1 of 2

DECLASSIFIED

May 13, 1955

HW-734571
1-

TO : H. T. Wells

FROM: R. O. Gumprecht

By Authority of R. M. Hen

CG-PR-2, 3-9-94

By J. E. Sawley 3-15-94

Verified By D. Hansen, 3-28-94

DRAFTThis Document consists of
101 Pages No. 1 of
1 Copies**PT 105-600-A - FIRST MEASUREMENT OF
GRAPHITE TEMPERATURE REACTIVITY COEFFICIENT AT KE** (Consolidation of data)**DECLASSIFIED****I. General Procedure for Test**

This test will consist of a series of helium purges of the pile gas atmosphere to bring the helium content up to about 70 to 80% helium followed by a series of CO₂ purges to restore the pile atmosphere to its initial composition. The purges will be spaced roughly four hours apart to enable the reactor to reach a steady temperature before each purge is undertaken. Stepwise, the procedure is as follows:

1. Record reactor thermocouple readings (complete traverse recorded on regular standard data sheet marked "save for Pile Physics PT 105-600-A").
2. Purge in about 5000 cu. ft. of helium.
3. Maintain carbon copy duplicate of ^{the} console log (normal 15 minute readings) including 15 minute readings of channels #1, #2 and #4 remote indicating Beckman meters for the duration of this test. (24 to 26 hours).
4. After the purge carried out under step 2 above is completed, allow about 3-1/2 to 4 hours for the reactor to reach its new equilibrium conditions and take complete traverse of reactor thermocouples. (Pile Physics representative will watch the course of the change and will indicate when thermocouple readings are to be taken.)
5. Purge in an additional amount of helium agreeable to both Operations and Pile Physics. (Probably 5000 to 10000 cu. ft. depending on the magnitude of the change produced by previous purge.)
6. Repeat steps 4 and 5 until either:
 - a. The pile has lost 50 ih of reactivity.
 - or b. The helium content of the gas atmosphere has reached 80% helium.
7. After the minimum pile reactivity or maximum helium content has been reached, the gas atmosphere will be restored to its initial composition by CO₂ purges carried out in the same fashion as the helium purges. The size of each CO₂ purge will be determined by agreement between Operations and Pile Physics and will depend on the

Distribution
1-DOO File**ROUGH DRAFT**

TO : H. T. Walls (cont'd.)

ROUGH DRAFT

magnitude of the changes observed during the helium purges. Each CO₂ purge will be followed by a waiting period and recording of reactor thermocouples as was done for the helium purges.

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II. Purge and Operating Procedure

A. Operating Instructions

1. General

- a. An orsat analysis of the reactor atmosphere will be taken prior to each purge. Following each purge, the make-up will be adjusted as specified by the Technical representative.
- b. The power level deviation recorder and the NO. 1 galvanometer readings are not expected to bear a constant relationship to each other during this test; therefore, the reactor will be controlled to maintain a constant reading on the power level deviation recorder.
- c. The 500 KW tube power limit applies throughout the test. The temperature distribution should be maintained as near normal as possible. MOR's 2 and 18 are located such that most of the inhour loss can be taken by pulling these 2 rods.

2. Data Required for Gas Composition Changes - KE - PT 105-600-A

- a. Complete traverse of reactor thermocouples before each change in gas composition. Use regular forms marked "save for File Physics PT 105-600-A."
- b. Carbon copy of console log marked "save for File Physics PT 105-600-A." Also include 15 minute readings of channel #1, #2, and #4 remote indicating Beckman meters.
- c. Temperature map of tube outlet temperatures once per hour during test (every three rows).

B. Procedure for Purging

1. Fill the make-up tanks, then isolate the tanks from the KW supply.
2. Open the "dryer loop bypass valve V-10." Leave dryer blower in operation.
3. Close the outlet division valve.
4. From the initial tank pressure, the curves provided, and the purge volume

TO : H. T. Wells (cont'd.)

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desired, estimate the final desired tank pressure. (Note that the curves are for each tank - multiple by 2 if two tanks are used.)

5. Build up a slight excess pressure by opening the automatic or the hand operated make-up valve. (Purge into the inlet to the 115 line and exhaust through the outlet from the 105 line.)
6. Gradually open the exit purge or vent valve, adjust it to maintain at least 2 inches of pressure on the unit.
7. Purge until the desired tank pressure is obtained. (Purge rate should be adjusted such that at least 15 minutes are required for 5000 cu. ft. purge.)
8. Close the exit purge or vent valve and then close the inlet purge valve - these may be done simultaneously to prevent excessive pressure being applied to the unit.
9. Open the outlet division valve.
10. Close the dryer loop by-pass valve V-10 to restore gas circulation. Set make-up to normal.

