2
ENGINEERING

CENC 1197

VOLUME IV

**LMFBR
SODIUM HEATED
STEAM GENERATOR
—TEST MODEL—**

AEC CONTRACT AT(11-1)-3031

FEBRUARY 1973

CE COMBUSTION DIVISION

COMBUSTION ENGINEERING, INC.

MASTER

DISTRIBUTION

CONTROLLED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

STRUCTURAL STEEL ANALYSES

LMFBR 30 MWT MODEL

CONTRACT NO. 7670

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

DISTRIBUTION STATEMENT

100

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L H F B R CONT. No. 7670 MADE BY THR DATE 2-9-73
LOCATION COL. LINE - "I" "H" DWG. No. _____ CHK'D BY W DATE 2-9-73

AISC 7th EDITION.
STEEL A 36

① $l_x = l_y = 14.65'$

$$\frac{Kl}{r} \leq 200$$

TRY $L 5 \times 3 \frac{1}{2} \times \frac{1}{4}$

$$P = 8 \text{ K}$$

$$P_{EQ} = 8 \times .75 = 6 \text{ K}$$

$$\frac{Kl}{r_y} = \frac{14.65 \times 12}{1.04} = 169$$

$$F_a = 6.93 \text{ ksi}$$

$$P_u = 6.93 \times 2.06 = 14.28 \text{ K} > 6 \text{ K} \quad \text{O.K.}$$

②

$$l_x = l_y = 21.4'$$

$$P = 13 \text{ K}$$

$L 5 \times 5 \times \frac{5}{16}$

$$P_{EQ} = 13 \times .75 = 9.75 \text{ K}$$

$$\frac{Kl}{r_y} = \frac{21.4 \times 12}{1.57} = 163.6$$

$$F_a = 7.14 \text{ ksi}$$

$$P_u = 7.14 \times 3.03 = 21.63 \text{ K} < 9.75 \text{ K} \quad \text{O.K.}$$

NOTE:

THE FOLLOWING COMPUTATIONS
ARE BASED ON THE LAST
INFO'S & ON THE WIND
ANAL. ONLY -

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L H F B R CONT. No. 76⁷⁰ MADE BY FBH DATE 2-9-73
LOCATION COL - LINE "I" DWG. No. _____ CHK'D BY M DATE 2-1-73

③ $l_x = 28'$ $P = 16 \text{ K}$ $L 5 \times 3\frac{1}{2} \times 58$
 $l_y = 14'$

$$P_{E.Q.} = 16 \times .75 = 12 \text{ K}$$

$$\frac{K L}{2 \pi} = \frac{28 \times 12}{1.7} = 197.65$$

$$F_a = 6.25 \text{ KSI}$$

$$P_L = 6.25 \times 4.92 = 30.75 \text{ K} > 12 \text{ K} \quad \text{O.K.}$$

④ $l_x = 28.4'$ $P = 16 \text{ K}$ $L 5 \times 3\frac{1}{2} \times 58$
 $l_y = 14.2'$

$$P_{E.Q.} = 16 \times .75 = 12 \text{ K}$$

$$\frac{K L}{2 \pi} = \frac{28.4 \times 12}{1.7} = 200$$

$$F_a = 6.22 \text{ KSI}$$

$$P_L = 6.22 \times 4.92 = 30.6 \text{ K} > 12 \text{ K} \quad \text{O.K.}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY THC DATE 2-9-73
LOCATION CN - LINE 'I' DWG. No. CHK'D BY JL DATE 2-9-73

⑤ $l_x = 25.6'$

$\angle 5 \times 3 \times \frac{1}{4}$

$l_y = 14'$

$l_x = l_y = 25.6'$

{	H	$P = 14^k$	I	{	$P = 14^k$
		$P_{eq} = 14 \times .75 = 10.5^k$			$\angle 6 \times 6 \times 516$
		$\frac{K}{Z_x} = \frac{25.6 \times 12}{1.62} = 189.6$			$\frac{K}{Z} = \frac{25.6 \times 12}{1.89} = 162.5$
		$\frac{K}{Z_y} = \frac{14 \times 12}{.861} = 195$			$F_a = 718 \text{ KN}$
		$F_a = 6.28 \text{ KN}$			$P_a = 7.18 \times 3.65 = 26.2^k$
		$P_a = 6.28 \times 1.94 = 12.18^k$			$0. K$

⑥ $l_x = 21.17'$
 $l_y = 12'$

$P = 8^k$

$\angle 5 \times 3 \times \frac{1}{4}$

$P_{eq} = 8 \times .75 = 6^k$

$\frac{K}{Z_y} = \frac{12 \times 12}{.861} = 167$

$F_a = 7 \text{ KN}$

$P_a = 7 \times 1.94 = 13.58^k < 6^k \quad , \quad 0. K.$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LNFBK CONT. No. 7670 MADE BY PHR DATE 2-8-73
LOCATION COL. LINE '3' '5' DWG. No. _____ CHK'D BY AL DATE 2.9.73

① $l_x = 17'$

$P = 43 \text{ K}$

$l_y = 17'$

$P_{E.P.} = 43 \times .75 = 32.25 \text{ K}$

$L \ 5 \times 5 \times \frac{1}{2}$

$\frac{K}{2} = \frac{17 \times 12}{1.54} = 132$

$F_a = 9.12 \text{ KN}$

$P_u = 9.12 \times 4.75 = 43.32 \text{ K} \rightarrow 32.25 \text{ K} \quad \text{O.K.}$

② $l_x = 17.5'$
 $l_y = 17.5'$

$P = 35 \text{ K}$

SEE ①

③ $l_x = 22'$

$P = 43 \text{ K}$

$L \ 5 \times 5 \times \frac{1}{2}$

$l_y = 11'$

$P_{E.P.} = 43 \times .75 = 32.25 \text{ K}$

$\frac{K}{2} = \frac{22 \times 12}{1.54} = 171$

$F_a = 6.85 \text{ KN}$

$P_u = 6.85 \times 4.75 = 32.54 \text{ K} \quad \text{O.K.}$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L H FBR CONT. No. 7670 MADE BY TBR DATE 2.9.73
LOCATION COL - LINE '3' DWG. No. _____ CHK'D BY PL DATE 2.9.73

④ $l_x = 24'$
 $l_y = 13'$

$P = 32^k$

$L 5 \times 5 \times \frac{1}{2}$

$P_{eq} = 32 \times .75 = 24^k$

$\frac{K}{l_x} = \frac{24 \times 12}{1.54} = 187$

$F_a = 6.42 \text{ KH}$

$P_u = 6.42 \times 4.75 = 30.49^k \quad O.K.$

⑤ $l_x = 20'$
 $l_y = 12'$

$P = 19^k$

$L 5 \times 5 \times \frac{5}{16}$

$P_{eq} = 19 \times .75 = 14.25^k$

$\frac{K}{l_x} = \frac{20 \times 12}{1.57} = 153$

$F_a = 7.64 \text{ KH}$

$P_u = 7.64 \times 3.03 = 23.14^k \quad O.K.$

⑥ $l_x = 16'$
 $l_y = 10'$

$P = 8^k$

$L 5 \times 3 \frac{1}{2} \times \frac{1}{4}$

$P_{eq} = 8 \times .75 = 6^k$

$\frac{K}{l_x} = \frac{16 \times 12}{1.04} = 184$

$F_a = 6.49 \text{ KH}$

$P_u = 6.49 \times 2.06 = 13.34^k \quad O.K.$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFR CONT. No. 7670 MADE BY THK DATE 2-9-73
LOCATION EL- 179'-4" DWG. No. _____ CHK'D BY HL DATE 2.9.73

①

BEND. GOVERN.

JE 15 x 33.9

$$h = 107.16 \text{ K'}$$

$$f_b = \frac{107.16 \times 12}{83.4} = 15.5 \text{ KSI}$$

②

18W55

$$H = 149.6 \text{ K'}$$

$$f_b = \frac{149.6 \times 12}{98.2} = 18.28 \text{ KSI}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L M F B R CONT. No. 7670 MADE BY THR DATE 2-6-73
LOCATION _____ DWG. No. 6951 CHK'D BY HL DATE 2-9-73

EL. 170'-4"

3 1

$$M = \frac{3.85 \times 14.3}{8} = 6.9 \text{ K'}$$

8 W 13

$L_u = 7.1'$

$$f_b = \frac{6.9 \times 12}{11.3} = 7.02 \text{ KSI}$$

O.K. 8 W 13

6 2

$$M = 10.5 \text{ K'}$$

8 W 13

$L_u = 7.1'$

$$f_b = \frac{10.5 \times 12}{11.8} = 10.7 \text{ KSI}$$

O.K. 9 W 12

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY me DATE 2-6-73
LOCATION _____ DWG. No. 6951 CHK'D BY h DATE 2-8-73

EL 162'-0"

B.

$$M = \frac{1.82 \times 11.66}{8} = 2.65 \text{ K'}$$

C 6x8.2

$L_u = 5'-0"$

$$l_b = \frac{2.65 \times 12}{4.4} = 7.23 \text{ ft}$$

B 2

$$M = 2.63 \text{ K'}$$

$$l_b = \frac{2.63 \times 12}{4.4} = 7.175 \text{ ft}$$

O.K. C 6x8.2

B 3

$$M = 3.57 \text{ K'}$$

8

O.K. C 6x8.2

$$l_b = \frac{3.57 \times 12}{4.4} = 9.74 \text{ ft}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L H FBR CONT. No. 7670 MADE BY 7/12 DATE 2-6-73
LOCATION _____ DWG. No. 6951 CHK'D BY 14 DATE 2-2-73

B4

$$n = 12.77 \text{ k'}$$

$$C 9 \times 13.5$$

$$f_s = \frac{12.77 \times 12}{10.5} = 14.59 \text{ k11}$$

$$L_u = 5.1$$

$$0.1C \quad C 9 \times 13.5$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY TRK DATE 2-7-13
LOCATION _____ DWG. No. 6951 CHK'D BY HL DATE 2-5-13

EL. 109'.0"

B₁

H₁ 17 k'

12 W 27

$$f_b = \frac{17 \times 12}{34.1} = 6 \text{ ksi}$$

O.K. 12 W 27
(R B = 6 1/2")

B₂

H₂ 47.5 k'

12 W 27

$$f_b = \frac{47.5 \times 12}{34.1} = 16.72 \text{ ksi}$$

O.K. 12 W 27

(R B = 6 1/2")

