SEABORNE

WAR DEPARTMENT

Office of the Chief Signal Officer
Plant Division
Radio Section

WASHINGTON, D. C.

CONSTRUCTION OF A RHOMBIC RECEIVING ANTENNA

MARCH 20, 1943

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WIND TURBINE COMPANY
West Chester, Penna.

W A R D E P A R T M E N T

Office of the Chief Signal Officer

Plant Division

Radio Section

Washington, D. C.

Instructions and Drawings

covering

Construction of a Rhombic Receiving Antenna

March 20, 1943

These Instructions Apply to Materials

Purchased as Follows

Antenna Harness Kit	Order 11898-Phila-43
Antenna Guying Kit	Order 12196-Phila-43 Order 12197-Phila-43
Transmission Line Kit	Order 17171-Phila-43
Instruction Book	Order 28075-Phila-43

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Section 1 - General

These specifications cover the construction of a one wire rhombic receiving antenna.

A total of 7 sizes of antennas have been designed for operation over various distance ranges at 4, to 22 megacycles as shown in Table 1. With the exception of the side wire length "L", the tilt angle "ϕ", and the antenna height above ground "H", all antennas have the same construction details. The basic information concerning the 7 antennas is shown in Table 1.

Section 2 - References

Specification tables and detail drawings are furnished with these instructions. The successful completion of an installation with the materials and equipment furnished, depends on careful attention to these specifications.

Section 3 - Locating Work

3.0 Antenna Site

If possible the antenna should be located on level or evenly sloping open ground. The usual procedure is to locate the antenna so that the transmission line may run directly from the rear of the antenna to the Receiver building.

In general, antennas should be constructed as near the receiver building as is practicable for any particular installation, and the transmission line made as short as possible.

3.0

If the antenna must be situated on ground covered by woods or brush, clear out around and between poles to facilitate setting the poles and hanging the antenna curtain. If practical, it is advisable to clear out all trees within and near the diamond of the antenna.

In selecting a site for an antenna, obstruction such as bills or buildings directly in front, and on the bearing line of the antenna should be avoided. It is desirable that no obstruction in front of the antenna shall be more than 2° or 3° above the horizontal plane of the antenna. This is approximately 200' or 300' at a mile.

3.1 Locating the Antenna

The bearing of an antenna, or its horizontal direction of transmission or reception is given in degrees measured clockwise from true North. A line bearing true North and South must therefore be available before proceeding with the location of the antenna. The bearing of the antenna should be determined with an accuracy of plus or minus fifteen minutes.

3.2 Locating Antenna Poles

The location of the front and rear poles of the antenna shall be determined by direct standard steel tape measurements along the major axis of the antenna which is also the bearing line of the antenna. To determine the location of the side poles, a stake shall be located on the major axis at the midpoint of the antenna. Perpendiculars shall be laid off each side of the base line from this midpoint, and the correct distance then measured to determine the location of the side poles on the minor axis of the antenna. Pole to Pole lengths and Pole to Pole widths are shown in Table No. 1 attached.

3.2

Pole location stakes shall be located with an accuracy of plus or minus C.2 feet and all distances should be chained at least twice to make certain the desired accuracy is obtained. Four reference stakes shall be set around each antenna axis and two of the stakes approximately at right angles to this axis. These stakes should be set at a sufficient distance from the pole location to eliminate the possibility of being disturbed while the pole is being set.

3.3 Locating Transmission Line Poles

Transmission line poles between the antenna and the **Receiver Building** are located in as nearly a direct line as possible. A staggered spacing should be used on locating these poles so that no two spans have the same length. Normally a 5 ft. or $7\frac{1}{2}$ ft. spacing interval is used as follows: 50', - 55' - 60' - 62' - 57' - 52' etc. Maximum span lengths should not exceed 65 feet.

3.4 Locating Anchors

All anchors should have a one to one lead; that is, the distance from the base of the pole to the upper and lower end of the guy are the same. Set a stake to indicate the point where the anchor rod breaks the ground. All antenna guys should be located along axis of the antenna.

Transmission line corner anchors, where required, should be located on a line bisecting the interior angle, and on the outside of the corner to be guyed.

3.5 Ground Elevations

Ground elevations at each antenna pole location stake must be obtained for use in determining the point above the ground for attaching the antenna harness. These elevations are also required to compute the position of the plane of the antenna curtain where the antenna must be located on uneven ground.

3.6 Establishing Plane of Antenna Curtain

In many antenna locations the ground will be more or less uneven and elevations taken at the antenna pole stakes may vary by several feet. Where these elevation variations are less than 10', the plane of the antenna should be made horizontal. As the pole heights and points of harness attachments shown in the table on Drawing No. ES-E-386-B are for level ground, pole heights and points of harness attachment must be calculated for each pole of the proposed antenna, taking into account the ground elevation at the base of each pole.

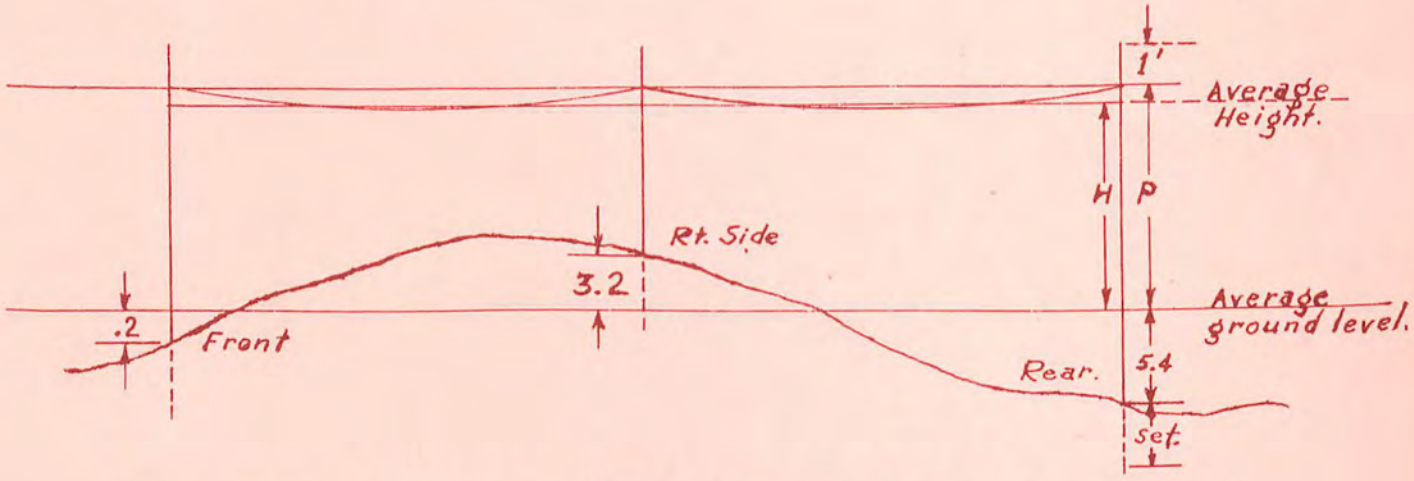
Where the elevation at one stake is considerably greater or less than the others, it should be disregarded. Determine the average elevation by averaging the remaining three elevations, and provide a longer or shorter pole for the fourth location. With the above exception, the elevations at all four antenna pole stakes should be averaged, and the antenna erected so that its plane is a distance "H" above this average elevation.

Points of attachment of curtain harnesses may be calculated as indicated in the following example.

EXAMPLE

Pole	Ground Elevation Front Pole = 0'	Ground Elevation Average = 0'	Points of Harness Attachement Above Ground
Front	0.	-0.2	P + 0.2
Rt. Side	+ 3.4	+3.2	P - 3.2
Lt. Side	+ 2.6	+2.4	P - 2.4
Rear	- 5.2	- 5.4	P + 5.4
	4/+0.8 = .2	0.0	
Average	+.2	0.0	

P = H + ½ Sag at 90° F
See Table 1



The calculation of the various dimensions associated with the poles will be greatly facilitated if a diagram is drawn similar to that shown above. Make the diagram large enough so that all dimensions for each pole can be put on it directly.

Required pole length = 1' + P + Pole Set ± Deviation of pole ground level from average ground level

+ If ground is low at the pole
− If ground is high at the pole

3.6

In calculating new pole heights, approximately one foot of pole top should be provided above the harness attachments. With but a single guy per pole, it is advisable to set the antenna poles the full required depth as shown in attached Table No. 1. In no case should the depths of setting be reduced by more than 2.0 ft.

At locations where ground elevations at antenna pole stakes vary by more than 10 ft. the plane of the antenna may be tilted to take advantage of the ground slope. This applies only where the slope is consistent from front to rear, and extending for at least 1000 yards in front of the antenna. The general practice in these cases is to make the front and rear poles approximately equal in height, varying the length of the side poles, as required, to bring the plane of the antenna parallel to the average ground level. The minor axis of the antenna should be horizontal.

In order to properly design the antenna structure for sloping ground, contour lines of the area for a considerable distance must be available and allowances made for the characteristics of the terrain. Wherever possible it is advisable to locate the antenna on level ground, or on ground where the difference in average ground level from front to rear of the antenna is not more than 20 feet.

Section 4 - Pole Work

4.0 Poles

Creosoted pine, Douglas Fir or poles of other woods obtained locally shall be used.

4.1 Stepping Poles

Spikehead pole steps 5/8 in. x 10 in. are staggered 18 inches apart on opposite sides of the pole, this makes steps on the same side of the pole 36" apart. Guide holes ($\frac{1}{2}$) inch in diameter and 3 inches deep are drilled in creosoted pine poles before installing the steps. In Douglas Fir, and Cedar poles (soft woods) the guide holes are 3/8 in. in diameter. All the boring can be done on the ground before the pole is set. Steps should be installed on the antenna poles at right angles to the axis of the antenna on which the pole is located.

4.2 Setting Poles (Antenna)

After the antenna pole hole has been dug to the required size and depth, the antenna pole may be set and accurately centered in the hole. Temporary guys are used to keep the antenna pole plumb while the hole is being backfilled and tamped.

A gin pole approximately 5' longer than half the length of the poles to be set will be found convenient in raising the antenna pole, and centering it in the hole. The gin pole should have adequate temporary guying in four directions, and may be raked toward the pole hole for ease in setting the antenna pole. Since a 90' pole may weigh 5000 pounds, it is evident that pole setting operations must be carefully planned.

The permanent back guy and the temporary guying should be attached to the antenna pole before it is raised. Care should be exercised to make certain that the bent thimble eye bolt for the guy and the thimble eye nut for the antenna harness are directly on the axis line of the antenna before the dirt is backfilled around the pole.

4.3 Setting Poles (Line)

Transmission line poles, varying in height from 20 to 30 feet as required for grading, shall be set in accordance with standard pole line construction practices.

Some saving of time will be effected if the crossarms and fixtures are attached to line poles before they are set.

Section 5 - Anchor and Guy Work

5.0 Installing Anchors

Expanding plate anchors have been specified for these antennas but alternate anchors of creosoted pine plank or logs, concrete blocks or other local substitutes of sufficient holding power may be used.

To install the expanding plate anchor, the hole should start at the anchor stake and extend downward at an angle in line with the guy. The hole should be large enough to take the unexpanded or closed anchor and should extend to practically the full length of anchor rod supplied. An earth auger and digging bar may be used on the small holes required for this type of anchor. To install, the anchor rod is attached to the anchor and the assembly is lowered into the anchor hole. The anchor is then expanded into the undisturbed sides of the hole by pounding with a special expanding bar which fits around the anchor rod. Care should be taken to thoroughly tamp the earth used in backfilling the hole, especially at the bottom of the hole on top of the anchor.

5.1 Assembling and Installing Guys

All antenna pole guys shall be broken at 18 ft. intervals with the first insulator 5' from the eye bolt in the pole. The last section next to the ground may be longer than 18 ft. But should not exceed 30 ft. in length.

The guys on the front and rear antenna poles are subject to considerable strain, and shall therefore be assembled using 7/16 in. wire strand (18,000#) and two 3-bolt guy clamps each side of the large porcelain strain insulators. The guys on the side antenna poles shall be assembled using 3/8 in. wire strand (10,800#) and a single 3-bolt guy clamp each side of the large porcelain strain insulators.