CONFIGURATION

Configuration														
Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	①	①	①	①	②	②	②	②	②	③	③	③	③	③
2	60.4 15	52.8 20	49.5 22	41.1 28	95.2 0 30.5	84.0 2.5 36	88.0 1.5 35	64.7 12 37	61.5 14 29.5	64.9 12	53.8 20	43.1 28.5 43	38.8 31	37.0 34
3					34.5 28.5	37.0 29	25.6 35	29.3 33	22.1 26.5	19.0 38	15.7 39.5	15.3 35.5	12.0 41	9.4 42
4	1.0 41	1.0 41	1.0 41	1.0 41	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40
5														
6														
7														
8														
9	12.5 35	12.5 35	12.5 35	12.5 35	0 30	0 30	0 30	0 30	0 30	0 30	0 30	0 30	0 30	0 30
10					88.0 2	73.0 1	83.6 2.5	85.0 3	45.7 17	30.1 22	31.5 21.5	20.0 25	19.0 25	
11											82.4 31.5	89.6 1.5	81.3 4	73.2 6.5
12														
13	57.0 16	57.0 16	57.0 16	49.5 19.5						1.0 30.5	1.0 30.5	1.0 30.5	0 30	0 30
14					34.3 19.5	21.0 26	26.3 24	12.9 28.5	21.4 26					
15														
16	1.0 41	1.0 41	1.0 41	1.0 41	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40	0 40
17														
18	76.5 6	37.0 29.5	29.5 33	22.5 33.5						75.5 6	68.8 10	67.3 10	60.0 15	50.9 17
19					34.0 32	29.0 35	17.7 41	22.2 38.5	14.8 42.5	43.0 25	36.6 30.5	33.0 23	31.6 34	20.0 40
20					84.6 2.0	73.0 7	70.5 8	55.0 19	61.7 14	13.0 48.5	10.4 50	3.1 52	1.0 52.5	8.4 51

Total 154 182.5 188 198 212.5 241.5 255.5 282.5 285.5 328 359 371 393 402.5
 Δ 29 - 5 - 10 - 25 - 25 - 8 - 27 - 8 - 42 - 31 - 12 - 22 - 10
 TEST RESULT 162 189 196 209 244 273 282 312 312 364 399 410 432 448
 Δ 27 - 7 - 13 - 35 - 29 - 8 - 36 - 8 - 32 - 15 - 11 - 22 - 16
 Δ 2 2 3 10 4 0 4 3 10 4 -1 0 6
 403 448 8 11 21 25 25 29 26 36 40 39 39 46
 154 162
 249 286 lb of transient
 lb of rod

16 ROD TAPE 52

FROM NATURAL CURVE

FROM TAPE 52

Hur-73451 RD.

10 ROD TAPE 52

HW-73451 RD

14 ROD TAPE 52

14-13451 RD

$$18\frac{1}{2} \text{ hr} = 30\%$$

$$24\frac{1}{2} = 40$$

$$55\frac{1}{2} = 90$$

$$1.6216$$

$$1.6326$$

$$1.6216\% = 1 \text{ hr.}$$

Nov-73457 RD

0	100.00	56.8	33.00
1.6	99.74	58.4	30.61
3.2	99.38	60.0	28.20
4.9	98.84	61.6	25.83
6.5	98.11	63.2	23.44
8.1	97.21	64.9	21.19
9.7	96.03	66.5	18.97
11.4	94.65	68.1	16.91
13.0	93.17	69.7	14.94
14.6	91.43	71.4	12.98
16.2	89.56	73.0	11.28
17.8	87.71	74.6	9.636
19.5	85.81	76.2	8.172
21.1	83.75	77.8	6.847
22.7	81.60	79.5	5.501
24.3	79.48	81.1	4.236
25.9	77.26	82.7	3.147
27.6	75.02	84.3	2.248
29.2	72.70	85.9	1.516
30.8	70.28	87.6	1.013
32.4	67.85	89.2	.599
34.1	65.45	90.8	.327
35.7	63.03	92.4	.141
37.3	60.65	93.7	0
38.9	58.32	95.7	
40.5	55.99		
42.2	53.65		
43.8	51.38		
45.4	49.19		
47.0	47.02		
48.6	44.84		
50.3	42.59		
51.9	40.21		
53.5	37.88		
55.1	35.44		

sr

1-40 3-15 9-12 14-18 16-3.0 19-12 20-17.5
 2-15.5 4-12 10-20 13-70 11-83

39'

14 road. (central Bank.)