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFBK CONT. NO. 7670 MADE BY TLU DATE 2-7-73
LOCATION LUMP TANKS DWG. NO. _____ CHK'D BY TLU DATE _____

ST/WT DUMP TANK $P = 37000 \text{ \#}$

SD/WT DUMP TANK $P = 21000 \text{ \#}$

$$P = 37000 \text{ \#}$$

$$q = \frac{37000}{8} = 4625 \text{ \#}$$

$$a \approx 6"$$

$$A = 9 + \frac{7}{8} = 9.87" \text{ SAY } 10"$$

$$\psi = 60^\circ$$

$$m = 2A = 20"$$

$$l = 20 \times .86 = 17.2" \text{ SAY } 18"$$

$$c = 8"$$

$$b = 8 \times .5 = 4"$$

$$N = \text{COL SUPPS} = 16$$

$$\frac{l}{r} = 120$$

$$R = \frac{4625 \times 6 \times 3}{4 \times 18} = 1156.25 \text{ \#}$$

$$V = \frac{4625}{4 \times 18} = 64.24 \text{ \#/IN}$$

$$T = \frac{6 \times 4625 \times 6}{18^2} = 513.89 \text{ \#/IN}$$

$$f_c = \frac{18000}{1 + \left(\frac{l^2}{22 \times 18000} \right)} = 10000 \text{ \#/IN}^2$$

$$t_c = \sqrt{\frac{6 \times 2312.5 \times 6}{4 \times 22000}} = .972"$$

SAY 1"

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER CHFR CONT. No. 7670 MADE BY JK DATE 2-7-73
LOCATION SUN TANK DWG. No. _____ CHK'D BY _____ DATE _____

$$f_L = \frac{2312.5 \times 6 \times 6}{4 \times 12} = 20812.5 \text{ lb/in}^2$$

$$f_{\text{WIND}} = \frac{(P_w/H) \frac{L}{Z}}{Z} = 1771.88 \text{ lb/in}^2$$

$$\frac{2312.5 / 1 \times 4}{10000} + \frac{20812.5 + 1771.88}{22000} < 1.33$$

$$A_b = \frac{4625}{33000} = .140 \text{ in}^2$$

$$\text{USE } t_b = 3/4"$$

$$F(\text{STRESS IN THE WELD}) = \sqrt{64.24^2 + 513.89^2} = 517.89 \text{ lb/in} \quad \text{USE } 5/16" \text{ MIN. WELD}$$

$$\text{USE } 8 \text{ } 7/8" \phi \text{ BOLTS.}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFBK CONT. No. 7670 MADE BY 7012 DATE 7-7-73
LOCATION GUMP TANK DWG. No. _____ CHK'D BY _____ DATE _____

$$P = 21000 \text{ lb}$$

$$Q = \frac{21000}{8} = 2625 \text{ lb}$$

$$R = \frac{2625 \times 6 \times 3}{4 \times 6} = 656.25 \text{ lb}$$

$$V = \frac{2625}{4 \times 18} = 36.46 \text{ lb/in}$$

$$T = \frac{6 \times 2625 \times 6}{18^2} = 291.7 \text{ lb/in}$$

$$t_c = \sqrt{\frac{6 \times 1312 \times 6}{4 \times 22000}} = .732" \quad \text{USE } 3/4"$$

$$J = \frac{1312 \times 6 \times 6}{4 \times .75^2} = 20992 \text{ lb/in}^2$$

$$I_{\text{WIND}} = \frac{(P_{\text{WIND}}) \frac{L}{2}}{Z} = 2700 \text{ lb/in}^2$$

$$\frac{1312}{4 \times 75} + \frac{20992 + 2700}{22000} < 1.33$$

$$M_s = \frac{2625}{33000}$$

USE 1/2"

WFLA: 1/4" H.W.

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LMFBR CONT. No. 1670 MADE BY THA DATE 2-6-72
LOCATION COL- LINE "I" DWG. No. _____ CHK'D BY MM DATE 2.8.72

Y
X

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L.H.F.B.R. CONT. No. 7670 MADE BY FBZ DATE 8-6-73
LOCATION COL. LINE "H" DWG. No. _____ CHK'D BY ML DATE 2-8-73

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFR CONT. No. 7670 MADE BY THK DATE 2-6-73
LOCATION COL. LINE- "5" DWG. No. _____ CHK'D BY ful DATE 2.7.73

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY TZU DATE 2-6-73
LOCATION COL - LINE "3" DWG. No. _____ CHK'D BY SL DATE 2-8-73

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY WBR DATE 3-6-73
LOCATION EL- 109'-0" DWG. No. _____ CHK'D BY W DATE 2-8-73

623

$$l = 6'$$

$$P = 24k$$

$$P_1 = 24 \times .75 = 18k$$

$$< 3 \times 3 \times 14$$

$$\frac{K_L}{L} = \frac{6 \times 12}{.93} = 77.4$$

$$F_m = 15.64 kH$$

$$l_y = 15.64 \times 1.44 = 22.52 k < 18 k \quad O.K.$$

B₁

14W34

①

Use BM for Joist
TAMMS 14W34 (K₁ = 6.2)

$$12.86k$$

$$11.14k$$

$$n = 56.41 k'$$

$$f_s = \frac{56.41 \times 12}{49.5} = 13.96 kH$$

$$\frac{13.96}{24} + \frac{1.13}{19.42} < 1.55$$

$$f_c = \frac{15 \times .75}{10} = 1.13 kH$$

$$\frac{K_L}{L} = \frac{4.5 \times 12}{1.46} = 37 \quad F_m = 19.42 kH$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L HBR CONT. No. 7670 MADE BY TBR DATE 3-6-73
LOCATION EL- 189'-4" DWG. No. _____ CHK'D BY FL DATE 2.3.73

$P = 5.7 \text{ K}$

USE 12W14

WINDSOR, CONN.

CONT. No

MADE BY

DATE 2-6-73

_DWG. No.

ЧК-В

DATE 7-9-63

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LMFBR CONT. No. 7670 MADE BY TRR DATE 2-9-73
LOCATION COL³ LOAD - DWG. No. _____ CHK'D BY mu DATE 2.18.73

D = DEAD LOAD

CONT = CONTINGENCY

L = LIVE LOAD

W = WIND LOAD

EL. COL	H3		H5		I3		I5		H6A		I6A	
	D+L	W	D+L	W	D+L	W	D+L	W	D+L	W	D+L	W
189'-4"	2	60	2	60	2	60	2	60				
183'-4"	2		2		2		2					
179'-4"	30		20		30		20					
170'-4"	4		2		1							
161'-10 1/2"	3		3		7		7					
151'-0"	1		1		3		3					
140'-6"	1	146	1	146	3	146	3	146				
130'-0"	1		1		3		3					
119'-6"	1		1		3		3					
109'-0"	6		24		6		20		25		31	
CONT	15		15		15		15		10		10	
	66k		72k		75k		78k		35k		41k	

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LANFRR CONT. NO. 7670 MADE BY TAK DATE 2-12-73
LOCATION BS. R. DWG. NO. _____ CHK'D BY M DATE 2-13-73

$$P = 189^k$$

H₃₋₅
I₃₋₅

$$f'_c = \text{CONCRETE} = 3000 \text{ psi}$$

at 28 days.

$$F_b(\text{B.P.}) = 27 \text{ ksi}$$

$$F_p = (\text{Bearing press. on sur}) =$$

$$= .25 \times 3000 = .750 \text{ ksi}$$

$$A_{req} = 170 \cdot 750 = 227 \text{ in}^2$$

$$\text{Assume } C = 18"$$

$$B = 252/18 = 12.6" \quad (\text{USE } 14")$$

$$m = (C - .95d) / 2 = 18 - .95 \times 10 = \frac{8.5}{2} = 4.25"$$

$$n = (B - .80b) / 2 = 14 - .80 \times 10 = \frac{6}{2} = 3"$$

$$t = \sqrt{\frac{3 \times .750 \times 4.25^2}{27}} = 1.226"$$

$$f_{\text{fact}} = \frac{189}{18 \times 14} = .750 \text{ ksi}$$

USE 18 x 1'-2" x 1'-4"

$$HBA - ICA =$$

$$8W17 \quad P = 41^k \quad d = 8" \quad b = 5\frac{1}{4}"$$

$$A_{req} = \frac{41}{.750} = 55 \text{ in}^2$$

$$C = 10$$

$$B = 55/10 = 5.5"$$

$$t = .345"$$

USE 10 x 6 x 3/8"

$$m = 1.2" \quad n = .518"$$

22

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER CHF RR CONT. No. 7670 MADE BY JMR DATE 2.12.73
LOCATION COLB. DWG. No. _____ CHK'D BY JMR DATE 2.13.73

H₃ - I₃ - H₅ - I₅ (I TR)

$$\frac{ke}{2} \leq 120$$

$$P_{0+L} = 78^k (\text{med})$$

$$P_w = 146^k (\text{med})$$

$$l_x = 21'$$

$$l_y = 21'$$

$$P_{013} = (78 + 148) \cdot 75 = 169.5^k$$

low 49

$$z_y = 2.54''$$

$$\frac{ke}{z_y} = \frac{21 \times 12}{2.54} = 99 \quad F_o = 13.10 \text{ KH}$$

$$P_{L1} = 13.10 \times 14.4 = 188.64^k > 169.5^k$$

O.K

II (TR)

low 49

$$P_{0+L} = 45^k$$

$$P_w = 60^k$$

$$P_{013} = (45 + 60) \cdot 75 = 78.75^k$$

$$l_x = l_y = 21'$$

$$\frac{ke}{z_y} = \frac{21 \times 12}{2.54} = 99$$

$$F_o = 13.10 \text{ KH}$$

$$P_{L1} = 13.1 \times 14.1 = 188.64^k - \underline{O.K}$$

23

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LMRFR CONT. No. 7670 MADE BY mx DATE 2-12-78
LOCATION COLJ- DWG. No. _____ CHK'D BY ml DATE 2-15-78