The guys on transmission line poles shall be assembled using 3/8 in. wire strand (10,800#) and one 3-bolt clamp each side of a single large porcelain strain insulator located 5' from the top of the guy.

The use of a coffing hoist is a simple and efficient way to take up or let out the final adjustment of the guys.

Wherever possible, guys may be fabricated in the shop where the use of a vise and wrench extensions will enable a thorough tightning of the clamps on the enclosed strand.

At locations where the nature of the soil is such that two anchors will be required for guys on the front and rear antenna poles, the last insulated section may be made in the form of a bridle with the strand passing from one anchor thru the porcelain strain insulator and back to the second anchor, with a clamp at the insulator.

Section 6 - Wire Work

6.0 General

High strength, 40% conductance #6 A.W.G. (.162) Copperweld wire has been specified for the antenna. It's rated breaking load is 2433 pounds. Other wire, such as 3 strand of #12, 40% conductance Copperweld, may be also used.

In handling the copperweld wire, care should be taken to prevent the wire being nicked or scratched by pliers, sharp rocks, or climbing spurs. Nicks which penetrate thru the outer shell of copper, will expose the steel core to corrosion, which will in time reduce the strength of the wire. Special importance in this regard should be given to handling the wire used in the antenna curtain.

6.1 Fabrication of Antenna Curtain

If the nature of the ground will permit, it is advisable to fabricate the antenna curtain at the location of the antenna. The antenna can then be raised into position on the poles directly from the ground. Generally there is sufficient space between the front and rear pole guy anchors, which provide convenient points for dead-ending the wires while they are measured under tension.

From either the front or rear pole anchor, measure off along the center line of the antenna a distance equal to twice the side length "L" of the antenna specified, plus 5 feet. Drive a stake to mark this distance. Set up a wire payout reel at the anchor and pull out two (2) Copperweld antenna wires between the anchor and the stake. One wire should pass on the left side of the antenna poles, and one wire on the right side.

A single long bar type strain insulator specified for the side corners of the antenna curtain should next be slid on each of these wires. Care should be taken to be sure that the saddleway end of each insulator is placed on the wire.

The most important part of the antenna curtain assembly is the forming, serving, and soldering of the wires to form the dead-end. Form a smooth loop through the insulator, bringing the fall back on and parallel to the line. If a down lead or a jumper is to be taken off at this point also, lay a 3" length parallel to the other two and temporarily lash the three together. All wires must be thoroughly cleaned before lashing. This group of wires is now neatly and tightly served with #18 soft copper wire; and the temporary lashing removed. The served joint should now be covered with a thin film of flux, and carefully tinned and soldered inside and out.

Handle very carefully until the solder has set. All dead ends are to be formed in this way.

To measure the wires to obtain the exact length "L" for the antenna, fasten an insulator, with wire attached, to an anchor. At the opposite end, attach a wire grip with a set of small blocks, and place the wire in tension. Place boxes or other supports under the wire so that it will be in as nearly a straight line as possible. The tension should be at least 200 lbs., and each wire should be measured under the same conditions of sag and tension.

Starting from the bearing point of the pole end of the insulator, measure off with a standard steel tape a distance equal to twice the side length "L" of the antenna specified, subtract the length of the insulator, and carefully mark the wire for the bearing point of the insulator. The wire length plus the length of the two insulators is to be 2 "L". As an example, this measurement is 2 x 375' = 750' for antenna type A. Repeat the measurements to be sure of accuracy. Mark the point so that it will not be lost. Two pieces of friction tape, one each side of the mark, wrapped around each wire is one way of retaining the marks. Similar marks should be established at the midpoint of each wire, to be used later in establishing the insulator locations at the side poles of the antenna. In every case, the wire should be attached to the insulator so that the mark falls on the bearing point of the insulator.

6.2 Erection of Antenna Curtain

Each half of the fabricated curtain is laid out on the ground, in smooth curves, between the end poles. The end harness, which has been previously assembled, may now be shackled to the end insulators, and the side insulators

moved along the wires to their previcusly marked center locations.

By means of suitable halyards or hand lines, hoist each end of the assembled curtain shackle to the eyenut on the pole. One end at a time may be raised. Care should be taken to avoid kinking or bending the antenna wires at any time.

The side harnesses may now be shackled to the side insulators, hand lines attached to the harnesses, and the antenna sides raised into position. With the antenna thus roughly positioned, the anchors and guys should be checked, and poles brought to approximate vertical position.

The entire antenna structure should now be approximately in position and the antenna sag should be roughly as specified when the verticies of the antenna are pulled up to 3' from the center of their respective poles. If the antenna does not fall reasonably into position with these preliminary adjustments, the difficulty should be found and remedied before accurate adjustment of sag is undertaken.

With the antenna approximately in position, locate a point on the side poles level with the antenna wire nearest the pole. At a distance below the point equal to the sag specified for the particular rhombic antenna being built and the prevailing atmospheric temperature, nail a lath horizontally on the pole so that it can be plainly seen from either end pole. Nail a lath similarly on each end pole so that it can be seen from each side pole. Adjust the saddle lengths to make the antenna wire dip to the line formed by two laths. The saddle lengths should be very near 3' when the sag is correct.

Section 7 - Transmission Line

7.0 Installation

The 4-wire, 200 ohm transmission line may be directly built up to final form except at the antenna end. At this point the end clevis insulator is strung on, and temporary rigging is attached to put equal tension of about 100 lbs. on each of the four wires. The end insulator should now be moved along the line to a position near the end of the antenna down lead, and its position accurately marked on each wire. The tension rigging may now be removed, and the wires served in position with the marks located accurately in corresponding positions on the end insulator.

7.1 Down Lead

The down lead used with the 200 ohm, 4-wire transmission line is a modified exponential line whereby the impedance is gradually changed from about 650 ohms at the antenna to 200 ohms at the 4-wire line. It is made of two #6 wires about 15 in. apart at the antenna, and about .45 in. at the lower end. The #6 wire used for this line should be very straight. Bends and waves should be removed as far as possible. Apply only enough tension at the lower end to make the line reasonably straight.

Table 1

RHOMBIC ANTENNA DIMENSIONS

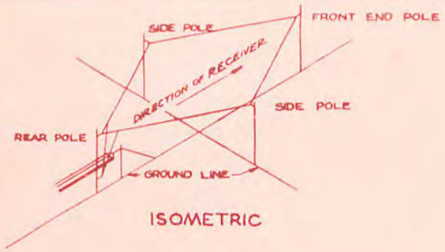
TYPE	MILES	L(ft.)	∅	H(ft.)	X(ft.)	W(ft.)	DEPTH SET (ft.)	P(ft.)	WIRE SAG (in.) 30°	60°	90°	TYPE
A	3000 +	375	70°	65	710	262.4	10.	67.	34	40	48	A
B	2000-3000	350	70°	60	663.6	245.6	9.5	61.9	29	35	42	B
C	1500-2000	315	70°	57	598	221.6	9.5	58.5	23	28	35	C
D	1000-1500	290	67.5°	55	542	228	9.0	56.2	19	24	30	D
E	600-1000	270	65°	53	495.4	234	8.5	54	17	21	26	E
F	400-600	243	62.5°	51	440.6	232	8.5	52	14	17	22	F
G	200-400	225	60°	50	396	231	8.5	51	12	15	18	G

L - Length of Side including Insulator
∅ - Tilt Angle
H - Average height of antenna above average ground level
X - Pole spacing - major axis
W - Pole spacing - minor axis
P - Height of harness attachment to pole above average ground level
All saddles are 3' long

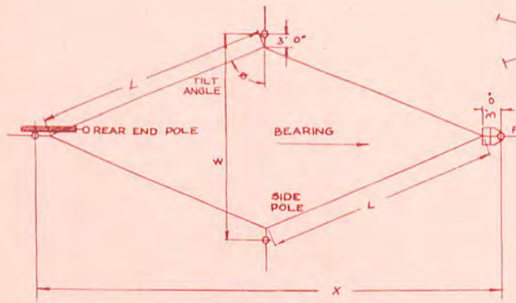
Table 2

POLE DATA

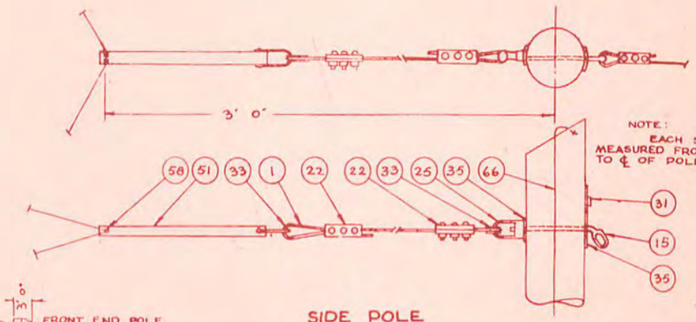
Total Length	Height Above Ground	Depth Set	Approximate Butt Diameter (in.)
16	12	4.	
20	15.5	4.5	8-10
25	20.	5.	
30	24.5	5.5	
35	29	6.	10-12
40	34	6.	
45	38.5	6.5	
50	43.	7.	
55	47.5	7.5	
60	52	8.	12-18
65	56.5	8.5	
70	61.	9.	
75	65.5	9.5	
80	70.	10.	18-28
85	74.5	10.5	
90	79.	11.	



ISOMETRIC

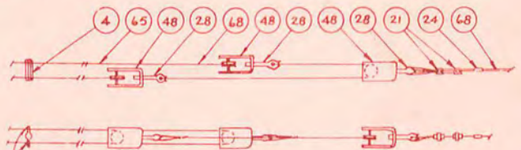


PLAN

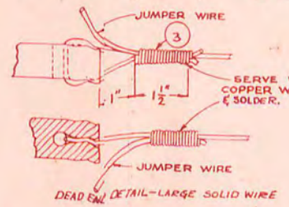


NOTE:
EACH SADDLE LENGTH 3'0" MEASURED FROM VERTEX OF ANTENNA TO ℄ OF POLE.

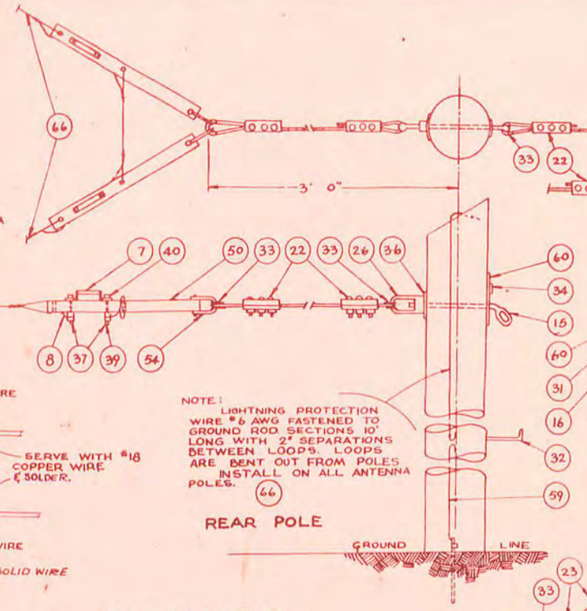
SIDE POLE



TEMP. TENSION RIGGING

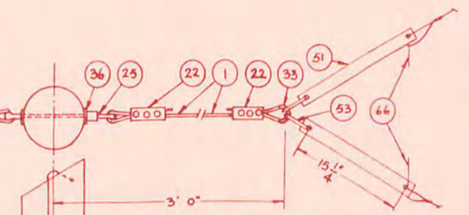


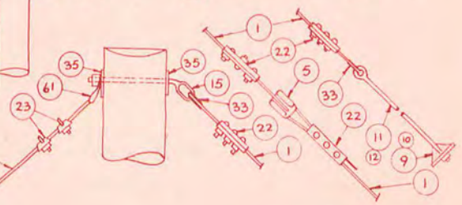
DEAD END DETAIL-LARGE SOLID WIRE



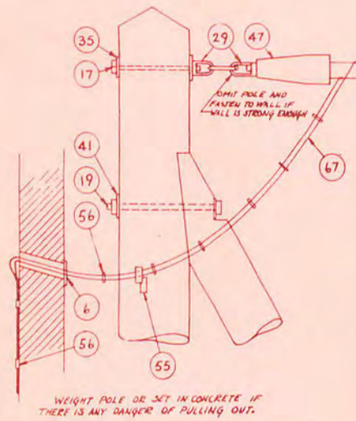
NOTE:
LIGHTNING PROTECTION WIRE #6 AWG FASTENED TO GROUND ROD SECTIONS 10' LONG WITH 2' SEPARATIONS BETWEEN LOOPS. LOOPS ARE BENT OUT FROM POLES INSTALL ON ALL ANTENNA POLES. (44)

REAR POLE



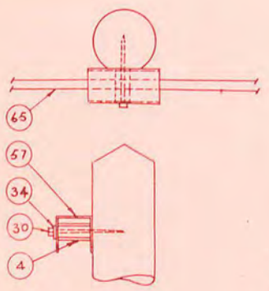


ANCHOR DETAIL



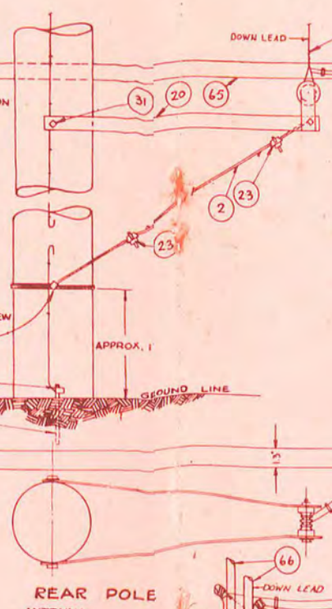
WEIGHT POLE OR SET IN CONCRETE IF THERE IS ANY DANGER OF PULLING OUT.

