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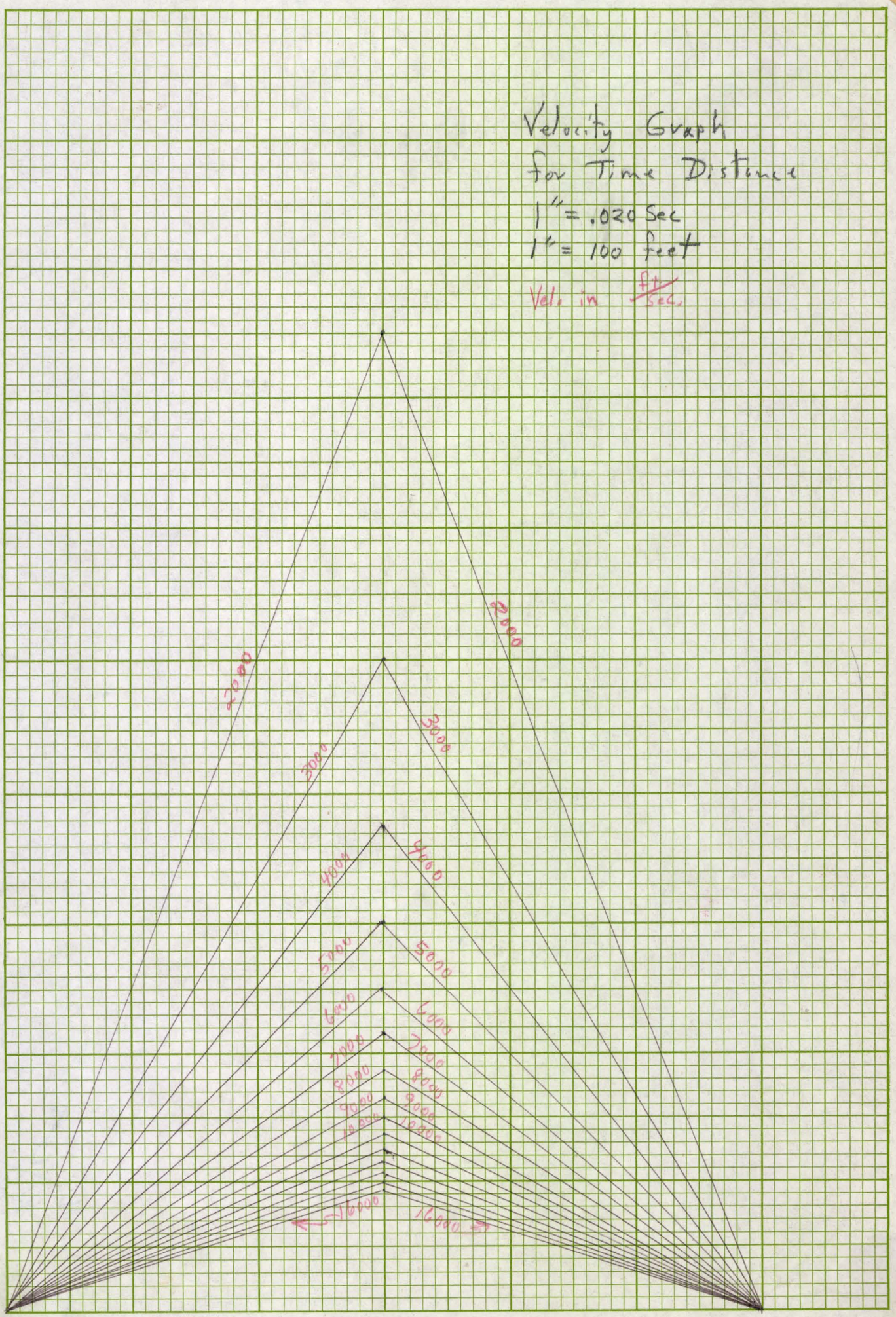

Test Hole A-14 · Location: 4+04 N 8+15 E 11/6/69 · Vertical Hole · Elevation of Collar: 2160 flat · Drilled: 2-18-56 to 2-27-56

Sample	$CaCO_3$	$MgCO_3$	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Loss	Total	Log
0-66'	44.2	0.8	39.60	7.82	1.82	26.43	1.09	20.75	97.51	Caliche conglomerate overburden.
66-90'	77.8	1.0	16.42	1.58	0.72	44.28	1.54	35.37	99.91	Light blue-grey ls. Very broken. 1st 10' has appearance of having gone through boulders. 81-90' very broken by talcy seams. contains greenish grey talcy material 81-84'.
90-108'	75.0	1.2	18.06	2.15	0.93	41.94	1.50	35.08	99.66	Light grey ls with numerous calcite veinlets. Quite broken with talcy seams.
108-139'	67.6	0.8	24.16	3.01	1.31	37.81	2.10	30.99	99.38	Grades to grey-green talcy material, then to Dolomitic ls. Numerous calcite veinlets. 108-118' very broken talc (20% recovery).
139-175'	64.6	0.8	24.28	3.75	1.27	37.58	2.51	30.44	99.83	Light blue-gey ls grading to brownish-grey shaley ls at 148'. Then back to blue-grey ls at 153'. At 162' grades back to brownish-grey shaley ls. 167-175' very broken loose brownish-grey shaley ls.
175-205'	84.2	0.8	10.00	1.39	0.51	47.36	1.88	38.57	99.71	Light blue-grey ls striated with calcite veinlets. Very broken at 185-190' by talcy seams. Ends in blue-grey ls.

	Na_2O	K_2O
0-66'	1.48	2.96
66-205'	0.05	0.44

Test Hole A-13 Location: 2+015, 15700E 60° Dip to N 78° W Elevation of Collar: 2170 feet Drilled: 2-8-56 to 2-17-56

Sample	$CaCO_3$	$MgCO_3$	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Loss	Total	Log
0-101'	48.0	0.7	37.80	6.96	1.60	27.87	3.42	21.89	99.54	Caliche conglomerate overburden.
101-157'	78.4	1.2	16.50	1.45	0.57	44.63	1.24	35.39	99.78	Light blue-grey ls. Heavily striated with calcite veinlets. Has pink color at 125'. Quite broken by shaley seams at 140'. Shaley seam at 151' shows 20° dip.
157-173'	27.4	1.0	60.66	5.72	1.08	15.60	2.01	13.67	98.74	Ls quite broken with shaley seams at 157' than changes to brownish-red shalry ls with calcite striations.
173-192'	75.0	1.0	18.78	1.93	0.96	41.96	2.22	34.00	99.85	Light blue-grey ls with numerous heavy calcite veins. 187-193' very broken by shaley seams.
192-219'	66.4	1.2	24.82	2.82	1.64	38.17	2.22	30.55	100.22	light blue-grey ls. Grades to brownish shaley ls at 199', then back to blue-greyls. Grades to yellowish-brown shaley ls at 212'.
219-239'	83.8	0.8	11.35	1.86	0.72	46.28	1.76	37.68	99.65	Light blue-grey ls heavily striated with calcite veins.
239-244'										This hole was cemented ~~it~~ for 52' above the 85' level. No cement was used for the remainder of this hole. Still, the last 5' of the hole was hydrated cement.

	Na_2O	K_2O
0-101'	1.56	1.92
101-157'	0.04	0.24
157-173'	0.04	0.91
173-239'	0.12	0.37

Form 122 E159 DIAMOND DRILL LOG Page No. 1

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-49	Started	10-1-59
Coordinates	1207S - & 548E	Finished	10-6-59
Elevation of Collar	~~2180~~ 2161.26	Core Size: NX	0' - 4'
Depth 150'6" Dip 90°	Direction Vertical	BX	4' - 10'
Driller V. Holcomb	Recorder D. Zimmerman	AX	10' - 150'6"

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
0'	20'	20'	14'	70	Dark greyish-black, dense to fine crystalline dolomitic(?) and or siliceous(?) limestone. Heavily reticulated with thin white calcite veinlets. An occasional buff to red shaley streak or inclusion.

S/R	3.9	SiO_2	4.26
$MgCO_3$	20.2	Al_2O_3	0.60
$CaCO_3$	70.6	Fe_2O_3	0.49
Total		CaO	39.27
		MgO	13.72
		Loss	41.87
		Na_2O	0.19
		K_2O	0.04
		Total	100.44

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
20'	41'	21'	20'	99.2	Generally the same as above but with occasional ± 6" large crystalline white calcite seams and areas of lighter grey fine crystalline limestone.

S/R	6.1	SiO_2	5.12
$MgCO_3$	12.6	Al_2O_3	0.45
$CaCO_3$	78.8	Fe_2O_3	0.38
Total		CaO	41.39
		MgO	10.34
		Loss	41.97
		Na_2O	0.32
		K_2O	0.06
		Total	100.03

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
41'	60'	19'	19'	100	Light grey fine to medium crystalline limestone. Occasional ± 4" large crystalline white calcite veinlets and ± 1/4" red to yellow shale seams.

S/R	0.58	SiO_2	0.67
$MgCO_3$	93.4	Al_2O_3	0.95
$CaCO_3$	4.42	Fe_2O_3	0.21
Total		CaO	51.20
		MgO	3.40
		Loss	43.39
		Na_2O	0.13
		K_2O	0.05
		Total	100.00

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
60'	80'	20'	15'	75'	Dark greyish-black fine crystalline dolomitic limestone, grading into a lighter grey shaley limestone at 79' to 80'. Core is badly broken.

S/R	3.8	SiO_2	3.07
$MgCO_3$	21.7	Al_2O_3	0.42
$CaCO_3$	72.8	Fe_2O_3	0.39
		CaO	34.32
		MgO	18.21
		Loss	43.76
		Na_2O	0.54
		K_2O	0.05
Total		Total	100.76

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
80'	103'	23'	23'	100	Light and dark grey dense and fine crystalline very dolomitic limestone. Light grey areas are generally shaley. A few ± 3" large crystalline calcite filled vugs and seams and many very thin white calcite veinlets.

S/R	3.2	SiO_2	2.46
$MgCO_3$	30.6	Al_2O_3	0.24
$CaCO_3$	63.0	Fe_2O_3	0.52
		CaO	35.61
		MgO	16.84
		Loss	44.69
		Na_2O	0.32
		K_2O	0.05
Total		Total	100.73

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
103'	127'	24'	24'	100	Light to medium grey fine crystalline dolomitic limestone. Many very thin white calcite veinlets. A few ± 10" shaley zones.

S/R	4.7	SiO_2	4.87
$MgCO_3$	30.9	Al_2O_3	0.50
$CaCO_3$	59.4	Fe_2O_3	0.54
		CaO	33.14
		MgO	18.37
		Loss	42.95
		Na2O	0.34
		K_2O	0.05
Total		Total	100.76

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
127'	150'6"	23'6"	19'	92	Light grey dense and fine crystalline limestone. A few thin shaley seams and large crystalline white calcite veins and veinlets. Core badly broken. Some of the limestone may be slightly dolomitic.

S/R	1.1	SiO_2	1.09
$MgCO_3$	14.4	Al_2O_3	0.62
$CaCO_3$	81.0	Fe_2O_3	0.41
		CaO	44.55
		MgO	8.22
		Loss	43.26
		Na_2O	0.22
		K_2O	0.06
Total		Total	98.43

89.5% Overall recovery (No overburden).

Form 122 E159 DIAMOND DRILL LOG Page No. 1

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-51	Started	10-10-59
Coordinates	902-S & 556-E	Finished	10-16-59
Elevation of Collar	2157.59	Core Size: NX	
Depth 150' Dip 90'	Direction Vertical	BX	0' - 10' 17' - 141'
Driller V. Holcomb	Recorder D. Zimmerman	AX	10' - 17' - 141' - 150'

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
0'	17'	17'	5'	29.4	Caliche fanglomerate, containing ± 1 mm to ± 3" shades of grey limestone and dolomitic limestone(?) clasts. Most of the soft cream colored caliche matrix was lost.

S/R	10.7	SiO_2	12.49
$MgCO_3$	4.2	Al_2O_3	0.81
$CaCO_3$	80.2	Fe_2O_3	0.36
		CaO	45.99
		MgO	2.67
		Loss	37.26
		Na_2O	0.10
		K_2O	0.13
Total		Total	99.81

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
17'	50'6"	33'6"	33'	99.6	Mostly very light whitish-grey dense to fine crystalline limestone with occasional gradational zones of slightly darker grey dolomitic limestone. Scattered vugs of ± 1/4" to ± 2" partially filled with white drusy calcite are common as well as thin white calcite veinlets. A few thin scattered shaley seams.

S/R	.90	SiO_2	1.02
$MgCO_3$	2.9	Al_2O_3	0.90
$CaCO_3$	94.6	Fe_2O_3	0.23
		CaO	50.81
		MgO	4.07
		Loss	42.90
		Na_2O	0.05
		K_2O	0.01
Total		Total	99.99

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
50'6"	80'	29'6"	29'	98.4	From 50'6" to 52' orange clayey gouge. From 52' to 80' dark grey to greyish-black dense to fine crystalline very dolomitic limestone. Heavily reticulated with thin white calcite veinlets. Contains a few thin irregular reddish shaley seams.

S/R	3.0	SiO_2	4.40
$MgCO_3$	51.2	Al_2O_3	0.84
$CaCO_3$	31.9	Fe_2O_3	0.65
		CaO	31.70
		MgO	19.15
		Loss	43.55
		Na_2O	0.10
		K_2O	0.05
Total		Total	100.44

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
80'	107'	27'	24'	89.2	Dark grey fine crystalline to amorphous very shaley and probably dolomitic limestone. Frequent ± 2" yellow clayey gouge zones. Limestone is generally siliceous with dissiminated shale as well as having many thin seams of red and yellow shaley material. Thin white calcite veinlets are fairly common.

S/R	4.6	SiO_2	11.39
$MgCO_3$	25.9	Al_2O_3	1.65
$CaCO_3$	50.8	Fe_2O_3	0.84
Total		CaO	29.28
		MgO	17.18
		Loss	39.40
		Na_2O	0.09
		K_2O	0.06
		Total	99.89

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
107'	127'	20'	18'	90	Same as above but with more yellow gougy shale and probably less dolomitic.

		SiO_2	9.76
		Al_2O_3	2.68
		Fe_2O_3	0.92
		CaO	31.53
		MgO	16.04
S/R	2.7	Loss	38.90
$MgCO_3$	57.6	Na_2O	0.33
$CaCO_3$	19.2	K_2O	0.12
Total		Total	100.28

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
127'	150'	23'	17'	74	From 127' to 137' mostly yellowish gougy shale with some limestone and dolomitic limestone. From 137 to 150 dark grey dense to fine crystalline very dolomitic limestone heavily reticulated with white calcite veinlets

		SiO_2	6.41
		Al_2O_3	1.31
		Fe_2O_3	0.63
		CaO	33.23
		MgO	17.45
S/R	3.6	Loss	40.98
$MgCO_3$	17.8	Na_2O	0.33
$CaCO_3$	68.0	K_2O	0.09
Total		Total	100.93

84.1% Overall recovery including overburden.
91.0% Overall recovery excluding overburden.

Form 122 E159 DIAMOND DRILL LOG

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-50	Started	10-7-59
Coordinates	1213-S & 353-E	Finished	10-10-59
Elevation of Collar	~~2180~~ 2160.90	Core Size:	NX 0' - 4'6"
Depth 150'6" Dip 90°	Direction Vertical		BX 4'6" - 10'
Driller V. Holcomb	Recorder D. Zimmerman		AX 10' - 150'6"

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
0'	35'	35'	16'	45.6	Caliche fanglomerate containing ± 1 mm to ± 8" shades of grey limestone and some dolomitic limestone clasts as well as a small amountof shale and chert. Almost all of the porous $CaCO_3$ caliche matrix was lost.

S/R	8.9	SiO_2	12.45
$MgCO_3$	2.9	Al_2O_3	0.87
$CaCO_3$	82.8	Fe_2O_3	0.53
Total		CaO	44.89
		MgO	3.47
		Loss	37.62
		Na_2O	0.10
		K_2O	0.12
		Total	99.96

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
35'	70'	35'	17'	48.7	Same as above.

		SiO_2	13.16
		Al_2O_3	1.02
		Fe_2O_3	0.55
		CaO	45.47
		MgO	2.26
S/R	8.4	Loss	37.33
$MgCO_3$	2.5	Na_2O	0.07
$CaCO_3$	80.6	K_2O	0.19
Total		Total	100.05

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
70'	111'	41'	16' to 18'	41.5	Light and dark grey, dense and fine crystalline limestone and dolomitic limestone with frequent thin shaley seams and inclusions. Core is very badly broken with pieces of over 1/2" to 1" long being rare. Grades into yellow shale at 110' to 111'.

		SiO_2	13.97
		Al_2O_3	0.86
		Fe_2O_3	1.03
		CaO	28.30
		MgO	17.11
S/R	7.4	Loss	39.12
$MgCO_3$	27.2	Na_2O	0.44
$CaCO_3$	53.0	K_2O	0.11
Total		Total	100.94

Form 122 A R160 DIAMOND DRILL LOG Page No. 2

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
111'	135'	24'	17'	71	From 111' to 120' very calcareous soft, yellow, earthy shale. Black dendrite and and thin white calcite veinlets common. From 120' to 135' reddish-tan sandy calcareous shale.

S/R	5.9	SiO_2	31.62
$MgCO_3$	36.2	Al_2O_3	3.94
$CaCO_3$	18.5	Fe_2O_3	1.46
		CaO	19.54
		MgO	14.48
		Loss	28.57
		Na_2O	0.18
		K_2O	0.75
Total		Total	100.54

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
135'	150'6"	15'6"	9'	58	Same as 111' to 120' with a few ± 1/4" inclusions of gypsum(?).

		SiO_2	17.44
		Al_2O_3	4.02
		Fe_2O_3	1.54
		CaO	27.04
		MgO	16.92
S/R	3.1	Loss	32.72
$MgCO_3$	13.9	Na_2O	0.15
$CaCO_3$	47.0	K_2O	0.05
Total		Total	99.88

49.0% Overall recovery including overburden.
53.5% Overall recovery excluding overburden.

Form 122 E159 DIAMOND DRILL LOG

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-24	Started	3/14/59
Coordinates	33 + 70S, 18 + 38W	Finished	3/26/59
Elevation of Collar	2202.2'	Core Size: NX	0' - 11'
Depth 410'6" Dip 30°	Direction S 60° W	BX	11' - 410'6"
Driller V. Holcomb	Recorder D. W. Zimmerman	AX	

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
0'	9'	9'	0'	0	Red clay and caliche, cobble to boulder conglomerate. Large cobbles and boulders being Balsa Quartz. No sample taken.
9'	38'	29'	29'	100	From 9' to 11' pinkish-grey fine crystalline to dense limestone with numerous thin black, brown, yellow and pink calcite veinlets and a few small inclusions of white chert. From 11' to 15' limey pink to greyish-white chert or dacite? May be healed fault zone. Some multicolored fine crystalline limestone as inclusions in "chert". From 15' to 38', faint pinkish-grey to light dark grey, dense and fine crystalline limestone. ±1/8" brownish-black and yellow calcite veinlets are frequent. Some reddish dendrite along fractures(?). No apparent banding or bedding visible, no recognizable chert in this section. A ±6" clay-caliche filled seam at 28° to 28'6". A few very thin reddish shale? seams also in this section. Some sections are faintly glassy and hard, may be high in Mg.

		SiO_2	7.26
		Al_2O_3	0.69
		Fe_2O_3	0.28
		CaO	51.09
S/R	7.5	MgO	0.16
S/A	10.5	Loss	40.11
$MgCO_3$	0.7	Na_2O	0.05
$CaCO_3$	90.2	K_2O	0.20
Total		Total	99.84

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
38'	58'	20'	20'	100	38' to 41' pinkish-grey fine crystalline hard limestone with many 1/8" yellow and black calcite veinlets (dolomitic?). From 41' to 48' pink and pinkish-grey dense and fine crystalline limestone with many red and black shaley seams in irregular wavy bands from ±1/8" to ±6". Several white crystalline calcite filled cavities from 45' to 48' and some brecciation. From 48' to 58' pinkish-grey to grey dense and fine crystalline limestone. ±2' of shaley breccia at 50' to 52'. Core broken from 53' to 57' and consisted of limestone-shale breccia with reddish dendrite along fracture in shaley areas. Many thin black, yellow and brown calcite veinlets in limestone portions. Several ± 1/2" clayey caliche and white calcite crystal filled seams between 50' and 58'.
					S/R 4.0 S/A 5.2 $MgCO_3$ 0.3 $CaCO_3$ 86.8 Total SiO_2 9.10 Al_2O_3 1.74 Fe_2O_3 0.56 CaO 49.23 MgO 0.40 Loss 38.87 Na_2O 0.08 K_2O 0.43 Total 100.41
58'	71'	13'	13'	100	Light grey and pinkish-grey dense and fine crystalline limestone. Some thin reddish shaley seams and yellow and black-ish-brown calcite veinlets abundant. A ±8" cavity at 60' and ± 18" cavity lined with reddish-yellow secondary calcite at 62'. 2' of reddish buff shale at 64'.
					S/R 5.2 S/A 7.5 $MgCO_3$ 0.3 $CaCO_3$ 91.8 Total SiO_2 6.04 Al_2O_3 0.81 Fe_2O_3 0.35 CaO 52.13 MgO 0.35 Loss 39.95 Na_2O 0.02 K_2O 0.19 Total 99.84
71'	86'	15'	15'	100	Pinkish-grey and light grey dense and fine crystalline limestone. Frequent white, yellow and brownish black ±1/8" calcite veinlets. A few reddish and buff-grey shaley areas. Subangular clasts of shale as a breccia(?) or inclusions in limestone may make up 10% of core. No recognizable banding in any core in A-24 as yet. Shale portions are generally noncalcareous. Some reddish and greenish dendrite along irregular fractures and talcy seams.
					S/R 2.3 S/A 2.8 $MgCO_3$ 0.7 $CaCO_3$ 89.2 Total SiO_2 5.89 Al_2O_3 2.13 Fe_2O_3 0.48 CaO 51.27 MgO 0.43 Loss 39.27 Na_2O 0.03 K_2O 0.34 Total 99.84

Form 122 A R160 DIAMOND DRILL LOG

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
86'	110'	24'	24'	100	Blackish-brown with red tints of shale in dull pink and grey limestone. The shale and limestone are either segregation of subangular clasts. The shale and limestone being in roughly equal proportions. Some of the reddish shale is calcareous, the blacker portions noncalcareous. Section is streaked and mottled with several colors of shale and limestone as well as numerous white calcite fossil(?) fragments, none which were definitely identifiable. Yellow, brown and white calcite veinlets in both shale and limestone portions. A ±1' clayey-caliche seam at 103' and 2' broken zone from 108' to 110'.

S/R	4.5	SiO_2	22.14
S/A	6.6	Al_2O_3	3.36
$MgCO_3$	1.5	Fe_2O_3	1.58
$CaCO_3$	67.0	CaO	39.91
		MgO	0.95
		Loss	30.92
		Na_2O	0.05
		K_2O	0.62
Total		Total	99.53

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
110'	127'	17'	17'	100	Light grey and greyish-pink dense to fine crystalline limestone with many yellow and blackish ±1/8" calcite veinlets. Some of the pinker areas are shaley. Broken greenish-buff and reddish shaley zone from 115' to 117'. Some green and reddish dendrite in shaley zones, grading into a mottled brecciated(?) area at 127'.

		SiO_2	9.63
		Al_2O_3	1.33
		Fe_2O_3	0.68
		CaO	48.81
S/R	4.8	MgO	0.68
S/A	7.2	Loss	38.58
$MgCO_3$	0.7	Na_2O	0.07
$CaCO_3$	86.6	K_2O	0.16
Total		Total	99.94

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Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
127'	147'	20'	20'	100	From 127' to 129' shale-limestone breccia with shades of grey, pink, yellow and brown and white ±1/2" subangular clasts of limestone and shale. Black and reddish dendrite along fracture. From 129' to 134' brownish-red-black shale(?) breccia. Some clasts of light grey limestone up to ±4". The dark shaley portions may be as altered shale or ignious in origin. The area from 127' to about 137' is probably a fault zone. From 134' to 147' black and red shales and dense to fine crystalline pinkish-grey limestone. The limestone-shale combination gives the core a marbled or mottled appearance. Some of the dense limestone is very hard and effervesces very weakly in HCl. Dolomitic(?)

S/R	3.8	SiO_2	24.76
S/A	5.6	Al_2O_3	4.39
$MgCO_3$	1.0	Fe_2O_3	2.05
$CaCO_3$	64.4	CaO	37.89
		MgO	0.99
		Loss	29.91
		Na_2O	0.08
		K_2O	0.83
Total		Total	100.90

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
147'	172'	25'	25'	100	Various shades of grey and greyish-pink dense and fine crystalline limestone. A few white and yellow ±1/8" calcite veinlets and thin irregular shaley seams and inclusions. Shaley areas are generally shades of brownish-red and greyish-green. ±8" clayey-caliche seam at 169'. Some black and reddish dendrite in shaley seams. No banding or bedding apparent.

S/R	5.4	SiO_2	8.69
S/A	9.2	Al_2O_3	0.95
$MgCO_3$	0.8	Fe_2O_3	0.67
$CaCO_3$	87.8	CaO	49.56
		MgO	0.69
		Loss	39.06
		Na_2O	0.03
		K_2O	0.08
Total		Total	99.73

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
172'	196'	24'	24'	100	172' to 182' shades of grey and greyish-pink dense and fine crystalline limestone. Irregular banding in ±1/4" to 1" streaks with reddish and greenish-grey shale. A ±2" pink crystalline calcite filled seam at 179'. Some reddish and black dendrite in shaley zones. From 182' to 192 mostly grey dense limestone with some pink dense limestone and a fewer red and greenish shale streaks. White blackish-brown and yellow ±1/8" calcite veinlets common.

S/R	5.6	SiO_2	19.16
S/A	8.0	Al_2O_3	2.41
$MgCO_3$	1.2	Fe_2O_3	0.99
$CaCO_3$	74.2	CaO	42.15
		MgO	1.23
		Loss	33.65
		Na_2O	0.04
		K_2O	0.31
Total		Total	99.94

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Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
196'	213'	17'	17'	100	From 196' to 198' dense red shale, slightly calcareous with some black dendrite and white calcite veinlets. From 198' to 201', greenish-grey calcareous shale with large mottles of pinkish-grey limestone. White calcite veinlets. From 201' to 213' red and grey shale and grey and pinkish-grey and pink dense and fine crystalline limestone in a streaked mottled mixture. Grey and pink limestone seem to predominate. ±1/4" talcy seam at 210'. ±2" partially filled vugs containing white, pink and brown calcite crystals at 204', 205', 205'6", 211', 212'6" and 213'.

		SiO_2	21.78
		Al_2O_3	3.84
		Fe_2O_3	1.58
		CaO	39.10
S/R	4.0	MgO	1.33
S/A	5.7	Loss	31.35
$MgCO_3$	1.2	Na_2O	0.10
$CaCO_3$	68.0	K_2O	0.62
Total		Total	99.70

213'	231'6"	18'6"	18'6"	100	From 213 to 227'6" various shades of pink, pinkish-grey and grey limestone. Mostly dense and fine crystalline but a small amount of medium crystalline in pinks. White and blackish-brown ±1/8" calcite veinlets common. ±1" cavity(?) at 223' with ±1/2" euhedral calcite rhombohedrons is salmon pink and white. From 227'6" to 230'6" red and greenish-grey shale dendrite. From 230'6" to 231'6" faint pinkish-grey dense limestone.

		SiO_2	19.81
		Al_2O_3	2.80
		Fe_2O_3	1.88
		CaO	41.12
S/R	4.2	MgO	0.91
S/A	7.1	Loss	32.74
$MgCO_3$	0.8	Na_2O	0.07
$CaCO_3$	70.8	K_2O	0.51
Total		Total	99.84

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Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
231'6"	255'	23.5'	23.5'	100	From 236'6" to 239' grey and lavenderish-grey, dense and fine crystalline limestone with some areas lightly mottled with red and greenish-grey shale. Section is reticulated with ±1/16" to ±1/8" white, yellow and brownish-black crystalline calcite veinlets. Core has a bell-like ring when tapped lightly. From 239' to 245' grey and pinkish-grey dense and fine crystalline limestone heavily mottled with red and greenish-grey shale. Abundant fossil fragments present, some which could be brachipodso but generally unidentifiable. Shale and limestone are streaked and splotched together as if the mixing occurred before lithification. White and yellow calcite veinlets present. From 245' to 255' grey and grey-black dense and fine crystalline limestone with occasional red and grey shale blebs. Between 245' and 250' dense black chert nodules from ±1/4" to ±3" are common. Chert is reticulated with very fine white calcite veinlets. This section also rings when struck lightly.
					SiO_2 14.26; Al_2O_3 1.76; Fe_2O_3 0.56; CaO 45.61; MgO 0.99; Loss 36.58; Na_2O 0.04; K_2O 0.30; Total 100.10
					S/R 6.2; S/A 8.1; $MgCO_3$ 1.0; $CaCO_3$ 80.8
255'	282'	27'	26'	96.5	From 255' to 259' greyish-green, green and red dense shale with bright red, yellow and black talcy seams and dendrite along joints. Greenish-grey portions non-calcareous. Red portions slightly calcareous. From 259' to 266' grey and pinkish-grey dense and fine crystalline shaley limestone. Reticulated with ±1/8" white, yellow and brownish-black calcite veinlets some red, green and black dendrite along talcy seams in shaley zones. From 266' to 280' primarily red calcareous shale mottled with greyish-white limestone. Some greenish-grey shale and pinkish-grey fine crystalline limestone. Black dendrite from 280' to 282' red shale grading into pinkish-grey shaley limestone.
					SiO_2 42.90; Al_2O_3 6.41; Fe_2O_3 2.29; CaO 25.20; MgO 2.29; Loss 20.75; Na_2O 0.08; K_2O 1.36; Total 101.28
					S/R 4.9; S/A 6.7; $MgCO_3$ 1.3; $CaCO_3$ 41.8

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Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
282'	303'	21'	21'	100	282' to 393' dense and fine crystalline grey and pinkish-grey shaley limestone. Shale is in greenish-grey and red mottles. Dendrite and red talcy seams in shaley zones. Section reticulated with yellow and white calcite veinlets. 293' to 296' broken zone of mixed greenish-grey and red shale with dendrite and red seams. From 296' to 299' pink fine crystalline limestone heavily reticulated with white, yellow and brownish-black crystalline calcite veinlets. From 299' to 301' brownish-red calcareous shale. From 301' to 303' grey dense limestone with thin shaley seams.
					S/R 4.4 S/A 5.6 $MgCO_3$ 1.0 $CaCO_3$ 63.2 Total
					SiO_2 26.38 Al_2O_3 4.74 Fe_2O_3 1.26 CaO 36.69 MgO 1.93 Loss 29.60 Na_2O 0.08 K_2O 0.83 Total 101.51
303'	308'	5'	5'	100	Brown-reddish-black shale? with many ±1" grey limestone inclusions and thin greenish-grey shale seams. This may be a shale or shaley limestone that has been altered by igneous activity.
					S/R 2.7 S/A 3.9 $MgCO_3$ 1.0 $CaCO_3$ 21.6 Total
					SiO_2 49.90 Al_2O_3 12.94 Fe_2O_3 5.44 CaO 12.87 MgO 1.27 Loss 13.22 Na_2O 0.14 K_2O 3.56 Total 99.34
308'	327'	19'	19'	100	Grey, pink and pinkish-grey, dense and fine crystalline shaley limestone. Grey-green and red shale is in streaks and inclusions. Core heavily reticulated with white, yellow and brownish-black crystalline calcite veinlets. Dendrite and red talcy seams in shaley areas. Contact of 308' was at 46° to core. A ±3" partially filled calcite cavity at 326'. Pink sections of core ring when struck lightly.
					S/R 6.2 S/A 10.4 $MgCO_3$ 1.0 $CaCO_3$ 81.2 Total
					SiO_2 13.19 Al_2O_3 1.27 Fe_2O_3 0.87 CaO 46.94 MgO 0.71 Loss 36.73 Na_2O 0.02 K_2O 0.22 Total 99.95

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Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
327'	351'	24'	24'	100	Shades of grey and pinkish-grey dense and fine crystalline limestone with irregular shaley zones from ±1/8" to ±2". Black dendrite and reddish talcy seams common in shaley zones. A few very small (±1/8") chert inclusions. Section is generally reticulated with white, brownish-black and yellow crystalline calcite veinlets from ±1/16" to ±1/2" wide.
					SiO_2 26.36; Al_2O_3 1.76; Fe_2O_3 1.42; CaO 39.35; MgO 1.03; Loss 30.95; Na_2O 0.02; K_2O 0.53; Total 101.42
					S/R 8.3; S/A 15.0; $MgCO_3$ 1.5; $CaCO_3$ 65.6
351'	375'	24'	24'	100	Same as above but with buff limestone from 365' to 375' otherwise with same features as greys and pinks.
					SiO_2 27.62; Al_2O_3 3.50; Fe_2O_3 1.22; CaO 35.95; MgO 1.24; Loss 28.60; Na_2O 0.02; K_2O 0.34; Total 98.49
					S/R 5.9; S/A 7.9; $MgCO_3$ 1.7; $CaCO_3$ 61.4
375'	397'	22'	22'	100	Same as above but with shaley limestone grading into contact metamorphic zone from 295' to 297' of mixed shale, limestone and granite.
					SiO_2 38.02; Al_2O_3 2.88; Fe_2O_3 1.10; CaO 31.01; MgO 0.51; Loss 24.60; Na_2O 0.01; K_2O 0.62; Total 98.75
					S/R 9.6; S/A 13.2; $MgCO_3$ 1.2; $CaCO_3$ 52.8
397'	410'6"	13'6"	13'	96.3	"Twin Peaks Granite" - Highly altered large crystalline greenish-grey granite. Resembles pinal schist and has gneissic or primary flow structure. Same type granite was fully described in A-20 and A-21.
					SiO_2 65.02; Al_2O_3 16.37; Fe_2O_3 5.59; CaO 2.68; MgO 1.84; Loss 4.46; Na_2O 0.08; K_2O 3.68; Total 99.72
					S/R 3.0; S/A 4.0; $MgCO_3$ 1.0; $CaCO_3$ 3.0
				97.5	overall recovery including overburden.
				99.4	overall recovery excluding overburden.

