AD-A034 242 MCDERMOTT (J RAY) CO INC NEW ORLEANS LA F/G 13/10

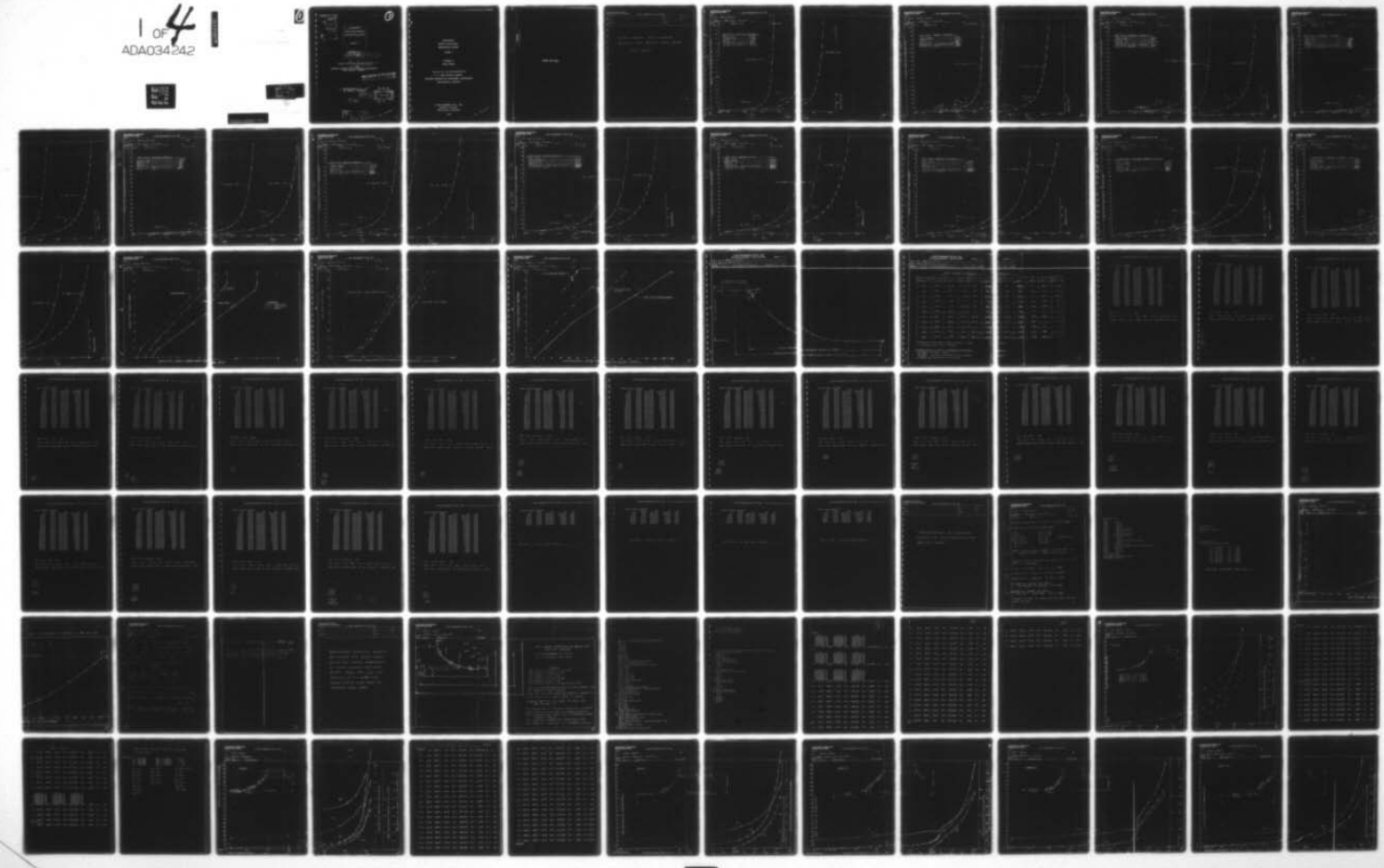
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 1. --ETC(U)

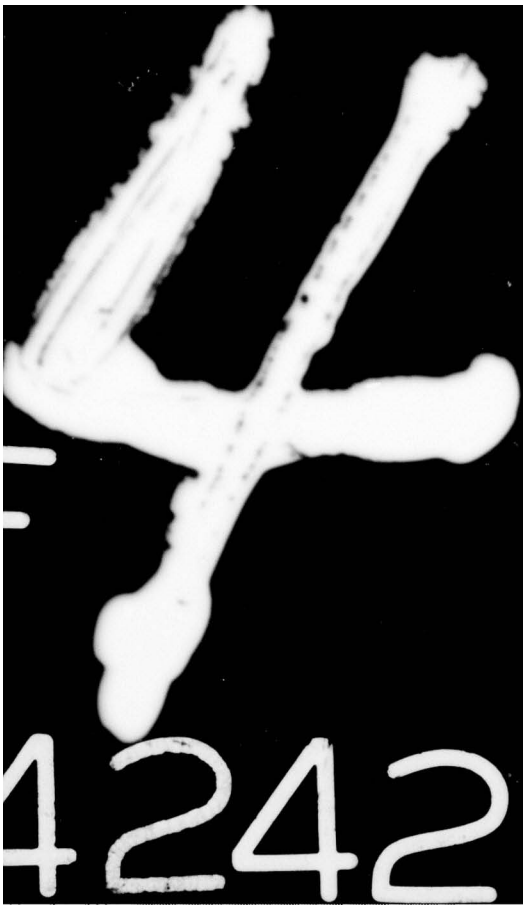
1966 DA-44-009-AMC-841(T)

UNCLASSIFIED NL

1 OF 4

ADA034242




4242

ACCESSION for
White Section
Buff Section
ANNOUNCED
JUSTIFICATION
DISTRIBUTION/AVAILABILITY CODES
Dist. and or SPECIAL
A

(1)

(6) ENGINEERING
DESIGN CALCULATIONS
MONO-MOORING SYSTEM.

VOLUME 1.

APPENDIX A.
TO
(9) FINAL REPORT on Phase I.

(15) Contract No. DA-44-009-AMC-841(T) new

U. S. ARMY
ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES
FORT BELVOIR, VIRGINIA

COPY AVAILABLE TO DDC DOES NOT
PERMIT FULLY LEGIBLE PRODUCTION

(J. RAY McDERMOTT & CO., INC.
NEW ORLEANS, LOUISIANA

(12) 300 p.

(11) 1966

DDC
RECEIVED
JAN 11 1977
D

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution unlimited

222 950

DC 77.817

ENGINEERING
DESIGN CALCULATIONS
MONO-MOORING SYSTEM

VOLUME 1

APPENDIX A
to
FINAL REPORT

Contract No. DA-44-009-AMC-841(T)

U. S. ARMY MATERIEL COMMAND

ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES

FORT BELVOIR, VIRGINIA

J. RAY McDERMOTT & CO., INC.
Saratoga Building
New Orleans, Louisiana

1966

DC 17.8 17

SECTION I

ANCHOR AND CHAIN

COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
PROJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

FINAL CURVES AND COMPUTER

RESULTS FOR VARIOUS WATER DEPTHS

(50' - 150')

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & Co., Inc.

FED 5036

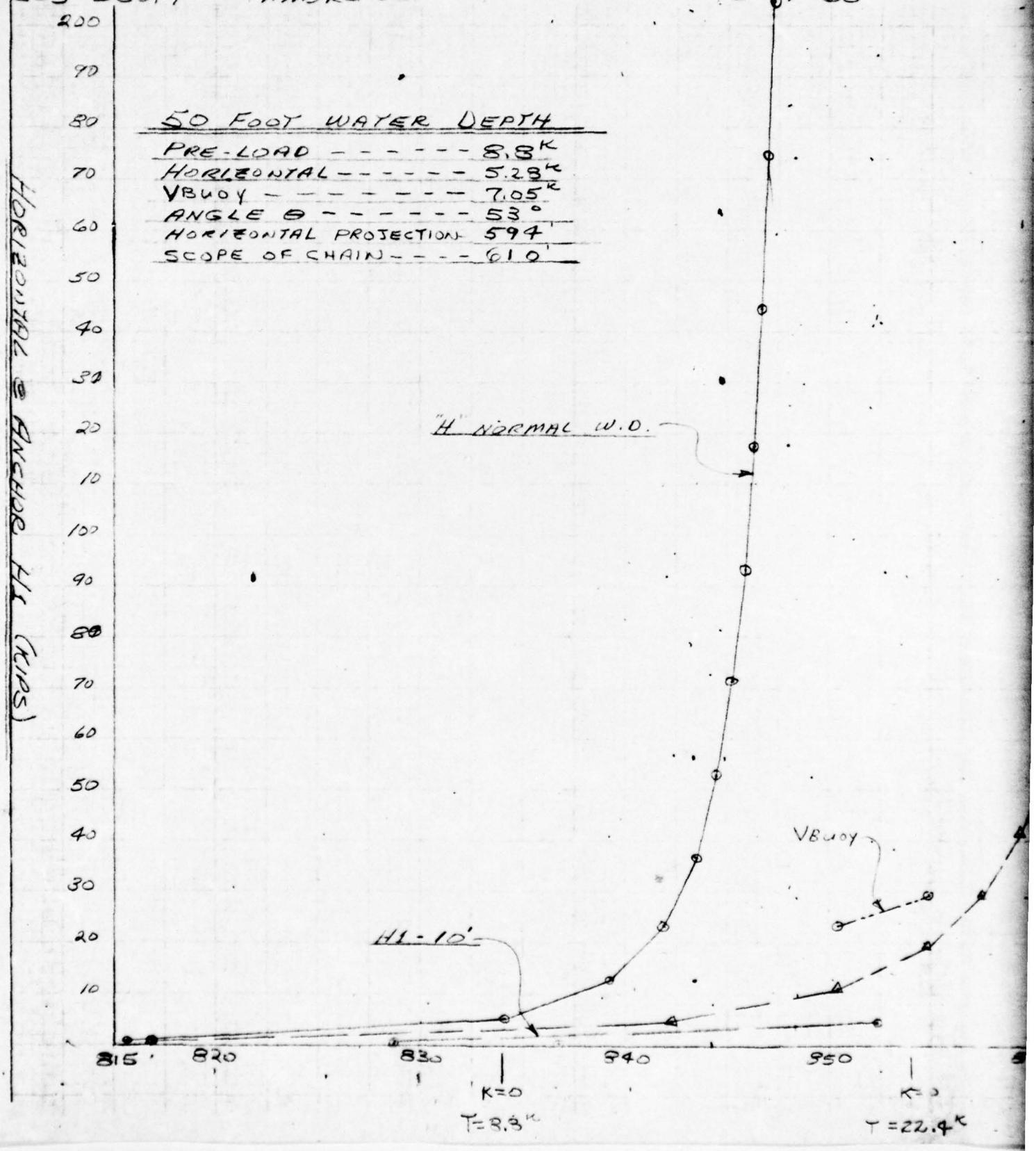
COMPANY: U.S. ARMY/ERDL | SHEET NO. 1

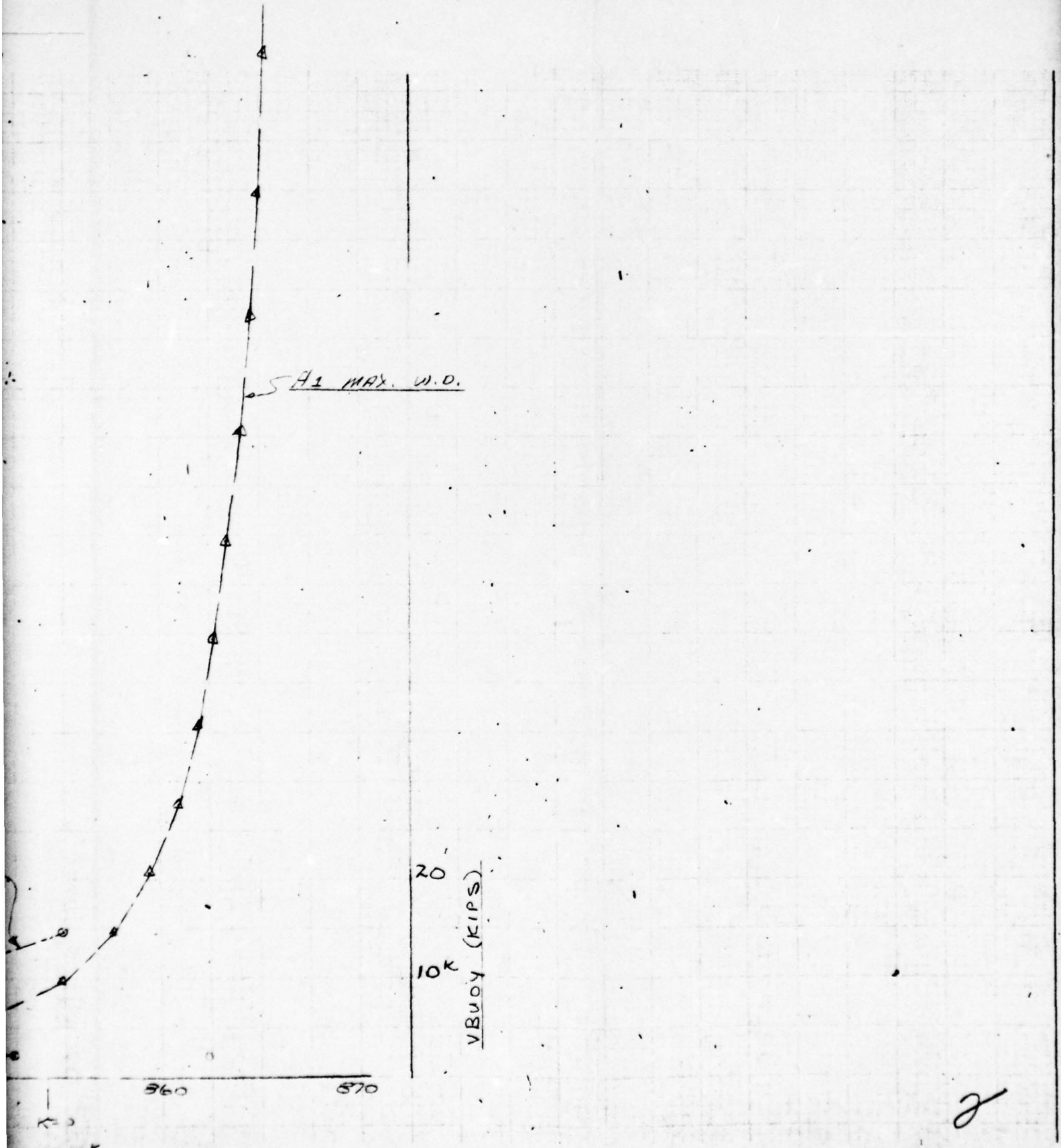
SUBJECT: MOMO - MOORING SYSTEM

DRAWING NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 6-17-65

50 FOOT WATER DEPTH

PRE-LOAD	8.8^K
HORIZONTAL	5.28^K
VBUOY	7.05^K
ANGLE θ	53°
HORIZONTAL PROJECTION	594'
SCOPE OF CHAIN	610'




A1 MAX. W.O.
20
10K
VBUOY (KIPS)
560
570
K=
=22.4K

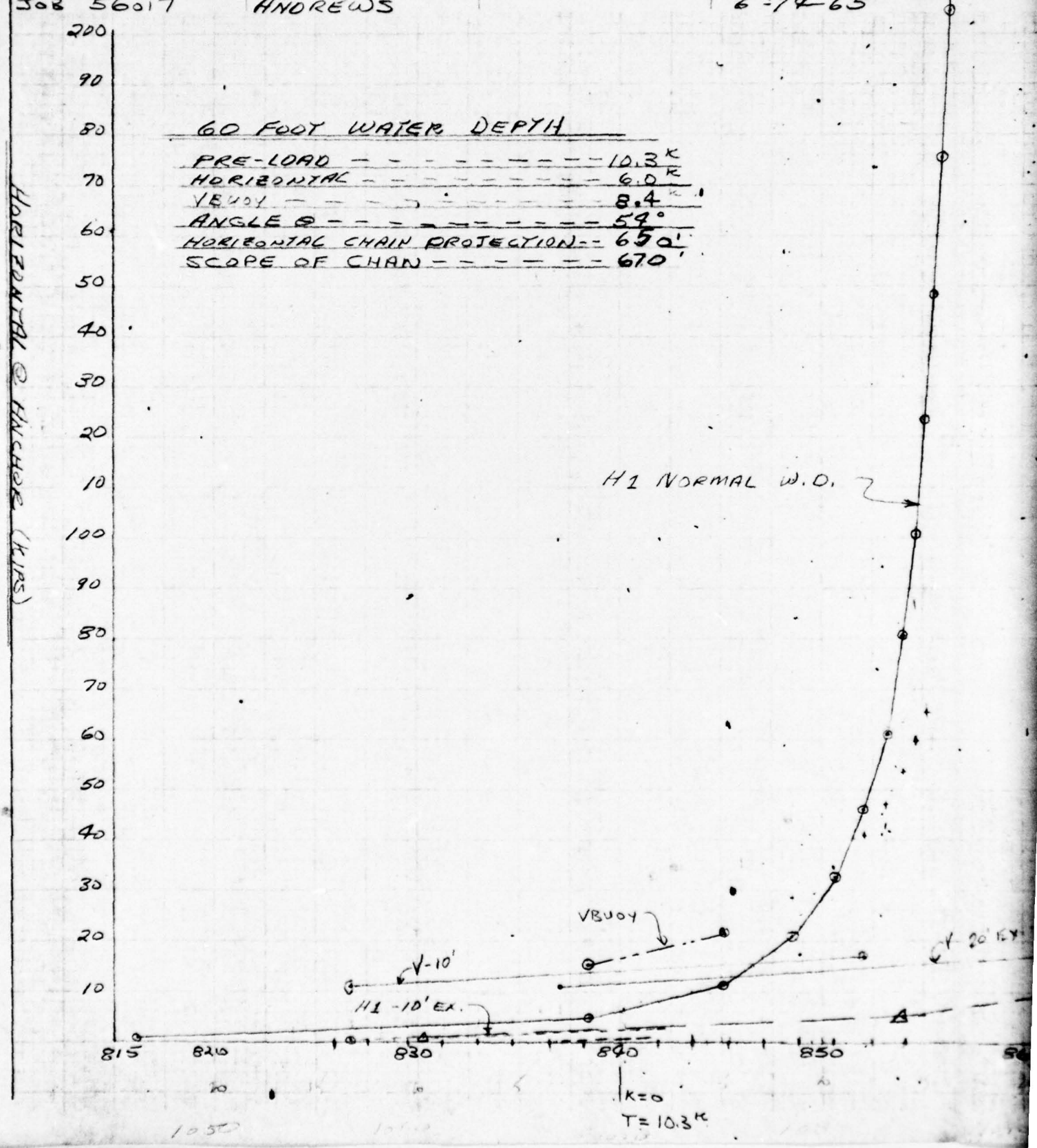
ENGINEERING DEPARTMENT
COMPUTATION SHEET
FCD 5036

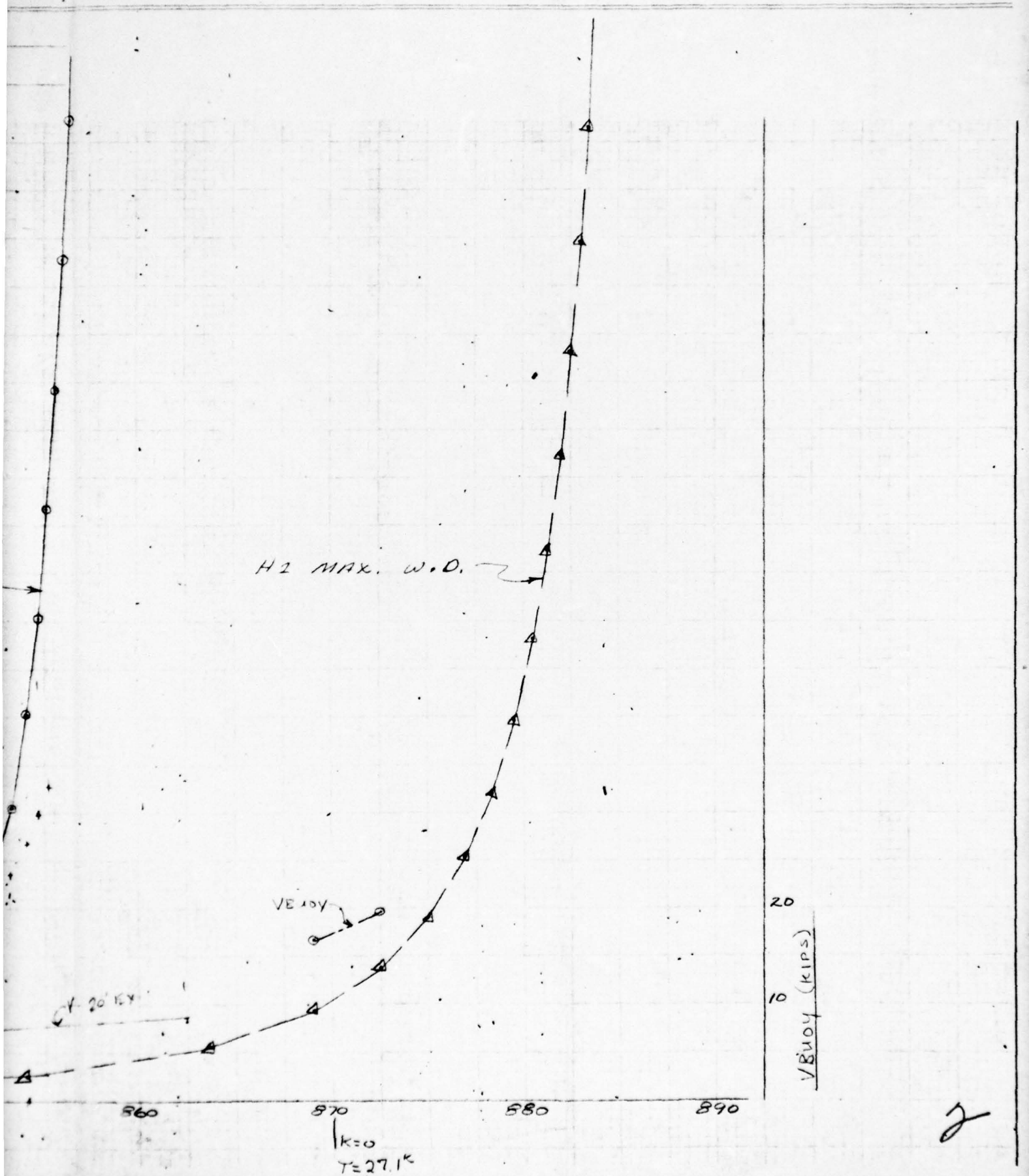
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / ERDL	2

SUBJECT: MONO - MOORING SYSTEM

NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-14-65





2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
FORM 5036

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY/EROL	3
SUBJECT	
MONO-MOORING SYSTEM	
~~DRAWING~~ NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-16-65

70 FOOT WATER DEPTH

PRE-LOAD	12.8 K
HORIZONTAL	9 K
VBUOY	100 K
ANGLE θ	50°
HORIZONTAL CHAIN PROJECTION	716.5
SCOPE OF CHAIN	740

HORIZONTAL @ ANCHOR (KIPS)

200 90 80 70 60 50 40 30 20 110 100 90 80 70 60 50 40 30 20 10

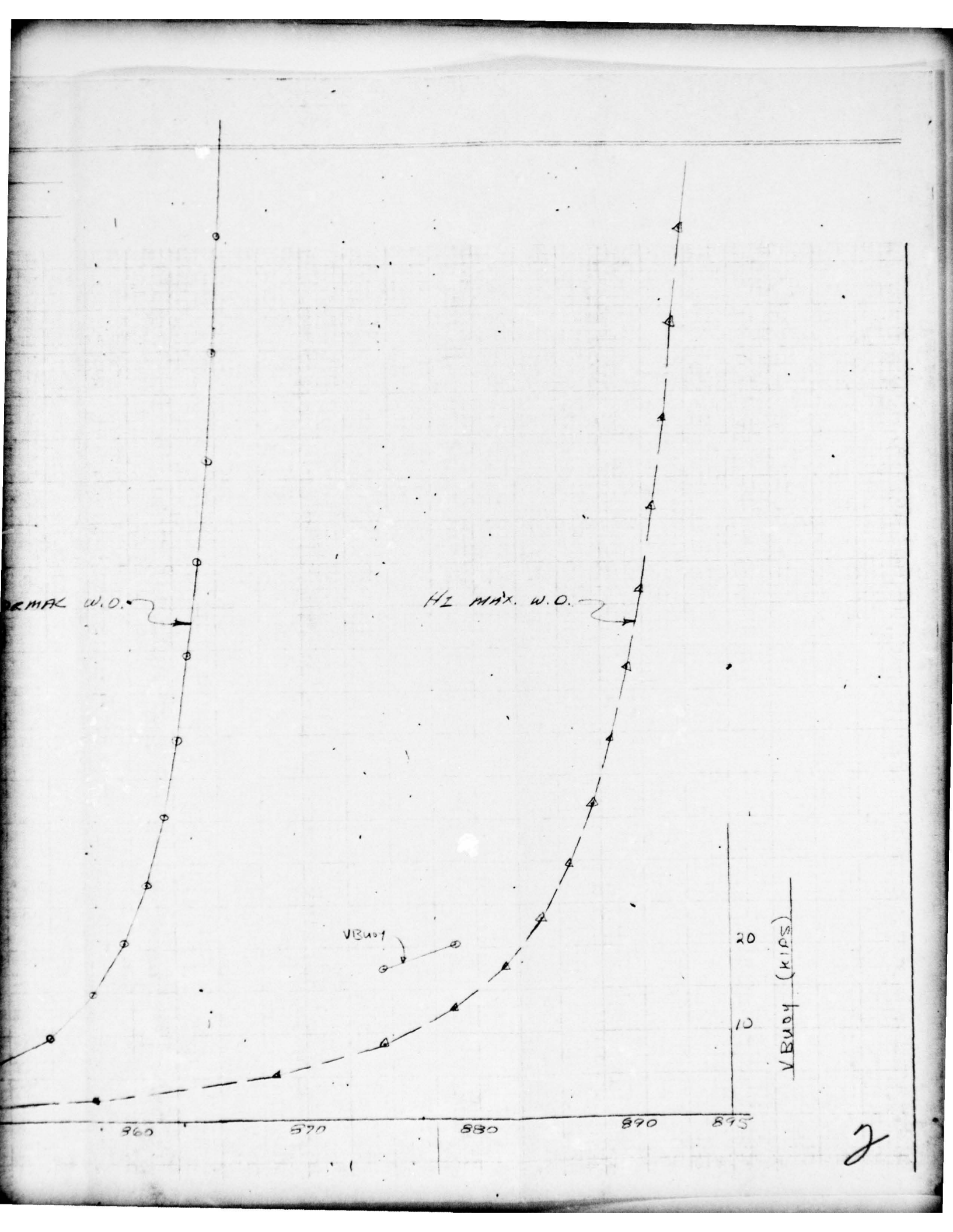
H1 NORMAL W.O.

VBUOY

H1 -10' EX.

815 820 830 840 850 860

K=0
T=



2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
7360 5036

J. RAY McDERMOTT & Co., INC.

COMPANY			SHEET NO
U.S. ARMY/ERDL			7
SUBJECT			
MOM2 - MOORING SYSTEM			
NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-16-65

80 FOOT WATER DEPTH

PRE-LOAD	17.3K
HORIZONTAL	10K
VBUOY	12.5K
ANGLE B	51°
HORIZONTAL CHAIN PROJECTION	797'
SCOPE OF CHAIN	770'

(H2) HORIZONTAL @ ANCHOR (KIPS)

200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

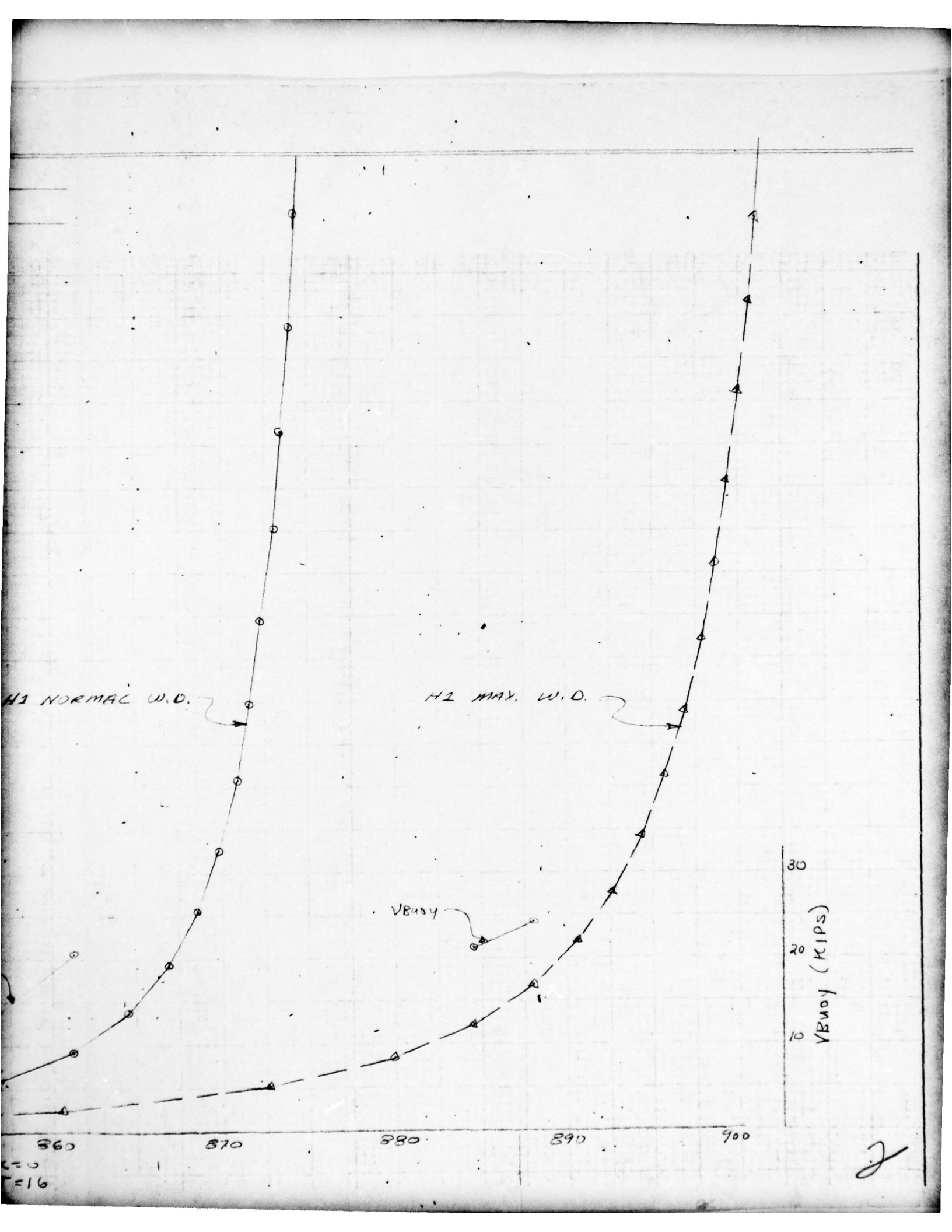
H1 NORMAL W

VBuoy

H1 - 10' EX.

820 830 840 850 860

K=0
T=16


H1 NORMAL W.O.
H1 MAX. W.O.
VBuoy
30
20
10
VBuoy (KIPS)
860
870
880
890
900
K=0
T=16

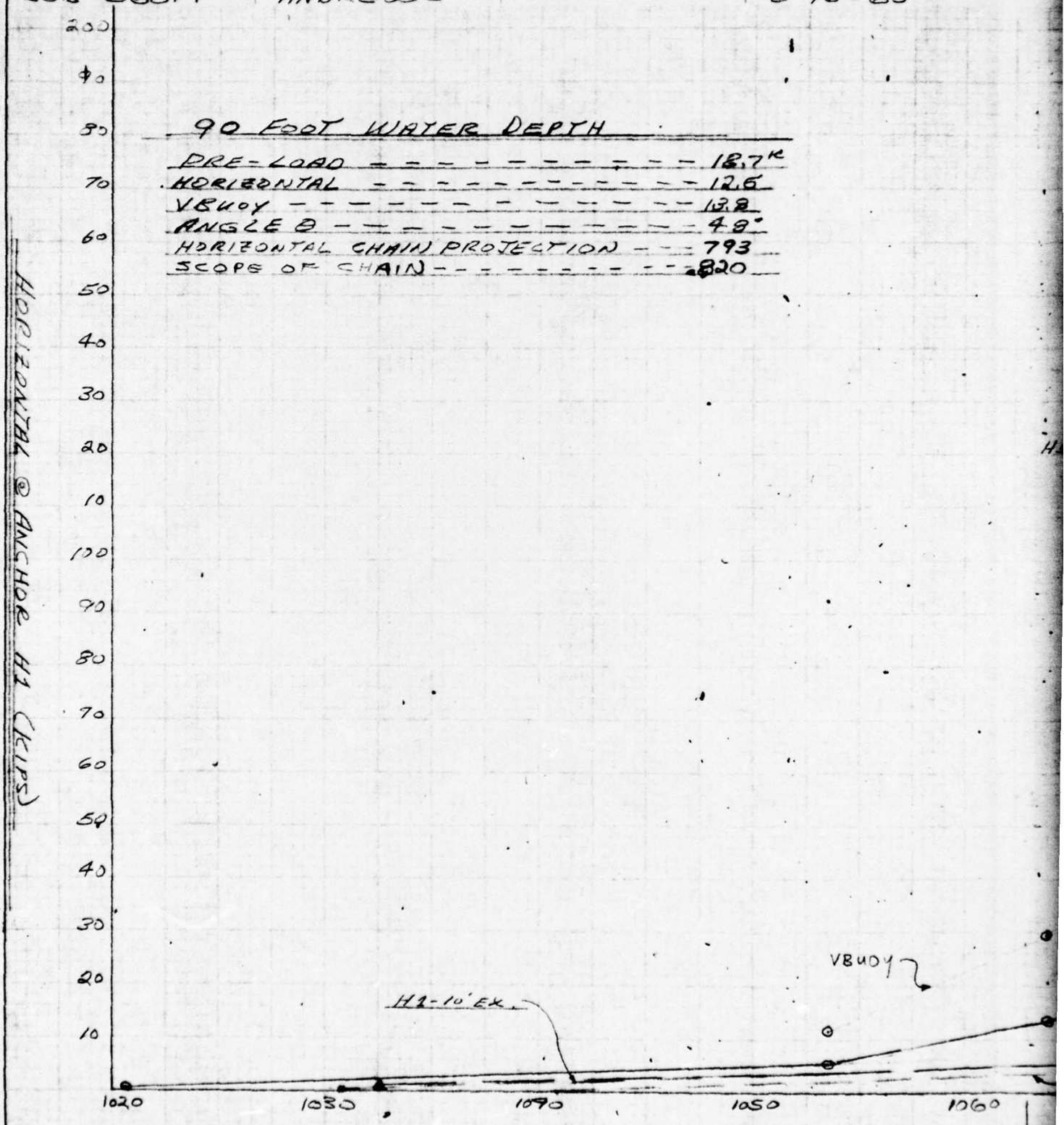
ENGINEERING DEPARTMENT
COMPUTATION SHEET
BCD 5036

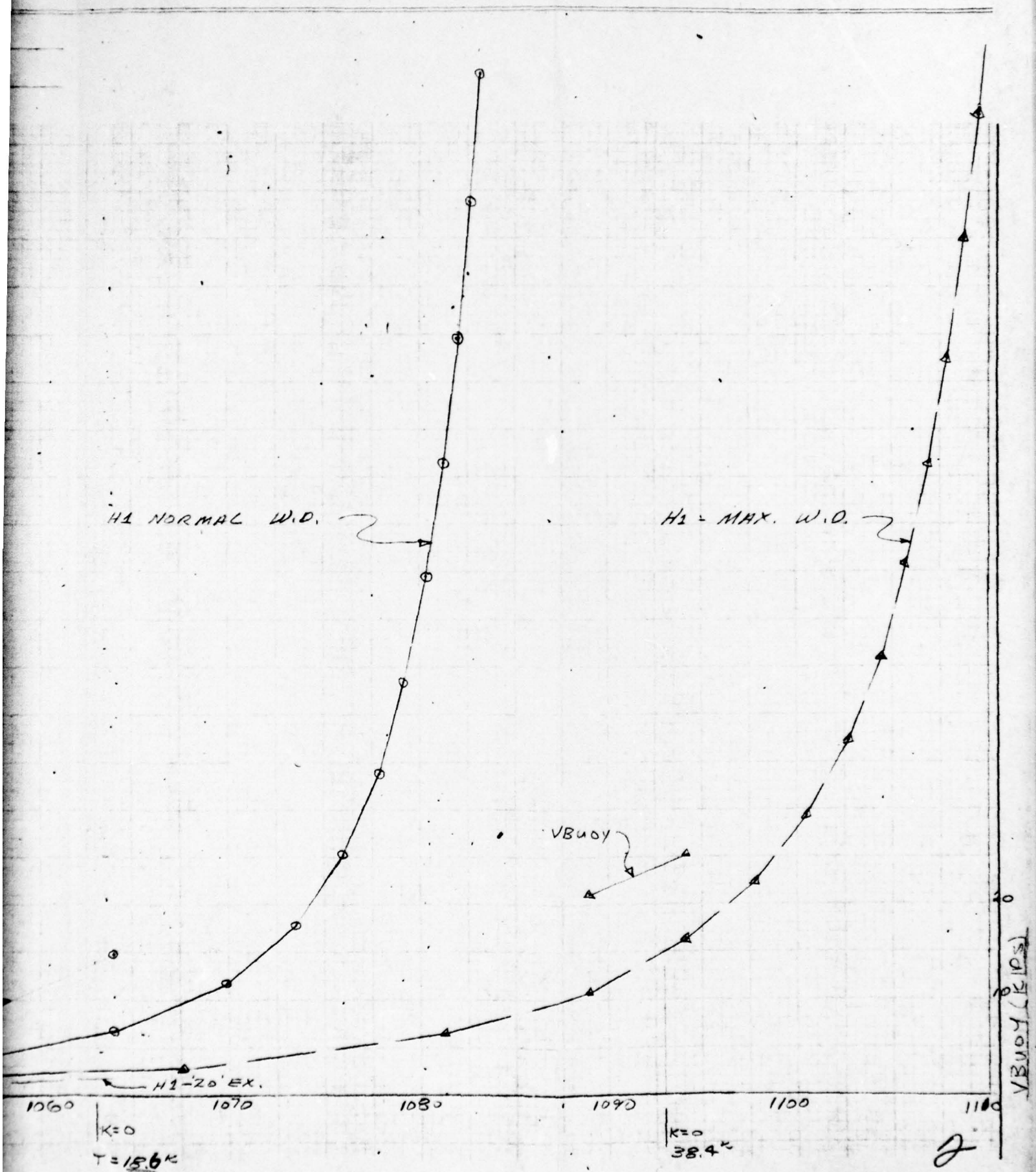
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO.
U. S. ARMY / ERDL	5

SUBJECT: MONO-MOORING SYSTEM

~~SHEETING~~ NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-16-65




H1 NORMAL W.D.
H1 - MAX. W.D.
VBUOY
H1-20' EX.
1060
1070
1080
1090
1100
1110
K=0
T=18.6K
K=0
38.4K
20
10
VBUOY (KIPS)

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

COMPANY: U.S. ARMY / EROL

SHEET NO.: 6

SUBJECT: MONO-MOORING SYSTEM

JOB NUMBER: JOB 56017

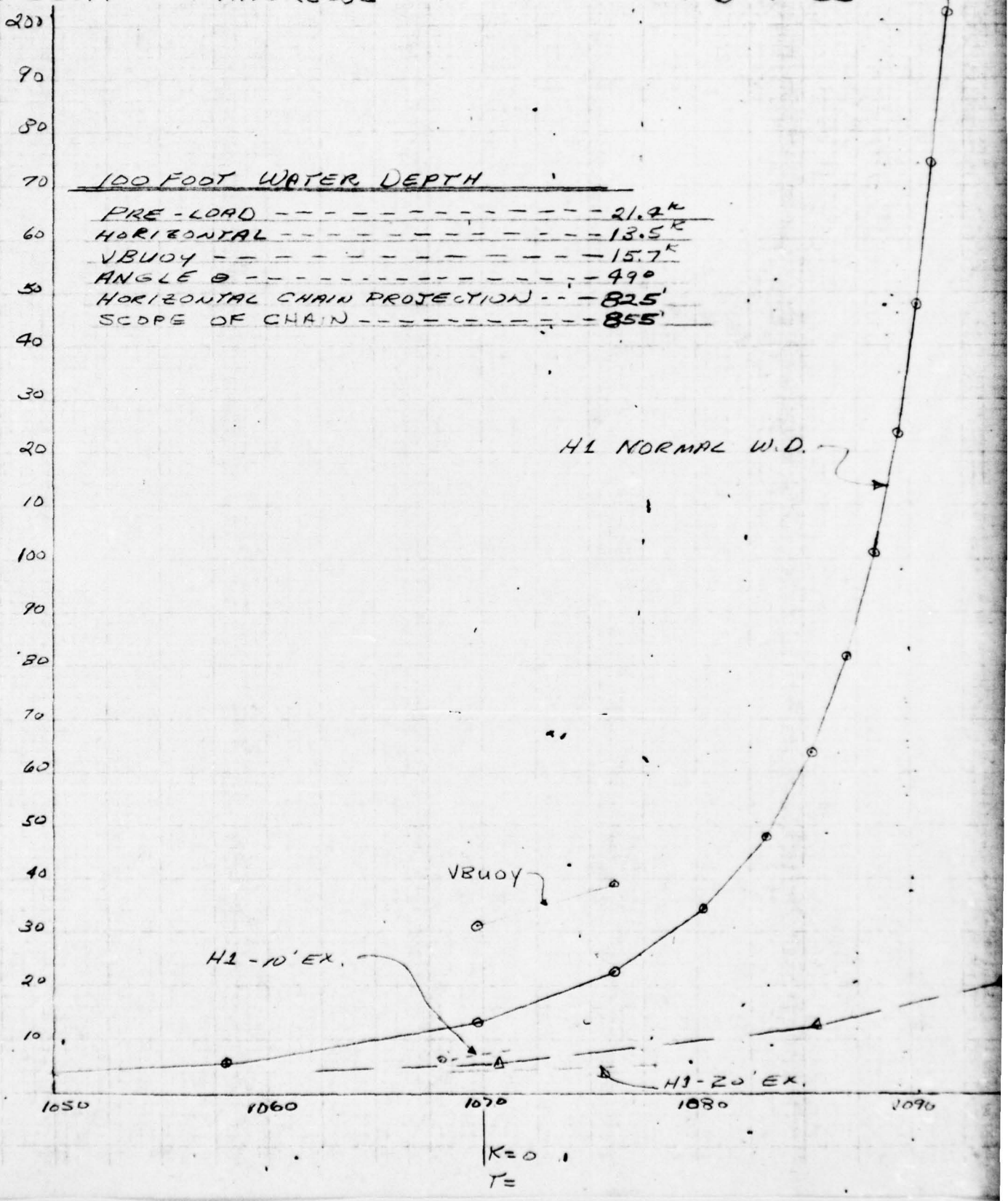
COMPUTER: ANDREWS

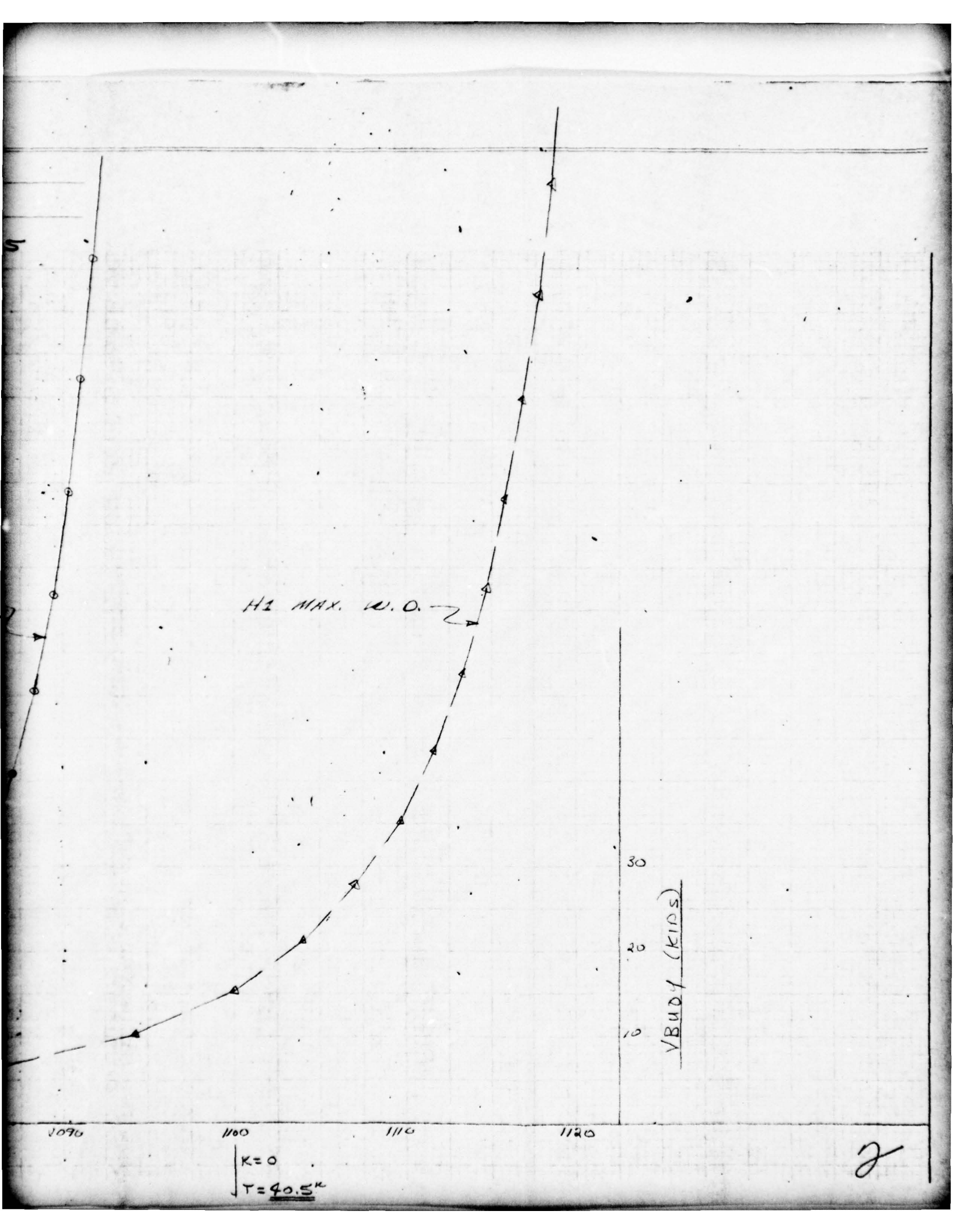
CHECKED BY:

DATE: 6-21-65

100 FOOT WATER DEPTH

PRE-LOAD	21.2^K
HORIZONTAL	13.5^K
VBUOY	15.7^K
ANGLE θ	49°
HORIZONTAL CHAIN PROJECTION	825'
SCOPE OF CHAIN	855'




H2 MAX. W.O.
30
20
10
VBUDY (KIPS)
1090
1100
1110
1120
K=0
T=40.5°

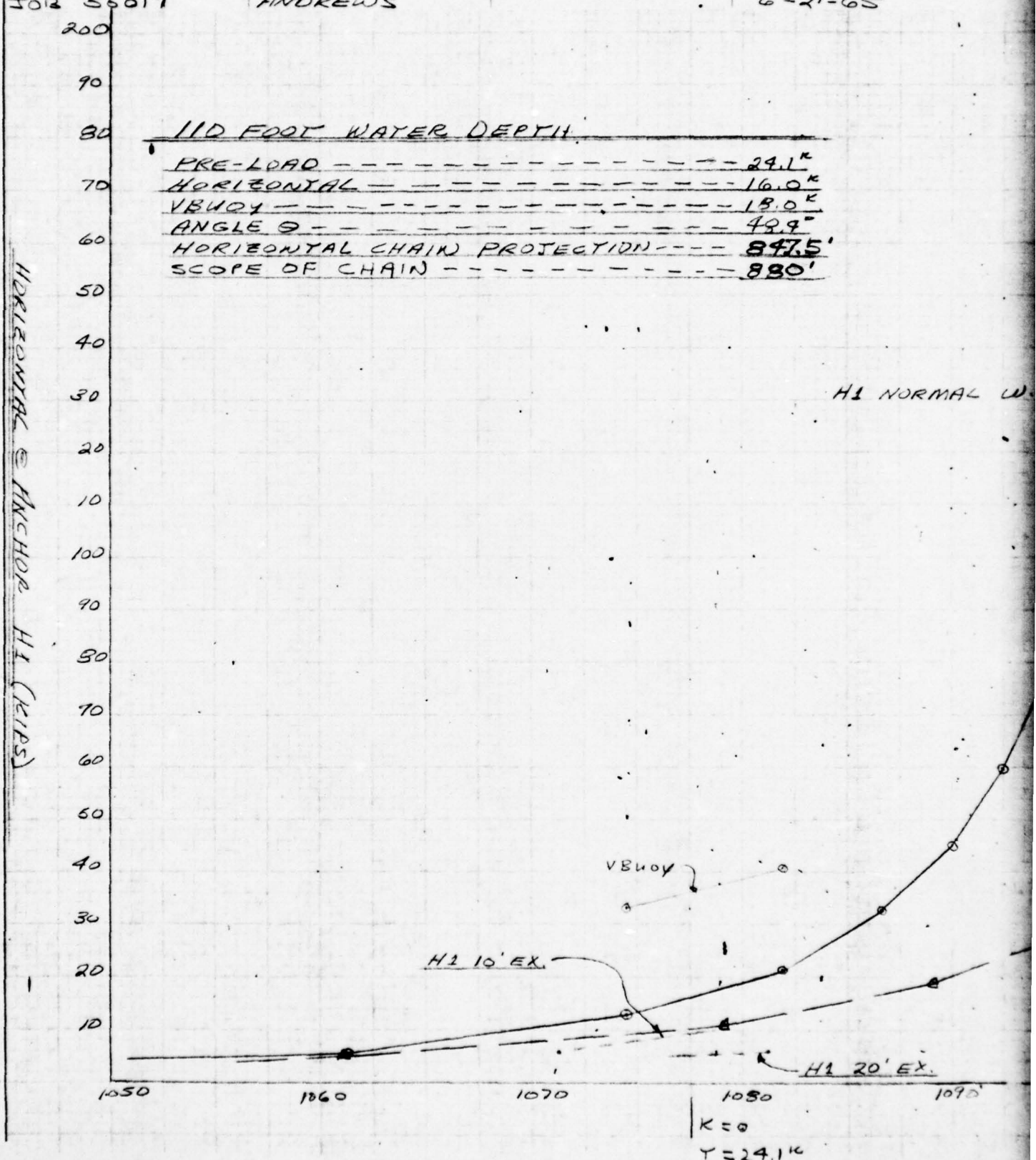
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U. S. ARMY/EROL	7
SUBJECT	
MONO-MOORING SYSTEM	
JOB NUMBER	**COMPUTER** / **CHECKED BY** / **DATE**
JOB 56017	ANDREWS / 6-21-65

110 FOOT WATER DEPTH

PRE-LOAD	24.1^K
HORIZONTAL	16.0^K
VBUOY	18.0^K
ANGLE θ	42.9°
HORIZONTAL CHAIN PROJECTION	847.5'
SCOPE OF CHAIN	880'



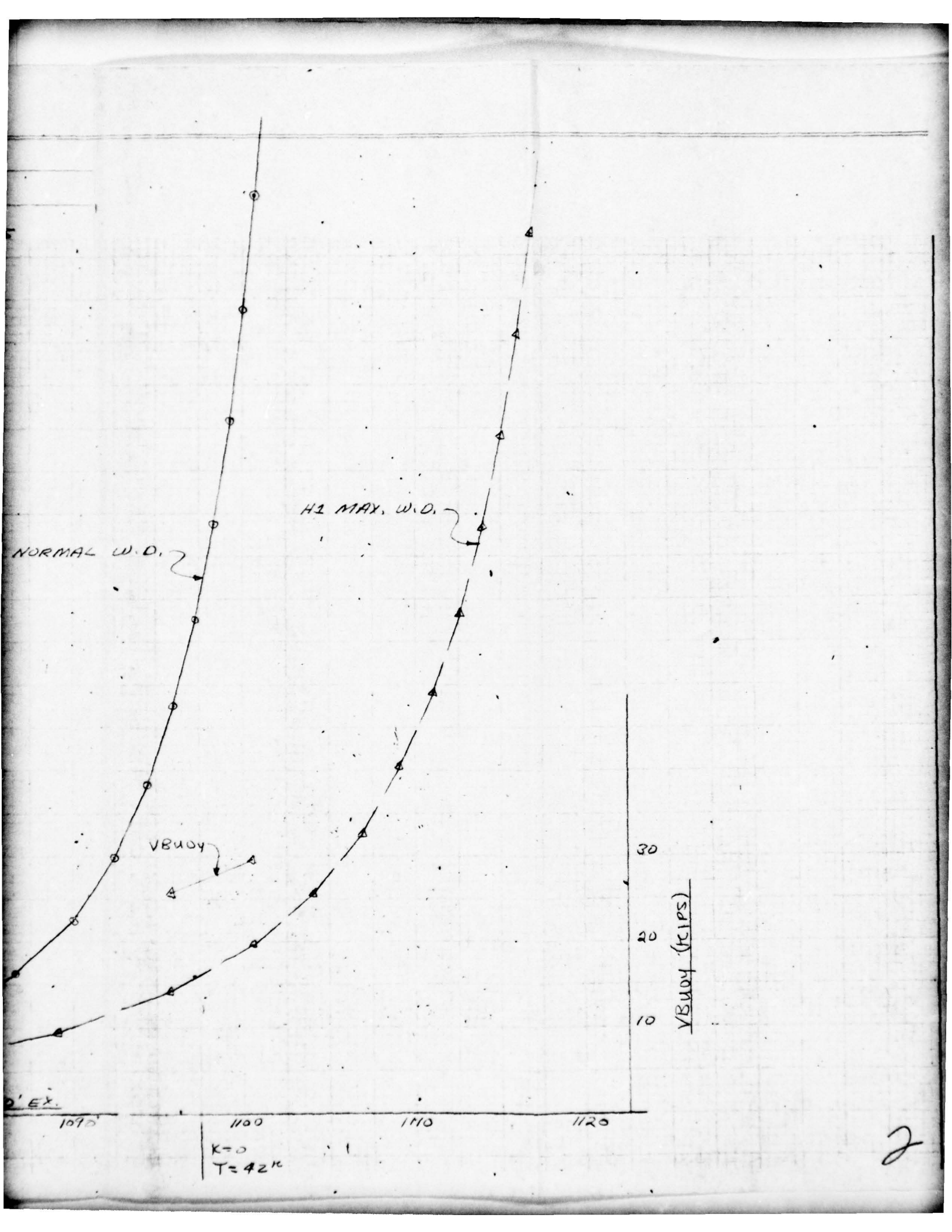
250
30
280

87
32

130
280
850
120
970

1110
970
140

1075
140
935


HI MAX. W.O.
NORMAL W.O.
VBUOY
30
20
10
VBUOY (KIPS)
1090
1100
1110
1120
K=0
T=42K
2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

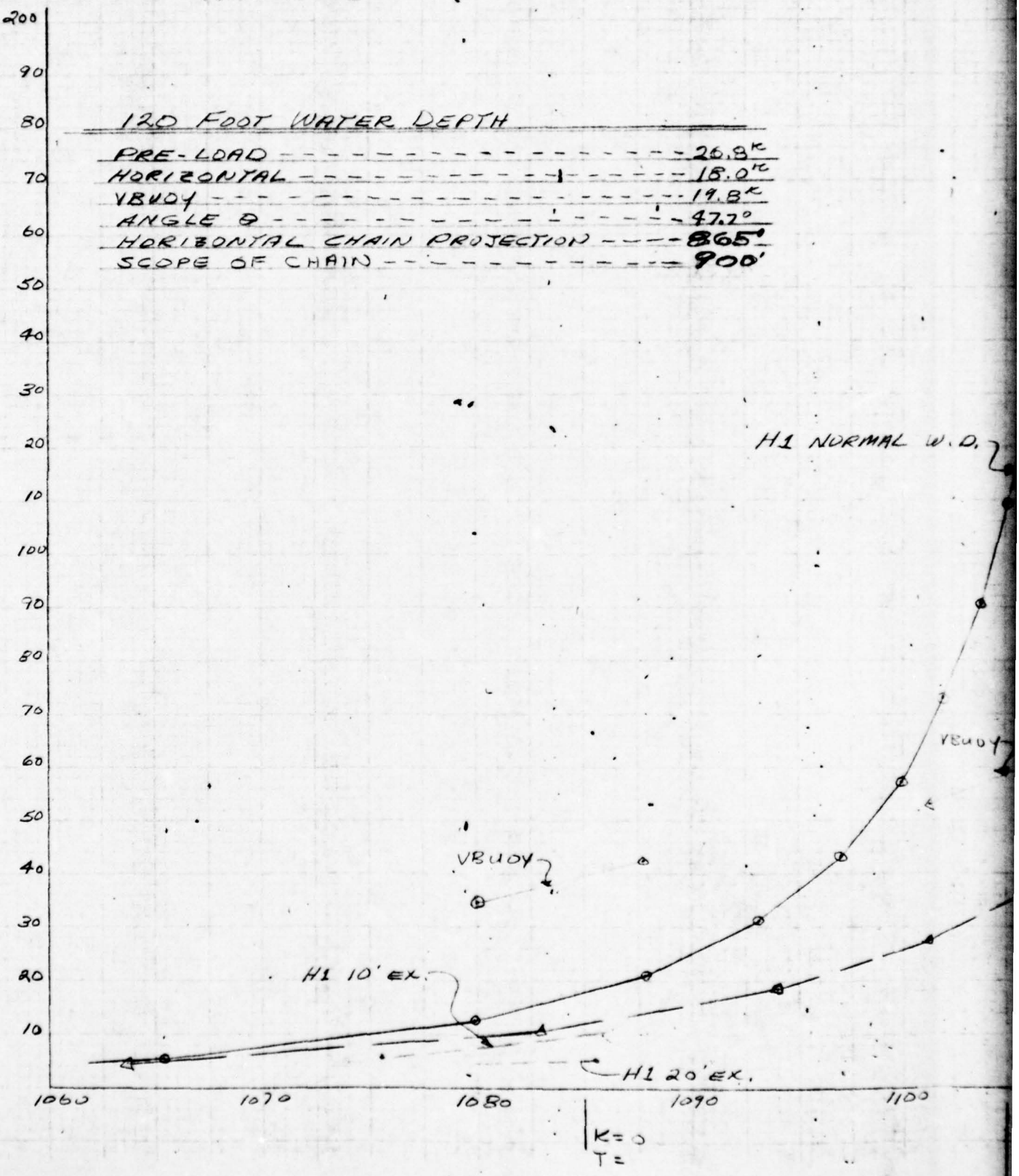
COMPANY	SHEET NO
U.S. ARMY/ERDL	8

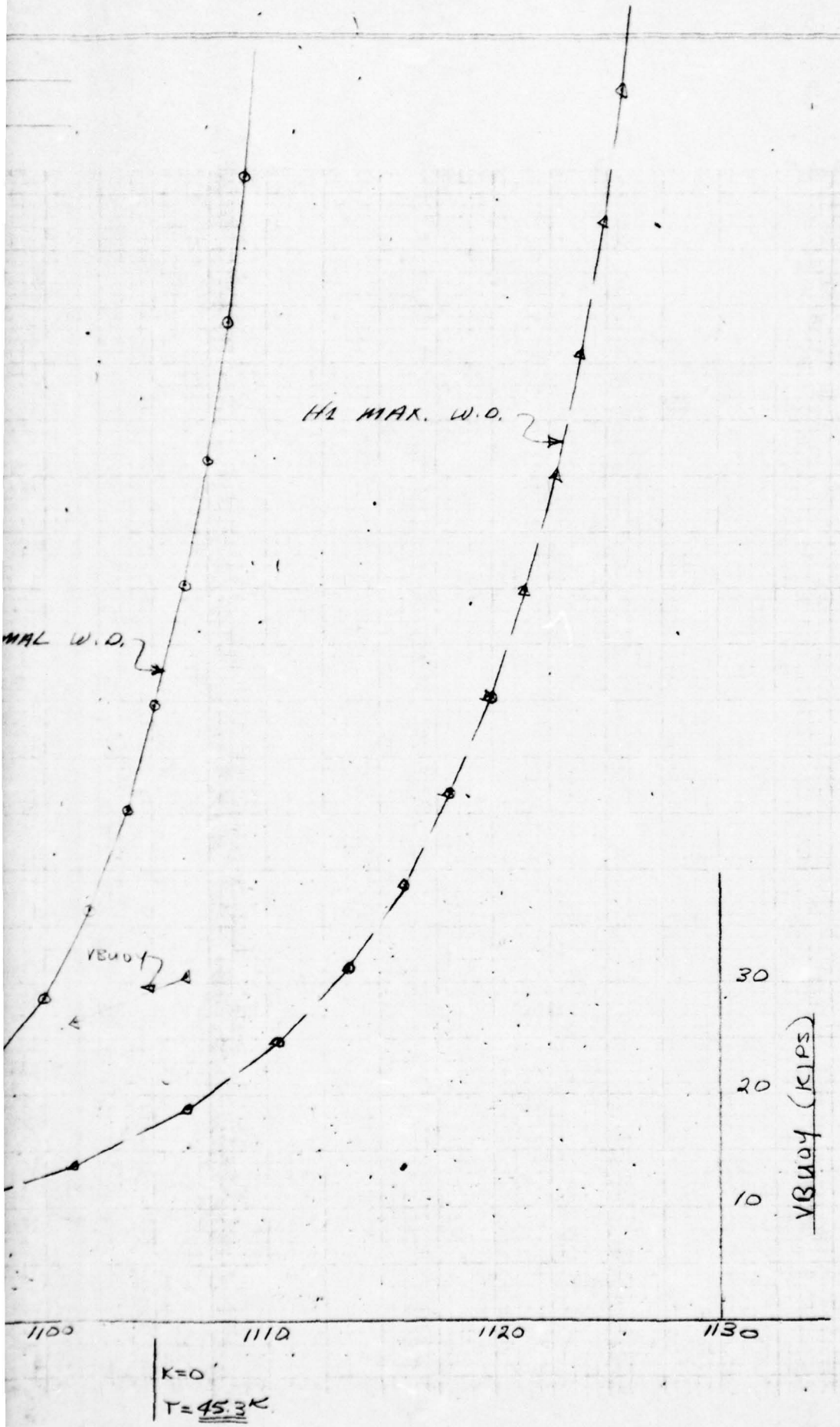
SUBJECT: MOMO - MOORING SYSTEM

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 66017	ANDREWS		6-21-65

120 FOOT WATER DEPTH

PRE-LOAD	26.8K
HORIZONTAL	18.0K
VBUOY	19.8K
ANGLE θ	47.2°
HORIZONTAL CHAIN PROJECTION	865'
SCOPE OF CHAIN	900'




H2 MAX. W.O.
MAL W.O.
VBUOY
30
20
10
VBUOY (KIPS)
1100
1110
1120
1130
K=0
T=45.3K

2

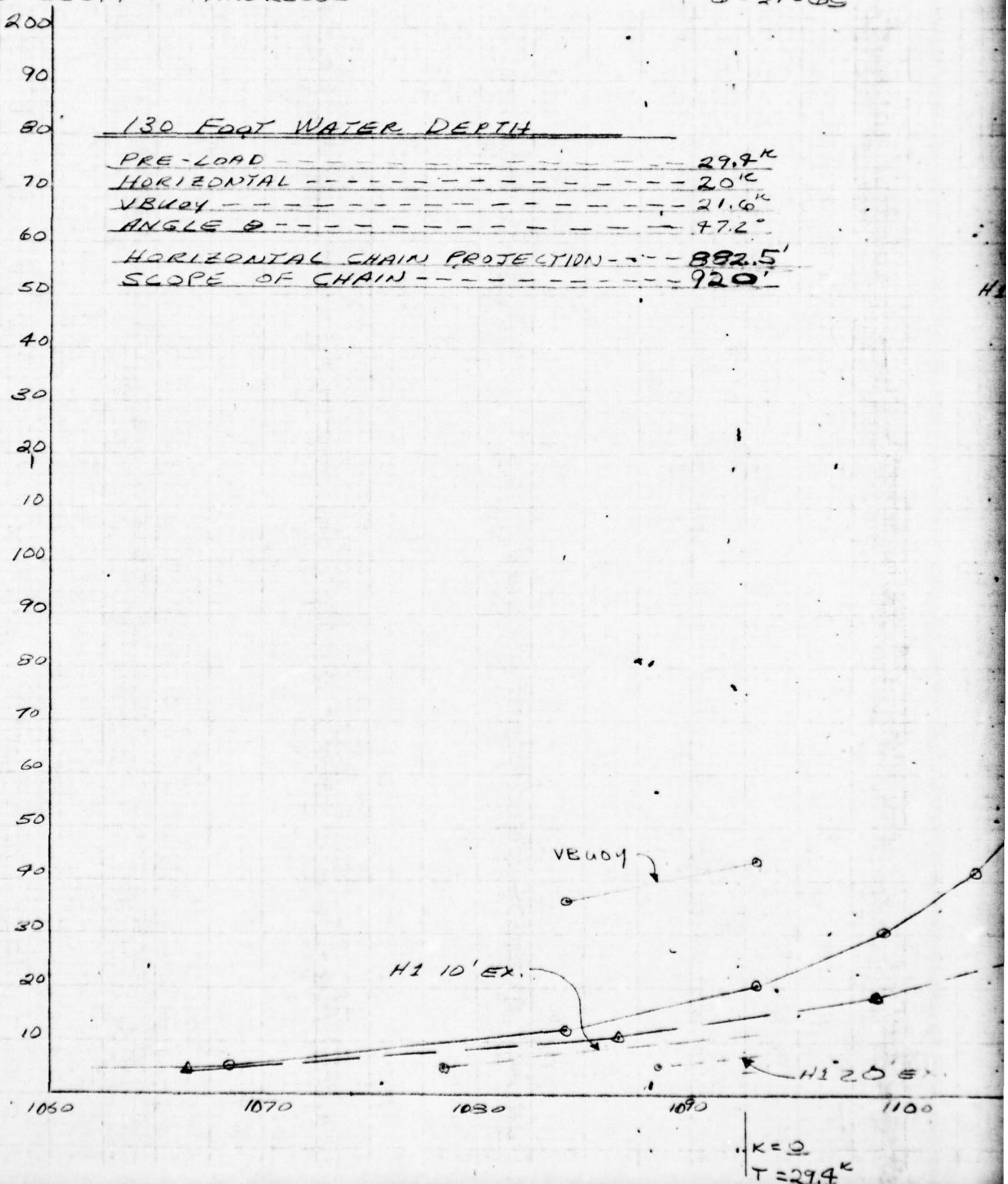
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & Co., INC.

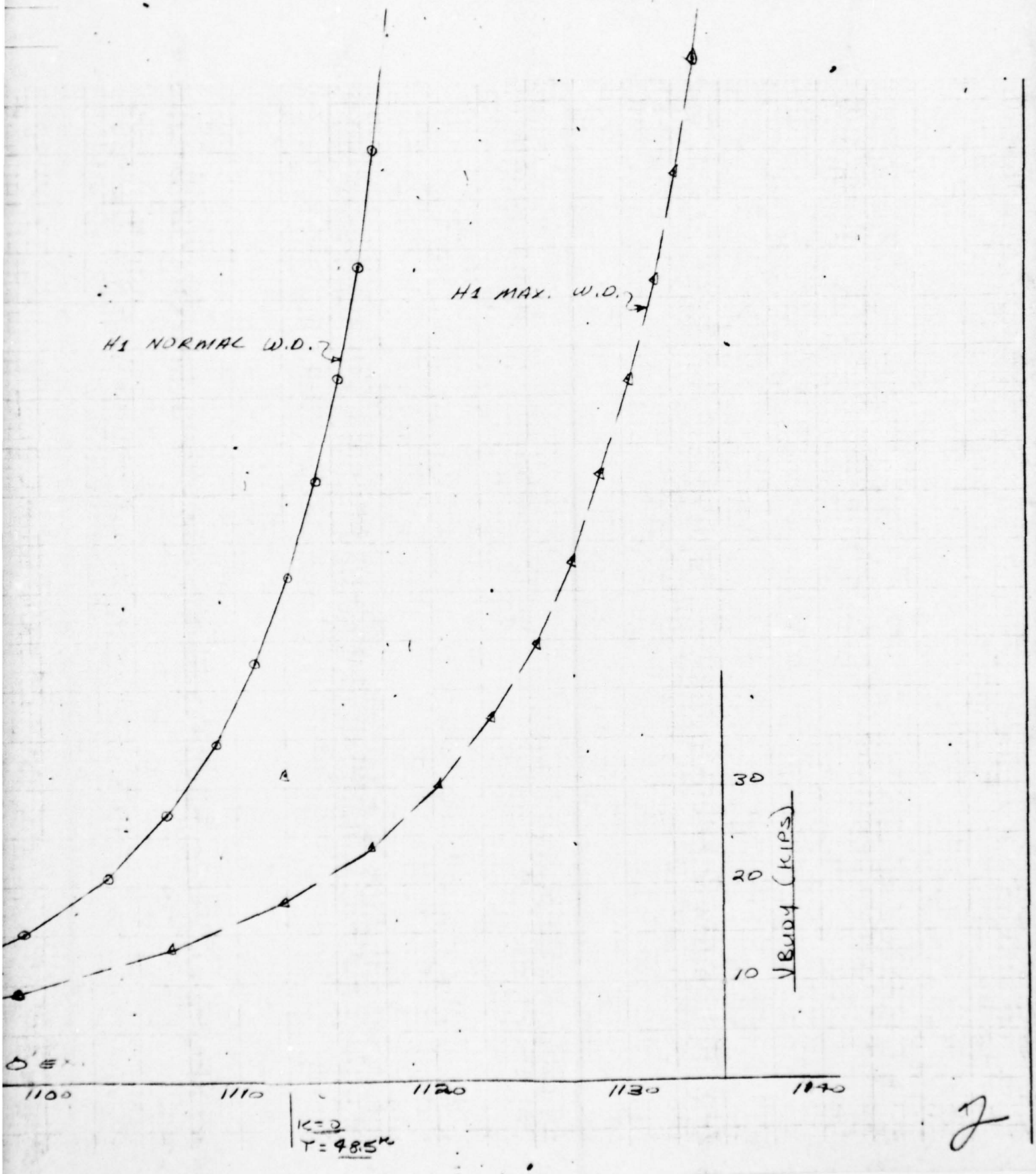
COMPANY			SHEET NO
U.S. ARMY/EROL			9
SUBJECT: MOMO - MOORING SYSTEM			
NUMBER	COMPUTER	CHECKED BY	DATE
JOB E6017	ANDREWS		6-21-65

130 FOOT WATER DEPTH

PRE-LOAD	29.7^K
HORIZONTAL	20^K
VBUOY	21.6^K
ANGLE θ	47.2°
HORIZONTAL CHAIN PROJECTION	892.5'
SCOPE OF CHAIN	920'



K = 0
T = 29.4^K


H1 NORMAL W.D.
H1 MAX. W.D.
30
20
10
VBUOY (KIPS)
1100
1110
1120
1130
1140
K=2
T=48.5K

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO
U.S. ARMY / EROL		10
SUBJECT		
MOMO - MOORING SYSTEM		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-21-65

140 FOOT WATER DEPTH

PRE-LOAD	32.4^K
HORIZONTAL	22.0^K
VBUOY	23.8^K
ANGLE θ	47.2°
HORIZONTAL CHAIN PROJECTION	890'
SCOPE OF CHAIN	930'

HORIZONTAL @ ANCHOR - M (KIPS)

200 90 80 70 60 50 40 30 20 10 100 90 80 70 60 50 40 30 20 10

1060 1070 1080 1090 1100

VBUOY

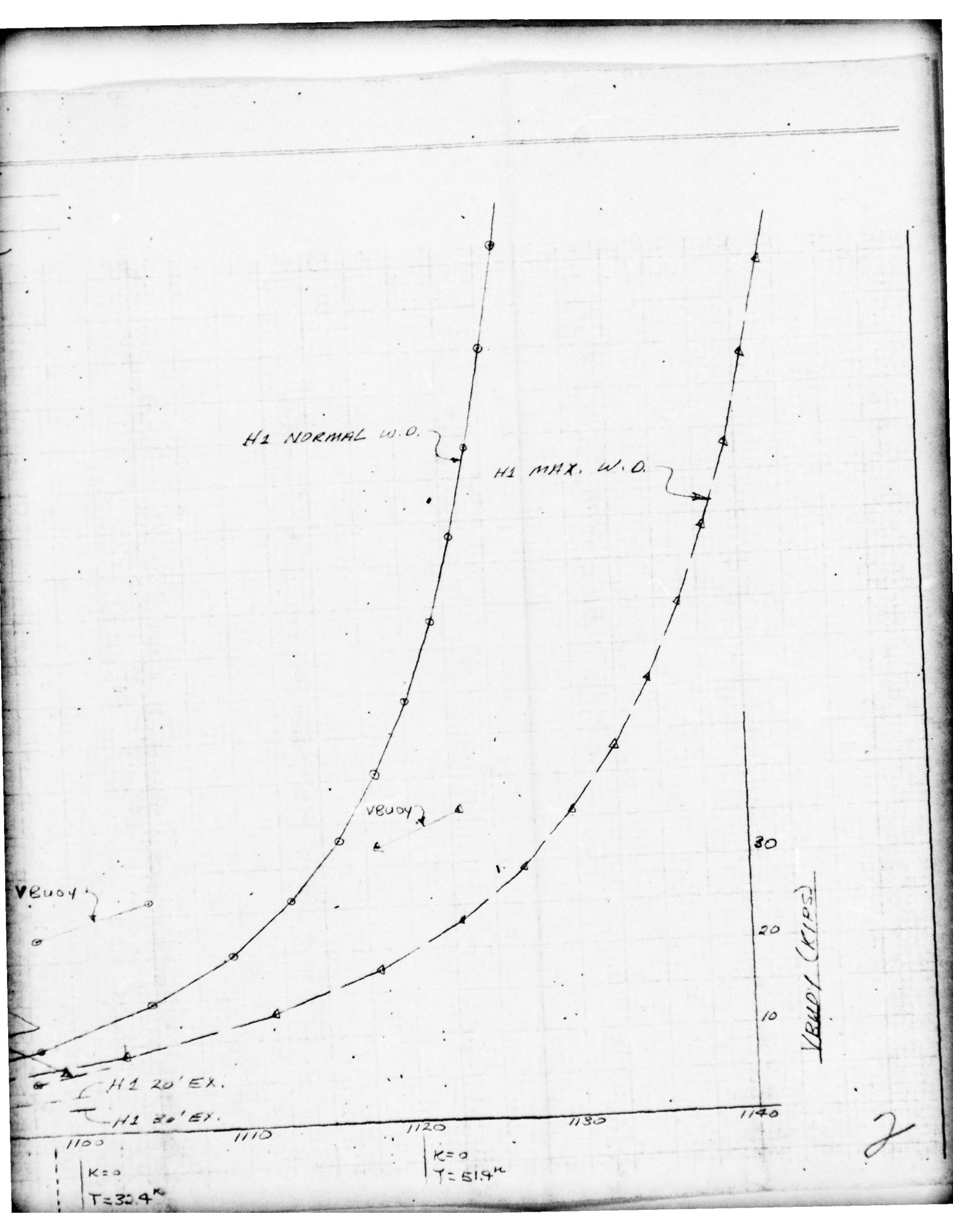
H1 10' EX.

H1

H1

K=0

T=32.4


H1 NORMAL W.O.
H1 MAX. W.O.
VBUOY
VBUOY
H1 20' EX.
H1 30' EX.
1100
1110
1120
1130
1140
30
20
10
VBUOY (KIPS)
K=0
T=32.4°K
K=0
T=51.4°K

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

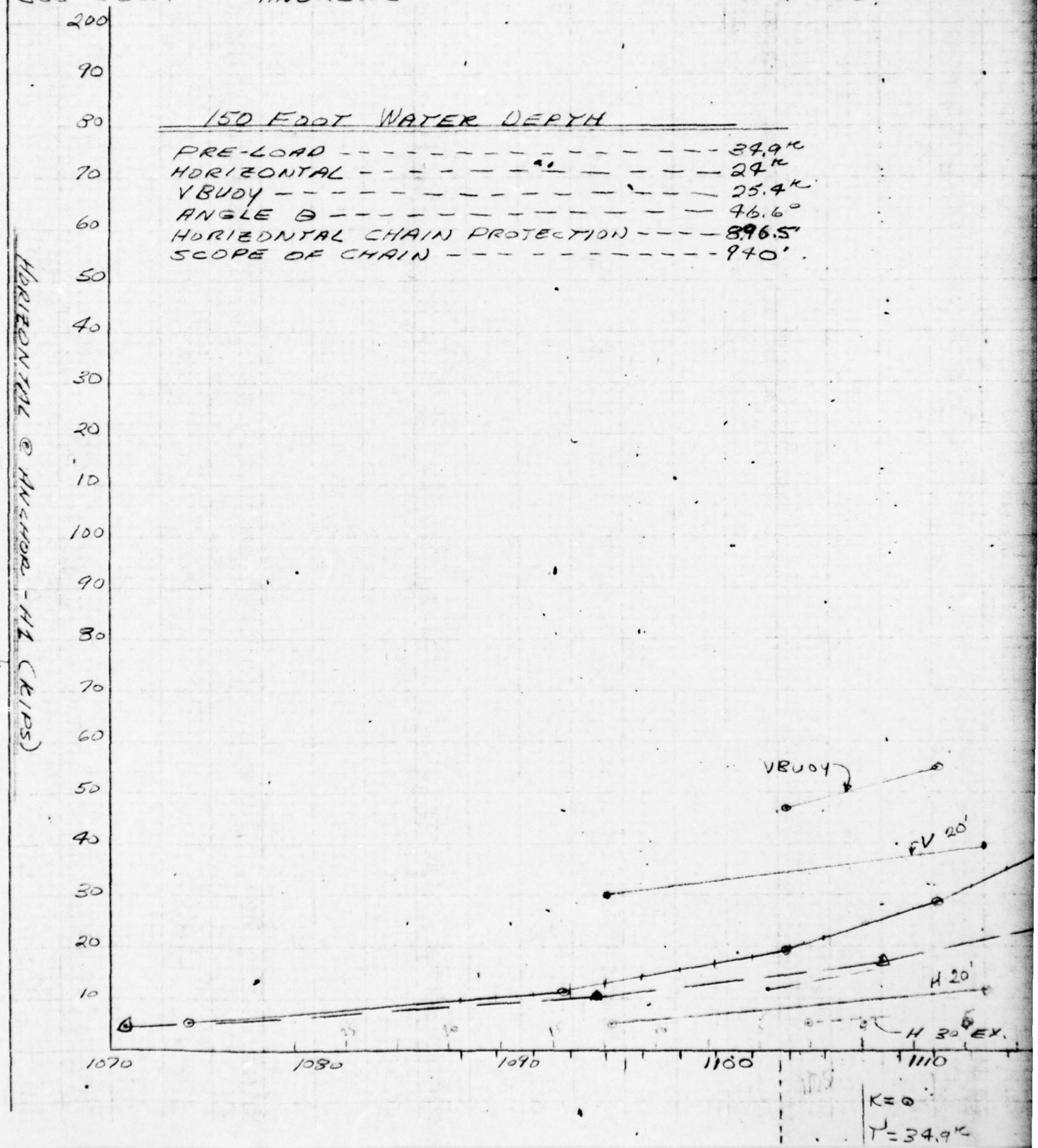
COMPANY	SHEET NO
U.S. ARMY / EROL	11

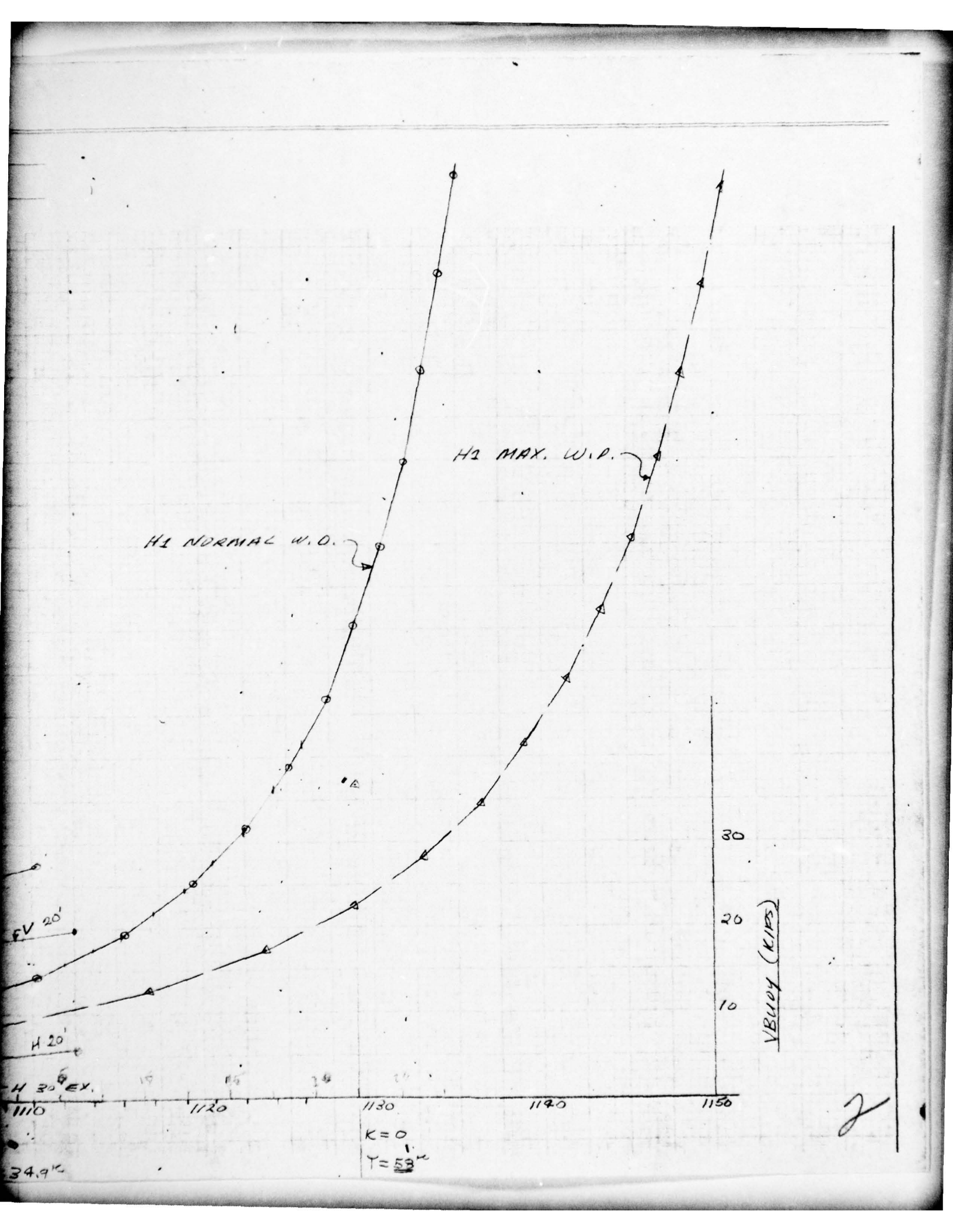
SUBJECT: MOOR - MOORING SYSTEM

JOB NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-21-65

150 FOOT WATER DEPTH

PRE-LOAD	34.9K
HORIZONTAL	27K
VBUOY	25.4K
ANGLE θ	46.6°
HORIZONTAL CHAIN PROTECTION	896.5'
SCOPE OF CHAIN	940'.

