
450	[illegible]	68	74	80	86	93
475	71	76	82	88	95	102
500	79	84	91	97	104	111
	(354)	(331)	(308)	(287)	(268)	(250)
525	87	93	99	106	114	121
550	95	102	109	116	123	131
575	105	111	118	126	134	142
600**	114	121	129	136	144	153
	[illegible]	(331)	(312)	(295)	(278)	(263)

*Max. Span Heavy Loading District (Will develop 75% Tension)
** develop 69% Tension in Medium Loading District and 52% Tension in Light Loading District.

SAG TABLE V

**Initial Stringing Sag and Tension Data
For
6/19/.109 Figure 8 Distribution Wire**

Temperature °F.

Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	5	5	6	7	8	10
125	8	8	9	11	12	14
150	11	12	13	15	17	20
175	15	16	18	20	23	25
200	19	21	23	26	29	32
	(379)	(346)	(313)	(282)	(254)	(228)
225	24	27	29	32	35	39
250	30	33	36	39	43	46
275	37	40	43	47	51	51
300	44	47	51	55	59	60
	(371)	(346)	(321)	(298)	(277)	(257)
325	52	55	59	63	68	73
350*	60	64	68	73	78	83
375	69	74	78	83	88	93
400	79	84	89	94	99	104
	(366)	(346)	(327)	(309)	(292)	(278)
425	90	95	100	105	111	116
450	101	106	111	117	123	128
475	113	118	124	130	136	141
500	125	131	137	143	149	155
	(361)	(346)	(331)	(317)	(304)	(293)
525	139	144	150	157	163	169
550	153	159	165	171	178	183
575	167	173	180	186	193	199
600**	183	189	195	202	209	215
	(358)	(346)	(334)	(323)	(313)	(304)

*Max. Span Heavy Loading District (Will develop 75% Tension)
**Will develop 71% tension in Medium Loading District and 57% tension in Light Loading District.

SAG TABLE VI

Initial Stringing Sag and Tension Data
For
1/19/.134 Figure 8 Distribution Wire

	Temperature °F.					
Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	Sag in Inches and (Tension in Pounds)					
100	2	2	3	3	4	5
125	3	4	4	5	6	8
150	5	5	6	7	9	11
175	6	7	8	10	12	15
200	8	9	11	13	15	18
	(542)	(482)	(416)	(358)	(298)	(243)
225	10	12	13	16	19	22
250	13	14	17	19	22	27
275	16	17	20	23	27	31
300	19	21	24	27	31	36
	(538)	(482)	(424)	(370)	(318)	(272)
325	22	24	28	31	36	42
350	25	28	32	36	41	47
375	29	32	36	41	47	53
400	33	37	41	46	52	59
	(535)	(482)	(430)	(382)	(338)	(299)
425	37	41	46	52	58	65
450	42	46	51	57	64	72
475	47	52	57	63	71	79
500	52	57	63	70	77	83
	(529)	(482)	(436)	(394)	(356)	(321)
525	57	63	70	76	84	93
550	63	69	76	83	92	100
575	69	75	83	90	99	108
600*	75	82	90	98	107	116
	(524)	(482)	(442)	(405)	(371)	(341)

*Will develop 74% Tension in Heavy Loading District; 53% Tension in Medium Loading District and 38% Tension in Light Loading District.

SAG TABLE VII

Initial Stringing Sag and Tension Date
For
3/22/.134 Figure 8 Distribution Wire

Temperature °F.

Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	2	3	3	4	5	6
125	4	4	5	6	7	9
150	5	6	7	8	10	12
175	7	8	9	12	13	15
200	9	10	12	14	16	19
	(558)	(495)	(439)	(372)	(313)	(261)
225	12	13	15	17	20	24
250	14	16	18	21	24	28
275	17	19	22	25	29	33
300	21	23	26	29	34	39
	(553)	(495)	(438)	(386)	(336)	(292)
325	24	27	30	34	39	44
350	28	31	35	39	44	50
375	32	36	40	44	50	56
400	37	41	45	50	56	63
	(545)	(495)	(445)	(400)	(357)	(319)
425	42	46	51	56	62	69
450	47	51	57	62	69	76
475	52	57	63	69	76	84
500	58	63	69	76	83	91
	(540)	(495)	(452)	(412)	(375)	(342)
525	64	70	76	83	91	99
550	70	76	83	91	99	107
575*	77	84	91	98	107	116
600**	84	91	98	106	115	124
	(534)	(495)	(457)	(423)	(391)	(362)

*Max. Span Heavy Loading District (Will develop 75%).
**Will develop 56% Tension in Medium Loading District and 43% Tension in Light Loading District.

SAG TABLE VIII

Initial Stringing Sag and Tension Data For 3/19/.134 and 6/22/.134 Figure 8 Distribution Wire

Temperature °F.						
Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	Sag in Inches and (Tension in Pounds)					
100	3	3	4	4	5	6
125	4	5	6	6	8	9
150	6	7	8	9	11	13
175	8	9	11	12	14	17
200	11	12	14	16	18	21
	(569)	(509)	(447)	(390)	(334)	(283)
225	14	15	17	20	23	26
250	17	19	21	24	27	31
275	20	23	25	28	32	37
300	24	27	30	34	38	43
	(562)	(509)	(455)	(406)	(360)	(318)
325	28	31	35	39	44	49
350	33	36	40	45	50	55
375	38	42	46	51	56	62
400	43	47	52	57	63	70
	(556)	(509)	(463)	(421)	(382)	(347)
425	49	54	59	64	70	77
450	55	60	65	71	78	85
475	62	67	73	79	86	93
500	69	74	80	87	94	101
	(549)	(509)	(470)	(434)	(401)	(371)
525	76	82	88	95	102	110
550*	83	90	96	103	111	119
575	91	98	105	112	120	129
600**	100	107	114	125	130	139
	(543)	(509)	(476)	(445)	(417)	(391)

*Max. Span Heavy Loading District (Will develop 75% Tension)
**Will develop 58% Tension in Medium Loading District and 46% Tension in Light Loading District.

