BOOK54R

Notes:
10151 on bottom edge

Blank pages: inside opposite page 1, 2-5, 10, 22, 24, 26-30, 34, 35, 38, 52, 54, 56-152, inside opposite page 152

-pages 9, 11, 12, 14, 17, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 53, 55 has 1 (8.5x11) sheet taped to it (very old tape, all these sheets were stapled down)
-page 33 has paperclip at top of it
-page 57 has post-it-note at top with "stop" wrote on it

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
August 16, 1999

14-2-2

SECRET

COMPUTATION BOOK

NAME	Number
	26

Course Summary of Solution Experiments

Used from ..... 19 ..... , to ..... 19 .....

Including Destruction Exp.

5,5

HARVARD COOPERATIVE SOCIETY
Cambridge, Massachusetts

"This document consists of 152 pages, No. 1 of 7 copies, Series A."

SECRET

10151

Inv. 60

AD Arc.

Inv. 60

Inv. 60

CLASSIFICATION CANCELLED
DATE 5/27/60
For the Atomic Energy Commission
Jack H. Kahn for the
Chief, Declassification Branch

RESTRICTED DATA
This document contains restricted data as defined in the Atomic Energy Act of 1946.

"This document consists of 153 pages, No. 1 of 7 copies, Series A."
5-25-60

SECRET

Summary Pg 31

$$H/x = \frac{2615}{(\%X)} - 36.32$$

$$\%X = \frac{21981}{8.406\,(H/x) + 305.34}$$

Suspect

see pg 33

DL

5½" 153. cm² 3.08

Areas of Reactor Cylinders

	Area cm²	Height correction *		
6"	182.4	3.50 Cm(?)	2.59 ✡	(cm²)
6½"	214.9	2.97	~~2.22~~ 2.20	
7"	248.7	2.57	1.90	
8"	324.3	1.97	1.45	
9"	410.4	1.55	1.15	
10"	506.7	1.26	0.93	
12"	729.75	0.896 ≒ 0.90	0.65	
15"	1140 cm²		0.41	
20"	2026.8	(13.97 cm)	0.23	

Note: * Height correction based on 5.5" height (tamped) in 3" section holding a volume of 637 cm³
✡ Based on experiment # 137 + 133 Correction should be equiv of 1.9, 7" cm. (Vol. = 471.5 cm³)

N_H/N_X	% X	Mass corrected ✡		Sp. G.r.	gm X/cc		
43.11% X	24.35	~~Mixed~~ 4612 X	593.7	410.6	2.02	~~0.8708~~ ~~0.9316~~	
38.7% X	31.12	41.45 X	494.1	341.2	1.87	0.7237 ~~0.7751~~	
32.5% X	43.87	34.86 X	370.4	255.8	1.667	0.5426 ~~0.5811~~	
26.89% X	62.6	26.39	252.5	187.0	1.501	0.3961	655 62.6
21.33% X	86.30	22.79 X	193.9	136.0	1.353	~~0.3083~~ 0.2836	
15.94	127.45	15.94 ✓	127.8	94.9	1.250	0.1993	32.9 127.45
26.76	61.2	26.76 ✓	250.6	185.6	1.47	0.3934	65.0 61.2
12.41	173.95	12.41 ✓	93.76	69.7	1.186	0.14718	24.4 173
	225.76	9.86 ✓	72.90	54	1.149	0.11444	18.9 225
	319.9	7.32 ✓ ✡	38.1		1.103	0.08074	
4.93	493.6	4.93 ✓ ✡	24.8		1.068	0.05264	
3.30	~~705~~ 755	X3.53X ✡	~~19.4~~	16.2	1.044	0.~~0368~~ .03445	
19.44% X	98.2	19.44 ✓ ✡	120.6		1.315	0.2557	
	58.38 ✓	27.61 ✓ ✡	198.0		1.52	0.4199	
8.52%	~~932~~ 1000	X2.70	~~13.1~~	12.2	1.03	0.~~0278~~ 1025956	
8.03							
11.45	192	X		63	1.167	0.1336	
26.92							
	26.2	41.8	389.8		1.978	0.8268	
	56.5	28.1	200.1		1.5105	0.4245	
	221.6	10.14	54.7		1.144	0.1160	
	118.8	16.85	100.2		1.262	0.2126	

6" Aluminum (182.4 cm²)

Exp. No.	N_H/N_X	Crit. Height	Corrected Ht. (+2.6cm)	Volume	Corrected Vol.	Critical Mass	Corrected Mass	Sp. Gr.	% X	
132	58.38	69.2	71.8	12630	13090	5300	5498	1.52	27.61	Tamped
170	26.2	EST. 75.0	77.6	13680	14152	11311	11700	1.978	41.8	"
185	~~40.88~~ 118.8	Not Crit.						1.262	16.85	"

5½" Aluminum

177	56.5	∞	∞					1.51	28.1	Tamped

6" Stainless

1	23	∞
2	30	∞
3	37	∞
4 = 37	45	∞
5	60	∞
10	29.3	∞
11	"	∞
3	37	∞
5	45	∞

Tamped
"
"
Untamped
Tamped
"
"

(637) (Area 214.4 cm²) 6½" Cylinder

Exp No.	N_H/N_X	Critical Height	Corrected Height	Volume	Corrected Volume	Critical Mass Gm.	Corrected Mass Gm.	Sp. Gr.	% X	Remarks
35	31.12	46.8	~~49.71~~ 49.0	10,034	10671	~~7778~~ 7262	~~8272~~ 7603	1.87	~~41.45~~ 38.7	
46	43.87	44.9	~~47.87~~ 47.1	9626	10263	~~5577~~ 5223	~~3964~~ 3477	1.667	~~34.86~~ 32.55	
60	62.60	45.7	~~48.61~~ 47.9	9798	10435	3881	~~4153~~ 4068	1.501	26.37	
61	86.3	51.6	~~54.57~~ 53.8	11063	11700	~~3411~~ 3193	~~3607~~ 3329	1.353	~~22.79~~ 21.33	
*82	127.45	78.0	~~80.71~~ 80.2	16723	17360	3333	~~3460~~ 3428	1.250	~~16~~ 15.94	Extrapolated Value
83	~~123~~ 173.96	N.C. ∞							12.40	

Alumimum 6½"

Exp No.	N_H/N_X	Critical Height	Corrected Height	Volume	Corrected Volume	Critical Mass	Corrected Mass	Sp. Gr.	% X	Remarks
174	26.2	EST. 42.3	44.5	~~9001~~ 9069	9541	7498	7888	1.978	41.8	Tamped.
– 181	56.5	~~37.7~~ 38.2	~~39.9~~ 40.4	8083	8655	3431	~~3634~~ 3630	1.51	28.1	Tamped.
184	118.9	50.35	52.55	10795	11267	2295	2395	1.262	16.85	Tamped
186	~~206.6~~ [illegible]	∞						1.144	10.14	"

7" Cylinder
Area = 248.29 cm²

add (2.5" Tamp) 1.9

Subt of 16.5 cc

Exp No.	H/X	Critical Height	Corrected Height	Volume	Corrected Volume	Critical Mass	Corrected Mass	Sp. Gr.	% X	Remarks
6	61.2	30.8	32.6 33.21	7647	8284	3008	3259	1.47	26.76	
13	24.35	~~33.6~~ 36.2	35.5 36.17	8343	8980	~~7272~~ 7272	8366	2.02	46.12	
34	31.12	32.1	34.0 34.67	7970	8607	~~6478~~ 6478	~~6614~~ 6614	1.87	~~41.45~~ 41.45	
40	43.87	30.8	32.7 33.37	7645	8282	~~4443~~ 4443	~~4877~~ 4877	1.667	~~34.86~~ 34.86	
64	86.3	34.1	36.0 36.67	8467	9104	~~2670~~ 2670	~~2807~~ 2807	1.353	~~22.74~~ 22.74	
81	127.45	40.4	42.7 42.97	10031	10669	1888	2093 2126	1.250	18.94	
97	183.95	55.40	57.7 57.97	13755	14393	2.024	2094 2118	1.186	12.41	
98	225.76	?								
133	58.38	30.7	* 32.6	7627	8095	~~3765~~	3397 3387	1.52	27.61	
139	180.04	N.G. +								
7	61.2	Approx 31	31.9							2 in Top Tamper
8	61.2	30								"
10		30								"
32	31.12	30								"
33	"	30								"
38	43.8	30								"
39	"	30								"
63	86.3	30								"
135	58.38	32.5		34.7	8144	8615	3420	3618	1.52	27.61	No Top Tamper
137	58.38	31.1	→	33.0	7722	8193	3242	3440	"	"	Special Top Tamper
138	180.4	60 +			14897+					"
139	180.4	60 +			14897+					

32.7 1113 1111

* Corrected height is critical height + 1.9cm as result of Exp 137.