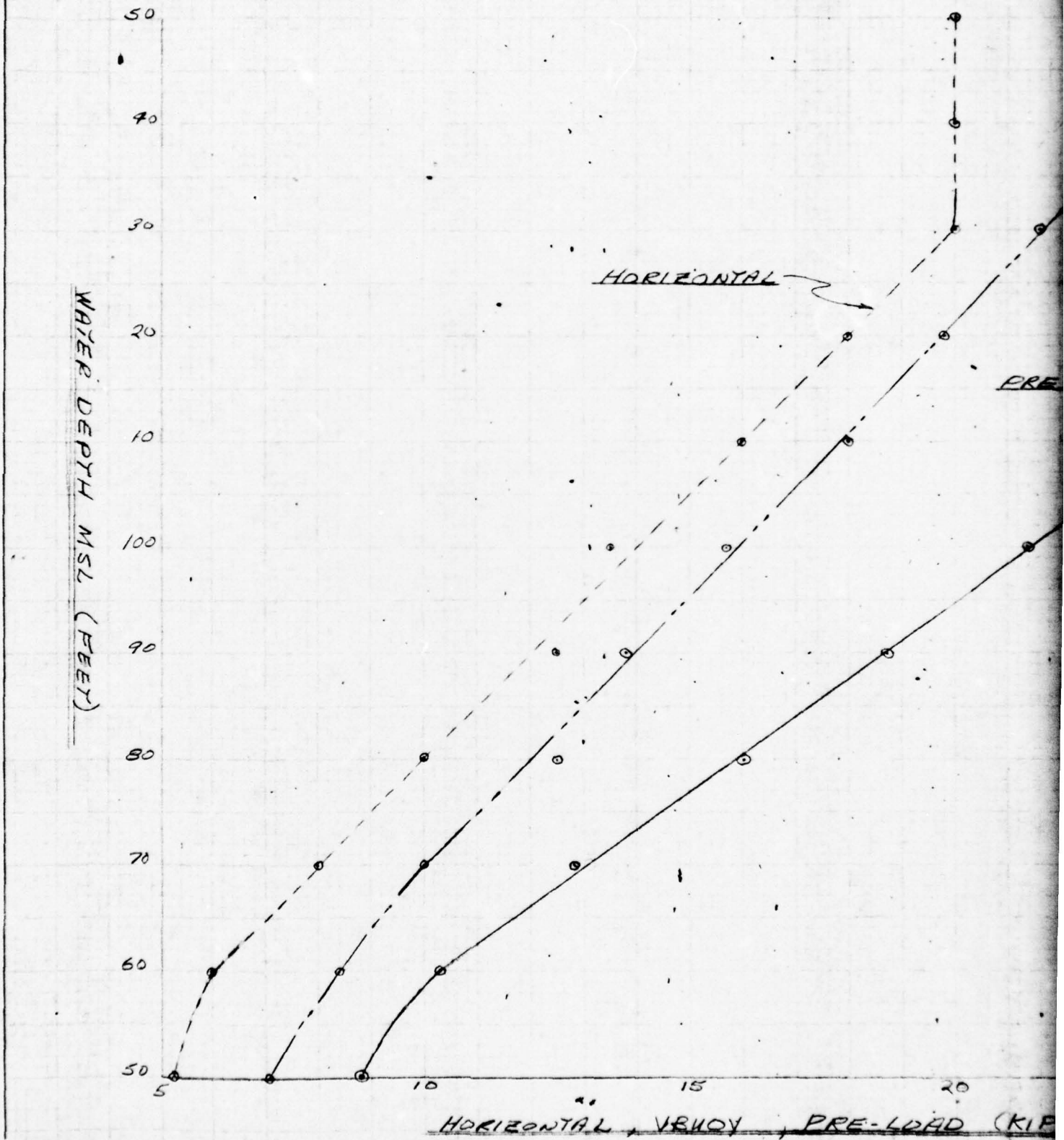


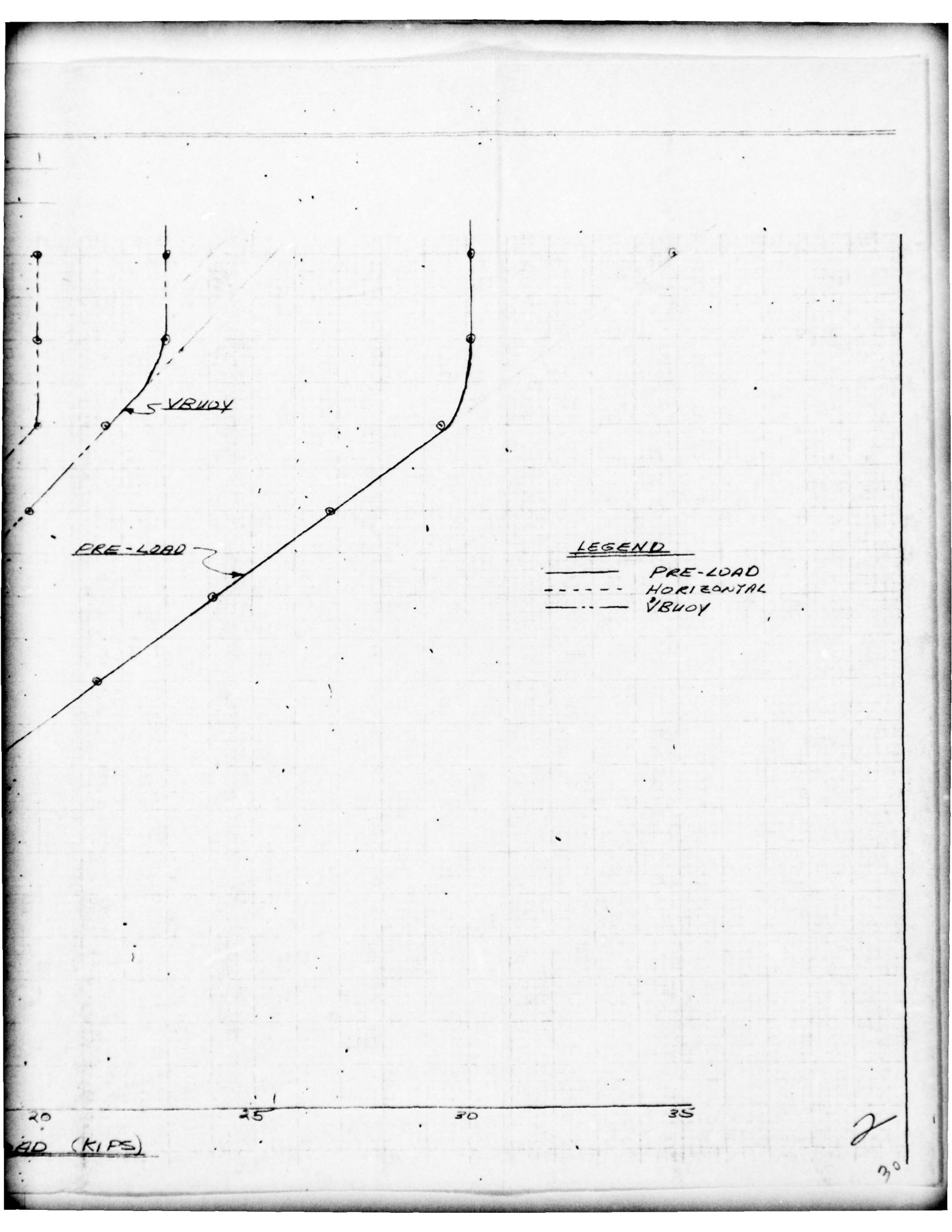

H1 MAX. W.P.
H1 NORMAL W.O.
FV 20'
H 20'
H 30° EX.
30
20
10
VBUOY (KIPS)
1110
1120
1130
1140
1150
K = 0
Y = 58'
34.9K

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY/EROL	12
SUBJECT	
MONO-MOORING SYSTEM	
DRAWING NUMBER	COMPUTER
JOB 55017	ANDREWS
CHECKED BY	DATE
	6-22-65




5 VBUOY
PRE-LOAD
LEGEND
PRE-LOAD
HORIZONTAL
VBUOY
20
25
30
35
AD (KIPS)

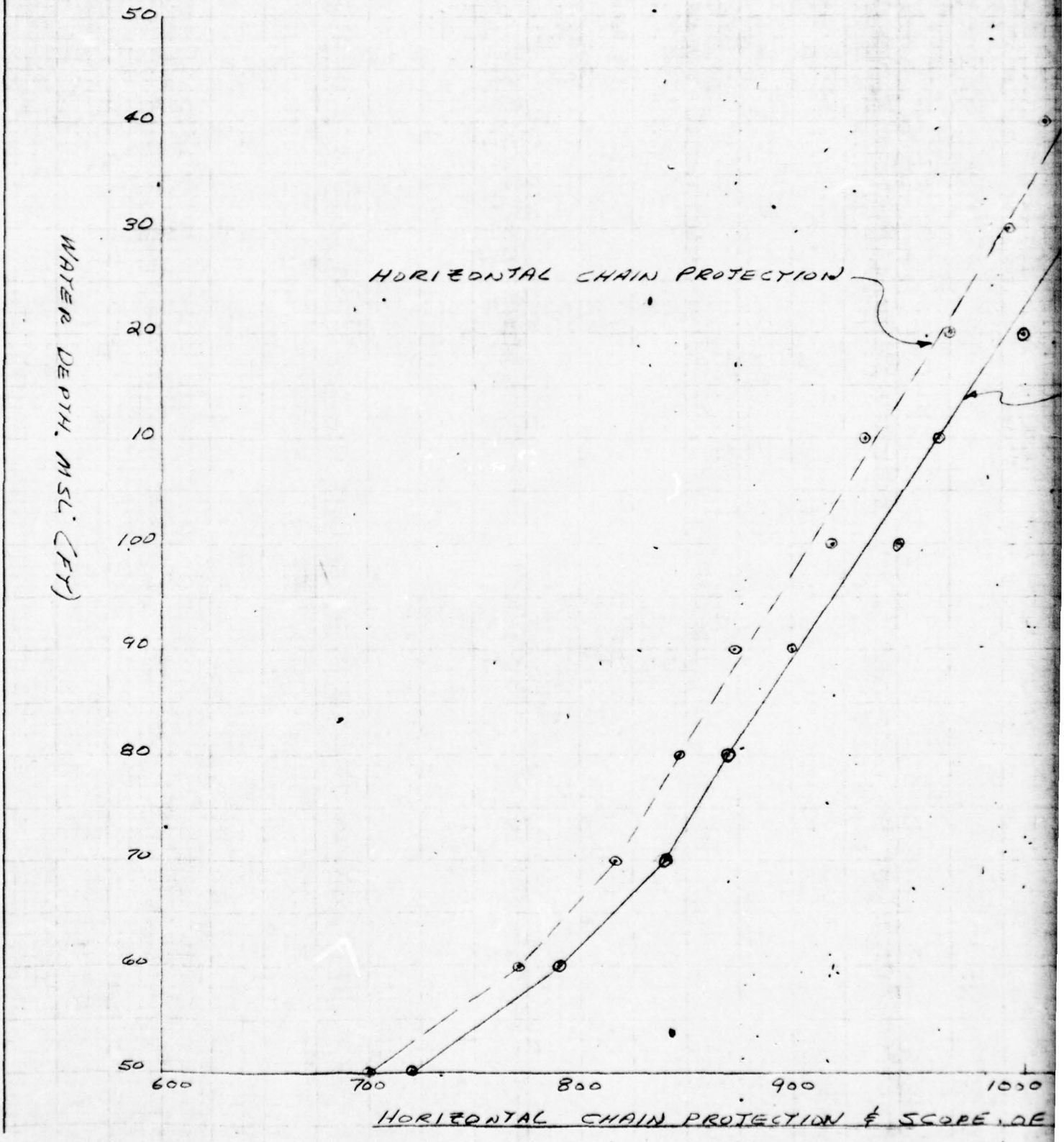
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

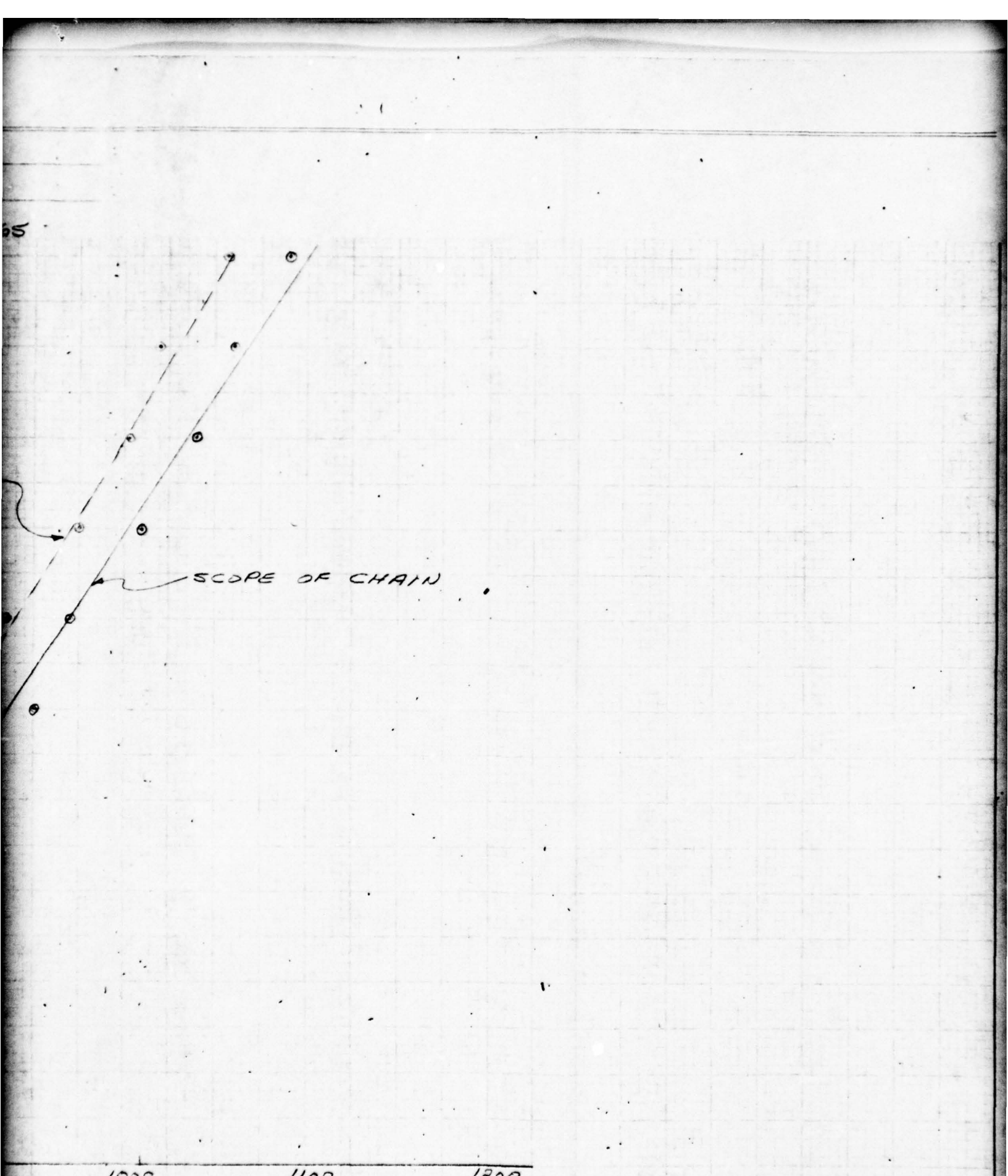
COMPANY	SHEET NO
U.S. ARMY/ERDL	13

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6-22-65



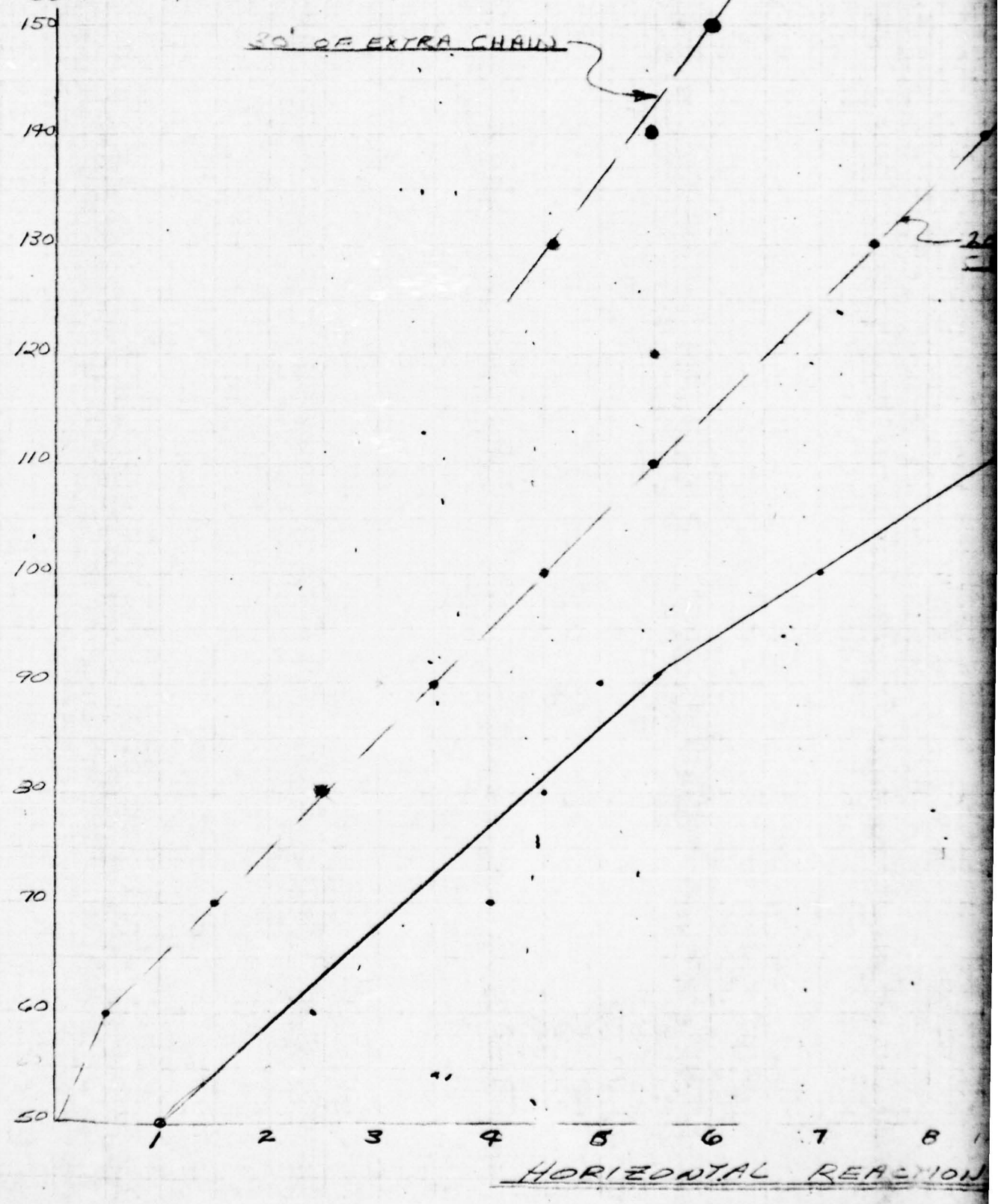
HORIZONTAL CHAIN PROTECTION & SCOPE OF

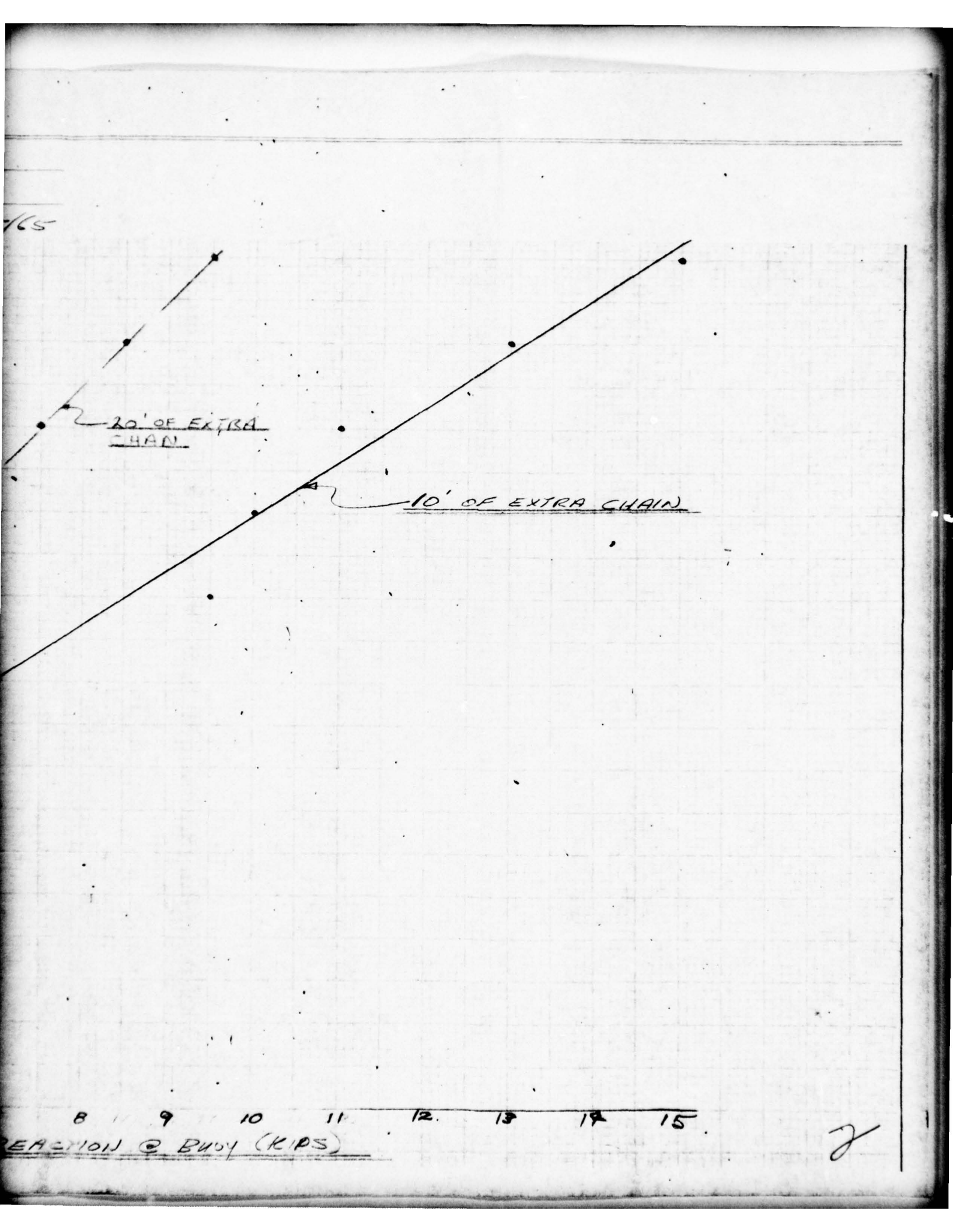

SCOPE OF CHAIN
1050
1100
1200
SCOPE OF CHAIN (FT)

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / EROL	1
SUBJECT	
MOOR-MOORING SYSTEM	
DRAWING NUMBER	**COMPUTER** / **CHECKED BY** / **DATE**
JOB 56017	ANDREWS / / 7/15/65




20' OF EXTRA CHAIN
10' OF EXTRA CHAIN
8
9
10
11
12
13
14
15
REACTION @ BUOY (KIPS)

J. RAY McDERMOTT & CO., INC.

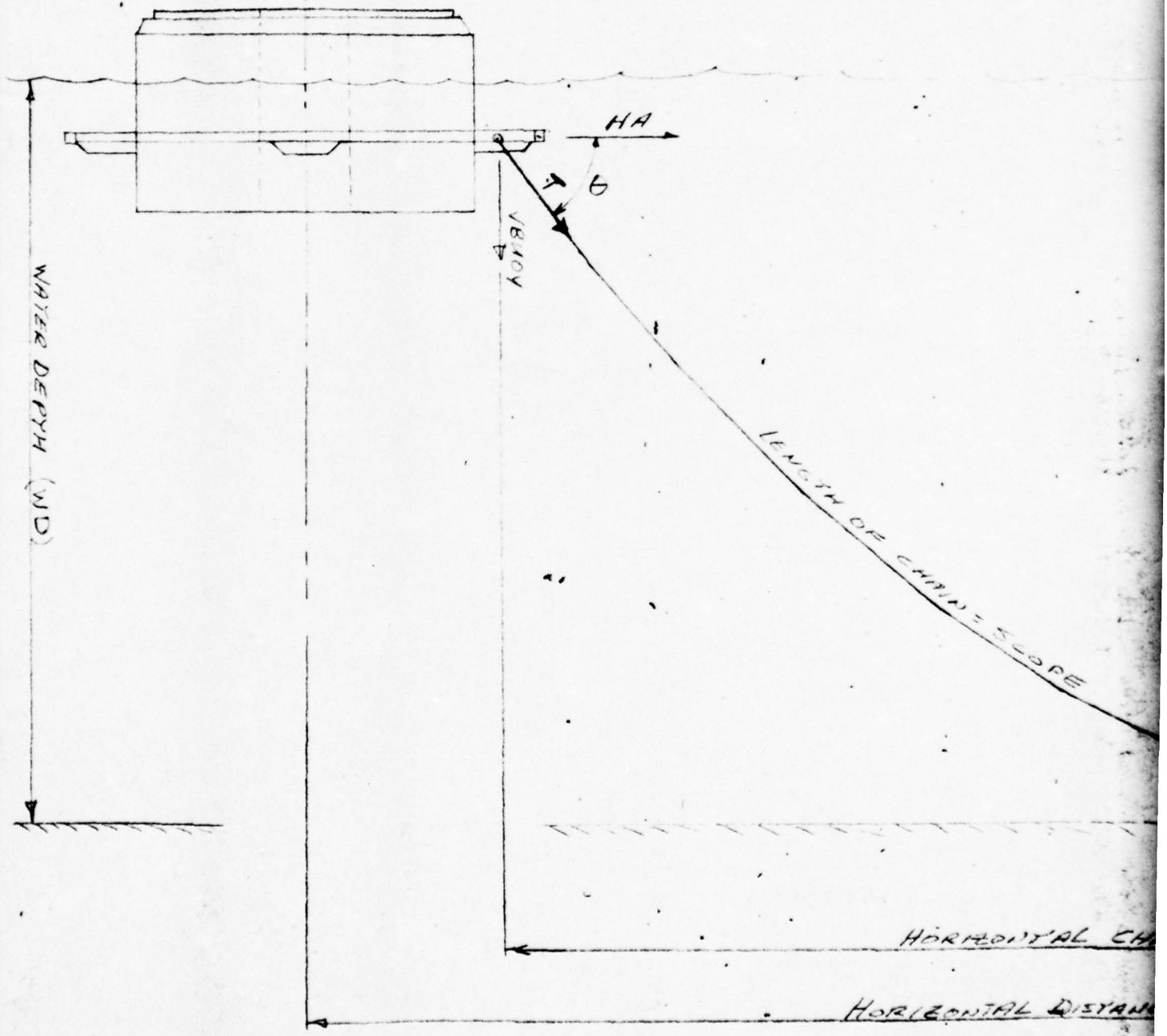
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO _____

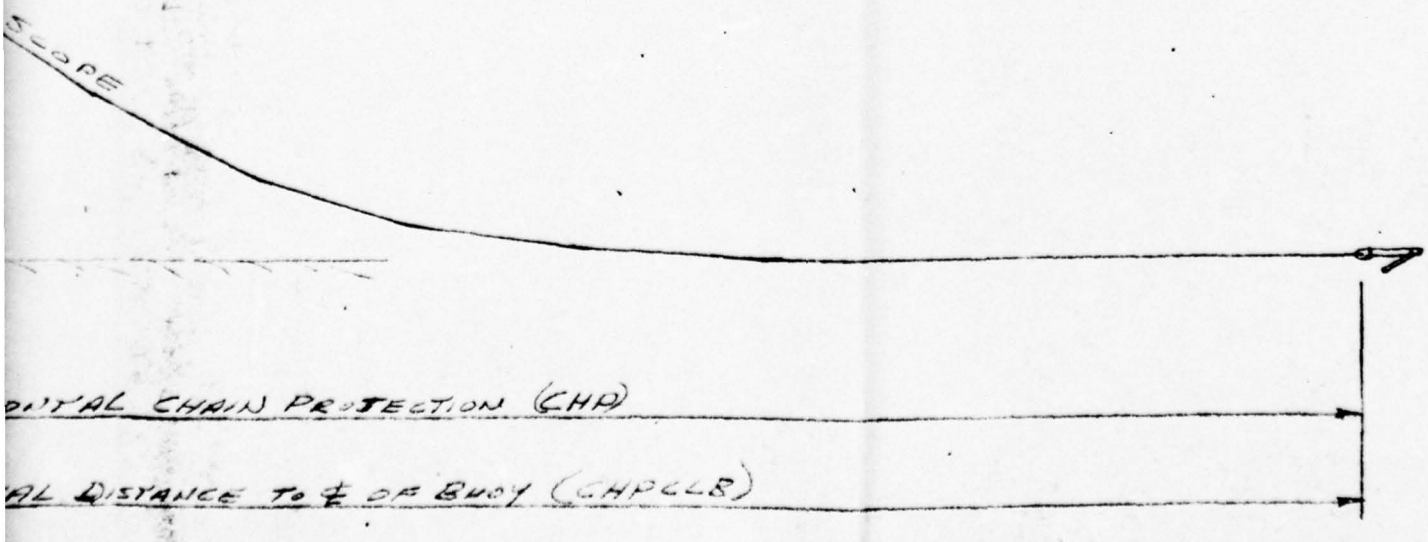
COMPANY U.S. ARMY / ERDL

SUBJECT MOOR - MOORING SYSTEM

JOB / DRAWING NO 5507 COMPUTER ANDREWS CHKD. BY _____ DATE 6-22 19 65



5177


SLOPE
ONTAL CHAIN PROTECTION (CHP)
AL DISTANCE TO ℄ OF BUOY (CHPCLB)

J. RAY McDERMOTT & CO., INC.

ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. _____

COMPANY U.S. ARMY/ERDL

SUBJECT MOOR-MOORING SYSTEM

JOB DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6-22 1965

INSTALLATION TABLE

WATER DEPTH WD (FEET)	PRE-LOAD T (KIPS)	HORIZONTAL HA (KIPS)	VERTICAL VBUOY (KIPS)	ANGLE θ (DEGREES)	SCOPE (FEET)
50	8.8	5.28	7.05	53	730
60	10.3	6.0	8.4	54	790
70	12.8	8.0	10.0	51	860
80	16.0	10.0	12.5	51	900
90	18.6	12.0	13.8	50°	940
100	21.4	13.5	15.7	49°	975
110	24.1	16.0	18.0	48.4	1000
120	26.8	18.0	19.8	47.7	1020
130	29.4	20.0	21.10	47.2	1040
140	30.3	19.5	23.0	49.7°	1050
150	30.3	19.5	23.0	49.7°	1060

* SCOPE IS DETERMINED BY ADDING 1/2 OF CHAIN TO SCOPE REQ'D. FROM CURVES.

EXTRA CHAIN IS PROPORTIONED AS FOLLOWS:

50 FEET ANCHOR DRAG

50 FEET ANCHOR PLACEMENT ALLOWANCE

10 FEET INSTALLATION ALLOWANCE

5177

SHEET No. _____

6-22 1965

TABLE

ANGLE θ (DEGREES)	SCALE* (FEET)	CHP (FEET)	CHPBCL (FEET)	BALLAST (Compare A & B)
53	730	669	686	YES
54	790	725	742	YES
51	660	792	809	YES
51	700	532	549	YES
50°	940	868	885	YES
49°	975	900	917	No
48.4	1000	923	940	No
47.7	1020	940	957	No
47.2	1040	958	975	No
49.7°	1050	964	981	No
49.7°	1060	968	985	No

CHAIN

OWS:

ANCE

2

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.42	3.91	815.6942	815.6942	0.00
5.28	7.05	834.1105	18.4162	0.00
12.93	10.19	839.3158	5.2053	0.00
23.43	13.32	841.9554	2.6395	0.00
36.63	16.46	843.5039	1.5484	0.00
52.56	19.59	844.5409	1.0369	0.00
71.46	22.73	845.3172	.7763	0.00
93.06	25.87	845.8896	.5723	0.00
117.36	29.00	846.3313	.4417	0.00
144.36	32.14	846.6843	.3529	0.00
174.36	35.27	846.9831	.2988	0.00
174.36	35.27	846.9831	0.0000	0.00
207.36	38.41	847.2378	.2546	0.00
243.36	41.55	847.4564	.2186	0.00
280.86	44.68	847.6194	.1630	0.00
322.86	47.82	847.7889	.1695	0.00
365.46	50.95	847.9099	.1210	0.00
413.46	54.09	848.0421	.1322	0.00
461.46	57.23	848.1343	.0922	0.00
515.46	60.36	848.2453	.1110	0.00
569.46	63.50	848.3285	.0832	0.00
626.46	66.63	848.3995	.0710	0.00

50' W.D. NORMAL 1A

H=0. DELTA=3.0 VPCC=45. WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=50. A2=400 A3=400 M=1

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.39	5.48	816.8751	816.8751	0.00
4.74	8.62	842.2695	25.3943	0.00
11.01	11.75	850.4478	8.1783	0.00
19.20	14.89	854.7917	4.3438	0.00
29.31	18.03	857.5246	2.7328	0.00
41.34	21.16	859.4127	1.8881	0.00
55.44	24.30	860.8449	1.4322	0.00
71.34	27.43	861.8999	1.0549	0.00
89.04	30.57	862.7165	.8166	0.00
108.84	33.71	863.4060	.6894	0.00
130.74	36.84	863.9903	.5842	0.00
130.74	36.84	863.9903	0.0000	0.00
154.14	39.98	864.4465	.4561	0.00
179.64	43.11	864.8498	.4032	0.00
207.24	46.25	865.2066	.3568	0.00
236.64	49.39	865.5127	.3061	0.00
267.84	52.52	865.7767	.2640	0.00
301.14	55.66	866.0152	.2385	0.00
337.14	58.79	866.2461	.2309	0.00
373.44	61.93	866.4188	.1727	0.00
412.44	65.07	866.5911	.1723	0.00
454.44	68.20	866.7615	.1704	0.00

50' W.D. MAX. 1B

H=0. DELTA=3.0 VPCC=65 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=70 A2=400 A3=400 M=1

7
270
260

270
260
610

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.40	4.70	816.1758	816.1758	0.00
4.96	7.83	838.3755	22.1997	0.00
11.80	10.97	845.0964	6.7209	0.00
20.89	14.11	848.5371	3.4407	0.00
32.29	17.24	850.6907	2.1535	0.00
46.09	20.38	852.1938	1.5030	0.00
61.99	23.51	853.2321	1.0383	0.00
80.29	26.65	854.0446	.8124	0.00
100.69	29.79	854.6626	.6180	0.00
123.49	32.92	855.1751	.5125	0.00
148.39	36.06	855.5869	.4118	0.00
148.39	36.06	855.5869	0.0000	0.00
175.99	39.19	855.9549	.3679	0.00
205.99	42.33	856.2681	.3131	0.00
237.19	45.47	856.5031	.2350	0.00
271.39	48.60	856.7296	.2265	0.00
307.99	51.74	856.9329	.2033	0.00
346.99	54.87	857.1091	.1762	0.00
387.49	58.01	857.2590	.1499	0.00
430.69	61.15	857.3992	.1402	0.00
476.29	64.28	857.5273	.1281	0.00
524.29	67.42	857.6417	.1144	0.00

10

60 W.D. NORMAL 2A

H=0. DELTA=3.0 VPCC=55. WW=0 W(1)=.0789 TOL=.1

W(3)=.0789 W(5)=.0789 A1=60 A2=400 A3=400 M=1

340
190
650

860
470
190

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.84	7.05	830.2668	830.2668	0.00
5.13	10.19	854.0942	23.8274	0.00
11.01	13.32	863.6312	9.5369	0.00
18.45	16.46	869.0178	5.3866	0.00
27.45	19.59	872.5294	3.5115	0.00
38.04	22.73	875.0351	2.5057	0.00
50.16	25.87	876.8855	1.8504	0.00
63.96	29.00	878.3642	1.4787	0.00
79.26	32.14	879.5198	1.1556	0.00
96.06	35.27	880.4525	.9326	0.00
114.36	38.41	881.2230	.7705	0.00
114.36	38.41	881.2230	0.0000	0.00
134.46	41.55	881.9069	.6838	0.00
156.06	44.68	882.4837	.5767	0.00
179.16	47.82	882.9777	.4940	0.00
203.76	50.95	883.4061	.4284	0.00
229.86	54.09	883.7837	.3776	0.00
257.76	57.23	884.1294	.3457	0.00
287.16	60.36	884.4364	.3070	0.00
318.06	63.50	884.7102	.2738	0.00
351.06	66.63	884.9744	.2642	0.00
384.66	69.77	885.1883	.2139	0.00

60' W.D. MAX. 2B

H=0.3 DELTA=3. VPCC=80 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=90 A2=400 A3=400 M=1

590
220
670

3A

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.39	5.48	816.8751	816.8751	0.00
4.74	8.62	842.2695	25.3943	0.00
11.01	11.75	850.4478	8.1783	0.00
19.20	14.89	854.7917	4.3438	0.00
29.31	18.03	857.5246	2.7328	0.00
41.34	21.16	859.4127	1.8881	0.00
55.44	24.30	860.8449	1.4322	0.00
71.34	27.43	861.8999	1.0549	0.00
89.04	30.57	862.7165	.8166	0.00
108.84	33.71	863.4060	.6894	0.00
130.74	36.84	863.9903	.5842	0.00
130.74	36.84	863.9903	0.0000	0.00
154.14	39.98	864.4465	.4561	0.00
179.64	43.11	864.8498	.4032	0.00
207.24	46.25	865.2066	.3568	0.00
236.64	49.39	865.5127	.3061	0.00
267.84	52.52	865.7767	.2640	0.00
301.14	55.66	866.0152	.2385	0.00
337.14	58.79	866.2461	.2309	0.00
373.44	61.93	866.4188	.1727	0.00
412.44	65.07	866.5911	.1723	0.00
454.44	68.20	866.7615	.1704	0.00

(12)

70' W.D. NORMAL 3A

H=0. Δ=3. VPCC=65. WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=70 A2=400 A3=400 M=1

3B

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.81	7.83	830.8668	830.8668	0.00
5.01	10.97	857.5774	26.7105	0.00
10.56	14.11	868.2554	10.6780	0.00
17.52	17.24	874.5165	6.2611	0.00
25.92	20.38	878.7233	4.2068	0.00
35.64	23.51	881.6425	2.9192	0.00
46.77	26.65	883.8618	2.2192	0.00
59.37	29.79	885.6316	1.7697	0.00
73.23	32.92	887.0009	1.3692	0.00
88.53	36.06	888.1450	1.1441	0.00
105.33	39.19	889.1242	.9792	0.00
105.33	39.19	889.1242	0.0000	0.00
123.33	42.33	889.9215	.7972	0.00
142.83	45.47	890.6242	.7027	0.00
163.83	48.60	891.2458	.6216	0.00
186.03	51.74	891.7727	.5269	0.00
210.03	54.87	892.2695	.4968	0.00
234.93	58.01	892.6769	.4074	0.00
261.33	61.15	893.0501	.3732	0.00
289.23	64.28	893.3915	.3414	0.00
318.33	67.42	893.6929	.3014	0.00
348.93	70.55	893.9732	.2803	0.00

70' WD MAX. 3B

H=0 Δ=3 VPCC=90 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=100 A2=400 A3=400 M=1

4A

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.48	6.27	820.0744	820.0744	0.00
4.71	9.40	846.7020	26.6276	0.00
10.65	12.54	856.0923	9.3902	0.00
18.27	15.67	861.1951	5.1028	0.00
27.57	18.81	864.4533	3.2581	0.00
38.67	21.95	866.8017	2.3484	0.00
51.27	25.08	868.4389	1.6372	0.00
65.67	28.22	869.7498	1.3109	0.00
81.87	31.35	870.8135	1.0636	0.00
99.57	34.49	871.6422	.8287	0.00
119.07	37.63	872.3483	.7060	0.00
119.07	37.63	872.3483	0.0000	0.00
140.37	40.76	872.9536	.6053	0.00
163.17	43.90	873.4538	.5001	0.00
187.77	47.03	873.8937	.4399	0.00
213.87	50.17	874.2689	.3752	0.00
241.77	53.31	874.6056	.3367	0.00
271.77	56.44	874.9187	.3131	0.00
302.67	59.58	875.1737	.2550	0.00
335.67	62.71	875.4129	.2392	0.00
370.47	65.85	875.6338	.2209	0.00
406.77	68.99	875.8318	.1980	0.00

(19)

80' W.D. NORMAC 4A

H=0 Δ=3. VPCC=.74 WW=0. W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=80 A2=400 A3=400 M=1

830
770
110

856
110
746

4B

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.81	8.62	831.7789	831.7789	0.00
4.89	11.75	860.5548	28.7759	0.00
10.23	14.89	872.7154	12.1606	0.00
16.83	18.03	879.8681	7.1527	0.00
24.63	21.16	884.5544	4.6863	0.00
33.72	24.30	887.9985	3.4441	0.00
44.07	27.43	890.6116	2.6130	0.00
55.65	30.57	892.6484	2.0368	0.00
68.55	33.71	894.3222	1.6738	0.00
82.65	36.84	895.6788	1.3565	0.00
97.95	39.98	896.8046	1.1258	0.00
97.95	39.98	896.8046	0.0000	0.00
114.75	43.11	897.8163	1.0116	0.00
132.45	46.25	898.6213	.8050	0.00
151.65	49.39	899.3620	.7407	0.00
172.05	52.52	900.0046	.6426	0.00
193.65	55.66	900.5684	.5638	0.00
216.45	58.79	901.0684	.5000	0.00
240.75	61.93	901.5342	.4658	0.00
265.95	65.07	901.9328	.3986	0.00
292.95	68.20	902.3239	.3911	0.00
320.55	71.34	902.6480	.3241	0.00

80' W.D. MAX. 4B

H=0 Δ=3. VPCC=100 WW=0 W(1)=.0789 TOL=.1

W(3)=.0789 W(5)=.0789 A1=110 A2=400 A3=400 M=1

910
140
770

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.48	7.05	1020.7070	1020.7070	0.00
5.85	10.97	1053.4851	32.7781	0.00
13.53	14.89	1064.1190	10.6339	0.00
23.58	18.81	1069.8828	5.7638	0.00
35.91	22.73	1073.4621	3.5793	0.00
50.61	26.65	1075.9693	2.5072	0.00
67.71	30.57	1077.8317	1.8624	0.00
86.97	34.49	1079.2099	1.3782	0.00
108.87	38.41	1080.3617	1.1518	0.00
132.87	42.33	1081.2559	.8942	0.00
158.97	46.25	1081.9756	.7197	0.00
158.97	46.25	1081.9756	0.0000	0.00
187.77	50.17	1082.6176	.6420	0.00
218.67	54.09	1083.1480	.5304	0.00
251.97	58.01	1083.6120	.4640	0.00
287.97	61.93	1084.0306	.4186	0.00
325.77	65.85	1084.3782	.3476	0.00
365.97	69.77	1084.6919	.3137	0.00
408.57	73.69	1084.9742	.2823	0.00
453.57	77.61	1085.2258	.2516	0.00
501.57	81.53	1085.4695	.2437	0.00
550.77	85.45	1085.6712	.2017	0.00

(13)

90' W.D. NORMAL 5A

H=0. Δ=3. VPCC=84. WW=0. W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=90 A2=500 A3=500 M=1

1090
920
270

1063
270
793

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.81	9.40	1032.5987	1032.5987	0.00
5.97	13.32	1067.5464	34.9477	0.00
12.93	17.24	1081.2710	13.7246	0.00
21.66	21.16	1089.0518	7.7808	0.00
32.16	25.08	1094.1458	5.0940	0.00
44.46	29.00	1097.7904	3.6446	0.00
58.56	32.92	1100.5310	2.7406	0.00
74.46	36.84	1102.6682	2.1372	0.00
91.98	40.76	1104.3254	1.6572	0.00
111.48	44.68	1105.7442	1.4188	0.00
132.78	48.60	1106.9266	1.1824	0.00
132.78	48.60	1106.9266	0.0000	0.00
155.58	52.52	1107.8828	.9562	0.00
180.48	56.44	1108.7496	.8668	0.00
206.88	60.36	1109.4705	.7209	0.00
235.08	64.28	1110.1073	.6368	0.00
265.38	68.20	1110.6949	.5876	0.00
297.18	72.12	1111.1964	.5015	0.00
330.78	76.04	1111.6510	.4546	0.00
366.78	79.96	1112.0859	.4349	0.00
403.38	83.88	1112.4322	.3463	0.00
442.38	87.80	1112.7689	.3367	0.00

90 W.D. MAX. 5B

H=0 A=3 VPCC=110 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(6)=.0784 A1=120 A2=500 A3=500 M=1

1120
300

520

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.57	7.83	1024.1073	1024.1073	0.00
5.85	11.75	1058.0617	33.9544	0.00
13.20	15.67	1069.7462	11.6845	0.00
22.68	19.59	1076.2263	6.4801	0.00
34.26	23.51	1080.3656	4.1393	0.00
47.94	27.43	1083.2555	2.8899	0.00
63.84	31.35	1085.4437	2.1882	0.00
81.63	35.27	1087.0515	1.6078	0.00
101.73	39.19	1088.3864	1.3349	0.00
123.93	43.11	1089.4667	1.0803	0.00
147.93	47.03	1090.3218	.8551	0.00
147.93	47.03	1090.3218	0.0000	0.00
174.33	50.95	1091.0809	.7591	0.00
202.83	54.87	1091.7276	.6467	0.00
233.43	58.79	1092.2850	.5574	0.00
265.83	62.71	1092.7546	.4696	0.00
300.63	66.63	1093.1865	.4319	0.00
337.53	70.55	1093.5673	.3808	0.00
376.53	74.47	1093.9096	.3423	0.00
417.63	78.39	1094.2153	.3057	0.00
460.83	82.31	1094.4898	.2745	0.00
505.83	86.23	1094.7364	.2466	0.00

17

100' W.D. NORMAL 6A

H=0 Δ=3. VPCC = 93 WW=0 W(1) = .0784 TOL=.1

W(3) = .0784 W(5)=.0784 A1 = 100 A2=500 A3=500 M=1

1100
355
245

1070
295
325

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.81	10.19	1033.3406	1033.3406	0.00
5.88	14.11	1070.7078	37.3672	0.00
12.57	18.03	1085.6460	14.9382	0.00
20.91	21.95	1094.3523	8.7063	0.00
30.84	25.87	1100.0467	5.6944	0.00
42.45	29.79	1104.1931	4.1464	0.00
55.65	33.71	1107.2813	3.0882	0.00
70.50	37.63	1109.7119	2.4306	0.00
87.00	41.55	1111.6748	1.9629	0.00
105.12	45.47	1113.2838	1.6090	0.00
124.92	49.39	1114.6420	1.3582	0.00
124.92	49.39	1114.6420	0.0000	0.00
146.22	53.31	1115.7694	1.1274	0.00
169.32	57.23	1116.7684	.9990	0.00
193.92	61.15	1117.6177	.8493	0.00
220.32	65.07	1118.3824	.7647	0.00
248.22	68.99	1119.0453	.6629	0.00
277.62	72.91	1119.6264	.5811	0.00
308.82	76.83	1120.1604	.5340	0.00
341.82	80.75	1120.6506	.4902	0.00
376.02	84.67	1121.0718	.4212	0.00
412.32	88.59	1121.4789	.4071	0.00

100' W.D. MAX. 6B

H=0 A=3 YPCC = 120 WW=0 W(1)=.0799 TOL=.1

W(3)=.0799 W(5)=.0799 A1 = 130 A2=500 A3=500 M=1

1130
275
855

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.57	8.62	1024.7986	1024.7986	0.00
5.70	12.54	1061.2336	36.4350	0.00
12.75	16.46	1074.5207	13.2871	0.00
21.69	20.38	1081.8809	7.3602	0.00
32.52	24.30	1086.6364	4.7555	0.00
45.24	28.22	1089.9851	3.3487	0.00
59.94	32.14	1092.5264	2.5413	0.00
76.44	36.06	1094.4468	1.9204	0.00
95.04	39.98	1096.0404	1.5936	0.00
115.20	43.90	1097.2594	1.2190	0.00
137.70	47.82	1098.3576	1.0982	0.00
137.70	47.82	1098.3576	0.0000	0.00
161.70	51.74	1099.2246	.8670	0.00
187.80	55.66	1099.9933	.7687	0.00
215.70	59.58	1100.6508	.6575	0.00
245.70	63.50	1101.2402	.5894	0.00
277.20	67.42	1101.7356	.4954	0.00
311.10	71.34	1102.2048	.4692	0.00
346.50	75.26	1102.6048	.4000	0.00
384.00	79.18	1102.9722	.3674	0.00
423.30	83.10	1103.3038	.3316	0.00
465.30	87.02	1103.6257	.3219	0.00

19

110' W.D. NORMAL 7A

H=0 Δ=3 VPCC=103 WW=0 W(1)=.0789 TOL=.1

W(3)=.0789 W(5)=.0789 A1=110 A2=500 A3=500 M=1

1110
930
230

1077.5
230
847.5

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.15	10.19	1009.5471	1009.5471	0.00
4.89	14.11	1061.1948	51.6477	0.00
11.19	18.03	1079.1609	17.9661	0.00
18.99	21.95	1089.2049	10.0440	0.00
28.32	25.87	1095.8219	6.6170	0.00
39.18	29.79	1100.5467	4.7248	0.00
51.57	33.71	1104.1028	3.5561	0.00
65.49	37.63	1106.8816	2.7788	0.00
80.94	41.55	1109.1154	2.2338	0.00
98.04	45.47	1110.9946	1.8792	0.00
116.43	49.39	1112.4891	1.4945	0.00
116.43	49.39	1112.4891	0.0000	0.00
136.53	53.31	1113.8086	1.3195	0.00
158.13	57.23	1114.9353	1.1267	0.00
181.23	61.15	1115.9089	.9736	0.00
205.83	65.07	1116.7613	.8524	0.00
232.23	68.99	1117.5440	.7827	0.00
259.83	72.91	1118.2062	.6622	0.00
288.93	76.83	1118.8017	.5955	0.00
319.83	80.75	1119.3582	.5565	0.00
351.93	84.67	1119.8416	.4834	0.00
385.83	88.59	1120.2982	.4566	0.00

110' W.D. MAX. 7B

H=0 Δ=3 VPCC=128 NN=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=130 A2=500 A3=500 M=1

1130
250
880

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.64	9.40	1027.6701	1027.6701	0.00
5.71	13.32	1065.3684	37.6983	0.00
12.55	17.24	1079.7703	14.4019	0.00
21.10	21.16	1087.8236	8.0533	0.00
31.42	25.08	1093.1524	5.3288	0.00
43.48	29.00	1096.9285	3.7761	0.00
57.31	32.92	1099.7732	2.8447	0.00
72.91	36.84	1101.9940	2.2208	0.00
90.31	40.76	1103.7860	1.7920	0.00
109.24	44.68	1105.1920	1.4060	0.00
130.24	48.60	1106.4401	1.2481	0.00
130.24	48.60	1106.4401	0.0000	0.00
152.74	52.52	1107.4498	1.0097	0.00
177.04	56.44	1108.3263	.8765	0.00
203.14	60.36	1109.0935	.7672	0.00
230.74	64.28	1109.7440	.6505	0.00
260.74	68.20	1110.3690	.6250	0.00
291.64	72.12	1110.8690	.5000	0.00
324.64	76.04	1111.3393	.4703	0.00
359.44	79.96	1111.7652	.4259	0.00
396.04	83.88	1112.1537	.3885	0.00
435.04	87.80	1112.5290	.3753	0.00

91

120' W.D. NORMAL 8A

H=0 Δ=3 VPCC=112 WW=0 W(1)=.0787 TOL=.1

W(3)=.0787 W(5)=.0787 A1=120 A2=500 A3=500 M=1

1120
900
220

1085
220
865

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.15	10.97	1009.5395	1009.5395	0.00
4.83	14.89	1063.7148	54.1753	0.00
10.95	18.81	1083.0122	19.2974	0.00
18.48	22.73	1094.0380	11.0258	0.00
27.42	26.65	1101.3295	7.2915	0.00
37.77	30.57	1106.5561	5.2266	0.00
49.56	34.49	1110.5343	3.9782	0.00
62.76	38.41	1113.6445	3.1102	0.00
77.46	42.33	1116.1966	2.5521	0.00
93.39	46.25	1118.2080	2.0114	0.00
110.85	50.17	1119.9457	1.7377	0.00
110.85	50.17	1119.9457	0.0000	0.00
129.75	54.09	1121.4300	1.4843	0.00
150.15	58.01	1122.7250	1.2950	0.00
171.75	61.93	1123.8087	1.0837	0.00
195.15	65.85	1124.8223	1.0136	0.00
219.45	69.77	1125.6475	.8252	0.00
245.55	73.69	1126.4315	.7840	0.00
272.85	77.61	1127.1110	.6795	0.00
301.65	81.53	1127.7331	.6221	0.00
331.95	85.45	1128.3036	.5705	0.00
363.75	89.37	1128.8280	.5244	0.00

120' W.D. MAX SB

H=0 Δ=3 VPCC=138 WW=0 W(1)=.0789 TOL=.1

W(3)=.0789 W(5)=.0789 A1=140 A2=500 A3=500 M=1

1190
350
890

900

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.64	10.19	1028.3242	1028.3242	0.00
5.62	14.11	1068.3911	40.0669	0.00
12.22	18.03	1084.1131	15.7220	0.00
20.41	21.95	1093.1028	8.9897	0.00
30.19	25.87	1099.0308	5.9280	0.00
41.59	29.79	1103.2995	4.2687	0.00
54.58	33.71	1106.5046	3.2051	0.00
69.28	37.63	1109.0711	2.5665	0.00
85.48	41.55	1111.0778	2.0067	0.00
103.24	45.47	1112.7172	1.6394	0.00
122.74	49.39	1114.1282	1.4110	0.00
122.74	49.39	1114.1282	0.0000	0.00
143.74	53.31	1115.3020	1.1738	0.00
166.54	57.23	1116.3452	1.0432	0.00
190,54	61.15	1117.1940	.8488	0.00
216.64	65.07	1117.9990	.8050	0.00
243.94	68.99	1118.6695	.6705	0.00
273.04	72.91	1119.2863	.6168	0.00
303.64	76.83	1119.8308	.5445	0.00
336.04	80.75	1120.3351	.5043	0.00
369.94	84.67	1120.7833	.4482	0.00
405.34	88.59	1121.1894	.4061	0.00

130' W.D. NORMAL 9A

H=0 Δ=3 VPCC=122 WW=0. W(1)=.0789 TOL=.1

W(3)=.0789 W(5)=.0789 A1=130 A2=500 A3=500 M=1

1130
920
210

1092.5
210
882.5

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.15	11.75	1009.6715	1009.6715	0.00
4.80	15.67	1066.2997	56.6282	0.00
10.74	19.59	1086.6479	20.3482	0.00
18.03	23.51	1098.6454	11.9975	0.00
26.64	27.43	1106.6485	8.0031	0.00
36.57	31.35	1112.4193	5.7708	0.00
47.82	35.27	1116.7973	4.3780	0.00
60.42	39.19	1120.2671	3.4698	0.00
74.28	43.11	1123.0270	2.7599	0.00
89.58	47.03	1125.3727	2.3457	0.00
106.08	50.95	1127.2863	1.9136	0.00
106.08	50.95	1127.2863	0.0000	0.00
123.90	54.87	1128.9225	1.6362	0.00
143.10	58.79	1130.3528	1.4303	0.00
163.80	62.71	1131.6377	1.2849	0.00
185.46	66.63	1132.6954	1.0577	0.00
208.86	70.55	1133.7029	1.0075	0.00
233.16	74.47	1134.5428	.8399	0.00
258.96	78.39	1135.3198	.7770	0.00
286.26	82.31	1136.0405	.7207	0.00
314.76	86.23	1136.6810	.6405	0.00
344.46	90.15	1137.2563	.5753	0.00

130' W.D. MAX. 9B

H=0 D=3 VPCC=148 WW=0 W(1)=.0789 TOL=.1

W(3)=.0739 W(5)=.0794 A1=150 A2=500 A3=500 M=1

1150
250
900

920

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.63	10.97	1028.8328	1028.8328	0.00
5.53	14.89	1071.1490	42.3162	0.00
11.92	18.81	1088.1824	17.0334	0.00
19.78	22.73	1098.0721	9.8897	0.00
29.14	26.65	1104.7136	6.6415	0.00
39.97	30.57	1109.4726	4.7590	0.00
52.27	34.49	1113.0669	3.5943	0.00
66.07	38.41	1115.9045	2.8376	0.00
81.37	42.33	1118.2021	2.2976	0.00
98.17	46.25	1120.1005	1.8984	0.00
116.47	50.17	1121.6952	1.5947	0.00
116.47	50.17	1121.6952	0.0000	0.00
136.27	54.09	1123.0540	1.3588	0.00
157.33	58.01	1124.1796	1.1256	0.00
180.13	61.93	1125.2076	1.0280	0.00
204.43	65.85	1126.1107	.9031	0.00
229.93	69.77	1126.8766	.7659	0.00
257.23	73.69	1127.5928	.7162	0.00
285.73	77.61	1128.2106	.6178	0.00
316.03	81.53	1128.7940	.5834	0.00
347.53	85.45	1129.3035	.5095	0.00
380.53	89.37	1129.7684	.4649	0.00

140' W.D. NORMAL 10A

H=0 A=3 VPCC=132 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=140 A2=500 A3=500 M=1

1190
930
210

1100
210
890

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.15	12.54	1009.7950	1009.7950	0.00
4.74	16.46	1068.4027	58.6077	0.00
10.59	20.38	1090.3911	21.9884	0.00
17.64	24.30	1103.1243	12.7332	0.00
25.95	28.22	1111.7972	8.6729	0.00
35.49	32.14	1118.0785	6.2813	0.00
46.29	36.06	1122.9013	4.8228	0.00
58.32	39.98	1126.6967	3.7954	0.00
71.58	43.90	1129.7680	3.0713	0.00
86.07	47.82	1132.3084	2.5404	0.00
101.82	51.74	1134.4602	2.1518	0.00
101.82	51.74	1134.4602	0.0000	0.00
118.92	55.66	1136.3387	1.8785	0.00
137.04	59.58	1137.8874	1.5487	0.00
156.54	63.50	1139.2826	1.3952	0.00
177.24	67.42	1140.5018	1.2192	0.00
199.14	71.34	1141.5780	1.0762	0.00
222.54	75.26	1142.5809	1.0029	0.00
246.84	79.18	1143.4315	.8506	0.00
272.64	83.10	1144.2347	.8032	0.00
299.64	87.02	1144.9581	.7234	0.00
327.54	90.94	1145.5874	.6293	0.00

140' W.D. MAX. 108

H=0 Δ=3 VPCC=158 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=160 A2=500 A3=500 M=1

1160
250
910

930

J. RAY McDERMOTT & CO., INC. ENGINEERS AND GENERAL CONTRACTORS NEW ORLEANS, LA

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.63	11.75	1029.3943	1029.3943	0.00
5.46	15.67	1073.8582	44.4639	0.00
11.67	19.59	1092.1266	18.2684	0.00
19.26	23.51	1102.9308	10.8042	0.00
28.26	27.43	1110.2683	7.3375	0.00
38.58	31.35	1115.4775	5.2092	0.00
50.31	35.27	1119.4892	4.0117	0.00
63.39	39.19	1122.6287	3.1395	0.00
77.88	43.11	1125.1938	2.5651	0.00
93.78	47.03	1127.3270	2.1332	0.00
111.00	50.95	1129.0968	1.7698	0.00
111.00	50.95	1129.0968	0.0000	0.00
129.60	54.87	1130.6094	1.5126	0.00
149.70	58.79	1131.9441	1.3347	0.00
171.00	62.71	1133.0699	1.1258	0.00
193.80	66.63	1134.0828	1.0129	0.00
218.10	70.55	1134.9972	.9144	0.00
243.60	74.47	1135.7889	.7917	0.00
270.60	78.39	1136.5125	.7236	0.00
298.80	82.31	1137.1508	.6383	0.00
328.50	86.23	1137.7403	.5895	0.00
359.40	90.15	1138.2653	.5250	0.00

150' W.O. NORMAL 11A

H=0 A=3 VPCC=142 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=150 A2=500 A3=500 M=1

1150
990
210

1106.5
210
896.5

1150
1090
60

1106.5
60
1046.5

11B

J. RAY McDERMOTT & CO., INC. ENGINEERS AND GENERAL CONTRACTORS NEW ORLEANS, LA

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.15	13.32	1009.9110	1009.9110	0.00
4.71	17.24	1070.7116	60.8006	0.00
10.41	21.16	1093.6801	22.9685	0.00
17.31	25.08	1107.5274	13.8473	0.00
25.35	29.00	1116.8256	9.2982	0.00
34.56	32.92	1123.6354	6.8098	0.00
44.94	36.84	1128.8611	5.2257	0.00
56.49	40.76	1133.0079	4.1468	0.00
69.18	44.68	1136.3588	3.3509	0.00
83.07	48.60	1139.1686	2.8098	0.00
98.10	52.52	1141.5249	2.3563	0.00
98.10	52.52	1141.5249	0.0000	0.00
114.30	56.44	1143.5449	2.0200	0.00
131.70	60.36	1145.3067	1.7618	0.00
150.30	64.28	1146.8554	1.5487	0.00
170.10	68.20	1148.2269	1.3715	0.00
190.80	72.12	1149.3873	1.1604	0.00
213.00	76.04	1150.4912	1.1039	0.00
236.10	79.96	1151.4396	.9484	0.00
260.40	83.88	1152.3061	.8665	0.00
286.20	87.80	1153.1337	.8276	0.00
312.90	91.72	1153.8570	.7233	0.00

150' W.D. MAX. 11B

H=0 A=3 VPCC=163 WW=0 W(1)=.0784 TOL=.1

W(3)=.0784 W(5)=.0784 A1=170 A2=500 A3=500 M=1

2

1170
250
920

940

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.39	5.48	826.8751	826.8751	0.00
4.80	8.66	852.3784	25.5032	0.00
11.19	11.83	860.5846	8.2062	0.00
19.59	15.01	864.9732	4.3886	0.00
29.85	18.18	867.6237	2.6505	0.00
42.18	21.36	869.5225	1.8988	0.00
56.58	24.53	870.9378	1.4152	0.00

60' W.D. 10' OF CHAIN ADDED

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.39	5.48	836.8751	836.8751	0.00
4.86	8.70	862.4847	25.6095	0.00
11.37	11.91	870.7165	8.2318	0.00
19.89	15.13	875.0366	4.3201	0.00
30.42	18.34	877.7391	2.7024	0.00
43.02	21.55	879.6267	1.8876	0.00
57.72	24.77	881.0257	1.3989	0.00

60' W.D. 20' OF CHAIN ADDED

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.63	11.75	1039.3943	1039.3943	0.00
5.52	15.71	1084.1570	44.7627	0.00
11.82	19.67	1102.4538	18.3018	0.00
19.50	23.63	1113.1606	10.7018	0.00
28.62	27.59	1120.4533	7.2927	0.00
39.12	31.55	1125.6845	5.2312	0.00

150' W.O. 10' OF CHAIN ADDED

THREE ELEMENT CATENARY

H	VBUOY	CHP	DX	V1
.63	11.75	1049.3943	1049.3943	0.00
5.58	15.75	1094.4516	45.0573	0.00
11.94	19.75	1112.6229	18.1713	0.00
19.77	23.75	1123.4794	10.8565	0.00
29.01	27.75	1130.6936	7.2142	0.00
39.69	31.75	1135.9256	5.2320	0.00

150' W.D. 20' OF CHAIN ADDED

COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

INVESTIGATION TO DETERMINE EXTENT OF SHIP FOULING WITH ANCHOR LEGS.

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U.S. ARMY / EROL			4
SUBJECT: MOOR - MOORING SYSTEM			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		3/23/66

VERTICAL PROJECTION FOR 60' W.D. = 60 - 2.5 = 57.5'

COMPUTER INPUT FOR 57.5' VPCC

H = 0
DELTA = 3.
VPCC = 57.5'
WW = 0.0
W(1) = .0797
TOL = .1

W(3) = .0797
W(5) = .0797
A1 = 90.
A2 = 300.
A3 = 400.

FORMAT (6F5.2)

NOTE: USE CURVES ALREADY DRAWN FOR 60'
& ADJUST CHP TO CHAIN LENGTH = 795'

INVESTIGATE POSSIBILITY OF SHIP'S HULL FOULING ANCHOR CHAINS.

PLOT CATENARY FOR 60 & 70 VPCC

HORIZONTAL @ PRELOAD 60' VPCC = 10.5^K

HORIZONTAL @ PRELOAD 70' VPCC ≈ 17.5^K

COMPUTER INPUT 60' VPCC
H = 10.5^K . W = .0797 VPCC = 60.

COMPUTER INPUT 70' VPCC
H = 17.5^K W = .0797 VPCC = 70.

SOME CONTACT OF SHIP WITH ANCHOR CHAINS WILL OCCUR.

```
PDQ FORTRAN C2
START
-6600        1 K=0
-6612          Y=0.0
-6624          X=0.0
-6636          WY=0.0
-6648          READ 2, H,W,VPCC
-6696        2 FORMAT (3F10.4)
-6728          C=H/W
-6764       10 IF(K-10)21,31,31
-6832       21 WY=WY+VPCC/10.
-6880          Y=C+WY
-6916          U=Y/C
-6952          X=LOG(U+(SQRT(U**2-1.0)))*C
-7048          K=K+1
-7084       40 PRINT 3, X,WY
-7120        3 FORMAT (10X,3HX =F10.4,5X,4HWY =F8.2)
-7190          GO TO 10
-7198       31 PAUSE
-7210          GO TO 1
-7218          END
 AD SUBROUTINES
PDQ FIXED FMT SUBROUTNS 11/63
PROCESSING COMPLETE
```

PDQ FORTRAN C2
START
PROCESSING COMPLETE
START

LOAD SUBROUTINES
PDQ FIXED FMT SUBROUTNS 11/63

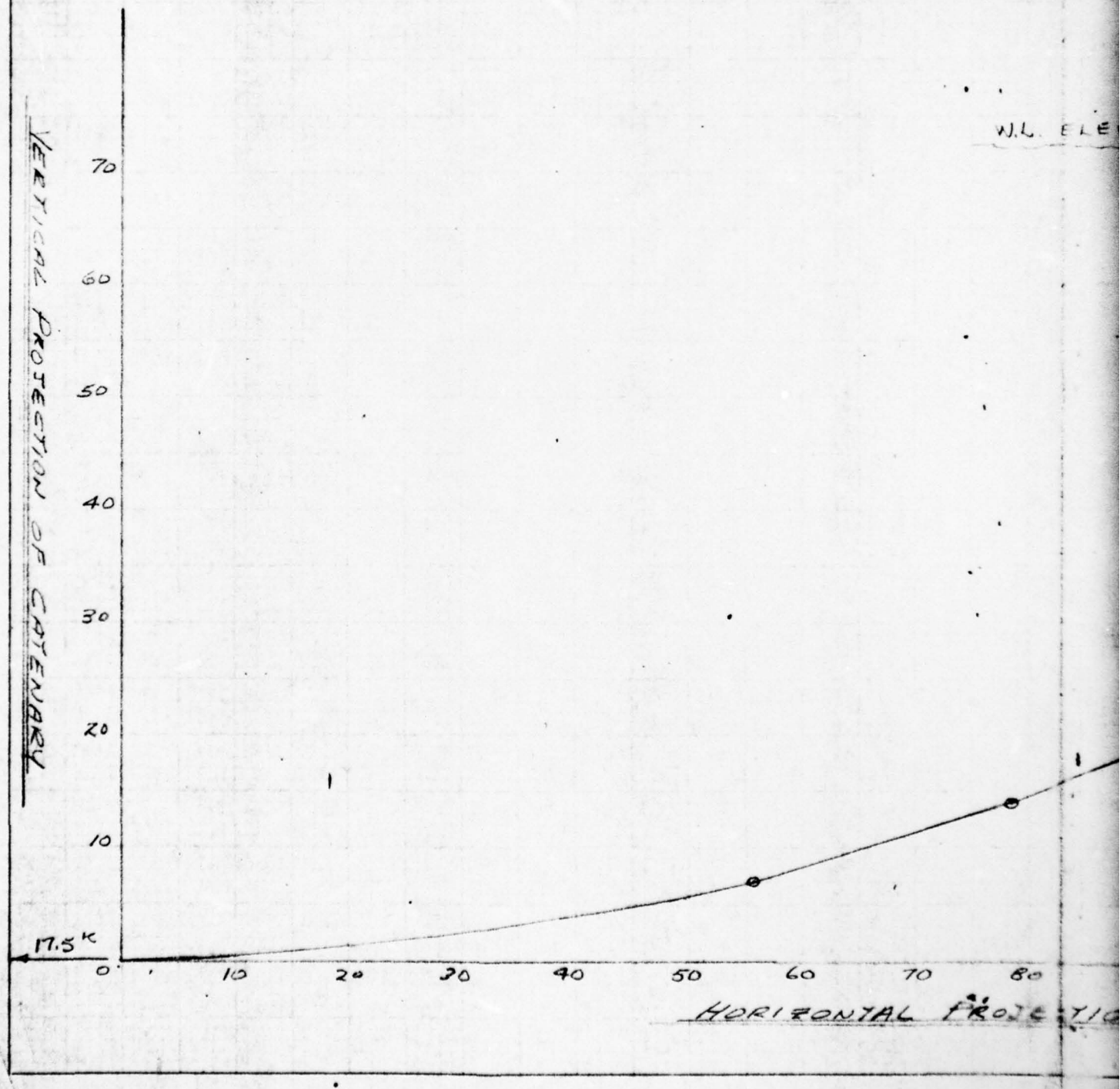
X =	55.7566	WY =	7.00
X =	78.6494	WY =	14.00
X =	96.0811	WY =	21.00
X =	110.6664	WY =	28.00
X =	123.4217	WY =	35.00
X =	134.8696	WY =	42.00
X =	145.3218	WY =	49.00
X =	154.9820	WY =	56.00
X =	163.9919	WY =	63.00
X =	172.4553	WY =	70.00

H=17.5 W=.0784 YPCC=70.

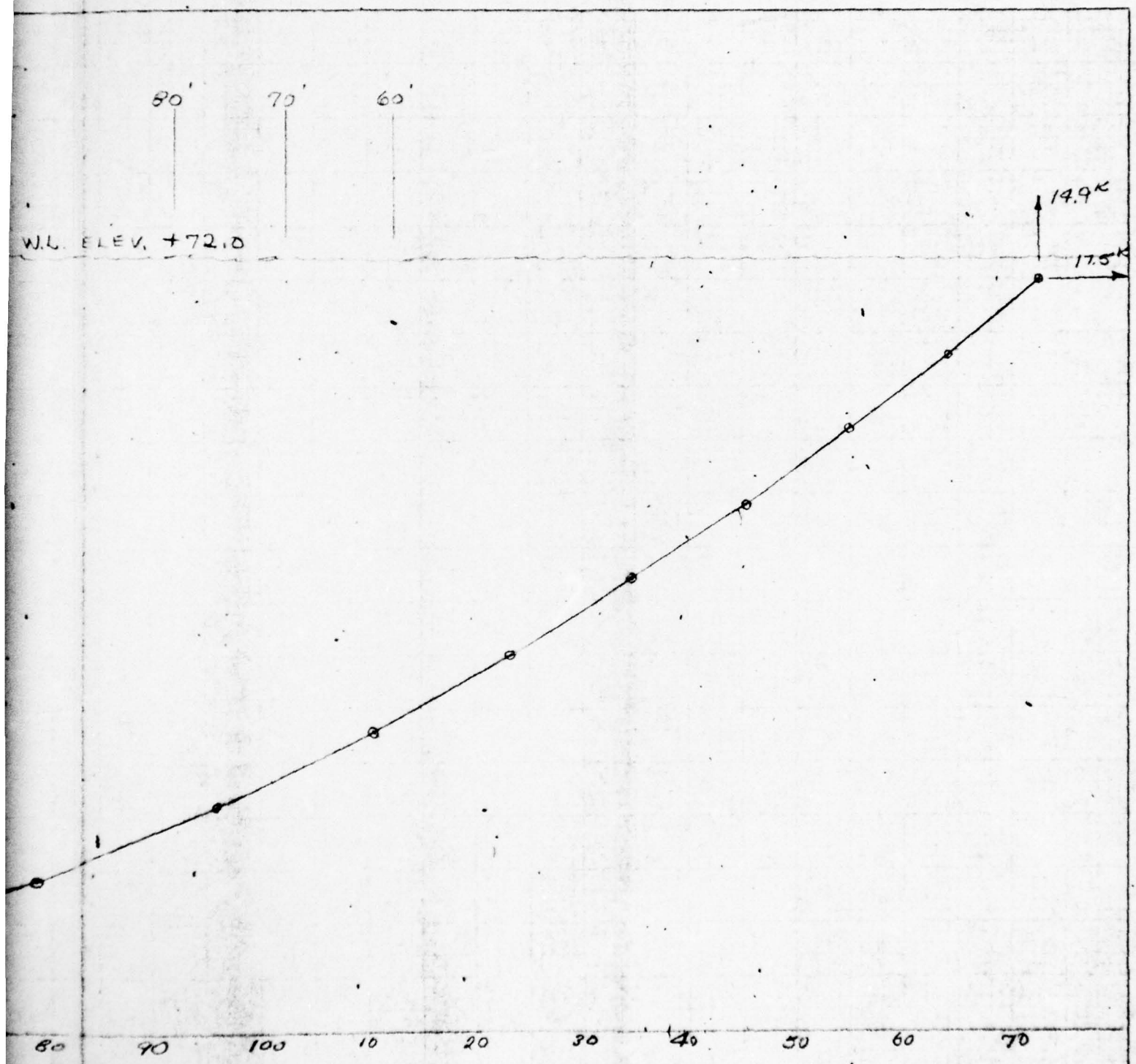
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO.
U.S. ARMY / EROL			5
SUBJECT: MONO - MOORING SYSTEM			
NUMBER	COMPUTER	CHECKED BY	DATE
JOB - 56017	ANDREWS		3/23/65



PLOT OF CATENARY FOR H=17.5^{K} W=.0789 VPCC=70.



PROJECTION OF CATENARY

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14903

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL — SHEET NO: 6

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER: JOB 56017 — COMPUTER: ANDREWS — CHECKED BY: — DATE: 3/24/65

INVESTIGATE 32' DIA. BUOY FOR MAX. W.D.

MSL = 150' TIDE 20' MAX. WAVE HT. 20'

WT. OF BUOY ≈ 100^T V_R FROM PRELOAD ≈ 230^K

10240 TRY 32' ϕ BUOY WITH 8½' ϕ WELL

.305
57
748

BUOYANCY/FT. = (.785(32)² − .785(8.5)²) 64
= 748(64)
= 47.8^K/'

DRAFT FREE FLOATING = 200/47.8 = 4.2'
DRAFT UNDER PRELOAD = 230/47.8 = 4.8'
DRAFT DUE TO MOORING LOAD ≈ 2.0'

TOTAL DRAFT ≈ 11.0'

173.3
5.0
168.3

TRY BUOY HT. = 13' PLUS 2' TO TOP OF DECK

DISTANCE FROM BOTTOM OF BUOY TO CHAIN ATTACH. = 6.0'

VERTICAL PROJECTION OF CATENARY ≈ 150 + 10 + 13.3 − 5 = 168.3'

USE 168'

NOTE: CATENARY WILL BE SAME FOR 32' ϕ BUOY AS FOR 30' ϕ BUOY SEE (PG. 2 3/12/64)

TOTAL DRAFT UNDER MOORING LOAD = $\frac{491.5}{47.8}$ = 10.3'

BUOY COULD BE MADE 32' ϕ IF NECESSARY.
THIS WILL BE INVESTIGATED FURTHER AFTER
EQUIPMENT LAYOUT & PRELIMINARY DESIGN OF
BUOY HULL, ROTATING DECK & MACHINERY.

COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO
PROJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

PRELIMINARY COMPUTER RESULTS AND CURVES FOR VARIOUS WATER DEPTHS AND VARIOUS COMBINATIONS OF CHAIN, SINKERS AND WIRE ROPE. FROM THIS DATA, THE DECISION TO GO WITH 3" ϕ CHAIN WITH NO WIRE ROPE OR SINKERS WAS MADE.

ENGINEERING DEPARTMENT
COMPUTATION SHEET

MCD 5036

J. RAY McDERMOTT & Co., INC.

COMPANY

SHEET NO. 1

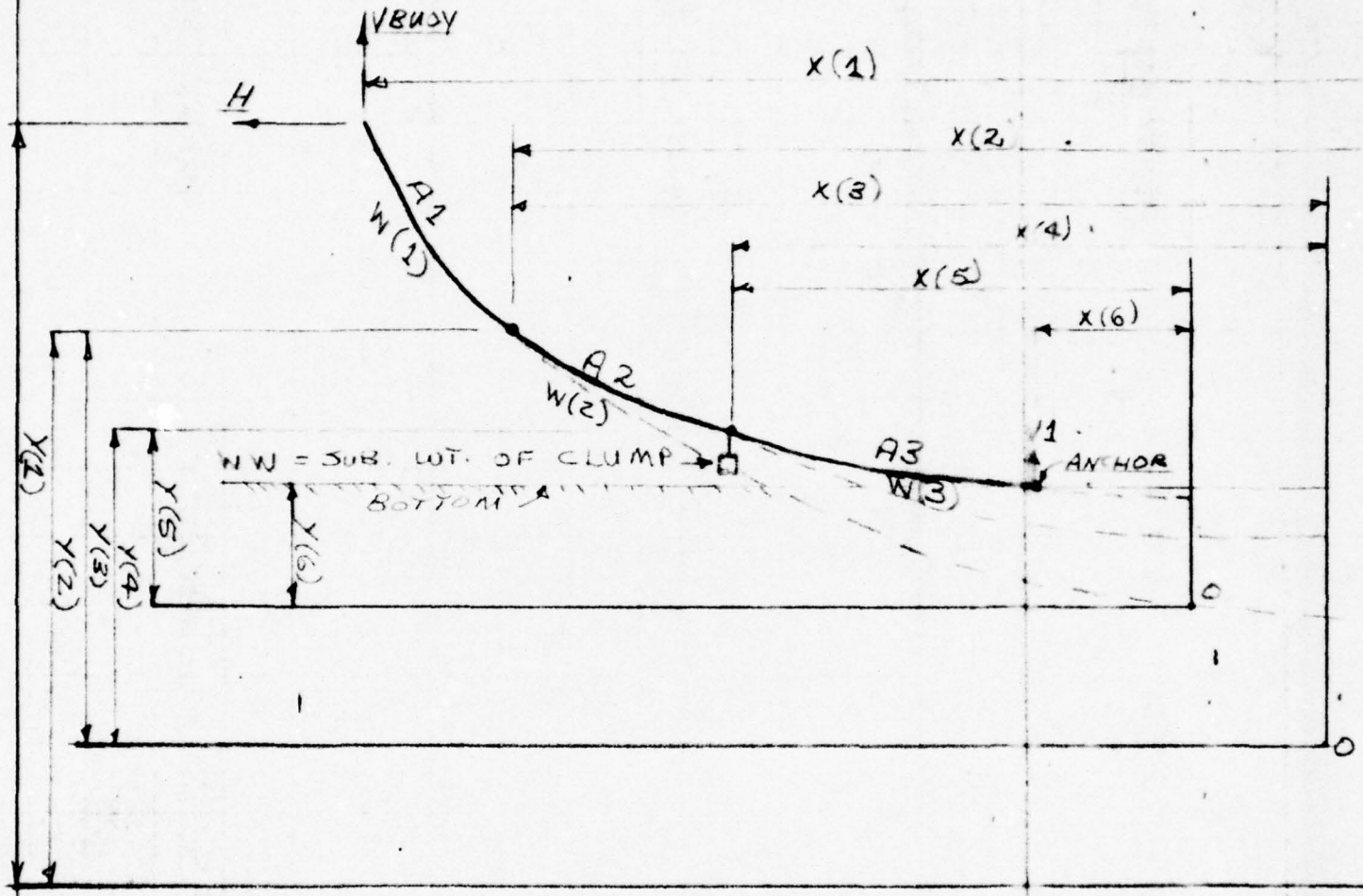
SUBJECT

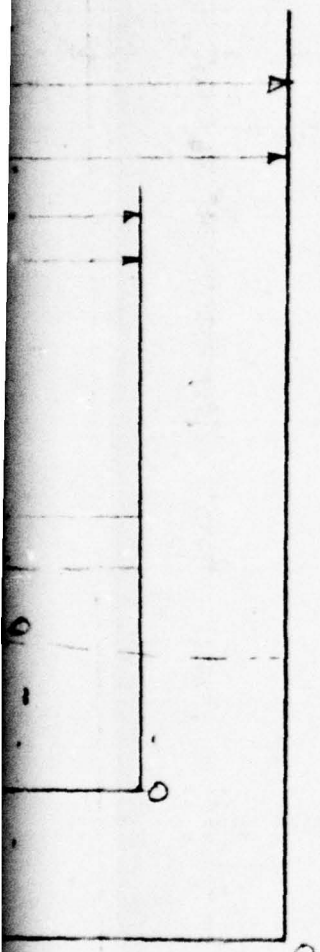
USA EROL

COMPOUND CATENARY

DRAWING NUMBER | COMPUTER | CHECKED BY | DATE

JOB 56017 | ANDREWS | 12/20/67





VPCC = WATER DEPTH (VERTICAL PROJECTION FROM H TO BOTTOM)

DELTA = INCREMENT TO VARY H

TOL = TOLERANCE FOR VPCC.

OUTPUT

T(1) = TENSION @ BUOY (TOP OF A1)
T(2) = TENSION @ BOTTOM OF A1
T(3) = TENSION @ TOP OF A2
T(4) = TENSION @ BOTTOM OF A2
T(5) = TENSION @ TOP OF A3
T(6) = TENSION @ BOTTOM OF A3 (AT ANCHOR)

X(1), X(2), X(3), X(4), X(5) & X(6) = HORIZONTAL PROJECTIONS AT CORRESPONDING "T" POINTS.

Y(1), Y(2), Y(3), Y(4), Y(5) & Y(6) = VERTICAL PROJECTION FROM ORIGIN TO CORRESPONDING "T" POINTS.

NOTE: IF SENSE 1 IS ON NONE OF ABOVE WILL BE PRINTED OUT.