A6A - I5A

8W17

$$P_{A+L} = 41K$$

$$L_x = L_y = 9.67'$$

$$\frac{L_x}{L_y} = \frac{9.67 \times 12}{1.22} = 95$$

$$\bar{F}_x = 13.6 KN$$

$$P_x = 13.6 \times 5 = 68K$$

O.K

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LEBR CONT. No. 7170 MADE BY THR DATE 2-13-73
LOCATION EL- 110'-0" DWG. No. _____ CHK'D BY PL DATE 2-15-73

$$W = 119K'$$

18W45

$$\sqrt{b} = \frac{119 \times 12}{78.9} = 18.1 \text{ KHI}$$

$$W = 151.9K'$$

18W55

$$\sqrt{b} = \frac{151.9 \times 12}{98.2} = 18.56 \text{ KHI}$$

25

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFBK CONT. No. 76⁷⁰ MADE BY PSL DATE 2-9-73
LOCATION EL - 112'-4" DWG. No. _____ CHK'D BY AL DATE 2-11-73

$$H = 29.95K'$$

12U14

$$f_s = \frac{29.95 \times 12}{14.8} = 24.2 K11$$

$$H = 16.74K'$$

12U14

$$f_b = \frac{16.74 \times 12}{14.8} = 13.59 K11$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LMFBR CONT. No. 76⁷⁰ MADE BY JKL DATE 2-9-73
LOCATION EL - 112'-4" DWG. No. _____ CHK'D BY JKL DATE 2-15-73

B.
(3' FROM SA)

$$M = 7.73 \text{ K'}$$

BW 13

$$f_s = \frac{7.73 \times 12}{9.9} = 9.37 \text{ K'}$$

$$L_4 = 59'$$

POST. LNA SUPP (EL. 105'-10")

$$l = 6.5' \quad \angle 4 \times 4 \times \frac{1}{4} \quad f_s = 1.5 \text{ K}$$

$$\frac{M}{Z_y} = \frac{6.5 \times 12}{1.25} = 62$$

$$f_a = 17.24 \text{ KH}$$

$$C_1 = 17.24 \times 1.94 = 33.5 \text{ K} \quad \text{O.K.}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFR CONT. No. 7670 MADE BY JMR DATE 2-12-73
LOCATION FL - 110' - 0" DWG. No. _____ CHK'D BY JL DATE 2-12-73

$$w_1 = \frac{90}{3.14 \times 75.5} = 4.56 \text{ K/FT}$$

$$w_2 = \frac{45}{3.14 \times 67} = 2.57 \text{ K/FT}$$

$$H_1 = 22 \text{ K'}$$

$$USE \quad 14/30 \quad (6 \frac{3}{4} \text{ ft})$$

$$H_2 = 154.291 \text{ K'}$$

$$18 \text{ W } 55$$

$$f_b = \frac{154.291 \times 12}{98.2} = 18.85 \text{ K/ft}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFR CONT. No. 76¹⁰ MADE BY JR DATE 2-13-72
LOCATION EL- 110'-0" DWG. No. _____ CHK'D BY /L DATE 2.12.73

$$H_2 = 201.6 \text{ k'}$$

21W 62

$$f_s = \frac{201.6 \times 12}{126.4} = 19.08 \text{ ksi}$$

$$H_2 = 82.96 \text{ k'}$$

16/36

$$f_s = \frac{82.96 \times 12}{56.3} = 17.68 \text{ ksi}$$

23

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER UNBR CONT. No. 7670 MADE BY THU DATE 2-13-73
LOCATION EL. 123'-0" DWG. No. _____ CHK'D BY fk DATE 2.12.73

$$h = 13.5'$$

8w17

$$f_b = \frac{13 \times 12}{14.1} = 11.06 \text{ ksi}$$

8w17

8w17

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LAHBR CONT. No. 7670 MADE BY TRK DATE 2-12-73
LOCATION EL- 123'-0" DWG. No. _____ CHK'D BY LL DATE 2.18.73

$$W = 86.5 \text{ K}'$$

14 W34

$$f_s = \frac{86.5 \times 12}{48.5} = 21.4 \text{ K}'$$

14/74

$$W = 79.9 \text{ K}'$$

$$f_s = \frac{79.9 \times 12}{48.5} = 19.74 \text{ K}'$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB CONT. No. 7674 MADE BY MA DATE 2-14-73
LOCATION CO. 5. DWG. No. _____ CHK'D BY ME DATE 2-15-73

$$G_x = 3x$$

$$P_2 = 53^k$$

8W 20

$$l_x = l_y = 10.5'$$

$$\frac{M}{Z} = \frac{10.5 \times 12}{1.2} = 105$$

$$F_2 = 12.33 \text{ kN}$$

$$P_2 = 12.33 \times 5.88 = 72.5 \text{ k}$$

$$G_x = 5A$$

8W 24

$$P_2 = 66^k$$

$$l_x = l_y = 13'$$

$$\frac{M}{Z} = \frac{13 \times 12}{1.61} = 97$$

$$F_2 = 13.35 \text{ kN}$$

$$P_2 = 13.35 \times 7 = 93.45 \text{ k}$$

31

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L HFB CONT. No. 7670 MADE BY MR DATE 2-14-13
LOCATION C203 DWG. No. _____ CHK'D BY PL DATE 2.13.13

CX - SA

$$i = 55 \text{ K}$$

8/24

$$L_x - L_y = 13.0'$$

$$\frac{K_x}{L_y} = \frac{13.0 \times 7}{1.61} = 97$$

$$\bar{h}_x = 12.36 \text{ K}$$

$$P_{hx} = 13.35 \times 7 = 93.45 \text{ K}$$

32

$$i = 26 \text{ K}$$

8/17

$$L_x - L_y = 10.5'$$

$$\frac{K_x}{L_y} = \frac{10.5 \times 12}{1.16} = 109$$

$$\bar{h}_x = 11.81 \text{ K}$$

$$P_{hx} = 11.81 \times 5 = 59.05 \text{ K}$$

32

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER CHFR CONT. No. 7610 MADE BY TH DATE 2-14-77
LOCATION CHS- DWG. No. _____ CHK'D BY JA DATE 2-15-77

Dx - 3 (DTW EL - 113 - 123)

P = 13K

9/17

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY TRR DATE 2-14-73
LOCATION BS ft - DWG. No. _____ CHK'D BY U DATE 2-15-73

COL: 3X
6x-3x
6x 5A
6x 5A

P = 66K

d = 7.8

b = 6.5

$\bar{f}_b(8.8) = 27 \text{ ksi}$

$f_c = 3000 \text{ psi}$ at 28 days.

$F_p = .25 \times 3000 = .750 \text{ ksi}$

$A_{req} = \frac{66}{.750} = 88 \text{ in}^2$

C = 12"

$f = \frac{88}{12} = 7.33" \text{ use } 8"$

$F_p(\text{actual}) = \frac{66}{12 \times 8} = .686 \text{ ksi}$

$t = \sqrt{\frac{3 \times .686 \times 2.259^2}{27}} = .623"$

$m = (C - .95 \times 7.875) / 2 = 2.259"$

$n = (6 - .8 \times 6.5) / 2 = 1.4"$

USE

12 x 8 x 3/4"

8W 24

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LHFB R CONT. No. 7670 MADE BY Philburn DATE 2-5-73
LOCATION WIND LOAD DWG. No. _____ CHK'D BY _____ DATE _____

WIND PRES. 30 #/FT²

COL. LINE H E I

COL. LINE 3 4 5

EL. 109'-0"

$$(6A) P_1 = 30 \times 10.1 \times 5.5 = 1.7^k$$

$$P_1 = P_2 = 10.085 \times 7 \times 30 = 2.1^k$$

$$(15) P_1 = 30 \times 10.1 \times 14.83 = 4.5^k$$

$$(33) P_2 = 30 \times 10.1 \times 9.33 = 2.8^k$$

EL. 119'-6"

$$P_1 = P_2 = 30 \times 15.75 \times 9.33 = 4.4^k$$

$$P_1 = P_2 = 15.75 \times 7 \times 30 = 3.3^k$$

EL. 140'-6"

$$P_1 = P_2 = 21.687 \times 9.33 \times 30 = 6.1^k$$

$$P_1 = P_2 = 21.687 \times 7 \times 30 = 4.6^k$$

EL. 161'-10 1/2"

$$P_1 = P_2 = 20.352 \times 9.33 \times 30 = 5.7^k$$

$$P_1 = P_2 = 20.352 \times 7 \times 30 = 4.3^k$$

EL. 179'-4"

$$P_1 = P_2 = 9.165 \times 9.33 \times 30 = 2.6^k$$

$$P_1 = P_2 = 9.165 \times 7 \times 30 = 1.9^k$$

EL. 189'-4"

$$P_1 = P_2 = 9.33 \times 5 \times 30 = 1.4^k$$

$$P_1 = P_2 = 5 \times 7 \times 30 = 1.1^k$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER LMBR CONT. No. 76⁷⁰ MADE BY TMR DATE 2-2-73
LOCATION H&S - COMPUT. DWG. No. _____ CHK'D BY _____ DATE _____

$$g = 386.4 \text{ IN. SEC}^{-2}$$

DRUM + PIP + DOWN C. + PUMP.

$$W = 100000 \text{ #}$$

4 POINTS SUPP.

$$u = \frac{100000}{4 \times 386.4} = 64.7 \text{ lb SEC}^2/\text{IN}$$

SILENCER + P

SIZE : 20" (EL. 183'-4") 2 SUPPS

$$u = \frac{1500}{386.4} = 3.88 \text{ lb SEC}^2/\text{IN}$$

SIZE : 18" (EL. 183'-4") 2 SUPPS

$$u = \frac{1000}{386.4} = 2.59 \text{ lb SEC}^2/\text{IN}$$

(EL. 189'-4")

$$u = \frac{1000}{386.4} = 2.59 \text{ lb SEC}^2/\text{IN}$$

SIZE 16" (EL. 189'-4")

$$u = \frac{700}{386.4} = 1.81 \text{ lb SEC}^2/\text{IN}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L H B R CONT. No. 767² MADE BY THR DATE 2-2-73
LOCATION HAM COMPUT. DWG. No. _____ CHK'D BY _____ DATE _____

PIPES

JOINT (52) EL: 119'-6"

$$u_1 = \frac{5000}{386.4} = 12.94 \text{ lb sec}^2/\text{in}$$

$$u_2 = \frac{1000}{386.4} = 2.59 \text{ lb sec}^2/\text{in}$$

ELEV - 109'-0"

$$u_3 = \frac{6000}{386.4} = 15.52 \text{ lb sec}^2/\text{in}$$

COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.