SAG TABLE IX

Initial Stringing Sag and Tension Data For 6/24/.134 Figure 8 Distribution Wire

	Temperature °F.					
Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	Sag in Inches and (Tension in Pounds)					
100	3	3	3	4	5	6
125	4	5	5	6	7	9
150	6	6	7	9	10	12
175	8	9	10	12	13	16
200	10	11	14	15	17	20
	(560)	(500)	(412)	(380)	(323)	(271)
225	13	14	16	18	21	25
250	16	17	20	22	26	30
275	19	21	24	27	31	35
300	22	25	28	31	36	42
	(554)	(500)	(446)	(394)	(346)	(304)
325	26	29	33	36	41	47
350	31	34	38	42	47	53
375	35	39	43	48	53	59
400	40	44	49	54	60	66
	(548)	(500)	(453)	(409)	(368)	(332)
425	45	50	55	60	66	73
450	51	56	61	67	73	81
475	57	62	68	74	81	88
500	63	69	75	81	89	96
	(543)	(500)	(459)	(422)	(387)	(356)
525	70	76	82	89	97	105
550*	77	83	90	97	105	113
575	84	91	98	105	114	122
600**	92	99	106	114	123	131
	(537)	(500)	(465)	(433)	(403)	(376)

*Max. Span Heavy Loading District (Will develop 75% Tension)
**Will develop 75% Tension in Medium Loading District and 57% Tension in Light Loading District.

SAG TABLE X

Initial Stringing Sag and Tension Data
For
6/19/.134 Figure 8 Distribution Wire

Temperature °F.

Heavy Loading	-30	0	30	60	90	120
Medium Loading	-15	15	45	75	105	135
Light Loading	0	30	60	90	120	150
Span Length - Feet	**Sag in Inches and (Tension in Pounds)**					
100	4	4	5	5	6	8
125	6	6	7	8	10	12
150	8	9	10	12	14	16
175	11	12	14	16	18	21
200	15	16	18	20	23	26
	(578)	(522)	(467)	(414)	(363)	(319)
225	18	20	22	25	28	32
250	23	25	28	31	34	38
275	27	30	33	37	40	45
300	33	36	39	43	47	52
	(569)	(522)	(476)	(434)	(394)	(358)
325	39	42	46	50	55	60
350	45	49	53	57	62	68
375	52	56	60	65	70	76
400	59	63	68	73	79	85
	(560)	(522)	(485)	(451)	(419)	(390)
425	67	71	77	82	88	94
450	75	80	86	91	97	104
475	84	89	95	101	107	114
500	93	99	105	111	118	125
	(553)	(522)	(492)	(464)	(438)	(414)
525*	103	109	115	122	129	136
550	114	120	126	133	140	147
575	124	131	138	144	152	159
600**	136	142	149	156	164	172
	(547)	(522)	(498)	(475)	(454)	(434)

*Max. Span Heavy Loading District (Will develop 75% Tension)
**Will develop 60% Tension in Medium Loading District and 48% Tension in Light Loading District.