25	26	27	28	25	26	27	28				
.110	.114	.104	.116	.111	.111	1.869	1.823	1.918	1.885	1.874	49.524
.142	.144	.140	.158	.146	.257	1.927	1.806	1.957	1.918	1.902	51.426
.221	.180	.229	.224	.214	.471	1.957	1.877	1.831	1.885	1.888	53.314
.310	.317	.307	.365	.325	.796	1.974	1.877	1.860	1.902	1.903	55.217
.350	.354	.423	.454	.395	1.191	1.927	1.745	1.918	2.016	1.902	57.119
.575	.523	.570	.632	.575	1.766	1.935	1.737	1.823	1.806	1.825	58.944
.694	.671	.689	.769	.707	2.473	1.823	1.573	1.806	1.847	1.762	60.706
.906	.832	.998	.684	.855	3.328	1.669	1.761	1.685	1.847	1.740	62.446
.912	.968	.947	1.147	.994	4.322	1.847	1.486	1.631	1.721	1.671	64.117
1.020	1.063	1.014	1.134	1.058	5.380	1.698	1.685	1.550	1.823	1.689	65.806
.956	1.044	.968	1.197	1.041	6.421	1.669	1.515	1.638	1.654	1.619	67.425
1.197	1.057	1.210	1.134	1.150	7.571	1.467	1.530	1.362	1.610	1.492	68.917
1.141	1.309	1.237	1.471	1.240	8.861	1.486	1.430	1.493	1.416	1.456	70.373
1.390	1.197	1.409	1.355	1.338	10.199	1.459	1.402	1.416	1.588	1.466	71.839
1.486	1.573	1.467	1.638	1.541	11.740	1.355	1.243	1.376	1.508	1.370	73.209
1.618	1.409	1.729	1.438	1.548	13.288	1.237	1.210	1.309	.880	1.159	74.368
1.550	1.618	1.618	1.669	1.614	14.902	.986	1.026	1.073	1.261	1.086	75.454
1.685	1.721	1.745	1.823	1.744	16.646	.901	.901	.941	.956	.925	76.379
1.806	1.713	1.761	1.806	1.772	18.418	.699	.684	.684	.774	.710	77.089
1.902	1.902	1.940	1.777	1.880	20.298	.584	.548	.543	.596	.568	77.657
1.902	1.831	1.823	1.869	1.856	22.154	.430	.430	.397	.438	.424	78.081
1.902	1.885	1.869	1.427	1.896	24.050	.301	.307	.258	.282	.287	78.368
1.847	1.927	1.823	1.918	1.879	25.929	.197	.203	.215	.203	.204	78.572
1.860	1.940	1.918	1.940	1.914	27.843						
1.935	1.957	1.957	1.823	1.918	29.761						
1.860	1.902	1.790	1.790	1.836	31.597						
1.902	1.877	1.831	1.847	1.864	33.461						
1.847	1.806	1.706	1.713	1.768	35.229						
1.790	1.823	1.646	1.603	1.716	36.945						
1.877	1.745	1.580	1.603	1.701	38.646						
1.839	1.823	1.646	1.588	1.724	40.370						
1.777	1.918	1.706	1.737	1.784	42.154						
1.877	1.927	1.790	1.761	1.839	43.993						
1.847	1.869	1.823	1.790	1.832	45.825						
1.814	1.918	1.823	1.745	1.825	47.650						

New-73437 RD

15-16-17-18

77.24

0	100	75.66	89.59			
1.6	99.77	77.51	91.78	48.6	45.60	54.0
3.2	99.43	79.22	93.81	50.3	43.13	51.1
4.9	98.95	80.82	95.70	51.9	40.62	48.1
6.5	98.30	82.13	97.25	53.5	38.19	45.2
8.1	97.48	83.22	98.54	55.1	35.76	42.3
9.7	96.40	83.89	99.34	56.8	33.42	39.6
11.4	95.13	84.27	99.79	58.4	31.08	36.8
13.0	93.71	84.45	100	60.0	28.84	34.2
14.6	92.17	84.45	100	61.6	26.58	31.5
16.2	90.46	84.18	99.68	63.2	24.34	28.8
17.8	88.71	83.80	99.23	64.9	22.24	26.3
19.5	86.81	83.08	98.38	66.5	20.21	23.9
21.1	84.85	82.16	97.29	68.1	18.12	21.5
22.7	82.88	81.01	95.93	69.7	16.17	19.1
24.3	80.81	79.56	94.21	71.4	14.25	16.9
25.9	78.74	77.98	92.34	73.0	12.51	14.8
27.6	76.60	76.20	90.23	74.6	10.86	12.8
29.2	74.46	74.30	87.98	76.2	9.26	11.0
30.8	72.23		85.53	77.8	7.72	9.1
32.4	69.94		82.82	79.5	6.28	7.4
34.1	67.60		80.05	81.1	4.91	5.8
35.7	65.19		77.19	82.7	3.73	4.4
37.3	62.79		74.35	84.3	2.69	3.2
38.9	60.37		71.49	85.9	1.88	2.2
40.5	57.91		68.57	87.6	1.24	1.5
42.2	55.41		65.61	89.2	0.76	0.9
43.8	52.94		62.69	90.8	0.40	0.5
45.4	50.49		59.79	92.4	0.16	0.2
47.0	48.04		56.88	93.7	0	0