CUSTOMER L H F&R CONT. No. 7570 MADE BY T.M.P. DATE 2/6/73
LOCATION _____ DWG. No. _____ CHK'D BY _____ DATE _____

	O.D	t _w	L (FT)	W _T /F _T (H ₂ T +) H/F _T (W)	TOT. WT #
Downcomer	8.58	.906	59	90.6	5345.4
Relief Tubes.	(6) 5	.480	11 + 11	29.	638.
	(3) 3 1/2	.340	11	14.2	156.2
Hot inlet Line	6.58	.816	7	53.	371.
Exp inlet Line	8.58	.816	7	76.	532.
F.W. Line	6.58	.816	7	53.	371.
PUMP.					10.000
DRUM.					17414 #
WT					65500 #
					<u>11526 #</u>
					94440 #
					SAY <u>100000 #</u>

Wind = 30 k/ft²

GENERAL NOTES:

CONTRACT

FURNISH ONE COMPLETE ARRST. AS SHOWN PER ~~E-994-014~~

ALL STRUCT. STEEL SHALL BE ASTM A-36 PER C.E.I. PURCHASE INSTRUCTIONS FIG 2(c)

DESIGN FABRICATION AND ERECTION OF STRUCT. STEEL SHALL BE IN ACCORDANCE WITH THE FOLLOWING:

- a) C.E.I. M&P SPECS. 5.11.1(h), M&P SPECS. 2.4.2.1(b) & PURCHASE INSTRUCTION FIG 2(c).
- b) LATEST AISC SPECS.

SHOP CONNECTIONS SHALL BE WELDED IN ACCORDANCE WITH C.E.I. DWG. E-994-014. MIN. CONNECTIONS, UNLESS LOADS (END REACTIONS, VERTICAL AND/OR AXIAL) OR DETAILS DICTATE A HEAVIER CONNECTION. ANY REQUIRED MODIFICATION OF THE FOREGOING SHALL BE COMPATIBLE WITH THE LATEST A.I.S.C. SPECS.

FIELD CONNECTIONS IN GENERAL TO BE 7/8" DIA. HIGH STRENGTH BOLTS, FRICTION TYPE, A325 (HEAVY SEMI-FINISHED HEX HEAD AND NUT WITH ONE PLAIN HARDENED WASHER FOR EACH BOLT; PLUS BEVELED WASTERNHISEN SURFACE HAS A SLOPE IN EXCESS OF 1:20) PER C.E.I. DWG. E-994-014 - MIN. CONNECTIONS - UNLESS LOADS (END REACTIONS, VERTICAL AND/OR AXIAL) OR DETAILS DICTATE A HEAVIER CONNECTION. ALL CONTACT SURFACES TO BE FREE OF PAINT. ANY REQUIRED MODIFICATIONS OF THE FOREGOING SHALL BE COMPATIBLE WITH THE LATEST A.I.S.C. SPECS. UNFINISHED BOLTS WILL BE PERMITTED FOR FIELD CONNECTIONS OF GIRTS AND STAIR TREADS.

DETAILER SHALL MAKE POINT TO POINT TAKE OFF OF FIELD BOLTS. FURNISH EXTRAS FOR EACH BOLT SIZE PER A.I.S.C. SPECS.

SHOP AND FIELD WELDS TO BE PER A.W.S. STANDARD CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION, EXCEPT BUILT UP WELDED GIRDERS SHALL BE IN ACCORDANCE WITH A.W.S. SPECIFICATION FOR WELDED HIGHWAY AND RAILWAY BRIDGES, D.2.0-66, AND C.E.I. M&P SPECS. 5.11.1.1.

ALL BEARING ENDS OF COLUMNS TO BE MILLED.

ALL FIELD METAL ARC WELDING ELECTRODES TO BE ASTM SPECS. A-233 CLASS E7015-16 OR 18. THE DETAILER SHALL BE GUIDED BY THE FOLLOWING WHEN DETAILING CONNECTIONS:

- a) BEAM CONNECTIONS WITH NO AXIAL LOADS

THE DETAILER SHALL USE THE BEAM CONNECTIONS AS SHOWN ON C.E.I. DWG. E-994-014 - MIN. CONNECTIONS - UNLESS THE END REACTION INDICATES A HEAVIER CONNECTION. BEAM CONNECTIONS SHOWN ON E-994-014 ARE FOR VERTICAL LOADS ONLY.

- b) BEAM CONNECTIONS WITH AXIAL LOADS

THE DETAILER SHALL CHECK THE PLAN AND ELEVATION DRAWINGS FOR AXIAL LOADS (USE LARGEST) TRANSFERRED THRU END CONNECTIONS AND DESIGN THE CONNECTION FOR BOTH AXIAL AND VERTICAL LOADS, BUT CONNECTION MUST BE AT LEAST EQUAL TO THE CONNECTIONS AS SHOWN ON C.E.I. DWG. E-994-014 - MIN. CONNECTIONS. AXIAL LOADS TRANSFERRED THRU END CONNECTIONS SHOWN THUS (+10K) ARE FOR DEAD AND LIVE LOAD & AS INDICATED IN SIGN AND MAGNITUDE. LOADS ARE REVERSIBLE SHOWN THUS $\pm 10K$ UNLESS INDICATED OTHERWISE AND MAY BE TREATED AS WIND OR SEISMIC LOADS AS DEFINED BY A.I.S.C.

IF THE BEAM HAS MORE THAN 10K AXIAL LOAD AND THE BEAM VERTICAL END REACTION IS NOT SHOWN, THE DETAILER SHALL ASSUME THE END REACTION TO BE 10K UP TO AND INCLUDING 14" MEMBERS AND 36K FOR MEMBERS ABOVE 14" TO AND INCLUDING 21" 50K FOR MEMBERS ABOVE 21".

c) MINIMUM POST, HANGER OR BRACING CONNECTION

LOADS TO BE 18^K UNLESS SHOWN OTHERWISE ON ARRGT. DWG.

d) MINIMUM BRACING, POST OR HANGER CONNECTION

1. TWO BOLTS FOR SINGLE ANGLES (18^K)
2. FOUR BOLTS FOR TEES (36^K)
3. FOUR BOLTS PER FLANGE FOR WIDE FLANGE BRACING (72^K)
4. TWO-BOLTS IN DOUBLE SHEAR OR FOUR BOLTS IN SINGLE SHEAR FOR DOUBLE ANGLES (36^K)

LIVE LOAD IS 100 PSF UNLESS NOTED.

LATERAL WIND FORCES ARE AS FOLLOWS:

30 PSF

LATERAL SEISMIC FORCES: 10% D-L.

BRACING LOADS SHOWN THUS (+10^K) ARE FOR DEAD AND LIVE LOAD AS INDICATED IN SIGN AND MAGNITUDE. LOADS SHOWN THUS +10^K ARE REVERSIBLE UNLESS INDICATED OTHERWISE AND MAY BE TREATED AS WIND OR SEISMIC LOADS AS DEFINED BY A.I.S.C.

WIND OR STABILITY LOADS ARE ADDITIVE TO D.L. & L.L. AND A ONE-THIRD INCREASE IN ALLOWABLE STRESS IS PERMITTED FOR THE TOTAL LOAD.

LOADS ARE SHOWN IN KIPS, 1^K INDICATES 1000 LBS. - SIGN INDICATES COMPRESSION.
SIGN INDICATES TENSION.

PIECE MARKS ON ALL MEMBERS TO BE PER C.E.I. STANDARD INSTRUCTIONS SI-14-C3 INDEX SD-2.1.4.

ALL ASSEMBLIES WEIGHING OVER TEN TONS SHALL HAVE THEIR LIFTING WEIGHT SHOWN ON THE DETAIL DRAWING AND PAINTED ON THE MEMBER IN THE SHOP AFTER THE SHOP COAT OF PAINT HAS BEEN APPLIED.

STEEL SHOWN THUS - - - - NOT BY C.E.I.

NO SHOP PAINT FOR A DISTANCE OF 3" FROM A GROUP OF OPEN HOLES FOR FRICTION TYPE BOLTS.

FIELD PAINT AND TOUCH UP NOT BY C.E.I.

FOR TYPICAL PLATFORM DETAILS SEE C.E.I. DWG. E-

STRUCTURAL STEEL SHALL BE PREPARED AND SHOP PAINTED IN ACCORDANCE WITH

ERECTOR NOTES:

ERECT MEMBER WITH PAINTED PIECE MARK TO END AS SHOWN ON ERECTION DRAWING.

PLACE ONE HARDENED STEEL WASHER UNDER ELEMENT TURNED (NUT OR BOLT HEAD) IN TIGHTENING.

HIGH STRENGTH BOLTS TO BE TIGHTENED WITH PROPERLY CALIBRATED WRENCHES OR BY THE TURN-OF-THE-NUT METHOD, AS OUTLINED IN THE "SPECIFICATIONS FOR STRUCTURAL JOINTS" USING ASTM A-325 BOLTS AS APPROVED BY THE RESEARCH COUNCIL ON RIVETED AND BOLTED STRUCTURAL JOINTS.

COLUMNS SHALL BE ERECTED PLUMB TO A TOLERANCE NOT EXCEEDING 1 TO 1000 WITH A MAX. OF 1" AT THE COLUMN CENTERLINE.

IN SETTING BASE PLATES TO GRADE, CHECK ELEVATION TO THE MILLED SURFACE ON THE TOP OF THE BASE PLATE SLAB. DO NOT WORK FROM THE BOTTOM OF THE SLAB. MILL OVERRUN ON THE THICKNESS AND FLATNESS IS TO BE TAKEN UP IN THE THEORETICAL FIGURE GIVEN FOR THE GROUT DIMENSION.

DISTRIBUTION &
ATTACHMENTS
TO LIST ATRANSMITTAL OF
DESIGN STANDARDMECHANICAL DESIGN
AND STANDARDS DEPT.

DESIGN
&
INSTRUCTION

STANDARD

REVISED

FOR TYPICAL PLATFORM, STAIR AND
FIXED LADDER DETAILS

IDENTIFY THIS STD. BY

INDEX SI-2.1.3

SI-1-69-4

Date: 1-2-73

INSTRUCTION NO. SI-1-69-4

DRAWING NO. See Remarks

THIS STANDARD TO BE EFFECTIVE IMMEDIATELY

THIS STANDARD SUPERSEDES AND CANCELS Standard Instruction SI-1-69-3, dated 1-5-72,
Index: SI-2.1.3, FE-603(1-72) and FE-596(6-71).

COPIES OTHER THAN LIST A

REMARKS: FE-603(1-73) Typical Platform & Stair Details
FE-596(1-73) Fixed Ladder Details

Revision: Revised forms in accordance with OSHA & ANSI Standards
& Deleted Paragraph 2.0 in text.