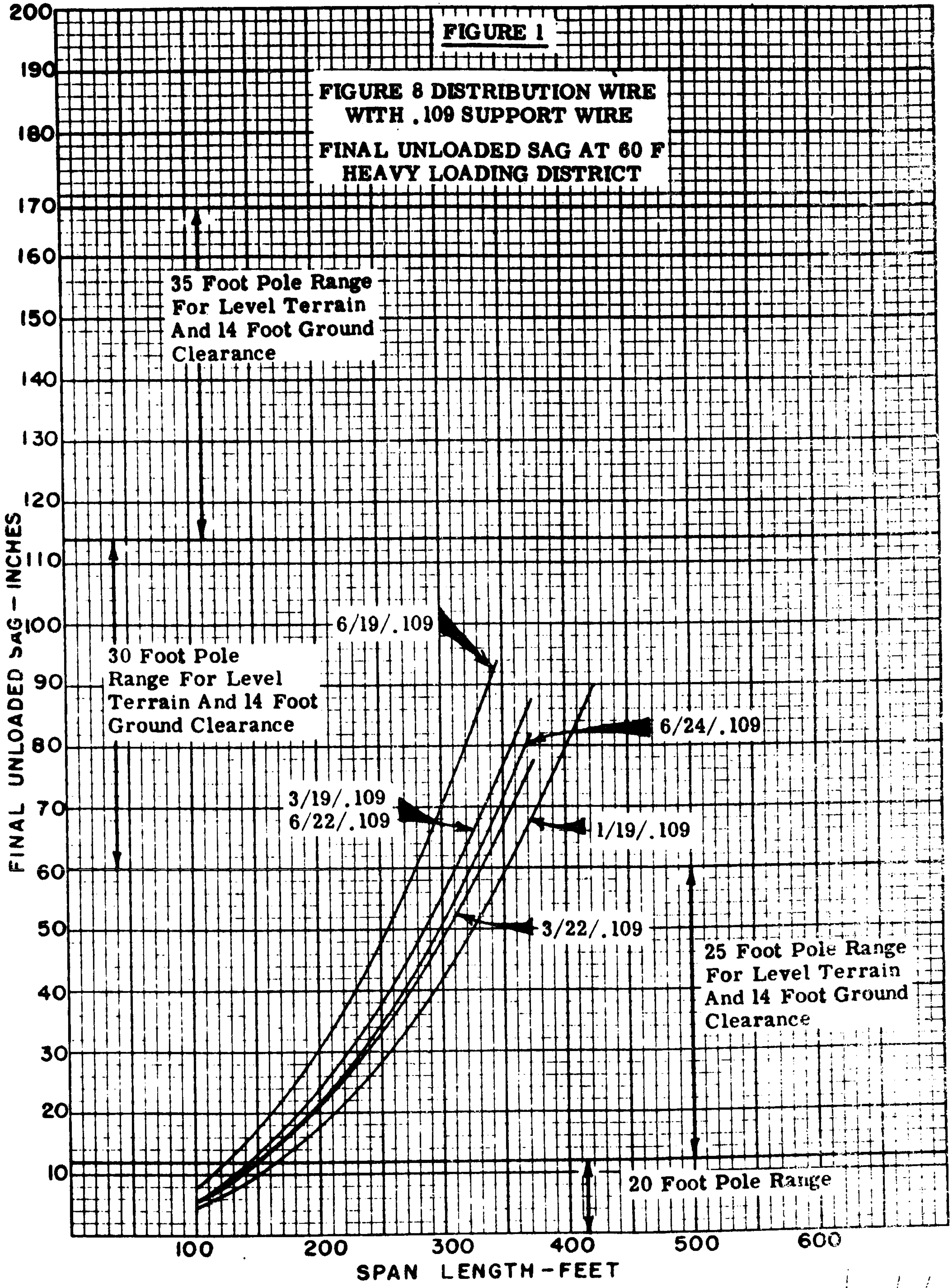


FIGURE 1
FIGURE 8 DISTRIBUTION WIRE
WITH .109 SUPPORT WIRE
FINAL UNLOADED SAG AT 60 F
HEAVY LOADING DISTRICT
35 Foot Pole Range
For Level Terrain
And 14 Foot Ground
Clearance
30 Foot Pole
Range For Level
Terrain And 14 Foot
Ground Clearance
6/19/.109
6/24/.109
3/19/.109
6/22/.109
1/19/.109
3/22/.109
25 Foot Pole Range
For Level Terrain
And 14 Foot Ground
Clearance
20 Foot Pole Range
FINAL UNLOADED SAG - INCHES
SPAN LENGTH-FEET
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
100
200
300
400
500
600

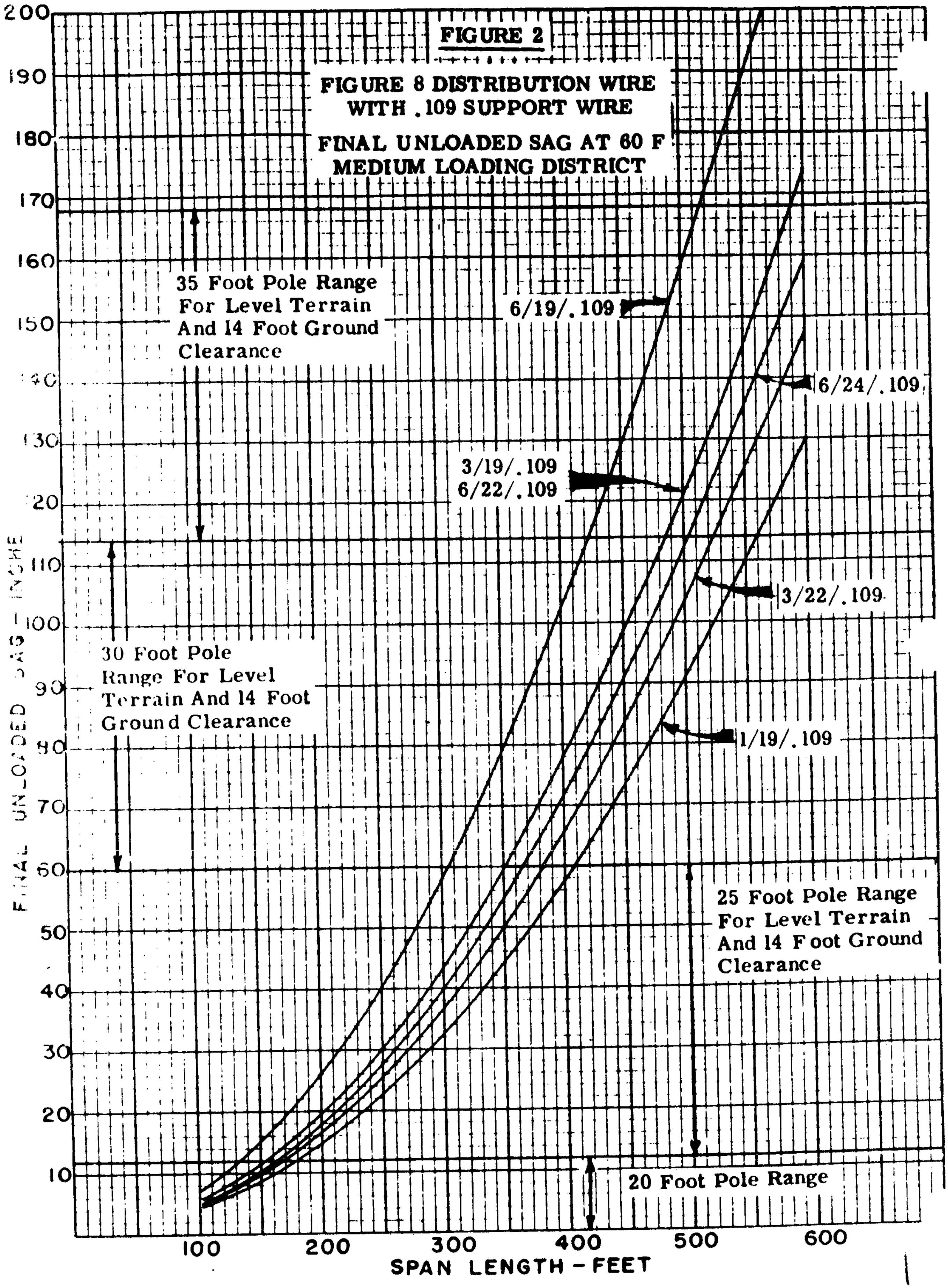


FIGURE 2
FIGURE 8 DISTRIBUTION WIRE WITH .109 SUPPORT WIRE
FINAL UNLOADED SAG AT 60 F
MEDIUM LOADING DISTRICT
35 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
30 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
25 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
20 Foot Pole Range
6/19/.109
6/24/.109
3/19/.109
6/22/.109
3/22/.109
1/19/.109
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
100
200
300
400
500
600
SPAN LENGTH - FEET