Form 122 E159 DIAMOND DRILL LOG

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-41	Started	8-15-59
Coordinates	1613-S 047-W	Finished	8-20-59
Elevation of Collar	2165.0 ?	Core Size:	NX -
Depth 151' Dip 90°	Direction Vertical		BX 0' - 11'
Driller V. Holcomb	Recorder D. Zimmerman		AX 11' - 151'

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
					(A-41 collared at bottom of ± 15' deep pit in caliche)
0'	30'	30'	5'	16.6	From 0 to ± 30' cream colored very soft and spongy caliche fanglomerate. Only fragments of ± 1/4" to ± 2" limestone types were recovered. Probably less than 0.5% of the spongy caliche matrix was recovered. The actual cut off of caliche and beginning of solid limestone was difficult to determine exactly but it appeared to be at 30'. However it may have been somewhere between 20' and 30'.
					S/R 11.7; $MgCO_3$ 0.7; $CaCO_3$ 81.2; Total
					SiO_2 14.97; Al_2O_3 0.78; Fe_2O_3 0.50; CaO 46.23; MgO 0.62; Loss 36.46; Na_2O 0.08; K_2O 0.12; Total 99.76
30'	52'	22'	21'	96	Light-grey and grey fine crystalline limestone containing scattered small vugs and cavities or seams (± 1") filled with caliche and some white calcite. A few thin white and brown calcite veinlets (± 1/8"). No banding. A few scattered ± 1" black chert nodules
					S/R 7.2; $MgCO_3$ 0.8; $CaCO_3$ 91.4; Total
					SiO_2 5.61; Al_2O_3 0.50; Fe_2O_3 0.28; CaO 51.88; MgO 0.58; Loss 40.80; Na_2O 0.08; K_2O 0.07; Total 99.80
52'	72'	20'	20'	100	Same as above but containing more frequent dark grey chert nodules from ± 1/4" to ± 3". A ± 1' band of pinkish red fine crystalline limestone at 61' grading back into grey on top and bottom. No regular contacts or banding. A few thin yellow calcite veinlets as well as white and brown.
					S/R 13.9; $MgCO_3$ 1.0; $CaCO_3$ 83.2; Total
					SiO_2 14.60; Al_2O_3 0.60; Fe_2O_3 0.45; CaO 46.68; MgO 1.70; Loss 36.54; Na_2O 0.04; K_2O 0.11; Total 100.72

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Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
72'	92'	20'	20'	100	Light blackish-grey fine crystalline limestone heavily reticulated with ± 1/8" white calcite veinlets. A few small vuggy areas with caliche linings. A few scattered ± 1" nodules of dark grey chert and very thin shaley seams with dendrite. S/R 9.9; $MgCO_3$ 0.7; $CaCO_3$ 87.4; Total. SiO_2 9.92; Al_2O_3 0.50; Fe_2O_3 0.50; CaO 49.26; MgO 0.58; Loss 38.75; Na_2O 0.07; K_2O 0.20; Total 99.78
92'	112'	20'	20'	100	Same as above. S/R 2.1; $MgCO_3$ 0.2; $CaCO_3$ 96.2; Total. SiO_2 2.20; Al_2O_3 0.36; Fe_2O_3 0.15; CaO 54.30; MgO Tr.; Loss 42.68; Na_2O 0.08; K_2O 0.08; Total 99.85
112'	136'	24'	24'	100	Same as above but with more frequent chert nodules some of which are as much as 6" in individual section. Some scattered white chalky seams or cavity filling, and light-grey limestone. S/R 8.5; $MgCO_3$ 2.7; $CaCO_3$ 73.4; Total. SiO_2 19.07; Al_2O_3 0.79; Fe_2O_3 0.34; CaO 42.00; MgO 3.78; Loss 33.75; Na_2O 0.06; K_2O 0.02; Total 99.82
136'	151'	15'	10'	75	Buff and orangish-buff calcareous shale and light grey fine crystalline limestone. Shale is very soft and clayey. Limestone and shale are mixed in a breccia and possibly also interbedded. No clear contacts were apparent. Both shale and limestone were heavily reticulated with white calcite veinlets of ± 1/8". Black dendrite was common in shaley zones. Two ± 1" chert nodules near 137'. S/R 4.2; $MgCO_3$ 3.2; $CaCO_3$ 70.8; Total. SiO_2 13.82; Al_2O_3 1.77; Fe_2O_3 1.49; CaO 40.87; MgO 7.89; Loss 33.45; Na_2O 0.08; K_2O 0.08; Total 99.45
				79.4	Overall recovery including overburden.
				95.0	Overall recovery excluding overburden.

Form 122 E159 DIAMOND DRILL LOG Page No. 1

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-45	Started	9-9-59
Coordinates	1620-S 514-W	Finished	9-12-59
Elevation of Collar	~~2170.4~~ 2147.39	Core Size:	NX 0' - 7'
Depth 153' Dip 90°	Direction Vertical		BX 7' - 10'6"
Driller V. Holcomb	Recorder D.W. Zimmerman		AX 10'6" - 15.3'

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
0'	50'	50'	25'	50	From 0' to 7' limey-sandy soil containing pebbles to boulders of limestone, quartzite, and a few shale types. Less than ± 2% of the cream colored caliche and soil was recovered. (Note: No taped representative sample for this hole was saved. All that was recovered were an assortment of fragments of many rock types in the general area. Virtually all of the caliche cementing material was lost). From 7' to 50' assorted limestone, shale, and quartzite fragments ranging in size from ± 1 mm to ± 6" in length. Probably less than 5% of the caliche cementing material was recovered.

SiO_2	32.02		
Al_2O_3	1.87		
Fe_2O_3	1.09		
CaO	34.05		
MgO	1.82		
S/R	10.8	Loss	27.86
$MgCO_3$	2.2	Na_2O	0.15
$CaCO_3$	60.2	K_2O	0.48
Total		Total	99.34

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
50'	100'	50'	20'	40	Same as 7' to 50' but with a few fragments of andesite.

SiO_2	39.12		
Al_2O_3	2.93		
Fe_2O_3	1.41		
CaO	28.45		
MgO	1.72		
S/R	9.0	Loss	24.08
$MgCO_3$	0.7	Na_2O	0.19
$CaCO_3$	52.0	K2O	0.98
Total		Total	98.88

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
100'	153'	53'	25'	47	Same as 50' to 100' but no andesite fragments were observed. Some of the individual limestone and quartzite clasts showed a core length of ± 11". "Bedrock" was not reached.

SiO_2	35.34		
Al_2O_3	2.22		
Fe_2O_3	1.02		
CaO	32.65		
MgO	1.91		
S/R	10.9	Loss	26.43
$MgCO_3$	1.2	Na_2O	0.12
$CaCO_3$	61.0	K_2O	0.56
Total		Total	100.25

45.6% Overall recovery including overburden
43.6% Overall recovery excluding overburden

Form 122 E159 DIAMOND DRILL LOG Page No. 1

☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☐ APC Co., Rillito, Arizona

Diamond Drill Hole No.	A-44	Started	9-3-59
Coordinates	1621-S 199-W	Finished	9-8-59
Elevation of Collar	~~2180~~ 2157.32	Core Size: NX	0' - 7'
Depth 150' Dip 90°	Direction Vertical	BX	7' - 10'6"
Driller V. Holcomb	Recorder D.W. Zimmerman	AX	10'6" - 150'

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
0'	16'	16'	2'	11.9	(No sample saved). Brown limey soil with some caliche containing fragments of limestone, quartzite, and shale.
					IMPORTANT Interface
16'	66'	50'	25'	50	Spongy cream colored caliche fanglomerate containing ± 1 mm to ± 3" individual clasts of assorted limestones, shales, and quartzites. Only about 8% of the caliche cementing agent was recovered. SiO_2 29.44; Al_2O_3 1.77; Fe_2O_3 1.09; CaO 36.08; MgO 1.63; Loss 29.46; Na_2O 0.10; K_2O 0.63; Total 100.20. S/R 10.3; $MgCO_3$ 1.2; $CaCO_3$ 63.0; Total
66'	116'	50'	32'	64	Same as 16' to 66' with possibly 15% of the caliche cementing agent being recovered. Limestone about 30%, quartzite about 14%, caliche about 14%, shale about 5% of rock types recovered. SiO_2 21.91; Al_2O_3 1.65; Fe_2O_3 1.04; CaO 38.92; MgO 2.70; Loss 32.78; Na_2O 0.15; K_2O 0.45; Total 99.60. S/R 8.1; $MgCO_3$ 4.4; $CaCO_3$ 68.8; Total
					Important interface
116'	135'	19'	19'	100	Light grey mostly dense and some fine crystalline limestone. A few scattered ± 1/16" white and yellow calcite veinlets as well as a few ± 2" caliche filled seams. Several slightly darker ± 1/2" oval calcite inclusions were observed which are probably fossils. SiO_2 0.92; Al_2O_3 0.66; Fe_2O_3 0.27; CaO 53.45; MgO 1.84; Loss 42.69; Na_2O 0.07; K_2O 0.02; Total 99.92. S/R 0.99; $MgCO_3$ 2.5; $CaCO_3$ 92.8; Total

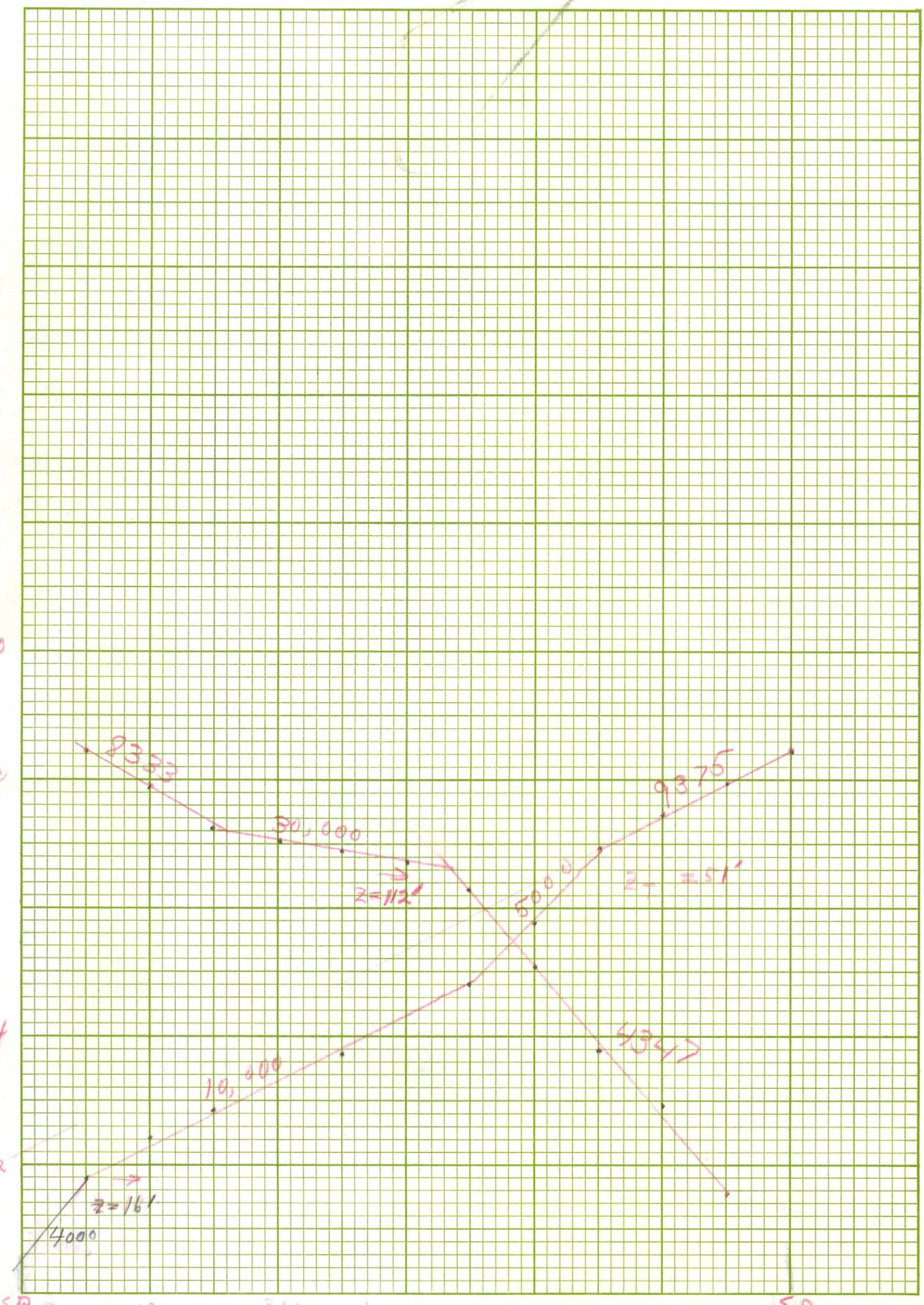
Form 122 A R160 DIAMOND DRILL LOG

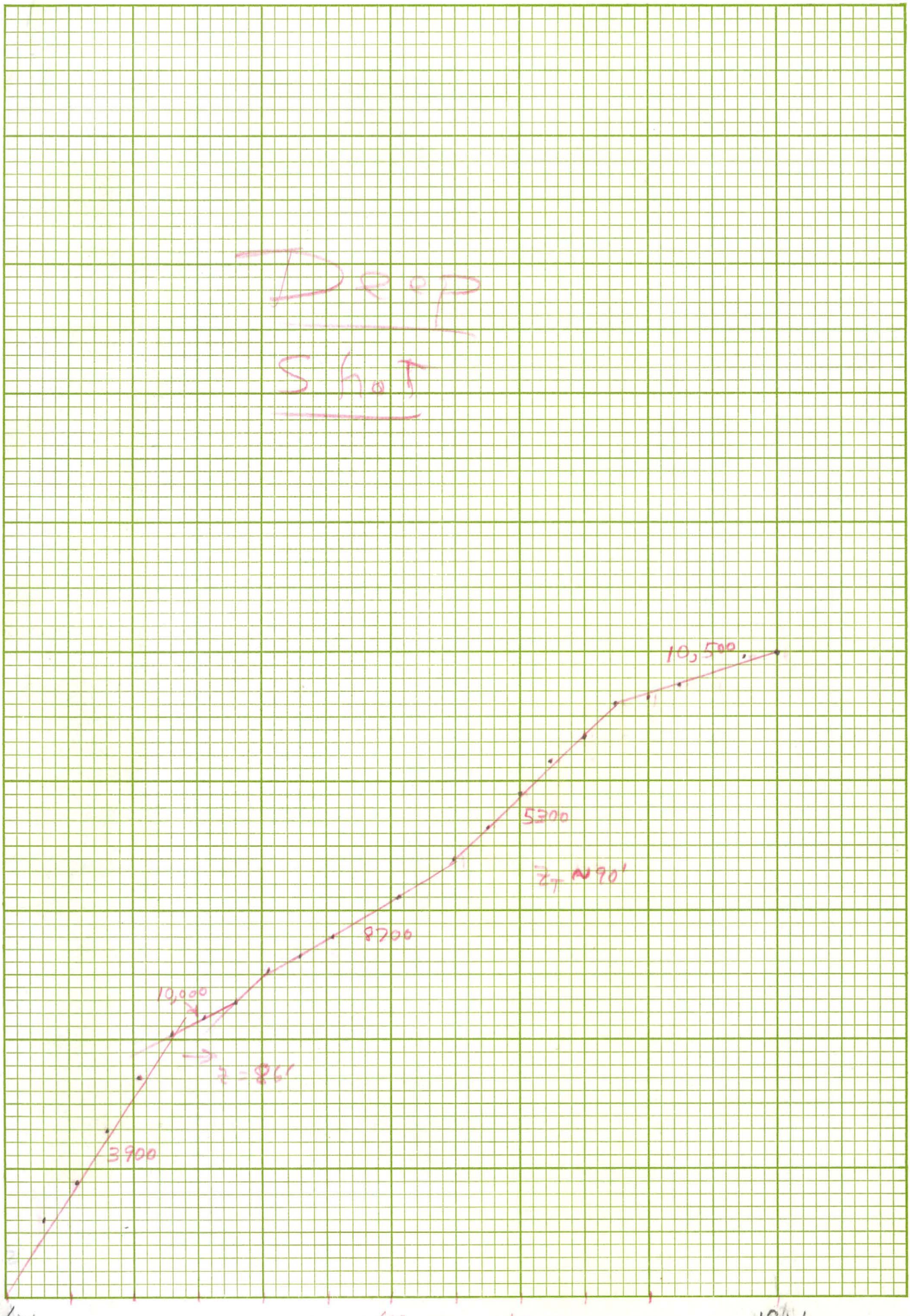
☐ CPC Co., Colton, California ☐ CPC Co., Mojave, California ☒ APC Co., Rillito, Arizona

Footage From	Footage To	Core Feet	Recovery Feet	Recovery %	Description and Analysis
135'	150'	15'	7'	46.6	From 135 to 140' white, brown, and light grey fine and medium crystalline limestone with gougy yellowish buff shale inclusions. This looks like a breccia. From 140' to 142' grey and lavender fine crystalline limestone with thin buff shale seams. From 142' to 150' shades of brown, grey and greyish green calcareous and non-calcareous shale. Badly broken with many soft gougy seams which were for the most part lost.

S/R	2.6	SiO_2	18.44
$MgCO_3$	1.7	Al_2O_3	5.14
$CaCO_3$	67.8	Fe_2O_3	1.84
		CaO	38.38
		MgO	2.78
		Loss	32.25
		Na_2O	0.13
		K_2O	0.98
Total		Total	99.94

53.3% Overall recovery including overburden
76.5% Overall recovery excluding overburden



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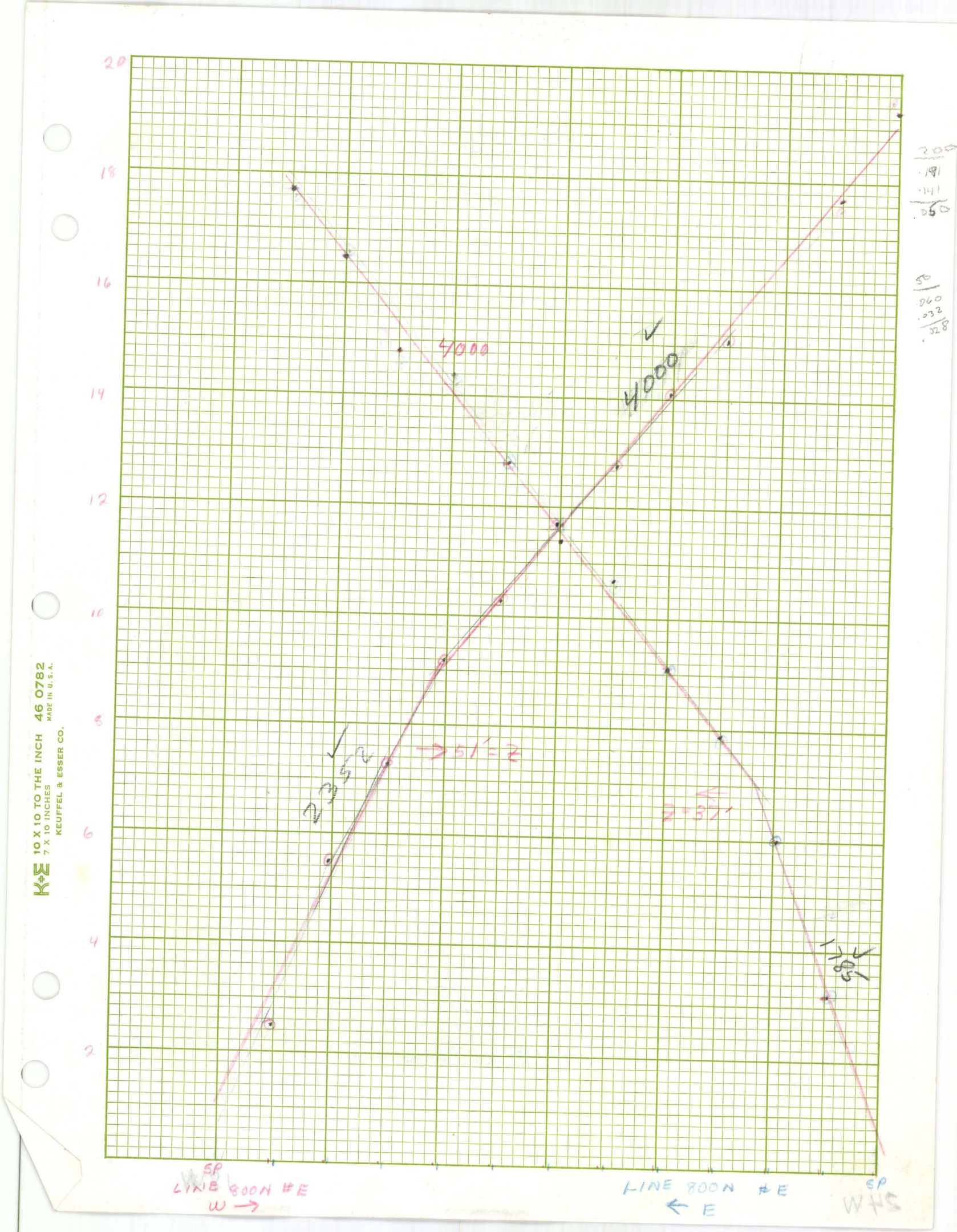

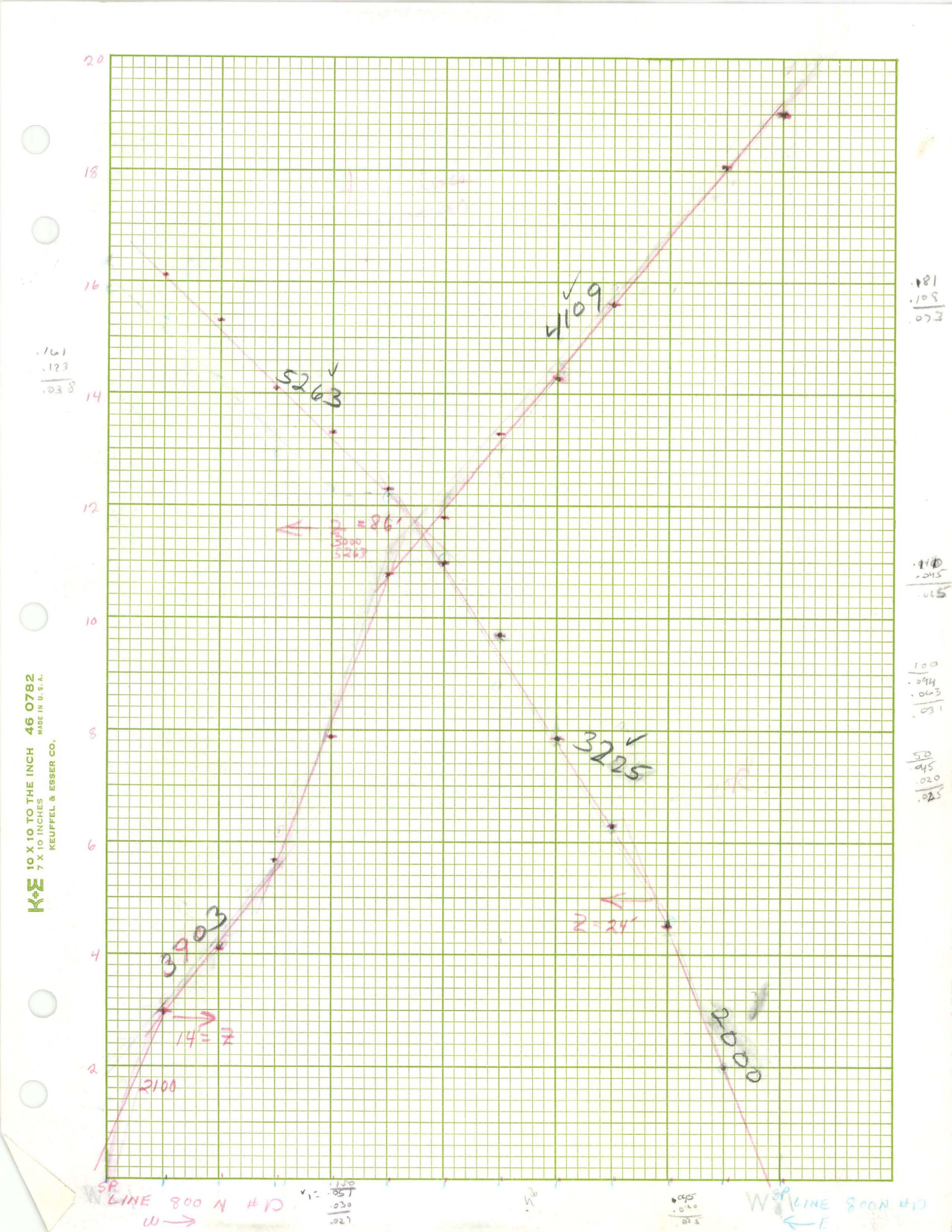
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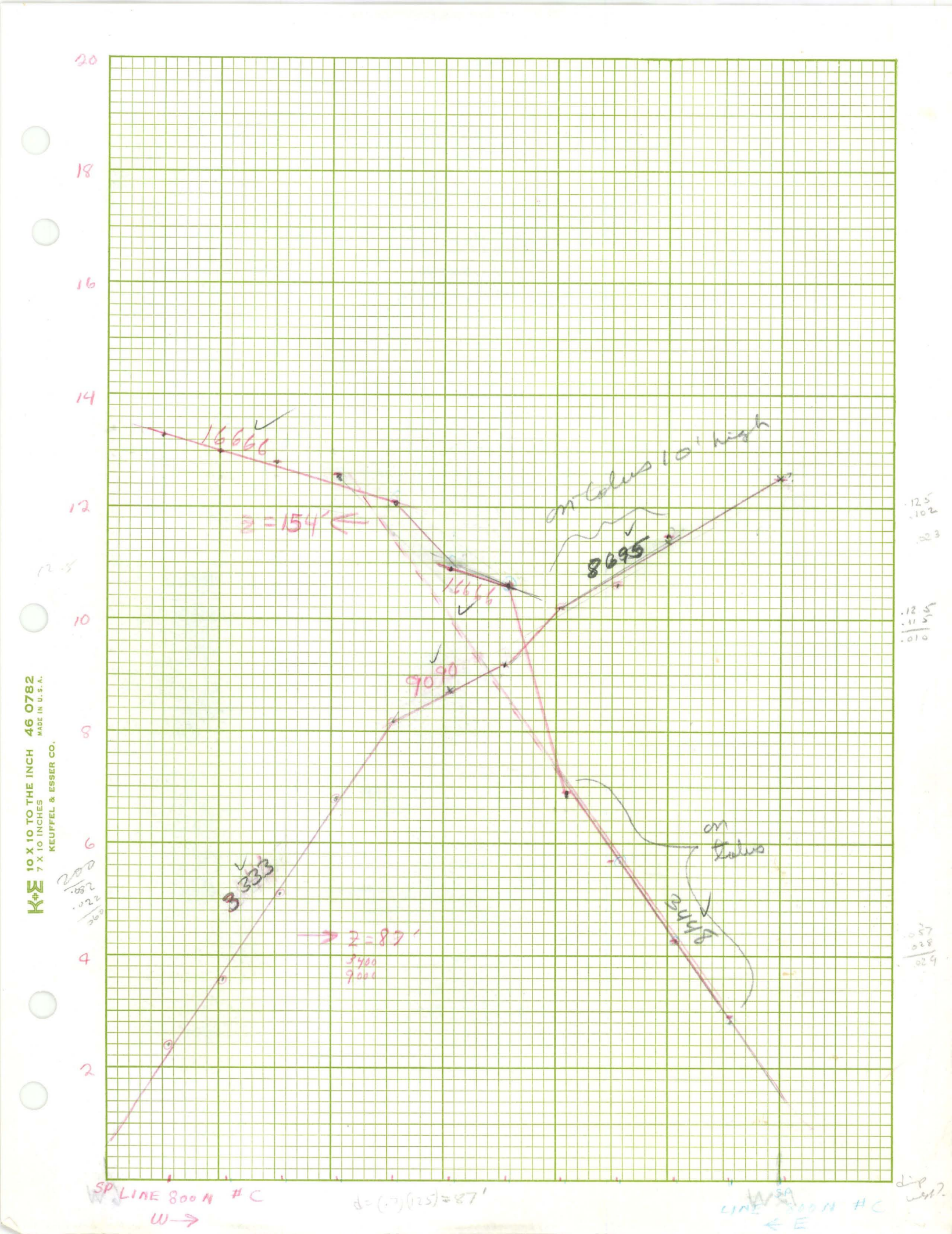
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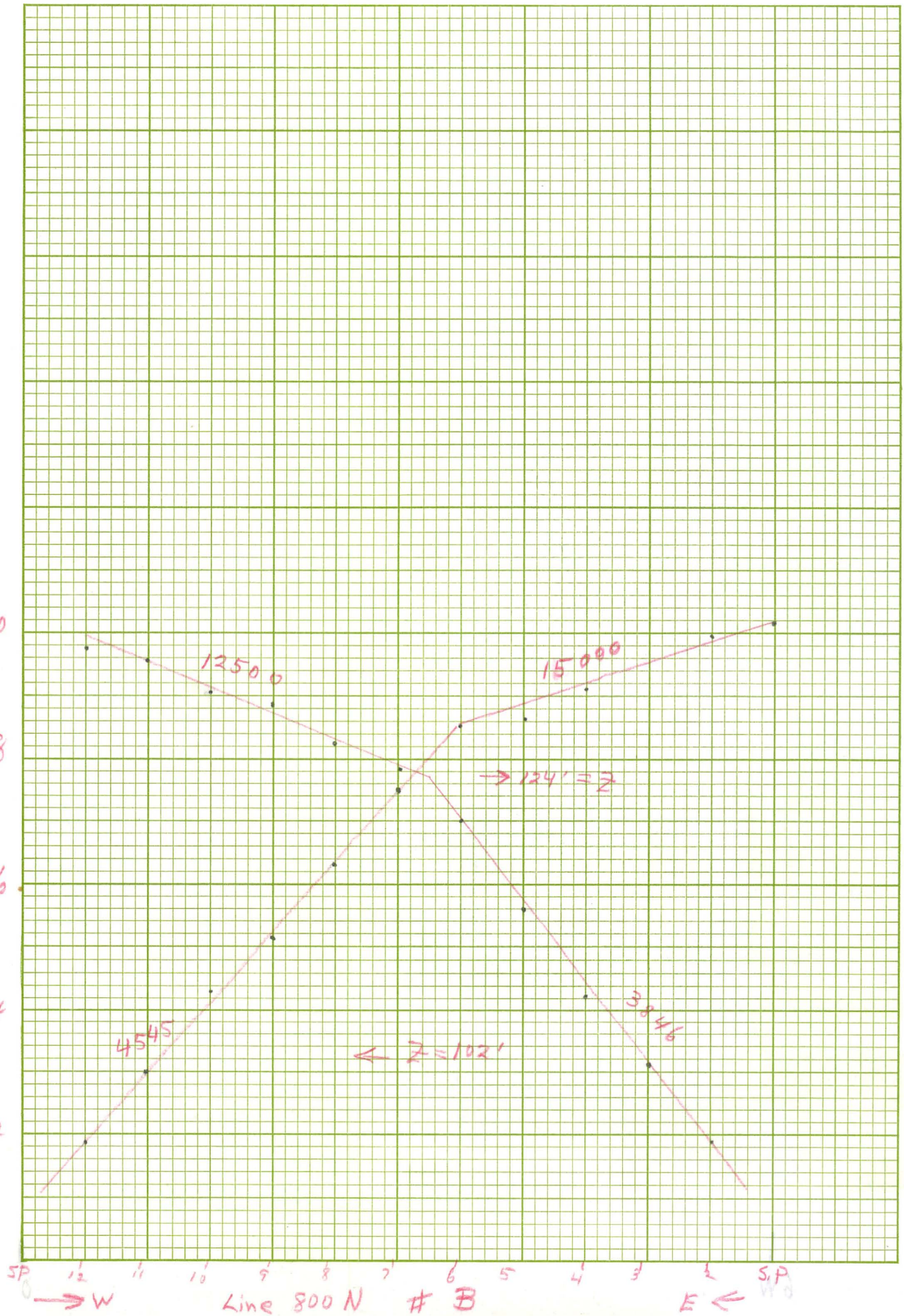
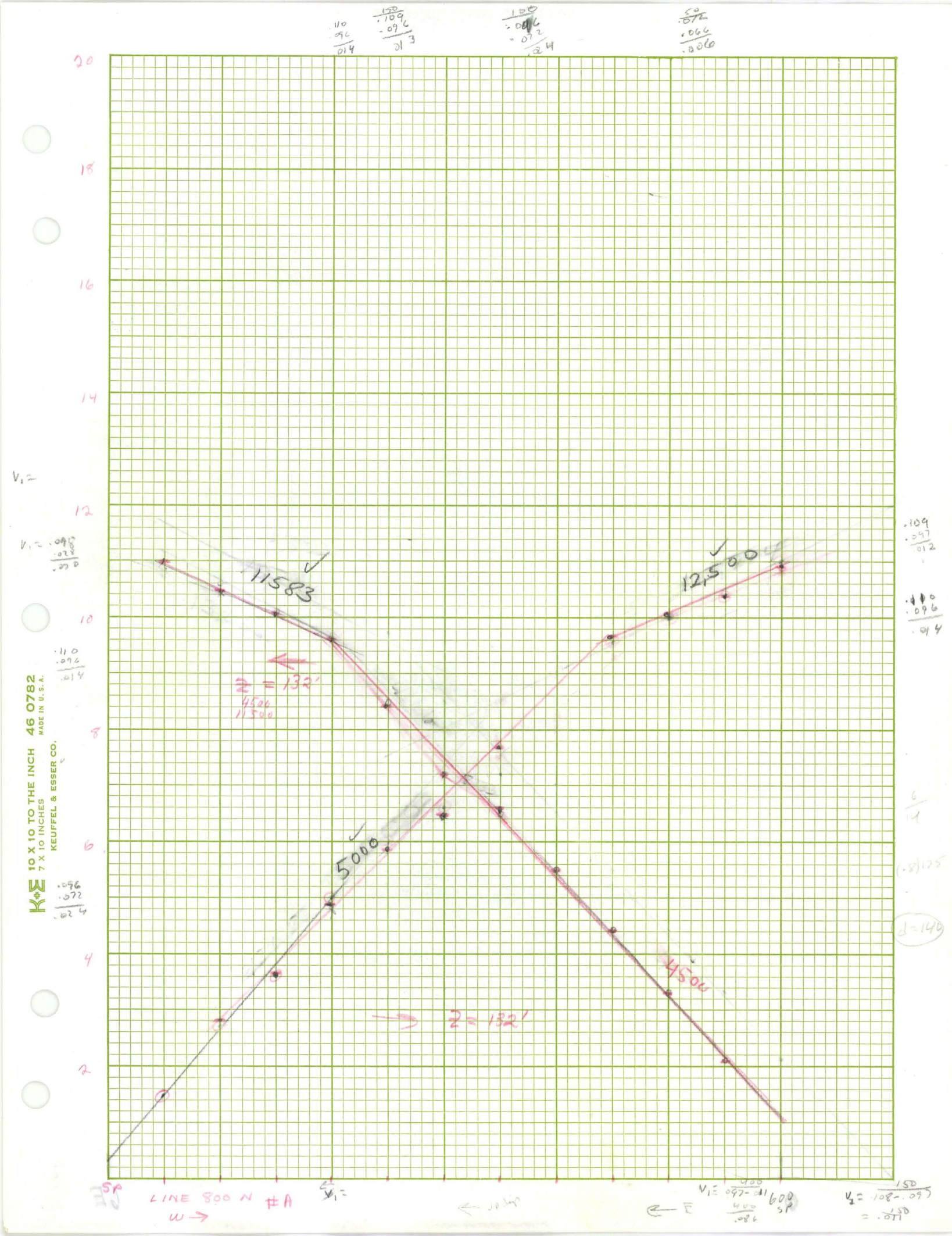
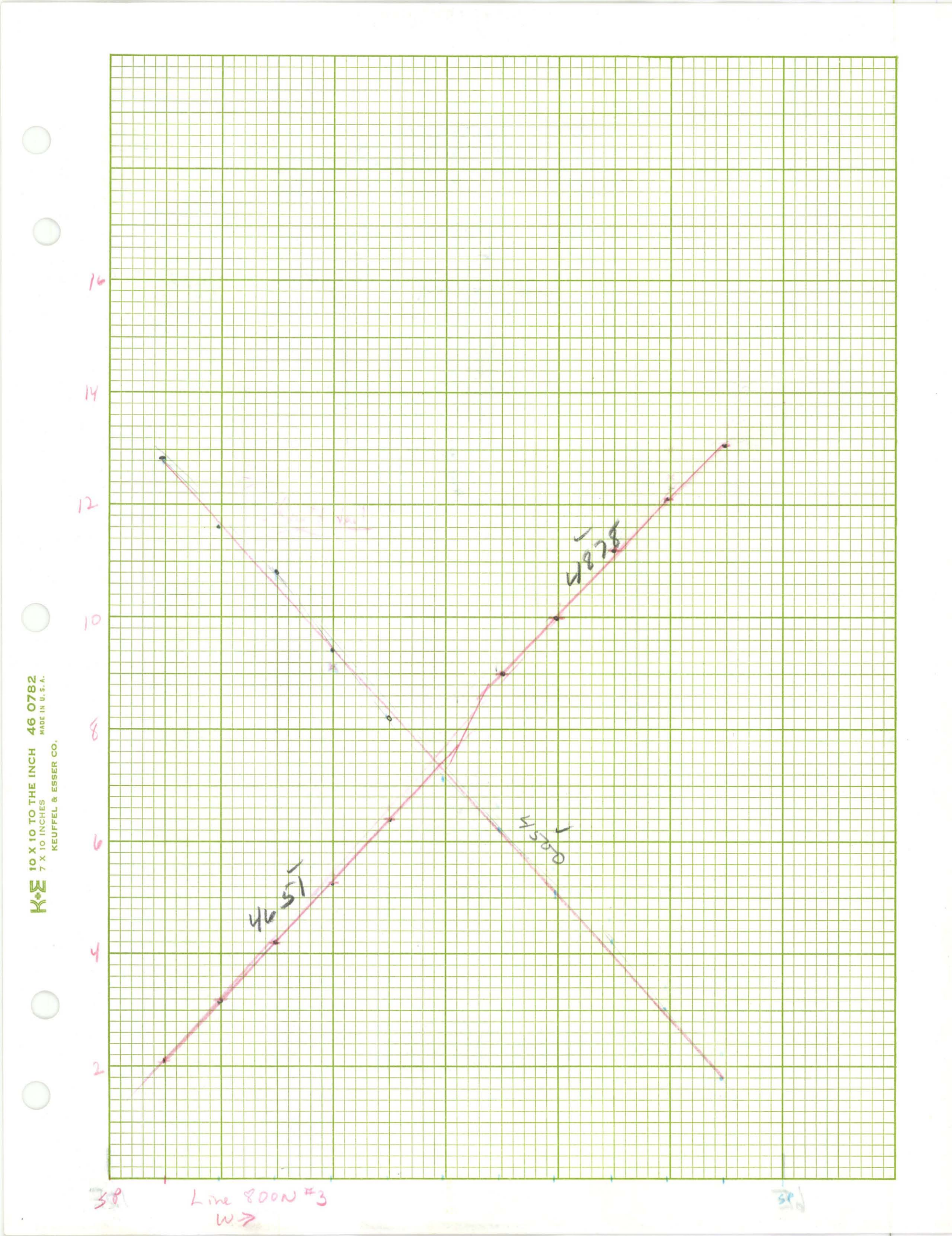
8
6
4
2
16666
Z=154'
16666
on talus 10' high
8695
9090
3333
Z=87'
3480
9000
on talus
2515/8
SP LINE 800N #C
W→
d=(.7)(125)=87'
SP
LINE 800N #C
←E
dip
well?