END POLE & BLDG. ENTRANCE
TRANSMISSION LINE



STRAIGHT LINE POLE
TRANSMISSION LINE

NOTE:
EACH TRANSMISSION LINE KIT IS FOR A 500' LINE.

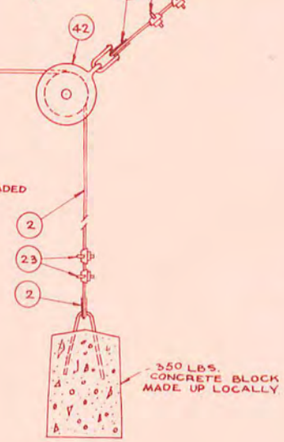


TURN POLE
TRANSMISSION LINE

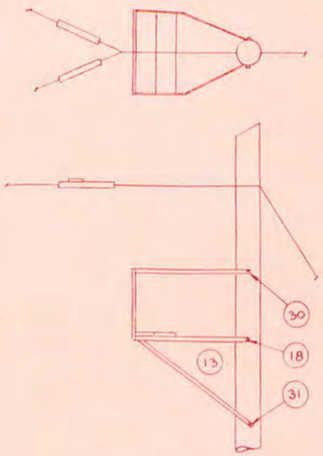
REAR POLE
ANTENNA

SALVAGE 2" STUD FROM THREADED END OF EYE BOLT

STUD DETAIL



350 LBS. CONCRETE BLOCK MADE UP LOCALLY



BALCONY
ON FRONT END POLE

RHOMBIC RECEIVING ANTENNA

DATA T.J.H.	CHECKED	APPROVED	ISSUE
DRAWN M.G.K.	VERIFIED JZ	DATE 3 26 45	
O.C.S.I.G.O. U.S. ARMY PLANT ENGINEERING AGENCY PHILA. PA.		ES-E-386	B

MATERIAL LIST FOR ES-E-386-B

Item No. on Dwg. ES-E-386-B	DESCRIPTION	Quantity	Furnished on Order No.	Sub-Item
1.	3/8" messenger	750 ft.	12196,7	26
2.	¼" yacht rigging	60 ft.	17171	15
3.	#18 copper S. D.	¼ lb.	(11898 (17171	(21 (24
4.	Isolantite 1015	12 ea.	17171	13
5.	Thomas 504 Strain	25 ea.	12196,7	15
6.	Porcelain Tube	3	17171	22
7.	200 ohm. 1 watt resistor	6	11898	8
8.	Solder lug	4	11898	6
9.	8" Anchor	4	12196,7	1
10.	10" Anchor	4	12196,7	2
11.	Rod, for 8" Anchor	4	12196,7	3
12.	Rod for 10" Anchor	4	12196,7	4
13.	Balcony	1	12196,7	9
14.	3/8" x 4 Machine Bolt	2	17171	3
15.	5/8" x 10 Benteye Bolt	4	12196,7	6
16.	3/4" x 12 Benteye Bolt	2	12196,7	5
17.	5/8" x 8 Machine Bolt	5	(12196,7 (17171	31 2
18.	5/8" x 12 Machine Bolt	1	12196,7	8
19.	5/8" x 14 Machine Bolt	1	17171	4
20.	Cross Arm Brace	2	17171	6
21.	7/16" Cable Clamp - 1 Hole	4	11898	2
22.	3-Bolt Guy Clamp	62	12196,7	10
23.	¼" Wire rope clip	12	17171	11
24.	Clips - Guywire, 3/16"	4	11898	3
25.	Thimbleye Nut, 5/8"	2	12196,7	13

Item No. on Dwg. ES-E-386-B	DESCRIPTION	Quantity	Furnished on Order No.	Sub-Item
26.	Eye Nut, 3/4"	2	12196,7	12
27.	5/8" x 8 ft. Ground Rod	4	12196,7	27
28.	Thimbleye bolt 5/8" x 8" (Hubbard 6508)	3	17171	5
29.	5/8" Eyenut	4	17171	14
30.	3/8" x 6 Lag Screw	7	12196,7	20
31.	$\frac{1}{2}$ x 4" Lag Screw	17	12196,7	19
32.	Pole Step	200	12196,7	21
33.	Thimble for 3/8" Wire	9	(17171 (11898	20 15
34.	Washer with 7/16" hole	20	12196,7	25
35.	Washer, Curved for 5/8" bolt	10	12196,7	23
36.	Washer, curved for 3/4" bolt	5	12196,7	24
37.	$\frac{1}{4}$" x 20 Brass nut	4	11898	1
38.	5/8" Iron Hex Nut	4	17171	30
39.	$\frac{1}{4}$" Brass washers	4	11898	16
40.	$\frac{1}{4}$" Brass RHB bolt	4	11898	1
41.	Steel washer for 5/8"	4	17171	29
42.	6" Pulley block	1	17171	1
43.	Book, Instruction	1	11898	20
44.	Bracket per dwg. SCB-275-B	2	17171	7
45.	Clamp - for 5/8" (Hubbard 9502 ground rod, copperweld)	4	12196,7	30
46.	Clevis, (Hubbard 8910 less insulator)	1	17171	8
47.	Clevis (Joslyn J0339 less insulator)	2	17171	9
48.	Clevis (Dead end-Hubbard 587)	3	17171	10
49.	Clip Hubbard 7454 or equal, Guy wire for 3/8" strand	62	12196,7	11
50.	Insulator (Per Dwg. SCA272A, hole, strain saddle way both ends	5 4	11898	4

Item No. on Dwg. ES-E-386-B	DESCRIPTION	Quantity	Furnished on Order No.	Sub-item
51.	Insulator (Per Dwg. SCA259A, 2-hole, strain, 17"	6	11898	5
52.	Insulator, 4-groove porc. Knob (Hubbard 9226)	10	17171	12
53.	Shackle (Per Dwg. SCA-274-A), 3" for 5/16" piece - 1-1/16" mouth	4	(17171 (11898	16 9
54.	Shackle (Per dwg. SCA-257-A), 2" for 5/16" piece, 1-1/16" mouth	4	11898	10
55.	Spacer (per detail 1 of dwg.) larger pc. SCA-277A	20	17171	18
56.	Spacer (per detail 2 of Dwg. SCA-277-A) smaller section	30	17171	19
57.	Shield (per dwg. SCA-276-A)	6	17171	17
58.	Shim, lead, 1/16 x 3/4 x 1" cushion	2	11898	11
59.	Staples, copperweld (Hubbard 7652)	200	12196,7	29
60.	Strap, Guy (Hubbard 8888) for 3/4" bolt	2	12196,7	22
61.	Thimbleye (Hubbard 1100) Angle, 5/8"	1	17171	21
62.	Nails, 3d copperweld (Hubbard 8253)	20	12196,7	16
63.	Nails, 10d copperweld (Hubbard 8200)	30	12196,7	17
64.	Washer, lead, 1/16 x 1" for 3/8" bolt	6	17171,27	27
65.	Wire, #14 AWG, copperweld (Trans Line)	2500	17171	23
66.	Wire, #6 AWG, copperweld			
	In Line Kit for Down Lead	200'	17171	25
	In Guy Kit for protective ground	300'	12196,7	28
	In Harness for Curtain	1500'	11898	17
67.	Wire, 26 strands #30 B & S tinned lead in from trans. Line	50'	17171	26
68.	Wire, messenger, 3/16 x 7-strand, 2400 lb. Galvanized			
	Strain Tension Equalizer	20'	11898	18

MATERIAL SUPPLIED ON
ORDER #11898 - PHILA. - 43
STOCK ITEMS NO. 2A1618

Kit, Rhombic, Receiving Antenna Harness complete except for eyebolts, eyenuts, and guys; to consist of the following sub items:
(Packed in Two Boxes.)

SUB ITEM NO.	DESCRIPTION OF SUB ITEMS	QUANTITY	ITEM NO. ON DWG. ES-E-368-B
1	Bolt, brass, $\frac{1}{4}$ by $1\frac{1}{2}$-inches with hex. nut.	4 ea.	40
2	Clamp, guy, 1-bolt, 1-7/16" long, 1-9/16" wide, medium type; accommodates $\frac{1}{4}$ to 7/16-inch strand.	4 ea.	21
3	Clip, guy wire, for 3/16" strand.	4 ea.	24
4	Insulator, strain, 19 inches long, per dwg. SC-A-272-A.	4 ea.	50
5	Insulator, strain, 17 inches long, per dwg. SC-A-259-B.	6 ea.	51
6	Lug, soldering, 3/8-inch.	4 ea.	8
7	Paste, soldering, Nokorode, 2 oz. can.	2 ea.	See Note A
8	Resistor, special high frequency carbonized, 2-watt, approximately 410 ohms, complete with mounting clips; per dwg. SC-B-273-A.	6 ea.	7
9	Shackle, insulator, special 3-inch per dwg. SC-A-274-A.	2 ea.	53
10	Shackle, insulator, per dwg. SC-A-257-A.	4 ea.	54
11	Shim, lead cushion, strip 1-inch wide, 3/4-inch long, 5/16" thick.	2 ea.	58
12	Solder, (half and half)	5 lbs.	See Note B
13	Solder, Nokorode core, 5 lb. spool.	5 lbs.	See Note C
14	Tape, friction, cotton, 3/4-inch, in $\frac{1}{2}$-lb. rolls.	5 ea.	See Note D
15	Thimble, guy, "Everdur", for 3/8" wire and $\frac{1}{2}$ and 5/8" guy rod.	4 ea.	33
16	Washer, brass, round, lock; for $\frac{1}{4}$-inch bolt.	4 ea.	39
17	Wire, #6AWG, single, solid, bare, 40% conductance, copperweld.	1600 ft.	66
18	Wire, messenger, 3/16-inch 7-wire strand, G.I., minimum breaking strength 2400 lbs.	20 ft.	68
19	Cloth, emery, #1, 9 x 11 inches.	3 sheets	See Note E
20	Instruction Book.(Transferred to Order 28075-Phila-43)	1 ea.	43
21	Wire, #18, copper, tinned, S. D.	$\frac{1}{4}$ lb.	3

Note:
A Item 7 not specifically indicated
B Item 12 " " "
C Item 13 " " "
D Item 14 " " "
E Item 19 " " "

MATERIAL SUPPLIED ON
ORDERS #12196 - PHILA. - 43
AND #12197 - PHILA. - 43

Kit, Rhombic, Receiving Antenna Guying Material, complete consisting of the following sub items:

SUB ITEM NO.	DESCRIPTION OF SUB ITEMS	QUANTITY	ITEM NO. ON DWG. ES-E-368-B
1	Anchor, four-way; expanding, 8-inch, for use with anchor rod 5/8 and 3/4-inch.	4 ea.	9
2	Anchor, four-way; expanding, 10-inch for use with anchor rod 3/4 and 1-inch.	8 ea.	10
3	Anchor Rod, 5/8-inch by 8 ft., drop-forged special eliminating use of a guy thimble. (For 8" Anchor - Sub item 1)	4 ea.	11
4	Anchor Rod, 1-inch by 10 ft., drop-forged special eliminating use of guy thimble. (For 10" Anchor - Sub item 2)	8 ea.	12
5	Bolt, thimbleye, angle, 3/4 by 10-inch.	2 ea.	16
6	Bolt, thimbleye, angle, 5/8 by 10-inch.	2 ea.	15
7	Bolt, thimbleye, angle, 5/8 by 8-inch.	2 ea.	15
8	Bolt, machine, 5/8 x 12-inches, G.I.	1 ea.	18
9	Balcony, steel.	1 ea.	13
10	Clamp, guy, 3-bolt, 6-inch long, 1-21/32-inch wide, heavy type; accommodates 5/16 to $\frac{1}{2}$-inch strand.	110 ea.	22
11	Clip, guy wire, for strand size 3/8-inch.	110 ea.	49
12	Eyenut (not thimbleye) G.I., for 3/4-inch bolt.	2 ea.	26
13	Eyenut thimbleye, G.I., for 5/8-inch bolt.	2 ea.	25
14	Hook, guy, "J", G.I., 6-inch, heavy	8 ea.	See Note A
15	Insulator, porcelain, strain, 5-3/8" long x $3\frac{1}{4}$" dia. (Thomas 504)	50 ea.	5
16	Nail, copperweld, 3d, or $1\frac{1}{4}$", 600 per lb.	20 ea.	62
17	Nail, copperweld, 10d, or 3", 62.5 per lb.	30 ea.	63
18	Plate, strain, G.I., 4" x 8".	4 ea.	See Note B
19	Screw, Lag, G.I., $\frac{1}{2}$" x $4\frac{1}{2}$".	17 ea.	31
20	Screw, Lag, G.I., 3/8" x 6", Square head.	7 ea.	30

SUB ITEM NO.	DESCRIPTION OF SUB ITEMS	QUANTITY	ITEM NO. ON DWG. ES-E-368-B
21	Step, pole, G.I., Standard hook 5/8-inch diameter.	200 ea.	32
22	Strap, guy, for 3/4-inch bolt, 13/16" x 1-1/16" x 1/4" curved.	2 ea.	60
23	Washer, curved, G.I., 11/16" hole.	10 ea.	35
24	Washer, curved, G.I., 13/16" hole.	5 ea.	36
25	Washer, round, flat, standard, 7/16" hole.	20 ea.	34
26	Wire, messenger - 3/8".	750 ea.	1
27	Rod, ground, copperweld, round 5/8" x 8'.	4 ea.	27
28	Wire, #6 AWG, single, solid, bare, 40% conductance copperweld.	300 ea.	66
29	Staples, copperweld, 3/8" x 1½".	200 ea.	59
30	Clamp, ground rod, copperweld, for 5/8" ground rod.	4 ea.	45
31	Bolt, machine, 5/8" x 8", G.I., Hubbard #9808, or equal.	2 ea.	17

Note:
A Item 14 not specifically indicated
B Item 18 " " "

MATERIAL SUPPLIED ON
ORDER #17171 - PHILA. - 43

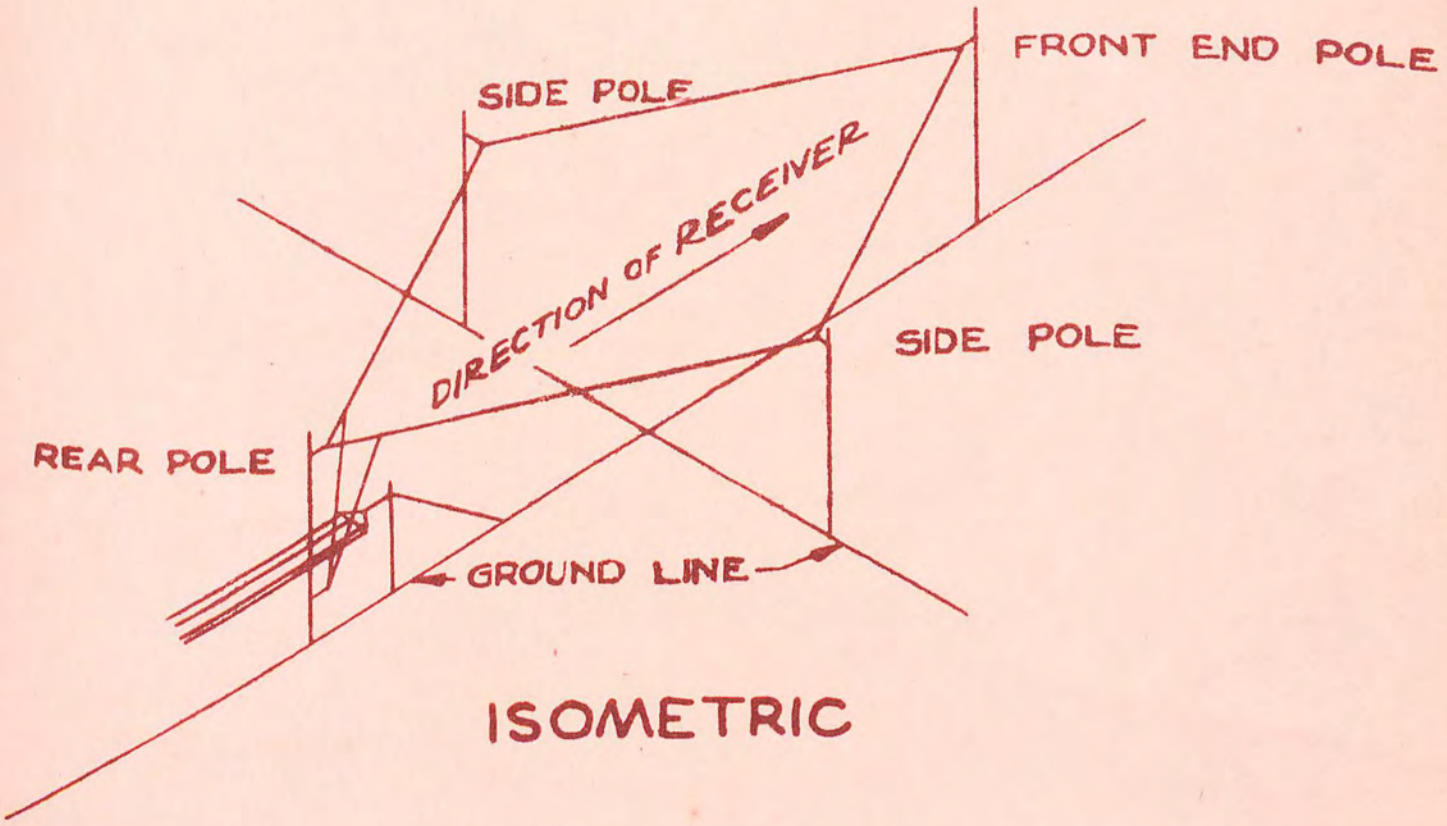
Kit, 4-wire Transmission Line, for Rhombic Receiving Antenna. Each kit consists of the following sub items:

SUB ITEM NO.	DESCRIPTION OF SUB ITEMS	QUANTITY	ITEM NO. ON DWG. ES-E-368-B
1	Block, pulley, 6-inch single sheave	1 ea.	42
2	Bolt, machine, 5/8" x 8".	3 ea.	17
3	Bolt, machine, galvanized iron 3/8" x 3½".	2 ea.	14
4	Bolt, machine, 5/8" x 14".	1 ea.	19
5	Bolt, thimbleye 5/8" x 8".	3 ea.	28
6	Brace, crossarm, flat, 30" x 7/32" punched at both ends for ½" bolt.	2 ea.	20
7	Bracket, corner, complete with 3 bushings and 3 bolts.	2 ea.	44

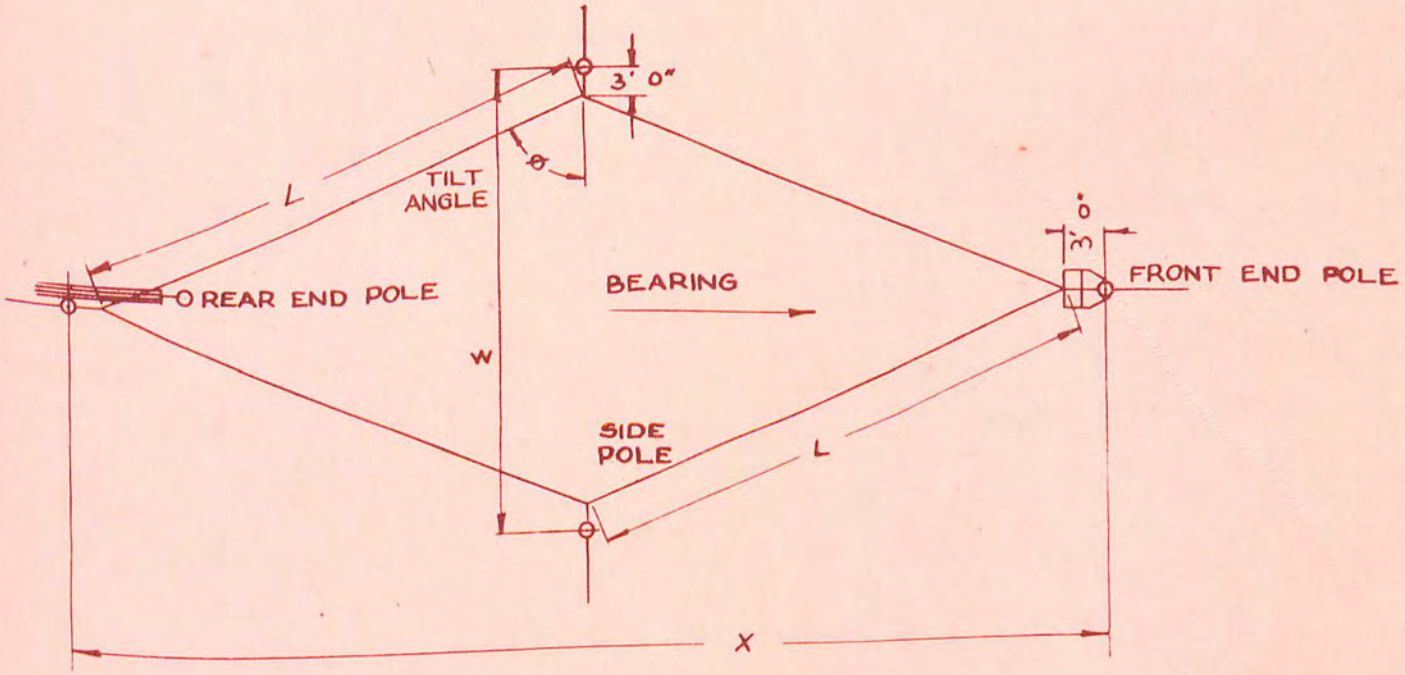
SUB ITEM NO.	DESCRIPTION OF SUB ITEMS	QUANTITY	ITEM NO. ON DWG. ES-E-368-B
8	Clevis (Hubbard).	1 ea.	46
9	Clevis (Joslyn).	2 ea.	47
10	Clevis, dead end, single roller.	3 ea.	48
11	Clip, wire rope, for $\frac{1}{4}$" strand.	12 ea.	23
12	Insulators, porcelain knob, 4 groove.	10 ea.	52
13	Insulator, 4-wire spacer, Isolantite 1015 or equal.	12 ea.	4
14	Eyenut 5/8".	3 ea.	29
15	Rope, wire, $\frac{1}{4}$"--5 x 7 hemp center.	60 ft.	2
16	Shackle.	1 ea.	See Note A
17	Shield, transmission line.	6 ea.	57
18	Spacer, bakelite, (per detail 1, dwg. SC-A-277-A).	20 ea.	55
19	Spacer, bakelite, (per detail 2, dwg. SC-A-277-A).	30 ea.	56
20	Thimble - 3/8".	5 ea.	33
21	Thimbleye, angle, 5/8".	1 ea.	61
22	Tube, porcelain, $\frac{1}{2}$" hole by 10" length.	3 ea.	6
23	Wire, #14 AWG, Single, solid, bare, 40% conductance Copperweld	2500 ft.	65
24	Wire, #18, s.d. copper, tinned.	200 ft.	3
25	Wire, copper, #6 AWG, single, solid, bare HD - Copperweld	200 ft.	66
26	Wire, single conductor of 26 strands of #30 B&S tinned copper S.C.C., rubber covered, 0.130 diameter	50 ft.	67
27	Washer, lead, 1/16" x 1", for 3/8" bolt.	6 ea.	64
28	Washer, lock - for 5/8" bolts.	4 ea.	See Note B
29	Washers for 5/8" bolts.	4 ea.	41
30	Nuts for 5/8" bolts.	4 ea.	38