8" Aluminum Reactor A = 324.3

Exp#	H/X	Crit Ht	+1.5 cm Corrected Hc	Volume	Corrected Vol.	critical MASS gm	corrected MASS	Sp. Gr.	% X by Wt.	Remarks.
125	98.2	20.9	22.4	6778	7264	1738.0	1862.6	1.319	19.44	Tamped
128	289.8	38.6	40.1	12518	13004	1107.4	1150.3	1.103	8.02	"
129	58.2	19.0	20.5	6162	6648	2560.6	2762.6	1.51	~~27.52~~ 27.35	"
135	~~174.53~~ 174.53	26.6	28.1	8626	9113	1152	1215	1.167	~~12.26~~ 11.40	"
148	493.6	∞	∞					1.068	4.93	Tamped
127	289.8	46.2	47.7	14983	15469	1325.4	1368.4	1.103	8.02	" with 1/16" S.S. shield
126	98.2	22.3	23.8	7232	7718	1854.4	1979.0	1.319	19.44	" " " " "
130	58.38	20.4	21.9	6616	7102	2776.5	2980.5	1.52	~~27.61~~ 27.46	" " " " "
134	~~174.53~~ 174.53	26.6	28.1	8626	9113			1.167	12.26	" " " " "
134	~~174.53~~ 174.53	29.3	30.8	9502	9988	1269	1332	1.167	~~12.40~~ 11.45	" " " " "
171	26.2	20.0	21.5	6486	6958	5363	5752	1.978	41.8	Tamped

8" Cylinder

Area = 324.3 cm²

Exp.	N_f/N_a	Critical Height	Corrected Height	Volume	Corrected Volume	Critical Mass	Corrected Mass	Sp. Gr.	% X	Remarks
15	24.3	21.0	22.94	6810	7449	~~6344~~ 5925	~~6539~~	2.02	~~42.72~~	
31	31.12	20.15	22.12	6535	7174	~~5065~~	~~5561~~	1.87	~~37.45~~	
41b	43.87	50.0	51.91	16247	16562	~~9849~~ 9071	~~10234~~	1.661	~~33.56~~	Cd shielded
42	43.81	19.4	21.37	6292	6930	~~3656~~	~~4026~~	"	"	
51	62.6	46.95	48.92	15226	15865	~~5476~~ 6216	~~6736~~	1.501	26.38	Cd shielded
53	62.6	21.40	23.37	6940	7579	2496 2935	~~2760~~	"	"	
65	86.3	55.1	57.07	11869	18508	~~5510~~	~~5701~~	1.338	~~22.49~~	Cd shielded
66	86.3	22.3	24.27	1,231.9	7871	~~2230~~	~~2427~~	"	21.33	
76	127.4	24.5	26.47	7,946	35.84	~~3467~~	~~4679~~ 1711	1.250	15.94	
84	173.96	~20								unstamped
85	173.96	28.6	~~30.57~~	9275	9914	1.365	1.435	1.186	12.81	
110	225.76	34.8	36.77	11.285	11.925	1.292	~~1346~~	1.149	9.96	
112	319.44	58.6	60.57	19,004	14.643	1.534	~~1586~~	1.103	7.32	Tamped
116	85 ?	23.6	25.1 *	7653	8139.9					Double Wall
117	320 ?	64.2	65.7 *	20820	21307					" "
118	85 ?	23.5	25.0 *	7621	8107					
119	320 ?	49.8	51.3 *	16150	16636.6					
120	296.5	60.3	61.8 *	19555	20042	1706.1	1748.6	1.110	7.85	Double wall
121	281.8	60.7	62.2 *	19685	20171	1792.9	1837.1	1.108	8.22	" "
122	302.5	50.8	52.3 *	16474	16960	1409.1	1450.7	1.108	7.72	
123	98.2	22.7	24.2 *	7362	7848	1876.3	2000.1	1.311	19.44	
124	98.2	24.0	25.5 *	7783	8270	1992.6	2117.3	1.317	19.44	Double wall
131	58.38	19.3	20.8 *	6259	6745	2626.7	2830.7	1.52	27.61	
136	~~177.63~~ 192	27.9	29.4 *	9048	9534	1209	1272	1.167	12.48	
173	26.2	22.0	23.5	7135	7607	5899	6289	1.978	41.8	Tamped (35" cyl.)
16	24.3	(Prelim)								Cd. Shield Tamped
175	26.2	21.1	22.6	6843	7315	5658	6048	1.978	41.8	Tamped (19" cyl.)

* Correction for 3" pipe = 1.5 cm. per exp. #137

elbows corr.
[Δ = 637 cc]

8" Cyl.

Exp. #	M_H/M_x	Crit. Ht. cm	estimated equivalent cm	Volume cc	estimated Equivalent Volume cc	Crit. mass g(x)	Equivalent Crit Mass g(x)	Sp Gr.	% X	Remarks
14	24.35	~~29.6~~ ∞	~~31.6~~		~~10248~~		~~9547~~	2.02	46.12	~~Untamped~~
15	24.35	20.95	22.92		7433		6925	2.02	46.12	Tamped
16	24.35	∞						2.02	46.12	~~Untamped~~ Tamped + Cd
29	31.12	∞ ?						1.87	41.45	Tamped + Cd
30	31.12	∞						1.87	41.45	Untamped
31	31.12	20.15	22.12 T		7174		5561	1.87	41.45	Tamped
41b	43.87	50.0	51.97		16854		9794	1.67	34.86	Tamped + Cd
42	43.87	19.4 ∞	21.37 T		6930		4027	1.67	34.86	Tamped
50a	43.87	∞						1.67	34.86	Untamped + Cd
50b	43.87							1.67	34.86	Untamped
51	62.60	46.95	48.92		15865		6284	1.501	26.39	Cd Tamped + Cd
52	62.60	∞						1.501	26.39	Untamped
53	62.60	21.4	23.37 T		7579		3002	1.501	26.39	Tamped
65	86.30	55.0	56.97		18475		5696	1.353	22.79	Cd Tamped + Cd
66	86.30	22.3 ∞	24.27		7871		2427	1.353	22.79	Tamped
67	86.30							1.353	22.79	Untamped
76	127.45	24.5 ∞	26.47		8584		1711	1.25	15.94	Tamped
77	127.45							1.25	15.94	Untamped
115	85	∞								Un
84	1745	∞								Untam
86	12.5	52.4								No Cd Tamp
87	12.5	30.4								" " Tam
91	R2E1	∞								UN
176	56.5	20.7	22.15	6713	7185	2850	3050	1.51	28.1	TALL - TAMPED

[redacted]

[redacted]

9" Cylinder
area 411.4 cm²

Exp.	N_H/N_X	Critical Height (+1.55 added)	Corrected Height	Volume	Corrected Volume	Critical Mass	Corrected Mass	Sp Gr.	% X	Remarks
19	24.3	11.2	12.75	7059	7685	~~6576~~	~~9552~~ 2169	2.02	~~46.12~~	
26	31.12	21.75	23.30	11389	12025	~~8328~~	~~9327~~	1.87	~~42.45~~	Cd Shielded
28	31.12	16.95	18.50	6956	7592	~~5392~~	~~5385~~	"	"	
43	43.87	27.65	29.20	11348	11984	~~6595~~	~~6464~~	1.667	~~34.86~~	Cd Shielded
44	43.87	16.65	18.20	6833	7469	~~3921~~	~~4340~~	"	"	
54	62.6	27.15	28.70	11142	11778	4412	~~4664~~	1.501	26.38	Cd Shielded
56	62.6	16.8	18.35	6895	7531	2130	2982	"	"	
68	86.3	28.0	29.55	11491	12127	~~3543~~	~~3439~~	1.353	~~21.33~~ 22.39	Cd Shielded
69	86.3	17.5	19.05	7182	7818	~~2216~~	~~2444~~	"	"	
78	127.4	30.8	32.35	12640	13276	2518	2645	1.250	15.94	Cd Shielded
79	127.4	18.7	20.25	7615	8311	1529	1656	"	"	
89	173.95	36.1	37.65	14815	15464	2180	~~2279~~	1.186	12.44	Cd Shielded
91	"	21.0	22.55	8618	9255	1268	1362			
101	225.76	44.8	46.35	18385	19022	~~3348~~	~~2177~~	1.149	7.96	Cd shielded & Insulated
102	"	24.1	25.65	9891	10526	1132	1265	"	"	Tamped
111	319.94	31.8	33.35	13051	13687	1054	1105	1.103	7.32	Tamped
147	493.6	∞ Prob.	∞					1.068	4.93	Tamped

9" Cyl

elbow con.
[A = 637 cc]