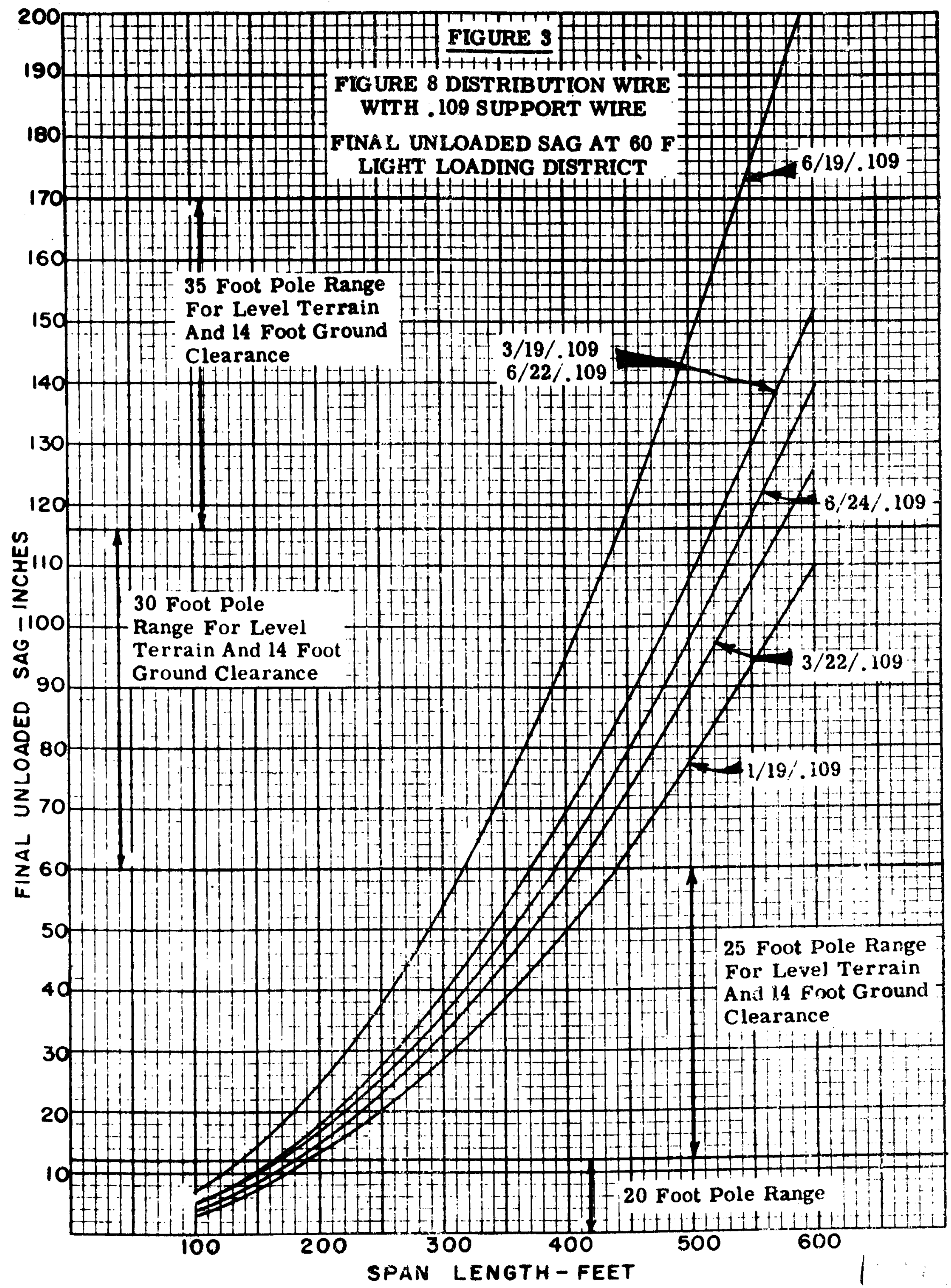


FIGURE 8
FIGURE 8 DISTRIBUTION WIRE WITH .109 SUPPORT WIRE
FINAL UNLOADED SAG AT 60 F
LIGHT LOADING DISTRICT
6/19/.109
3/19/.109
6/22/.109
6/24/.109
3/22/.109
1/19/.109
35 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
30 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
25 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
20 Foot Pole Range
FINAL UNLOADED SAG - INCHES
SPAN LENGTH - FEET
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
100
200
300
400
500
600