Note:

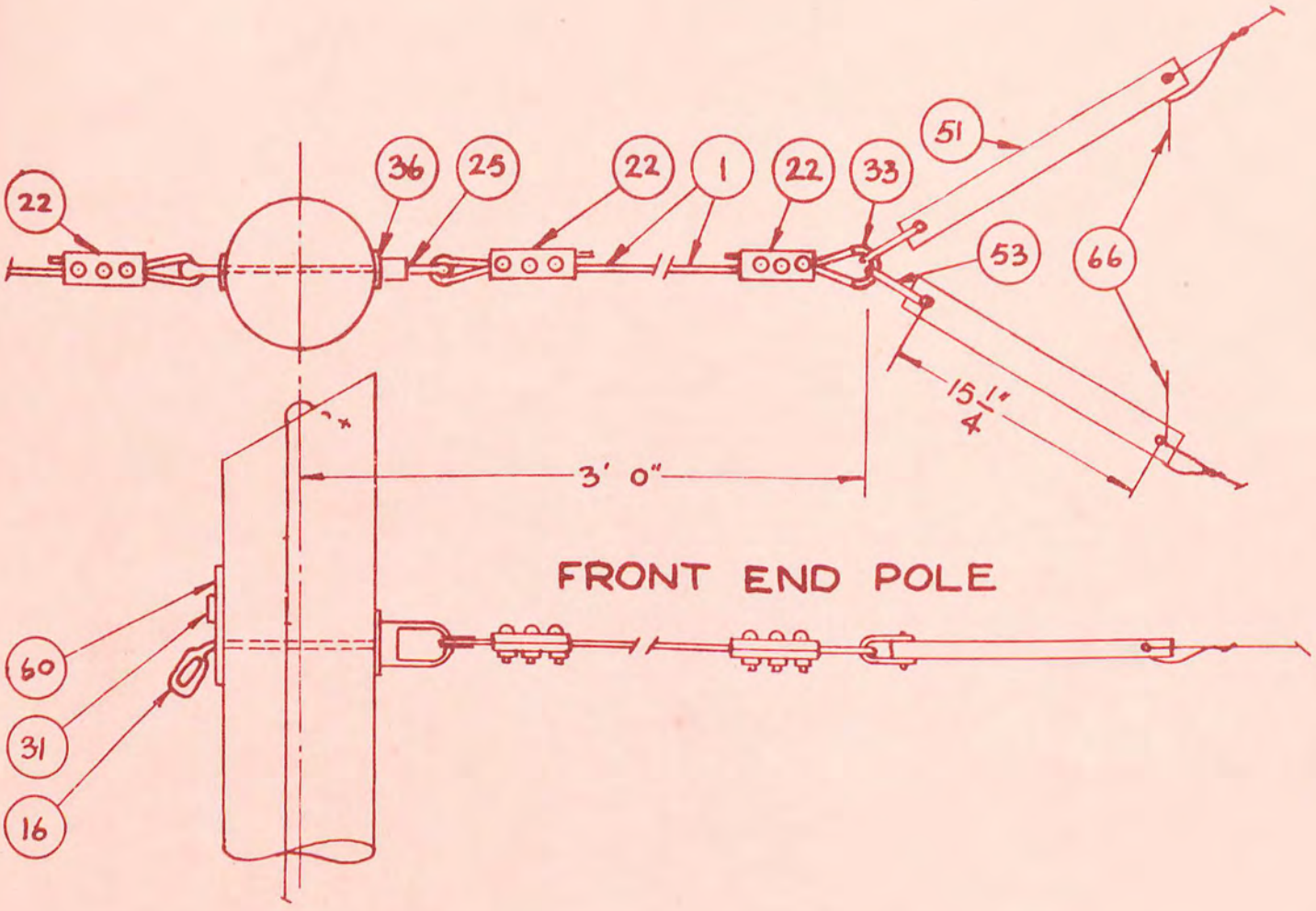
A Item 16 not specifically indicated
B Item 28 " " "



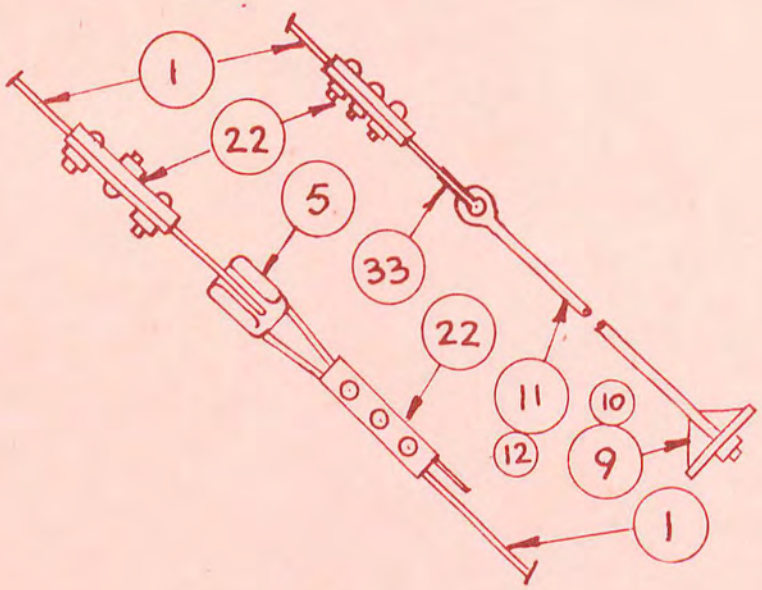
ISOMETRIC



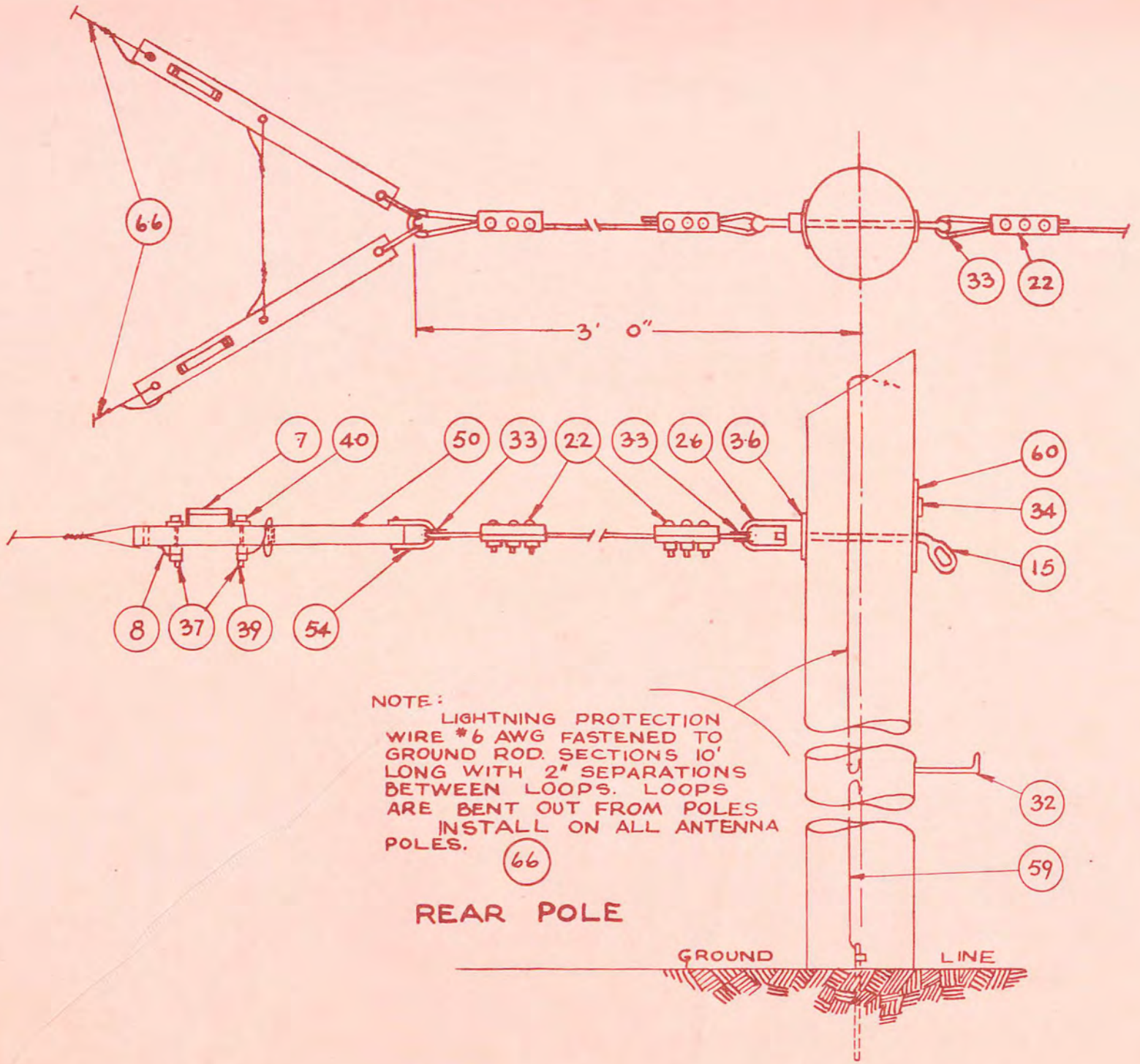
PLAN



FRONT END POLE



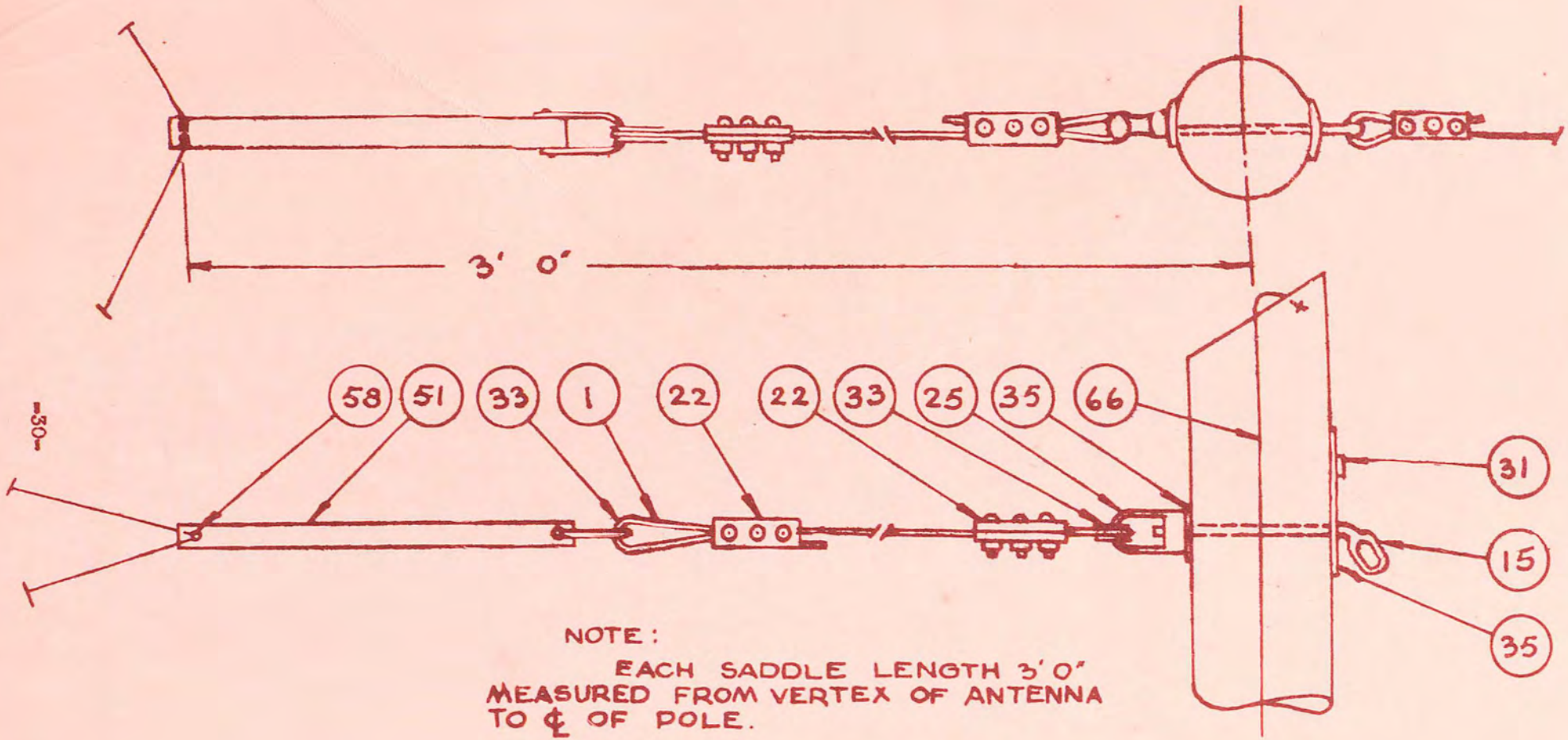
ANCHOR DETAIL



NOTE:
LIGHTNING PROTECTION WIRE #6 AWG FASTENED TO GROUND ROD. SECTIONS 10' LONG WITH 2" SEPARATIONS BETWEEN LOOPS. LOOPS ARE BENT OUT FROM POLES INSTALL ON ALL ANTENNA POLES.

