

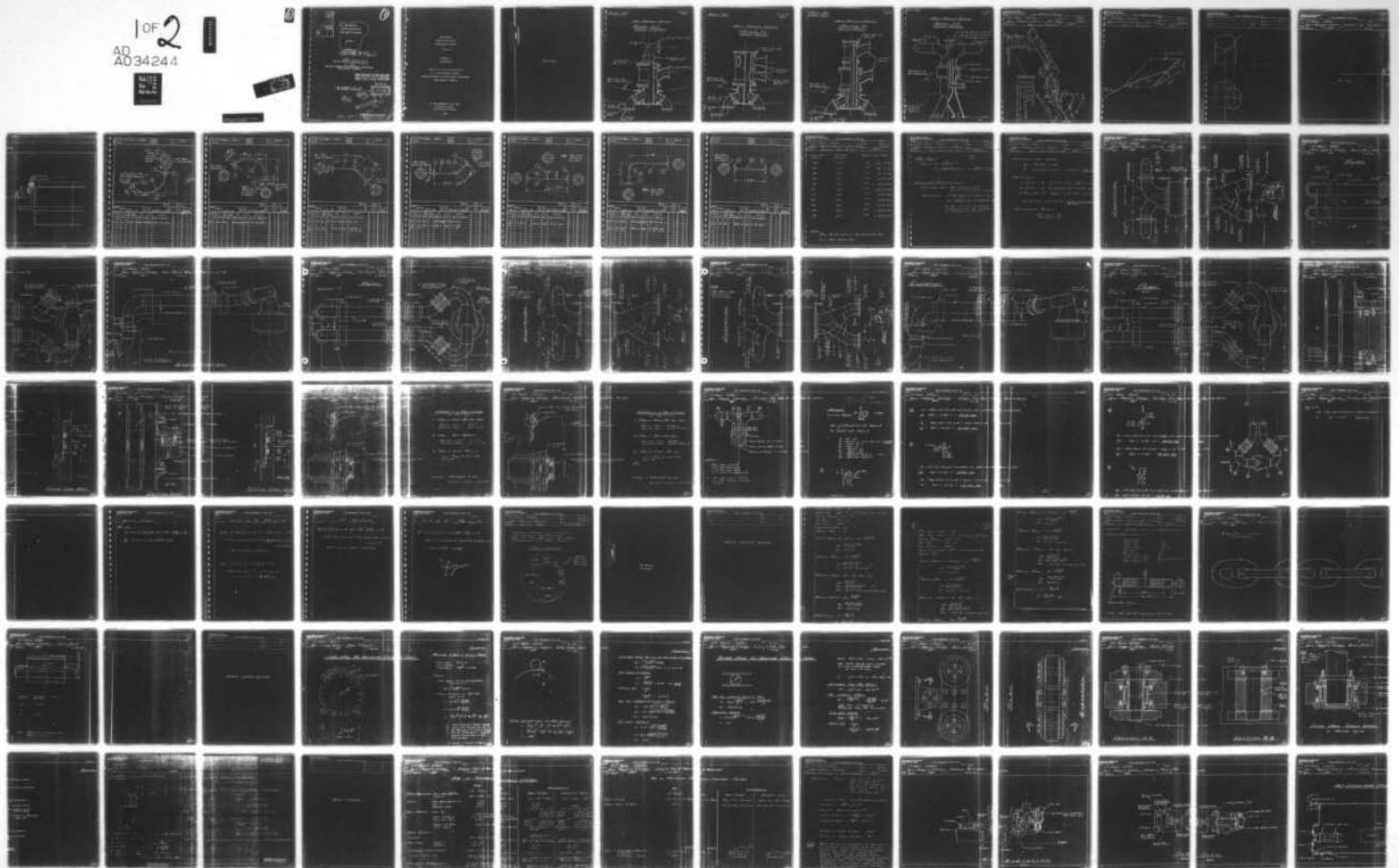
AD-A034 244

MCDERMOTT (J RAY) CO INC NEW ORLEANS LA  
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 3. --ETC(U)  
1966

F/G 13/10  
DA-44-009-AMC-841(T)  
NL

UNCLASSIFIED

1 OF 2  
AD A034244



1

White Section	<input checked="" type="checkbox"/>
Suff Section	<input type="checkbox"/>
	<input type="checkbox"/>
CLASSIFICATION/AVAILABILITY CODES	
Dist.	avail. and/or SPECIAL
A	

6

ENGINEERING  
DESIGN CALCULATIONS  
MONO-MOORING SYSTEM.

VOLUME 3.

APPENDIX A.

9 TO FINAL REPORT, *in Phase 1.*

15

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

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

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ENGINEERING  
DESIGN CALCULATIONS  
MONO-MOORING SYSTEM

VOLUME 3

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

SECTION 1

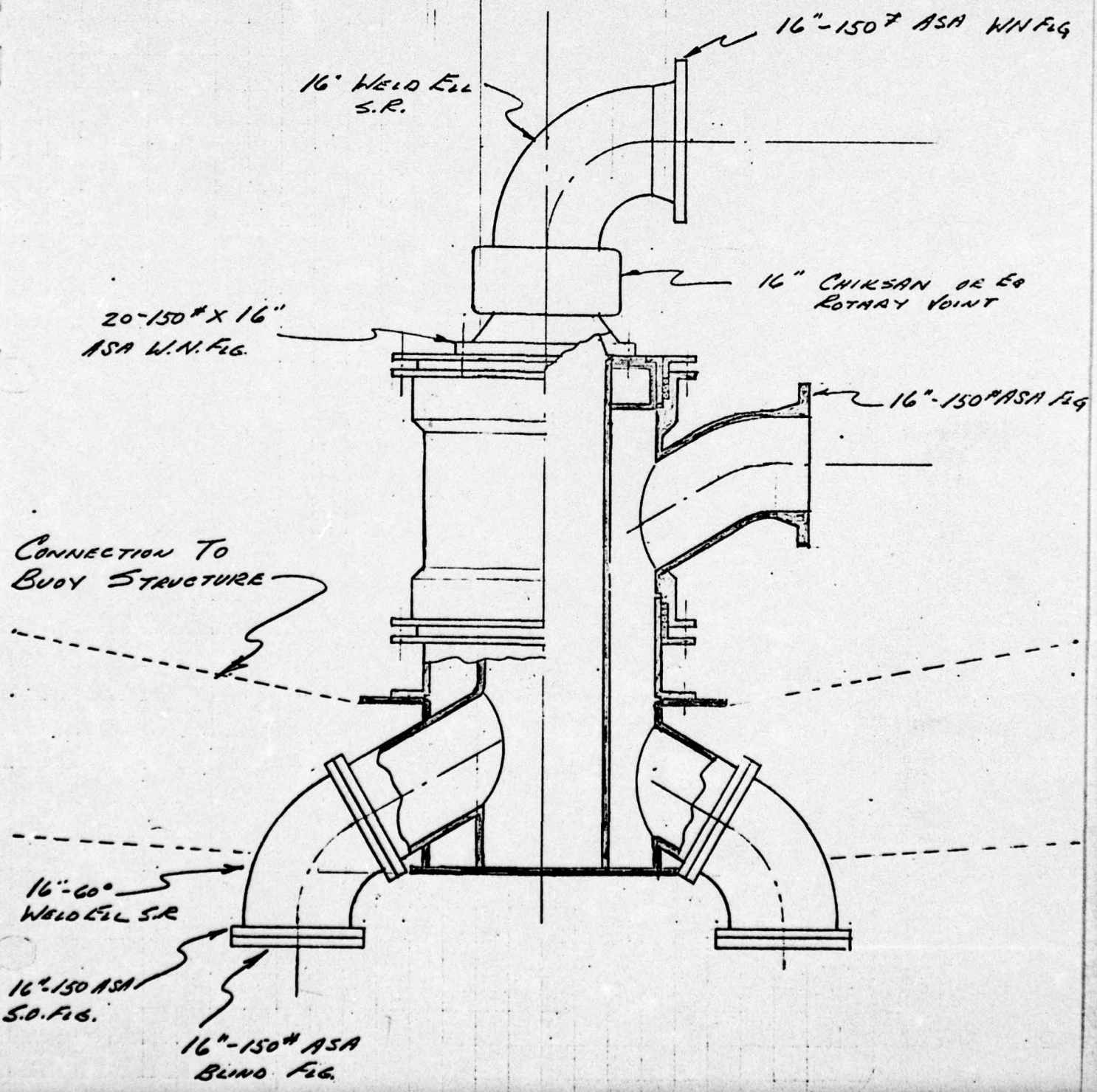
SWIVEL DESIGN

PROJECT 2971

12-10-64  
W.P.

MONO MOORING SYSTEM

PROPOSAL # 1  
SWIVEL DESIGN

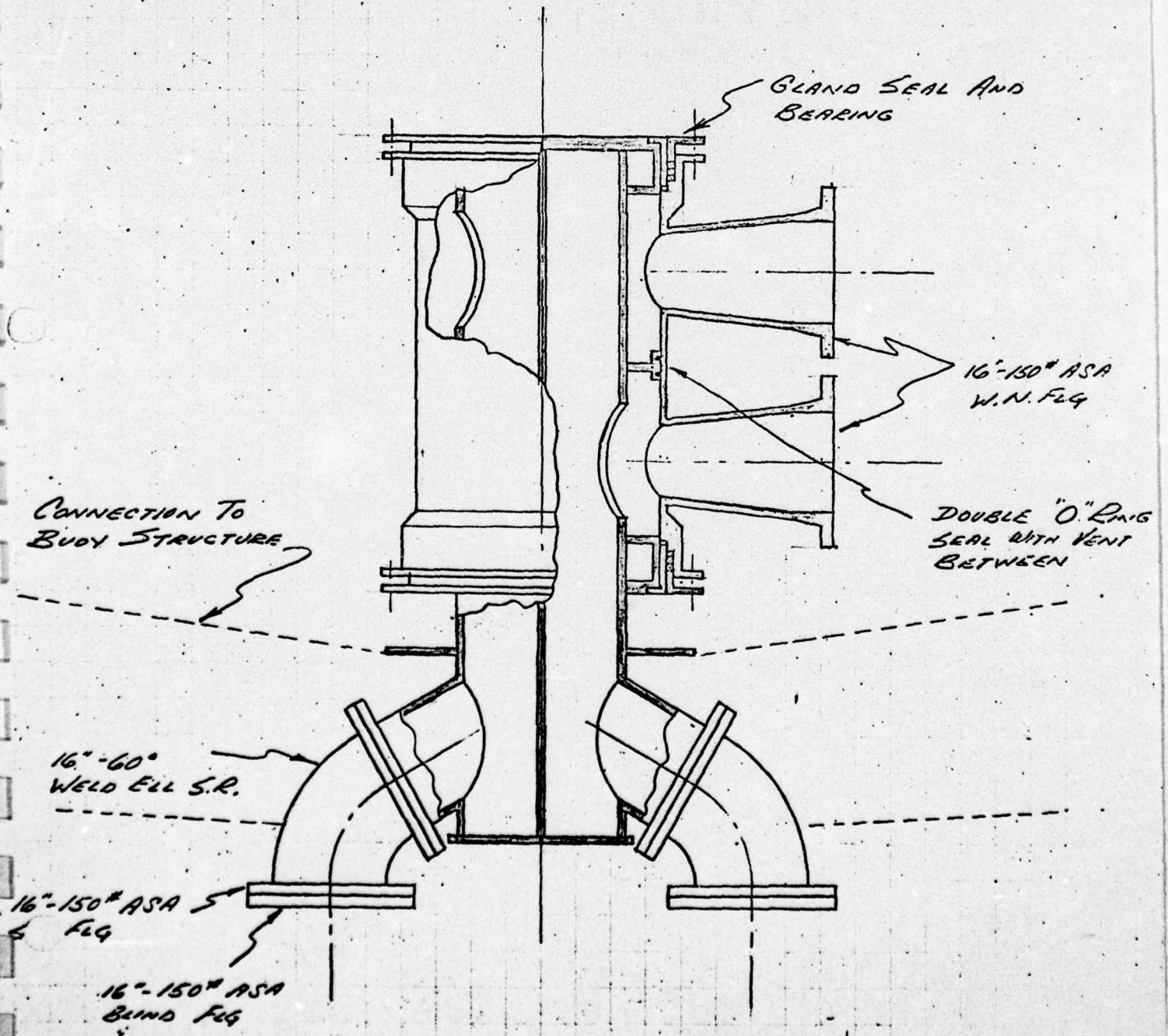


PROJECT 2971

12-11-64  
WAP

MONO MOORING SYSTEM

PROPOSAL # 2  
SWIVEL DESIGN



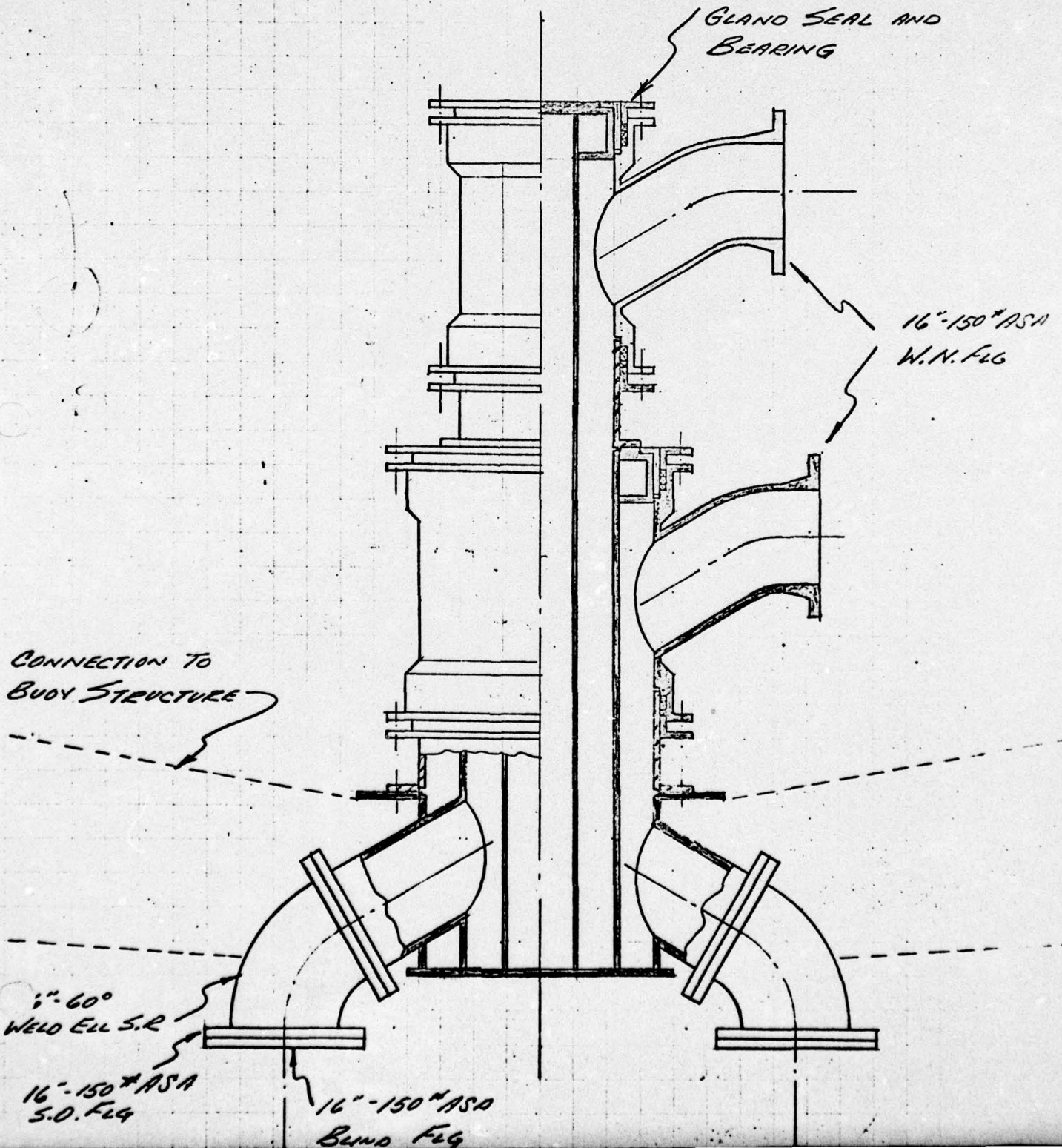
12-14-61

W.F.P.

PROJECT 2971  
JOB ORDER 56017

MONO MOORING SYSTEM

PROPOSAL #3  
SWIVEL DESIGN



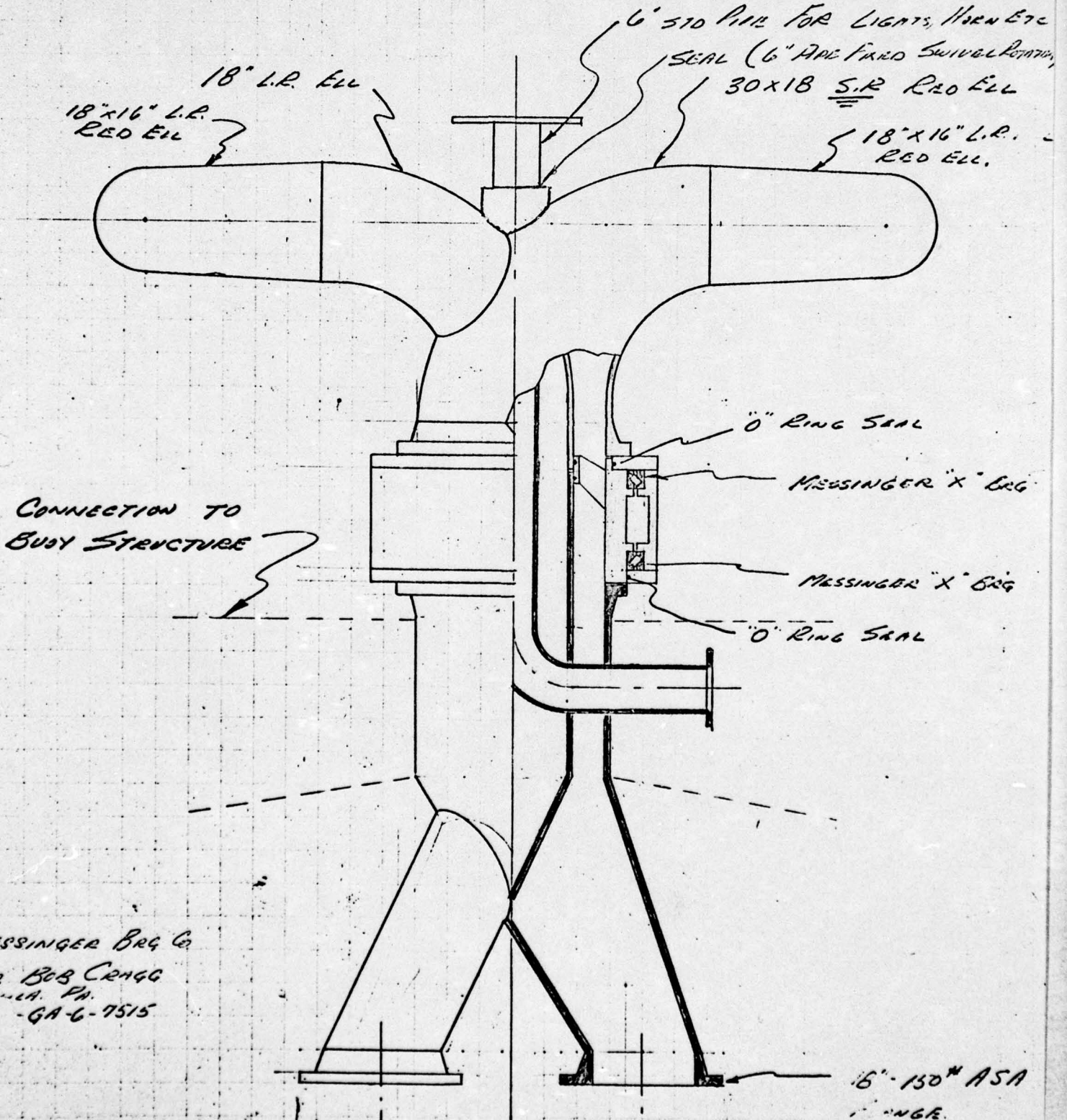
PROJECT 2971

1-11-65

WJD

MONO MOORING SYSTEM

PROPOSAL # 4  
SWIVEL DESIGN



MESSINGER BRG CO  
MR BOB CRAIG  
PHILA. PA.  
-GA-6-7515



MCD 5011

COMPANY

U.S. Army - ERDL

FIELD

SHEET NO

24

DATE

MONO MOORING SYSTEM - DECK PILING

WELL NO.

DATE

4/29/65

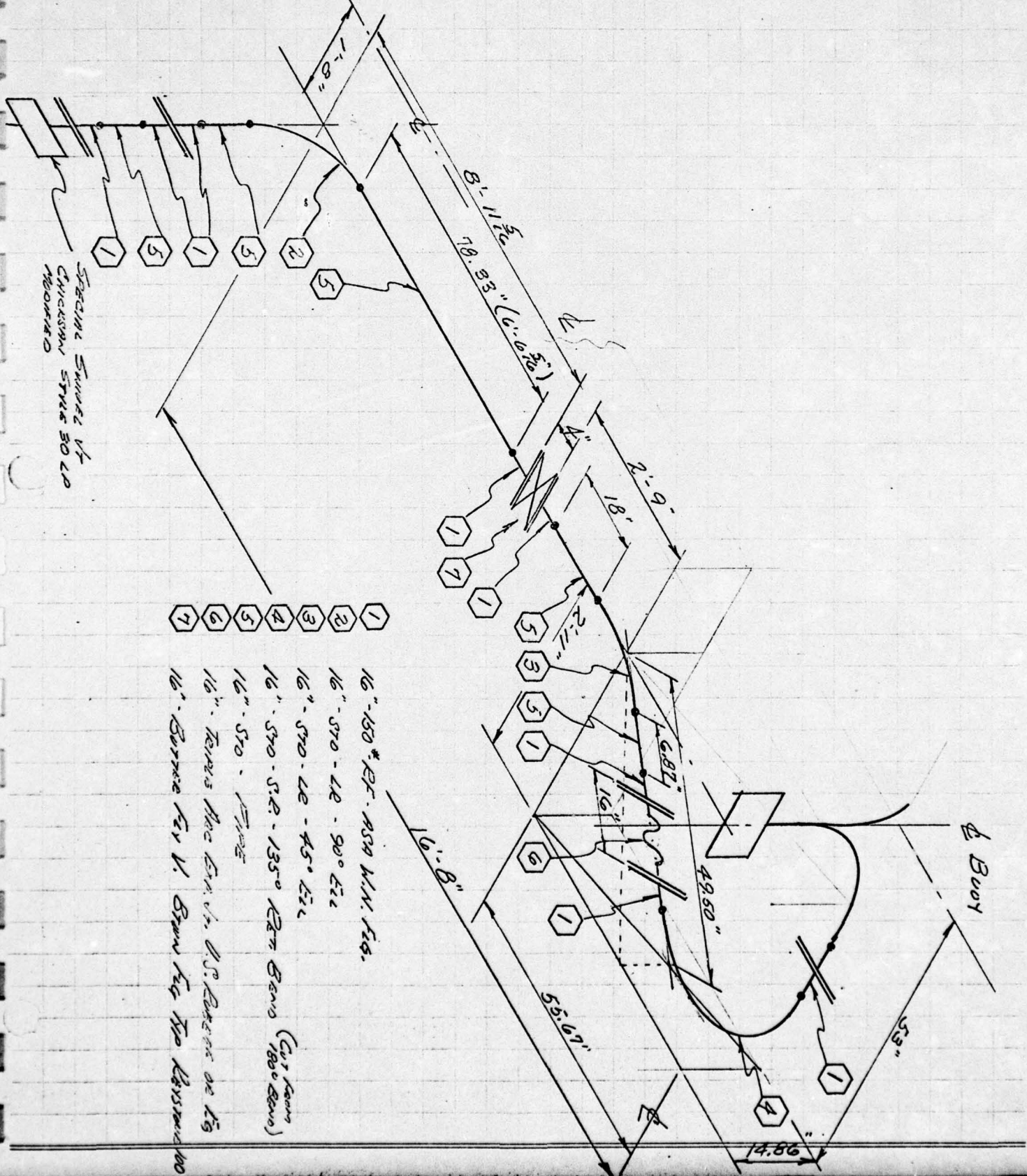
DRAWING NO.

COMPUTER

10.56017

SCHEMATIC DIAGRAM

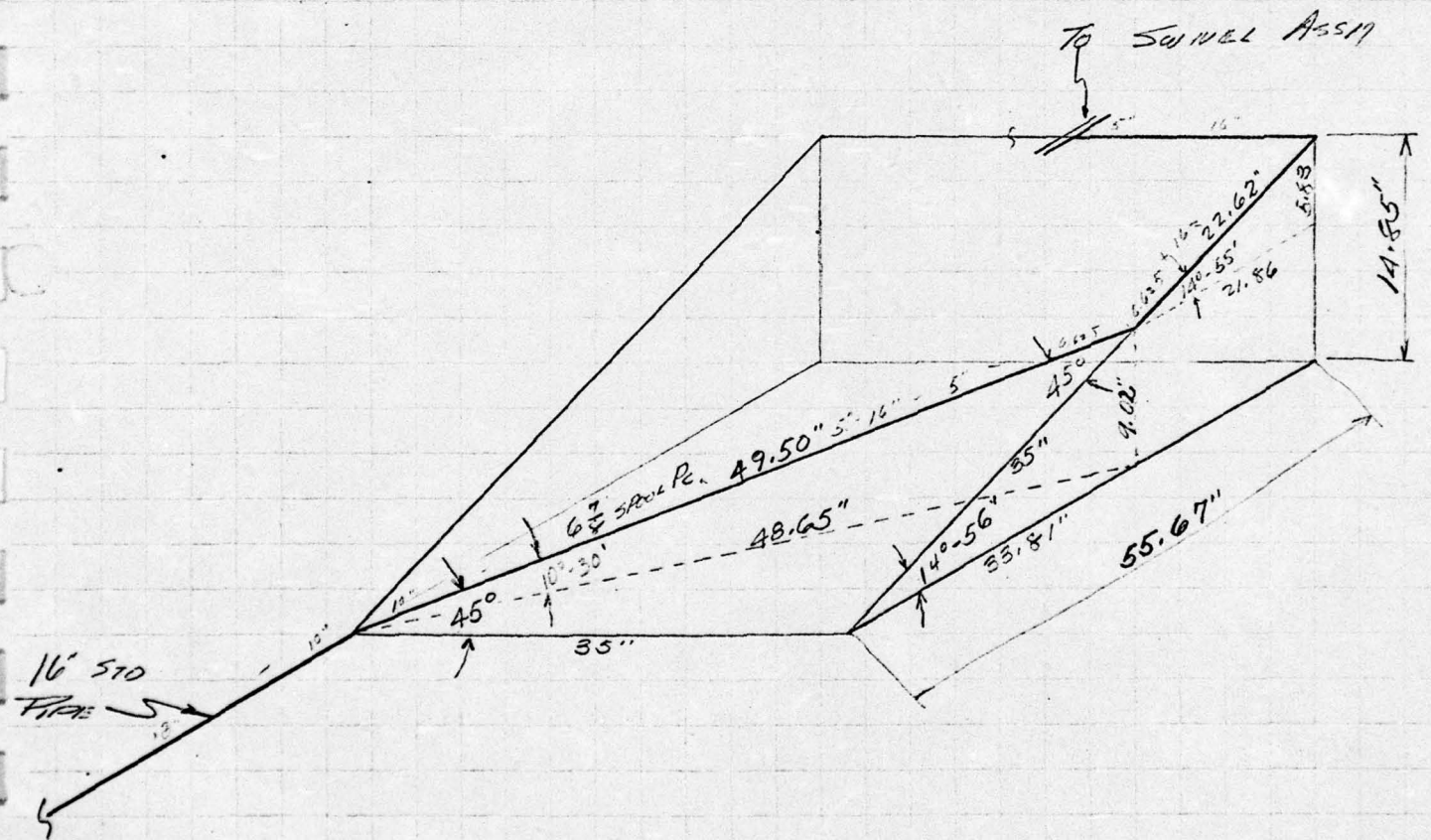
WAF



COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY MCDERMOTT & CO., INC.

MCD 5011	FIELD	SHEET NO.
COMPANY <i>U.S. ARMY - ERDL</i>		<i>1 of</i>
SI. SECT <i>MONO MOORING SYSTEM - DECK PLANS</i>	WELL NO.	DATE <i>4/22/65</i>
DRAWING NO. <i>OFFSET DIAGRAM</i>	COMPUTER <i>WAF</i>	



COMPUTATION SHEET  
ENGINEERING DEPARTMENT

MCD 5011

J. RAY McDERMOTT & Co., INC.

COMPANY

FIELD

SHEET NO.

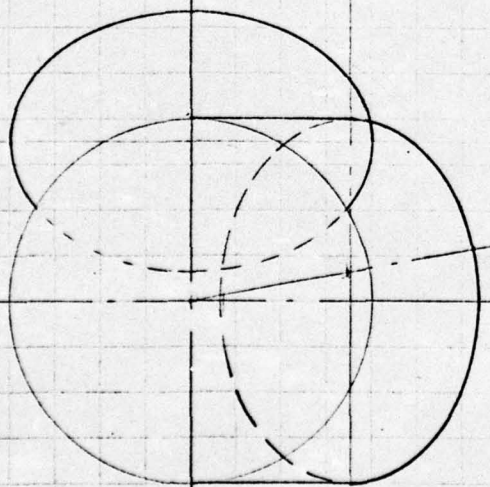
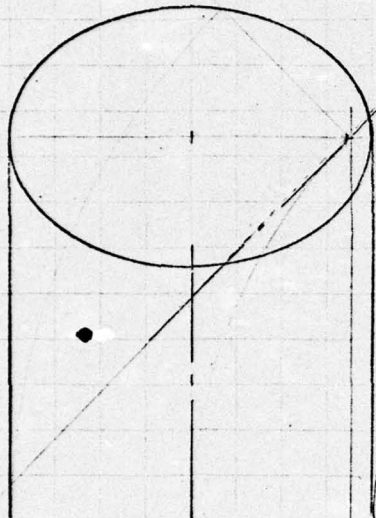
SUBJECT

WELL NO.

DATE

DRAWING NO.

COMPUTER



10  
11

ENGINEERING DEPARTMENT  
COMPUTATION SHEET

MCD 5036

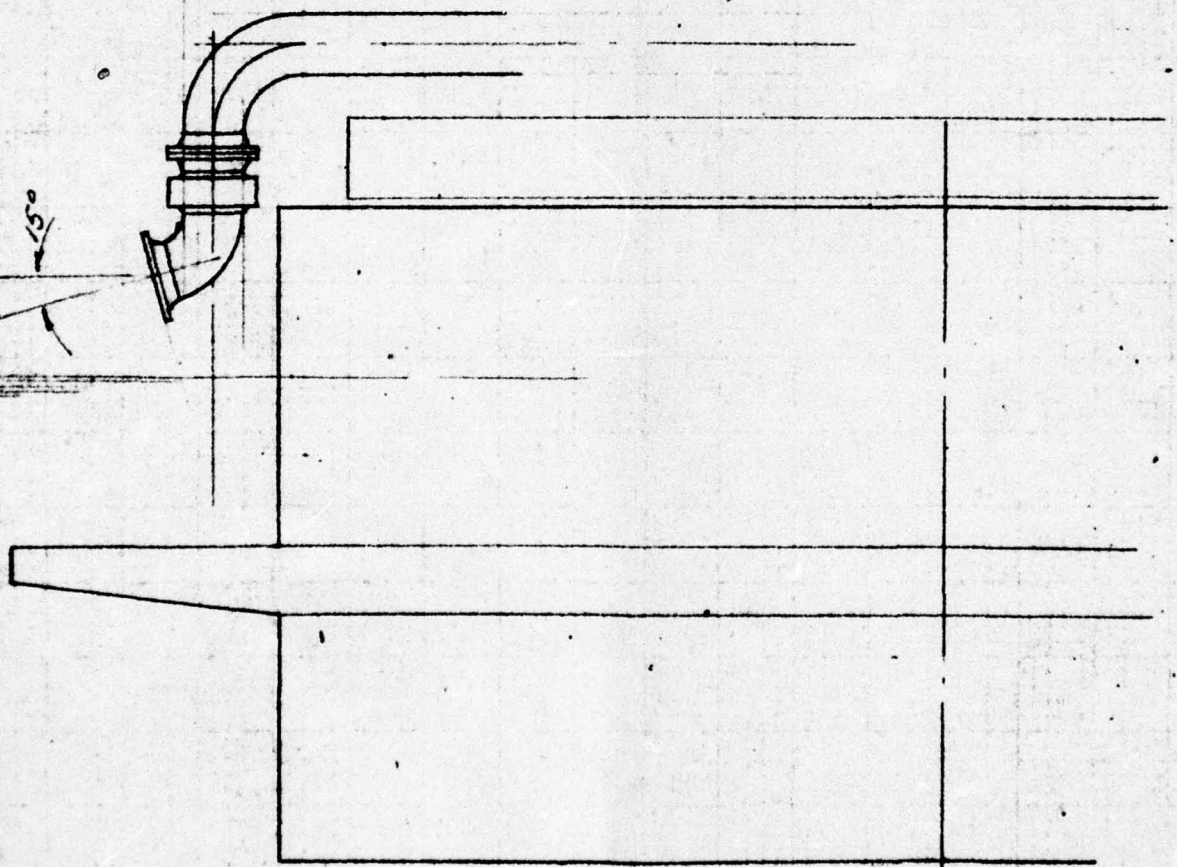
J. RAY McDERMOTT & CO., INC.

COMPANY <i>U.S. Army - ERDL</i>		SHEET NO. <i>1 of 1</i>	
SUBJECT <i>MONO MOORING SYSTEM - OVERBOARD HOSE CONNECTION</i>			
DRAWING NUMBER <i>V.O. 56017</i>	COMPUTER <i>WAF</i>	CHECKED BY	DATE <i>8/11/65</i>

*HOSE LAY 7*



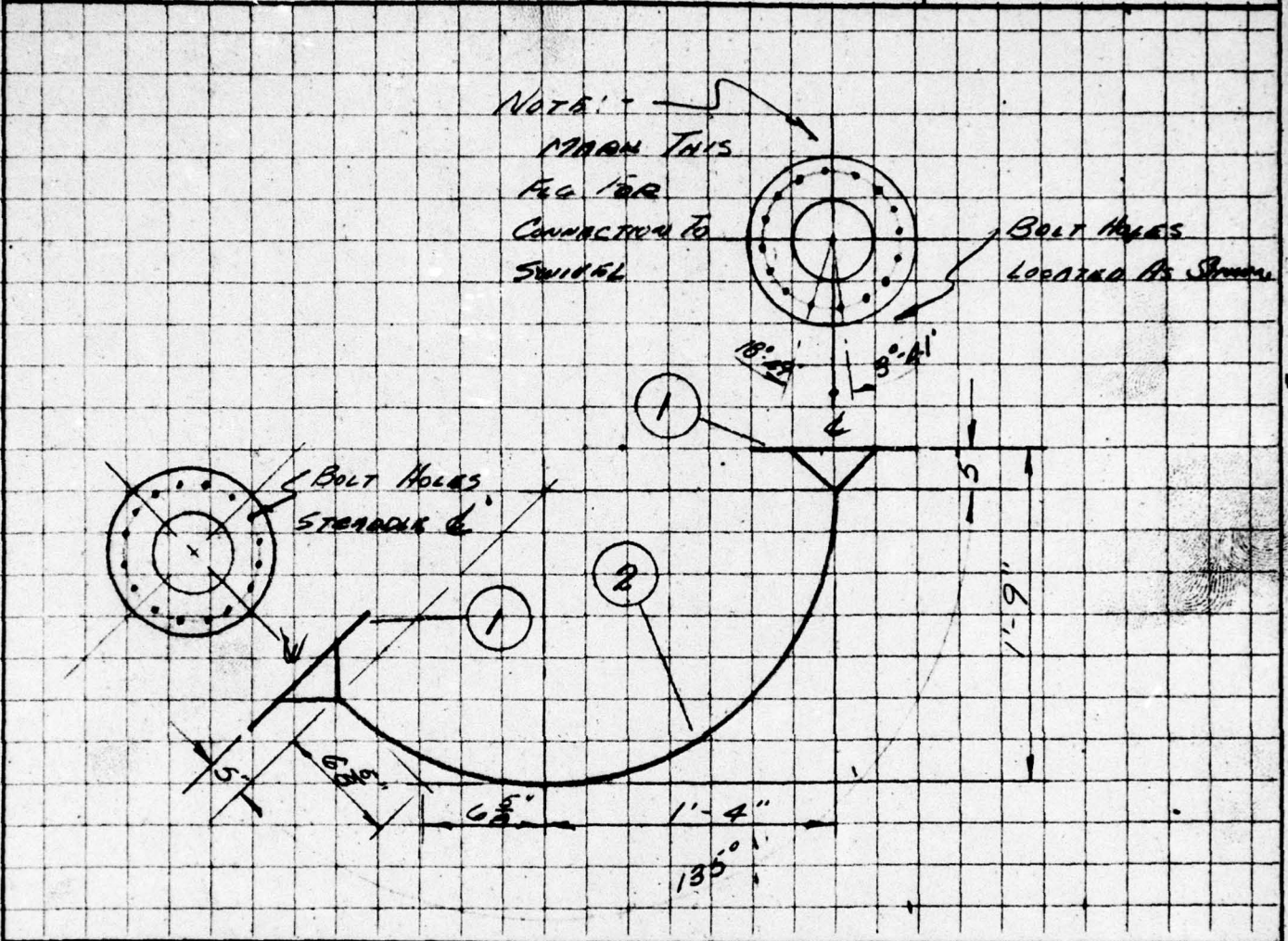
SECTION



2

MCD 12084

CUSTOMER <b>U.S. ARMY - EEDL</b>	CUSTOMER JOB NO.	JOB NO. <b>56017</b>
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



No. REQ'D <b>1</b>		MARK NO. <b>FPS-1R</b>	ISO. REF.	REV.	CHKD.
			DWG. REF. <b>USA 2971-SHT 870</b>	REV.	DRWN.
					DATE: <b>8-9-65</b>

MARK	REQ'D	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	570	150	A181-GR1	FF	WIN. FLANGE		
2	1	16	570	570	A234-WPS	S.R.	135° RET. BAND		

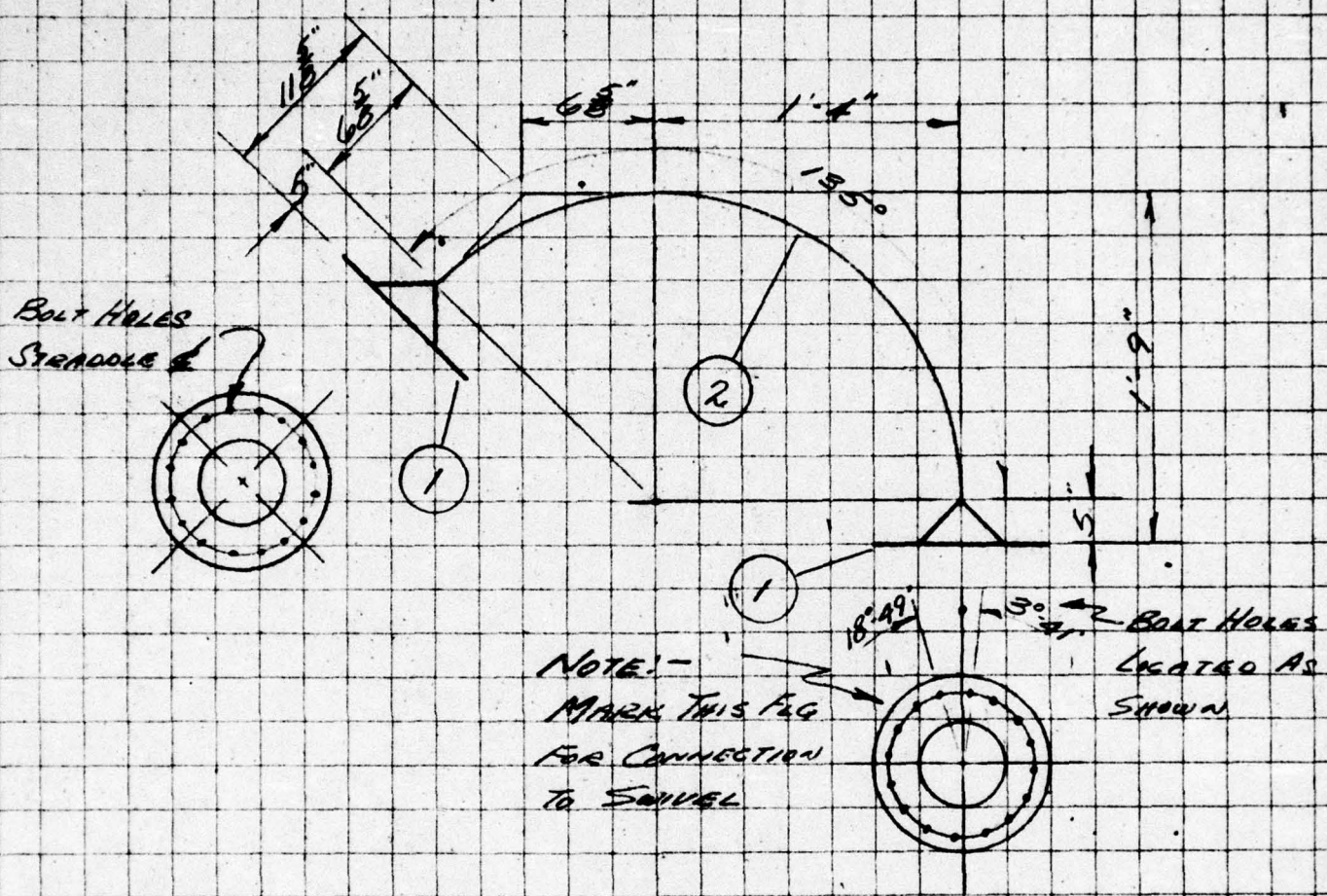
CHECKED:

FIT-UP:

MATERIAL CHECK:

MCD 12054

CUSTOMER <i>US Army ERDL</i>	CUSTOMER JOB NO.	JOB No. <i>56017</i>
ADDRESS	CUSTOMER ORDER NO.	SKETCH No.



STRESS RELIEVED _____	TEST PRESSURE _____
-----------------------	---------------------

No. REQ'D <i>1</i>	MARK NO. <i>FPS-1L</i>	ISO. REF.	REV.	CHKD. _____
		DWG. REF. <i>ISA-2971-SHT 870</i>	REV.	DRWN. _____
				DATE. <i>6-11-65</i>

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
<i>1</i>	<i>2</i>	<i>16"</i>	<i>STD</i>	<i>150</i>	<i>A181-601</i>	<i>FF</i>	<i>W.N. FLANGES</i>		
<i>2</i>	<i>1</i>	<i>16"</i>	<i>STD</i>		<i>A234-WPB S.R.</i>		<i>135° RET BEND</i>		

CHECKED:

FIT-UP:

MATERIAL CHECKS:





MED 12054

CUSTOMER *U.S. Army - ERDL*

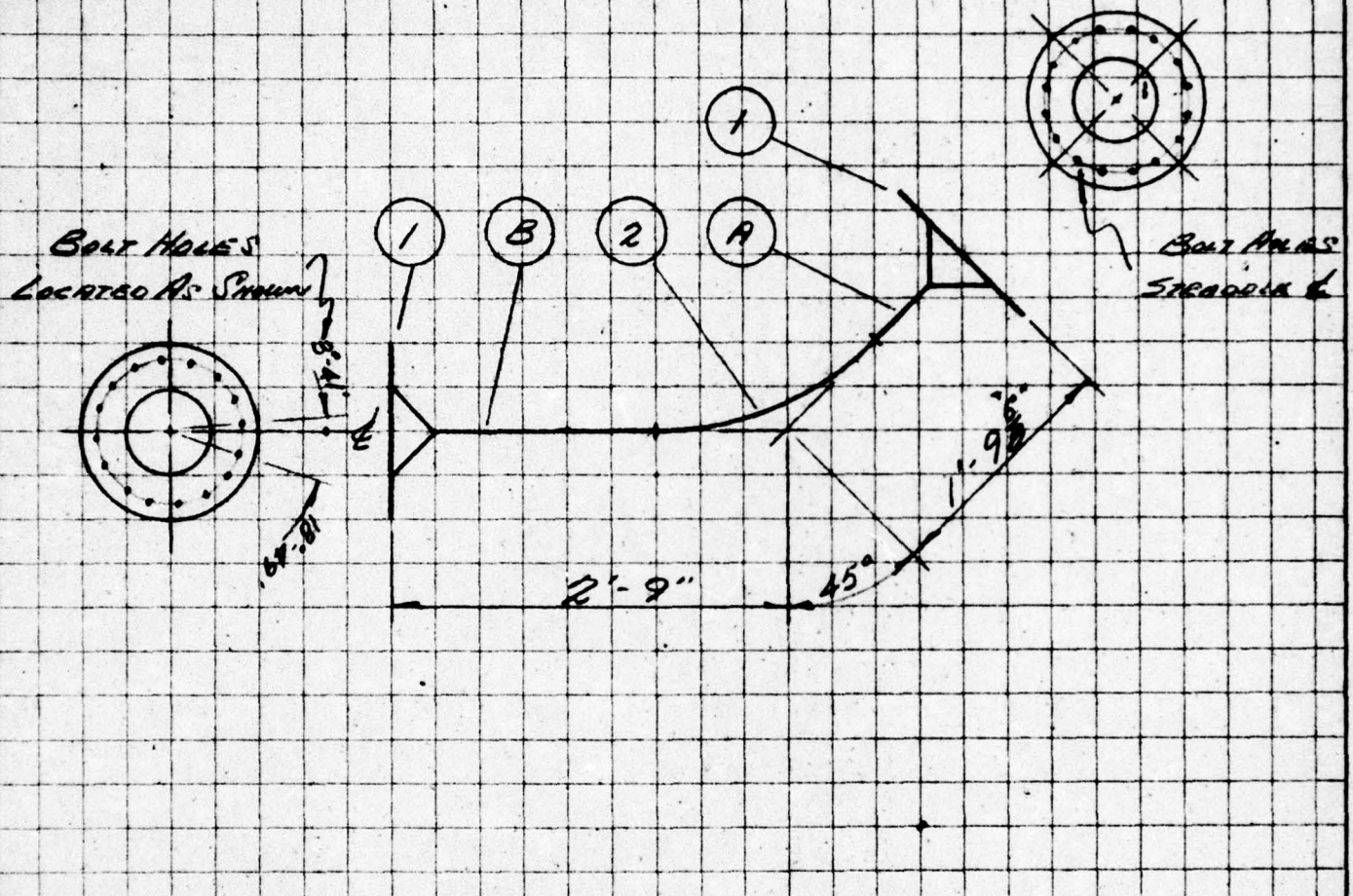
CUSTOMER JOB NO.