Expt #	N_H/N_X	Crit Ht. cm	Estimated equivalent cm	Volume cc	equivalent volume cc	Crit mass gm(x)	Equivalent Crit mass gm(x)	Sp Gr.	% X	Remarks
17	24.35	~~31+?~~						2.02	~~46.12~~	Tamped + Cd
18	24.35	40+?						2.02	~~46.12~~	Untamped
19	24.35	17.2	18.75	~~2695~~	7695		7169	2.02	~~46.12~~	Tamped
26	31.12	27.75	29.30		12025		9321	1.87	~~41.45~~	Tamped + Cd
27	31.12	∞						1.87	~~41.45~~	Untamped
28	31.12	16.95	18.50		7592		5885	1.87	~~41.45~~	Tamped
43	43.87	27.65	29.20		11984		6964	1.67	~~34.86~~	Cd Tamped + Cd
44	43.87	16.65 ∞ ?	18.20		7469		4340	1.67	~~34.86~~	Tamped
45	43.87							1.67	~~34.86~~	Untamped
54	62.60	27.15	28.70		11778		4665	1.501	26.39	Cd Tamped + Cd
55	62.60	55 ? ∞ +						1.501	26.39	Untamped
56	62.60	16.75	18.30		7510		2975	1.501	26.39	Tamped
68	86.30	28.0	29.55		12127		3739	1.353	~~22.79~~	Cd Tamped + Cd
69	86.30	17.5	19.05		7818		2410	1.353	~~22.79~~	Tamped
70	86.30	∞ ?						1.353	~~22.79~~	Untamped
78	127.45	30.9	32.45		13317		2654	1.25	15.94	Cd Tamped + Cd
79	127.45	18.7	20.25 ?		8311		1656	1.25	15.94	Tamped
80	127.45	∞ ?						1.25	15.94	Untamped
90										
110										
147										

10" Aluminum Reactor. (506.7)

Exp. No.	H/X	critical Height	(493) corrected Height	crit. ~~Mass~~ volume	corrected ~~Mass~~ Vol.	crit. MASS	corrected mass	Sp. Gr.	% X	REMARKS.
152	493.6	34.3	35.23	17380	17851	914.9	939.7	1.068	4.93	TAMPED
153	493.6	∞ N.C.						"	"	UNTAMPED
163	~~705~~ 355	N.C. ∞						1,044	3.30	TAMPED.

STAINLESS. 10" Cylinder

Area = 506.7

Exp No.	H/X	Critical Height	Corrected Height (+.33*) (add 1.26 cm)	Volume	Corrected Volume (add 637 cc)	Critical Mass (subtract 165 cc)	Corrected Mass Kg	Sp. Gr.	% X	Remarks
22	24.3	14.4	15.66 (15.33)	7297	7934 ~~7297~~	6549 ~~6798~~	6799 ~~7391~~	2.02	43.11 ~~46.12~~	
23	31.12	14.35	15.61 (15.28)	7272	7909	5265 ~~5637~~	5606 ~~6130~~	1.87	38.7 ~~41.45~~	
25	31.12	20.25	21.51 (21.18)	10261	10898	7428 ~~7953~~	7769 ~~8447~~	1.87	38.7 ~~41.45~~	Cd shielded
47	43.87	20.50	21.76 (21.43)	10388	11025	5638 ~~6036~~	5873 ~~6447~~	1.667	32.55 ~~34.86~~	Cd shielded
48	43.87	13.95	15.21 (14.88)	7069	7706	4383 ~~4788~~	4073 ~~4780~~	"	"	
49	43.87	31.4	32.66 (32.33)	15911	16548	8636 ~~9246~~	8892 ~~9416~~	"	"	untamped
57	62.6	21.05	22.31 (21.98)	10667	11304	4225	4478 (4412)	1.501	26.39	Cd Shielded
58	62.6	30.8	32.06 (31.73)	15607	16244	6182	6434 (6369)	"	"	untamped
59	62.6	14.3	15.56 (15.23)	7246	7883	2870	3122 (3057)	"	"	
71	86.3	21.05	22.31 (21.98)	10667	11304	3072 ~~3289~~	3208 ~~3485~~	1.353	21.33 ~~22.79~~	Cd Shielded
73	86.3	31.0	32.26 (31.93)	15708	16345	4524 ~~4844~~	4660 ~~5039~~	"	"	untamped
72	86.3	14.5	15.76 (15.43)	7348	7985	2116 ~~2265~~	2252 ~~2462~~			
74	127.45	33.4	34.66 (34.33)	16924	17561	3373	3500 (3.468)	1.250	15.94	untamped
75	127.45	15.9	17.16 (16.83)	8057	8695	1606	1733 (1.701)	"	"	
95	173.95	17.2	18.46 (18.13)	8715	9353.6	1.2827	1.3767 (1.352)	1.186	12.[illegible]	
96	"	37.8	39.06 (38.73)	19153	19792	2.819	2.913 (2.888)	"	"	Untamped
106	225.76	45.7	46.96 (46.63)	23156	23.795	2.6499	2.723 (2.704)	1.149	9.96	Untamped
107	"	19.1	20.36 (20.03)	.96779 ~~10316~~	10316	1.1075	1.1805 (1.162)	1.149	9.96	Tamped
109	319.94	24.1	25.4 (25.07)	12211	12870	0.9859 ~~1.3974~~	1.039 (1.024)	1.103	7.32	Tamped
108	319.94	70+ [illegible]						(Untamped)	"	not critical at max sol. Ht.
145	4936	39.8	40.73*	20167	20638	1061.8	1,086.6	1.068	4.93	Tamped.
146	"	∞	∞					"	"	UNTAMPED
20	24.3	23 EXT. +2, -1	24		12160		10.589	2.02	43.11	[illegible]
21	24.3	34+ EXT.	35+		17735 +		15.44+ +	"	"	[illegible]
24	31.12	40+, Prob ∞	41 +		20774 +		15.034 +	1.87	38.7	
169	26.2	EST. 25.0	25.9	12668	13140	10.474	10864	1.978	41.8	UNTAMPED
191	~~206.60~~ 221.6	27.8	28.75	14084	14557 ~~13615~~	1.6340	1.6886 ~~15,774~~	1.144	10.14	Cd Shielded

12" Reactor. Area = 729.66 sq cm

Exp. No.	N_{ij}/N_x	Critical Ht. Cm	Corrected by 0.90cm (*.65)	Volume	Corrected Volume	Critical Mass	Corrected Mass $\times 2088$	Sp. Gr.	% X	Remarks
92 ✓	173.9	18.8	19.45 19.70	13718	14374	~~2.619~~ ~~1.6295~~	~~2.1156~~ ~~1.7048~~	1.186	12.41	Cd Shielded Tamped
93 ✓	"	24.4	25.05 25.3	17804	18460	~~2.629~~	2.689 2.717	"	"	Untamped
94 ✓	"	14.15	14.8 16.05	1032	10981	1.519	1.588 1.676	"	"	Tamped
103	225.76	20.25	20.9 21.15	14776	15432	1.691	1745 1.766	1.149	9.86	Cd Shielded
104	"	25.5	26.15 26.4	18606	19263	2.129	2183 2.090	"	"	Untamped
105	"	15.8	16.05 16.7	11528	12185	1.319	1373 1.394	"	"	Tamped
114 ✓	319.94	17.8	18.45 18.7	12987	13645	1.091	1079 1.017	1.103	7.32	Tamped
113	"	29.6	30.25 30.5	21598	22255	1.743	1782 1.797	"	"	UN Tamped
140 ✓	61.49	11.65	12.3*	8500.5	8974.8	33763	3564.9	1.486	26.73	Tamped
141 ✓	"	EST. 21.0	EST. 21.65*	15323	15797	6086.4	6274.7	"	2673	UN Tamped
142 ✓	493.6	48.2	48.85*	35170	35644	1851.8	1876.7	1.068	4.93	"
143 ✓	"	25.6	26.25*	18679	19154	9834	1.0085	"	4.93	Tamped
144 ✓	"	32.1	32.75*	23422	23896	12332	1258.2	"	4.93	" with Cd. shield
161	~~705~~ 755	N.C.∞						1.094	~~3.30~~ 3.30	" " " "
162	755	48.0	48.65*	35024	35495	1205	1223	"	3.30 "	TAMPED
167	~~1699~~ 1732	N.C.∞						1.03	2.52	"
168	26.2	EST. 14.8	15.45	10799	11271	8929	9319	1.978	41.8	TAMPED WITH Cd. Shield
182	56.5	15.15	15.8	11054	11526	4692	4892	1.51	28.1	" " " "