66

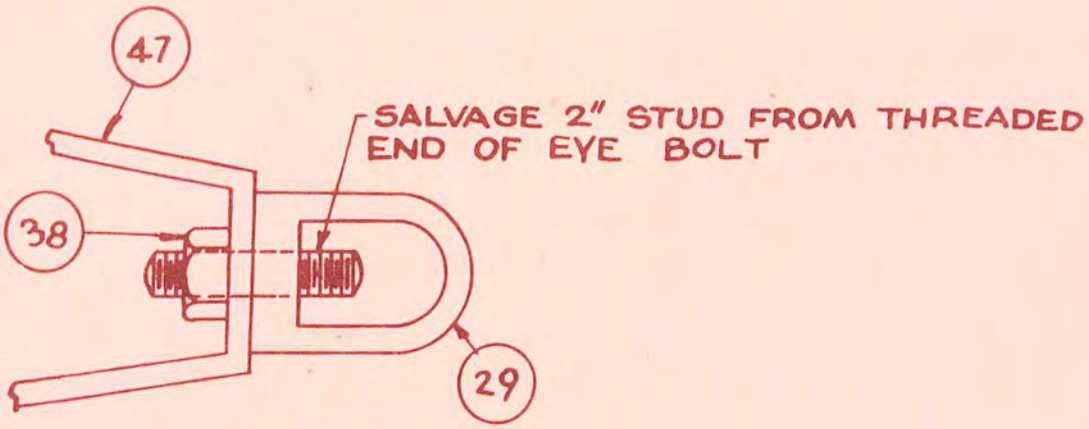
REAR POLE



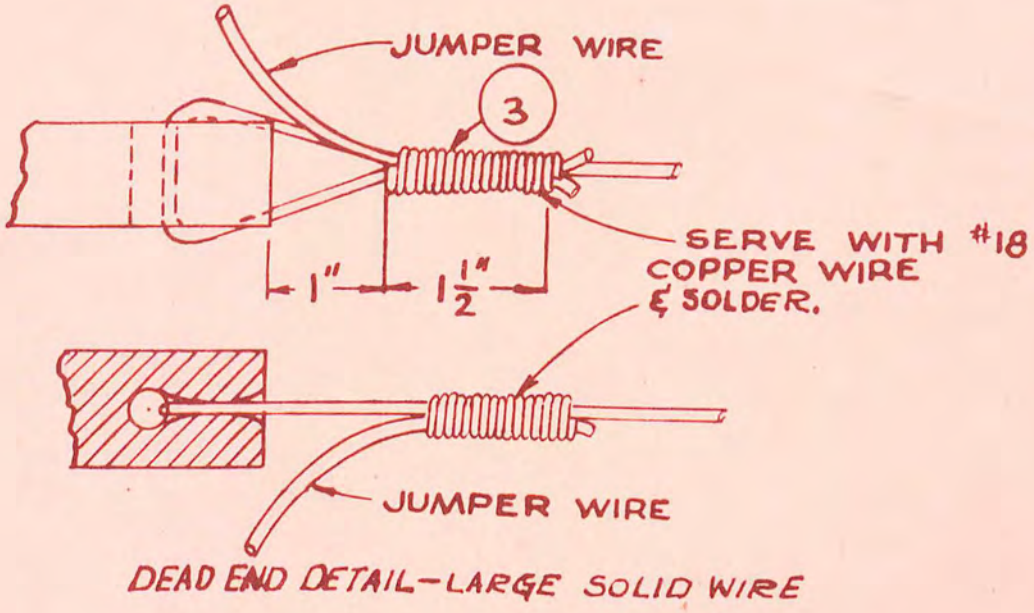
NOTE:

EACH SADDLE LENGTH 3' 0" MEASURED FROM VERTEX OF ANTENNA TO ℄ OF POLE.