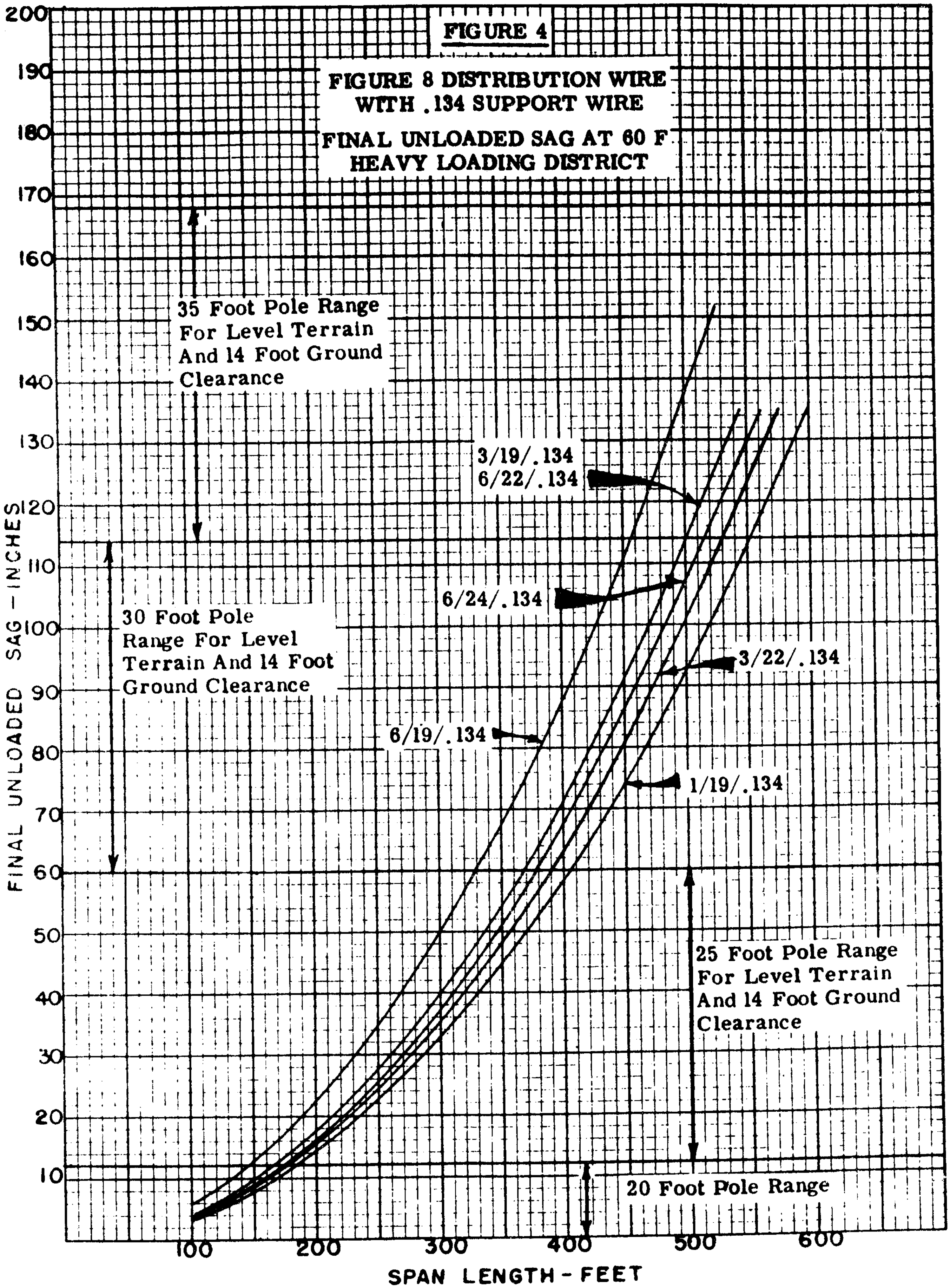


FIGURE 4
FIGURE 8 DISTRIBUTION WIRE WITH .134 SUPPORT WIRE
FINAL UNLOADED SAG AT 60 F HEAVY LOADING DISTRICT
35 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
30 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
25 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
20 Foot Pole Range
3/19/.134
6/22/.134
6/24/.134
3/22/.134
6/19/.134
1/19/.134
FINAL UNLOADED SAG - INCHES
SPAN LENGTH - FEET
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
100
200
300
400
500
600

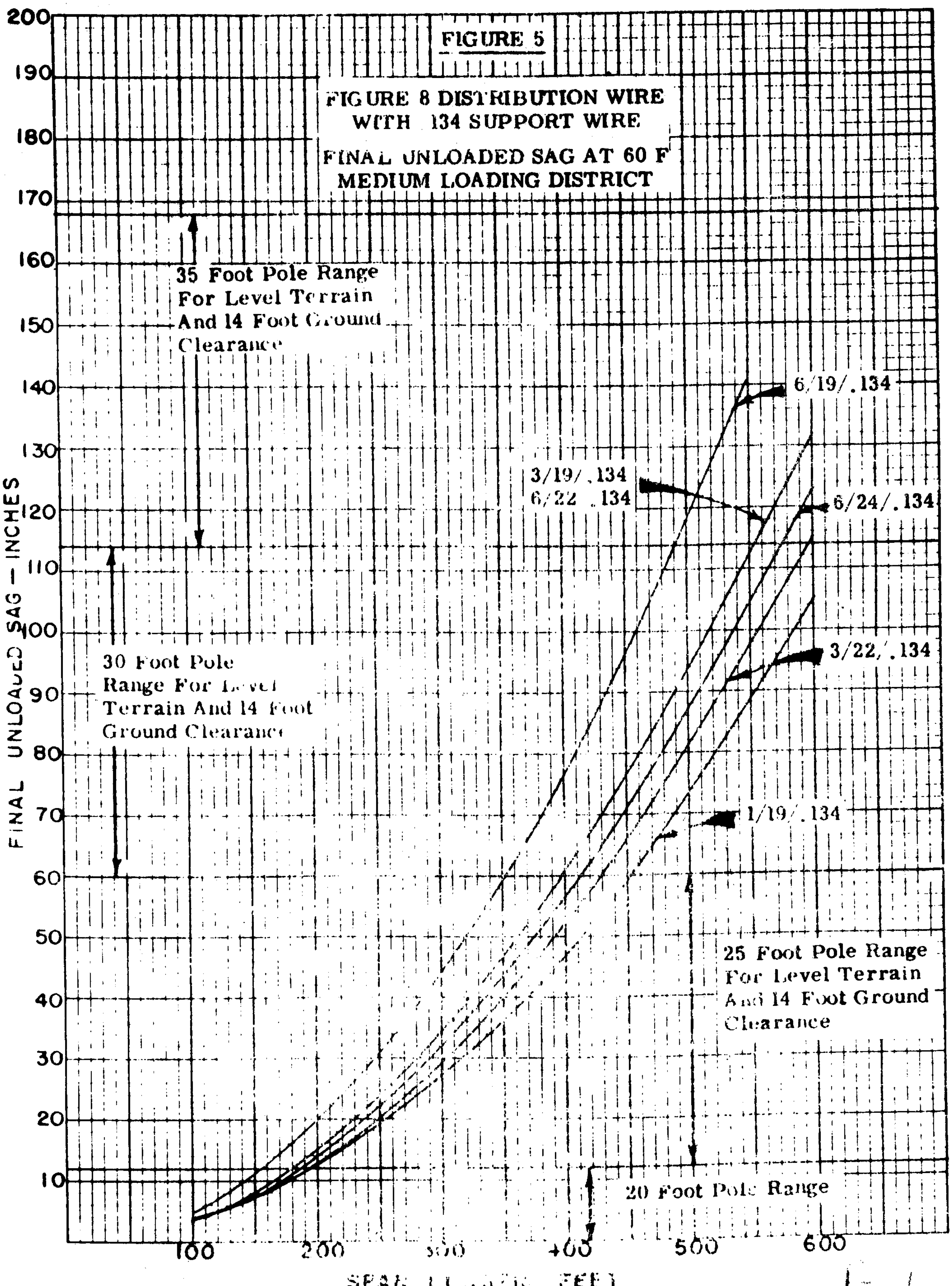


FIGURE 5
FIGURE 8 DISTRIBUTION WIRE
WITH .134 SUPPORT WIRE
FINAL UNLOADED SAG AT 60 F
MEDIUM LOADING DISTRICT
35 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
30 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
25 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
20 Foot Pole Range
6/19/.134
3/19/.134
6/22/.134
6/24/.134
3/22/.134
1/19/.134
FINAL UNLOADED SAG — INCHES
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
100
200
300
400
500
600