Her-73437 RD H

	18	19	20	21		18	19	20	21				
40	.123	.130	.121	.123	.124	✓	1.918	1.927	1.831	2.056	1.933	44.73	
42	.185	.177	.182	.203	.187	.311	✓	1.927	1.918	1.885	1.847	1.894	46.62
	.307	.270	.255	.279	.278	.589	✓	1.974	1.806	1.860	1.902	1.879	48.50
44	.372	.354	.361	.404	.373	.962	✓	1.806	1.860	1.790	1.918	1.844	50.35
	.473	.486	.426	.575	.490	1.45	✓	1.918	1.753	1.831	1.940	1.860	52.21
46	.642	.591	.615	.651	.625	2.08		1.745	1.877	1.538	2.056	1.809	54.02
	.869	.789	.729	.821	.802	2.88		1.777	1.638	1.877	1.790	1.770	55.79
48	.c	.924	.869	.929	.907	3.79		1.745	1.721	1.603	1.831	1.725	57.51
	1.092	1.163	.956	1.147	1.064	4.85		1.737	1.588	1.662	1.631	1.655	59.17
50	1.086	1.173	1.073	1.117	1.112	5.96		1.669	1.646	1.423	1.860	1.650	60.82
	1.160	1.210	1.223	1.166	1.190	7.15		1.654	1.452	1.631	1.654	1.598	62.42
52	1.197	1.250	1.153	1.355	1.239	8.39		1.713	1.631	1.362	1.721	1.607	64.02
	1.275	1.295	1.295	1.197	1.266	9.66		1.631	1.573	1.383	1.486	1.518	65.54
54	1.402	1.409	1.141	1.459	1.353	11.01		1.631	1.486	1.362	1.573	1.513	67.05
	1.603	1.376	1.416	1.538	1.483	12.49		1.459	1.409	1.409	1.573	1.462	68.52
56	1.329	1.603	1.438	1.638	1.502	14.00		1.355	1.402	1.261	1.416	1.358	69.87
	1.631	1.669	1.654	1.508	1.616	15.61		1.390	1.261	1.261	1.362	1.318	71.19
58	1.573	1.565	1.376	1.777	1.573	17.18		1.250	1.210	1.069	1.243	1.193	72.38
	1.698	1.565	1.638	1.565	1.616	18.80		1.846	1.073	1.014	1.197	1.095	73.48
60	1.646	1.790	1.550	1.918	1.726	20.53		1.968	1.026	.901	1.014	.977	74.46
	1.790	1.588	1.706	1.918	1.750	22.28		1.783	.891	.774	.874	.830	75.29
62	1.662	1.669	1.745	1.869	1.736	24.01		1.579	.619	.661	.729	.647	75.93
	1.806	1.823	1.685	1.869	1.746	25.81		1.473	.465	.494	.543	.494	76.43
64	1.737	1.814	1.721	1.970	1.810	27.62		1.358	.372	.343	.415	.372	76.80
	1.940	1.877	1.831	1.869	1.879	29.50		1.267	.252	.255	.252	.256	77.06
66	1.974	1.877	1.745	1.918	1.878	31.38		1.189	.172	.170	.189	.180	77.23
	1.974	1.918	1.902	1.974	1.942	33.32							58.44
68	2.016	1.823	1.902	1.877	1.904	35.22							
	2.016	1.790	1.777	1.957	1.885	37.11							
70	2.016	1.823	1.831	1.902	1.893	39.00							
	1.974	1.877	1.790	1.940	1.895	40.89							
72	2.008	1.918	1.831	1.860	1.904	42.80							

GENERAL ELECTRIC

DECLASSIFIED

1. HT Wells
2. GC Fuller
3. RO Gumprecht
4. JD Orton
5. Extra

November 15, 1955

SECOND HORIZONTAL ROD CALIBRATION: PT 105-600-AGENERAL INSTRUCTIONS

I. Pile Period Procedure (to apply after obtaining critical by the normal cold startup procedure during which all provisions of Reactor Process Standards will be in force)

1. The pile is shut down with a particular horizontal rod configuration and five vertical rods inserted.
2. Position ECR's in the desired configuration.
3. Withdraw the five VSR's, 36, 38, 46, 54, and 56.
4. Record period data during the rise in power.
5. Terminate the rise at the 1 to 5 MW level by scrambling the five VSR's manually with the individual control switches.
6. Beckman trips will be set at approximately 10 MW for all periods. No change in setting is required while the reactor is shut down between period measurements.
7. The SNM relay will be by-passed to allow manual dropping of the five VSR's.
8. The low level period meter will be by-passed from the scram circuit.
9. The KE-KW Beckman trip inter-tie will be by-passed.