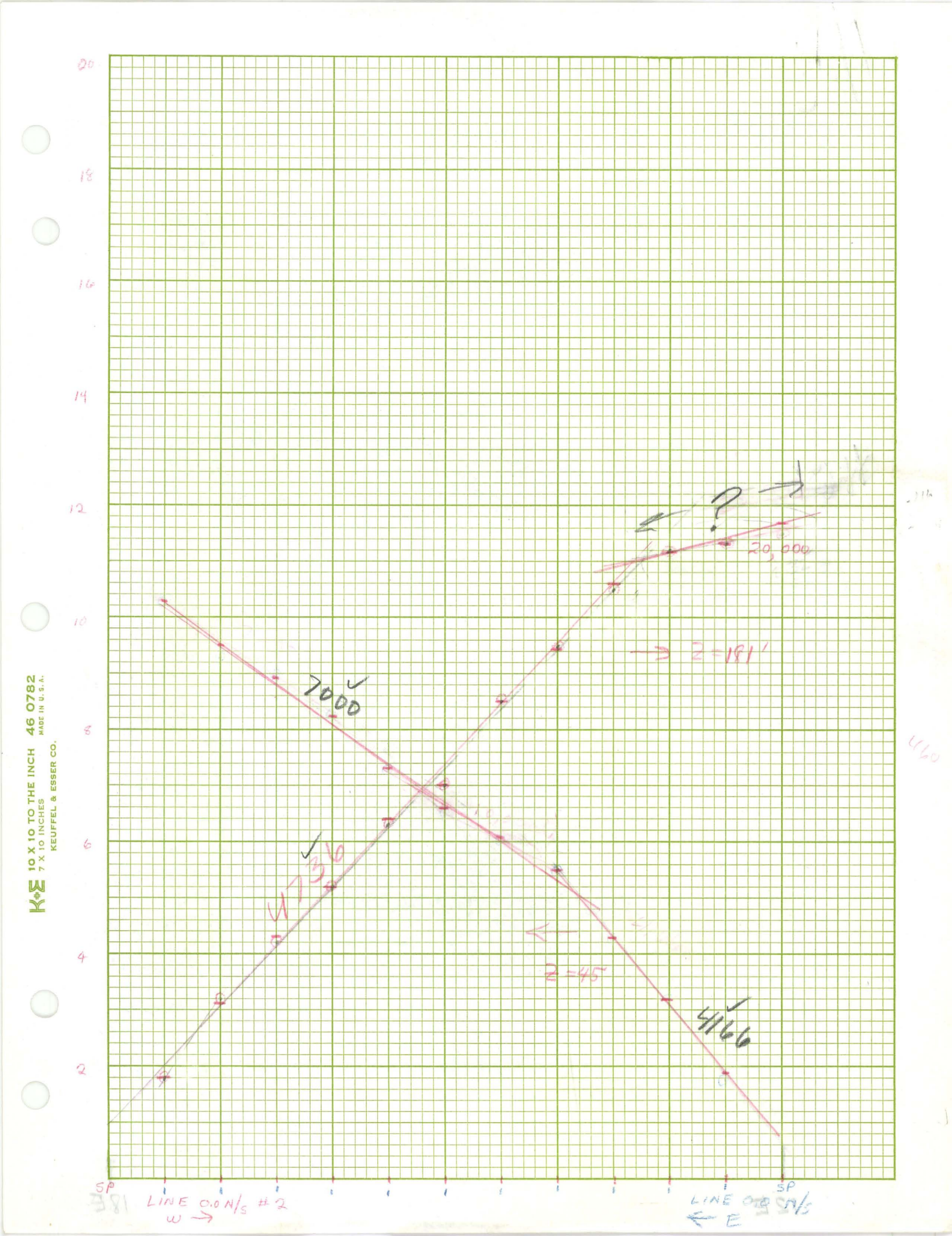


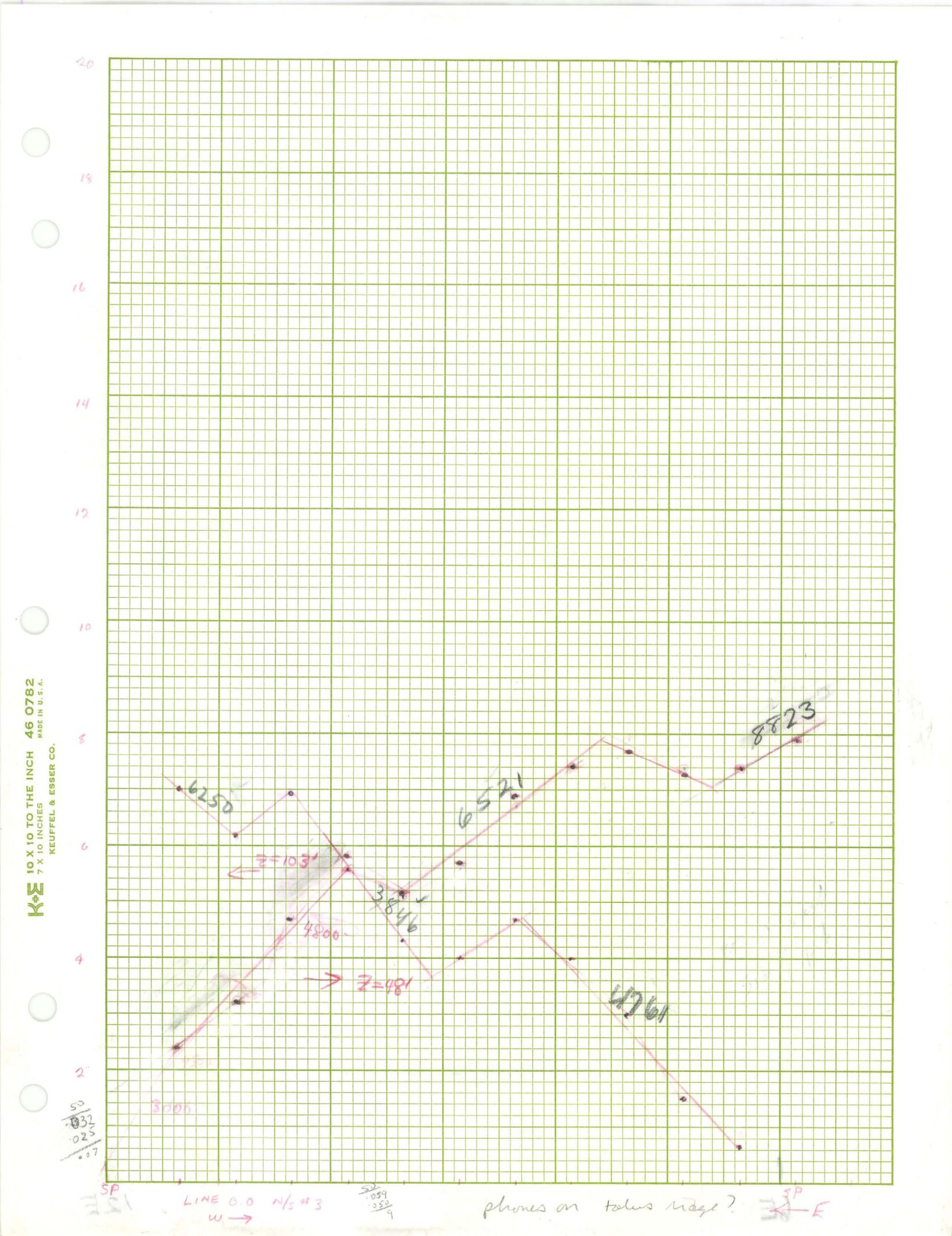

11583
12,500
5000
4500
Z = 132'
Z = 132'
LINE 800 N #A
W →
E

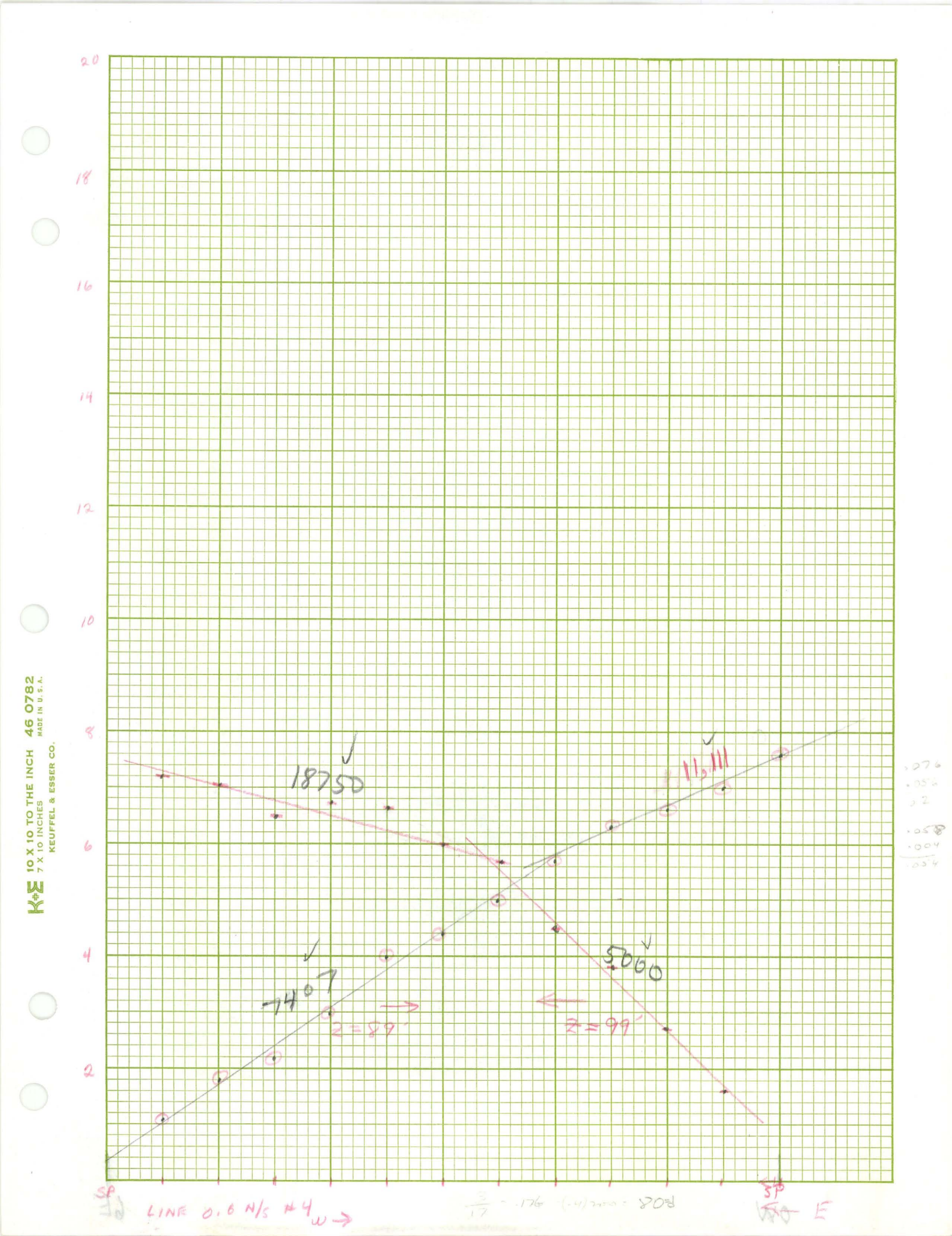


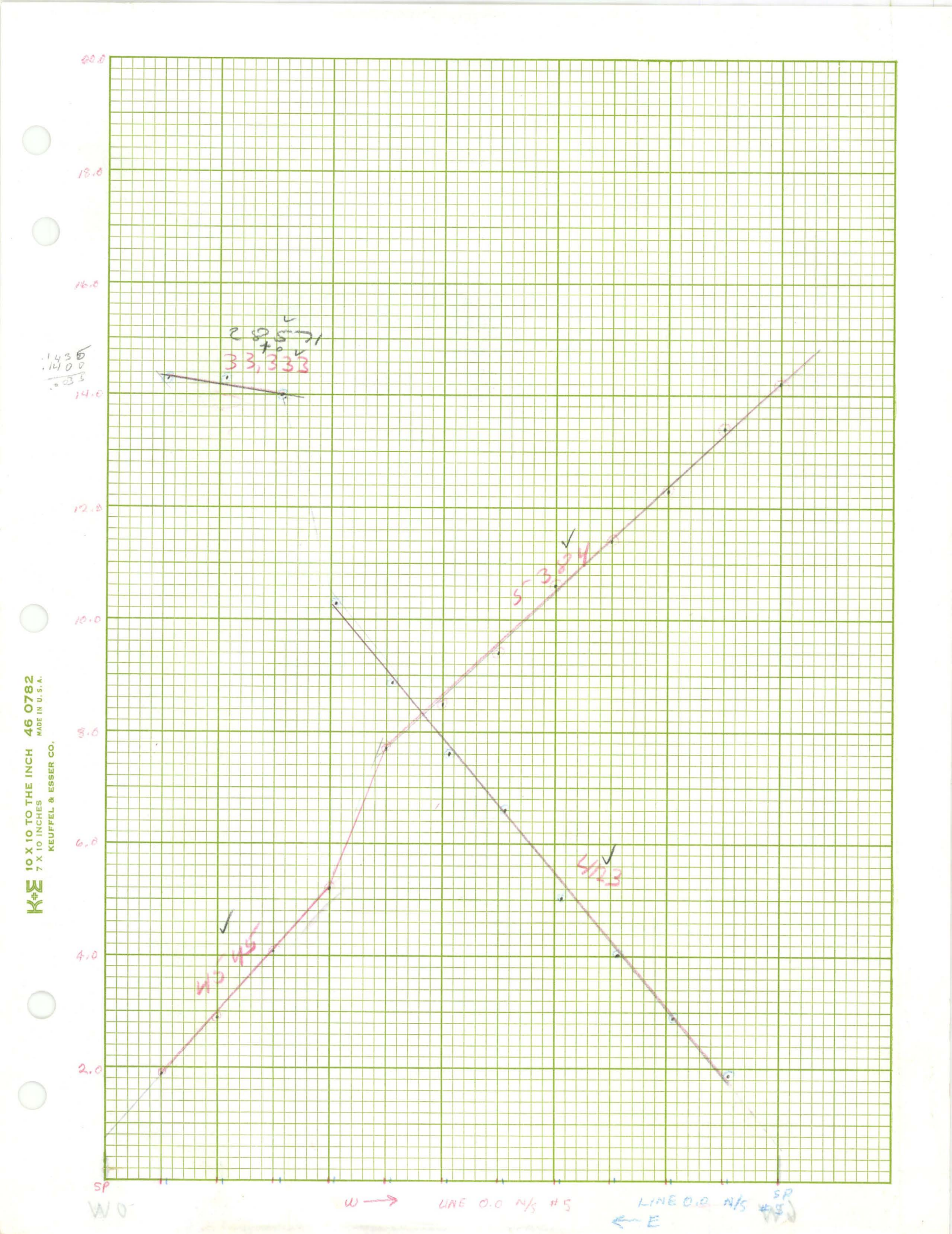
K&E 10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

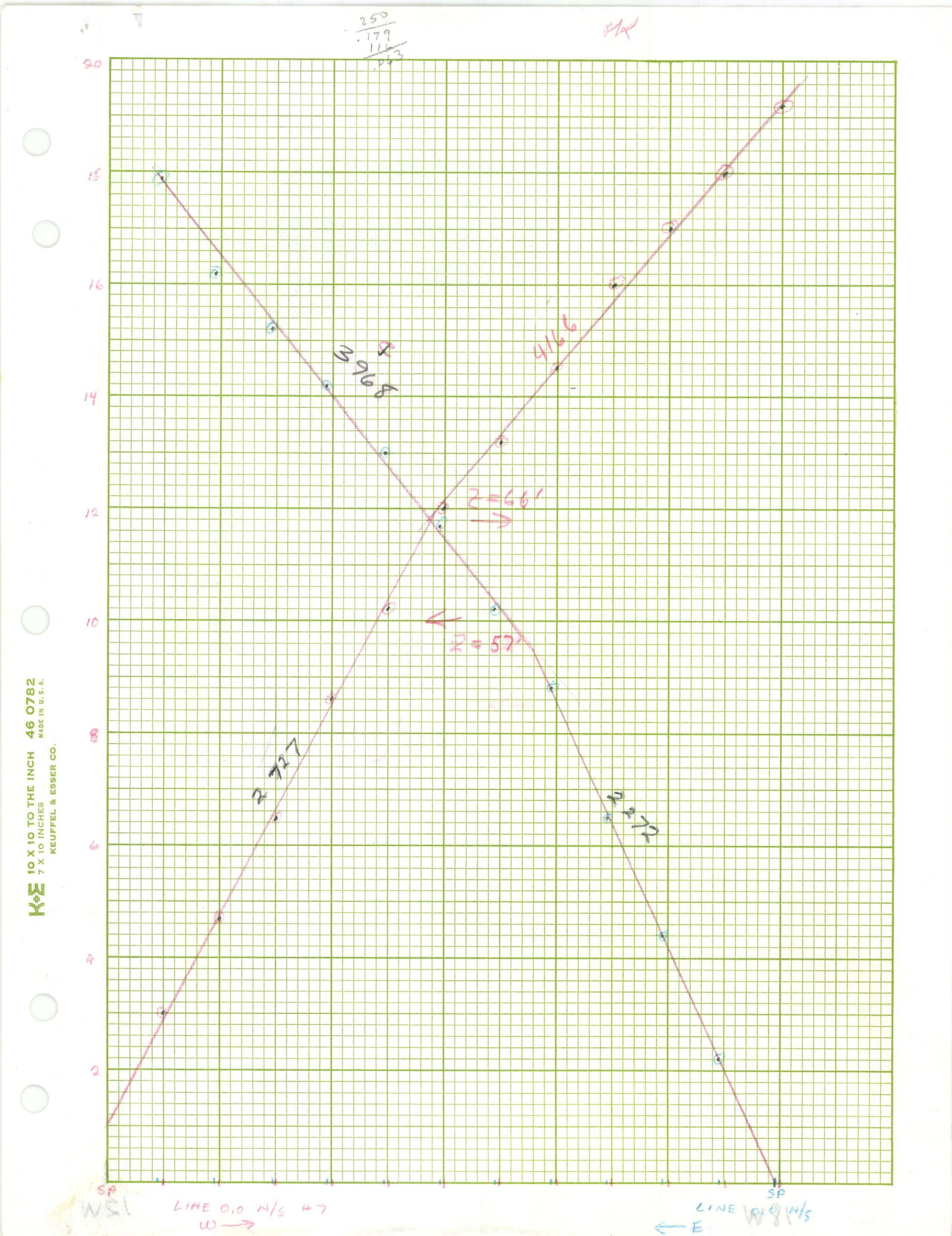

18
16
14
12
10
8
6
4
2
SP
Line 800N #1
W →
← E

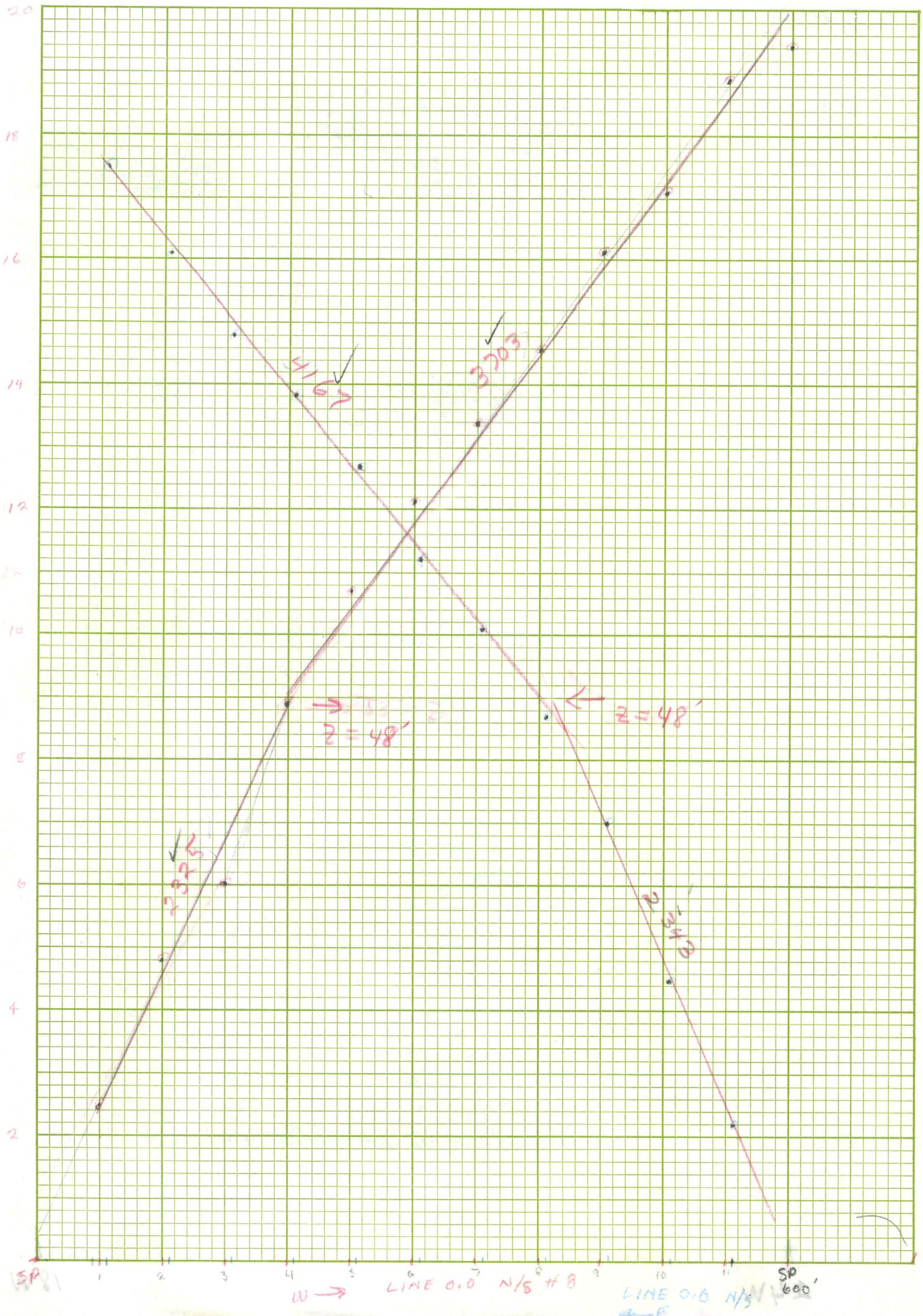

20
18
16
14
12
10
8
6
4
2
SP
SP
20,000
Z=181'
7000
Z=45'
4466
LINE 0.0 N/S #2
W →
← E

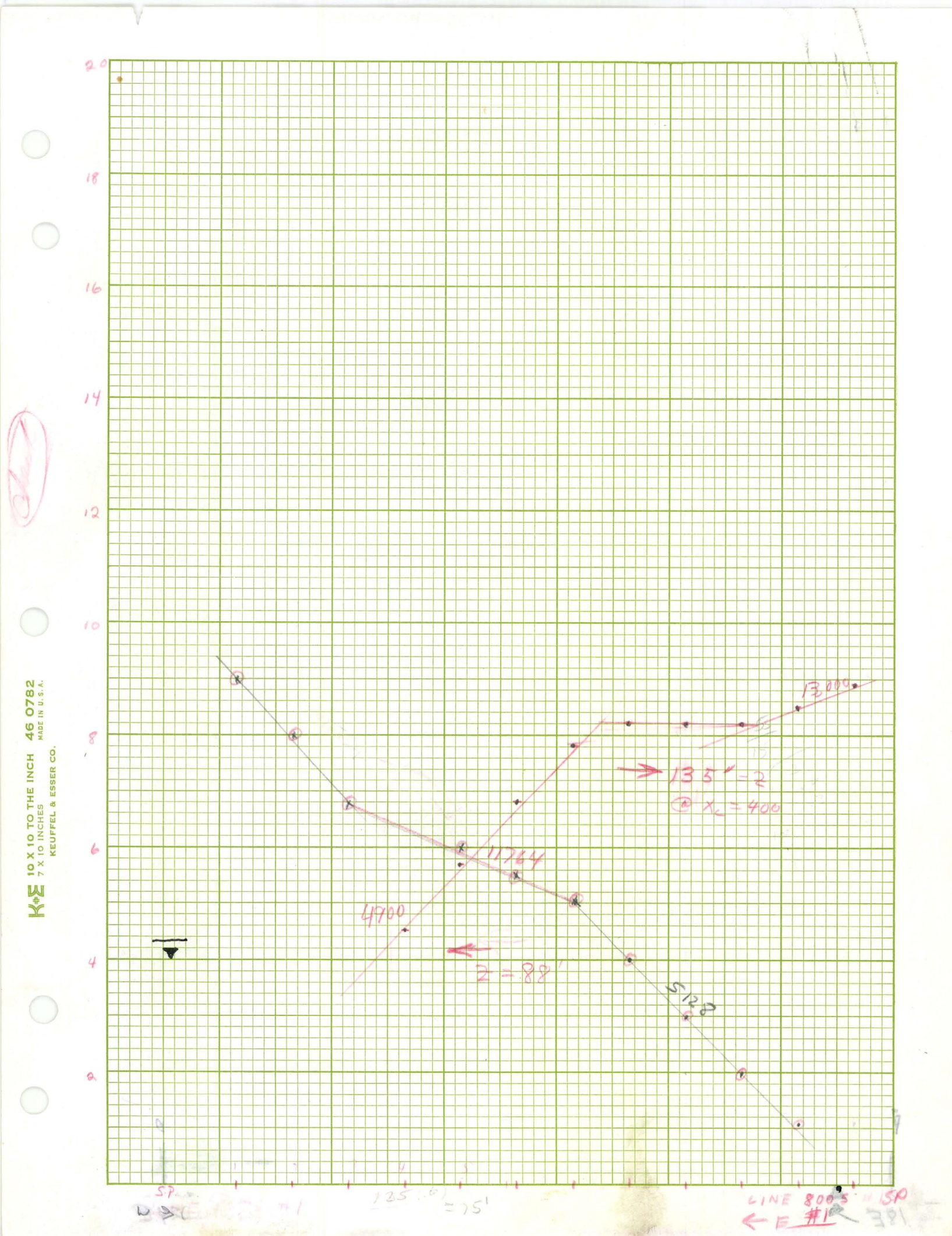

20
18
16
14
12
10
8
6
4
2
6250
Z=103
3846
4800
6521
8823
Z=481
4361
3000
SP
LINE 0.0 N/S #3
W →
phones on talus ridge?
SP
E