JOB No. *56017*

ADDRESS

CUSTOMER ORDER NO.

SKETCH No.



CHECKED:

STRESS RELIEVED \_\_\_\_\_

TEST PRESSURE \_\_\_\_\_

No. REQ'D

MARK NO. *FSP-2L*

ISO. REF.

REV.

CHKD. \_\_\_\_\_

*1*

DWG. REF. *USA 2971 ENT 870*

REV.

DRWN. \_\_\_\_\_

DATE. *8-11-65*

FIT-UP:

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
<i>1</i>	<i>2</i>	<i>16"</i>	<i>STD</i>	<i>150</i>	<i>A187-G01</i>	<i>F.F</i>	<i>N.N. FLANGES</i>		
<i>2</i>	<i>1</i>	<i>16"</i>	<i>STD</i>		<i>A234-W28</i>	<i>L.R</i>	<i>45° ELL</i>		
<i>A</i>	<i>1</i>	<i>16"</i>	<i>STD</i>		<i>A106-B</i>	<i>SMS</i>	<i>0'-6 1/2"</i>		
<i>B</i>	<i>1</i>	<i>16"</i>	<i>"</i>		<i>"</i>	<i>"</i>	<i>1'-6"</i>		

MATERIAL CHECK:

MCD 12054

CUSTOMER *U.S. ARMY - ERDL*

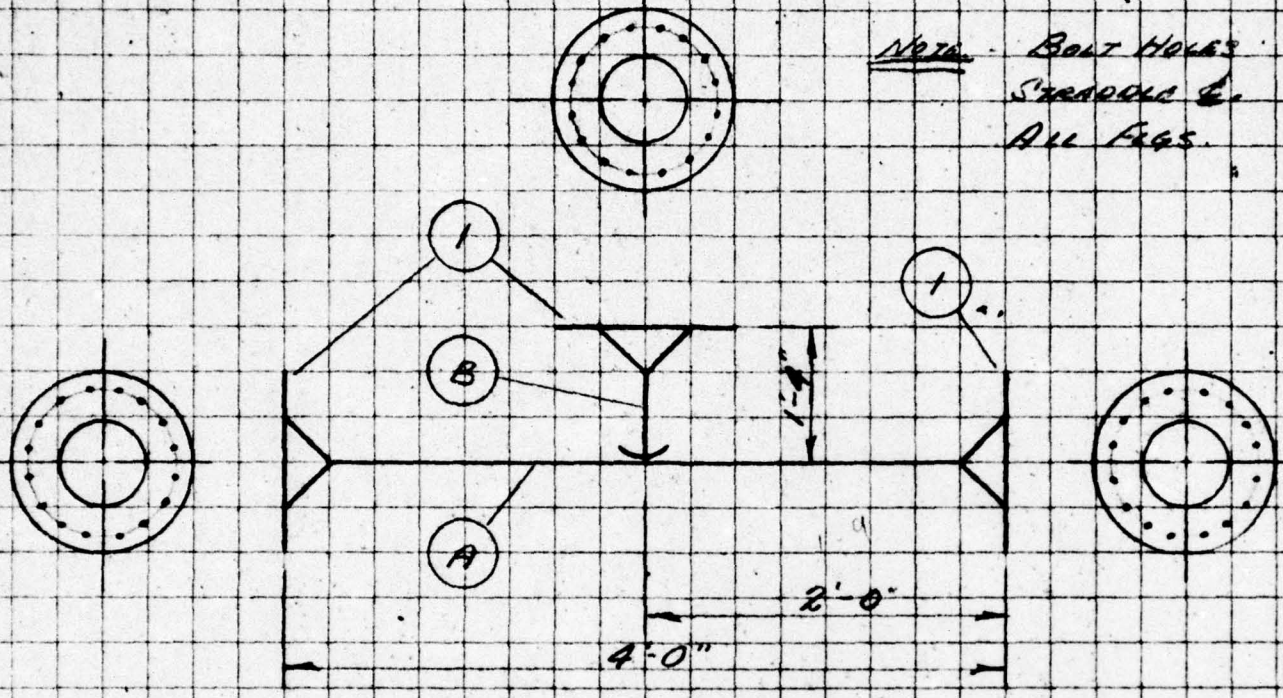
CUSTOMER JOB NO.

JOB NO. *56017*

ADDRESS

CUSTOMER ORDER NO.

SKETCH NO.



STRESS RELIEVED

TEST PRESSURE

No. REQ'D

MARK NO. *FSP - 3*

ISO. REF.

REV.

CHKD.

DRWN.

DATE. *8/20/65*

DWG. REF. *USA 2971-SMT 870*

REV.

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
<i>1</i>	<i>3</i>	<i>16</i>	<i>STD</i>	<i>150</i>	<i>A191-GR1</i>	<i>F.F.</i>	<i>WIN FLANGE</i>		
<i>A</i>	<i>1</i>	<i>16</i>	<i>STD</i>		<i>A191-B</i>	<i>3/16</i>	<i>3'-2" B.B.</i>		
<i>B</i>									

CHECKED:

FIT-UP:

MATERIAL CHECK:

MCD 12084

CUSTOMER *U.S. Army - ERDL*

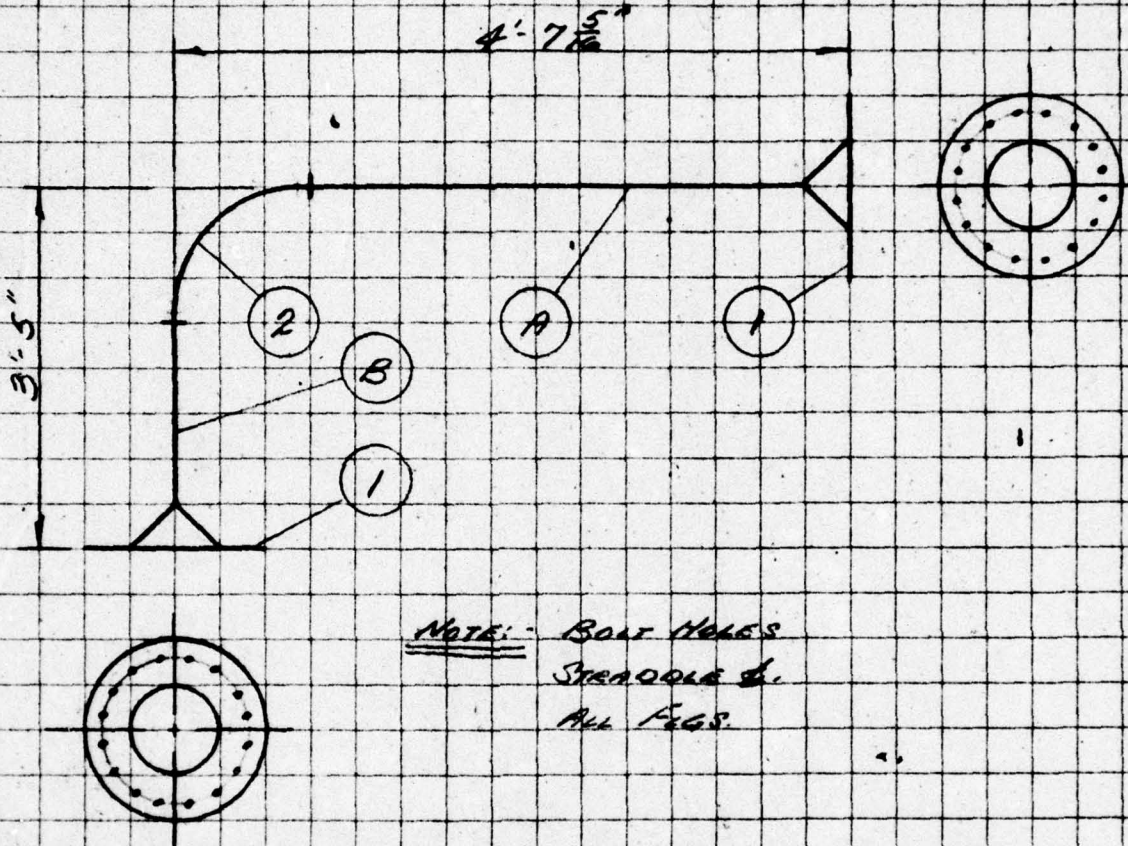
CUSTOMER JOB NO.

JOB No. *56017*

ADDRESS

CUSTOMER ORDER NO.

SKETCH No.



STRESS RELIEVED \_\_\_\_\_ TEST PRESSURE \_\_\_\_\_

No. REQ'D  
*2*

MARK NO. *FSP-4*

ISO. REF. \_\_\_\_\_  
DWG. REF. *USA 2971 517 870*

REV. \_\_\_\_\_  
REV. \_\_\_\_\_

CHKD. \_\_\_\_\_  
DRWN. \_\_\_\_\_  
DATE. *8/10/65*

FIT-UP:

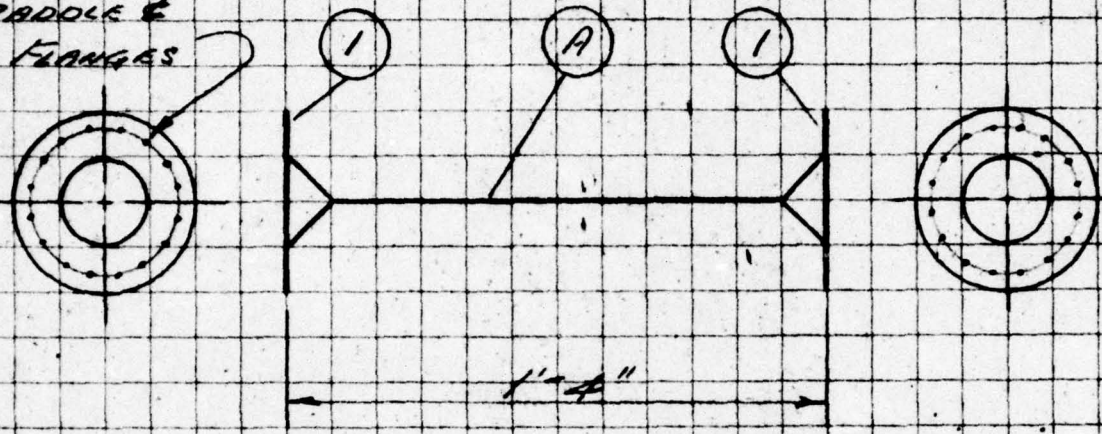
MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
<i>1</i>	<i>2</i>	<i>16"</i>	<i>STD</i>	<i>150</i>	<i>A181-601</i>	<i>FF</i>	<i>W.N. FLANGE</i>		
<i>2</i>	<i>1</i>	<i>16"</i>	<i>STD</i>		<i>A234-WP</i>	<i>SMLS</i>	<i>90° L.R. ELB.</i>		
<i>A</i>	<i>1</i>	<i>16"</i>	<i>STD</i>		<i>A186-B</i>	<i>SMLS</i>	<i>2'-2 5/16" B.B.</i>		
<i>B</i>	<i>1</i>	<i>16"</i>	<i>STD</i>		<i>"</i>	<i>"</i>	<i>1'-0" B.B.</i>		

MATERIAL CHECKS

MCD 12084

CUSTOMER	CUSTOMER JOB NO.	JOB NO.
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.

BOLT HOLES  
STRADDLE &  
ALL FLANGES



CHECKED:

STRESS RELIEVED _____		TEST PRESSURE _____
No. REQ'D <b>2</b>	MARK NO. <b>FSP-5</b>	ISO. REF. _____
	DWG. REF. <b>USA 2977 SIT 870</b>	REV. _____
		CHKD. _____
		DRWN. _____
		DATE. <b>8-11-65</b>

FIT-UP:

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150"	A101-Gal	F.F.	W.N. FLANGE		
A	1	16"	STD		A106-B	SABS	0'-6" B.B.		

MATERIAL CHECKS:

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY McDERMOTT & Co., INC.

MCD 5011

COMPANY

U.S. ARMY - ERDL

FIELD

SHEET NO

ECT

MONO MOORING SYSTEM - CARGO PIPING

WELL NO.

DATE

8/11/65

DRAWING NO.

J.O. 56017 OVERBOARD SPOOL PE LGT.

COMPUTER

WAP

LOCATION WATER DEPTH	BUOT HULL FEEL BOARD	SALPE #	SPOOL PE LGT.
50'	5.8'	FSP-5	1.22' (1'-2 <sup>5</sup> / <sub>8</sub> "
60'	5.5'	FSP-5	.92' (0'-11 <sup>1</sup> / <sub>2</sub> "
70'	5.2'	FSP-5	.62' (0'-7 <sup>7</sup> / <sub>16</sub> "
80'	4.7'	NONR	.12' (0'-1 <sup>7</sup> / <sub>16</sub> "
90'	4.5'	NONR	-.07' (-0'- <sup>13</sup> / <sub>16</sub> "
100'	5.8'	FSP-5	1.22' (1'-2 <sup>5</sup> / <sub>8</sub> "
110'	5.4'	FSP-5	.82' (0'-9 <sup>13</sup> / <sub>16</sub> "
120'	5.0'	FSP-5	.42' (0'-5 <sup>7</sup> / <sub>16</sub> "
130'	4.7'	NONR	.12' (0'-1 <sup>7</sup> / <sub>16</sub> "
140'	4.2'	NONR	-.38' (-0'-4 <sup>9</sup> / <sub>16</sub> "
150'	3.9'	NONR	-.68' (-0'-8 <sup>3</sup> / <sub>16</sub> "

NOTE: -

SPOOL PE LGT BASED ON HOSE CONNECTING POINT  
2'-3" ABOVE WATER LINE.

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY McDERMOTT & Co., INC.

MCD 5011

COMPANY

U.S. Army - ERDL

FIELD

SHEET NO.

1 of 1

PROJECT

Mono Mucking System - Flaring

WELL NO.

DATE

7/29/60

DRAWING NO.

10.5417

Proc. of Concrete Cond. Reinf.

COMPUTER

WAF/etw

PIPE WALL:-

200 psi

125°F

$$\text{Thickness} = t_m = \frac{PD}{25 + 24P} + C$$

$$t_m = \frac{200 \times 30}{(2 \times 25,500) + (2 \times 4 \times 200)} + .06 = \frac{6000}{51,000 + 160} + .06 = .178$$

INTERSECTION REINFORCEMENT:-

$$\text{REINF. AREA REQD} = (A_R = t_R d_1)(2 - \sin \beta)$$

$$A_R = (.178 \times 17)(2 - \sin 32^\circ 50') = 4.459$$

REINFORCEMENT

$$A_1 = (T_b - t_b)(d) = (.500 - .178)17 = 5.57$$

$$A_2 = 2(L_4)(T_b - t_b) = 2(1.25)(.500 - .178) = .66$$

$A_1 + A_2 = 5.57 + .66 = 6.23$  WHICH  
IS GREATER THAN  $A_R$  THEREFORE  
NO REINFORCEMENT REQUIRED

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY McDERMOTT & CO., INC.

MCD 5011

COMPANY U.S. ARMY ERDL	FIELD	SHEET NO. 1 of
SUBJECT Mono Molding System - Piping -	WELL NO.	DATE 7/29/65
DRAWING NO. J.O. 56017	COMPUTER WAP	
BRANCH END REINFORCEMENT		

REINFORCEMENT AREA REQUIRED

$$A_R = (t_h d_i)(2 - \sin \beta)$$

$$A_R = (.375 \times 17)(2 - \sin 32^\circ 50') = 6.37(1.45) = \underline{\underline{9.25 \text{ sq. in.}}}$$

REINFORCEMENT

$$\text{IN HEADER} = A_1 = T_h - t_h (d) = (.500 - .375)(17) = 2.1 \text{ sq. in.}$$

$$\text{IN BRANCH} = A_2 = T_b - t_b (2)(L_b) = (.500 - .375)(2)(1.25) = .31 \text{ sq. in.}$$

$$\text{IN REINF. COLLAR} = A_3 = 2(t_c)(w) = 2(.500)(6.5) = 6.5 \text{ sq. in.}$$

$$A_1 + A_2 + A_3 = 2.1 + .31 + 6.5 = \underline{\underline{8.91 \text{ sq. in.} + WELDING}} \\ = > 9.25''$$

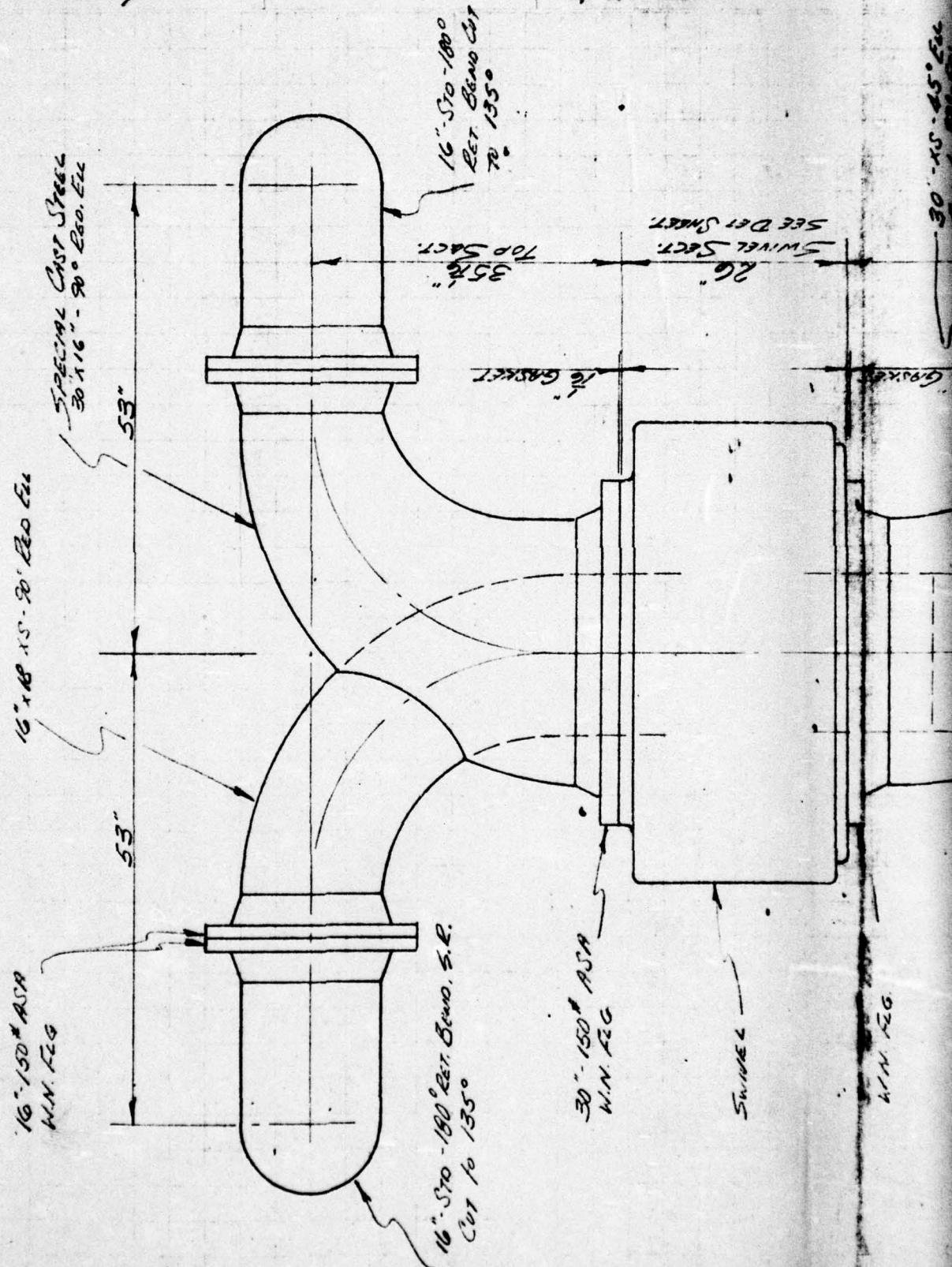
REINFORCEMENT COLLAR =

$$6.5'' \text{ WIDE} = w$$

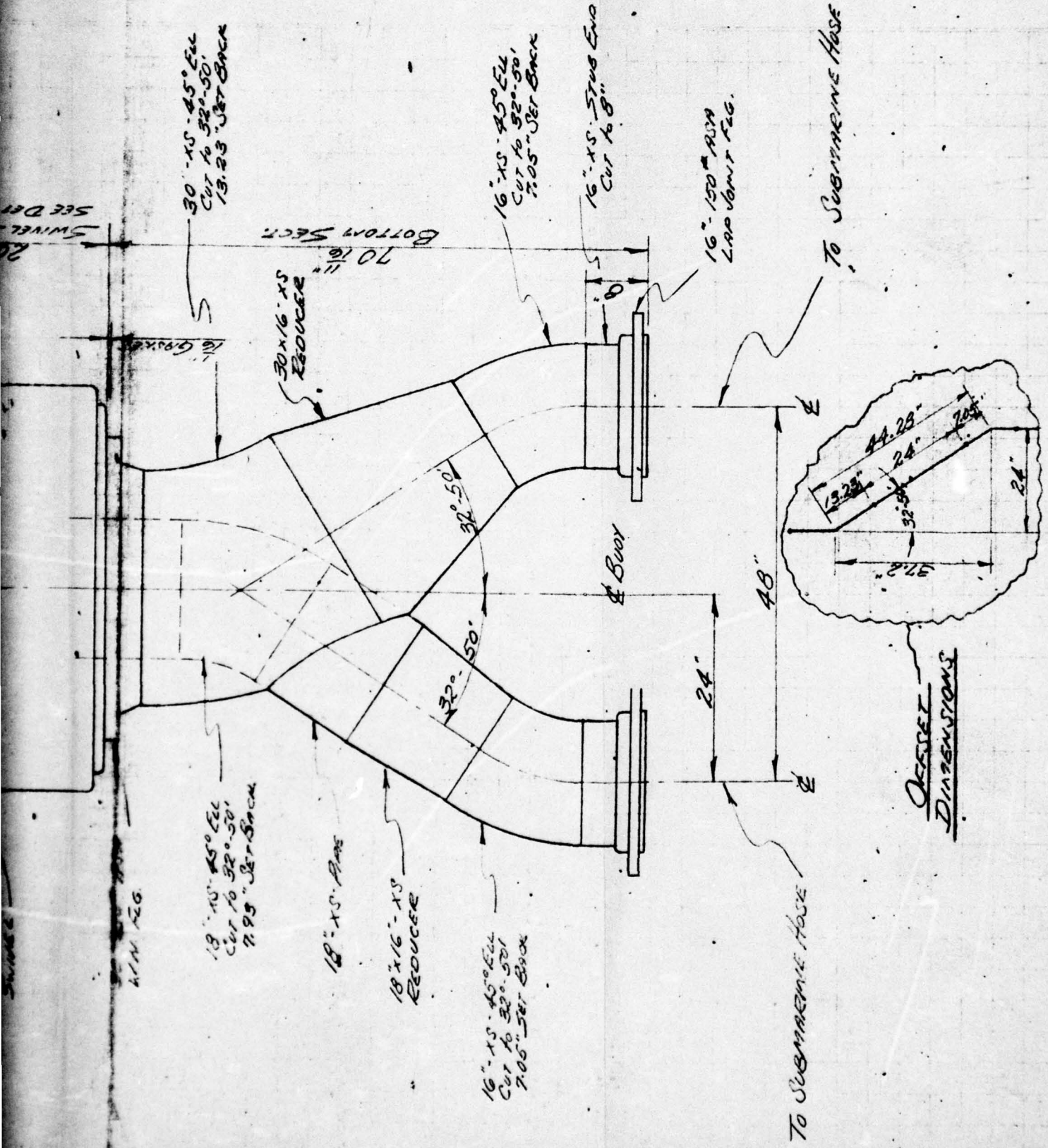
$$.500'' \text{ THICK} = t_c$$

COMPANY <b>U. S. ARMY - ERDL</b>	SHEET NO <b>1 of</b>		
SUBJECT <b>MONO MOORING SYSTEM - SWINEL, DESIGN #3</b>			
DRAWING NUMBER <b>JO. 56017</b>	COMPUTER <b>WAP</b>	CHECKED BY	DATE <b>4-21-65</b>

ELEVATION

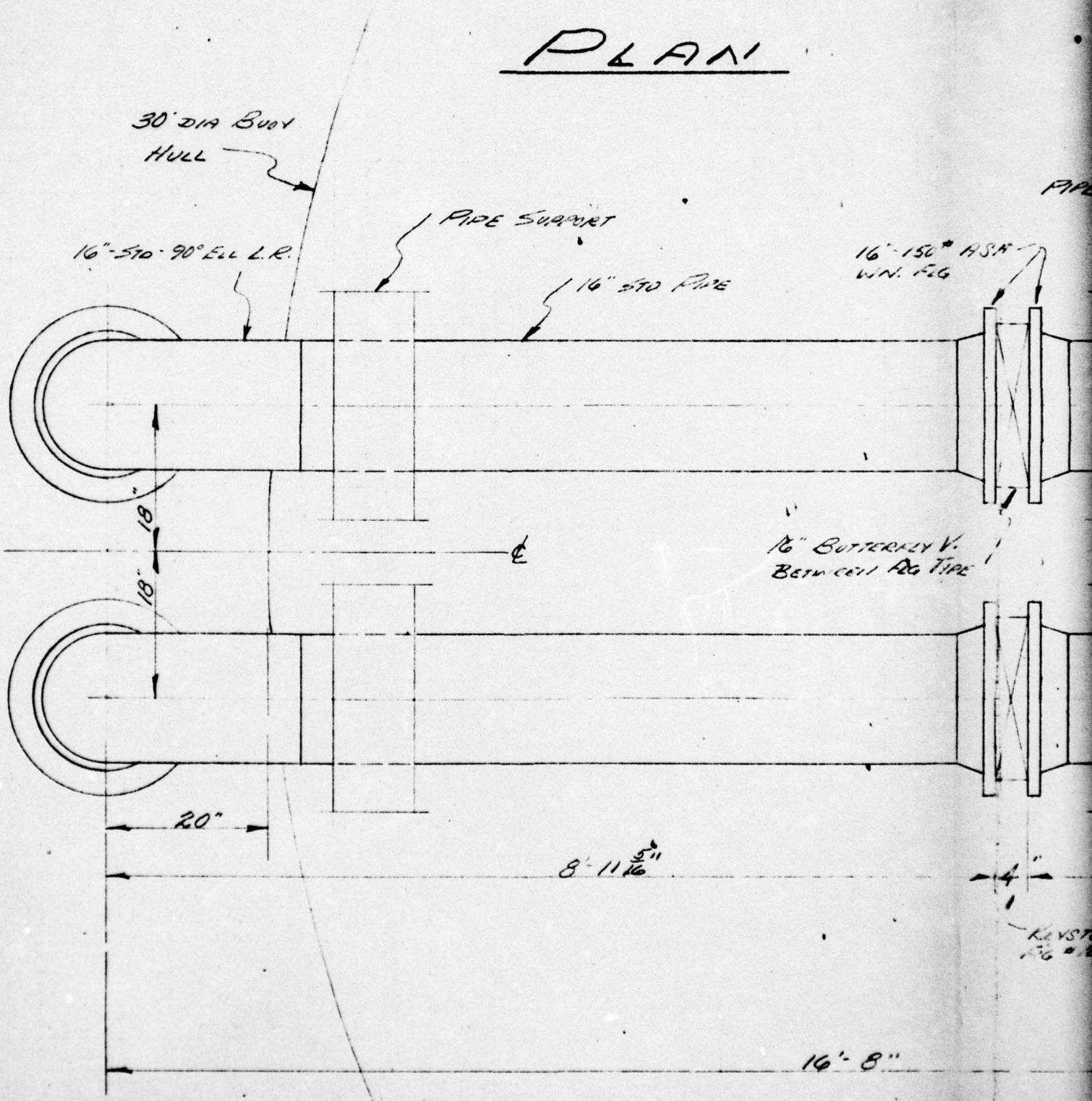




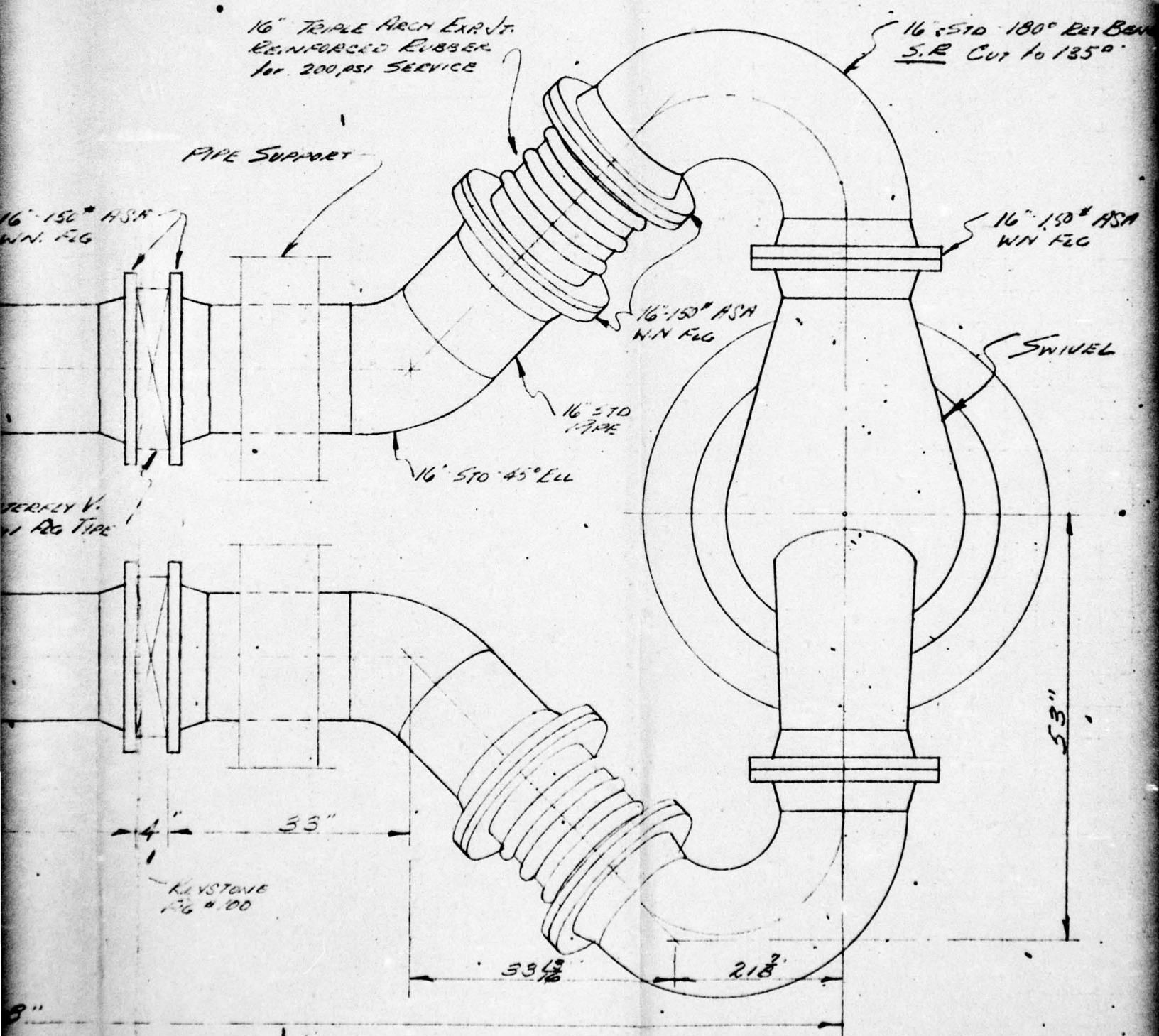


COMPANY	U.S. ARMY - ERDL		SHEET NO	2 of
SUBJECT	MONO MOORING SYSTEM - DECK PILING ALBERT DESIGN			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
J.O. 56017	WAP		4-22-65	

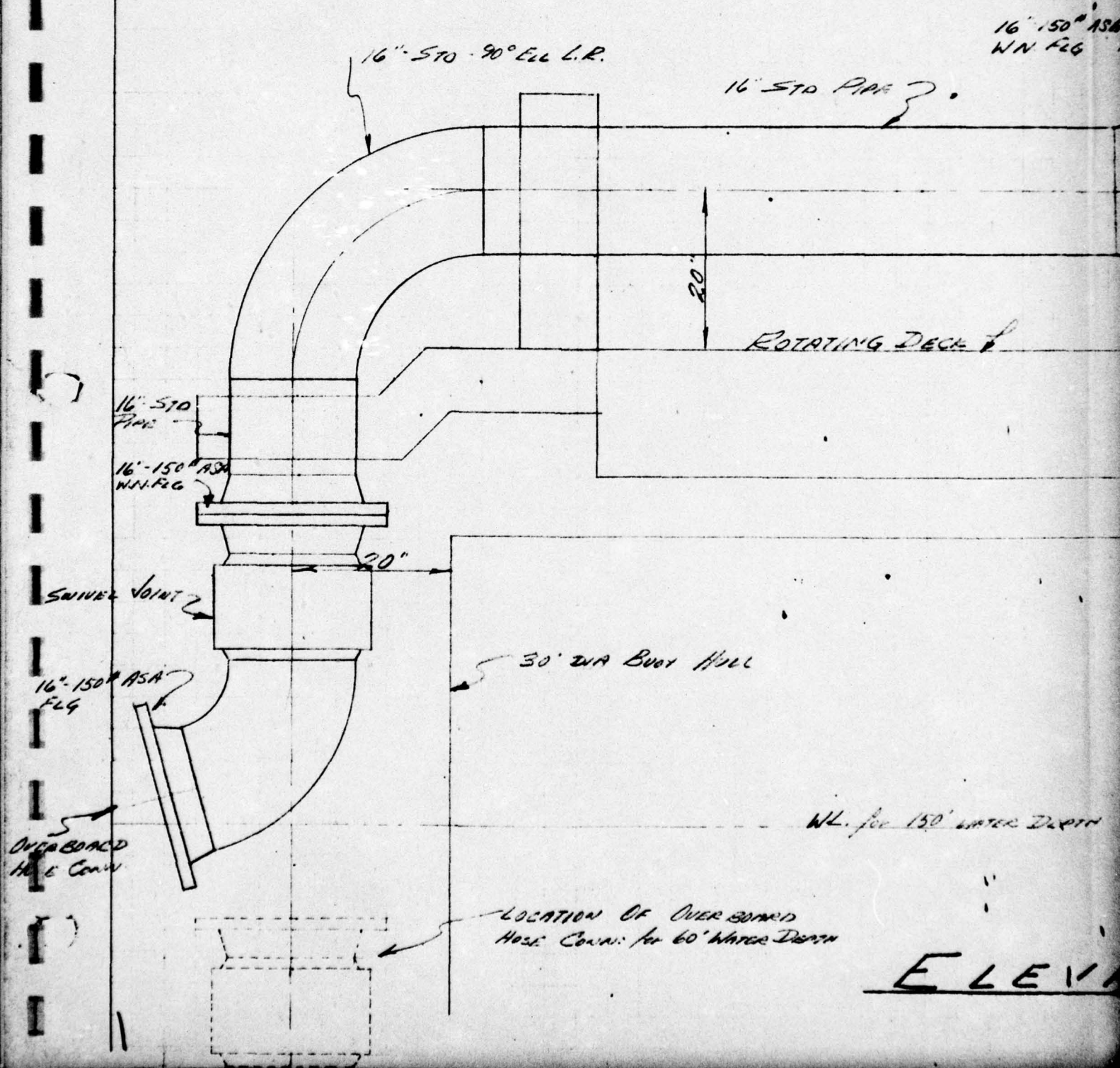
# PLAN



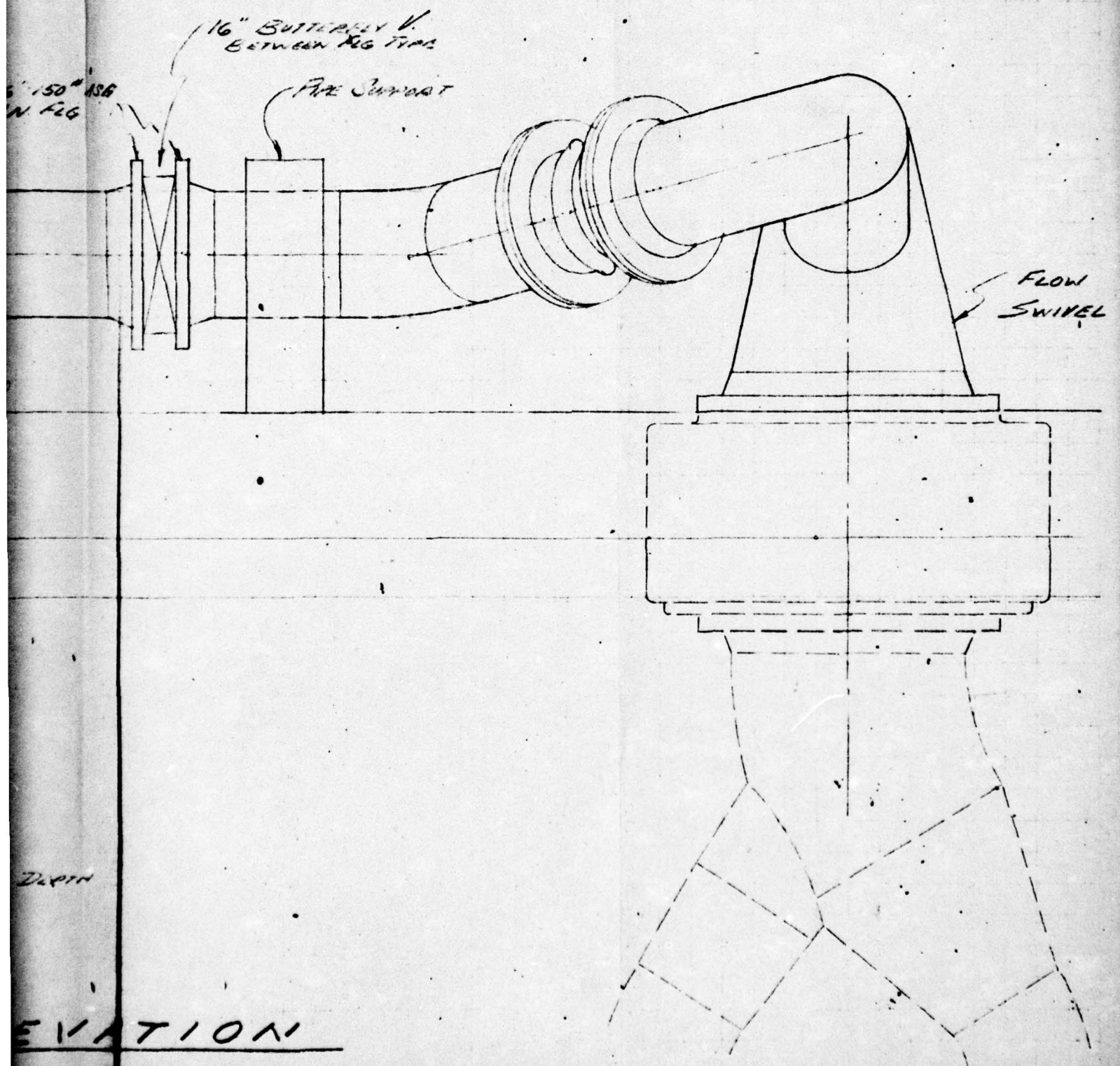
ALBERT DESIGN #3



COMPANY	U.S. ARMY - ERDL		SHEET NO	3 of
SUBJECT	MONO MOORING SYSTEM - DECK PIPING ARRGT.			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
10.56017	WAP		4/22/65	



PERGT. DESIGN #3

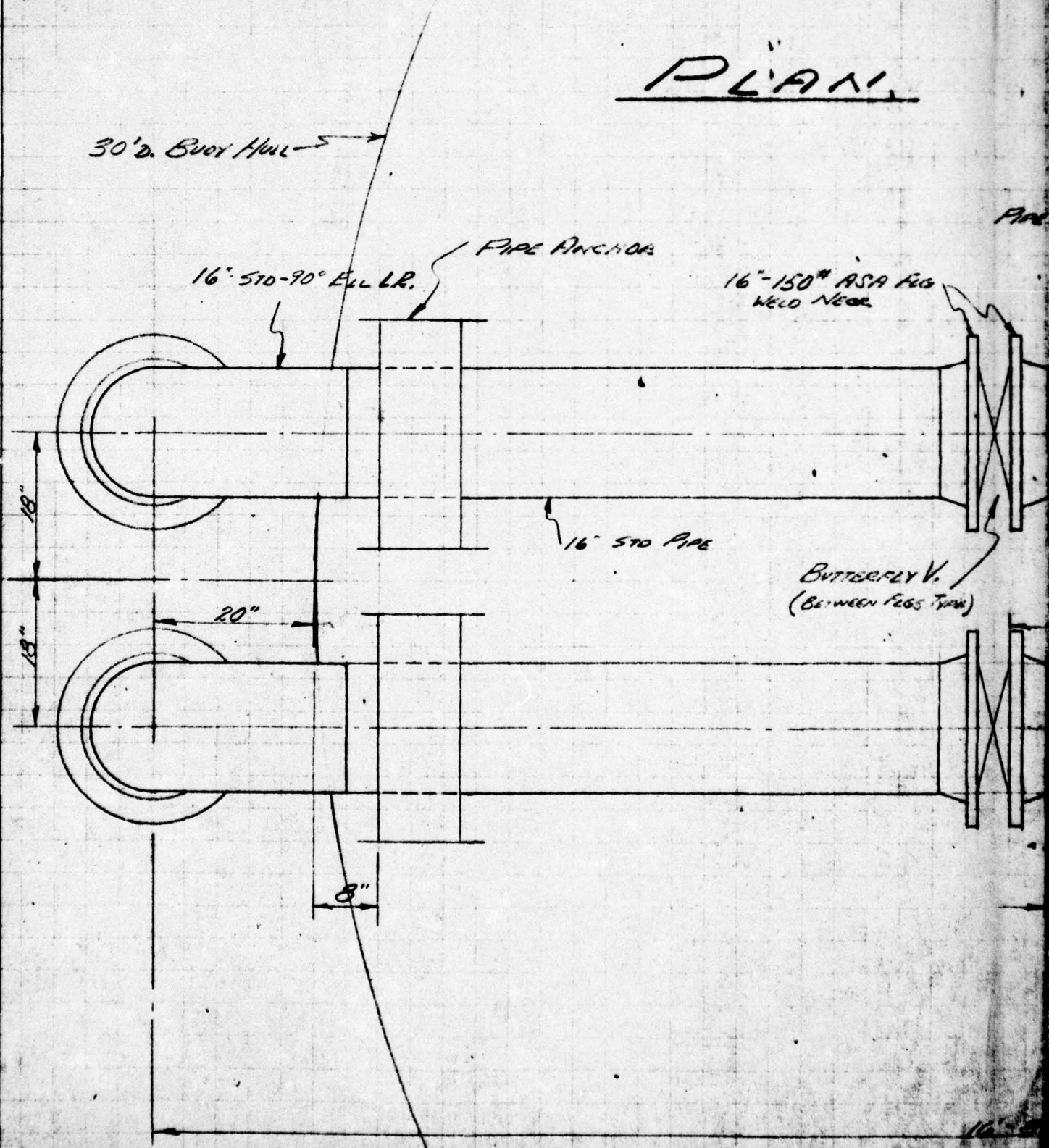


DEPTH

ELEVATION

COMPANY	U.S. ARMY - ERDL	SHEET NO	2 of
SUBJECT	MOORING SYSTEM - FLOW SWIVEL PIPING		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
10. 56017	WAP		3-29-65

PLAN



PIPE DESIGN #1  
65

16" - TRIPLE ARCH EXP. JOINT  
REIN. RUBBER SUITABLE  
FR 150 PSI SERVICE

16" - XS - 45° ELL  
LONG TAN ONE END  
(TRIMED)

18x16" - XS  
90° RED ELL. S.R.