H = HORIZONTAL COMPONENT THROUGHOUT CATENARY
VBUOY = VERTICAL COMPONENT OF CATENARY @ BUOY.
CHP = HORIZONTAL PROJECTION OF CATENARY FROM ANCHOR TO BUOY
DX = CHANGE IN HORIZONTAL PROJECTION (CHP).
V1 = VERTICAL COMPONENT OF CATENARY @ ANCHOR.

```
      DIME SIO  C(6),S(6),T(6),U(6),W(6),X(6),Y(6)
    1 K=0
      CHPL=0.0
      A1L=0.0
      A2L=0.0
      B2L=0.0
      V1 =0.0
      N=1
      DO 2 I=1,6
      X(I)= 0.0
      Y(I)= 0.0
    2 S(I)= 0.0
      READ 3, H,DELTA,VPCC,WW,W(1),TOL
      READ 3, W(3),W(5),A1,A2,A3
    3 FORMAT (F8.2,F8.2,F8.2,F8.2,F8.2,F8.2)
      CON = DELTA
      W(2)= W(1)
      W(4)= W(3)
      W(6)= W(5)
    9 S(6)= V1/ W(6)
      S(5)= S(6)+ A1L
      S(4)= S(5)+ B2L
      S(3)= S(4)+ A2L
      S(2)= (S(3)*W(3))/ W(2)
      S(1)= S(2) + A1
   10 DO 4 I=1,6
      C(I)= H/ W(I)
    4 Y(I)= SQRT(S(I)**2 + C(I)**2)
      CVP = (Y(1)+Y(3)+Y(5)) - (Y(2)+Y(4)+Y(6))
        TEST= CVP-VPCC
      IF(CVP-VPCC)11,12,13
   11 IF(TEST+TOL)111,12,12
  111 H= H- CON
      CON = CON / 10.0
      GO TO 10
   13 IF (TEST-TOL)12,12,113
  113 H= H+ CON
      GO TO 10
   12 CON= DELTA
      DO 5 I=1,6
      U(I)= Y(I)/ C(I)
      IF(U(I)-1.0)17,18,18
   17 U(I)= 1.0
   18 X(I)= LOG(U(I)+(SQRT(U(I)**2-1.0))) * C(I)
    5 T(I)= Y(I) * W(I)
      VBUOY=SQRT(T(1)**2-H**2)
      SUM= A2+A3-A1L-A2L
      CHP = (X(1)+X(3)+X(5)) - (X(2)+X(4)+X(6)) + SUM
      DX=CHP-CHPL
      IF(SENSE SWITCH 1)50,51
   51 PRINT 15
   15 FORMAT(10X,1HT,17X,1HX,17X,1HY)
```

```
      DO  6  I=1,6
    6 PRINT  7  , T(I),X(I),Y(I)
    7 FORMAT(E10.8,E10.8,E10.8)
   50 PRINT 8,H,VBUOY,CHP,DX,V1




    8 FORMAT (3X,3HH =F8.2,3X,7HVBUOY =F7.2,3X,5HCHP =F10.4,3X,
     14HDX =F8.4,3X,4HV1 =F6.2)
      CHPL=CHP
      PRINT 16
   16 FORMAT(1H /)
      GO TO (60,70,80,90),N
   60 IF(K-10)61,69,69
   61 A2L= A2L +(A2/ 10.0)
      K=K+1
      GO TO 9
   69 K=0
   70 IF(K-10)71,79,79
   71 B2L= B2L +(WW/ (W(4)*10.0))
      K=K+1
      N=2
      GO TO 9
   79 K=0
   80 IF(K-10)81,89,89
   81 A1L=A1L+(A3/10.0)
      K=K+1
      N=3
      GO TO 9
   89 K=0
   90 IF(K-10)91,99,99
   91 V1= V1 + (H/ 100.0)
      K=K+1
      N=4
      GO TO 9
   99 PAUSE
      GO TO 1
      END
```

H=0. DELTA=310 VPCC=100 WW=10^K W(1)=.0676 TOL=.1
W(2)=.0784 W(3)=.0784 A1=110 A2=300 A3=400

4

OAD DATA

T	X	Y
.74693451E 01	.31821752E 02	.11049327E 03
.70499999E 00	.00000000E-50	.10428994E 02
.70500000E 00	.00000000E-50	.89923469E 01
.70500000E 00	.00000000E-50	.89923469E 01
.70500000E 00	.00000000E-50	.89923469E 01
.70500000E 00	.00000000E-50	.89923469E 01

H = .70 VBOUY = 7.43 CHP = 731.8217 DX = .73182175E 03 V1 = .00

T	X	Y
.10413595E 02	.91368048E 02	.15404727E 03
.42626199E 01	.32653794E 02	.63056508E 02
.42626200E 01	.28155568E 02	.54370153E 02
.35550000E 01	.00000000E-50	.45344388E 02
.35550000E 01	.00000000E-50	.45344388E 02
.35550000E 01	.00000000E-50	.45344388E 02

H = 3.55 VBOUY = 9.78 CHP = 756.8698 DX = 25.0480 V1 = .00

T	X	Y
.14076406E 02	.13731178E 03	.20823086E 03
.85377529E 01	.65322879E 02	.12629812E 03
.85377537E 01	.56324324E 02	.10889992E 03
.71250000E 01	.00000000E-50	.90880102E 02
.71250000E 01	.00000000E-50	.90880102E 02
.71250000E 01	.00000000E-50	.90880102E 02

H = 7.12 VBOUY = 12.13 CHP = 768.3132 DX = 11.4433 V1 = .00

H = 11.41 VBOUY = 14.49 CHP = 775.3588 DX = 7.0456 V1 = .00

H = 16.39 VBOUY = 16.84 CHP = 780.1734 DX = 4.8145 V1 = .00

H = 22.12 VBOUY = 19.19 CHP = 783.8351 DX = 3.6617 V1 = .00

H = 28.54 VBOUY = 21.54 CHP = 786.6379 DX = 2.8027 V1 = .00

H = 35.74 VBOUY = 23.90 CHP = 788.9558 DX = 2.3179 V1 = .00

H = 43.54 VBOUY = 26.25 CHP = 790.7566 DX = 1.8007 V1 = .00

H = 52.09 VBOUY = 28.60 CHP = 792.2991 DX = 1.5425 V1 = .00

H = 61.39 VBOUY = 30.95 CHP = 793.6309 DX = 1.3317 V1 = .00

H = 65.44 VBOUY = 31.95 CHP = 794.0876 DX = .4567 V1 = .00

(4-2)

H =	69.64	VBOUY =	32.95	CHP =	794.5303	DX =	.4427	V1 =	.00
H =	73.57	VBOUY =	33.95	CHP =	794.8063	DX =	.2760	V1 =	.00
H =	77.77	VBOUY =	34.95	CHP =	795.1384	DX =	.3320	V1 =	.00
H =	81.67	VBOUY =	35.95	CHP =	795.3267	DX =	.1882	V1 =	.00
H =	85.87	VBOUY =	36.95	CHP =	795.5847	DX =	.2580	V1 =	.00
H =	89.77	VBOUY =	37.95	CHP =	795.7207	DX =	.1359	V1 =	.00
H =	93.76	VBOUY =	38.95	CHP =	795.8683	DX =	.1476	V1 =	.00
H =	97.96	VBOUY =	39.95	CHP =	796.0519	DX =	.1835	V1 =	.00
H =	101.86	VBOUY =	40.95	CHP =	796.1422	DX =	.0902	V1 =	.00
H =	115.06	VBOUY =	44.09	CHP =	796.5682	DX =	.4260	V1 =	.00
H =	129.76	VBOUY =	47.22	CHP =	797.1567	DX =	.5885	V1 =	.00
H =	145.66	VBOUY =	50.36	CHP =	797.7630	DX =	.6063	V1 =	.00
H =	162.76	VBOUY =	53.50	CHP =	798.3628	DX =	.5998	V1 =	.00
H =	181.36	VBOUY =	56.63	CHP =	798.9724	DX =	.6096	V1 =	.00
H =	200.86	VBOUY =	59.77	CHP =	799.5148	DX =	.5424	V1 =	.00
H =	221.86	VBOUY =	62.90	CHP =	800.0460	DX =	.5312	V1 =	.00
H =	244.36	VBOUY =	66.04	CHP =	800.5602	DX =	.5142	V1 =	.00
H =	267.76	VBOUY =	69.18	CHP =	801.0076	DX =	.4474	V1 =	.00
H =	292.66	VBOUY =	72.31	CHP =	801.4426	DX =	.4350	V1 =	.00

H =	316.66	VBOUY =	75.24	CHP =	801.7947	DX =	.3521	V1 =	2.92
H =	341.86	VBOUY =	78.40	CHP =	802.0745	DX =	.2798	V1 =	6.09
H =	369.46	VBOUY =	81.82	CHP =	802.3244	DX =	.2499	V1 =	9.51
H =	399.46	VBOUY =	85.52	CHP =	802.5380	DX =	.2136	V1 =	13.20

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & Co., INC.

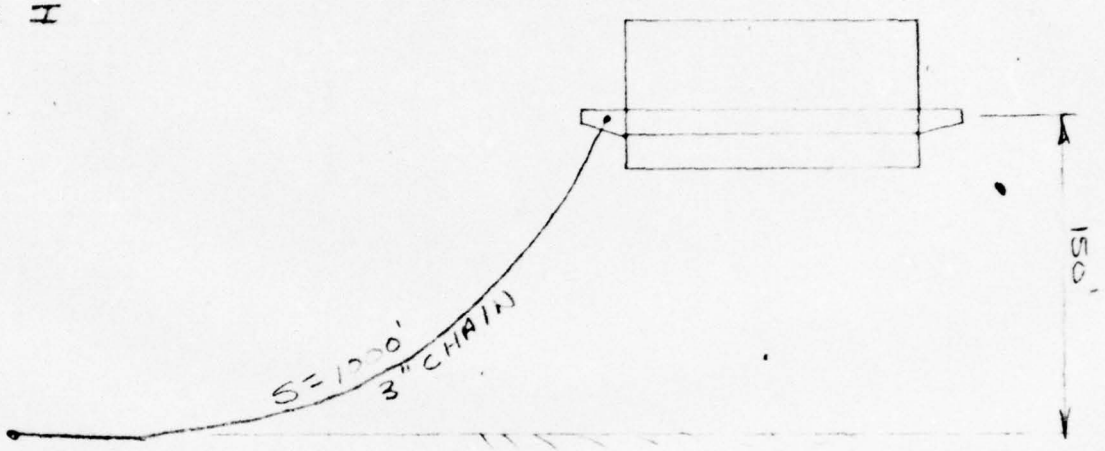
MCD 5036

COMPANY: US ARMY ERDL

SUBJECT: MONO - MOORING SYSTEM

DRAWING NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: | SHEET NO.

CASE I



ANCHOR LOAD = 210^K
BUOY DISPLACEMENT = 34'
PRE-LOAD TEN. = 31.5^K
SCOPE OF CHAIN ≈ 1000'
MAX T @ BUOY = 222^K

H, HORIZONTAL @ BUOY (KIPS)

200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

DISPLACEMENT → 1280 1290 1300 1310

"K" DISTANCE -30 -20 -10 0

1000
900
800
700
600
500
400
300
200
100
S = LENGTH OF CHAIN (FEET)
300
200
100
EL HORIZONTAL MOORING LOAD (KIPS)
1320
1330
1340
1350
10
20
30
V
H_1
F_H

LOAD DATA

H = .81	VBUOY = 12.54	CHP = 1235.4804	DX = .12354804E 04	V1 =	.
H = 6.78	VBUOY = 17.24	CHP = 1283.8529	DX = 48.3725	V1 = .00	
H = 14.61	VBUOY = 21.95	CHP = 1302.9082	DX = 19.0553	V1 = .00	
H = 24.33	VBUOY = 26.65	CHP = 1314.0036	DX = 11.0954	V1 = .00	
H = 35.91	VBUOY = 31.36	CHP = 1321.3373	DX = 7.3337	V1 = .00	
H = 49.41	VBUOY = 36.06	CHP = 1326.6551	DX = 5.3178	V1 = .00	
H = 64.74	VBUOY = 40.76	CHP = 1330.6210	DX = 3.9659	V1 = .00	
H = 81.99	VBUOY = 45.47	CHP = 1333.7573	DX = 3.1363	V1 = .00	
H = 101.19	VBUOY = 50.17	CHP = 1336.3105	DX = 2.5532	V1 = .00	
H = 122.19	VBUOY = 54.87	CHP = 1338.3758	DX = 2.0653	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = 1.7113	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	
H = 144.99	VBUOY = 59.58	CHP = 1340.0871	DX = .0000	V1 = .00	

(2) 150' W.D.

H = 144.99 VBUOY = 59.58 CHP = 1340.0871 DX = .0000 V1 = .00

H = 144.99 VBUOY = 59.58 CHP = 1340.0871 DX = .0000 V1 = .00

H = 169.89 VBUOY = 64.28 CHP = 1341.5926 DX = 1.5055 V1 = .00

H = 196.59 VBUOY = 68.99 CHP = 1342.8691 DX = 1.2765 V1 = .00

H = 225.09 VBUOY = 73.69 CHP = 1343.9674 DX = 1.0983 V1 = .00

730'

H = 255.39 VBUOY = 78.39 CHP = 1344.9242 DX = .9568 V1 = .00

H = 287.79 VBUOY = 83.10 CHP = 1345.7949 DX = .8707 V1 = .00

H = 321.99 VBUOY = 87.80 CHP = 1346.5629 DX = .7680 V1 = .00

T	X	Y
.36975033E 03	.11672459E 04	.47162032E 04
.36681293E 03	.10117016E 04	.46787363E 04
.36681293E 03	.10117016E 04	.46787363E 04
.35950117E 03	.41940588E 03	.45854741E 04
.35950117E 03	.41940588E 03	.45854741E 04
.35799000E 03	.00000000E-50	.45661990E 04

H = 357.99 VBUOY = 92.51 CHP = 1347.2459 DX = .6830 V1 = .00

H = 395.79 VBUOY = 97.21 CHP = 1347.8578 DX = .6119 V1 = .00

H = 435.69 VBUOY = 101.91 CHP = 1348.4237 DX = .5659 V1 = .00

H = 477.69 VBUOY = 106.62 CHP = 1348.9528 DX = .5291 V1 = .00

H = 520.59 VBUOY = 111.40 CHP = 1349.4441 DX = .4913 V1 = 4.77

BUOY HEEL ΔS FOR 150' W.D. 3" CHAIN

30' DIA. BUOY

LOAD DATA

B = 460.0000	DEG = 7.347197	F_V = 0
B = 410.0000	DEG = 4.085060	= 50
B = 360.0000	DEG = 1.092838	= 100
B = 310.0000	DEG = -1.647242	= 150

R_1 = 15

R2 = 17

R_3 = 12

W = 200

C = 10

D = 14

E = 20

BK = 9

F_H = 300

H_1 = 210

H_2 = 56.5

H_3 = 6.0

H_4 = 8.5

F_V = (SEE ABOVE)

V_1 = 71.0

V_2 = 45.0

V_3 = 17.0

V_4 = 18.0

V_5 = 23

WL = .064

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5038

J. RAY MCDERMOTT & CO., INC.

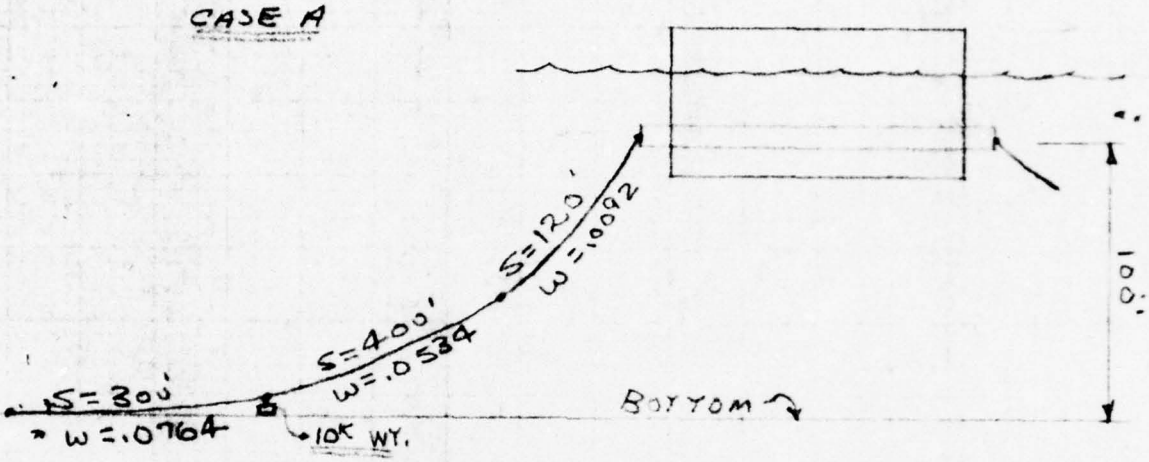
COMPANY: USA EROL | SHEET NO: 1

SUBJECT: MONO-MOORING

DRAWING NUMBER | COMPUTER: ANDREWS | CHECKED BY | DATE

JOB 56017

CASE A

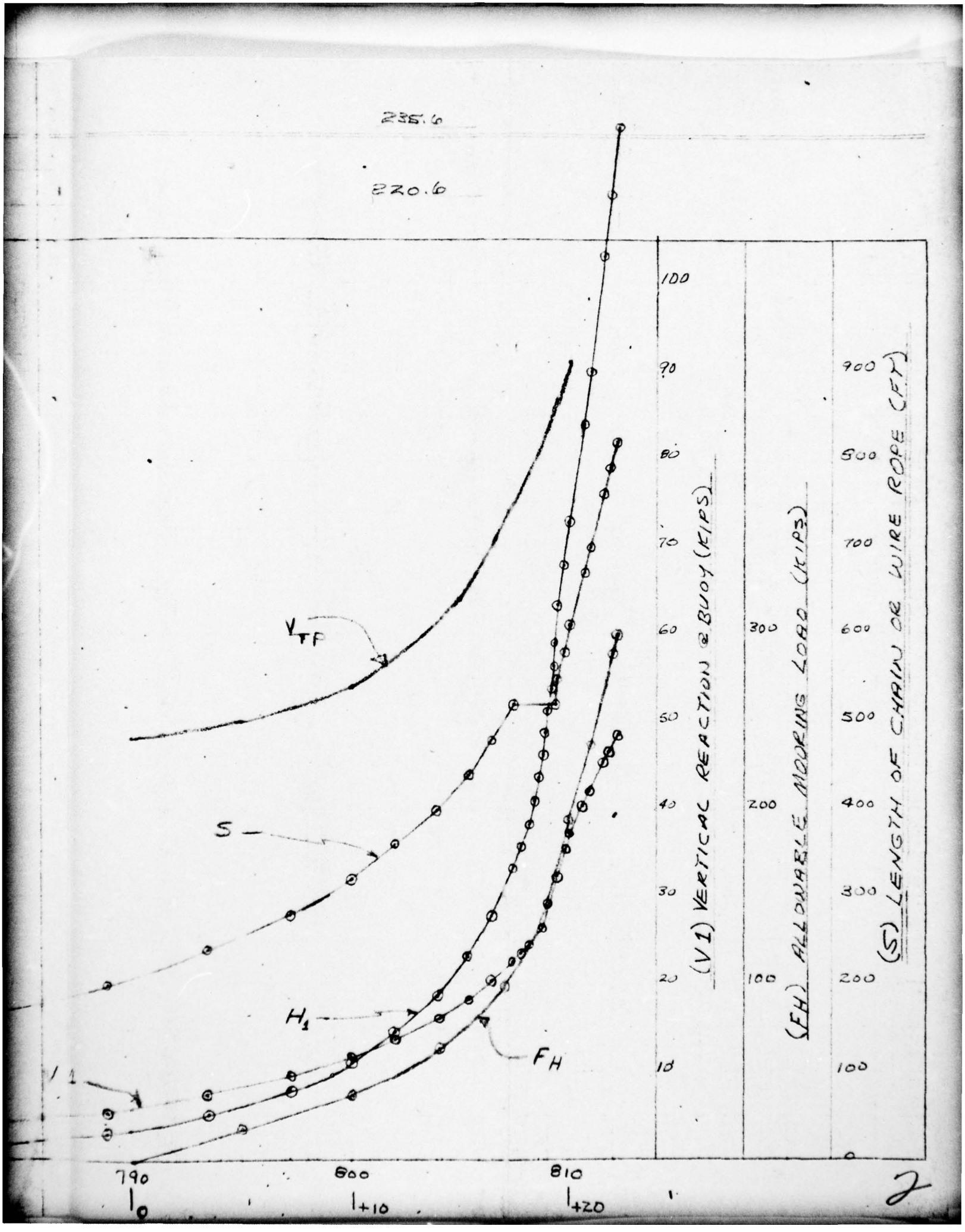


(H) HORIZONTAL & BUOY AXIS

10 200 90 80 70 60 50 40 30 20 10 100 90 80 70 60 50 40 30 20 10

(DIST. 750 760 770 780

BUOY DISPLACEMENT -20 -10


235.6
220.6
100
90
80
70
60
50
40
30
20
10
300
200
100
900
500
700
600
500
400
300
200
100
0
(V1) VERTICAL REACTION @ BUOY (KIPS)
(FH) ALLOWABLE MOORING LOAD (KIPS)
(S) LENGTH OF CHAIN OR WIRE ROPE (FT)
V_{TF}
S
H_1
F_H
790
600
810
l_0
l_{+10}
l_{+20}
2

H=0.10 DELTA=3.0 WW=10^{14} W(1)=.0092 TOL=0.1
W(2)=.0539; W(3)=.0764 A1=120 A2=400 A3=300

CASE A

LOAD DATA

H =	.20	VBOUY =	1.10	CHP =	752.5842	DX =	.75258429E 03	V1 =
H =	2.60	VBOUY =	3.23	CHP =	780.1042	DX =	27.5199	V1 = .00
H =	6.05	VBOUY =	5.37	CHP =	788.3591	DX =	8.2549	V1 = .00
H =	10.49	VBOUY =	7.51	CHP =	793.5624	DX =	5.2032	V1 = .00
H =	15.86	VBOUY =	9.64	CHP =	797.2198	DX =	3.6573	V1 = .00
H =	22.16	VBOUY =	11.78	CHP =	800.0045	DX =	2.7847	V1 = .00
H =	29.27	VBOUY =	13.92	CHP =	802.0794	DX =	2.0749	V1 = .00
H =	37.37	VBOUY =	16.05	CHP =	803.8602	DX =	1.7808	V1 = .00
H =	46.22	VBOUY =	18.19	CHP =	805.2371	DX =	1.3769	V1 = .00
H =	55.97	VBOUY =	20.32	CHP =	806.4182	DX =	1.1811	V1 = .00
H =	66.59	VBOUY =	22.46	CHP =	807.4266	DX =	1.0084	V1 = .00
H =	71.78	VBOUY =	23.46	CHP =	807.8319	DX =	.4053	V1 = .00
H =	76.94	VBOUY =	24.46	CHP =	808.1458	DX =	.3139	V1 = .00
H =	82.07	VBOUY =	25.46	CHP =	808.3949	DX =	.2491	V1 = .00
H =	87.23	VBOUY =	26.46	CHP =	808.6139	DX =	.2190	V1 = .00
H =	92.36	VBOUY =	27.46	CHP =	808.7910	DX =	.1771	V1 = .00
H =	97.52	VBOUY =	28.46	CHP =	808.9459	DX =	.1549	V1 = .00
H =	102.65	VBOUY =	29.46	CHP =	809.0737	DX =	.1278	V1 = .00
H =	107.78	VBOUY =	30.46	CHP =	809.1918	DX =	.1181	V1 = .00
H =	112.91	VBOUY =	31.46	CHP =	809.2884	DX =	.0966	V1 = .00

H = 118.04 VBOUY = 32.46 CHP = 809.3693 DX = .0809 V1 = .00

H = 126.74 VBOUY = 34.06 CHP = 809.5430 DX = .1737 V1 = .00

H = 136.04 VBOUY = 35.66 CHP = 809.7934 DX = .2504 V1 = .00

H = 145.94 VBOUY = 37.27 CHP = 810.0713 DX = .2779 V1 = .00

H = 156.74 VBOUY = 38.87 CHP = 810.3833 DX = .3120 V1 = .00

H = 168.14 VBOUY = 40.47 CHP = 810.7054 DX = .3221 V1 = .00

H = 180.14 VBOUY = 42.07 CHP = 811.0185 DX = .3131 V1 = .00

H = 193.04 VBOUY = 43.67 CHP = 811.3432 DX = .3247 V1 = .00

H = 206.54 VBOUY = 45.28 CHP = 811.6491 DX = .3059 V1 = .00

H = 220.64 VBOUY = 46.88 CHP = 811.9471 DX = .2980 V1 = .00

H = 235.64 VBOUY = 48.48 CHP = 812.2368 DX = .2897 V1 = .00

H = 251.24 VBOUY = 50.13 CHP = 812.4800 DX = .2432 V1 = 2.35

H = 267.74 VBOUY = 51.88 CHP = 812.7048 DX = .2248 V1 = 4.86

H = 285.74 VBOUY = 53.75 CHP = 812.9153 DX = .2105 V1 = 7.54

H = 304.34 VBOUY = 55.75 CHP = 813.0431 DX = .1278 V1 = 10.40

H = 324.44 VBOUY = 57.88 CHP = 813.2035 DX = .1604 V1 = 13.44

H = 346.04 VBOUY = 60.15 CHP = 813.3137 DX = .1102 V1 = 16.69

H = 368.84 VBOUY = 62.56 CHP = 813.4090 DX = .0953 V1 = 20.15

H = 393.14 VBOUY = 65.14 CHP = 813.4953 DX = .0863 V1 = 23.84

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

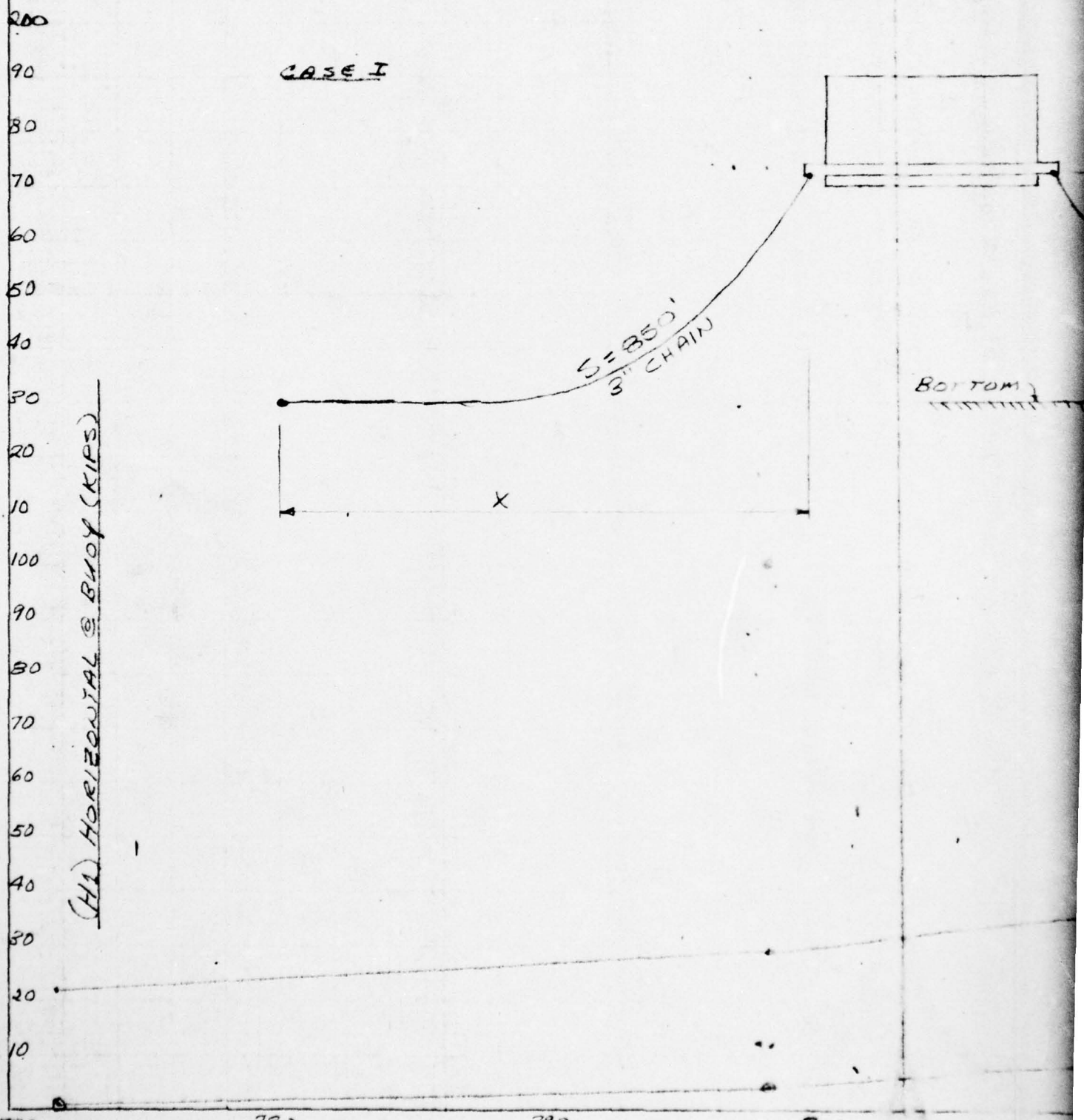
J. RAY McDERMOTT & CO., INC.

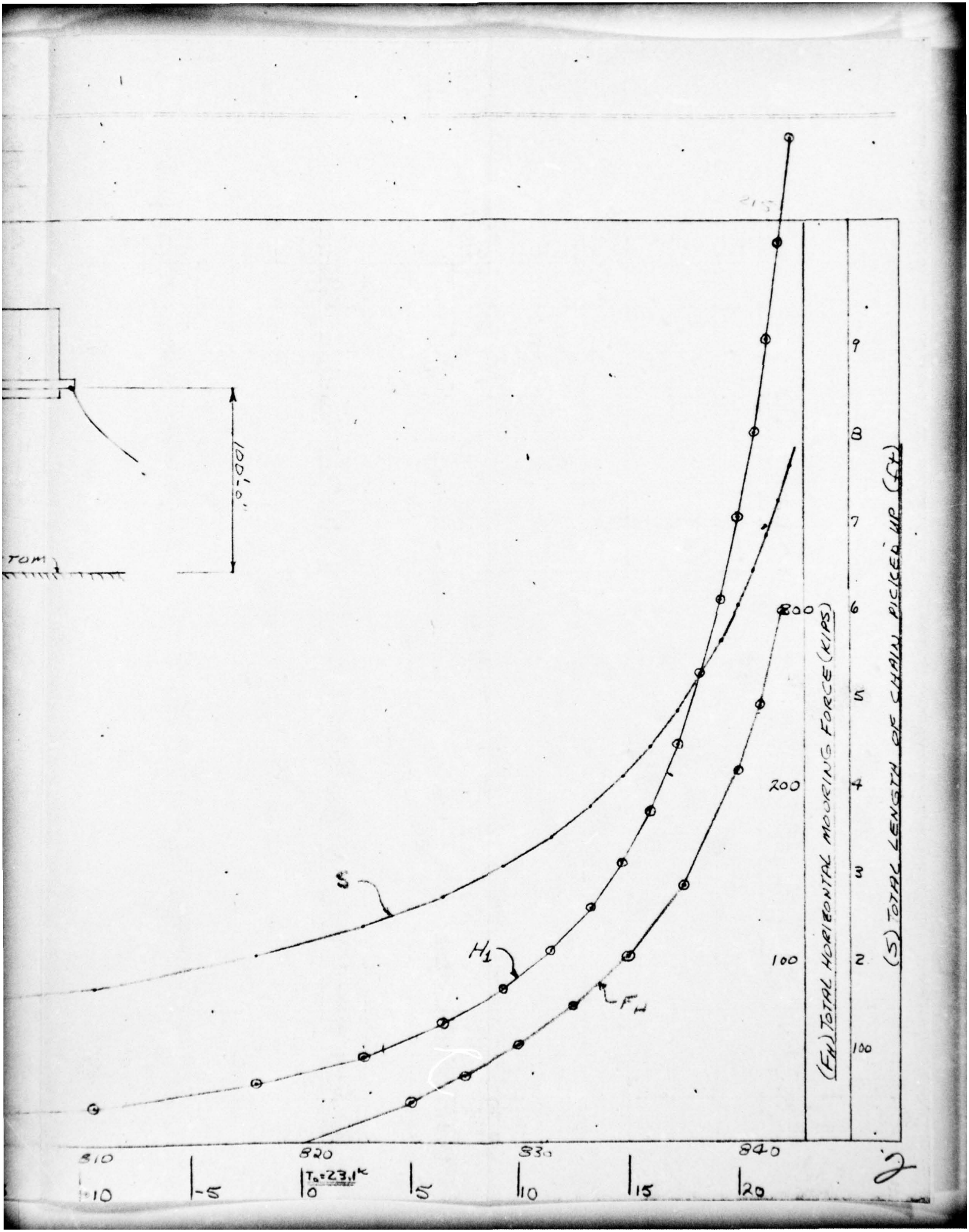
COMPANY: USA ERDL — SHEET: 2

SUBJECT: MOOR - MOORING SYSTEM

DRAWING NUMBER: JOB 55217 — COMPUTER: ANDREWS — CHECKED BY: — DATE: 12/22/64

CASE I




100'-0"
TOM
S
H_1
F_H
(S) TOTAL LENGTH OF CHAIN PICKED UP (FT)
(FH) TOTAL HORIZONTAL MOORING FORCE (KIPS)
215
9
8
7
6
5
4
3
2
100
200
800
810
820
830
840
-10
-5
0
5
10
15
20
T_0=23.1K

ENGINEERING DEPARTMENT
COMPUTATION SHEET

MCD 5036

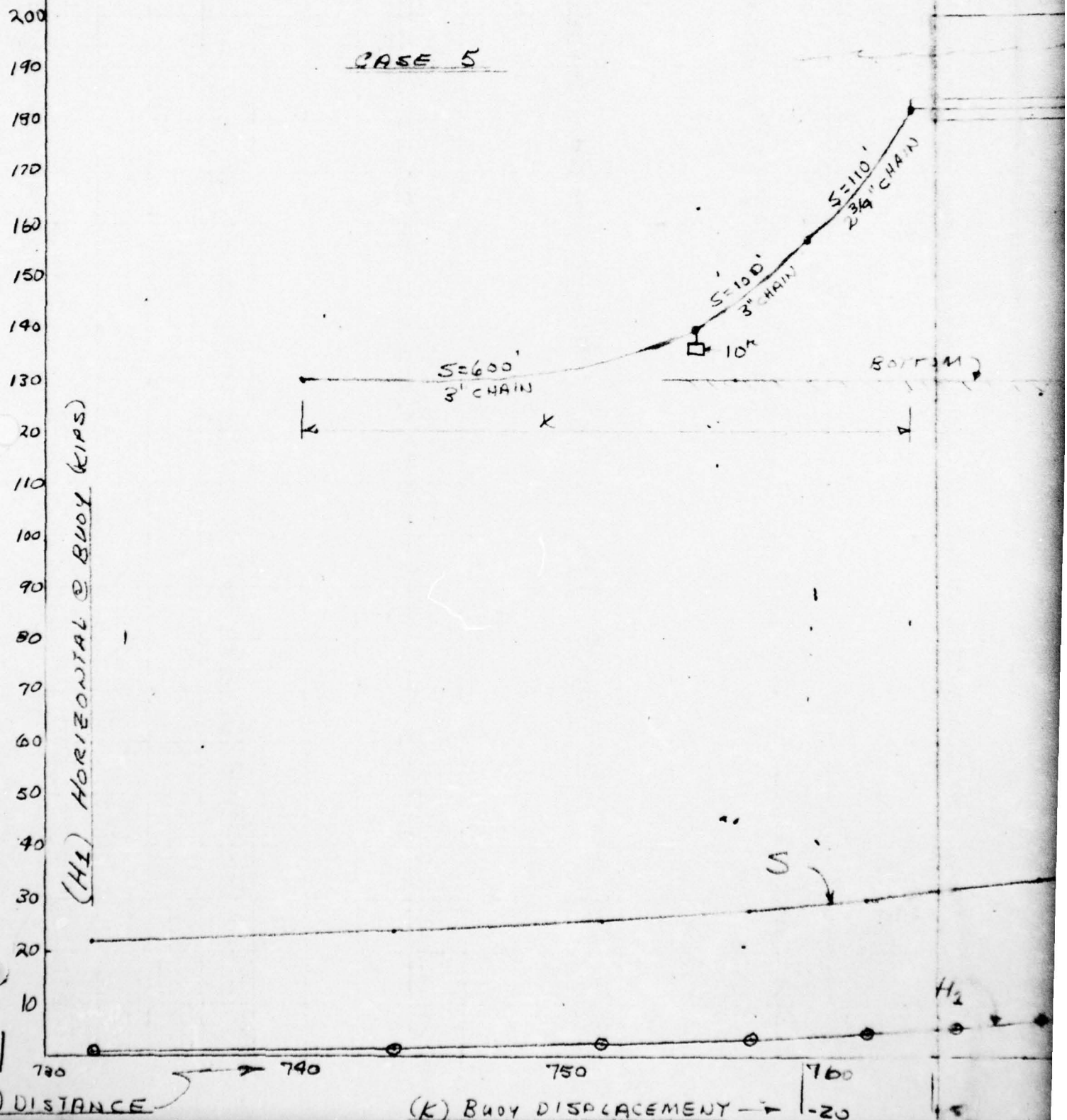
J. RAY MCDERMOTT & CO., INC.

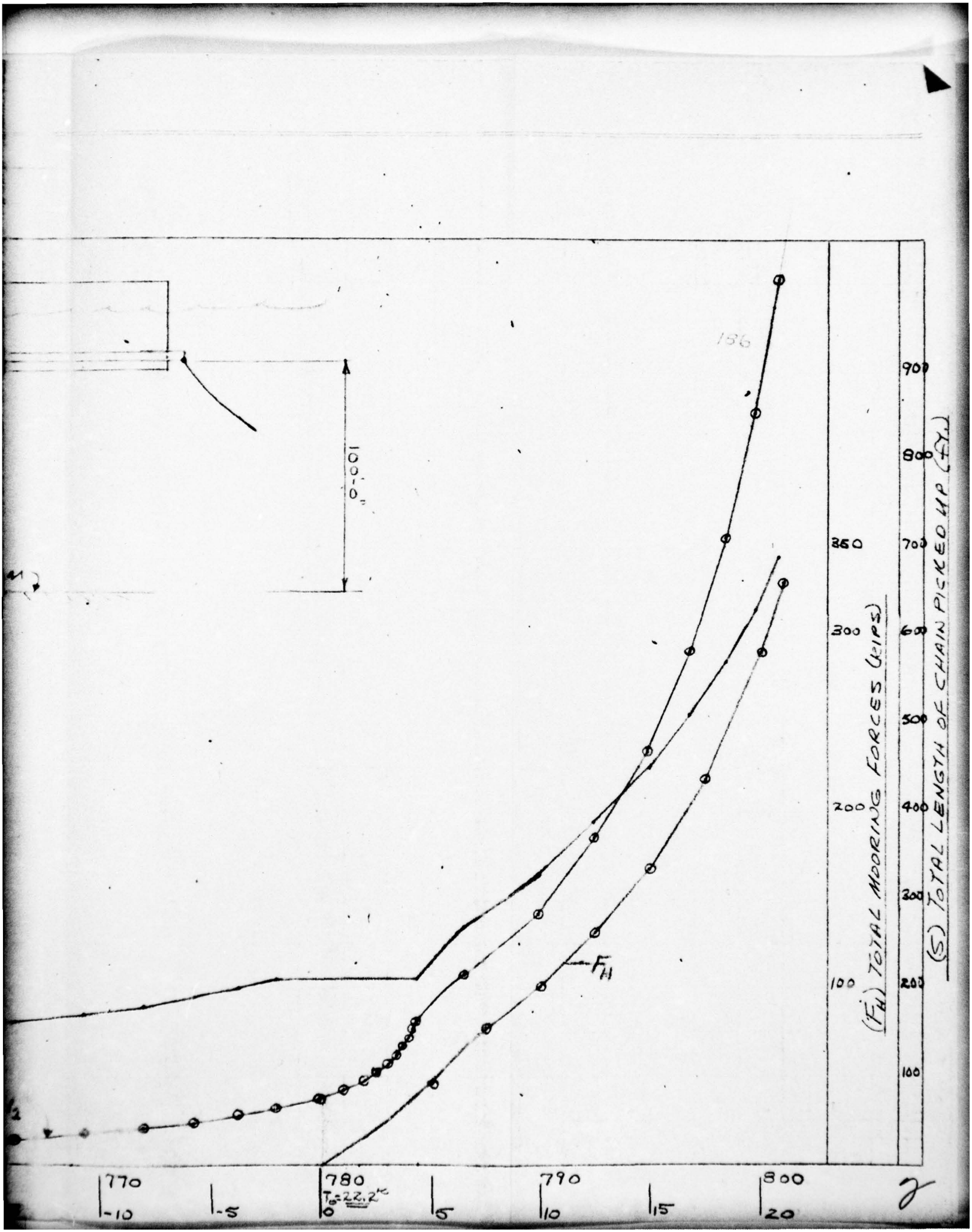
COMPANY: USA EROL | SHEET NO: 3

SUBJECT: MOND - MOORING SYSTEM

NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 12/19/69

CASE 5



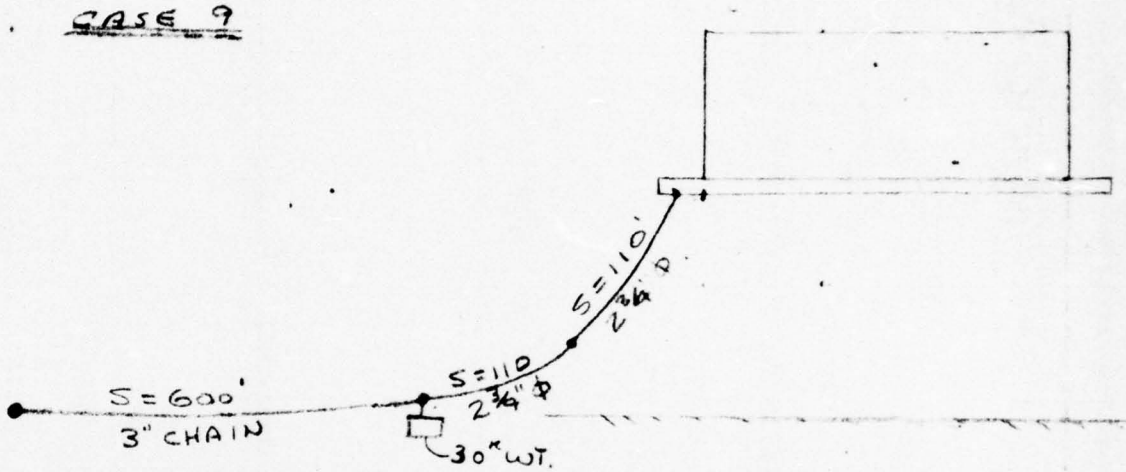

100'-0"
156
350
300
200
100
900
800
700
600
500
400
300
200
100
F_H
(FH) TOTAL MOORING FORCES (KIPS)
(S) TOTAL LENGTH OF CHAIN PICKED UP (FT.)
770
-10
-5
780
T_0=22.2k
0
5
790
10
15
800
20

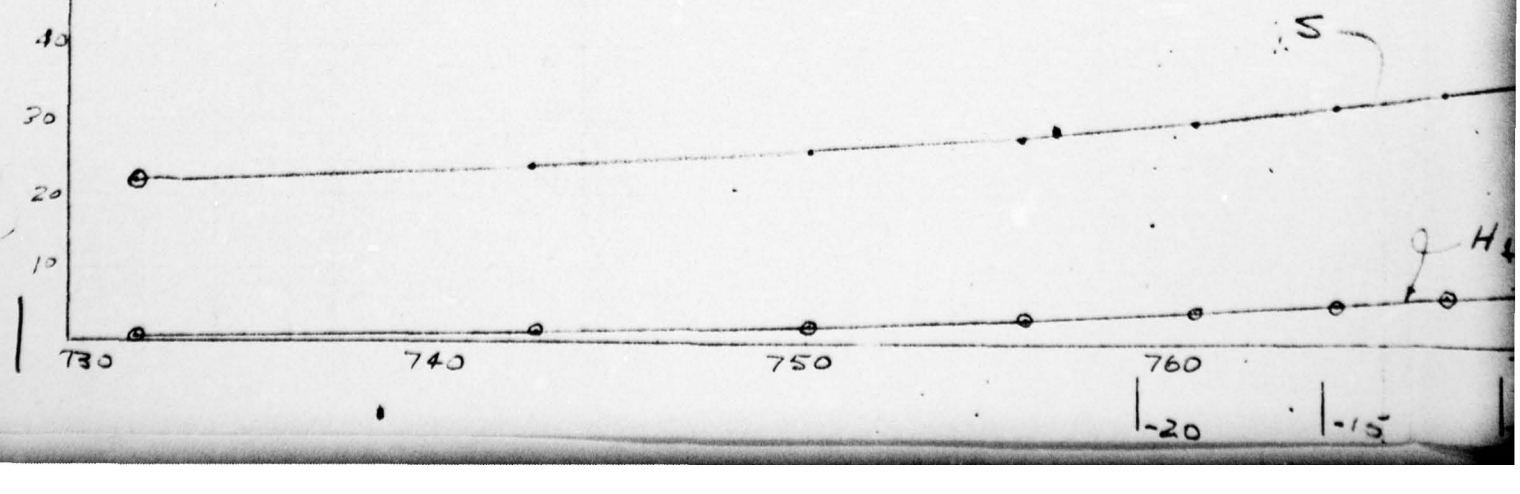
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

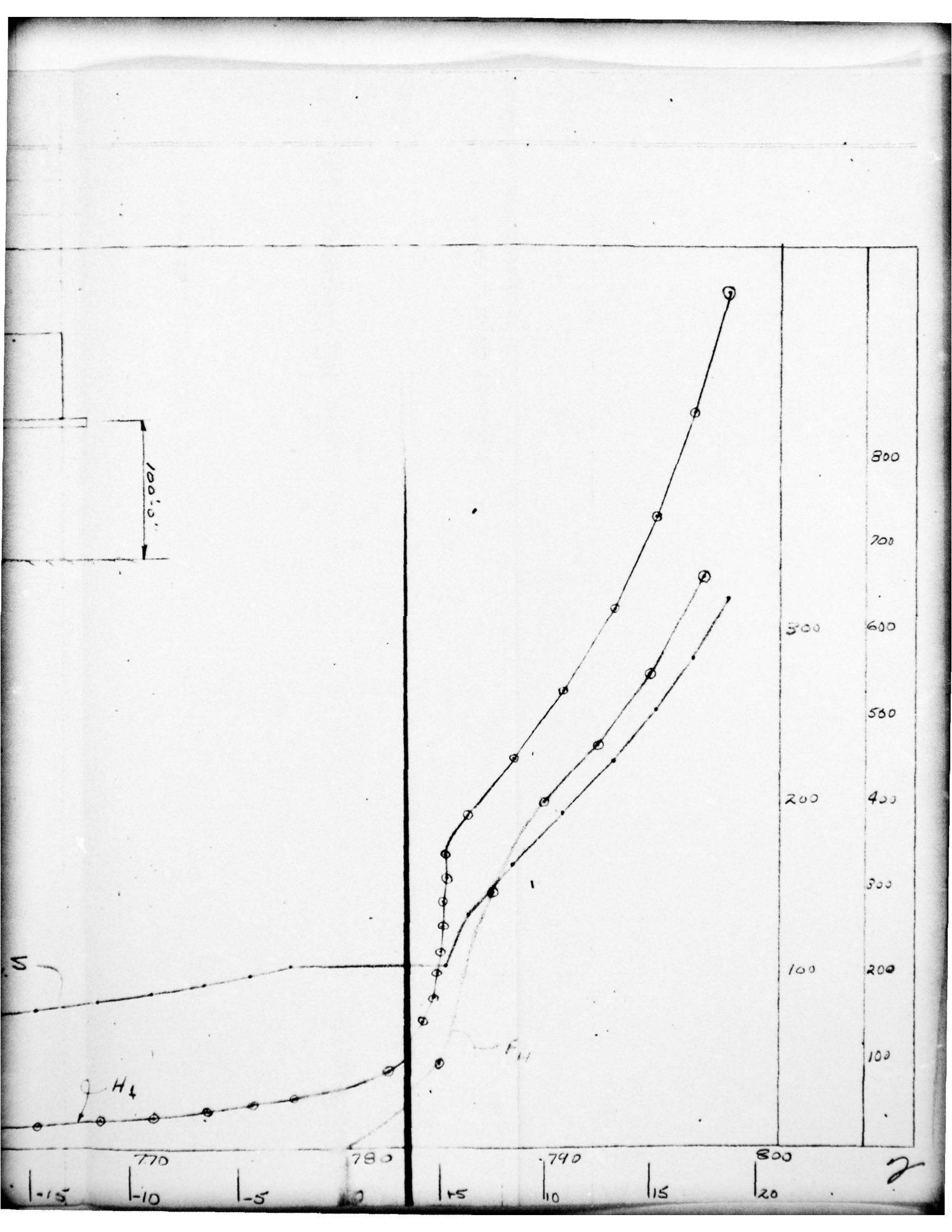
J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO
USA ERDL		4
SUBJECT		
MOORING SYSTEM		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 66017	ANDREWS		12/21/67

CASE 9





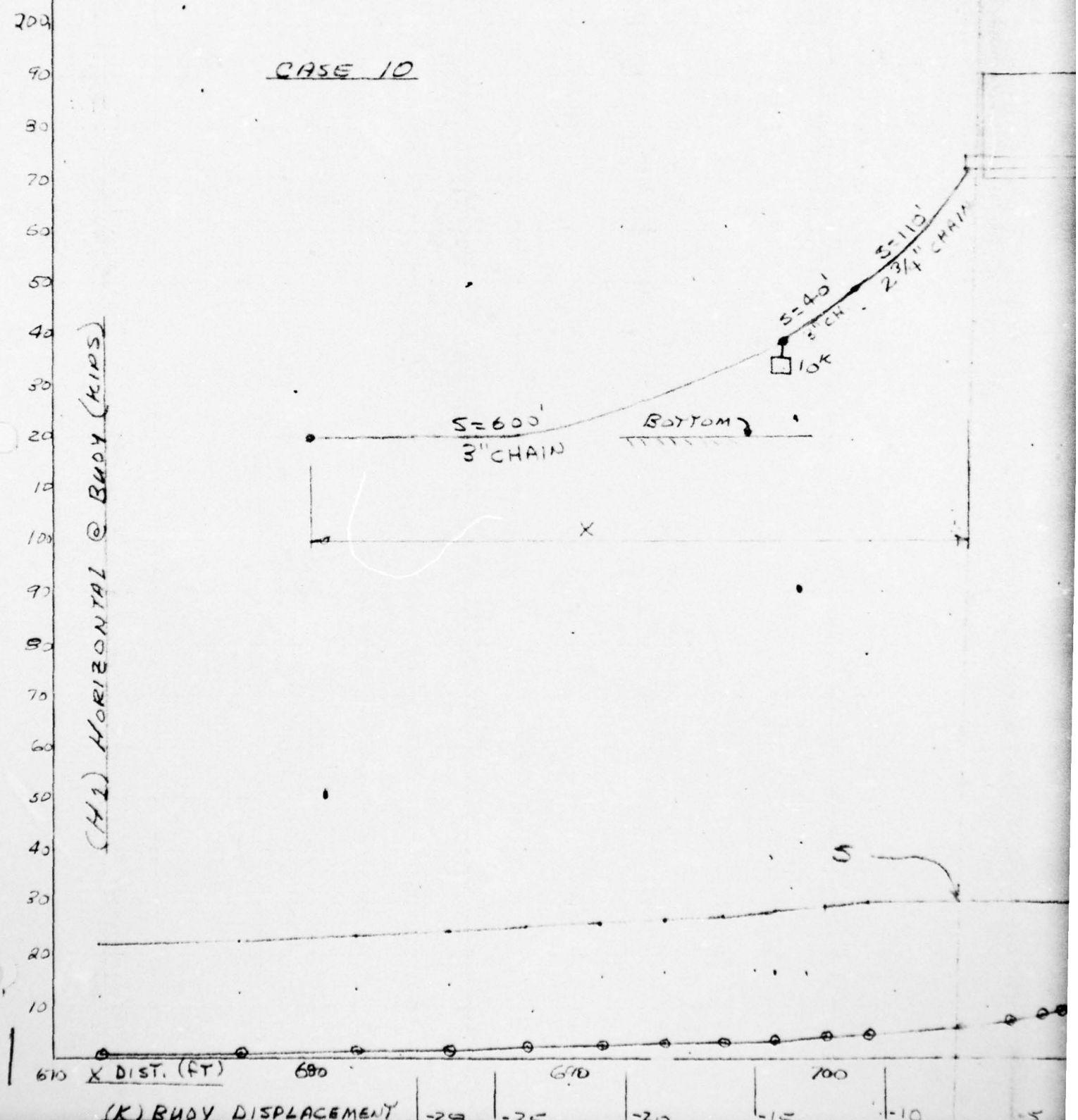

100'-0"
800
700
600
500
400
300
200
100
H1
770
780
790
800
-15
-10
-5
0
5
10
15
20

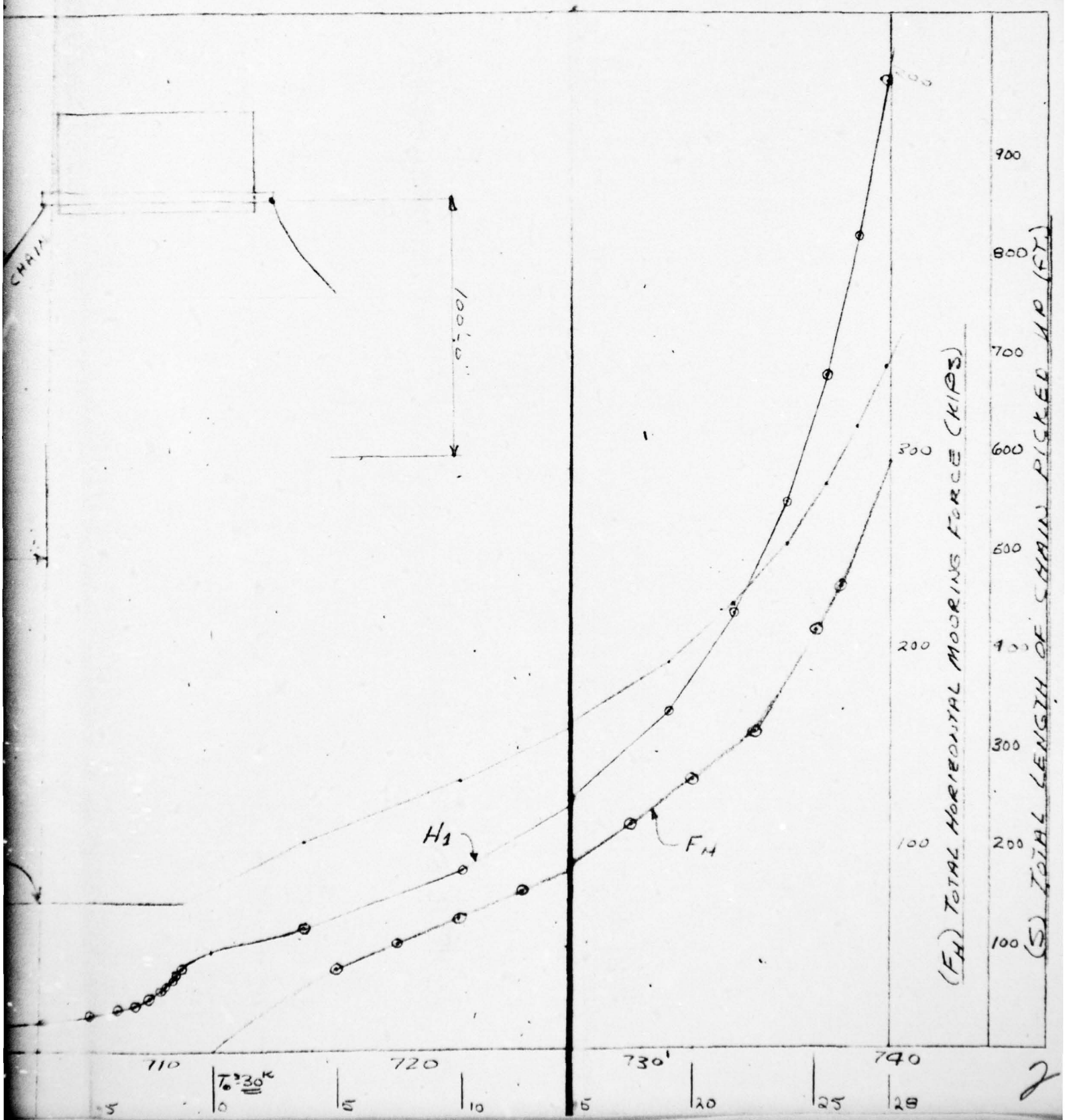
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & Co., INC.

COMPANY: USA ERDL
SHEET NO: 5
SUBJECT: MONO-MOORING SYSTEM
DRAWING NUMBER | COMPUTED BY: ANDREWS | CHECKED BY | DATE: 12/22/69
JOB 56017

CASE 10





CHAIN
100'-0"
H_1
F_H
(F_H) TOTAL HORIZONTAL MOORING FORCE (KIPS)
(S) TOTAL LENGTH OF CHAIN PICKED UP (FT)
100
200
300
400
500
600
700
800
900
710
720
730'
740
$T_0 = 30^K$
-5
0
5
10
15
20
25
28

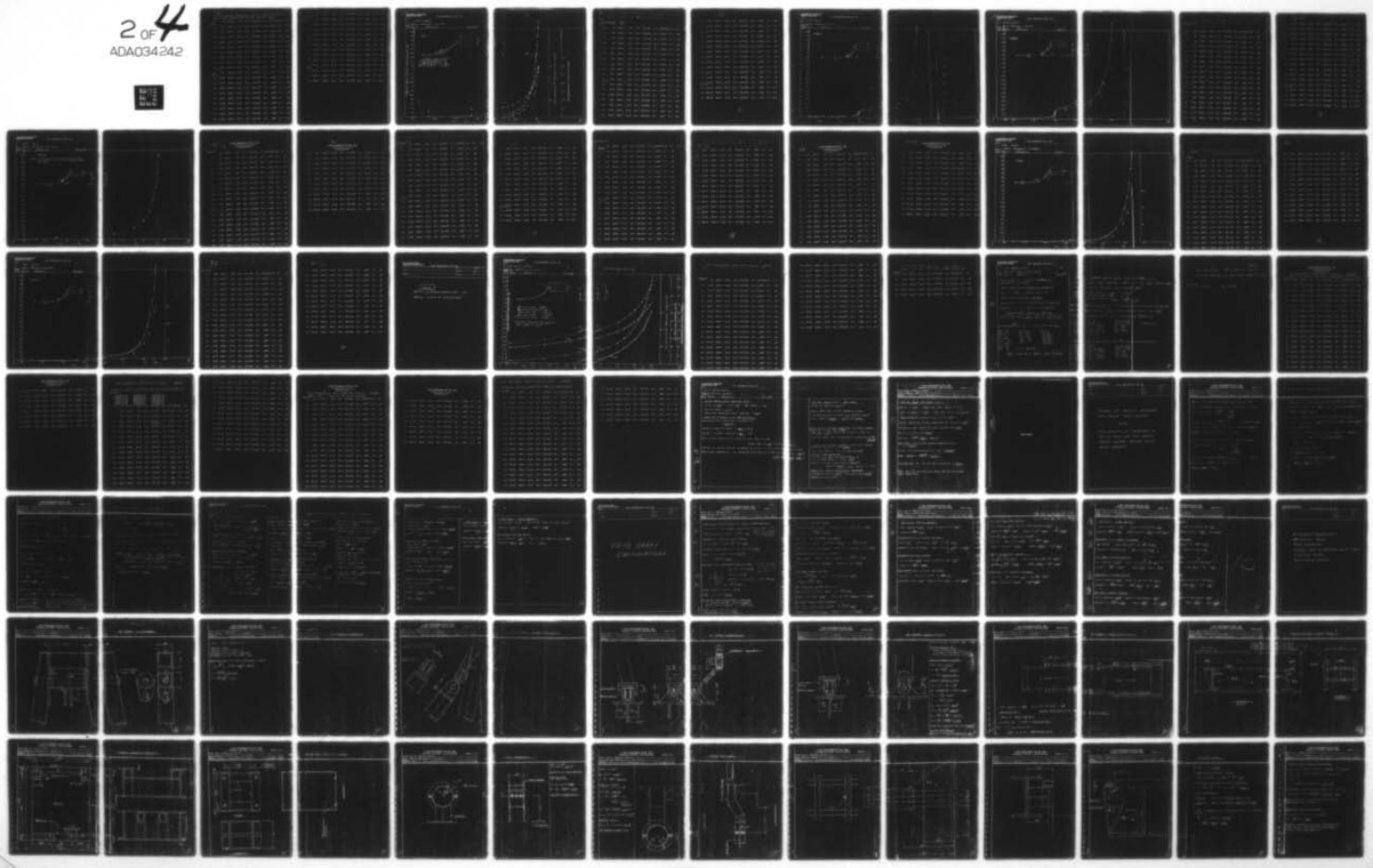
2

AD-A034 242 MCDERMOTT (J RAY) CO INC NEW ORLEANS LA F/G 13/10

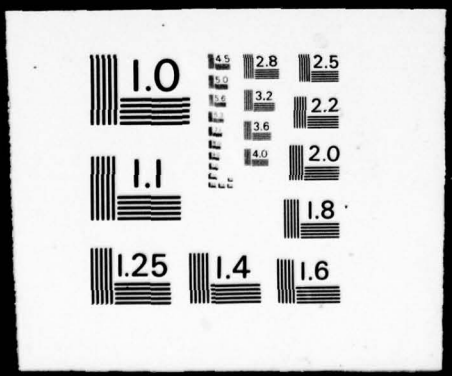
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 1. --ETC(U)
1966 DA-44-009-AMC-841(T)

UNCLASSIFIED NL

2 OF 4
ADA034242



2 OF 4
ADA034242



(1)

H=0 DELTA=3.0 VPCC=60. WN=0 W(1)=.0789 TOL=.1
W(3)=.0789 W(5)=.0789 A1=65 A2=300 A3=300

H =	.40	VBUOY =	5.09	CHP =	616.5848	DX =	.61658485E 03	V1 =		
H =	3.55	VBUOY =	7.44	CHP =	637.3306	DX =	20.7457	V1 =	.00	
H =	7.84	VBUOY =	9.80	CHP =	644.7661	DX =	7.4354	V1 =	.00	
H =	13.33	VBUOY =	12.15	CHP =	648.9969	DX =	4.2308	V1 =	.00	
H =	19.99	VBUOY =	14.50	CHP =	651.7230	DX =	2.7261	V1 =	.00	
H =	27.82	VBUOY =	16.85	CHP =	653.6386	DX =	1.9155	V1 =	.00	
H =	36.82	VBUOY =	19.20	CHP =	655.0629	DX =	1.4243	V1 =	.00	
H =	47.02	VBUOY =	21.56	CHP =	656.1759	DX =	1.1130	V1 =	.00	
H =	58.42	VBUOY =	23.91	CHP =	657.0684	DX =	.8925	V1 =	.00	
H =	71.02	VBUOY =	26.26	CHP =	657.7994	DX =	.7309	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.6087	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	
H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00	

H =	84.82	VBUOY =	28.61	CHP =	658.4081	DX =	.0000	V1 =	.00
H =	99.52	VBUOY =	30.96	CHP =	658.8883	DX =	.4801	V1 =	.00
H =	115.72	VBUOY =	33.31	CHP =	659.3359	DX =	.4476	V1 =	.00
H =	132.82	VBUOY =	35.67	CHP =	659.7003	DX =	.3643	V1 =	.00
H =	151.12	VBUOY =	38.02	CHP =	660.0226	DX =	.3222	V1 =	.00
H =	170.92	VBUOY =	40.37	CHP =	660.3258	DX =	.3032	V1 =	.00
H =	191.92	VBUOY =	42.72	CHP =	660.5940	DX =	.2682	V1 =	.00
H =	213.52	VBUOY =	45.07	CHP =	660.8106	DX =	.2166	V1 =	.00
H =	236.62	VBUOY =	47.43	CHP =	661.0183	DX =	.2077	V1 =	.00
H =	260.92	VBUOY =	49.78	CHP =	661.2076	DX =	.1893	V1 =	.00
H =	286.12	VBUOY =	52.13	CHP =	661.3723	DX =	.1647	V1 =	.00
H =	317.92	VBUOY =	54.99	CHP =	661.5918	DX =	.2195	V1 =	2.86
H =	353.92	VBUOY =	58.17	CHP =	661.7121	DX =	.1203	V1 =	6.04
H =	392.92	VBUOY =	61.71	CHP =	661.8188	DX =	.1067	V1 =	9.57

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

MCD 5036

COMPANY

SHEET NO.

SUBJECT

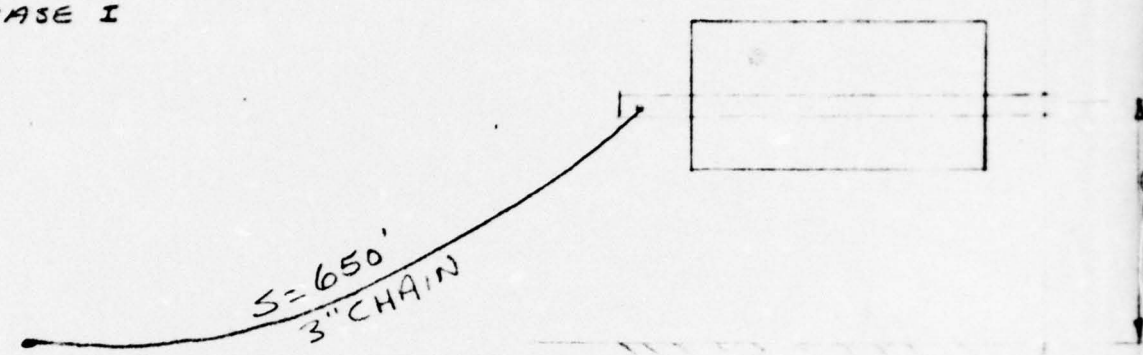
USA EROL

MONO-MOORING SYSTEM

DRAWING NUMBER | COMPUTER | CHECKED BY | DATE

JOB 56017 ANDREWS 1/26/65

CASE I



ANCHOR LOAD ≅ 240ᵏ
BUOY DISPLACEMENT ≅ 17'
PRE-LOAD TENSION ≅ 11ᵏ
SCOPE OF CHAIN = 650'
MAX T @ BUOY ≅ 245ᵏ

H = HORIZONTAL PENDANT LOAD (KIPS)

200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

610 620 630 640

745 745

-16 -10

665' 790.
663
125'

F_H = HORIZONTAL MOORING LOAD (KIPS)

S = LENGTH OF CHAIN (FEET)

300
200
100

700
600
500
400
300
200
100

1/1

S

F_H

40

650

660

+10

+16

2

H=0 DELTA=3. VPCC=60 WW=10 W(1)=.0784 TQL=.1
W(3)=.0784 W(6)=.0784 M1=65 M2=20 A3=5.00

LOAD DATA ~~#1~~ (2)

H =	.40	VBUOY =	5.09	CHP =	636.5848	DX =	.63658485E 03	V1 =	.00
H =	.58	VBUOY =	5.25	CHP =	639.5002	DX =	2.9153	V1 =	.00
H =	.76	VBUOY =	5.40	CHP =	641.8346	DX =	2.3344	V1 =	.00
H =	.94	VBUOY =	5.56	CHP =	643.7586	DX =	1.9240	V1 =	.00
H =	1.12	VBUOY =	5.72	CHP =	645.3742	DX =	1.6156	V1 =	.00
H =	1.33	VBUOY =	5.88	CHP =	647.2180	DX =	1.8437	V1 =	.00
H =	1.51	VBUOY =	6.03	CHP =	648.3633	DX =	1.1453	V1 =	.00
=	1.72	VBUOY =	6.19	CHP =	649.7520	DX =	1.3887	V1 =	.00
H =	1.93	VBUOY =	6.35	CHP =	650.9565	DX =	1.2044	V1 =	.00
H =	2.14	VBUOY =	6.50	CHP =	652.0082	DX =	1.0516	V1 =	.00
H =	2.35	VBUOY =	6.66	CHP =	652.9942	DX =	.9859	V1 =	.00
H =	3.64	VBUOY =	7.66	CHP =	656.6305	DX =	3.6362	V1 =	.00
H =	4.78	VBUOY =	8.66	CHP =	657.9340	DX =	1.3035	V1 =	.00
H =	5.89	VBUOY =	9.66	CHP =	658.7010	DX =	.7670	V1 =	.00
H =	6.94	VBUOY =	10.66	CHP =	659.0268	DX =	.3258	V1 =	.00
H =	7.99	VBUOY =	11.66	CHP =	659.2880	DX =	.2611	V1 =	.00
H =	9.04	VBUOY =	12.66	CHP =	659.5017	DX =	.2137	V1 =	.00
H =	10.06	VBUOY =	13.66	CHP =	659.5918	DX =	.0901	V1 =	.00

(2)

H =	11.08	VBUOY =	14.66	CHP =	659.6701	DX =	.0782	V1 =	.00
H =	12.10	VBUOY =	15.66	CHP =	659.7386	DX =	.0685	V1 =	.00
H =	13.12	VBUOY =	16.66	CHP =	659.7989	DX =	.0603	V1 =	.00
H =	21.97	VBUOY =	21.36	CHP =	665.2882	DX =	5.4892	V1 =	.00
H =	36.49	VBUOY =	26.07	CHP =	670.8405	DX =	5.5523	V1 =	.00
H =	55.69	VBUOY =	30.77	CHP =	674.3593	DX =	3.5187	V1 =	.00
H =	79.39	VBUOY =	35.47	CHP =	676.5836	DX =	2.2243	V1 =	.00
H =	107.29	VBUOY =	40.18	CHP =	678.0307	DX =	1.4471	V1 =	.00
H =	140.29	VBUOY =	44.88	CHP =	679.1090	DX =	1.0783	V1 =	.00
H =	177.49	VBUOY =	49.59	CHP =	679.8753	DX =	.7663	V1 =	.00
H =	219.49	VBUOY =	54.29	CHP =	680.4728	DX =	.5975	V1 =	.00
H =	266.29	VBUOY =	58.99	CHP =	680.9501	DX =	.4773	V1 =	.00
H =	317.59	VBUOY =	63.70	CHP =	681.3297	DX =	.3796	V1 =	.00
H =	353.89	VBUOY =	66.87	CHP =	681.5629	DX =	.2332	V1 =	3.17
H =	394.09	VBUOY =	70.41	CHP =	681.7079	DX =	.1450	V1 =	6.71
H =	439.09	VBUOY =	74.35	CHP =	681.8213	DX =	.1134	V1 =	10.65

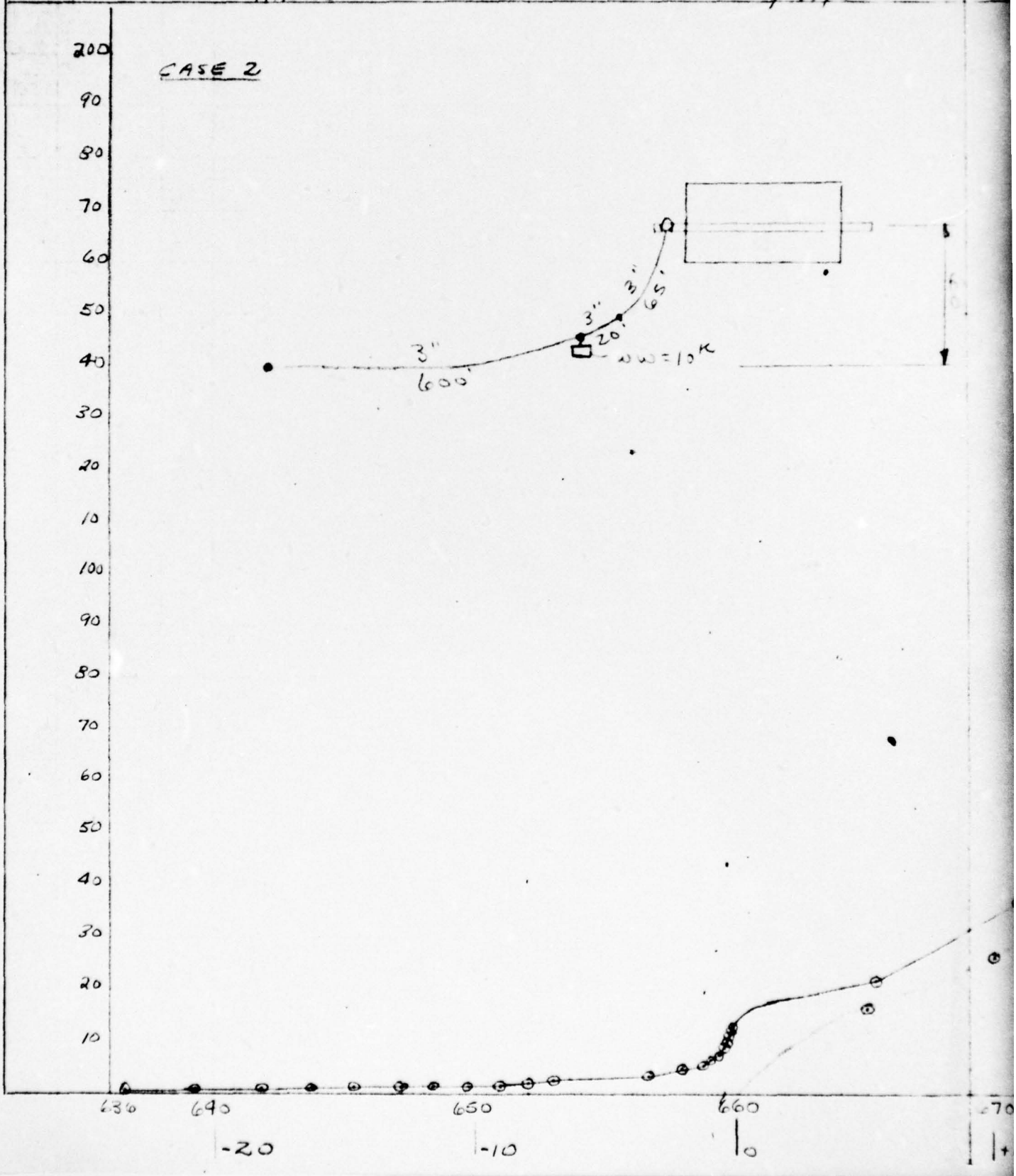
(1)

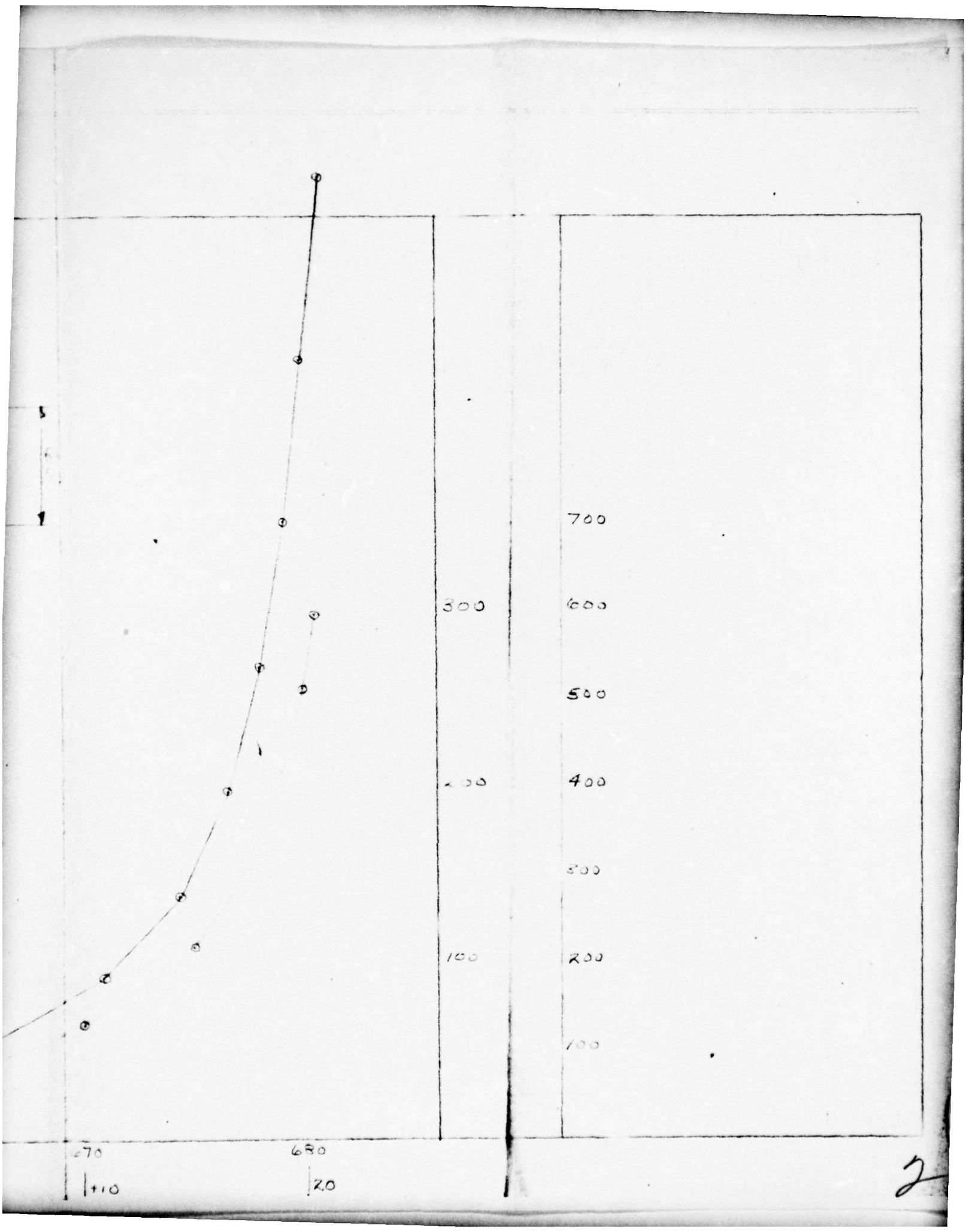
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5038

J. RAY MCDERMOTT & CO., INC.

COMPANY: USA ERDL
SHEET NO:
SUBJECT: MONO - MOORING SYSTEM
DRAWING NUMBER:
JOB 56017
COMPUTER: ANDREWS
CHECKED BY:
DATE: 4/21/65

CASE 2





2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & Co., INC.

COMPANY: USA / EROL

SHEET NO:

SUBJECT: MONO-MOORING SYSTEM

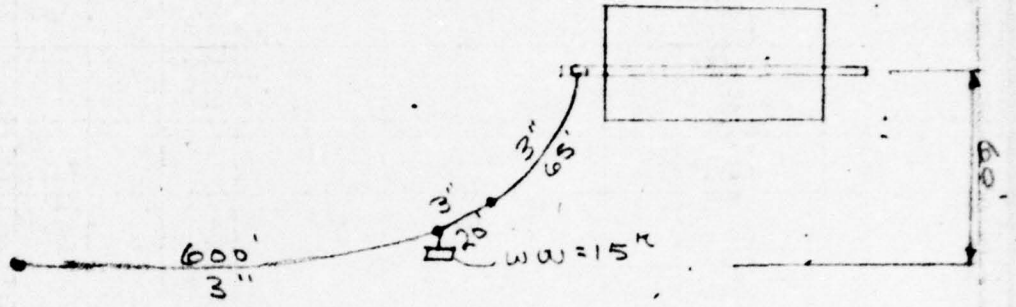
JOB NUMBER: JOB 6017

COMPUTER: ANDREWS

CHECKED BY:

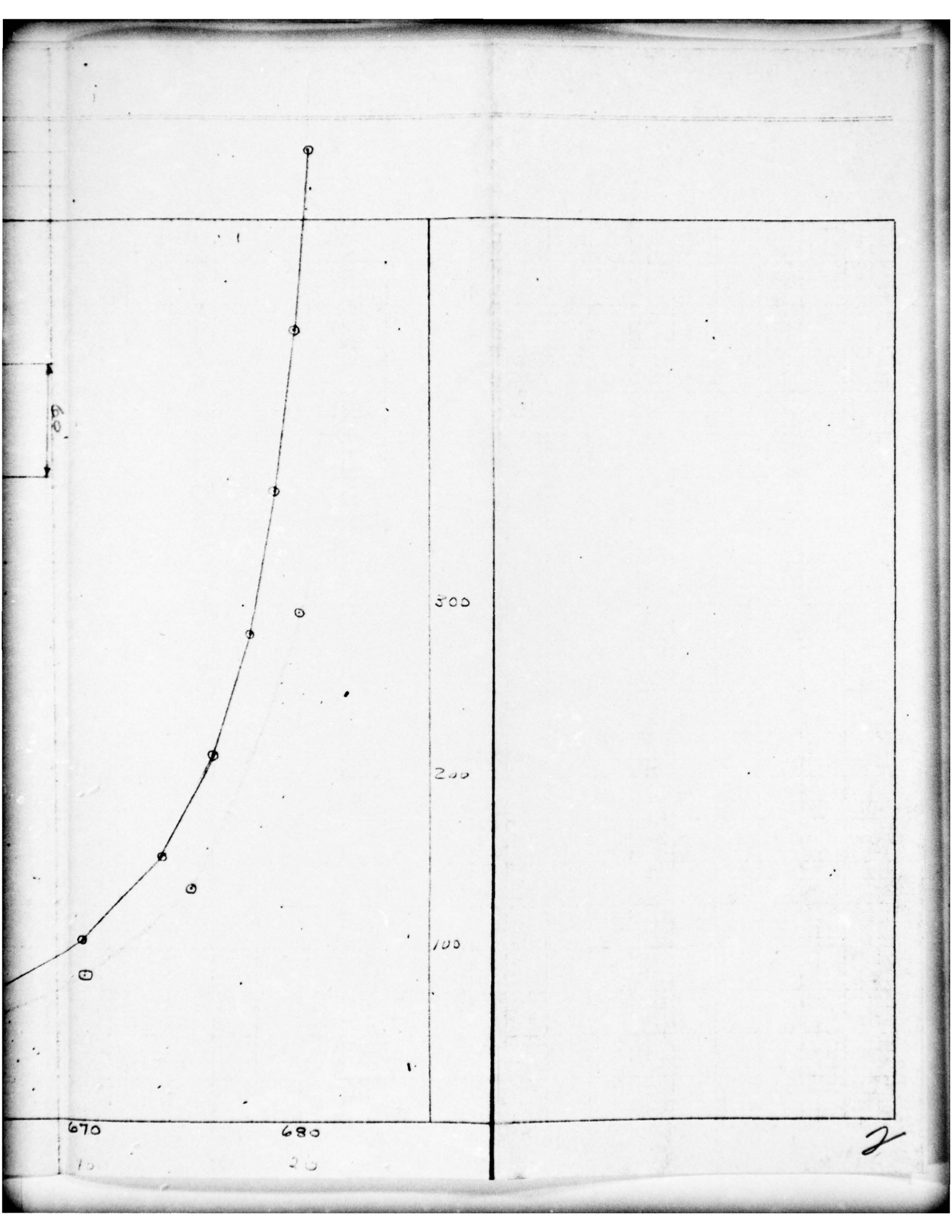
DATE: 1/29/65

CASE 4



200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

636 640 650 660 670


300
200
100
670
680
10
20
2

H=0 DELTA=3. VPCC=60 WW=15 W(1)=.0789 TOL=.1
W(3)=.0789 W(5)=.0789 A1=65 A2=20 A3=600

OAD DATA #4

H =	.40	VBUOY =	5.09	CHP =	636.5848	DX =	.63658485E 03	V1 =	.00
H =	.58	VBUOY =	5.25	CHP =	639.5002	DX =	2.9153	V1 =	.00
H =	.76	VBUOY =	5.40	CHP =	641.8346	DX =	2.3344	V1 =	.00
H =	.94	VBUOY =	5.56	CHP =	643.7586	DX =	1.9240	V1 =	.00
H =	1.12	VBUOY =	5.72	CHP =	645.3742	DX =	1.6156	V1 =	.00
H =	1.33	VBUOY =	5.88	CHP =	647.2180	DX =	1.8437	V1 =	.00
H =	1.51	VBUOY =	6.03	CHP =	648.3633	DX =	1.1453	V1 =	.00
H =	1.72	VBUOY =	6.19	CHP =	649.7520	DX =	1.3887	V1 =	.00
H =	1.93	VBUOY =	6.35	CHP =	650.9565	DX =	1.2044	V1 =	.00
H =	2.14	VBUOY =	6.50	CHP =	652.0082	DX =	1.0516	V1 =	.00
H =	2.35	VBUOY =	6.66	CHP =	652.9942	DX =	.9859	V1 =	.00
H =	4.24	VBUOY =	8.16	CHP =	657.5416	DX =	4.5474	V1 =	.00
H =	5.89	VBUOY =	9.66	CHP =	658.7010	DX =	1.1593	V1 =	.00
H =	7.48	VBUOY =	11.16	CHP =	659.2226	DX =	.5215	V1 =	.00
H =	9.04	VBUOY =	12.66	CHP =	659.5017	DX =	.2791	V1 =	.00
H =	10.57	VBUOY =	14.16	CHP =	659.6323	DX =	.1306	V1 =	.00
H =	12.10	VBUOY =	15.66	CHP =	659.7386	DX =	.1062	V1 =	.00
H =	13.63	VBUOY =	17.16	CHP =	659.8264	DX =	.0878	V1 =	.00

(2) #4

H =	15.16	VBUOY =	18.66	CHP =	659.8999	DX =	.0735	V1 =	.00
H =	16.69	VBUOY =	20.16	CHP =	659.9624	DX =	.0624	V1 =	.00
H =	18.19	VBUOY =	21.66	CHP =	659.9667	DX =	.0043	V1 =	.00
H =	27.19	VBUOY =	26.36	CHP =	664.5899	DX =	4.6231	V1 =	.00
H =	41.95	VBUOY =	31.07	CHP =	669.9165	DX =	5.3266	V1 =	.00
H =	61.45	VBUOY =	35.77	CHP =	673.6135	DX =	3.6970	V1 =	.00
H =	85.45	VBUOY =	40.47	CHP =	676.0463	DX =	2.4327	V1 =	.00
H =	113.65	VBUOY =	45.18	CHP =	677.6567	DX =	1.6104	V1 =	.00
H =	146.65	VBUOY =	49.88	CHP =	678.8241	DX =	1.1674	V1 =	.00
=	184.15	VBUOY =	54.59	CHP =	679.6762	DX =	.8521	V1 =	.00
H =	226.15	VBUOY =	59.29	CHP =	680.3201	DX =	.6439	V1 =	.00
H =	272.95	VBUOY =	63.99	CHP =	680.8312	DX =	.5111	V1 =	.00
H =	324.25	VBUOY =	68.70	CHP =	681.2359	DX =	.4047	V1 =	.00
H =	361.45	VBUOY =	71.94	CHP =	681.4760	DX =	.2401	V1 =	3.24
H =	403.45	VBUOY =	75.56	CHP =	681.6534	DX =	.1774	V1 =	6.85
H =	448.45	VBUOY =	79.59	CHP =	681.7862	DX =	.1328	V1 =	10.89
H =	499.45	VBUOY =	84.08	CHP =	681.8985	DX =	.1123	V1 =	15.37

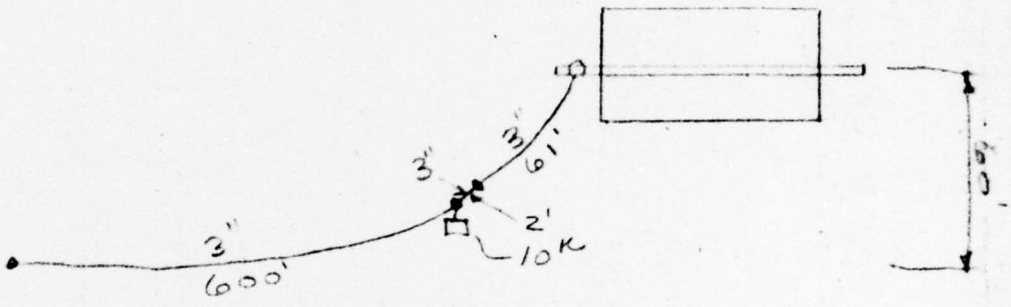
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY: USA EROL
SHEET NO:
SUBJECT: MONO-MOORING SYSTEM
NUMBER: JOB 56017
COMPUTER: ANDREWS
CHECKED BY:
DATE: 2/2/65

CASE 6

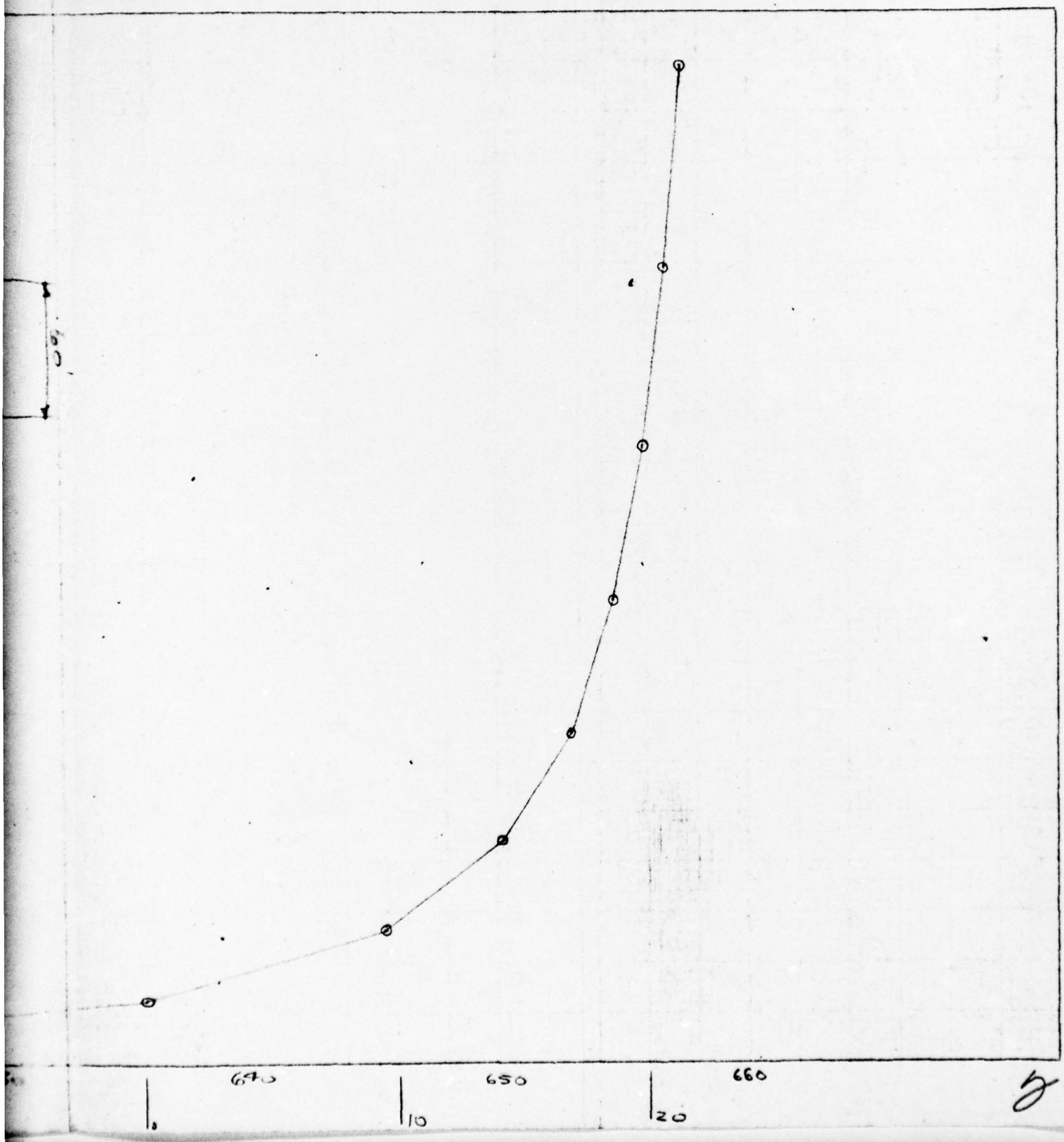
NOTE: IT MAY BE SEEN BY COMPARING H_1 CURVE WITH CASE I THAT F_H WILL APPROXIMATELY THE SAME.