V.V. Kantisaria *Ex*
ENGINEER

APPROVED BY:

A. Patt
A. PATT

Reproducible to:
Mr. F. A. Witrylak - Montreal
Mr. H. R. Marlin - Chattanooga

SUBJECT: TYPICAL PLATFORM, STAIR
AND FIXED LADDER DETAILS

Date: 1-2-73
Index No.: SI-2.1.3
Inst. No.: SI-1-69-4
Sheet 1 of 1

1.0 The anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail.

1.1 Standard railing shall consist of top rail, intermediate rail, and post, and shall have a vertical height of 42 inches nominal from the upper surface of top rail to the floor, platform, runway, or ramp level. The top rail shall be smooth surfaced throughout the length of the railing.

1.1.1 A stair railing shall be of construction similar to a standard railing but the vertical height shall be not more than 34 inches nor less than 30 inches from the upper surface of the top rail to the surface of the tread in line with face of riser at forward edge of tread.

1.2 A standard toe plate shall be 4 inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and with not more than 1/4 inch clearance above floor level.

Reference: 1. Occupational Health & Safety Standards (OSHA).
2. American National Standard - ANSI A12.1

COMBUSTION ENGINEERING, INC.

COMBUSTION DIVISION
NUCLEAR PRODUCTION SCHEDULE

CUSTOMER: A.E.C. CONTRACT NO. 7670
TYPE VESSEL: STEAM DRUM & PIPING UNIT NO. 30 TYPE Model
CUSTOMER'S ORDER NO. _____ REVISION NO. _____
ISSUED BY: J.H.W. CHECKED BY: _____ DATE ISSUED: 2/5/75
FABRICATION OF THIS UNIT IS BASED ON A _____ DAY WORK WEEK

FABRICATION LEGEND
ATT = ATTACHMENTS
B.W. = BURN
C.W. = CLEAN
F & W = FIT & WELD
F.W. = FUME
S.S. = STEEL SHEET
S.S. = STEEL STRIPS
M.T. = MACHINING
M.P. = MOUNT
L.O. = LAY OUT
L.S. = LONG SHAM
V.S. = VESSEL
M.S. = MOUNT
S.S. = SAEY

DETAILED MATERIAL LISTING
A = DRAWING RELEASE TO SHOP FOR FABRICATION
B = DRAWING RELEASE TO CUSTOMER FOR APPROVAL
C = DRAWING RELEASE TO C.E. WITH COMMENTS
D = DRAWING RELEASE TO C.E. WITH COMMENTS
E = DRAWING RELEASE TO C.E. WITH COMMENTS
F = DRAWING RELEASE TO C.E. WITH COMMENTS
G = DRAWING RELEASE TO C.E. WITH COMMENTS
H = DRAWING RELEASE TO C.E. WITH COMMENTS
I = DRAWING RELEASE TO C.E. WITH COMMENTS
J = DRAWING RELEASE TO C.E. WITH COMMENTS
K = DRAWING RELEASE TO C.E. WITH COMMENTS
L = DRAWING RELEASE TO C.E. WITH COMMENTS
M = DRAWING RELEASE TO C.E. WITH COMMENTS
N = DRAWING RELEASE TO C.E. WITH COMMENTS
O = DRAWING RELEASE TO C.E. WITH COMMENTS
P = DRAWING RELEASE TO C.E. WITH COMMENTS
Q = DRAWING RELEASE TO C.E. WITH COMMENTS
R = DRAWING RELEASE TO C.E. WITH COMMENTS
S = DRAWING RELEASE TO C.E. WITH COMMENTS
T = DRAWING RELEASE TO C.E. WITH COMMENTS
U = DRAWING RELEASE TO C.E. WITH COMMENTS
V = DRAWING RELEASE TO C.E. WITH COMMENTS
W = DRAWING RELEASE TO C.E. WITH COMMENTS
X = DRAWING RELEASE TO C.E. WITH COMMENTS
Y = DRAWING RELEASE TO C.E. WITH COMMENTS
Z = DRAWING RELEASE TO C.E. WITH COMMENTS

- LEGEND**
- ① ENGINEERING RELEASE TO PRODUCE MATERIAL
 - ② RELEASE DTD FOR MATERIAL
 - ③ PURCHASE ORDER DATE
 - ④ ENGINEERING RELEASE TO FABRICATE
 - ⑤ M.T.E. ENGR. FIXTURE RELEASE
 - ⑥ TRAVELER RELEASE
 - ⑦ RECEIVE MATERIAL
 - ⑧ START R/A P FABRICATION
 - ⑨ START NUCLEAR FABRICATION
 - ⑩ SUBLET FABRICATION
 - ⑪ COMPLETION DATE
 - ⑫ SHIPMENT DATE

* WEEKS OF FABRICATION

STEAM DRUM

CONTRACT SHIP DATE: 8/22/75

PIPING

ES-7670-9

SS = Structural Analysis
ST = Thermal Analysis
XXO = Superheater Analysis
XXS = Evaporator Analysis

COMBUSTION ENGINEERING, INC.

COMBUSTION DIVISION
ANALYTICAL SCHEDULE
CE

CUSTOMER: AEC CONTRACT NO. 7670
TYPE VESSEL: 30 MW Sodium Steam Generator
CUSTOMER'S ORDER NO.: AT 111-1 - 3031 REVISION NO. 9
ISSUED BY: G. J. Lawrence CHECKED BY: _____ DATE ISSUED: 1/24/73

ES-7670-5-1

SS141 & SS146 SODIUM-WATER REACTION

SS100 & SS105
TENTATIVE SIZING

SS255 FATIGUE OF
WATER INLET NOZZLE

SS280 & SS285 FATIGUE OF
SECONDARY RELIEF NOZZLES

SS410 & SS415 FATIGUE OF SUPPORT
SKIRT

ST100 & ST105 PRELIMINARY
THERMAL/HYDRAULIC SIZING

ST255 & ST250 WATER INLET NOZZLE,
SUPERHEATED STEAM OUTLET NOZZLE

ST280 & ST285 SECONDARY
RELIEF NOZZLES

ST410 & ST415 SUPPORT
SKIRT

1/2 OF SS340, SS345, SS380 & SS385 FATIGUE OF
TUBES, TUBE SUPPORTS, SODIUM SIDE INTERNALS

SS250 FATIGUE OF SUPERHEATED STEAM
OUTLET NOZZLE

1/2 OF SS310, SS315, SS350 & SS355 (SEE
FIRST HALF)

ST310 & ST315 THER/HYDRAULIC ST280 & ST285
TUBES, TUBE SUPPORTS SODIUM INTERNALS

SS110 & SS115 H.P. TUBESHEET, SODIUM
FLANGE, SUPPORT SKIRT JOINTURE

SS120 & SS125 FATIGUE OF TUBE TO TUBESHEET WELD

ST120 & ST125 TUBE TO
TUBESHEET WELD

SS111 & SS116 FATIGUE OF HIGH PRESSURE TUBESHEET, SODIUM FLANGE, SUPPORT SKIRT JOINTURE

SS420 & SS425 FATIGUE OF LOWER SEISMIC
SUPPORTS

ST110 & ST115 H.P. TUBESHEET, SODIUM FLANGE,
SUPPORT SKIRT JOINTURE

ST420 & ST425 LOWER
SEISMIC SUPPORTS

SS130 & SS135 TOP HEAD, STEAM FLG.,
HIGH PRESSURE SHELL

SS340 & SS345 FATIGUE OF SATURATED
STEAM NOZZLES

SS320 & SS325 FATIGUE OF SODIUM CROSSOVER NOZZLES

ST340 & ST345 SATURATED
STEAM NOZZLES

ST320 & ST325 SODIUM
CROSSOVER NOZZLES

SS131 & SS136 FATIGUE OF TOP HEAD,
STEAM FLANGE, HIGH PRESSURE SHELL

SS330 & SS335 FATIGUE OF 1/2 OF
STEAM SIDE INTERNALS

ST130 & ST135 TOP HEAD, STEAM FLANGE,
HIGH PRESSURE SHELL

ST330 & ST335 STEAM SIDE
INTERNALS

SS20 & SS25 FATIGUE OF SODIUM INLET/OUTLET NOZZLE

ST20 & ST25 SODIUM INLET/OUTLET NOZZLE

SS140 & SS145 FATIGUE OF SODIUM SHELL

ST140 & ST145 SODIUM SHELL

ST500 & ST505 MISC.

INDEPENDENT ANALYSIS TO
VERIFY THERMAL SIZING CODE

ES-7670-5-1

CONTRACT 7670 CUSTOMER IEC

TYPE VESSEL EM/IO ATOP UNIT JO MMS MODEL

DATE ISSUED 2/1/73 REV 2 COAT PREFIX

STATUS DATE 11/11/73 ISSUED BY J.N.H.