II. Application of the Procedure

The procedure has been written specifying the minimum number of period measurements necessary to provide the required information. If the rate of gain of reactivity is slower than expected, some configurations scheduled for single measurements will receive second measurements. The term configuration as used in the following step-by-step procedure refers only to those listed in Table I.

III. Detailed Procedure

1. Two hours prior to the time of estimated minimum downtime critical, withdraw all vertical and horizontal rods in accordance with the procedure for cold startups specified by Reactor Process Standards.

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2. Wait with all rods out (base point 1) until first indication has been observed.
3. Insert five of the central nine VSR's.
4. Wait thirty minutes.
5. Measure a rising period from base point 1, using the general period procedure.
6. From the magnitude of this period, estimate the rate of gain of pile reactivity.
7. Insert approximately twenty inhours worth of horizontal rod (base point #2) and measure a rising period.
8. Measure a rising period from base point 1.
9. Insert about 20 inhours worth of rod more than base point 2. This will be base point 3.
10. Measure a rising period from base point 3.
11. Measure a rising period from base point 2.
12. Insert sufficient rod to make the following period about 25 inhours. This is base point 4.
13. Measure a rising period from base point 4.
14. Measure a rising period from base point 3.
15. Repeat steps 11-14 for base points 5, 6, 7, etc.
16. When the reactor has gained 220 inhours above base point 1, the next period will be measured from Configuration 1. (See summary of Configurations, Table I.)
17. Measure a rising period from Configuration 1.
18. Measure a rising period from preceeding base point.
19. Measure a rising period from Configuration 1.
20. " " " " " " 2.
21. " " " " " " 2.
22. " " " " " " 3.

GENERAL ELECTRIC

-3-

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23.	Measure a rising period from Configuration 4.	
24.	" " " " " "	5.
25.	" " " " " "	4.
26.	" " " " " "	6.
27.	" " " " " "	5.
28.	" " " " " "	6.
29.	" " " " " "	7.
30.	" " " " " "	8.
31.	" " " " " "	9.
32.	" " " " " "	10.
33.	" " " " " "	11.
34.	" " " " " "	12.
35.	" " " " " "	13.
36.	" " " " " "	11.
37.	" " " " " "	14.
38.	" " " " " "	14.

Pile Physics Unit
Pile Technology Section
ENGINEERING DEPARTMENT

RO Gumprecht:mbs

TABLE -

CONFIGURATION

1	2	3	4	5	6	7	8	9	10	11	12	13
71.3	64.7	54.1	55.0	59.4	44.2	30.5	28.9	67.0	23.9	62.1	57.0	13.2
24.0	23.0	16.5	24.5	19.5	20.5	18.6	20.5	20.7	21.1	11.7	11.1	11.4
14.7	11.9	91.9	78.9	74.7	75.7	86.0	73.7	32.2	68.7	26.7	25.0	64.3
		10.2	in	in	in	12.0	2.1	in	2.2	in	in	12.5
								86.0		81.2	78.8	84.5
								85.5		82.7	89.2	
73.0	68.0	67.0	20.5	19.0	17.0	23.5	14.0	in	10.5	in	in	17.2
	90.6	84.7		86.4	88.0		76.0	42.7	69.6	36.6	32.7	77.0
				87.5	86.6	89.9	84.5	57.7	67.9	50.8	50.0	86.0
63.0	18.0	14.2	17.5	16.0	16.2	18.1	17.9	3.5	9.3	4.2	3.5	9.5
										81.2		
18.0	20.0	17.1	11.0	11.1	6.5	87.2	6.0	96.6	0.8	84.8	86.5	71.9
						9.5		7.5		6.5	6.0	9.0
94.7	89.5	68.1	69.8	62.9	54.6	84.0	87.9	84.7	86.8	77.9	69.4	62.0
20.9	19.0	11.1	22.1	17.5	19.0	8.0	42.1	40.3	37.3	31.5	34.7	20.0
							15.2	30.2	13.3	23.5	23.0	in