15" Reactor Aluminum

1140

EXP. No.	H/X	Hc	corrected Hc (+4½)	Volume	corrected Vol.	crit. mass Kg	corrected MASS Kg	Sp. Gr.	%X		REMARKS
154	493.6	26.95	27.36	30723	31194	1.6173	1.6421	1.068	4.93		UN tamped.
155	493.6	16.5	16.91	18810	19281	0.9902	1.0150	1.068	4.93		Tamped.
156	755 ~~705~~	25.65	26.06	29241	29712	1.0074	1.0236	1.044	~~3.53~~	3.30	Tamped.
157	755 ~~705~~	43.15	43.56	49191	49662	1.7108	1.7270	1.044	~~3.53~~	3.30	Un tamped.
165	1000 ~~932~~	43.85	44.25	49989	50460	~~1.3902~~ ~~1.4033~~		1.03	2.70	2.52	Tamped.
172	26.2	8.2 est.	8.6	9348	9820	1.2975 / 7.729	1.3097 / 8.119	1.978	41.8		Tamped.
178	56.5	8.1	8.5	9234	9706	3.920	4.120	1.51	28.1		"
190	~~226 60~~	10.87	corrected 11.27	12392	~~12920~~		~~1.383~~	1.144	10.14		tamped
	221.5				12863		1.492				

[redacted]" Reactor. Stainless Steel

A = 1140 cm²

Exp. No.	H/X	Hc	Hc Corrected by 0.4 cm	Volume	Corrected Volume	critical MASS(g)	Corrected Mc(g)	Sp. Gr.	% X	Remarks.
149	493.6	~~19.6~~	~~20.0~~	~~22344~~	~~22800~~			1.068	4.93	Tamped.
"	"	19.0	19.4	21660	22116	1.140.4	1164.4	"	"	"
150	"	26.6	27.0	30324	30780	1.596.6	1620.6	"	"	UNTAMPED.
158 ✓	705	41.3	41.7	47082	47553	1.622	1.638	1.049	~~3.30~~ 3.53	Un Tamped.
159 ✓	705	28.4	28.8	32376	32847	1.115	1.132	"	"	Tamped.
166	~~932~~ 1000	~~52.0~~ 52.4 APPROX		59280	59751	~~1539~~ 1486	~~1.551~~ 1662.	1.03	~~2.52~~ 2.70	TAMPED
~~172~~	~~26.2~~	~~8.2~~	~~8.6~~					~~1.978~~	~~41.8~~	~~TAMPED~~
179	~~56.5~~ 56.5	9.65	10.05	11001	11473	4.670	4.870	1.51	28.1	TAMPED
180	56.5	16.7	17.1	19038	19509	8.082	8.282	1.51	28.1	UNTAMPED
~~188~~	~~206.60~~	~~19.1~~	~~drifted~~	~~21774~~	~~21343~~		~~2.471~~	~~1.144~~	~~10.14~~	~~untamped~~
~~189~~	~~206.60~~	~~12.6~~	~~corrected~~	~~14364~~	~~13893~~		~~1.728~~	~~1.144~~	~~10.14~~	~~Stainless tamped~~
~~192~~	~~"~~	~~19.0~~	~~corrected~~	~~21660~~	~~21189~~		~~2.462~~	~~1.144~~	~~10.14~~	~~untamped~~ tamper test remark
188	~~206.60~~	19.1	~~19.5~~	21774	22245	2.580		1.144	10.14	UNTAMPED
189	~~206.60~~	12.6	~~13.0~~	14364	14835	1.721 ✓		1.144	10.14	TAMPED.
192	~~206.60~~ 221.56	19.0	~~19.4~~	21660	22131	2.567		1.144	10.14	UNTAMPED WATER TANK REM.

1160?

8310

20" Reactor S.S.

AREA = 2026.8 cm²

Exp. No.	H/X	Hc	Corrected Hc(23)	Vol.	Corrected Vol.	mass	Corrected mass	Spec. Gr.	% X	
~~151~~	~~493.6~~	~~20.65~~	~~20.83~~	~~41853~~	~~42319~~	~~2203.7~~	~~2228.2~~	~~1.068~~	~~4.93~~	~~Untamped.~~
✓151	493.6	20.2	20.43	40941	41412	2,1551	21799	1.068	4.93	UNTAMPED.
160 ✓	755	26.5	26.73	53710	54181	1850.	1.867	1.044	~~3.33~~ 3.30	"
✓ 164	~~932~~ 1000	39 EXTRAPOLATED 37.5	39	79045	79045	~~2198.~~ 2052	~~2198.~~ 2066	1.03	~~270~~ 252	"
183	~~40.88~~ 1188	14.1	~~[illegible]~~	28578	~~28107~~		~~6.580~~	1.262	16.85	Untamped
✓187	~~206.60~~ [illegible]	15.5	~~[illegible]~~	31415	~~30944~~		~~3.590~~	1.144	10.14	Untamped
183					29049		6.177			
187					31886		3.700			

6 1/2" Al Area = 214.377 cm²

Exp No.	H/X	H_c (cm)	H_c corr	Vol.	Vol corr	Mass	Mass corr	Sp Ht	% X
174	26.18	42.3		9,069	9540		7,888	1.978	41.8
181	56.5	37.7	38.2	8190	8661		3,675	1.51	28.1
184	110.88	49.85	50.35	10,795	11266		2.375	1.262	16.85
186	206.60	∞							

See page 9

Summary of Single Cylinder Solution Experiments

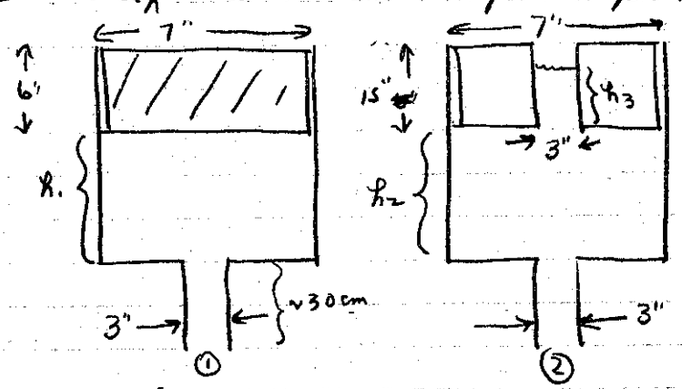
The results of the critical experiments using UO_2F_2 solution in eight cylindrical vessels are summarized on the following pages. These results also appear at each experiment's record in the appropriate note book, #23, #24 or #25. They were calculated by Pressey and Murray and ~~the~~ independently done by Moffitt and Callihan.

The constants of the cylinders are:

Diameter in"	Area cm^2	Correction to height required by 3" bottom pipe* (cm).
5 1/2	153.0	3.08
6	182.4	2.59
6 1/2	214.0	2.20
7	248.2	1.90
8	324.2	1.45
9	410.3	1.15
10	506.6	0.93
12	729.5	0.65
15	1140	0.41
20	2026	0.23
5	126.6	3.72

*This correction was determined in the following manner:

In Experiments 133 + 137 a top tamper was used which was 7" OD and had through it a 3" central hole, as was the usual top tamper. ~~used used~~



In Fig. 1, with normal top tamper, h_1 is critical height observed

In Fig 2, with modified top tamper, h_2+h_3 is observed height at critical ($h_3 = 30$ cm).

$h_2 < h_1$ by, effectively the contribution of h_3

Let C = Correction required to be applied to h_1 to compensate for lower 3" pipe.

(over)

* continued

Let H = true critical height in right circular cylinder - at this H/X and for this reactor

$H = h_1 + c$

$H = h_2 + c + c_t$ where c_t is contribution by h_3 - $c = c_t$

$h_1 + c = h_2 + 2c$

$c = h_1 - h_2$ is the effective height of solution in a 7" cylinder which is contributed by the 30 cm x 3" dia section of ~~bot~~ solution at bottom of reactor.

In Exp 133 & 137 $h_1 - h_2 = 1.9$ cm which corresponds to a volume of solution in a 7" reactor. Corrections, values of c, for other sized cylinders were calculated from this volume and appropriate cylinder areas. These corrections were then added to the observed heights.