200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

600 610 620 63

-20 -10


640
650
660
0
10
20

#6, 6

J. RAY McDERMOTT & CO., INC.

ENGINEERS AND GENERAL CONTRACTORS
NEW ORLEANS, LOUISIANA

LOAD DATA

H =	.07	VBUOY =	4.78	CHP =	605.4901	DX =	.60549011E 03	V1 =			
H =	.08	VBUOY =	4.79	CHP =	605.8314	DX =	.3412	V1 =	.00		
H =	.09	VBUOY =	4.79	CHP =	606.1602	DX =	.3288	V1 =	.00		
H =	.09	VBUOY =	4.80	CHP =	606.3406	DX =	.1803	V1 =	.00		
H =	.10	VBUOY =	4.81	CHP =	606.6516	DX =	.3110	V1 =	.00		
H =	.11	VBUOY =	4.82	CHP =	606.9531	DX =	.3015	V1 =	.00		
H =	.12	VBUOY =	4.82	CHP =	607.1167	DX =	.1636	V1 =	.00		
H =	.12	VBUOY =	4.83	CHP =	607.4042	DX =	.2874	V1 =	.00		
H =	.13	VBUOY =	4.84	CHP =	607.6840	DX =	.2798	V1 =	.00		
H =	.14	VBUOY =	4.85	CHP =	607.8343	DX =	.1502	V1 =	.00		
H =	.15	VBUOY =	4.86	CHP =	608.1025	DX =	.2682	V1 =	.00		
H =	.63	VBUOY =	5.86	CHP =	613.5917	DX =	5.4891	V1 =	.00		
H =	.96	VBUOY =	6.86	CHP =	614.5442	DX =	.9524	V1 =	.00		
H =	1.26	VBUOY =	7.86	CHP =	614.9504	DX =	.4062	V1 =	.00		
H =	1.56	VBUOY =	8.86	CHP =	615.2886	DX =	.3381	V1 =	.00		
H =	1.86	VBUOY =	9.86	CHP =	615.5624	DX =	.2737	V1 =	.00		
H =	2.07	VBUOY =	10.86	CHP =	615.1719	DX =	-.3904	V1 =	.00		
H =	2.37	VBUOY =	11.86	CHP =	615.4252	DX =	.2532	V1 =	.00		
H =	2.67	VBUOY =	12.86	CHP =	615.6343	DX =	.2091	V1 =	.00		

(6)

J. RAY McDERMOTT & CO., INC.

ENGINEERS AND GENERAL CONTRACTORS
NEW ORLEANS, LOUISIANA

H =	2.97	VBUOY =	13.86	CHP =	615.8100	DX =	.1756	V1 =	.00
H =	3.12	VBUOY =	14.86	CHP =	615.2751	DX =	-.5349	V1 =	.00
H =	12.87	VBUOY =	19.56	CHP =	636.0530	DX =	20.7779	V1 =	.00
H =	26.49	VBUOY =	24.26	CHP =	645.4608	DX =	9.4077	V1 =	.00
H =	44.19	VBUOY =	28.97	CHP =	650.2196	DX =	4.7587	V1 =	.00
H =	66.09	VBUOY =	33.67	CHP =	652.9179	DX =	2.6982	V1 =	.00
H =	92.49	VBUOY =	38.38	CHP =	654.6414	DX =	1.7235	V1 =	.00
H =	123.39	VBUOY =	43.08	CHP =	655.8164	DX =	1.1750	V1 =	.00
H =	159.09	VBUOY =	47.78	CHP =	656.6798	DX =	.8634	V1 =	.00
H =	199.29	VBUOY =	52.49	CHP =	657.3222	DX =	.6424	V1 =	.00
H =	244.29	VBUOY =	57.19	CHP =	657.8299	DX =	.5077	V1 =	.00
H =	293.49	VBUOY =	61.90	CHP =	658.2249	DX =	.3950	V1 =	.00

H=0 DELTA=.3 VPCC=60 WN=10 W(4)=.0789 TOL=.1
W(3)=.0789 W(5)=.0789 A1=65 A2=90 A3=600

LOAD DATA #2

H =	.40	VBUOY =	5.09	CHP =	656.5848	DX =	.65658485E 03	V1 = .00
H =	.76	VBUOY =	5.40	CHP =	661.8346	DX =	5.2498	V1 = .00
H =	1.12	VBUOY =	5.72	CHP =	665.3742	DX =	3.5396	V1 = .00
H =	1.51	VBUOY =	6.03	CHP =	668.3633	DX =	2.9890	V1 = .00
H =	1.93	VBUOY =	6.35	CHP =	670.9565	DX =	2.5932	V1 = .00
H =	2.35	VBUOY =	6.66	CHP =	672.9942	DX =	2.0376	V1 = .00
H =	2.81	VBUOY =	6.97	CHP =	674.8236	DX =	1.8294	V1 = .00
H =	3.29	VBUOY =	7.29	CHP =	676.4790	DX =	1.6553	V1 = .00
H =	3.80	VBUOY =	7.60	CHP =	678.0065	DX =	1.5274	V1 = .00
=	4.31	VBUOY =	7.91	CHP =	679.2318	DX =	1.2253	V1 = .00
H =	4.85	VBUOY =	8.23	CHP =	680.3931	DX =	1.1612	V1 = .00
H =	6.53	VBUOY =	9.23	CHP =	682.7469	DX =	2.3538	V1 = .00
H =	8.09	VBUOY =	10.23	CHP =	683.7947	DX =	1.0477	V1 = .00
H =	9.62	VBUOY =	11.23	CHP =	684.4280	DX =	.6333	V1 = .00
H =	11.15	VBUOY =	12.23	CHP =	684.8919	DX =	.4639	V1 = .00
H =	12.65	VBUOY =	13.23	CHP =	685.1810	DX =	.2890	V1 = .00
H =	14.15	VBUOY =	14.23	CHP =	685.4098	DX =	.2287	V1 = .00
H =	15.59	VBUOY =	15.23	CHP =	685.4882	DX =	.0783	V1 = .00
H =	17.09	VBUOY =	16.23	CHP =	685.6512	DX =	.1630	V1 = .00

+2 (2)

I =	18.50	VBUOY =	17.23	CHP =	685.6527	DX =	.0014	V1 =	.00
H =	20.00	VBUOY =	18.23	CHP =	685.7801	DX =	.1273	V1 =	.00
H =	30.20	VBUOY =	22.93	CHP =	688.8404	DX =	3.0603	V1 =	.00
H =	45.80	VBUOY =	27.63	CHP =	692.5351	DX =	3.6947	V1 =	.00
H =	66.20	VBUOY =	32.34	CHP =	695.2211	DX =	2.6860	V1 =	.00
H =	91.40	VBUOY =	37.04	CHP =	697.1004	DX =	1.8792	V1 =	.00
H =	121.10	VBUOY =	41.75	CHP =	698.4015	DX =	1.3011	V1 =	.00
H =	155.30	VBUOY =	46.45	CHP =	699.3401	DX =	.9386	V1 =	.00
=	194.30	VBUOY =	51.16	CHP =	700.0591	DX =	.7190	V1 =	.00
H =	237.80	VBUOY =	55.86	CHP =	700.6126	DX =	.5535	V1 =	.00
H =	286.10	VBUOY =	60.56	CHP =	701.0584	DX =	.4458	V1 =	.00
H =	338.90	VBUOY =	65.27	CHP =	701.4200	DX =	.3616	V1 =	.00
H =	378.80	VBUOY =	68.66	CHP =	701.6321	DX =	.2121	V1 =	3.38
H =	423.80	VBUOY =	72.44	CHP =	701.8235	DX =	.1914	V1 =	7.17
H =	473.00	VBUOY =	76.68	CHP =	701.9284	DX =	.1049	V1 =	11.41

LOAD DATA #3

=	.40	VBUOY =	5.09	CHP =	656.5848	DX =	.65658485E 03	V1 =	.00
H =	.76	VBUOY =	5.40	CHP =	661.8346	DX =	5.2498	V1 =	.00
H =	1.12	VBUOY =	5.72	CHP =	665.3742	DX =	3.5396	V1 =	.00
H =	1.51	VBUOY =	6.03	CHP =	668.3633	DX =	2.9890	V1 =	.00
H =	1.93	VBUOY =	6.35	CHP =	670.9565	DX =	2.5932	V1 =	.00
H =	2.35	VBUOY =	6.66	CHP =	672.9942	DX =	2.0376	V1 =	.00
H =	2.81	VBUOY =	6.97	CHP =	674.8236	DX =	1.8294	V1 =	.00
H =	3.29	VBUOY =	7.29	CHP =	676.4790	DX =	1.6553	V1 =	.00
H =	3.80	VBUOY =	7.60	CHP =	678.0065	DX =	1.5274	V1 =	.00
H =	4.31	VBUOY =	7.91	CHP =	679.2318	DX =	1.2253	V1 =	.00
H =	4.85	VBUOY =	8.23	CHP =	680.3931	DX =	1.1612	V1 =	.00
H =	7.31	VBUOY =	9.73	CHP =	683.3250	DX =	2.9318	V1 =	.00
H =	9.62	VBUOY =	11.23	CHP =	684.4280	DX =	1.1030	V1 =	.00
H =	11.90	VBUOY =	12.73	CHP =	685.0454	DX =	.6174	V1 =	.00
H =	14.12	VBUOY =	14.23	CHP =	685.3505	DX =	.3051	V1 =	.00
H =	16.31	VBUOY =	15.73	CHP =	685.5220	DX =	.1714	V1 =	.00
H =	18.50	VBUOY =	17.23	CHP =	685.6527	DX =	.1307	V1 =	.00
H =	20.69	VBUOY =	18.73	CHP =	685.7558	DX =	.1030	V1 =	.00
H =	22.85	VBUOY =	20.23	CHP =	685.8024	DX =	.0465	V1 =	.00

H=0 DELTA=3. VPCC=60 WN=15 W(1)=.0789 TOL=1
W(3)=.0789 W(9)=.0789 H1=65 H2=90 H3=600

H3 (2)

H = 25.01 VBUOY = 21.73 CHP = 685.8408 DX = .0384 V1 = .00

H = 27.20 VBUOY = 23.23 CHP = 685.9041 DX = .0632 V1 = .00

H = 37.40 VBUOY = 27.93 CHP = 688.3889 DX = 2.4848 V1 = .00

H = 53.30 VBUOY = 32.63 CHP = 691.9385 DX = 3.5495 V1 = .00

H = 74.00 VBUOY = 37.34 CHP = 694.6926 DX = 2.7541 V1 = .00

H = 99.20 VBUOY = 42.04 CHP = 696.6430 DX = 1.9504 V1 = .00

H = 129.20 VBUOY = 46.75 CHP = 698.0668 DX = 1.4238 V1 = .00

H = 163.40 VBUOY = 51.45 CHP = 699.0785 DX = 1.0117 V1 = .00

H = 202.40 VBUOY = 56.16 CHP = 699.8549 DX = .7764 V1 = .00

H = 246.20 VBUOY = 60.86 CHP = 700.4636 DX = .6087 V1 = .00

H = 294.50 VBUOY = 65.56 CHP = 700.9408 DX = .4772 V1 = .00

H = 347.30 VBUOY = 70.27 CHP = 701.3239 DX = .3831 V1 = .00

H = 389.30 VBUOY = 73.74 CHP = 701.6186 DX = .2947 V1 = 3.47

H = 434.30 VBUOY = 77.63 CHP = 701.7342 DX = .1156 V1 = 7.36

H = 485.30 VBUOY = 81.98 CHP = 701.8735 DX = .1393 V1 = 11.70

H =	.07	VBUOY =	4.78	CHP =	605.4901	DX =	.60549011E 03	V1 =	
H =	.08	VBUOY =	4.79	CHP =	605.8314	DX =	.3412	V1 =	.00
H =	.09	VBUOY =	4.79	CHP =	606.1602	DX =	.3288	V1 =	.00
H =	.09	VBUOY =	4.80	CHP =	606.3406	DX =	.1803	V1 =	.00
H =	.10	VBUOY =	4.81	CHP =	606.6516	DX =	.3110	V1 =	.00
H =	.11	VBUOY =	4.82	CHP =	606.9531	DX =	.3015	V1 =	.00
H =	.12	VBUOY =	4.82	CHP =	607.1167	DX =	.1636	V1 =	.00
H =	.12	VBUOY =	4.83	CHP =	607.4042	DX =	.2874	V1 =	.00
H =	.13	VBUOY =	4.84	CHP =	607.6840	DX =	.2798	V1 =	.00
H =	.14	VBUOY =	4.85	CHP =	607.8343	DX =	.1502	V1 =	.00
H =	.15	VBUOY =	4.86	CHP =	608.1025	DX =	.2682	V1 =	.00
H =	.81	VBUOY =	6.36	CHP =	614.3341	DX =	6.2315	V1 =	.00
H =	1.26	VBUOY =	7.86	CHP =	614.9504	DX =	.6163	V1 =	.00
H =	1.65	VBUOY =	9.36	CHP =	614.9279	DX =	-.0225	V1 =	.00
H =	2.07	VBUOY =	10.86	CHP =	615.1719	DX =	.2440	V1 =	.00
H =	2.46	VBUOY =	12.36	CHP =	615.1888	DX =	.0168	V1 =	.00
H =	2.85	VBUOY =	13.86	CHP =	615.2126	DX =	.0238	V1 =	.00
H =	3.24	VBUOY =	15.36	CHP =	615.2374	DX =	.0247	V1 =	.00

#5 (2)

J. RAY McDERMOTT & CO., INC.

ENGINEERS AND GENERAL CONTRACTORS
NEW ORLEANS, LOUISIANA

H =	3.63	VBUOY =	16.86	CHP =	615.2609	DX =	.0234	V1 =	.00
H =	3.99	VBUOY =	18.36	CHP =	615.1754	DX =	-.0854	V1 =	.00
H =	4.59	VBUOY =	19.86	CHP =	615.8852	DX =	.7097	V1 =	.00
H =	15.21	VBUOY =	24.56	CHP =	634.2503	DX =	18.3651	V1 =	.00
H =	29.70	VBUOY =	29.26	CHP =	644.0916	DX =	9.8412	V1 =	.00
H =	48.00	VBUOY =	33.97	CHP =	649.3165	DX =	5.2249	V1 =	.00
H =	70.20	VBUOY =	38.67	CHP =	652.3030	DX =	2.9864	V1 =	.00
H =	96.90	VBUOY =	43.38	CHP =	654.2368	DX =	1.9338	V1 =	.00
H =	128.10	VBUOY =	48.08	CHP =	655.5491	DX =	1.3123	V1 =	.00
H =	164.10	VBUOY =	52.78	CHP =	656.5016	DX =	.9525	V1 =	.00
H =	204.00	VBUOY =	57.49	CHP =	657.1751	DX =	.6735	V1 =	.00
H =	249.00	VBUOY =	62.19	CHP =	657.7202	DX =	.5451	V1 =	.00
H =	298.50	VBUOY =	66.90	CHP =	658.1457	DX =	.4255	V1 =	.00

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 8036

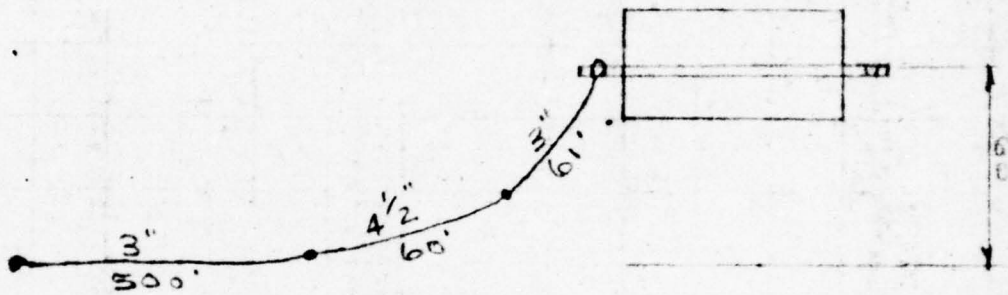
J. RAY McDERMOTT & CO., INC.

COMPANY: USA ERDL | SHEET NO:

SUBJECT: MOND - MOORING SYSTEM

NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 3/2/65

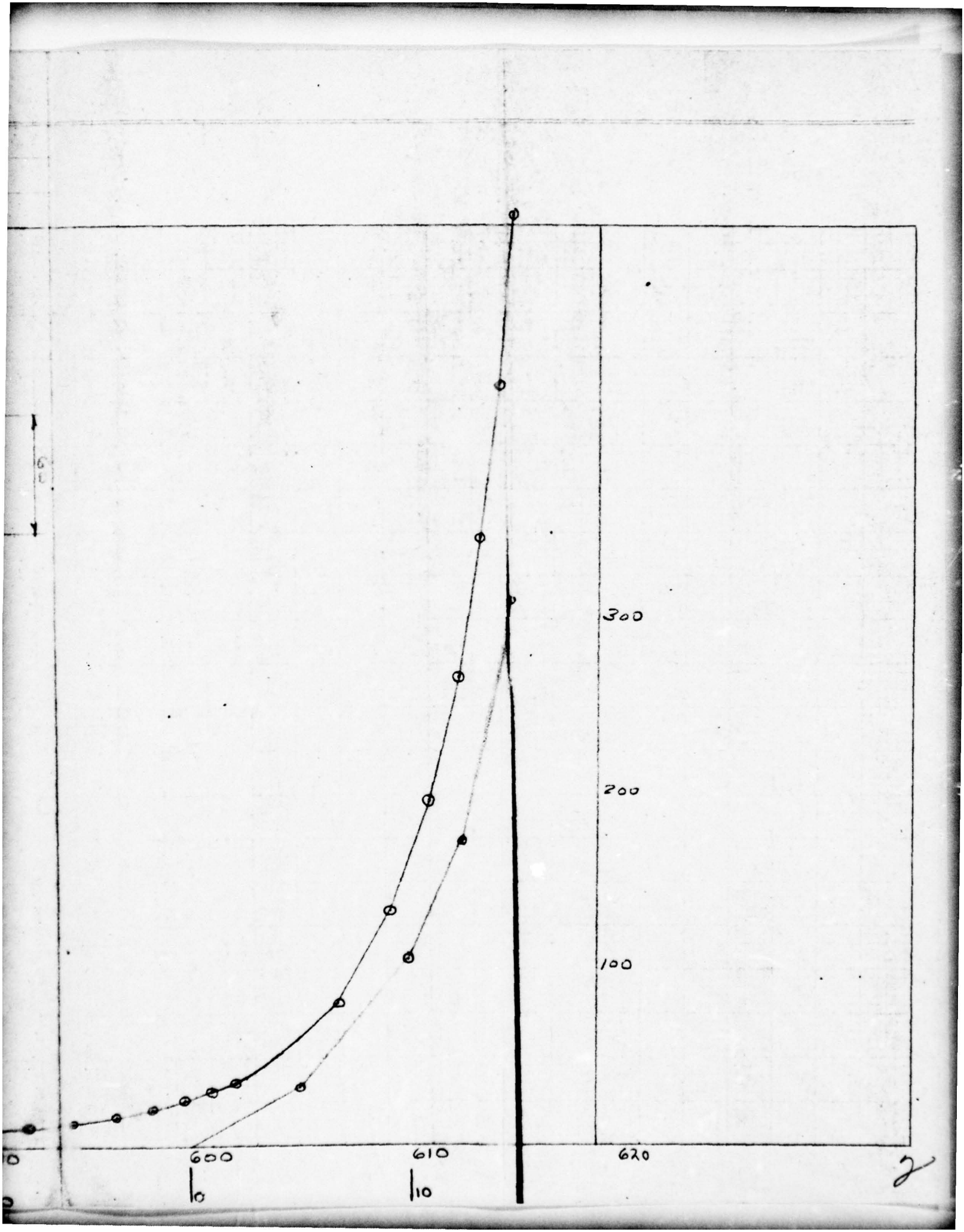
CASE B



200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

560 570 580 590

-15 -10


300
200
100
600
610
620
10
10

#2 N=0 DELTA=3.0 VPCC=6.0 WW=0 W(1)=.0789 TOL=.1
W(3)=.172 W(4)=.0789 A1=6.1 A2=6.0 A3=500

1 0 DATA

H =	.07	VBUOY =	4.78	CHP =	564.4901	DX =	.56449011E 03	V1 = .00
H =	.94	VBUOY =	5.81	CHP =	578.0810	DX =	13.5909	V1 = .00
H =	1.90	VBUOY =	6.84	CHP =	583.9294	DX =	5.8484	V1 = .00
H =	3.01	VBUOY =	7.87	CHP =	588.0661	DX =	4.1366	V1 = .00
H =	4.27	VBUOY =	8.91	CHP =	591.2960	DX =	3.2299	V1 = .00
H =	5.62	VBUOY =	9.94	CHP =	593.6547	DX =	2.3586	V1 = .00
H =	7.12	VBUOY =	10.97	CHP =	595.7229	DX =	2.0682	V1 = .00
=	8.71	VBUOY =	12.00	CHP =	597.3619	DX =	1.6389	V1 = .00
H =	10.42	VBUOY =	13.03	CHP =	598.7886	DX =	1.4266	V1 = .00
H =	12.25	VBUOY =	14.07	CHP =	600.0489	DX =	1.2602	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	1.0681	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 = .00

#2

H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 =	.00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 =	.00
H =	14.17	VBUOY =	15.10	CHP =	601.1170	DX =	.0000	V1 =	.00
H =	32.17	VBUOY =	23.70	CHP =	605.7871	DX =	4.6701	V1 =	.00
H =	53.50	VBUOY =	32.30	CHP =	608.2045	DX =	2.4173	V1 =	.00
H =	78.40	VBUOY =	40.90	CHP =	609.9768	DX =	1.7722	V1 =	.00
H =	106.90	VBUOY =	49.50	CHP =	611.3647	DX =	1.3878	V1 =	.00
H =	138.40	VBUOY =	58.10	CHP =	612.4169	DX =	1.0522	V1 =	.00
H =	173.50	VBUOY =	66.70	CHP =	613.3048	DX =	.8879	V1 =	.00
H =	212.50	VBUOY =	75.30	CHP =	614.0744	DX =	.7696	V1 =	.00
H =	253.60	VBUOY =	83.90	CHP =	614.6586	DX =	.5842	V1 =	.00
H =	298.90	VBUOY =	92.50	CHP =	615.1975	DX =	.5389	V1 =	.00
H =	347.20	VBUOY =	101.10	CHP =	615.6503	DX =	.4528	V1 =	.00
H =	392.20	VBUOY =	108.71	CHP =	616.0346	DX =	.3843	V1 =	3.47

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

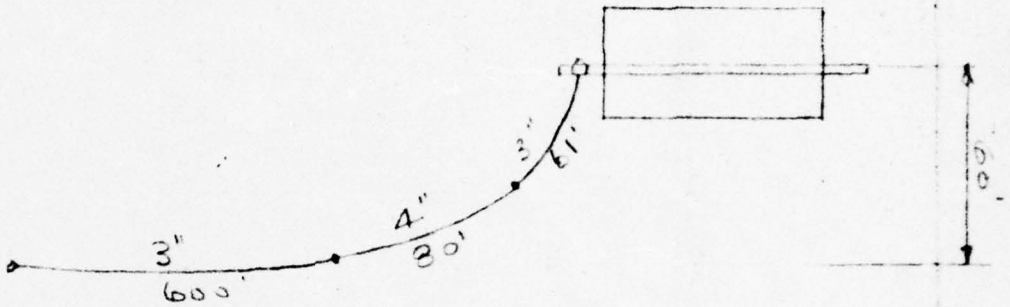
J. RAY MCDERMOTT & CO., INC.

COMPANY: USA EROL — SHEET NO: 1

SUBJECT: MONO-MOORING SYSTEM

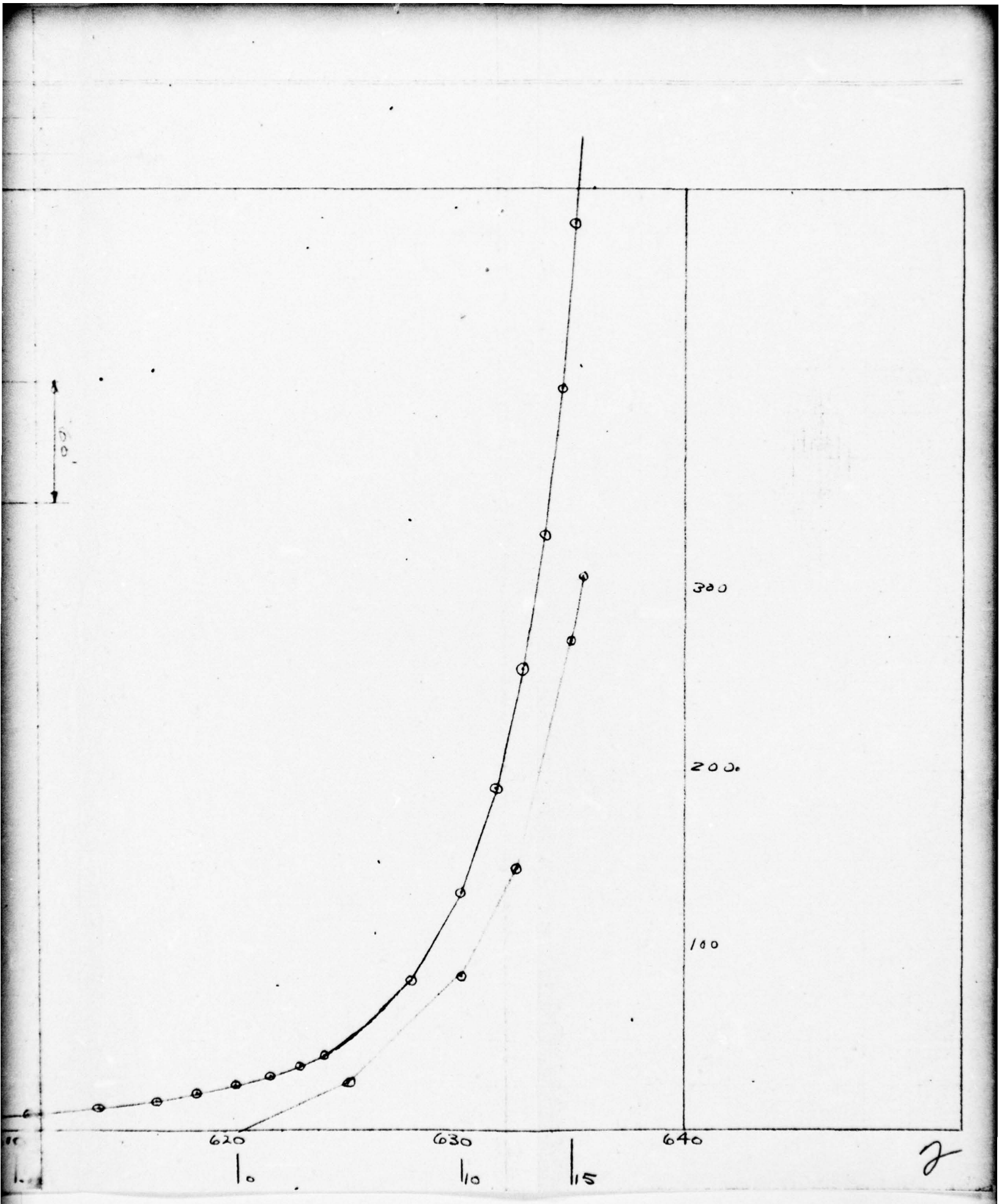
NUMBER: JOB - 56017 — COMPUTER: ANDREWS — CHECKED BY: — DATE: 2/2/65

CASE 7



200
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10

580 590 600 61


300
200
100
620
630
640
10
10
15

M=0 DELTA=3.0 YPOS=60 WW=0 W(1)=.0791 TOL=.1
W(3)=.13 W(5)=.0789 A1=61 A2=50 A3=50

#1

#7

LOAD DATA

H =	.07	VBUOY =	4.78	CHP =	584.4901	DX =	.58449011E 03	V1 =	.00
H =	1.03	VBUOY =	5.82	CHP =	599.3679	DX =	14.8778	V1 =	.00
H =	2.14	VBUOY =	6.86	CHP =	606.0394	DX =	6.7214	V1 =	.00
H =	3.43	VBUOY =	7.90	CHP =	610.6357	DX =	4.5462	V1 =	.00
H =	4.87	VBUOY =	8.94	CHP =	613.9037	DX =	3.2680	V1 =	.00
H =	6.46	VBUOY =	9.98	CHP =	616.4261	DX =	2.5224	V1 =	.00
H =	8.17	VBUOY =	11.02	CHP =	618.3616	DX =	1.9354	V1 =	.00
H =	10.06	VBUOY =	12.06	CHP =	620.0780	DX =	1.7164	V1 =	.00
H =	12.10	VBUOY =	13.10	CHP =	621.5374	DX =	1.4593	V1 =	.00
H =	14.29	VBUOY =	14.14	CHP =	622.7991	DX =	1.2617	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	1.0591	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00

#1 (7)

=	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	16.60	VBUOY =	15.18	CHP =	623.8583	DX =	.0000	V1 =	.00
H =	33.10	VBUOY =	21.68	CHP =	627.8238	DX =	3.9655	V1 =	.00
H =	52.90	VBUOY =	28.18	CHP =	630.0371	DX =	2.2133	V1 =	.00
H =	76.00	VBUOY =	34.68	CHP =	631.5910	DX =	1.5538	V1 =	.00
H =	102.70	VBUOY =	41.18	CHP =	632.8171	DX =	1.2260	V1 =	.00
H =	132.70	VBUOY =	47.68	CHP =	633.7688	DX =	.9516	V1 =	.00
H =	165.70	VBUOY =	54.18	CHP =	634.5092	DX =	.7404	V1 =	.00
H =	202.00	VBUOY =	60.68	CHP =	635.1253	DX =	.6161	V1 =	.00
H =	241.60	VBUOY =	67.18	CHP =	635.6451	DX =	.5198	V1 =	.00
H =	284.50	VBUOY =	73.68	CHP =	636.0864	DX =	.4413	V1 =	.00
H =	331.00	VBUOY =	80.18	CHP =	636.4713	DX =	.3849	V1 =	.00
H =	371.20	VBUOY =	85.67	CHP =	636.7574	DX =	.2861	V1 =	3.31

COMPUTATION SHEET
ENGINEERING DEPARTMENT
FORM 5011

J. RAY MCDERMOTT & CO., INC.

ON Y	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

PREL.

MISC. INFORTMATION ON

BUOY SIZE & BUOYANCY

ENGINEERING DEPARTMENT
COMPUTATION SHEET

NED 5036

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / EROL

SHEET NO: 2

SUBJECT: MONO - MOORING SYSTEM

JOB NUMBER: JOB 56017

COMPUTER: ANDREWS

CHECKED BY:

DATE: 3/12/65

ANCHOR LOAD = 195^K

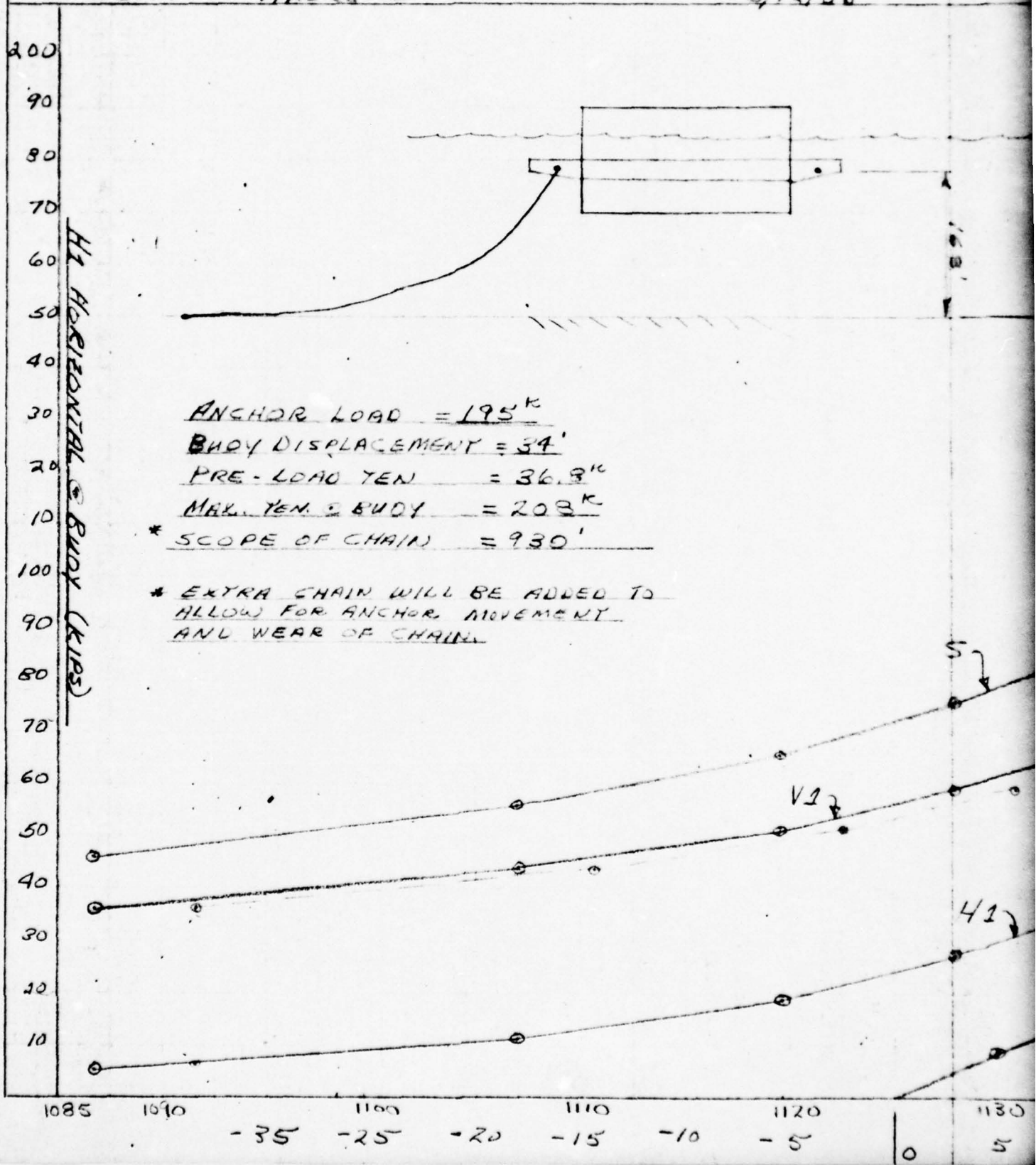
BUOY DISPLACEMENT = 34'

PRE-LOAD TEN = 36.8^K

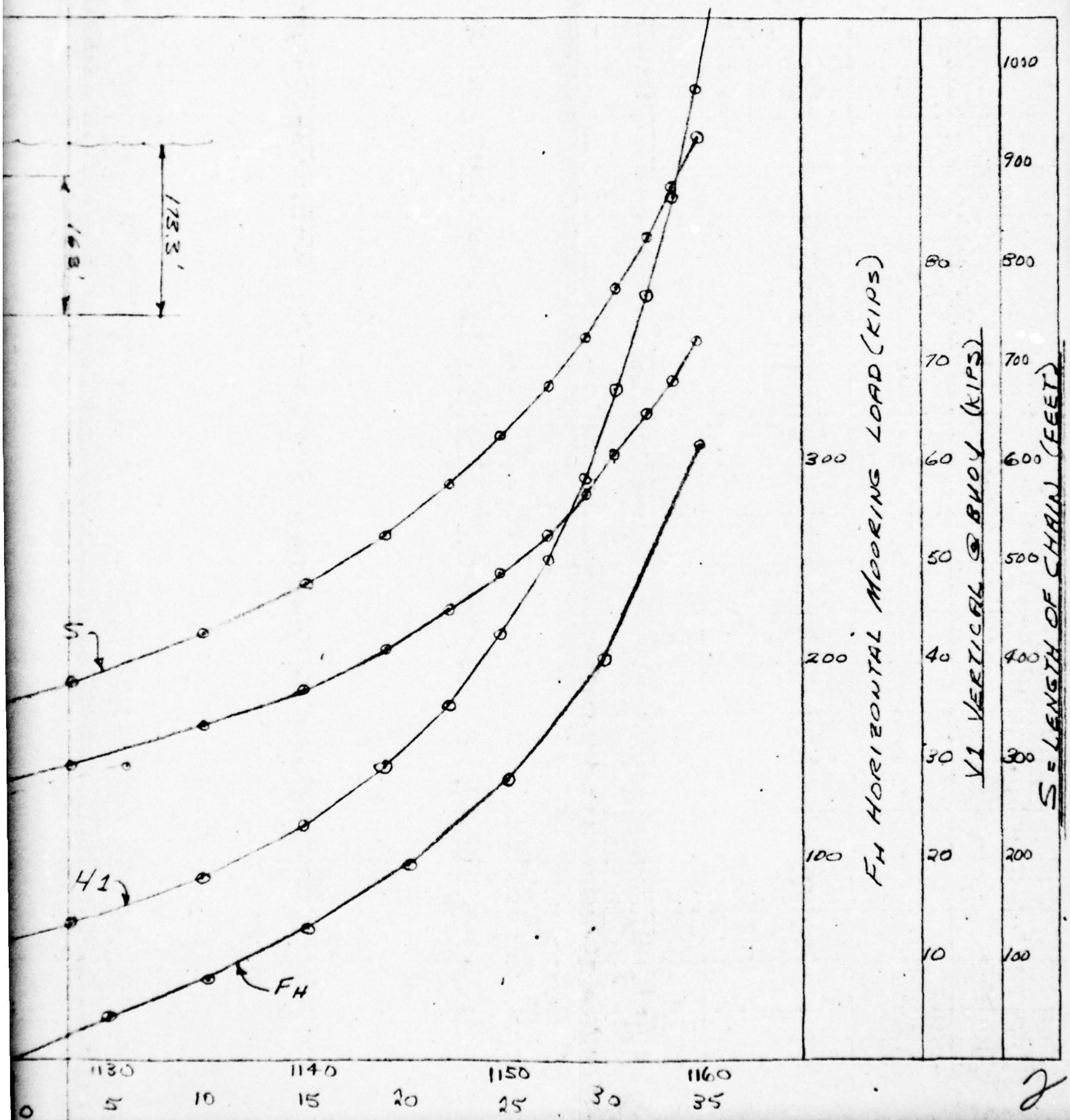
MAX. TEN. @ BUOY = 208^K

* SCOPE OF CHAIN = 930'

* EXTRA CHAIN WILL BE ADDED TO ALLOW FOR ANCHOR MOVEMENT AND WEAR OF CHAIN



CURVES FOR 150' W.D.



2

U.S. ARMY/ERDL MOORING SYSTEM 3/15/65

U=5 DECK=3.0 VPSC=1.68 NN=0 W(1)=.0189 TN=1

W(2)=.0189 W(3)=.0184 A1=180 A2=500 A3=500

LOAD DATA

H = .96	VBUOY = 14.11	CHP = 1041.5963	DX = .10415963E 04	V1 =	.
H = 5.76	VBUOY = 18.03	CHP = 1086.6447	DX = 45.0484	V1 =	.00
H = 11.70	VBUOY = 21.95	CHP = 1107.0088	DX = 20.3641	V1 =	.00
H = 18.81	VBUOY = 25.87	CHP = 1119.6075	DX = 12.5987	V1 =	.00
H = 27.09	VBUOY = 29.79	CHP = 1128.3348	DX = 8.7273	V1 =	.00
H = 36.54	VBUOY = 33.71	CHP = 1134.7883	DX = 6.4535	V1 =	.00
H = 47.16	VBUOY = 37.63	CHP = 1139.7739	DX = 4.9856	V1 =	.00
H = 58.92	VBUOY = 41.55	CHP = 1143.7195	DX = 3.9456	V1 =	.00
H = 71.88	VBUOY = 45.47	CHP = 1146.9765	DX = 3.2570	V1 =	.00
H = 85.98	VBUOY = 49.39	CHP = 1149.6710	DX = 2.6945	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = 2.3005	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00
H = 101.28	VBUOY = 53.31	CHP = 1151.9715	DX = .0000	V1 =	.00

H =	101.28	VBUOY =	53.31	CHP =	1151.9715	DX =	.0000	V1 =	.00
H =	101.28	VBUOY =	53.31	CHP =	1151.9715	DX =	.0000	V1 =	.00
H =	101.28	VBUOY =	53.31	CHP =	1151.9715	DX =	.0000	V1 =	.00
H =	117.78	VBUOY =	57.23	CHP =	1153.9563	DX =	1.9848	V1 =	.00
H =	135.30	VBUOY =	61.15	CHP =	1155.6256	DX =	1.6693	V1 =	.00
H =	154.20	VBUOY =	65.07	CHP =	1157.1540	DX =	1.5284	V1 =	.00
H =	174.00	VBUOY =	68.99	CHP =	1158.4359	DX =	1.2819	V1 =	.00
H =	195.30	VBUOY =	72.91	CHP =	1159.6493	DX =	1.2134	V1 =	.00
H =	217.50	VBUOY =	76.83	CHP =	1160.6851	DX =	1.0358	V1 =	.00
H =	240.90	VBUOY =	80.75	CHP =	1161.6257	DX =	.9406	V1 =	.00
H =	265.50	VBUOY =	84.67	CHP =	1162.4828	DX =	.8571	V1 =	.00
H =	291.30	VBUOY =	88.59	CHP =	1163.2684	DX =	.7856	V1 =	.00
H =	318.30	VBUOY =	92.51	CHP =	1163.9878	DX =	.7194	V1 =	.00

H=0 DELTA=3 VPCC=164 WW=0 W(1)=.0799 TOL=.1
W(3)=.0784 W(5)=.0787 A1=180 A2=500 A3=560

LOAD DATA

H = 1.32 VBUOY = 14.11 CHP = 1051.5999 DX = .10515999E 04 V1 = .00

H = 6.21 VBUOY = 18.03 CHP = 1091.5901 DX = 39.9902 V1 = .00

H = 12.30 VBUOY = 21.95 CHP = 1110.6993 DX = 19.1092 V1 = .00

H = 19.59 VBUOY = 25.87 CHP = 1122.6092 DX = 11.9099 V1 = .00

H = 28.08 VBUOY = 29.79 CHP = 1130.8836 DX = 8.2744 V1 = .00

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

MCD 14503

COMPANY: U.S. ARMY / ERDL — SHEET NO. 3

SUBJECT: MOMO - MOORING SYSTEM

DRAWING NUMBER: JOB 56017 — COMPUTER: ANDREWS — CHECKED BY: — DATE: 3/22/65

CONSIDED TWO UPPER COMPARTMENTS FILLED WITH FOAM.

MODED VOL. OF FOAM $= \frac{650(7.5)}{2} = 2,490$ c.f.

WT. OF FOAM $= 2,490(.0025) = 6.1^K$

TOTAL WT $\approx 423.6 + 6.1 = 429.7^K$

230
490
6670

TOTAL VOL. OF FOAM $\approx 4,230 + 2440 = 6,670$ cf

BUOYANT FORCE $\approx 6,670(.064) = 427.0^K$

$429.7 \approx 427$ BUOYANCY CAN BE FULFILLED BY FILLING BOTTOM COMPARTMENTS & TWO OF TOP COMPARTMENTS WITH FOAM.

19
2
16

DETERMINE MAX. HEEL $\measuredangle$ OF BUOY FOR 150' W.D.

R1 = 15.	FH = 300.	FV = 0.
R2 = 17.	H1 = 195.	V1 = 72.
R3 = 13.	H2 = 85.	V2 = 43.9
145 W = 200.	H3 = 5.	V3 = 20.0
120 C = 6.5	H4 = 7.	V4 = 21.0
75 D = 14.		V5 = 29.0
11.2 E = 16.		
BK = 6.		

FORMAT (F10.4)

MAX. HEEL $\measuredangle$ = 6.15° (FROM COMPUTER)

CHECK BUOY SIZE FOR 60' W.D.

MSL = 62' TIDE = 2.0' MAX. WAVE HT. = 20' BUOY WT. = 20K

VERTICAL REACTION FROM PRELOAD ≈ 80K

FREE FLOATING DRAFT	=	4.3'
PRE LOAD DRAFT = $\frac{80}{41.6}$	=	1.9
MOORING LOAD DRAFT	=	2.0
TOTAL	=	8.7 USE 9'

VERTICAL PROJECTION OF CATENARY = 60+10+13.3 - 2.5 = 80.8'

MIN. VERTICAL PROJECTION OF CATENARY = 60 - 10 - 2.5 = 47.5'

COMPUTER INPUT FOR 80.8' VERTICAL PROJECTION

H = 0.	W(3) = .0784	
DELTA = 3.	W(5) = .0784	FORMAT (6F8.2)
VPCC = 80.8	A1 = 90.	
VW = 0.	A2 = 300.	
V(1) = .0784	A3 = 400.	
TOL = .1		

COMPUTER INPUT FOR 47.5' VERTICAL PROJECTION

H = 0.	W(3) = .0784	
DELTA = 3.0	W(5) = .0784	
VPCC = 47.5	A1 = 90.	
VW = 0.	A2 = 300.	
V(1) = .0784	A3 = 400.	
TOL = .1		

3/23/65

U.S. ARMY / EROL MONO-MOORING SYSTEM

COMPUTER RESULTS (SEE PG. 3 DATED 3/22/65 FOR INPUT)

LOAD DATA

B = 486.8000 DEG = 6.146639

J. RAY McDERMOTT & CO., INC.

ENGINEERS AND GENERAL CONTRACTORS

NEW ORLEANS, LOUISIANA

U.S. ARMY/EROL MONO-MOORING SYSTEM 3/23/65

COMPUTER RESULTS 1375 VPCC (SEE RESULTS OF 168' FOR INPUT)

LOAD DATA

H = 4.17	VBUOY = 14.11	CHP = 1102.8354	DX = .11028354E 04	V1 =	
H = 10.14	VBUOY = 18.03	CHP = 1123.2925	DX = 20.4571	V1 =	.00
H = 17.58	VBUOY = 21.95	CHP = 1134.7234	DX = 11.4309	V1 =	.00
H = 26.46	VBUOY = 25.87	CHP = 1142.1307	DX = 7.4073	V1 =	.00
H = 36.78	VBUOY = 29.79	CHP = 1147.3750	DX = 5.2443	V1 =	.00
H = 48.60	VBUOY = 33.71	CHP = 1151.3634	DX = 3.9884	V1 =	.00
H = 61.83	VBUOY = 37.63	CHP = 1154.4319	DX = 3.0685	V1 =	.00
H = 76.56	VBUOY = 41.55	CHP = 1156.9241	DX = 2.4922	V1 =	.00
H = 92.76	VBUOY = 45.47	CHP = 1158.9729	DX = 2.0488	V1 =	.00
H = 110.46	VBUOY = 49.39	CHP = 1160.6968	DX = 1.7239	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = 1.3993	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00
H = 129.39	VBUOY = 53.31	CHP = 1162.0961	DX = .0000	V1 =	.00

H =	129.39	VBUOY =	53.31	CHP =	1162.0961	DX =	.0000	V1 =	.00
H =	129.39	VBUOY =	53.31	CHP =	1162.0961	DX =	.0000	V1 =	.00
H =	129.39	VBUOY =	53.31	CHP =	1162.0961	DX =	.0000	V1 =	.00
H =	150.09	VBUOY =	57.23	CHP =	1163.3753	DX =	1.2792	V1 =	.00
H =	171.99	VBUOY =	61.15	CHP =	1164.4354	DX =	1.0601	V1 =	.00
H =	195.39	VBUOY =	65.07	CHP =	1165.3757	DX =	.9403	V1 =	.00
H =	220.29	VBUOY =	68.99	CHP =	1166.2133	DX =	.8376	V1 =	.00
H =	246.69	VBUOY =	72.91	CHP =	1166.9652	DX =	.7519	V1 =	.00

U.S. ARMY/EROL MOOR-MOORING SYSTEM 3/23/65

COMPUTER RESULTS 50.8' VPCC (SEE PG. 3 DATED 3/22/65)

LOAD DATA

T	X	Y
.70963844E 01	.28249685E 02	.90515107E 02
.75600000E 00	.00000000E-50	.96428571E 01
.75600000E 00	.00000000E-50	.96428571E 01
.75600000E 00	.00000000E-50	.96428571E 01
.75600000E 00	.00000000E-50	.96428571E 01
.75600000E 00	.00000000E-50	.96428571E 01

H = .75 VBUOY = 7.05 CHP = 728.2496 DX = .72824969E 03 V1 = .

H = 3.81 VBUOY = 9.40 CHP = 749.5474 DX = 21.2977 V1 = .00

H = 7.74 VBUOY = 11.75 CHP = 759.0372 DX = 9.4898 V1 = .00

H = 12.54 VBUOY = 14.11 CHP = 764.7351 DX = 5.6978 V1 = .00

22.99 7707

H = 18.24 VBUOY = 16.46 CHP = 768.6508 DX = 3.9157 V1 = .00

H = 24.75 VBUCY = 18.81 CHP = 771.4065 DX = 2.7556 V1 = .00

H = 32.16 VBUOY = 21.16 CHP = 773.5499 DX = 2.1434 V1 = .00

H = 40.44 VBUOY = 23.52 CHP = 775.2425 DX = 1.6926 V1 = .00

H = 49.62 VBUOY = 25.87 CHP = 776.6293 DX = 1.3867 V1 = .00

H = 59.64 VBUOY = 28.22 CHP = 777.7621 DX = 1.1327 V1 = .00

H = 70.53 VBUOY = 30.57 CHP = 778.7164 DX = .9543 V1 = .00

H = 70.53 VBUOY = 30.57 CHP = 778.7164 DX = .0000 V1 = .00

H = 70.53 VBUOY = 30.57 CHP = 778.7164 DX = .0000 V1 = .00

H = 70.53 VBUOY = 30.57 CHP = 778.7164 DX = .0000 V1 = .00

H = 70.53 VBUOY = 30.57 CHP = 778.7164 DX = .0000 V1 = .00

H = 70.53 VBUOY = 30.57 CHP = 778.7164 DX = .0000 V1 = .00

H =	70.53	VBUOY =	30.57	CHP =	778.7164	DX =	.0000	V1 =	.00
H =	70.53	VBUOY =	30.57	CHP =	778.7164	DX =	.0000	V1 =	.00
H =	70.53	VBUOY =	30.57	CHP =	778.7164	DX =	.0000	V1 =	.00
H =	70.53	VBUOY =	30.57	CHP =	778.7164	DX =	.0000	V1 =	.00
H =	70.53	VBUOY =	30.57	CHP =	778.7164	DX =	.0000	V1 =	.00
H =	86.43	VBUOY =	33.71	CHP =	779.7831	DX =	1.0667	V1 =	.00
H =	104.13	VBUOY =	36.84	CHP =	780.7063	DX =	.9232	V1 =	.00
H =	123.03	VBUOY =	39.98	CHP =	781.4244	DX =	.7180	V1 =	.00
H =	143.43	VBUOY =	43.11	CHP =	782.0356	DX =	.6112	V1 =	.00
H =	165.63	VBUOY =	46.25	CHP =	782.5885	DX =	.5529	V1 =	.00
H =	189.33	VBUOY =	49.39	CHP =	783.0643	DX =	.4758	V1 =	.00
H =	214.53	VBUOY =	52.52	CHP =	783.4799	DX =	.4156	V1 =	.00
H =	241.53	VBUOY =	55.66	CHP =	783.8596	DX =	.3797	V1 =	.00
H =	269.43	VBUOY =	58.80	CHP =	784.1708	DX =	.3112	V1 =	.00

J. RAY MCDERMOTT & CO., INC.

ENGINEERS AND GENERAL CONTRACTORS

NEW ORLEANS, LOUISIANA

U.S. ARMY/EROL MOOR-MOORING SYSTEM 3/23/65

VPCC = 57.5' (SEE PG. 4 DATED 3/23/65)

LOAD DATA

H =	3.27	VBUOY =	7.05	CHP =	763.0666	DX =	.76306667E 03	V1 =	
H =	7.56	VBUOY =	9.40	CHP =	770.6827	DX =	7.6161	V1 =	.00
H =	13.08	VBUOY =	11.75	CHP =	774.8349	DX =	4.1521	V1 =	.00
H =	19.80	VBUOY =	14.11	CHP =	777.4569	DX =	2.6220	V1 =	.00
H =	27.78	VBUOY =	16.46	CHP =	779.3206	DX =	1.8637	V1 =	.00
H =	37.08	VBUOY =	18.81	CHP =	780.7375	DX =	1.4169	V1 =	.00
H =	47.37	VBUOY =	21.16	CHP =	781.7367	DX =	.9992	V1 =	.00
H =	59.07	VBUOY =	23.52	CHP =	782.5901	DX =	.8534	V1 =	.00
H =	71.97	VBUOY =	25.87	CHP =	783.2764	DX =	.6862	V1 =	.00
H =	86.07	VBUOY =	28.22	CHP =	783.8414	DX =	.5650	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.4745	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00

H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	101.37	VBUOY =	30.57	CHP =	784.3159	DX =	.0000	V1 =	.00
H =	123.87	VBUOY =	33.71	CHP =	784.8604	DX =	.5445	V1 =	.00
H =	148.17	VBUOY =	36.84	CHP =	785.2845	DX =	.4241	V1 =	.00
H =	175.17	VBUOY =	39.98	CHP =	785.6715	DX =	.3869	V1 =	.00
H =	203.67	VBUOY =	43.11	CHP =	785.9711	DX =	.2996	V1 =	.00
H =	234.87	VBUOY =	46.25	CHP =	786.2499	DX =	.2788	V1 =	.00
H =	267.87	VBUOY =	49.39	CHP =	786.4825	DX =	.2326	V1 =	.00

U.S. ARMY/EROL MONO-MOORING SYSTEM 3/23/65

COMPUTER RESULTS 475' VPCC (SEE PG. 3 DATED 3/22/65)

LOAD DATA

H =	4.83	VBUOY =	7.05	CHP =	772.2565	DX =	.77225654E 03	V1 =			
H =	10.02	VBUOY =	9.40	CHP =	777.0400	DX =	4.7835	V1 =	.00		
H =	16.68	VBUOY =	11.75	CHP =	779.7348	DX =	2.6948	V1 =	.00		
H =	24.84	VBUOY =	14.11	CHP =	781.5014	DX =	1.7666	V1 =	.00		
H =	34.47	VBUOY =	16.46	CHP =	782.7385	DX =	1.2370	V1 =	.00		
H =	45.57	VBUOY =	18.81	CHP =	783.6559	DX =	.9174	V1 =	.00		
H =	58.17	VBUOY =	21.16	CHP =	784.3701	DX =	.7142	V1 =	.00		
H =	72.27	VBUOY =	23.52	CHP =	784.9415	DX =	.5714	V1 =	.00		
H =	87.87	VBUOY =	25.87	CHP =	785.4086	DX =	.4670	V1 =	.00		
H =	104.97	VBUOY =	28.22	CHP =	785.7973	DX =	.3887	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.3281	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00		

H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00
H =	123.57	VBUOY =	30.57	CHP =	786.1255	DX =	.0000	V1 =	.00
H =	150.57	VBUOY =	33.71	CHP =	786.4853	DX =	.3598	V1 =	.00
H =	180.57	VBUOY =	36.84	CHP =	786.7967	DX =	.3113	V1 =	.00
H =	212.37	VBUOY =	39.98	CHP =	787.0338	DX =	.2370	V1 =	.00
H =	247.47	VBUOY =	43.11	CHP =	787.2531	DX =	.2193	V1 =	.00
H =	284.97	VBUOY =	46.25	CHP =	787.4382	DX =	.1851	V1 =	.00

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

MCD 5035

COMPANY: U. S. ARMY / EROL | SHEET NO. 1

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 3/12/65

SIZE BUOY FOR MAXIMUM W.D.

MSL = 150' TIDE = 20' MAX. WAVE HT = 20'

WT. OF BUOY ≈ 100T

VERTICAL REACTION FROM PRELOAD ≈ 200K

TRY 30' ϕ BUOY WITH 8½' ϕ WELL

BUOYANCY/FT. = $(.785(30)^2 - .785(8.5)^2)64$

= 41.6 K/i

DRAFT FLOATING FREE = $\frac{200}{41.6}$ = 4.8'

DRAFT UNDER PRELOAD = $\frac{200}{41.6}$ = 4.8'

ADDITIONAL DRAFT WITH MOORING LOAD APPLIED = 2'

TOTAL DRAFT ≈ 11.6' USE 12'

DISTANCE FROM BOTTOM OF BUOY TO CHAIN ATTACHMENT = 6

VERTICAL PROJECTION OF CATENARY ≈ 150 + 10 + 13.3 - 5 = 168

USE 160

12
6.0
5.6

73.3'
5.5
167.8

ACTUAL DRAFT UNDER PRE-LOAD

TOTAL V = 28.8(8) = 230 K

FIND VERTICAL UNDER MOORING LOAD

V = 28.8(2) + 72.9 + 2(50) + 20 + 2(20.5) = 291.5 K

TOTAL DRAFT = $\frac{291.5}{41.6}$ = 11.8' ≈ 12' O.K.

DETERMINE TOTAL VERTICAL ON BUOY WHEN DECK IS 2" OUT OF WATER.

ASSUME DEPTH FROM TOP OF DECK TO BOTTOM OF BUOY = 16'

VERTICAL PROJECTION OF CATENARY = 160 + 10 + 13.3 - 9.5 = 163.8'

USE 164'

SINCE CHP MUST REMAIN, PICK OFF VBUOY CORRESPONDING TO CHP = 112.5

V1 = 26.6 K/LEG TOTAL V1 = 26.6(8) = 213 K

DETERMINE TOTAL WT.

VOLUME OF FOAM ≈ 650(6.5) = 4,230 cf

WT. OF FOAM = 4,230 (.0025) = 10.6 K

TOTAL WT = 200 + 213 + 10.6 = 423.6 K

DRAFT = $\frac{423.6}{41.6}$ = 10.2' > 6.5' NO GOOD

TOTAL WT. WHICH FOAM CAN SUPPORT

W = 4,230(.064) = 270 K 270 - 10.6 - 200 = 59.4 K

59.4 K = WT. OF CHAIN.

USE 12'

EXT = 6.5'

-.05 = 167.8'

USE 168'

J. RAY McDERMOTT & CO., INC.
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 1

COMPANY U.S. ARMY/ERDL

SUBJECT MONO-MOORING SYSTEM

JOB DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY DATE 6-17 1965

CHECK BUOY FOR MAX. W.D.

MSL = 150' TIDE = 20 MAX. WAVE HT. = 20

WT. OF BUOY = 103 T VERTICAL REACTION = 230 K

206
230
3
219

EQUIPMENT, PIPING & FUEL --- 63 K

TOTAL VERTICAL UNDER. PRELOAD = 206 + 230 + 63 = 499 K

BUOYANCY FROM SKIRT = $[.785(40)^2 - .785(30)^2](1)(64) = 35^K$

NET WT. = 499 - 35 = 465 K

DRAFT = $\frac{465}{41.6} = 11.2'$ USE 12'

VERTICAL CHAIN LOAD UNDER MOORING LOAD
Vc = 291.5 K

TOTAL V = 291.5 + 206 + 63 + -35 = 525.5 K

MAX. DRAFT = $\frac{525.5}{41.6} = 12.6^K$

FREEBOARD TO TOP OF DECK = 16.5 - 12.6 = 3.9'

ADD 6" TO DEPTH OF BUOY TO ALLOW FOR ANY ADDED WT.

SECTION II

BUOY DESIGN

COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

CHECK OF POSITIVE FREEBOARD FOR VARIOUS WATER DEPTHS.

ALSO

CALCULATIONS ON FREEBOARD TO TOP OF BUOY HULL FOR VARIOUS WATER DEPTHS. (NORMAL W.O. & NORMAL PRE-LOAD)

$\frac{384}{.064} = 4750$

J. RAY McDERMOTT & CO., INC.

ENGINEERING DEPARTMENT - COMPUTATION SHEET SHEET NO. 1

COMPANY U. S. ARMY / ERDL

SUBJECT MONO - MOORING SYSTEM

DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE ~~6-30~~ 10/1/65 19 ~~65~~

CHECK POSITIVE FREEBOARD FOR VARIOUS W.D.

50 FOOT WATER DEPTH (TWO COMPARTMENTS FLOODED)

TOTAL BUOYANCY ≈ 20.8(8) = 166
31.2(7) = 218
SKIRT = 40.2
≈ 424.2^k

VOLUME OF FOAM ≈ $\frac{384}{.064}$ = 6,000 cf WT = 4.0(6.0) = 24.0^k

TOTAL WT. ≈ 290 + 56.4 + 24 = 310.4 < 424.2

∴ BUOY WILL HAVE POSITIVE FBD.

60 FOOT WATER DEPTH (TWO COMPTS. FLOODED)

TOTAL BUOYANCY ≈ 31.2(7) = 218^k
20.8(8) = 166
SKIRT = 40.2
≈ 434.2^k

VOLUME OF FOAM ≈ $\frac{384}{.064}$ = 6,000 cf WT = 6(2.5) = 15^k

TOTAL WT. = 290 + 67.2 + 24 = 381.2^k

428 > 381.2 O.K.

POSITIVE FBD. CALCULATIONS

77

70 FOOT WATER DEPTH (TWO COMPTS. FLOODED)

TOTAL BUOYANCY ≈ 434.2^K TOTAL WT = 290+80+24 = 394^K

423 > 394 O.K.

80 FOOT WATER DEPTH (TWO COMPTS. FLOODED)

TOTAL BUOYANCY ≈ 429^K TOTAL WT ≈ 290+100+24 = 414^K

429 > 414 O.K.

90 FOOT WATER DEPTH (TWO COMPTS. FLOODED)

B = 429^K WT. = 290+110+24 = 424^K

429 > 424 O.K.

100 FOOT WATER DEPTH

B = 2972^K (SEE 110' W.O.)

TOTAL WT. = 290+125+23.6 = 443.6

2972 > 443.6 O.K.

2

J. RAY McDERMOTT & CO., INC.
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 2

COMPANY U.S. ARMY/ERDL
SUBJECT MONO-MOORING SYSTEM
JOB ~~DRAWING~~ NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6/30 1965

110 FOOT WATER DEPTH

TOTAL BUOYANCY ≈ 41.6(7) = 291
20.8(8) = 166
SKIRT = 40.2
497.2

VOLUME OF FOAM ≈ $\frac{457}{.064}$ = 7,150 c.f. WT = 7.15(4.0) = 28.6^k

TOTAL WT. = 290 + 144 + 28.6 = 462.6^k

497.2 > 462.6 O.K.

120 FOOT WATER DEPTH

B = 497.2^k WT. = 290 + 159 + 28.6 = 477.6^k

497.2 > 477.6 O.K.

130 FOOT WATER DEPTH

B = 491^k WT. = 290 + 173 + 28.6 = 491.6^k

497.2 > 491.6^k O.K.

140 FOOT WATER DEPTH

B = 497.2^k WT. = 290 + 184 + 28.6 = 502.6^k

502.6^k > 497.2

502.6 − 16 = 486.6

497.2 > 486.6 O.K.

APPROX. DECREASE IN VERTICAL DUE TO DEPOSITING CHAIN ON BOTTOM SEE PG. 1 OF ANCHOR SYSTEM CALCULATIONS DATED 3/12/61 DECREASE ≈ 16^k

3177

POSITIVE FBD CALCULATIONS

150 FOOT WATER DEPTH

B = 497.2^K WT = 270 + 187 + 23.6 = 502.6^K

502.6 > 497.2

ESTIMATE REDUCTION IN VERTICAL CHAIN REACTION WITH INCREASE IN DRAFT.

SEE SHT. 1 OF ANCHOR SYSTEM CALCULATIONS DATED: 3/14/65

APPROX. REDUCTION = $\frac{5.25}{4}(2) = 2.62^K$/LEG = 8(2.62) = 21^K

NOTE: BODY CONTAINS APPROX 105^K OF STRUCTURAL STEEL WITH A SUBMERGED WT. ≅ 91^K WHICH HAS BEEN FIGURED IN THE BUOYANCY OF 497.2^K.

REDUCTION IN TOTAL WT. = 105 − 91 + 21 = 35.0^K

TOTAL IN WATER WT. = 502.6 − 35.0 = 467.6

497.2 > 467.6^K O.K.

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

M.C.D. 5035

COMPANY: U.S. ARMY/EROL | SHEET NO. 1

SUBJECT: MOMO - MOORING SYSTEM

JOB NUMBER: 56011 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 10/1/65

WT. OF BUOY PLUS EQPT. = 290^K

WT. OF FOAM

TWO COMPTS. FLOODED = 6,000(9) = 27^K

NO " " = 7,150(9) = 25.6^K

DETERMINE BUOYANCY OF STEEL

$B = [.785(90.17)^2 - (80)^2(.785)]\frac{1.33}{12}(69) = 37^K$

BUOYANCY OF RUBBER BUMBER

$B = [.785(92)^2 - (90.17)^2(.785)]\frac{10}{12}(69) = 6.2^K$

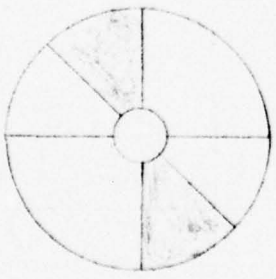
50 FOOT WATER DEPTH

VERTICAL FROM PRELOAD = 7.05(8) = 56.4^K

TOTAL V = 290 + 28.6 - 37 - 6.2 + 56.4

DRAFT = $\frac{331.8}{41.6}$ = 8.04'

CONSIDER TWO COMPTS. FLOODED



$F_D = 41.6(.75) = 31.2$

31.2(7) = 218^K

331.8 − 218 = 116

$D' = \frac{116}{41.6} = 2.78'$

TOTAL D = 7 + 2.78 = 9.78

FBD = 15 − 9.78 = 5.22'

50 FOOT WATER

$V_{PL} = 8.4(8) = 67$

TOTAL V = 290 + 6

DRAFT = $\frac{395.2}{41.6}$ =

FBD. = 15 − 8.3 =

CONSIDER TWO C

$F_D = 31.2$ 395.

$D' = \frac{132.9}{41.6} = 3.1'$

DRAFT = 10.1' F

70 FOOT WATER

$V_{PL} = 10(9) = 31^K$

TOTAL V = 290 + 9

DRAFT = $\frac{355.9}{41.6}$ =

TWO COMPTS.

$F_D = 31.2$ 35.8

$D' = \frac{135.8}{41.6} = 3.26'$

DRAFT = 10.26'

CHECK DRAFT OF BUOY FOR VARIOUS WATER DEPTHS

...T WATER DEPTH

...(8) = 67.2^k

... = 290 + 67.2 + 28.6 - 40.2 = 345.6

$\frac{345.6}{41.6}$ = 8.30

...5 - 8.3 = 6.7'

... TWO COMPTS. FLOODED

345.6 - 218 = 127.6

...6 = 3.1'

...10.1' FBD. = 4.9'

... WATER DEPTH

...) = 80^k

... = 290 + 80 + 28.6 - 40.2 = 358.4

$\frac{358.4}{41.6}$ = 8.6' FBD = 6.4'

...MPTS. FLOODED

... 358.4 - 218 - 4.6 = 135.8

... = 3.26'

...0.26' FBD. = 4.74'

80 FOOT WATER DEPTH

V_{PL} = 12.5(8) = 100^k

TOTAL V = 290 + 100 + 28.6 - 40.2 = 378.4

DRAFT = $\frac{378.4}{41.6}$ = 9.1' FBD. = 5.9'

TWO COMPTS. FLOODED

378.4 - 218 - 4.6 = 155.8

D' = $\frac{155.8}{41.6}$ = 3.75'

FBD. = 15 - 10.75 = 4.25'

90 FOOT WATER DEPTH

V_{PL} = 13.8(8) = 110^k

TOTAL V = 290 + 110 + 28.6 - 40.2 = 388.4

DRAFT = $\frac{388.4}{41.6}$ = 9.34'

FBD. = 15 - 9.34 = 5.66'

CONSIDER TWO COMPTS. FLOODED

388.4 - 218 - 4.6 = 165.8

D' = $\frac{165.8}{41.6}$ = 3.99

FBD. = 15 - 10.99 = 4.01'

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO 2
SUBJECT			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

100 FOOT WATER DEPTH

$V_{PL} = 15.7(8) = \underline{125^k}$

TOTAL $V = 290 + 125 + 28.6 - 40.2 = \underline{403.4}$

DRAFT $= \frac{403.4}{41.6} = \underline{9.70}$ FBD. $= \underline{5.3'}$

110 FOOT WATER DEPTH

$V_{PL} = 18(8) = \underline{144^k}$

TOTAL $V = 290 + 144 + 28.6 - 40.2 = \underline{422.4}$

DRAFT $= \frac{422.4}{41.6} = \underline{10.15'}$ FBD. $= \underline{4.85'}$

120 FOOT WATER DEPTH

$V_{PL} = 19.8(8) = \underline{159^k}$

TOTAL $V = 290 + 159 + 28.6 - 40.2 = \underline{437.4}$

DRAFT $= \frac{437.4}{41.6} = \underline{10.51'}$ FBD. $= \underline{4.49'}$

130 FOOT WATER DEPTH

$V_{PL} = 21.6(8) = \underline{173^k}$

TOTAL $V = 290 + 173 + 28.6 - 40.2 = \underline{451.4}$

DRAFT $= \frac{451.4}{41.6} = \underline{10.85'}$

FBD. $= \underline{4.15'}$

140 FOOT WATE

$V_{PL} = 23.8(8) = \underline{190^k}$

DRAFT $= \frac{462.4}{41.6} = \underline{1}$

150 FOOT WATER

$V_{PL} = 25.4(8) = \underline{203}$

DRAFT $= \frac{462.7}{41.6} = \underline{11.1}$

INC.

SHEET NO. 2

DATE

140 FOOT WATER DEPTH

$V_{DL} = 23.8(8) = 190^{k}$ TOTAL $V = 290 + 184 + 23.6 - 40.2 = 462.7$

DRAFT $= \frac{462.7}{41.6} = 11.12'$ FBD. $= 3.88'$

150 FOOT WATER DEPTH

$V_{DL} = 25.4(8) = 203^{k}$ TOTAL $V = 290 + 184 + 28.6 - 40.2 = 462.7$

DRAFT $= \frac{462.7}{41.6} = 11.12'$ FBD. $= 3.35$

COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
WING NO.	COMPUTER	

VOID DRAFT

CALCULATIONS

J. RAY McDERMOTT & CO., INC.
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 1

COMPANY U. S. ARMY / ERDL
SUBJECT MONO-MOORING SYSTEM
JOB NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6-28 1965

CHECK DRAFT OF BUOY FOR VARIOUS WATER DEPTHS

WEIGHT OF BUOY ≈ 206^k EQUIPMENT, PIPING & FUEL -- 65^k

FREE FLOATING DRAFT $= \frac{271}{41.6} = 6.5'$

10/1/65
WT OF BUOY INCREASE FROM 271^k TO 290^k; INCREASE IN DRAFT $= \frac{19}{41.6} = \boxed{.45'}$

DETERMINE BUOYANCY FROM SKIRT

$B = [.785(40.17)^2 - .785(30)^2]\frac{11.38}{12}(64) = 34^k$

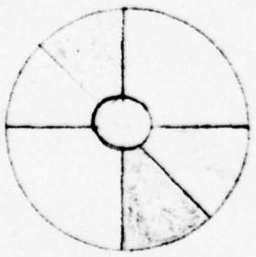
VERTICAL FROM PRE-LOAD $V_{PL} = 7.05(8) = 56.4^k$

TOTAL $V = 271 + 56.4 - 34 = 293.4^k$

DRAFT $= \frac{293.4}{41.6} = 7.05'$

CONSIDER TWO COMPARTMENTS FLOODED

WT. OF FOAM ≈ 15^k
SEE PG. 1 OF CALS ENTITLED "POSITIVE FBD CALS."



$F_D = 41.6(.75) = 31.2^k/_1$

$31.2(7) = 218^k$

$293.4 - 218 + 15 = 90.4$

DRAFT $= \frac{15}{41.6} = .36$

$D' = \frac{90.4}{41.6} = 2.17'$

TOTAL DRAFT $= 7 + 2.17 = 9.17'$

FBD. $= 15 - 9.17 = 5.83'$

CONSIDER FOUR COMPARTMENTS FLOODED

$F_D = 41.6(.5) = 20.8^k/_1$ $20.8(7) = 145.6^k$

$293.4 - 145.6 = 147.8^k$ $D' = \frac{147.8}{41.6} = 3.55'$

TOTAL DRAFT $= 7 + 3.55 = 10.55'$

FREEBOARD $= 15 - 10.55 = 4.45'$

$\frac{96}{-21}$
317

60 FOOT WATER DEPTH

$V_{PL} = 5.4(8) = \underline{67.2^K}$ TOTAL V = 271. + 67.2 - 37 = $\underline{307.2}$

DRAFT = $\frac{307.2}{41.6} = \underline{7.32'}$

CONSIDER TWO COMPTS. FLOODED

$F_D = 41.6(.75) = \underline{31.2^K}$ 307.2 - 218 = $\underline{86.2}$ $D' = \frac{86.2}{41.6} = \underline{2.09'}$

DRAFT = 7 + 2.09 = $\underline{9.09'}$ FBD = 15 - 9.09 = $\underline{5.92'}$ - .36 = $\underline{5.56'}$

CONSIDER FOUR COMPTS. FLOODED

$F_D = \underline{20.8^K}$ 307.2 - 145.6 = $\underline{158.6^K}$ $D' = \frac{158.6}{41.6} = \underline{3.82'}$

DRAFT = 7 + 3.82 = $\underline{10.82'}$ FBD = 15 - 10.82 = $\underline{4.18'}$

70 FOOT WATER DEPTH

$V_{PL} = 10(8) = \underline{80^K}$ TOTAL V = 271 + 80 - 37 = $\underline{317^K}$

DRAFT = $\frac{317}{41.6} = \underline{7.6'}$

CONSIDER TWO COMPTS. FLOODED

$F_D = 31.2^K$ 317 - 218 = $\underline{99^K}$ $D' = \frac{99}{41.6} = \underline{2.38'}$

DRAFT = 7 + 2.38 = $\underline{9.38'}$ FBD = 15 - 9.38 = $\underline{5.62'}$ - .36 = $\underline{5.26'}$

CONSIDER FOUR COMPTS. FLOODED

$F_D = 20.8^K$ 317 - 145.6 = $\underline{171.4^K}$ $D' = \frac{171.4}{41.6} = \underline{4.12'}$

DRAFT = 7.0 + 4.12 = $\underline{11.12}$ FBD = 15.0 - 11.12 = $\underline{3.88'}$

2

J. RAY McDERMOTT & Co., INC.
ENGINEERING DEPARTMENT - COMPUTATION SHEET SHEET NO. 2

COMPANY U.S. ARMY/ERDL
SUBJECT MONO-MOORING SYSTEM
JOB NO. 56017 COMPUTER ANDREWS CHKD. BY DATE 6-28 19 65

30 FOOT WATER DEPTH

$V_{PL} = 12.5(8) = 100^K$ TOTAL $V = 271 + 100 - 34 = 337^K$

371
34
337

DRAFT $= \frac{337}{41.6} = 8.1'$

CONSIDER TWO COMPTS. FLOODED

$F_D = 31.2$ $337 - 218 = 119^K$ $D' = \frac{119}{41.6} = 2.86'$

DRAFT $= 7 + 2.86 = 9.86'$ FBD $= 15 - 9.86 = 5.14' - .36 = 4.78'$

90 FOOT WATER DEPTH

$V_{PL} = 13.8(8) = 110^K$ TOTAL $V = 271 + 110 - 34 = 347^K$

DRAFT $= \frac{347}{41.6} = 8.35'$

CONSIDER TWO COMPTS. FLOODED

$F_D = 31.2$ $347 - 218 = 129^K$ $D' = \frac{129}{41.6} = 3.1'$

DRAFT $= 7 + 3.1 = 10.1'$ FBD $= 15 - 10.1 = 4.9' - .36 = 4.54'$

1

5177

SEE PG. 2 OF CALS. ENTITLED "POSITIVE FBD CALS." DATED 6/30/65

WT. OF FOAM ≈ 18# ADDT. DRAFT = $\frac{18}{41.6}$ = .43'

100 FOOT WATER DEPTH

VOL = 15.7(8) = 125# TOTAL V = 271 + 125 - 37 = 361#

DRAFT = $\frac{362}{41.6}$ = 8.7' FBD = 15 - 8.7 = 6.3' - .43 = 5.87'

CONSIDER TWO COMPTS. FLOODED

F_D = 31.2 362 - 218 = 144 D' = $\frac{144}{41.6}$ = 3.55'

DRAFT = 7 + 3.55 = 10.55' FBD = 9.45' - .43 = 9.02'

110 FOOT WATER DEPTH

VOL = 18.0(8) = 144# TOTAL V = 271 + 144 - 37 = 381#

DRAFT = $\frac{381}{41.6}$ = 9.16' FBD = 5.84' - .43 = 5.41'

CONSIDER TWO COMPTS. FLOODED

F_D = 31.2 381 - 218 = 163# D' = $\frac{163}{41.6}$ = 3.92'

DRAFT = 7 + 3.92' = 10.92' FBD = 4.08'

2

COMPANY U. S. ARMY/ERDL

SUBJECT MOND - MOORING SYSTEM

JOB DRAWING No. 56612 COMPUTER ANDREWS CHKD. BY DATE 6-28 1965

120 FOOT WATER DEPTH

$V_{DL} = 19.8(8) = 159^K$ TOTAL $V = 159 + 271 - 34 = 396$

DRAFT $= \frac{396}{41.6} = 9.5'$ FBD $= 15 - 9.5 = 5.5' - .43 = 5.07'$

CONSIDER TWO COMPTS. FLOODED

$F_D = 21.2^K/_1$ $396 - 218 = 178^K$ $D' = \frac{178}{41.6} = 4.28'$

DRAFT $= 7 + 4.28 = 11.28'$ FBD $= 15 - 11.28 = 3.72'$

130 FOOT WATER DEPTH

$V_{DL} = 21.6(8) = 173^K$ TOTAL $V = 173 + 271 - 34 = 410^K$

DRAFT $= \frac{410}{41.6} = 9.85'$ FBD $= 5.15' - .43 = 4.72'$

3.35

140 FOOT WATER DEPTH

$V_{DL} = 23.8(8) = 190^K$ TOTAL $V = 190 + 271 - 34 = 427^K$

DRAFT $= \frac{427}{41.6} = 10.3'$ FBD $= 4.7' - .43 = 4.27'$

2.82

150 FOOT WATER DEPTH

$V_{DL} = 25.4(8) = 203^K$ TOTAL $V = 203 + 271 - 34 = 440^K$

DRAFT $= \frac{440}{41.6} = 10.6'$ FBD $= 4.4' - .43 = 3.97'$

2.2'

5177

cDERMOTT & CO., INC.
EPARTMENT - COMPUTATION SHEET SHEET NO. 3

SYSTEM

REWS CHKD. BY DATE 6-28 1965

EPTH

TOTAL V = 159 + 271 - 34 = 396

FBD = 15 - 9.5 = 5.5' - .43 = 5.07'

FLOODGD

= 178^K D' = 178/41.6 = 4.28'

FBD = 15 - 11.28 = 3.72'

PTH

TOTAL V = 173 + 271 - 34 = 410^K

FBD = 5.15' - .43 = 4.72'

3.35

TH

TOTAL V = 190 + 271 - 34 = 427^K

FBD = 4.7' - .43 = 4.27'

2.82

TOTAL V = 203 + 271 - 34 = 440^K

FBD = 4.4' - .43 = 3.97'

2.2'

COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
PROJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

A-FRAME CONNECTIONS

MACHINERY BASES

PIPE SUPPORTS

SWIVEL KEY TO ROTATING DECK CONN.