264	236	264	272	264	298	328	328	332	342	364	370	385
198 in	234 in	267 in	284 in	293 in	308 in	327 in	338 in	348 in	357 in	382 in	387 in	388 in
10-3-55	10-3-55	10-2-55	9-1-55	9-1-55	9-2-55	10-2-55	9-2-55	11-8-55	9-1-55	11-8-55	11-7-55	10-2-55
0830 am	0100 am	1700 pm	2230 pm	1645 pm	0430 am	0900 am	1300 pm	0415 am	0930 am	1030 am	2130 pm	0030 am
5th test	5th test	5th test	4th test	4th test	4th test	5th test	4th test	6th test	4th test	6th test	6th test	6th test

Δd	36	33	17	9	15	19	11	10	9	25	5	27
Warren Disk	32	28	8	12	14	30	0		12	22	5	19
232	264	292	302	32	321	345	349	393	370	437	438	419

DECLASSIFIED

For 173451

Mem-73451 PR

2nd HCR Call

SECOND HCR CALIBRATION

N TEST 11-22-55

- 43.6 HUR-73451 RD

Appears that rods are stronger than
calibrated at low end, and weaker
than calibrated at high end

With assumption of 1/2 in. dia.
test indicates that 1/2 in. dia. calibration
should continue to increase at the full
in position instead of dropping
5 lb each

*Running Rod Calibration Chart
on H-22 Compared to Kenon Standard*

changes of dry wt can & over mem.

2nd HCR Calab test

Nov-73451 PD

358-11

40 X 10 TO THE 1/2 INCH
KEUFFEL & ESSER CO.
MADE IN U.S.A.

KE

11

total observed

Cal b + x + 4 Cal

5

1-5" Bay
1-8" Bay
8-10" Bay
+ Exp

Hv-73457 RD

Analysis of differences on
2nd HCR Calibration list:

I Difference Between ^{observed} ~~Calculated~~ + ^{Calculated} ~~observed~~ elements:

time	diff	Δ diff
1600	+ 47	- 8
1700	+ 39	- 9
1800	+ 30	- 8
1900	+ 22	- 7
2000	+ 15	- 7
2100	+ 8	- 6
2200	+ 2	- 6
2300	- 4	- 7
2400	- 11	- 5
2500	- 16	- 6
02600	- 22	- 6
0300	- 28	- 6
0400	- 34	- 2
0500	- 36	- 2
0600	- 38	- 5
0700	- 43	

532
485
47

358-11
MADE IN U.S.A.

K&E 10 X 10 TO THE 1/2 INCH
KEUFFEL & ESSER CO.

BP 10

BP 9

Actual (as measured) Strength Breakdown

9/15/58

Second MC R Cal. 5 Eval Mar-73457 RD

Second HCR Palat Eval

Her-73451 RD

Actual cis measured sluff base on B.P. 1-158

Analysis of diff Between obs. & Calc. transient
 on 2nd H₂O x Calcd. 11-22-51

410-73451 R.D.

K&E 10 X 10 TO THE 1/2 INCH 358-11
 KEUFFEL & ESSER CO. MADE IN U.S.A.

total diff

1.11

Built in P/c. Diesel System -

~~SECRET~~

7178 9590

NEW-13431 RD
2

KE SEMI-LOGARITHMIC 358-71
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

How-73457 3RD

New 73427 R.D. ⁴

9413 @ 15%
 1416 @ 15%
 2419 @ 80%

$\frac{31}{93} \text{ sec} = 29 \text{ ul}$

8.45

Her-73451 RD⁵

6
HCV-73457 RD

BP 10

94130 15%

4416 @ 15%

24190 80

~ 4000
~ 5000

HW-73451 87

8
HW-73457 RD

9
HW-73457 RD

C2

37.5
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0

11.21

11.18

11.13

10
 73457 RD

12
 Hw-73457 RD

Start C_3 at 0074

1550
 1274
 176

150
 168

0020

12
 255

358-71
 KEUFFEL & ESSER CO.
 MADE IN U.S.A.
 3 CYCLES X 70 DIVISIONS

11

Nov 73427 RD 14

63

Start at 0045

358-71
KEUFFEL & ESSER CO.
MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

0.0065
↓

CA
Start @ 0.106

83 31.5

180
16
30
22
3/249
93

0.109

Nov 73451¹⁷ RD

Cd
Store @ 0146

KE SEMI-LOGARITHMIC 358-71
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CIRCLES X 70 DIVISIONS

18
Her 73457 RD

C-6
Start @ 0200

180
12
2
36 197
65

0202
65
378
1.0700

SEMI-LOGARITHMIC 358-71
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

K&E SEMI-LOGARITHMIC 358-71
 KEUFFEL & ESSER CO. MADE IN U.S.A.
 8 CYCLES PER DIVISION

50.2
 43
 0.18

3
 129
 43
 120

1720
 5-5

14-73451 RD

K_E SEMI-LOGARITHMIC 358-71
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