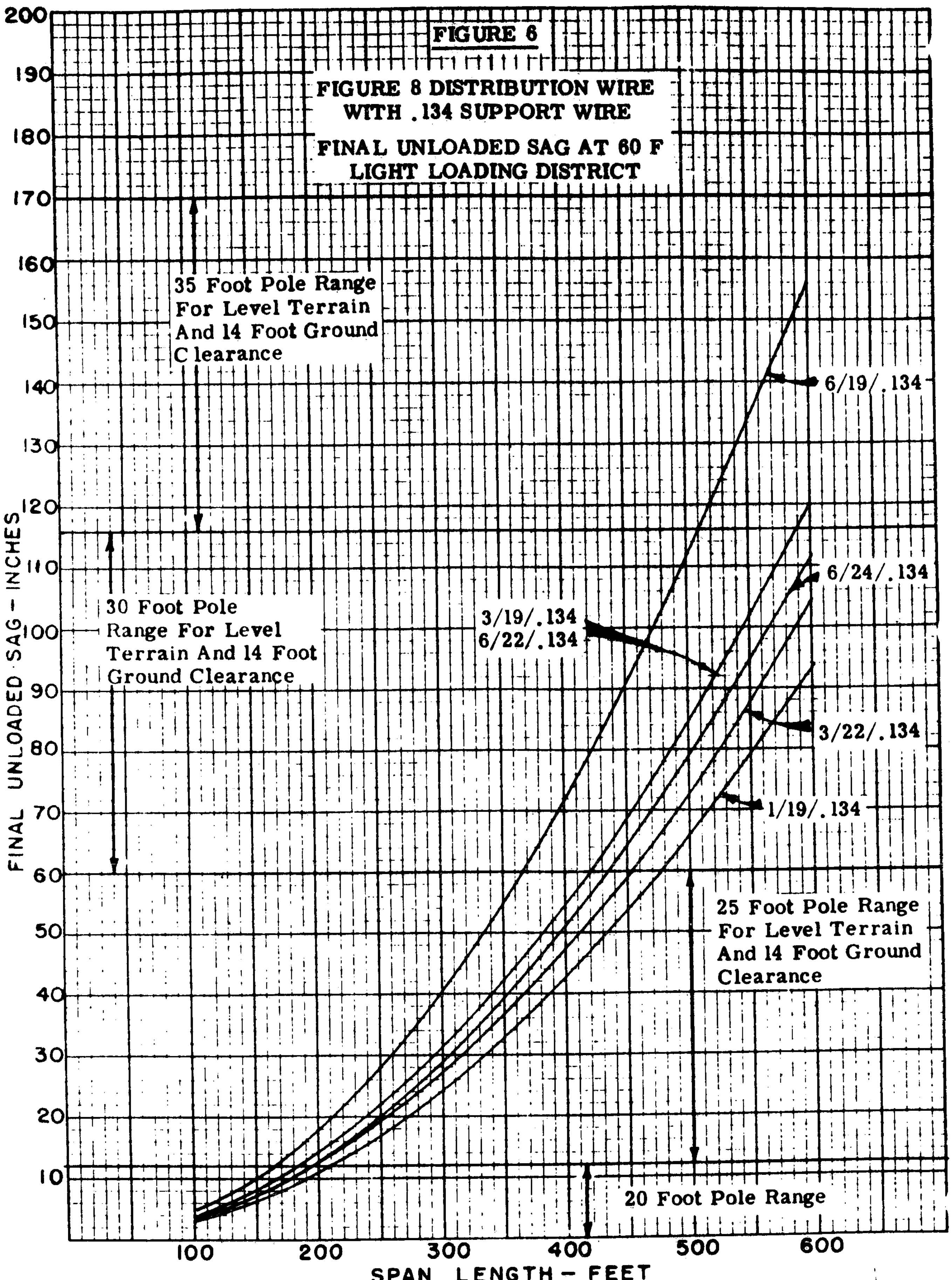
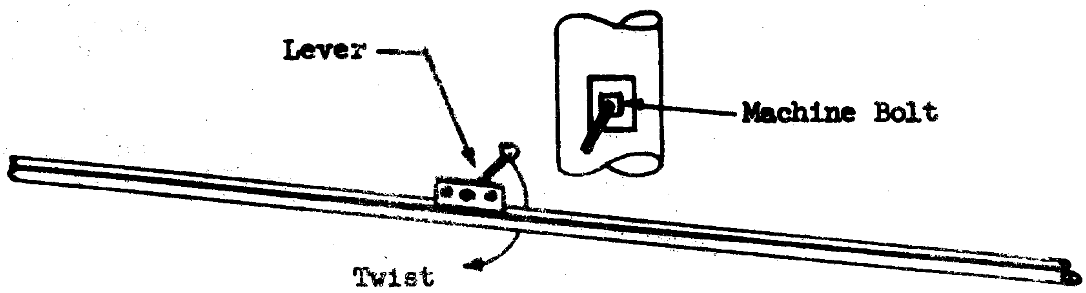
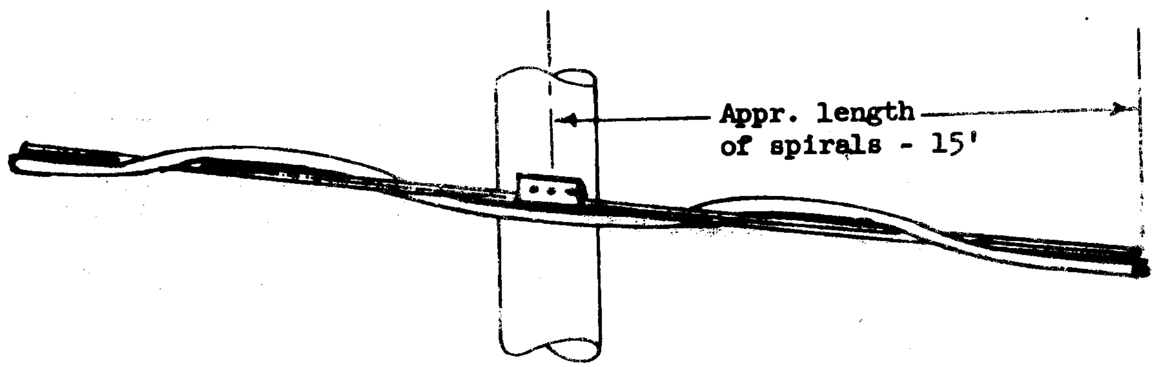