Method of Calculating H/X

The laboratory reported mass of uranium per unit mass of solution (weight % U).

$$L = \frac{\text{mass } U}{\text{mass } UO_2F_2 + \text{mass } H_2O} = \frac{m_1'}{m_2 + m_3}$$

$$AL = \frac{m_1'}{m_2 + m_3} = \frac{X\frac{M_1}{N}}{U\frac{M_2}{N} + \frac{H}{2}\frac{M_3}{N}} = \frac{X M_1}{U M_2 + \frac{H}{2} M_3}$$

$$AL\left(UM_2 + \tfrac{H}{2}M_3\right) = X M_1$$

$$AL\,U M_2 + \tfrac{H}{2} AL M_3 = X M_1$$

$$\frac{M_1}{M_U}\; 2XL M_2 + HAL M_3 = 2X M_1$$

$$X\left(2L M_2 \tfrac{M_1}{2M_U} - 2M_1\right) = -HAL M_3$$

$$\frac{H}{X} = \frac{2\left(M_1 - \frac{M_1}{M_U} L M_2\right)}{AL M_3}$$

~~$= \frac{2(235 -$~~

$$= \frac{2M_1}{AL M_3} - \frac{2M_2}{A M_3}\frac{M_1}{M_U}$$

$$= \frac{2 \cdot 235}{0.934 \cdot 18\, L} - \frac{2 \cdot 305}{0.934 \cdot 18}$$

$$= \frac{27.96}{L} - 36.27 \quad \leftarrow \text{when } L \text{ is gm U / gm sol.}$$

$$H/X = \frac{26.11}{L_1} - 36.27 \quad \text{when } L_1 \text{ is gm X / gm solution}$$

$$[\%\ X \text{ by wt}] = \frac{26.11}{[H/X] + 36.27} \times 100$$

L = ~~wt % U~~ mass U / mass sample
m_1' = mass U in sample
m_1 = " X " "
m_2 = " UO_2F_2 " "
m_3 = " H_2O " "
A = assay (wt %)
M_1 = molecular wt X
M_2 = " " UO_2F_2
M_3 = " " H_2O
X = number X atoms in sample
U = " U " " "
H = " H " " "
$X = AU\frac{M_3}{M_1}$ (Since A is wt %)
N = Avogadro's number
M_U = molecular wt of uranium

3/24/65

		inches								
						gm X/gm sec				Kg X
6	✓	7"	30.7	32.6	61.1	.2680	1.47	8.09	.3940	3.19
13	✓	7"	33.5	35.4	24.4	.4301	2.02	8.79	.8688	7.63
15	✓	8"	~~21.95~~ 20.95	~~23.4~~ 22.4	24.4	.4301	2.02	~~7.59~~ 7.56	.8688	~~6.31~~ 6.59
19	✓	9"	17.2	18.4	24.4	.4301	2.02	7.55	.8688	6.56
22	✓	10"	14.4	15.3	24.4	.430	2.02	7.75	.8688	6.73
23c	✓	10"	14.4	15.3	31.6	.385	1.88	7.75	.724	5.61
28	✓	9"	16.9	18.1	31.6	.385	1.88	7.43	.724	5.38
31	✓	8"	20.1	~~22.6~~ 21.6	31.6	.385	1.88	~~7.33~~ 7.80	.724	~~5.07~~ 6.31
34	✓	7"	32.1	34.0	31.6	.385	1.88	8.44	.724	6.11
35	✓	6½"	46.8	49.0	31.6	.385	1.88	10.49	.724	7.59
30	✓	7"	30.8	32.7	43.9	.326	1.65	8.12	.538	4.37
2	✓	8"	19.4	~~21.9~~ 20.9	43.9	.326	1.65	~~7.78~~ 6.78	.538	~~3.92~~ 3.65
	✓	9"	16.6	17.8	43.9	.326	1.65	7.30	.538	3.93
	✓	6½"	44.9	47.1	43.9	.326	1.65	10.08	.538	5.42
	✓	10"	14.0	14.9	43.9	.326	1.65	7.55	.538	4.06
	✓	8"	21.4	22.9	62.7	.264	1.50	7.42	.396	2.94
	✓	9"	16.8	18.0	62.7	.264	1.50	7.39	.396	2.93
	✓	10"	14.3	15.2	62.7	.264	1.50	7.70	.396	3.05
	✓	6½"	45.7	47.9	62.7	.264	1.50	10.25	.396	4.06
	✓	6½"	51.6	53.8	86.4	.213	1.35	11.51	.288	3.31
	✓	7"	34.1	36.0	86.4	.213	1.35	8.94	.288	2.57
	✓	8"	22.3	23.8	86.4	.213	1.35	7.72	.288	2.22
	✓	9"	17.5	18.7	86.4	.213	1.35	7.67	.288	2.21
	✓	10"	14.5	15.4	86.4	.213	1.35	7.80	.288	2.25
	✓	10"	15.9	16.8	123.2	.164	1.25	8.51	.205	1.74
	✓	8"	~~24.5~~	26.0	123.2	.164	1.25	8.43	.205	1.73
	✓	9"	16.7	19.9	123.2	.164	1.25	8.16	.205	1.67
	✓	7"	40.4	42.3	123.2	.164	1.25	10.50	.205	2.15
	✓	8"	28.6	30.1	174	.124	1.19	9.76	.148	1.44
	✓	9"	21.0	22.2	174	.124	1.19	9.11	.148	1.35
	✓	12"	14.2	14.9	174	.124	1.19	10.87	.148	1.61
	✓	10"	17.2	18.1	174	.124	1.19	9.17	.148	1.36
	✓	7"	55.4	57.3	174	.124	1.19	14.22	.148	2.10

CRITICAL CYLINDERS

STAINLESS TAMPED - I

	Inches								
100	✓ 8"	34.8	36.3	226	.0995	1.15	11.77	.114	1.3
102	✓ 9"	24.1	25.3	226	.0995	1.15	10.38	.114	1.
105	✓ 12"	15.8	16.5	226	.0995	1.15	12.04	.114	1.
107	✓ 10"	19.1	20.0	226	.0995	1.15	10.13	.114	1.
109	✓ 10"	24.1	25.0	320	.0732	1.10	12.67	.0805	1.
111	✓ 9"	31.8	33.0	320	.0732	1.10	13.54	.0805	1.
112	✓ 8"	58.6	60.1	320	.0732	1.10	12.[illegible]	.0805	1.
114	✓ 12"	17.8	18.5	320	.0732	1.10	13.50	.0805	1.
123	✓ 8"	22.7	24.2	99.5	.1924	1.32	7.85	.254	1.
131	✓ 8"	19.3	20.8	58.8	.2745	1.51	6.74	.345	2.
136	✓ 8"	27.9	29.4	192	.1145	1.17	9.53	.134	1.
140	✓ 12"	11.6	12.3	62.6	.2641	1.49	8.97	.334	3.
143	✓ 12"	25.6	26.3	499	0.0488	1.07	19.19	0.0522	1.0
~~145~~	~~✓ 10"~~	~~39.2*~~	~~40.7~~	~~499~~	~~0.0488~~	~~1.07~~	~~20.62~~	~~0.0522~~	~~1.0~~
149	✓ 15"	19.6	20.0	499	0.0488	1.07	22.12	0.0523	1.1
159	✓ 15"	28.4	28.8	755	0.0330	1.04	32.83	0.0343	1.1
162	✓ 12"	42.0	43.7	755	0.0330	1.04	35.53	0.0343	1.2
~~166~~	~~✓ 15"~~	~~52*~~	~~52.4~~	~~999~~	~~0.0254~~	~~1.03~~	~~59.74~~	~~0.0260~~	~~1.~~
173	✓ 8" long	22.0	23.5	26.2	0.4139	1.98	7.62	0.827	6.
175	✓ 8" short	21.1	22.6	26.2	0.4139	1.98	7.33	0.827	6.
176	✓ 8" long	20.7	22.2	56.2	0.2810	1.51	7.20	0.424	3.
179	✓ 15"	9.65	10.1	56.7	0.2810	1.51	11.51	0.424	4.
189	✓ 15"	12.6	13.0	221	0.1014	1.14	14.82	0.116	1.

CRITICAL CYLINDERS

STAINLESS STEEL - II

* by extrapolation

		cm	cm				L		kg
9	6"	∞	87.6	61.1	0.2680	1.47	15.98	0.394	∞
11	6"	∞	56.9	24.4	0.4301	2.02	10.382	0.8688	∞
36	6"	∞	66.6	31.6	0.385	1.88	12.15	0.724	∞
62	6"	∞	~~86.4~~ 72.9	86.4	0.213	1.35	11.51	0.288	∞
82	6½"	~~78~~ 80	77.2	123.2	0.164	1.25	16.52	0.205	3.5
83	6½"	∞	72.3	174	0.124	1.19	15.47	0.148	∞
98	7"	>100	69.9	226	0.0995	1.15	17.35	0.114	>2.8
139	7"	63	54.4	183	0.1194	1.18	13.50	0.141	2.2
147	9"	>75	40.5	499	0.0488	1.07	16.62	0.0522	>1.6
167	12"	∞	69.0	999	0.0252	1.03	50.34	0.0260	∞
37	6"	?	76.6	43.9					