PIPE ANCHOR

SWIVEL  
SEE SHEET 1  
DATED 3/29/65

16" - STD - 45° ELL  
LONG TAN BOTH ENDS  
(ONE END TRIMMED)

V.  
(Taper)

30"

14"

48"

4"

12"

16"

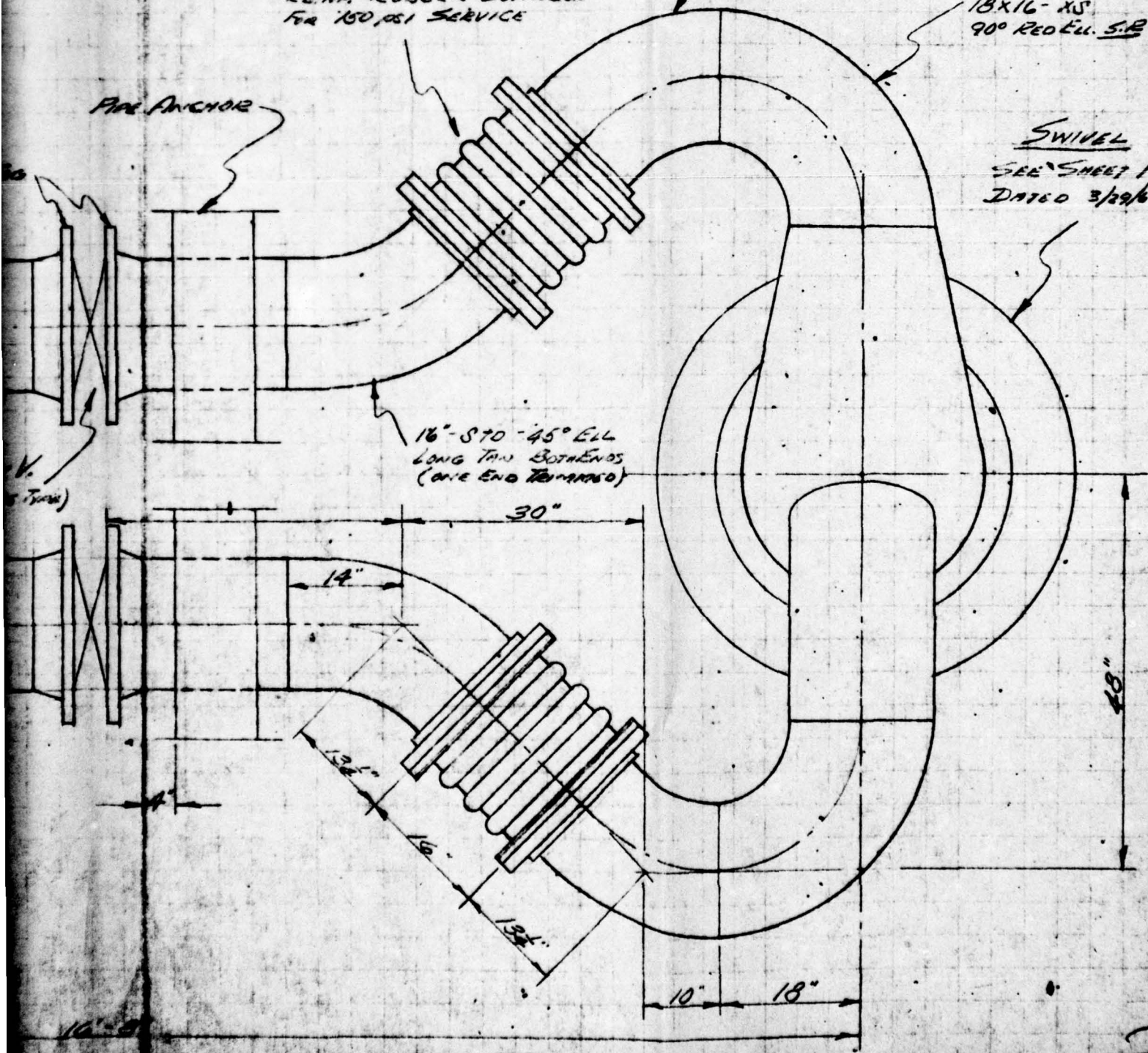
18"

10"

18"

16" - STD

2



COMPANY U.S. ARMY - ERDL

SHEET NO 1 of 1

SUBJECT MONO PROCKING SYSTEM - *Final Design #1*

NUMBER NO. 56014

COMPUTER *W.P.*

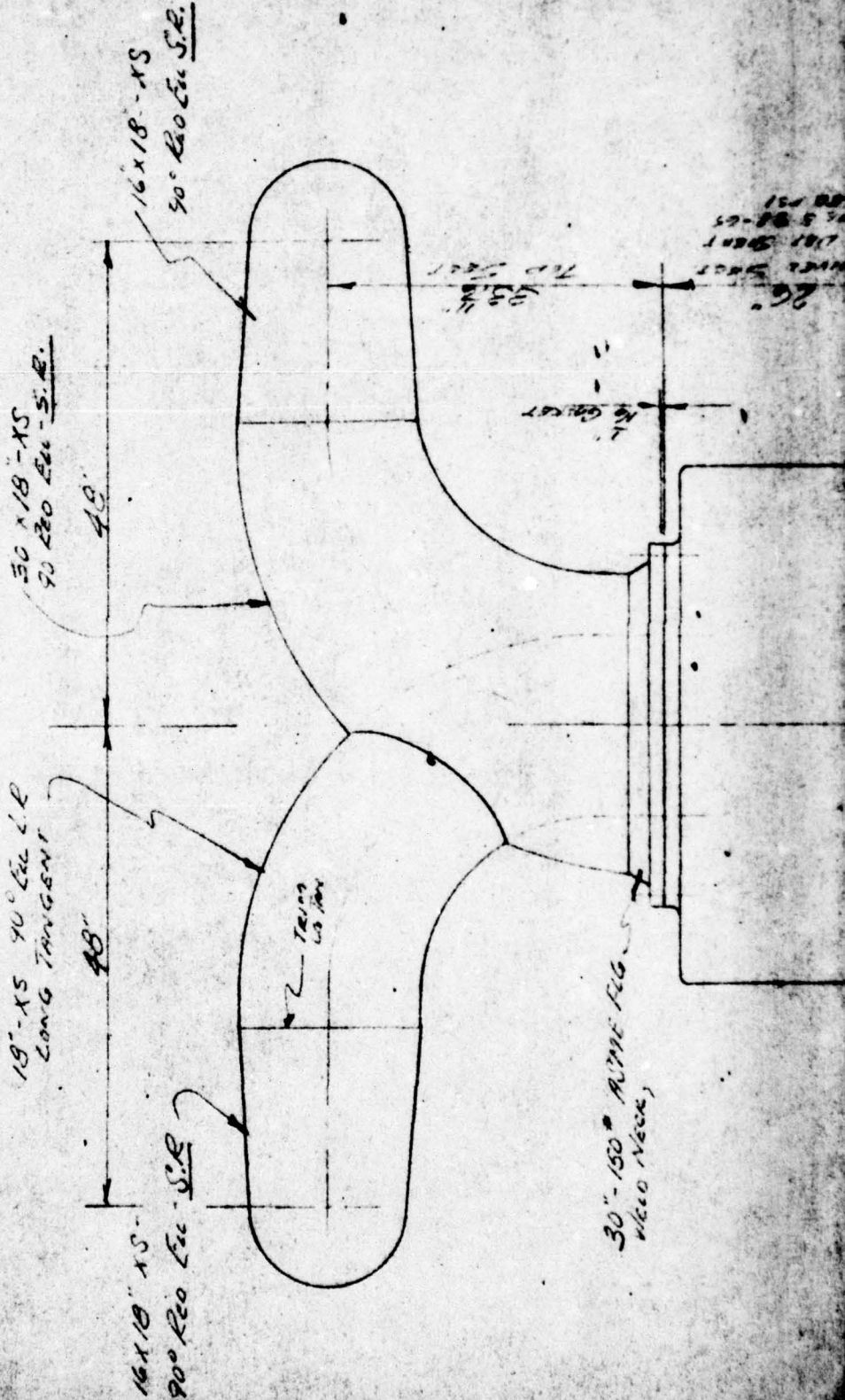
CHECKED BY

DATE 3-29-65

NOTE

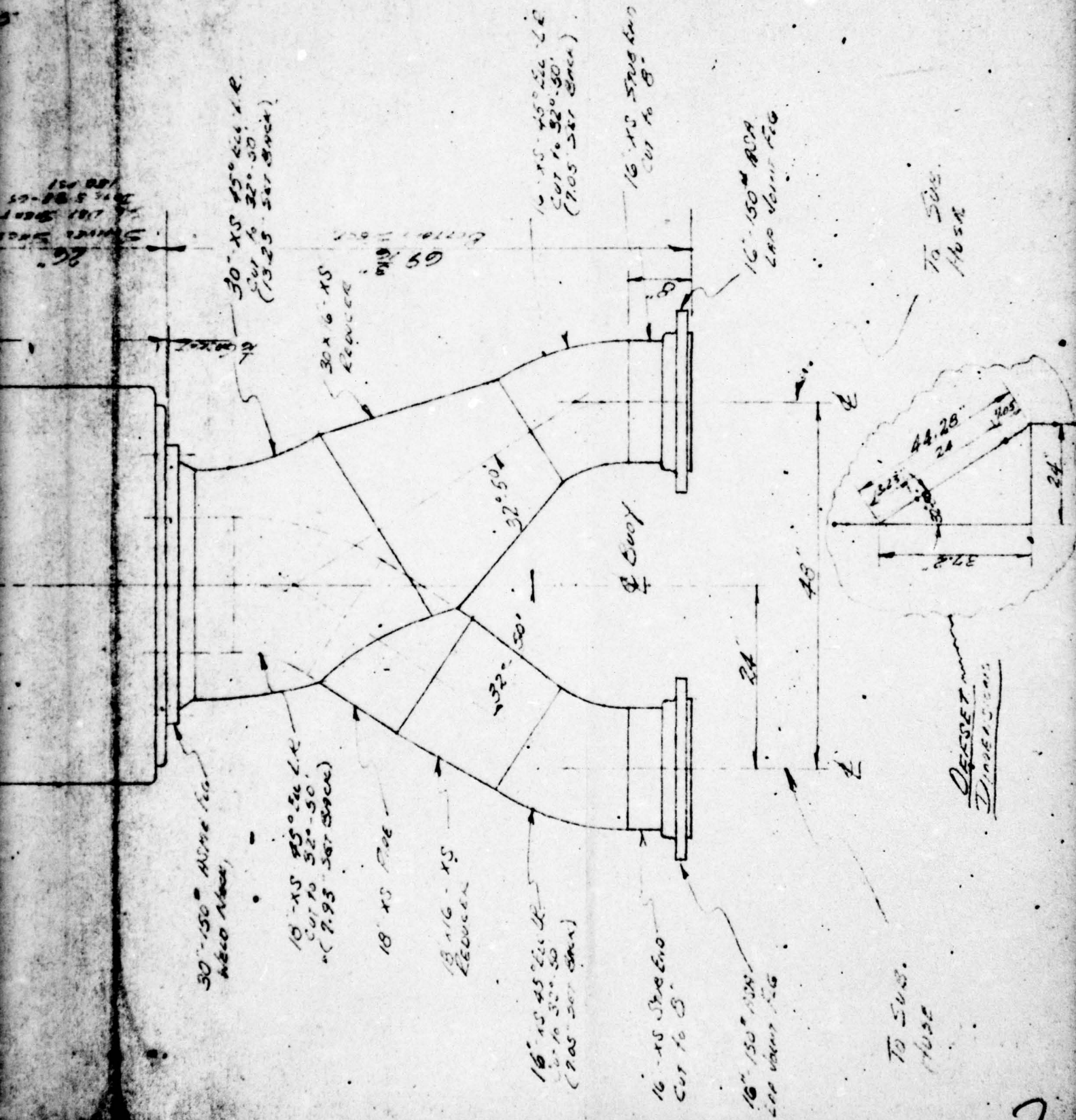
FOR PLAN VIEW  
SEE SHEET 2  
OF SAME DATE

ELEVATION





SWITCH SIDE  
 181 500-5  
 181 500-5  
 181 500-5

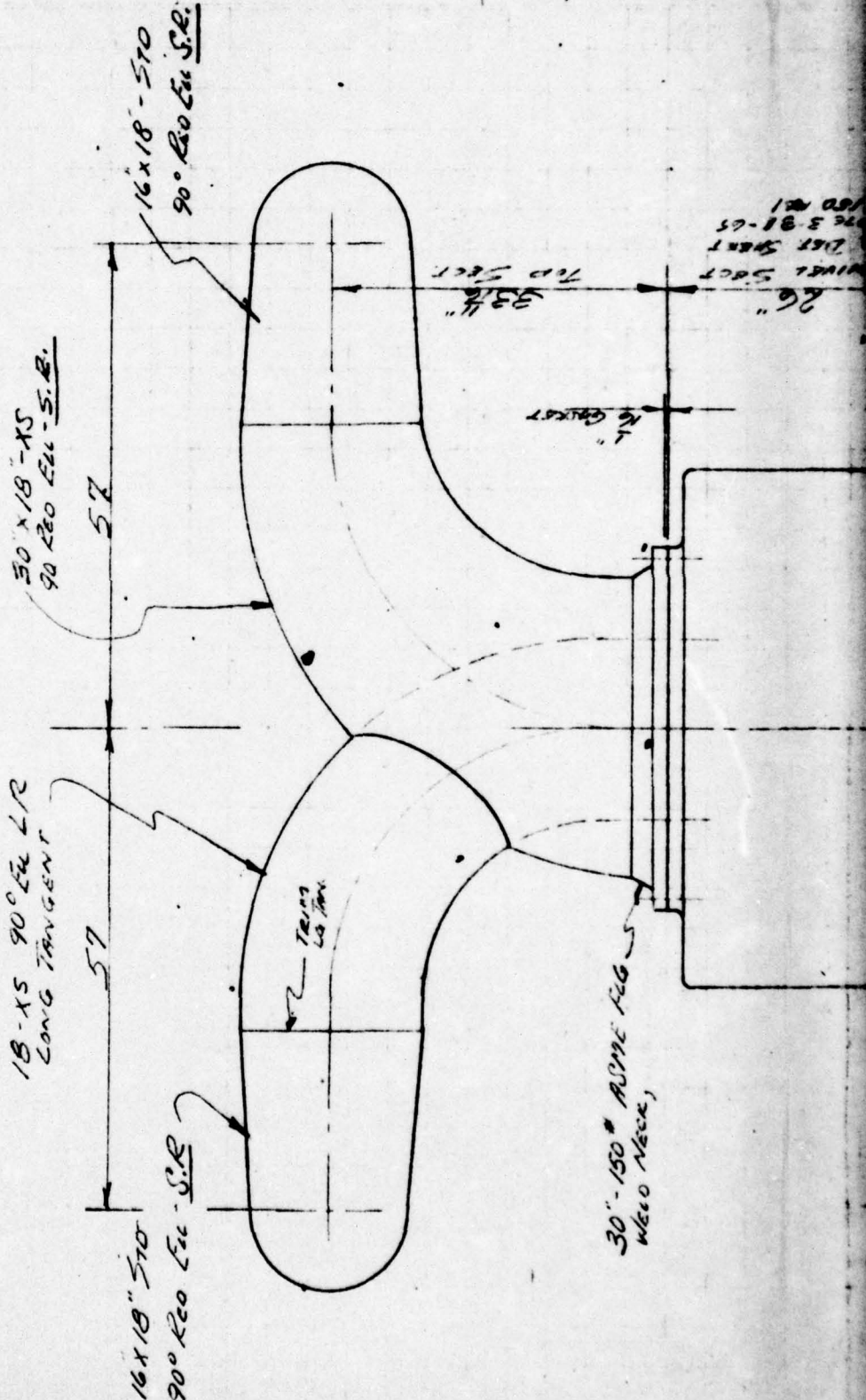


COMPANY	U.S. ARMY - ERDL		SHEET NO	1 of
SUBJECT	MONO MOUNTING SYSTEM - SWIVEL DESIGN #2			
WORK NUMBER	COMPUTER	CHECKED BY	DATE	
JO. 56017	WAP		4-21-65	

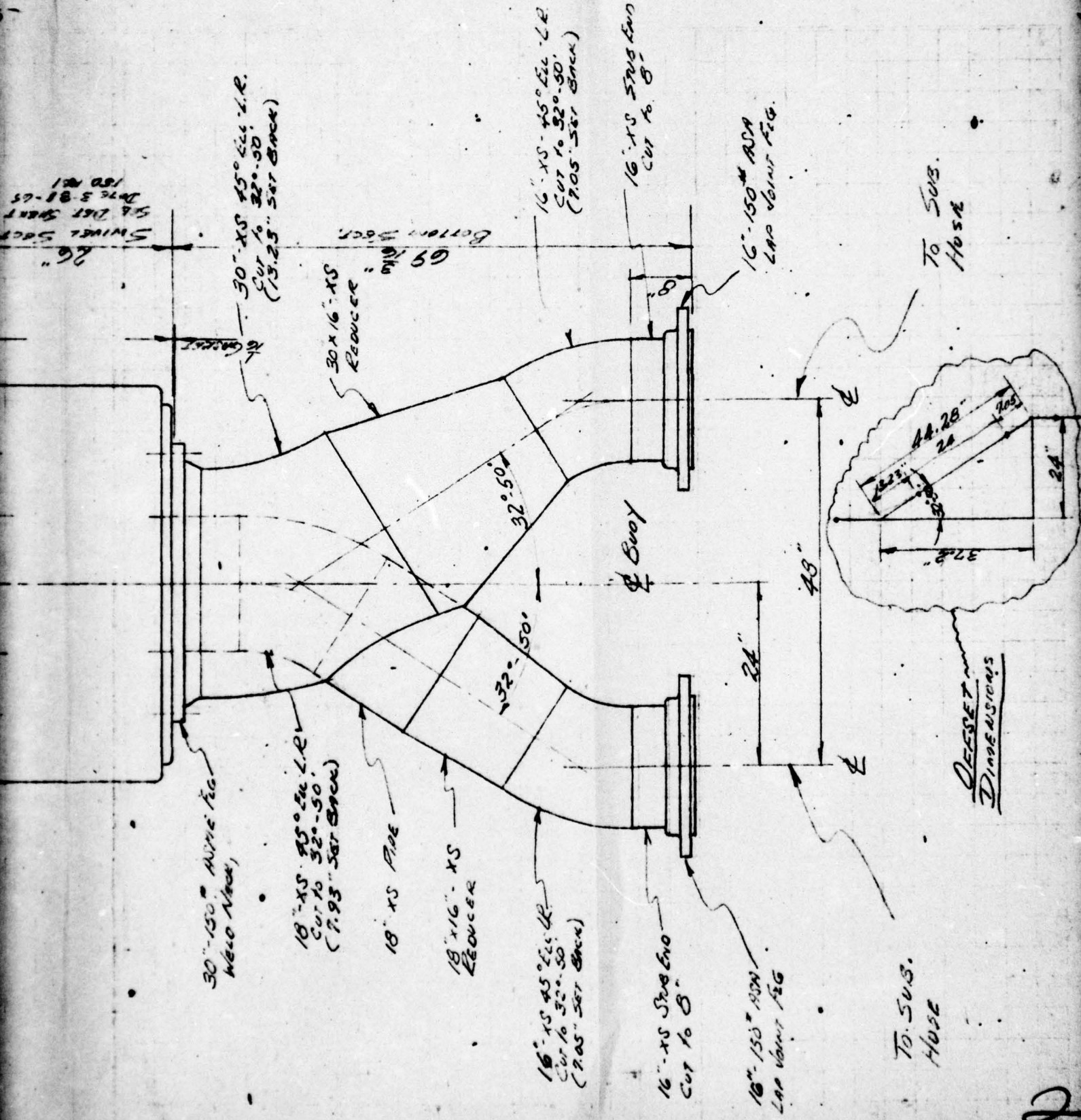
NOTE

FOR PLAN VIEW  
SEE SHEET 2  
OF SAME DATE

ELEVATION



SWIVEL SECT  
DATE 3-81-65  
180 #1



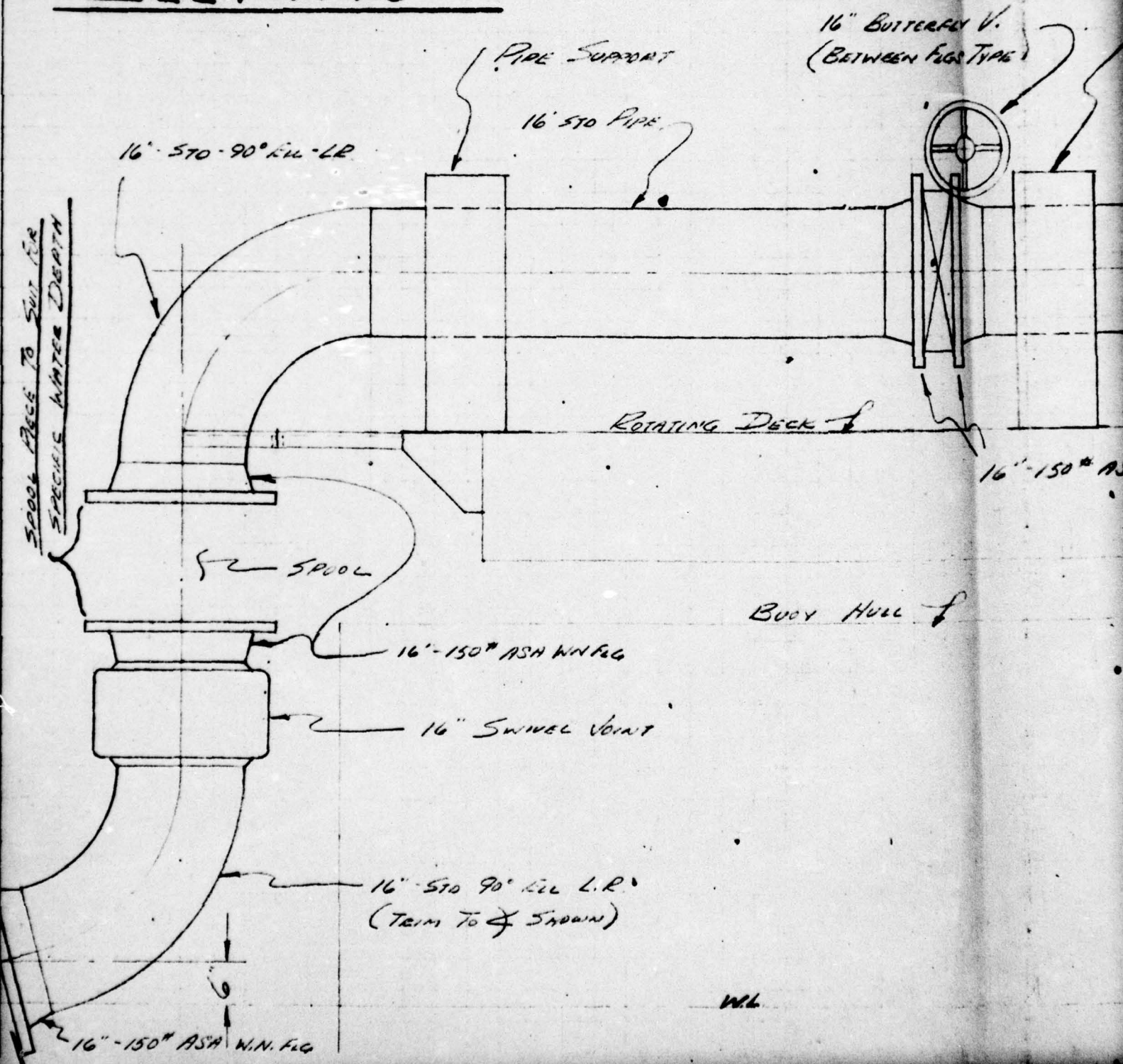
To SUS.  
HOSE

To SUS.  
HOSE

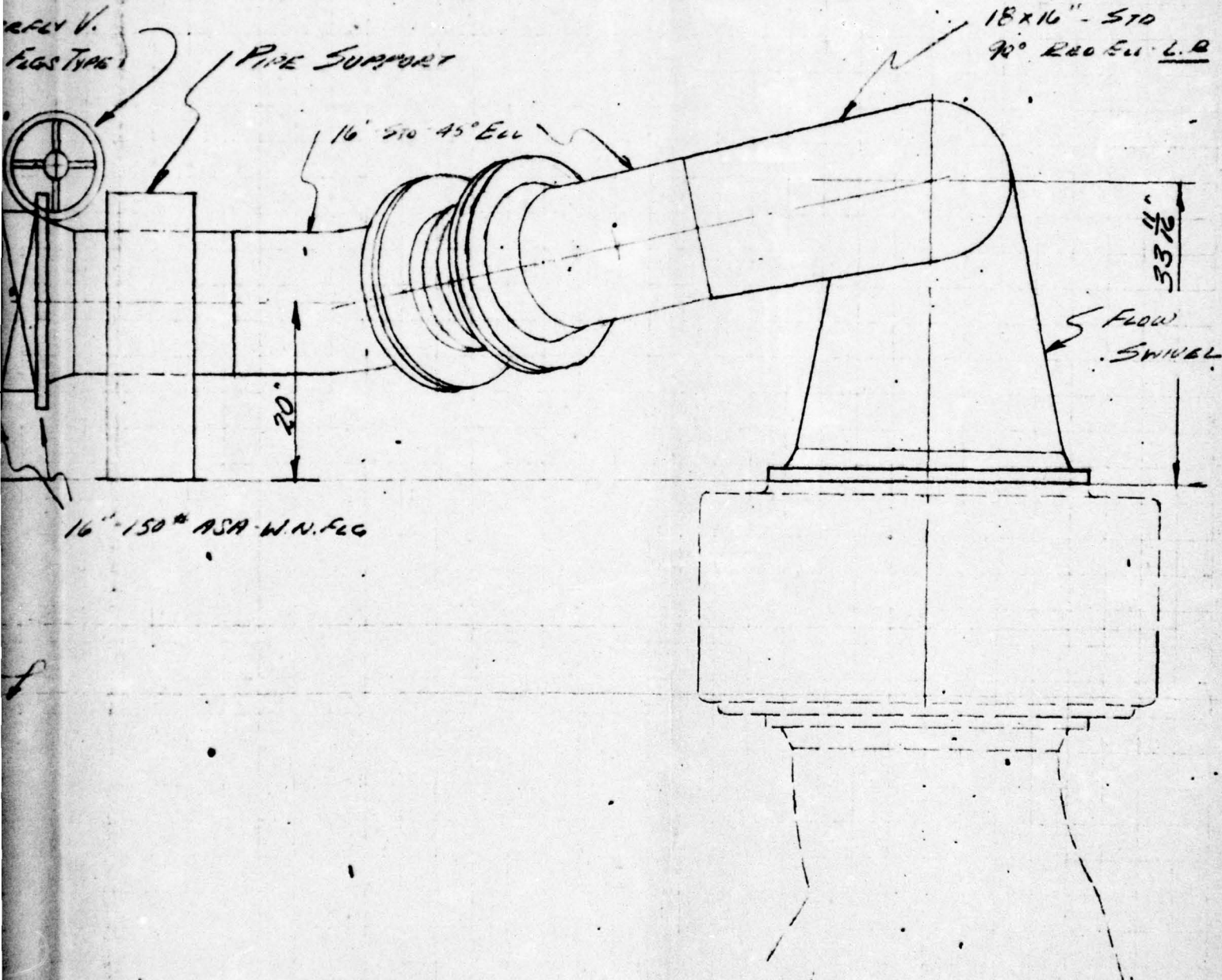
RESET  
DIMENSIONS

COMPANY	U.S. ARMY - ERDL		SHEET NO	3 of
SUBJECT	Mono Mooring System - Flow Swivel Piping D			
DRAWING	10.56017	COMPUTER	WAP	CHECKED BY
				DATE
				4/20/65

# ELEVATION



PIPING DESIGN #2



COMPANY <i>U.S. ARMY - ERDL</i>	SHEET NO <i>21</i>		
SUBJECT <i>MONO MOORING SYSTEM - FLOW SWIVEL PIPING</i>			
DRAWING NUMBER <i>J.O. 56017</i>	COMPUTER <i>WAP</i>	CHECKED BY	DATE <i>4-20-65</i>

# PLAN

(N.T.S.)

16" TRIPLE ARCH EAR  
REINFORCED RUBBER  
FOR 20001 SERVICE

30' DIA  
BODY HULL

16" STD 90° EL-L.R.

PIPE SUPPORT

16" STD PIPE

16"-150" ASA  
W.N. FIG

PIPE SUPPORT

16" BUTTERFLY V  
(BETWEEN FLS TYPE)

20"

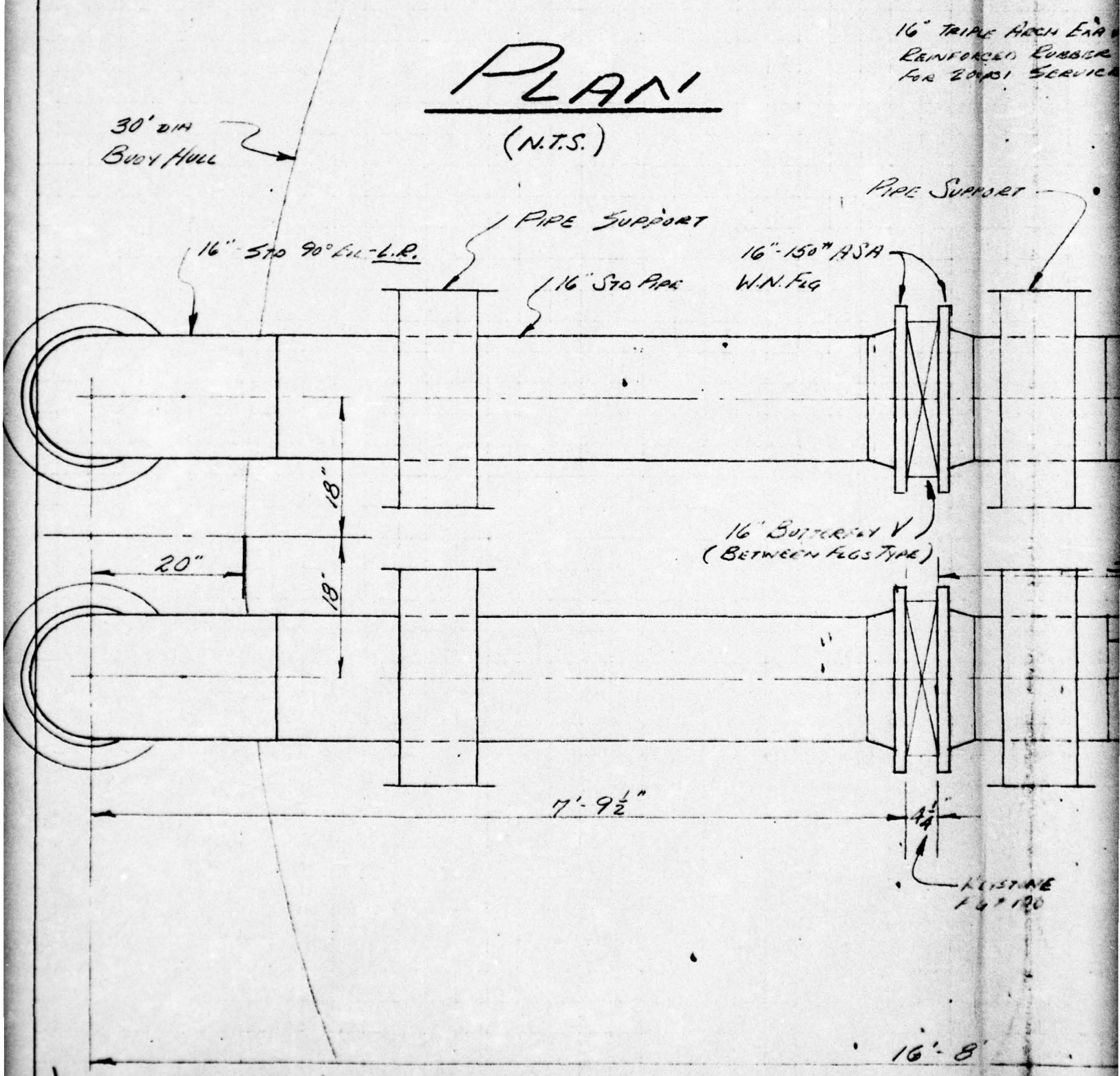
18"

18"

7'-9 1/2"

KLISTINE  
14" 120

16'-8"



# SPRING DESIGN #2

TRIPLE ARCH EAR VT.  
REINFORCED RUBBER  
FOR ZONE I SERVICE

16" STD 45° ELL

18" x 16" STD  
90° Red Ell - L.R.

SUPPORT

16" 150° - ASA  
W.N. FLG

TRIM

16" STD 45° ELL  
LONG TAN. BOTH ENDS  
(ONE END TRIMMED)

37"

29 1/2"

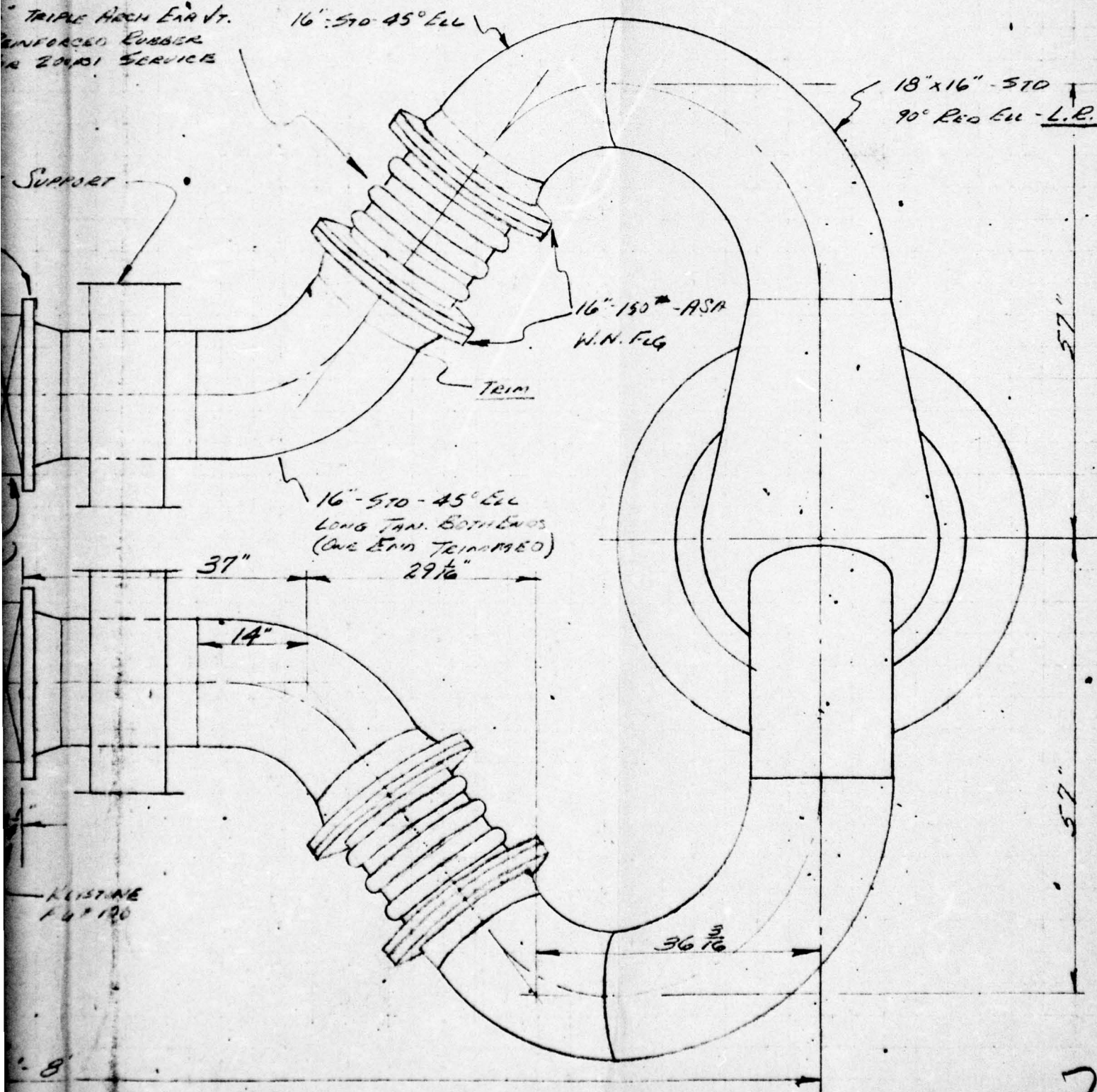
14"

KLEISTONE  
1 1/2" ID

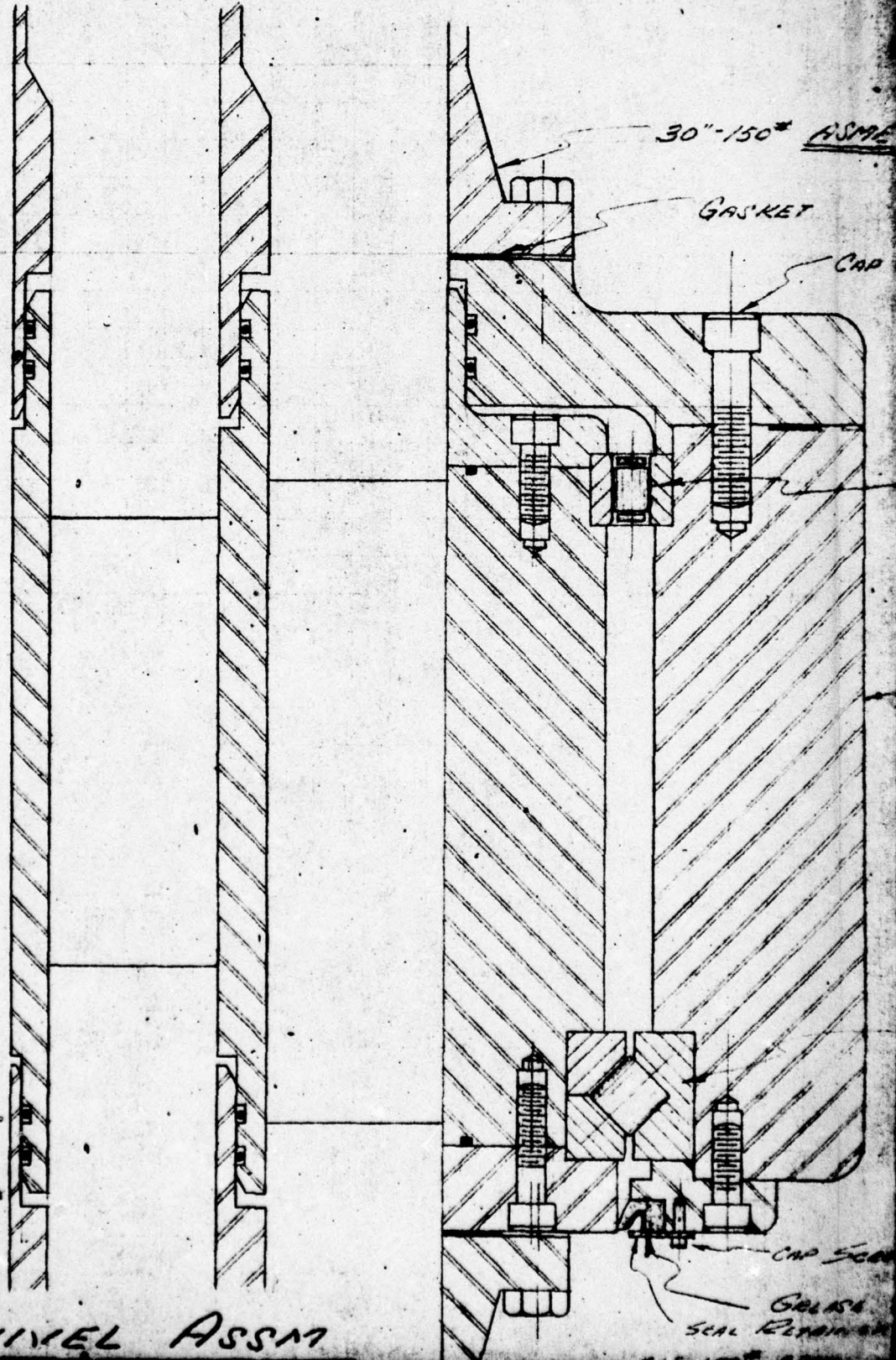
36 3/16"

57"

57"



COMPANY	U.S. ARMY - ERDL		SHEET NO
SUBJECT	MONO MOORING SYSTEM - SWIVEL DESIGN for 150		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
J.O. 56017	WAP		3-25-65



- NOTE: -
1. ALL SURFACES WHICH O RINGS FORM DYNAMIC SEAL TO BE 16 RMS
  2. STATIC O RING SEAL TO BE 32 RMS
  3. TIR TO 30.004" max

SWIVEL ASSM



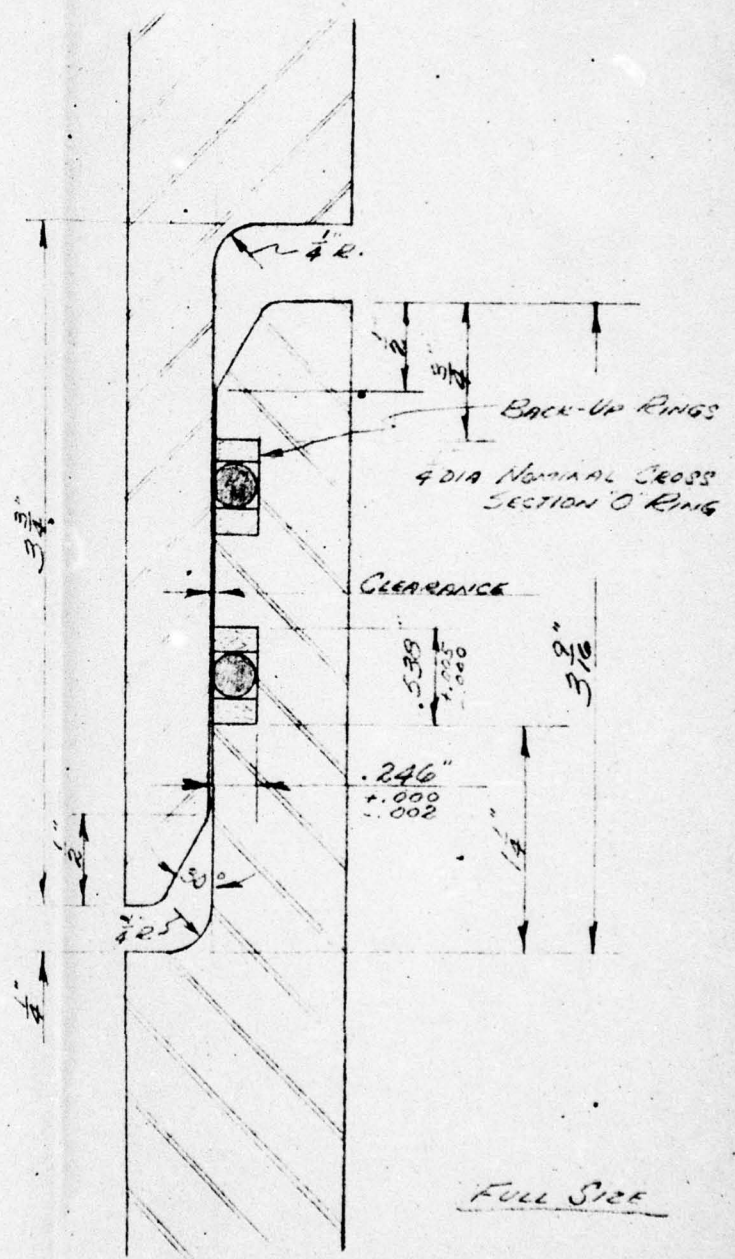
ME WIN FLG

AD REEVIS

RADIAL ROLLER BRG.

HOUSING

X-TYPE ROLLER BRG.



TYPICAL SEAL ASSY.

COMPANY

U.S. ARMY - E.R.D.L.

SHEET NO

1 of

PROJECT

MONO MOORING SYSTEM - SWIVEL DESIGN

NUMBER

10 56017

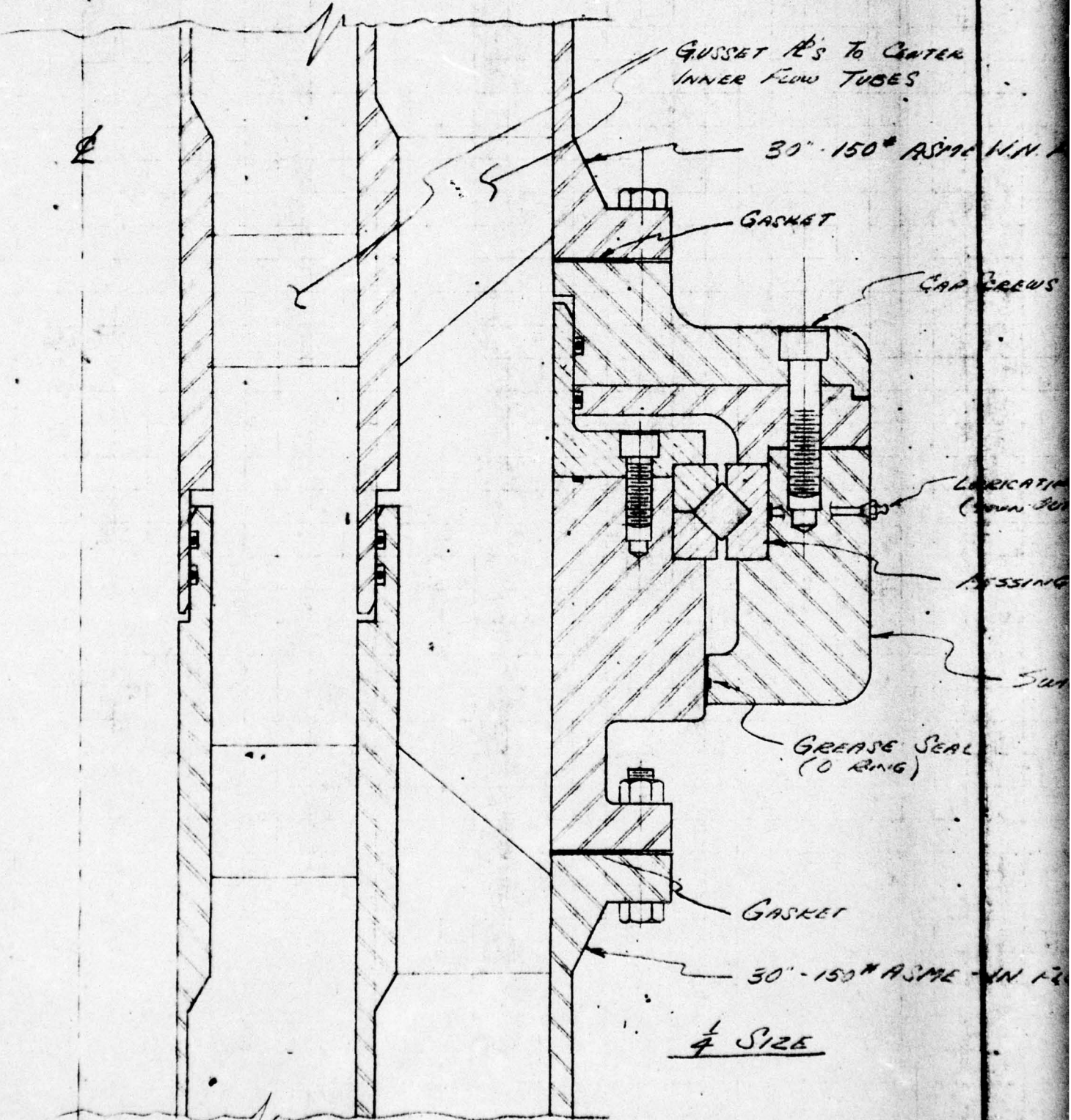
COMPUTER

WDP

CHECKED BY

DATE

2-25-65



SWIVEL ASSY

DESIGN

5

TO CENTER  
TUBES

50° ASME W.N. FLG

CAP SCREWS



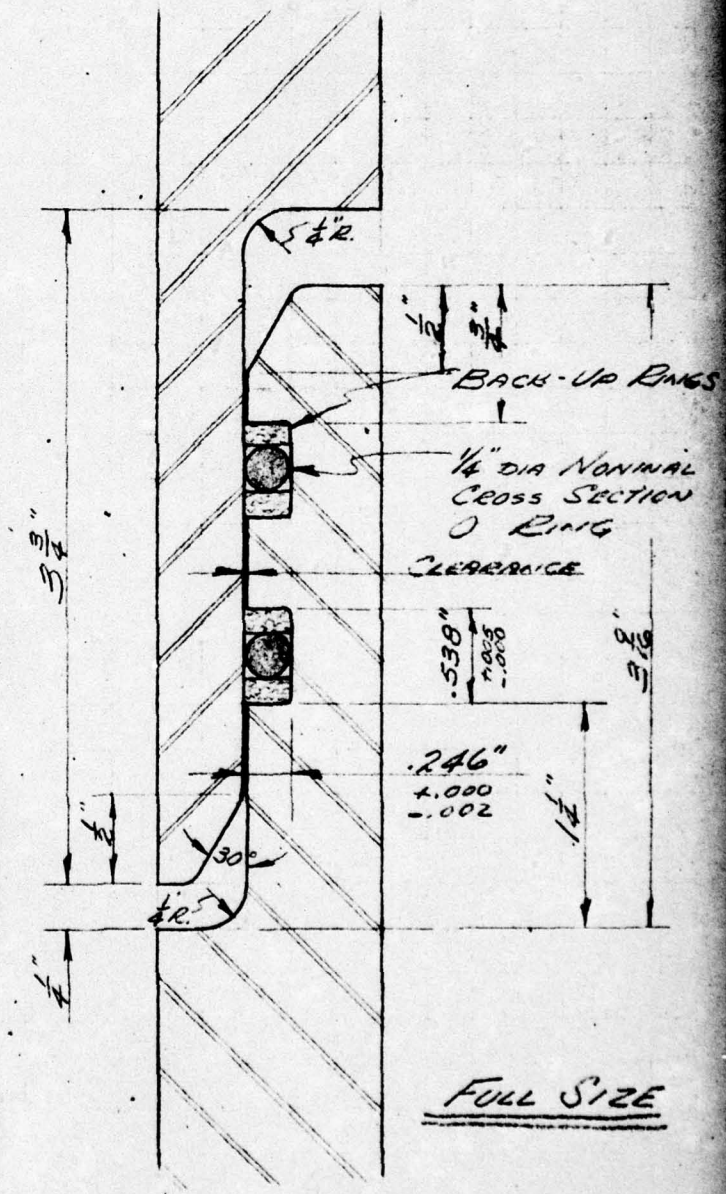
LUBRICATING FITTING  
(DOWN BUT IN PHASE FOR CLARITY)

MESSINGER & BEARING

SWIVEL HOUSING

BASE SEAL  
(RING)

ASME W.N. FLG



FULL SIZE

TYPICAL SEAL ASSM.