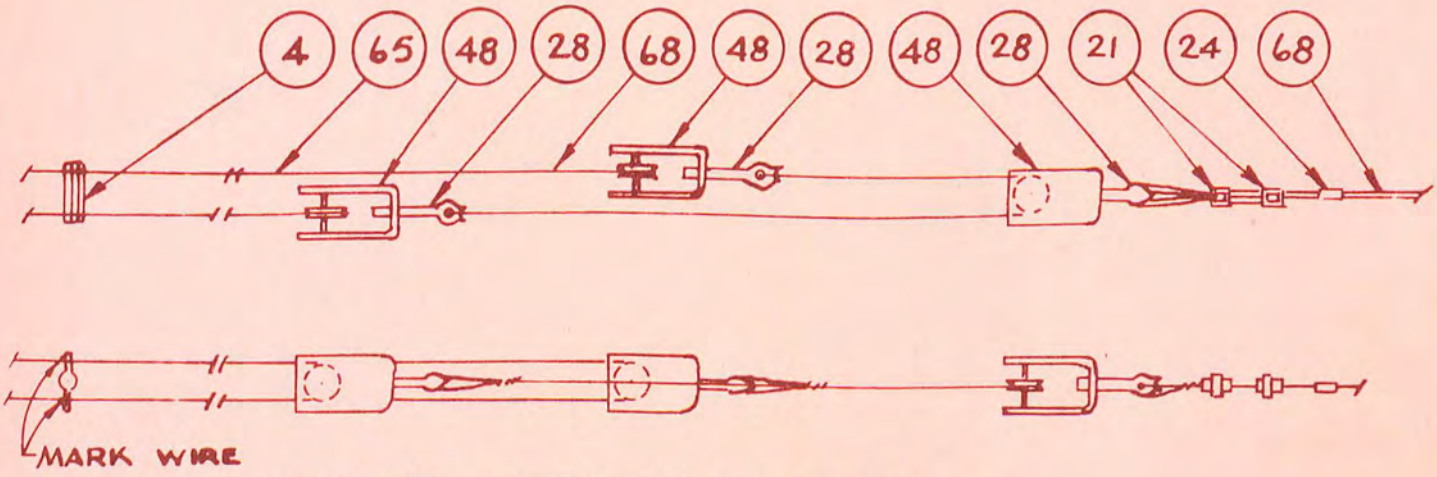
SIDE POLE



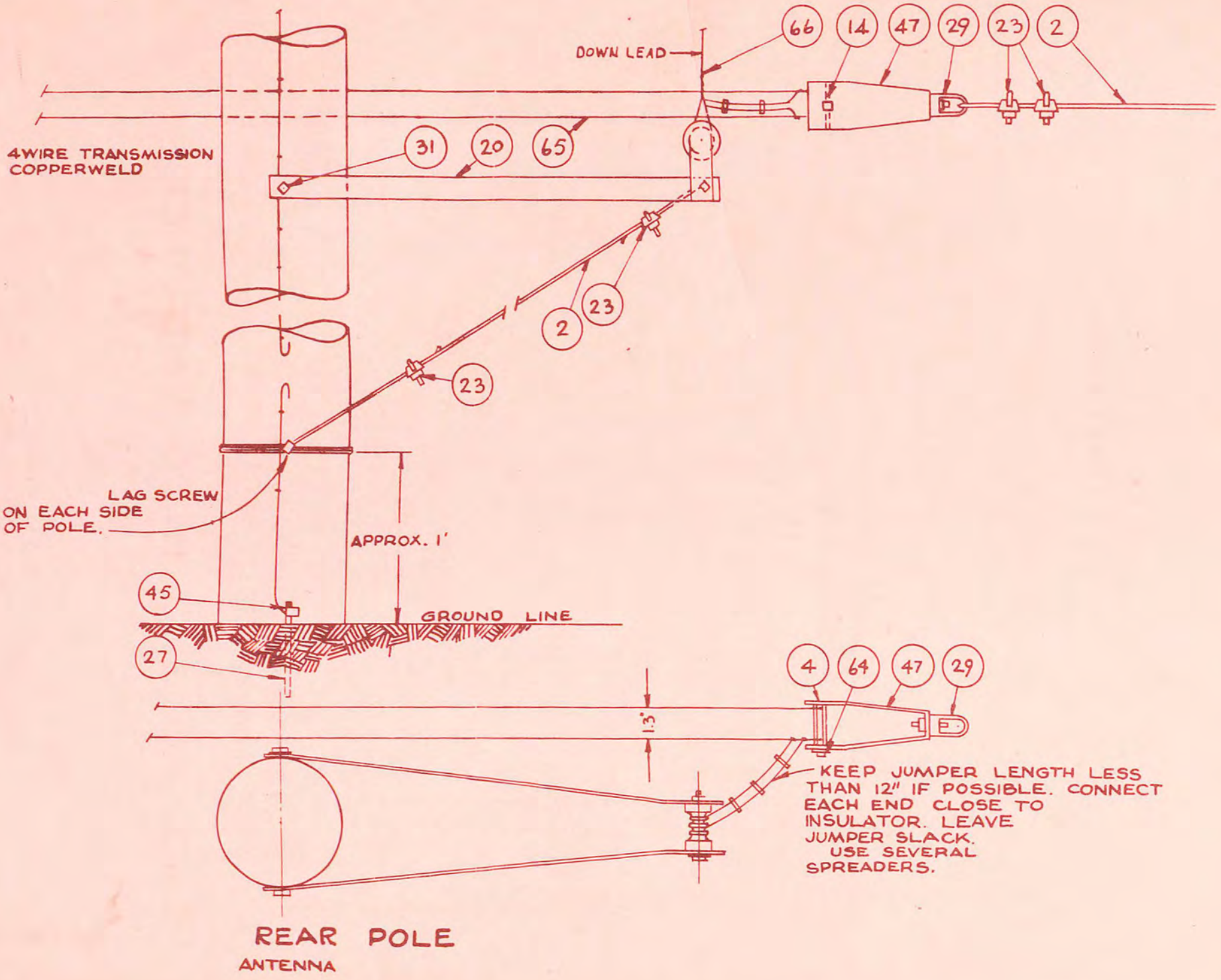
STUD DETAIL

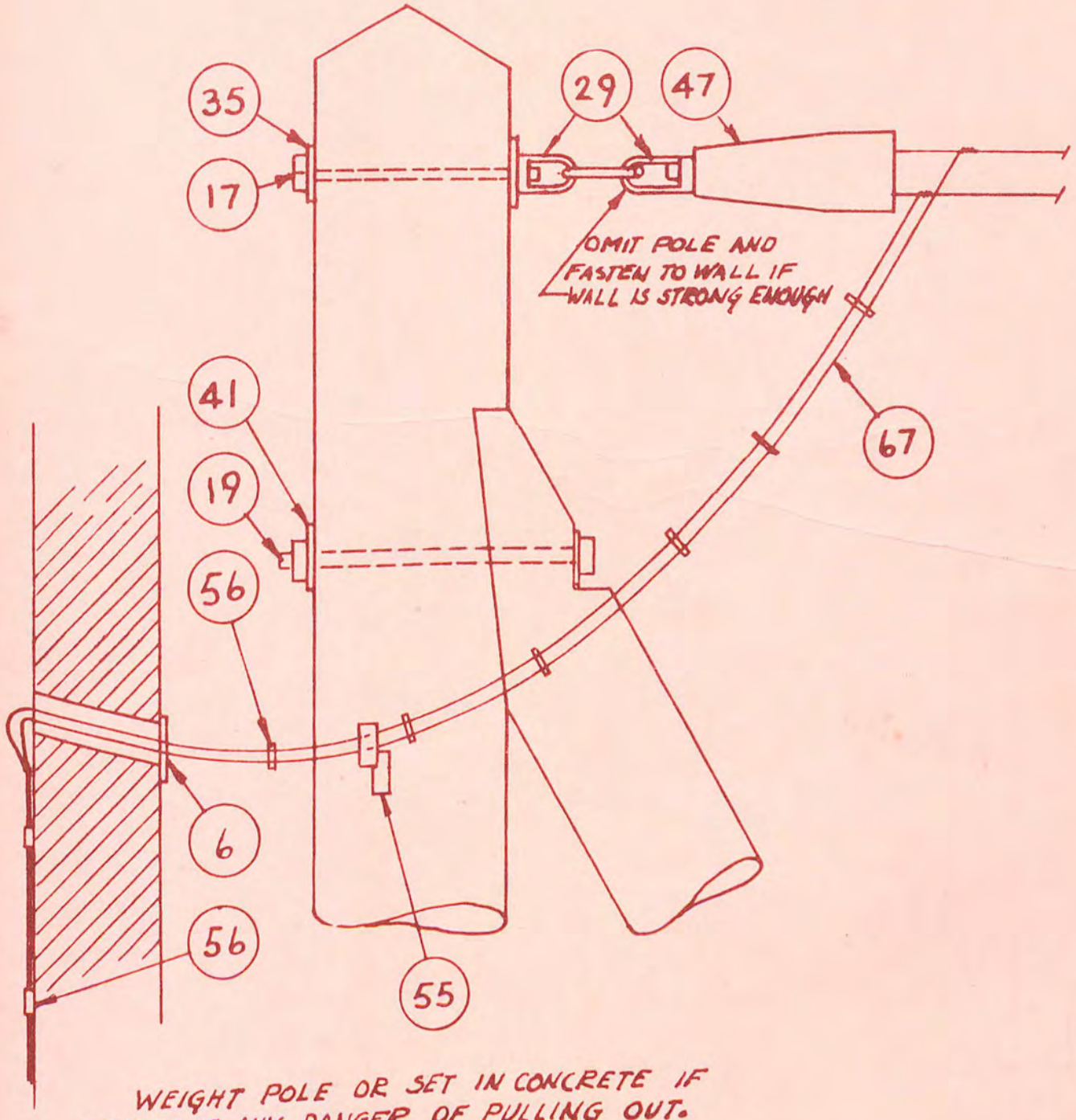


DEAD END DETAIL-LARGE SOLID WIRE



TEMP. TENSION RIGGING

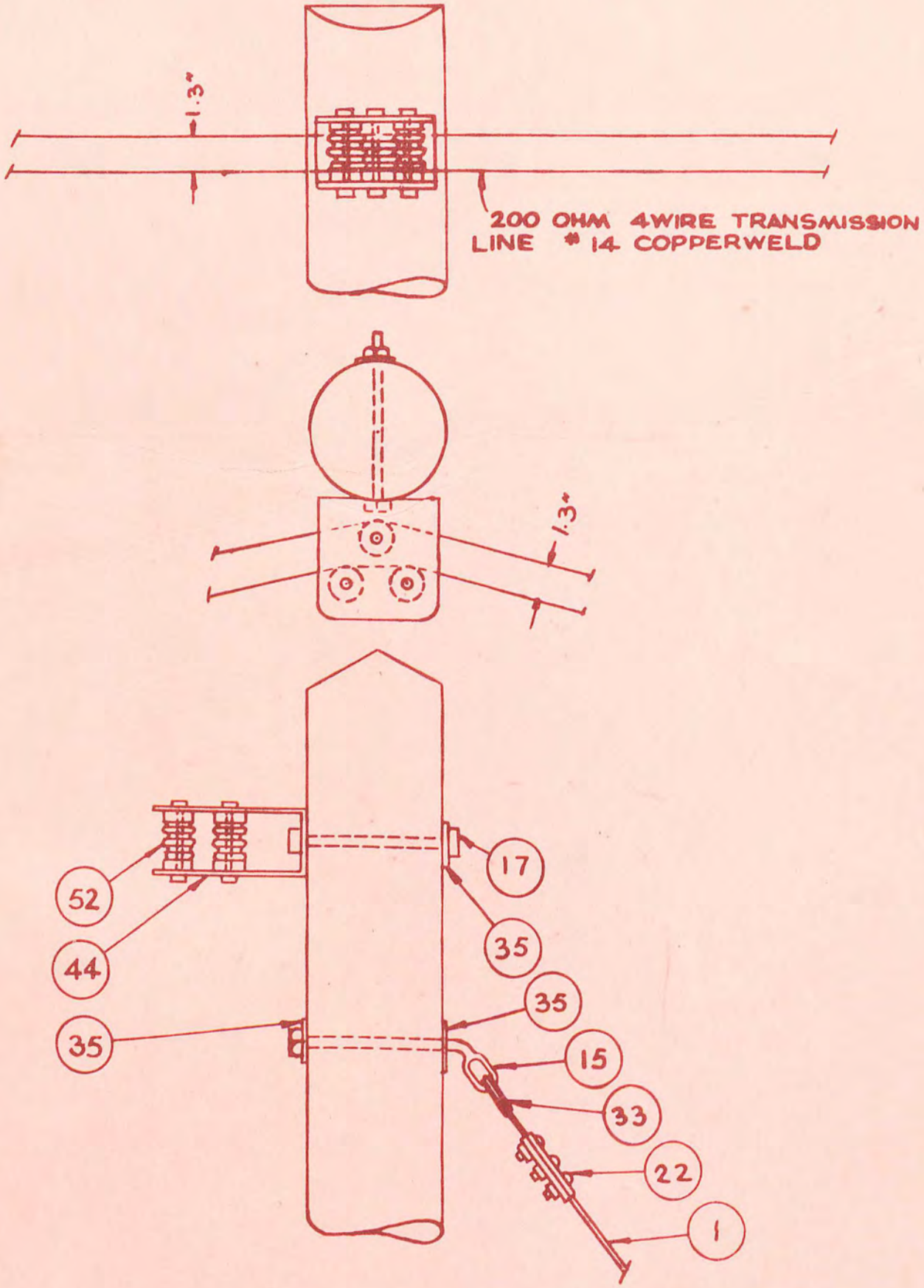

DOWN LEAD
66
14
47
29
23
2
4WIRE TRANSMISSION COPPERWELD
31
20
65
2
23
23
LAG SCREW ON EACH SIDE OF POLE.
APPROX. 1'
45
GROUND LINE
27
4
64
47
29
13"
KEEP JUMPER LENGTH LESS THAN 12" IF POSSIBLE. CONNECT EACH END CLOSE TO INSULATOR. LEAVE JUMPER SLACK. USE SEVERAL SPREADERS.
REAR POLE
ANTENNA



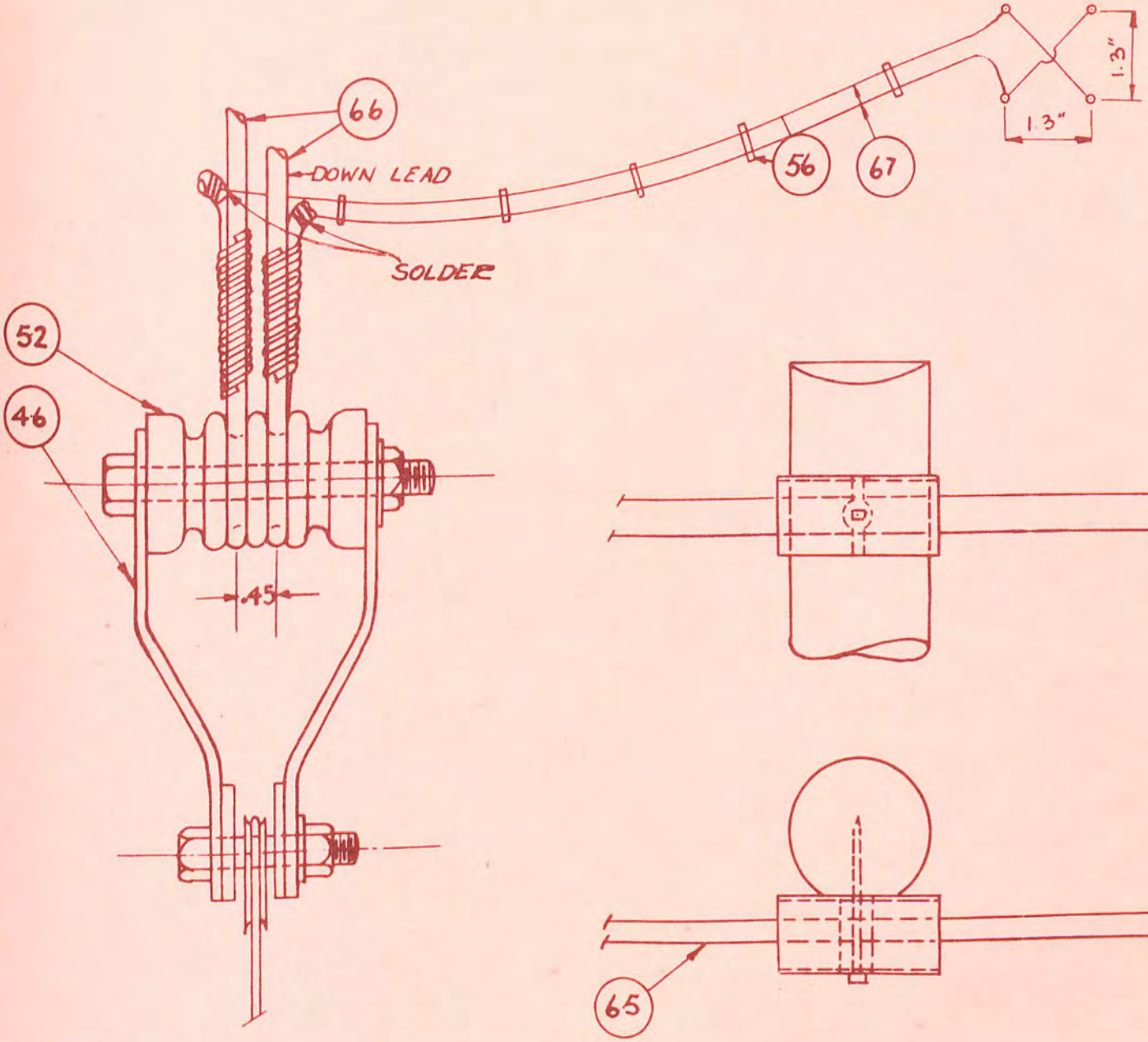
END POLE & BLDG. ENTRANCE

TRANSMISSION LINE

NOTE:
EACH TRANSMISSION LINE KIT
IS FOR A 500' LINE.