Stainless Cylinders, Tamped.
Not Critical

				gm Y/gm sol				
10"	35.0*	35.9	31.6	.385	1.88	18.19	.724	13.
10"	31.4	32.3	93.9	.326	1.65	16.36	.538	8.
10"	30.8	31.7	62.7	.264	1.50	16.05	.396	6.
10"	31.0	31.9	86.7	.213	1.35	16.16	.288	4.
10"	33.4	34.3	123.2	.164	1.25	17.38	.205	3.
12"	24.0	24.7	174	.124	1.19	16.02	.148	2.
10"	37.8	38.7	174	.124	1.19	19.61	.148	2.
12"	25.5	26.2	226	.0995	1.15	19.11	.114	2.
10"	45.7	46.6	226	.0995	1.15	23.61	.114	2.
12"	29.6	30.3	320	.0732	1.10	20.10	.0805	1.
~~12"~~	~~21.0*~~	21.7	60.6	.2641	1.44	15.83	.394	6.
12"	48.2	48.9	499	0.0488	1.07	35.67	0.0522	1.
15"	26.6	27.0	499	0.0488	1.07	30.78	0.0522	1.6
20"	20.3	20.5	499	0.0488	1.07	41.54	0.0522	2.
15"	41.3	41.7	755	0.0330	1.04	47.54	0.0343	1.6
20"	26.5	26.7	755	0.0330	1.04	52.10	0.0343	1.8
15"	16.7	17.1	56.7	0.3810	1.51	19.49	0.424	8.
20"	12.1	12.3	119	0.1625	1.26	28.98	0.212	6.
20"	15.5	15.7	221	0.1014	1.14	31.81	0.116	3.6
15"	19.1	19.5	221	0.1014	1.14	22.23	0.116	2.5

CRITICAL CYLINDERS

STAINLESS UNTAMPED

Exp	[illegible] in	HC [illegible] cm	[illegible] cm	[illegible]	[illegible] x10	[illegible]	[illegible] L	[illegible]	[illegible] kg	[illegible]
8	7"	∞	87.1	61.1	~~0.2680~~ 26.8	1.47	21.62	0.394	∞	8.5[illegible]
~~9~~	~~6"~~	~~∞~~	~~87.6~~	~~61.1~~	~~0.2680~~	~~1.47~~	~~15.98~~	~~0.394~~	~~∞~~	~~6.30~~
10	6"	∞	63.1	24.4	43.01	2.02	11.51	0.8688	∞	10.0[illegible]
12	7"	∞	43.5	24.4	43.01	2.02	10.80	0.8688	∞	9.33
14	8"	∞	31.2	24.4	43.01	2.02	10.12	0.8688	∞	8.7[illegible]
18	9"	>~~45~~ ∞ ~~47.0~~	24.9	24.4	43.01	2.02	10.22	0.8688	~~16.7~~ [illegible] ∞	8.8[illegible]
21	10"	>28	19.4	24.4	43.01	2.02	9.83	0.8688	>12.4	8.5[illegible]
24	10"	>35.[illegible]	27.1	31.6	38.5	1.88	13.73	0.724	~~13.2~~ >12.8	9.4[illegible]
27	9"	∞ ~~[illegible]~~	32.0	31.6	38.5	1.88	13.13	0.724	∞	9.5[illegible]
30	8"	∞	39.3	31.6	38.5	1.88	12.74	0.724	∞	9.2[illegible]
33	7"	∞	47.9	31.6	38.5	1.88	11.89	0.724	∞	8.6[illegible]
39	7"	∞	62.0	43.9	32.6	1.65	15.39	0.538	∞	8.2[illegible]
45	9"	~~75~~ 90	40.7	43.9	32.6	1.65	16.70	0.538	~~[illegible]~~ ~20.4	[illegible]
50	8"	∞	54.8	43.9	32.6	1.65	17.77	0.538	∞	[illegible]
52	8"	∞	71.5	62.7	~~24.6~~ 26.4	1.50	23.18	0.396	∞	[illegible]
55	9"	~~755~~ 36	45.3	62.7	~~24.6~~ 26.4	1.50	18.59	0.396	~~[illegible]~~ 9.1	7.3[illegible]
67	8"	∞	81.2	86.4	21.3	1.35	26.33	0.288	∞	[illegible]
72	9"	>60 57.5	46.3	86.4	21.3	1.35	19.00	0.288	~~>7.7~~ 6.8	[illegible]
77	8"	∞	81.7	123.2	16.4	1.25	26.49	0.205	∞	[illegible]
80	9"	~70	46.0	123.2	16.4	1.25	18.88	0.205	~5.9	[illegible]
84	8"	∞	85.8	174	12.4	1.19	27.82	0.148	∞	[illegible]
90	9"	∞	46.2	174	12.4	1.19	18.96	0.148	∞	[illegible]
99	8"	∞	85.8	226	9.95	1.15	27.82	0.114	∞	[illegible]
108	10"	>75	46.7	320	7.32	1.10	23.66	0.0805	>3.0	[illegible]
146	10"	∞	45.9	499	4.88	1.07	23.25	0.0522	∞	[illegible]
164	20"	~36	29.5	999	2.52	1.03	59.77	0.0260	~1.9	[illegible]
169	10"	>25	19.0	26.2	41.79	1.98	9.62	0.827	>10.5	[illegible]

Stainless S. Unlagged
Not Critical

Run No.	Reactor Size inches	Hc (meas) cm	Hc (corr) cm	H/X	wgt X gm X/gm sol	sp. g.	Vc lit. soln.	[illegible]	Mc Kg X
[illegible]	9"	31.5*	32.7	24.4	.4301	2.02	13.42	.8658	11.66
[illegible]	~~10"~~	~~22.5~~	~~23.4~~	~~24.4~~	~~.4301~~	~~2.02~~	~~11.9~~	~~.8658~~	~~10.3~~
[illegible]	10"	20.2	21.1	31.6	.385	1.88	10.69	.724	7.74
[illegible]	9"	27.8	29.0	31.6	.385	1.88	11.90	.724	8.62
[illegible]	9"	27.6	28.8	43.9	.326	1.65	11.82	.538	6.36
[illegible]	10"	20.5	21.4	43.9	.326	1.65	10.84	.538	5.83
[illegible]	8"	50.0	51.5	43.9	.326	1.65	16.70	.538	8.98
[illegible]	8"	46.9	48.4	62.7	.264	1.50	15.69	.396	6.21
[illegible]	9"	27.1	28.3	62.7	.264	1.50	11.64	.396	4.61
[illegible]	10"	21.1	22.0	62.7	.264	1.50	11.15	.396	4.42
[illegible]	8"	55.0	56.5	86.4	.213	1.35	18.32	.288	5.28
[illegible]	9"	28.0	29.2	86.4	.213	1.35	11.98	.288	3.45
[illegible]	10"	21.1	22.0	86.4	.213	1.35	11.15	.288	3.21
[illegible]	9"	30.8	32.0	123.2	.164	1.25	13.13	.205	2.69
[illegible]	9"	36.1	37.3	174	.124	1.19	15.30	.148	2.26
[illegible]	12"	18.8	19.5	174	.124	1.19	14.22	.148	2.10
[illegible]	12"	20.2	~~20.7~~ 20.9	226	.0995	1.15	~~15.10~~ 15.25	.114	~~1.72~~ 1.74
[illegible]	12"	32.1	32.8	499	0.0488	1.07	23.93	0.0522	1.25
[illegible]	12" NOT CRITICAL	~~[illegible]*~~	~~[illegible]~~	~~23.2~~	~~0.4[illegible]~~	~~1.98~~	~~11.31~~	~~0.827~~	9.35
[illegible]	12"	15.1	15.8	56.7	0.2810	1.51	11.53	0.424	4.89
[illegible]	10"	27.8	28.7	221	[illegible]	1.14	12.54	0.116	1.69

CRITICAL CYLINDERS

STAINLESS STEEL CADMIUM COVERED

* by extrapolation

		cm	cm				L		
16	8"	>47	30.8	24.4	0.4301	2.02	9.99	0.8688	>13.24
17	9"	>32.7	24.7	24.4	0.4301	2.02	10.13	0.8688	~~11.4~~ 11.66
20	10"	~~28.4~~ ~23.4	19.6	24.4	0.4301	2.02	9.93	0.8688	M 10.3 12.5
29	8"	∞	35.9	31.6	0.385	1.88	11.64	0.724	∞
32	7"	∞	50.3	31.6	0.385	1.88	12.48	0.724	∞
63	7"	∞	71.9	86.4	0.213	1.35	17.85	0.288	∞
101	9"	46.2	41.2	226	0.0995	1.15	16.90	0.114	2.16
110	9"	∞	40.5	320	0.0732	1.10	16.62	0.0805	∞
161	12"	∞	58.3	755	0.0330	1.04	43.53	0.0343	∞
148	12"	15.5	13.2	26.2	0.4179	1.98	—	0.827	9.35 7.96