2

U.S. Army ERDL

4 of 4

MONO MOORING SYSTEM PRELIMINARY SKETCH

DRAWING NUMBER

COMPUTER

CHECKED BY

DATE

*WJP*

1-13-65

16 510 PRC FIXED (SHOUL ROTATE WITH THIS LINE)

O RING SEAL

41,000 PSI AIR PASSAGE  
61,000 PSI WATER PASSAGE

18,600  
EITHER DIAL

18 X 16 LR  
RED. EEL

30 X 16 SR  
RED. EEL

38

O RING SEAL (TWO)

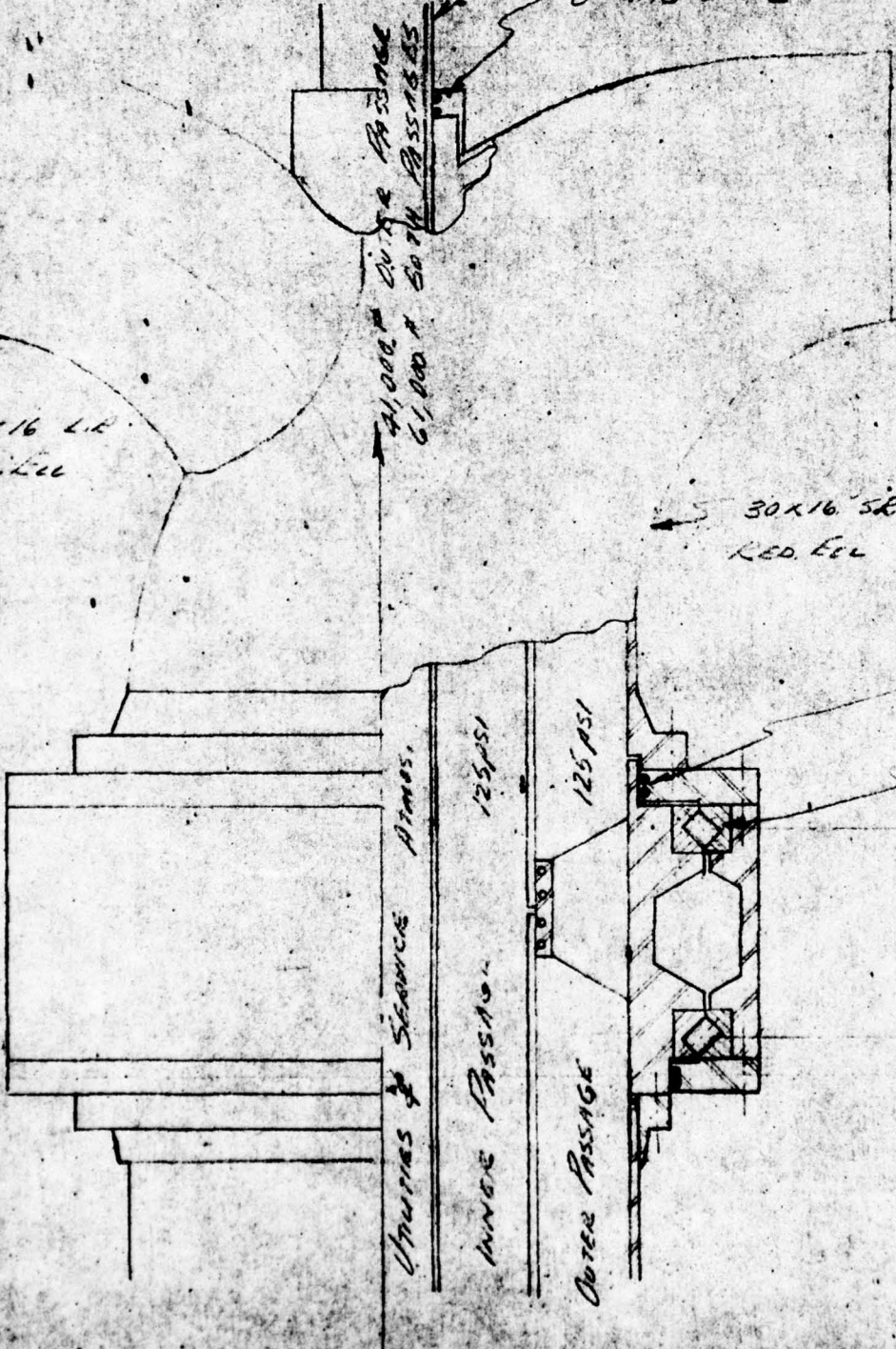
MESSINGER X  
(TYP. TABLE)

UNIONS & SERVICE AIRWAYS

INNER PASSAGE 125 PSI

OUTER PASSAGE 125 PSI

12.5



for 100 psi

OPERATING CONDITIONS

for 100 PSI SERVICE

1. FLOW IN OUTER PASSAGE ONLY

VERTICAL THRUST = 41,000<sup>lb</sup>  
OVERHUNG LOAD = 18,600<sup>lb</sup> @ 40"

2. FLOW IN BOTH PASSAGES

VERTICAL THRUST = 61,000<sup>lb</sup>  
OVERHUNG LOAD = 22,000<sup>lb</sup> @ 40"

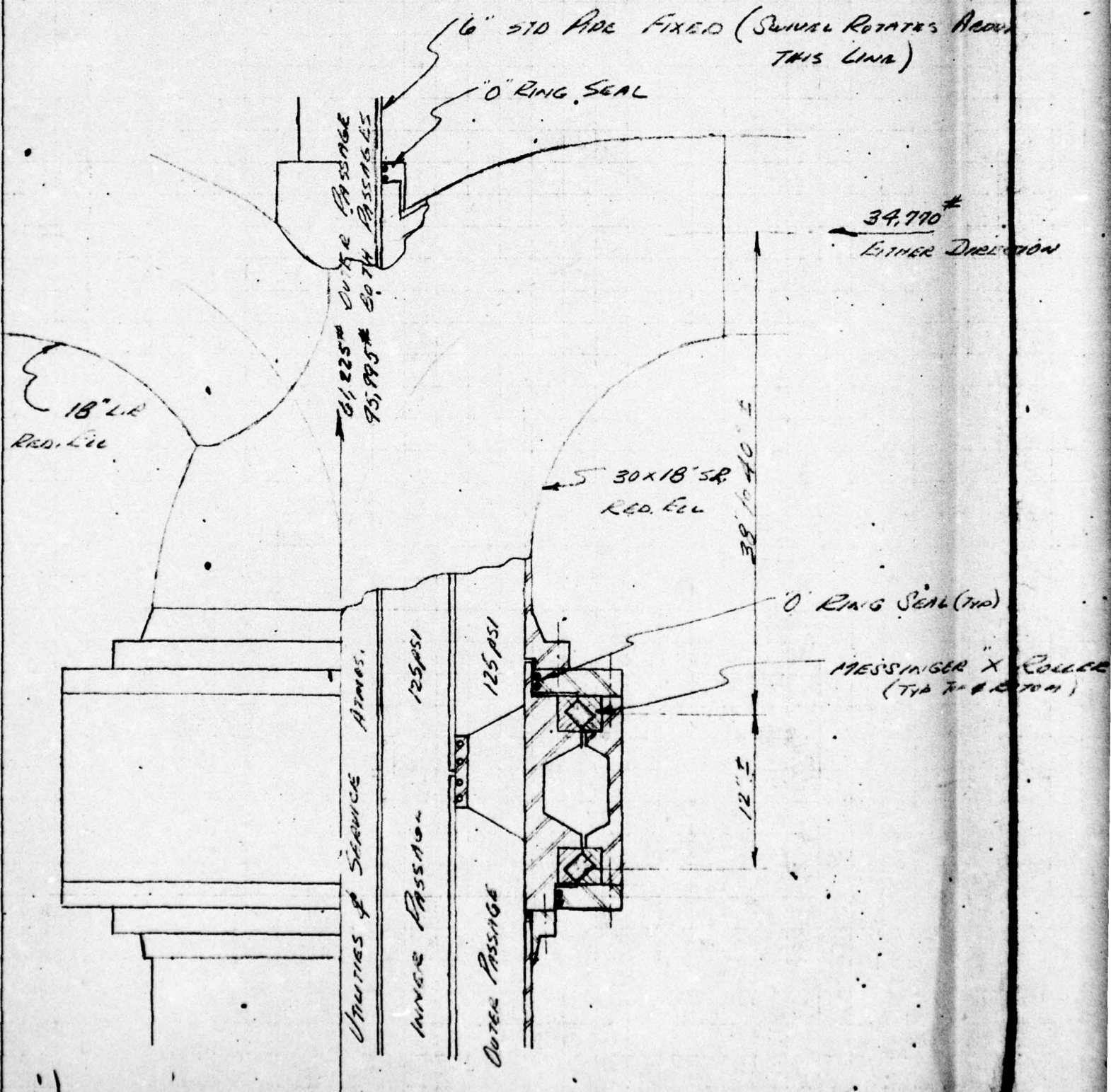
3. FLOW IN INNER PASSAGE

LOADS EQUAL OR LESS THAN  
CONDITION 1.

NOTE: - ROTATION TO BE

ALMOST STATIC CONDITION

COMPANY	U.S. ARMY E.R.D.L.		SHEET NO	5 of
SUBJECT	MONO MOORING SYSTEM PRELIMINARY SKETCH			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
			2-22-65	



Vertical Thrust for 150 PSI

Vertical Reaction

3970 #  
Inner Direction

SEAL (110)

INNER X ROLLER B.G.  
(Type 7-10-1)

OPERATING CONDITIONS  
for 150 PSI SERVICE

1. FLOW IN OUTER PASSAGE ONLY

VERTICAL THRUST = 61,225 #  
OVERHUNG LOAD = 39,770 # @ 40" ±

2. FLOW IN BOTH PASSAGES

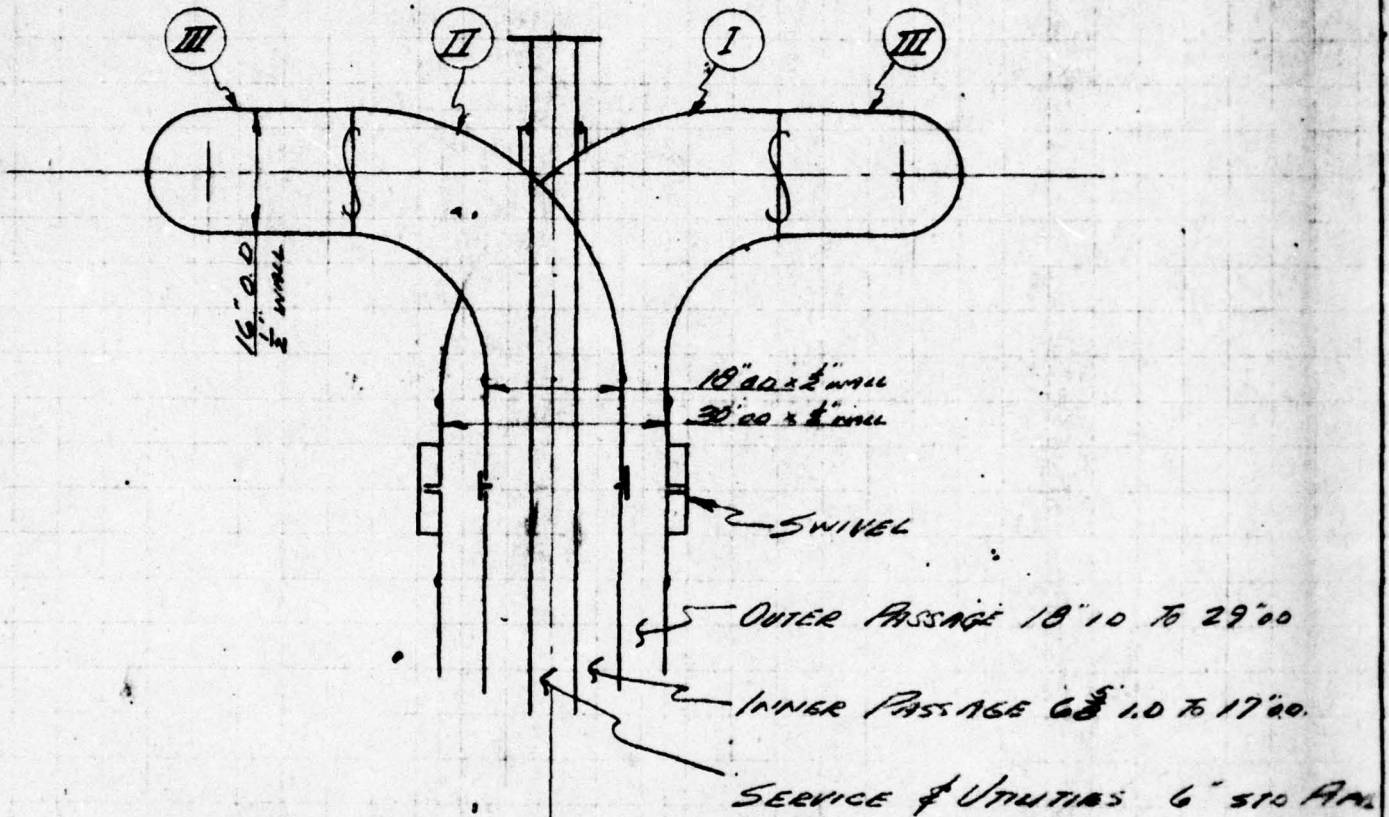
VERTICAL THRUST = 95,995 #  
OVERHUNG LOAD = 58,850 # @ 40" ±

3. FLOW IN INNER PASSAGE

LOADS EQUAL OR LESS THAN  
CONDITION 1.

NOTE: - ROTATION TO BE  
ALMOST STATIC CONDITION

COMPANY	U.S. Army - ERDL.		SHEET NO	1 of
SUBJECT	MONO MOORING SYSTEM - Dynamic Flow Loads on			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WMP		1-4-65	



NOTES: —

1. FLOW THRU INNER & OUTER PASSAGES TO BE 10,500 GPM EACH. TOTAL FLOW 21,000 GPM (39,000 BPH)
2. FLOW THRU EITHER PASSAGE OR BOTH DURING OPERATING PERIODS



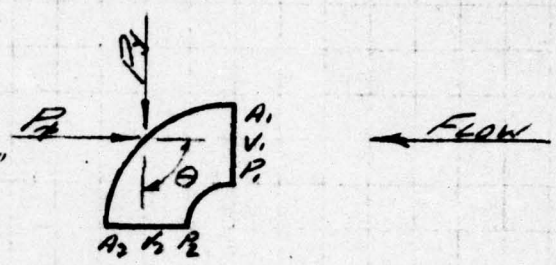
loads on Survival

REVISED for 150 PSI

SEE SHEET DATED 2/19 & 2/22

FORMULAS:

"BERNOULLI THEOREM"

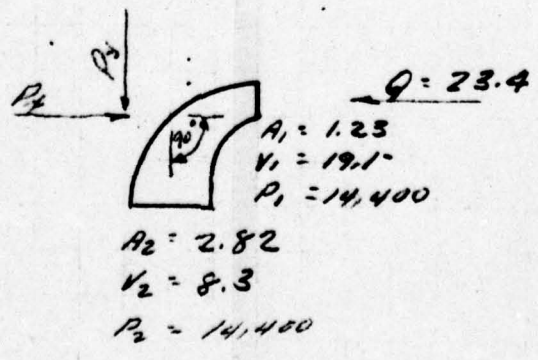


$$P_x = -\rho Q (V_2 \cos \theta - V_1) + P_1 A_1 - P_2 A_2 \cos \theta$$

$$P_y = \rho Q V_2 \sin \theta + P_2 A_2 \sin \theta$$

- Q = Flow cfs
- $\rho$  = DENSITY IN SLUGS PER CU FT = Use 1.935 for WATER
- A1 = AREA SQ FT
- A2 = AREA SQ FT
- V1 = VELOCITY FPS
- V2 = VELOCITY FPS
- P1 = PRESSURE LBS/SQ FT (100 PSI)
- P2 = PRESSURE LBS/SQ FT

(I)



(Contd)

2

ENGINEERING DEPARTMENT  
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

COMPANY

U.S. Army - E.R.D.L.

SHEET NO

2 of

SUBJECT

Mono Mooring System - Dynamic Flow Loads on

DRAWING NUMBER

COMPUTER

waf

CHECKED BY

DATE

1-4-65

①

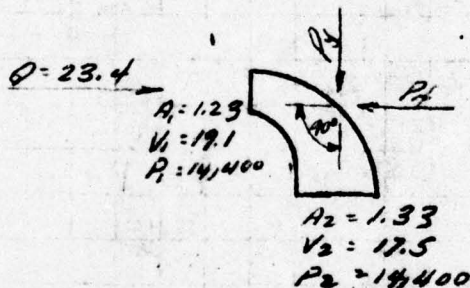
$$P_x = -1.935 \times 23.4 (8.3 \cos 90^\circ - 19.1) + 14,400 \times 1.23 - 14,400 \times 2.8 \cos 90^\circ$$

$$\underline{P_x} = 865 + 17,700 - 0 = \underline{18,565 \text{ LBS}}$$

$$P_y = 1.935 \times 23.4 \times 8.3 \sin 90^\circ + 14,400 \times 2.82 \sin 90^\circ$$

$$\underline{P_y} = 395 + 40,550 = \underline{40,925 \text{ LBS}}$$

②



$$P_x = 1.935 \times 23.4 (17.5 \cos 90^\circ - 19.1) + 14,400 \times 1.23 - 14,400 \times 1.3 \cos 90^\circ$$

$$\underline{P_x} = 865 + 17,700 - 0 = \underline{18,565 \text{ LBS}}$$

$$P_y = 1.935 \times 23.4 \times 17.5 \sin 90^\circ + 14,400 \times 1.33 \sin 90^\circ$$

$$\underline{P_y} = 770 + 19,150 = \underline{19,920 \text{ LBS}}$$

LEADS ON SURVIVAL

REVISED

SEE NEW STRATS

$14,400 \times 2.8 \cos 90^\circ$

$2 \sin 90^\circ$

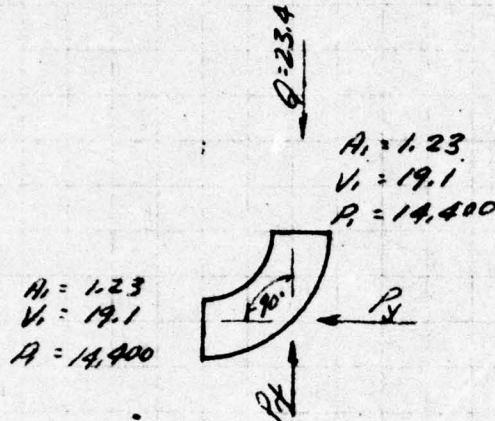
$400 \times 1.3 \cos 90^\circ$

$517 \sin 90^\circ$

✓

COMPANY	U.S. ARMY ERDL		SHEET NO	3 of
SUBJECT	MONO MOORING SYSTEM - DYNAMIC FLOOD FORCE ON			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WAP		1-4-65	

III



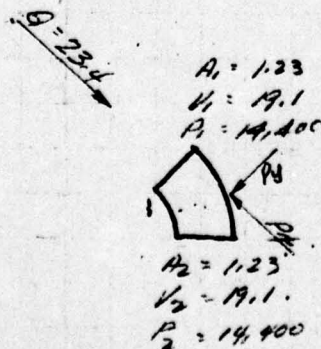
$$P_x = -1.935 \times 23.4 (19.1 \sin 90^\circ - 19.1) + 14,400 \times 1.23 - 14,400 \times 1.23 \cos 90^\circ$$

$$P_x = 865 + 17,700 - 0 = \underline{18,565 \text{ LBS}}$$

$$P_y = 1.935 \times 23.4 \times 19.1 \sin 90^\circ + 14,400 \times 1.23 \sin 90^\circ$$

$$P_y = 865 + 17,700 = \underline{18,565 \text{ LBS}}$$

IV



$$P_x = -1.935 \times 23.4 (19.1 \cos 45^\circ - 19.1) + 14,400 \times 1.23 - 14,400 \times 1.23 \cos 45^\circ$$

$$P_x = 281 + 17,700 - 12,500 = \underline{2,481 \text{ LBS}}$$

REVISION

See New Sheets

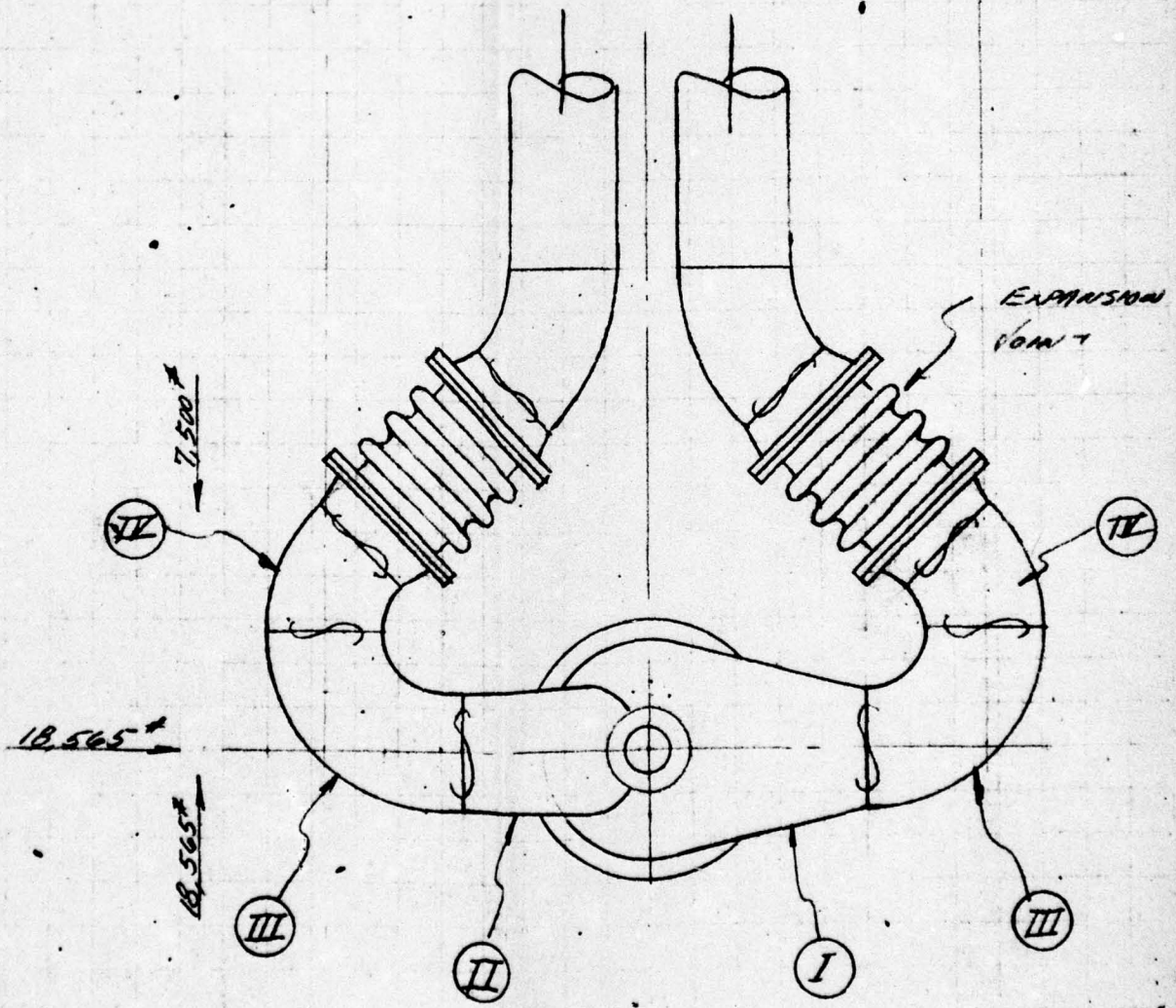
FRAGILE ON SWIVEL

14,400 x 113 cos 90°

LBS

3 sin 90°

S



14,400 x 113 cos 45°

COMPANY U.S. Army E.R.D.L.		SHEET NO 9 of	
SUBJECT MONO MOORING SYSTEM - DYNAMIC FLOW FORCES ON BARGE			
DRAWING NUMBER	COMPUTER OJ	CHECKED BY	DATE 1-5-65

Ⓧ cont'd ..

$$P_y = 1.935 \times 23.4 \times 19.1 \sin 45^\circ + 14,400 \times 1.23 \cos 45^\circ$$

$$P_y = 612 + 12,500 = \underline{13,112 \text{ LBS}}$$

V.O 56017

is in *Exhibit*

*London*  
*Sir*

450

2

COMPANY		SHEET NO	
SUBJECT <i>BERNOULLI THEOREM</i>			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

*Formulas -*

$$P_x = -\rho Q (V_2 \cos \theta - V_1) + P_1 A_1 - P_2 A_2 \cos \theta$$

$$P_y = \rho Q V_2 \sin \theta + P_2 A_2 \sin \theta$$



ENGINEERING DEPARTMENT  
COMPUTATION SHEET

J. RAY McDERMOTT & Co., INC.

COMPANY		SHEET NO	
SUBJECT			
DRAWING NUMBER		COMPUTER	CHECKED BY
			DATE

30 x 16 Full 90° flow 30 to 16

$$P_x = -\rho Q (V_2 \cos \theta - V_1) + P_1 A_1 - P_2 A_2 \cos \theta$$

$$= -1.935 \times 23.4 (19.1 \cos 90^\circ - 8.3) + 14,400 \times 2.8 - 14,112 \times$$

$$1.2 \cos 90^\circ$$

$$375 + 40,400 = 40,775 \text{ LBS}$$

$$P_y = \rho Q V_2 \sin \theta + P_2 A_2 \sin \theta$$

$$= 1.935 \times 23.4 \times 19.1 \times 1 + 14,112 \times 1.2 \times 1$$

$$= 856 + 16,900 = 17,756 \text{ LBS}$$

ENGINEERING DEPARTMENT  
COMPUTATION SHEET  
MCD 5015

J. RAY MCDERMOTT & CO., INC.

COMPANY		SHEET NO	
SUBJECT 30 x 16 89° flow 30 to 16			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

$$\begin{aligned}
 P_H &= \rho Q (V_2 \cos \theta - V_1) + P_1 A_1 - P_2 A_2 \cos \theta \\
 &= 1.935 \times 23.4 (19.1 \cos 89^\circ - 8.3) + 14,400 \times 2.8 - 14,112 \times \\
 &\qquad\qquad\qquad 1.2 \cos 89^\circ \\
 &= 390 + 40,400 - 282 = 40,508 \text{ LBS}
 \end{aligned}$$

ENGINEERING DEPARTMENT  
COMPUTATION SHEET

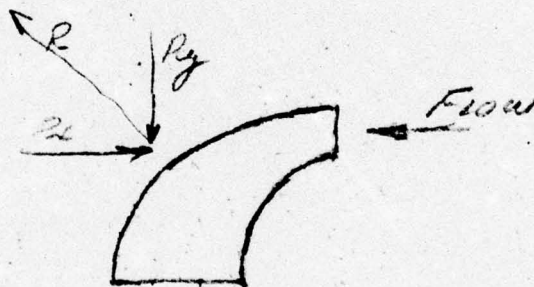
J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO	
SUBJECT 30 x 16 Ell 90° flow 16 to 30			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

$$P_x = -\rho Q (v_2 \cos 90^\circ - v_1) + P_1 A_1 - P_2 A_2 \cos \theta$$

$$= -1.935 \times 23.4 (8.3 \cos 90^\circ - 19.1) + 14,400 \times 1.2 - 100 \times 2.8 \cos 90^\circ$$

$$856 + 17,600 = 18,456$$



COMPUTATION SHEET  
ENGINEERING DEPARTMENT

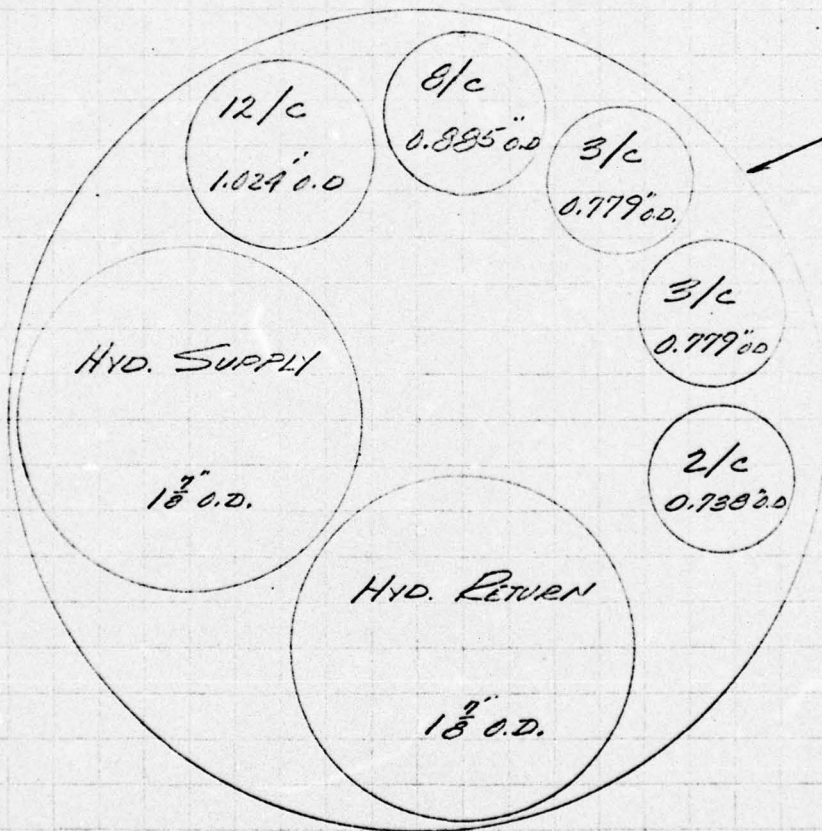
J. RAY McDERMOTT & CO., INC.

MCD 5011

COMPANY <i>U.S. ARMY ERDL</i>	FIELD	SHEET NO. <i>1 of 1</i>
TCT <i>MONO MODEMING SYSTEM</i>	WELL NO.	DATE <i>11/12/65</i>
DRAWING NO. <i>105607 GUT LINE ARRGT.</i>	COMPUTER <i>WAF/ETRIC</i>	

SECTION SHOWING PAGA REQUIRED  
FOR HYDRAULIC & ELECTRICAL  
SERVICE RUNS BETWEEN BUOY MACH'Y  
COMPARTMENT AND CONTROL CONSOLE

CROSS SECTION



4 1/2" I.D.  
GUT LINE  
THRU UPPER  
SWIMMER UNIT

SECTION II

BUOY EQUIPMENT  
AND SYSTEMS

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

4CD 5011

J. RAY MCDERMOTT & CO., INC.

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

CHAIN STOPPER DESIGN

PITCH DIA .852 D

WIRE DIA .148" = d,  $d^3 = .0032$ ,  $d^4 = .00048$

INITIAL TENSION = 10# = P

NO COILS = 64 = N

COIL LENGTH = 9.47"

LENGTH INSIDE HOOKS 12"

OUTSIDE DIA = 1"

INITIAL TENSIONING STRESS =  $S = \frac{2.55 PD}{d^3}$

$$S_1 = \frac{2.55 \times 10 \times .852}{.0032}$$

$$S_1 = 6800 \text{ psi}$$

SPRING RATE =  $P = \frac{G d^4}{8 D^3 N}$

$$P = \frac{9.5 \times 10^6 \times .00048}{8 \times .615 \times 64}$$

$$\frac{4500}{315}$$

$$P = 1415 \text{ #/"} \text{ DEFLECTION}$$

TORSIONAL STRESS =  $S_T = (\text{USE } 75,000 \text{ MAX})$

$$P_{\text{MAX}} = \frac{S_T \pi d^3}{16 R \frac{\pi}{4}}$$

$$P_{\text{MAX}} = \frac{75000 \times 3.14 \times .0032}{16 \times .426 \times .615}$$

$$\frac{7155}{785}$$

$$P_{\text{MAX}} = 96.2 \text{ # (MAX ALLOWABLE SPRING LOAD)}$$

BENDING STRESS =  $S_B = \frac{32 PR}{\pi d^3}$

$$S_B = \frac{32 \times 96.2 \times .426}{3.14 \times .0032}$$

$$S_B = 139,000 \text{ psi}$$

DEFLECTION =  $F = \frac{P_{\text{MAX}} - P}{P}$

$$F = \frac{96.2 - 10}{10} = 8.62$$

2/12/65  
wfp

PITCH DIA .838 = D

Wire Dia .162 = d,  $d^3 = .0042$ ;  $d^4 = .0007$

INITIAL TENSION = 10# = P

No COILS = 79 = N

Coil LENGTH 12.96"

LENGTH INSIDE HOOPS  $15\frac{1}{4}"$  OVER LIMITS FOR STAINL

OUTSIDE DIA 1"

INITIAL TENSIONING STRESS =  $S = \frac{2.55 PD}{d^3}$

$$S = \frac{2.55 \times 10 \times .838}{.0042}$$

$$S = 5100 \text{ psi}$$

SPRING RATE =  $P = \frac{G d^4}{8 D^3 N}$

$$P = \frac{9.5 \times 10^6 \times .0007}{8 \times .59 \times 79}$$

$$P = 17.9 \# / " \text{ DEFLECTION}$$

TORSIONAL STRESS =  $S_T$  (USE 75,000 MAX)

$$P_{MAX} = \frac{S_T \pi d^3}{16 \times R \times \frac{1}{2}}$$

$$P_{MAX} = \frac{75000 \times 3.14 \times .0042}{16 \times .419 \times 1.15}$$

$\frac{995}{27}$

$$P_{MAX} = 128 \# \text{ (MAX ALLOWABLE SAFE LOAD)}$$

BENDING STRESS =  $S_B = \frac{32 PR}{\pi d^3}$



$$\text{INITIAL TENSIONING STRESS} = S = \frac{2.55 PD}{d^3}$$

$$S = \frac{2.55 \times 10 \times .838}{.0042}$$

$$S = 5100 \text{ psi}$$

$$\text{SPRING RATE} = P = \frac{G d^4}{8 D^3 N}$$

$$P = \frac{9.5 \times 10^6 \times 0.007^4}{8 \times .59 \times 79}$$

$$P = 17.9 \# / \text{IN DEFLECTION}$$

$$\text{TORSIONAL STRESS} = S_T \quad (\text{USE } 75,000 \text{ MAX})$$

$$P_{\text{MAX}} = \frac{S_T \pi d^3}{16 \times R \times \frac{1}{4}}$$

$$P_{\text{MAX}} = \frac{75000 \times 3.14 \times .0042^3}{16 \times .419 \times 1.15}$$

$$\frac{999}{27}$$

$$P_{\text{MAX}} = 128 \# \quad (\text{MAX ALLOWABLE SAFE LOAD})$$

14.5

$$\text{BENDING STRESS} = S_B = \frac{32 PR}{\pi d^3}$$

$$S_B = \frac{32 \times 128 \times .419}{3.14 \times .0042^3}$$

$$S_B = 130,000 \text{ psi}$$

$$\text{DEFLECTION} = F = \frac{P_{\text{MAX}} - P_i}{P}$$

$$F = \frac{128 - 10}{17.9} = 6.6 \text{ IN}$$

$$\frac{118 - 10}{17.9}$$

2

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

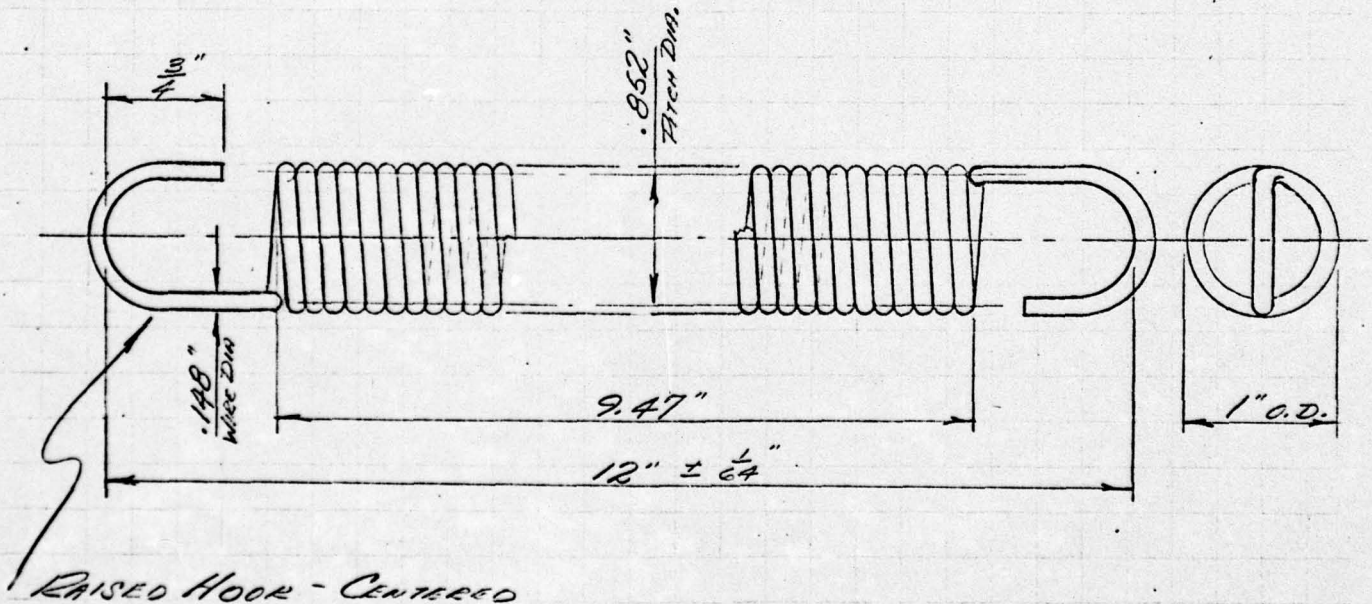
J. RAY McDERMOTT & Co., INC.

MCD 5011		
COMPANY U.S. Army - ERDL	FIELD	SHEET NO. 1 of 1
SUBJECT Munic Mucking System - Chain Stripper	WELL NO.	DATE 2/12/65
DRAWING NO. J.O 56017	COMPUTER VMP	
	SPRING CALCULATION	

MATERIAL:- SAE 30316 STAINLESS OR A3140 TITANAL

WORKING SPECIFICATIONS:-

OUTSIDE DIA	1"
PITCH DIA	.852"
WIRE DIA	.148"
INITIAL TENSION	10 LBS
NO COILS	64
COIL LENGTH	9.47"
LENGTH INSIDE HOOPS	12"
APPROX SPRING RATE	14.5 LBS/" DEFLECTION
TOTAL DEFLECTION	6" MAX



NOTE: TOTAL LOAD @ 6" DEFLECTION 95# ± 5%

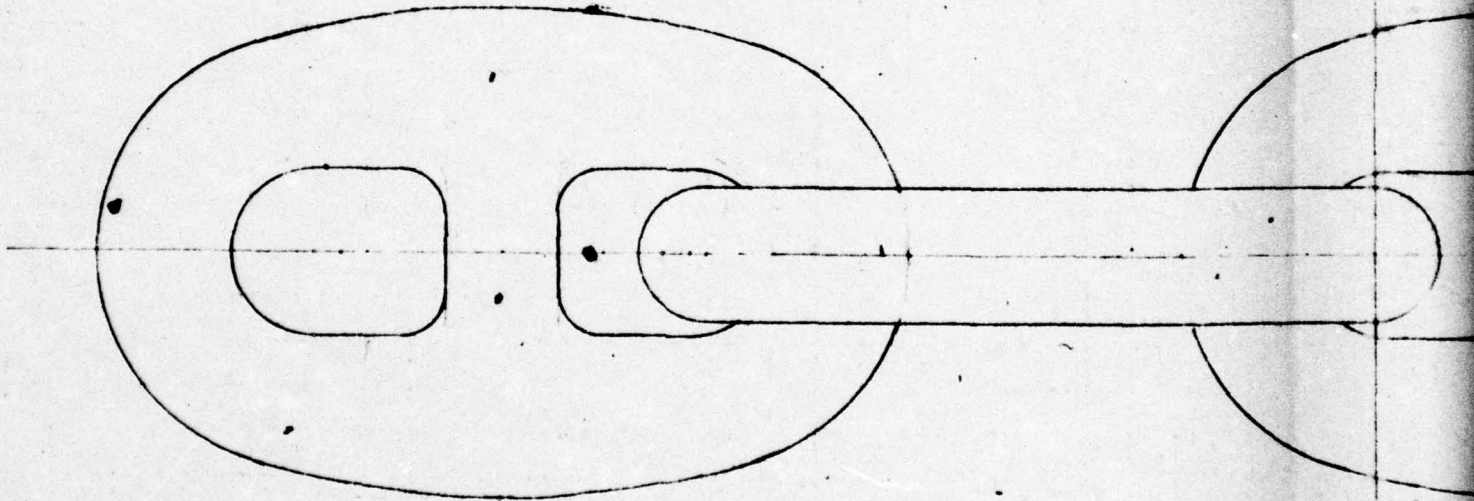
ENGINEERING DEPARTMENT  
COMPUTATION SHEET

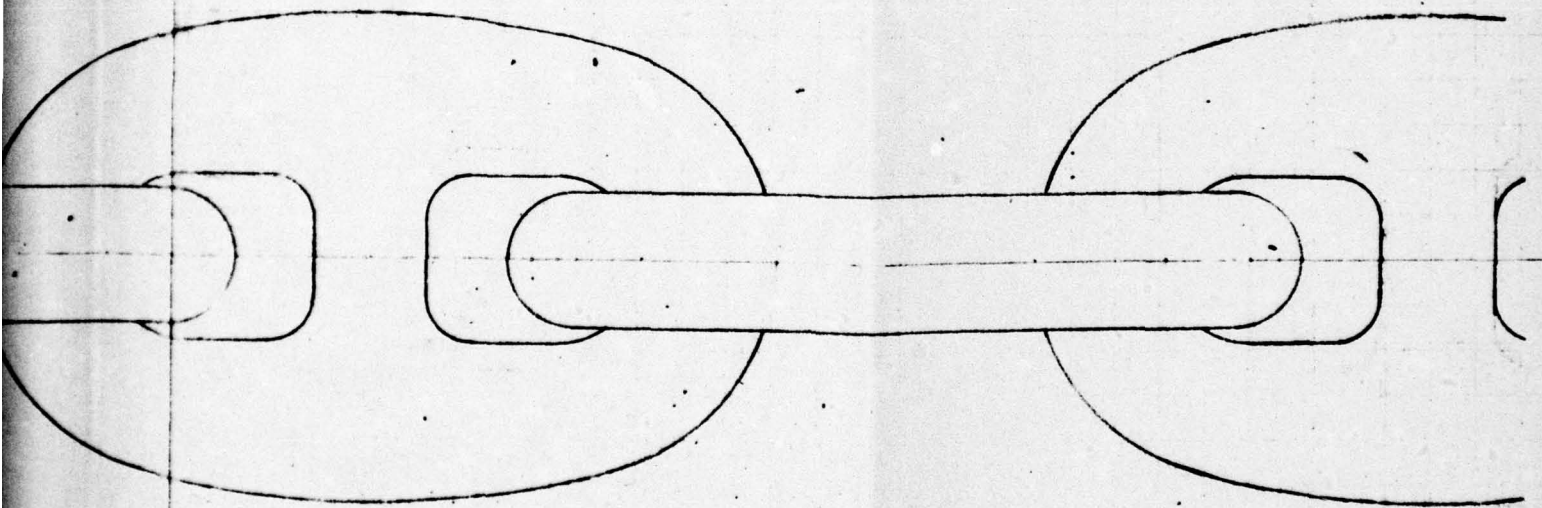
MCD 14003

J. RAY MCDERMOTT & CO., INC.

COMPANY	U.S. ARMY - ERDL		SHEET NO
SUBJECT	MONO MOORING SYSTEM - ANCHOR CHAIN		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WOP		

3" DIA STUD LINK CHAIN.  
(BALL OR EQUAL)

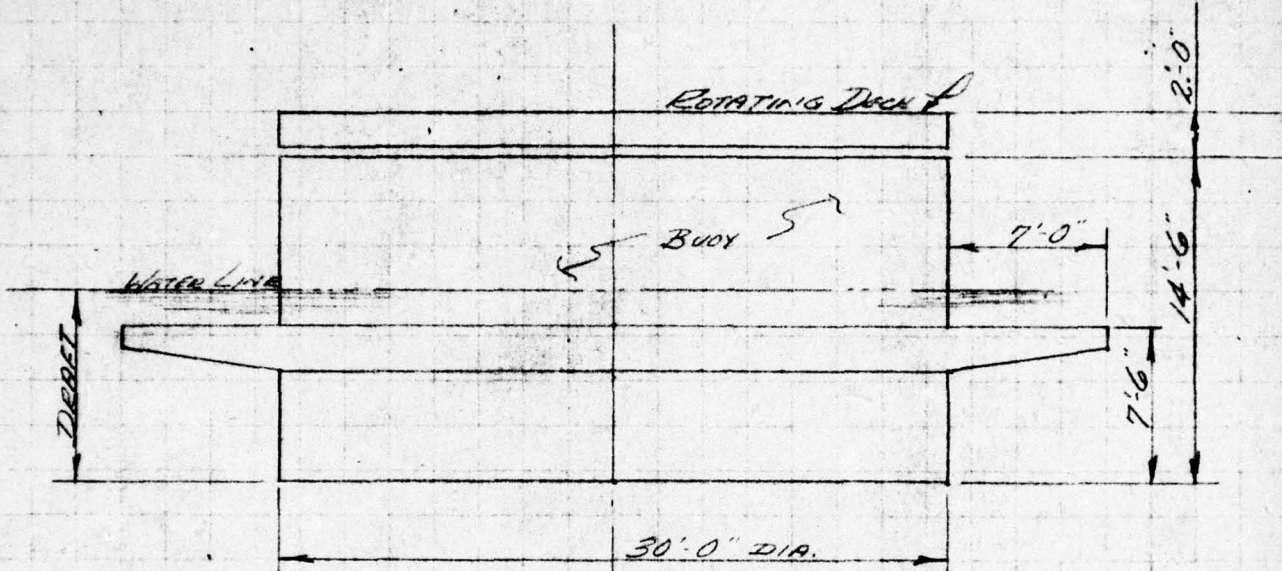




1

2

COMPANY <b>U.S. ARMY - ERDL</b>		SHEET NO	
SUBJECT <b>MONO MOORING SYSTEM - BUOY DRAFT</b>			
DRAWING NUMBER <b>V.O. 56017</b>	COMPUTER <b>WAD</b>	CHECKED BY	DATE <b>4-23-65</b>



LOCATION ; WATER DEPTH	BUOY DRAFT (PRE LOAD)	PRE LOAD
60'	6.7'	
100'		
150'	11.5'	

NOTE: MOORED LOAD INCREASES TOTAL DRAFT OF BUOY.