WEEK 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

DATE 1973 1974 1975 1976 1977 1978 1979

CONTRACT RFP DATE 8/22/75

LEGEND

1. SUBMITTER'S RELEASE TO PROCEED MATERIAL

2. RELEASE AND FOR MATERIAL

3. PURCHASE ORDER DATE

4. SUBMITTER'S RELEASE TO SUBMITTER

5. AVE. SUBMITTER'S RELEASE TRAVELER RELEASE

6. RECEIVE MATERIAL

7. START DIAP FABRICATION

8. START NUCLEAR FABRICATION

9. SUBLET FABRICATION

10. COMPLETION DATE

11. SHIPMENT DATE

12. COMPLETION MILESTONE

COMPLETION MILESTONES

1. HOLD CENTER PLATE

2. INSPECT TUBESHEET DRILLING

3. SETUP TO RECEIVE EGG CRATES

4. FINAL INSPECT EGG CRATE INSTALLATION

5. SETUP TO RECEIVE TUBES

6. FINAL INSPECT TUBE INSTALLATION

7. INSTALL BAFFLE

8. SUBMIT STUD HOLE / MATHS SURFACE MACHINING

9. SETUP LOWER PRESSURE SHELL AND FLANGE

10. SETUP FINAL HIGH PRESS SHELL MACHINING

11. SETUP OF UPPER ASSEMBLY

12. HYDRO UPPER ASSEMBLY

13. FINAL FLANGE, CONE, & BUNG TO BOTTOM SHELL

14. SETUP ADAPTER TO SODIUM BUREL

15. SETUP KEY BUNG AND SHORT SHELL TO ANODIZE SHELL

16. SETUP SODIUM / MIDDLE SHELL

17. SETUP BOTTOM HEAD TO LOWER SHELL ASSEMBLY

18. INSTALL LINERS AL LOWER SHELL ASSEMBLY

19. HYDRO LOWER ASSEMBLY

20. INSPECT FINAL MACHINING

21. INSTALL SHIPPING EQUIPMENT

22. FINAL INSPECT / RELEASE FOR SHIPMENT

SEAL RING

VESSEL STUDS, NUTS / WASHERS

COVER PLATE STUDS, NUTS, / WASHERS

TOP COVER PLATE

PLENUM COVER PLATE

THERMAL LOCK SLEEVE

TUBE LOCK JOINT

RAYONET BOTTOM

RAYONET TUBE

INSULATOR TUBE

CYLINDER

PLENUM BASE PLATE

THERMAL LINER

NOZZLE SAFE-ENDS

NOZZLES

FLANGE

HIGH PRESSURE SHELL

HIGH PRESSURE TUBES

EGG CRATES

EGG CRATE SUPPORT RING

BAFFLE FLANGES

BAFFLE ASSEMBLY

TUBESHEET CENTER PLATE

TUBESHEET FORGING

LOWER SHELL ASSEMBLY

SODIUM SHELL

FLANGE

CONE

RINGS

SUPPORT SKIRT

SUPPORT BASE

NOZZLES

MIDDLE SHELL

KEY RING

KEYS

SHORT SHELL

BOTTOM HEAD

NOZZLE

SHELL

SAFE-END

LINERS

SHELL LINERS

NOZZLE LINERS

DIVERTER BASE

GUSSETS

PIPE

ELBOW

FLANGE

INSTRUMENTATION

SHIPPING COVERS

SHIPPING SAYS

CRITICAL PATH

UPPER VESSEL ASSEMBLY JOB #

VESSSEL ASSEMBLY JOB #

NEW LOWER VESSEL ASSEMBLY

NEW UPPER VESSEL ASSEMBLY

NEW COMPLETION

NEW COMPLETION OF TUBESHEET JOINT

WELDING PROGRAM

PROCEDURE 1

PROCEDURE 2

PROCEDURE 3

PROCEDURE 4

PROCEDURE 5

PROCEDURE 6

PROCEDURE 7

PROCEDURE 8

PROCEDURE 9

PROCEDURE 10

PROCEDURE 11

PROCEDURE 12

PROCEDURE 13

PROCEDURE 14

PROCEDURE 15

PROCEDURE 16

PROCEDURE 17

PROCEDURE 18

PROCEDURE 19

PROCEDURE 20

PROCEDURE 21

PROCEDURE 22

PROCEDURE 23

PROCEDURE 24

PROCEDURE 25

PROCEDURE 26

PROCEDURE 27

PROCEDURE 28

PROCEDURE 29

PROCEDURE 30

PROCEDURE 31

PROCEDURE 32

PROCEDURE 33

PROCEDURE 34

PROCEDURE 35

PROCEDURE 36

PROCEDURE 37

PROCEDURE 38

PROCEDURE 39

PROCEDURE 40

PROCEDURE 41

PROCEDURE 42

PROCEDURE 43

PROCEDURE 44

PROCEDURE 45

PROCEDURE 46

PROCEDURE 47

PROCEDURE 48

PROCEDURE 49

PROCEDURE 50

PROCEDURE 51

PROCEDURE 52

PROCEDURE 53

PROCEDURE 54

PROCEDURE 55

PROCEDURE 56

PROCEDURE 57

PROCEDURE 58

PROCEDURE 59

PROCEDURE 60

PROCEDURE 61

PROCEDURE 62

PROCEDURE 63

PROCEDURE 64

PROCEDURE 65

PROCEDURE 66

PROCEDURE 67

PROCEDURE 68

PROCEDURE 69

PROCEDURE 70

PROCEDURE 71

PROCEDURE 72

PROCEDURE 73

PROCEDURE 74

PROCEDURE 75

PROCEDURE 76

PROCEDURE 77

PROCEDURE 78

PROCEDURE 79

PROCEDURE 80

PROCEDURE 81

PROCEDURE 82

PROCEDURE 83

PROCEDURE 84

PROCEDURE 85

PROCEDURE 86

PROCEDURE 87

PROCEDURE 88

PROCEDURE 89

PROCEDURE 90

PROCEDURE 91

PROCEDURE 92

PROCEDURE 93

PROCEDURE 94

PROCEDURE 95

PROCEDURE 96

PROCEDURE 97

PROCEDURE 98

PROCEDURE 99

PROCEDURE 100

ES-7670-7

WEEK# _____
DATE _____

1973
1974
1975

" WEEKS OF FIBERATION

CONTRACT END DATE: 6/1/75

① ENGINEERING RELEASE TO PROCEED WITH FABRICATION	② RECEIVE MATERIAL
③ RELEASE D/D FOR MATERIAL	③ START D/D FABRICATION
④ PURCHASE ORDER DATA	④ START NUCLEAR FABRICATION
⑤ ENGINEERING RELEASE TO FABRICATE.	⑤ COMPLETION DATE
⑥ ATE-SUB-RETUNE RELEASE.	⑥ SHIPMENT DATE
⑦ TRAVELED RELEASE.	⑦ COMPLETION MILESTONE

2. WELD CENTER PLATE.
3. INSPECT TUGSHEET DRILLING
4. SETUP TO RECEIVE EGG CRATES
5. FINAL INSPECT EGG CRATE ASSEMBLY
6. SETUP TO SETUP TO SETUP
7. FINAL INSPECT TUGS WELDING
8. INSTALL PARTS
9. ASSEMBLY STEP HOLE / PARTS
10. INSPECT HOLE PARTS
11. SETUP LAMP PARTS SHELL AND FLANGE
12. SETUP, FINAL HIGH PRESS SHELL MACHINING
13. SETUP OF LOWER ASSEMBLY
14. LOWER LAMP ASSEMBLY
15. FROM FLANGE, COIL, 1/2 INCH TO SODIUM SHELL
16. SETUP ADDRESS TO SODIUM SHELL
17. FROM CITY AND BUILT SHELL TO ANGLE SHELL
18. FROM SODIUM / MIDDLE SHELL
19. SETUP BOTTOM HOLE TO LOWER SHELL
20. INSTALL LAMP / LOWER SHELL ASSEMBLY
21. HYDRO LOWER ASSEMBLY
22. INSPECT FINAL MACHINING
23. FROM LOWER ASSEMBLY
24. FINAL INSPECT / RELEASE FOR SHIPMENT

VESSEL STUDS, NUTS / WASHERS:

COVER PLATE STUDS, NUTS, & WASHERS
FOR COVER PLATE

PLENUM COVER PLATE:

TIME LOCK AUT.

ALPINE BUTTER
ALPINE BUTTER

INSULATOR TUBE

PLENUM BASE PL

THERMAL LINER.

NOZZLES.

FLANGE.

HIGH PRESSURE SHELL

514 10450

EGG (DATE 9/10/80) D/ANG-

BAFFLE FLANGES

DAFFLE ASSEMBLY

FOUO (FBI USE ONLY) CENTER FIVE

LOWER SHELL ASSEMBLY-

SECTION THREE

CONCLUSIONS:

RING-

SUPPORT SKIRT.

SUPPORT CASE:

MIDDLE SKILL

KEY RING:

KEYS:

SHORT SHELL:

NOZZLE:

SHELL
SAFE FLUID

LIVERS:

NOZZLE LINERS

INVERTER-BASE-
CAPACITOR

PIPE

FLANGE.

INSTRUMENTATION

SHIPPING SMO.

SUPERLATER	
FROM 1MEBR	
TO 30 MWS MOBILE	
MESSAGE NO. 1	DATE 17/11/78
MESSAGE BY 1 ME MWS	
REMARKS BY	
<div style="display: flex; justify-content: space-between;"> <div style="width: 40%;"> </div> <div style="width: 60%;"> <p>THE CONTENTS OF THIS MESSAGE IS CONFIDENTIAL AND NOT TO BE DISCLOSED TO THE PUBLIC WITHOUT THE AUTHORITY OF THE SECRETARY OF DEFENSE AND THE SECRETARY OF THE NAVY</p> </div> </div>	
CLASS. CODE	
DRAWING NO. ES-7870-10

EGG CRATE ASSEMBLY
LMFBR STEAM GENERATOR

THIS DRAWING MADE BY CHATTANOOGA

CONTRACT NO. 7670	
EGG CRATE ASSEMBLY	
FOR LMFBR STEAM GENERATOR	
SCALE <i>NONE</i>	DATE <i>1-26-73</i>
DRAWN BY <i>DODSON</i>	CHECKED BY
TRACED BY	APPROVED <i>JRP-LW 1/25/73</i>
	THIS DRAWING IS THE PROPERTY OF COMBUSTION ENGINEERING, INC. WINDSOR, CONN.
	AND IS NOT TO BE REPRODUCED, OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OR APPARATUS EXCEPT WHERE PROVIDED FOR BY AGREEMENT WITH SAID COMPANY.
DRAWING NO. <i>ES-7670-6</i>

THIS DRAWING MADE BY CHATTANOOGA

CONTRACT NO. 7670

TUBESHEET RING FORGING
ORDERING SKETCH FOR SUPERHEATER
FOR LMFBR

SCALE: 4" = 1'-0"
DRAWN BY: T. ROBERTS
TRACED BY

DATE: 2-6-79
CHECKED BY: J. A.
APPROVED: A. Simerone

**THIS DRAWING IS THE PROPERTY OF
COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.**

**AND IS NOT TO BE REPRODUCED, OR
USED TO FURNISH ANY INFORMATION
FOR MAKING OF DRAWINGS OR APPA-
RATUS EXCEPT WHERE PROVIDED FOR
BY AGREEMENT WITH SAID COMPANY.**

DRAWING NO. *SC-7670-4-D*

REVISED

SUPERHEATER 43'-4 1/2" OVER HEADS
EVAPORATOR 44'-10" OVER HEADS

VESSEL

4'-2" SUPERHEATER
4'-5" EVAPORATOR

FLOOR OF CAR

ELEVATION
SCALE: NONE

VIEW "A-A"
(LIFTING RIG NOT SHOWN)

SECTION "B-B"

SECTION "C-C"
TYP. (2) PLACES

VIEW "D-D"

SECTION "E-E"

LIFTING RIG - SUPERHEATER

SECTION "F-F"

LIFTING RIG - EVAPORATOR

THIS DRAWING MADE BY CHATTANOOGA

CONTRACT NO. D-51101

LIFTING, SHIPPING AND UP-ENDING
EQUIPMENT - 30 MW MODEL
FOR SUPERHEATER & EVAPORATOR
LMERR PDP

SCALE NONE
DRAWN BY JAB
TRACED BY

DATE 1-9-73
CHECKED BY DDD 2-2-73
APPROVED RBL 2-2-73

THIS DRAWING IS THE PROPERTY OF
COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.
AND IS NOT TO BE REPRODUCED, OR
USED TO FURNISH ANY INFORMATION
FOR MAKING OF DRAWINGS OR APPA-
RATUS EXCEPT WHERE PROVIDED FOR
BY AGREEMENT WITH SAID COMPANY.