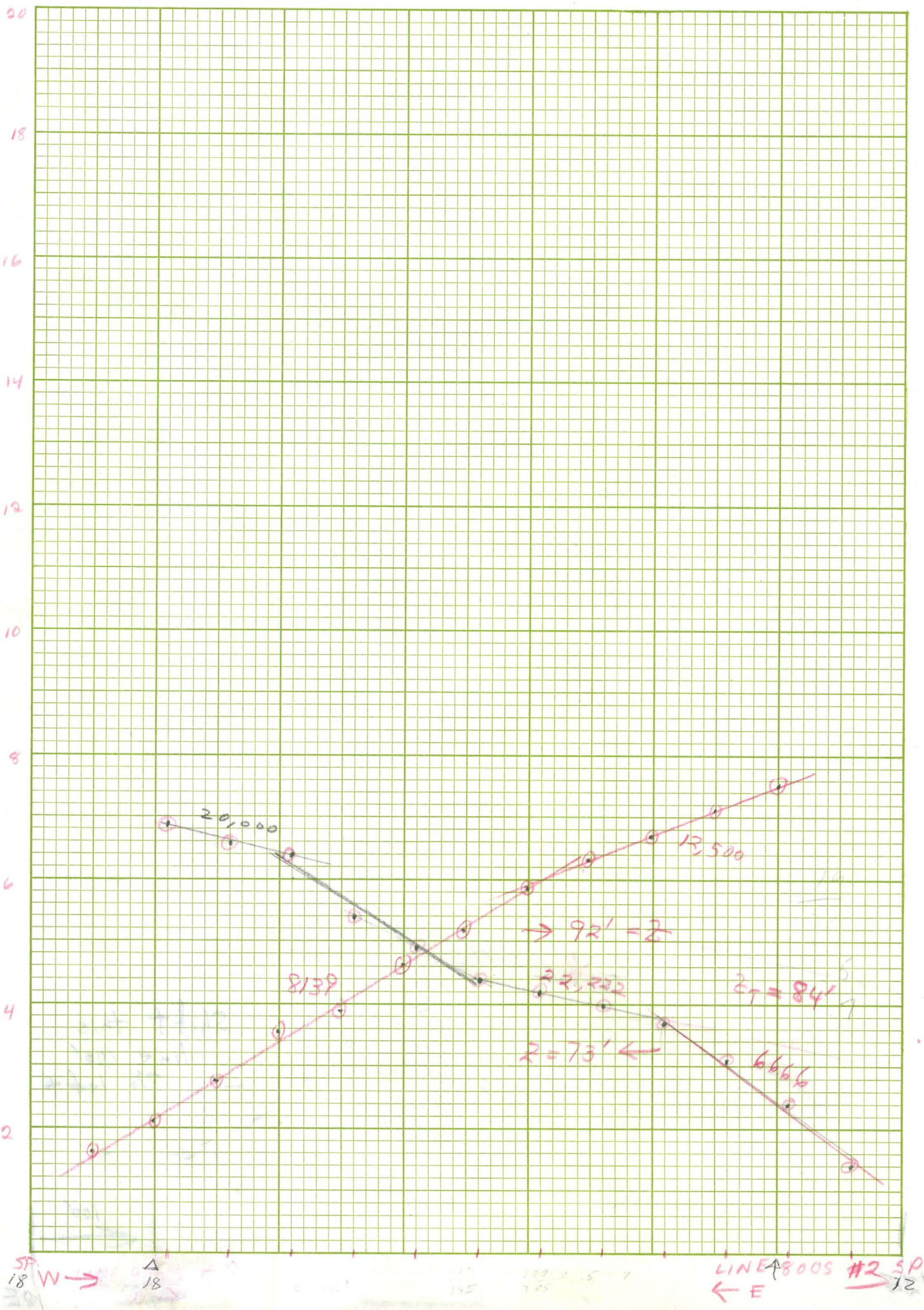


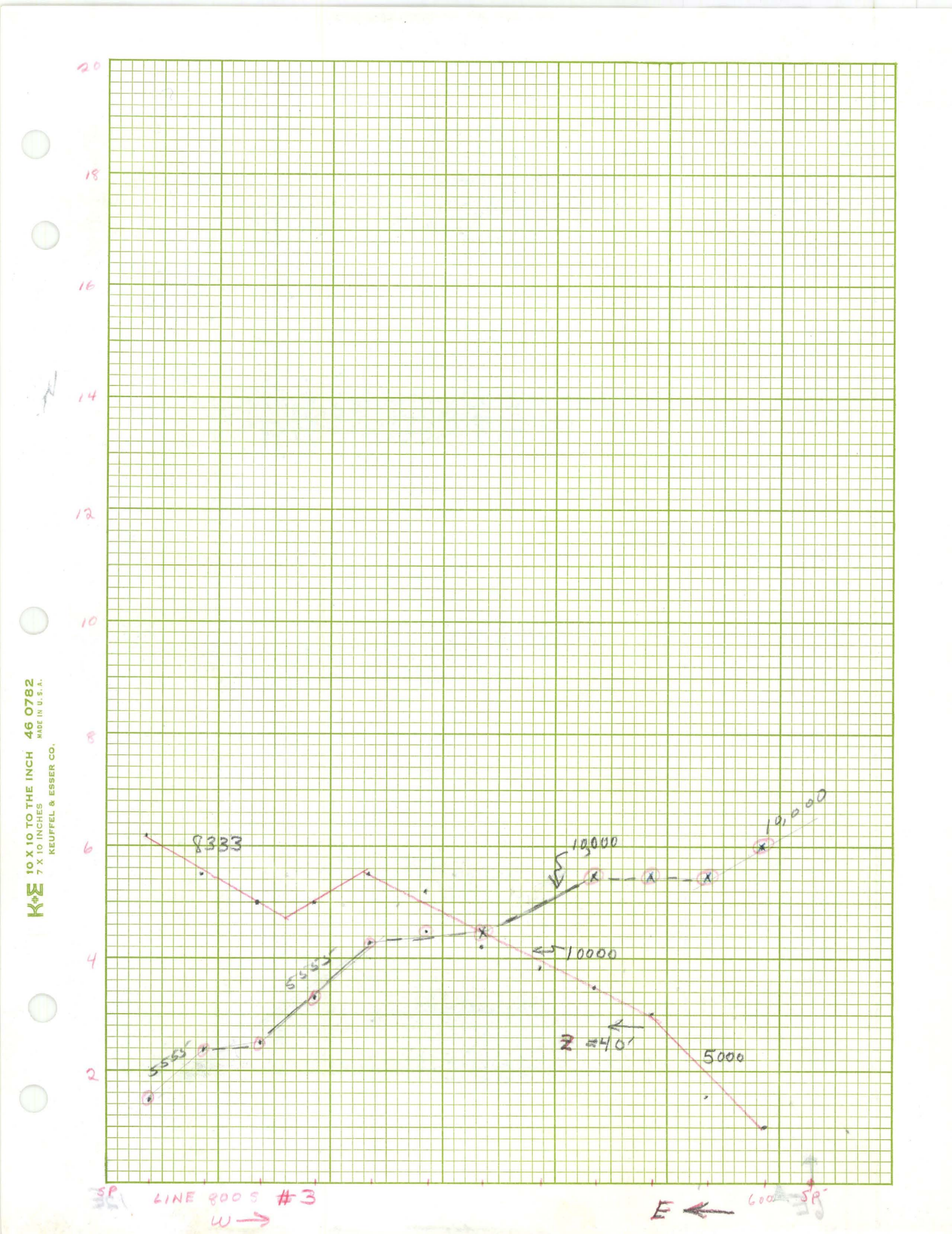

20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
SP
W →
LINE 0.0 N/S #5
LINE 0.0 N/S #5
SP
E
10 X 10 TO THE INCH 46 0782
7 X 10 INCHES
MADE IN U.S.A.
KEUFFEL & ESSER CO.

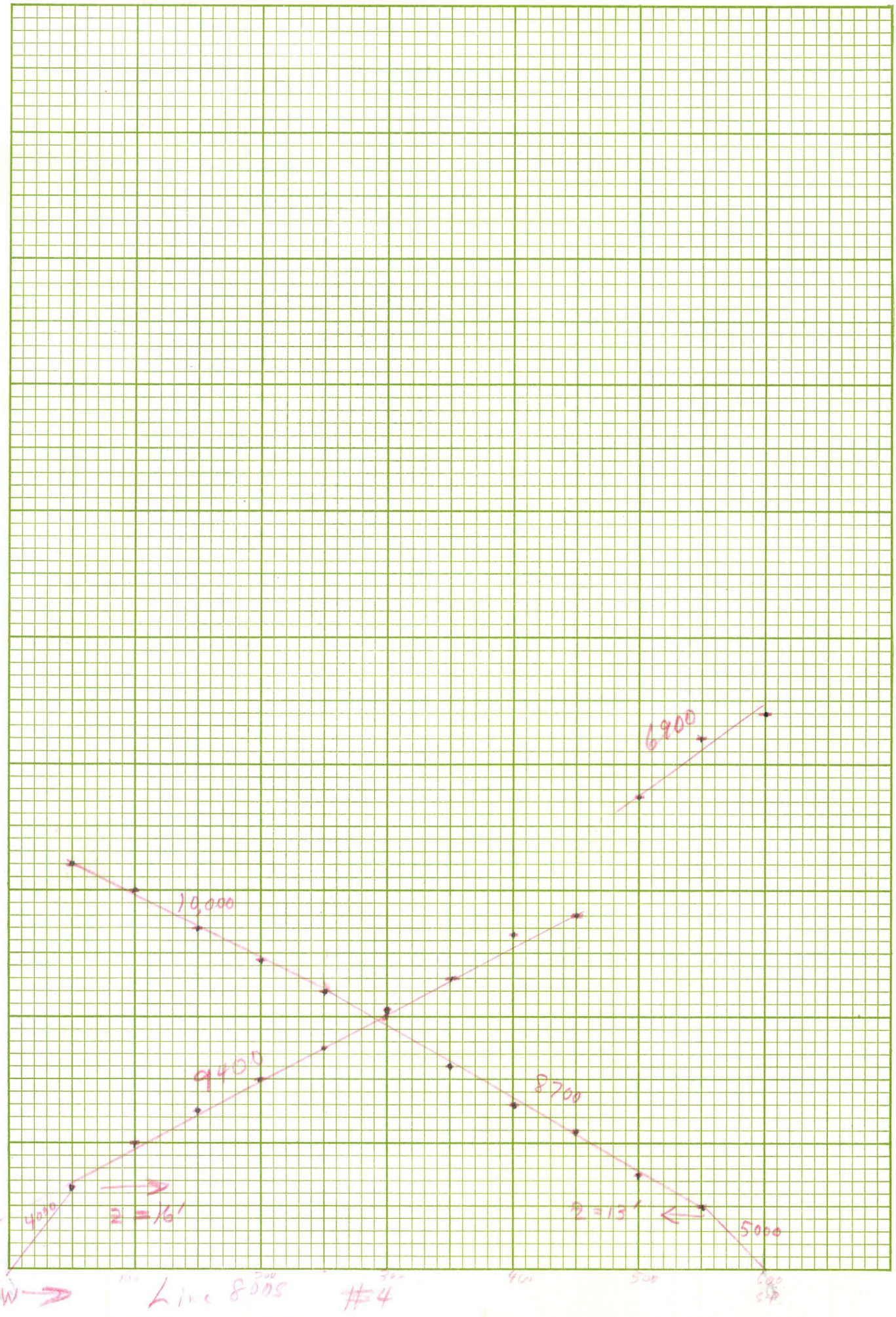

20
18
16
14
12
10
8
6
4
2
SP
SP
Z=396'
Z=416'
Z=661'
Z=572'
Z=727'
LINE 0,0 N/S #7
W
E
LINE 0,0 N/S
K&E 10 X 10 TO THE INCH 46 0782
7 X 10 INCHES
MADE IN U.S.A.
KEUFFEL & ESSER CO.

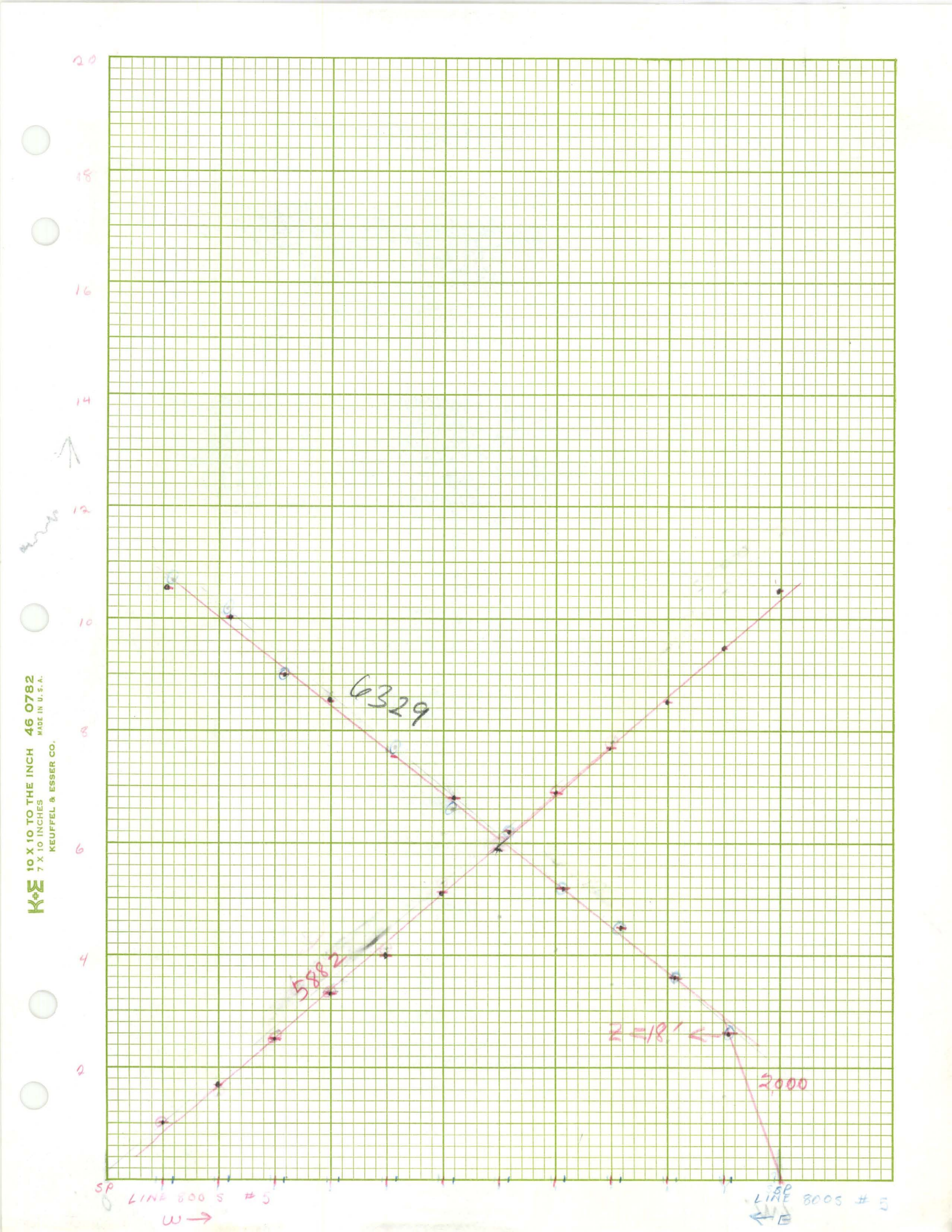


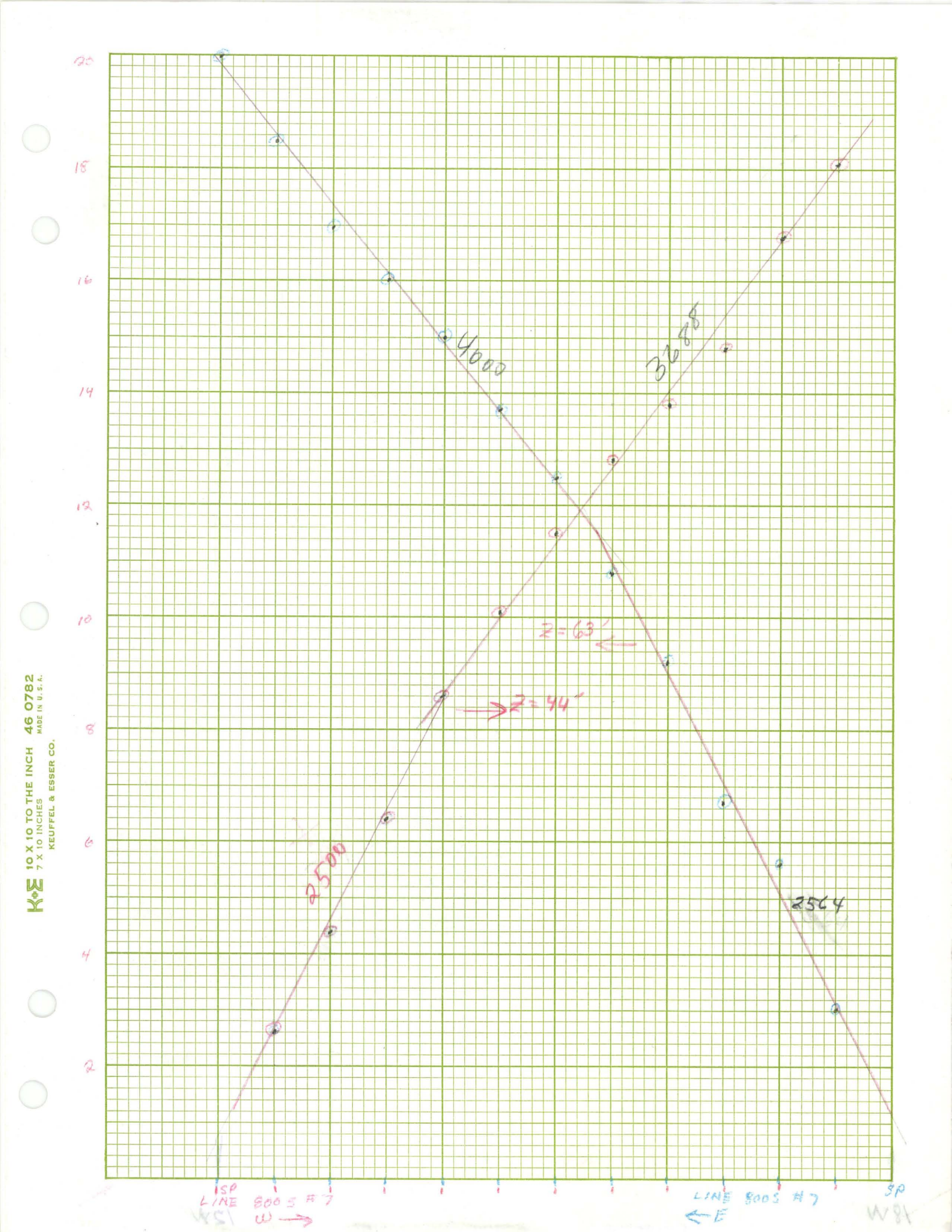

20
18
16
14
12
10
8
6
4
2
13,000
135° = Z
@ X_L = 400
11764
4700
Z = 88
5128
LINE 800 S
E #1

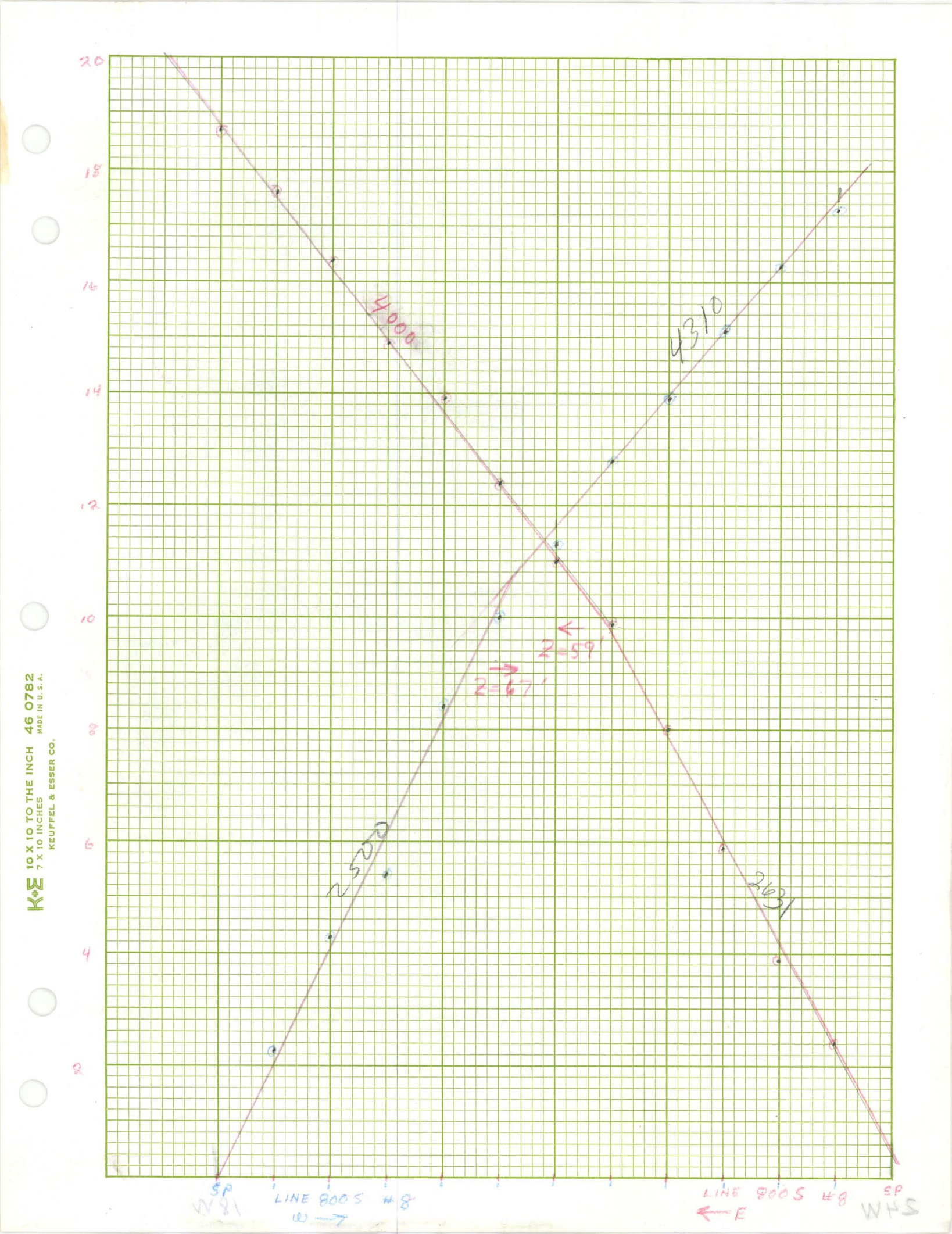


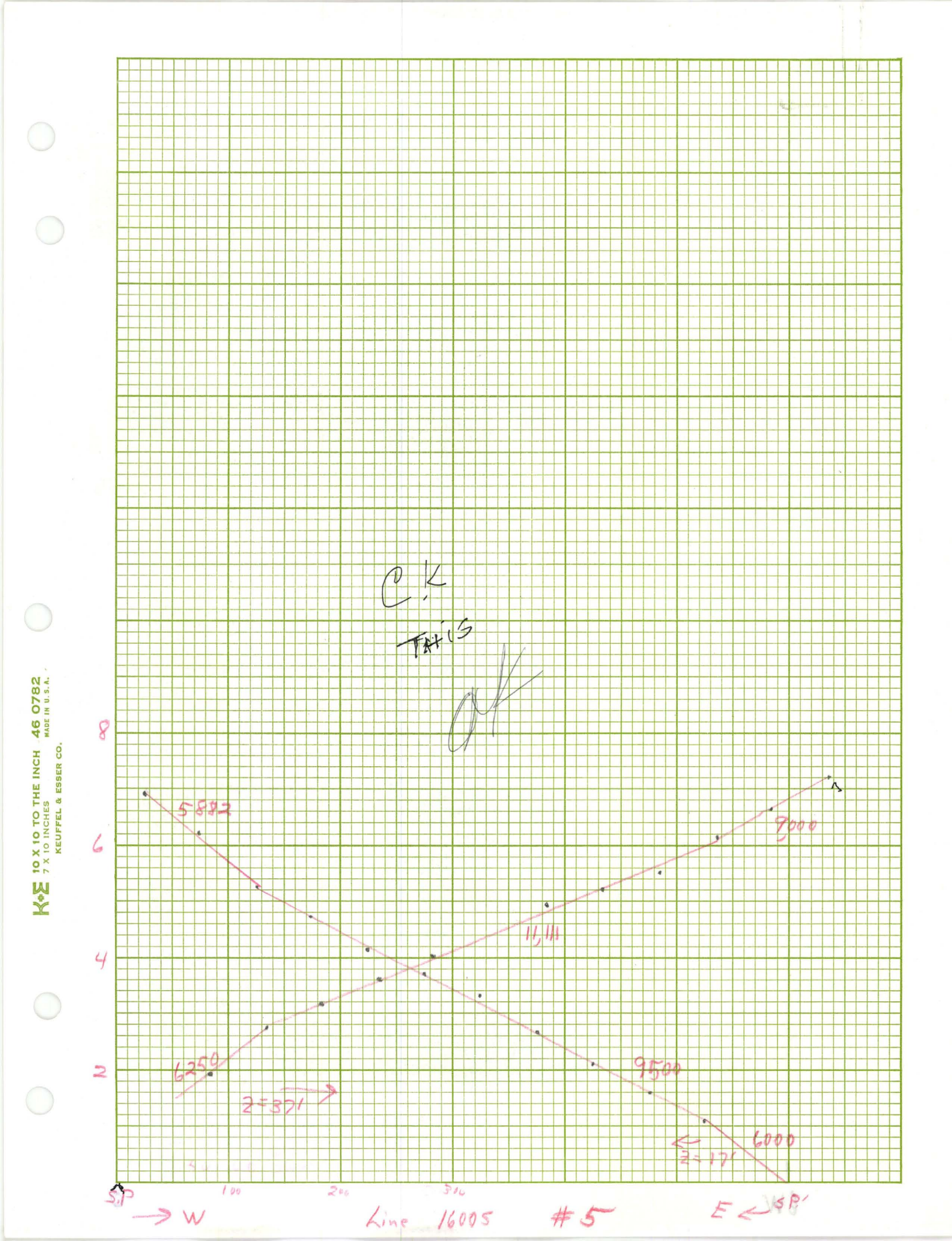

20
18
16
14
12
10
8
6
4
2
8333
10000
10,000
5555
5555
10000
Z = 40'
5000
SP
LINE 800 S #3
W →
E ←
600
SP

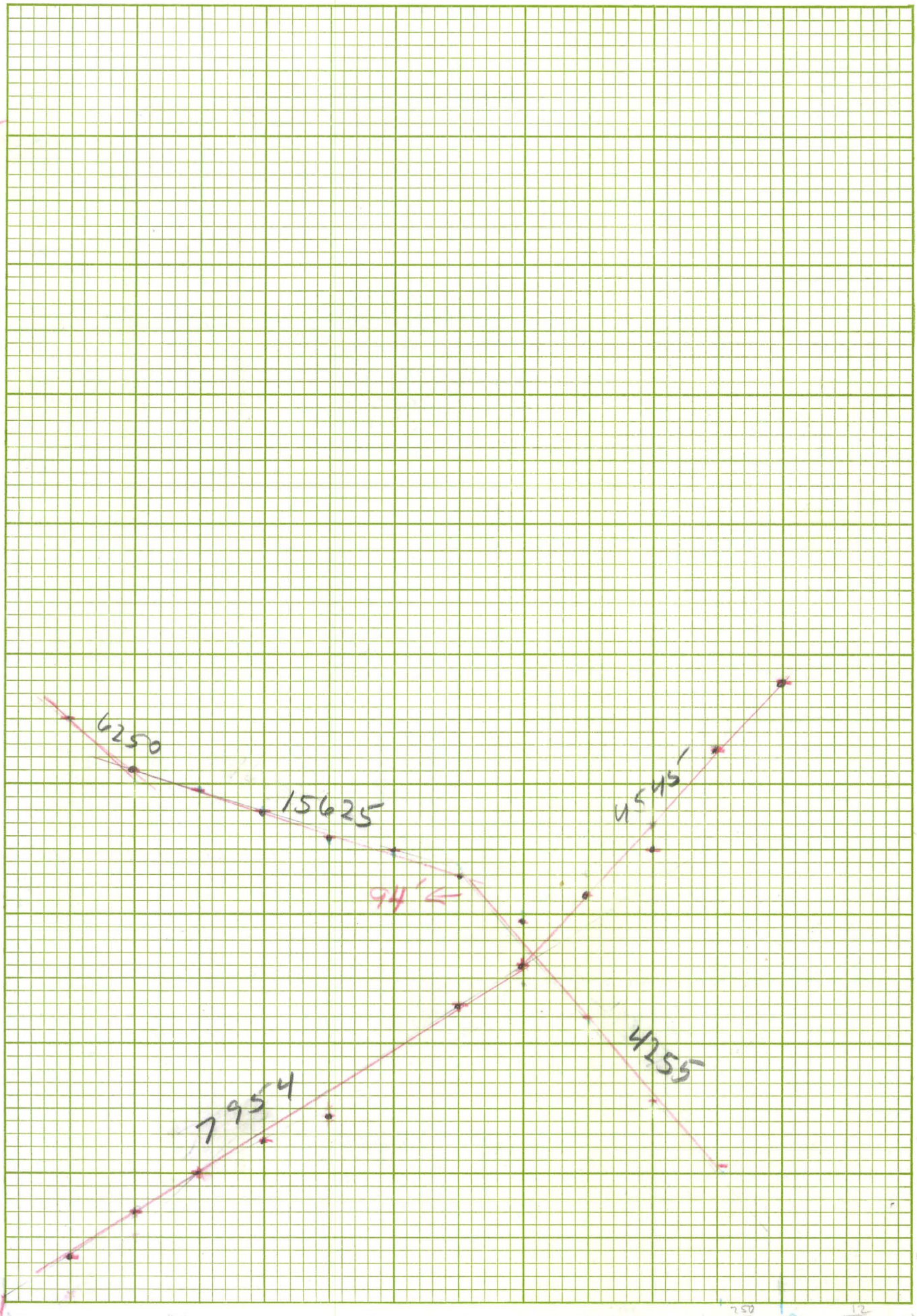



20
18
16
14
12
10
8
6
4
2
6329
5882
2000
SP
LINE 800 S #5
W →
SP
LINE 800S #5
E




20
18
16
14
12
10
8
6
4
2
4000
4310
2631
2500
Z=59'
Z=47'
SP
W81
LINE 8005 #8
W
LINE 8005 #8
SP
E
WHS
10 X 10 TO THE INCH 46 0782
7 X 10 INCHES
MADE IN U.S.A.
KEUFFEL & ESSER CO.