5

2

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY MCDERMOTT & CO., INC.

MCD 5011

COMPANY

FIELD

SHEET NO.

SUBJECT

WELL NO.

DATE

DRAWING NO.

COMPUTER

BOGIE WHEEL DESIGN

COMPANY

U.S. ARMY ERD.L

SHEET NO

1 of

SUBJECT

MONO MOUNTING SYSTEM - BOGIE WHEEL LOADS

DRAWING NUMBER

COMPUTER

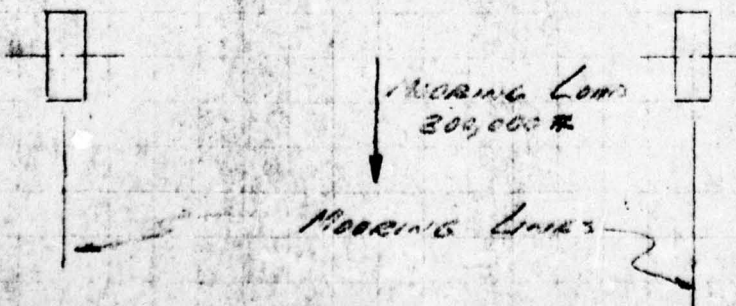
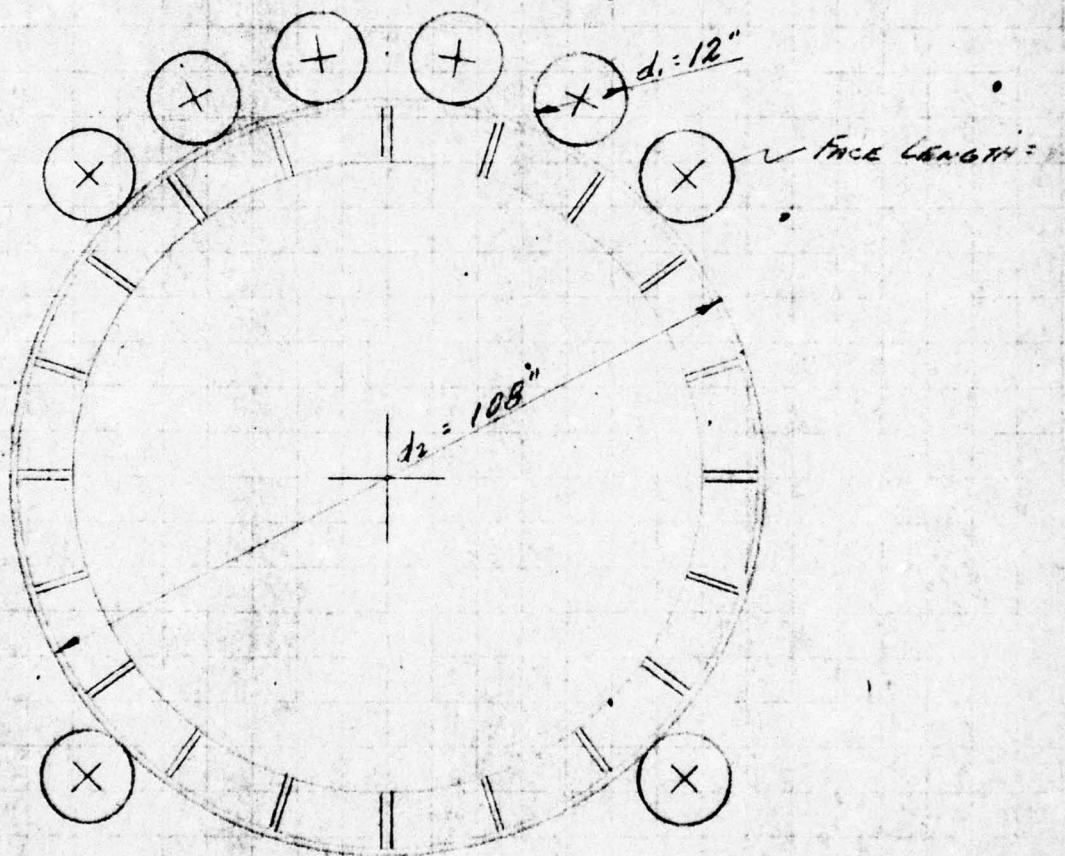
W.R.D.

CHECKED BY

DATE

1-14-65

INNER RACE FOR HORIZONTAL LOAD





PRELIMINARYPRESSURES & AREAS OF CONTACT / BOGIELOAD

TOTAL LOAD = 300,000 #

ACTIVE WHEELS = 6

LOAD/WHEEL =  $\frac{300,000}{6} = 50,000 \#$

formula: -

LOAD CAPACITY PER LIN. INCH OF WHEEL  
(AISC) # 5-19

$$F_p = \left( \frac{F_y - 13,000}{20,000} \right) 660 d$$

AREAS OF CONTACT AND PRESSURES  
(KENT 8-36)

$$s = .591 \sqrt{F_p E \left( \frac{d_1 + d_2}{d_1 \times d_2} \right)}$$

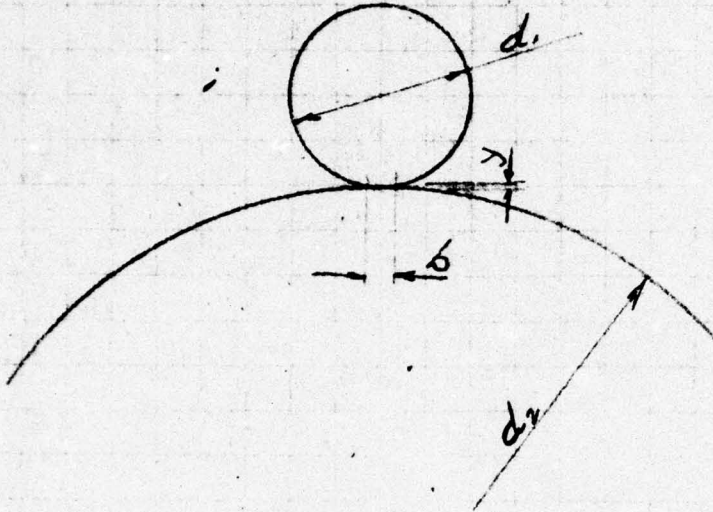
$$b = 2.15 \sqrt{\frac{F_p}{E} \left( \frac{d_1 \times d_2}{d_1 + d_2} \right)}$$

$$v = \frac{2(1-v^2)}{E} \frac{F_p}{\pi} \left( \frac{2}{3} + \log_e \frac{2d_1}{b} + \log_e \frac{2d_2}{b} \right)$$

- $F_y$  = YIELD STRENGTH OF STEEL = 46,000  
 $F_p$  = WHEEL LOAD CAPACITY PER LIN. IN.  
 $s$  = MAX PRESSURE AT CONTACT (WHEEL)  
 $E$  = MODULUS OF ELASTICITY = 30,000,000  
 $v$  = COMBINED DEFORMATION OF BOTH  
 WHEEL & RAIL

ALL FIGURES IN INCHES &amp; POUNDS

COMPANY <i>U.S. ARMY - ERDL</i>		SHEET NO <i>2 of</i>	
SUBJECT <i>MONO MOORING SYSTEM - BOGIE WHEEL LOADS</i>			
DRAWING NUMBER	COMPUTER <i>WJP</i>	CHECKED BY	DATE <i>1-15-65</i>



TOTAL DEFORMATION OF BOTH BODIES

$$y = \frac{2(1-.3^2)}{E} \frac{F_D}{\pi} \left( \frac{2}{3} + 1.08 \frac{2d_1}{b} + \frac{2d_2}{b} \right)$$

$$y = \frac{2(1-.3^2)}{30 \times 10^6} \times \frac{11,100}{3.14} \left( \frac{2}{3} + 1.08 \frac{2 \times 12}{.063} + \frac{2 \times 108}{.063} \right)$$

$$y = .003''$$

LOADS

PRELIMINARYALLOWABLE LOAD PER INCH OF FACE WIDTH OF WHEEL

$$F_p = \left( \frac{F_s - 13,000}{20,000} \right) 660d_1$$

$$F_p = \left( \frac{42,000 - 13,000}{20,000} \right) 660 \times 12 = 11,500 \#$$

FACE WIDTH OF WHEEL

$$W = \frac{\text{LOAD}}{F_p}$$

$$W = \frac{50,000}{11,500} = 4.35" \text{ USE } \underline{4\frac{1}{2}"}$$

$$\underline{\text{ACTUAL } F_p} = \frac{\text{LOAD}}{W}$$

$$\frac{50,000}{4.5} = 11,100 \#$$

MAX. UNIT STRESS @ CONTACT POINT

$$S_c = .591 \sqrt{F_p \times E \left( \frac{d_1 + d_2}{d_1 \times d_2} \right)}$$

$$S_c = .591 \sqrt{11,100 \times 30 \times 10^6 \left( \frac{12 + 108}{12 \times 108} \right)}$$

$$S_c = 103,000 \text{ PSI}$$

CONTACT WIDTH

$$b = 2.15 \sqrt{\frac{F_p}{E} \left( \frac{d_1 \times d_2}{d_1 + d_2} \right)}$$

$$b = 2.15 \sqrt{\frac{11,100}{30 \times 10^6} \left( \frac{12 \times 108}{12 + 108} \right)}$$

$$b = .063"$$

McD 14003

COMPANY	U.S. ARMY - ERDL		SHEET NO	3 of
SUBJECT	MONO MOORING SYSTEM - BOGIE WHEEL LOAD			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WAP		1-18-65	

OUTER RACE FOR VERTICAL LOAD



MAX. UNIT STRESS @ CONTACT POINT

$$S_c = .591 \sqrt{\frac{F E}{d}} = .591 \sqrt{\frac{7200 \times 30 \times 10^6}{12}}$$

$$S_c = 79,000 \text{ PSI}$$

CONTACT WIDTH

$$b = 2.15 \sqrt{\frac{F d}{E}} = 2.15 \sqrt{\frac{7200 \times 12}{30 \times 10^6}}$$

$$b = .115$$

LOAD

PRELIMINARYLOAD

TOTAL VERTICAL LOAD = 195,000\*

USE SAME DIA & WIDTH WHEEL  
AS FOR HORIZONTAL LOAD  
12" DIA X 4" WIDE

 $F_p = 11,500 \text{ #/LIN IN. FROM SHEET 2}$ 
ALLOWABLE LOAD PER WHEEL

$$F = 11,500 \times 4 = 46,000 \text{ #}$$

NO WHEELS REQD.

$$N = \frac{195,000}{F} = \frac{195,000}{46,000} = 4.24$$

USE MIN 5 WHEELS  
DESIGN IN PAIRS, USE 6 WHEELS

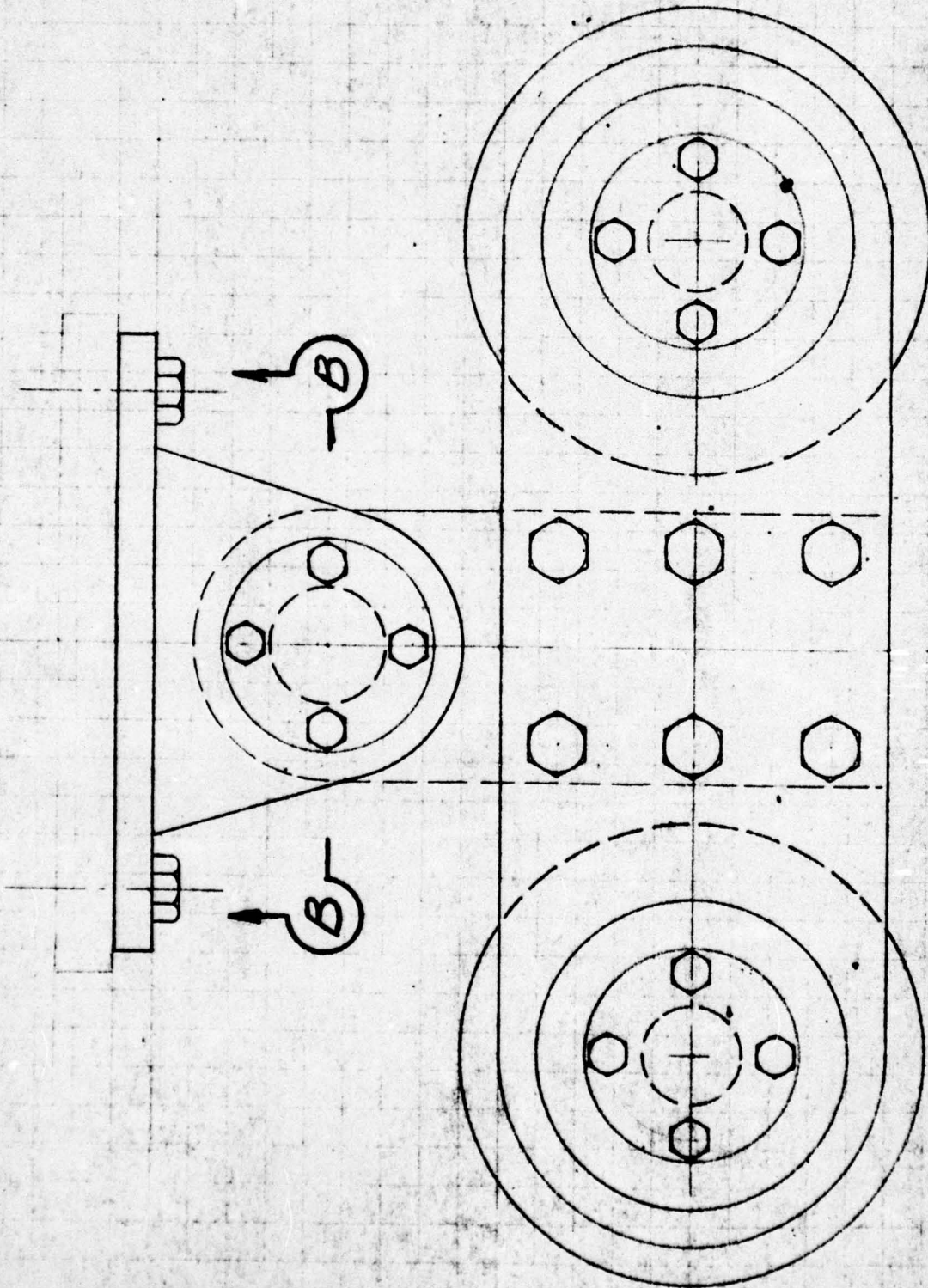
LOAD PER WHEEL

$$\text{LOAD} = \frac{195,000}{6} = 32,500 \text{ #}$$

ACTUAL  $F_p$  =

$$\frac{\text{LOAD}}{N} = \frac{32,500}{4.5} = 7,200 \text{ #/"}$$

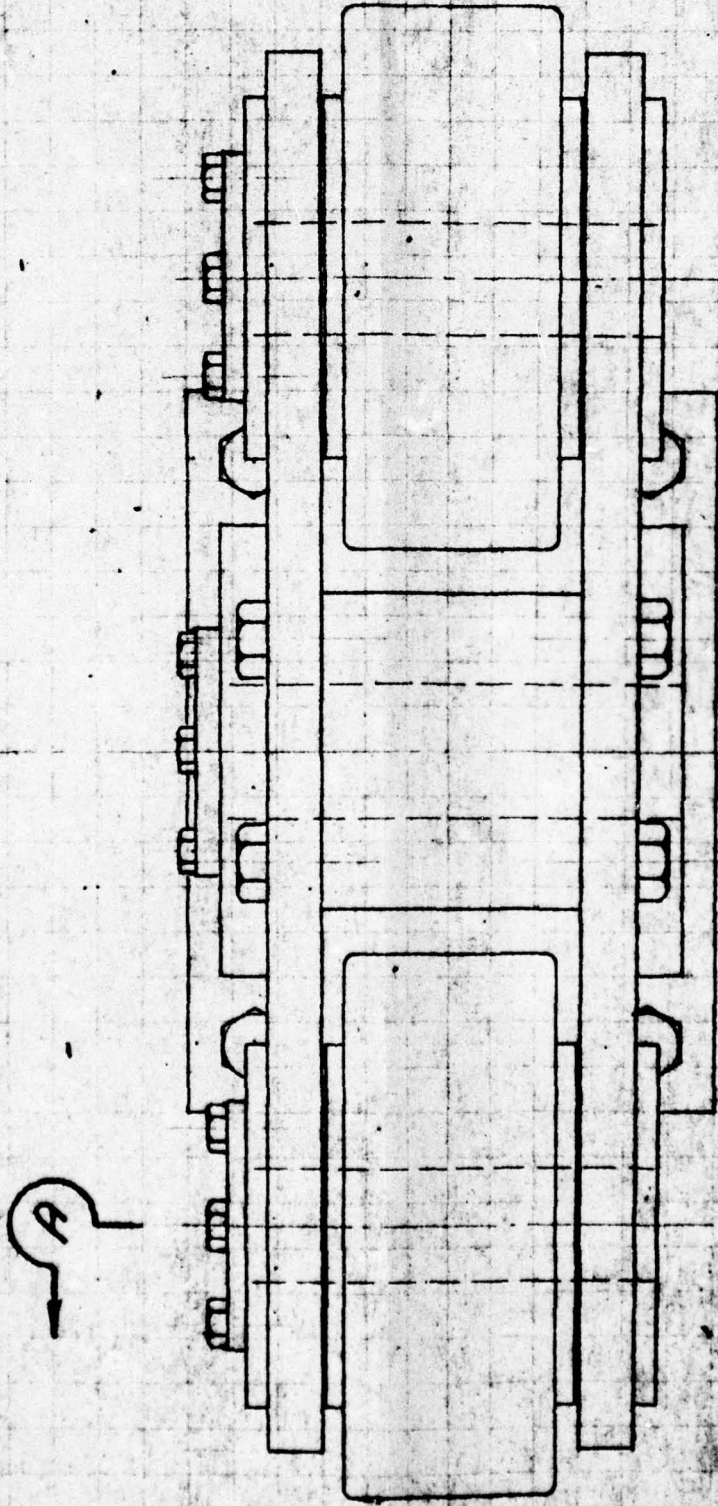
COMPANY	U.S. Army - ERDL		SHEET NO	4 of
SUBJECT	MONO-MOORING SYSTEM - BOGIE DESIGN			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WAP		1-21-65	



PLAN

PRELIMINARY

PLAN

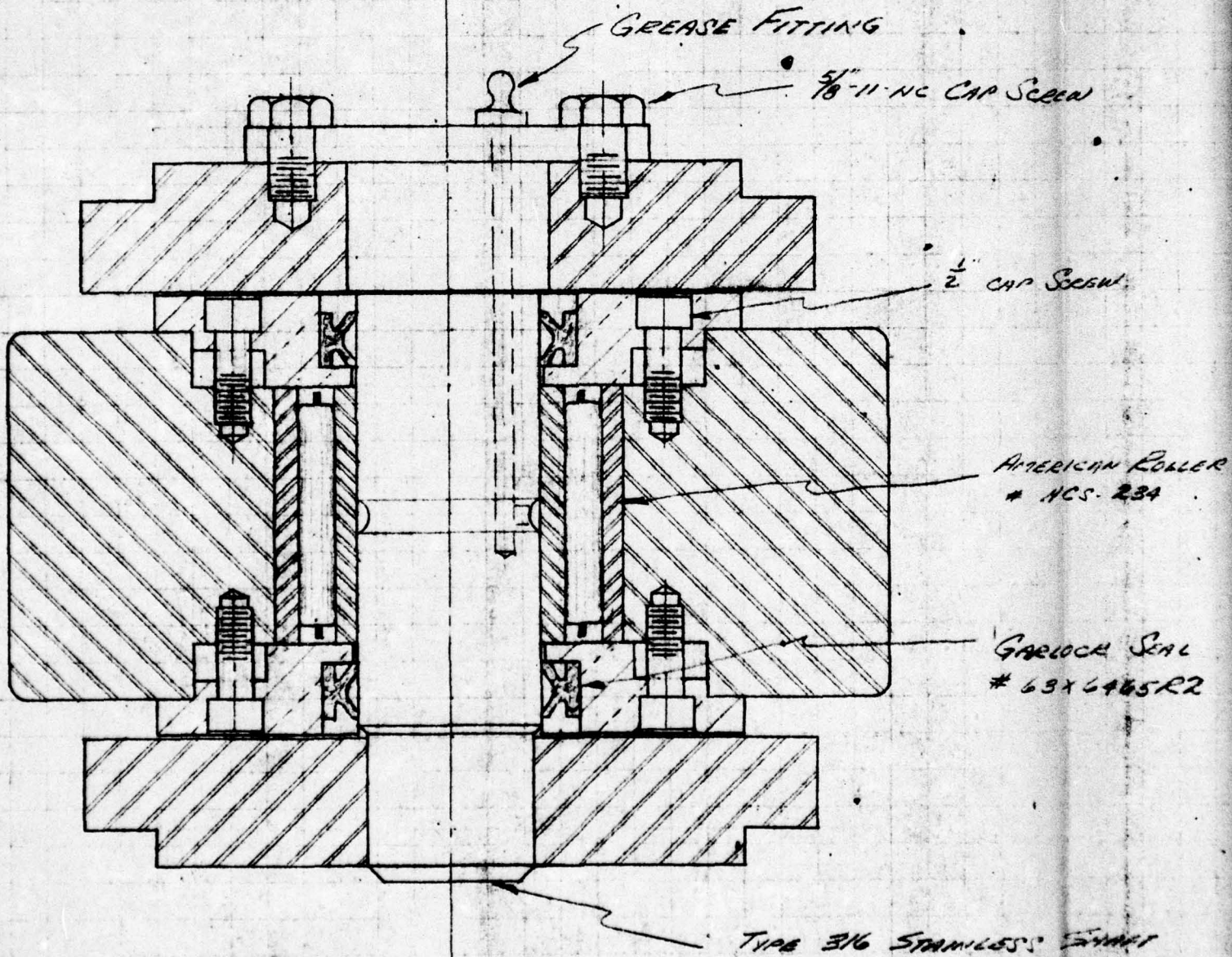


ELEVATION



P

COMPANY	U.S. ARMY - ERDL		SHEET NO	5 of
SUBJECT	MONO MOORING SYSTEM - BOGIE DESIGN			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
		WAP	1-21-65	



SECTION A-A

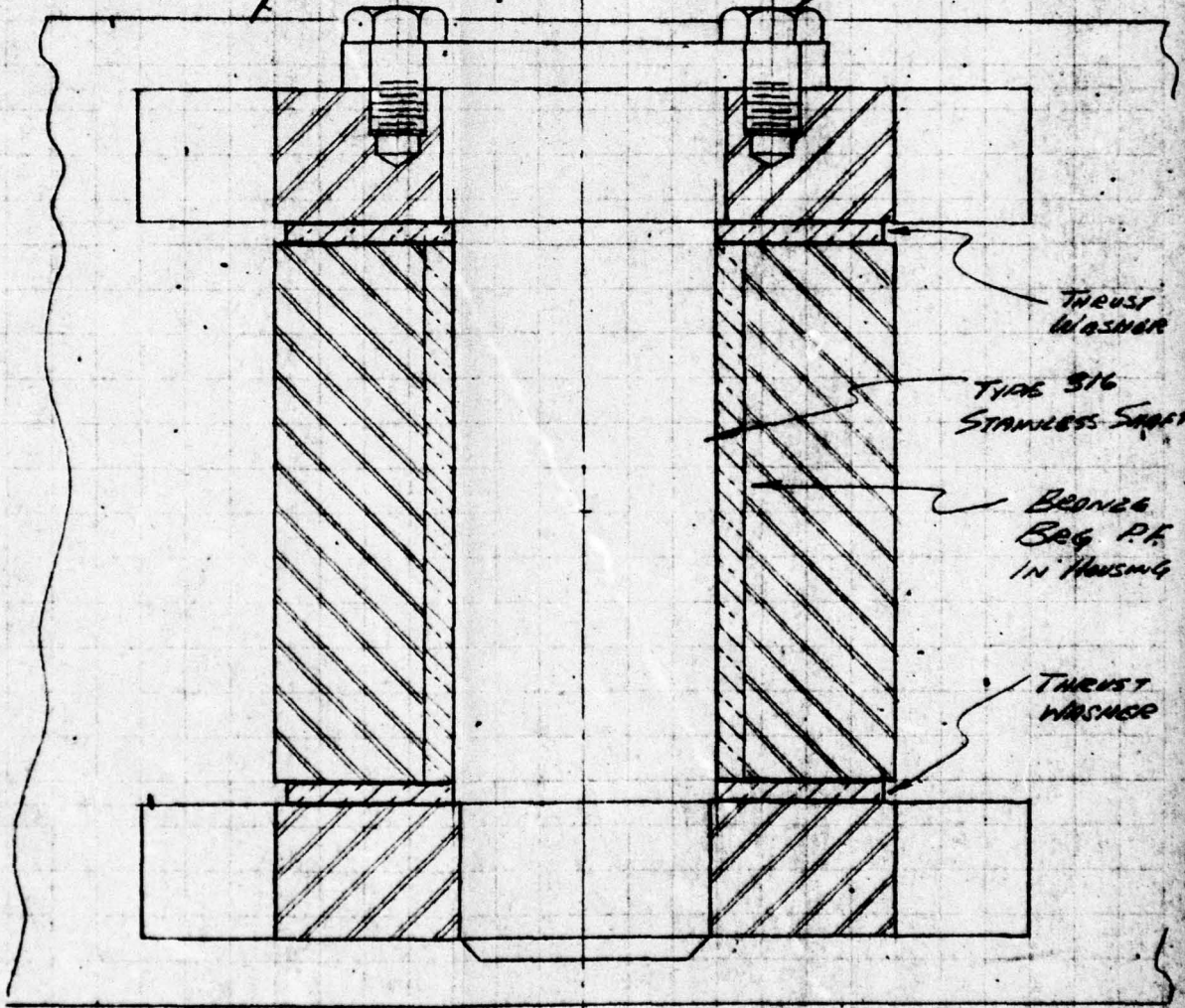


56017

PRELIMINARY

FEMALE  
CLEVIS

7/8-11-NC Cap Screw



THRUST  
WASHER

TYPE 316  
STAINLESS SHAFT

BRONZE  
Brg. Pk.  
in Housing

THRUST  
WASHER

SECTION B-B

2

SEEN

NO SEEN

AMERICAN ROLLER BRG  
# NCS-234

GARLOCK SEAL  
# 63X6465R2

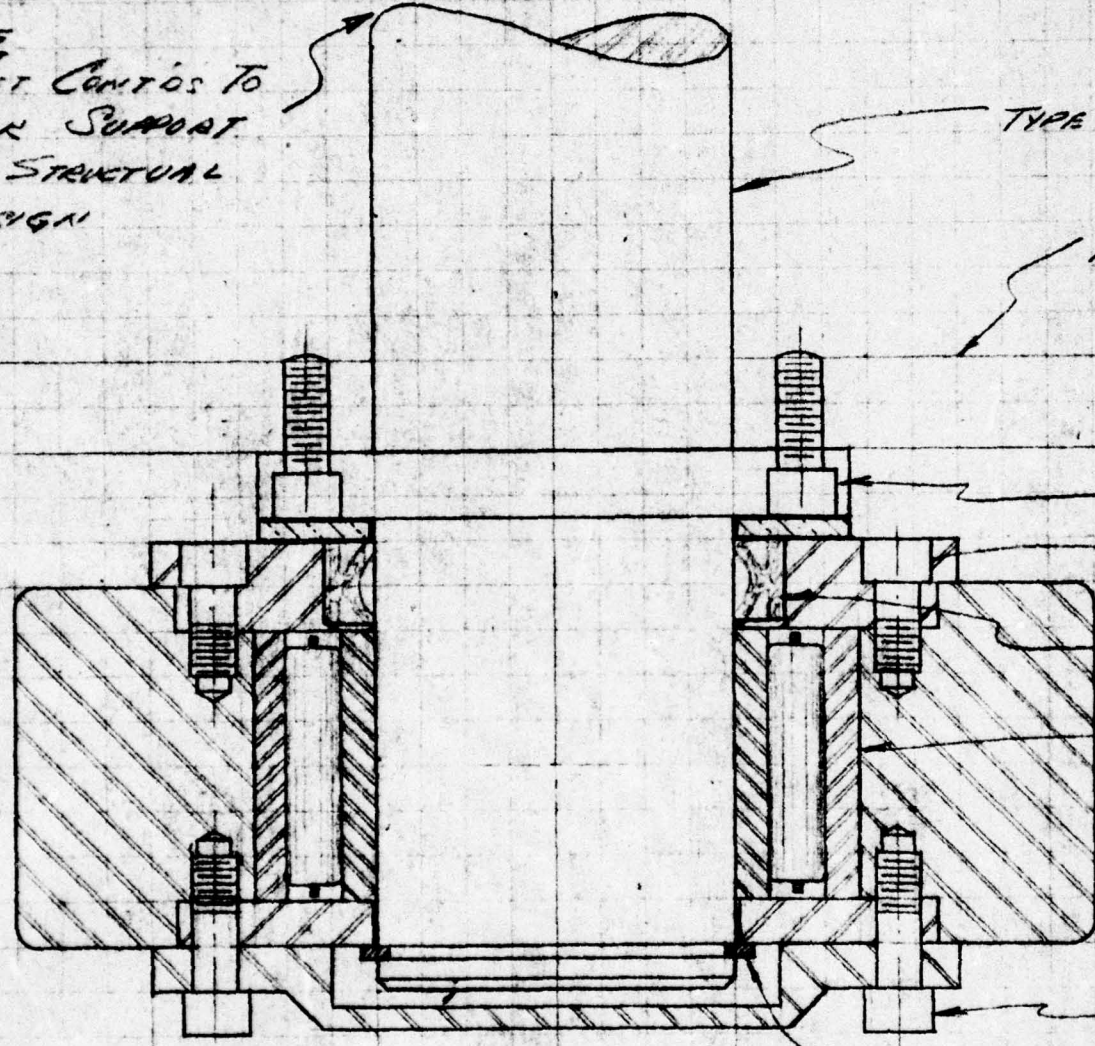
NO SEEN

MCD 14003

COMPANY	U.S. ARMY - ERDL		SHEET NO	6 of
SUBJECT	MONO MOORING SYSTEM - BOGIE DESIGN			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	

NOTE

SHAFT CONT'D TO  
BACK SUPPORT  
PER STRUCTURAL  
DESIGN



TYPE 316 STAINLESS S

ROTATING DECK

5/16" CAR SCREW

1/2" CAP S

GARLOCK # 53X755

AMERICAN # ACS-2

1/2" CAP SCREW

TEVARC RETAINING RING # 5100-400

OUTER RACE BOGIE WHEEL

for VERTICAL FORCES

PRELIMINARY

STAINLESS SHAFT

ATING DECK STRUCTURE

5/16" CAP SCREW

1/2" CAP SCREW

GARLOCK SEAL  
# 53X7559R2

AMERICAN ROLLER BAG  
# ACS-271

1/2" CAP SCREW

STAINING RING

REC

COMPANY  
USA ERDL

SHEET NO  
9

SUBJECT  
MOND-MOORING SYSTEM

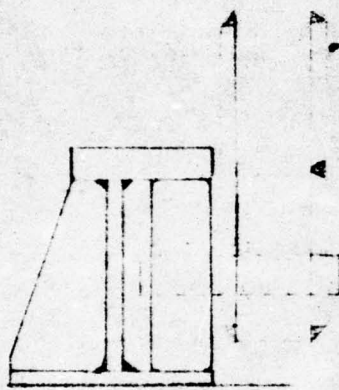
JOB NO  
56017

PROJECT  
A. C. R. E. S.

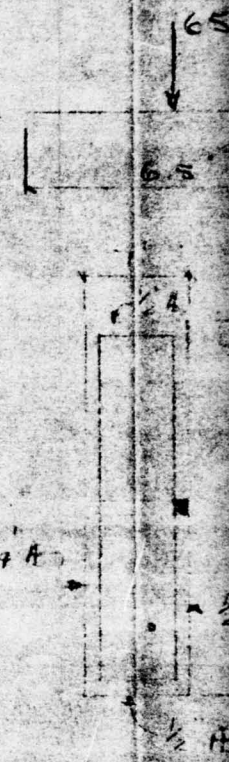
DATE  
7/21/65

PRELIMINARY DESIGN OF SUPPORT FOR OILER-  
FACE BOSIE WHEELS

CONSIDER



1625



CHECK PIN & SHEAR



$$A = 325(3) = 975 \checkmark$$

$$S = 12 \text{ } \checkmark \text{ for } 70,000 \text{ tensile}$$

$$B = 163 + 325 = 488 \checkmark$$

TRY 3/4" PIN

$$d = \sqrt[3]{\frac{M}{.098 \times S}}$$

$$M = 325(5) = 1625 \text{ } \checkmark \text{ } < 1011 \text{ O.K.}$$

$$d = \sqrt[3]{\frac{1625}{.098 \times 12}}$$

THICKNESS OF PLATE

$$d = 4.3 \text{ } \checkmark \text{ pin}$$

$$t = \frac{488}{104} = 4.7 \text{ } \checkmark \text{ use } 5 \text{ } \checkmark \text{ } 1/4 \text{ } \checkmark \text{ } 1/2$$

$$t = \frac{13}{5 \times 4} = \frac{4818}{12 \times 4.3} = .945 \text{ } \checkmark$$

NOTE: PL

CONSIDER BENDING IN THE GIRDER

65k

$$\text{MAX } M = 3(65)(6.5) = 1270 \text{ in}^k$$

DETERMINE MOMENT OF INERTIA

$$I = \frac{2023}{12} = 7097$$

$$= \frac{55(21.5)^3}{12} = 4555$$

$$I = 2542 \text{ in}^4$$

$$f = \frac{Mc}{I} = \frac{1270(11.5)}{2542} = 575 \text{ ksi}$$

$$I = \frac{11(21)^3}{12} = 7097$$

$$= \frac{575(22)^3}{12} = 5102$$

$$I = 1995 \text{ in}^4$$

$$f = \frac{Mc}{I} = \frac{1270(11.5)}{1995} = 281 \text{ ksi } 2.1k$$

NOTE: PUT STIFFENERS NEAR PIN LOCATION TO DISTRIBUTE SHEAR

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY MCDERMOTT & CO., INC.

CD 5011

COMPANY

FIELD

SHEET NO.

SUBJECT

WELL NO.

DATE

ENGINEERING NO.

COMPUTER

BUOY SYSTEMS

COMPANY <b>U.S. ARMY - ERDL</b>		SHEET NO.	
PROJECT <b>Mobile Manpower System - Derrick Hoist &amp; Arch</b>			
NUMBER <b>J.O. 56017</b>	COMPUTER <b>WJP</b>	CHECKED BY	DATE <b>5-4-65</b>

AIR IS HYDRAULIC

**AIR**

**IR. \* K60**

<b>SPACE REQUIREMENT</b> (Prime Mover & Assembly) (HOIST)		<b>46 1/2" x 31 1/2" x 86"</b>
<b>WEIGHT</b> (Prime Mover & Assembly) DRY (HOIST)		<b>5000*</b>
(HYDRAULIC FLUID)		<b>1315*</b>
		<b>NONE</b>
<b>HOIST CAPACITY</b> (LINE FULL)		<b>10,700* w/200' cable</b>
(DRUM CAP.) 3/4 CABLE		<b>200 FT for Rating (40' dia)</b>
(LINE SPEED) 1/2 MIN		<b>65' / MIN.</b>
(PRESSURE & GPM)		<b>125 PSI &amp; 50 cfm</b>
(H.P. REQ'D)		
<b>BRAKE CAPACITY</b>		
<b>CONTROLS</b>		<b>MANUAL VALVE IN REAR</b>
<b>FLOW LINES</b> (SUPPLY)		<b>1 1/2" IPS</b>
(RETURN)		<b>NONE</b>
<b>CLEANLINESS REQUIREMENTS</b>		<b>FILTER ON COMP. INTAKE</b>
<b>SYSTEM COMPLEXITY</b>		<b>SINGLE LINE SYSTEM HI FLOW LUBRICATOR</b>
<b>FLEXIBILITY &amp; RELIABILITY</b>		<b>IMMEDIATE RESPONSE EXT. CABLE SUPPORT TO L</b>

**HYDRAULIC SYSTEM**

**HYDRAULIC**

K6U

**MARCO #H0960**

**GEAROMATIC #22S**

31 1/2" x 36" H.

36" L. x 33" W. x 28 3/4" H.

31 1/4" L. x 23 1/2" W. x 21 1/4" H.

1000 #

3600 #

15 #

1000 #

15 #

130 GAL @ 2.5 % = 475 #

200 GAL @ 7.5 % = 1500 #

1/2" x 100' CURR  
for RETURN (4.0' DIA)  
P.A.N.

(1500 PSI MAX)  
14,800 # Base Drum  
19,000 # Full Drum

(1500 PSI)  
16,500 #  
9,100 #

825 #  
(1900 PSI MAX)  
22,000 # Base Drum  
12,700 # Full Drum

150 PSI @ 30 CFM

88 GPM 200 FT  
50 / MIN  
70 / MIN  
46 GPM  
57 / MIN Base D.  
123 / MIN Full D.

46 GPM  
40 / MIN  
72 / MIN  
1500 PSI @ 46 GPM

212 FT  
55 GPM  
60 / MIN Base D.  
104 / MIN Full D.  
1900 PSI @ 65 GPM

1500 PSI @ 46 GPM  
54 HP

1500 PSI @ 46 GPM  
54 HP

59 HP

15,000 # Line Pull  
MEAN DRUM CAP.

LINE INTEGRAL

MANUAL 4 WAY - 3 POSITION  
PRESSURE REGULATING CONTROLS

MANUAL 4 WAY - 3 POSITION  
PRESSURE REGULATING CONTROLS

150 PSI

1 1/2" IPS  
1 1/4" IPS

1 1/2" IPS  
1 1/4" IPS

COMP. AIR

25 MICRON FILTER

25 MICRON FILTER

LINE SYSTEM  
LUBRICATOR

SUPPLY & RETURN LINES  
PRESSURE CONTROLS

SUPPLY & RETURN LINES  
PRESSURE CONTROLS

RESPONSE  
DESIGNED FOR MARINE  
SERVICE

IMMEDIATE RESPONSE  
DESIGNED FOR MARINE  
SERVICE

IMMEDIATE RESPONSE  
USED FOR PRESSURE OIL INDUST.



COMPANY	U.S. ARMY - ERDL			SHEET NO
SUBJECT	Mono Mooring System - Derrick Hoist & Machinery			
PROJECT NUMBER	COMPUTER	CHECKED BY	DATE	
J.O. 56017	WAP		5-4-65	

AIR VS HYDRAULIC S

HOIST FINISH	AIR
OTHER UNITS TO POWER	IR * KGU
	DEMOUNT SMC. CASE
	NONE

COST - (PRIME MOVER & POWER UNIT)  
(HOIST)  
(HYDRAULIC FLUID)

18,791<sup>00</sup> job  
NONE  
C. 1206 Ch. 107 P. 90

MACHINERY

HYDRAULIC SYSTEM (Contd)

HYDRAULIC

60

5.5. CASE

VE

MARCO # W0960

GALV. W/ 5.5. FASTNERS

POSSIBLE AIR COMPRESSOR

GEARMATIC 225

DETENT COAT SPEC ORDER

POSSIBLE AIR COMPRESSOR

CONTROL CABO  
1.7.790

9,350<sup>00</sup> LOSS CONTROL  
CABINET

6454<sup>00</sup> Job Ohio  
2900<sup>00</sup> Job Seattle  
75<sup>00</sup>/100 GAL

(14,791<sup>00</sup> INC CONTROL  
CHAIN  
75<sup>00</sup>/100 GAL

2

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY MCDERMOTT & Co., INC.

MCD 5011

COMPANY

U.S. ARMY ERDL

FIELD

SHEET NO.

SUBJECT

Mono Mooring System -

WELL NO.

DATE

1 of  
8/5/65

DRAWING NO.

10.56017 - ENG. LOAD ON BOLTS @ LAUNCHING

COMPUTER

WAP

CONDITIONS: ENGINE G.M. TYPE 371 HE Ceclad  
 Dry Wt Approx 1800#  
 G.G. ABOVE MOUNTS Approx 19"  
 DISTANCE B/TW. MOUNTS 24" center  
 TOTAL BOLTING 6 - 1/2" φ  
 LAUNCH IMPACT Assume 5g

$$1800 \times 5 = 9000 \# \text{ LOAD @ LAUNCH ON BOLTS}$$

$$\text{SHEAR/BOLT} = \frac{9000}{6} = 1500 \#$$

$$\text{MOMENT} = 9000 \times 19 = 171,000 \text{ " \#}$$

$$\text{TENSION IN BOLTING} = \frac{171,000}{24} = 7120 \#$$

$$\text{LOAD/TENSION/BOLT} = \frac{7120}{3} = 2370 \#$$

1/2" BOLT IN SHEAR ALLOWABLE 2.6 K

1/2" BOLT IN TENSION ALLOWABLE 4 K

NOTE:

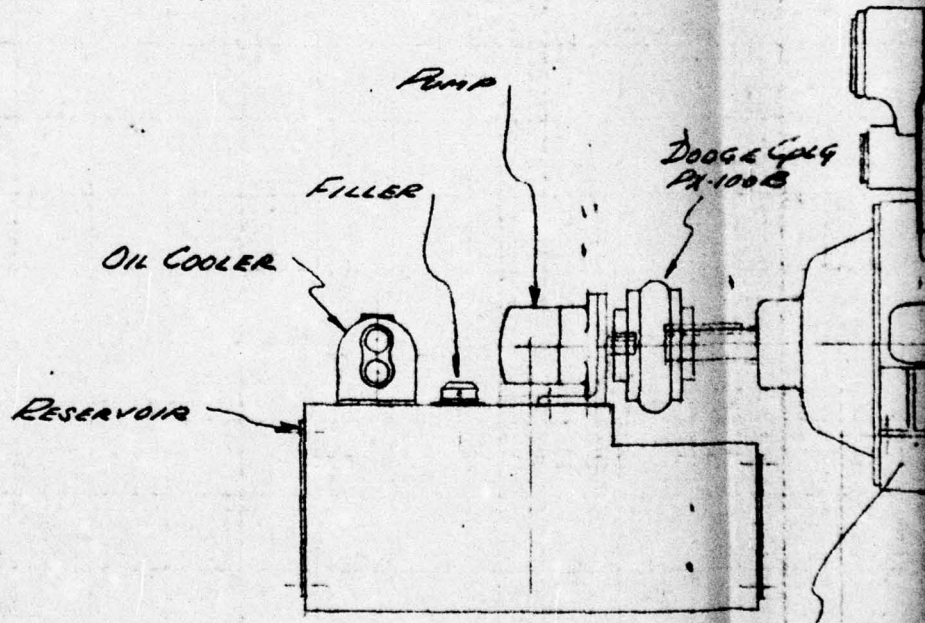
WHILE BOLTING IS ADEQUATE TO HOLD ENGINE ON FOUNDATION DURING BOY LAUNCHING THE ENGINE MFG. ADVISERS THAT MOUNTS & FRAME ARE OF CAST IRON AND ADVISE THAT LATERAL BRACING FROM ENGINE LIFTING BOLTS TO BOY OVERHEAD SHOULD BE INSTALLED TO RELIEVE LOAD FROM CAST FRAME WORK, A FRACTURE IN THE FRAME WOULD REQUIRE REBUILDING THE ENGINE INSIDE THE BOY WHICH COULD BE DIFFICULT.