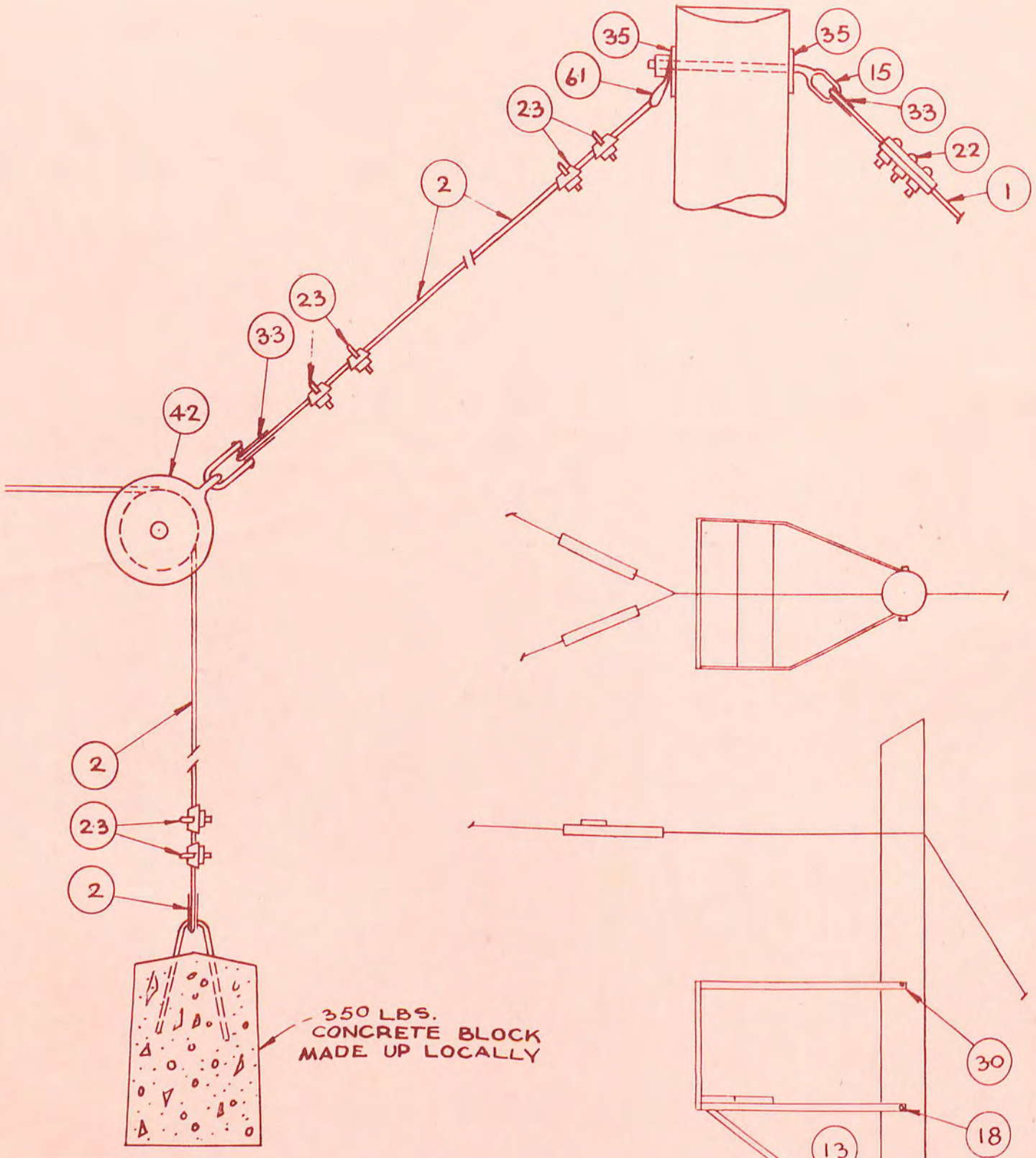
TURN POLE
TRANSMISSION LINE



INSULATOR ARRANGEMENT DETAIL

STRAIGHT LINE POLE

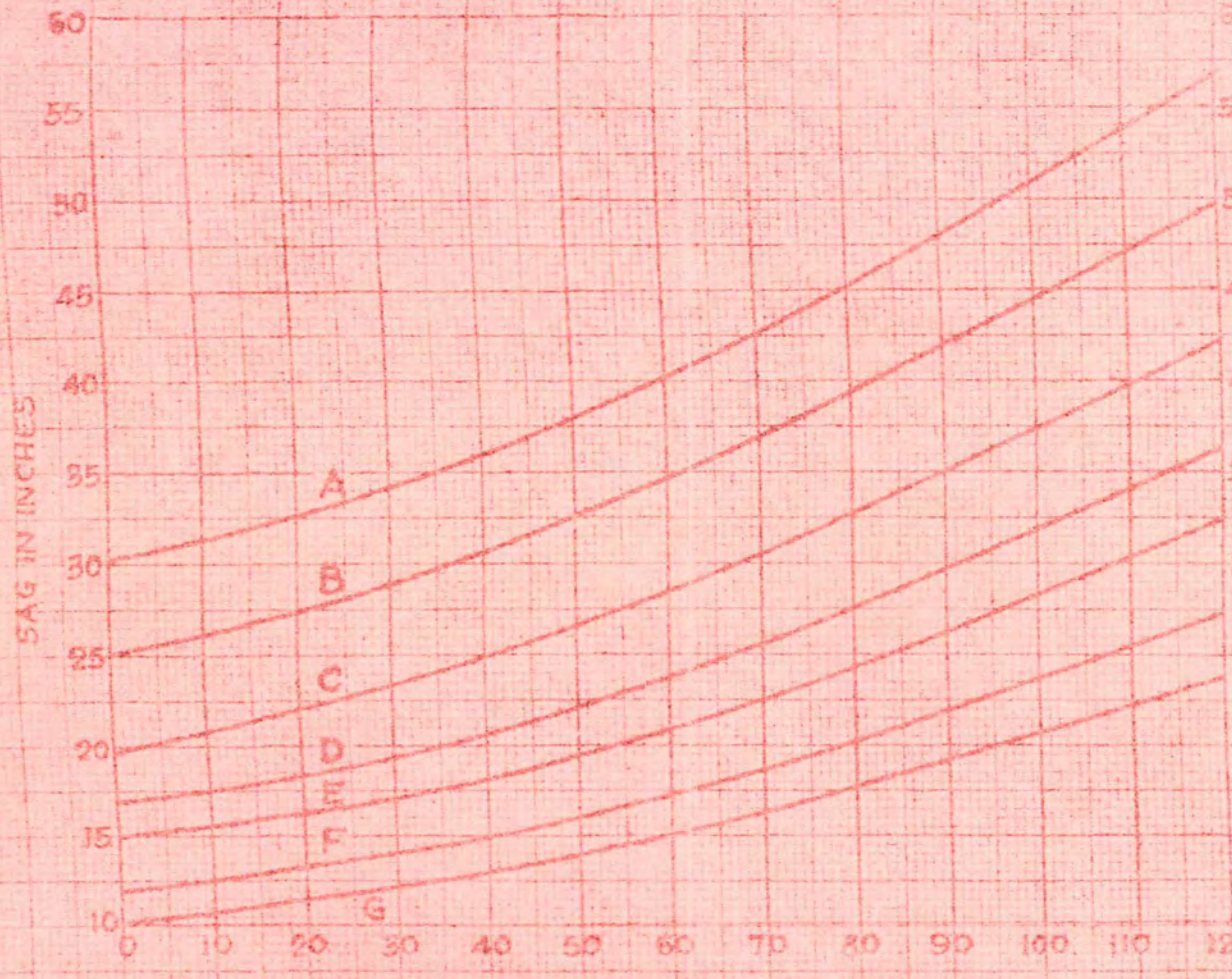
TRANSMISSION LINE



COUNTER WEIGHT
ARRANGEMENT

BALCONY
ON FRONT END POLE

SAG CHART - RHOMBIC ANTENNA CURTAINS, #16-2 (#6 AWG) COPPERWELD High Strength, 40% Conductance



ANTENNA	SPAN
A	375'
B	350'
C	315'
D	290'
E	270'
F	245'
G	225'

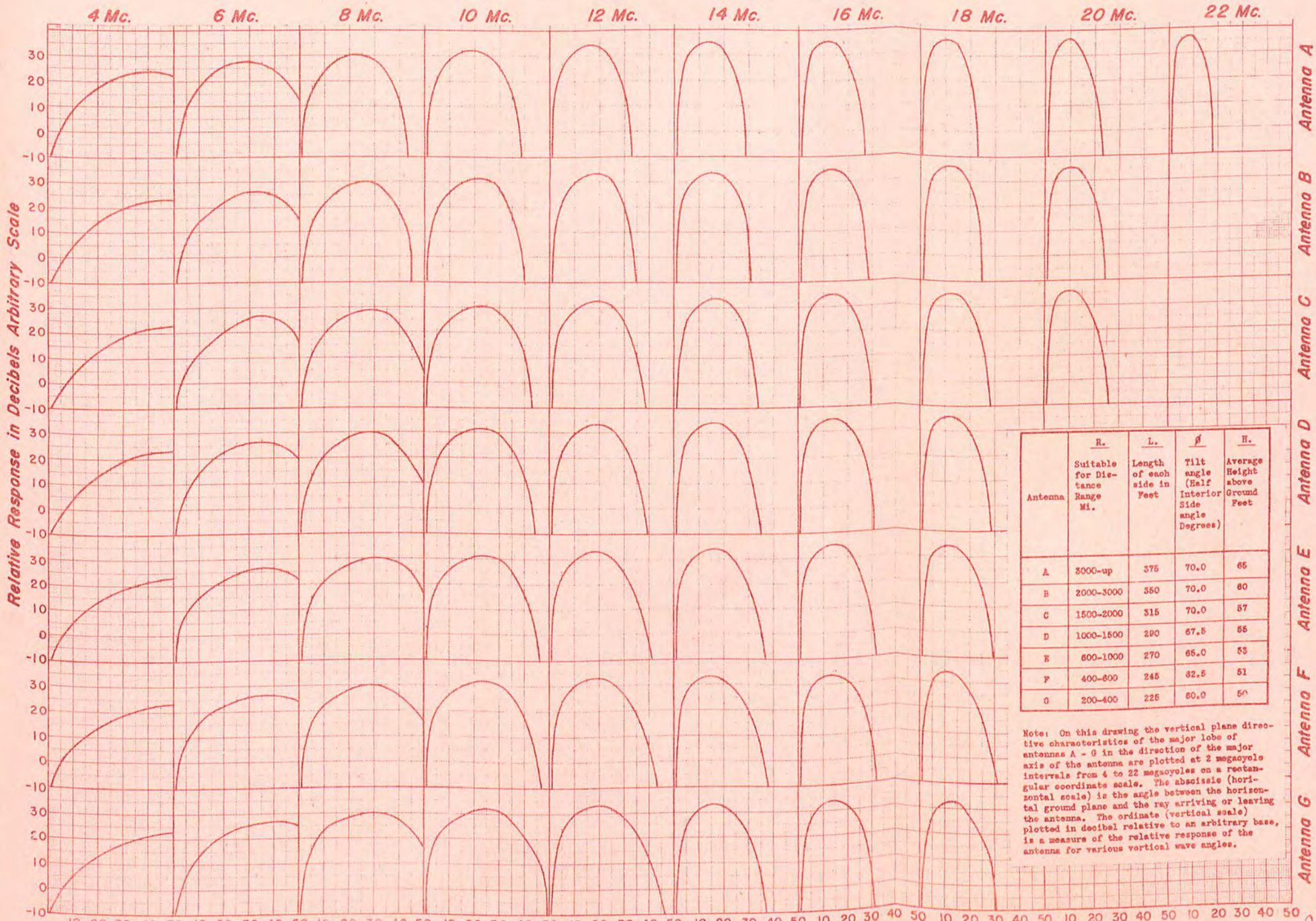
7-2-45

Sags based on a stringing tension of 380 lbs. at 60° F.

SK-237-A

O.C.Sig.O., U.S. ARMY
PLANT DIV.

COMPUTED VERTICAL PLANE DIRECTIVE CHARACTERISTICS OF RHOMBIC ANTENNAS DESIGNED FOR OPERATION FOR VARIOUS DISTANCE RANGES AT 4, 6, 8, 10, 12, 14, 16, 18, 20, & 22 MEGACYCLES



Antenna	R. Suitable for Distance Range Mi.	L. Length of each side in Feet	∅ Tilt angle (Half Interior Side angle Degrees)	H. Average Height above Ground Feet
A	3000-up	375	70.0	65
B	2000-3000	350	70.0	60
C	1500-2000	315	70.0	57
D	1000-1500	290	67.5	55
E	600-1000	270	65.0	53
F	400-600	245	62.5	51
G	200-400	225	60.0	50

Note: On this drawing the vertical plane directive characteristics of the major lobe of antennas A - G in the direction of the major axis of the antenna are plotted at 2 megacycle intervals from 4 to 22 megacycles on a rectangular coordinate scale. The abscissa (horizontal scale) is the angle between the horizontal ground plane and the ray arriving or leaving the antenna. The ordinate (vertical scale) plotted in decibel relative to an arbitrary base, is a measure of the relative response of the antenna for various vertical wave angles.

SK-235-C

O.C. Sig. O., U.S. Army - Mont Dir 5-8-42

PL 295