FIGURE 6
FIGURE 8 DISTRIBUTION WIRE WITH .134 SUPPORT WIRE
FINAL UNLOADED SAG AT 60 F LIGHT LOADING DISTRICT
35 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
30 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
25 Foot Pole Range For Level Terrain And 14 Foot Ground Clearance
20 Foot Pole Range
6/19/.134
6/24/.134
3/19/.134
6/22/.134
3/22/.134
1/19/.134
FINAL UNLOADED SAG - INCHES
SPAN LENGTH - FEET
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
100
200
300
400
500
600



Step 1 - Support and position distribution wire with cable placing blocks. Tension the distribution wire in accordance with the sag tables specified.

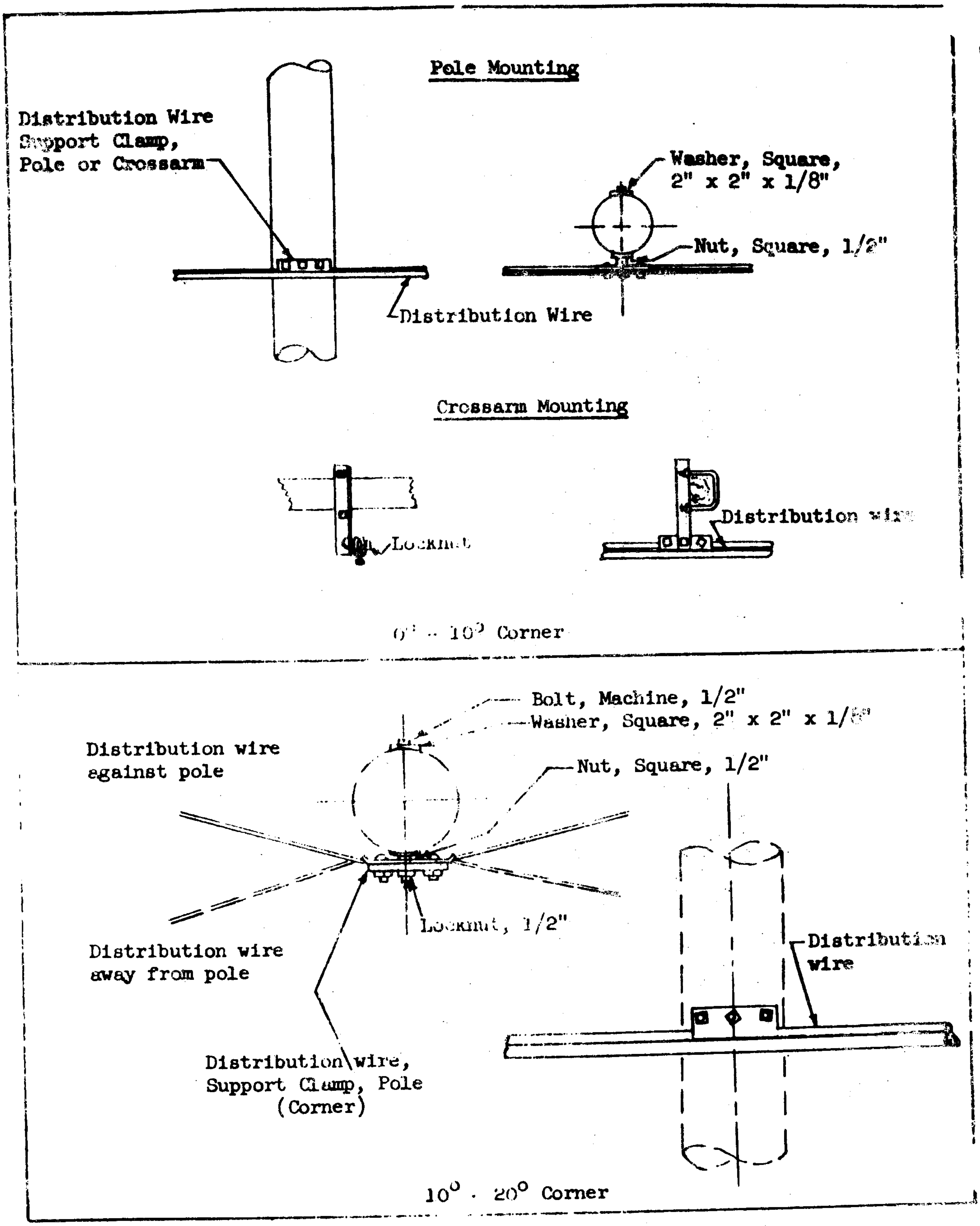
Step 2 - Fasten a support clamp to the support messenger at the pole. Tighten the carriage bolts to the manufacturer's specifications.



Step 3 - Using a lever, on the clamp, spiral distribution wire in the opposite direction from which the previous adjacent spiraling operation was performed. If the adjacent spans are unequal, use the shorter span for determini.g the number of spirals.