ENGINEERING DEPARTMENT  
COMPUTATION SHEET

MCD 8036

J. RAY MCDERMOTT & CO., INC.

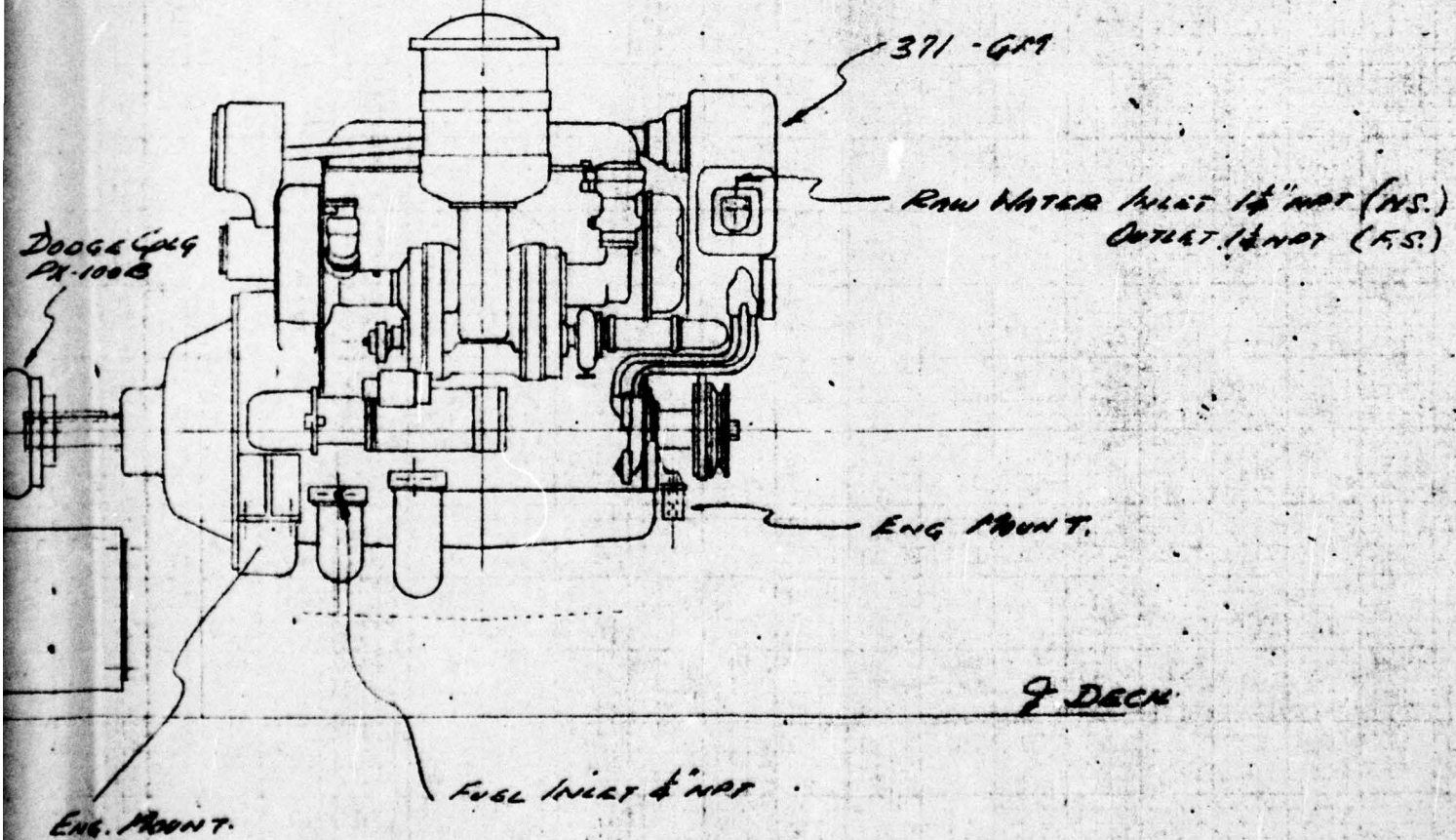
COMPANY	U.S. Army - ERDL		SHEET NO.	1 of
SUBJECT	MONO MOORING SYSTEM - HYDRAULIC PUMPING UNIT			
PROJECT NUMBER	COMPUTER	CHECKED BY	DATE	
J.O. 56017	MAP		6-2-65	



ENG. MOUNT.

E

ENG UNIT



ELEVATION

N.T.S.

COMPANY U.S. ARMY - ERDL.

SHEET NO 2 of

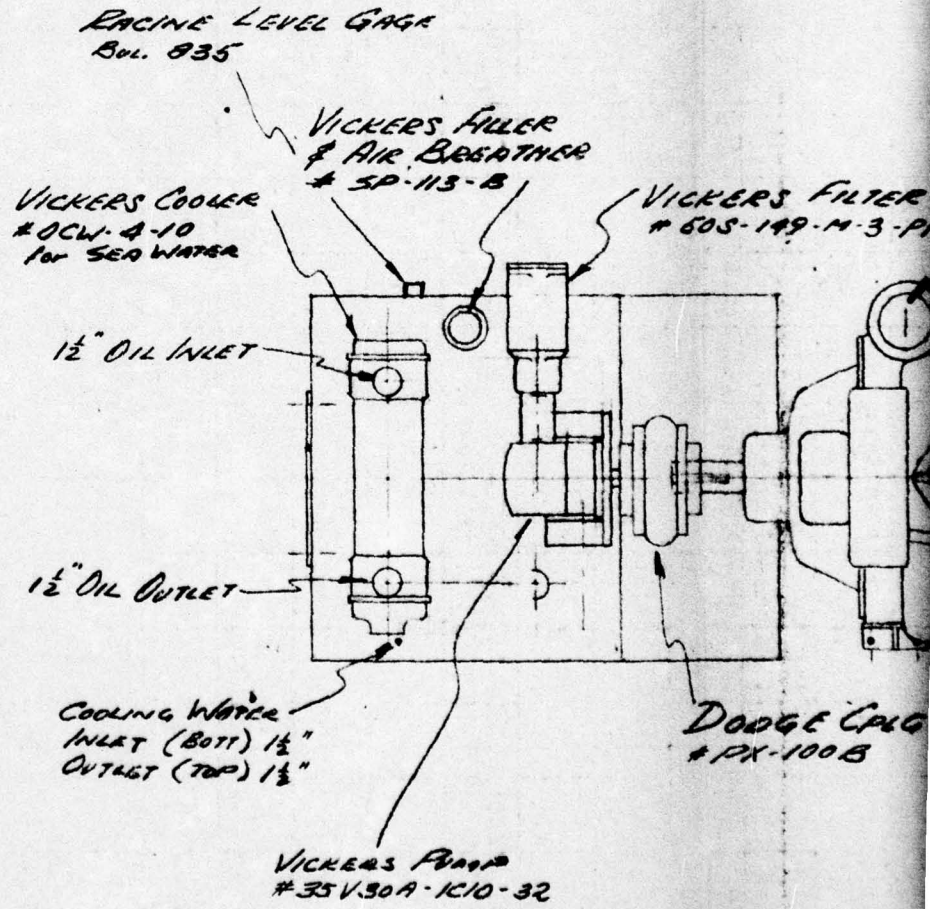
SUBJECT Mono Mooring System - Hydraulic Pumping Unit

DRAWING NUMBER J.O. 56017

COMPUTER NAF

CHECKED BY

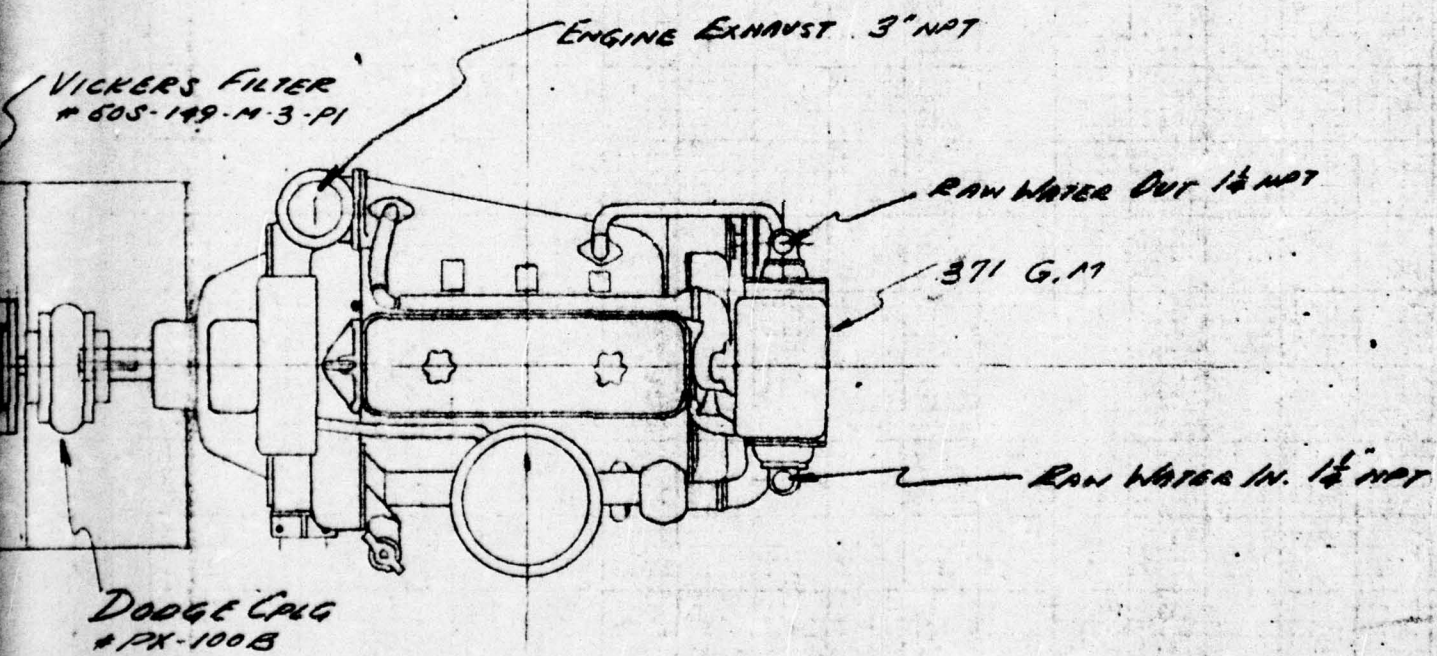
DATE 6-3-65



PLA

N.T.S.

Unit  
5



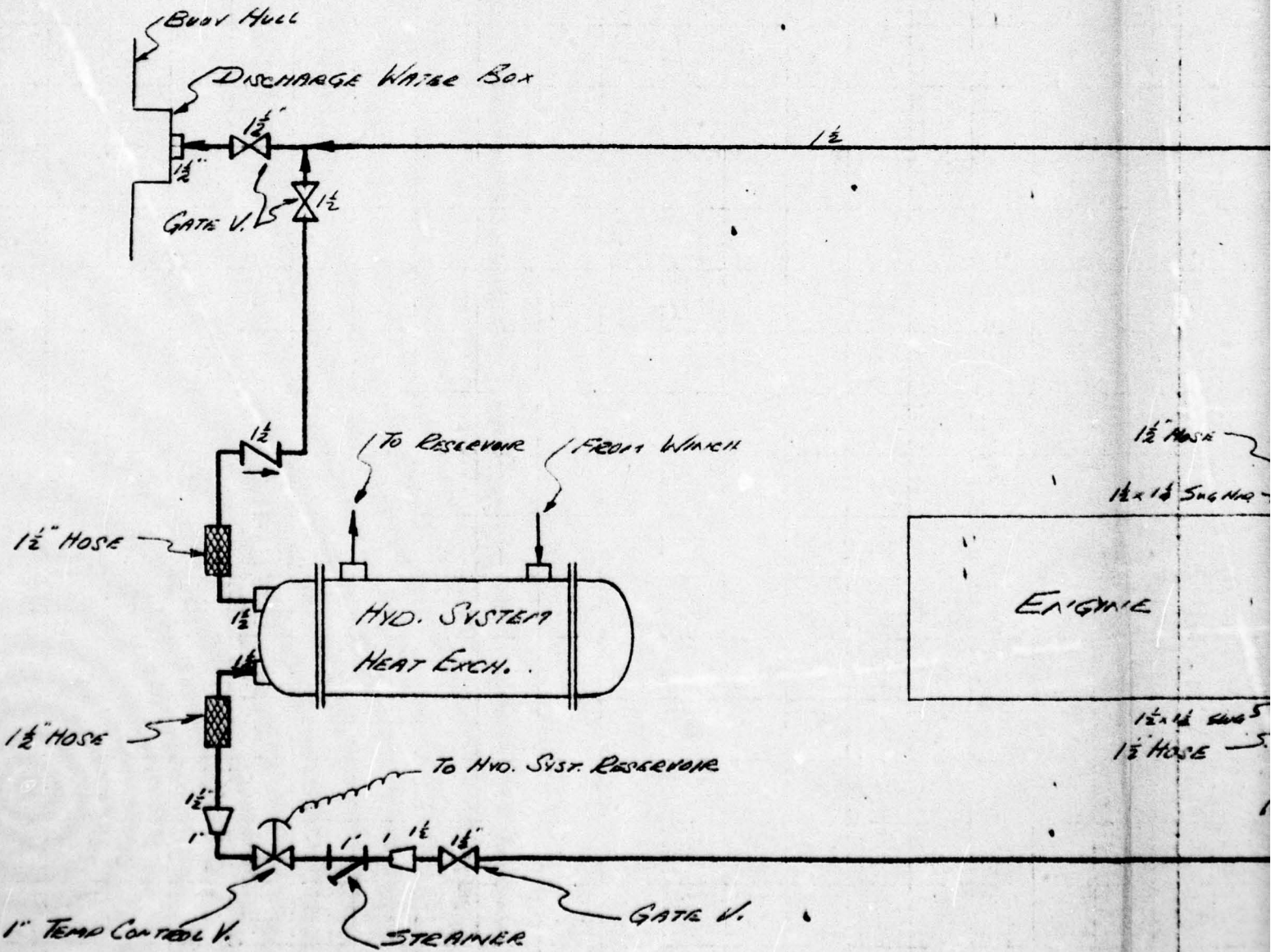
PLAN

N.T.S.

2

COMPANY	U.S. ARMY - E.R.D.L.	SHEET NO.	1 of
SUBJECT	MONO. MOORING SYSTEM - PIPING SYSTEMS - COOLING WATER		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
JO. 56017	WAP		7-20-65

# HEAT EXCHANGER RAN





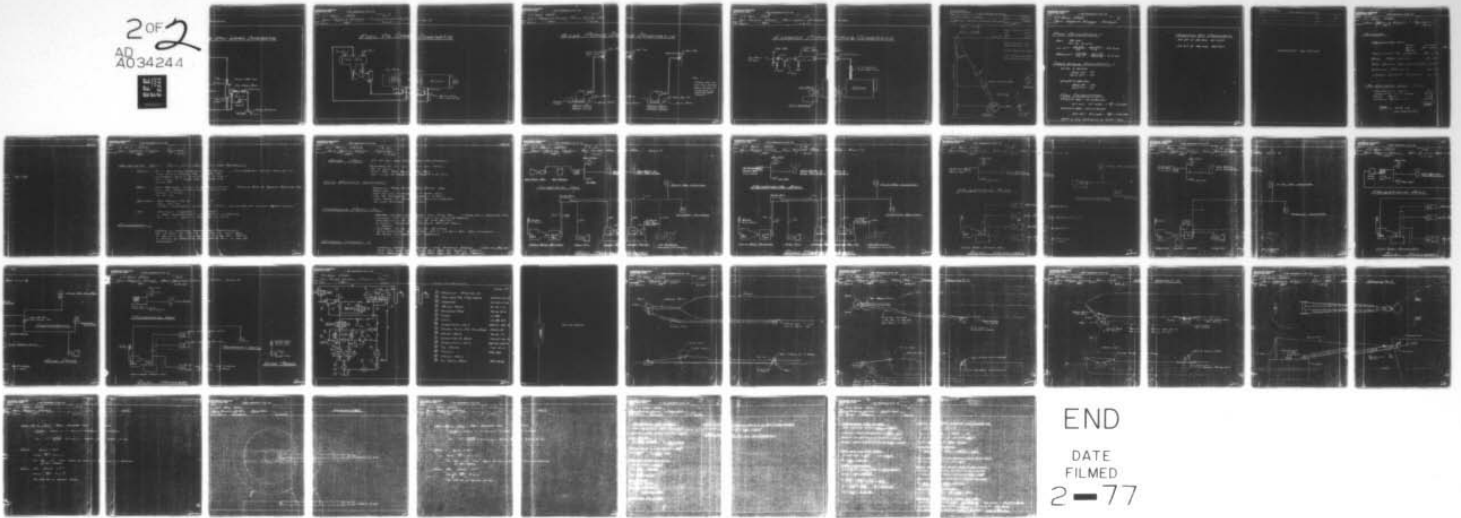
AD-A034 244

MCDERMOTT (J RAY) CO INC NEW ORLEANS LA  
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 3. --ETC(U)  
1966

F/6 13/10  
DA-44-009-AMC-841(T)  
NL

UNCLASSIFIED

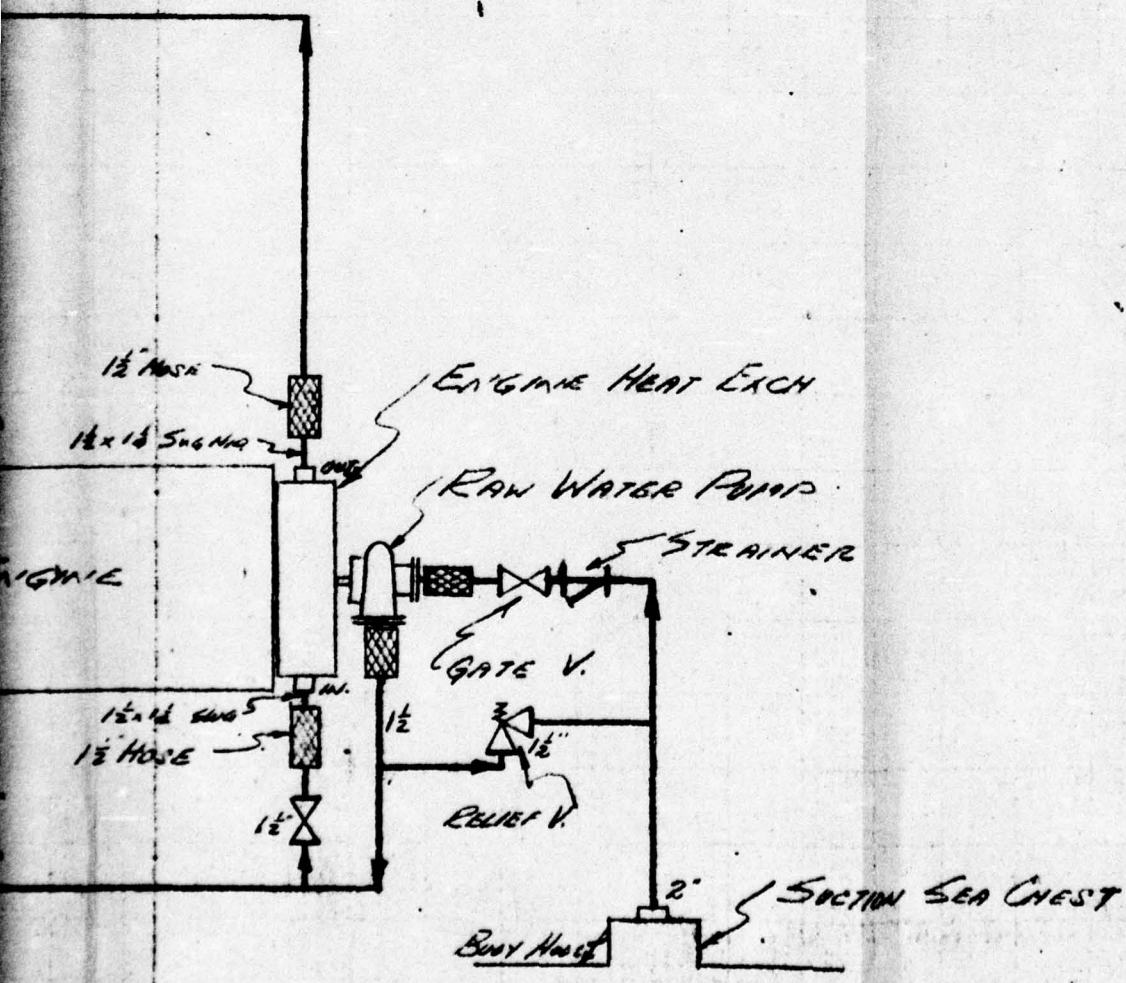
2 OF 2  
AD A034244  
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DATE  
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2-77

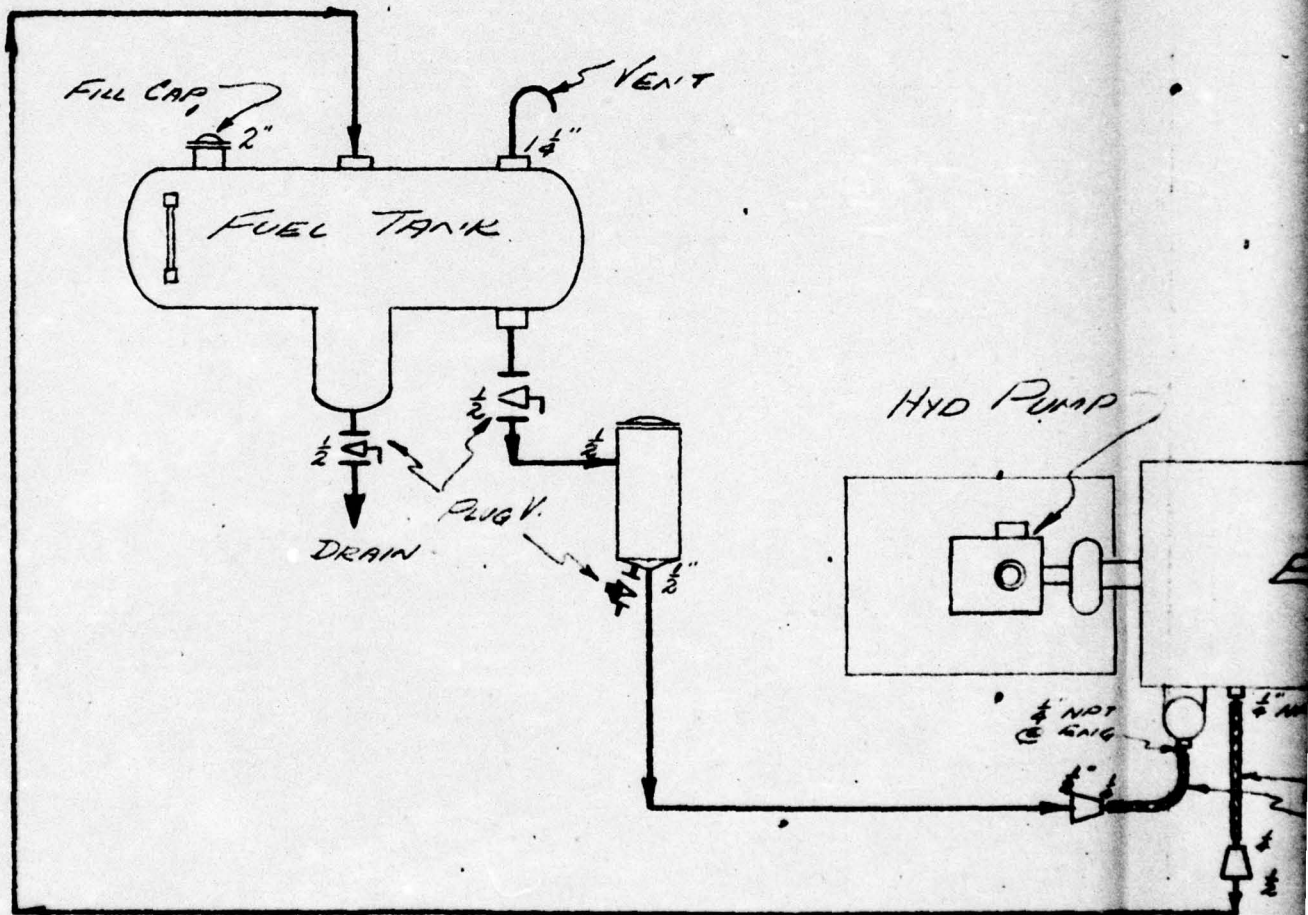
COOLING WATER

# RAW WATER SCHEMATIC



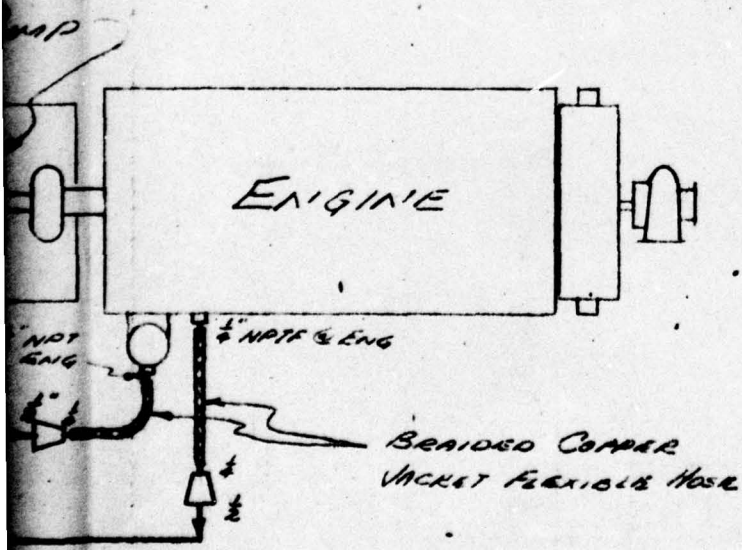
COMPANY <i>U.S. ARMY - ERDL</i>	SHEET NO. <i>2 of</i>		
SUBJECT <i>MONO MOORING SYSTEM - PIPING SYSTEMS - FUEL OIL</i>			
DRAWING NUMBER <i>JO. 56017</i>	COMPUTER <i>WAP</i>	CHECKED BY	DATE <i>7-70-65</i>

# FUEL OIL SCHE



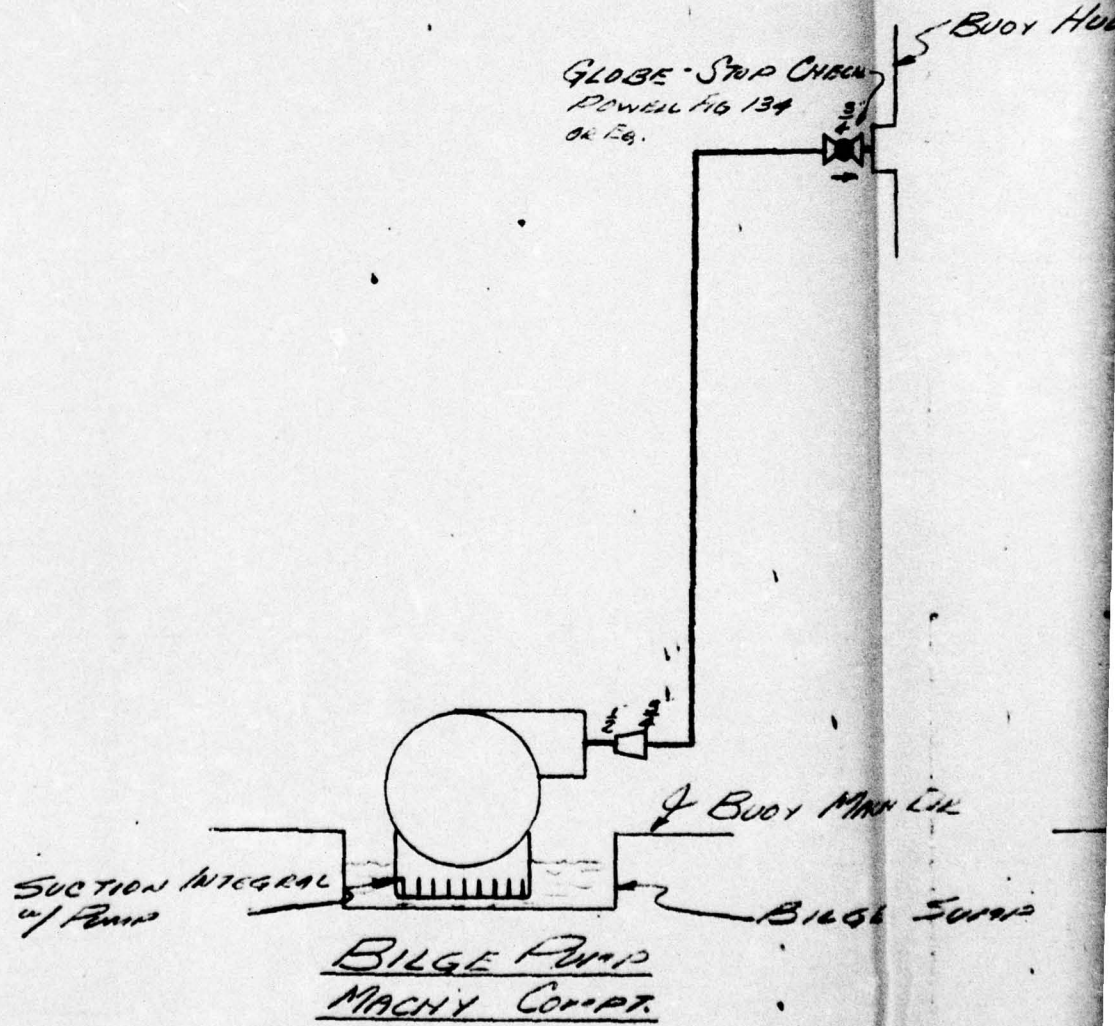
S - FUEL OIL

# SCHEMATIC



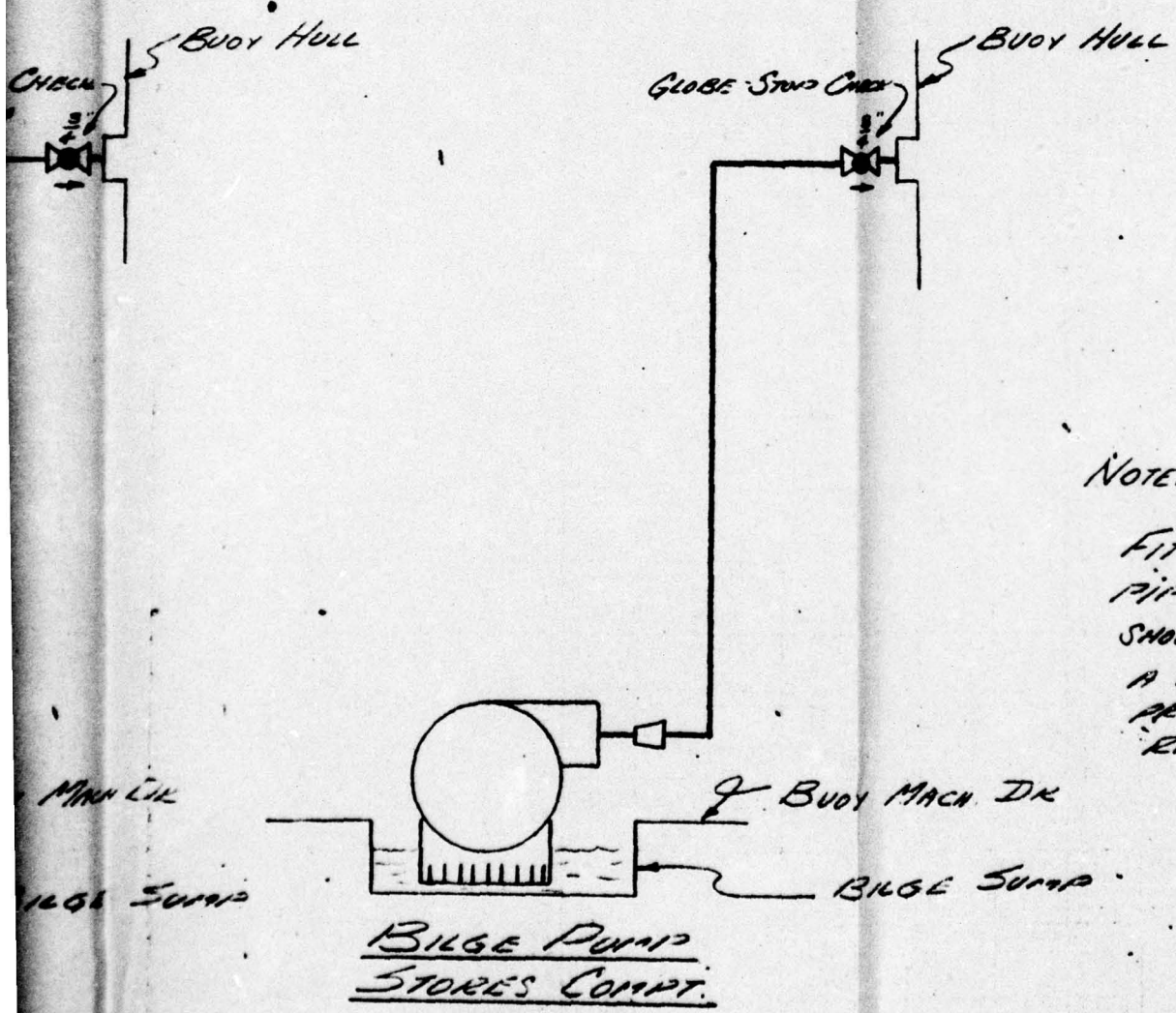
COMPANY U.S. Army - ERDL	SHEET NO 3 of		
SUBJECT MONO MOORING SYSTEM PIPING SYSTEMS - BILGE			
DRAWING NUMBER NO. 56017	COMPUTER WAF	CHECKED BY	DATE 7-21-65

# BILGE PIPING SC.



BILGE

# ING SCHEMATIC



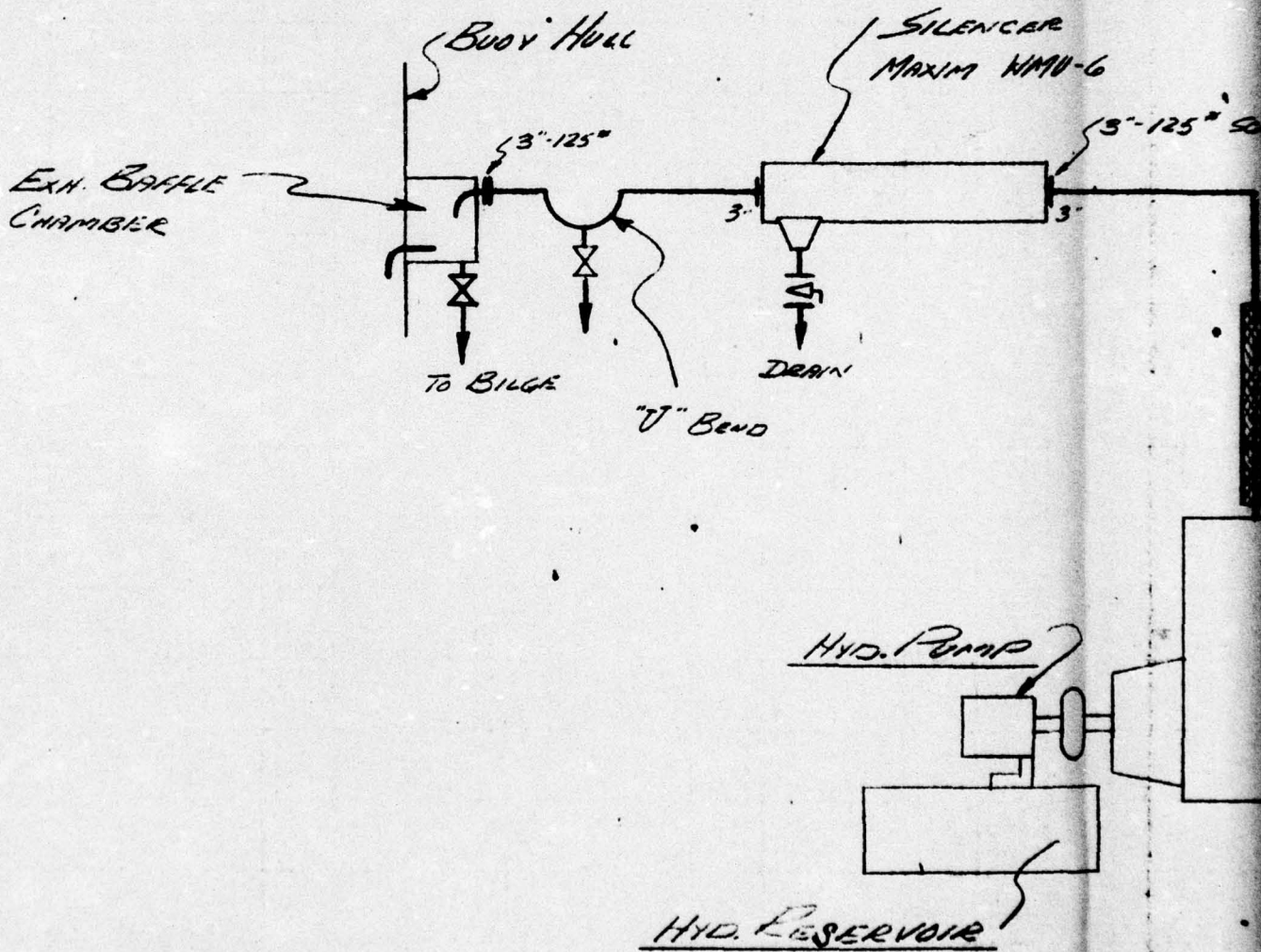
NOTE: -

FITTINGS USED TO  
PIPE THIS SYSTEM  
SHOULD BE KEPT TO  
A MINIMUM FOR  
PRESSURE DROP  
REASONS.

2

COMPANY <i>U.S. Army - ERDL</i>	SHEET NO <i>4 of</i>		
SUBJECT <i>MONO MOORING SYSTEM - PIPING SYSTEMS - ENG. EXHAUST</i>			
DRAWING NUMBER <i>JO. 56017</i>	COMPUTER <i>WAP</i>	CHECKED BY	DATE <i>7-21-65</i>

# EXHAUST PIPING

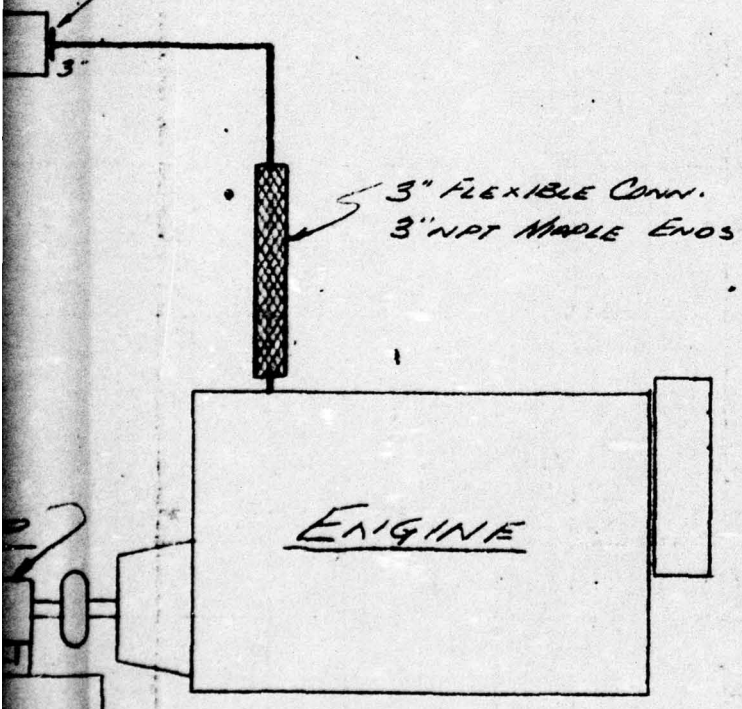


EXHAUST

# PIPING SCHEMATIC

MMU-6

3"-125" SCR PIG (TIP)





COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY MCDERMOTT & CO., INC.

MCD 5011

COMPANY

U.S. ARMY ERDL

FIELD

SHEET NO.

141

SUBJECT

DIESEL ENGINE EXHAUST LOCATION

WELL NO.

DATE

11/30/65

DRAWING NO.

COMPUTER

WAT

$$O-X = 5-6\frac{3}{8}"$$

$$O-Y = 9'-4\frac{15}{16}"$$

$$O \text{ to } a = 180" - .09" = 179.91"$$

$$a \text{ to } c = 49.66"$$

$$c \text{ to } e = 5.87"$$

$$\angle = 27^{\circ}-52'-30"$$

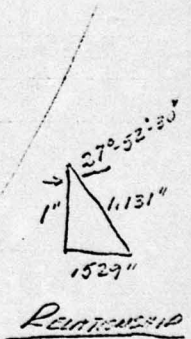
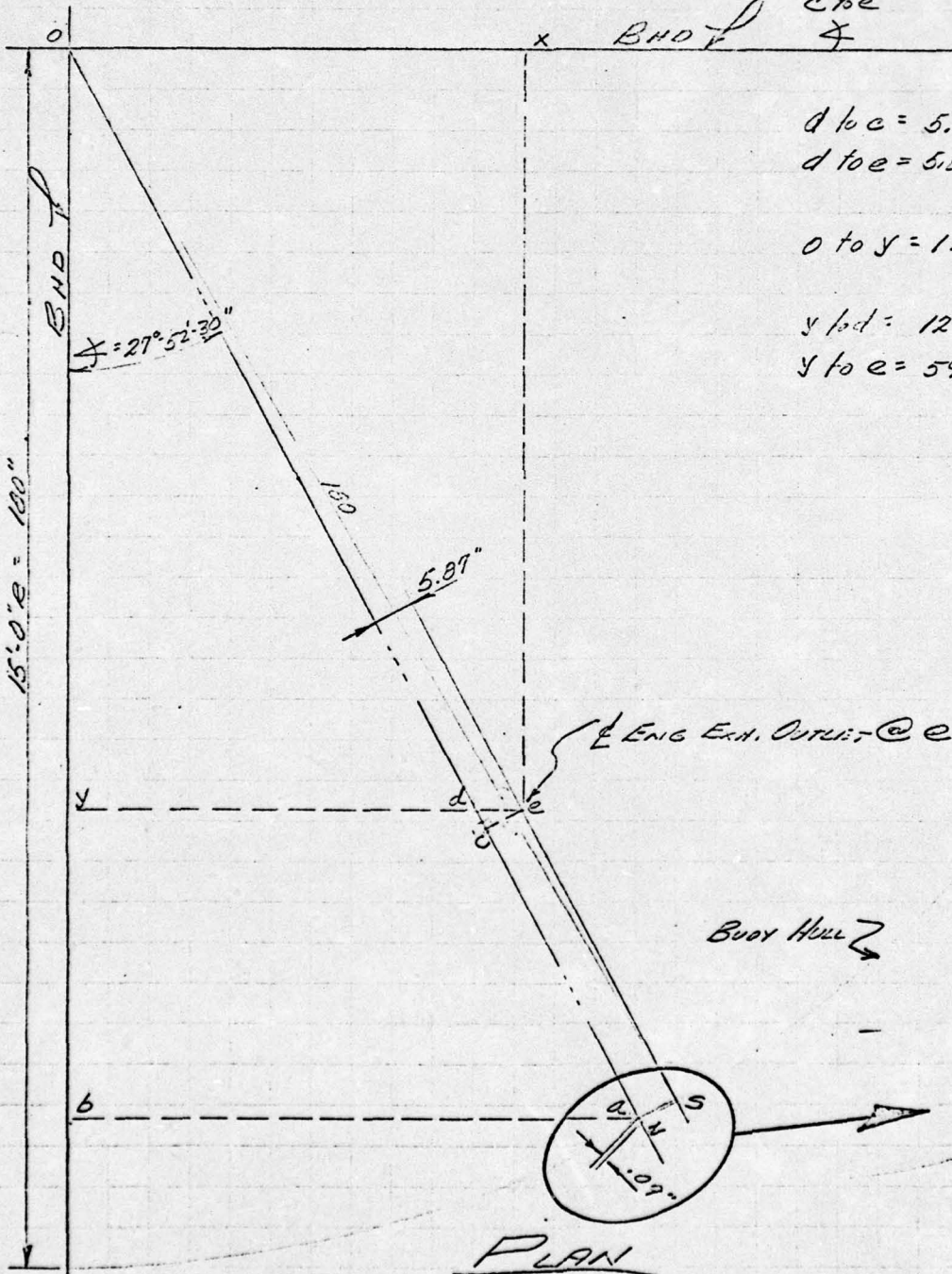
$$d \text{ to } c = 5.87 \times \tan \angle = 5.10$$

$$d \text{ to } e = 5.87 \div \cos \angle = 6.64"$$

$$O \text{ to } Y = 127.75 \times \cos \angle = 112.93"$$

$$Y \text{ to } d = 127.75 \times \sin \angle = 59.72"$$

$$Y \text{ to } e = 59.72 + 6.64 = 66.36"$$



$$2-S = 5.87"$$

$$RAD = 180"$$

U.S. ARMY - ERDL

4

MONO MOORING SYSTEM - HYDRAULIC

## PUMP CALCULATIONS :-

REQD - 38 GPM  
1500 PSI @ WINCH

$$\text{HYD. H.P.} = \frac{\text{GPM (HP)}}{1714} = \frac{38 \times 1500}{1714} = 33.3 \text{ HP}$$

$$\text{BRAKE H.P.} = \frac{\text{GPM (HP)}}{1714 \times E} = \frac{38 \times 1500}{1714 \times .80} = 41.5 \text{ HP}$$

## DRIVE ENGINE CALCULATIONS :-

371 GPM @ 1800 RPM

RATED H.P. = 97  
CONT'S H.P. = 75

471 GPM @ 1800 RPM

RATED HP = 133  
CONT'S H.P. = 101

## FUEL CONSUMPTION

371 GPM @ 1800 = .46 LBS/BHP/HR

$$.46 \times 41.5 = 19.1 \text{ LBS/HR} = \frac{19.1}{7} = 2.73 \text{ GPM}$$

471 G.M. @ 1800 = .447 LBS/BHP/HR

$$.447 \times 41.5 = 18.6 \text{ LBS/HR} = \frac{18.6}{7} = 2.66 \text{ GPM}$$

BHP OF ENG 14% LOWER ON "CITE" FUEL

COMBUSTION AIR REQUIREMENTS

371 G/M @ 1800 RPM 319 SCFM

471 G.M @ 1800 RPM 425 SCFM

J

COMPUTATION SHEET  
ENGINEERING DEPARTMENT

J. RAY MCDERMOTT & CO., INC.

CD 5011  
COMPANY

FIELD

SHEET NO.