LIFTING EYES

LAUNCHING FORCE

J. RAY McDERMOTT & CO., INC.

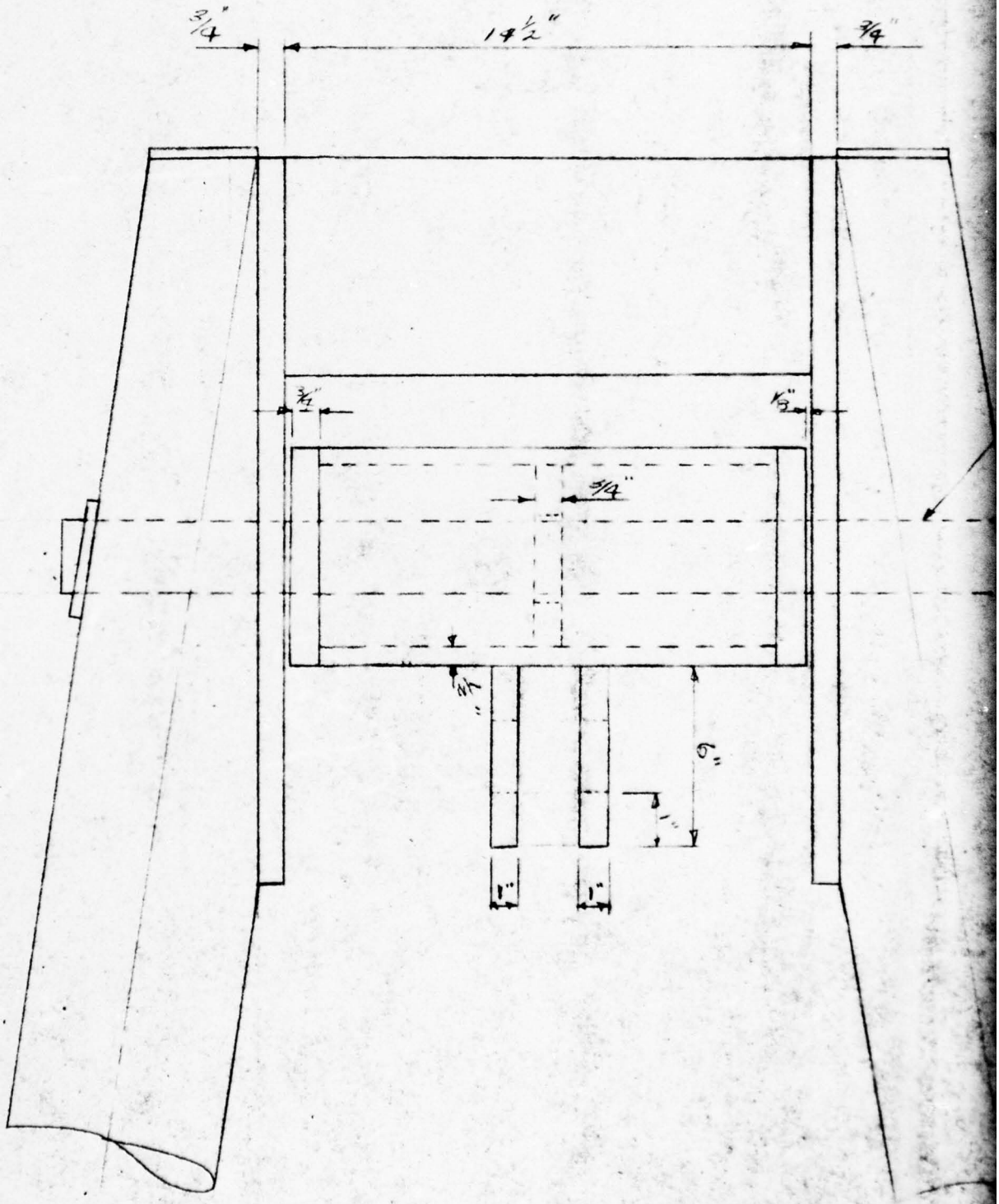
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 1

COMPANY U. S. ARMY / ERDL

SUBJECT MOOD - MOORING SYSTEM

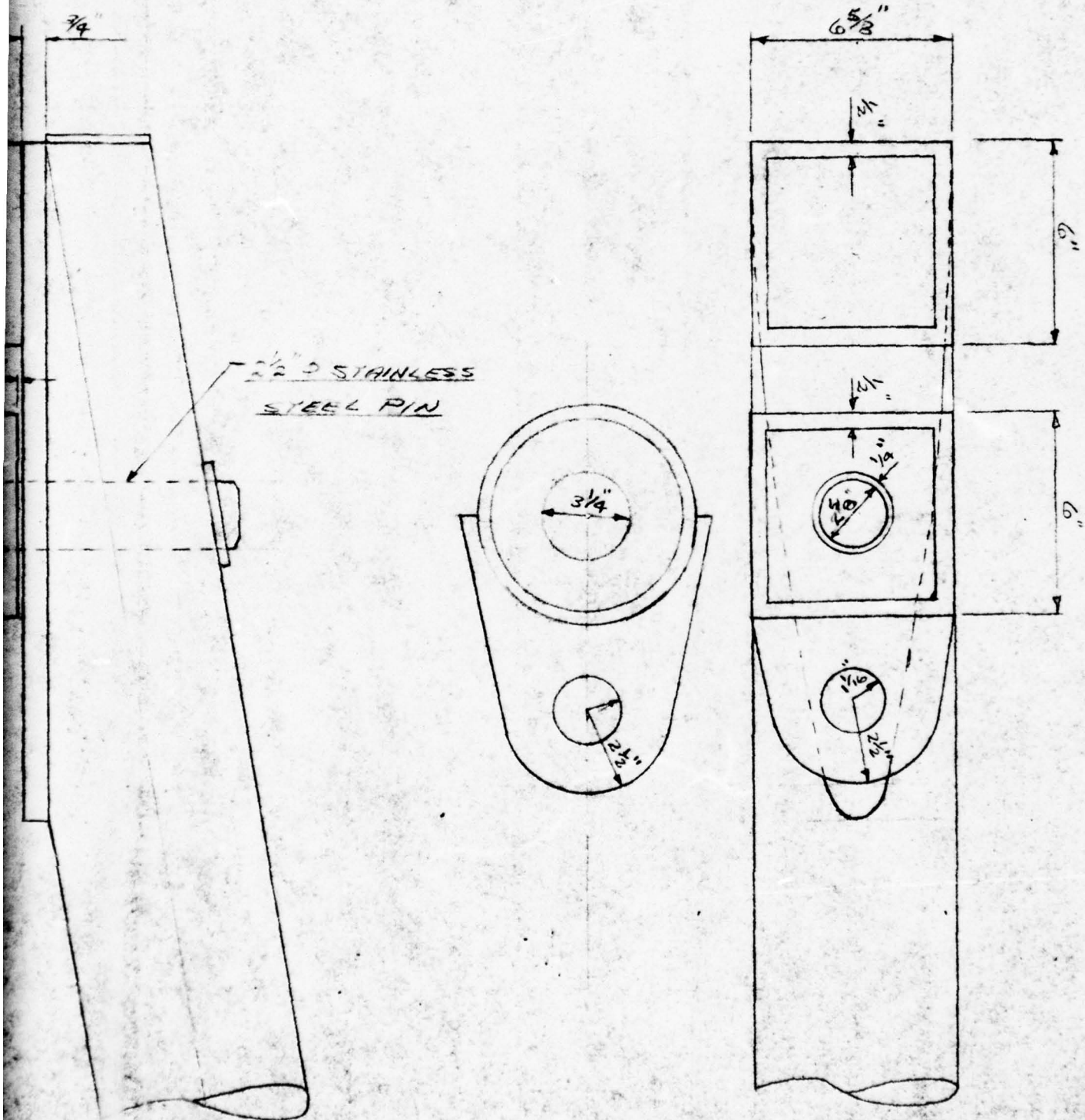
JOB DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6 - 2 1965



1

.5(.75)(13.5) = 5.06 k/" $\frac{50}{12}$ = 4.16

"A" FRAME CONNECTIONS



COMPANY U. S. ARMY / ERDL

SUBJECT MONO-MOORING SYSTEM

JOB DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY DATE 6-7 1965

CHECK PEAK CONNECTION

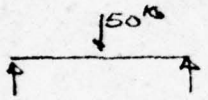
2½" DIA PIN

SHEAR = 147.3^k > 50^k O.K.

BEARING = 80(1.5) = 120^k > 50^k O.K.

M = 25(.875) = 22 "^{k} < 45.9 "^{k} O.K.

CHECK BENDING OF 6"ϕ EXTRA STRONG PIPE



$M = \frac{PL}{4} = \frac{50(14)}{4} = 175$ "^{k}

$f = \frac{175(3.32)}{40.5} = 14.3$ ksi

$\Delta \approx \frac{30(1.16)^3}{83+(40.5)} = .0023$ "

EET SHEET NO 2

"A" FRAME CONNECTIONS

DATE 6-7 1965

2

J. RAY McDERMOTT & CO., INC.

ENGINEERING DEPARTMENT - COMPUTATION SHEET

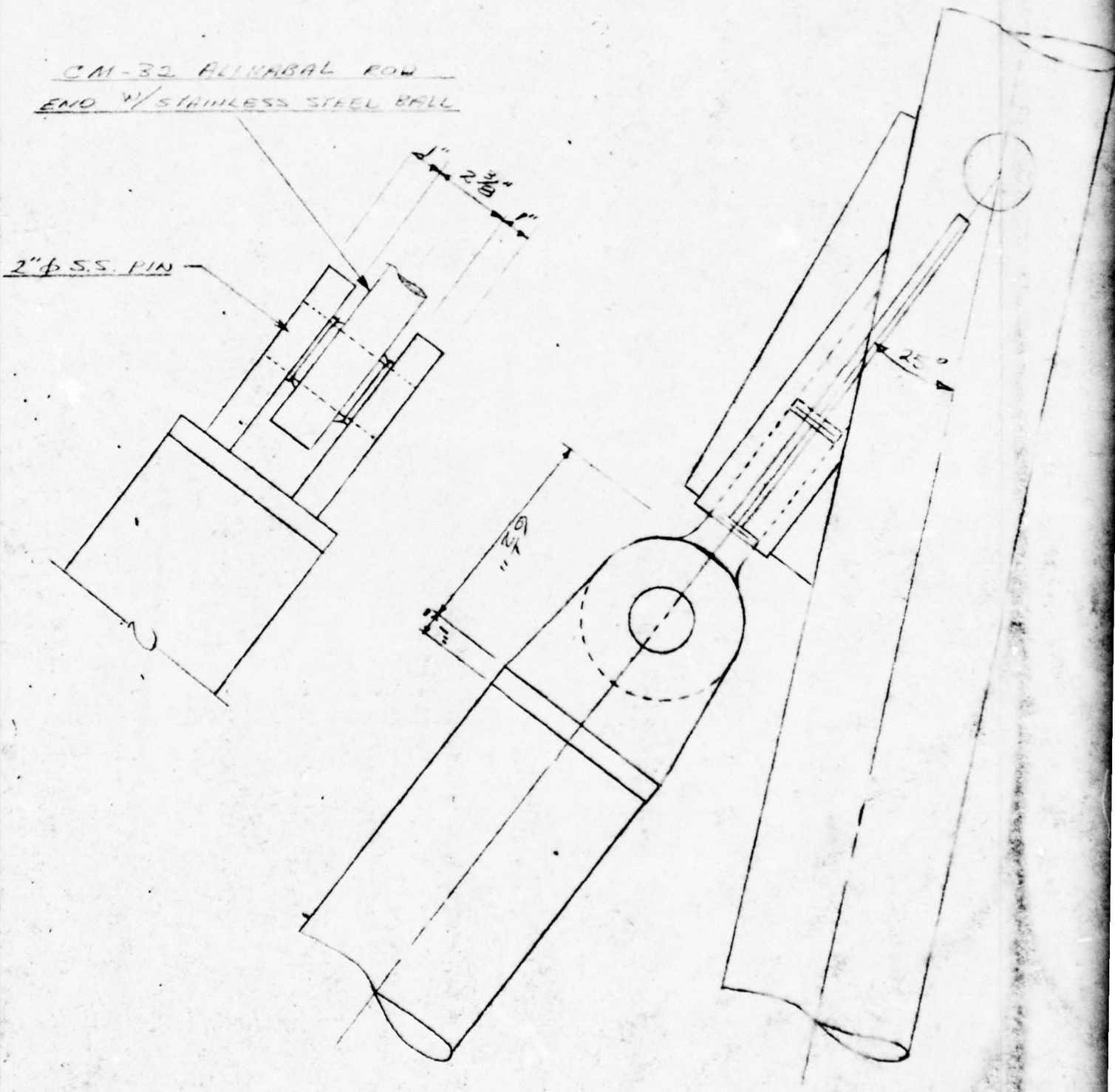
SHEET NO 3

COMPANY U.S. ARMY / ERDL

SUBJECT MOMO - MOORING SYSTEM

DRAWING NO. 5667 COMPUTER ANDREWS CHKD. BY DATE 6-3 1965

CM-32 ALUMABAL ROD
END W/ STAINLESS STEEL BALL



3177

3

10.65

"A" FRAME CONNECTIONS

2

J. RAY McDERMOTT & CO., INC.

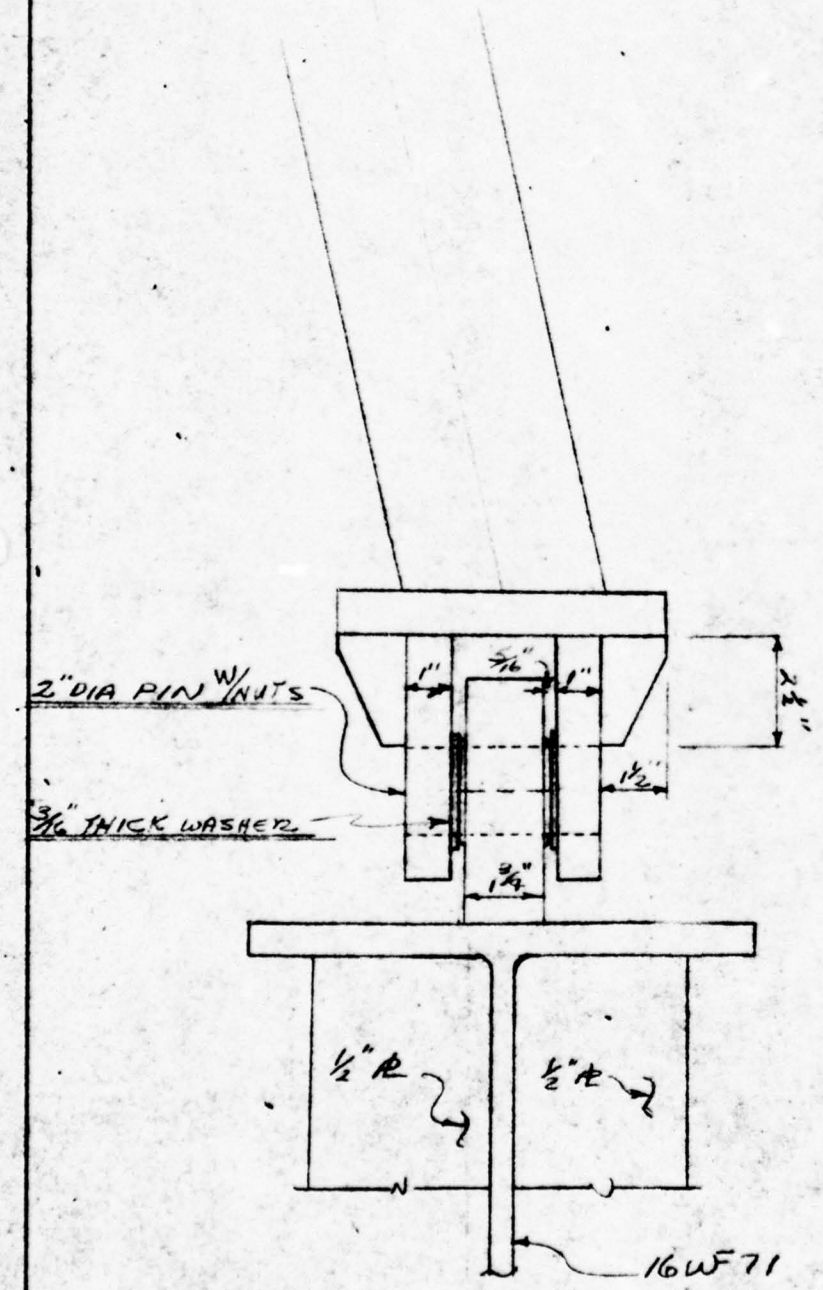
ENGINEERING DEPARTMENT - COMPUTATION SHEET

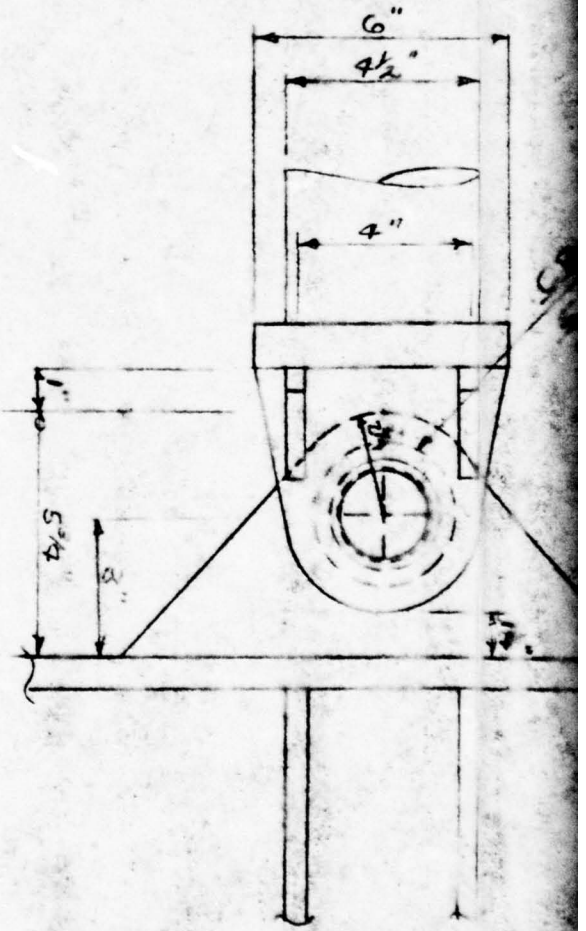
SHEET NO. 4

COMPANY U.S. ARMY / ERDL

SUBJECT MOOR - MOORING SYSTEM

JOB DRAWING NO. 50017 COMPUTER ANDREW CHKD. BY _____ DATE 6 - 7 1965



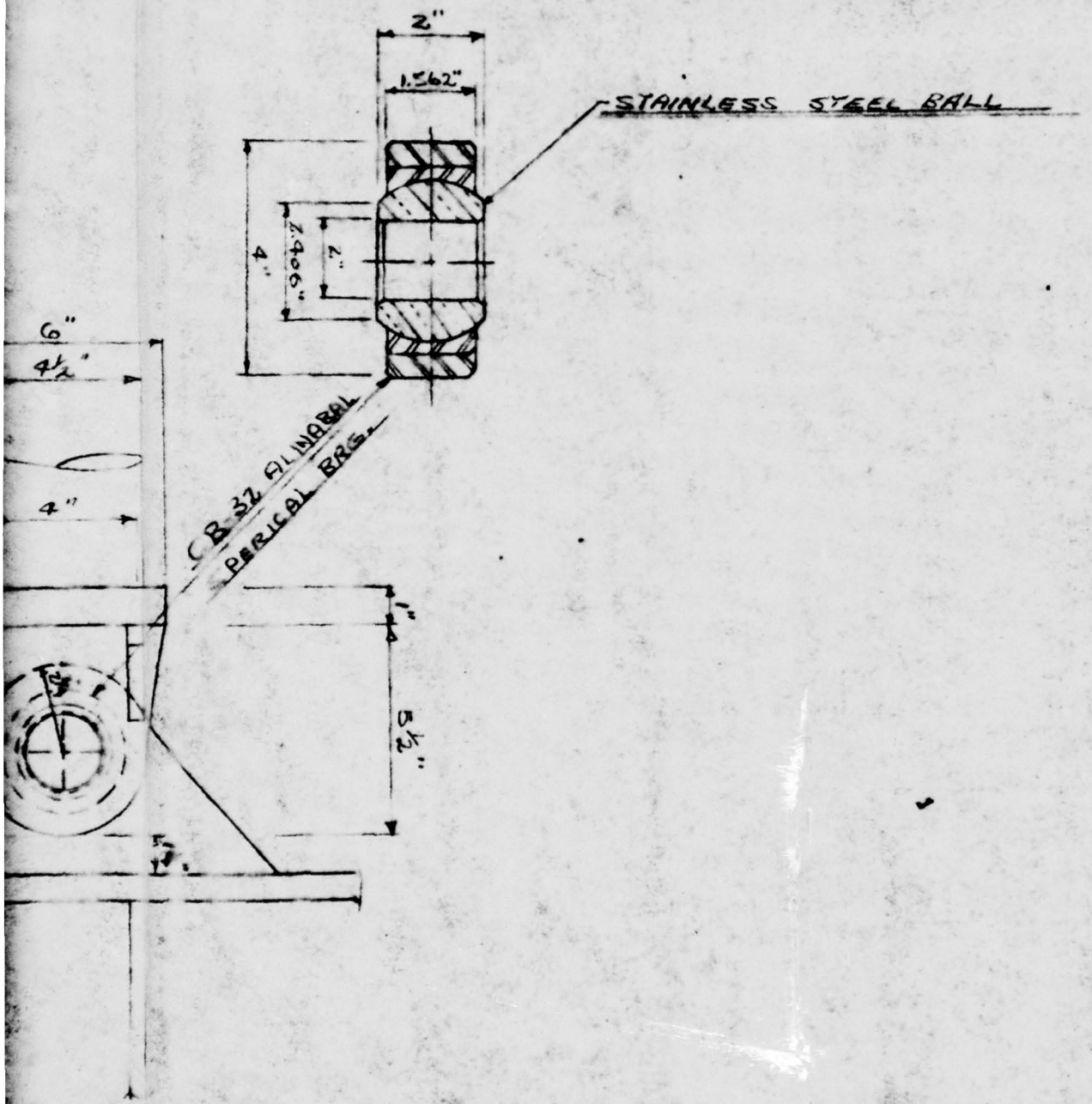


5177

4

1065

"A" FRAME CONNECTIONS



2

J. RAY McDERMOTT & CO., INC.

ENGINEERING DEPARTMENT - COMPUTATION SHEET

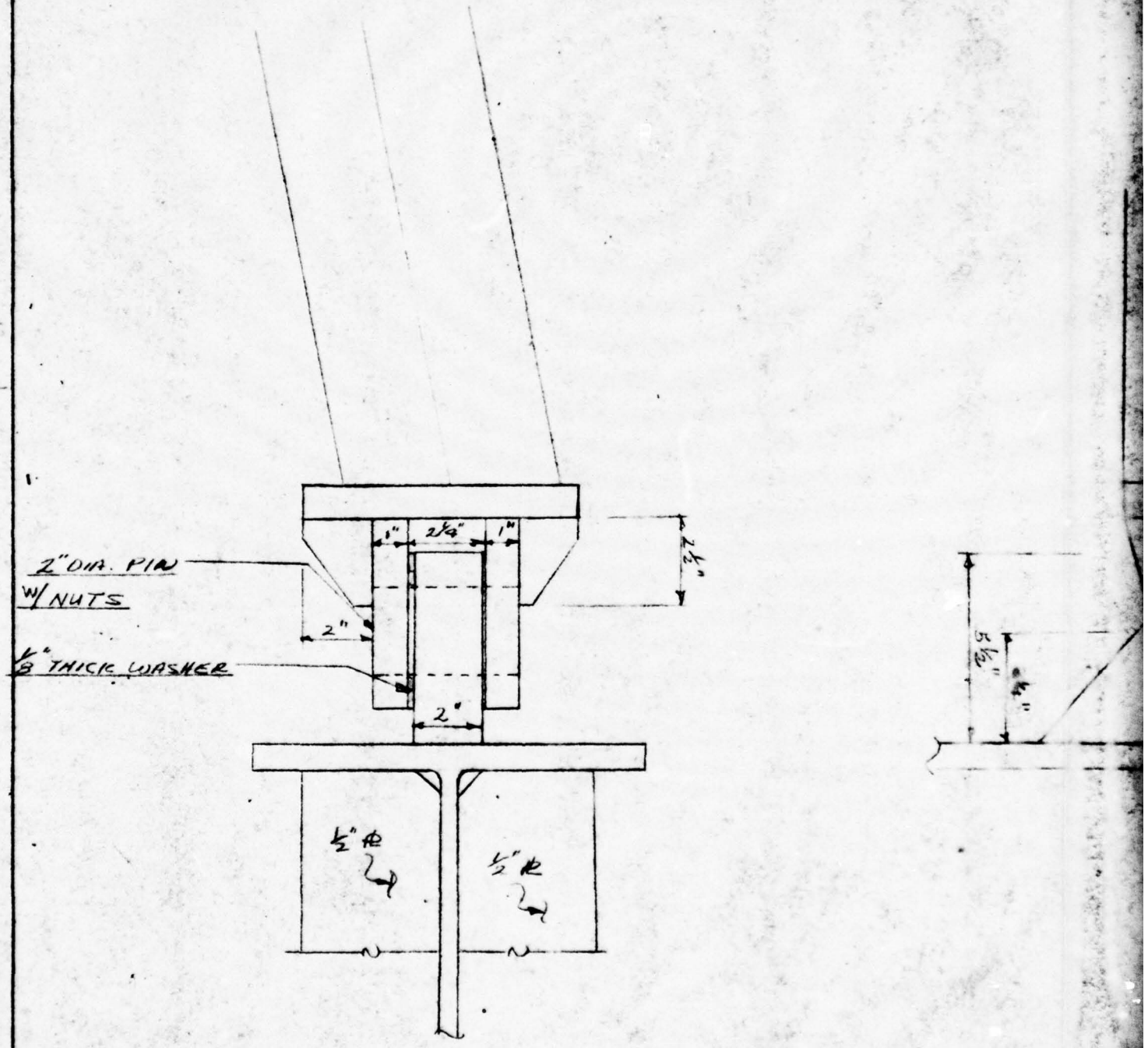
SHEET NO. 5

COMPANY U. S. ARMY / ERDI

SUBJECT MONO-MOORING SYSTEM

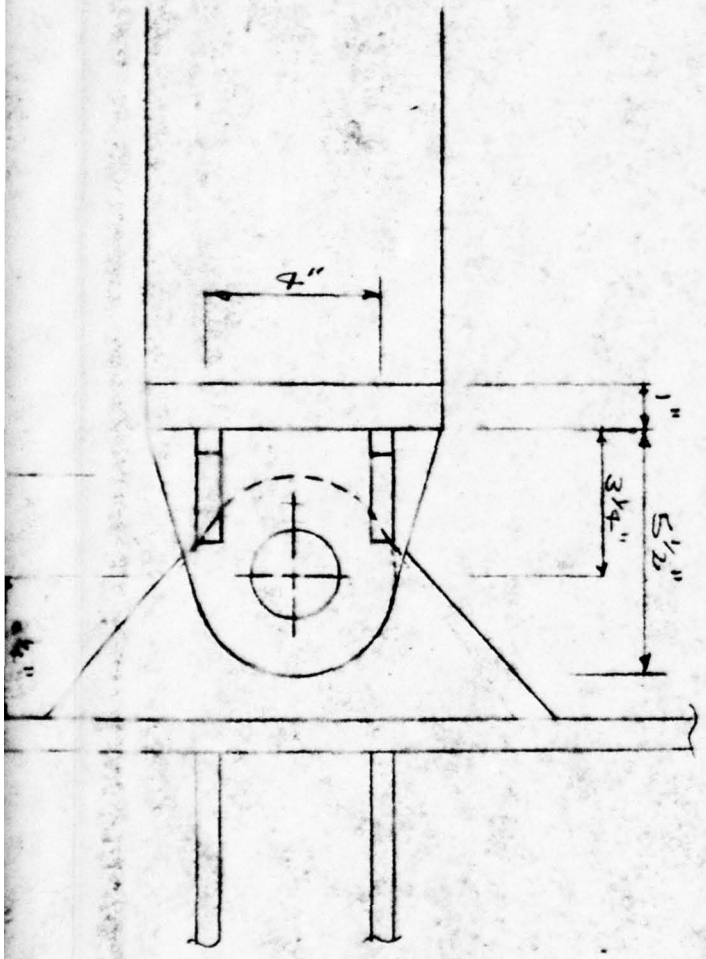
JOB ~~DRAWING~~ No. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6-7 1965

.024
1.56
.31
2.694



3177

"A" FRAME CONNECTIONS



MAX. P ≈ 40^K $H \approx \frac{3}{16}(40) = \underline{7.5^K}$ $V \approx \underline{40^K}$

CHECK PIN DIA. 2"

SHEAR = 99.3^K > 40^K O.K.

BEARING = 64(2) = 128^K > 40^K O.K.

$M = 20(1.125) = 22.5''^K < 23.7''^K$ O.K.

CHECK BENDING IN 2" Ø

$M \approx 7.5(2) = \underline{15.0''^K}$

$S = \frac{bd^2}{6} = \frac{2(2)^2}{6} = \underline{1.33 \text{ in.}^3}$

$f = \frac{15}{1.33} = \underline{11.2 \text{ ksi O.K.}}$

CHECK WELD IN 2" Ø

$H_{xx} = \underline{7.5^K}$ $H_{yy} = \underline{7.5^K}$

$M_{xx} = 7.5(5) = \underline{37.5''^K}$ $M_{yy} = 7.5(3.25) = \underline{24.4''^K}$

$K/\text{in}_{xx} = \frac{7.5}{24} = \underline{.312^K/\text{in}}$

$K/\text{in}_{yy} = \frac{7.5}{24} = \underline{.312^K/\text{in}}$

$I_{xx} = Ad^2 = 24(1)^2 = \underline{24 \text{ in.}^4}$

$I_{yy} = \frac{bd^3}{12} = \frac{2(12)^3}{12} = \underline{288 \text{ in.}^4}$

$f_{xx} = \frac{Mc}{I} = \frac{37.5(1)}{24} = \underline{1.56^K/\text{in}}$

$f_{yy} = \frac{Mc}{I} = \frac{24.4(6)}{288} = \underline{.51^K/\text{in}}$

TOTAL $K/\text{in} = .312 + .312 + 1.56 + .51 = \underline{2.694^K/\text{in}}$

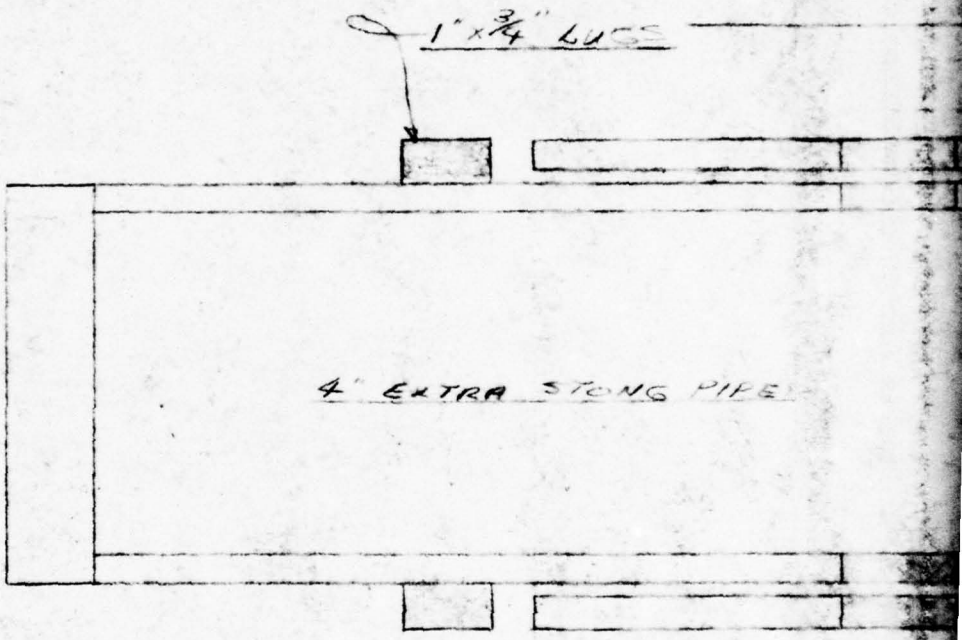
TRY ½" FILLET WELD

ALLOW $K/\text{in} = .5(.707)(13.5) = \underline{4.7^K/\text{in} > 2.7}$ O.K.

COMPANY U.S. ARMY/ERDL

SUBJECT MOOR-MOORING SYSTEM

JOB DRAWING NO. 56917 COMPUTER ANDREWS CHKD. BY DATE 6-4 1965



MAX. TENSION ≈ 12^K MIN. WALL THICKNESS = .337"

TRY 1¼" ϕ PINS SPACE 1 3/16" ϕ HOLES 12" O.

ALLOW V = 36.8^K > 12^K O.K.

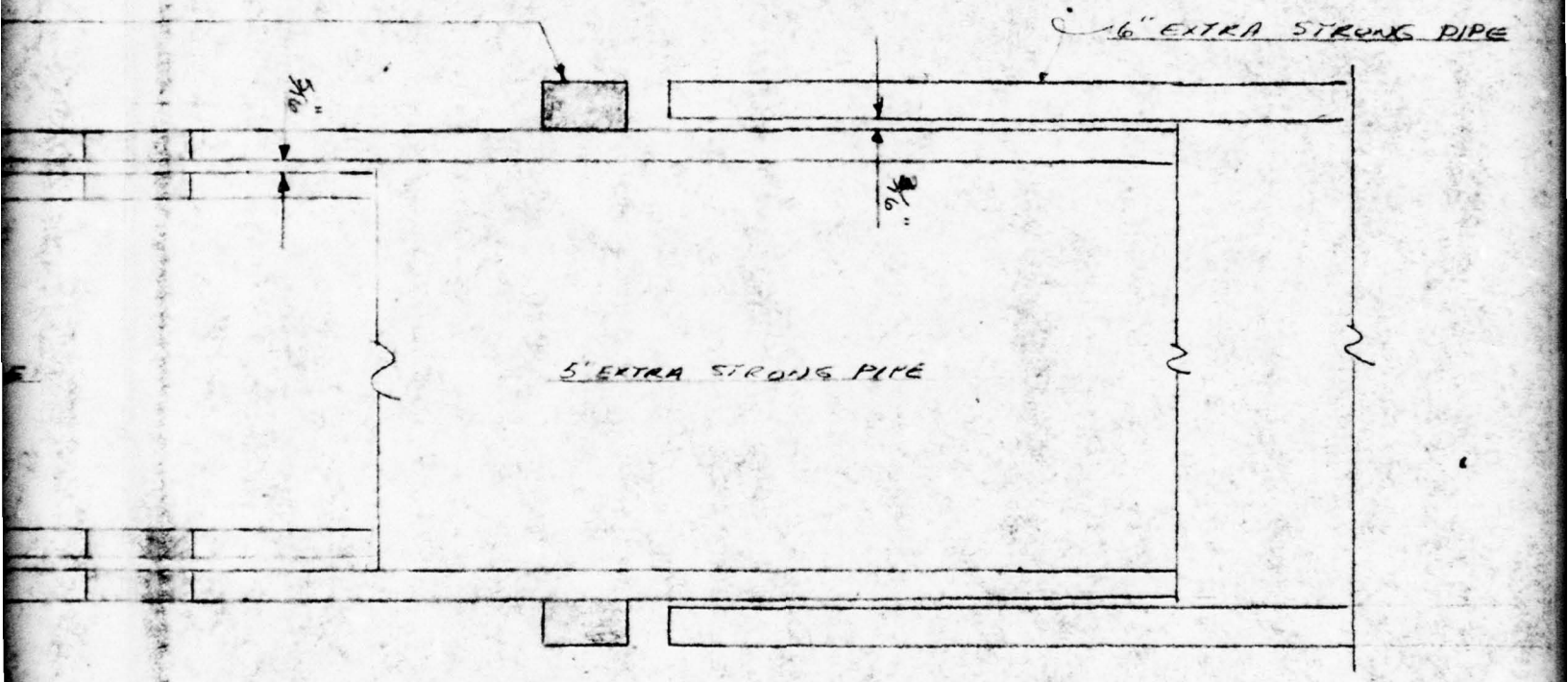
ALLOWABLE BRG. = .337(2)(40) = 27^K > 12^K O.K.

M = 6(.75) = 4.5^K < 5.7 O.K.

USE 1¼" ϕ PINS W/RETAINING NUTS

5177

"H" FRAME TELESCOPING LEGS



2" O. IN 5 & 6" PIPE

J. RAY McDERMOTT & CO., INC.

ENGINEERING DEPARTMENT - COMPUTATION SHEET

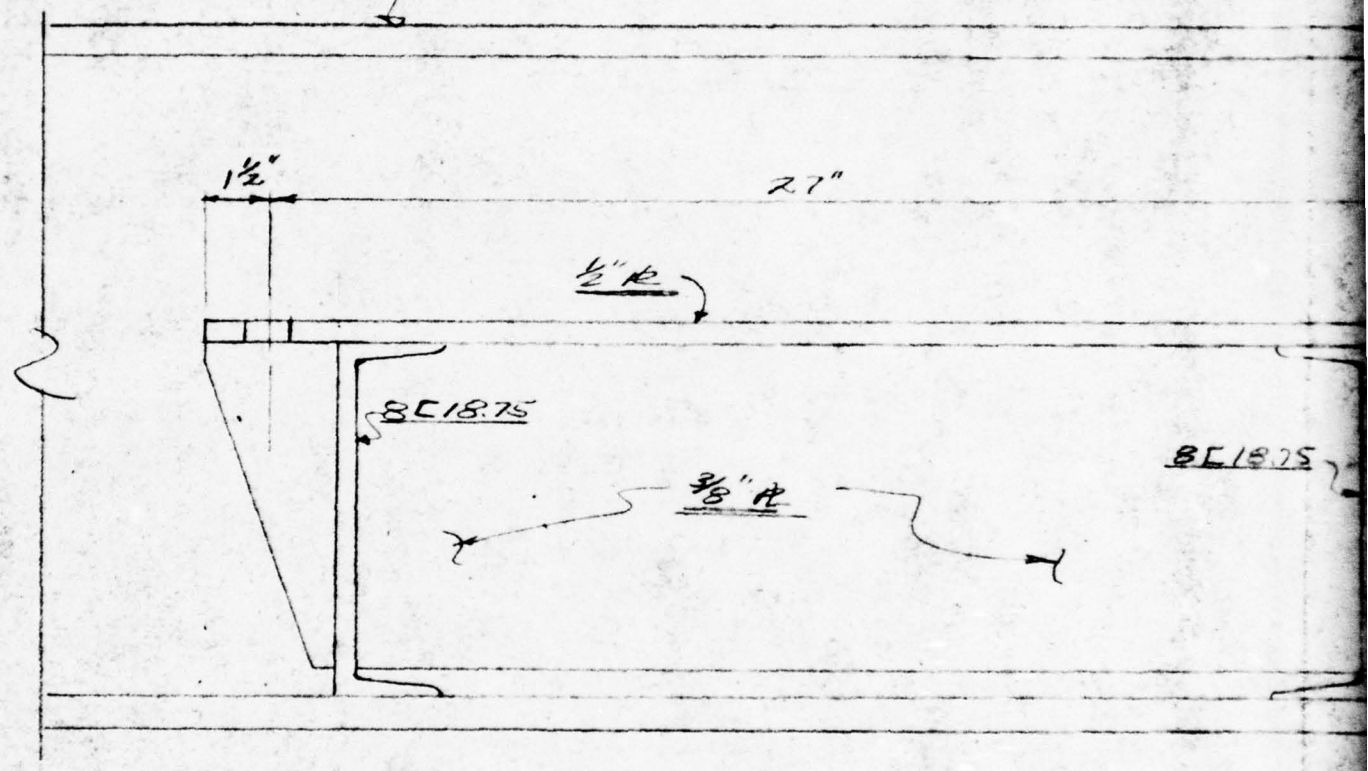
SHEET NO. 2

COMPANY U.S. ARMY / EROL

SUBJECT MONO-MOORING SYSTEM

JOB No. 56017 COMPUTER ANDREWS CHKD. BY DATE 6-8 19 65

DRILL 31/32" DIA. H
REAM FOR 1" DIA
@ INSTALLATION

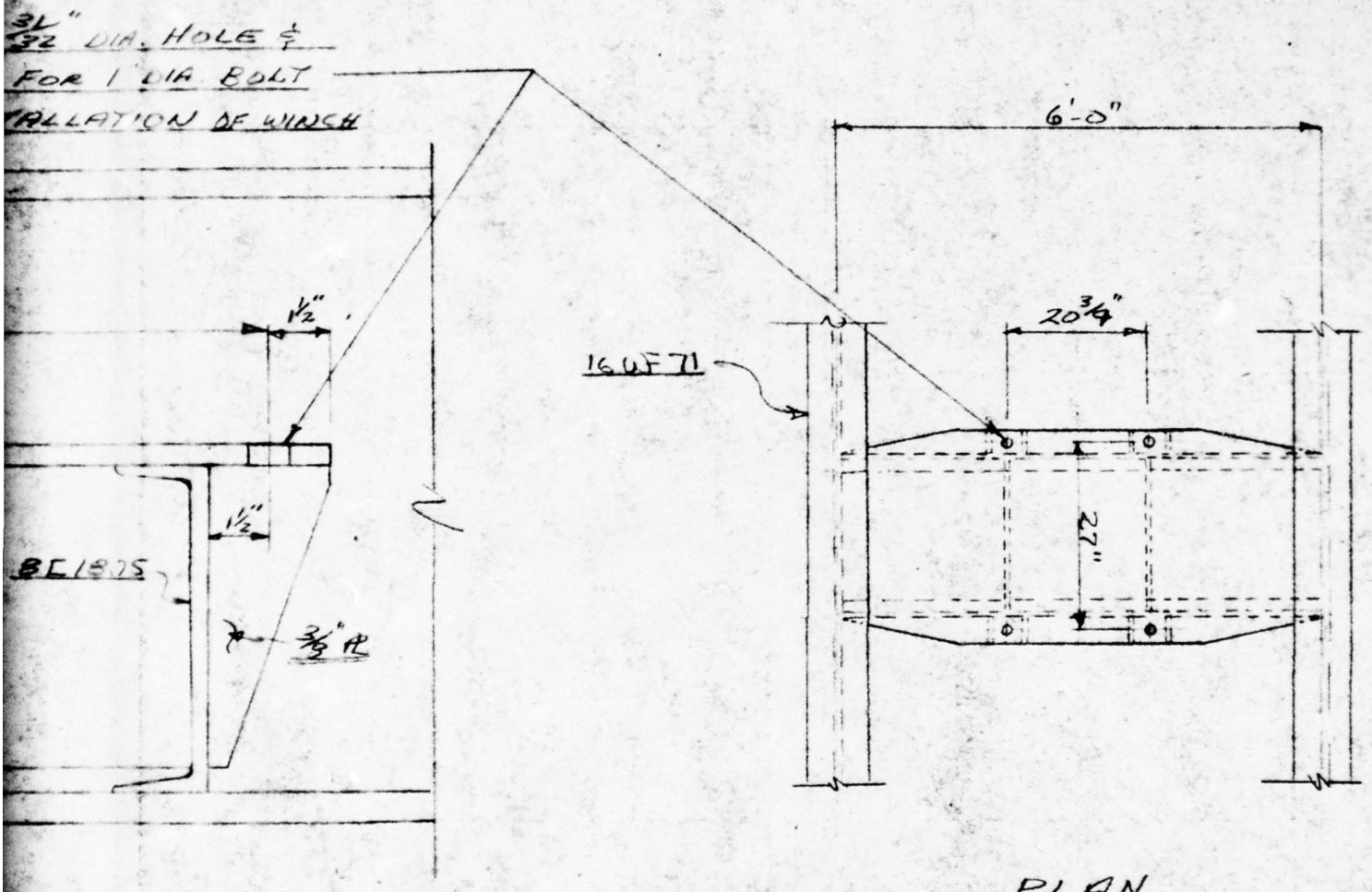


SECTION
½" = 1"

3177

HYDRAULIC WINCH FOUNDATION

65



PLAN
½" = 1'-0"

J. RAY McDERMOTT & CO., INC.

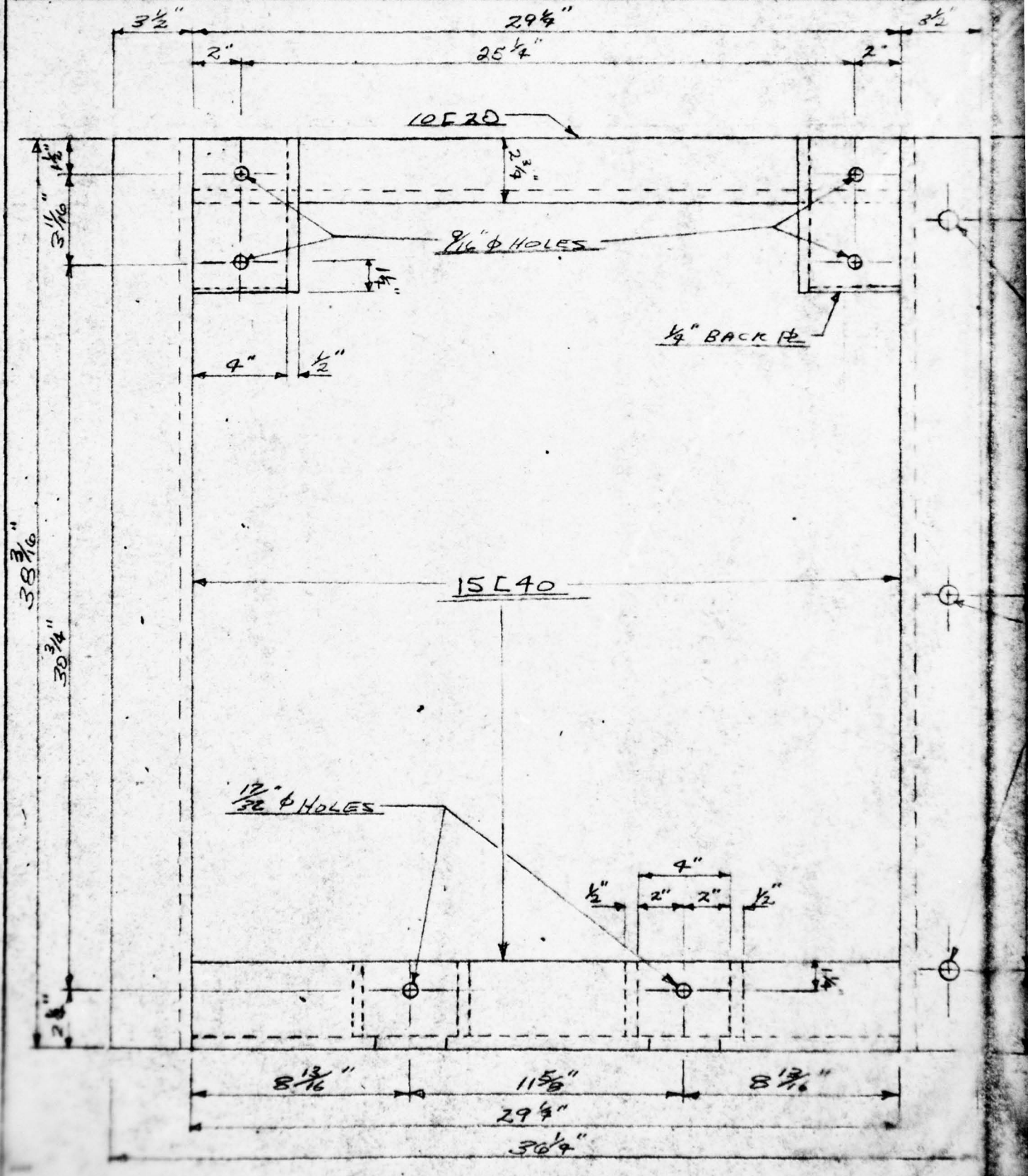
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 1

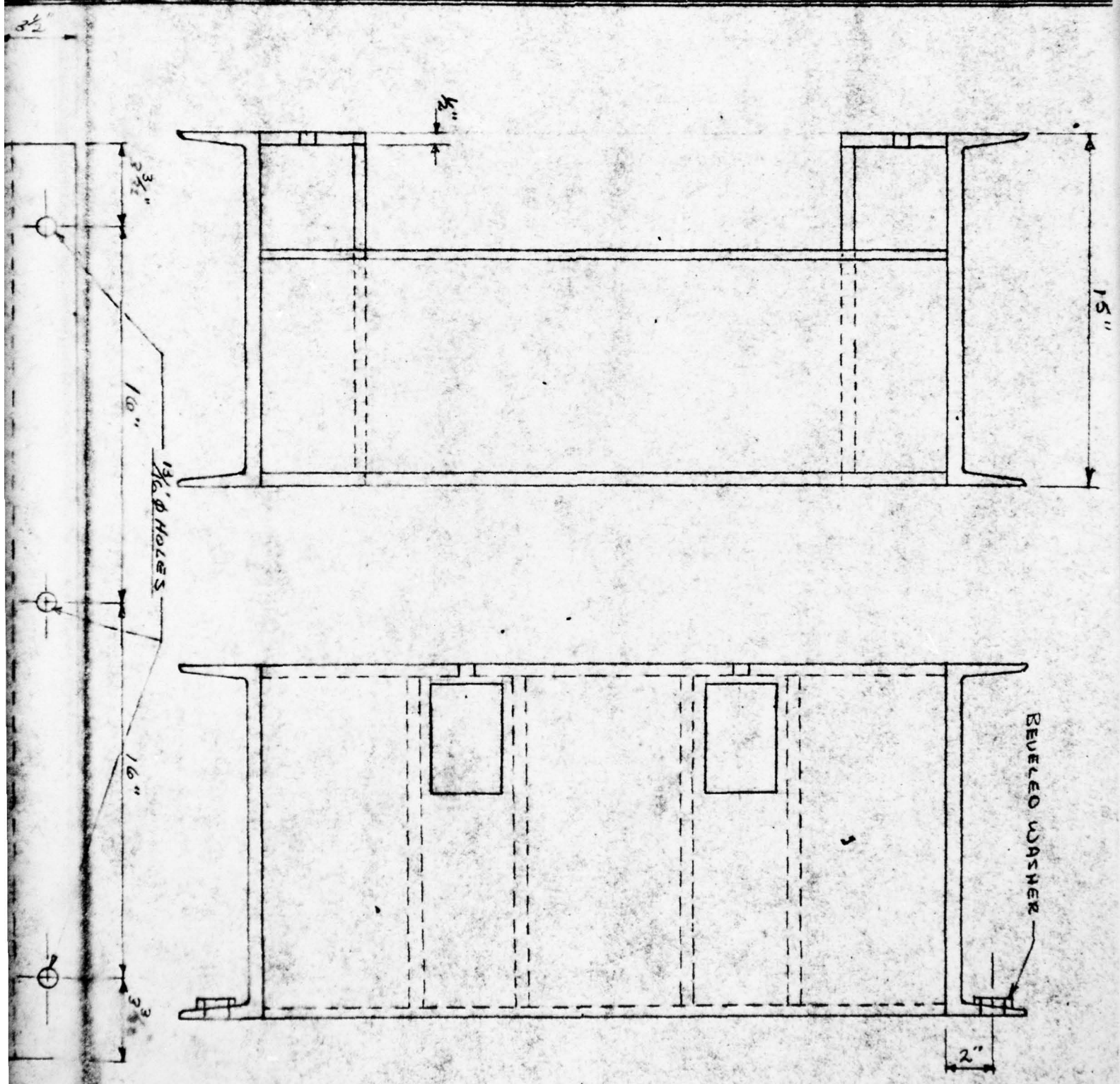
COMPANY U. S. ARMY / ERDL

SUBJECT MOND - MOORING SYSTEM

JOB DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6 - 8 1965



DIESEL ENGINE SUPPORTS



J. RAY McDERMOTT & CO., INC.

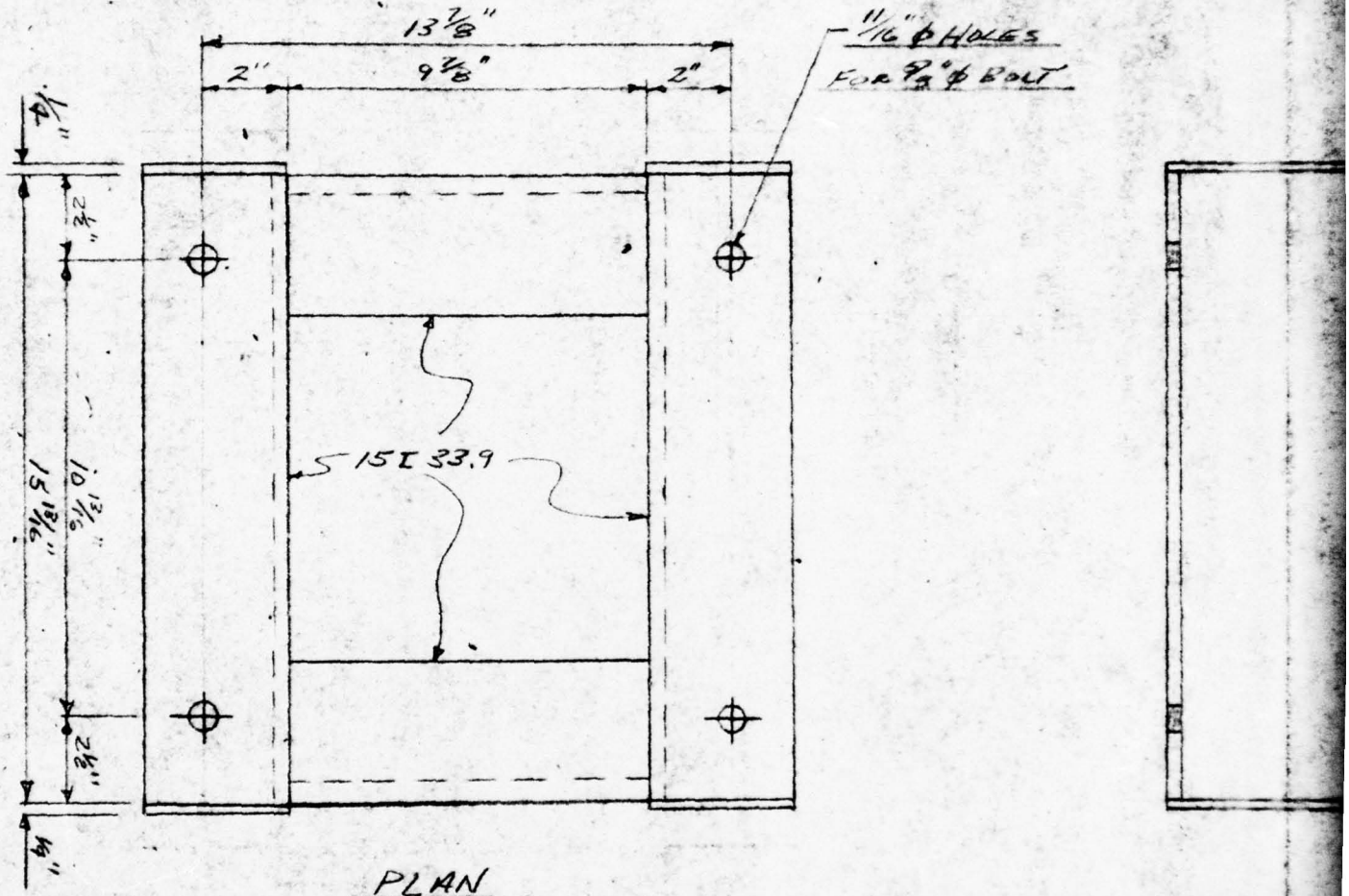
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET No. 1

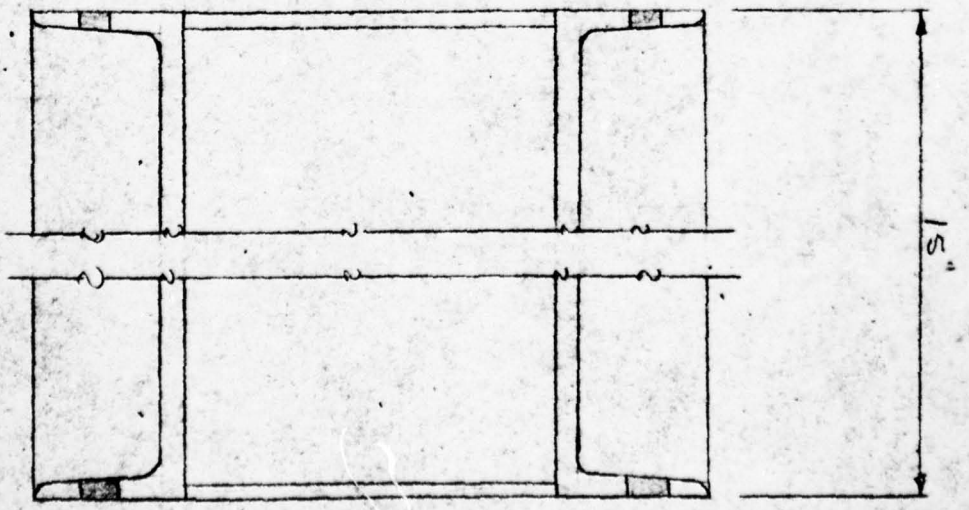
COMPANY U. S. ARMY / ERDL

SUBJECT MONO - MOORING SYSTEM

JOB DRAWING No. 56017 COMPUTER ANDREWS CHKD. BY DATE 7/22 1965



PLAN



ELEVATION

5177

BASE FOR 5T HAND WINCH

ELEVATION

J. RAY McDERMOTT & CO., INC.

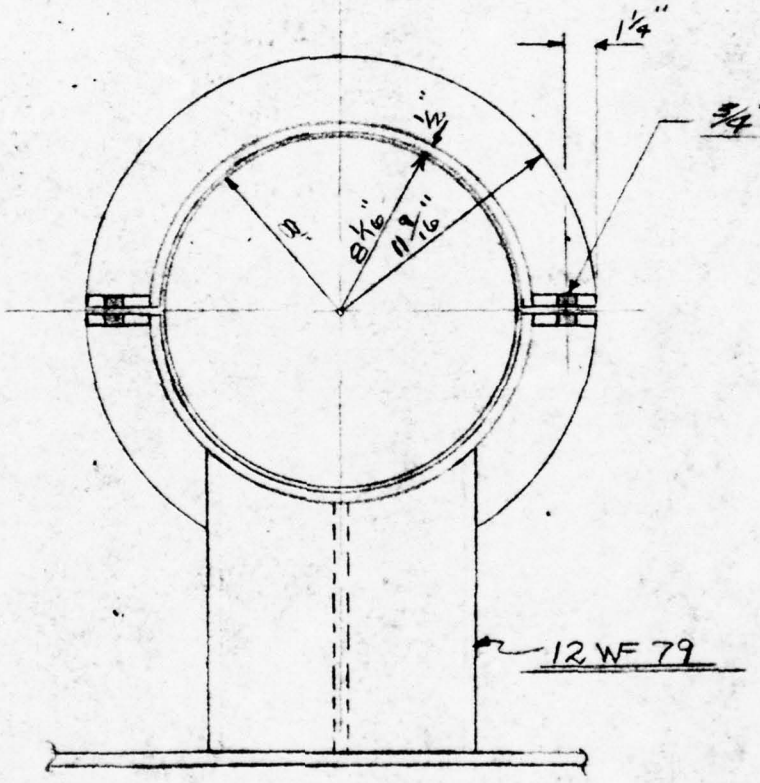
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET No. 1

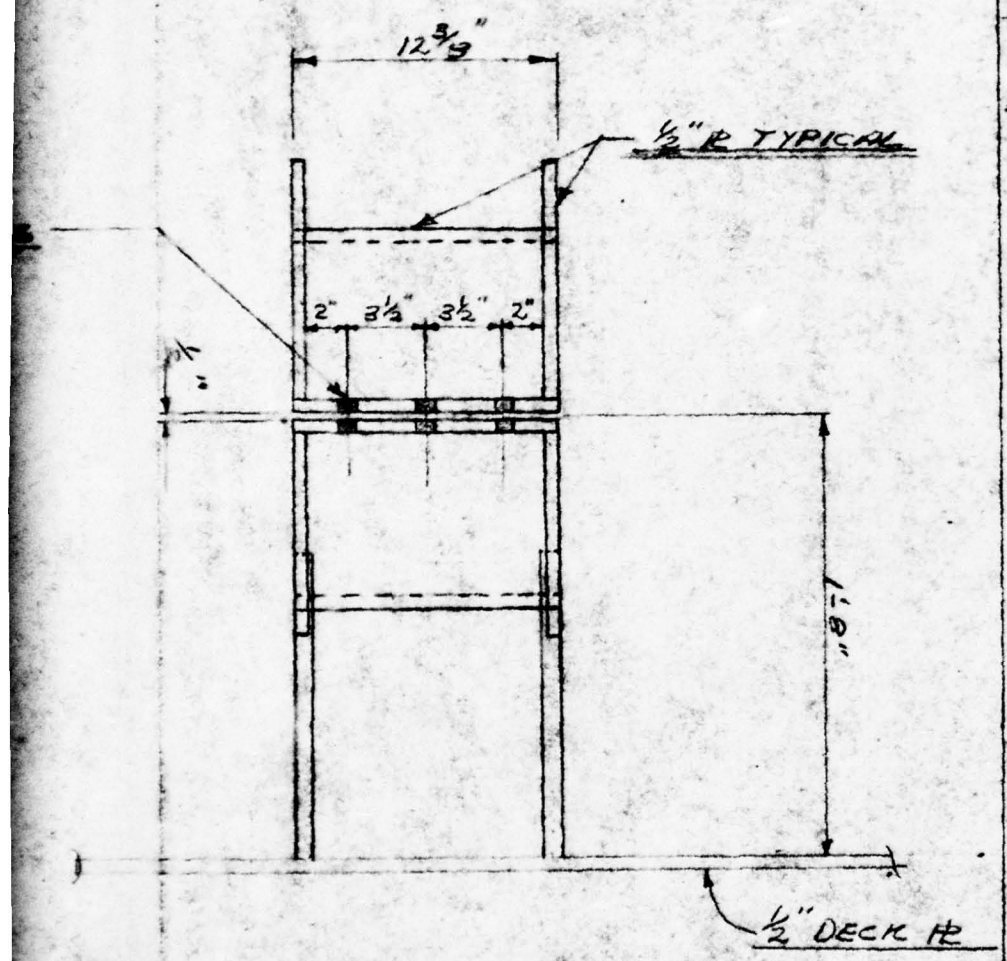
COMPANY U. S. ARMY / EROL

SUBJECT MOOR-MOORING SYSTEM

JOB No. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6-15 1965



PIPE SUPPORTS



MAX. F = 14^K

M = 14(20) = 280 "K

12 WF 79 O.K. BY INSPECTION

CHECK WELD

$k/_{11} = \frac{14}{20} = .7\ ^{k}/_{11}$

$I = AD^2 = 24(6)^2 = 865$

$k/_{11} = \frac{Mc}{I} = \frac{280(6)}{865} = 1.94\ ^{k}/_{11}$

USE ¼" FILLET WELD

J. RAY McDERMOTT & CO., INC.
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 2

COMPANY U.S. ARMY / ERDL

SUBJECT MONO-MOORING SYSTEM

DRAWING NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 6-15 1965

MAX. H ≈ 16^K

M = 16(38) = 606"^K

$f = \frac{M}{S} = \frac{606}{45} = 13.5$ KSI

CHECK WELD

TOTAL INCHES ≈ 36"

$K/_{11} = \frac{16}{36} = .445\ K/_{11}$

$I = \frac{bd^3}{12} = \frac{8(14)^3}{12} = 1840$

$\frac{6(12)^3}{12} = 864$

976 IN.^4

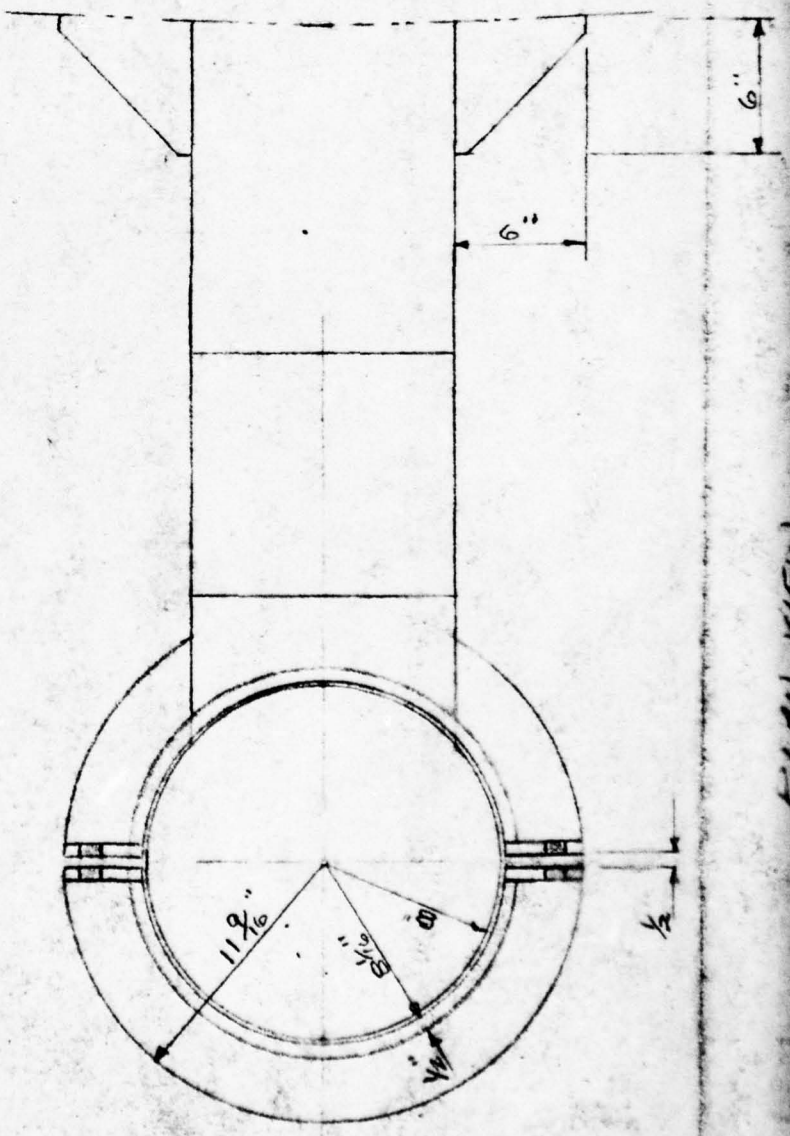
$K/_{11} = \frac{Mc}{I} = \frac{606(6)}{976} = 3.72\ K/_{11}$

TOTAL $K/_{11} = 3.72 + .445 = 4.165\ K/_{11}$

TRY ½" WELD

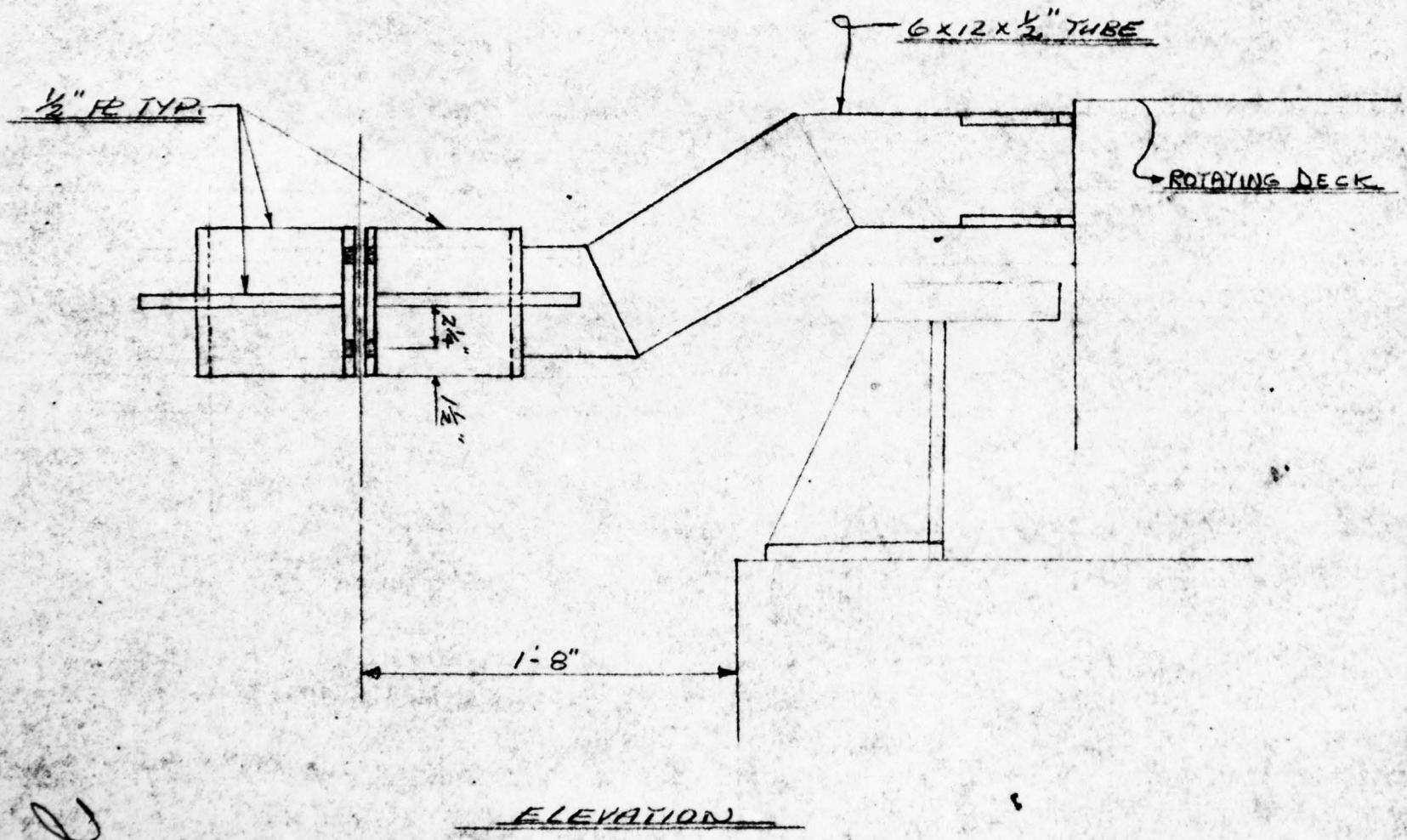
ALLOW $K/_{11} = .5(.707)(13) = 4.6\ K/_{11}$

½" FILLET WELD O.K.



PLAN VIEW

ELEVATION



PIPE SUPPORTS

J. RAY McDERMOTT & CO., INC.

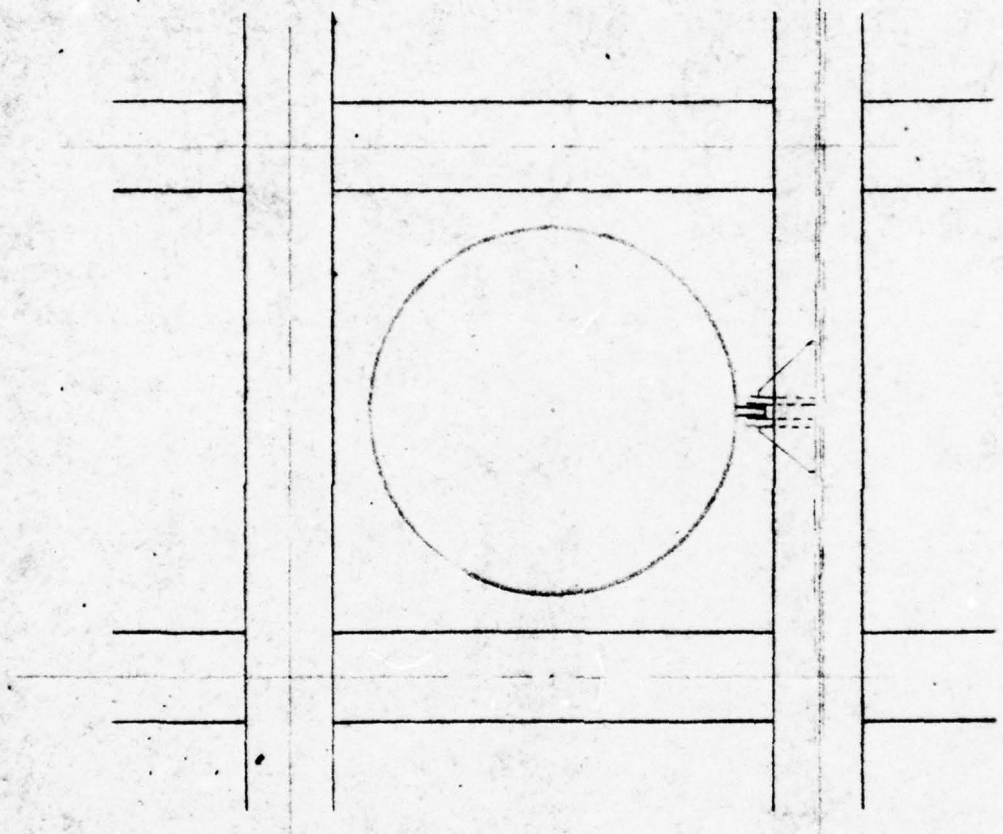
ENGINEERING DEPARTMENT - COMPUTATION SHEET

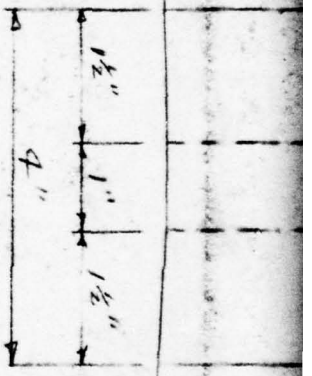
SHEET NO. 1

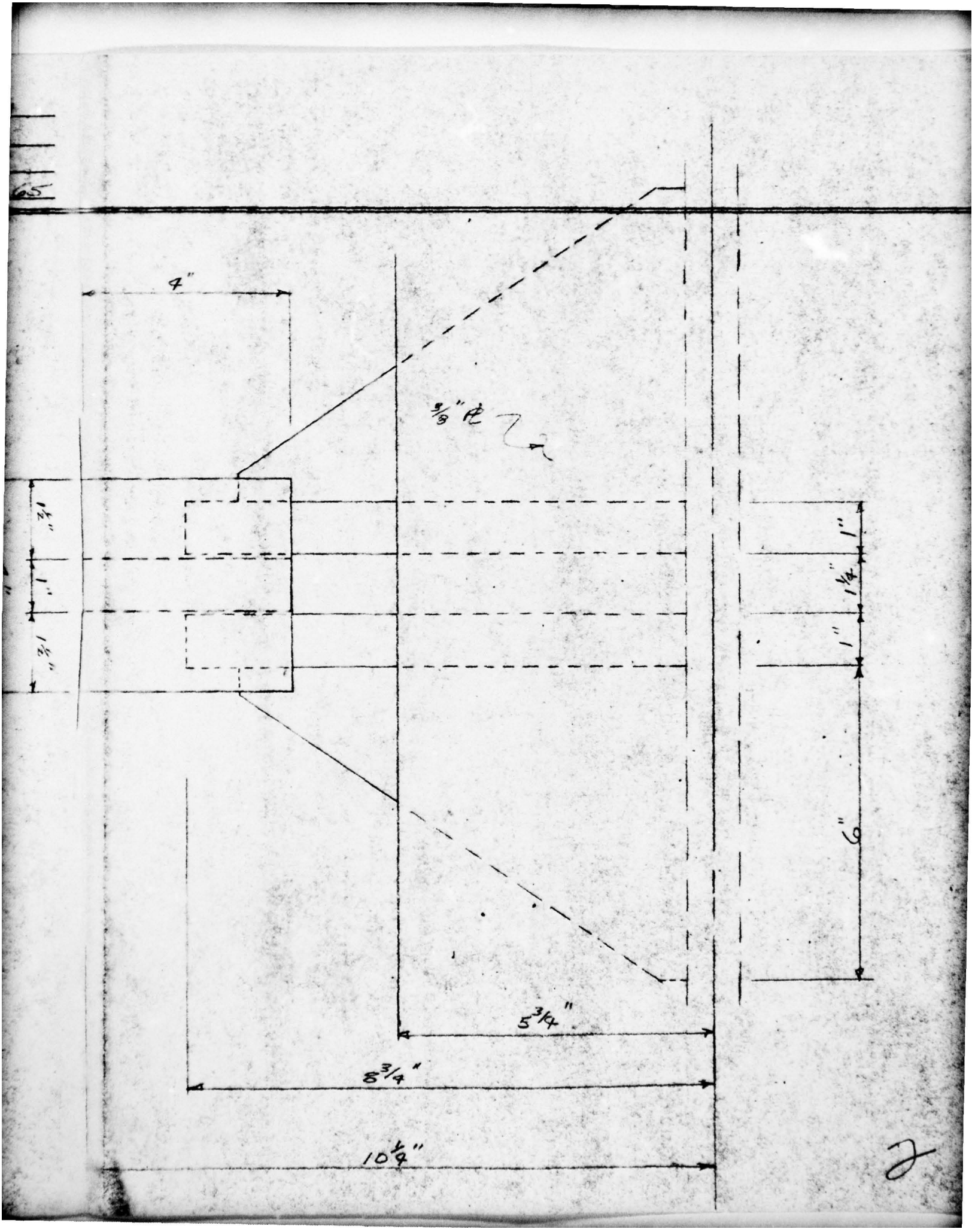
COMPANY U. S. ARMY/ERDL

SUBJECT MOOR-MOORING SYSTEM

JOB NO. 56017 COMPUTER ANDREWS CHKD. BY DATE 7/14 1965






4"
9/8" R
1 1/2"
1"
1 1/2"
1"
1 1/4"
1"
6"
5 3/4"
8 3/4"
10 1/4"

J. RAY McDERMOTT & CO., INC.

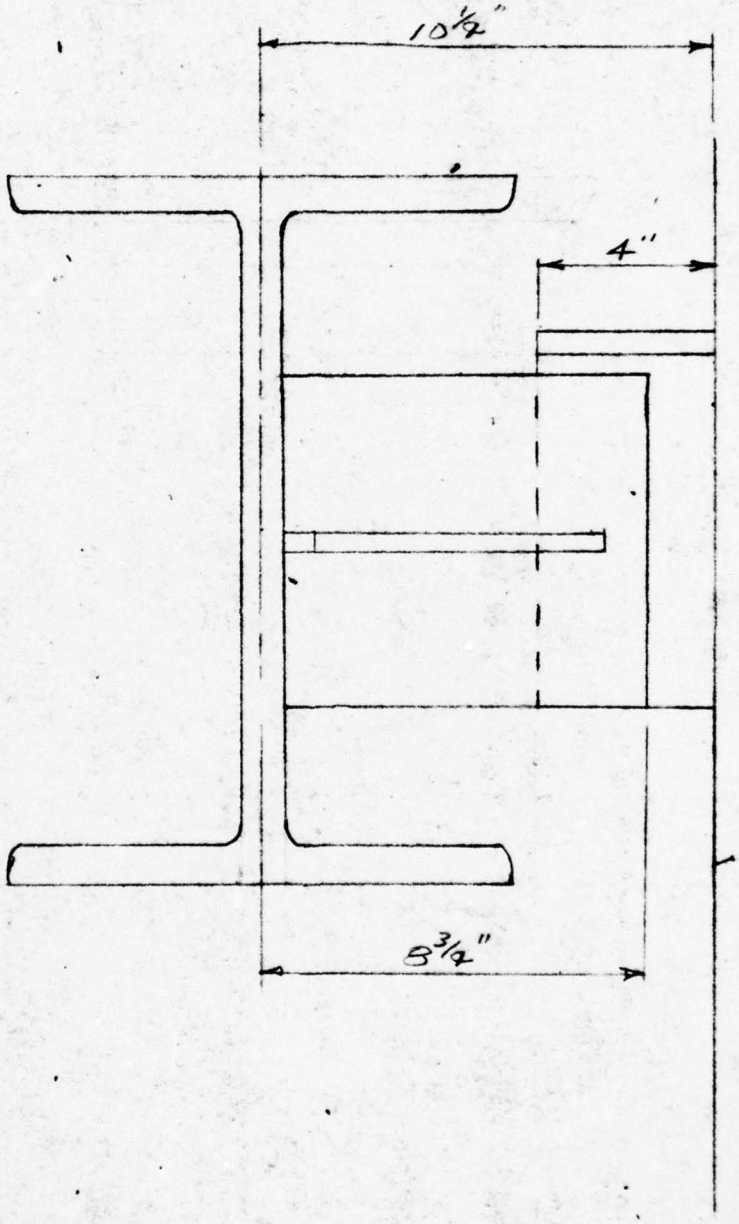
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO._____

COMPANY_____

SUBJECT_____

DRAWING NO._____ COMPUTER_____ CHKD. BY_____ DATE_____ 19____



8177

J. RAY McDERMOTT & CO., INC.

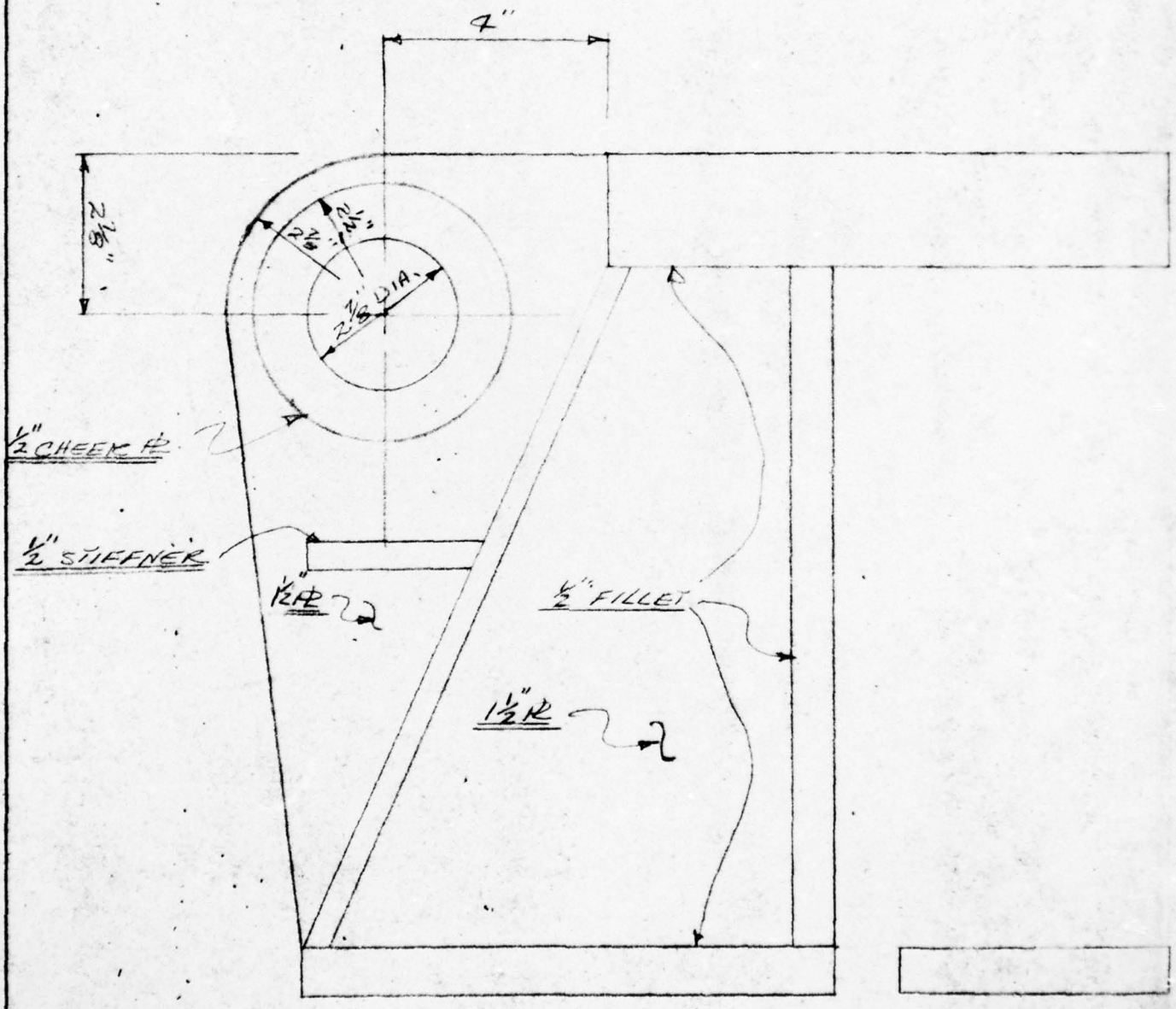
ENGINEERING DEPARTMENT - COMPUTATION SHEET

SHEET NO. 1

COMPANY U. S. ARMY/ERDL

SUBJECT MOOR-MOORING SYSTEM

JOB ~~DRAWING~~ NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 7-8 19 65



LIFTING EYES

MAX. WT. ≈ 280^K

USE FOUR PICK-UP POINTS

VERTICAL REACTION/PT. = $\frac{280}{4}$ = 70^K

ASSUME SLING ∠ = 30° FROM VERTICAL

$P = \frac{70}{.866} = 81^K \times 2$ FOR IMPACT = 162^K

TRY 2 3/4" ϕ PIN

SHEAR ALLOW P = 178^K > 162^K O.K.

BEARING ALLOW P = 88(2.5) = 220^K > 162^K O.K.

CHECK LENGTH OF 1/2" FILLET WELD TO DEVELOPE 162^K

$P/_{11} = .707(.5)(13.6) = 4.8^{K}/_{11}$

$L = \frac{162}{4.8} = 33.7"$ O.K.

2

COMPANY U. S. ARMY/ERDL

SUBJECT MONO-MOORING SYSTEM

JOB DRAWING NO. 56017 COMPUTER ANDREW 3 CHKD. BY DATE 6-2 1965

CHECK LAUNCHING LOAD ON BUOY

WEIGHT = 100T VELOCITY = 20 FPS Δ = 3 FEET

$$KV = \frac{1}{2}MV^2 = \frac{1}{2}\left(\frac{200{,}000}{32.2}\right)(20)^2 = 1{,}240{,}000 \text{ ft}^{\#}$$

$$KV = \frac{PA}{2}$$

$$P = \frac{2(KV)}{\Delta} = \frac{2(1{,}240{,}000)}{8} = 310{,}000^{\#}$$

ASSUME CONTRIBUTORY AREA 17 FT. X 20 FT.

$$\text{PRESSURE} = \frac{P}{A} = \frac{310{,}000}{17(20)(17)} = 7.70 \text{ psi}$$ O.K.