C.K
THIS
8
6
4
2
5882
6250
9000
11,111
9500
6000
Z=37'
Z=17'
S.P
100
200
300
S.P'
W
E
Line 16005 #5



d=100

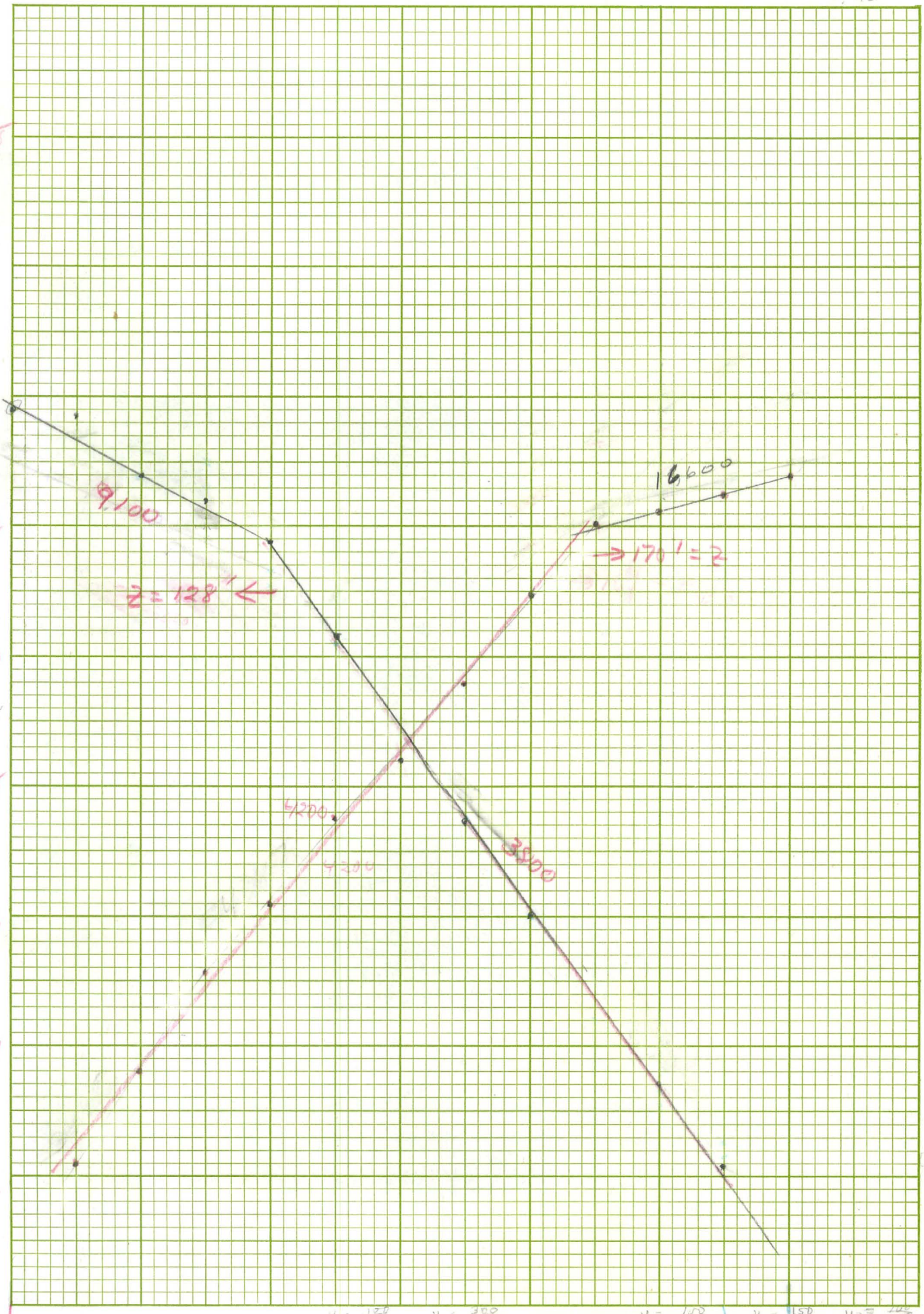
WSP

W→ 16005 #6

250

WSP

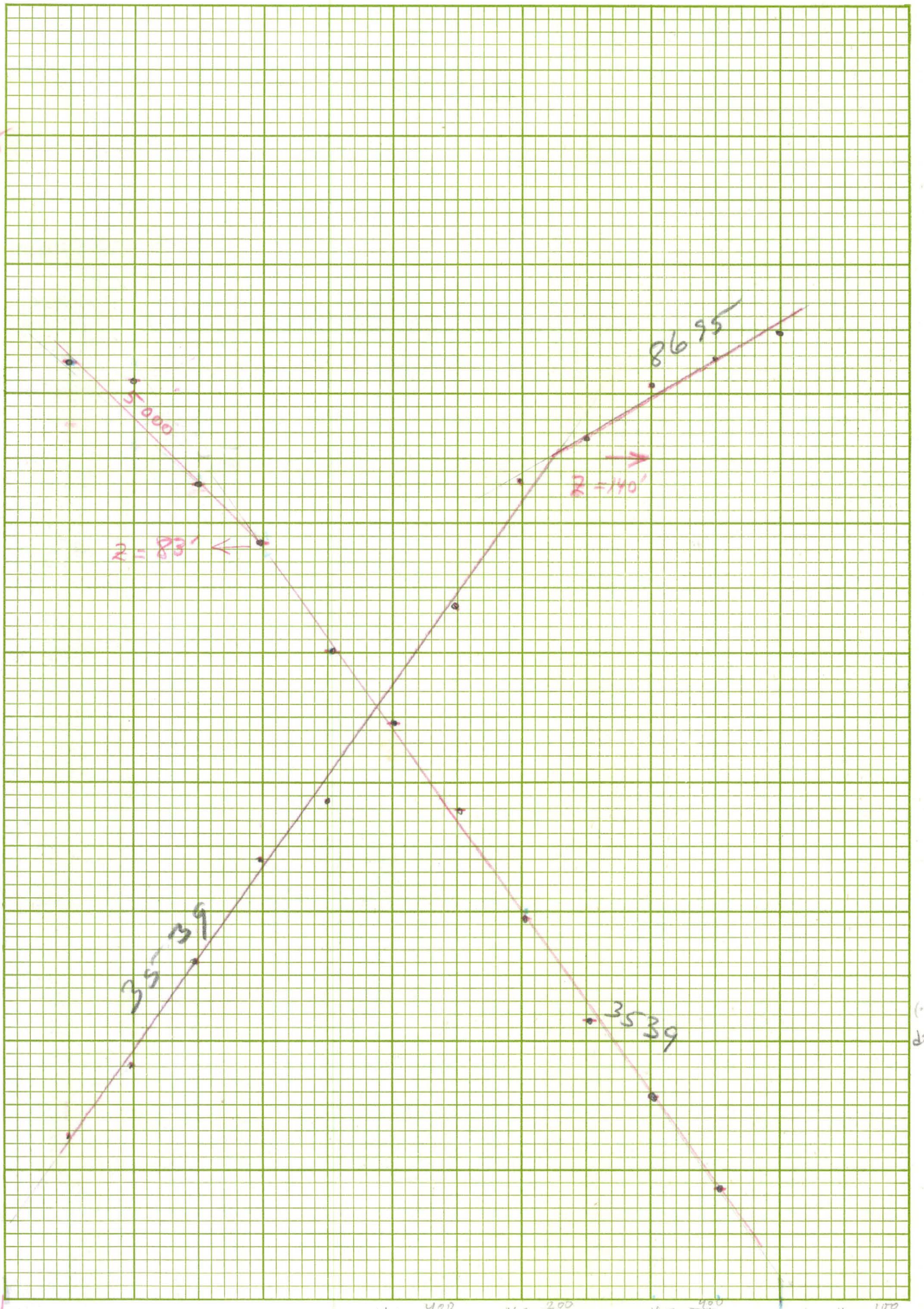
12/20 (.8) 125

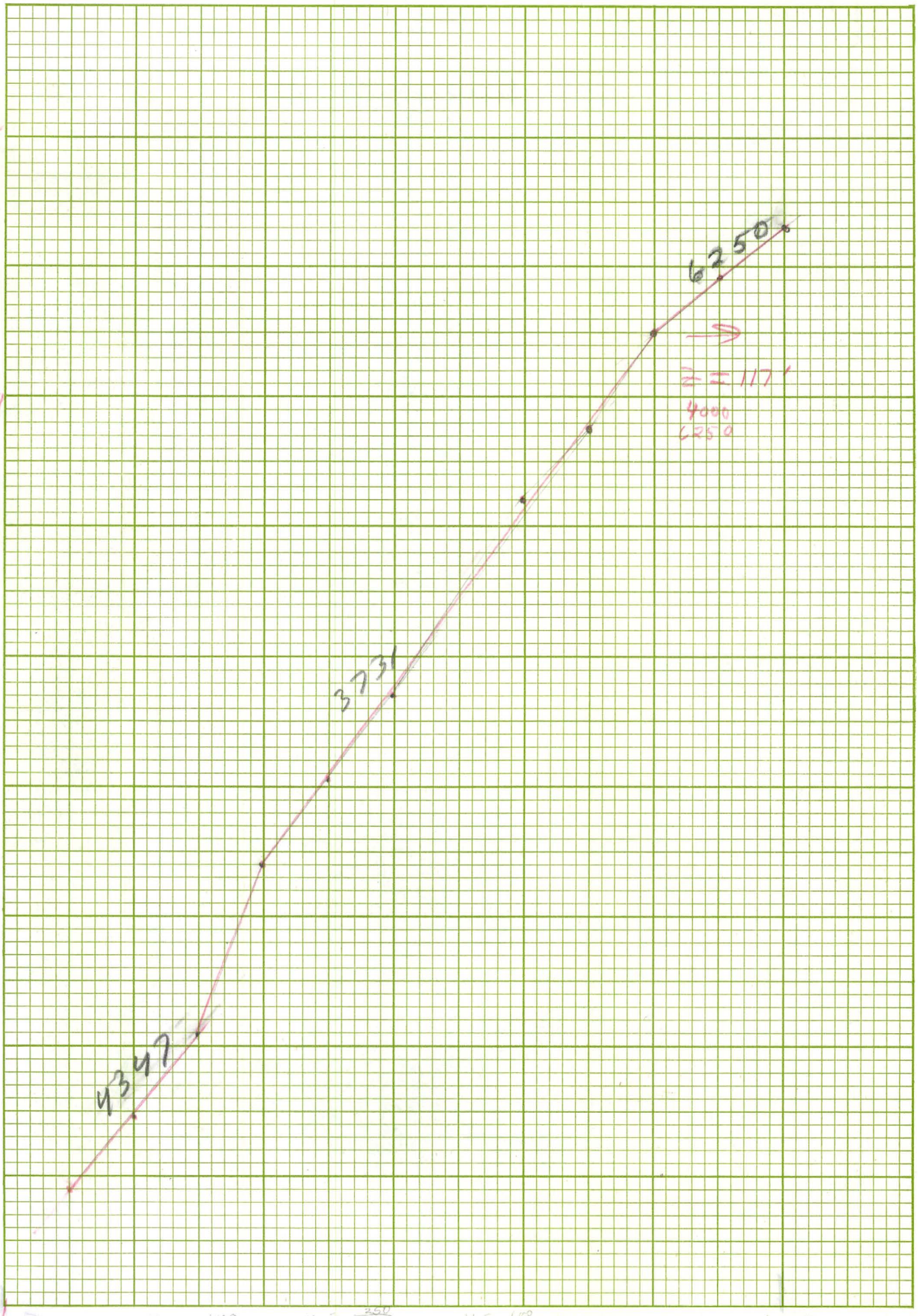


K+E 10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

W → 16005#n

← E

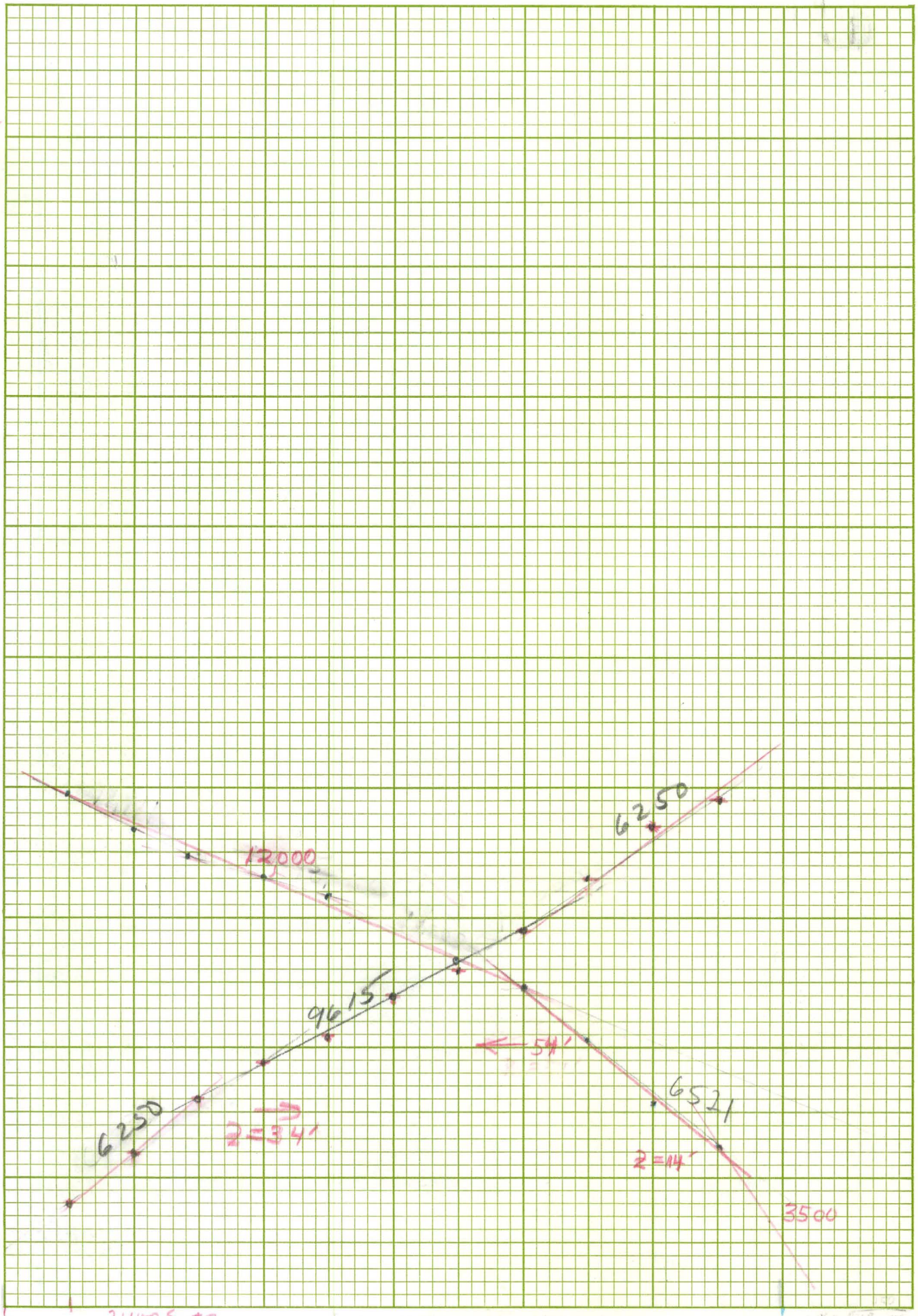


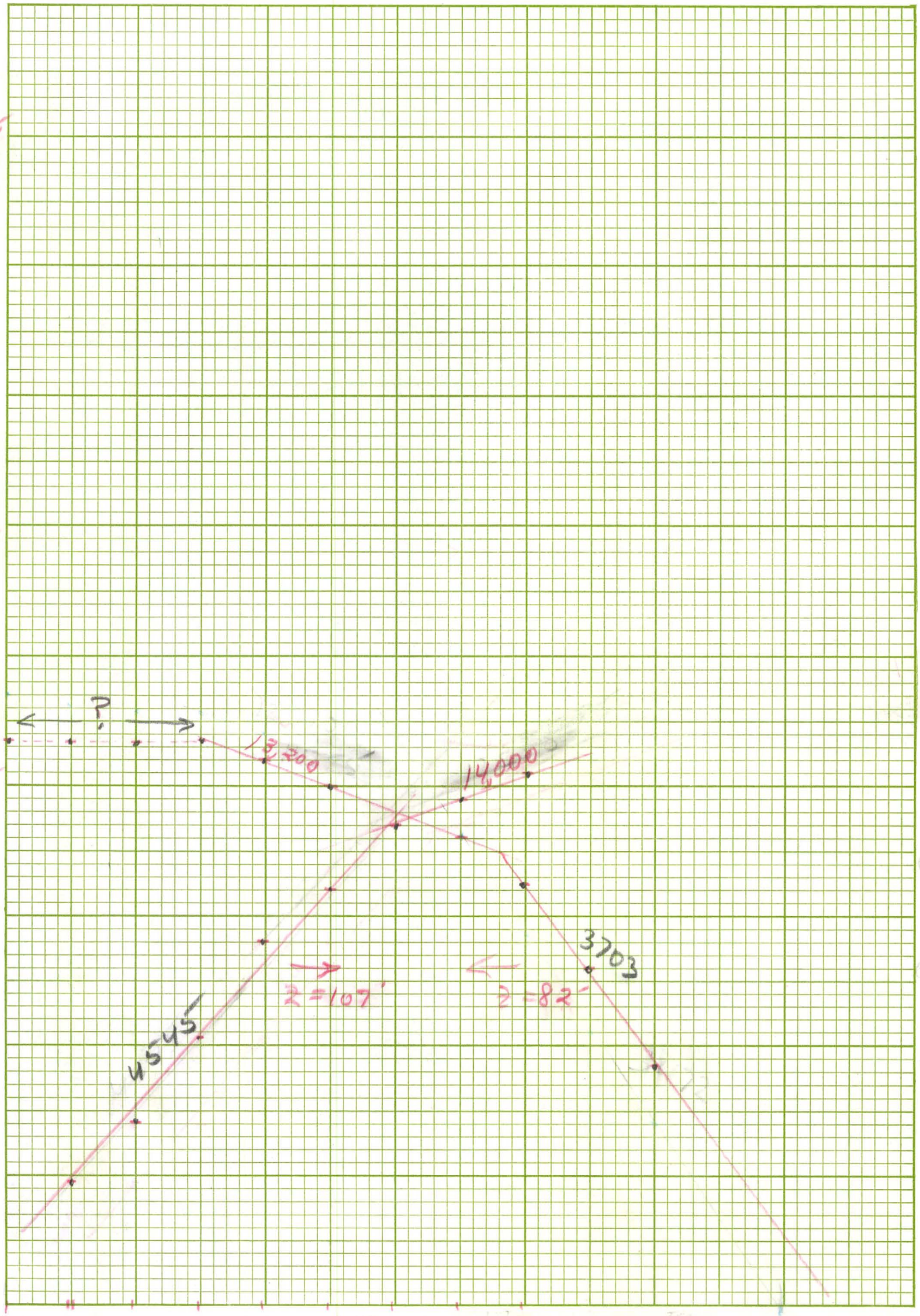


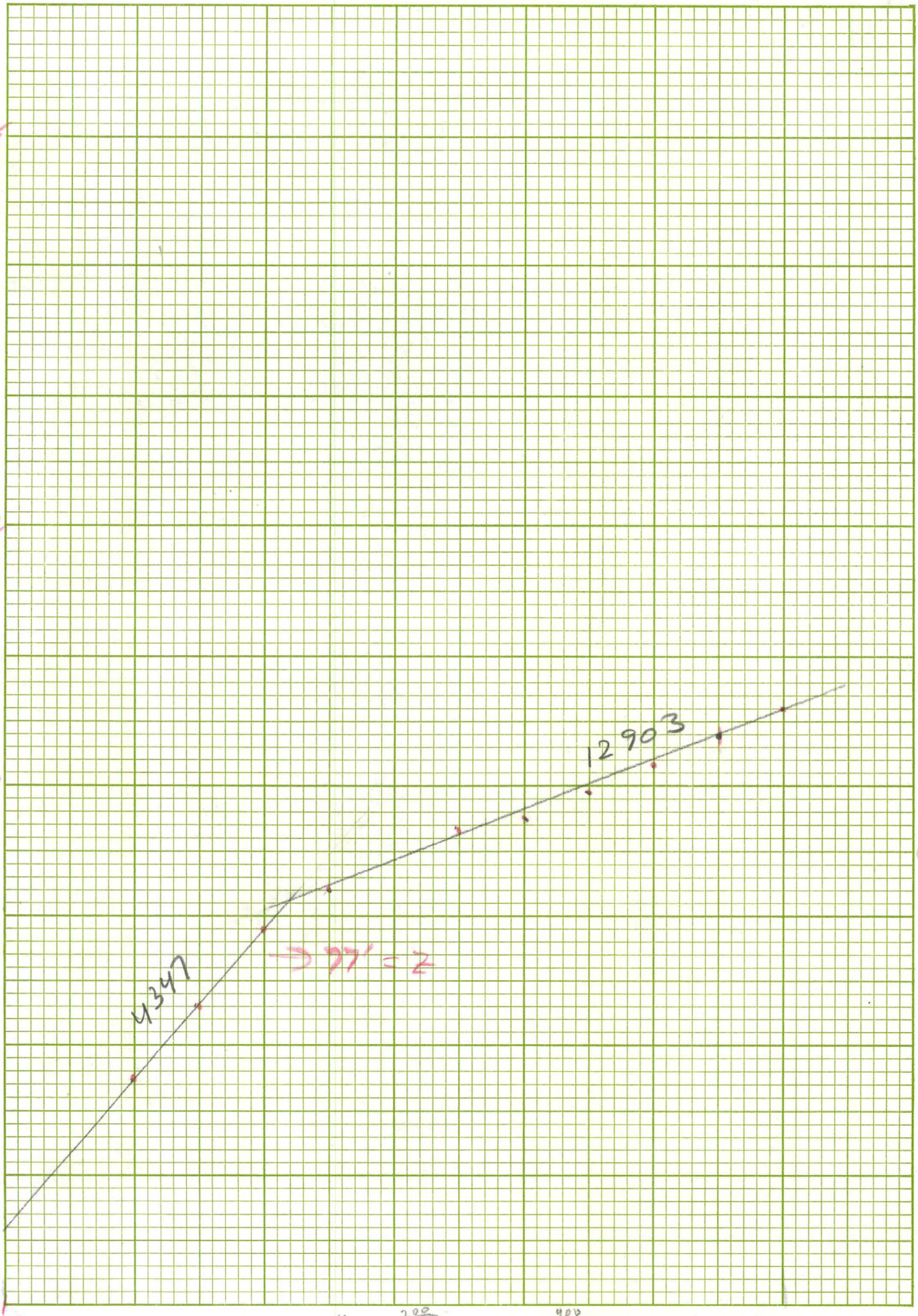
10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

$V_1 = \frac{100}{.042}$ $V_2 = \frac{350}{.136}$ $V_3 = \frac{100}{.116}$

16005 #9




18
16
14
12
10
8
6
4
2
?
14000
3703
45°
45°
Σ=107
Σ=82
24005 #8
WSD



K&E 10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

7/17

(-7)110

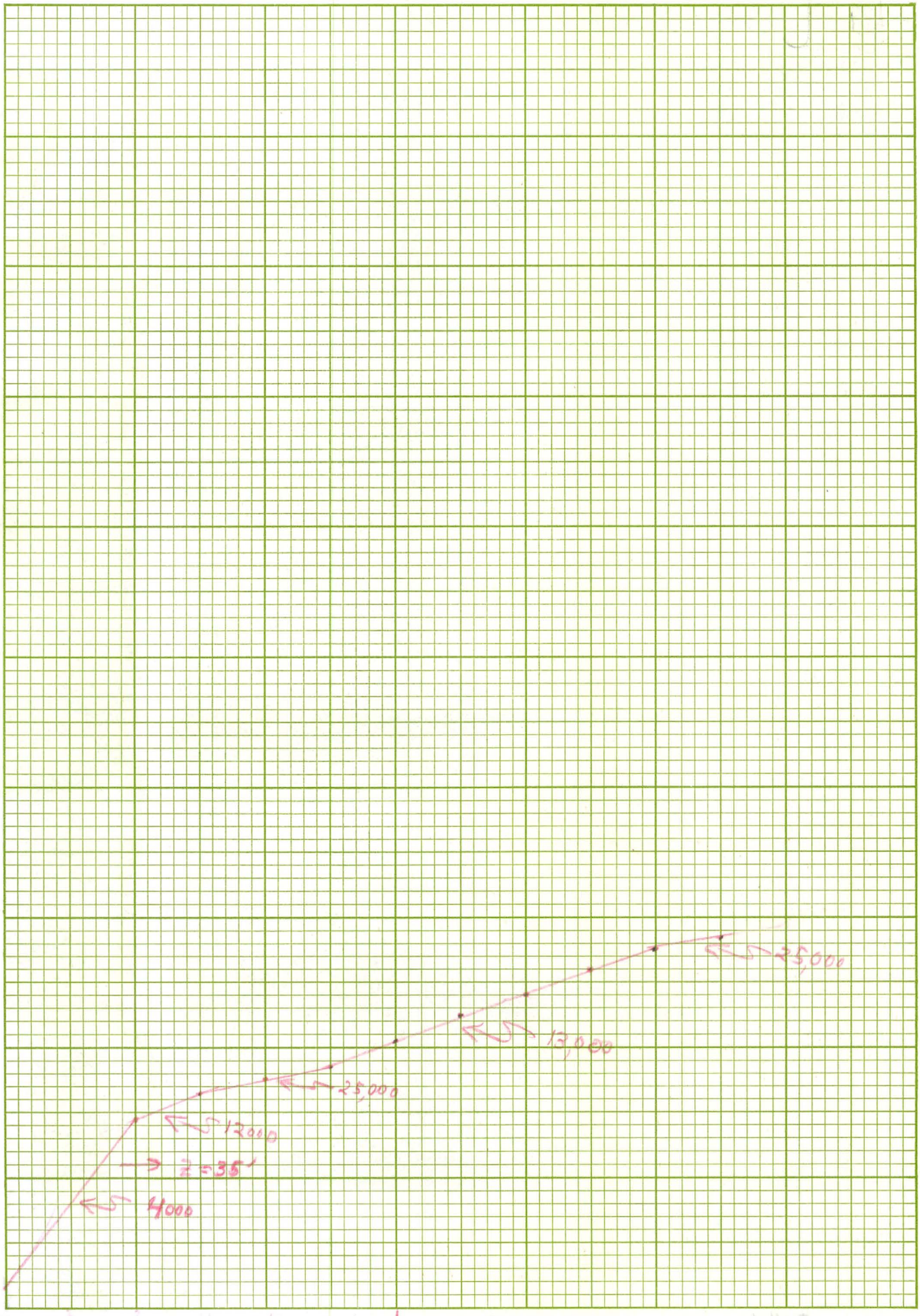
d=77'

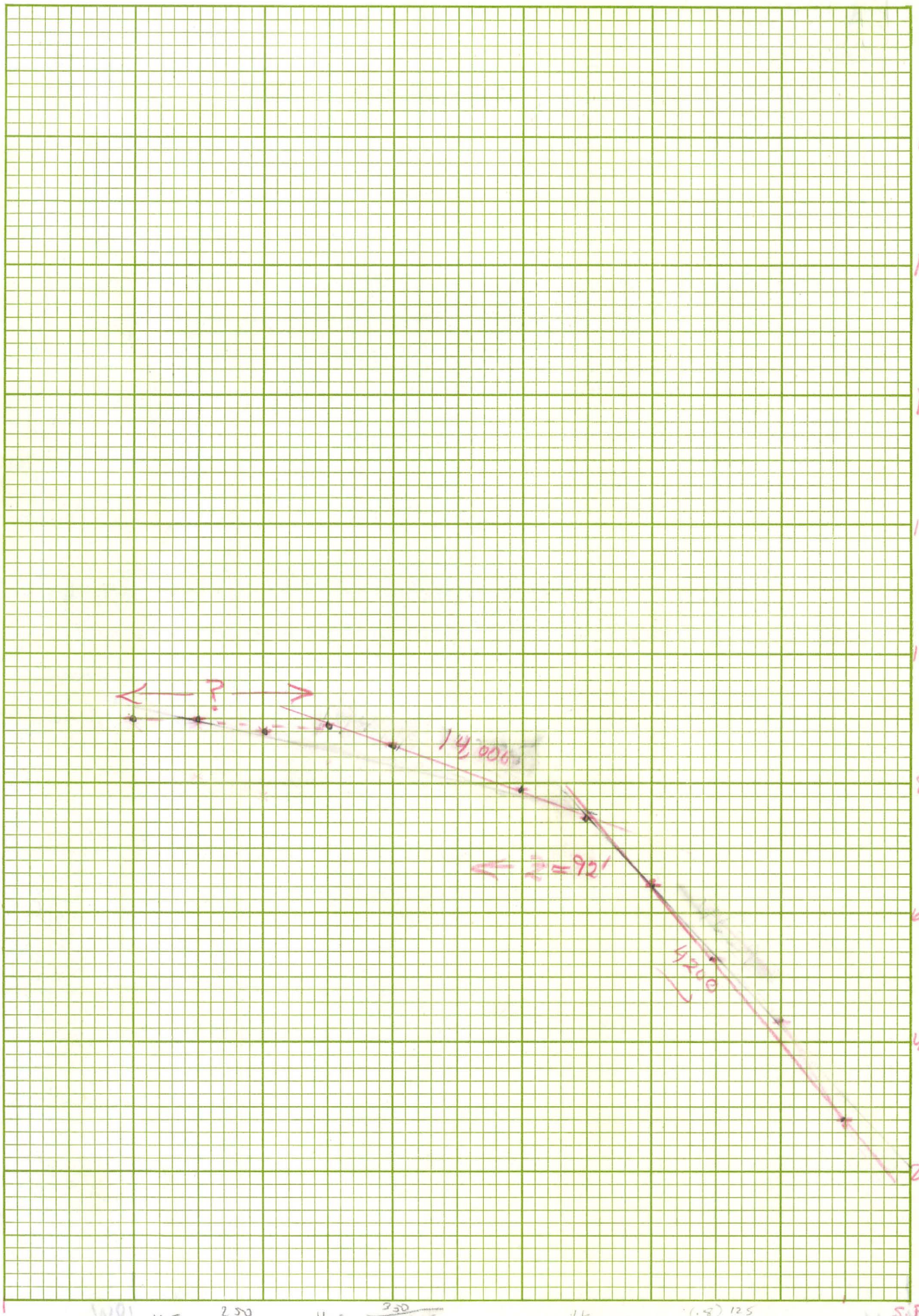
WSP
W ⇒ 24005#9(only)

$V_1 = \frac{200}{.058 - .012} = 4346$

$V_2 = \frac{484}{.092 - .061} = .031$

d = 77' WOE





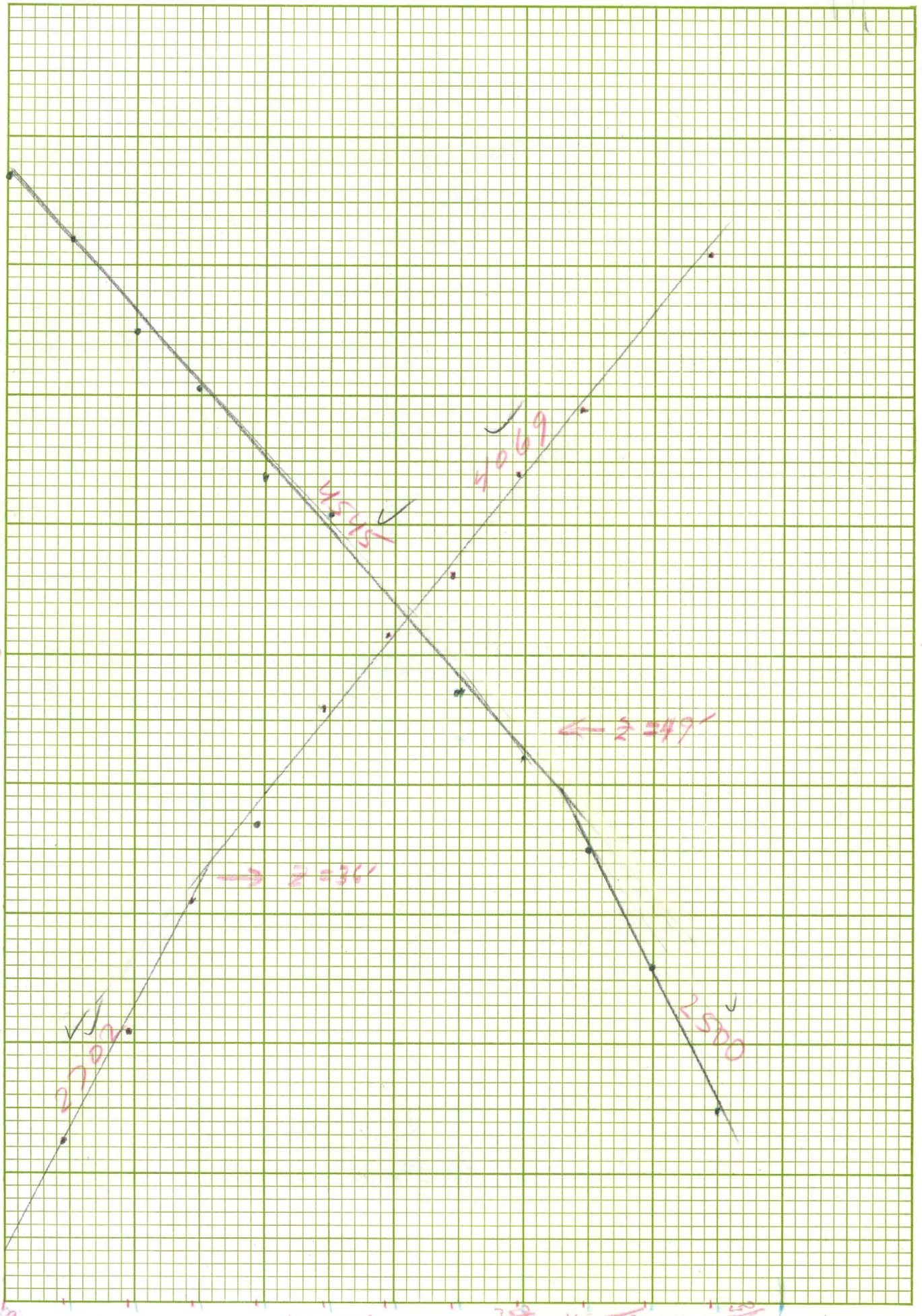
K&E 10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

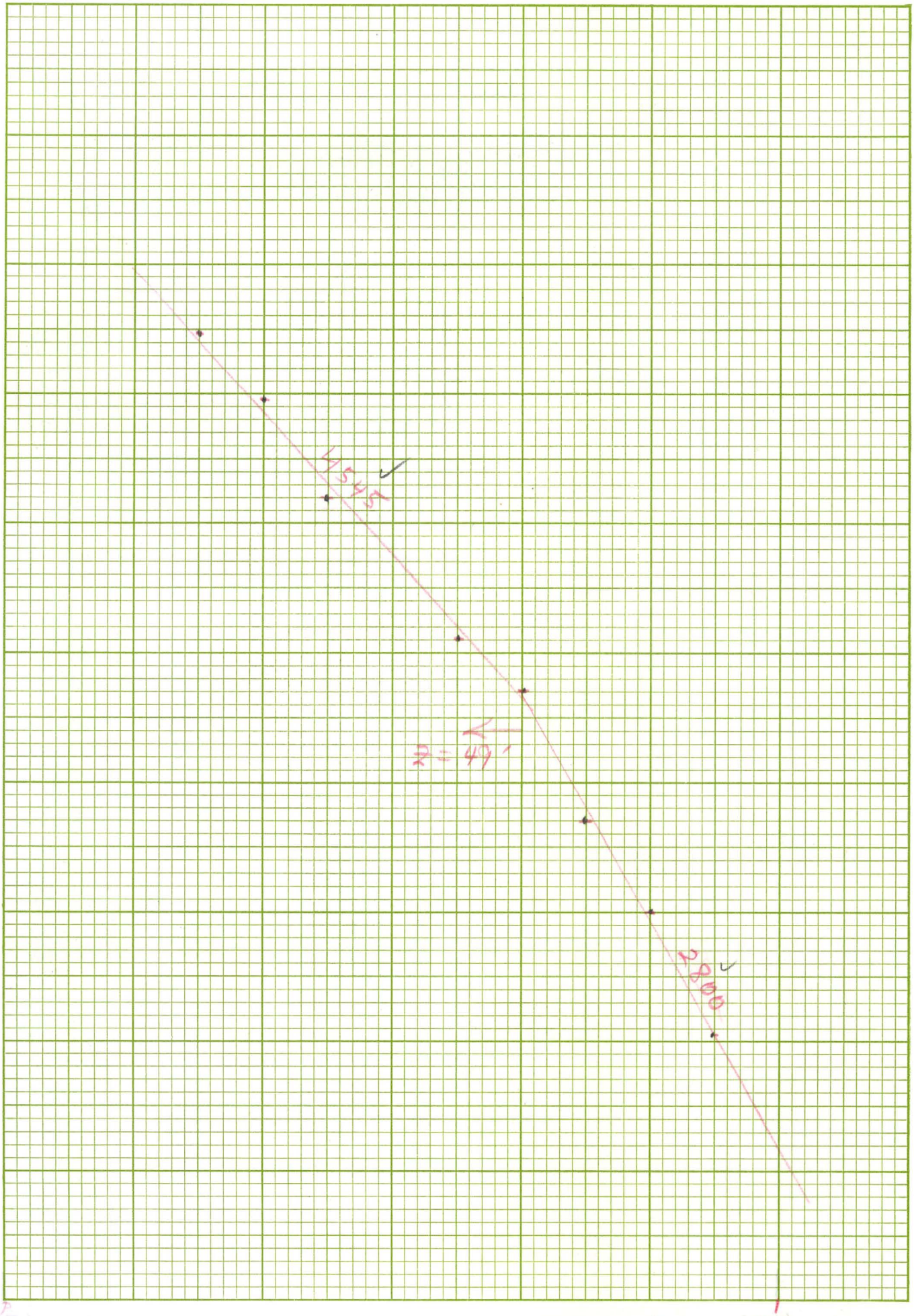
$V_1 = \frac{250}{.075 - .021}$ $V_2 = \frac{330}{.092 - .075}$ (.8) 125