SUBJECT

WELL NO.

DATE

LOG NO.

COMPUTER

MACHINERY AND POWER

COMPANY	U.S. ARMY - ERDL		SHEET NO
SUBJECT	MONO MOORING SYSTEM - MACHINERY		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		1-26-65

MACHINERY:

NAVIGATIONAL AIDS:

LIGHTS	10 WATTS
HORN	320 WATTS
BEACON	

(Blow off)

ILLUMINATION FOR WORKING 2000 WATTS

BILGE PUMP (100 GPM) 1 1/2 HP

DECK ROTATING MACHINERY (HYDRAULIC) (2 HP)

HYDRAULIC PUMPING SET 22 HP

DERRICK WINDLASS (HYDRAULIC) (20 HP)

MAX ELECTRICAL LOAD: (WATTS)

NAVIGATIONAL AIDS	330
ILLUMINATION FOR WORKING	2000
BILGE PUMP	1119
HYDRAULIC PUMPING SET	16512

19,961

$\frac{19,961}{1,000} = 19.9 \text{ KW}$   
(RADIO BEACON NOT INCL.)

TTTS  
TTTS

(Blow 2 SEC  
OFF 18 SEC)

TTTS

HP

HP

HP

HP

COMPANY U.S. ARMY - ERDL		SHEET NO	
SUBJECT MONO MOORING SYSTEM - MACHINERY			
DRAWING NUMBER	COMPUTER WAP	CHECKED BY	DATE 1-26-65

NAVIGATIONAL AIDS: - (ALL TO U.S. COAST GUARD)

LIGHTS: - 200 mm BODY & STRUCTURE LANTERN  
MULTI-LAMP & CHANGER TYPE  
WATERTIGHT, GASKETED CONSTRUCTION  
360° VISIBILITY - CLEAR LENS  
12 VOLT DC

HORN: - OMNI-DIRECTIONAL - 2 MILE RANGE  
WATER TIGHT GASKETED CONSTRUCTION  
BATTERY OPERATED  
12 VOLT DC

BATTERIES: - DRI PRIMARY TYPE OR  
LEAD ACID TYPE  
Ni-CAD - CHARGING PLATE TYPE (ALT)

MISC: - NECESSARY ACCESSORIES  
TO MEET REQUIREMENTS FOR  
AIDS AS SET FORTH IN SPEC

ILLUMINATION:

LIGHTING IN MACHINERY COMPARTMENT  
AND ON DECK OF BODY TO BE  
TO BE DONE AT NIGHT FOR  
A VESSEL & MAINTAINING 50  
REQUIRED

COAST GUARD REQUIREMENTS)

OR LANTERN (WALLACE & TIERMAN, TORLONDS SPECIALTIES, ETC)  
OR TYPE  
OR CONSTRUCTION  
CLEAR LENS

OR MILL RANGE (AUTOMATIC RANGE INC, TORLONDS SPECIALTIES, ETC)  
CONSTRUCTION

OR  
OR (ACT) REQUIRE DEFINITE PROTECTION AGAINST EXPLOSION

OR  
OR FOR OPERATING  
OR IN SPECS

OR COMPARTMENTS  
OR BODY TO ALLOW WORK  
OR NIGHT FOR BOTH MOUNTING  
OR BODY AS MAY BE



MCD 14003

COMPANY	U.S. ARMY - E.R.D.G.		SHEET NO.	3 of
SUBJECT	Mooring System - MACHINERY			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WAP		1-26-65	

BILGE PUMP : (TO U.S. COAST GUARD REGULATIONS)

CENTRIFUGAL TYPE WITH 3/4" MIN 2" SUCTION  
1 1/2 HP Elec. Motor Drive  
MIN FLOWING CAP. 100 GPM

DECK ROTATING MACHINERY:

HYDRAULIC MOTOR, DRIVE  
REDUCTION.  
WHEN NOT USED TO ROTATE  
MUST BE DISENGAGED  
FREE SWING OF DECK  
BY SEA CONDITION.

HYDRAULIC PUMP SET:

VARIABLE VOLUME, AXIAL  
COMPACT WITH Elec  
REQUIREMENTS B C  
@ 1500 PSI, ALLOWABLE  
TO 2000 PSI  
INTEGRAL 60 GPM  
MOTOR CHARACTERISTIC 20  
OIL COOLER NOT REQD

DERRICK WINDLASS:

HYDRAULIC OPERATED  
LINE PULL WITH  
LINE SPEED WITH

5  
 GUANO REQUIREMENTS)

WITH SELF PRIMING

MOTOR DRIVE

100 GPM @ 35' HEAD

MOTOR DRIVEN GEAR

TO ROTATE DECK

ENGAGED TO ALLOW

OF DECK AS REQUIRED

CONDITIONS

GEAR, AXIAL PISTON TYPE (DENISON, VICKERS, RACINE S&CO, ETC)

WITH ELECTRIC MOTOR & COUPLING

13 GPM DELIVERY

ALLOWABLE PRESSURE RANGE

60 GAL RESERVOIR

208 V, 3  $\phi$ , 60 CYC A.C. (APPROX 20 HP MOTOR)

NOT REQUIRED

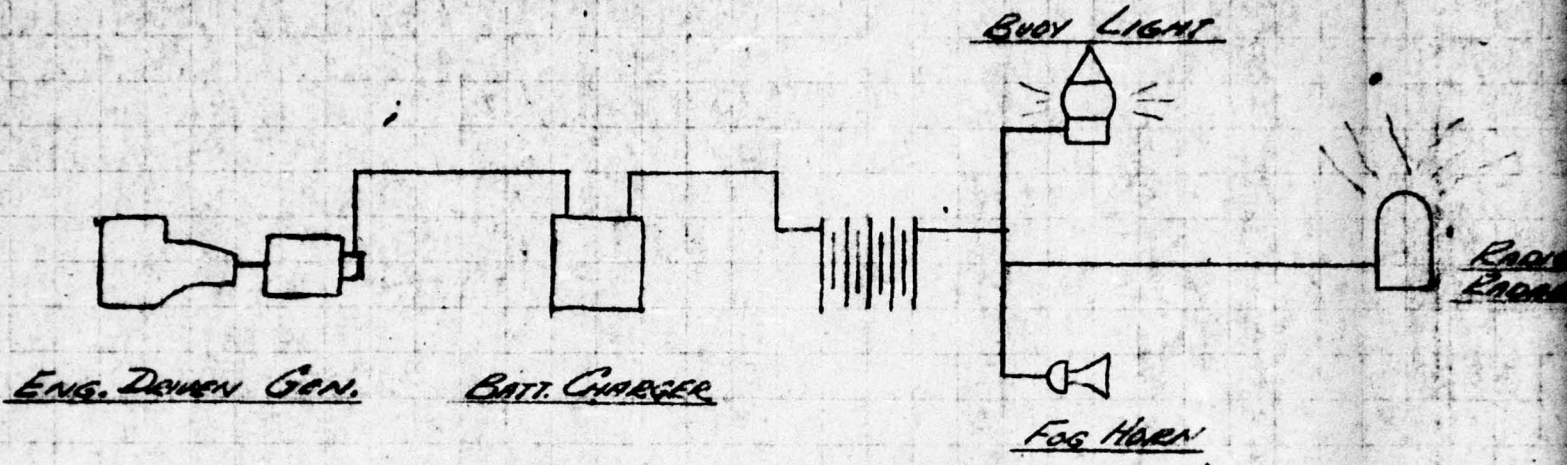
OPERATED WITH AUTOMATIC BRAKING (GEORANTIC, MARCO ETC)

WITH MEAN DRAIN CAP. 17,000 LBS (FURNISH)

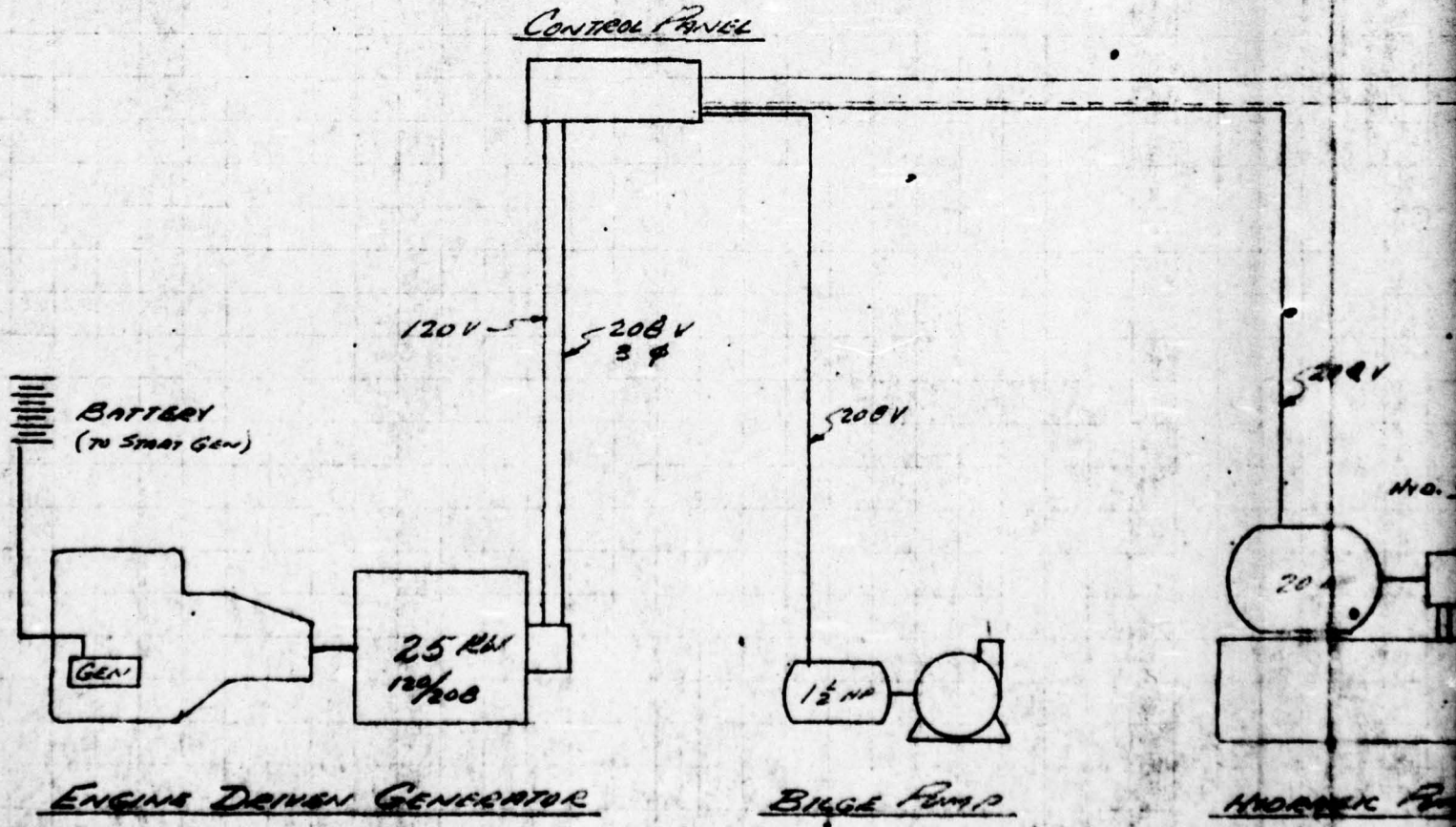
WITH MEAN DRAIN CAP. 23 fpm (FURNISH)

MCD 14003

COMPANY <b>U.S. ARMY - ERDL</b>	SHEET NO <b>4 of</b>		
SUBJECT <b>Mono Mooring System - Basic Machinery Panel</b>			
DRAWING NUMBER	COMPUTER <b>MAP</b>	CHECKED BY	DATE <b>1-28-45</b>

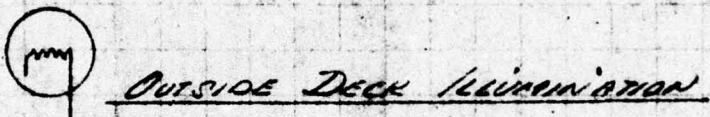
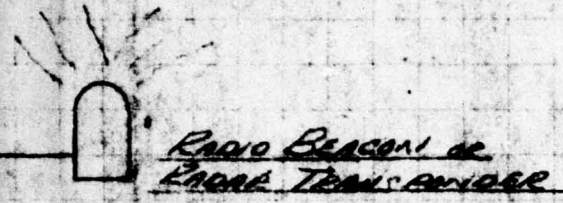


NAVIGATIONAL AIDS

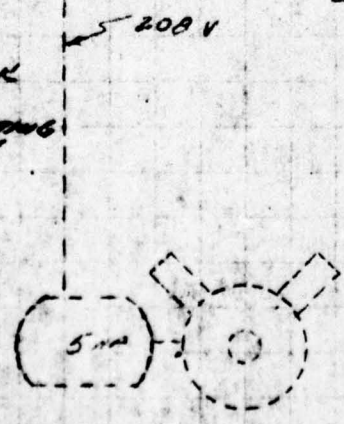
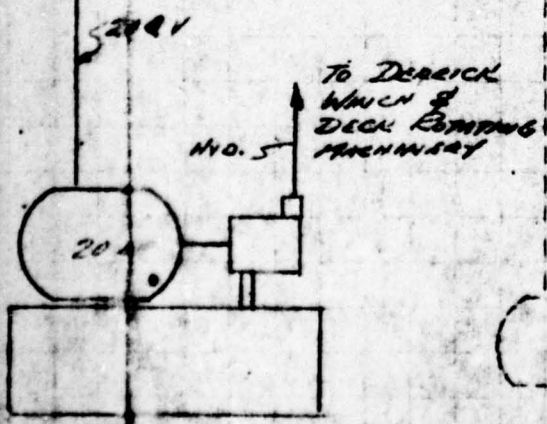
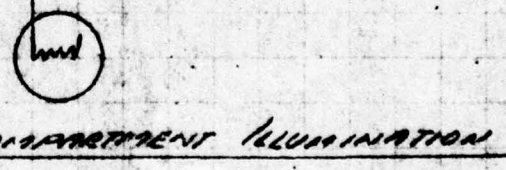


BUOY MACHINE

Proposal #1



120V



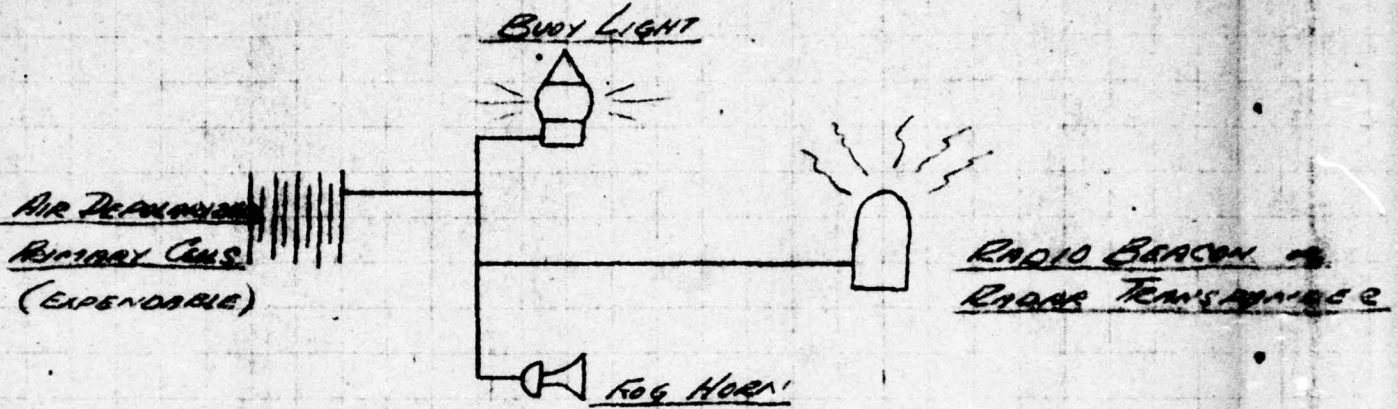
HYDRAULIC PUMP UNIT

AIR COMPRESSOR  
(REQUIREMENT NOT DETERMINE)

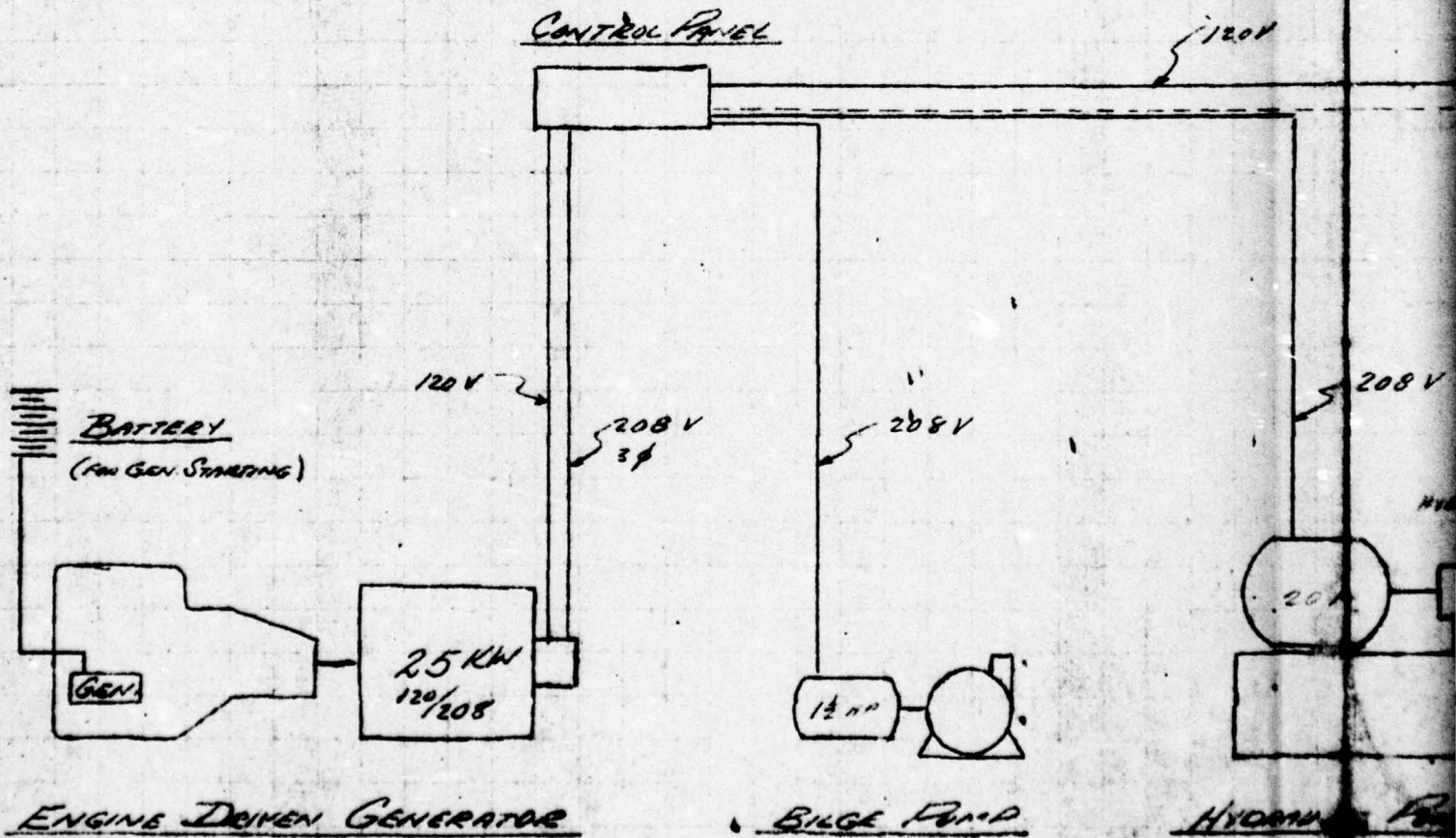
MACHINERY

2

COMPANY	U.S. ARMY - ERDL		SHEET NO	5 of
SUBJECT	MONO MOORING SYSTEM - BASIC MACHINERY POWER -			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WAP		1-29-65	



NAVIGATIONAL AIDS



BUOY MACHINERY

PLAN - PROPOSAL #2

ACOM  
WINDMILL

120V



OUTSIDE DECK ILLUMINATION



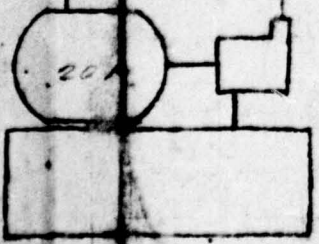
COMPARTMENT ILLUMINATION

208V

TO DERRICK  
WINCH &  
DECK ROTATING  
MACHINERY

208V

H10 5



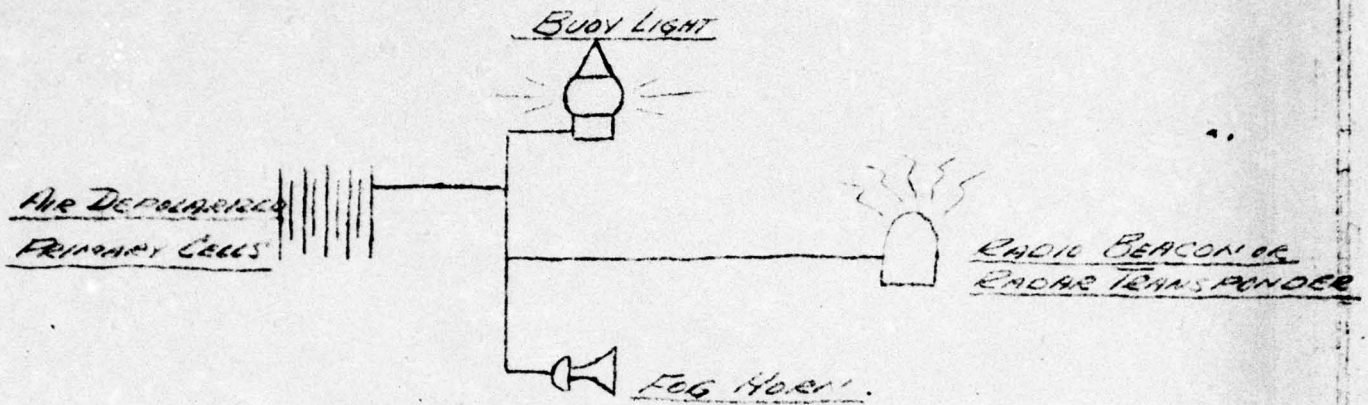
AIR COMPRESSOR  
(REQUIREMENT NOT DEFINITE)

HYDRA PUMP UNIT

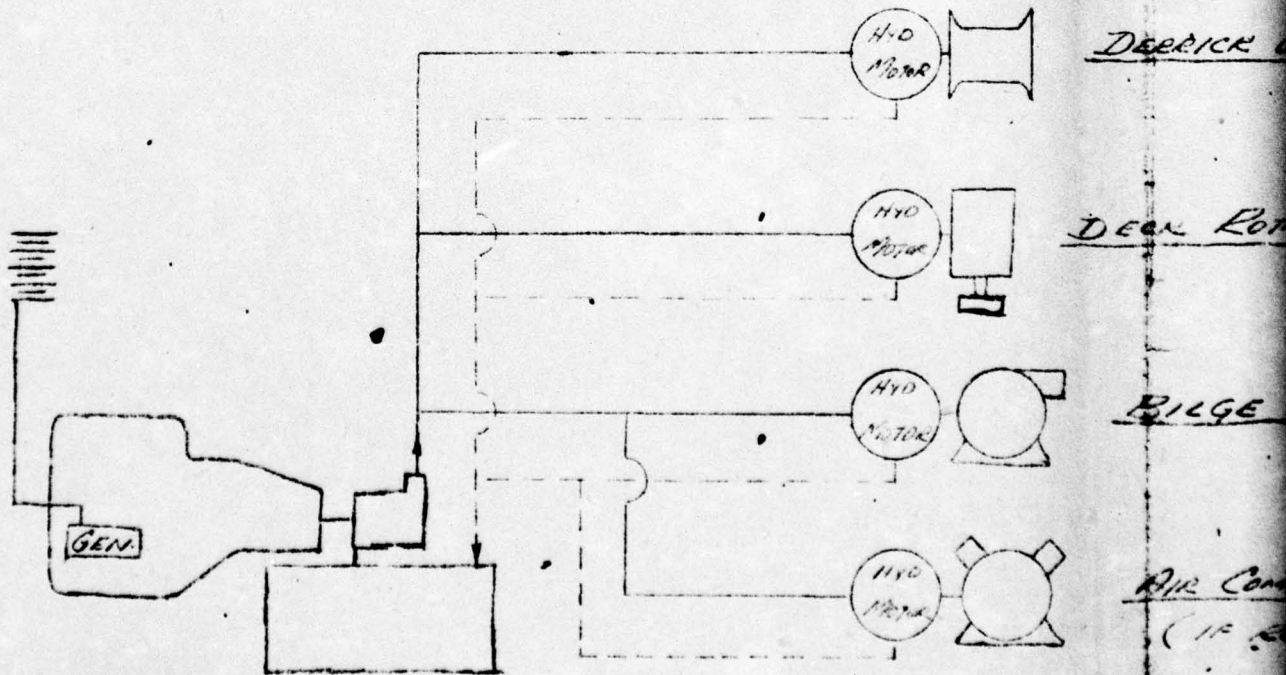
CANNERY

2

COMPANY	U.S. Army - ERDL		SHEET NO	6 of
SUBJECT	Mono Mooring System - BASIC Machinery Power			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
	WAF		1-29-65	



NAVIGATIONAL AIDS

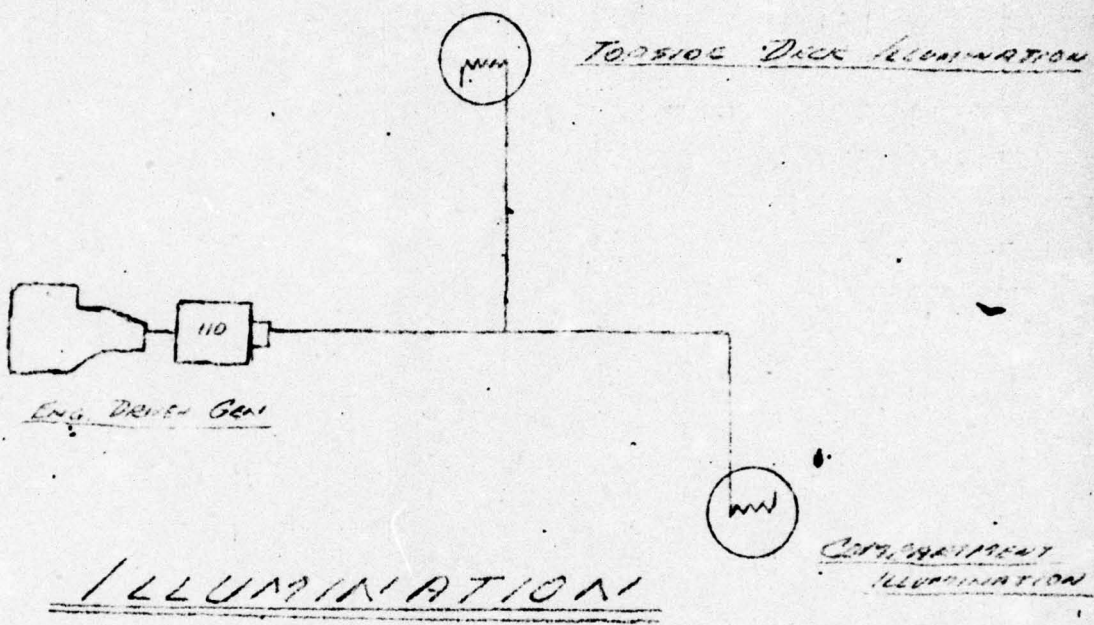


ENGINE DRIVEN HYDRAULIC PUMP

BUOY MACHINERY

Power - 110V AC

ON OR  
SPINDLE



DERRICK WINCH

DECK ROTATING MECHANISM

BILGE PUMP

AIR COMPRESSOR  
(1/2 HP)

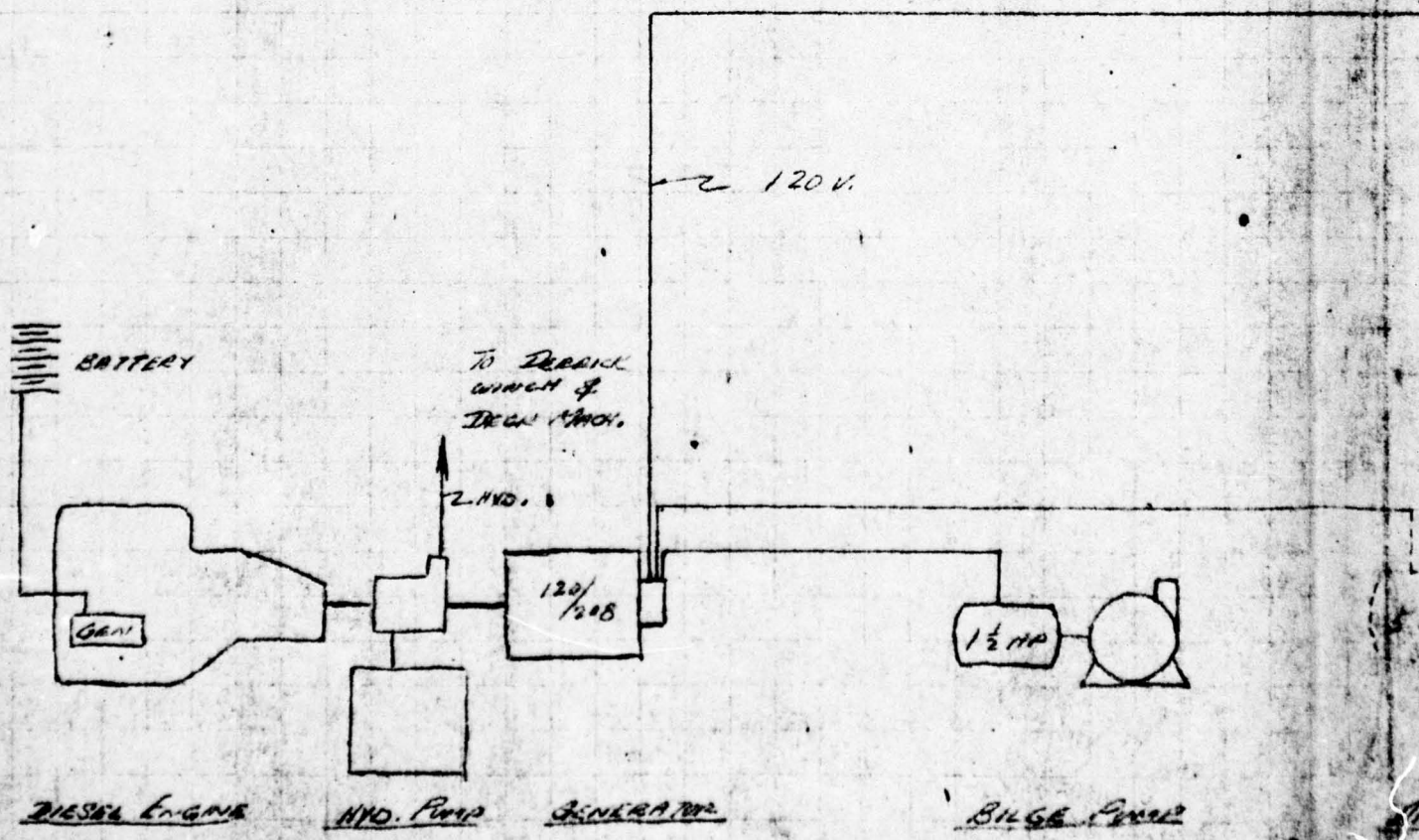
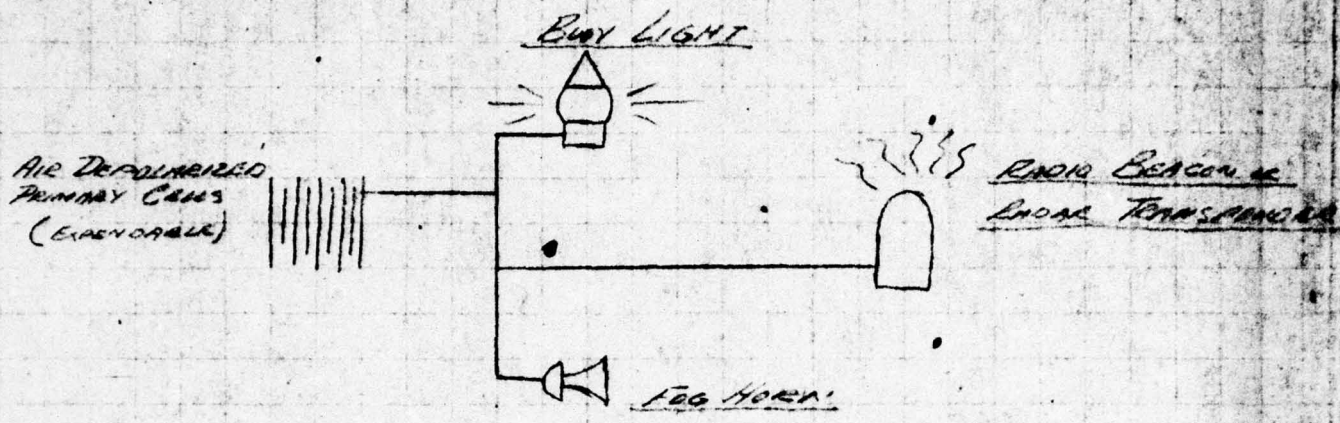
2



COMPANY: U.S. Army - ERDL SHEET NO: 7 of

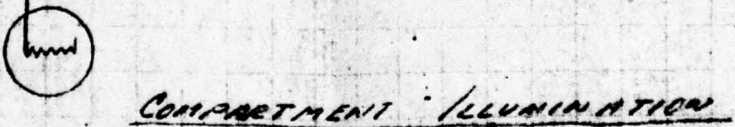
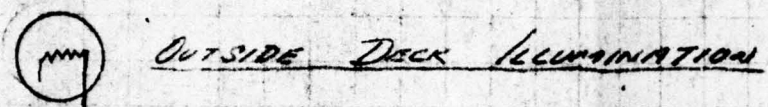
SUBJECT: MONO MOORING SYSTEM - BASIC MACHINERY & PUMP - 12

DRAWING NUMBER: \_\_\_\_\_ COMPUTER: WJP CHECKED BY: \_\_\_\_\_ DATE: 1-30-05



V. H. R. - Power 14

CON. 14  
SP. 14



AIR COMPRESSOR  
(1F 2000)

2

MCD 14003

COMPANY *U.S. Army - ERDL*

SHEET NO *80A*

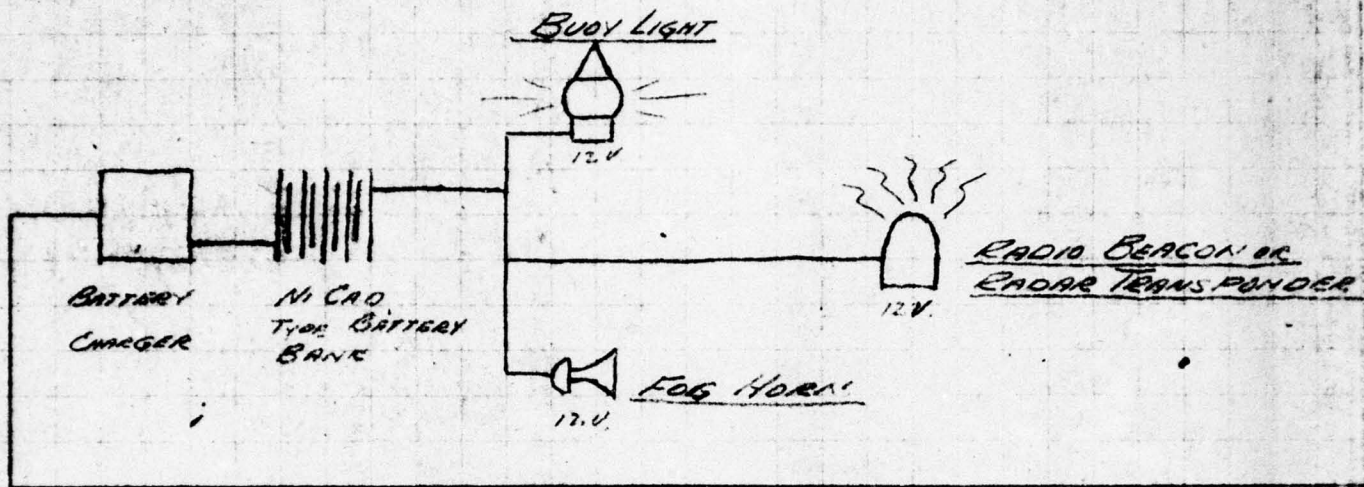
SUBJECT *MONO MOUNTING SYSTEM - BASIC MECHANICAL POWER - BUNKER*

DRAWING NUMBER

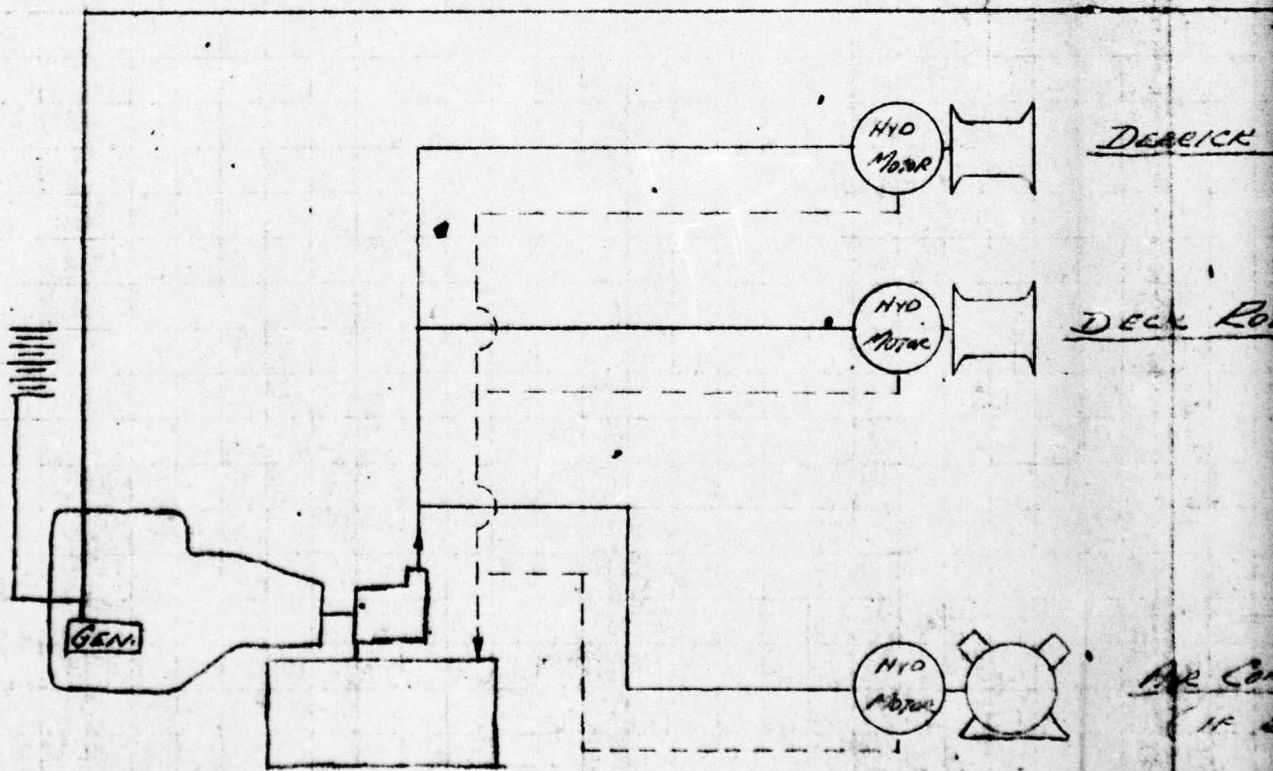
COMPUTER *WAP*

CHECKED BY

DATE *3-1-65*



NAVIGATIONAL AIDS



ENGINE DRIVEN HYDRAULIC PUMP

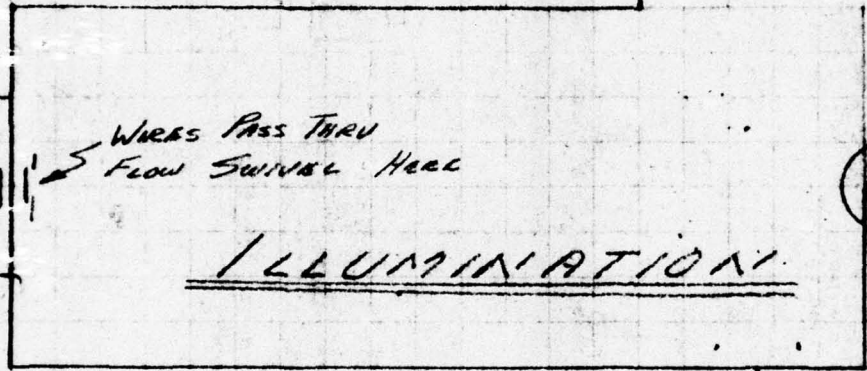
BUDY MACHINERY

POWER - MACHINE #5

CON OR  
SPINDER



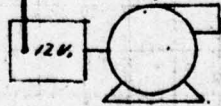
TOPSIDE DECK ILLUMINATION



COMPARTMENT ILLUMINATION

DECK WINCH

DECK ROTATING WINCH

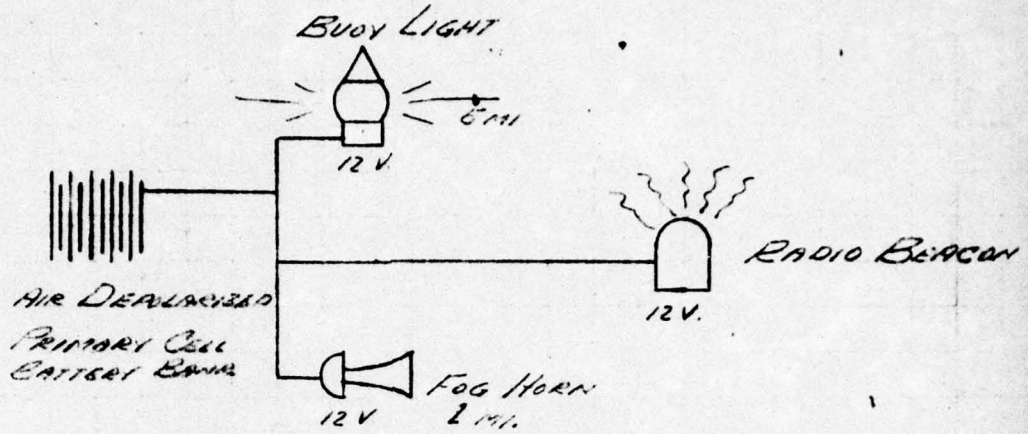


BILGE PUMPS

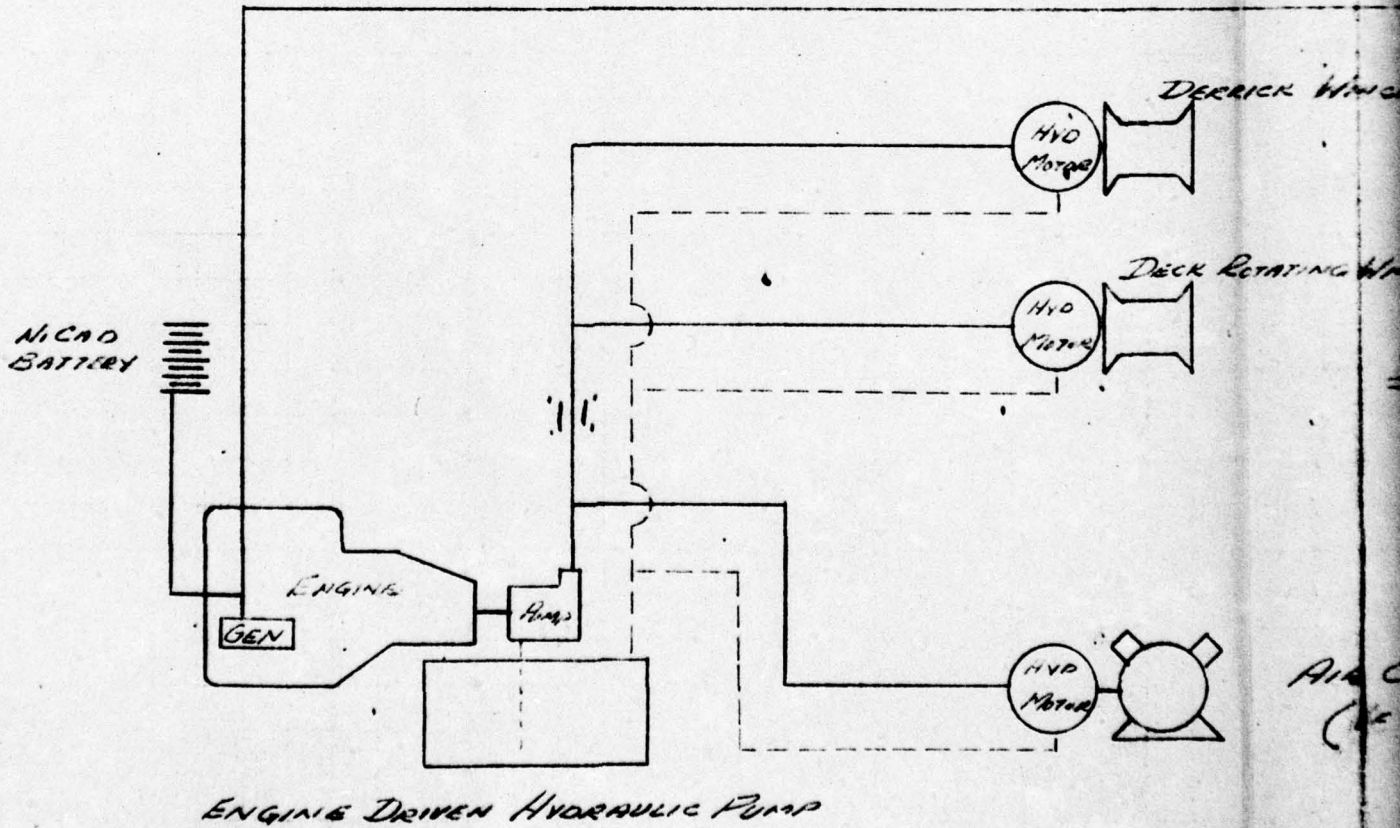
AIR COMPRESSOR  
(IF USED)