BUOY HULL WILL WITHSTAND LAUNCHING PRESSURE OF 7.70 psi

CONSIDER SWIVEL SUPPORT

ASSUME WT. OF SWIVEL = 20^K

$$P = \frac{20}{200}(310) = 31^K$$

SWIVEL SUPPORT ADEQUATE BY INSPECTION

SEE PG. 2 CALCULATIONS ENTITLED: SWIVEL TO BUOY CONN.

AD-A034 242 MCDERMOTT (J RAY) CO INC NEW ORLEANS LA F/G 13/10

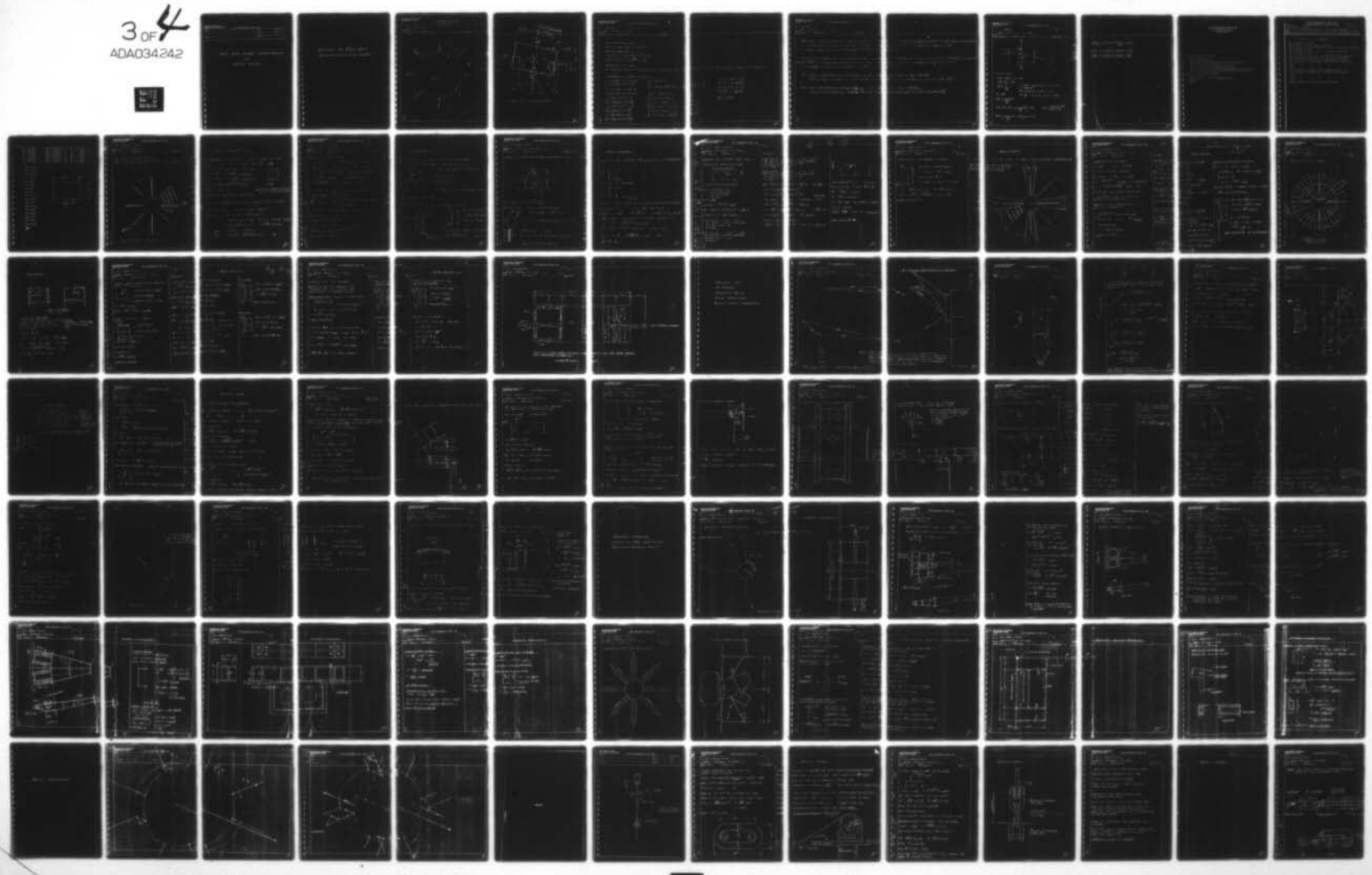
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 1. --ETC(U)

1966 DA-44-009-AMC-841(T)

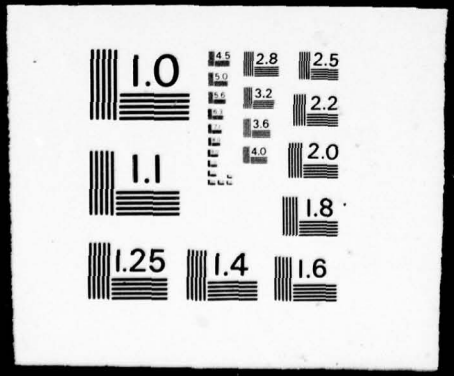
UNCLASSIFIED NL

3 OF 4

ADA034242



3 OF 4
ADA034242



COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
PROJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

BUOY HEEL ANGLE COMPUTER PROGRAM

AND

SAMPLE RESULTS

DESIGN OF BUOY HULL

ROTATING DECK & A-FRAME

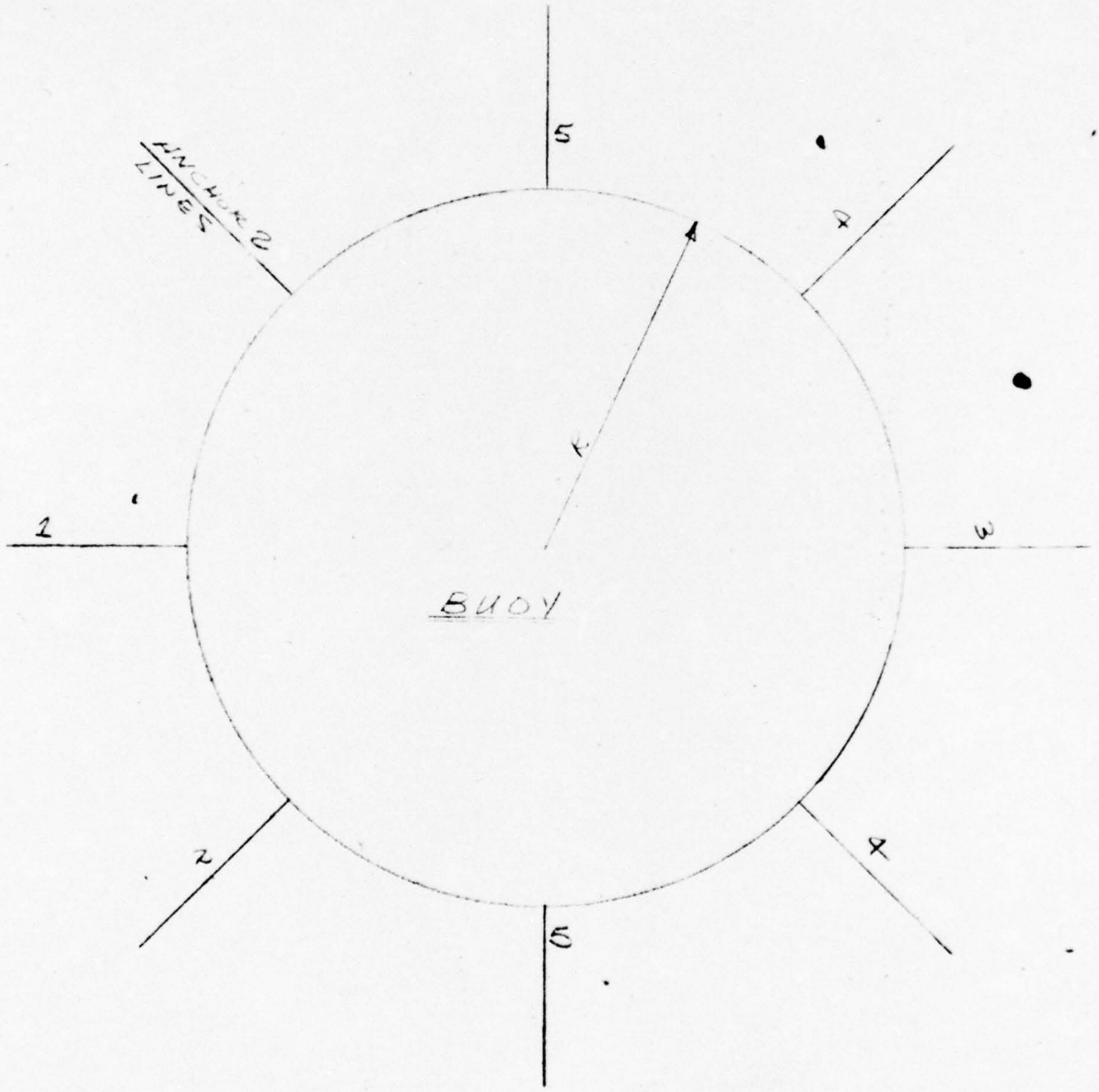
ENGINEERING DEPARTMENT
COMPUTATION SHEET

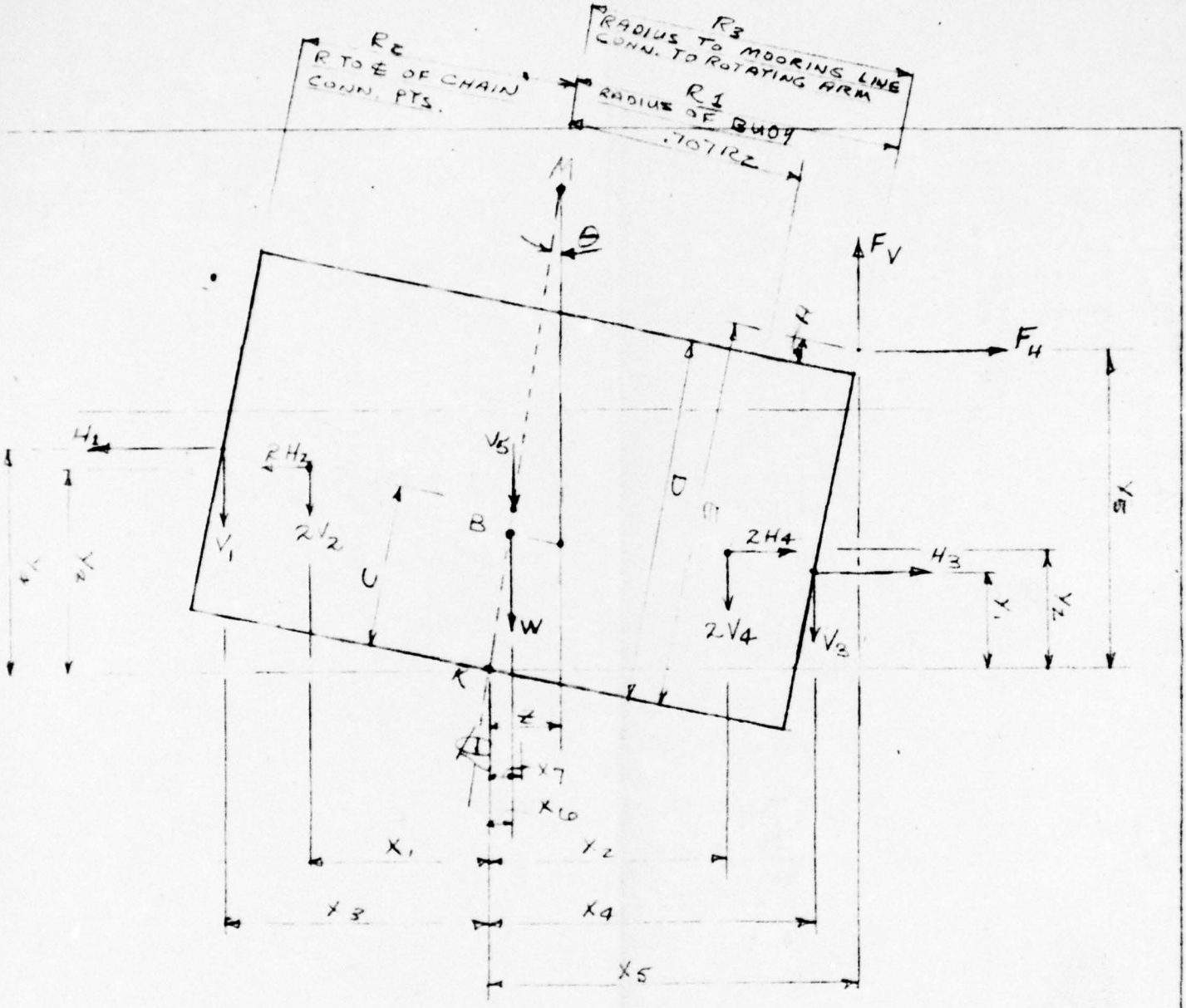
J. RAY McDERMOTT & CO., INC.
DEVELOPMENT LABORATORIES

COMPANY U. S. ARMY ENGINEER RESEARCH

SUBJECT MOOR-MOORING SYSTEM

NUMBER JOB 56017 COMPUTED ANDREWS CHECKED BY DATE 12/4/67





FREE BODY DIAGRAM OF BUOY

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

COMPANY | SHEET NO.

SUBJECT: ERDL, MONO-MOORING SYSTEM

NUMBER | COMPUTED | CHECKED BY | DATE

JOB 56017 | ANDREWS | | 12/7/67

Σ HORIZONTALS $= 0$

$\Sigma H = F_H + H_3 + 2H_4 - H_1 - 2H_2 = 0$

Σ VERTICALS $= 0$

$\Sigma V = F_V - V_1 - 2V_2 - 2V_4 - V_3^{NS} - W + B$

$$\boxed{B = V_1 + 2V_2 + 2V_4 + V_3^{NS} + W - F_V}$$

Σ MOMENT @ K $= 0$

$M = F_H(Y_5) + H_3(Y_1) + 2H_4(Y_2) + V_3(X_4) + 2V_4(X_2) + 2V_5(X_1) + W(X_1) - F_V($

DETERMINE X, Y & Z DISTANCES

$X_1 = (.707R_2 - C\tan\theta)\cos\theta$

$$\boxed{X_1 = (.707R_2\cos\theta - C\sin\theta)}$$

$X_2 = (.707R_2 + C\tan\theta)\cos\theta$

$$\boxed{X_2 = (.707R_2\cos\theta + C\sin\theta)}$$

$X_3 = (R_2 - C\tan\theta)\cos\theta$

$$\boxed{X_3 = (R_2\cos\theta - C\sin\theta)}$$

$X_4 = (R_2 + C\tan\theta)\cos\theta$

$$\boxed{X_4 = (R_2\cos\theta + C\sin\theta)}$$

$X_5 = (R_3 + E\tan\theta)\cos\theta$

$$\boxed{X_5 = (R_3\cos\theta + E\sin\theta)}$$

$$\boxed{X_6 = \bar{K}\bar{B}\sin\theta}$$

$$\boxed{B = (\gamma .7854 R_1^4 + B\bar{T}\bar{E})\sin\theta}$$

$Y_1 = (C - R_2\tan\theta)\cos\theta$

$$\boxed{Y_1 = (C\cos\theta - R_2\sin\theta)}$$

$Y_2 = (C - .707R_2\tan\theta)\cos\theta$

$$\boxed{Y_2 = (C\cos\theta - .707R_2\sin\theta)}$$

$Y_3 = (C + .707R_2\tan\theta)\cos\theta$

$$\boxed{Y_3 = (C\cos\theta + .707R_2\sin\theta)}$$

$$\ldots_5(X_1) + W(X_1) - F_Y(X_5) - H_1(Y_4) - 2H_2(Y_3) - V_1(X_3) - 2V_2(X_1) - BZ = 0$$

$$Y_4 = (C + R_2 \tan\theta)\cos\theta$$

$$\boxed{Y_4 = (C\cos\theta + R_2\sin\theta)}$$

$$Y_5 = (E - R\tan\theta)\cos\theta$$

$$\boxed{Y_5 = (E\cos\theta - R_3\sin\theta)}$$

$$\boxed{X_7 = C\sin\theta}$$

$\boxed{\ldots - E + \overline{E})\sin\theta}$

$\ldots\cos\theta$

$\ldots\theta)$

$\ldots\theta)\cos\theta$

$\boxed{\ldots R_2\sin\theta)}$

$\ldots\theta)\cos\theta$

$\boxed{\ldots R_2\sin\theta)}$

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

COMPANY

SHEET NO.

SUBJECT EROL

NUMBER MOOR - MOORING SYSTEM

JOB 56017 COMPUTED BY ANDREWS CHECKED BY DATE 12/7/77

$$M = F_H(E\cos\theta - R_3\sin\theta) + H_3(C\cos\theta - R_2\sin\theta) + 2H_4(C\cos\theta - .707$$
$$+ W(\overline{KB}\sin\theta) - F_V(R_3\cos\theta + E\sin\theta) - H_1(C\cos\theta + R_2\sin\theta) - 2H_2$$
$$- 2V_2(.707R_2\cos\theta - C\sin\theta) - (\gamma .7854R_1^4 + B\overline{KB})\sin\theta = 0$$

$$M = F_H E\cos\theta - F_H R_3\sin\theta + H_3 C\cos\theta - H_3 R_2\sin\theta + 2H_4 C\cos\theta - 1.414$$
$$+ 2V_5 C\sin\theta + W\overline{KB}\sin\theta - F_V R_3\cos\theta - F_V E\sin\theta - H_1 C\cos\theta - H_1 R_2\sin\theta - 2H_2$$
$$- 1.414V_2 R_2\cos\theta + 2V_2 C\sin\theta - \gamma .7854R_1^4\sin\theta - B\overline{KB}\sin\theta = 0$$

$$\tan\theta = \frac{(F_H E + H_3 C + 2H_4 C + V_3 R_2 + 1.414V_4 R_2 - F_V R_3 - H_1 C - 2H_2}{-(-F_H R_3 - H_3 R_2 - 1.414H_4 R_2 + V_3 C + 2V_4 C + 2V_5 C + W\overline{KB} - F_V E - H_1 R}$$

$$\tan\theta = \frac{(F_H E + H_3 C + 2H_4 C + V_3 R_2 + 1.414V_4 R_2 - F_V R_3 - H_1 C - 2H_2 C - 1, R_2}{(F_H R_3 + H_3 R_2 + 1.414H_4 R_2 - V_3 C - 2V_4 C - 2V_6 C - W\overline{KB} + F_V E + H_1 R_2 +}$$

$C\cos\theta - .707R_2\sin\theta) + V_3(R_2\cos\theta + C\sin\theta) + 2V_4(.707R_2\cos\theta + C\sin\theta) + 2V_5 C\sin\theta$

$R_2\sin\theta) - 2H_2(C\cos\theta + .707R_2\sin\theta) - V_1(R_2\cos\theta - C\sin\theta)$

$)\sin\theta = 0$

$C\cos\theta - 1.414H_2R_2\sin\theta + V_3R_2\cos\theta + V_3C\sin\theta + 1.414V_4R_2\cos\theta + 2V_4C\sin\theta$

$R_2\sin\theta - 2H_2C\cos\theta - 1.414H_2R_2\sin\theta - V_1R_2\cos\theta + V_1C\sin\theta$

$\bar{B}\sin\theta = 0$

$-H_1C - 2H_2C - V_1R_2 - 1.414V_2R_2)$

$\overline{RB} - V_1E - H_1R_2 - 1.414H_2R_2 + V_1C + 2V_2C - \gamma.7854R_1^4 - B\overline{RB})$

$-H_2C - V_1R_2 - 1.414V_2R_2)$

$F_1E + H_1R_2 + 1.414H_2R_2 - V_1C - 2V_2C + \gamma.7854R_1^4 + B\overline{RB})$

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

MCD 5036

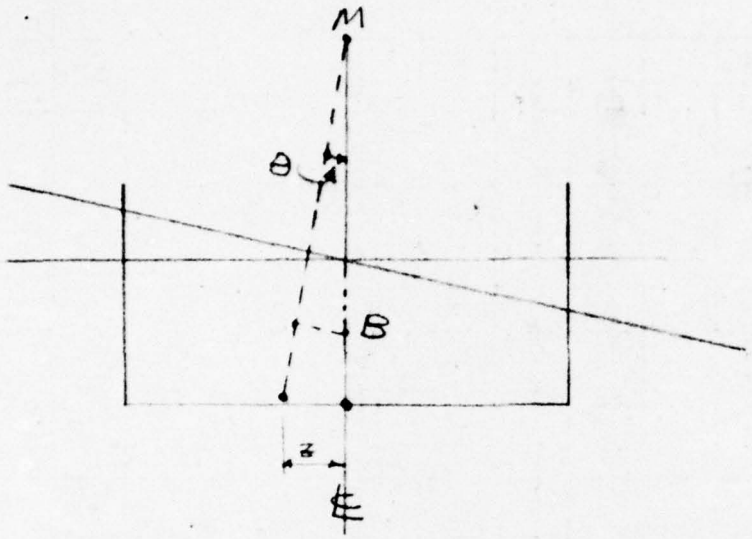
COMPANY: EROL

SHEET NO: 4

SUBJECT: MOOD - MOORING SYSTEM

DRAWING NUMBER | COMPUTER | CHECKED BY | DATE

JOB 56017 ANDREWS 12/9/64



$$B = W + \Sigma V$$

$$B\bar{z} = \overline{KM} \sin\theta \times B$$

$$\overline{KM} = \overline{KB} + \overline{BM}$$

$$\overline{BM} = \frac{I}{\nabla}$$

I = WATER PLANE MOMENT OF INERTIA

$I = .7854 R^4$

∇ = DISPLACED VOLUME IN CU. FT.

$B = \gamma \nabla$

$\nabla = \frac{B}{\gamma}$ γ = WT. OF LIQUID IN K/FT^3

$$\overline{BM} = \frac{.7854 R^4}{\frac{B}{\gamma}}$$

$$\overline{KM} = \overline{BM} + \overline{KB} = \left(\frac{.7854 R^4}{\frac{B}{\gamma}}\right) + \overline{KB}$$

$\overline{KB} = \frac{d}{2}$ } FOR CYLINDER WITH FLAT BOTTOM

$$B\bar{z} = \left(\frac{.7854 R^4}{\frac{B}{\gamma}} + \overline{KB}\right) \sin\theta \times B$$

$$B\bar{z}\,\frac{B}{\gamma} = \left(.7854\,R^4 + K\bar{B}\,\frac{B}{\gamma}\right)\sin\theta \times B$$

$$B\bar{z}\,B = \left(.7854\,R^4\,\gamma + K\bar{B}\,B\right)\sin\theta \times B$$

$$\boxed{B\bar{z} = \left(.7854\,R^4\,\gamma + K\bar{B}\,B\right)\sin\theta}$$

```
   10 READ 1,R1,R2,R3,W,C,D,E,BK
      IF(R1)20,30,20
   20 READ 1,FH,H1,H2,H3,H4
      READ 1,FV,V1,V2,V3,V4,V5,WL
    1 FORMAT (F10.4,F10.4,F10.4,F10.4,F10.4,F10.4,F10.4,F10.4)
      B=V1+2.*V2+2.*V4+V3+2.*V5+W-FV
      TOP1 = (FH*E+H3*C+2.*H4*C+V3*R2+1.414*V4*R2)
      TOP2 = (-FV*R3-H1*C-2.*H2*C-V1*R2-1.414*V2*R2)
      BOT1 = (FH*R3+H3*R2+1.414*H4*R2-V3*C-2.*V4*C-2.*V5*C-W*BK+FV*E)
      BOT2 = (H1*R2+1.414*H2*R2-V1*C-2.*V2*C+WL*.7854*R1**4+B*BK)
  100 TANA =(TOP1+TOP2)/(BOT1+BOT2)
  200 DEG = 180.*ATANF(TANA)/3.14
      PRINT 4,B,DEG
    4 FORMAT (10X,3HB =,F10.4,10X,5HDEG =,F10.6)
      GO TO 10
   30 PAUSE
      END
```

J. RAY McDERMOTT & CO., INC.

Form McD-568 ENGINEERING DEPARTMENT - COMPUTATION SHEET SHEET No. 1

COMPANY USA ERDL

SUBJECT MONO MOORING SYSTEM BUOY HEEL ANGLE

JOB DRAWING No. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 12/29 1969

DEFINITION OF VARIABLES

R1 = RADIUS OF BUOY
R2 = RADIUS TO ℄ OF PENDANT CONN. PT.
R3 = RADIUS TO ℄ OF MOORING LINE CONN. TO ROTATING PLATFORM.
W = WEIGHT OF BUOY
C = DISTANCE FROM PT. K TO PENDANT CONN. PT.
D = DEPTH OF BUOY
E = DISTANCE FROM PT. K TO MOORING LINE CONN. PT.
BK = DISTANCE FROM PT. K TO POINT OF BUOYANCY
FH = HORIZONTAL COMPONENT FROM MOORING LINE
H1 = HORIZONTAL @ BUOY FROM CORRESPONDING PENDANT
H2 = " " " " " "
H3 = " " " " " "
H4 = " " " " " "
FV = VERTICAL COMPONENT FROM MOORING LINE
V1 = VERTICAL @ BUOY FROM CORRESPONDING PENDANT
V2 = " " " " "
V3 = " " " " "
V4 = " " " " "
V5 = " " " " "
WL = WEIGHT OF LIQUID FLOATING BUOY

LOAD DATA

B = 314.1000	DEG = 15.98099	Cp=0	C = 4	F_V = 50
B = 314.1000	DEG = 14.656417	1	5	= 50
B = 314.1000	DEG = 11.823692	3	7	= 50
B = 314.1000	DEG = 8.730104	5	9	= 50
B = 314.1000	DEG = 5.358545	7	11	= 50
B = 364.1000	DEG = 20.022306	0	4	= 0
B = 264.1000	DEG = 12.164299	0	4	= 100
B = 214.1000	DEG = 8.584930	0	4	= 150
B = 164.1000	DEG = 5.246722	0	4	= 200

R1 = 12.5

R2 = 13.5

R3 = 12.5

W = 200

D = 14.5

E = 19.5

BK = 9.5

FH = 300

H1 = 2089

H2 = 52.5

H3 = 4

H4 = 4.95

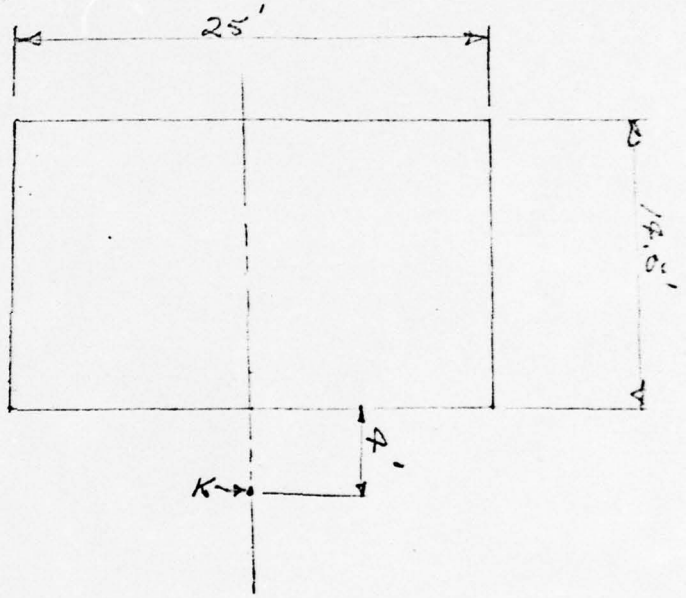
V1 = 58.7

V2 = 34.6

V3 = 11.9

V4 = 12.9

WL = .064



ENGINEERING DEPARTMENT
COMPUTATION SHEET

MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL | SHEET NO: 1

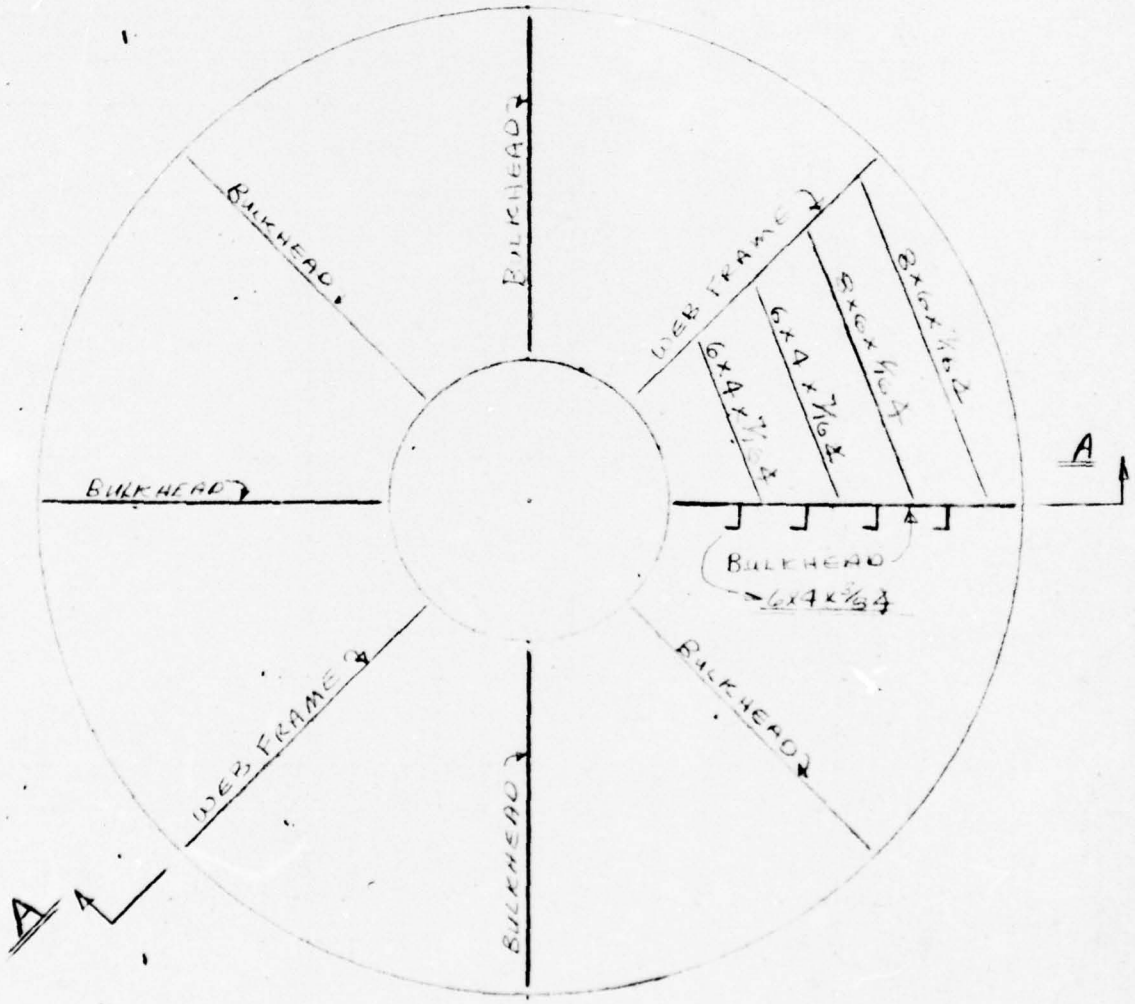
SUBJECT: NOW - MOORING SYSTEM

JOB NUMBER: 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 4/20/65

DESIGN OF BUOY BOTTOM

(ASSUME DECK 9'-0" UNDER WATER)

MAX. PRESSURE = (16.5 + 7) 67 = 1310 PSF = 9.1 PSI



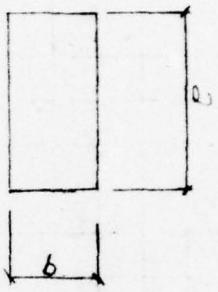
FRAMING PLAN OF BUOY BOTTOM

BUOY DESIGN

DETERMINE PL THICKNESS (CONSIDER FIXED CONDITION)

MAX. $a \approx 11.0$ MAX. $b \approx 2.1'$ $a/b = \frac{11.0}{2.1} = 5.24$

$K_y = .0284$ $K_a = .250$ $K_b = .500$



$S_a = \frac{K_a w b^2}{t^2} = \frac{.25(9.1)(25.2)^2}{(.375)^2} = 10{,}300$ psi

$S_b = \frac{K_b w b^2}{t^2} = \frac{.50(9.1)(25.2)^2}{(.375)^2} = 20{,}500$ psi

DEF'L. $= \frac{K_y w b^4}{E t^3} = \frac{.0284(9.1)(25.2)^4}{30{,}000{,}000(.375)^3} = .0676$

$\frac{.0676}{25.2} = \frac{1}{373}$ O.K.

REF. STEEL PLATES, BETHLEHEM STEEL CO., CATALOG 234, 1948.

3/8" PL O.K. USE 1/2" PL ON BOTTOM

DESIGN OF RIBS (USE ∠S) ASSUME 30t FL. WIDTH

$2.1(1.310) = 2.75^k/'$

$M = 1.5(2.75)(10.5)^2 = 455''^k$

S REQ'D $\approx \frac{455}{2.0} = 23$ IN.^{3}

USE A 8 × 6 × 7/16 ∠ $S_t = 26.5$ $S_c = 53.6$ $I = 150.8$

$f_t = \frac{455}{26.5} = 17.1$ KSI $f_c = \frac{455}{53.6} = 8.5$ KSI

DETERMINE DEF'L.

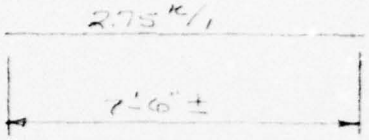
$\Delta = \frac{wL^4}{1333\,I} = \frac{2.75(10.5)^4}{1{,}333(150.8)} = .167'' = \frac{1}{630}$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / ERDL	2
SUBJECT: MONO-MOORING SYSTEM	
DRAWING NUMBER: JOB 5601.7	COMPUTER: ANDREWS
CHECKED BY:	DATE: 4/21/65

DESIGN OF RIBS (CONT.)



$M = 1.5(2.75)(7.5)^2 = \underline{232}^{'k}$

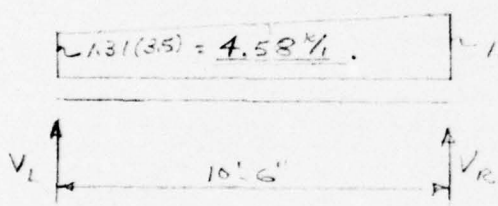
S REQ'D. $= \frac{232}{20} = \underline{11.6 \text{ IN.}}$

USE $6 \times 4 \times 7/16$ ∡ $S_t = 13.8$ $S_c = 35.4$ $I = 65.1$

$f_t = \frac{232}{13.8} = 16.8 \text{ ksi}$ $f_c = \frac{232}{35.4} = 6.4 \text{ ksi}$

$\Delta = \frac{2.75(7.5)^4}{1{,}333(65.1)} = .101 = \underline{\frac{1}{742}}$ O.K.

CONSIDER WEB FRAME (DESIGN AS SIMPLE BEAM)



14.40
4.58
9.82

$V_R = \frac{4.58(10.5)}{2} + \frac{9.82(10.5)}{3} = 24.1 + 34.4$

$V_R = \underline{58.5^k}$

$V_L = 24.1 + \frac{9.82(10.5)}{6} = 24.1 + 17.2 = \underline{41.3^k}$

DETERMINE PT. OF MAX. MOMENT

$\frac{5.7}{10.5}(9.82)$

$4.58(x) + \frac{x}{10.5}(9.82)\frac{x}{2} - V_L = 0$

$.467x^2 + 4.58x - 41.3 = 0$ $x = \underline{5.70'}$

36
03.2
132.8

$M = 41.3(5.7) - \frac{4.58(5.7)^2}{2} - \frac{5.32(5.7)^2}{6}$

$M = 132.8^{'k} = \underline{1{,}590^{''k}}$

14.4
28.8
13.2

BUOY DESIGN

APPROXIMATE SECTION MODULUS REQUIRED

$S \approx \frac{1590}{20} = 79.5 \text{ IN.}^3$ USE R AS SHOWN

$S_t = 77.68$ $S_c = 108.82$ $I = 667 \text{ IN.}^4$

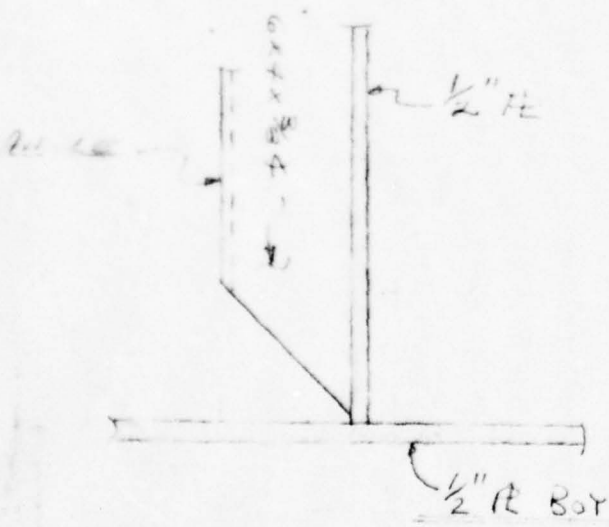
$f_t = \frac{1590}{77.68} = 19.7 \text{ KSI}$

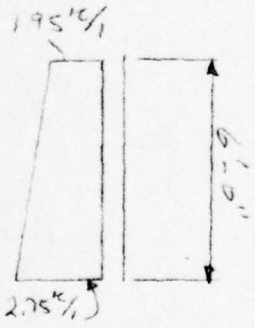
$f_c = \frac{1590}{108.82} = 14.7 \text{ KSI}$

HORIZ AREA = 7.0" ALLOWABLE $V = 7.0(13) = 91^{K} > 58.5^{K}$ O.K.

USE 14 × 9 × ½" R

DIAPHRAGM RIVETED @ BOTTOM OF BUOY





$M \approx 1.5(2.5)(6)^2 = 135^{\text{IK}}$

$S \text{ REQ'D.} \approx \frac{135}{20} = 6.75 \text{ IN.}^3$

USE 6 × 4 × 3/8 ∠

$S_t = 12.2 \text{ IN.}^3$ $S_c = 35.7 \text{ IN.}^3$ $I = 58.9 \text{ IN.}^4$

$f_t = \frac{135}{12.2} = 11.1 \text{ KSI}$ O.K.

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

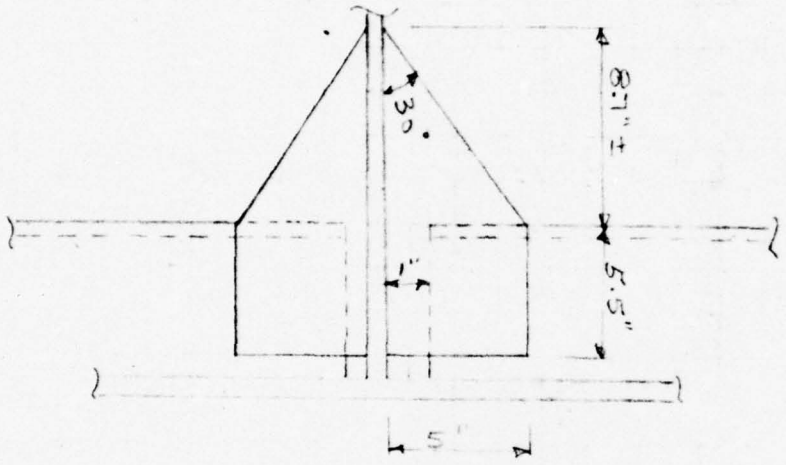
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / ERDL	3

SUBJECT: MONO-MOORING SYSTEM

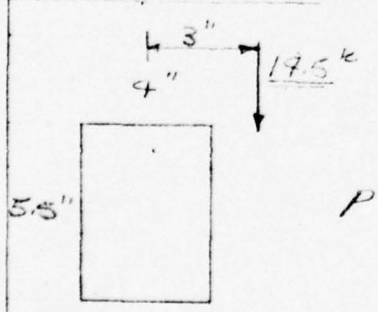
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB - 56017	ANDREWS		4/22/65

RIB TO BULKHEAD & RIB TO WEB FRAME CONN.



MAX. REACTION $= \frac{2.75(10.5)}{2} = \underline{14.5^k}$

USE $\frac{1}{4}$" WELD $F/_{11}$ ALLOW $= .25(.707)(13.6) = \underline{2.4^k/_{11}}$



$a = \frac{3.0}{5.5} = \underline{.545}$ $k = \frac{4}{5.5} = .727$

$P = CDl = 1.05(4)(5.5) = \underline{23.1^k} > 14.5^k$ O.K.

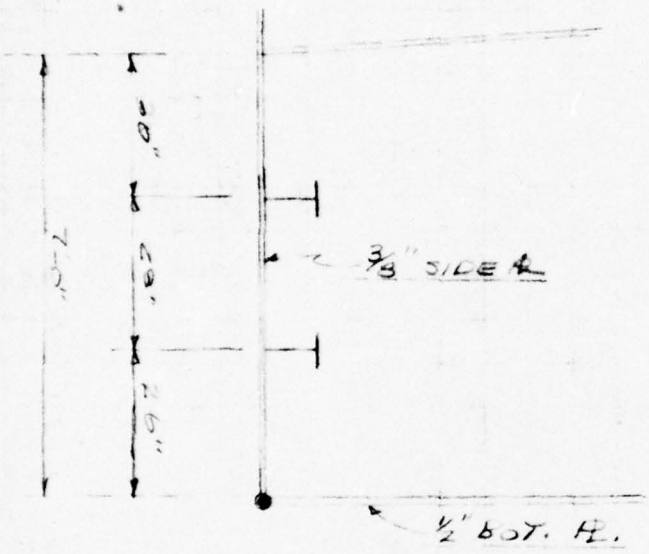
$a = \frac{3}{14.2} = \underline{.211}$ $C = \underline{.750}$

$P = CDl = .75(4)(14.2) = 42.6^k > 14.5$ O.K.

USE $\frac{1}{4}$" FILLET WELD

BUOY DESIGN

DESIGN OF CIRCULAR RIBS IN LOWER COMPARTMENT



DESIGN OF PL (ASSUME RECTANGULAR - UNIFORMLY LOADED)

(CONSIDER FIXED CONDITION) REF. SEE PG. 1

$b = 24''$ $a = 144''$ $a/b = \frac{144}{24} = 6.0$ $K_y = .0284$ $K_a = .25$ $K_b = .500$

TRY 3/8" PL $P_{AVG} \approx 19.0(.4) = 1210$ psf $= 8.45$ psi $= w$

$S_a = \frac{K_a w b^2}{t^2} = \frac{.25(8.45)(26)^2}{(.375)^2} = 10,100$ psi

$S_b = \frac{K_b w b^2}{t^2} = \frac{.5(8.6)(26)^2}{(.375)^2} = 20,200$ psi $\approx 20,000$ O.K.

DEF $\frac{K_y w b^4}{E t^3} = \frac{.0284(8.45)(26)^4}{30,000,000(.375)^3} = .0694'' = \frac{1}{375}$

USE 3/8" PL

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

MCD 14003

COMPANY: U.S. ARMY / ERDL | SHEET NO: 9

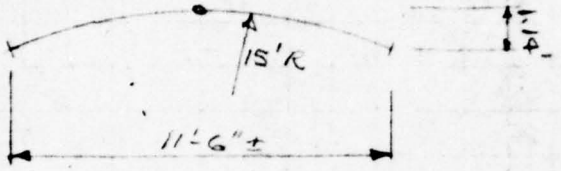
SUBJECT: MONO-MOORING SYSTEM

JOB NUMBER: JOB 66017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 4/22/65

DESIGN OF CIRCULAR RIBS CONT.

DESIGN AS THREE-HINGED ARCH

$w = 1.24(2) = 2.48^{k}/_{1}$



$V_L = V_R = 2.48(11.5)/2 = \underline{14.25^{k}}$

$RISE = r - \frac{1}{2}\sqrt{4r^2 - c^2}$

$= 15 - \frac{1}{2}\sqrt{4(15)^2 - (11.5)^2}$

$= 15 - \frac{1}{2}\sqrt{767.75}$

$= 15 - 13.86$

$RISE = \underline{1.14'}$

$H_L = H_R = \frac{14.25(11.5)}{4(1.14)} = \underline{35.9^{k}}$

$MAX.\ THRUST = \sqrt{(14.25)^2 + (35.9)^2} = \underline{38.7^{k}}$

FIND PT. OF MAX. MOMENT

ΣM @ PT. 1 $x = 30''$ $y = 9''$

$M = 14.25(30) - 35.9(9) - 2.48(30)^2/2$

$M = 427 - 323 - 113$

$M = \underline{-9''^{k}}$

ΣM @ PT. 2 $x = 24''$ $y = 8.4''$

$M = 14.25(24) - 35.9(8.4) - 2.48(24)^2/2$

$M = 342 - 302 - 71.5$

$M = \underline{-31.5''^{k}}$

ΣM @ PT. 3

$M = 14.25(20) - 35.9$

$M = 285 - 270 -$

$M = \underline{-39.6''^{k}}$

ΣM @ PT. 4

$M = 14.25(16) - 35.9($

$M = 228 - 215 -$

$M = \underline{-13.7''^{k}}$

MAX. MOMENT =

THRUST = 38.7

TRY 10 x 7 x 3/8"

$S_t = 22.72$

$P/A = \frac{38.7}{5.11} =$

$S_t = \frac{40}{22.72} =$

$F_a = 19.23$ ksi

UNITY CHECK

$\frac{1.62}{19.03} + \frac{1.7}{20} =$

11.50	215	270	11.250
	31.1	49.6	3.61
	246.7	319.6	14.86
	228.0	285	
	18.7	34.6	

3 $X = 20''$ $Y = 7.5''$

$(20) - 35.9(7.5) - 2.48(20)^2/2$

$- 270 - 49.6$

$6''^K$

4 $X = 16''$ $Y = 6''$

$16) - 35.9(6) - 2.48(16)^2/2$

$- 215 - 31.7$

$''^K$

ENT ≈ $40''^K$ $L \approx 70''$

$= 38.7^K$

$\times 4 \times 3/8$ PL

AREA = 5.11

72 $S_c = 40.48$ $r = 4.02$

$\frac{8.7}{5.11} = 7.62$ ksi

$\frac{0}{72} = 1.76$ ksi $L/r = \frac{70}{4.02} = 17.5$

03 ksi $F_b = 20$ ksi

CHECK

$\frac{1.76}{20} = .4 + .088 = .488 < 1.0$

TRY $6 \times 4 \times 3/8$ PL

PL ONLY

$S_c = 11.5$ $S_t = 22.7$ $r = 2.49$ $A = 3.75$

$P/A = 38.7/3.61 = 10.3$ ksi

$f_c = \frac{40}{11.5} = 3.48$ psi

$L/r = \frac{70}{2.49} = 28$ $F_a = 18.48$ ksi $F_b = 20$ ksi

UNITY CHECK

$\frac{10.3}{18.48} + \frac{3.48}{20} = 0.55 + .17 = 0.72 < 1.0$

USE $6 \times 4 \times 3/8$ PL

7

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

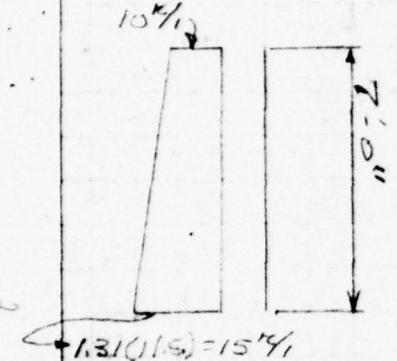
MCD 14-003

COMPANY: U.S. ARMY / EROL | SHEET NO: 5

SUBJECT: MONO-MOORING SYSTEM

JOB NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 4/23/65

DESIGN OF WEB FRAME FOR OUTSIDE



MAX. MOM. $\approx 1.5(12.5)(7)^2 = 920$ "K

S REQ'D. $\approx \frac{920}{20} = 46$ IN.^{3}

TRY 13 x 8 x 3/8 PL

$S_t = 71.33$ $S_c = 60.19$ $I = 362.59$

$f_t = \frac{920}{71.33} = 13.6$ KSI $f_c = \frac{920}{60.19} = 15.3$ KSI

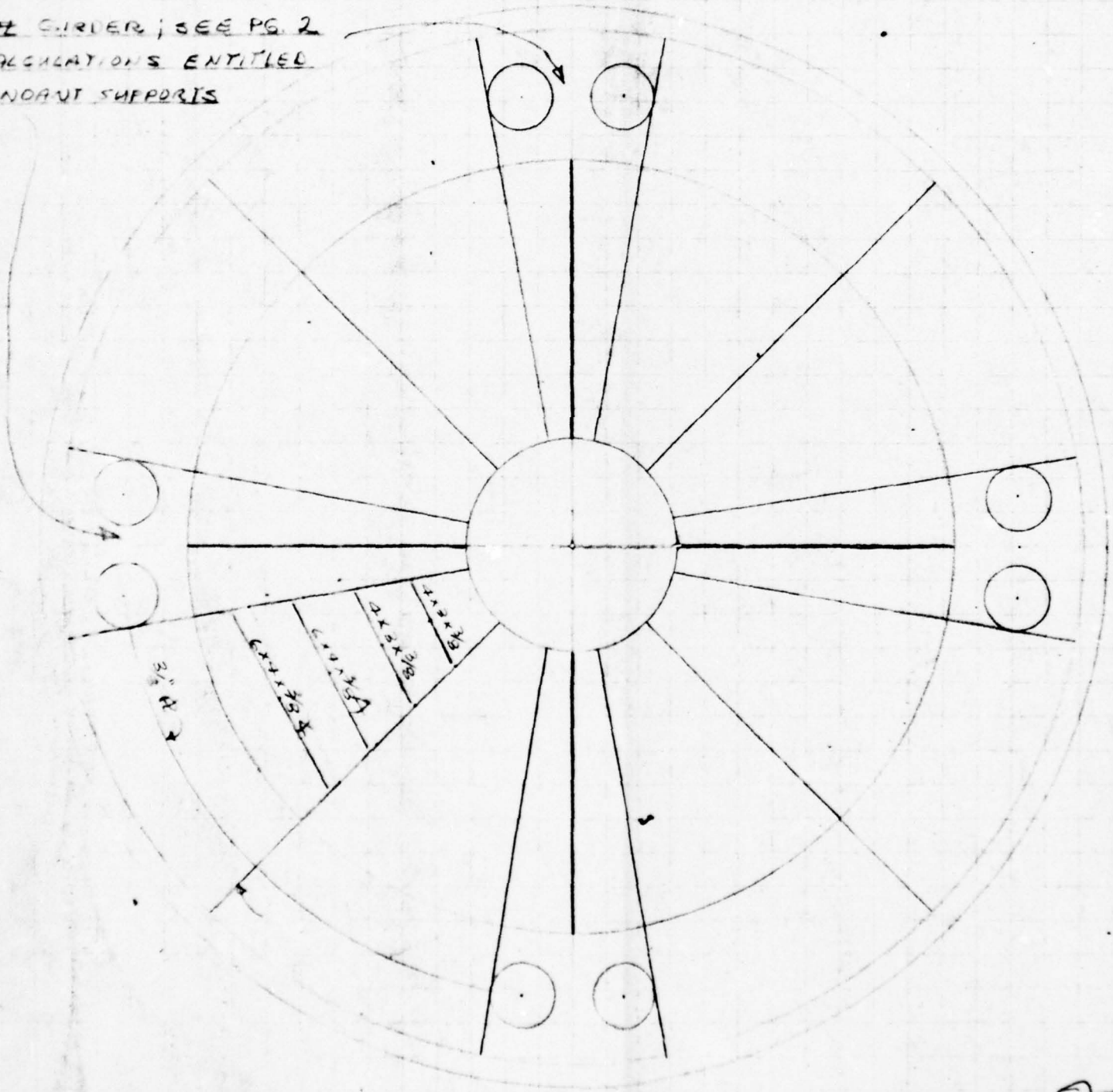
DEF'L $= \frac{wL^4}{1333\,I} = \frac{12.5(7)^4}{1,333(363)} = .0622" = \frac{1}{1351}$

USE 13 x 8 x 3/8 PL

BUOY DESIGN

FRAMING PLAN OF MACHINERY & STORAGE COMPARTMENTS

H GIRDER; SEE PG. 2 CALCULATIONS ENTITLED PENDANT SUPPORTS



ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / ERDL	6

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB - 56017	ANDREWS		4/23/65

CHECK 3/8" PL ON SKIRT

$a \approx 127''$ $b = 30''$ $a/b = 4.23$

$w = (20.5 - 6)64/144 = 6.45\,psi$

$K_a = 0.250$ $K_b = .500$ $K_Y = .0284$

$S_a = \frac{.25(6.45)(30)^2}{(.375)^2} = 10{,}300\,psi$ $S_b = 20{,}600\,psi$

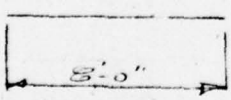
$DEF'L. = \frac{.0284(6.45)(30)^4}{30{,}000{,}000(.375)^3} = .094'' = \frac{1}{320}$

3/8" PL O.K. FOR SKIRT TOP & BOTTOM

USE 3/8" PL INSIDE FOR FLOOR OF UPPER COMPARTMENTS.

DESIGN OF ∠s SUPPORTING FLOOR OF UPPER COMPARTMENT.

$w \approx 14.5(6.4)2.1 = 1.95^k/'$



$M = 1.5(1.95)(8)^2 = 187''^k$

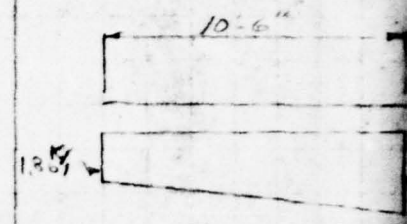
S_i REQ'D: $\approx \frac{187}{20} = 9.3\ IN.^3$

TRY 6x4x3/8 ∠

$f = \frac{187}{11.5} = 16.2\,ksi$

USE 6x4x3/8 ∠

DESIGN OF TOP O



MAX MOM. ≈ 1.5(4.6

S REQ'D ≈ 775/20

TRY 11x8x3/8 PL

$S_c = 40.06$ $S_t =$

$f_c = \frac{775}{40.06} = 19.0\,k$

USE 11x8x3/8 PL

CHECK INSIDE

STIFFNERS

CONSIDER CASE 9

AND STRAIN B

ASSUME θ = 10°

NO FORCES = 360/20 =

$S = \frac{bd^2}{6} = \frac{12(.375)^2}{6} = .282$

NEED STIFFNE

$20^\circ \quad 20 \frac{180}{360} \quad (18) \qquad 20.5(64) = 1.31$

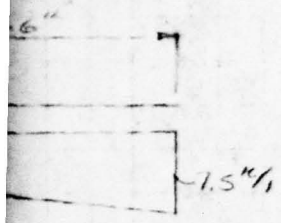
$CIR. = 3.14(8.5) = 26.7 \qquad \frac{1.31(26.7)}{18} = 1.94^k$

$180^\circ = 57.26$

$\frac{10}{180}(57.26) = 3.18$

BUOY DESIGN

OF TOP OF WEB FRAME



$\approx 1.5(4.68)(10.5)^2 = \underline{775}^{''k}$

$\approx \frac{775}{20} = \underline{38.7 \text{ IN.}^3}$

8 x 3/8 PL

06 $S_t = 49.49 \quad I = 251.33$

$\frac{}{6} = \underline{19.1 \text{ KSI}}$

8 x 3/8 PL

INSIDE WELL WITH NO

RS (TRY 3/8" PL)

CASE 9 pg. 153 IN STRESS

IN B. ROARK

$\theta = 10^\circ \quad 2\theta = 20^\circ$

$s = \frac{380}{20} = 18 \qquad F = \frac{1.31(26.7)}{18} = \underline{1.94^k}$

$\text{MAX. } M = \frac{1}{2} WR\left(\frac{1}{s} - \frac{1}{\theta}\right)$

$= \frac{1}{2}(1.94)(51)\left(\frac{1}{.174} - \frac{1}{3.18}\right)$

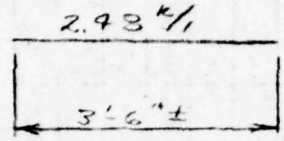
$\text{MAX } M = .5(.194)(51)(5.44) = \underline{26.9}^{''k}$

$= .282 \text{ IN.} \qquad f = \frac{26.7}{.282} = \underline{95.4 \text{ KSI}}$

STIFFNERS

DESIGN OF STIFFNERS FOR WELL

(DESIGN AS SIMPLE BEAM)



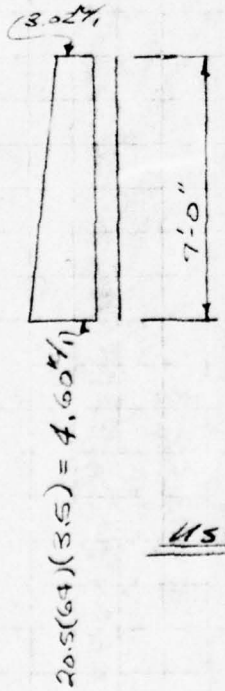
$M = 1.5(2.48)(3.5)^2 = \underline{45.6}^{''k}$

$S \text{ REQ'D.} \approx \frac{45.6}{20} = \underline{2.3 \text{ IN}^3}$

USE 4 x 3 x 3/8 PL $\quad S = \underline{5.3 \text{ IN.}^3} \quad S = \underline{10.3 \text{ IN.}^3} \quad I = \underline{15.1 \text{ IN.}^4}$

O.K. BY INSPECTION

DESIGN OF WEB FRAME FOR INTERIOR WELL



$\text{MAX. MOM.} \approx 3.82(1.5)(7)^2 = \underline{281}^{''k}$

$S \text{ REQ'D.} \approx \frac{281}{20} = \underline{14.1 \text{ IN.}^3}$

TRY 7 x 4 x 3/8 PL

$S_t = \underline{14.1} \quad S_c = \underline{27.0} \quad I = \underline{68.2}$

$f = \frac{281}{14.1} = \underline{19.9} \text{ KSI}$

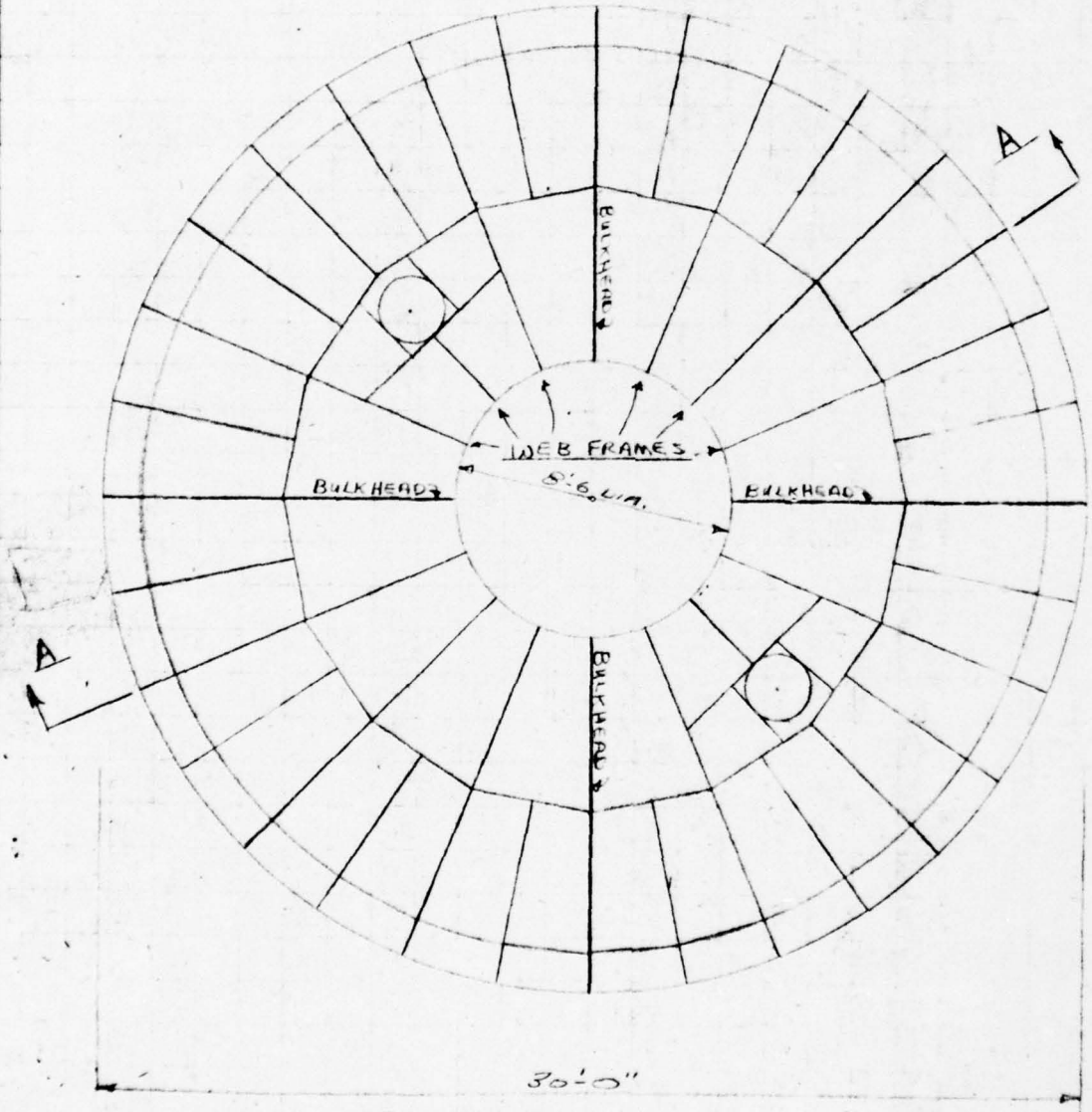
USE 8 x 4 x 3/8 PL O.K. BY INSPECTION

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY MCDERMOTT & CO., INC.

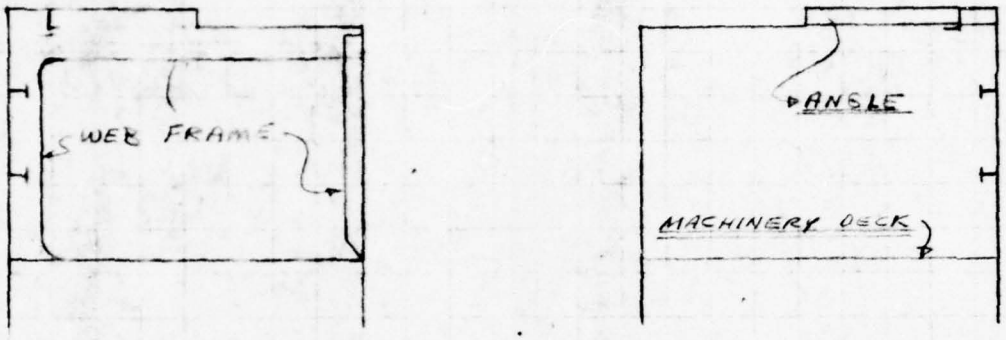
COMPANY			SHEET NO
U. S. ARMY/EROL			7
SUBJECT: NOMO - MOORING SYSTEM			
ORIGINATOR'S NUMBER: JOB 56017	COMPUTER: ANDREWS	CHECKED BY	DATE: 4/26/65

DESIGN OF TOP OF BUOY



FRAMING PLAN
SCALE 3/16" = 1'-0"

BUOY DESIGN



SECTION A-A
3/16" = 1'-0"

LOADS ON BUOY TOP

HYDROSTATIC PRESSURE ≈ 6(67)/144 = 2.67 psi
REACTION FROM "A"-FRAME - - - - 41 K/LEG = 20.5 K/WHEEL
MOORING LOAD (VERTICAL COMP.) - - 195 K = 32.5 K/WHEEL
WT. OF DECK - - - - - - - - - - 20 K ±

CHECK 7/8" PL

MAX a = 60" b = 45" a/b = 1.33

K_y = .0237 K_a = .250 K_b = .462

$$\sigma_b = \frac{.462(2.67)(45)^2}{(.875)^2} = 17{,}300 \text{ psi} \quad \text{O.K.}$$

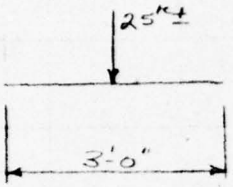
3/8 PL O.K. FOR TOP

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / EROL	8
SUBJECT: MONO-MOORING SYSTEM	
DRAWING NUMBER: JOB 56017 — COMPUTER: ANDREWS — CHECKED BY:	DATE: 4/26/65

CHECK WHEEL SUPPORT FOR REACTION FROM "A" FRAMES.



$M = 3PL = 3(25)(3) = \underline{225}$ "k

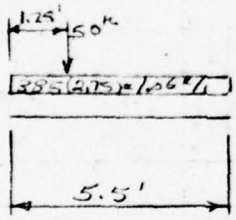
TRY 8 x 4 x 1/16" ∠

$S_t = \underline{19.0}$ $S_c = \underline{32.2}$ $I = \underline{100.2}$

$f = \frac{225}{19} = \underline{11.8 \text{ KSI}}$

$DEF'L. = \frac{PL^3}{834I} = \frac{25(3)^3}{834(100.2)} = \underline{.00794"}$

CHECK SUB-ANGLE SUPPORT



$V_L = \frac{1.06(5.5)}{2} + \frac{50(4.25)}{5.5}$

$V_L = 2.91 + 38.6 = \underline{41.50^k}$

$M = 41.50(1.25) - 1.06(1.25)^2/2$

$M = 41.5 - .83$

$M \approx 41'^k = \underline{492}$ "k

TRY 10x6 x 3/8 PL

$S_t = \underline{29.19 \text{ IN.}^3}$

$f = \frac{492}{29.19} = \underline{16.9 \text{ KSI}}$

USE 10x6 x 3/8 PL

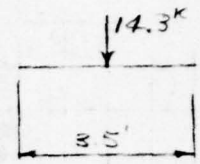
2.91
38.6
41.51

2.91
19.3
21.21

8.5

9
19.4
14.3k

DESIGN OF STEP-D



M = 3PL = 3

5 REQ'D

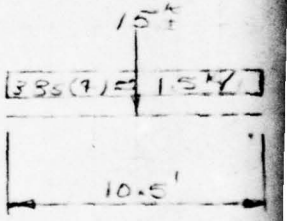
CHECK AS 6 x 4 x 3/8

$f = \frac{150}{11.5} = \underline{13.0 \text{ KSI}}$

3/8 PL AS STEP OK.

DESIGN OF WEB

TOP



$M = 15.35(5.25) - \frac{.5(5}{2}$

$M = 80.5 - 20.5$

TRY 12 x 6 x 3/8 PL

$f_t = \frac{720}{38.35} = 18.8$

USE 12 x 6 x 3/8 M

$13.5(64)(6) = 5.18^{k}/_{1}$ $\quad 6(64)(6) = 2.3^{k}/_{1}$

$$\begin{array}{r} 1.75 \\ .77 \\ \hline .98 \end{array} \qquad \begin{array}{r} 77 \\ 49 \\ \hline 126 \end{array} \qquad \begin{array}{r} 5.18 \\ 2.30 \\ \hline 2.88 \end{array} \qquad \begin{array}{r} 2.30 \\ 1.44 \\ \hline 3.74 \end{array}$$

BUOY DESIGN

5'

...N OF STEP-DOWN

$M = 3\,\Delta L = 3(14.3)(3.5) = \underline{150''^{k}}$

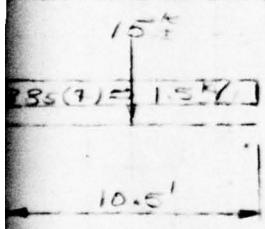
$S\ REQ'D \approx \frac{150}{20} = \underline{7.5\ IN.^3}$

AS $6 \times 4 \times 3/8$ ∠

$\frac{0}{5} = \underline{13.0\ ksi}$

STEP OK.

...OF WEB FRAMES



$V_L \approx V_R \approx 7.5 + 7.85$

$V_L \approx V_R \approx \underline{15.35^{k}}$

$...5(5.25) - \frac{.5(5.25)^2}{2}$

$...5 - 20.5 = 60''^{k} = \underline{720''^{k}}$

$12 \times 6 \times 3/8$ PL

$\frac{720}{38.35} = \underline{18.8\ ksi}$

$12 \times 6 \times 3/8$ MIN DEPTH

OUTSIDE

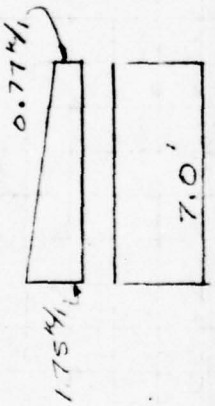
$M \approx 1.5(3.74)(7.5)^2 = \underline{315''^{k}}$

TRY $10 \times 4 \times 3/8$ PL

$f = \frac{315}{22.72} = \underline{14\ ksi}$

USE $10 \times 4 \times 3/8$ PL

INSIDE



$M \approx 1.5(1.26)(7.0)^2 = \underline{92.5''^{k}}$

TRY $6 \times 4 \times 3/8$ ∠

$f = \frac{92.5}{11.5} = \underline{8.04\ ksi}$

USE $6 \times 4 \times 3/8$ ANGLE

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY/ERDL	9

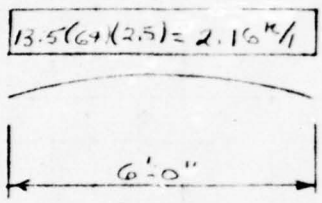
SUBJECT: MONO-MOORING SYSTEM

~~DRAWING~~ NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		4/27/65

DESIGN OF RIB FRAMES

NOTE: NO RIBS ARE REQUIRED FOR INTERIOR WELL SINCE BULKHEADS & WEB FRAMES ARE APPROX. 2'-0" O.C.

OUTSIDE RIBS (DESIGN AS STRAIGHT BM)



$M = 1.5(2.16)(6)^2 = 117''^k$

TRY 5x3x3/8 PL

$f = \frac{117}{7.5} = 15.6$ ksi

USE 5x3x3/8 PL

CHECK 3/8 PL FOR OUTSIDE BUOY HULL

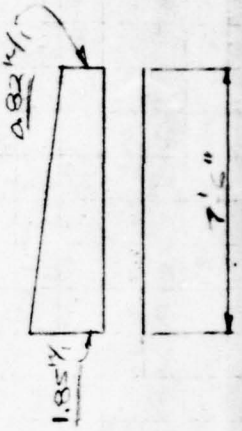
$w = 13.5(64)/144 = 6$ psi $a = 72'$ $b = 30''$ $a/b = 2.4$

$K_y = 0.0280$ $K_a = .250$ $K_b = 0.499$

$S_b = \frac{K_b w b^2}{t^2} = \frac{.499(6)(30)^2}{(.375)^2} = 17{,}200$ psi

3/8" PL O.K. FOR BUOY HULL

DESIGN OF
UPPER BU



DESIGN OF

MAX. SPAN

W = 150 P

M = 1.5(.4

TRY 6x4

$f = \frac{44}{3.3} =$

FRAME W

1.85 .82 1.03 | .82 .62 1.39

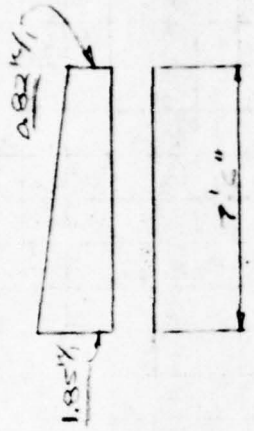
CO., INC.

SHEET NO 9

DATE 4/27/65

BUOY DESIGN

DESIGN OF ∡ SUPPORTS FOR UPPER BULKHEAD



$M = 1.34(1.5)(7.5)^2 = \underline{114}$ "K

TRY 6x4x3/8 ∡

$f = \frac{114}{11.5} = \underline{9.9 \text{ KSI}}$

USE 6x4x3/8 ∡

DESIGN OF PLATFORM

MAX. SPAN OF ∡ ≈ 8' SPC. ≈ 3'

W ≈ 150 PSF

$M = 1.5(.45)(8)^2 = \underline{44}$ "K

TRY 6x4x3/8" ∡

$f = \frac{44}{3.3} = 13.3 \text{ KSI}$

FRAME WITH 6x4x3/8 ∡s & GRATING

Y BM.)

"K

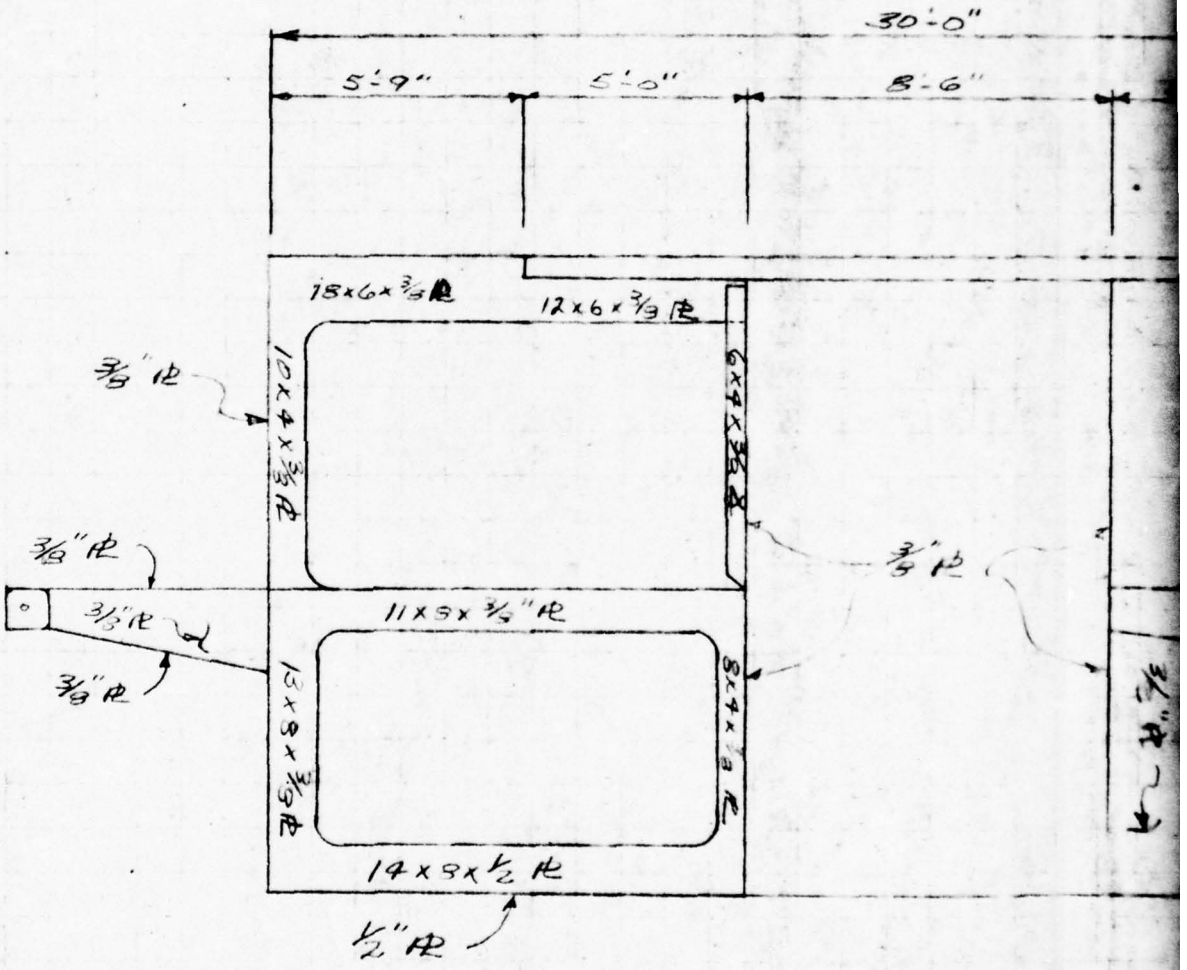
ULL

0" $\frac{a}{b} = 2.4$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

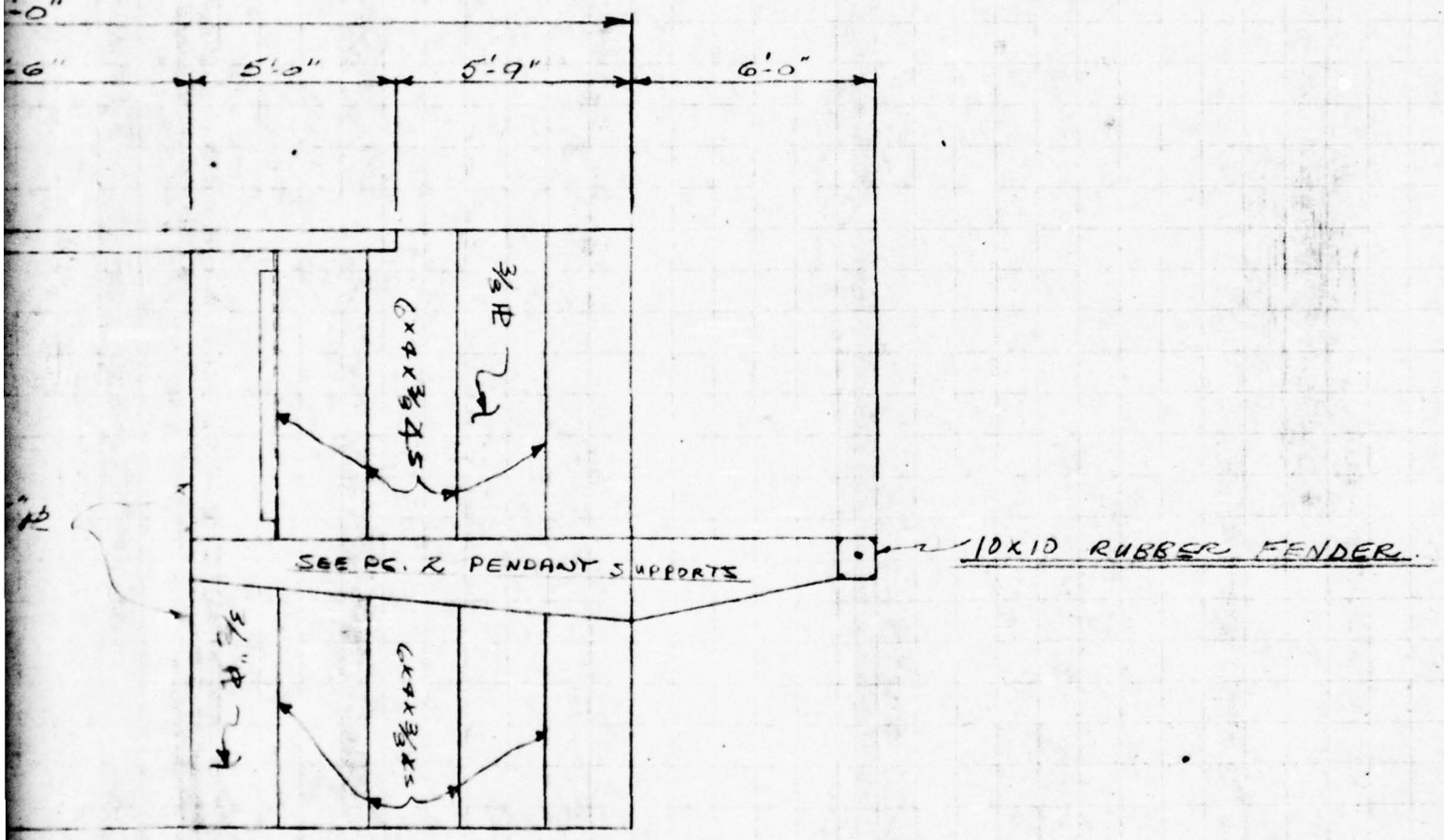
J. RAY MCDERMOTT & CO., INC.

COMPANY			SHEET NO
U. S. ARMY / ERDL			10
SUBJECT: MONO-MOORING SYSTEM			
~~DRAWING~~ NUMBER	COMPUTER	CHECKED BY	DATE
JOB - 56017	ANDREWS		4/27/65



SECTION THRU BUOY SHOWING TYP
AND BULKHEAD FRAMING

SCALE 1/4" = 1'-0"



OWING: TYPICAL WEB FRAME

DESIGN OF:

A-FRAME

ROTATING DECK

BOGIE RACEWAYS

BOGIE WHEEL SUPPORTS

ENGINEERING DEPARTMENT
COMPUTATION SHEET

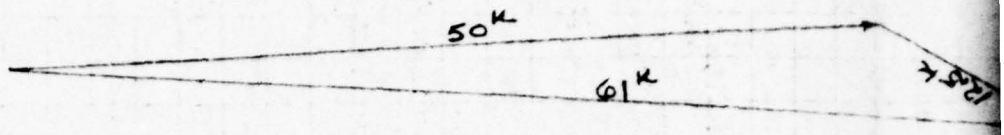
J. RAY McDERMOTT & CO., INC.

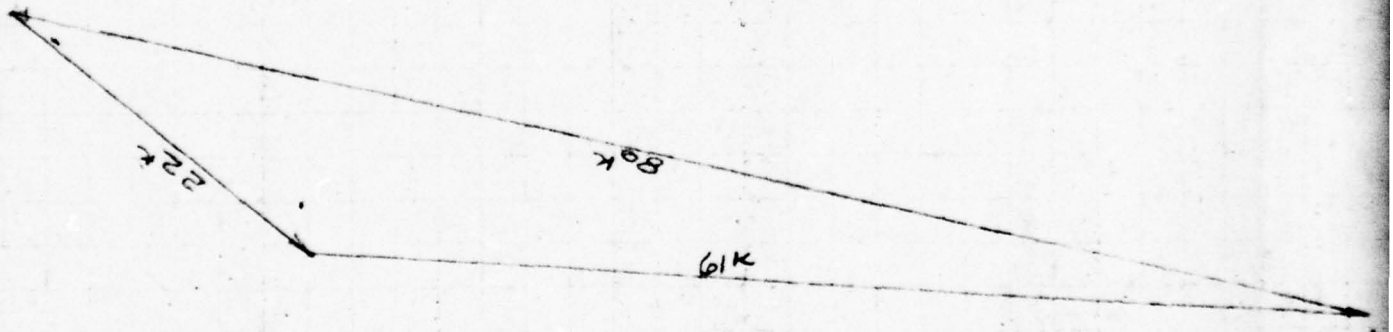
MOD 14003

COMPANY: U.S. ARMY / ERDL — SHEET NO. 1

SUBJECT: MOND - MOORING SYSTEM

DRAWING NUMBER: JOB - 56017 — COMPUTER: ANDREWS — CHECKED BY: — DATE: 3/29/65

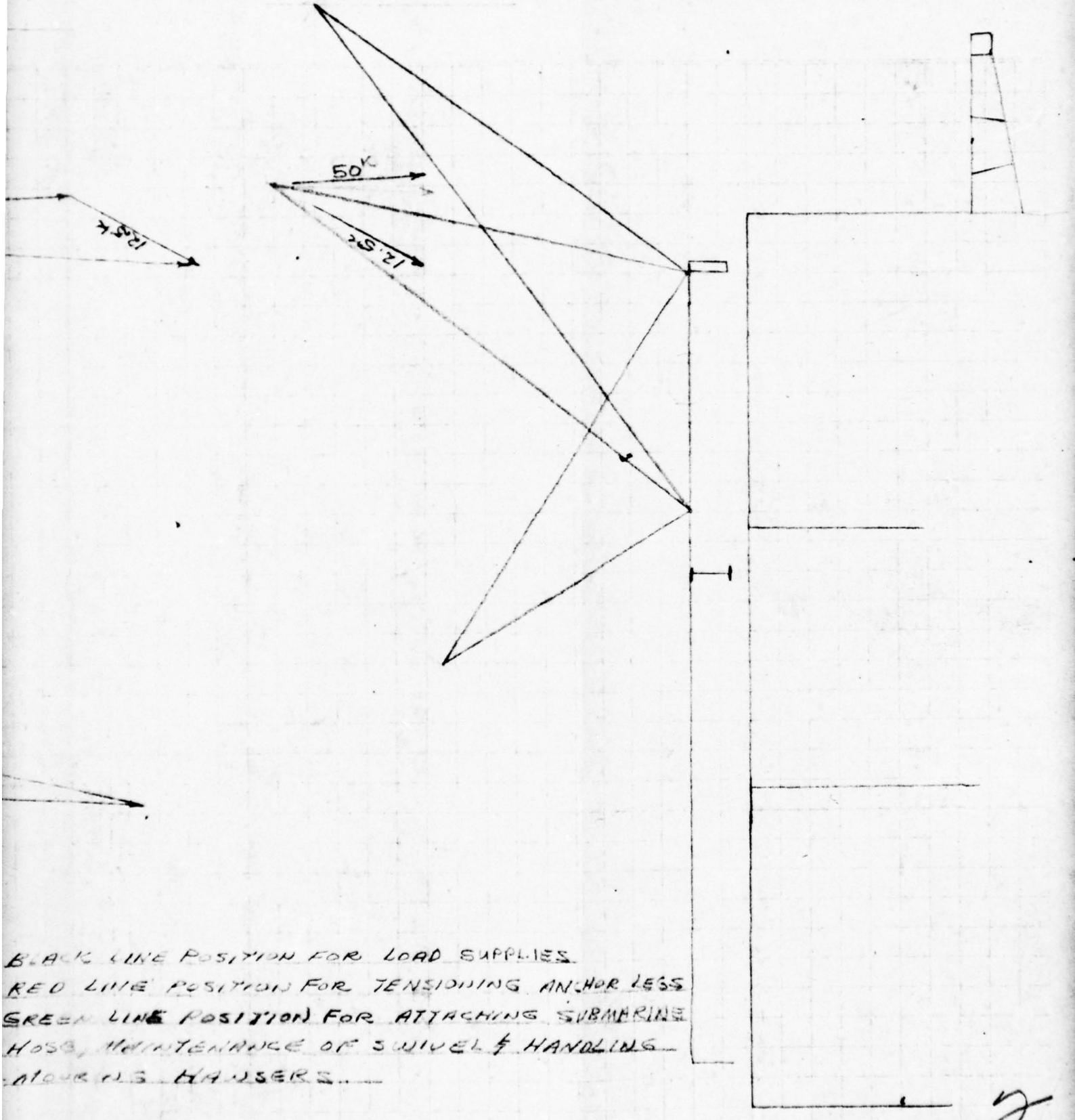




NOTE: BLACK LINE
RED LINE
GREEN LINE
HOSE, MOOR
MOORING

MAX. F/LEG = 41K C MAX. TENSION/LEG ≈ 12K T

"A" FRAME & ROTATING DECK DESIGN.