21.
Nur 73457 RD

C-7
Shattuck (2) 0247

0248

0248
75 m
34 in

180
27
18
236
75
3

K&E SEMI-LOGARITHMIC 358-71
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

23
HW-73451 RD

C-9
~~Start~~ 0325

less than 13 in

03425

KEE SEMI-LOGARITHMIC 358-71
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

0325

24
 11-73451 RD

14-13451 RD

27
 Nov-73451 RD

C-11
 Start 451

27
 Nov-73451 RD

KE SEMI-LOGARITHMIC 358-71
 KUFFEL & ESSER CO. MADE IN U.S.A.
 3 CYCLES X 70 DIVISIONS

35.23

320 dec

330

222
 144
 888
 888
 222
 31968

180
 180
 36
 212

29
K&E 73457 (B)

30
Hw-73451 RD

C-14
Start 6.28

246
179
984
984
246
354.29

240
18
18
346

KE SEMI-LOGARITHMIC 358-71
KE KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES 0628 0634

K&M 10 X 10 TO THE 1/2 INCH 358-11L
KEUFFEL & ESSER CO. MADE IN U.S.A.

0300

0300

0500

0700

0600

0500

0400

0300

HW-73451 RD
WSH - 9-16

Total Str. - old Calib.

K&E 10 X 10 TO THE CM. 358-14
KEUFFEL & ESSER CO. MADE IN U.S.A.

1000
900
800
700
600
500
400
300
200
100
0

Difference between old & New Calibration Position 1200'

Mr-73451 RD

Slope of the line is 1.5

$$\frac{1.5}{1.4} = \frac{750 - 120}{630} = 1.07815$$

$$\frac{D_{1st}}{D_{2nd}} = 1.14127$$

Let $T.S. = \text{data from calculation}$

How to find actual total strength of Rods, knowing odd strength of rods & Denominator.

① First denominator is odd strength to get ratio of denominator as a function of odd strength, then multiply by odd total strength.

Let $T.S. = \text{odd Rod Calc.}$

$$\frac{D_{1st}}{T.S.} = \frac{90}{552} = 16.304$$

which means what to look at in odd T.S. we get 16.304 at calculation.

I odd strength change by 282.5

then new strength change by 282.5 x 16.304 = 4602.5

which check OK

$$\therefore \text{old Rod strength} = 800$$

$$\text{New Rod St.} = 800 \times 16.304 + 800 = 930$$

We started by assuming that the Rod Value was correct at 1st Configuration:

at that time, when Rod from chart = 120
 $\gamma = \frac{49}{149}$

$$\begin{array}{r} 454 \\ 149 \\ \hline 335 \end{array}$$

at End of test, increase in Reactivity = 335

$$\begin{array}{r} \text{total React at End of test} = 454 \\ - \gamma = 35 \\ \hline \text{Rod} = 449 \end{array}$$

$$\begin{array}{r} 449 \\ 120 \\ \hline 329 \end{array}$$

old calib change in Rod = 702.5 - 120 = 582.5
 change indicated by PT = 449 - 120 = 329
 diff = 46 in rest of our actual 329

$$\begin{array}{r} 702.5 \\ 120 \\ \hline 582.5 \end{array}$$

$$\% \frac{46}{329} = .13982$$

$$\begin{array}{r} 329 \\ 283 \\ \hline 46 \end{array}$$

$$\begin{array}{r} 149 \\ 120 \\ \hline 329 \end{array}$$

~~terminal value at end of test~~
~~not by~~
46

Difference Between Conf. 12 & 13

Rod No.	from	to		Δ in
1	43	39	+	4.5
2	7.6	1.4	+	2
3	15.3	12.0	+	1.5
6	95.4	84.3	+	1.5 ?
10	31.5	20	+	3.5 ?
11	89.6	81.3	-	2.5 2.5 + 2.5
18	67.3	60	+	5
19	33.0	31.6	+	1
- 20	3.1 3.1	1.0	+	.5
				<u>16</u>

Diff Between Conf. 1 & 2

Rod No.	from	to	Δ in
2	60.4	52.8	+ 5
18	76.5	37.0	+ 23.5
			<u>28.5</u>

Conf. No.	old total ih	new total ih	Δ in
1	154	162	8
2	182.5	189	6.5
3	189	196	8
4	198	209	11
5	222.5	244	21.5
6	247.5	273	25.5
7	255.5	282	26.5
8	282.5	312	29.5
9	285.5	312	26.5
10	328	364	36
11	359	399	40
12	371	410	38.39
13	376	432	39