DRAWING NO. C-63673025-0

CHART NO.	DESCRIPTION	NO. APPROX.	SIZE	MATL SPEC.	STANDARD	QUANTITY
1-M	FEEDWATER LINE TO STEAM DRUM	1	6" O.D.	SA 387-B	688	2840
2-M	STEAM DRUM	1	60" I.D.	SA 387-B	688	2878
3-M	DOWNCOMER	1	8" W.B.	SA 387-B	688	2878
4-M	CIRCULATING PUMP	1	2" O.D.	SA 387-B	688	2878
5-M	PUMP DISCHARGE LINE	1	2" O.D.	SA 387-B	688	2878
6-M	EVAPORATOR OUTLET LINE	1	2" O.D.	SA 387-B	688	2878
7-M	EVAPORATOR OUTLET DISTR. HDR	1	1/2" O.D.	SA 387-B	688	2878
8-M	RELIEF TUBES	6	6" O.D.	SA 387-B	688	2878
9-M	SATURATED STEAM CONN. TUBES	3	3/4" O.D.	SA 387-B	688	2878
10-M	SATURATED STEAM COLLECT. HDR	1	1/2" O.D.	SA 387-B	688	2878
11-M	SUPERHEATER INLET LINE	1	2" O.D.	SA 387-B	688	2878
12-M	SUPERHEATER OUTLET LINE	1	2" O.D.	SA 387-B	688	2878
13-M	EVAP. INLET QUICK CLOSING VALVE	1	2" O.D.	SA 387-B	688	2878
14-M	EVAP. OUTLET	1	2" O.D.	SA 387-B	688	2878
15-M	SUPHTR. INLET	1	2" O.D.	SA 387-B	688	2878
16-M	SUPHTR. OUT	1	2" O.D.	SA 387-B	688	2878
17-M	EVAP. QUICK OPEN DUMP VALVE	1	2" O.D.	SA 387-B	688	2878
18-M	EVAP. DUMP LINE	1	2" O.D.	SA 387-B	688	2878
19-M	SUPHTR. QUICK-OPENING DUMP VALVE	1	2" O.D.	SA 387-B	688	2878
20-M	SUPHTR. DUMP LINE	1	2" O.D.	SA 387-B	688	2878
21-M	DUMP TANK INLET VALVE	1	2" O.D.	SA 387-B	688	2878
22-M	DUMP TANK DRAIN VALVE	1	2" O.D.	SA 387-B	688	2878
23-M	DUMP TANK DRAIN LINE	1	2" O.D.	SA 387-B	688	2878
24-M	DUMP	1	2" O.D.	SA 387-B	688	2878
25-S	SUPHTR. SODIUM PIPE INLET	1	1/2" O.D.	TP 304-H	1000	100
26-S	SUPHTR. TO EVAP. CROSS. DRAIN LINE	1	1/2" O.D.	TP 304-H	900	100
27-S	EVAP. SODIUM PIPE OUTLET	1	1/2" O.D.	TP 304-H	700	100
28-S	SUPHTR. SODIUM DRAIN LINE	1	1/2" O.D.	TP 304-H	1000	100
29-S	EVAP. SODIUM DRAIN LINE	1	1/2" O.D.	TP 304-H	700	100
30-S	SUPHTR. TO EVAP. CROSS. DRAIN LINE	1	1/2" O.D.	TP 304-H	900	100
31-S	INTERCONNECT. STORAGE TANK DRAIN	1	1/2" O.D.	TP 304-H	1000	100
32-S	STORAGE TANK - EXISTING	1	1/2" O.D.	TP 304-H	1000	100
33-S	STORAGE TANK	1	1/2" O.D.	TP 304-H	1000	100
34-S	COVER GAS EQUALIZER STORAGE TANK LINE	1	1/2" O.D.	TP 304-H	1000	100
35-S	SUPHTR. SODIUM DUMP VALVE (BATH)	1	2" O.D.	TP 304-H	1000	100
36-S	CROSSOVER PIPE DUMP VALVE (BATH)	1	2" O.D.	TP 304-H	1000	100
37-S	SODIUM MIXED REACTION DUMP LINE	1	1/2" O.D.	A 100-GE	800	100
38-S	STACK VENT FROM SEPARATOR TANK	1	1/2" O.D.	SA 387-B	300	100
39-S	RUPTURE DISC ASSEMBLY SUPHTR.	1	1/2" O.D.	SA 387-B	1000	250
40-S	" " " " " " " "	1	1/2" O.D.	SA 387-B	1000	250
41-S	" " " " " " " "	1	1/2" O.D.	SA 387-B	1000	250
42-S	SEPARATOR TANK	1	1/2" O.D.	A 100-GE	800	100
43-S	STACK RUPTURE DISC	1	1/2" O.D.	A 100-GE	800	100
44-M	EM FLOWMETER	2	1/2" O.D.	SS-304-L	900	100
45-M	" " " "	2	1/2" O.D.	SS-304-L	900	100
46-M	H ₂ DETECTOR	2	1/2" O.D.	"	"	"
47-M	EM PUMP	1	1/2" O.D.	"	"	"
48-M	H ₂ DETECTOR LINE	1	1/2" O.D.	"	"	"
49-M	H ₂ DRAIN LINE	1	1/2" O.D.	"	"	"
50-M	H ₂ RECIRCULATING LINE	1	1/2" O.D.	"	"	"
51-M	H ₂ PUMP INLET LINE	1	1/2" O.D.	"	"	"
52-M	H ₂ RECIRCULATING LINE	1	1/2" O.D.	"	"	"
53-M	H ₂ PUMP INLET LINE	1	1/2" O.D.	"	"	"
54-M	ISOLATION VALVE	2	1/2" O.D.	"	"	"
55-M	ISOLATION VALVE	2	1/2" O.D.	"	"	"
56-M	EM FLOWMETER	1	1/2" O.D.	"	"	"
57-M	SODIUM LEVEL CONTROL PROBE (40-M)	2	1/2" O.D.	"	"	"
58-M	SODIUM	2	1/2" O.D.	"	"	"
59-M	SODIUM RELIEF LINE	2	1/2" O.D.	"	"	"
60-M	LINE	2	1/2" O.D.	"	"	"
61-M	VAPOR TRAP	2	1/2" O.D.	"	"	"
62-M	VENT LINE	2	1/2" O.D.	"	"	"
63-M	" VALVE	2	1/2" O.D.	"	"	"
64-M	CONTROL VALVE	2	1/2" O.D.	"	"	"
65-M	CHECK VALVE	2	1/2" O.D.	"	"	"
66-M	INSTRUMENT VALVE	2	1/2" O.D.	"	"	"
67-M	PRESSURE REGULATOR	2	1/2" O.D.	"	"	"
68-M	VALVE	2	1/2" O.D.	"	"	"
69-S	RUPTURE DISC (PRIMARY)	2	1/2" O.D.	"	"	"
70-S	CONTROL VALVE	2	1/2" O.D.	"	"	"
71-S	SODIUM RELIEF LINE PRIMARY	2	1/2" O.D.	"	"	"
72-S	PRESSURE REGULATOR	2	1/2" O.D.	"	"	"
73-S	CHECK VALVE	2	1/2" O.D.	"	"	"
74-S	VENT LINE	2	1/2" O.D.	"	"	"
75-S	TANK	2	1/2" O.D.	"	"	"
76-S	VALVE	2	1/2" O.D.	"	"	"
77-S	PRESSURE REGULATOR	2	1/2" O.D.	"	"	"
78-S	NITROGEN INLET LINE	2	1/2" O.D.	"	"	"
79-M	FILTER	2	1/2" O.D.	"	"	"
80-M	GAS CHRONOMETER	2	1/2" O.D.	"	"	"
81-M	FLOWMETER (WATER)	2	1/2" O.D.	"	"	"
82-M	VALVE (FROM CONTROL)	2	1/2" O.D.	"	"	"
83-M	SUPERHEATER	1	1/2" O.D.	"	"	"
84-M	EVAPORATOR	1	1/2" O.D.	"	"	"
85-M	WATER SYMBOL PUMP TANK	1	1/2" O.D.	"	"	"
86-M	DUMP TANK INLET LINE	1	1/2" O.D.	"	"	"

07670-1E0314

STEAM GENERATOR FLUID DIAGRAM

NO. 1

DATE: 1/1/70

SCALE: 1" = 10'

DESIGNED BY: [Signature]

CHECKED BY: [Signature]

APPROVED BY: [Signature]

THIS DRAWING IS THE PROPERTY OF CONCEPTS ENGINEERING, INC. AND IS NOT TO BE REPRODUCED, COPIED, OR USED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF CONCEPTS ENGINEERING, INC.