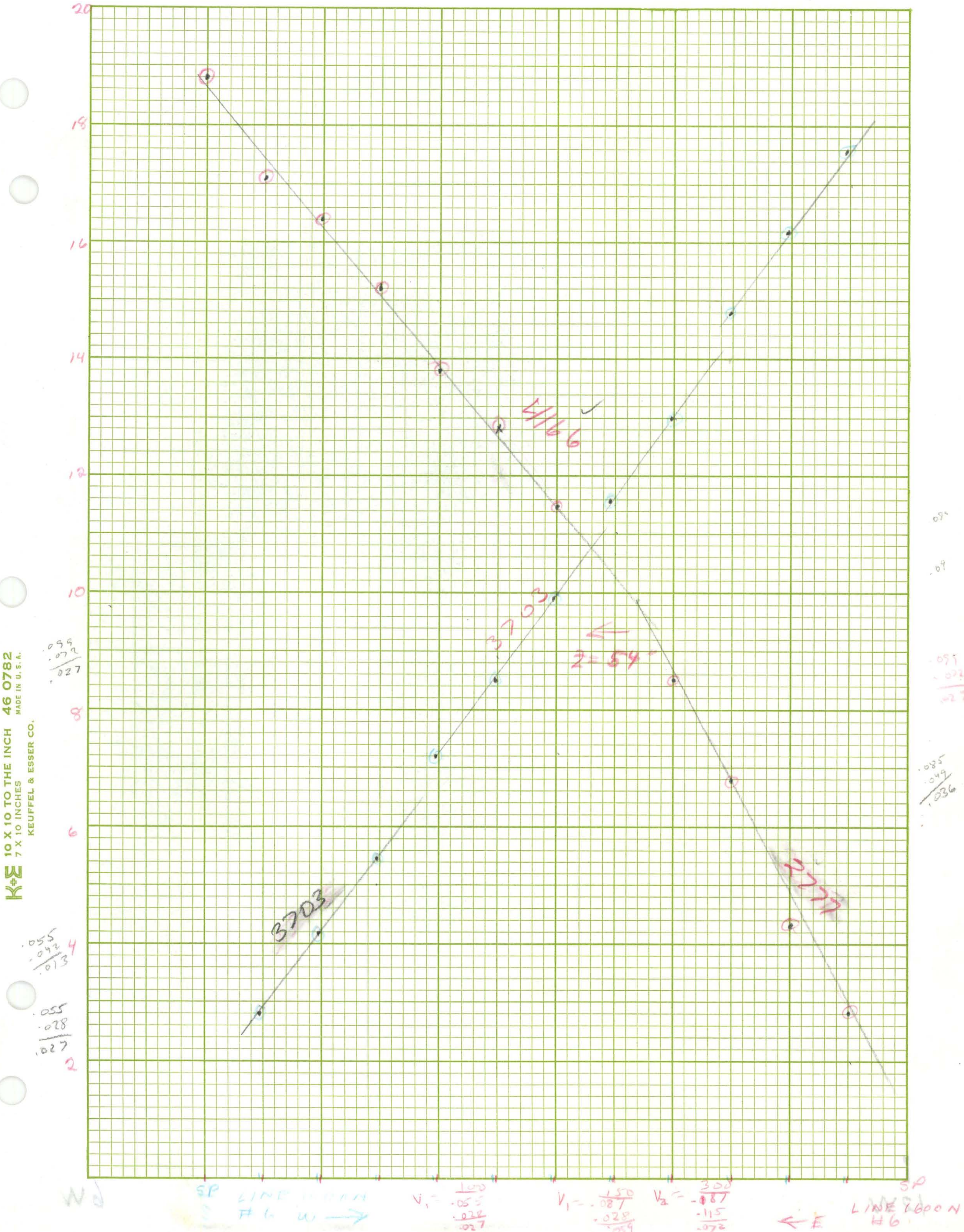
.017

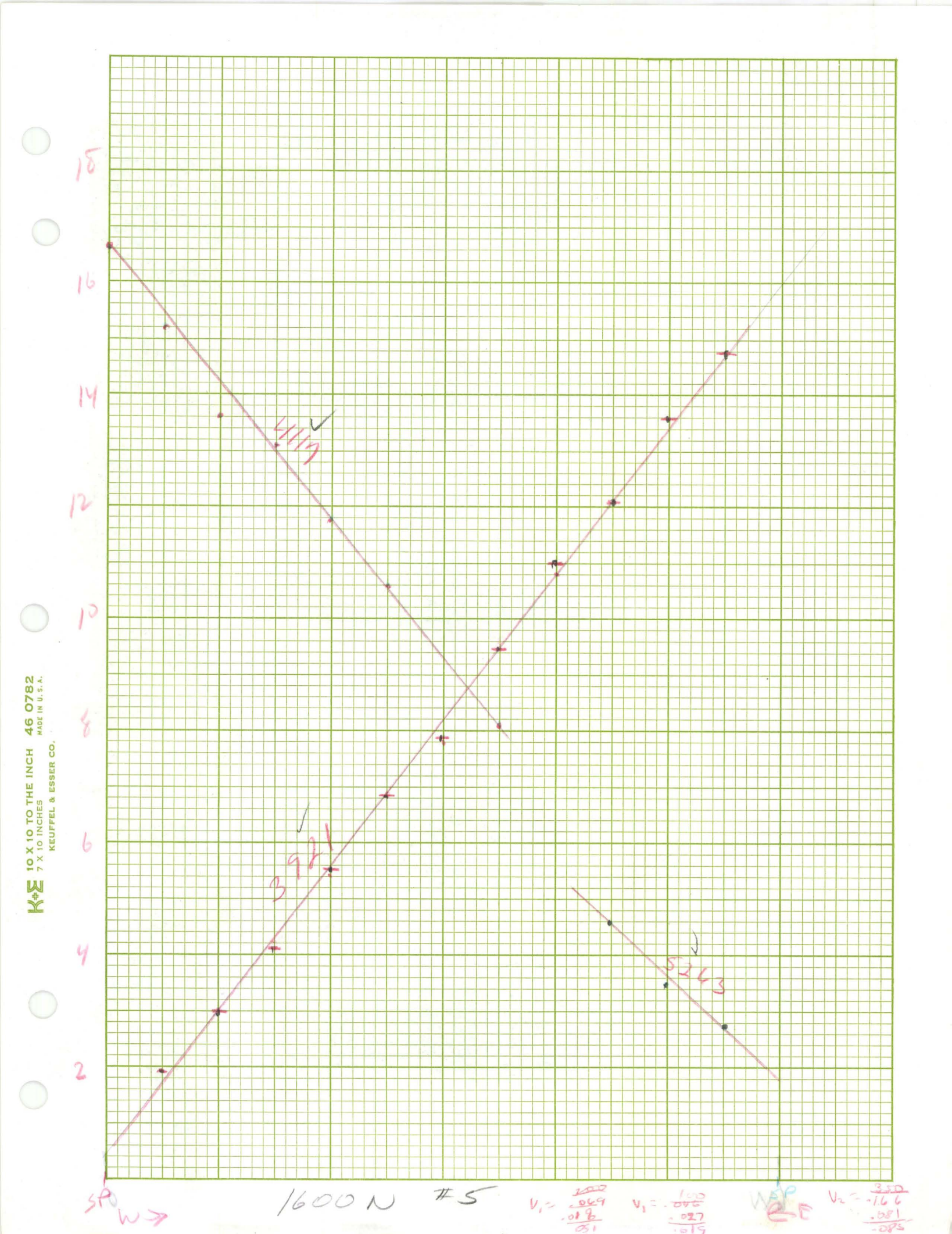
4/0005 #8

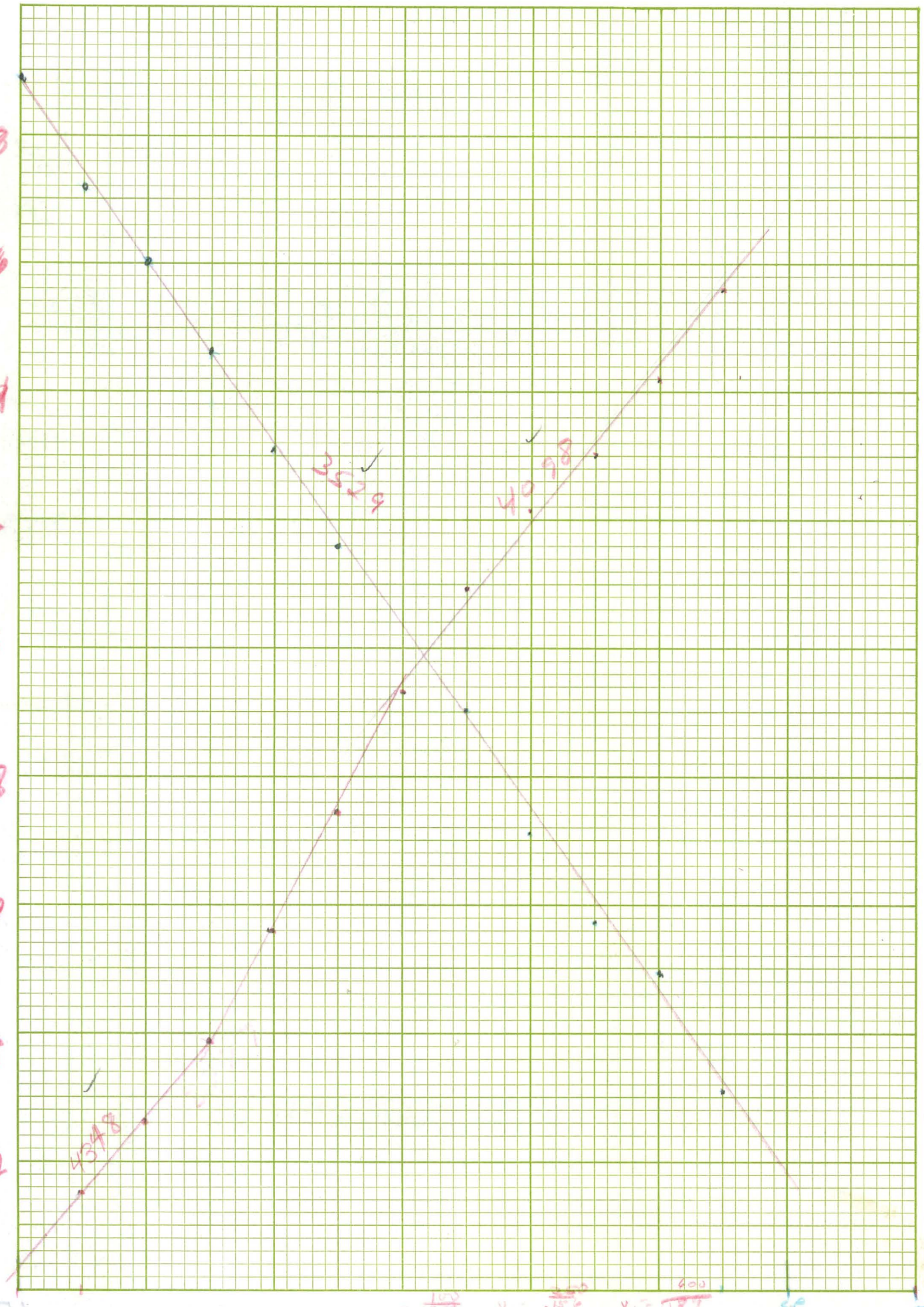
d = 100

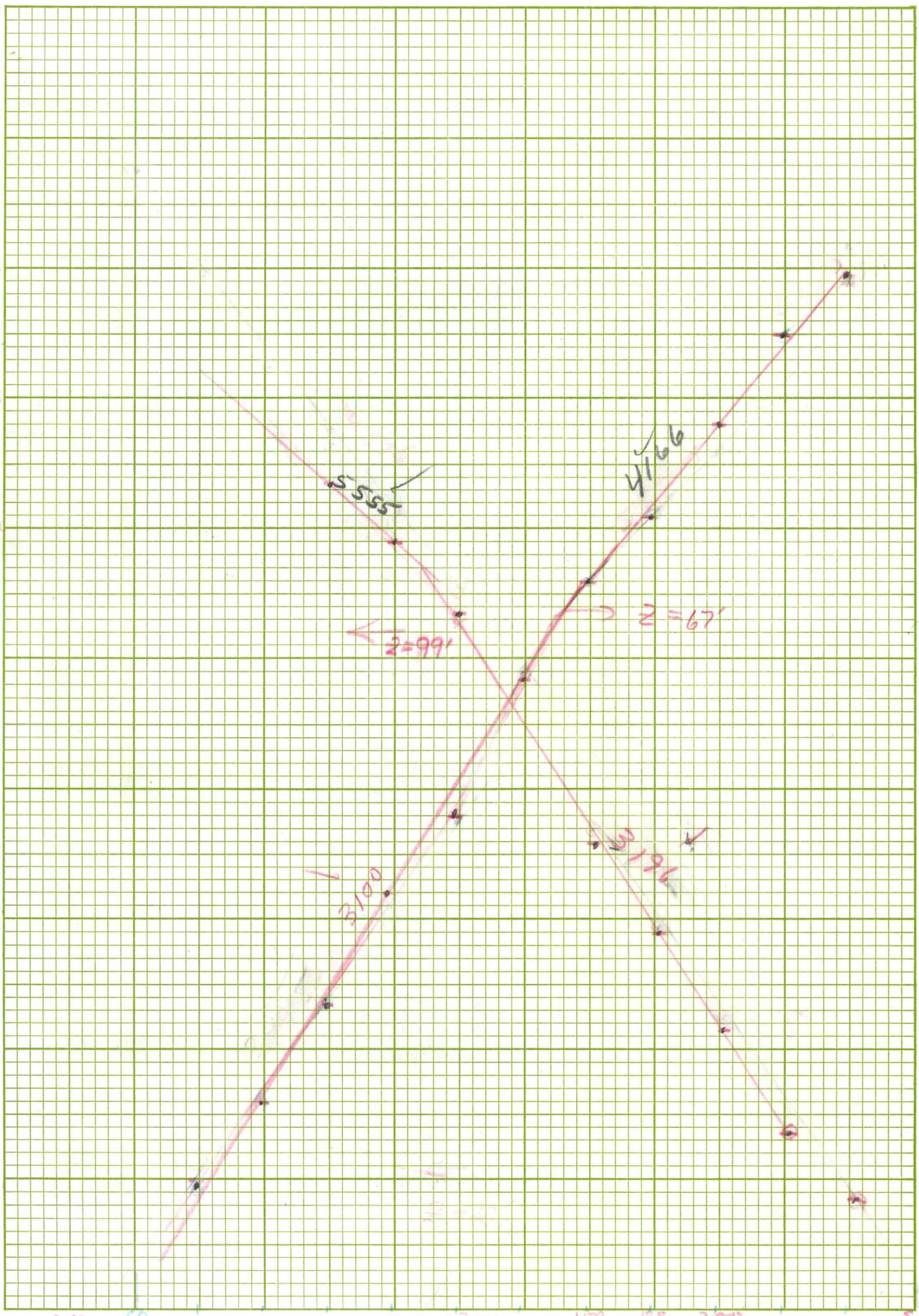


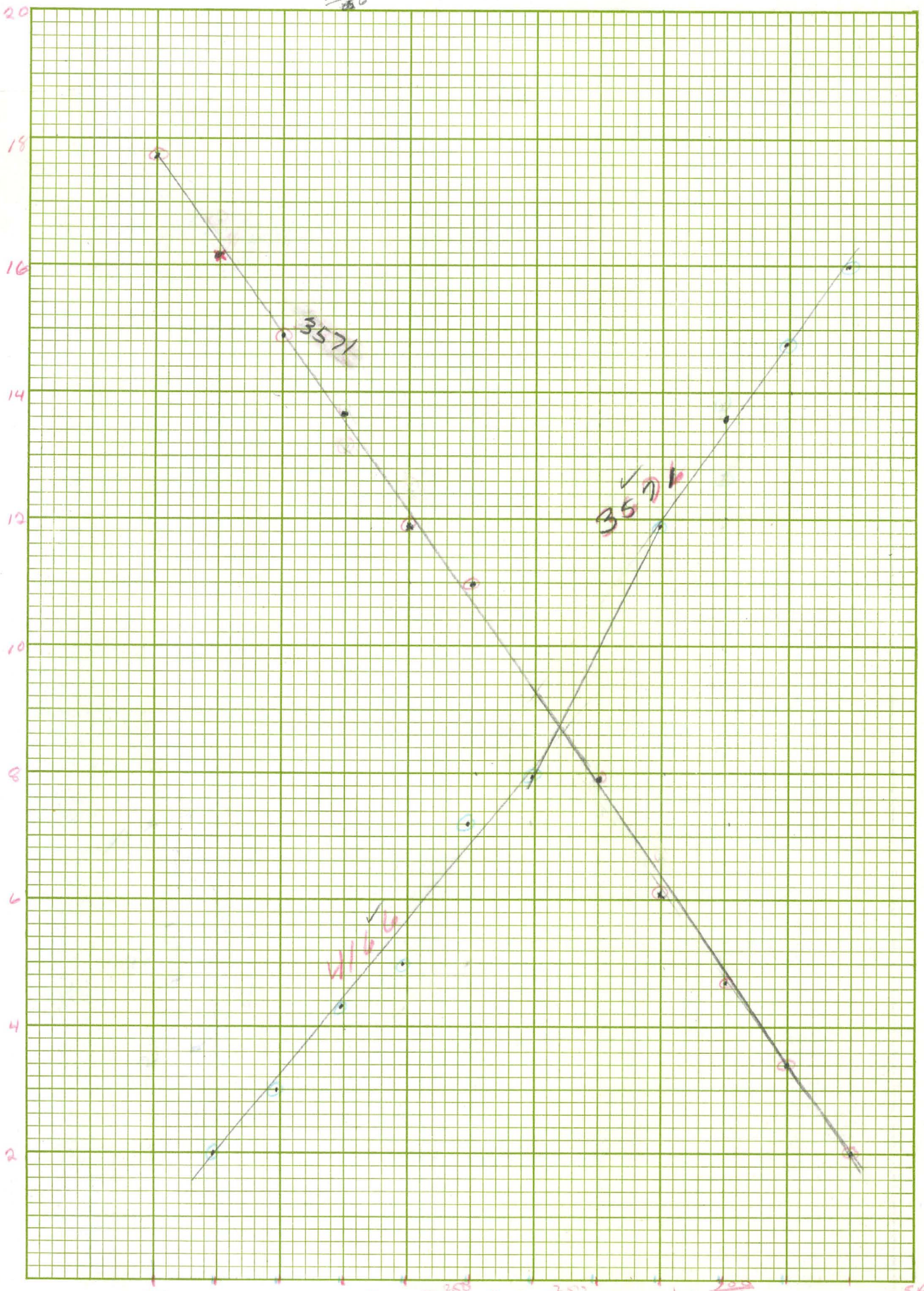


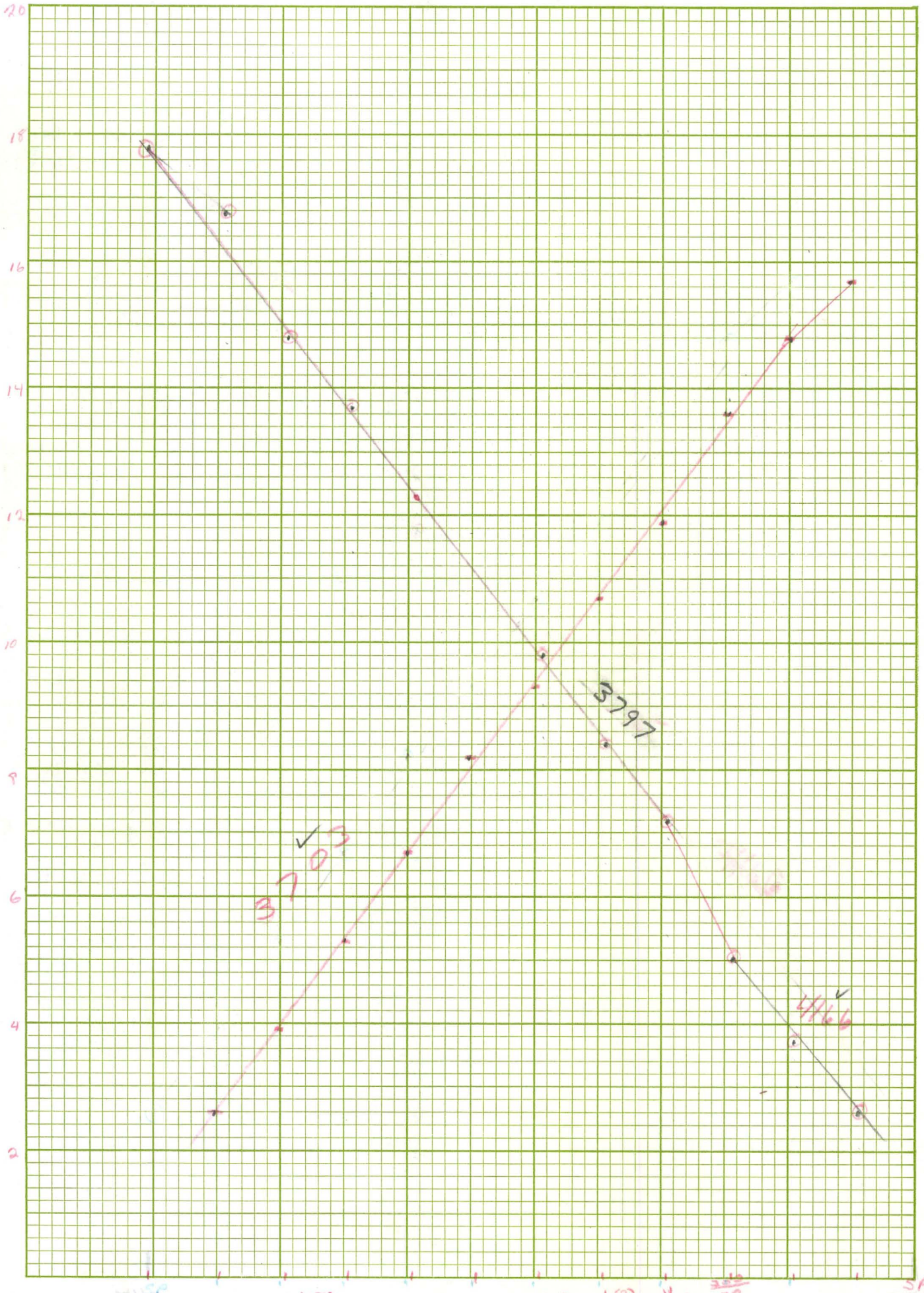

K+E 10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.
20
18
16
14
12
10
8
6
4
2
3703
3703
2777
4166
2=54'
SP
SP
LINE 1600N
H6

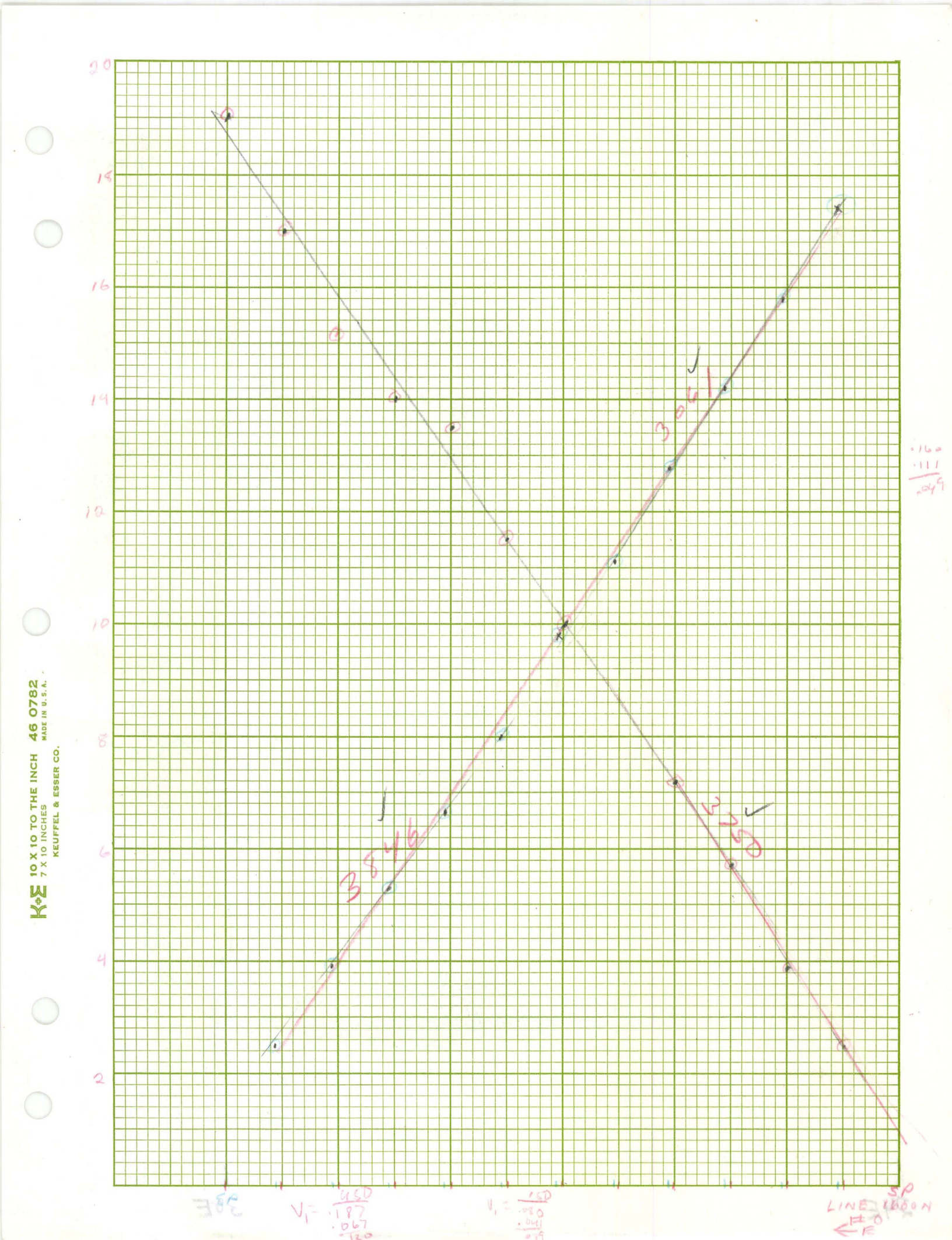




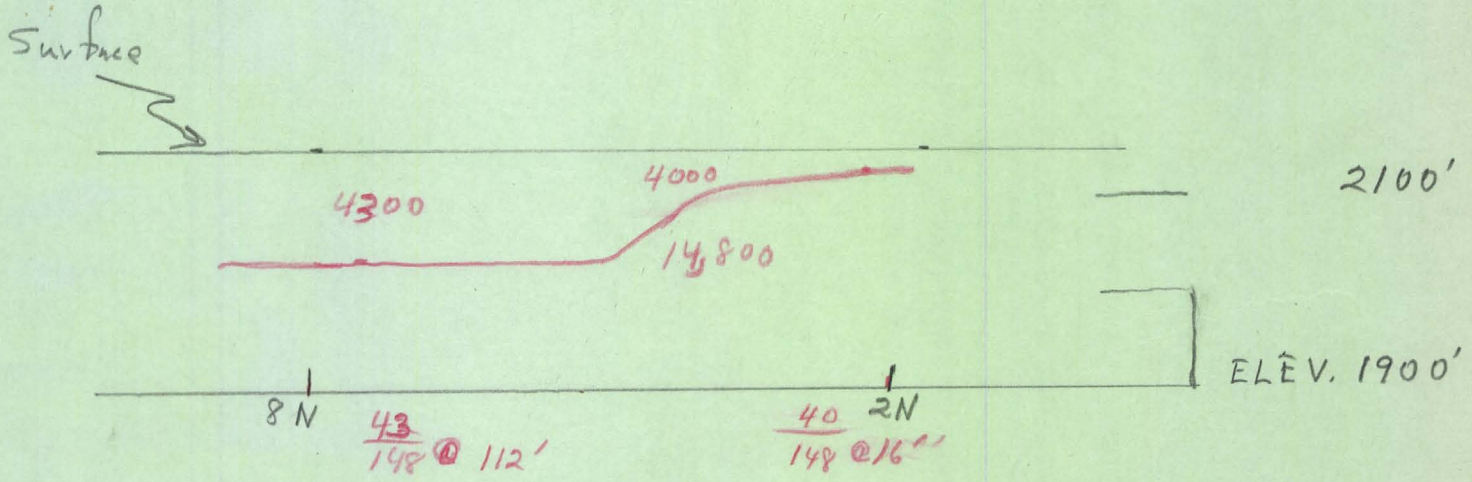







20
18
16
14
12
10
8
6
4
2
10 X 10 TO THE INCH 46 0782
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.


20
18
16
14
12
10
8
6
4
2
3.947
2.631
10,000
2.273
8333
3.750
4166.
7142
5263
← 2.31
SP
LINE 0.0 N/S #1
W →
V
SP
LINE 0.0 #1
← E
V_1 = .033 = .012 / .021
V_2 = .047 / .033 / .014
10 X 10 TO THE INCH 46 0782
7 X 10 INCHES
MADE IN U.S.A.
KEUFFEL & ESSER CO.



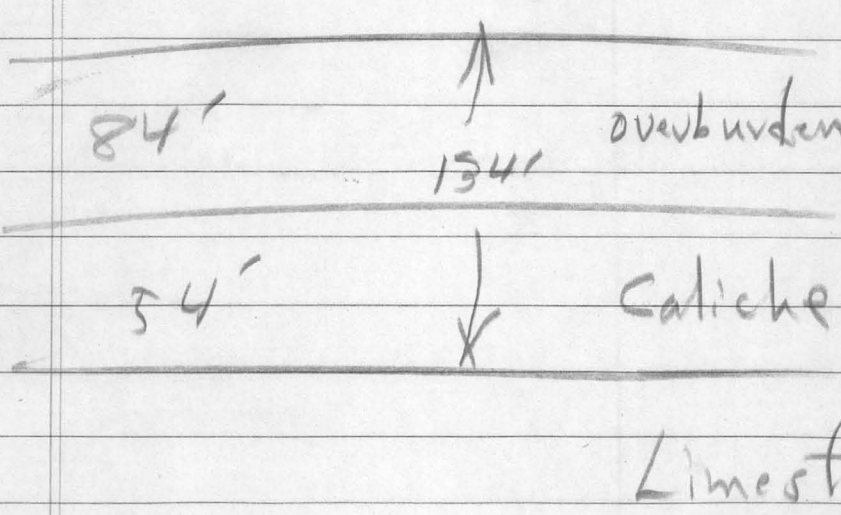
Line 500E
Looking East

Arizona Portland Cement

Arizona Portland Cement

Send raw data copies
plot sheets of Time-Distance curves
Subsurface computed strata sheets on their supplied
cross sections

from Seismic Record
Line 500N #B going East



SEISMIC REFRACTION SURVEY

RILLITO QUARRY

TWIN PEAKS AREA

PIMA COUNTY, ARIZONA

for

ARIZONA PORTLAND CEMENT COMPANY

December 1969 - January 1970

by

HEINRICHS GEOEXPLORATION COMPANY

P. O. Box 5671 - Tucson, Arizona 85703

Phone: 623-0578 - Area Code: 602

TABLE OF CONTENTS

INTRODUCTION

At the request of Mr. Jack Joyce, Chief Geologist of California Portland Cement Company and on behalf of Arizona Portland Cement Company, Heinrichs Geoexploration Company conducted and completed a fairly thorough and comprehensive preliminary seismic refraction reconnaissance survey of the Rillito Quarry Area, located in Pima County, Arizona, near Rillito, Arizona. Field work was done during the interim 13 December through 16 December 1969 and compilation, interpretation and report since then through 23 January 1970.

Heinrichs personnel involved in the field work were William Rasmussen, acting as Crew Chief, with Brian Libby, Carlos Aiken and David Chaffin as Technical Assistants. Interpretation, compilation and report by William Rasmussen assisted by the GEOEX Tucson Staff.

Cooperation and assistance provided by Mr. Jack Joyce, Mr. Dominic Chiaro and other personnel of Arizona Portland Cement Company is most appreciated.

PROCEDURE

A seismic survey utilizing the refraction reverse shooting method was conducted with a total linear coverage of 26,400 feet. Eighty-four time-distance curves were plotted and used for interpretation. On several deep shots, information of subsurface material was obtained in excess of 350 feet below surface, while the majority of the survey gave good information down to approximately 150 feet.

Data was obtained utilizing a twelve channel graphic recording oscillograph, using twelve geophones spaced fifty feet apart. Records were obtained on dry-white photographic paper which was developed initially by sunlite in the field and then chemically developed and fixed in the office. Chemical developing proved rather good on some records and bad on others and as a result of this difficulty, data from five records was lost because it was not immediately recorded before chemical developing and later the records proved unreadable. Part of this problem was ascribed to a bad or old batch of record paper not immediately identified. In routine work this situation can be avoided.

All seismic spreads and lines surveyed were oriented E/W with the exception of one 600 foot spread oriented N/S.

Data are presented on sectional data sheets as well as on a plan map of the area surveyed. Velocities in feet per second for the various materials encountered as well as depths to interfaces

are given on both of the above. Time-distance curves for each line are on the sectional data sheet of that particular line. The raw field data is enclosed at the end of the report.

CONCLUSIONS AND RECOMMENDATIONS

(1) In general, at least for the immediate area surveyed, the following velocity table appears somewhat valid, but it should be used with reservation, especially in any single instance. Moreover, it should be refined by statistically adding new data points whenever the opportunity occurs to do so.

Velocity (ft./sec.)	Material
1800-4000	Alluvium
4000-5000	Consolidated Alluvium and/or Caliche
5000-7000	Caliche and/or Limestone
7000-15000	Limestone
15000-25000	Limestone, Quartzite, Schist

The reason for not being able to state exactly what a particular material has for a seismic velocity of propogation, is that the material is not perfectly homogenious and isotropic. For example, it may be: cyrstaline, reticulated or containing small veinlets, fractured, brecciated, etc. The velocities associated with any two of these cases might easily be falsely interpretated as two entirely different materials.