BLACK LINE POSITION FOR LOAD SUPPLIES.
RED LINE POSITION FOR TENSIONING ANCHOR LEGS
GREEN LINE POSITION FOR ATTACHING SUBMARINE
HOSE, MAINTENANCE OF SWIVEL & HANDLING
MOORING HAWSERS.

T

2

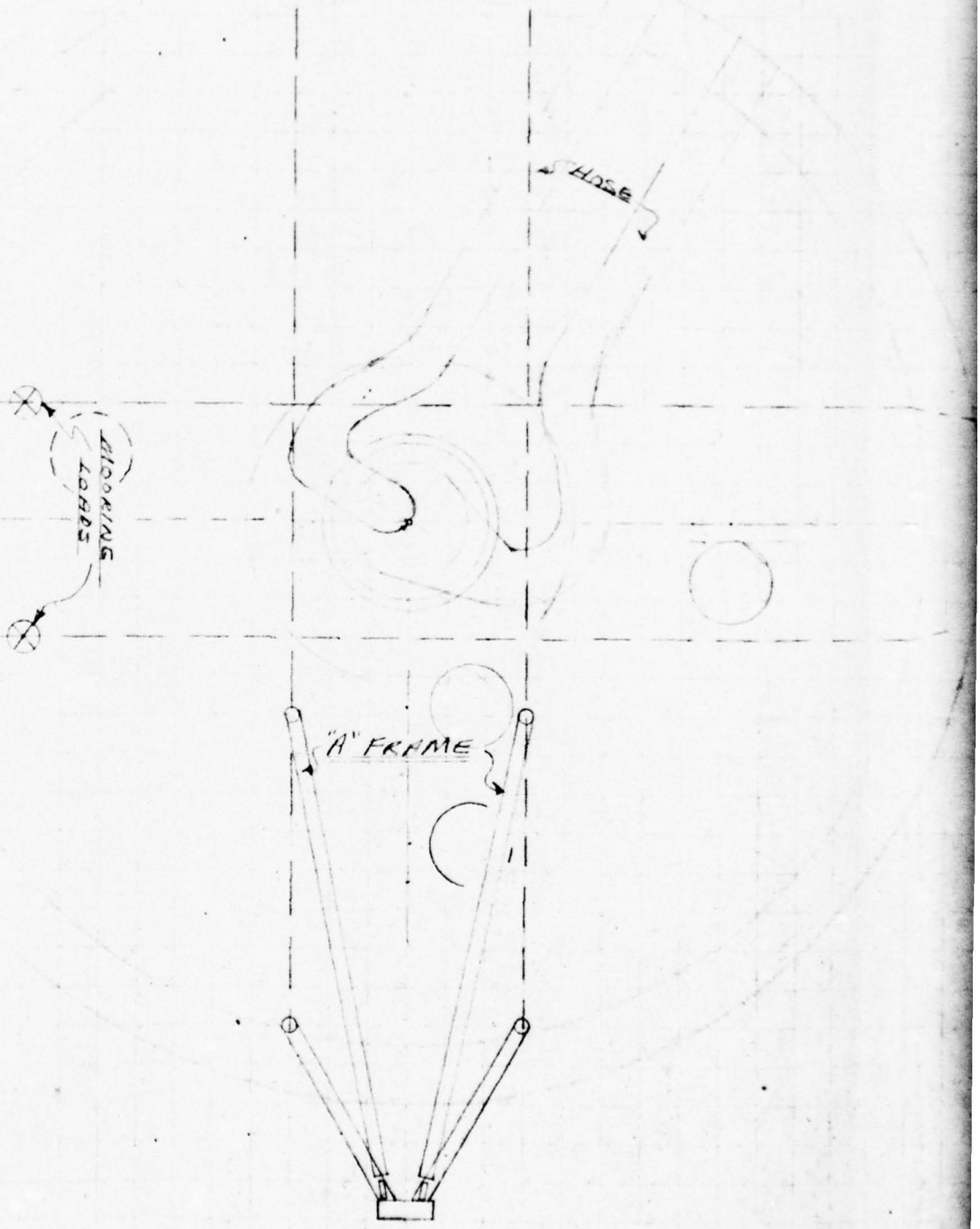
ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

COMPANY: U.S. ARMY / EROL | SHEET NO. 2

SUBJECT: MONO-MOORING SYSTEM

JOB NUMBER: JOB - 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 3/30/65



299
156
445

445
9
454

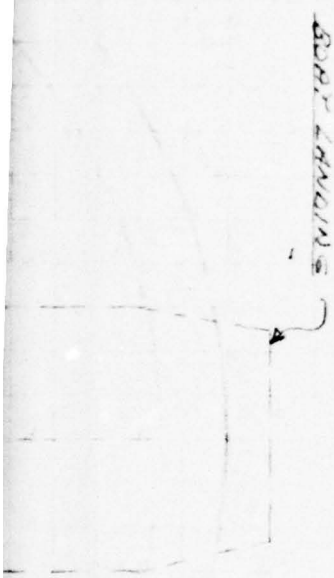
156
81
237

237
164
68

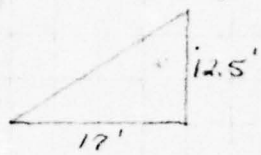
68
25
93

237
9
246

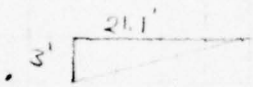
93
9
102



DETERMINE ANGLE CHANGE OF BACKSTAYS IN MOVING FROM BLACK LINE TO RED LINE POSITION.



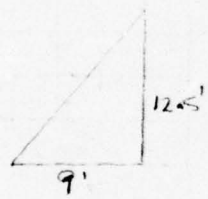
$\sqrt{(17)^2+(12.5)^2} = \underline{21.1'}$



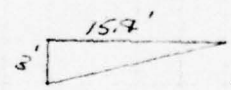
TRUE LENGTH $= \sqrt{(3)^2+(21.1)^2} = \underline{21.3'}$

$\tan\theta = \frac{3}{21.1} = .142$

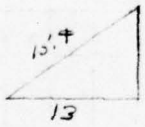
$\theta = \underline{8.1^\circ}$



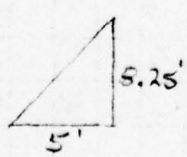
$\sqrt{(9)^2+(12.5)^2} = \underline{15.4'}$



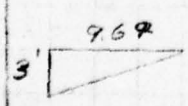
$L = \underline{15.69'}$



$\sqrt{(15.4)^2-(13)^2} = \underline{8.25'}$



$\sqrt{(8.25)^2+(5)^2} = \underline{9.64'}$



$\sqrt{(3)^2+(9.64)^2} = \underline{10.1'}$

$\tan\theta = \frac{3}{9.64} = .312$

$\theta = \underline{17.3^\circ}$

2

$\angle$ CHANGE IS FROM 8.1° TO 17.3°

USE A BALL JOINT CONNECTION TO ALLOW FOR $\angle$ CHANGE.

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL | SHEET NO: 3

SUBJECT: MOMO - MOORING SYSTEM

JOB NUMBER: 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 3/30/65

PRELIMINARY DESIGN OF LEGS FOR "A" FRAME

MAX. COMPRESSION IN FRONT LEGS = 41^{k} L = 15.61'

TRY 6 ϕ .250 r = 2.26

$\frac{L}{r} = \frac{15.69(12)}{2.26} = 83.2$ · $F_a = 14.03$ KSI

PALLOWABLE = 14.03(5.01) = 70.4^{k} > 41^{k} O.K.

MAX. TENSION IN BACKSTAYS = 12^{k} . L = 21.3'

AREA REQ'D: $\frac{12}{20} = .6^{in^2}$

USE THREE SIZES OF TELESCOPING PIPE

SAY! 6 ϕ .25 ; 5 ϕ .258 ; 4 ϕ .250 (NOMINAL SIZES)

ENGINEERING DEPARTMENT
COMPUTATION SHEET

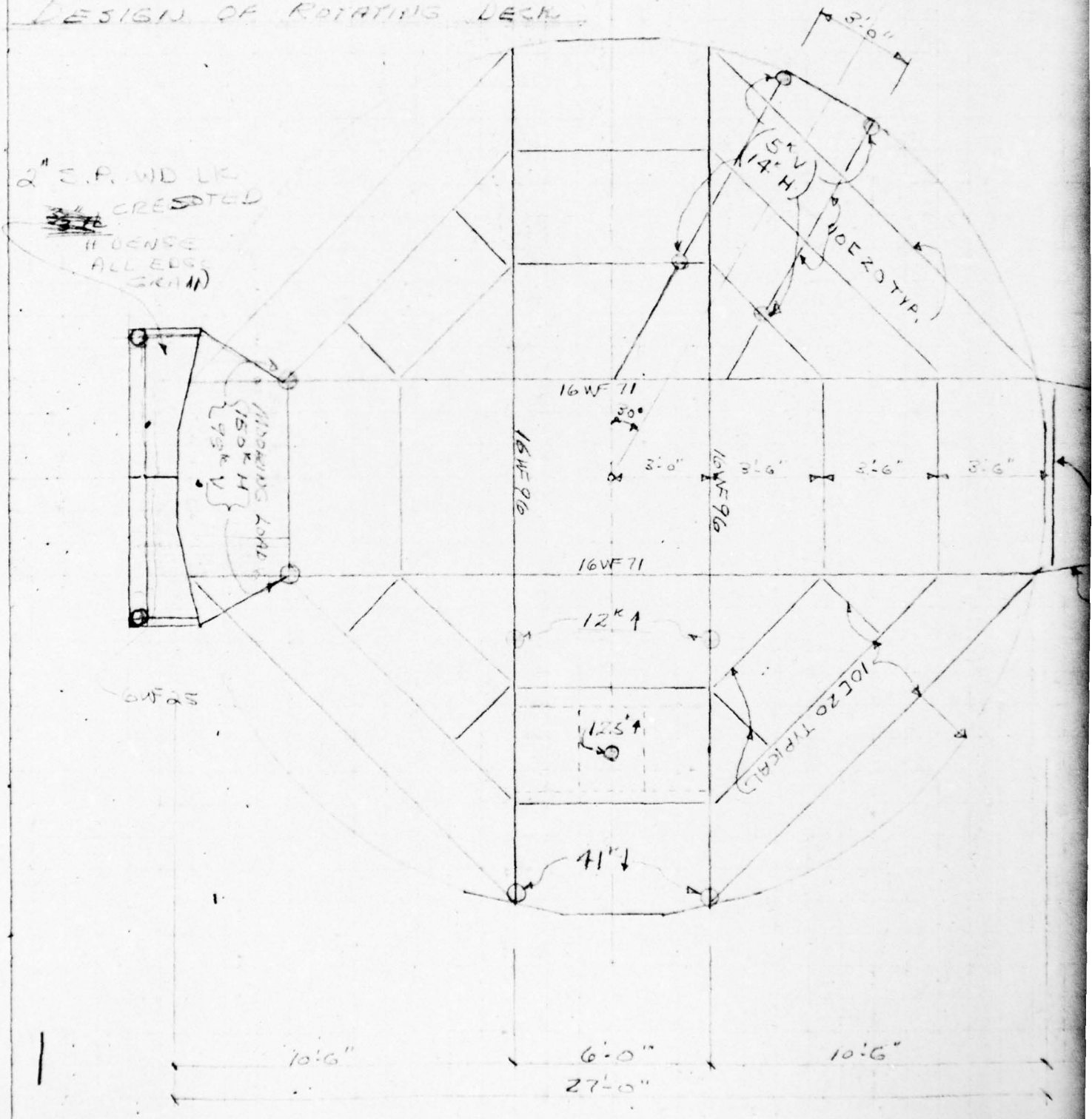
J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL — SHEET NO: 4

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER: JOB 50017 — COMPUTER: ANDREWS — CHECKED BY: — DATE: 8/30/65

DESIGN OF ROTATING DECK

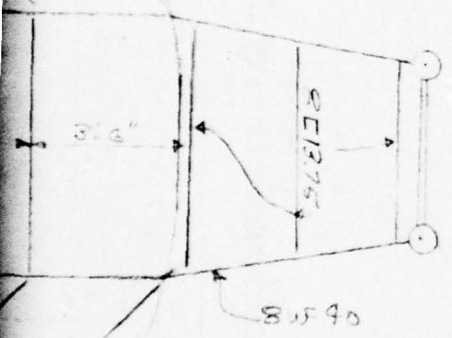


LIGHTING DECK

DESIGN LOADS

HORIZONTAL MOORING LOAD - - - - - 300 K →
VERTICAL MOORING LOAD - - - - - - 196 K ↑
VERTICAL REACTION FORWARD LEG "A" FRAME - 41 K ↓ /LEG
VERTICAL REACTION, BACK LEG "A" FRAME - - 12 K ↑ /LEG
VERTICAL REACTION FROM WINCH - - - - 12.5 K ↑
VERTICAL REACTION FROM PIPES - - - - - 2.0 K ↓/SUPPORT
MAX. HORIZONTAL THRUST FROM PIPES - - - - - 19 K /SUPPORT

DESIGN ENTIRE DECK AREA FOR 150 psf PLUS CONCENTRATED LOADS AS SHOWN ABOVE.



ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

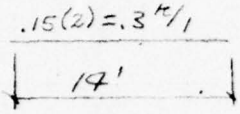
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / ERDL	5

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		8/31/65

DESIGN OF SUB-BEAMS



$M = 1.5(.3)(14)^2 = 88.2''^k$

TRY 8 B 10

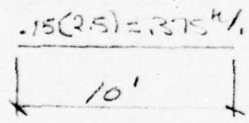
$f = \frac{88.2}{7.8} = 11.3$ ksi

$F_b = \frac{12{,}000}{Ld/Af} = \frac{12{,}000}{14(12)(9.83)} = 7.26$ ksi < 11.3 NO GOOD

TRY 8B13

$f = \frac{88.2}{9.9} = 8.9$ ksi $\quad F_b = \frac{12{,}000}{14(12)(7.87)} = 9.1$ ksi O.K.

~~USE 8B13 OR 9E 13.4~~ NOTE: USE 10[20 TO HOLD MIN. ℄ THICKNESS TO 3/8" FOR HARD TO REPLACE ITEMS.



$M = 1.5(.375)(10)^2 = 56''^k$

TRY 8B10 $\quad f = \frac{56}{8.1} = 6.9$ ksi

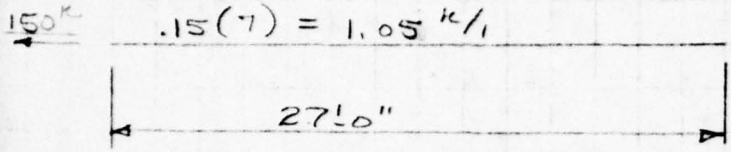
~~USE 8B10 OR 8E 11.5~~ NOTE: USE 10[20 (SEE ABOVE NOTE)

$M = 3PL = 3(5)(5) = 75''^k$

~~USE 8[11.5 OR 8B10~~ NOTE: USE 10[20 (SEE ABOVE NOTE)

ROTATING DECK

DESIGN OF MAIN CROSS BEAMS



$M = 1.5(1.05)(27)^2 = \underline{1{,}150}\ ''^k$

MAX. MOMENT = $\underline{1150}\ ''^k$ AXIAL FORCE = $\underline{150^k}$

TRY 16 WF 71

$f = \frac{1150}{115.9} = \underline{10\ ksi}$ $\quad P/A = \frac{150}{20.86} = \underline{7.2\ ksi}$

CHECK DEFLECTION

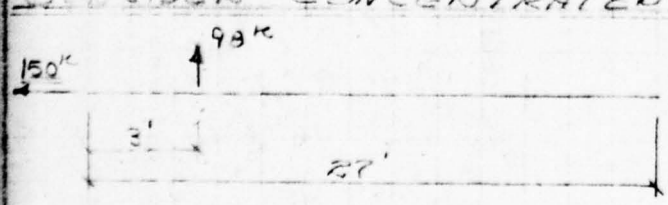
$\Delta = \frac{wL^4}{1{,}333\,I} = \frac{1.05(27)^4}{1{,}333(936.9)} = \underline{0.445''} = \frac{1}{727}$

CHECK HORIZONTAL SHEAR

MAX. ALLOWABLE SHEAR = $114^k < 98^k$ O.K.

BEARING LENGTH REQ'D ≈ $\underline{6''}$

CONSIDER CONCENTRATED LOAD



$V_L = \frac{24}{27}(98) = \underline{87^k}$

$M = 87(3)(12) = \underline{3{,}130}\ ''^k$

TRY 16 WF 71

$f = \frac{3130}{115.9} = \underline{27\ ksi}$ $\quad P/A = \frac{150}{20.86} = 7.2\ ksi$

16 WF 71 NO GOOD FOR BEAMS CARRYING MOORING LOAD

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO.
U.S. ARMY / ERDL	6

SUBJECT: MONO-MOORING SYSTEM

NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		4/1/65

TRY 16 WF 96

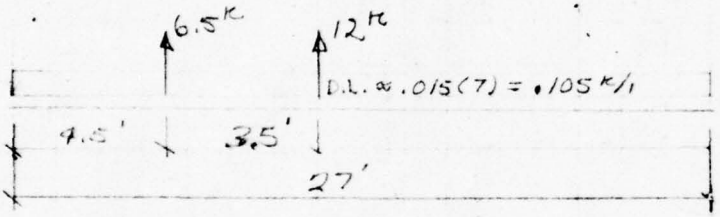
$f = \frac{3130}{166} = 18.9$ ksi $\quad P/A = \frac{150}{28.22} = 5.3$ ksi

$18.9 + 5.3 = 24.2$ ksi ≈ 24 ksi

USE 16 WF 96 FOR BEAMS CARRYING MOORING LOADS

NOTE: IF EQUALIZER IS NOT USED MUST CONSIDER UNEQUAL LOADS. (SEE SHEET 6-A)

CONSIDER LOADS FROM "A" FRAME



$V_L = \frac{.105(27)}{2} - \frac{6.5(22.5)}{27} - \frac{12(19)}{27}$

$V_L = 1.42 - 5.42 - 8.45 = -12.45^k$

$V_R = 1.42 - \frac{6.5(4.5)}{27} - \frac{12(8)}{27}$

$V_R = 1.42 - 1.08 - 3.56 = -3.22^k$

MAX. MOM. $= 3.22(19) - \frac{.105(19)^2}{2}$

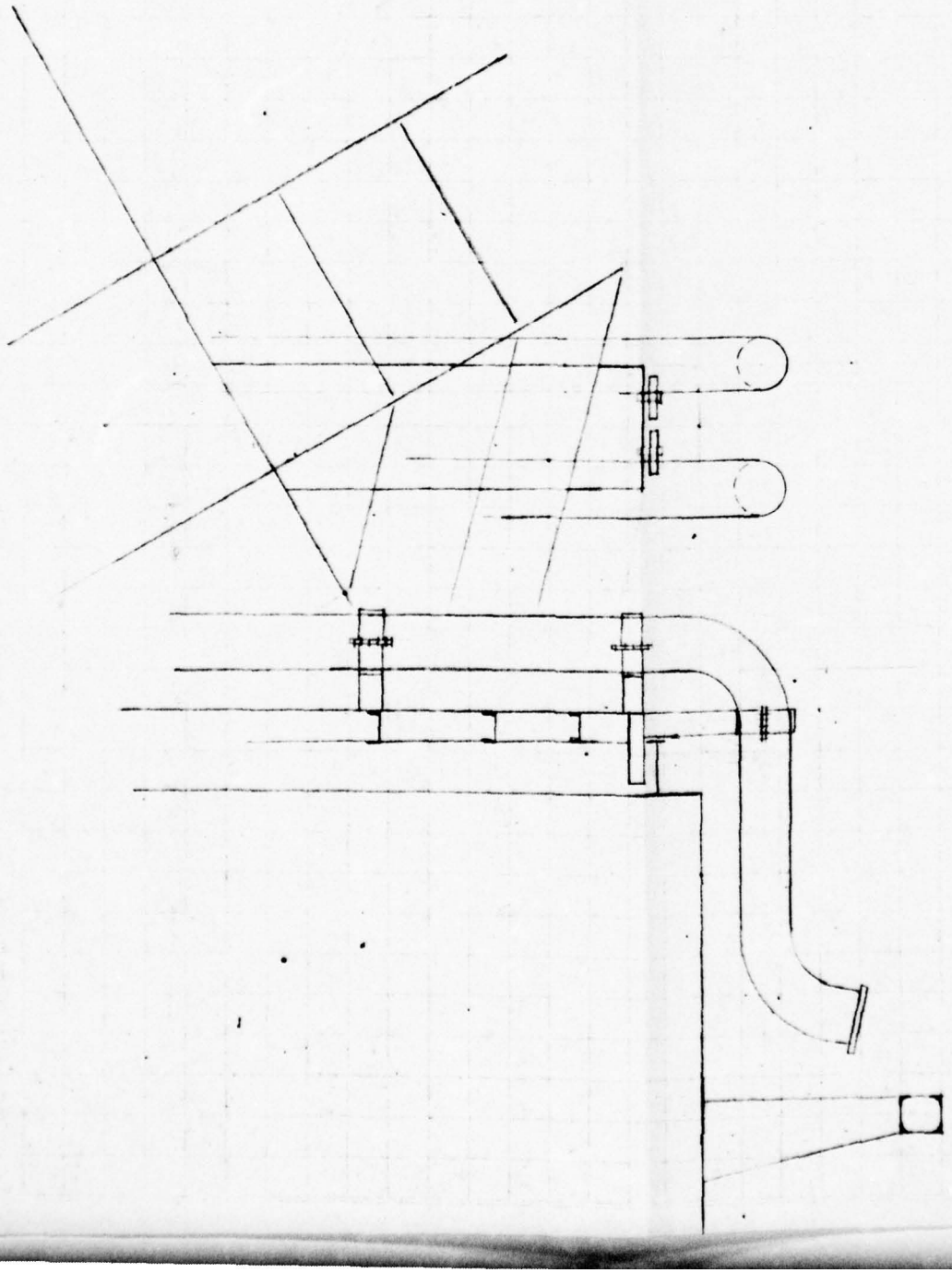
MAX. MOM. $= 61.2 - 18.9 = 42.3'^k = 508''^k$

16 WF 71 O.K. FOR BEAMS SUPPORTING "A" FRAME (BY INSPECTION)

6

CONSIDER METHOD OF SUPPORTING PIPE OVER-THE-SIDE.

LOADS



2

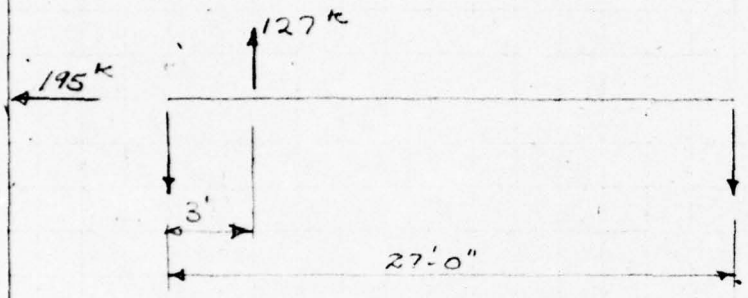
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U.S. ARMY / ERDL			6-A
SUBJECT: MONO - MOORING SYSTEM			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		5/6/65

RE-DESIGN 16 WF 96 FOR ONE PAD-EYE TO TAKE 65% OF MOORING LOAD

$300(.65) = \underline{195^k}$ $\quad 195(.65) = \underline{127^k}$



$V_L = \frac{24}{27}(127) = \underline{113^k}$

$M = 113(3)(12) = \underline{4{,}060^{''k}}$

$f_B = \frac{4060}{166} = 24.4$ ksi $\quad P/A = \frac{195}{28.22} = \underline{6.9 \text{ ksi}}$

TRY H.S. STEEL WITH 50 KSI YIELD

$F_a = \underline{30 \text{ ksi}}$ $\quad F_B = \underline{33 \text{ ksi}}$

UNITY CHECK

$\frac{24.4}{33} + \frac{6.9}{30} = .74 + .23 = 0.97 < 1.0$ O.K.

16 WF 96 O.K. WITH 50 KSI STEEL

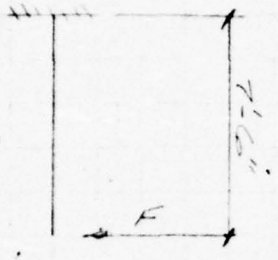
ENGINEERING DEPARTMENT
COMPUTATION SHEET
J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL | SHEET NO: 7

SUBJECT: MOMO - MOORING SYSTEM

DRAWING NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 4/2/65

DETERMINE ALLOWABLE FORCE ON 16" ϕ PIPE



$M = 7.5F(12)$

$f = \frac{M}{S} \qquad f = \frac{7.5F(12)}{S}$

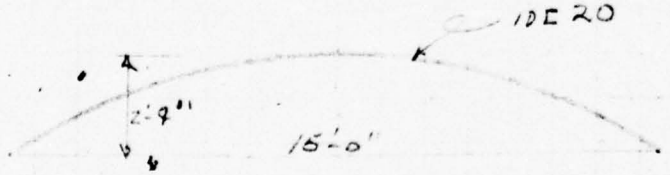
$f_{ALLOWABLE} \approx 20\ KSI$

FOR 16 ϕ .375 $S = 70.25\ IN.^3$

$F = \frac{fS}{7.5(12)} = \frac{20(70.25)}{7.5(12)} = 15.6^K$

USE 16ϕ.375 PIPE SINCE A FORCE LESS THAN 15.6^K WOULD TURN THE DECK AND RELIEVE THE MOMENT.

CHECK OUTSIDE CURVED CHANNEL FOR BENDING AND TORSION.



ASSUME UNIFORM LOAD WITH 1'-6" SPC.

$M = 1.5(.225)(15)^2 = 76^{"K}$ $\qquad f = \frac{76}{15.7} = 4.84\ KSI$

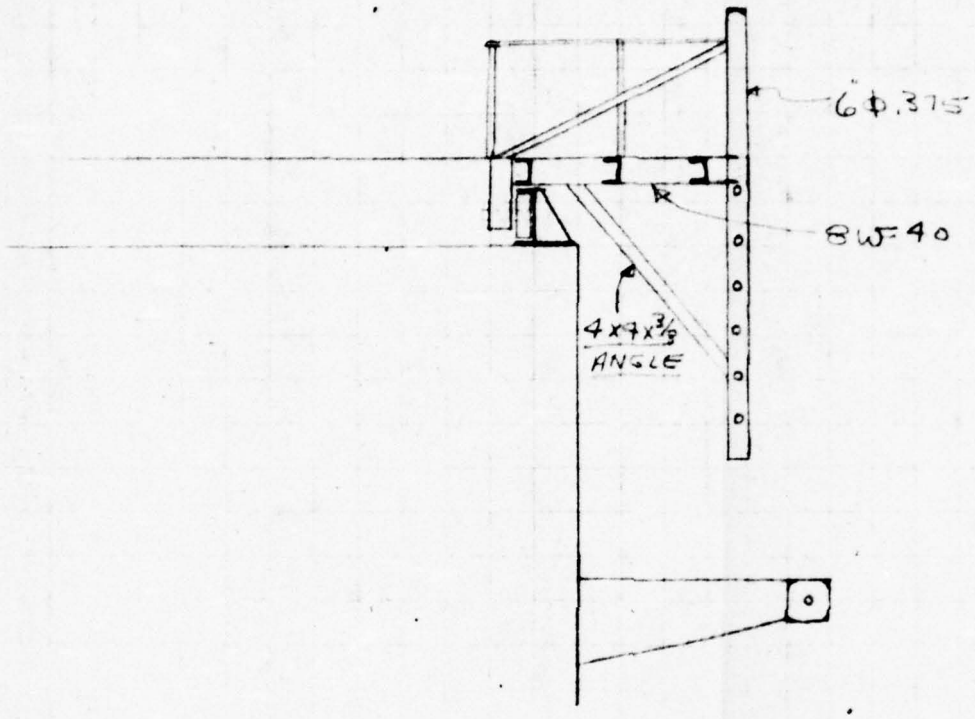
TORSIONAL MOMENT $\approx .225(15)(0.33)(.8)(12) = 75^{"K}$

POLAR MOMENT OF INERTIA $= I_x + I_y = 78.5 + 2.8 = 101.3\ IN.^4$

$S_S = \frac{Tc}{J} = \frac{75(5)}{101.3} = 3.7\ KSI < 13.5\ KSI$ O.K.

10E 20 O.K. FOR OUTSIDE MEMBER

DESIGN OF BOATLANDING



ASSUME MAX. VERTICAL LOAD ON BOATLANDING ≈ 1000#

MAX. MOM. = 5.5 (1)(12) = 66"K

$f = \frac{66}{35.5} = 1.85$ KSI

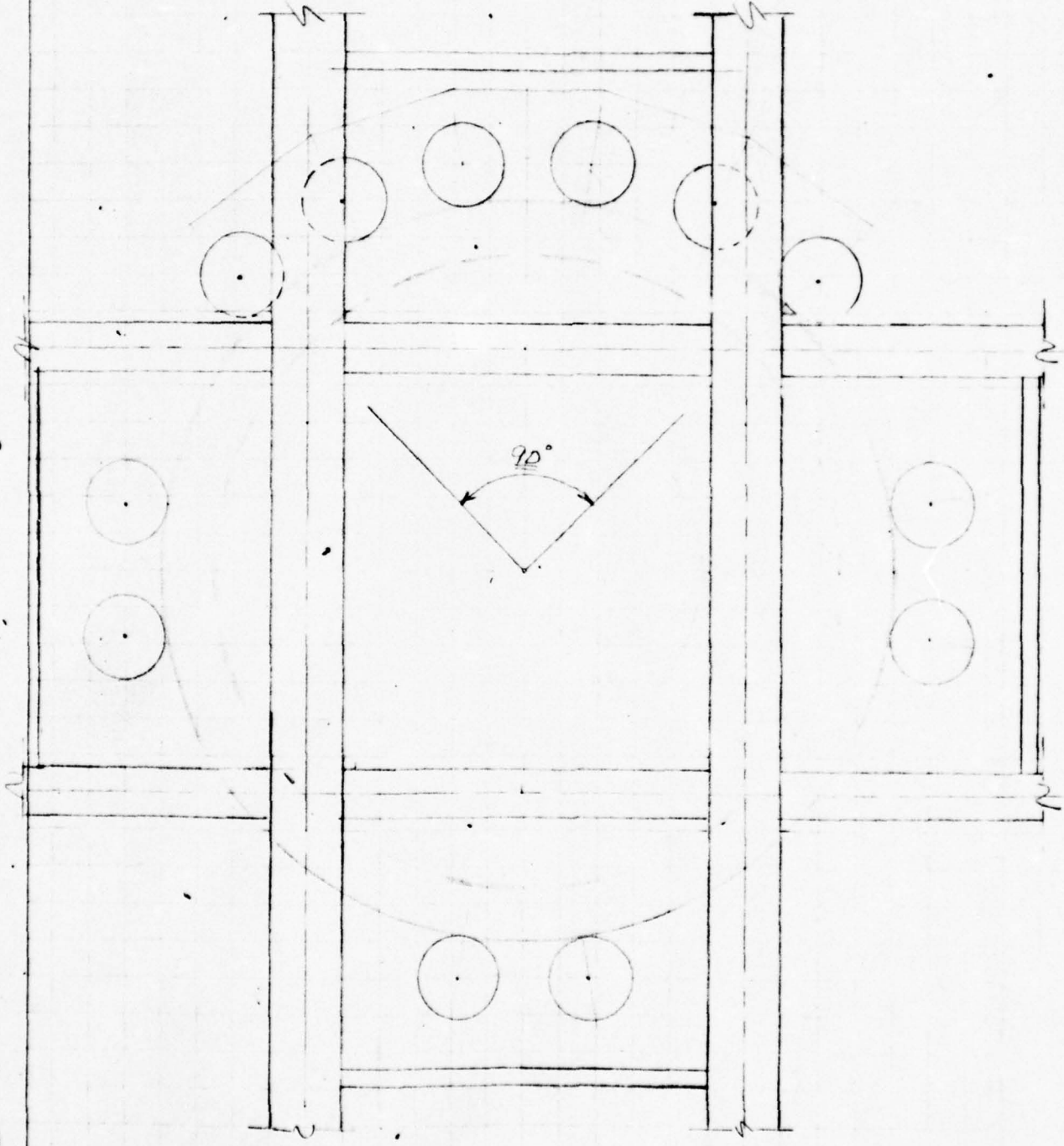
HOLD ALL MATERIAL EXCEPT HANDRAILS TO MIN 3/8" THICK

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

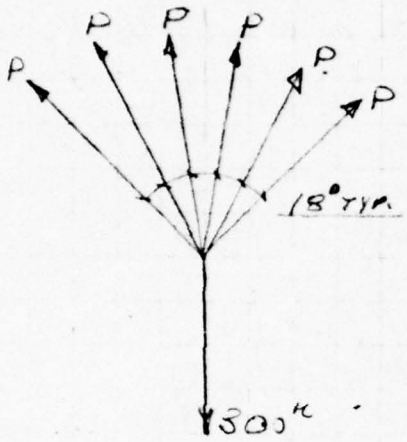
COMPANY	SHEET NO
U.S. ARMY / ERDL	8
SUBJECT	
MOOR-MOORING SYSTEM	
NUMBER	COMPUTER / CHECKED BY / DATE
JOB 50017	ANDREWS / 4/2/65

DESIGN OF BOGIE WHEEL SUPPORTS



9
18
27

DETERMINE MAX. FORCE IN WHEELS.
(ASSUME ALL WHEEL CARRY EQUAL LOAD)



$\Sigma H = 0 = 300 - 2P\cos 45° - 2P\cos 27° - 2P\cos 9°$

$\Sigma H = 300 - 2P(.707) - 2P(.891) - 2P(.988)$

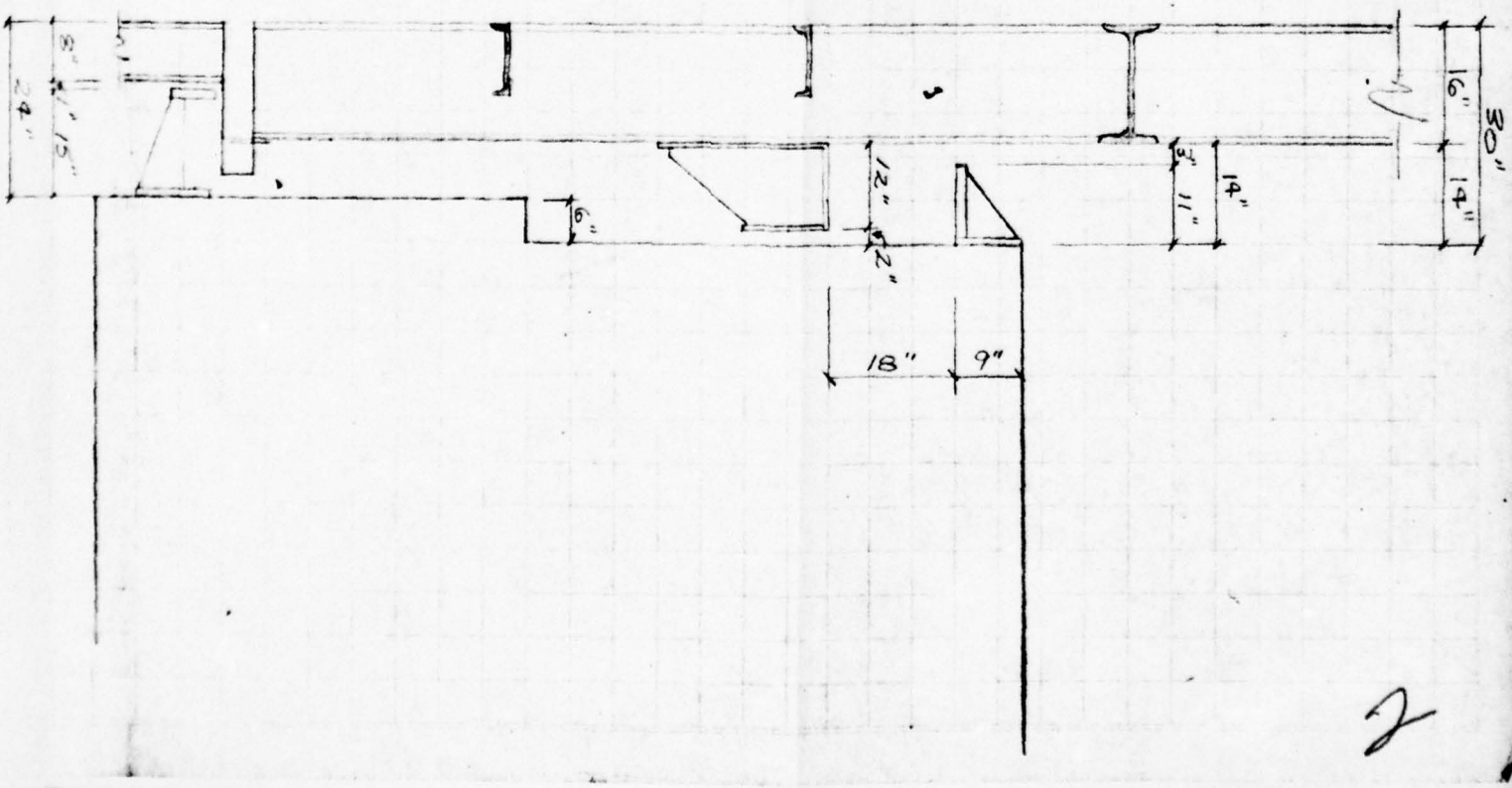
$H = 300 - 1.414P - 1.78P - 1.975P$

$H = 300 - 5.169P$

$P = \frac{300}{5.169}$

$P = 58^{K}$

CLEARANCES.



2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

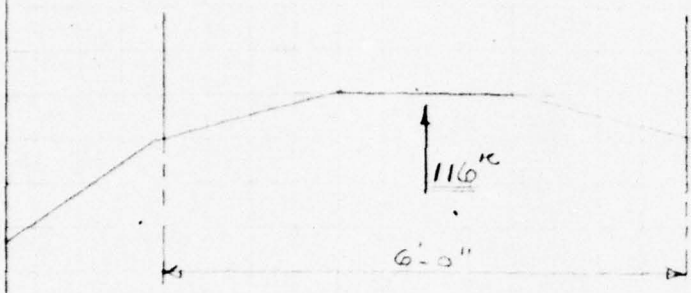
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY / ERDL	9

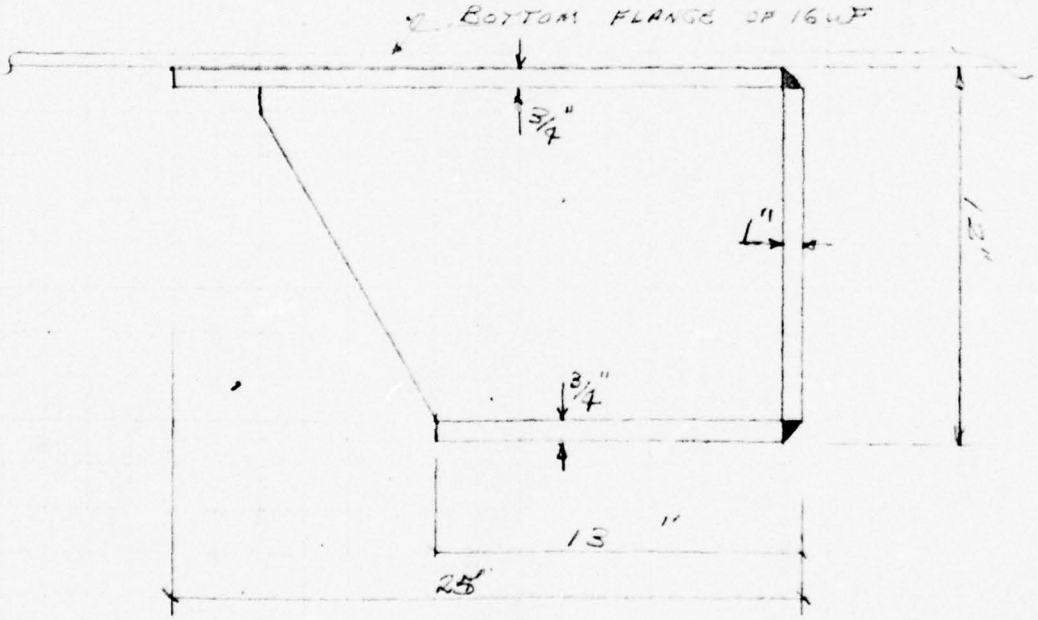
SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		4/7/65

DESIGN OF BOGIE WHEEL SUPPORT



$M = \frac{PL(k)}{4} = 3(116)(6) = \underline{2090}''^k$ SHEAR FOR WELD ≈ $\underline{300}^k$



FIND C. OF G.

AREA		LEVER ARM		dA
18	x	13	=	234
9	x	7	=	63
10.5	x	.5	=	5.25
37.5				302.25

$\bar{X} = \frac{302.25}{37.5} = \underline{8.06}''$

DETERMINING M

$I = \left(\frac{.75(8.06)^3}{3}\right) 2$

$= \frac{.75(15.94)^3}{3}$

$= \frac{.75(3.94)^3}{3}$

$= 10.5(7.55)^2$

$f_c = \frac{Mc}{I} = \frac{2090}{18}$

$f_t = \frac{Mc}{I} = \frac{209}{}$

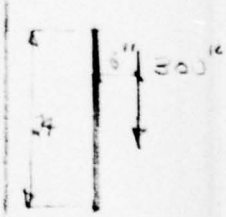
TORQUE = 11

TORQUE O.K.

CHECK LEN

TOTAL F =

TRY 7/8 FIL



I =

FORCE/1 =

FORCE/1 = 3

F/1 ALLOWAL

.75(.707)(13.5) =

ERMINE MOMENT OF INERTIA

$\frac{.75(8.06)^3}{3}\Big)\,2 = 262.0$

$\frac{.75(15.94)^3}{3} = 1015.0$

$\frac{.75(3.14)^3}{3} = 15.6$

$.5(7.55)^2 = 604.0$

$I = 1,896.6 \text{ IN.}^4$

$\frac{Mc}{I} = \frac{2090(8.06)}{1896.6} = 8.8 \text{ KSI}$

$\frac{Mc}{I} = \frac{2090(15.94)}{1896.6} = 17.5 \text{ KSI}$

QUE = 116(6) = 696"K

QUE O.K. BY INSPECTION

CK. LENGTH OF WELD REQD

AL P = 300K L = 24(4) = 96"

7/8 FILLET WELD

300K M = 300(6) = 1800"K

$I = \frac{(24)^3}{12}(4) = 4,600 \text{ IN.}^4$

ORCE/" = $\frac{P}{A} + \frac{Mc}{I} = \frac{300}{96} + \frac{1800(12)}{4,600}$

RCE/" = 3.12 + 4.7 = 7.82 K/"

ALLOWABLE = .75(.707)(14.5) = 8.96 K/" → A-36

(13.0) = 8.04 K/" → A-7

USE 7/8" FILLET WELD TO BOTTOM FLANGE OF 16 WF 96

CHECK APPROXIMATE DEF'L. OF SUPPORT.

$\Delta = \frac{PL^3}{834I} = \frac{116(6)^3}{834(1896)} = .0159"$ O.K.

7

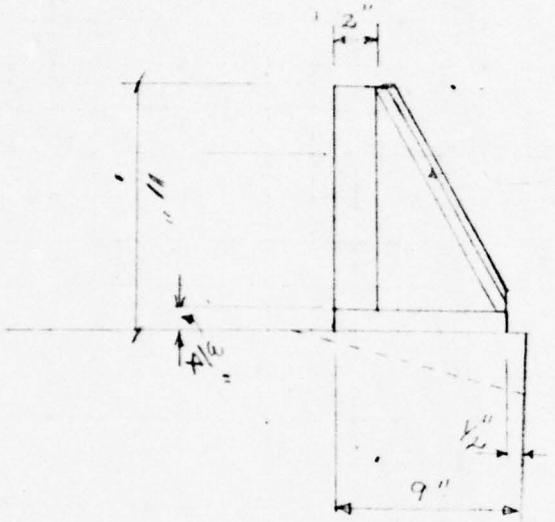
ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

MCD 14003

COMPANY		SHEET NO
U.S. ARMY / ERDL		10
SUBJECT		
MONO-MOORING SYSTEM		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 5601?	ANDREWS		4/7/65

DESIGN OF INTER-RACE



CHECK CASE 50 PG. 206 OF "FORMULAS FOR STRESS & STRAIN" BY ROARK.

MAX. CONC LOAD = 58^K

APPROXIMATE EQUIVALENT UNIFORM LOAD

$$\frac{58(2)}{21(10.25)} = 530 \text{ psi}$$

MAX. $S = \beta \frac{w a^2}{t^2}$ $\quad a/b = \frac{21}{10.25} = 2.09 \quad \beta = 2.35$

$$S = \frac{.35(530)(21)^2}{(2)^2} = 20{,}300 \text{ psi} \quad \text{O.K.}$$

CHECK DEFLECTION $\quad \alpha \approx .075$

$$y = \frac{w a^4}{E t^3} \alpha = \frac{.530(21)^4}{30{,}000(2)^3}(.075) = .0522"$$

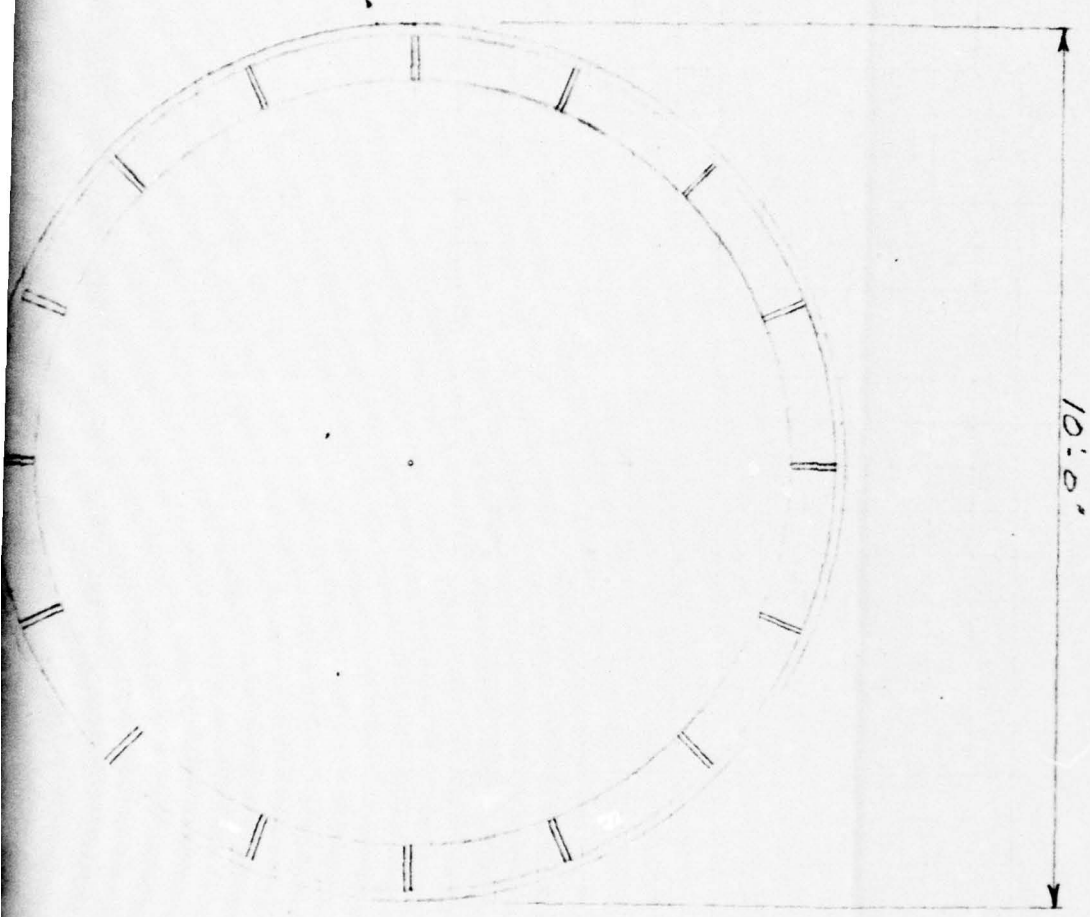
USE 2" ℄ H.S. STEEL

CHECK WELD
IS DIRECTLY

MAX. P = 58^K

$F/11 = \frac{58}{13} = 4.46$

M = 58(E) = 4.6



HECK WELD OF STIFFNER, ASSUMING WHEEL
T DIRECTLY OVER STIFFNER.

Y. P = 59^K LENGTH OF WELD ≈ 6.5(2) = 13"

= $\frac{59}{13}$ = 4.46 K/" $I = \frac{(13)^3}{12}(2) = 375 in.^3$

= 59(8) = 472"K $f = \frac{Mc}{I} = \frac{472(3.25)}{370} = 4.08$ K/"

TOTAL F_v = 5.54 K/"

TRY 3/4" FILLET .5(.707)(20) = 10.6 K/" O.K.

NOTE: USE HIGH STRENGTH STEEL & WELDING ROD FOR RACE.

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

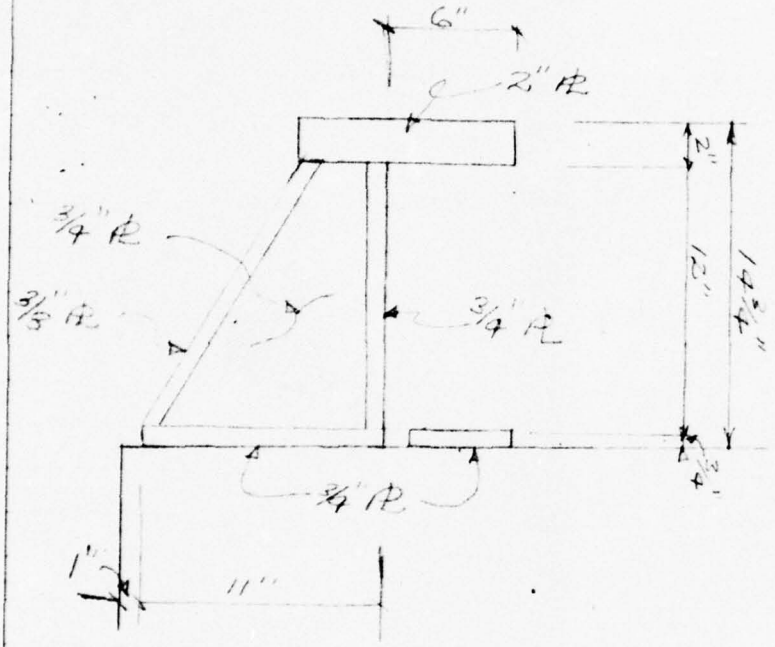
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U. S. ARMY / ERDL	11
SUBJECT: MONO-MOORING SYSTEM	

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		4/7/65

DESIGN OF OUTER-RACE

MAX. LOAD/1 $\approx \frac{195}{6} = \underline{32.5^k}$



MAX. MOM. $\approx 32.5(4) = \underline{130.0''^k}$

ASSUME WIDTH OF SECTION = 6t & LOADED AS A CANTILEVERED BEAM. TRY t = 2"

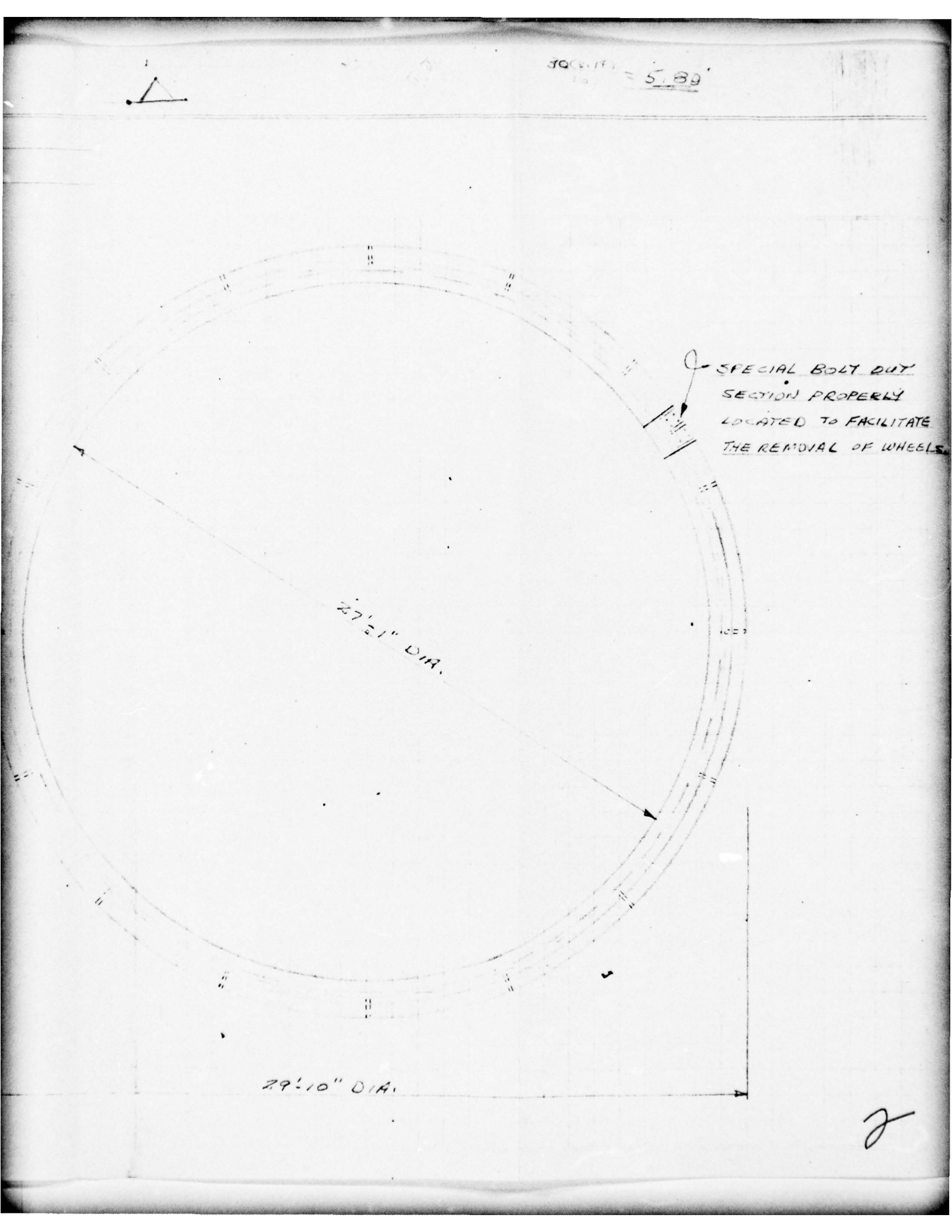
$S = \frac{bd^2}{6} = \frac{12(2)^2}{6} = \underline{8 \text{ IN.}^3}$ $\quad f = \frac{130}{8} = \underline{16.3 \text{ ksi}}$

CHECK CASE 63 PG. 211 IN ROARK

$a/b = \frac{168}{162} = 1.04$ $\quad$ USE $\beta = 3.2$

MAX. $S = \frac{\beta W}{t^2} = \frac{3.2(37.5)}{(2)^2} = \underline{26 \text{ ksi}}$

USE 2" PL H.S. STEEL


SPECIAL BOLT OUT
SECTION PROPERLY
LOCATED TO FACILITATE
THE REMOVAL OF WHEELS.
27'-21" DIA.
29'-10" DIA.

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY MCDERMOTT & CO., INC.

MCD 14003

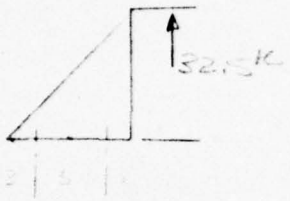
COMPANY: U.S. ARMY / EROL | SHEET NO: 12

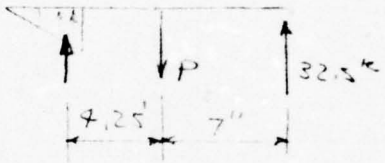
SUBJECT: MOND - MOORING SYSTEM

JOB NUMBER: 36017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 4/5/65

DESIGN OF BOLT DOWN CONN.

ASSUME WHEEL IN MIDDLE OF SECTION





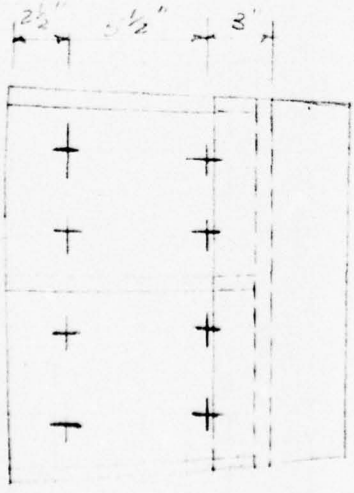
$$M = 0 = 32.5(11.25) - P(9.25)$$

$$P = \frac{32.5(11.25)}{9.25} = 86^{K}$$

USE A.S. BOLTS A325

NO. REQ'D. $= \frac{86}{31.42} = 2.7$

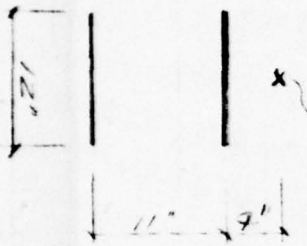
USE 8 1"ϕ - A325 BOLTS.



65

ASSUME WHEEL SPACED APPROXIMATELY 18" O.C.

CHECK WELD FOR 1' WIDE SECTION



$M = 32.5(9.5) = 308''^K$

$I = Ad^2 = 24(5.5)^2 = 726\ in.^4$

$\frac{P}{11} = \frac{32.5}{24} = 1.35\ ^K/_{11}$ $\qquad \frac{Mc}{I} = \frac{308(5.5)}{726} = 2.34\ ^K/_{11}$

$1.35 + 2.34 = 3.69\ ^K/_{11}$

TRY $\frac{1}{2}$" FILLET WELD

ALLOWABLE $f = ^K/_{11} = .5(.707)(13) = 4.6\ ^K/_{11} > 3.69$ O.K.

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

MCD 14303

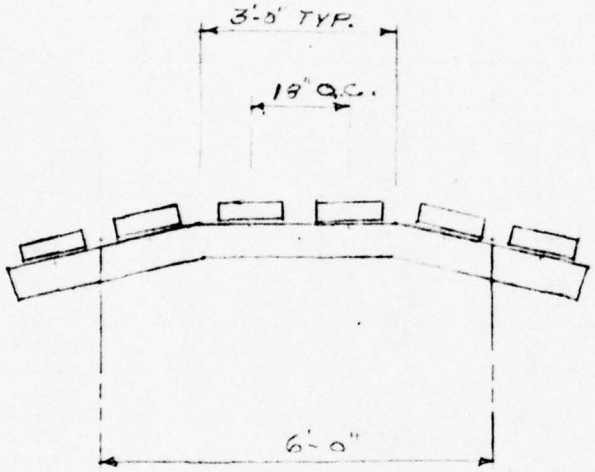
COMPANY: U.S. ARMY/ERDL | SHEET NO. 13

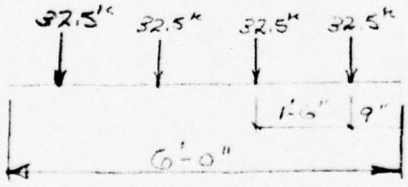
SUBJECT: M200 - MOORING SYSTEM

DRAWING NUMBER | COMPUTER: ANDREWS | CHECKED BY | DATE: 4/6/65

JOB 56017

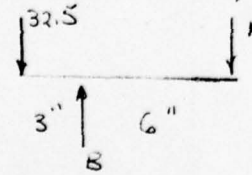
DESIGN OF SUPPORTS FOR OUTER BOGIE WHEELS.





MAX. M = 65(2.25) - 32.5(1.5) = 97.2 IK = 1165 IN K

CHECK PIN & SIDE PLATES



$A = \frac{32.5(3)}{6} = 16.3^K$ $\quad B = \frac{32.5(1)}{6} = 48.3^K$

M = 32.5(3) = 97.5 IN K USE 3 1/4" ϕ PIN

ϕ THICKNESS REQ'D = $\frac{48.8}{109}$ = .447" USE 3/4" ϕ

1550
208
1758

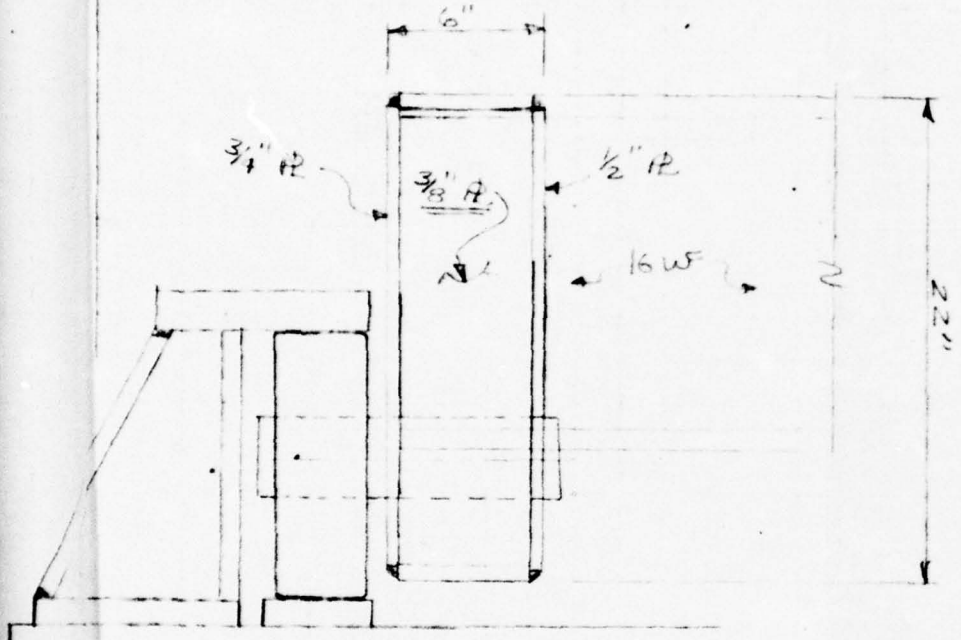
4.75

CONSIDER BENDING ON SUPPORT

MAX MOM. = 1165 "IK

MAX TORQUE ≈ 65(9) + 65(7.5)(2)

T = 1559 "IK



DETERMINE MOMENT OF INERTIA

$I_{xx} = \frac{6.0(22)^3}{12} = 5230$

$- \frac{4.75(21)^3}{12} = -3680$

$I_{x-x} = 1550 \text{ IN}^4$

$I_{yy} = \frac{22(6.0)^3}{12} = 396$

$- \frac{21(4.7)^3}{12} = 188$

$I_{y-y} = 208 \text{ IN}^4$

$f = \frac{Mc}{I} = \frac{1165(11)}{1550} = 8.26 \text{ KSI}$

$T_s = \frac{Tc}{J} = \frac{1559(11.5)}{1758} = 10.2 \text{ KSI}$

$R_s = \sqrt{(4.13)^2 + (9.2)^2} = 11.06 \text{ KSI}$

MAX $S = \frac{f}{2} + R_s = 4.13 + 11.06 = 15.19 \text{ KSI}$ O.K.

DETERMINE POLAR MOMENT OF INERTIA.

$J = I_{xx} + I_{yy} = 1758 \text{ IN}^4$

2

PENDANT SUPPORTS

SWIVEL TO BUOY CONNECTION

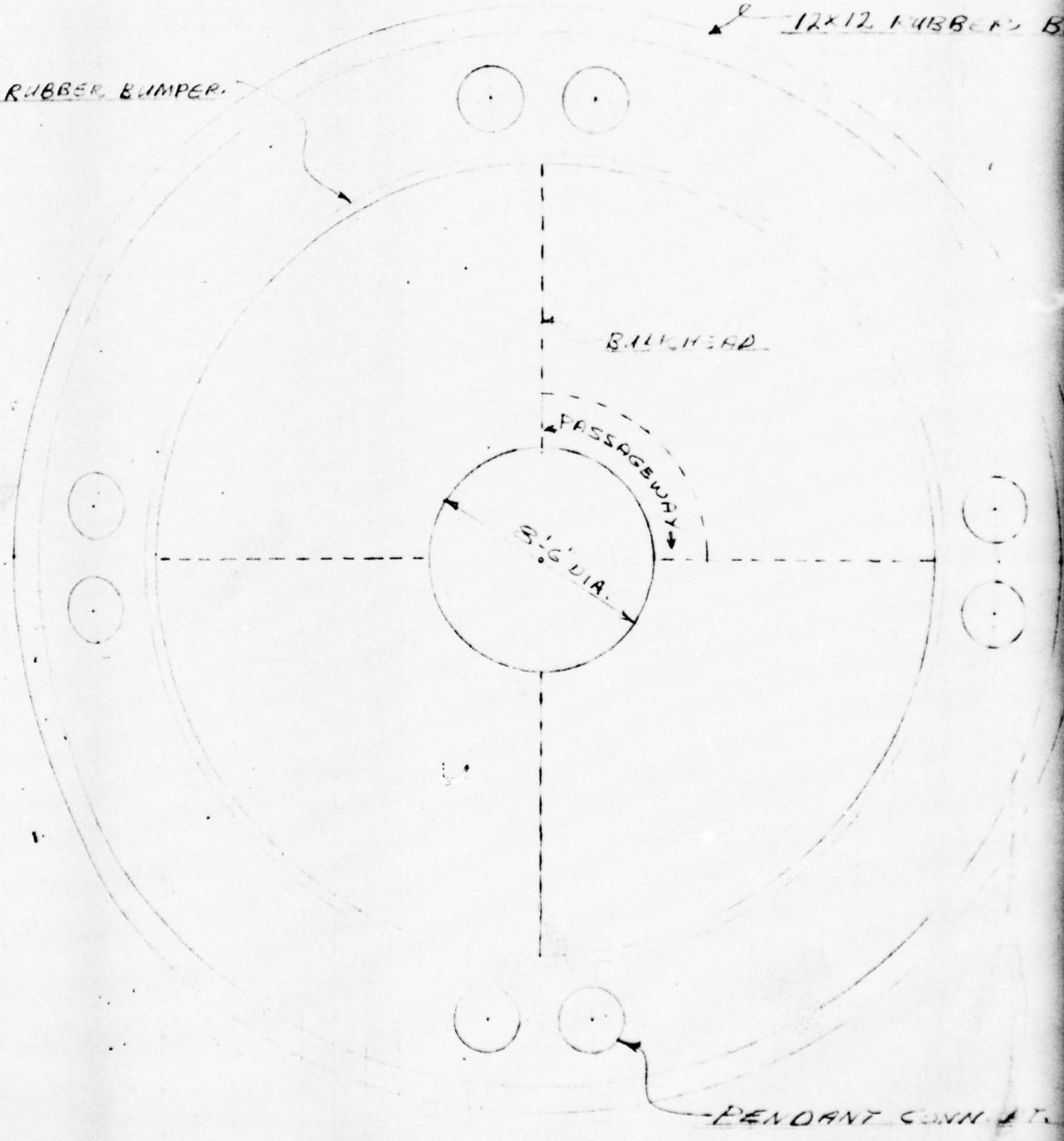
TEMPORARY MOORING POINT

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

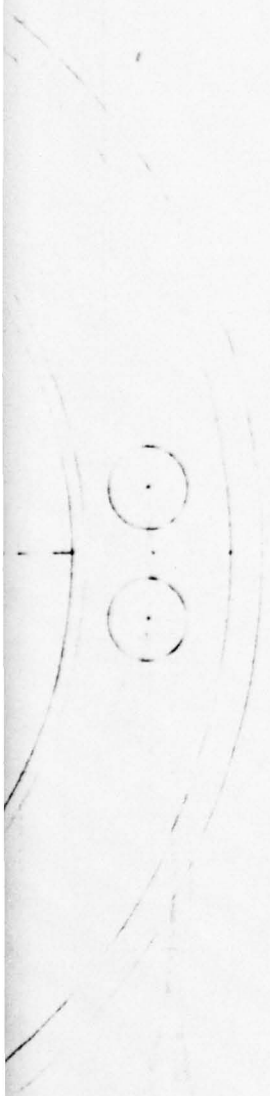
COMPANY			SHEET NO
U. S. ARMY/ERDL			1
SUBJECT			
MONO-MOORING SYSTEM (PENDANT SUPPORTS)			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		4/9/65

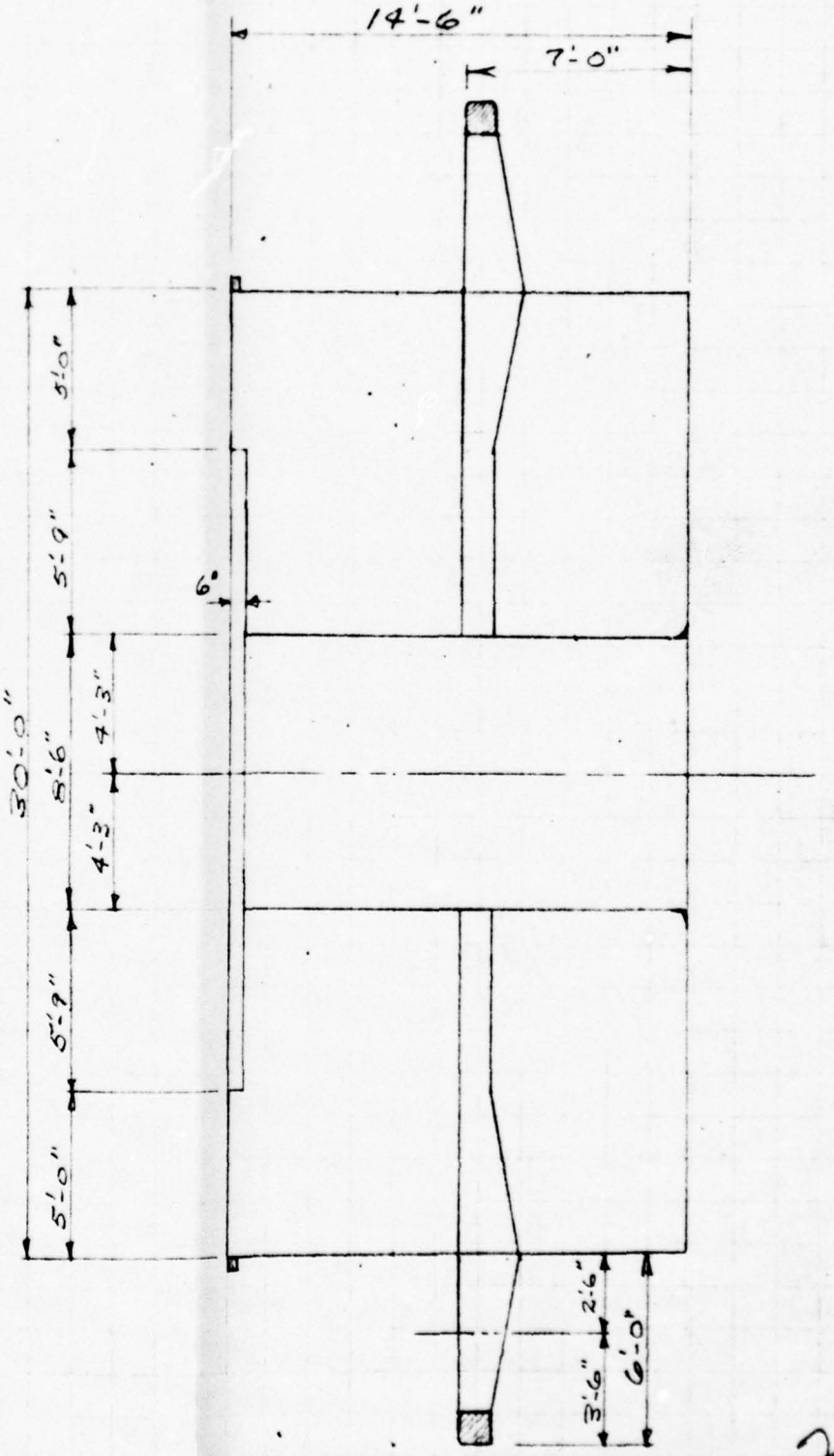
DESIGN OF PENDANT SUPPORTS



PENDANT SUPPORTS

RUBBER BUMPER





CONN. AT.

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET

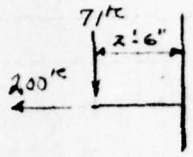
J. RAY MCDERMOTT & CO., INC.

McD 14003

COMPANY		SHEET NO
U.S. ARMY / ERDL		2
SUBJECT		
MONO-MOORING SYSTEM		
~~DRAWING~~ NUMBER	COMPUTER	CHECKED BY	DATE
JOB. E6017	ANDREWS		4/12/65

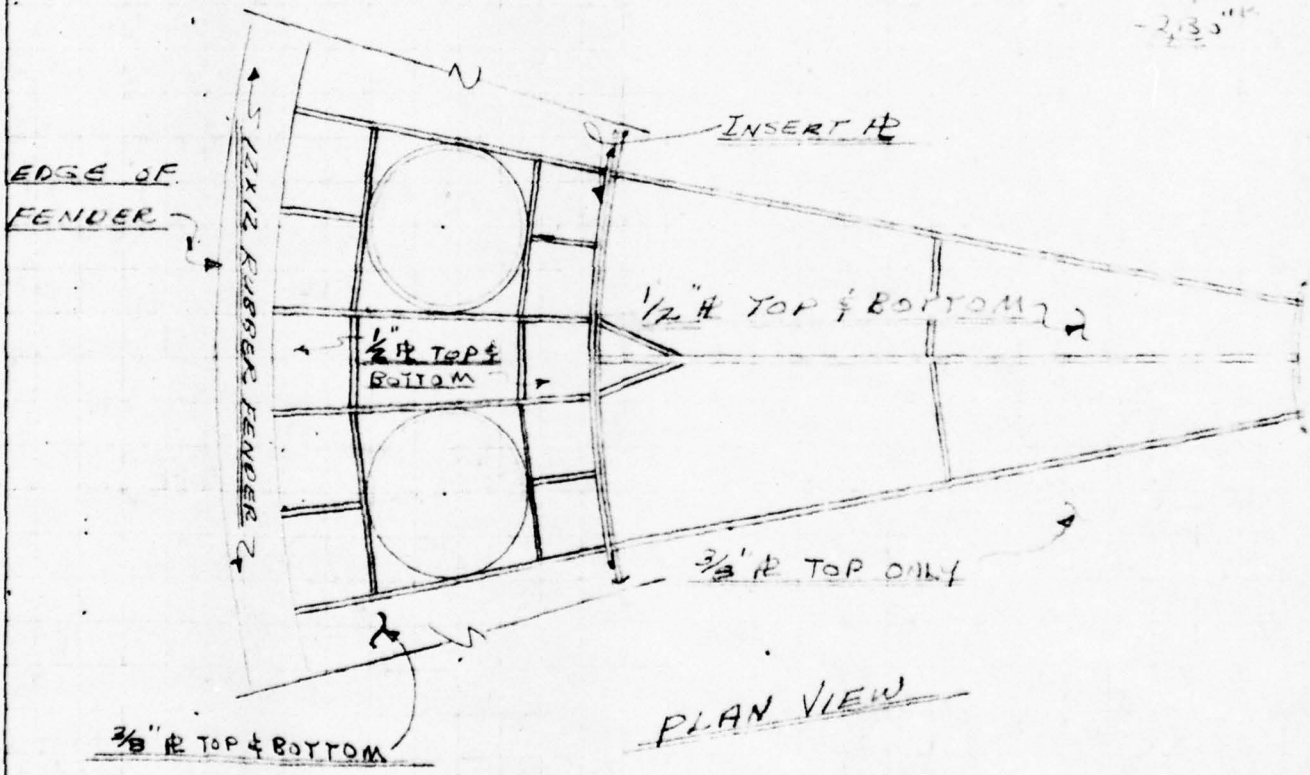
MAX. HORIZONTAL @ PENDANT ≃ 240^K V = 42^K

HORIZONTAL REACTION @ 16B' VPCC = 200^K V = 71^K

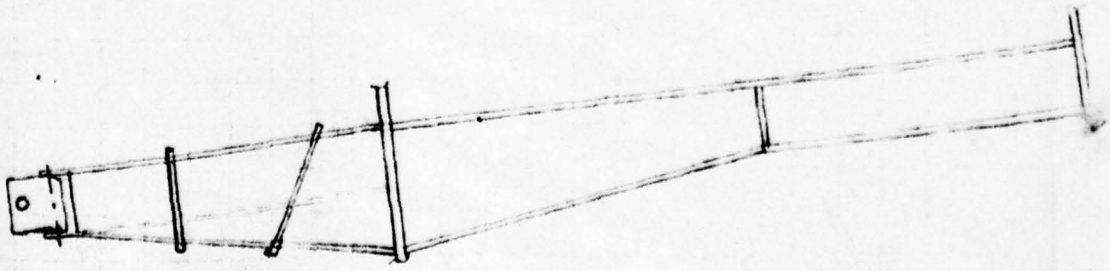


M = 71(30) = 2,130^{K'}

-2,130^{K'}



PLAN VIEW



SECTION

1750

1

DETERMINE SECTION MODULUS OF
24 × 33 × 3/8 # BOX BEAM

$I = \frac{bd^3}{12} = \frac{33(24)^3}{12} = 38{,}200$

$- \frac{bd^3}{12} = \frac{32.25(23.25)^3}{12} = 34100$

$A = 33(24) = 792$ $\quad I = 4{,}100 \text{ IN.}^4$

$32.25(23.25) = 750$

$A = 42^{0}$" $\quad S = \frac{4100}{12} = 342 \text{ IN.}^3$

1065"

SECTION MODULUS OF 12×21×3/8" R. BM.

$I = \frac{bd^3}{12} = \frac{21(12)^3}{12} = 3030$

$= \frac{bd^3}{12} = \frac{20.25(11.25)^3}{12} = 2920$

$A = 21(12) = 252$ $\quad I = 610 \text{ IN.}^4$

$20.25(11.25) = 228$

$A = 24^{0}$" $\quad S = \frac{610}{6} = 101.5 \text{ IN.}^3$

CHECK 12" DEEP SECTION

$f = \frac{M}{S} = \frac{1065}{101.5} = 10.5 \text{ KSI}$

$P/A = \frac{200}{24} = 5.3 \text{ KSI}$

15.8 KSI

NOTE: CHANGE THICK OF TOP & BOTTOM # ON BEAM TO 1/2" TO ALLOW FOR CORROSION

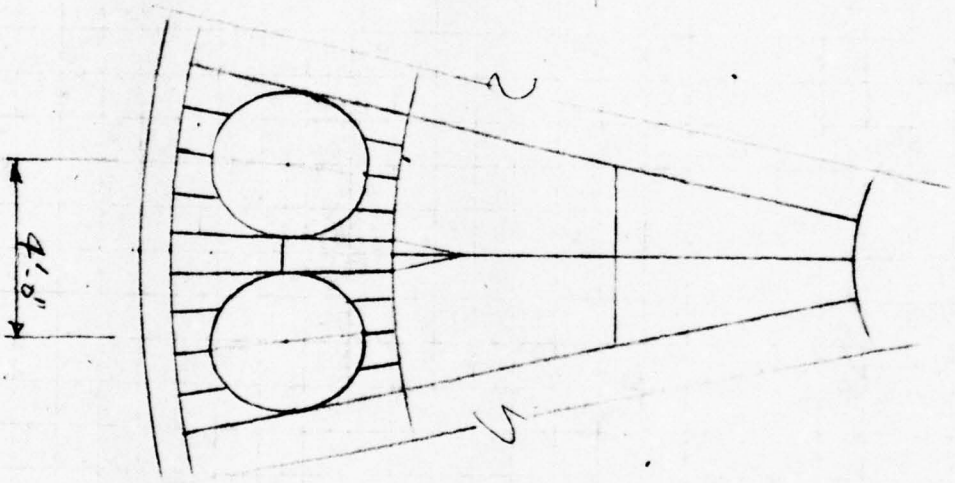
2

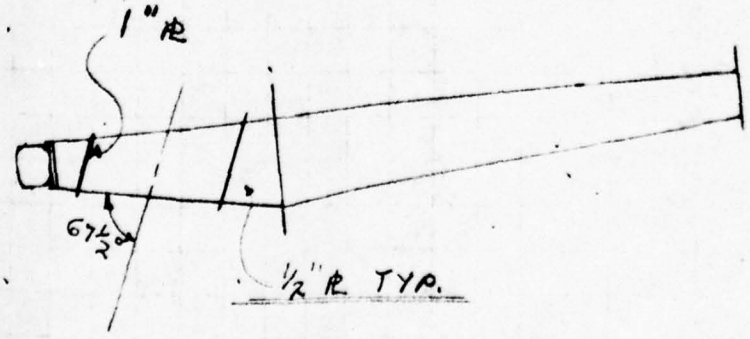
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U.S. ARMY/ERDL			2-A
SUBJECT: MOOR-MOORING SYSTEM			
~~DRAWING~~ NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDRENS		5/6/65

REVISE PENDANT TO BUOY CONN.





ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

144

J. RAY McDERMOTT & CO., INC.

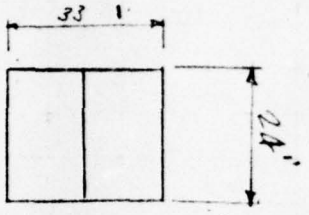
COMPANY: U.S. ARMY / EROL | SHEET NO: 3

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER | COMPUTER: JOB 56017 · ANDREWS | CHECKED BY | DATE: 4/16/85

SHEAR WELD @ OUTSIDE BUOY EDGE

SHEAR = 71^K TENSION = 200^K M = 2,130 "^K



TOTAL L = 132"

$P/L = \frac{71+200}{132} = 1.96^{K}/_{11}$

$I = \left[\frac{33(27)^3}{12} - \frac{31(22)^3}{12}\right] + \frac{(2)^3}{12}$

$I = 38{,}200 - 27{,}600 + 890$

$I = 11{,}490\ in^4$

$\frac{Mc}{I} = \frac{2{,}130(12)}{11490} = 2.24^{K}/_{11}$

TOTAL FORCE/11 = 2.24 + 1.96 = $4.20^{K}/_{11}$

TRY 1/2" FILLET WELDS

FORCE/11 ALLOWABLE = .5(.707)(13.5) = $4.86^{K}/_{11} > 4.20$

1/2" FILLET WELD O.K.

NOTE: VOID ABOVE & MAKE TOP & BOTTOM RE: CONTINUOUS. USE INSERT R TO TRANSFER SHEAR INTO BUOY HULL.

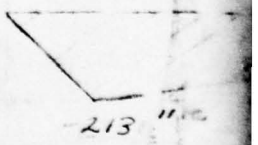
CHECK VERTICA

V = 71^K h/t = 24/.37

ALLOW V = 13.1(.3

DETERMINE S.

MOM.



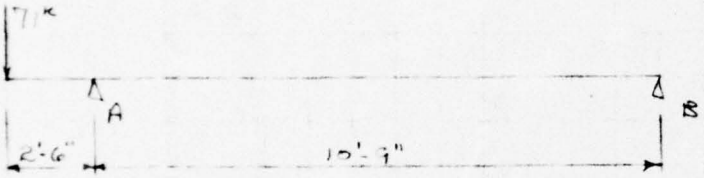
1490

CHECK VERTICAL SHEAR IN WEBS

$V = 71^k$ $\frac{h}{t} = \frac{22}{.375} = 59$ ALLOW $v = 13.1$ ksi

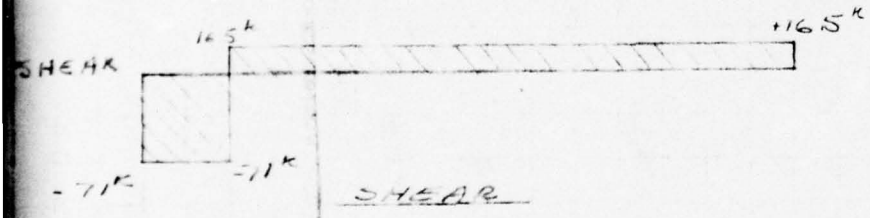
ALLOW $V = 13.1(.375)(27)(1.5) = 172^k > 71^k$ O.K.