57
40
19

Her-73451 RD

Change Bet. 11 + 12

<u>Red No.</u>	<u>from</u>	<u>to</u>	<u>Adj</u>
1	53.8	43.1	8.5
2	13.5	7.6	+ 2
3	15.7	15.3	0
6	0	95.4	0 ?
10	32.1	31.5	- .5
11	82.4	89.6	+ 2
13	1.0	0	- .5
18	68.8	67.3	0
19	36.6	33.0	+ 2.5
20	10.4	3.1	+ 2

HW-73451 RD

Period #1

358-92 KEUFFEL & ESSER CO.
Semi-Logarithmic. 5 Cycles X 6 to the half inch.
MADE IN U S A

Her-73451 RD

Period #2

Same rod configuration as period #1

$\frac{R_{002}}{T} = \frac{120}{41.4}$
 $\frac{161.4}{2032.5}$

356-92 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 6 to the half inch.
MADE IN U.S.A.

Point #3

AN-73451 RD

HW-73451 RD

Period # 4 No evaluation

Period # 5

Period = 89.6

Time = 2141

KEUFFEL & ESSER CO.
1.5 Cycles X 6 to the hal
MADE IN U.S.A

NY-73457 PD

HW-73451 RD

Period 8 C.2

Period = 20.8 ih
Time = 2240

21

12.0
12.5
13

140' - 20.8 ih

358-92 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 6 to the half inch.
MADE IN U.S.A.

Revised 9 C.1

NR-73457 RD

Revised 11/1/54
him 2254

Period 10 C 3

Her-73451 RD

Period = 29.2

Time = 2311

Her-73451 RD

Period 11 C. 2

Period: 73

Time = 2325

Her-73457 RD

Period 12 C. 9

Period 31.3

Time 2345

Rev 73427 RD

Period 13 C.3

Period 54
Time 1203

$$\begin{array}{r} 90 \\ 23 \\ \hline 113 \\ 377 \end{array}$$

Her-73457 RD

Period 14 C.5

Period 20

Time

Nov-73451 RD

Period 15 C. 4

Period 59
time 2035

90
9
33E

1233,5 34 35 30 31

279

Period 16 c. 6

Her-73457 RD

263

Period 16
time 0115

0110

13

14

15

Her 73457 RD

Period 12 c. 5

Band 40.7 in

Time 0129

358-92 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 6 to the half inch.
MADE IN U.S.A.

P. of 18 46

HW-73451 RD

Point 28.4

Time 0139

Wm-73457 RD

Point 20 C.G.

Point 48

Point 00-1

37
10

Period 21 C.8

Her-73457 RD

Period 21
Time 3.289

4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00

Period 22 C 7 Her-73451 RD

Period 56.3

Time 0253

398-92 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 6 to the half inch.
MADE IN U.S.A.

0052

53

54

350-92 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 6 to the half inch.
MADE IN U. S. A.

Run-73457 RT
2.9
2.10
2.7

Limit = 32X
Time = 0.307

344

32

Her-73451 RD

Period 24

Ref C-8

Period = 41 1/2
Time 0.824

Comp 8

312
41
550

Her-73451 RD

Period 35

Config Inter med

Quint = 32
Time 0849

HR-73451 RD

PERIOD 26

Conf. 9

PERIOD = 58

Time 0413

158-92 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 6 to the half inch.
MADE IN U.S.A.

14w-73451 RD

Period 27

Compz 10

Period 16.3
time - 5422

?

Period 30

Her 73457 RD

Comp 10

Period: 40.9

time: 0511

150
5
16
2 111
58

0512

19

Period 29

Her-73451 RI

Defining: Internal

28 June

HN-73457 RD.

Period 31

Her-73457 RD

Conf. / 10 11?

Period: 16.1
Time: 0535

Period #32

Nuv-73451 RD

VSR #34 rad

Period

22

Time

0558

358-71
SEMI-LOGARITHMIC
KEUFFEL & ESSER CO. MADE IN U.S.A.
3 CYCLES X 70 DIVISIONS

Period 3+

Her-73457 RD

Config. 12

Period: 21.7

Time: 0614

2 of 2

Run 73451 PD

Run 35

Run 11

Run 43.6

Time: 0636.5

Period 37

Nov-73451 RD

Capacitor- 12

Period: 57

Time: 0717

0716

17

12

Period 39

Her-73451 RD

Configuration 13

Period: 46

Time: 0754

Period 40

Nur-73451 RD

Configuration 14

Period: 35.4

Time: 0009

11

Rev 78451 R13

Reactivity in Inhours

K&E 10 X 10 TO THE 1/2 INCH 358-11
KEUFFEL & ESSER CO. MADE IN U.S.A.

AIIM

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1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

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