(2) A zone of high velocity material (11,000-14,000 feet per second), which is probably crystaline limestone, seems to extend from 2,000 E. on Line 800 S. northwesterly through 400 W. on Line 800 N. on further to Line 1600 N. This material is at depths of

approximately 90 feet at 2000 E. on Line 800 S., 90 feet at 300 E. on Line 0.0 N/S, 120 feet at 300 W. on Line 800 N., and 260 feet at 1000 W. on Line 1600 N. The material exists in: a quite highly faulted area on Line 800 S., an area with eastern and western faulting on Line 0.0 N/S., an area with a western fault whose throw is about 90 feet on the western edge and an undetermined throw to the east on Line 800 N., and no apparent faulting shows on Line 1600 N. The width of the material which is likely within 150 feet of surface is: undetermined on Line 800 S., about 900 feet on Line 0.0 N/S, 18000 feet on Line 800 N., and below this depth on Line 1600 N.

(3) Another zone of material of (11,000-14,000 feet per second) velocity as in (2) goes west-southwest of 2000 E. on Line 800 S. to 300 W. on Line 1600 S., then to 2000 W. on Line 2400 S. and thence south to 2000 W. on Lines 3200 S. and 4000 S.. Line 1600 S. is quite faulted and broken for about 1000 feet west and an undetermined distance east of 300 W. The material is at a depth of approximately 20(feet at 300 W., with a gradation to a lower velocity of material to the west within 300 feet. The eastern extension of this is unknown, as this was the edge of the survey coverage in that direction. Line 2400 S., shows a slightly higher velocity material buried about 80 feet and extending an undetermined distance to the west with a fault to the east at approximately 1400 W.. Lines 3200 S. and 4000 S. show two layer situations with the

material of interest having overburdens of 32 and 95 feet respectively.

(4) Lower velocity material is seen to lie on top of or bordering the material given as crystaline limestone in (2) and (3) above. This material might be limestone which is fractured, reticulated, brecciated, etc., or a very consolidated caliche.

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(6) Several shots are required to determine the exact position of a lateral interface (contact) of materials of differing seismic velocities as the interpretation of a single shot could be a lateral or horizontal contact. Hence the position of the lateral interfaces are shown to be in question on the sectional data sheets.

(7) Several resistivity interfaces determined from a previous Induced Polarization Survey of the property (Geoex, 1967) are roughly plotted on the plan map. In the case of resistivity the limestone has a higher resistivity than caliche which in turn is higher than the alluvium. One zone of high resistivity appears to be located between (2300 S., 2900 W.) and (1600 S., 2300 E.). This zone could be limestone going into caliche and/or alluvium at the ends. Another zone of somewhat lower resistivity appears to extend

from (300 S., 1200 W.) to (200 N., 1700 E.). This zone could also be limestone and/or caliche going into alluvium at the ends. These zones were determined using a 1500 foot dipole spacing and, as a result of that, the majority of the material sensed is probably deeper than 150 feet. Information primarily representative of the top 150 feet of material usually will not be obtained using a dipole spacing this large. Dipoles from 100 feet to 500 feet would be preferable for studying the top 150 foot layer. Another resistivity interface is located at approximately (1100 S., 1000 W.), with the higher resistive body (probably limestone) to the south-southeast with possibly caliche and/or alluvium to the north-northwest. This interface is on a line with a dipole spacing of 500 feet and 500 foot dipoles. Thus the results did not focus on the material in the first 50-75 feet of depth below the surface and hence the resistivity of that top layer of material was not determined.

(8) Resistivity or gravity methods might be used to give additional information on the property or to aleviate any ambiguities of seismic interpretation. In general the seismic method appears best suited for determining the subsurface structure over any other geophysical method.

(9) Any information that might be given Geoex in the future about drilling results along the lines surveyed will let Geoex make the most effective use of the geophysical data already obtained. Very

often this information will allow a more refined interpretation that can be quite valuable to the client's programs.

INTERPRETATION

The following velocity table is derived from the observed results and may be used with proper exceptions, reservations and appropriate refinements as available.

Velocity (ft./sec.)	Material
1800-4000	Alluvium
4000-5000	Consolidated Alluvium and/or Caliche
5000-7000	Caliche and/or Limestone
7000-15000	Limestone
15000-25000	Limestone, Quartzite, Schist

It is important to emphasize some of the reasons for not being able to state exactly what a particular material has for a seismic velocity of propogation, therefore, these are herewith repeated. Among them may be a material which is: cyrstaline, reticulated or containing small veinlets, fractured, brecciated, etc. The velocities associated with any two these cases might easily be falsely interpretated as two entirely different materials.

Several shots are required to differentiate between a horizontal or a vertical contact in materials of varying seismic velocities. This is why the vertical contacts are shown to be in question as to their position.

The position of a particular profile is found on the plan map by the coordinates of line number and then spread number on the line, eg., Line 800 S., Spread 7 is on the 800 N. major grid

line and between 1800 W. and 1200 W.. Spread numbering goes from right to left when looking northerly.

LINE 1600 N.

Deep shots on this line show a high velocity material approximately 260 feet from 1800 W. to 0.0 E/W. Beyond this, no further deep sensing was done on this line. Hence, extension of the formation in both directions from the above is possible. This high velocity material is probably crystaline limestone.

LINE 800 N.

This line shows a high velocity material with abrupt edges (faults) at approximately 1100 W. and 600 E. The shallowest point to this body is around 600 W. where the material is approximately 95 feet below surface. This material again is probably crystaline limestone.

LINE 0 N.

The high velocity material (probable crystaline limestone) seen on Lines 1600 N. and 800 N., is again seen from 0.0 E/W to 650 E. with apparent faults or folds at both ends. The depth to the body is approximately 90 feet. Overlying this material is a lower velocity material which outcrops around 500-650 E., with further extension toward the east to approximately Station 2000 E.. This particular material, from the looks of the outcrop, is lower velocity limestone than that mentioned at the western edge of the high velocity material on this line and on the lines north of this

one. The depth of 181 feet to a 20,000 feet per second material at the eastern edge of spread two is possibly due to an instrumental error giving erroneous data.

LINE 800 S.

This line shows a medium velocity body, possibly limestone, beginning close to 0.0 E/W and extending somewhere into the area of 1000 E. It appears to lie beneath a 15-40 foot overburden of probable caliche. A 22,200 feet per second material (crystaline limestone, quartzite or schist) seems to occur from 12000-15000 E.; it seems overlain by caliche or low velocity limestone at 1300 E. to a depth of approximately 75 feet. A probable fault appears near 1600 E. with the overburden changing to a higher velocity material (probably limestone of medium velocity) with a change in the buried material to a lower velocity (12,400 feet per second which best fits a crystaline limestone). The overburden at this point is approximately 90 feet. At 1800 E. is an apparent vertical change in velocity of the overburden from 8100 to 5100 feet per second with no apparent change in velocity of the buried material. The overburden from Station 1800 E., on to 2400 and indefinitely beyond, is likely to be caliche with a crystaline limestone beneath it. The depth of overburden goes from approximately 90 feet at 1800 E. to 135 feet at 2400 E..

LINE 1600 S.

There appears to be several lateral changes in seismic velocity

along this line which are most apt to be due to faults. The line begins at 3000 W. likely with a consolidated aluvium overburden over caliche or a low velocity limestone at a depth of approximately 100 feet. There appears to be a fault in the overlain material or at least a change in it's velocity at roughly 2100 W.. The lower material is now likely a medium velocity limestone at an approximate depth of 130 feet with the same overburden as to the west. At about 1500 W. there is another change in the overlain material to a higher velocity material (probable crystaline limestone); this material is at roughly 100 feet. A fault appears near 800 W. giving a single layer with a velocity of near 8000 feet per second which suggests a limestone that increases in compactness or crystallinity as it goes east to 0.0 E/W. This high velocity material has a surface cover beginning near 600 W. and going on to 0.0 E/W. This overburden has a velocity of 6100 feet per second, (possible caliche or a broken limestone) with a thickness of near 20 feet at 500 W.

LINE 2400 S.

This line begins with an overburden of consolidated alluvium at 3000 W. of a depth of 80 feet with a high speed material below (probable crystaline limestone). At 1800 W. there seems to be a change in the overburden to a higher velocity material (caliche or low speed limestone). The lower layer material undergoes a lateral change near 1400 W. to a medium speed material (9600 feet

per second which probably represents a limestone) with an overburden thickness of 35 feet at 1300 W.

LINE 3200 S.

Only one profile of the three shots for this line were usable. This record showed an overburden of 35 feet (consolidated alluvium ?) at 1800-2400 W. overlying a high speed material (crystaline limestone ?).

LINE 4000 S.

Only one of the three records made were usable to give a time-distance graph. This record implied an overburden of consolidated alluvium or caliche with a thickness of about 90 feet at 2400-1800 W. The lower layer is high velocity material (14000 feet per second which is believed to be crystaline limestone, quartzite, or schist).

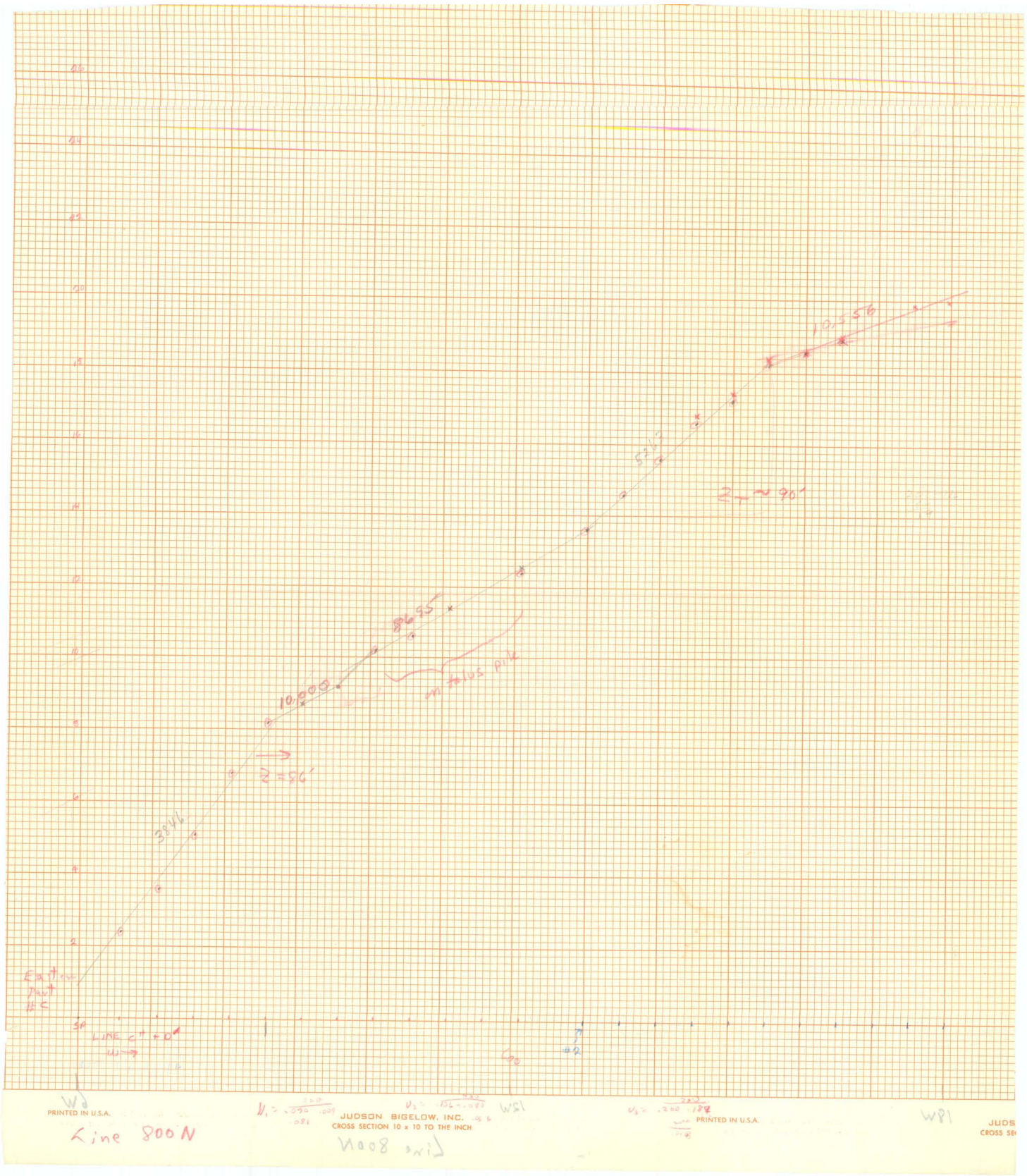
LINE 500 E.

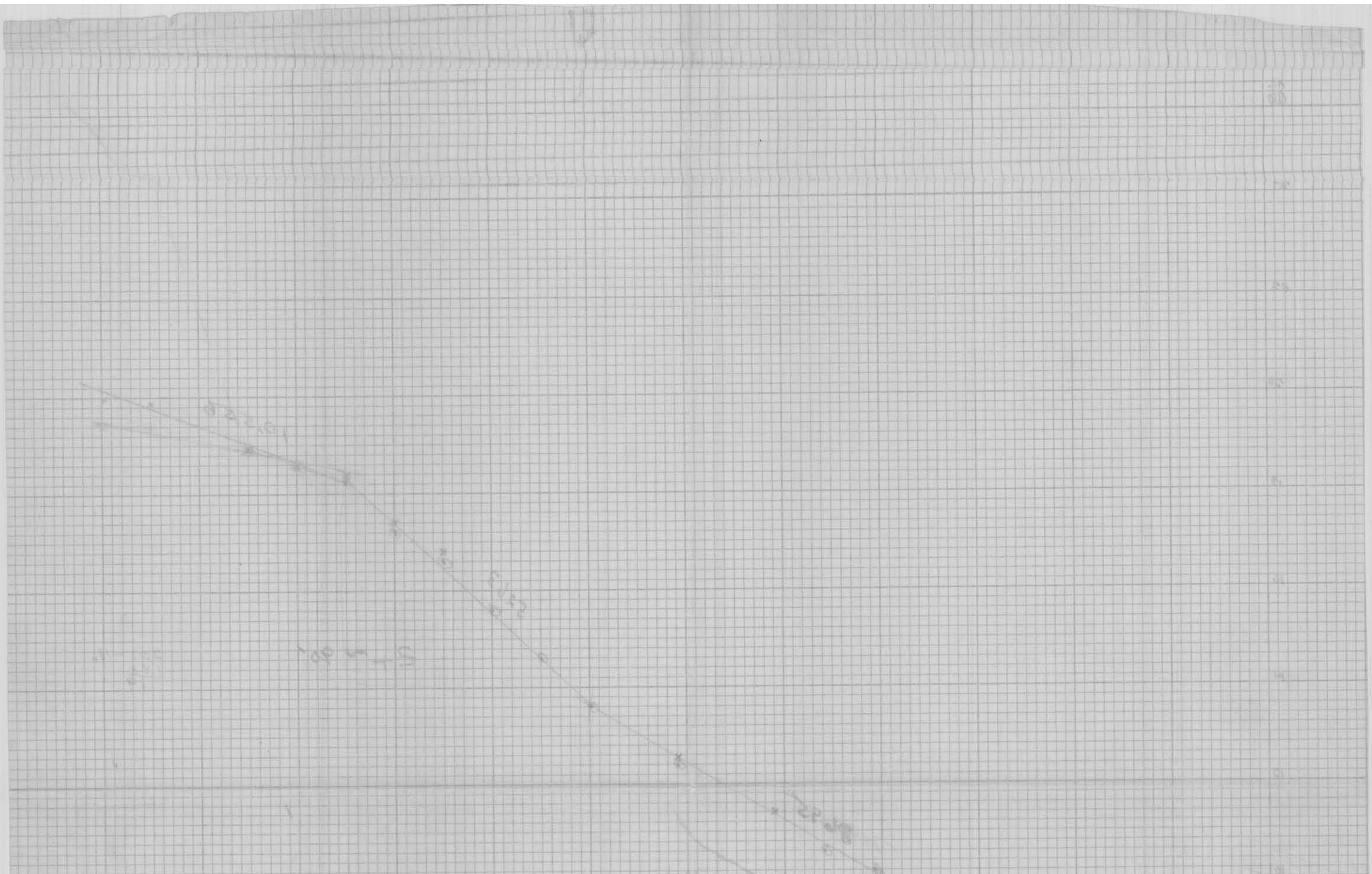
This line has an overburden of a low velocity material (probable caliche) with a thickness of 16 feet at the southern end, deepening, with a throw of 50 feet toward the middle, to a thickness of approximately 110 feet at the northern end. The underlying material has a high velocity and should be crystaline limestone.

Respectfully submitted,
HEINRICHS GEOEXPLORATION COMPANY

William O. Rasmussen
Physicist

WOR/md





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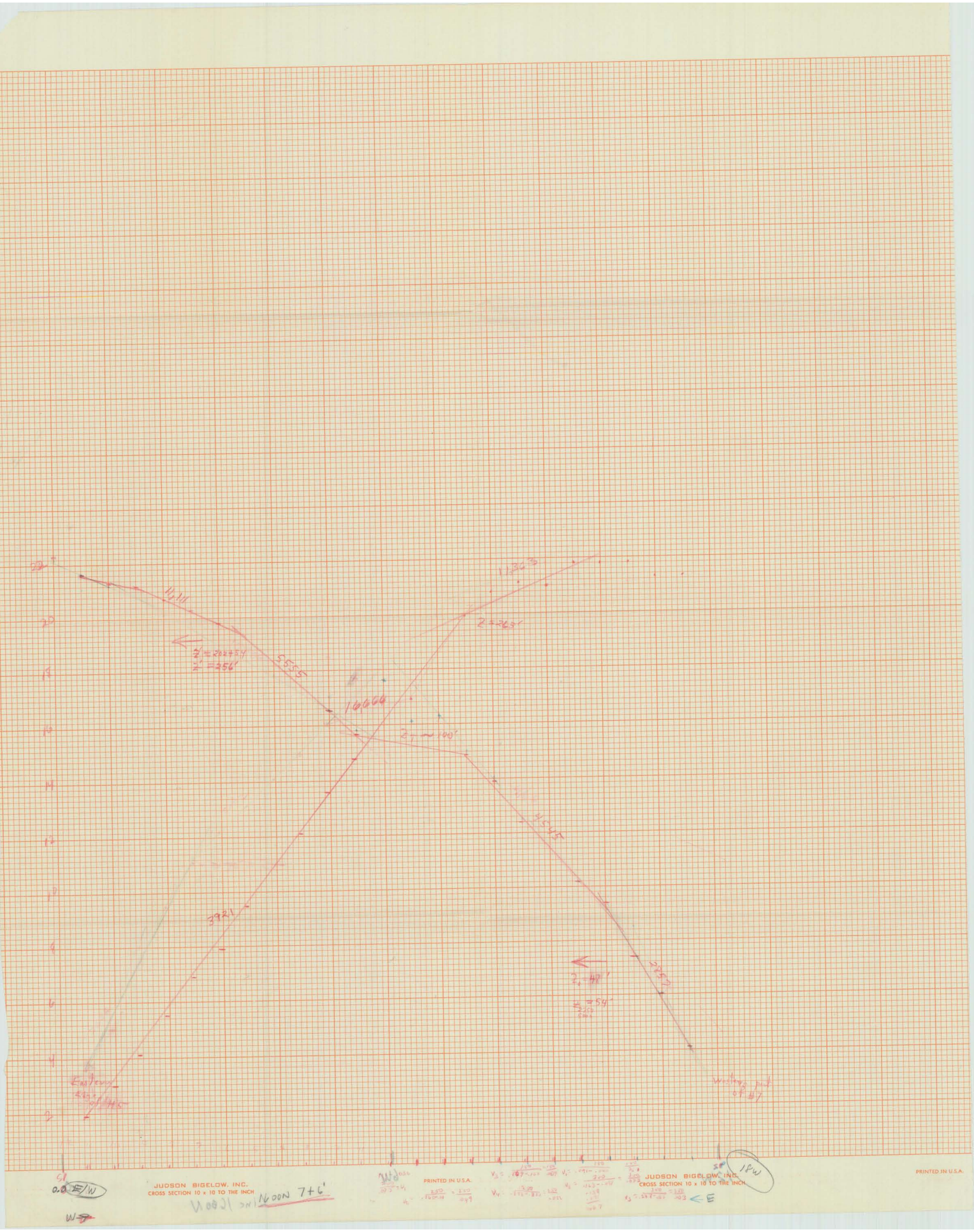
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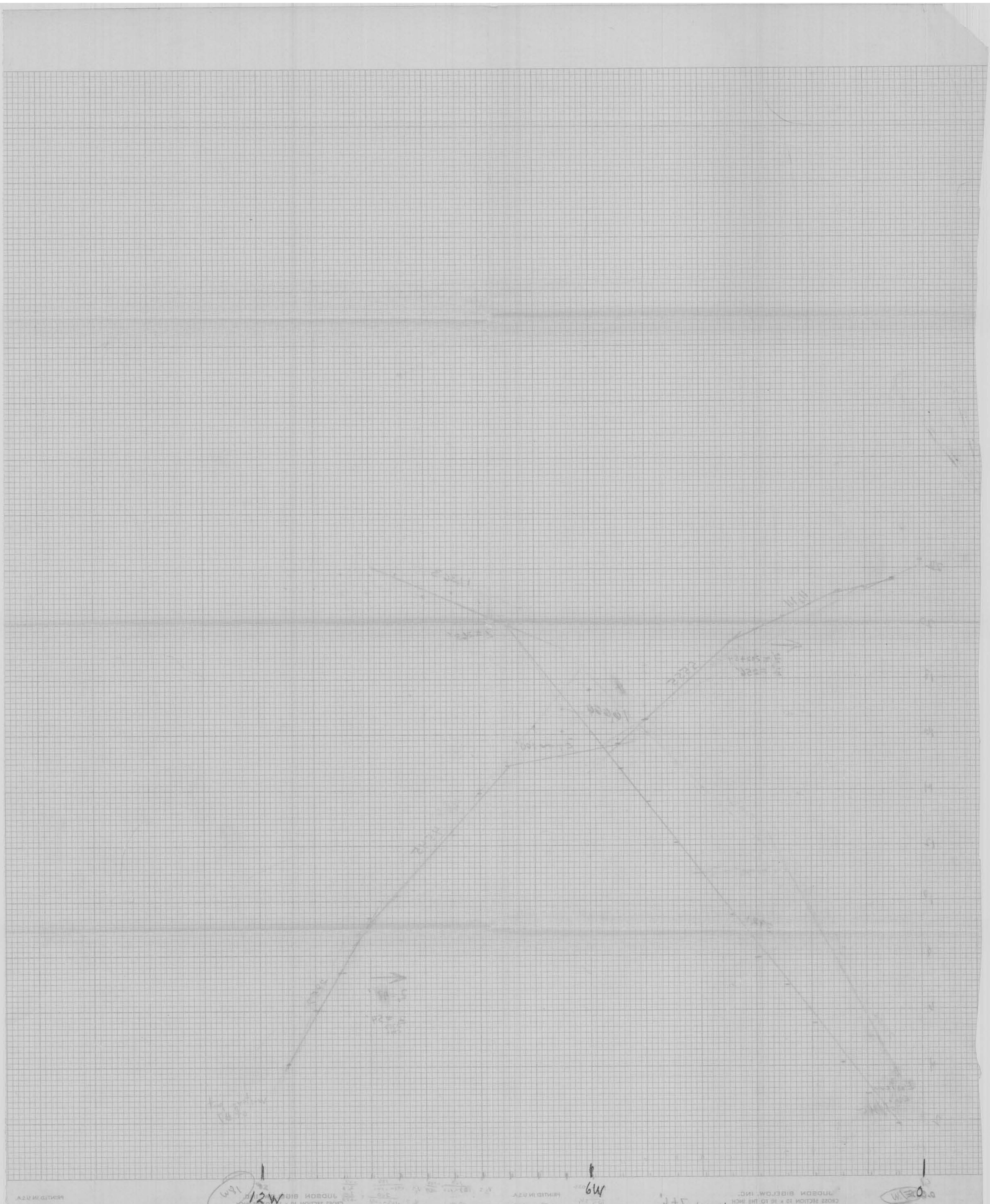

12W
6W
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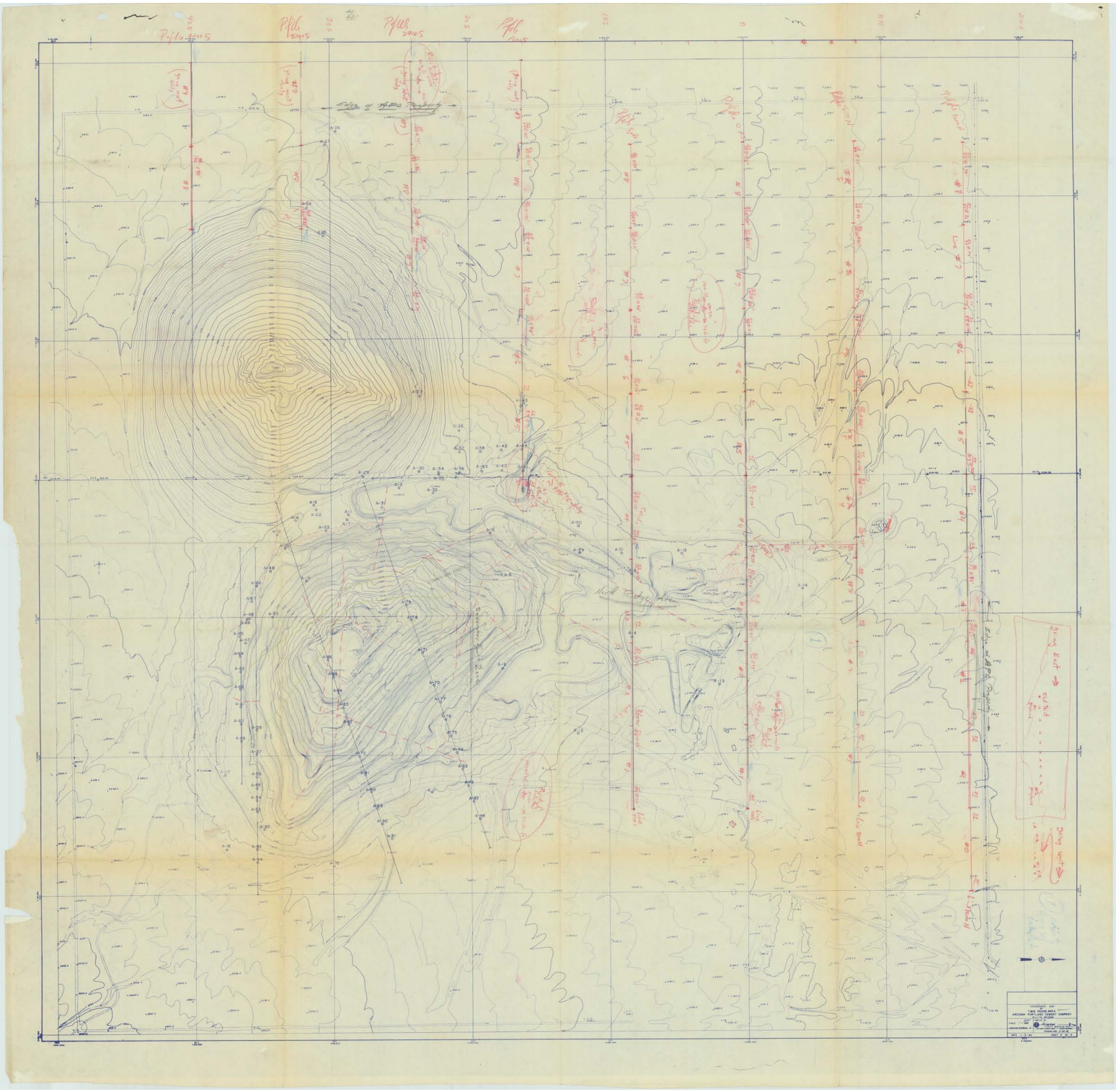
Line 1680N



SEISMIC REFRACTION SURVEY
RILLITO QUARRY
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA

ARIZONA PORTLAND CEMENT COMPANY
December 1969 - January 1970
Job # 492

February 6, 1970

Mr. J. E. Joyce
Arizona Portland Cement Company
612 South Flower
Los Angeles, Calif. 90017

Dear Mr. Joyce:

Enclosed you will find the original and one copy of our report "Seismic Refraction Survey, Rillito Quarry, Twin Peaks Area, Pima County, Arizona". Along with these are the raw field data bound separately.

If you would please return the two copies of the rough text that Walt loaned you last week, we will update the white copy and return it along with the sepias. At that time we also will have further comment on the comparison between seismic versus resistivity methods for your particular application.

Thank you very much for being so understanding in the report taking so long due to the large amount of data handling involved.

Any and all questions are welcome.

Sincerely yours,
Heinrichs GEOEXploration Co.

W. O. Rasmussen, Physicist

WOR:jh
Enclosures as listed

SEISMIC REFRACTION SURVEY

RILLITO QUARRY

TWIN PEAKS AREA

PIMA COUNTY, ARIZONA

for

ARIZONA PORTLAND CEMENT COMPANY

December 1969 - January 1970

by

HEINRICHS GEOEXPLORATION COMPANY

P. O. Box 5671 - Tucson, Arizona 85703

Phone: 623-0578 - Area Code: 602

TABLE OF CONTENTS

GENERAL LOCATION
of
TWIN PEAKS AREA
for
ARIZONA PORTLAND CEMENT COMPANY

ARIZONA

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

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(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5671
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson

INTRODUCTION

At the request of Mr. Jack Joyce, Chief Geologist of California Portland Cement Company and on behalf of Arizona Portland Cement Company, Heinrichs Geoexploration Company conducted and completed a fairly thorough and comprehensive preliminary seismic refraction reconnaissance survey of the Rillito Quarry Area, located in Pima County, Arizona, near Rillito, Arizona. Field work was done during the interim 13 December through 16 December 1969 and compilation, interpretation and report since then through 23 January 1970.

Heinrichs personnel involved in the field work were William Rasmussen, acting as Crew Chief, with Brian Libby, Carlos Aiken and David Chaffin as Technical Assistants. Interpretation, compilation and report by William Rasmussen assisted by the GEOEX Tucson Staff.

Cooperation and assistance provided by Mr. Jack Joyce, Mr. Dominic Chiaro and other personnel of Arizona Portland Cement Company is most appreciated.

PROCEDURE

A seismic survey utilizing the refraction reverse shooting method was conducted with a total linear coverage of 26,400 feet. Eighty-four time-distance curves were plotted and used for interpretation. On several deep shots, information of subsurface material was obtained in excess of 350 feet below surface, while the majority of the survey gave good information down to approximately 150 feet.

Data was obtained utilizing a twelve channel graphic recording oscillograph, using twelve geophones spaced fifty feet apart. Records were obtained on dry-white photographic paper which was developed initially by sunlight in the field and then chemically developed and fixed in the office. Chemical developing proved rather good on some records and bad on others and as a result of this difficulty, data from five records was lost because it was not immediately recorded before chemical developing and later the records proved unreadable. Part of this problem was ascribed to a bad or old batch of record paper not immediately identified. In routine work this situation can be avoided.

All seismic spreads and lines surveyed were oriented E/W with the exception of one 600 foot spread oriented N/S.

Data are presented on sectional data sheets as well as on a plan map of the area surveyed. Velocities in feet per second for the various materials encountered as well as depths to interfaces

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are given on both of the above. Time-distance curves for each line are on the sectional data sheet of that particular line. The raw field data is enclosed in a separate folder.

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CONCLUSIONS AND RECOMMENDATIONS

(1) In general, at least for the immediate area surveyed, the following velocity table appears somewhat valid, but it should be used with reservation, especially in any single instance. Moreover, it should be refined by statistically adding new data points whenever the opportunity occurs to do so.

Velocity (ft./sec.)	Material
1800-4000	Alluvium
4000-5000	Consolidated Alluvium and/or Caliche
5000-7000	Caliche and/or Limestone
7000-15000	Limestone
15000-25000	Limestone, Quartzite, Schist

The reason for not being able to state exactly what a particular material has for a seismic velocity of propogation, is that the material is not perfectly homogenious and isotropic. For example, it may be: cyrstaline, reticulated or containing small veinlets, fractured, brecciated, etc. The velocities associated with any two of these cases might easily be falsely interpretated as two entirely different materials.

(2) A zone of high velocity material (11,000-14,000 feet per second), which is probably crystaline limestone, seems to extend from 2,000 E. on Line 800 S. northwesterly through 400 W. on Line 800 N. on further to Line 1600 N. This material is at depths of

approximately 90 feet at 2000 E. on Line 800 S., 90 feet at 300 E. on Line 0.0 N/S, 120 feet at 300 W. on Line 800 N., and 260 feet at 1000 W. on Line 1600 N. The material exists in: a quite highly faulted area on Line 800 S., an area with eastern and western faulting on Line 0.0 N/S., an area with a western fault whose throw is about 90 feet on the western edge and an undetermined throw to the east on Line 800 N., and no apparent faulting shows on Line 1600 N. The width of the material which is likely within 150 feet of surface is: undetermined on Line 800 S., about 900 feet on Line 0.0 N/S, 18000 feet on Line 800 N., and below this depth on Line 1600 N.

(3) Another zone of material of (11,000-14,000 feet per second) velocity as in (2) goes west-southwest of 2000 E. on Line 800 S. to 300 W. on Line 1600 S., then to 2000 W. on Line 2400 S. and thence south to 2000 W. on Lines 3200 S. and 4000 S.. Line 1600 S. is quite faulted and broken for about 1000 feet west and an undetermined distance east of 300 W. The material is at a depth of approximately 20 feet at 300 W., with a gradation to a lower velocity of material to the west within 300 feet. The eastern extension of this is unknown, as this was the edge of the survey coverage in that direction. Line 2400 S., shows a slightly higher velocity material buried about 80 feet and extending an undetermined distance to the west with a fault to the east at approximately 1400 W.. Lines 3200 S. and 4000 S. show two layer situations with the

material of interest having overburdens of 32 and 95 feet respectively.