STAINLESS CYLINDERS
NOT CRITICAL

TAMPED & CADMIUM SHIELDED

[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		Ko X [illegible]
				gm X/gm [illegible]				
8"	20.9	22.4	99.5	.1925	1.32	7.26	.254	1.84
8"	38.6	40.1	290	.0801	1.10	13.00	.0881	1.15
5"	19.0	20.5	58.8	.2745	1.51	6.65	.415	2.76
5"	69.2	71.8	58.8	.2745	1.51	13.10	.915	5.44
8"	26.6	28.1	192	.1145	1.17	9.11	.134	1.22
10"	34.3	35.2	499	0.0488	1.07	17.830	0.0522	0.93
15"	16.5	16.9	499	0.0488	1.07	19.27	0.0522	1.01
15"	25.65	27.1	755	0.0330	1.04	29.75	0.0343	1.02
15"	43.85	44.3	999	0.0252	1.03	50.50	0.0260	1.31
8"	20.0	21.5	26.2	0.4179	1.98	6.97	0.827	5.76
15"	8.27	8.6	26.2	0.4179	1.98	9.80	0.827	8.10
6½"	42.3	44.5	26.2	0.4179	1.98	9.56	0.827	7.91
15"	8.1	8.5	56.7	0.2810	1.51	9.69	0.424	4.11
6½"	38.2	40.4	56.7	0.2810	1.51	8.65	0.424	3.67
6½"	50.4	52.6	119	0.1685	1.26	11.26	0.212	2.39
15"	10.17	11.3	221	0.1014	1.14	12.88	0.116	1.49
	7.5							

CRITICAL CYLINDERS

ALLUMINUM TAMPED

	in	Estimated Crit. mass	Crit. mass		$\times 10^{-2}$		Time / mass		Est.	Time
		Cm	Cm				L		kg	mass kg
148	8"	∞	74.5	499	0.0488	1.07	24.15	0.0522	∞	1.26
163	10"	∞	56.4	755	0.0330	1.04	28.57	0.0343	∞	0.98
170	6'	> 75	51.6	26.2	0.4179	1.98	9.41	0.827	11.3	7.78
177	5 1/2"	∞	74.3	56.7	0.2810	1.51	11.4	0.424	∞	4.83
185	6"	∞	72.6	119	0.1685	1.26	13.24	0.212	∞	2.81
186	6 1/2"	∞	61.6	221	0.1014	1.14	12.71	0.116	∞	1.47
	15"	8.6	7.5	262	0.4179	1.98	—	.827	8.10	7.07

Aluminium Cylinders, NOT CRITICAL.
TAMPED.

Exp #	Reactor Size	Hc (meas)	Hc (corr)	H/X	wgt % X	sp. g.	Vc	X/ [illegible]	Mc
	in.	cm	cm		X10 [illegible]		l. soln.		Kg X
					gm X / gm sol				
154	15"	26.95	27.4	499	0.0488	1.07	31.24	0.0522	1.63
157	15"	43.15	43.6	755	0.0330	1.04	49.70	0.0343	1.70

CRITICAL CYLINDERS
ALUMINIUM - UNTAMPED

Exp		Diameter	Thickness						
		cm	cm				L.		Kg
153	10"	∞	61.9	499	0.0488	1.07	31.36 L	0.0522	∞ Kg

Aluminium Cylinders,
NOT CRITICAL
Untamped.

	No. Reactor	Separation	H_c meas.	H_c corr.	H/X	g U/g soln	sp g.	V_c	g U/cc soln.	M_c
	ID.	cm.	cm.	cm.				l.		Kg X
213B	#1 6½	7.0	29.0	31.2	52.9	0.293	1.566	6.68	0.454	3.07
	#2 6	—	29.0	29.0	52.9	0.293	1.566	5.29	0.454	2.43
213C	#1 6½	10.5	34.2	36.4	52.9	0.293	1.566	7.79	0.454	3.58
	#2 6	—	34.2	34.2	52.9	0.293	1.566	6.24	0.454	2.86
213D	#1 6½	13.0	35.8	38.0	52.9	0.293	1.566	8.13	0.454	3.73
	#2 6	—	35.8	35.8	52.9	0.293	1.566	6.53	0.454	3.00
213E	#1 6½	20.0	37.1	39.3	52.9	0.293	1.566	8.41	0.454	3.86
	#2 6	—	37.1	37.1	52.9	0.293	1.566	6.77	0.454	3.11
216A	6*	0.0	19.65	21.0	52.9	0.293	1.566	3.83	0.454	1.76
B	6*	2.9	22.70	24.0	52.9	0.293	1.566	4.38	0.454	2.01
C	6*	5.8	30.2	31.5	52.9	0.293	1.566	5.74	~~0.19~~ 0.454	2.64
D	6*	8.7	39.4	40.7	52.9	0.293	1.566	7.42	0.454	3.41
E	6*	11.0	46.3	47.6	52.9	0.293	1.566	8.68	0.454	3.98
F	6*	13.0	50.5*	51.8	52.9	0.293	1.566	9.45	0.454	4.34
217A	15✓	0.0	7.05	7.3	52.9	0.293	1.566	8.32	0.454	3.82
B	15✓	2.9	7.35	7.6	52.9	0.293	1.566	8.66	0.454	3.97
C	15✓	5.8	7.40	7.6	52.9	0.293	1.566	8.66	0.454	~~3.97~~ 4.00
D	15✓	11.6	7.45	7.7	52.9	0.293	1.566	8.78	0.454	4.03
218	5†	0.2	34.5	36.4	52.9	0.293	1.566	4.61	0.454	2.12
219A	5†	2.9	50.0	51.9	52.9	0.293	1.566	6.57	0.454	3.02
B	5†	3.3	54.3	56.2	52.9	0.293	1.566	7.11	0.454	3.26
D	5†	3.8	63.4	65.3	52.9	0.293	1.566	8.27	0.454	3.80
E	5*	4.2	74*	76	52.9	0.293	1.566	9.6	0.454	4.4
M	5*	4.0	68.3	70.2	52.9	0.293	1.566	8.89	0.454	4.08
220A	8*	0.6	11.85†	13.2	52.9	0.293	1.566	4.28	0.454	1.96
B	8*	3.5	13.55†	14.9	52.9	0.293	1.566	4.83	0.454	2.22
C	8*	14.7	17.80†	19.1	52.9	0.293	1.566	6.19	0.454	2.84
D	8†	7.0	15.70†	17.0	52.9	0.293	1.566	~~5.51~~ 5.54	0.454	2.53
E	8*	1.8	12.35†	13.7	52.9	0.293	1.566	4.44	0.454	2.04
222A	6 8*	0.4	27.6	28.9	169.3	0.127	1.187	5.27	0.151	0.796
B	6†	2.0	31.2	32.5	169.3	0.127	1.187	5.93	0.151	0.895
C	6*	4.0	40.9	42.2	169.3	0.127	1.187	7.70	0.151	1.16
D	6*	6.0	59.5	60.8	169.3	0.127	1.187	10.90 ~~10.85~~	0.151	1.65
E	6*	8.0	∞	∞	169.3	0.127	1.187	∞	0.151	∞

Two Aluminium Cylinders Tamped, Critical & Non-critical

* Extrapolation
† Shimmed

Mc is mass/cylinder

Exp #	Dia Reactor in.	Separation cm.	Hc meas cm.	Hc corr. cm.	H/x	g x/g soln.	sp.g.	Vc l.	g x/cc soln	M Kg. x
229A	15	0.0	8.8	9.0	169.3	0.127	1.187	10.26	0.151	1.55
B	15	3.0	9.1	9.3	169.3	0.127	1.187	10.60	0.151	1.60
C	15	22.0	9.47	9.7	169.3	0.127	1.187	11.06	0.151	1.67
230A	15	0.0	11.3	11.5	328.7	0.0715	1.101	13.11	0.0787	1.03
B	15	5.0	12.1	12.3	328.7	0.0715	1.101	14.02	0.0787	1.10
C	15	20.0	12.35	12.6	328.7	0.0715	1.101	14.36	0.0787	1.13
236 263 B	10	0.0	16.4	16.9	328.7	0.0715	1.101	8.56	0.0787	0.674
C	10	3.0	18.2	18.7	328.7	0.0715	1.101	9.47	0.0787	0.745
D	10	8.0	20.6	21.1	328.7	0.0715	1.101	10.69	0.0787	0.841
237A	6	0.2	61.3	63.1	328.7	0.0715	1.101	11.51	0.0787	0.905
B	6	0.5	64.4	66.2	328.7	0.0715	1.101	12.07	0.0787	0.950
C	6	0.8	68.0	69.8	328.7	0.0715	1.101	12.73	0.0787	1.00

Two Aluminum Cylinders Tamped, Critical & Non-critical

Continued on next page.