DETERMINE SHEAR & MOMENT DIAGRAM FOR BEAM



$V_A = \frac{71(13.25)}{10.75} = 87.5^k$

$V_B = \frac{71(2.5)}{10.75} = 16.5^k$



SHEAR

MOMENT

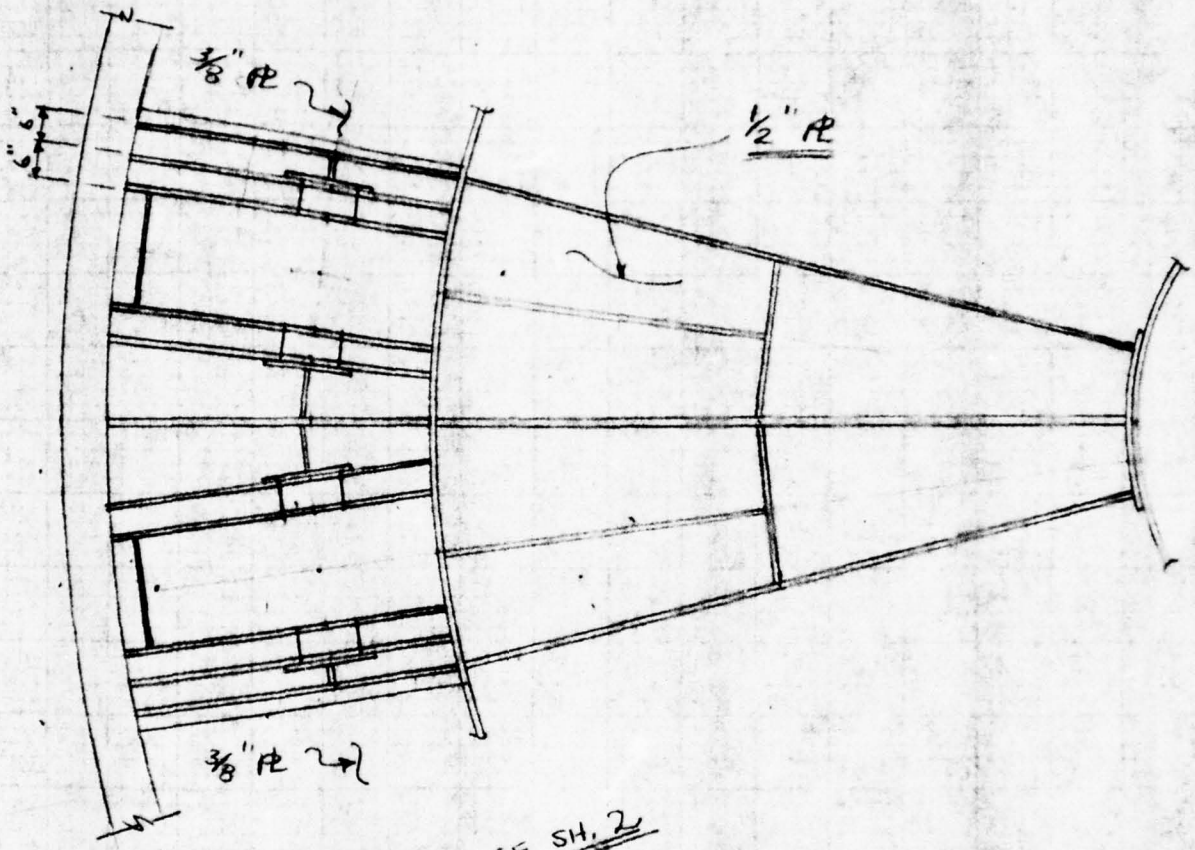
2

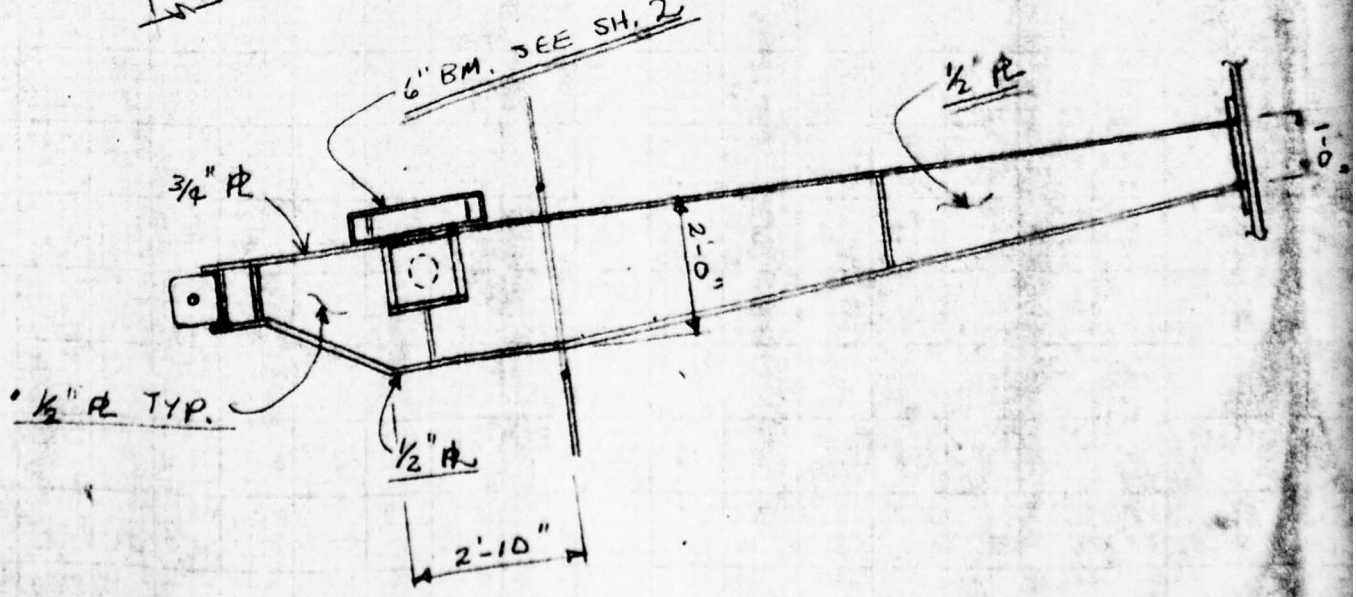
ENGINEERING DEPARTMENT
COMPUTATION SHEET

McD 5036

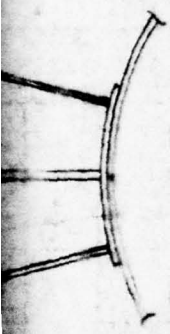
J. RAY McDERMOTT & CO., INC.

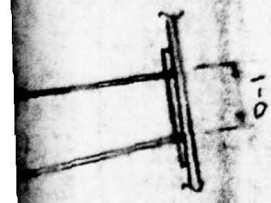
COMPANY		SHEET NO
U.S. ARMY / ERDL		1
SUBJECT		
MONO-MOORING SYSTEM		
WORK ORDER NUMBER	COMPUTED BY	CHECKED BY	DATE
JOB 56017	ANDREWS		5/19/65





PENDANT CONNECTIONS





CHECK BEAM

MAX. V = 72^k = 36^k/SIDE

MAX. H = 240^k = 120^k/SIDE

MAX. MOM. = 36(24) = 865$^{"k}$

$I = \frac{bd^3}{12} = \frac{.5(23)^3}{12} = 507\ in^4$

$AD^2 = .5(24)(11.5)^2 = 1590\ in^4$

$I = 2097\ in^4$

$S = \frac{2097}{12} = 171\ in^3$

$P/A = \frac{120}{24(.5)} = 10\ ksi$

$f = \frac{865}{171} = 5.1\ ksi$

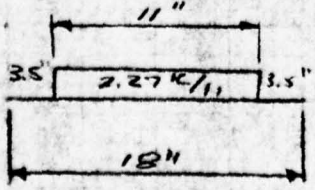
15.1 ksi O.K.

USE ½" PL.

CHECK COVER PL

MAX. VERTICAL PULL = 50^k ≈ $\frac{50}{2(11)} = 2.27^{k/"}$

MAX. SPAN ≈ 18"



$V_L = V_R = \frac{2.27(11)}{2} = 12.5^k$

$M = 12.5(9) - \frac{2.27(6.5)^2}{2}$

$M = 112.5 - 34.4$

$M = 78.1^{"k}$

$S = \frac{bd^2}{6} = \frac{6(1)^2}{6} = 1\ in^3$

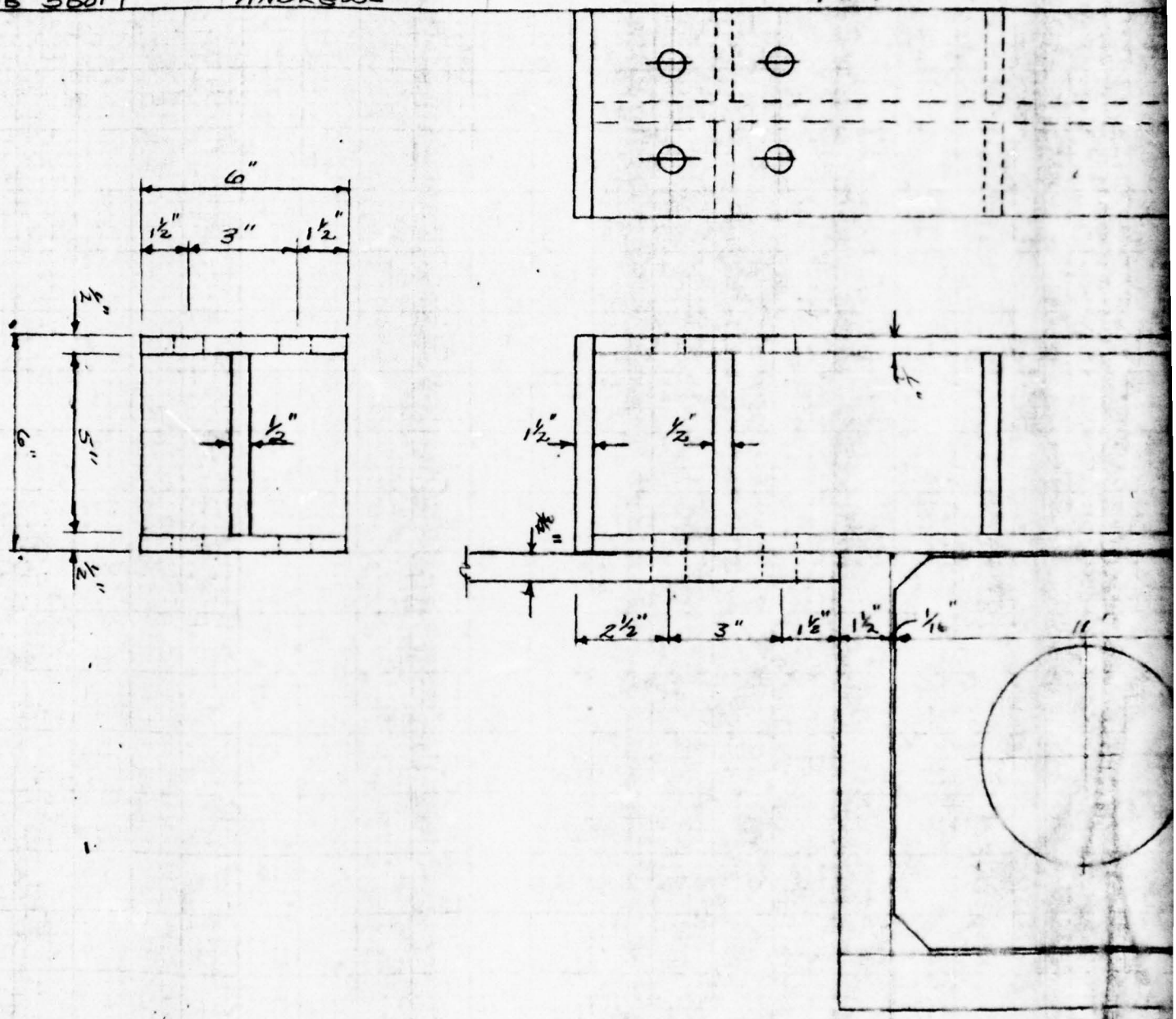
S REQ'D ≈ $\frac{78.1}{15} = 5.2\ in^3$

112.5
34.4
78.1

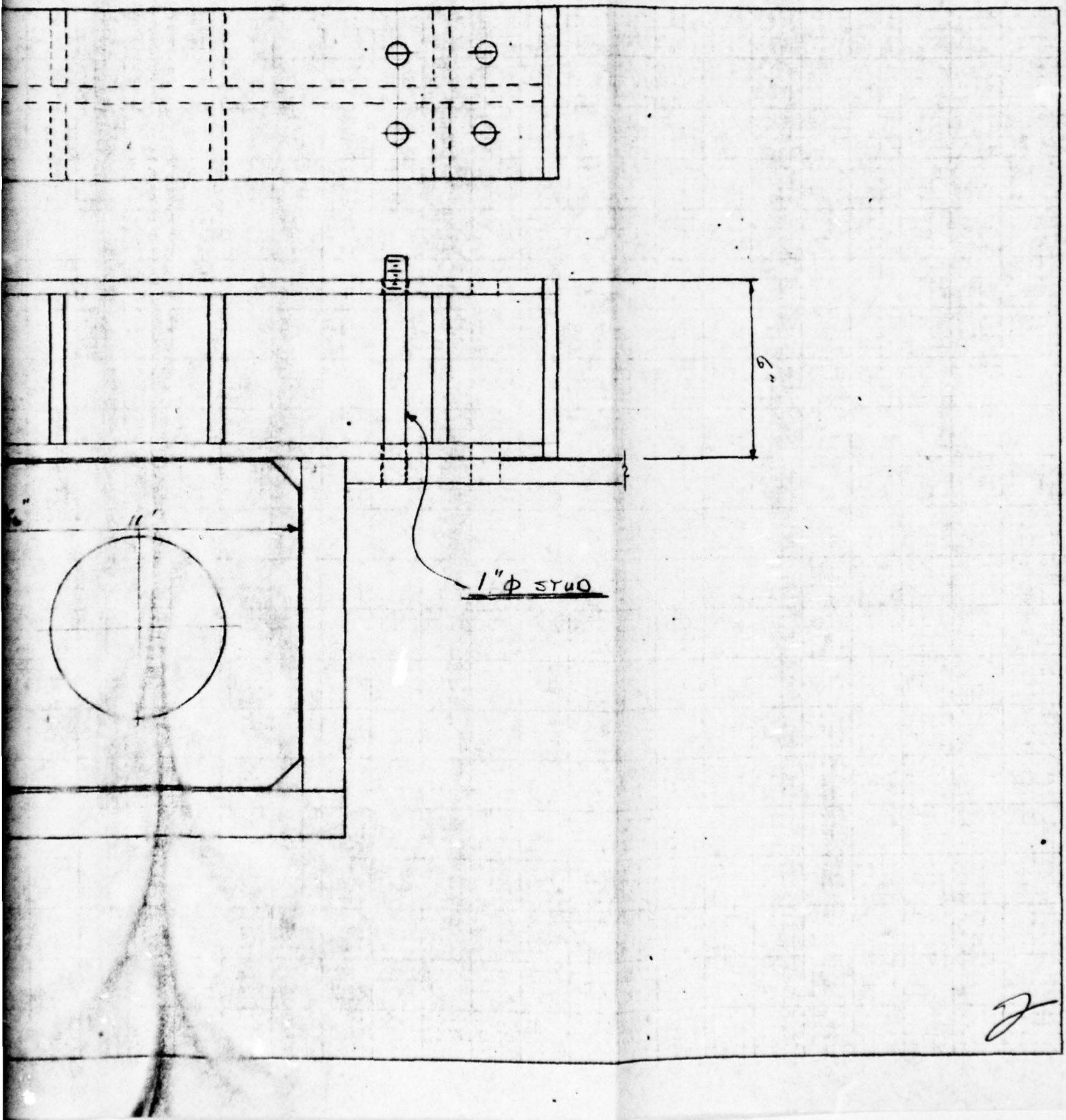
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO.
US ARMY/EROL			2
SUBJECT: MONO-MOORING SYSTEM			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		5/28/65



PENDANT CONNECTION



ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 8036

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY/EROL
SHEET NO: 3
SUBJECT: MONO-MOORING SYSTEM
DRAWING NUMBER: JOB 56017
COMPUTER: ANDREWS
CHECKED BY:
DATE: 5/28/65

CHECK 6" BM COVER

$I = \frac{bd^3}{12} = \frac{6(6)^3}{12} = 108$

$= \frac{5.5(5)^3}{12} = 37.2$

70.8 IN.^4

$S = \frac{70.8}{3} = 23.6 \text{ IN}^3$

$f = \frac{78.1}{23.6} = 3.3 \text{ ksi}$

6" BM O.K.

CHECK SHEAR IN 1"ϕ BOLTS

MAX. $P \approx \frac{120}{2} = 60^K$

ALLOWABLE SINGLE SHEAR 1"ϕ BOLT = 15.71^K

ALLOW $P = 15.71(4) = 63^K > 60^K$ O.K.

USE 1"ϕ A354 Gr BC

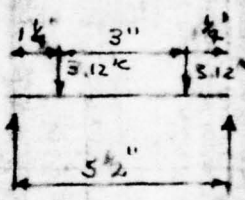
CHECK BEARING

$H = 60^K$

ALLOWABLE H = 33.7

1"ϕ BOLT O.K. IN

CHECK BENDING



$S = \frac{bd^2}{6} = \frac{3(.75)^2}{6}$

$f = \frac{3.9}{.29} = 12 \text{ KSI}$

3

PENDANT CONNECTION

2/8/65

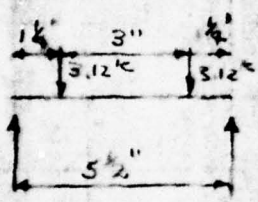
CHECK BEARING ON 1" ϕ BOLTS

H = 60^k

ALLOWABLE H = 33.75(4) = 135^k

1" ϕ BOLT OK IN BEARING

CHECK BENDING IN 3/4" PL



M = (1.25) = 3.9"^k

CONSIDER 3" WIDE SECTION

$S = \frac{bd^2}{6} = \frac{3(.75)^2}{6} = 0.28$

$f = \frac{3.9}{.28} =$ 12 KSI O.K.

2

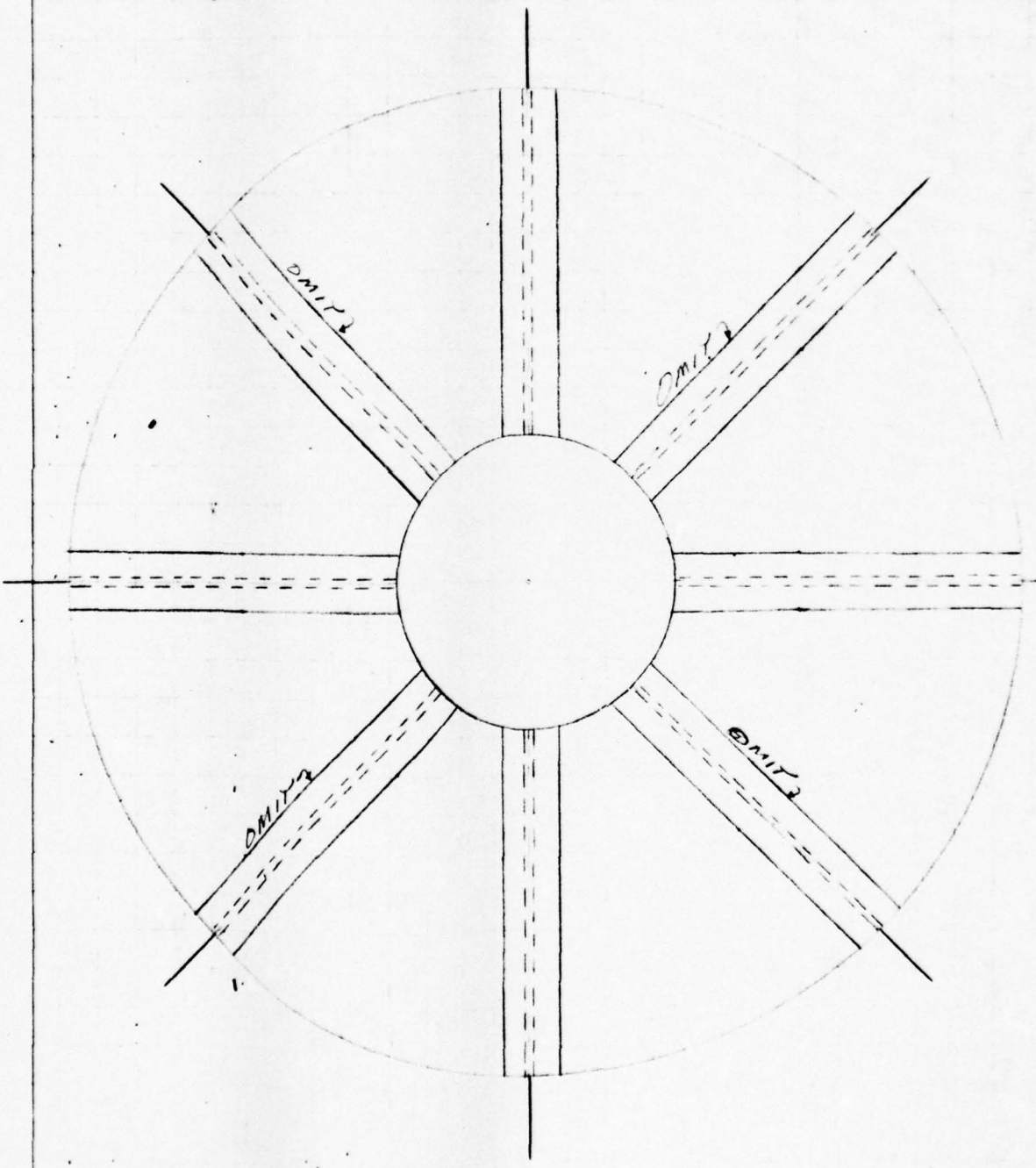
ENGINEERING DEPARTMENT
COMPUTATION SHEET

McD 14003

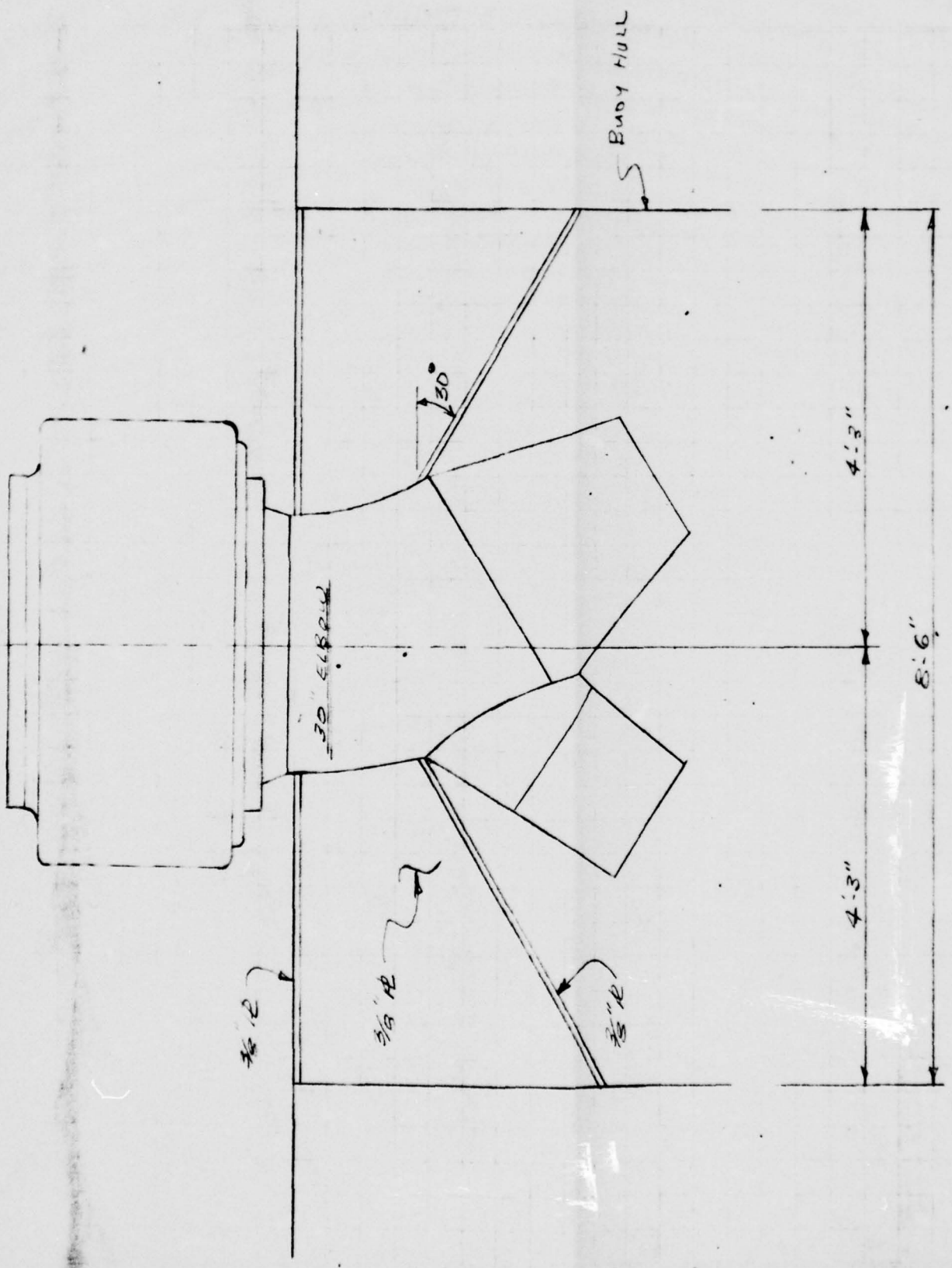
J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U. S. ARMY / EROL			1
SUBJECT			
MOND - MOORING SYSTEM			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017.	ANDREWS		4/21/65

DESIGN OF SWIVEL TO BUOY CONN.



SWIVEL TO BODY CONNECTION



2

2:30 26 6,000 [14,000#]

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U. S. ARMY/ERDL	2

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		4/28/65

SWI

421

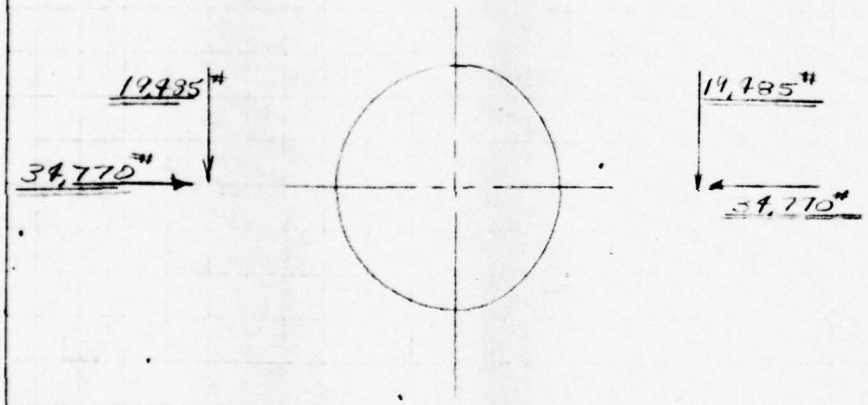
LOADS ACTING ON SWIVEL

WEIGHT ≈ 18,000#

161
61
612

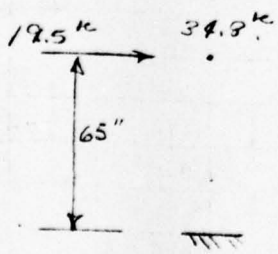
UPWARD PUMPING LOAD = 96^k

UPWARD PUMPING LOAD WITH ONE LINE FLOWING = 62^k



35
26
65"

CONSIDER UNBALANCED CONDITION WITH SWIVEL FROZEN OR LOCKED



$M_{xx} = 19.5(65) = 1270''^k$

$M_{yy} = 34.8(65) = 2260''^k$

$\sqrt{(1270)^2 + (2260)^2} = 2590''^k$

TORQUE $= 19.5(53) = 1030''^k$

$f = \frac{2590}{255.29} = 10.2$ ksi $\quad S_s = \frac{1030}{255.29(2)} = 2.02$ ksi

30" ϕ O.K.

CONSIDER WEL
30" ϕ ELBOW

UPLIFT = 62^k

T = C = 2,590/30

$F/_{11} = \frac{62}{8(16)} = .47$

$F/_{11} = \frac{86.4}{4(16)} = 1.35$

F/11 TOTAL = 1.84

TRY 1/4" WELD

F/11 ALLOWABLE =

USE FOUR STIF

CHECK WELD
MECHANISM (SEE
DATED 4/28/65)

MAX F ≈ 20^k

$F/_{11} = \frac{20}{12} = 1.67$

S_s 3/8" ⌀ = 2

3/8" ⌀ & 1/4" F
SOCKET

00 #)

SWIVEL TO BUOY CONN. & DECK LOCKING MECHANISM

8/65

CONSIDER WELD OF STIFFNERS TO 30" ϕ ELBOW.

UPLIFT = 62^k M.O.M. = 2,590''^k

T = C = 2,590/30 = 86.4^k

F/11 = 62/8(16) = .47 k/11

F/11 = 86.4/4(16) = 1.35 k/11

F/11 TOTAL = 1.84 k/11

TRY 1/4" WELD

F/11 ALLOWABLE = .707(.25)(13.6) = 2.4 k/11

USE FOUR STIFFNERS

CHECK WELD ON DECK LOCKING MECHANISM (SEE FIG. 1 OF 2 BY PETRIE DATED 4/28/65)

MAX F ≈ 20^k LENGTH OF WELD ≈ 12"

F/11 = 20/12 = 1.67 k/11 1/4" WELD O.K.

S_s 3/8" PL = 20/6(.75) = 8.9 ksi < 13.6 ksi O.K.

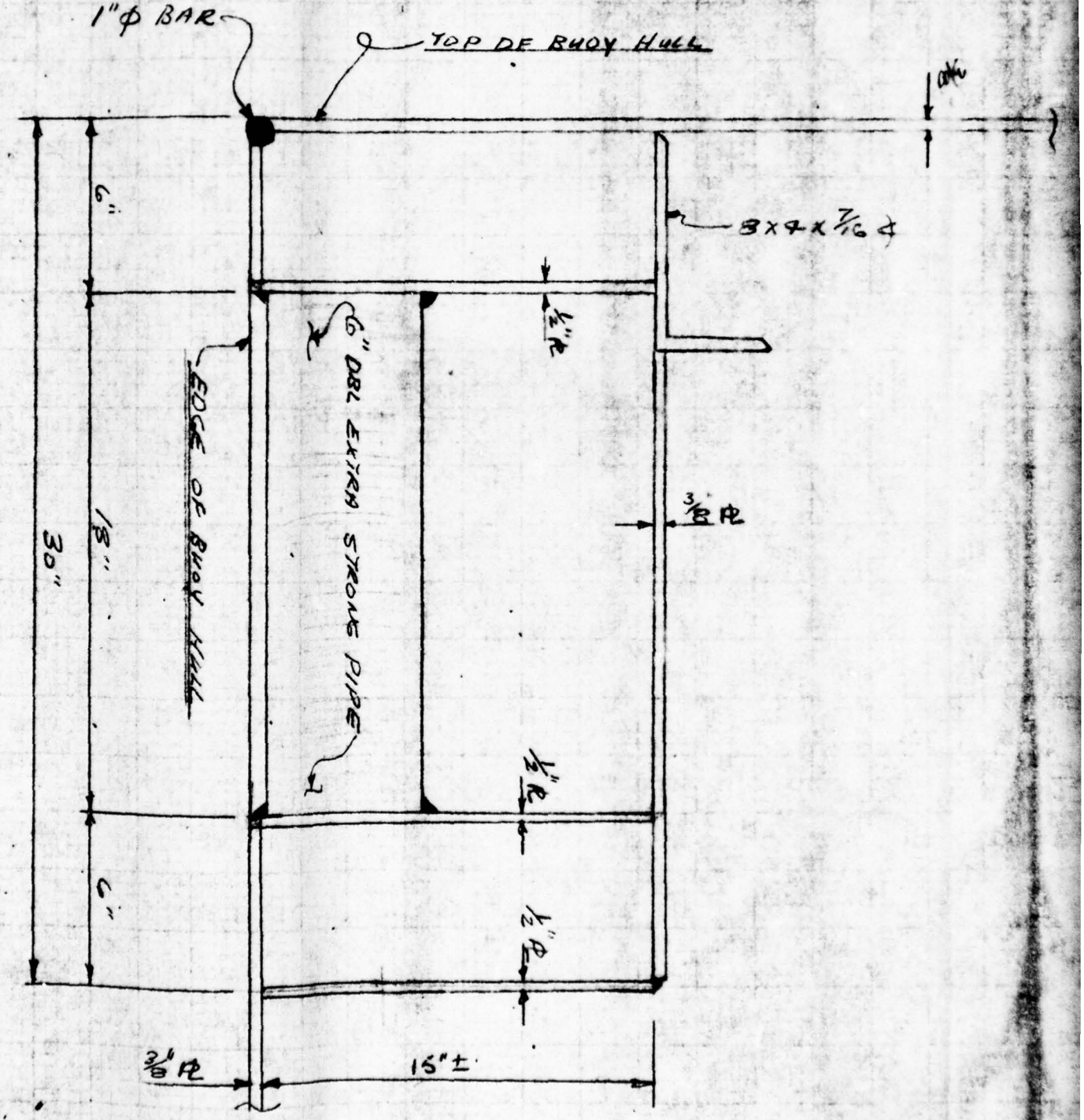
3/8" PL & 1/4" FILLET WELDS O.K. FOR SOCKET.

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

J. RAY MCDERMOTT & CO., INC.

COMPANY			SHEET NO.
U. S. ARMY / EROL			2
SUBJECT			
MONO-MOORING SYSTEM			
NUMBER	COMPUTER	CHECKED BY	DATE
JOB 56017	ANDREWS		6/1/65



TEMPORARY RECESSED MOORING BIT

4

2

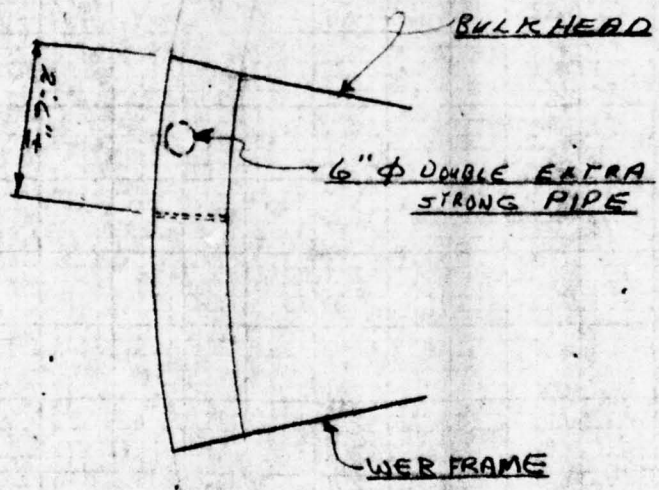
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

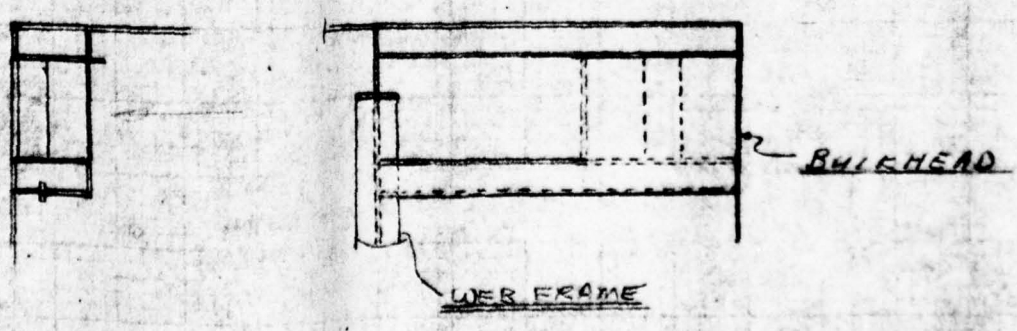
RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO.
U. S. ARMY/ERDL	1
SUBJECT: MONO-MOORING SYSTEM	
JOB NUMBER: Job 56017	COMPUTER: ANDREWS / CHECKED BY: / DATE: 6/1/65

DESIGN OF TEMPORARY BIT.

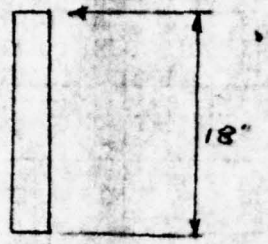
DESIGN BIT FOR LOAD OF 100^{K}





TEMPORARY RECESSED MOORING PIT

CHECK 6" DBL. EXTRA STRG. PIPE



MAX. MOM. $= \frac{PL}{4} = \frac{100(18)}{4} = \underline{450\ ''K}$

$f = \frac{Mc}{I} = \frac{450(3.12)}{66.33} = \underline{21.2\ ksi}$ O.K.

CHECK WELD

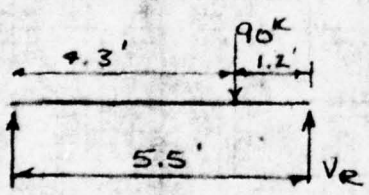
$L = 3.14(6.25) = 19.5''$

$F/'' = \frac{90}{19.3} = \underline{4.6\ ^K/_{''}}$

TRY $\frac{1}{2}$" FILLET WELD

ALLOW $^K/_{''} = .5(.707)(13.5) = 4.77\ ^K/_{''} > 4.60\ ^K/_{''}$ O.K.

CHECK BENDING & SHEAR ON R GIRDER BETWEEN BULKHEAD AND WEB FRAME



$V_e = 90\left(\frac{4.3}{5.5}\right) = \underline{70.5^K}$

$M = 70.5(1.2)(12) = \underline{1030\ ''K}$

$I = \frac{bd^3}{12} = \frac{6(15)^3}{12} = 1700\ IN.^4$

$\frac{bd^3}{12} = \frac{6(19.125)^3}{12} = 1185$

$\overline{I = \underline{515\ IN.^4}}$

$S = \frac{515}{7.5} = \underline{68.6\ IN.^3}$

$f = \frac{1030}{68.6} = \underline{15\ ksi}$ O.K.

ALSO $V = .5(15)(2)(13.5) = \underline{202^K > 70.5}$ O.K.

MISC. SKETCHES

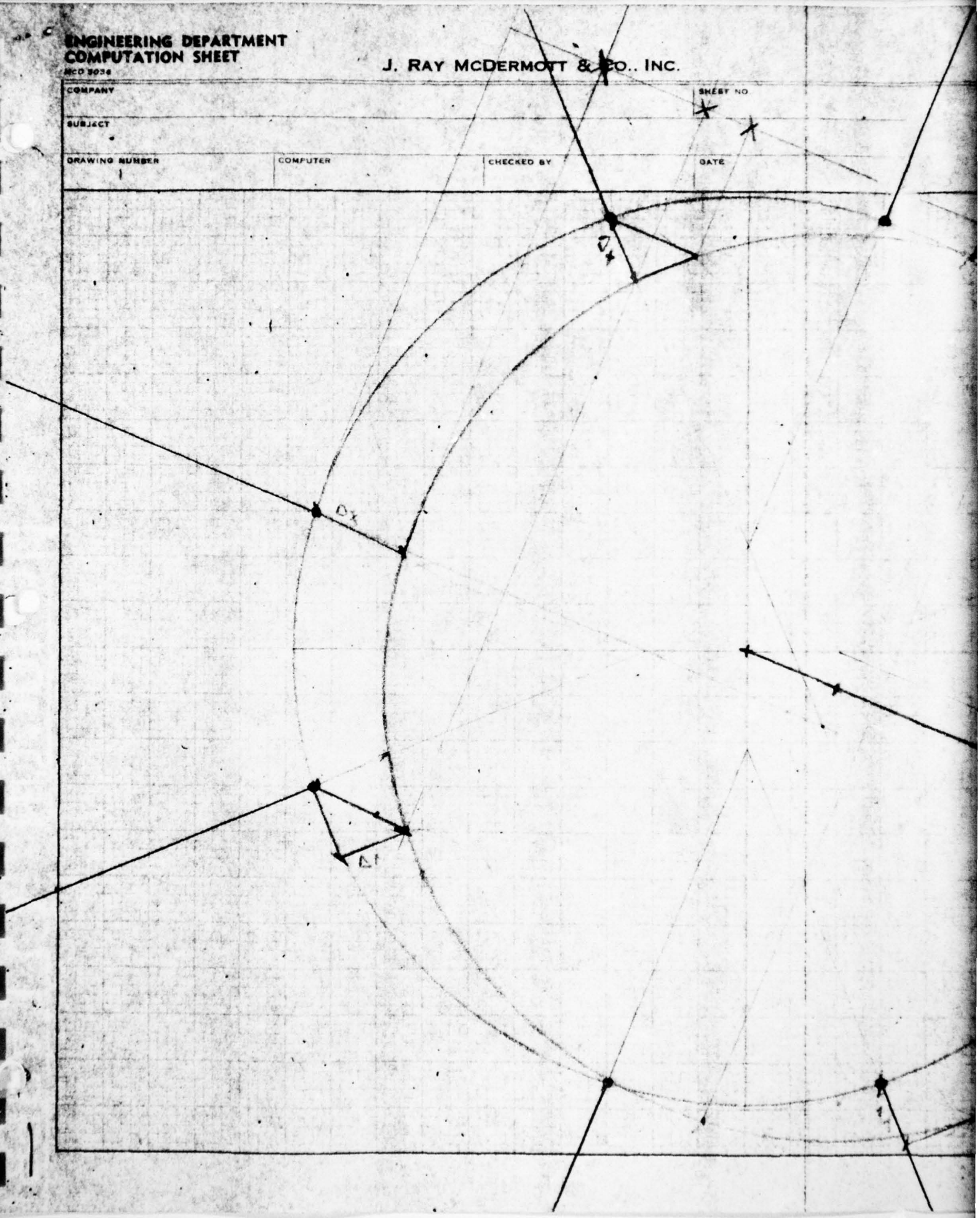
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 3036

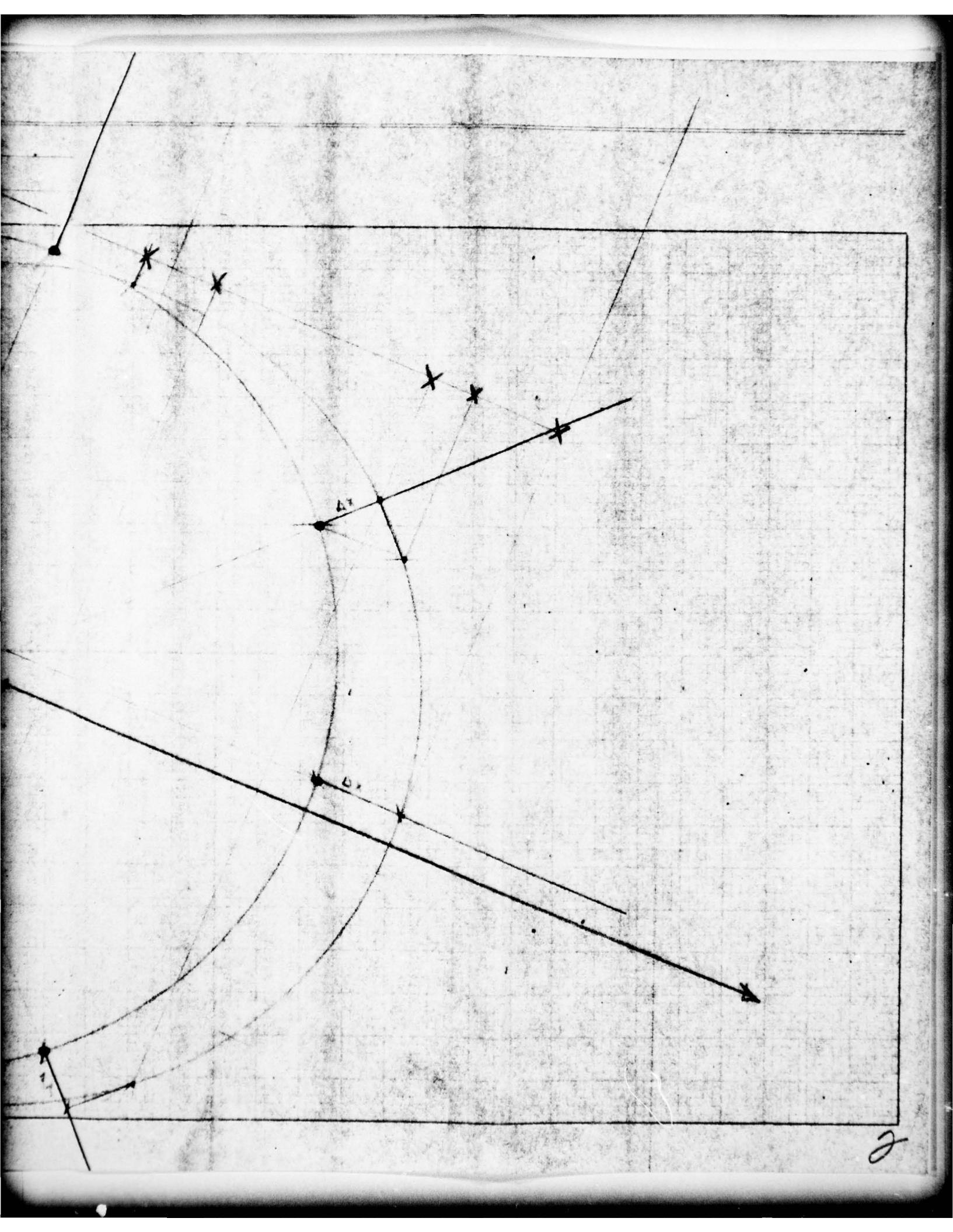
J. RAY MCDERMOTT & CO., INC.

COMPANY | SHEET NO.

SUBJECT

DRAWING NUMBER | COMPUTER | CHECKED BY | DATE

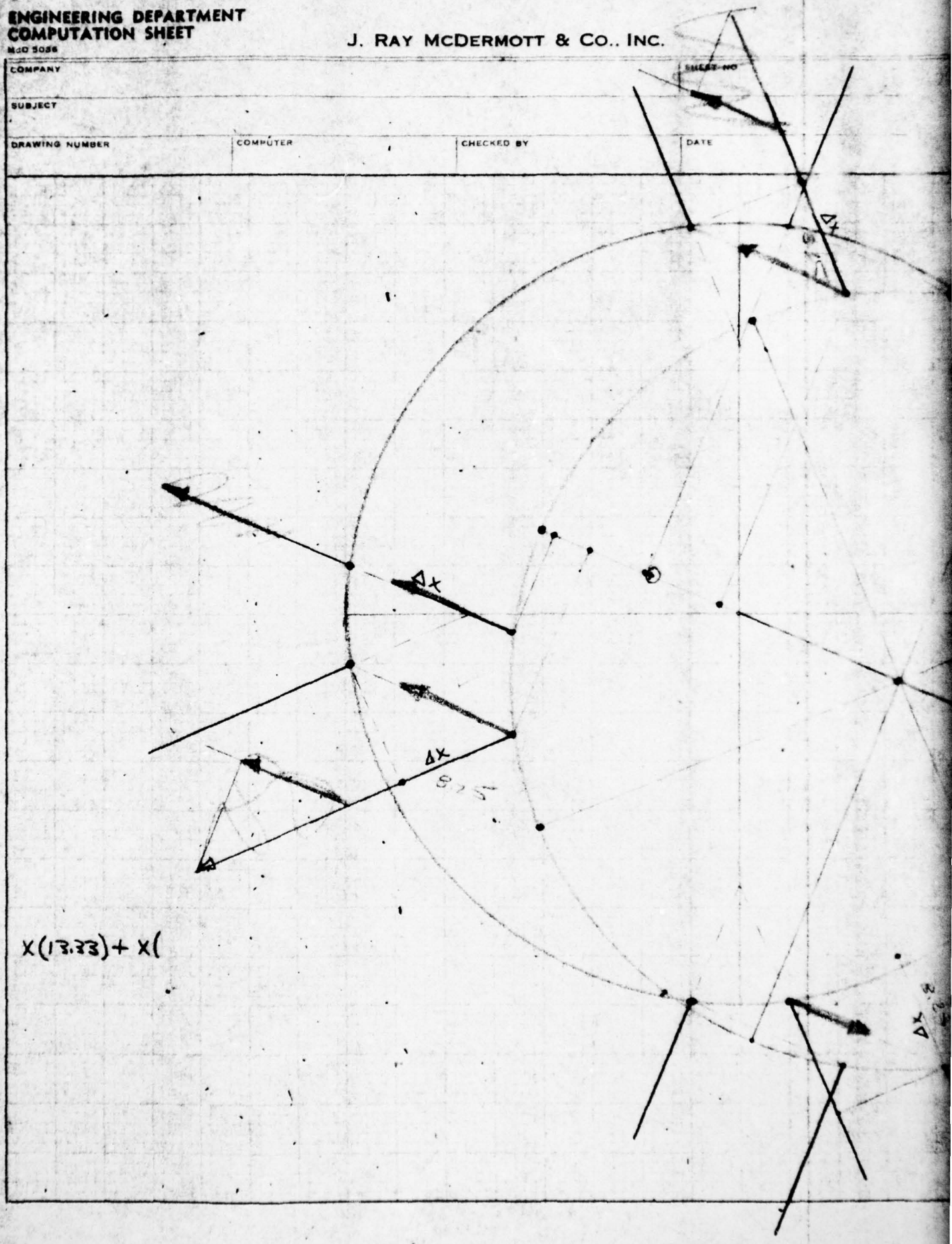



Δx
Δx

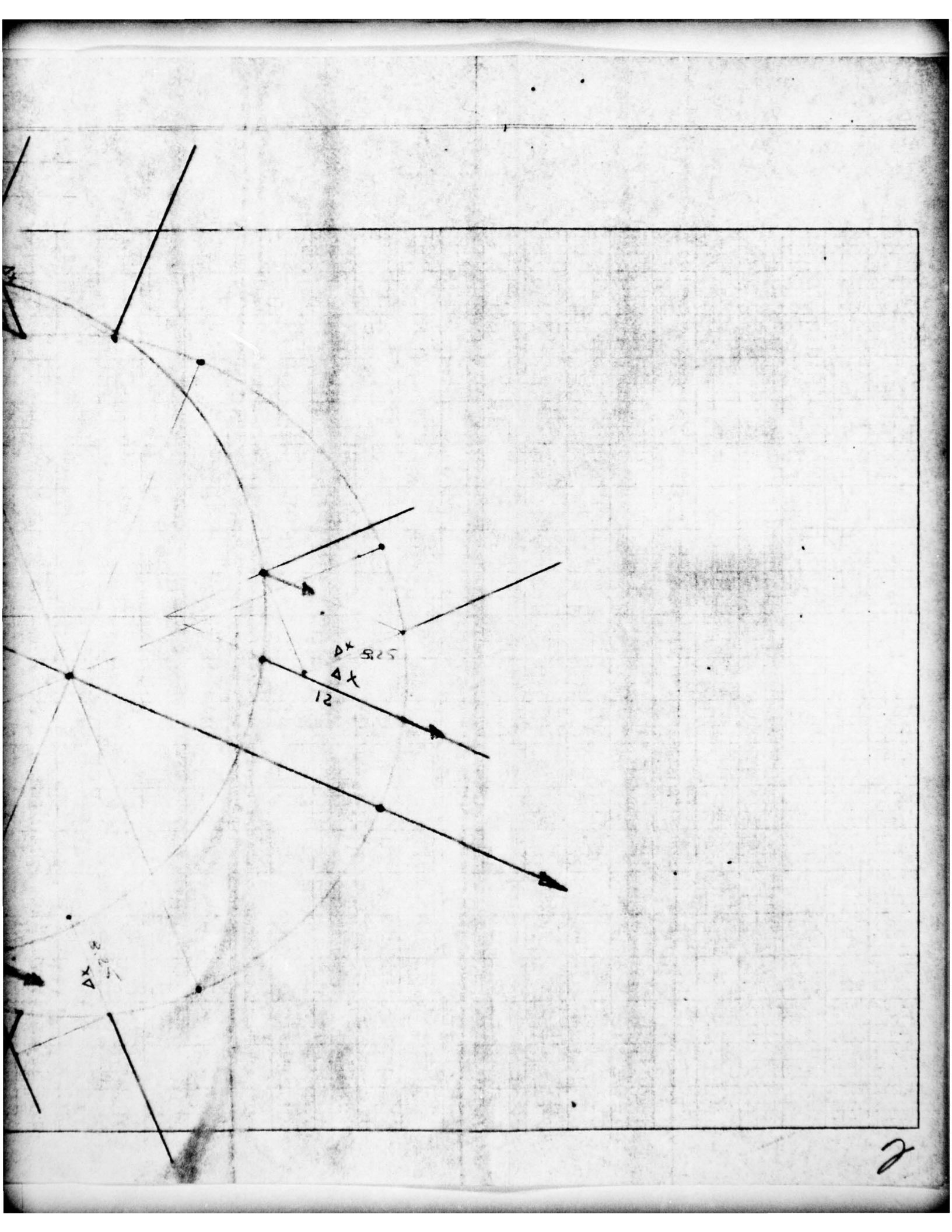
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCO 5056

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
SUBJECT			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE



X(13.33)+ X(


Δx
12
Δx
Δx

SECTION III

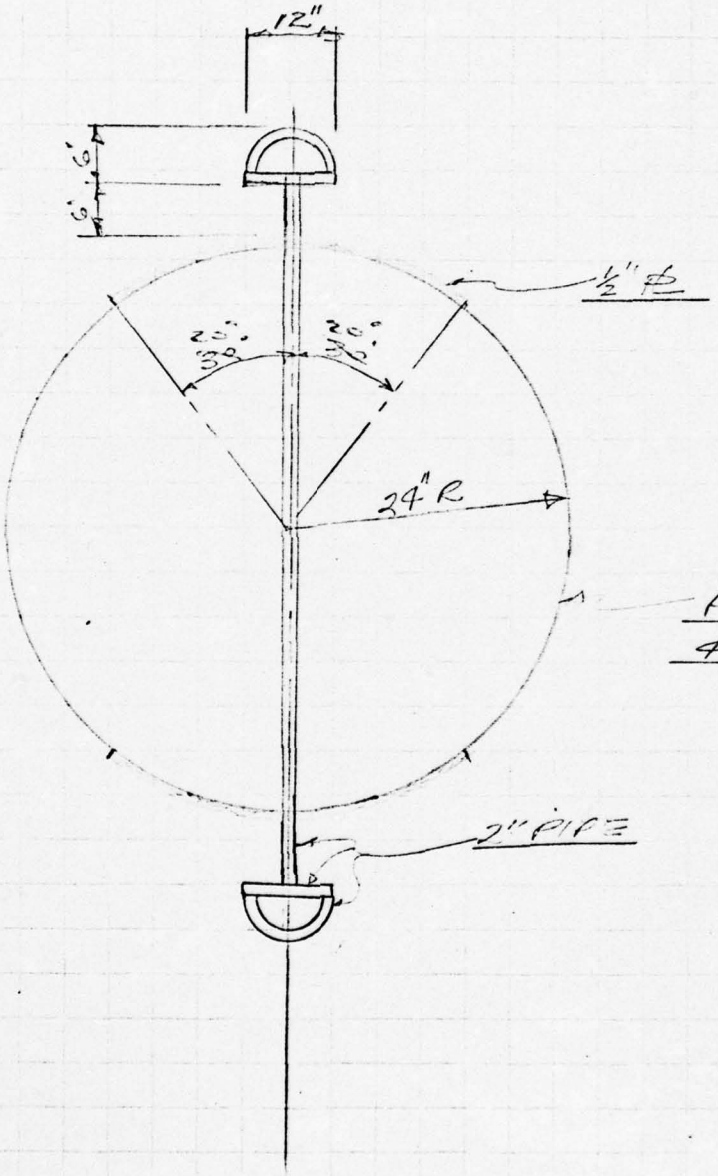
MOORING

COMPUTATION SHEET
ENGINEERING DEPARTMENT

MCD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	



ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY MCDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL | SHEET NO: 1

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 5/10/65

SIZE CHAIN ENDS FOR S.F. 2.0 FOR PROOF LOAD OF CHAIN.

PROOF LOAD REQUIRED $\approx \frac{300(.65)(2)}{.866} = 450^{K} = 225^{T}$

USE SIZE 3½ ROUND-PIN CHAIN SHACKLE

BREAKING LOAD $\approx$ ____ T

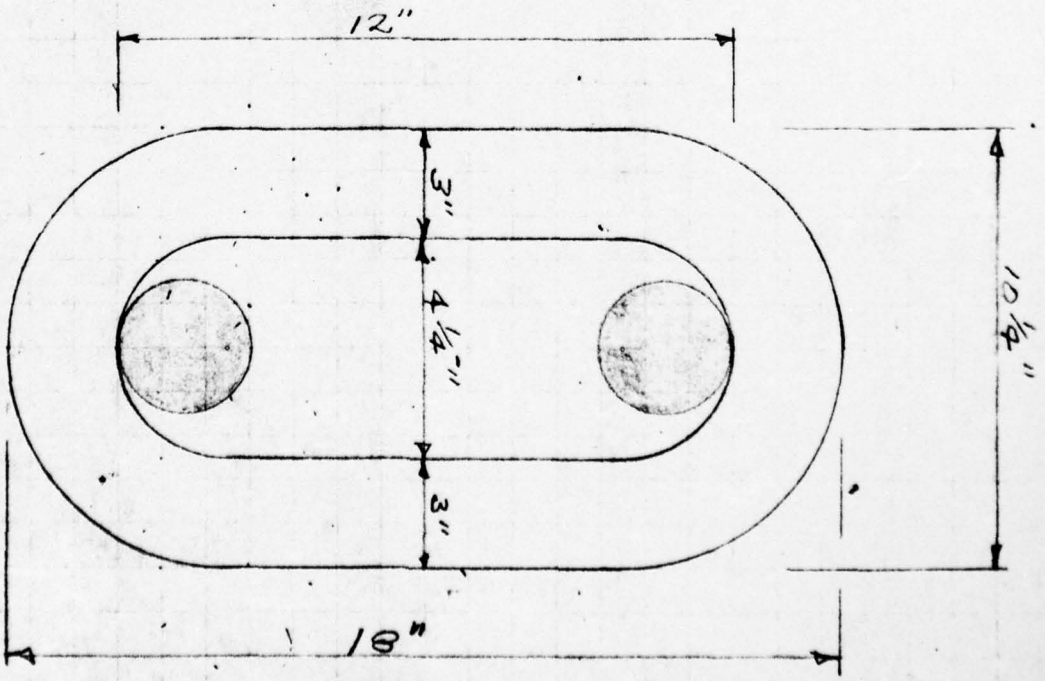
DESIGN OF ENDLESS CONNECTING LINK

USE A ALLOWABLE PROOF LOAD STRESS = 35 ksi

$A_{REQ'D} = \frac{450}{2(35)} = 6.94^{\square''}$ $\quad D^2 = \frac{6.94}{1.785} = 8.20$

$D = 2.86''$

TRY 3" ϕ LINK



MOORING LINES

DESIGN OF PAD EYE (USE 65% UNBALANCED & ALLOWABLE STRESSES)

MAX H LOAD ≈ 300 (.65) = 195^K RESULTANT @ 30° = $\frac{195}{.866}$ = 225^K

PIN DIA. FOR NO. 3 ROUND PIN SHACKLE = 3"

SPREAD OF SHACKLE = 4 3/4" TRY 2½" R WITH 1" CHEEK PLS.

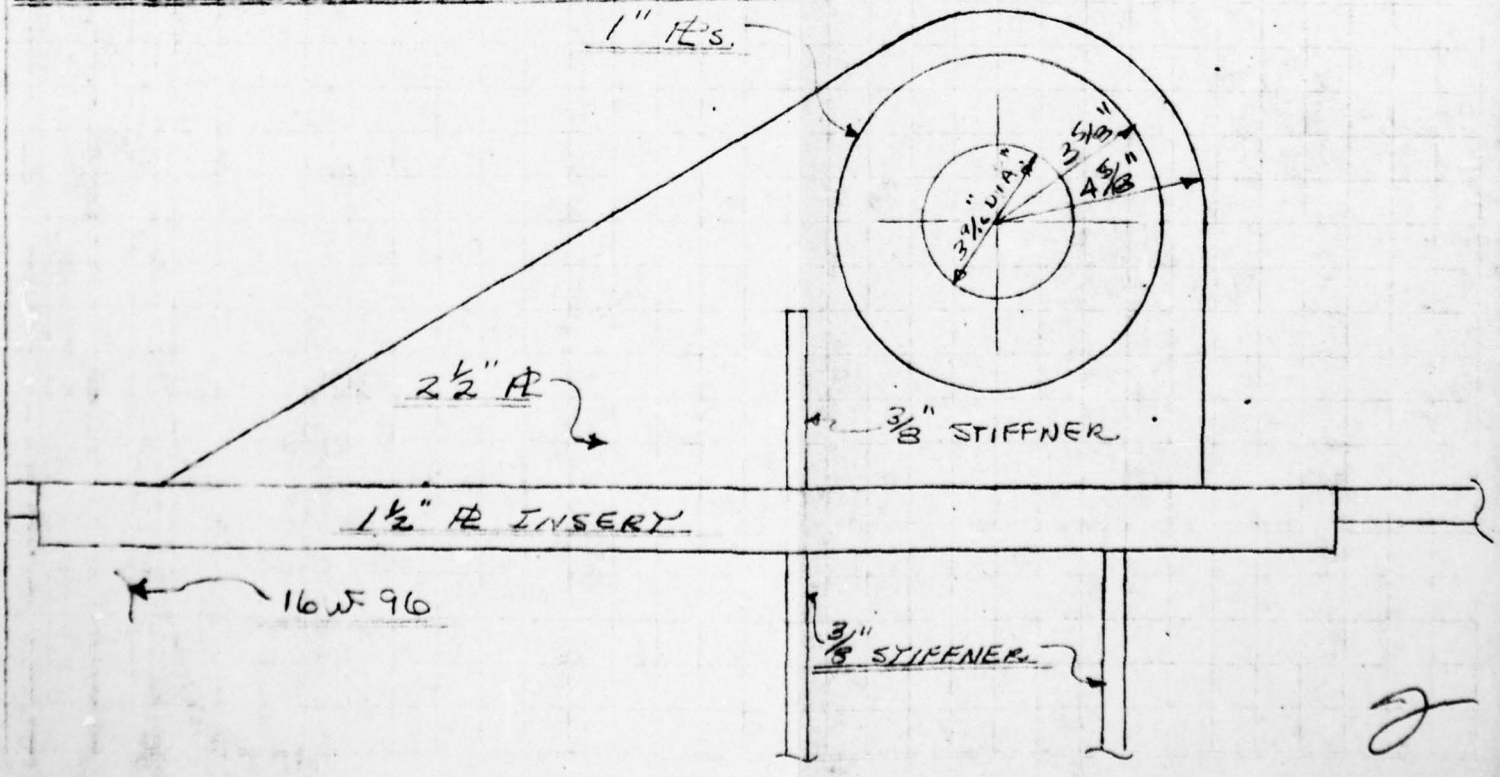
ALLOWABLE BEARING ON 3" PIN = 96 (4.5) = 431^K > 225^K O.K.

ALLOWABLE SHEAR 15,000 psi P = 212.1 < 225 NO GOOD

ALLOWABLE SHEAR = 20,000 psi P = 283^K > 225 O.K.

~~FABRICATE PIN OF 60,000 psi YIELD STEEL~~

CHANGE TO 3½" ϕ PIN FOR #3½ SHACKLE



ENGINEERING DEPARTMENT
COMPUTATION SHEET

MCD 14003

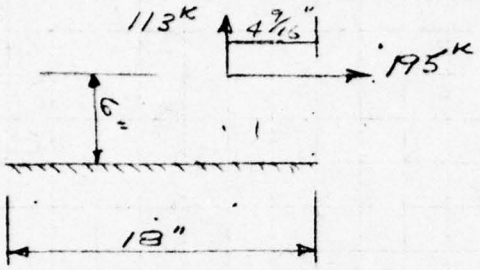
J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY / ERDL | SHEET NO: 2

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER: JOB 156017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 5/11/65

CHECK WELD OF RAD EYE TO 16 WF



TOTAL $L = 36''$ $S = \frac{bd^2}{6} = \frac{(11)(18)^2}{6}(2) = 108\ IN.^3$

$M = 195(6) - 113(4.44) = 1170 - 501 = 669''^K$

$F_{11} = \frac{669}{108} = 6.2^{K}/_{11}$ $F_{11} = \frac{225}{36} = 6.25^{K}/_{11}$

TOTAL $F_{11} = 6.2 + 6.25 = 12.45^{K}/_{11}$

TRY $\frac{1}{2}''$ FILLET WELD

ALLOWABLE $F_{11} = .5(.707)(14.5) = 5.12^{K}/_{11} > 12.45$ NO GOOD

INCREASE LENGTH OF WELD TO 24" EACH SIDE

TOTAL $L = 48''$ $S = \frac{t(24)^2}{6}(2) = 192\ IN.^3$

$M = 195(6) - 113(7.44) = 1170 - 840 = 330''^K$

$F_{11} = \frac{330}{192} = 1.72^{K}/_{11}$ $F_{11} = \frac{225}{48} = 4.7^{K}/_{11}$

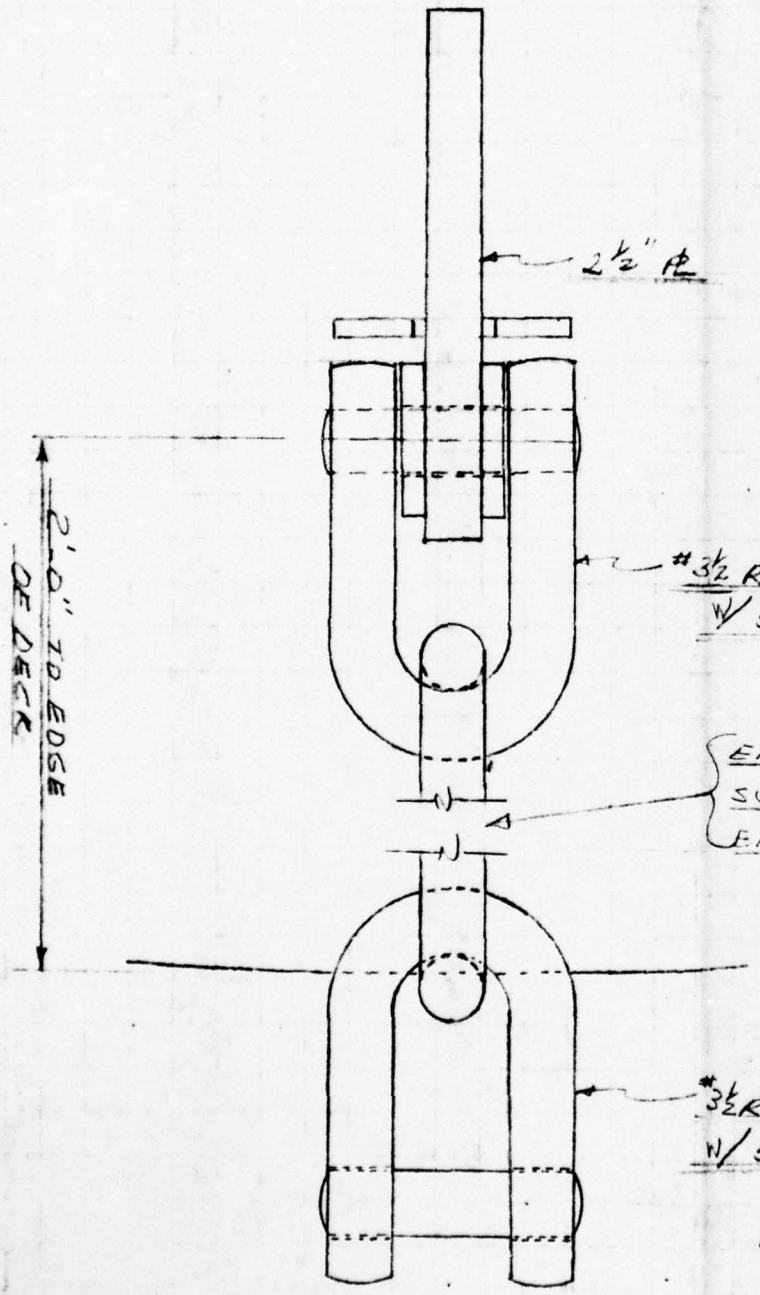
TOTAL $F_{11} = 6.42^{K}/_{11}$

TRY $3/4''$ FILLET WELD

ALLOWABLE $F_{11} = .75(.707)(14.5) = 7.7^{K}/_{11} > 6.42^{K}/_{11}$ O.K.

USE $3/4''$ FILLET WELD.

MOORING DESIGN



2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY: U. S. ARMY / ERDL | SHEET NO: 3

SUBJECT: MONO-MOORING SYSTEM

DRAWING NUMBER: JOB 56017 | COMPUTER: ANDREWS | CHECKED BY: | DATE: 5/11/65

DESIGN OF NYLON ROPE MOORING LINES

ASSUME 65% UNBALANCED & F.S. 1.25

PREQD: $\approx 300(.65)(1.25) = 244^{K}$

USE 12" CIR. NYLON ROPE BREAKING STRENGTH $\approx 360^{K}$

DESIGN OF WIRE ROPE CONNECTING TO SHIP'S BOLLARDS.

SIZE FOR S.F. 2.0 $P = 300(.65)(2) = 390^{K} = 195^{T}$

USE 2"ϕ 6x37 CLASSIFICATION WIRE ROPE IWRC EXTRA IMPROVED PLOW STEEL.
USE 150' OF WIRE ROPE TO ALLOW ADJUSTMENT TO PROPER LENGTH.

SIZE OF WIRE ROPE FOR CARRYING OUT TO SHIP.

USE 1 1/8"ϕ 6x37 CLASSIFICATION WIRE ROPE IWRC, EXTRA IMPROVED PLOW STEEL.
USE 350' LONG LINE

BREAKING STRENGTH. = 123.8K.

61.9
2
123.8

3

MOORING DESIGN

/11/65

NT

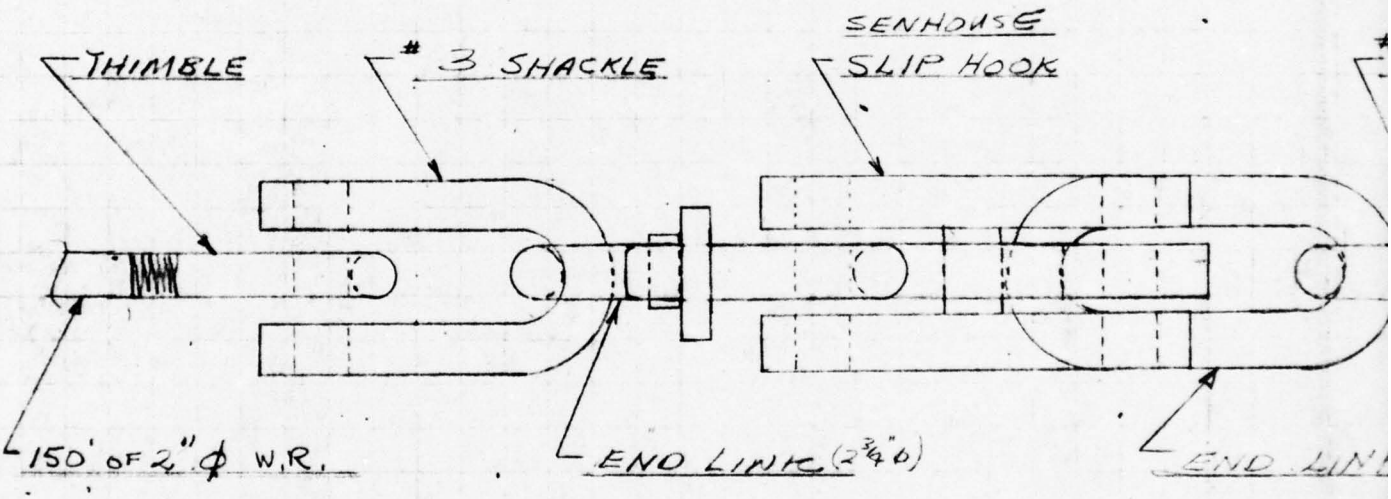
2

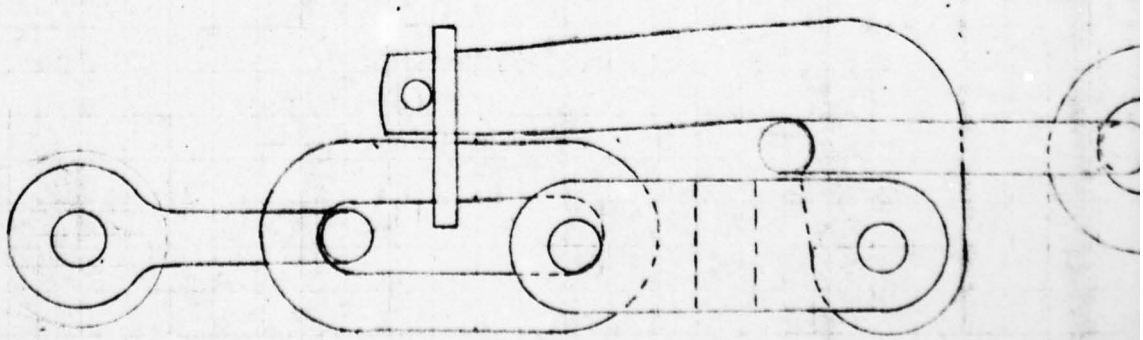
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U.S. ARMY / EROL			4
SUBJECT: MONO-MOORING SYSTEM			
NUMBER: JOB 56017	COMPUTER: ANDREWS	CHECKED BY	DATE: 5/14/65

NOTE: MIN. PROOF CAPACITY OF THIMBLE, SHACKLES, OPEN LINK AND SLIP HOOK TO BE





510" ±

AD-A034 242 MCDERMOTT (J RAY) CO INC NEW ORLEANS LA F/G 13/10

ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 1. --ETC(U)
1966 DA-44-009-AMC-841(T)

UNCLASSIFIED NL

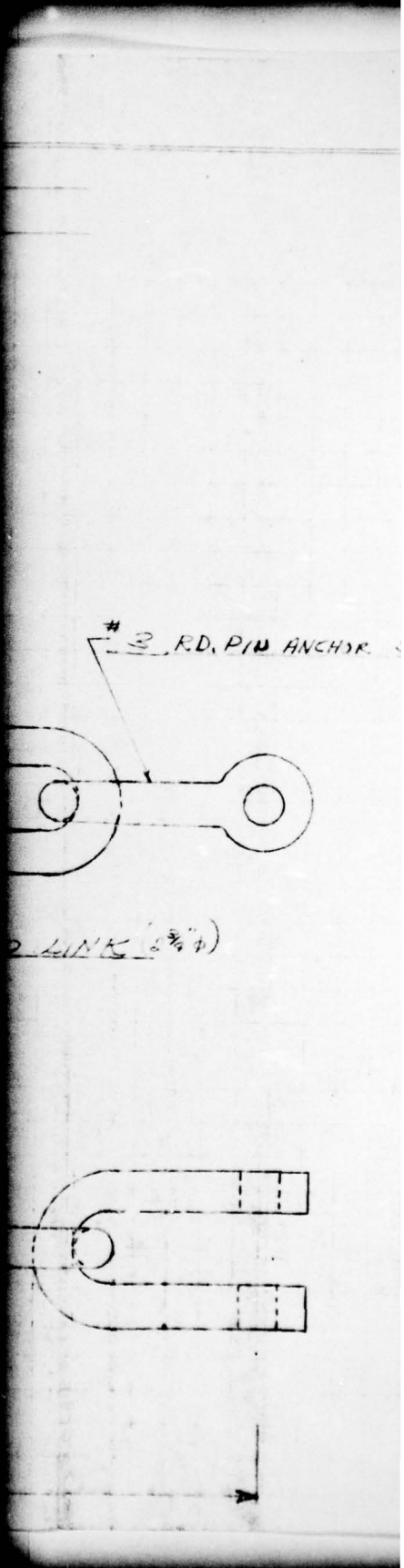
4 OF 4
ADA034242

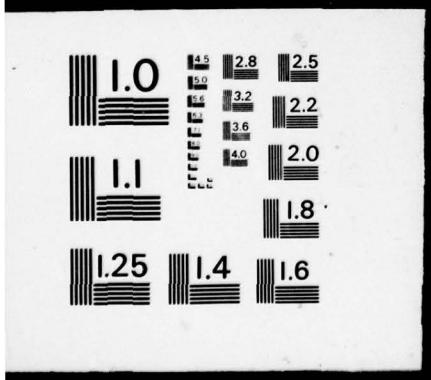
END

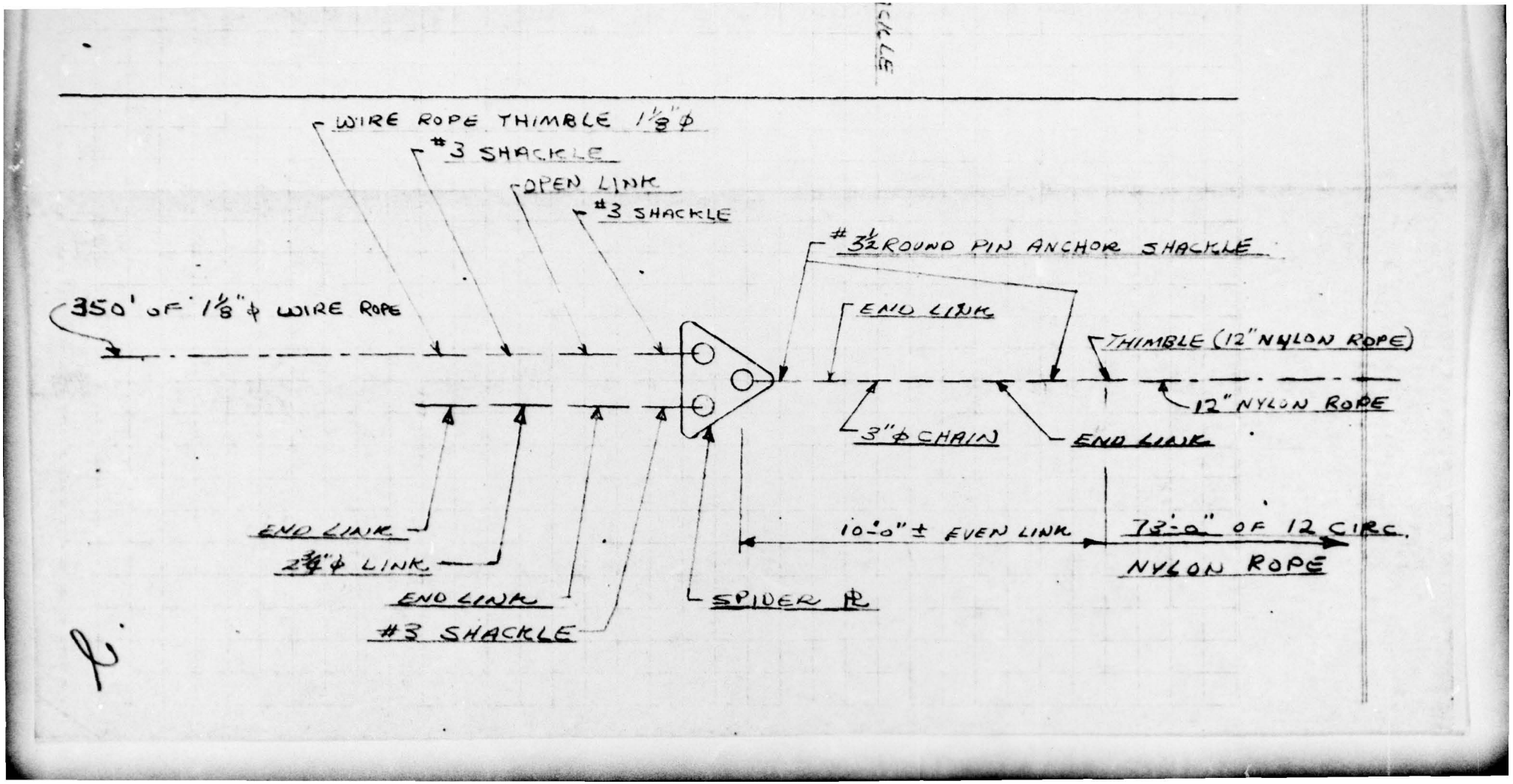
DATE
FILMED
2 - 77

OF 4

034242






WIRE ROPE THIMBLE 1⅛"ϕ
#3 SHACKLE
OPEN LINK
#3 SHACKLE
#3½ ROUND PIN ANCHOR SHACKLE
350' OF 1⅛"ϕ WIRE ROPE
END LINK
THIMBLE (12" NYLON ROPE)
12" NYLON ROPE
3"ϕ CHAIN
END LINK
END LINK
2¾"ϕ LINK
END LINK
#3 SHACKLE
SPIDER PL
10'-0" ± EVEN LINK
72'-0" OF 12 CIRC.
NYLON ROPE

J. RAY McDERMOTT & CO., INC.

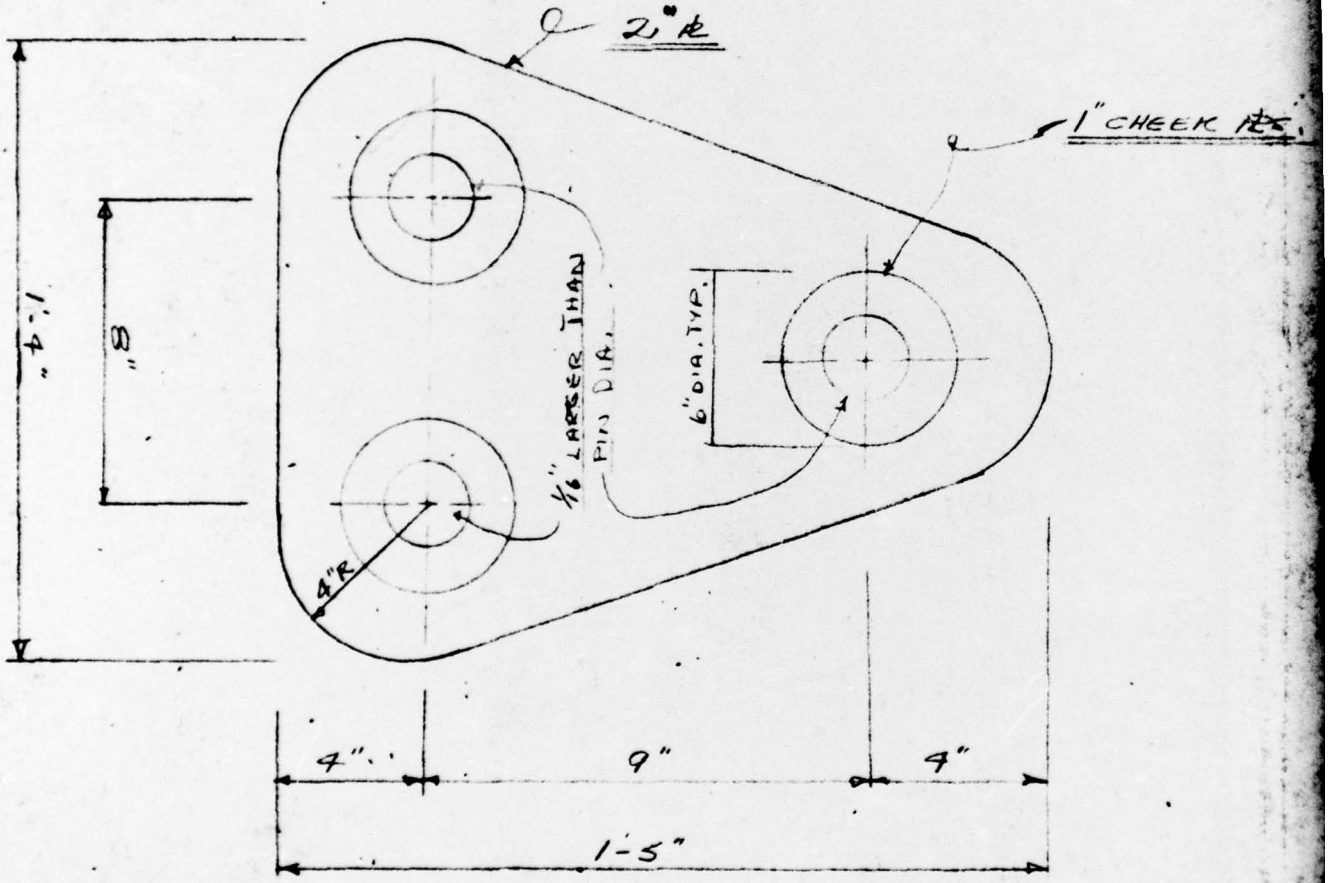
ENGINEERING DEPARTMENT - COMPUTATION SHEET SHEET NO. _____

U. S. ARMY / ERDL

MOORING SYSTEM

JOB NO. 56017 COMPUTER ANDREWS CHKD. BY _____ DATE 3/25 1965

DESIGN OF SISTER PLATE

MAX. F = 400 K. USE A-36 STEEL

AREA REQ'D = $\frac{400}{20}$ = 20 "