(4) Lower velocity material is seen to lie on top of or bordering the material given as crystaline limestone in (2) and (3) above. This material might be limestone which is fractured, reticulated, brecciated, etc., or a very consolidated caliche.

(5) Additional seismic coverage is recommended to the east on Lines 0.0 N/S, 800 S., and 2400 S. as well as repeat coverage of Lines 3200 S. and 4000 S. More N/S lines are also recommended over areas of apparent limestone occurrence to better define faulting and or dip from Line to Line E/W.

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(8) Resistivity or gravity methods might be used to give additional information on the property or to aleviate any ambiguities of seismic interpretation. In general the seismic method appears best suited for determining the subsurface structure over any other geophysical method.

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line and between 1800 W. and 1200 W.. Spread numbering goes from right to left when looking northerly.

LINE 1600 N.

Deep shots on this line show a high velocity material approximately 260 feet from 1800 W. to 0.0 E/W. Beyond this, no further deep sensing was done on this line. Hence, extension of the formation in both directions from the above is possible. This high velocity material is probably crystaline limestone.

LINE 800 N.

This line shows a high velocity material with abrupt edges (faults) at approximately 1100 W. and 600 E. The shallowest point to this body is around 600 W. where the material is approximately 95 feet below surface. This material again is probably crystaline limestone.

LINE 0 N.

The high velocity material (probable crystaline limestone) seen on Lines 1600 N. and 800 N., is again seen from 0.0 E/W to 650 E. with apparent faults or folds at both ends. The depth to the body is approximately 90 feet. Overlying this material is a lower velocity material which outcrops around 500-650 E., with further extension toward the east to approximately Station 2000 E.. This particular material, from the looks of the outcrop, is lower velocity limestone than that mentioned at the western edge of the high velocity material on this line and on the lines north of this

one. The depth of 181 feet to a 20,000 feet per second material at the eastern edge of spread two is possibly due to an instrumental error giving erroneous data.

LINE 800 S.

This line shows a medium velocity body, possibly limestone, beginning close to 0.0 E/W and extending somewhere into the area of 1000 E. It appears to lie beneath a 15-40 foot overburden of probable caliche. A 22,200 feet per second material (crystaline limestone, quartzite or schist) seems to occur from 12000-15000 E.; it seems overlain by caliche or low velocity limestone at 1300 E. to a depth of approximately 75 feet. A probable fault appears near 1600 E. with the overburden changing to a higher velocity material (probably limestone of medium velocity) with a change in the buried material to a lower velocity (12,400 feet per second which best fits a crystaline limestone). The overburden at this point is approximately 90 feet. At 1800 E. is an apparent vertical change in velocity of the overburden from 8100 to 5100 feet per second with no apparent change in velocity of the buried material. The overburden from Station 1800 E., on to 2400 and indefinitely beyond, is likely to be caliche with a crystaline limestone beneath it. The depth of overburden goes from approximately 90 feet at 1800 E. to 135 feet at 2400 E..

LINE 1600 S.

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along this line which are most apt to be due to faults. The line begins at 3000 W. likely with a consolidated aluvium overburden over caliche or a low velocity limestone at a depth of approximately 100 feet. There appears to be a fault in the overlain material or at least a change in it's velocity at roughly 2100 W.. The lower material is now likely a medium velocity limestone at an approximate depth of 130 feet with the same overburden as to the west. At about 1500 W. there is another change in the overlain material to a higher velocity material (probable crystaline limestone); this material is at roughly 100 feet. A fault appears near 800 W. giving a single layer with a velocity of near 8000 feet per second which suggests a limestone that increases in compactness or crystallinity as it goes east to 0.0 E/W. This high velocity material has a surface cover beginning near 600 W. and going on to 0.0 E/W. This overburden has a velocity of 6100 feet per second, (possible caliche or a broken limestone) with a thickness of near 20 feet at 500 W.

LINE 2400 S.

This line begins with an overburden of consolidated alluvium at 3000 W. of a depth of 80 feet with a high speed material below (probable crystaline limestone). At 1800 W. there seems to be a change in the overburden to a higher velocity material (caliche or low speed limestone). The lower layer material undergoes a lateral change near 1400 W. to a medium speed material (9600 feet

per second which probably represents a limestone) with an overburden thickness of 35 feet at 1300 W.

LINE 3200 S.

Only one profile of the three shots for this line were usable. This record showed an overburden of 35 feet (consolidated alluvium ?) at 1800-2400 W. overlying a high speed material (crystaline limestone ?).

LINE 4000 S.

Only one of the three records made were usable to give a time-distance graph. This record implied an overburden of consolidated alluvium or caliche with a thickness of about 90 feet at 2400-1800 W. The lower layer is high velocity material (14000 feet per second which is believed to be crystaline limestone, quartzite, or schist).

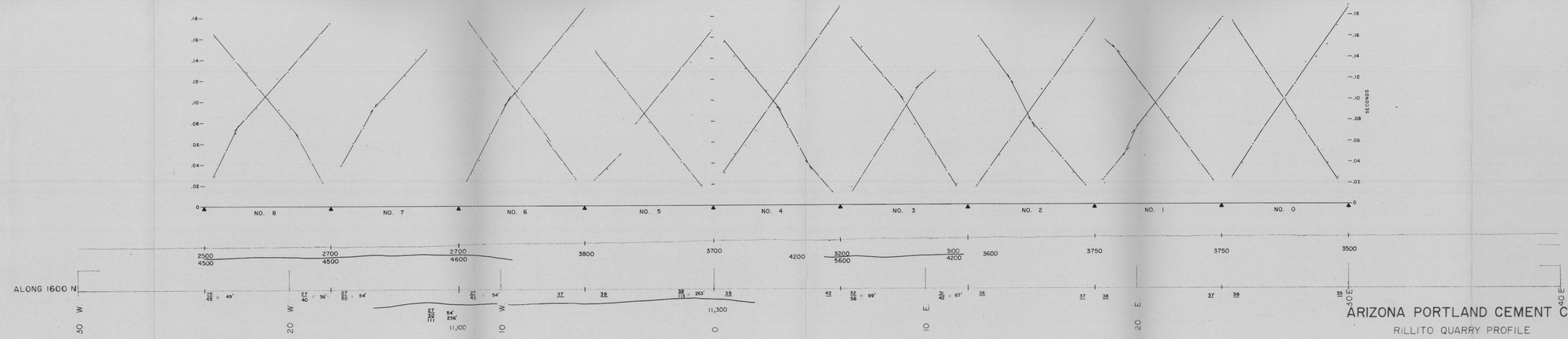
LINE 500 E.

This line has an overburden of a low velocity material (probable caliche) with a thickness of 16 feet at the southern end, deepening, with a throw of 50 feet toward the middle, to a thickness of approximately 110 feet at the northern end. The underlying material has a high velocity and should be crystaline limestone.

Respectfully submitted,
HEINRICHS GEOEXPLORATION COMPANY

William O. Rasmussen
Physicist

WOR/md



SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 1500N
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 2 — SPREAD NUMBER
▲ — SHOT POINT
VELOCITY IN HUNDREDS OF FEET SECOND
31/42 = 67' — DEPTH TO HORIZONTAL INTERFACE

HEINRICHS GEOEX
Geophysical engineers

ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE

E-W ALONG 1600 N.

SCALE 1"=200'

NOV 1969 VH

492-69

SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES

of

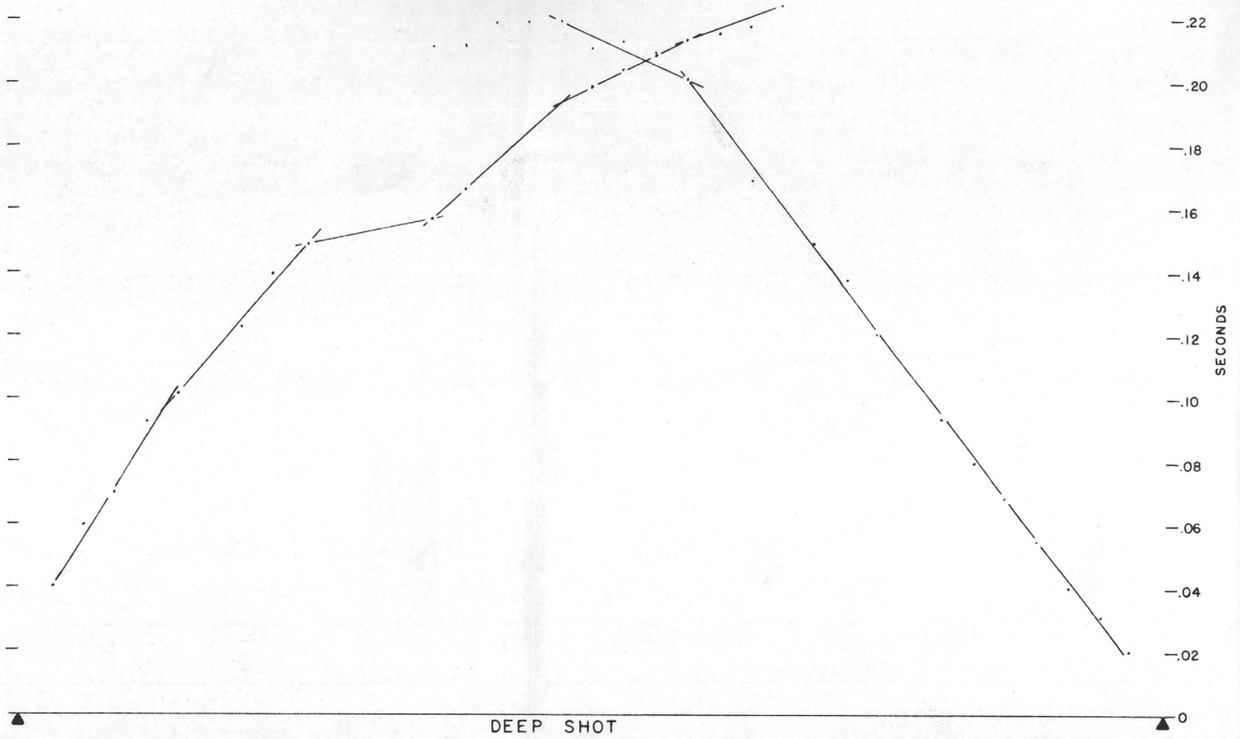
LINE NUMBER 1600N
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA

for

ARIZONA PORTLAND CEMENT COMPANY

by

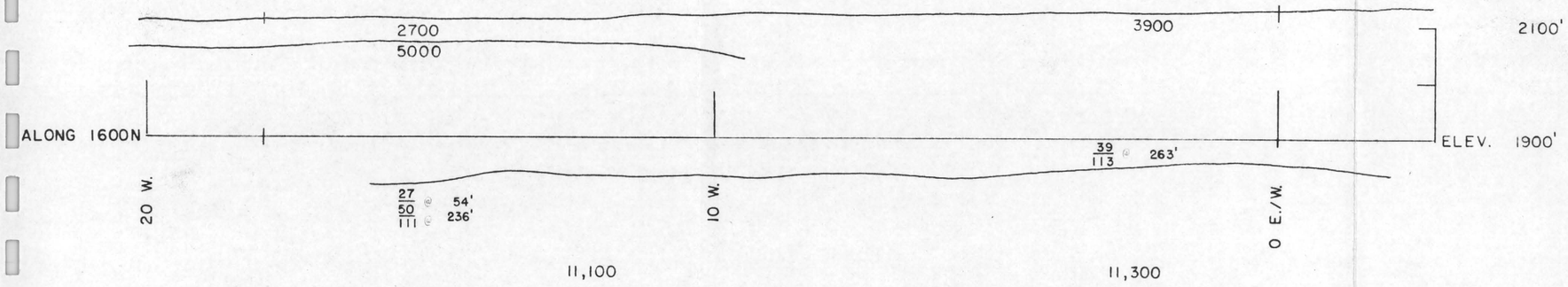
HEINRICHS GEOEXPLORATION COMPANY



▲ ——— SHOT POINT

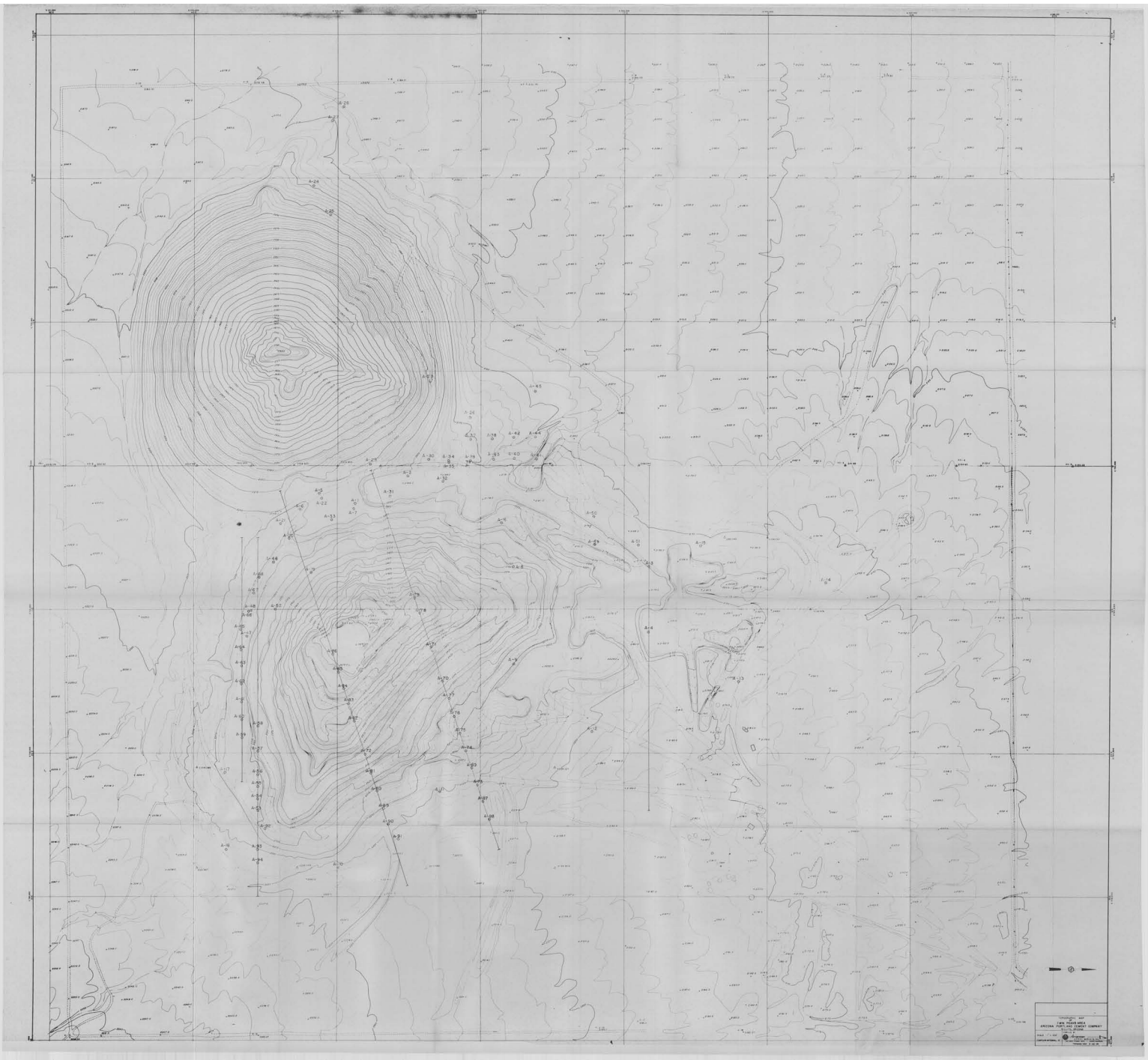
——— VELOCITY IN HUNDREDS OF FEET SECOND

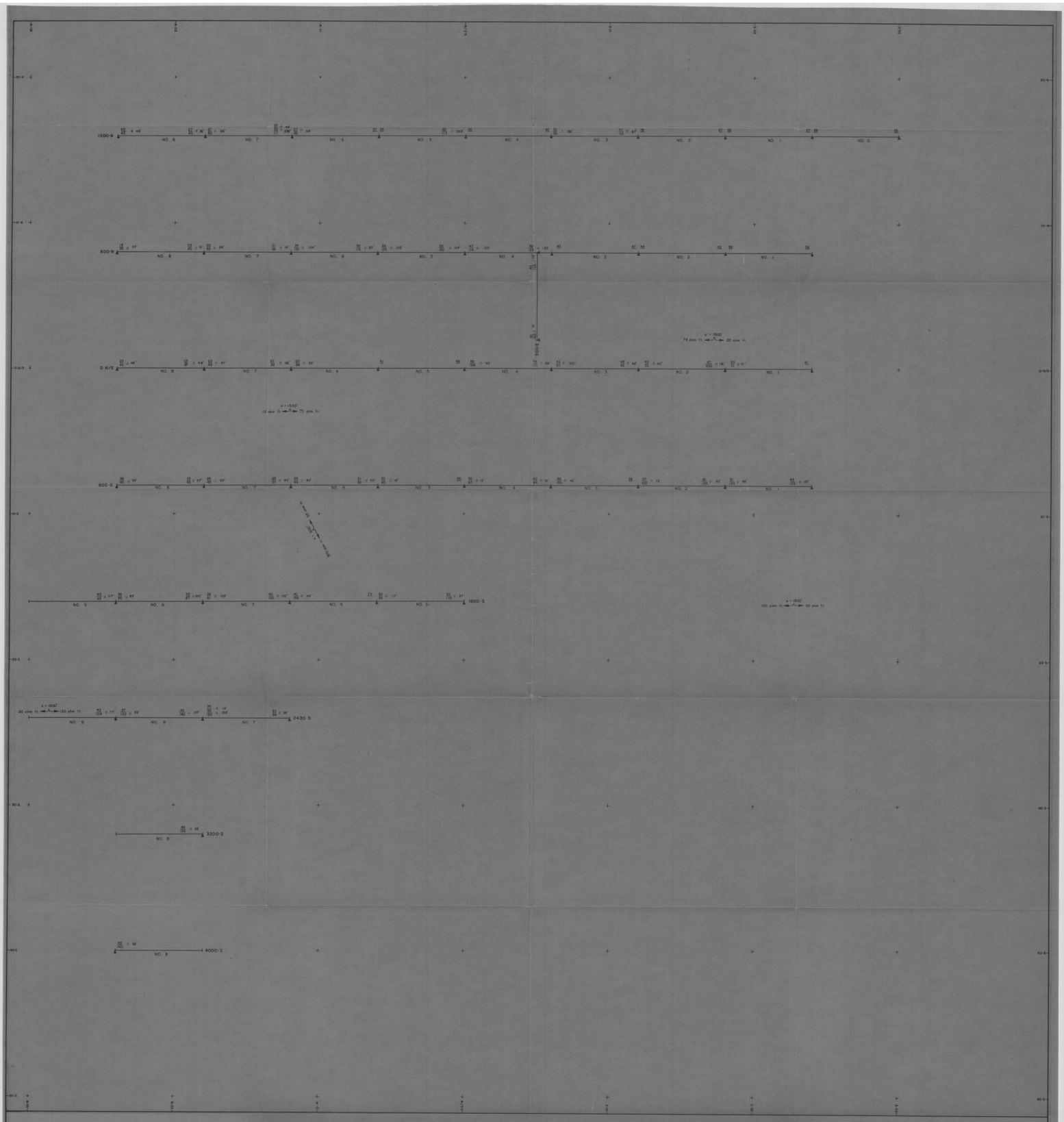
$\frac{39}{113}$ @ 263' ——— DEPTH TO HORIZONTAL INTERFACE



HEINRICHS GEOEX
geophysical engineers

JAY DOWNS 492-69



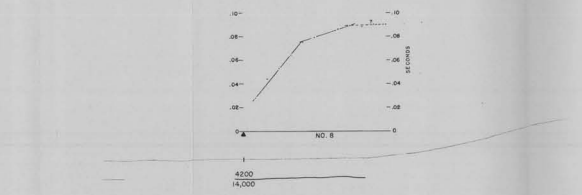


SEISMIC REFRACTION SURVEY LOCATION PLAN
AND
RESISTIVITY DATA
of
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by

GEOEXPLORATION COMPANY
492-69

THIS SHEET OVERLAYS TOPOGRAPHIC MAP OF TWIN PEAKS AREA FURNISHED BY ARIZONA PORTLAND CEMENT COMPANY

SCALE: 1" = 200'
DECEMBER 1969



ALONG 4000 S.

AR/40 = 90'

30 W | 20 W | 10 W | 0 | 10 E | 20 E | 30E | 30E

2100'

ELEV. 1900'

SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 4000S
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 8 — SPREAD NUMBER
▲ — SHOT POINT
VELOCITY IN HUNDREDS OF FEET/SECOND
AR/40 = 90' — DEPTH TO HORIZONTAL INTERFACE

HEINRICHS GEOEX Geophysical Engineers

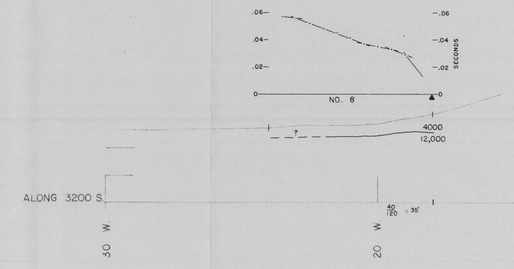
ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE

E-W ALONG 4000 S.

SCALE 1"=200'

492-69



SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 3200S
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 8 —— SPREAD NUMBER
▲ —— SHOT POINT
40/120 - 35' —— VELOCITY IN HUNDREDS OF FEET SECOND / DEPTH TO HORIZONTAL INTERFACE

ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE
E-W ALONG 3200 S.
SCALE 1"=200'

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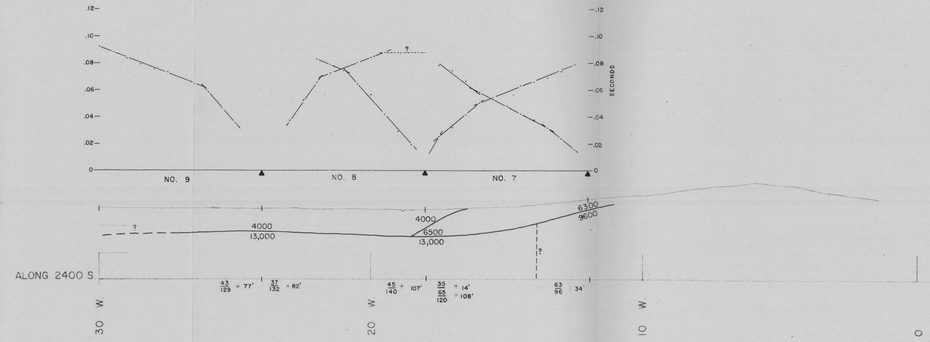

SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 2400S
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 7 —— SPREAD NUMBER
▲—— SHOT POINT
—— VELOCITY IN HUNDREDS OF FEET SECOND
63/96 = 34'—— DEPTH TO HORIZONTAL INTERFACE

ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE
E-W ALONG 2400 S.

SCALE 1"=200'

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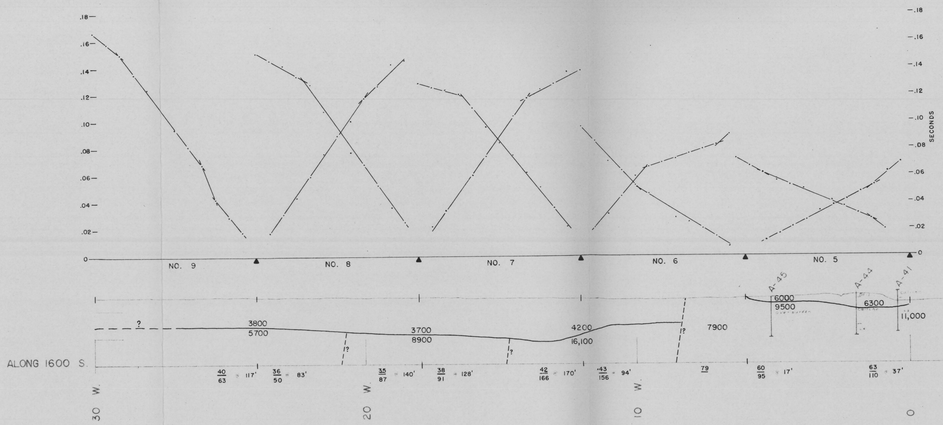

SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 1600S
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 5 — SPREAD NUMBER
▲ — SHOT POINT
VELOCITY IN HUNDREDS OF FEET SECOND
63/110 = 37' — DEPTH TO HORIZONTAL INTERFACE

ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE

E-W ALONG 1600 S.

SCALE 1"=200'

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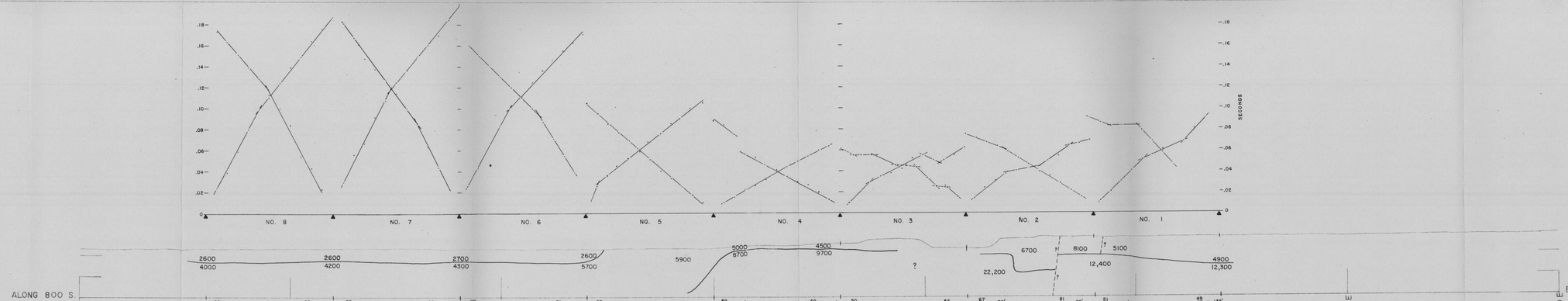

SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 800 S
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 3 — SPREAD NUMBER
▲ — SHOT POINT
VELOCITY IN HUNDREDS OF FEET SECOND
50/100 40' — DEPTH TO HORIZONTAL INTERFACE

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RILLITO QUARRY PROFILE

E-W ALONG 800 S.

SCALE 1"=200'

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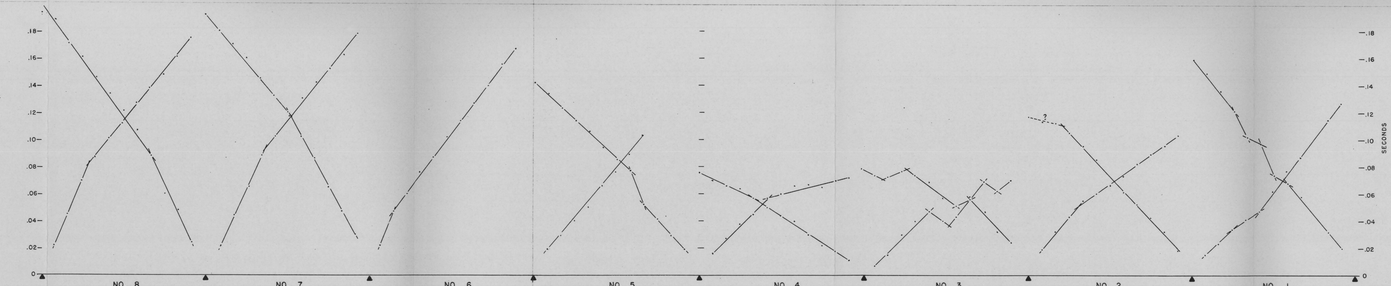

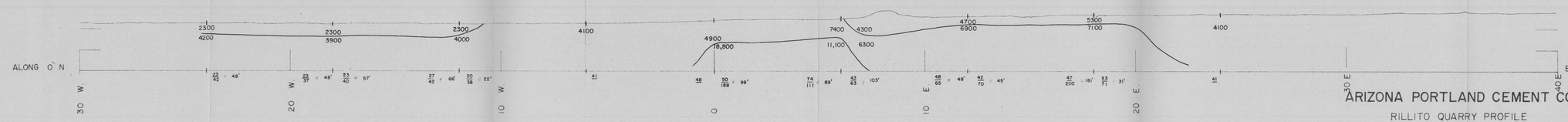

SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER O N
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 2 — SPREAD NUMBER
▲ — SHOT POINT
VELOCITY IN HUNDREDS OF FEET/SECOND
42/70 × 45' — DEPTH TO HORIZONTAL INTERFACE

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geophysical engineers

ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE

E-W ALONG O N.

SCALE 1"=200'

NOV. 1969 VH
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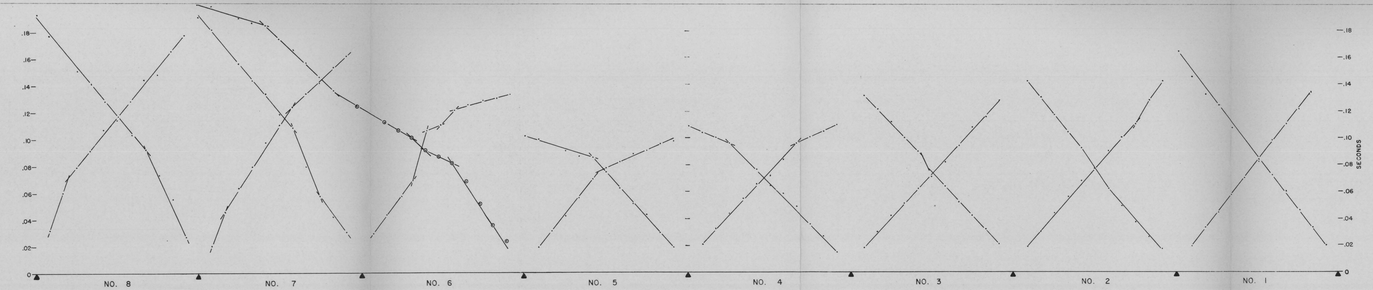
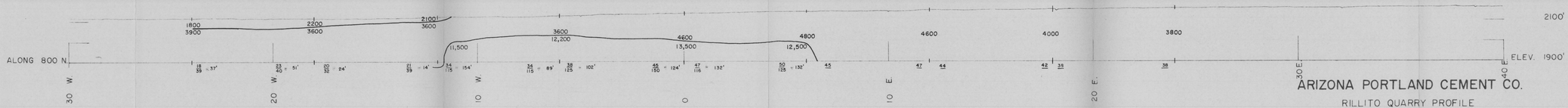


SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES
of
LINE NUMBER 800 N
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA
for
ARIZONA PORTLAND CEMENT COMPANY
by
HEINRICHS GEOEXPLORATION COMPANY

NO. 2 — SPREAD NUMBER
▲ — SHOT POINT
VELOCITY IN HUNDREDS OF FEET SECOND
50/125 = 132' — DEPTH TO HORIZONTAL INTERFACE



ARIZONA PORTLAND CEMENT CO.

RILLITO QUARRY PROFILE

E-W ALONG 800 N.

SCALE 1"=200'

HEINRICHS GEOEX geoexploration engineers

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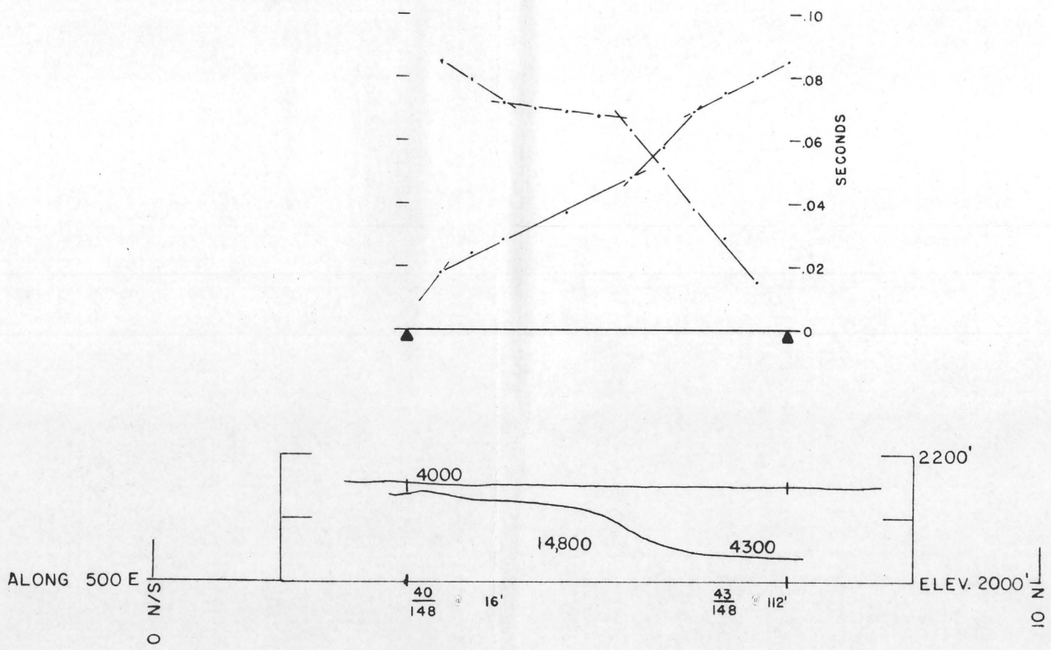
492-69



SECTIONAL STRUCTURE (VELOCITY) PROFILE
AND TIME-DISTANCE CURVES

of

LINE NUMBER 500 E
TWIN PEAKS AREA
PIMA COUNTY, ARIZONA

for

ARIZONA PORTLAND CEMENT COMPANY

by

HEINRICHS GEOEXPLORATION COMPANY

▲ —— SHOT POINT

—— VELOCITY IN HUNDREDS OF FEET/SECOND

43/148 = 112' —— DEPTH TO HORIZONTAL INTERFACE

HEINRICHS GEOEX
geophysical engineers

JAY DOWNS 492-69