DRAWING NO. 07670-1E0314-00

07670-1E0314

A-A
VIEW DETECTOR SIGHT GLASS
APPROXIMATE DETECTOR SIGHT GLASS

↑ INDICATES POINT OF ZERO EXPANSION

- ~ REFERENCE DWGS ~
- 07670 1F 0109 — PPA SECT SIDE ELEV
 - 07670 1F 0119 — PPA FRONT ELEV
 - 07670 1E 0351 — PPA PLAN VIEWS 34' x 8' 5"
 - 07670 1E 0352 — PPA PLAN VIEWS 34' x 12' 0"
 - 07670 1E 0314 — STEAM GEN FLOW DIAGRAM
 - 07670 1E 0305 — FRONT ELEV LOOKING WEST
 - 07670 1E 0400 — CIRC PUMP FLOW DIAGRAM

Q.D.	DESCRIPTION
1	STEAM INLET
2	STEAM INLET
3	STEAM INLET
4	STEAM INLET
5	STEAM INLET
6	STEAM INLET
7	STEAM INLET
8	STEAM INLET
9	STEAM INLET
10	STEAM INLET
11	STEAM INLET
12	STEAM INLET
13	STEAM INLET
14	STEAM INLET
15	STEAM INLET
16	STEAM INLET
17	STEAM INLET
18	STEAM INLET
19	STEAM INLET
20	STEAM INLET
21	STEAM INLET
22	STEAM INLET
23	STEAM INLET
24	STEAM INLET
25	STEAM INLET
26	STEAM INLET
27	STEAM INLET
28	STEAM INLET
29	STEAM INLET
30	STEAM INLET
31	STEAM INLET
32	STEAM INLET
33	STEAM INLET
34	STEAM INLET
35	STEAM INLET
36	STEAM INLET
37	STEAM INLET
38	STEAM INLET
39	STEAM INLET
40	STEAM INLET
41	STEAM INLET
42	STEAM INLET
43	STEAM INLET
44	STEAM INLET
45	STEAM INLET
46	STEAM INLET
47	STEAM INLET
48	STEAM INLET
49	STEAM INLET
50	STEAM INLET
51	STEAM INLET
52	STEAM INLET
53	STEAM INLET
54	STEAM INLET
55	STEAM INLET
56	STEAM INLET
57	STEAM INLET
58	STEAM INLET
59	STEAM INLET
60	STEAM INLET
61	STEAM INLET
62	STEAM INLET
63	STEAM INLET
64	STEAM INLET
65	STEAM INLET
66	STEAM INLET
67	STEAM INLET
68	STEAM INLET
69	STEAM INLET
70	STEAM INLET
71	STEAM INLET
72	STEAM INLET
73	STEAM INLET
74	STEAM INLET
75	STEAM INLET
76	STEAM INLET
77	STEAM INLET
78	STEAM INLET
79	STEAM INLET
80	STEAM INLET
81	STEAM INLET
82	STEAM INLET
83	STEAM INLET
84	STEAM INLET
85	STEAM INLET
86	STEAM INLET
87	STEAM INLET
88	STEAM INLET
89	STEAM INLET
90	STEAM INLET
91	STEAM INLET
92	STEAM INLET
93	STEAM INLET
94	STEAM INLET
95	STEAM INLET
96	STEAM INLET
97	STEAM INLET
98	STEAM INLET
99	STEAM INLET
100	STEAM INLET

PROJ 300 180 7670

SIDE ELEVATION LOOKING NORTH

LMFBE

30 MW STEAM GENERATOR

DATE 7/15/1978

BY J. L. BROWN

CHECKED BY J. L. BROWN

APPROVED BY J. L. BROWN

THE DESIGN IS PROPERTY OF COMBUSTION ENGINEERING, INC. WILSON, CALIF.

NO PART OF THIS DESIGN IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM COMBUSTION ENGINEERING, INC.

DRAWING NO. 07670-1E 0303-00

FOR REFERENCE DRAWINGS, DESCRIPTION OF
NUMBERED ITEMS AND SYMBOL LEGEND
SEE DWG 07670-1E 0305

PROJECT: 501-180, DRAWING NO. 7670	
FRONT ELEVATION LOOKING WEST	
FOR LMFBR	
SOMMER STEAM CONDENSER	
SCALE: 1/4" = 1'-0"	DATE: 7-75
DRAWN BY: J. A. GUNTER	CHECKED BY: J. A. GUNTER
THIS DRAWING IS THE PROPERTY OF COMMISSIONER OF CONSTRUCTION, INC. INDIANAPOLIS, INDIANA	
AND IS NOT TO BE REPRODUCED, IN WHOLE OR IN PART, OR FOR ANY PURPOSE WITHOUT THE WRITTEN PERMISSION OF THE COMMISSIONER OF CONSTRUCTION, INC.	
DRAWING NO. 07670-1E 0305-00

DRAW MATERIAL			
INCHES NUMBER	DESCRIPTION	MAT'L ITEM #	MIN. TEN. SPECIFICATION
G 625	54ELL R	*27(SA-387-D)	75,000 P.S.I.
S. 088	HEAD R	*27(SA-387-D)	75,000 P.S.I.

MATERIAL		
FOR INDEX TO MATERIAL ITEM NUMBERS REFER TO STANDARD INSTRUCTIONS NO. 11-OR 1000 ST 12.2		
ITEM NO.	SPECIFICATION	PURCHASE INSTRUCTIONS
27	SA-387-D	MAWELL/25D
		1"TEMPERED
25	SA-387-D	P5F2
161	SA-335-P22	P5A4
188	SA-182-F11	—
91	A-576 GR.1015	PI61

FROM
1/2 75 MIN.
MAX MAT'L.
161

- [illegible]

STD. REF. DWG'S:

E-980-217	WELDING JOINT
D-990-099	TEST NOZZ. CAP
B-990-215	WELD. STOP MARK
C-990-980	WELDING
E-990-239	CRIM TBL
D-990-911	WELDING DETAIL 0.4C-1/2 & 2 K
C-990-729	WELD. PAD BAR/ST.ET.
D-990-097	MANHOLE COVER ASS'Y.

SHOP REF. DWG'S:

07670-101457	MAT'L ORDER
07670-101461	ARCAS OF INTERVALS
07670-1C-1462	CONV. W/CH. NOZZ.
07670-101456	SLICED NOZZ.
07670-101458	MANHOLE COVER R.

01-02-1001			
MAY 200-130		CONTRACT NO. 7670	
60-STEAM DRUM			
FOR			
LMFBR		STEAM GENERATOR	
SCALE		DATE 2-7-77	
GENERAL COOPER		APPROVED	
TRACES BY		THESE DRAWINGS ARE THE PROPERTY OF COMBUSTION ENGINEERING, INC. SPRINGFIELD, CONN. AND ARE NOT TO BE REPRODUCED, COPIED, OR USED TO PREPARE ANY REPRODUCTION, FOR SALE OR OTHERWISE, OR ANY ACTIVE EXCEPT THESE PROVISIONS IN AGREEMENT WITH SAID COMPANY.

DRAWING NO 07670-1E1402-00			
H

07670-1B1457

REVISIONS

ATTACHMENT #9 SI-37-69 INDEX NO. SI-1.10

07670-1B1458

REVISIONS

B/M MAT'L. SPECIFICATION CHART		
MAT'L. ITEM NO.	SPECIFICATION	PURCHASE INSTRUCTION
2ter	SA-387-D	(Later.) NORMALIZED & TEMPERED
91	A576, GR. 1015	FIG 1

- NOTES**
- THICKNESS OF MANHOLE COVER
PER ASME POWER BOILER SECTION I
 $P = \frac{3L^2}{2d^2}$ WHERE $C = 0.3$
 $d = 17"$
 - SURFACE FINISH PER ANSI B46.1.
 - UNLESS OTHERWISE NOTED:
RADIUS $\frac{1.03}{.00}$
DIMENSIONAL TOLERANCES $\pm .06"$
TOLERANCES NOT ACCUMULATIVE

REFERENCE DRAWING LIST		
REFERENCE NUMBER	DESCRIPTION	DRAWING NUMBER
1	CAST STL. BRACKET DET.	B-990-829

PROJ. 900-130

DETAIL OF 16.0 DIA. FLAT
MANHOLE COVER
FOR
LMFBR
30-MWT STEAM GENERATOR

SCALE NONE DATE 2-5-79
DRAWN BY I.F. (REPR) CHECKED BY RSL 2-12-79
TRACED BY APPROVED *[Signature]* 2/12/79

CE

THIS DRAWING IS THE PROPERTY OF
COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.
AND IS NOT TO BE REPRODUCED, OR
USED TO FURNISH ANY INFORMATION
FOR MAKING OF DRAWINGS OR APPA-
RATUS EXCEPT WHERE PROVIDED FOR
BY AGREEMENT WITH SAID COMPANY.

COMP. CODE: 01-92-1001 CONT. 7670-

DRAWING NO. 07670-1B1458-00

CONTRACT NO. 76⁷⁰

COLUMN LINES 'H' & '5'

FOR
LMFBR
30 MWT MODEL

SCALE 8" = 1'-0"
DRAWN BY *J. J. J.*
TRACED BY

DATE 1-18-73
CHECKED BY *J. J. J.* 2-1-73
APPROVED

CE

THIS DRAWING IS THE PROPERTY OF
COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.
AND IS NOT TO BE REPRODUCED, OR
USED TO FURNISH ANY INFORMATION
FOR MAKING OF DRAWINGS OR APPA-
RATUS EXCEPT WHERE PROVIDED FOR
BY AGREEMENT WITH SAID COMPANY.

DRAWING NO. 07670-1C-6952-0

STEAM GENERATOR SCHEMATIC FLOW DIAGRAM

FIG. 2 OF 9

COMP CODE 91-60-0000 CONTRACT NO 7670 UNIT #1	
CONTROL SYSTEM ARRANGEMENT AND FUNCTIONAL SCHEMATIC FOR LMFBR STEAM GENERATOR 30 MW MODEL	
SCALE: DRAWN BY C.I. TRACED BY	DATE: 2-7-73 CHECKED BY JRE 2-7-73 APPROVED BY JRE 2/11/73
THIS DRAWING IS THE PROPERTY OF COMBUSTION ENGINEERING, INC. WINDSOR, CONN. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OR APPARATUS EXCEPT WHERE PROVIDED FOR BY AGREEMENT WITH SAID COMPANY.	
DRAWING NO 07670-ID4601-00

07670-ID4604

REVISION

- NOTES
1. THE TRANSFER LOGIC PROVIDES FOR TWO MODES OF OPERATION:
FIRST - VARYING PUMP SPEED PER FLOW SCHEDULE. CONTROL VALVES IN MANUAL.
SECOND - VARYING PUMP SPEED PER FEEDWATER PRESSURE TO MAINTAIN A CONSTANT BOILER FEED PUMP DISCHARGE PRESSURE. FEEDWATER FLOW IS CONTROLLED BY THE VALVES.
THE THIRD MODE IS WHEN PUMP AND VALVES ARE MANUALLY CONTROLLED USING THE M/A CONTROL STATIONS.
 2. THE TWO FW VALVES CONNECTED IN PARALLEL ARE "SPLIT RANGED". THE SMALL VALVE (#2) SHALL OPEN AT 9 PSI AND CLOSE AT 3 PSI. THE LARGER VALVE (#1) SHALL OPEN AT 15 PSI AND CLOSE AT LESS THAN 9 PSI.
 3. FOR LOGIC SYMBOLS SEE DWG. NO. 07670-1D4600
 4. FINAL FEEDWATER FLOW CONTROL SUBSYSTEM WILL BE ADAPTED TO LMFC/SCTI REQUIREMENTS.