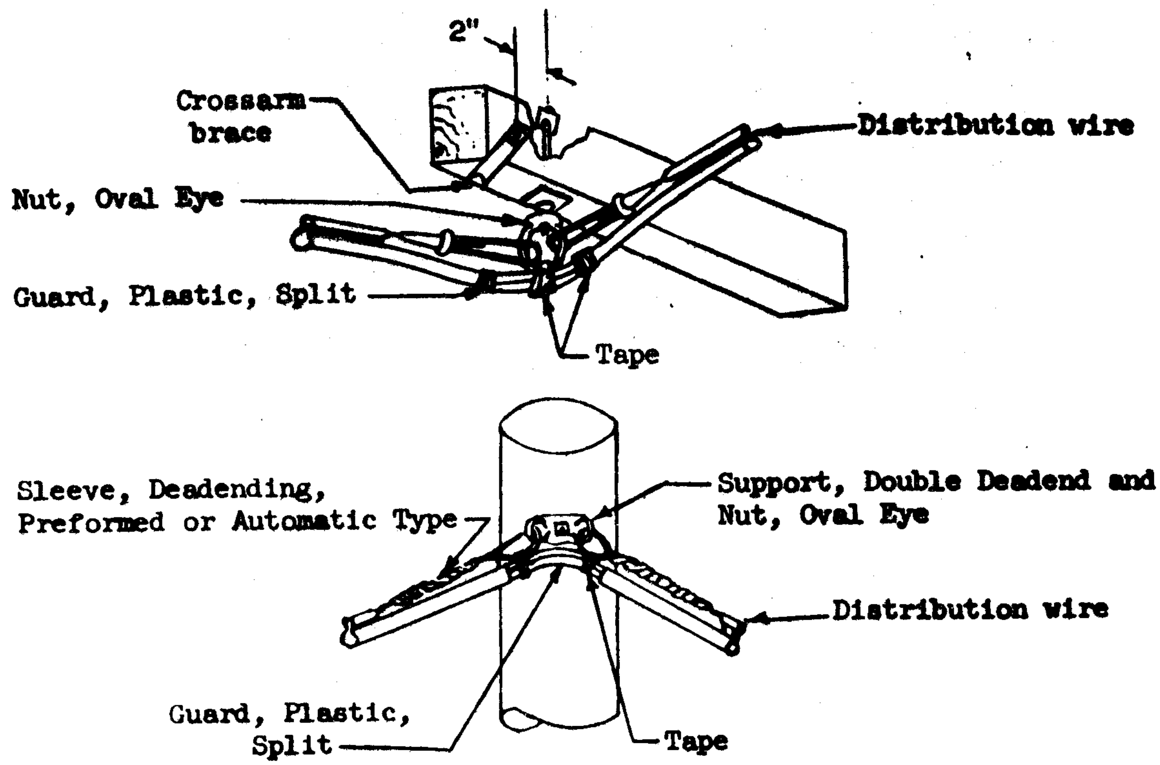
Step 4 - Place the clamp on the machine bolt and tighten nuts to the manufacturer's specifications.

FIGURE 7

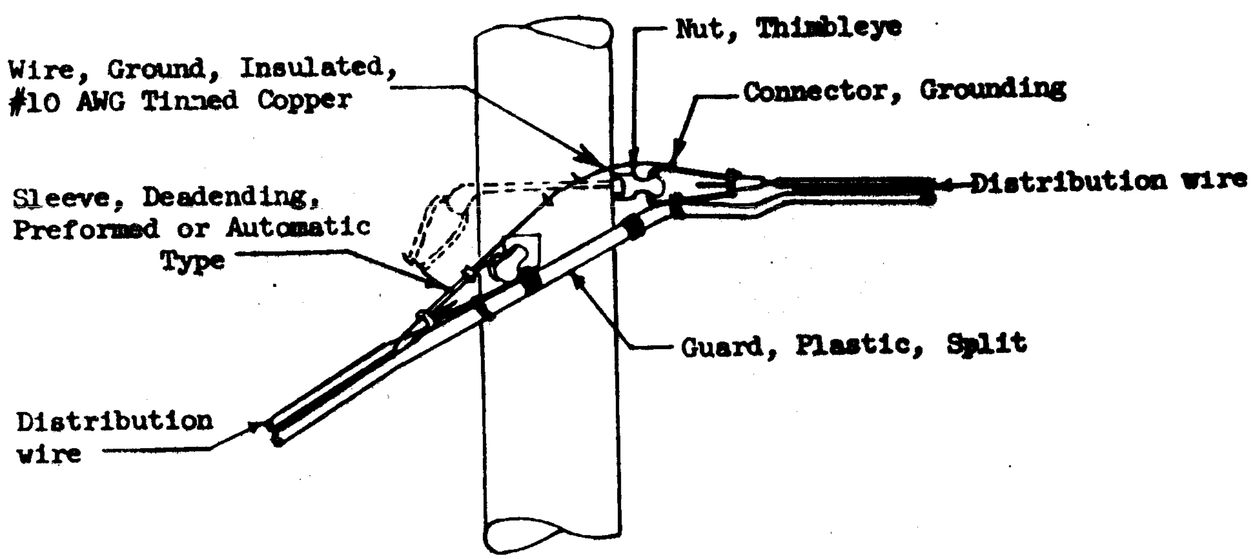


Pole Mounting
Distribution Wire Support Clamp, Pole or Crossarm
Washer, Square, 2" x 2" x 1/8"
Nut, Square, 1/2"
Distribution Wire
Crossarm Mounting
Locknut
Distribution wire
0° - 10° Corner
Bolt, Machine, 1/2"
Washer, Square, 2" x 2" x 1/8"
Distribution wire against pole
Nut, Square, 1/2"
Locknut, 1/2"
Distribution wire away from pole
Distribution wire
Distribution wire, Support Clamp, Pole (Corner)
10° - 20° Corner

FIGURE 8



20^{o} - 60^{o} Corner



60^{o} - 90^{o} Corner

FIGURE 9