2

COMPANY	U.S. Army - ERDL		SHEET NO	9 of
SUBJECT	MONO MOORING SYSTEM - BASIC MACHINERY & POWER			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
		WAP	3-24-65	



NAVIGATIONAL AIDS

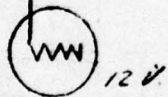


BUOY MACHINERY

Power Proposal #6

DERRICK WINCH

BACK ROTATING WINCH



COMPARTMENT LIGHTING

AIR COMPRESSOR  
(1/2 HP)

AIR DEPOLARIZED  
PRIMARY CELLS  
BATTERY BANK



BILGE PUMPS

2

U.S. ARMY - ERDL

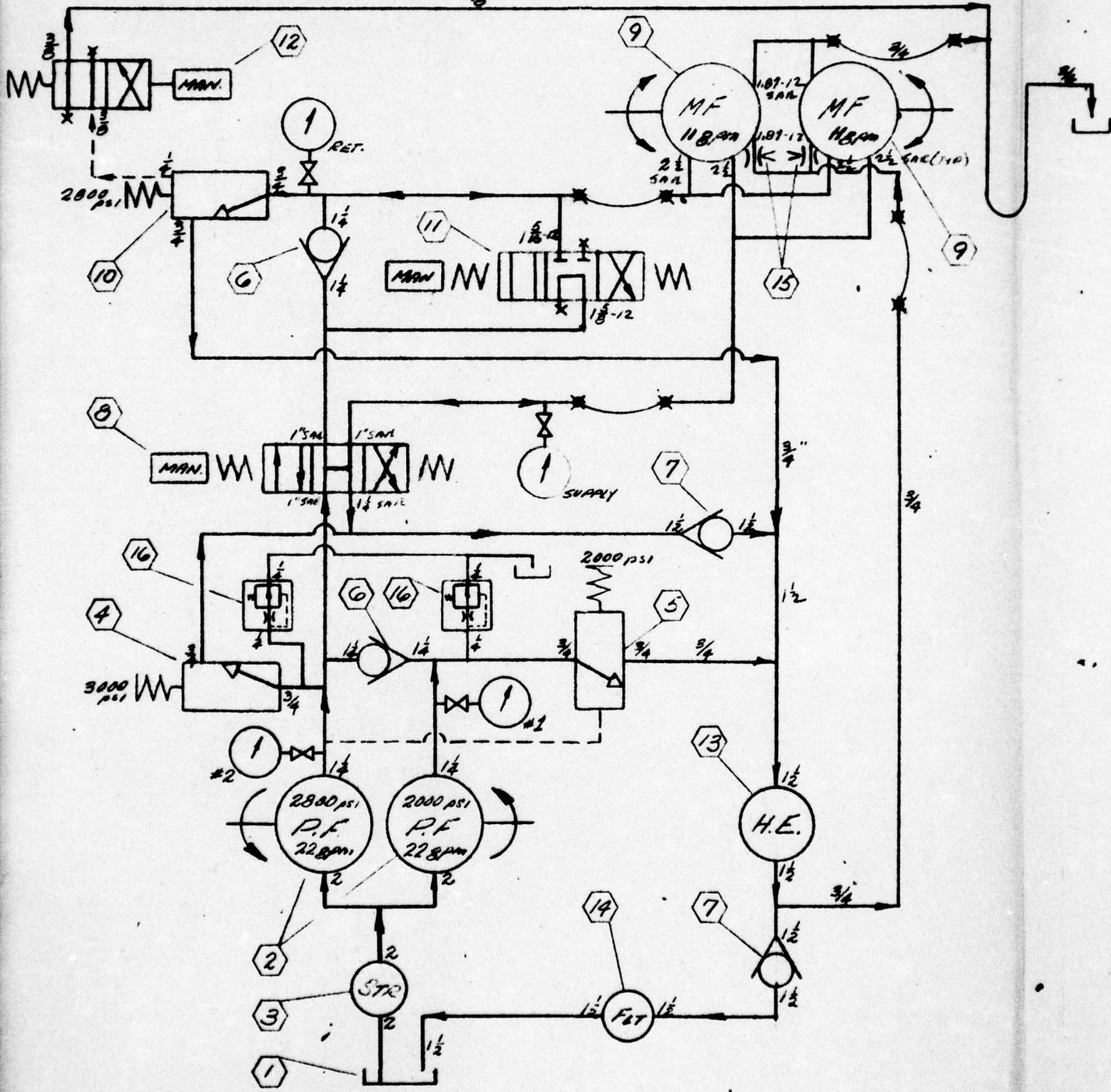
1 of 1

SND MOUNTED WINDLASS - HYDRAULIC CIRCUIT

U.O. 56017

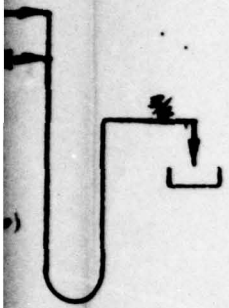
waf

11/23/45



1

INSTALLATION EQUIPMENT



		VICKERS NO
①	RESERVOIR 88 GAL NOM. CAP.	
②	PUMP - VANE TYPE - FIXED VOLUME	35V25A-1C10-132
③	STRAINER	50S-149-M-3-PA
④	RELIEF VALVE	CG-06-F-10
⑤	UNLOADING VALVE	RG-06-FA-10
⑥	CHECK	C2-825
⑦	CHECK	C2-830-S19
⑧	DIRECTIONAL VALVE	CM3N01-KBL-20
⑨	MOTOR - PISTON TYPE - FIXED VOLUME	MFA120-30
⑩	RELIEF VALVE	CG-06-F-10
⑪	DIRECTIONAL VALVE	CM2N02-KDL-20
⑫	DIRECTIONAL VALVE	DG17S4-012A-41
⑬	OIL COOLER	OCA-30-10
⑭	FILTER	OFM-202
⑮	NEEDLE VALVE	
⑯	AIR BLEED VALVE	ABT-02-10

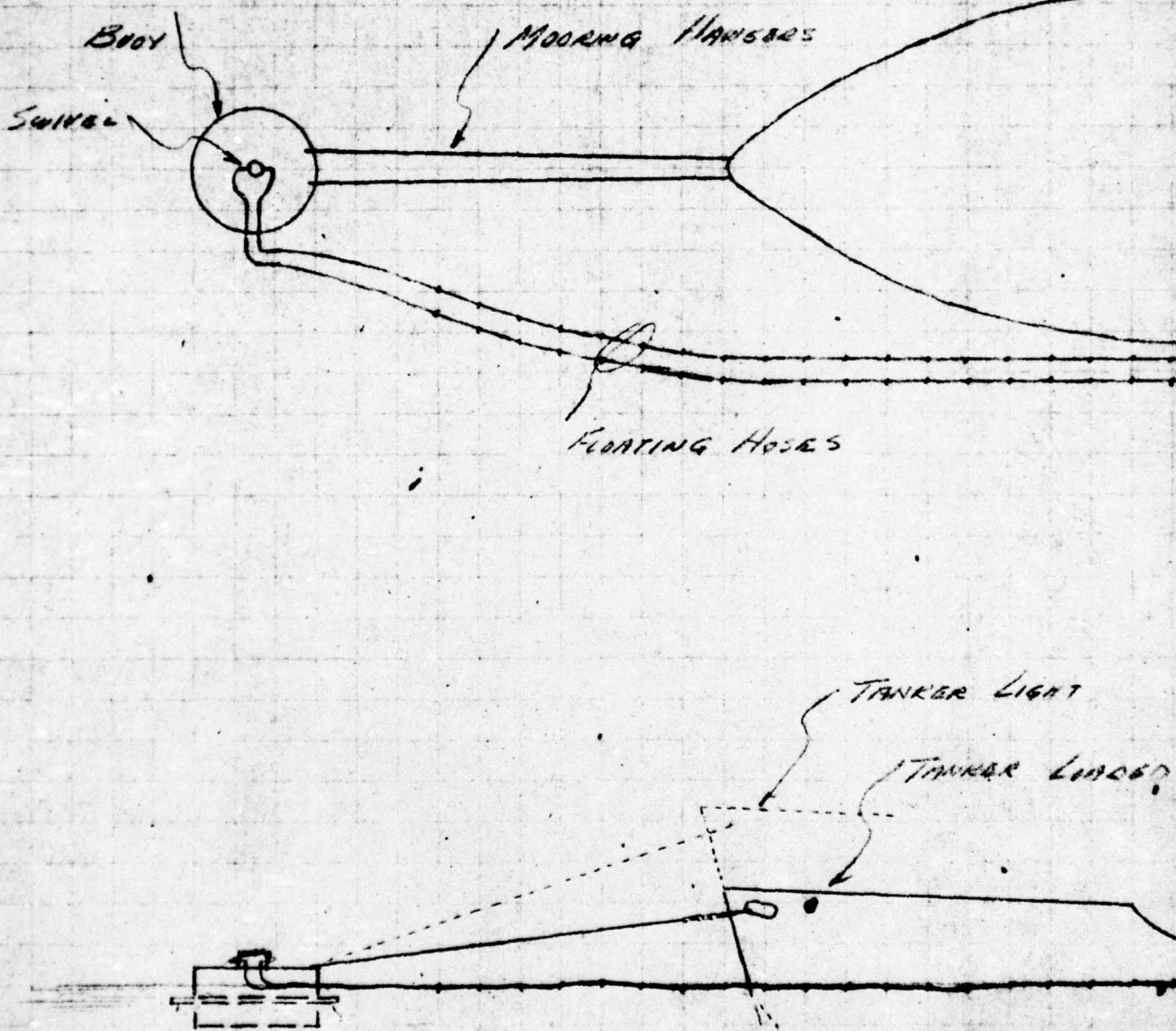
*[Handwritten signature]*



SECTION III

RIGID ARM APPROACHES

COMPANY	U.S. ARMY - ERDL	SHEET NO	1 of 1
SUBJECT	MONO MOORING SYSTEM -		
DRAWN BY	U.O. 56017	COMPUTER	WAF
CHECKED BY		DATE	3-4-65



TANKER

MOORING LINES TO KEEP  
BUOY AT TANKER SIDE

MANIFOLD

BOOM TO HANDLE HOSE TO TANKER

HOSE CONNECT  
TO MANIFOLD

BOUY

2

U.S. Army - E.R.D.L

1 of 1

MONO MOORING SYSTEM - RIGID ARM

APPRO

J.O. 56017

WAD

2/22/65

Buoy

MAIN MOORING LINES

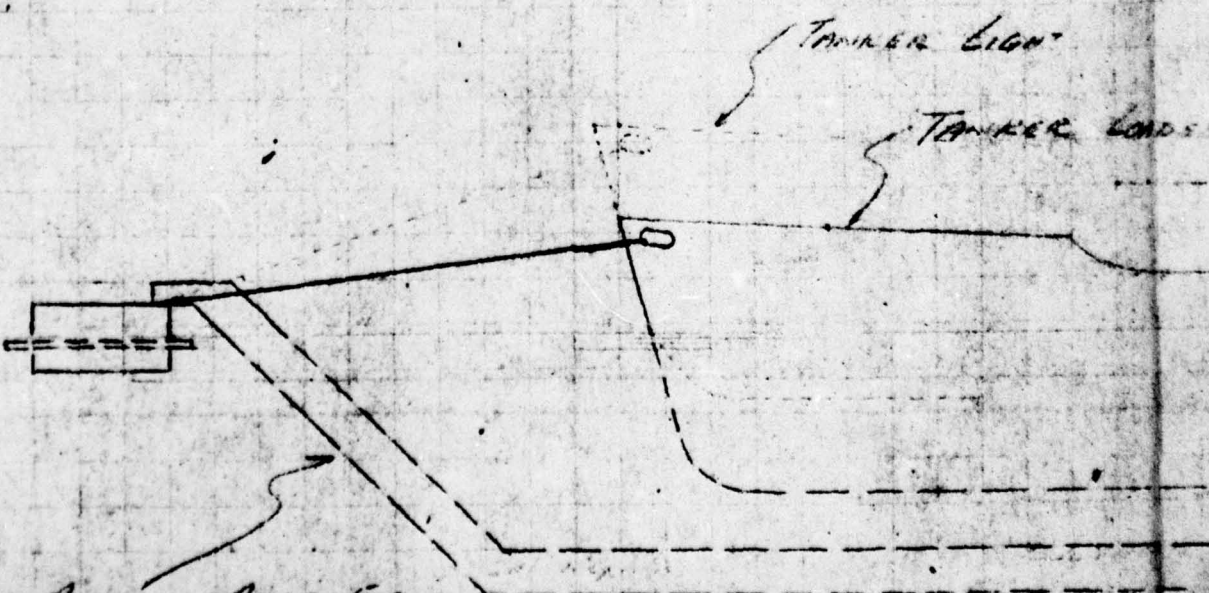
AVOY

SWIVEL

STRUCTURAL MEMBERS  
TO BE USED AS PINE LUM.  
FROM TANKER TO BUOY

TANKER LIGHT

TANKER LOADS



PROBLEM AREA FOR  
SHALLOW WATER INSTALLATION.  
MOORING CHAIN INTERFERENCE

APPROACH #1-A



MOORING LINES  
from TANKER

BOAT LANDING  
for SERVICE LAUNCH

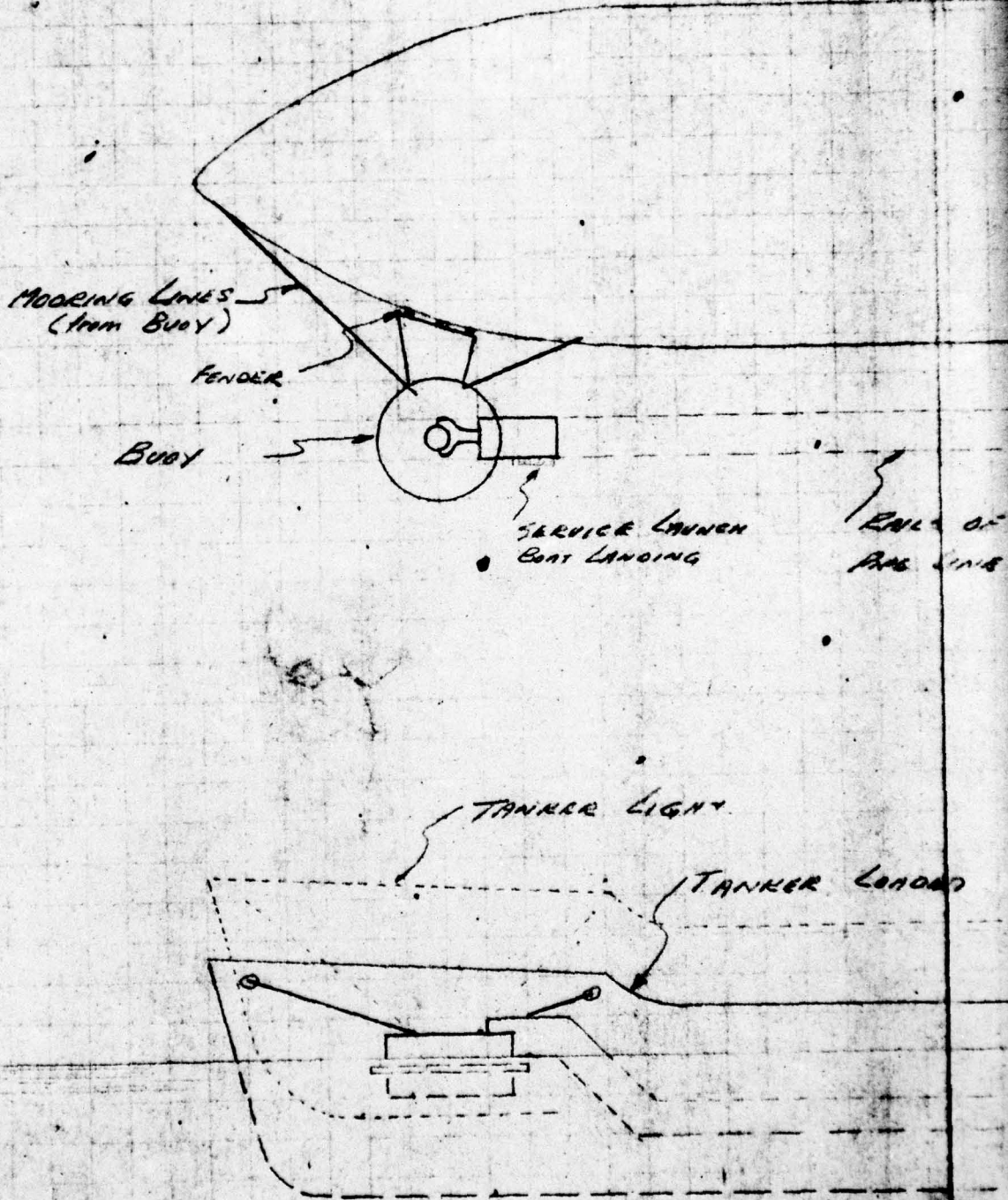


BOOM TO RAISE HOSE TO TANKER

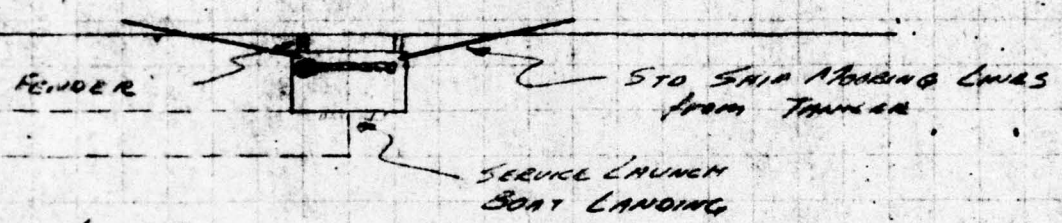
BUOYANCY COMPARTMENT

2

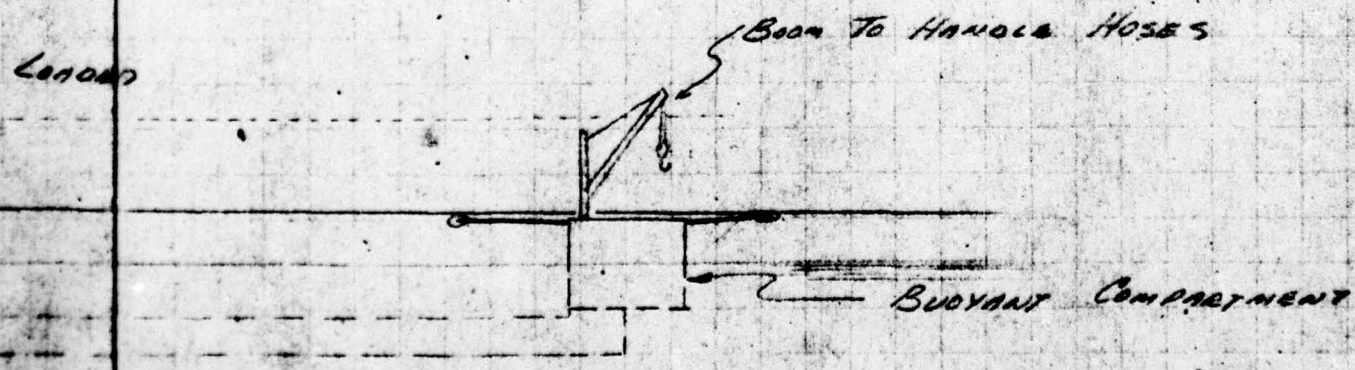
COMPANY	U.S. Army - ERDL.		SHEET NO	1 of 1
SUBJECT	Mound Mooring System - RIGID ARM			APP
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE	
10. 56017	RAF		2/25/65	



APPROACH # 1-B



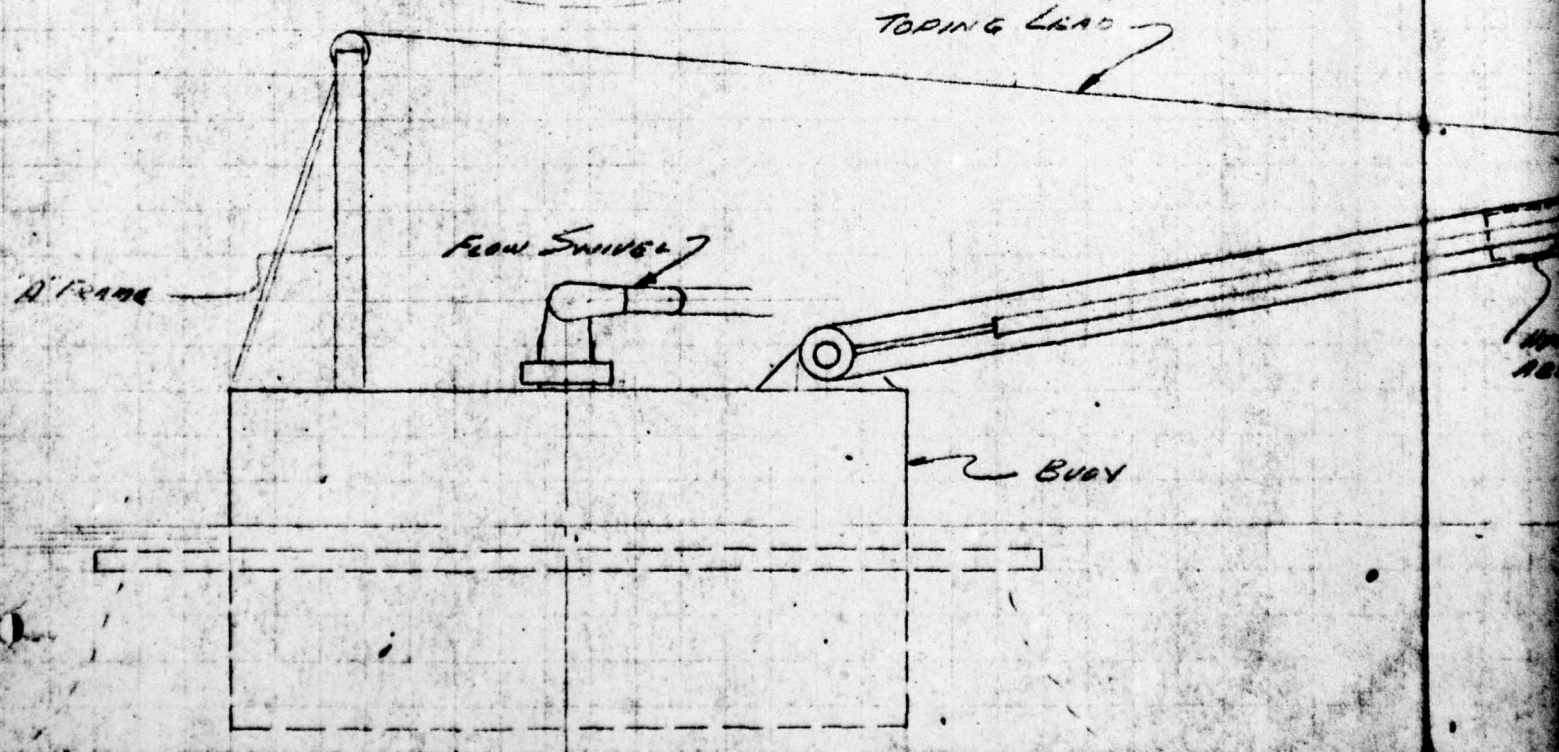
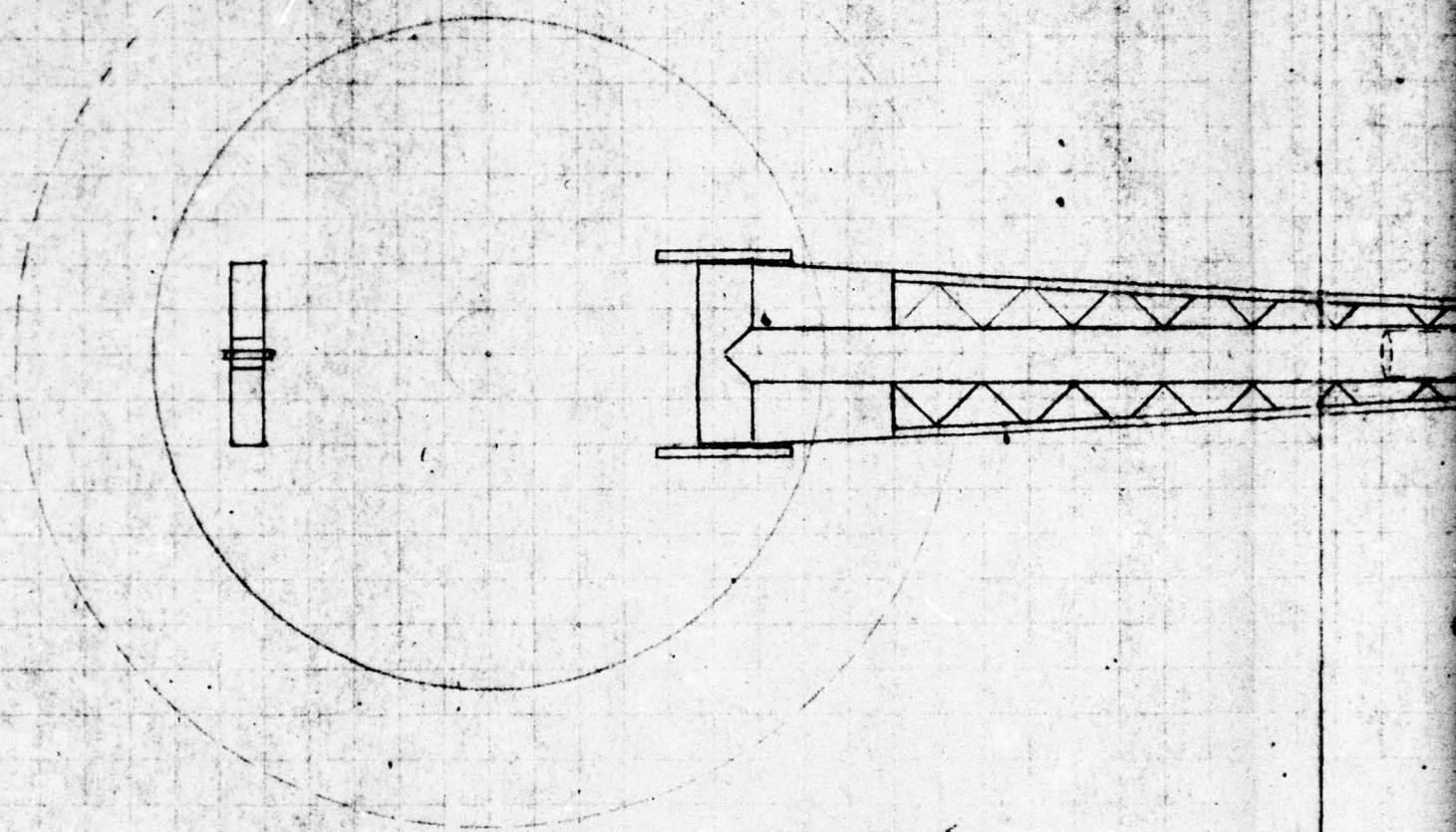
END OF ARM USED AS  
AUX LINE TO BUIY.



COMPANY *U.S. ARMY - ERDL* SHEET NO *1 of 2*

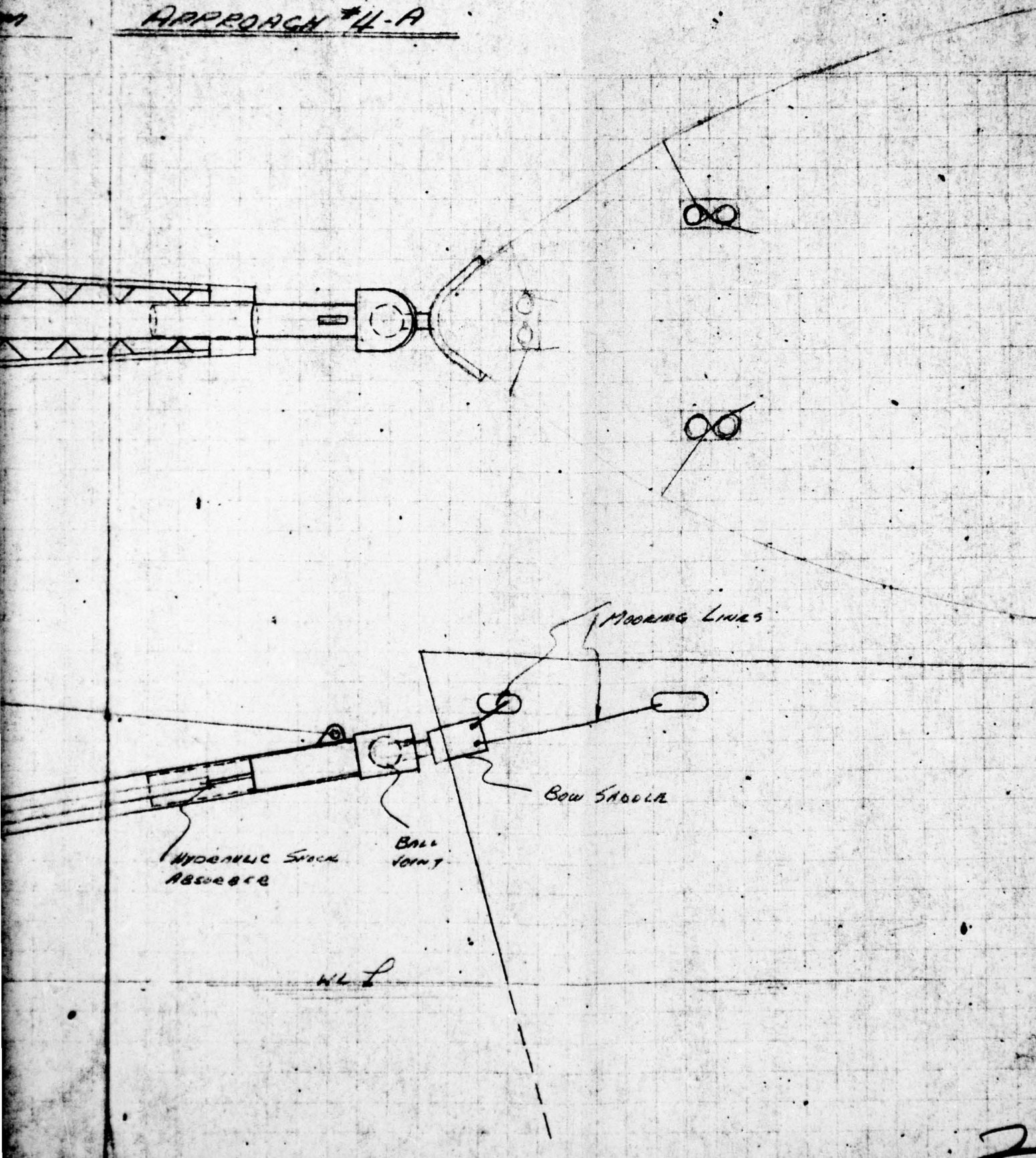
SUBJECT *17070 MOORING SYSTEM - RIGID ARM*

DRAWING NUMBER *10. 56017* COMPUTER *MAP* CHECKED BY \_\_\_\_\_ DATE *2-25-65*





APPROACH #4-A



HYDRAULIC SWACK  
ASSEMBLY

BALL  
JOINT

BOW SADDLE

MOORING LINES

WLP

2

COMPANY U.S. ARMY - ERDL	SHEET NO. 2012
PROJECT MORO MOORING SYSTEM	
DRAWING NUMBER V.O. 56017	COMPUTER WJF
CHECKED BY	DATE 2-23-65

Beam Shear Area - 500psi Allowable Load

$$\frac{300,000}{500} = 600 \text{ sq. in. in tension or compression}$$

$$DIA = \sqrt{2} = \frac{600 \times 2}{2 \times 1416} = 19.5 \text{ min dia + Allowance for}$$

BEAM - TENSION = 300K

$$AREA = \frac{300}{12} = 25 \text{ sq in}$$

Use 24" x 1.375 PIPE BRACE AS SHOWN FOR  
24" PIPE = 95A/ET

DECK PIN SHEAR = 300K

$$AREA = \frac{300}{10} = 30 \text{ sq in}$$

Use 4 1/2" PIN IN DOUBLE SHEAR

#4-A

LINE

CONDUITS

ALLOWANCE FOR SLOT

ALLOWANCE FOR BENDING

2

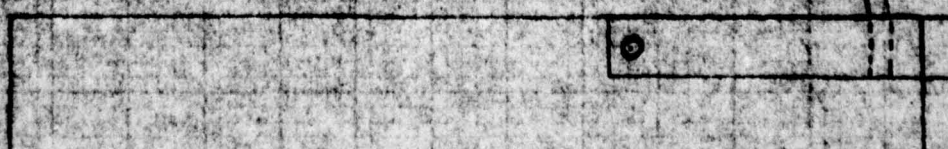
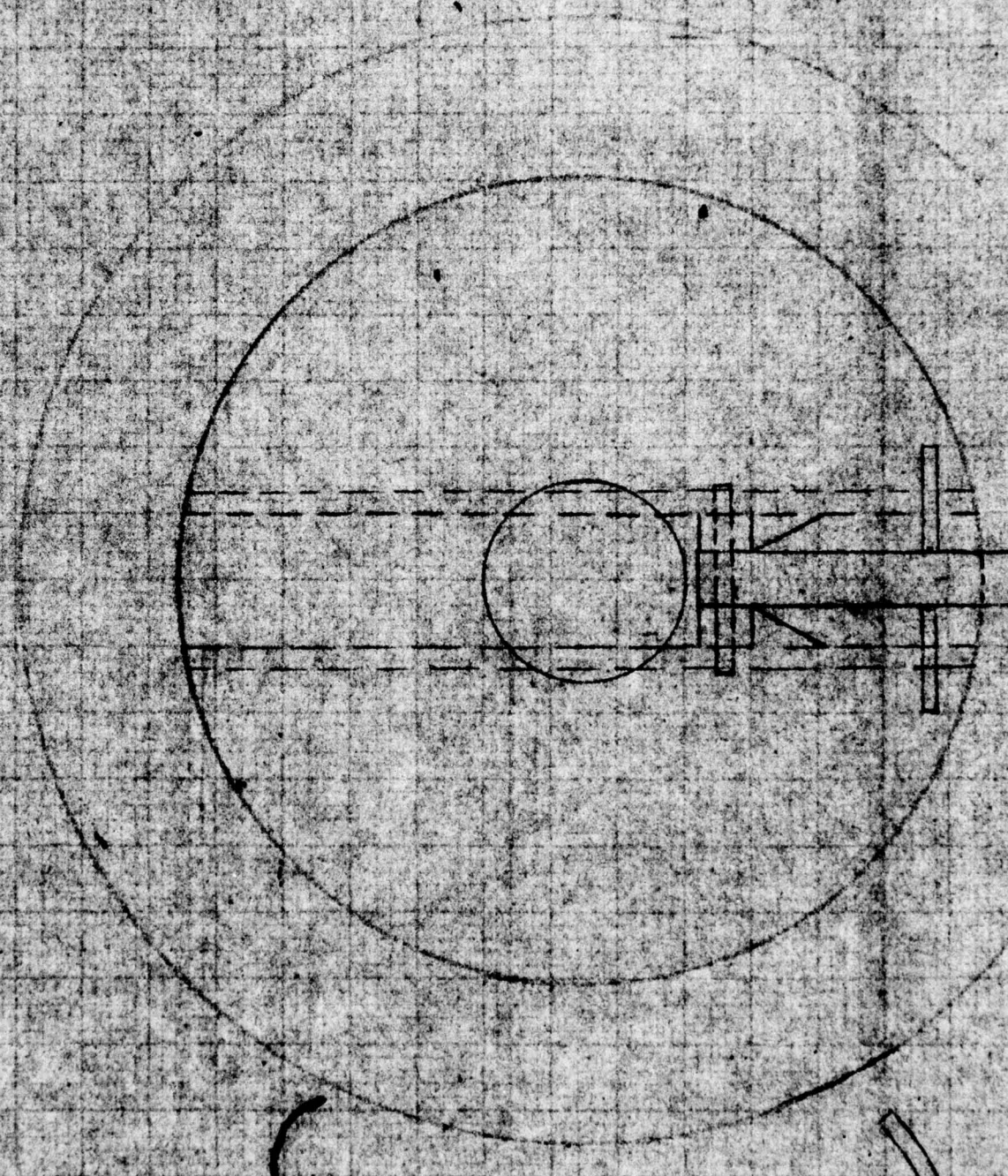
20' 15" 18"

7.

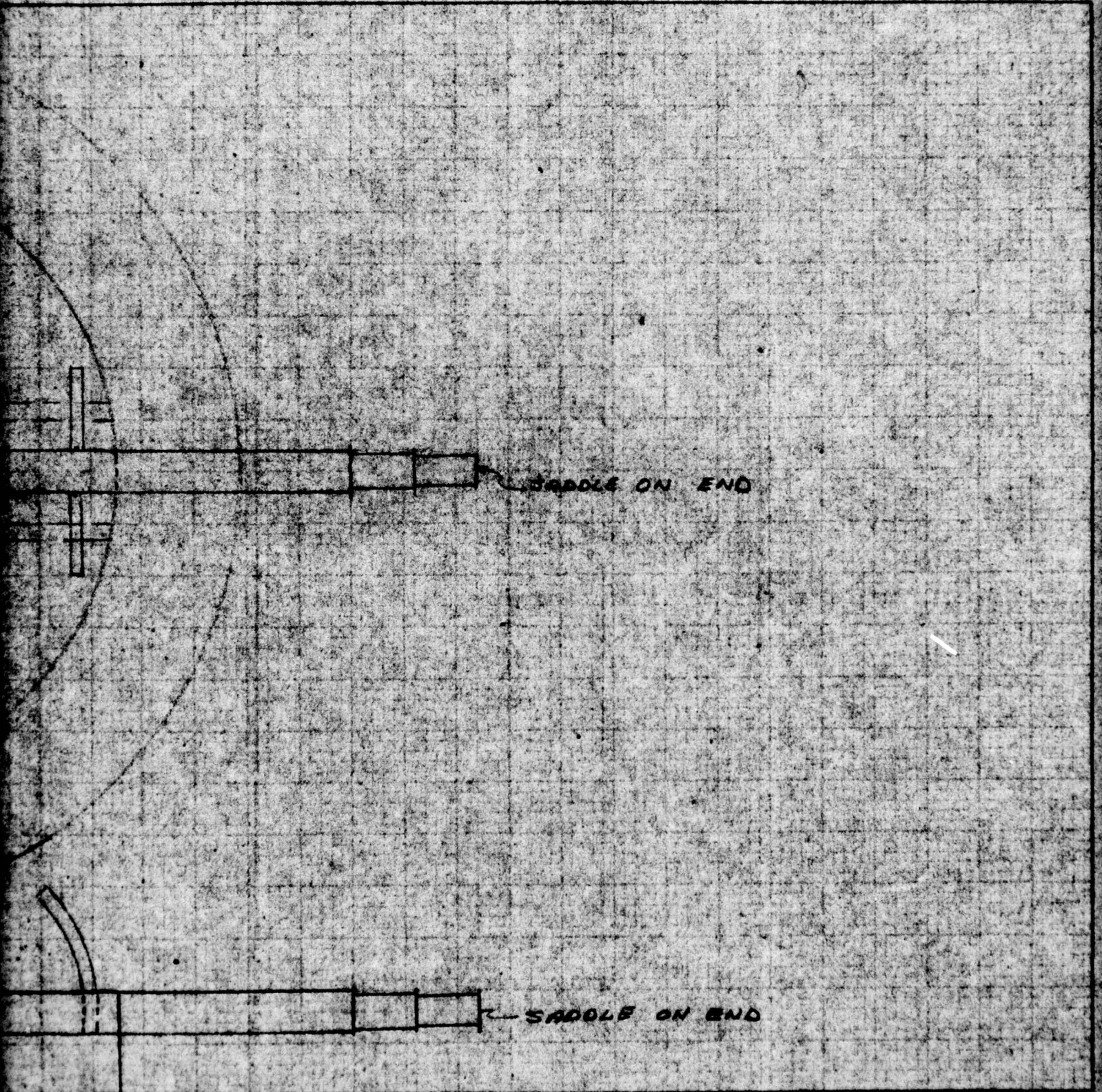
ENGINEERING DEPARTMENT  
COMPUTATION SHEET

J. RAY McDERMOTT & Co., INC.

COMPANY U.S. ARMY ERDL		SHEET NO. 1	
PROJECT MANG-MARKING SYSTEM (RIGID ARM)			
JOB NUMBER JOB 56017	COMPUTER ANDREWS	CHECKED BY	DATE 2/29/65



APPROACH \*35C



REPORT: U.S. Army - ERDL SHEET NO. 20/2

TITLE: HAND MORING SYSTEM

PROJECT NUMBER: 12. 56017 COMPUTER: [Signature] CHECKED BY: DATE: 2-23-65

Base Level Area = 50sqm Allowable Load

$$\frac{300,000}{500} = 600 \text{ kg/m}^2 \text{ IN TENSION OR COMPRESSION}$$

$$DIA = \sqrt{\frac{600,000}{25,000}} = 155 \text{ mm dia} + Allowance$$

Beam - Tension = 300K

$$Area = \frac{300}{12} = 25 \text{ sq in}$$

Use 24" x .375 Pipe BRACE AS SHOWN  
24" DIA = 95000

Deck Pin Shear = 300K

$$Area = \frac{300}{10} = 30 \text{ sq in}$$

Use 4" PIN IN DOUBLE SHEAR

14-A

1

2

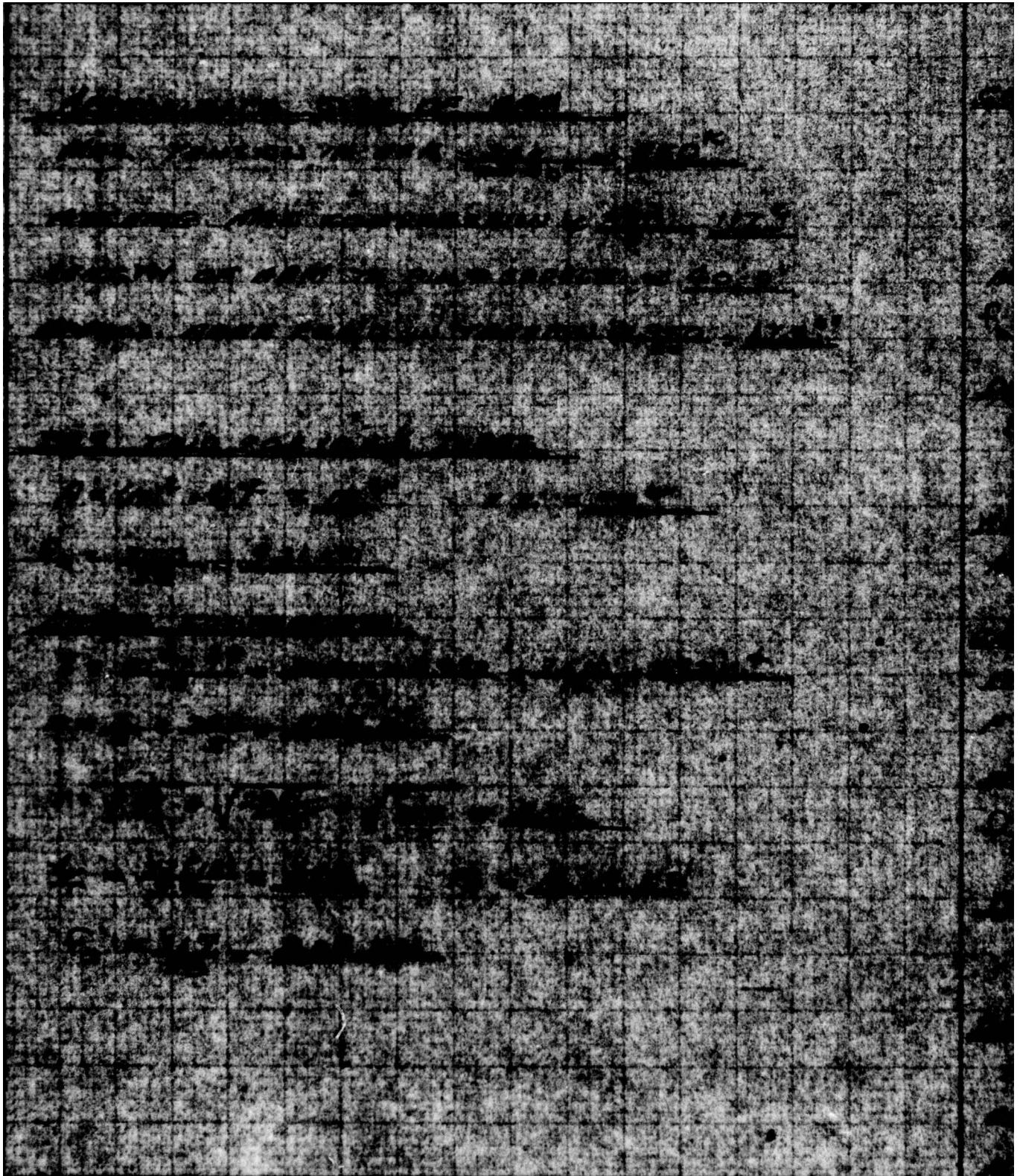
3

4

1910

Date	Description	Debit	Credit	Balance
1910	Jan 1			
1910	Jan 2			
1910	Jan 3			
1910	Jan 4			
1910	Jan 5			
1910	Jan 6			
1910	Jan 7			
1910	Jan 8			
1910	Jan 9			
1910	Jan 10			
1910	Jan 11			
1910	Jan 12			
1910	Jan 13			
1910	Jan 14			





$\rho(\text{air}) = 69.5 \%$

$2560,000 (1)$

$(3326292)$