	Dia. Cyl.	Separation (cm)	H_c (meas) (cm)	H_c (corr) (cm)	H/x	g U/liter sol'n	sp.g.	V_c (l)	g U/cc soln	M_c (kg)
198B	8*	~~3.3~~ 0.4	~~12.8~~ 0.4	13.5	29.9	0.394	1.926	4.38	0.759	3.32
198A	8*	~~3.3~~ 0.0	~~12.8~~ 12.7	13.4	29.9	0.394	1.926	4.34	0.759	3.29
199A	8*	0.0	12.7	13.4	29.9	0.394	1.926	4.34	0.759	3.29
199B	8*	1.45	13.25	13.95	29.9	0.394	1.926	4.52	0.759	3.43
201A	6*	0.1	21.5	22.8	29.9	0.394	1.926	4.16	0.759	3.16
201B	6*	2.9	25.6	26.9	29.9	0.394	1.926	4.91	0.759	3.73
202A	5½*	0.5	25.6	27.1	29.9	0.394	1.926	4.15	0.759	3.15
202B	5½*	2.9	29.5	31.0	29.9	0.394	1.926	4.74	0.759	3.60
203	10	0.0	10.5	11.0	29.9	0.394	1.926	5.57	0.759	4.23
205A	8*	0.8	12.85	13.60	52.9	0.293	1.566	4.41	0.459	2.02
205B	8*	3.6	14.55	15.30	52.9	0.293	1.566	4.96	0.459	2.28
205C	8	10.9	17.7	18.4	52.9	0.293	1.566	5.97	0.459	2.74
205D	8*	1.7	13.15	13.9	52.9	0.293	1.566	4.51	0.459	2.07
205E	8	14.7	18.1	18.8	52.9	0.293	1.566	6.09	0.459	2.80
205F	8	0.0	12.05	12.8	52.9	0.293	1.566	4.15	0.459	1.90
205G	8*	6.8	15.9	16.6	52.9	0.293	1.566	5.38	0.459	2.47
205H	8	20.1	17.85	18.6	52.9	0.293	1.566	6.03	0.459	2.77
205I	8	14.4	18.1	18.8	52.9	0.293	1.566	6.09	0.459	2.80
205J	8	43.	18.1	18.8	52.9	0.293	1.566	6.09	0.459	2.80
205K	8*	8.6	16.9	17.6	52.9	0.293	1.566	5.71	0.459	2.62
205L	8*	5.7	15.4	16.1	52.9	0.293	1.566	5.22	0.459	2.40
205M	8*	4.2	14.5	15.2	52.9	0.293	1.566	4.93	0.459	2.26
205N	8*	4.2	14.5	15.2	52.9	0.293	1.566	4.93	0.459	2.26
208A	10	0.2	9.85	10.30	52.9	0.293	1.566	5.22	0.459	2.40
208B	10	3.0	10.7	11.2	52.9	0.293	1.566	5.67	0.459	2.60
208C	10	7.0	11.7	12.2	52.9	0.293	1.566	6.18	0.459	2.84
208D	10	10.5	12.25	12.7	52.9	0.293	1.566	6.43	0.459	2.95
208E	10	13.0	12.45	12.9	52.9	0.293	1.566	6.54	0.459	3.00
208F	10	20.0	12.5	13.0	52.9	0.293	1.566	6.59	0.459	3.02
212	#1 6½	0.1	17.65	18.9	52.9	0.293	1.566	4.04	0.459	1.85
	#2 6	—	17.65	17.7	52.9	0.293	1.566	3.23	0.459	1.48
213A	#1 6½	3.0	21.1	23.3	52.9	0.293	1.566	4.99	0.459	2.29
	#2 6		21.1	21.1	52.9	0.293	1.566	3.85	0.459	1.77

Two Aluminum Cylinders, Tamped Critical & Non-Critical

Exp #	Dia Reactor	Separation	H_c (meas)	H_c (corr)	H/X	gx/gm sol.	Sp g.	V_c	gm X/cc sol.	M_c
	"	cm.	cm.	cm.				l.		Kg X
207	8	0.0	>38cm	—	52.9	0.293	1.566	> 12.32	0.459	> 5.65
210	10	0.0	> 20cm	—	52.9	0.293	1.566	> 10.13	0.459	> 4.65
221	8	0.0	∞	∞	169.3	0.127	1.187	∞	0.151	∞
223A	20	0.0	14.55†	14.7	169.3	0.127	1.187	29.78	0.151	4.50
B	20	5.0	14.65†	14.8	169.3	0.127	1.187	29.98	0.151	4.53
C	20	20.0	14.7†	14.8	169.3	0.127	1.187	29.98	0.151	4.53
224A	10	0.0	28.2	28.7	169.3	0.127	1.187	14.54	0.151	2.20
B	10	2.0	30.15	30.7	169.3	0.127	1.187	15.55	0.151	2.35
C	10	5.8	32.3	32.8	169.3	0.127	1.187	16.62	0.151	2.51
D	10	9.55	33.8	34.3	169.3	0.127	1.187	17.38	0.151	2.62
E	10	15.6	35.3	35.8	169.3	0.127	1.187	18.14	0.151	2.74
F	10	24.65	~~37.1~~ 36.7	37.2	169.3	0.127	1.187	18.85	0.151	2.85
G	10	33.9	37.7	38.2	169.3	0.127	1.187	19.35	0.151	2.92
226	10	50.0	38.6	39.1	169.3	0.127	1.187	19.81	0.151	2.99
227A	15	0.3	17.1	17.3	169.3	0.127	1.187	19.72	0.151	2.98
B	15	5.0	17.6	17.8	169.3	0.127	1.187	20.29	0.151	3.06
C	15	15.0	17.8	18.0	169.3	0.127	1.187	20.52	0.151	3.10
D	15	50.0	18.1	18.3	169.3	0.127	1.187	20.86	0.151	3.15
232A	15	0.2	19.9	20.1	328.7	0.0715	1.101	22.91	0.0787	1.80
B	15	9.7	20.75	21.0	328.7	0.0715	1.101	23.94	0.0787	1.88
B'	15	5.0	20.6	20.8	328.7	0.0715	1.101	23.71	0.0787	1.87
C	15	50.0	21.25	21.5	328.7	0.0715	1.101	24.51	0.0787	1.93
D	15	31.3	21.1	21.3	328.7	0.0715	1.101	24.28	0.0787	1.91
234A	20	0.0	16.8° †	~~17.0~~ 16.7	328.7	0.0715	1.101	33.83	0.0787	2.66
B	20	10.0	16.3†	17.0	328.7	0.0715	1.101	34.44	0.0787	2.71
C	20	25.0	16.55†	17.3	328.7	0.0715	1.101	35.05	0.0787	2.76
235A	10	0.0	40.3	40.8	328.7	0.0715	1.101	20.67	0.0787	1.63
B	10	1.9	44.4	44.9	328.7	0.0715	1.101	22.75	0.0787	1.79
C	10	4.8	49.5	50.0	328.7	0.0715	1.101	25.33	0.0787	1.99
D	10	8.0	54.3	54.8	328.7	0.0715	1.101	27.76	0.0787	2.18
E	10	16.6	64.2	64.7	328.7	0.0715	1.101	32.78	0.0787	2.58
F	10	31.3	73.9	74.4	328.7	0.0715	1.101	37.69	0.0787	2.97
G	10	43.3	79.6	80.1	328.7	0.0715	1.101	40.58	0.0787	3.19

Two Aluminum Cylinders, Unstamped Critical & Non-Critical.

† Stainless steel cylinder

Exp #	Dia. Reactor in	Cyl # & Tamping	H_c (meas) cm.	H_c (corr) cm.	H/X	gm X / gm soln	Sp. g.	V_c l	g X / ℓ soln.	M_c Kg X
196	8	#1 Tamped	19.3	20.7	29.9	0.394	1.926	6.71	0.759	5.09
200	8	#2 Tamped	20.5	20.5	29.9	0.394	1.926	6.65	0.759	5.05
204 203	8	#1 Untamped	∞	∞	52.9	0.293	1.566	∞	0.459	∞
206	8	#1 Tamped	18.05	19.50	52.9	0.293	1.566	6.32	0.459	2.90
V09A	10	#1 Tamped	12.5	13.4	52.9	0.293	1.566	6.79	0.459	3.12
V09B	10	#1 Untamped	33.1 ✓	34.0	52.9	0.293	1.566	17.22	0.459	7.90
211	10	#2 Tamped	13.15	13.2	52.9	0.293	1.566	6.69	0.459	3.07
214	6½	#1 Tamped	37.0	39.2	52.9	0.293	1.566	8.39	0.459	3.85
215	6	#1 Tamped	68.3	70.9	52.9	0.293	1.566	12.93	0.459	5.93
217E	15	#1 Tamped	7.5	7.9	52.9	0.293	1.566	9.01	0.459	4.14
225	10	#1 Untamped	40.3 ✓	41.2	169.3	0.127	1.187	20.87	0.151	3.15
228	15	#1 Untamped	18.05	18.5	169.3	0.127	1.187	21.09	0.151	3.18
231	15	#1 Untamped	21.3	21.7	328.7	0.0715	1.101	24.73	0.0787	1.95
233	20	#1 Untamped	17.2 †	17.4	328.7	0.0715	1.101	35.25	0.0787	2.77
236 A	10	#1 Tamped	21.5	22.4	328.7	0.0715	1.101	11.35	0.0787	0.893

Single Cylinders Tamped & Untamped Aluminum unless marked †
Critical & Non-critical

† Stainless steel

Stop


SECRET