Attachment 3

Final Test Report CRD Performance Evaluation Testing with Driveline Misalignment

September 1994

FINAL TEST REPORT

CRD PERFORMANCE EVALUATION TESTING WITH DRIVELINE MISALIGNMENT

DRF B11-00604 TP&P 511.1590

Prepared by R K Loui Date 9/7/94
Responsible Test Engineer R.K. Loui

Reviewed and Approved by Test Requestor J. Charnley Date 7 Sept 94
J. Charnley

Approved by Project Manager Date 7 SEPT 94
J. Rodabaugh

DISCLAIMER OF RESPONSIBILITY FOR FINAL TEST REPORT

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CRD PERFORMANCE EVALUATION TESTING WITH DRIVELINE MISALIGNMENT

1.0 INTRODUCTION

CRD System testing was recently completed utilizing a D-Lattice driveline configuration.

Testing was conducted to evaluate CRD scram performance under abnormal core plate and top guide misalignment conditions. The control rod and fuel bundles were also inspected for wear as a consequence of the misalignment as testing progressed.

Testing targeted BWR/4 operating conditions.

Detailed testing requirements were contained in TP&P 511.1590 Rev. A. Relevant data to be maintained in DRF B11-00604. See Appendix A for an explanation of how the actual core plate displacement configuration being used can be correlated to Hatch Unit 1.

2.0 CONCLUSION

Overall CRD scram performance was unaffected for the maximum static misalignment condition (core plate = 0.500 inch, top guide = 0.200 inch in opposite direction).

There were no significant differences in scram time with core plate misalignment of 0.500 inches with or without top guide misalignment.

Post-test inspection of the test vessel internals showed minimal wear for the conditions explored during test.

3.0 TEST CONFIGURATION

A BWR/5 CRD (S/N 7341) was used during test. The only available D-Lattice control rod (P/N 706E855G1 S/N 818) was modified previously and contained spacer pads instead of the standard pins and rollers.

The 30-inch test vessel was configured for BWR/4 operation, including a BWR/6 hydraulic control unit which was modified for BWR/4 operating parameters.

Scram testing began with the vessel internals in alignment. As testing progressed, the core plate and the top guide were misaligned per requester supplied requirements as follows:

	Core Plate	Upper Guide
Test 1	0.000	0.000
Test 2	0.250	0.000
Test 3	0.500	0.000
Test 4	0.500	0.200 (in opposite direction)

Test 4 displacements simulated the primary mode of the shroud during a seismic event.

4.0 TEST PROCEDURE AND RESULTS

4.1 CRD Functional Testing

Using the standard BWR/4 scram accumulator charge combination of 575 psig N_2 precharge, with a final water charge of 1510 psig (1510/575), a total of four accumulator scrams were accumulated. Two of the scrams were performed at zero vessel pressure and the remaining two at cold hydrostatic pressure of 1050 psig. Two full stroke drive traces, full stroke settle friction and ten collet cycles preceded the accumulator scrams.

Testing concluded with a repeat of the above tests after the vessel depressurized to ambient vessel pressure.

The above test sequence was repeated at each of the misalignment conditions. Also, for the maximum misalignment condition, two accumulator scrams were conducted at 850 psig cold hydrostatic vessel pressure.

CRD performance was monitored as testing progressed. Testing under BWR/4 operating conditions was completed satisfactorily. CRD performance data ranges are summarized on the next page.

Test Result Summary

			Data Range			
Misalignment (inch)		Vp	Scram (sec)	Drive (in/sec)		Settle Fr (psig)
Core Plate	Top Guide	Psig	90%	Up	Down	Notch 00-48
0.000	0.000	20	1.860-1.950	2.97-3.17	2.86-2.92	43-48
0.000	0.000	1050	2.252-2.282			
0.250	0.000	20	1.910-1.966	3.17-3.21	2.86-2.90	37-48
0.250	0.000	1050	2.228-2.242			
0.500	0.000	20	1.918-1.962	3.10-3.23	2.88-2.91	35-45
0.500	0.000	1050	2.263-2.284			
0.500	0.200	20	1.906-1.928	3.10-3.18	2.84-2.91	35-47
0.500	0.200	850	2.430-2.445			
0.500	0.200	1050	2.246-2.258			

The above results showed that with a core plate misalignment of 0.500 inches with and without top guide misalignment, the scram data indicated no significant difference.

At the conclusion of testing additional data points were taken for core plate misalignment of 0.625 inches while holding the top guide at 0.200 inches. The additional data points are summarized below:

Core Plate	Top Guide	Psig	90%	Up	Down	Notch 00-48
0.625	0.200	20	1.870-1.932	2.99-3.08	2.73-2.80	27-45
0.625	0.200	850	2.500-2.600			
0.625	0.200	1050	2.305-2.326			
0.625	0.200	700*	2.933-3.163			
0.625	0.200	850*	2.758-2.791			
0.625	0.200	1050*	2.586-2.624			18-51

* Hot Testing

Complete results of the operating data are shown in Appendix B of this report.

4.2 Visual Inspection Of Internals

Following completion of each test phase, the vessel internals (control rod, fuel bundles) were removed and visually inspected for evidence of test damage.

Visual inspection of the control rod as testing progressed showed no obvious damage. No major dings or nicks were noted. The fuel channels showed normal wear. Observed scratches had no obvious depth.

Sketch of core plate and top guide misalignment is shown in Appendix C. Also shown are sketches and photographs of observed scratches on the control rod and fuel channels.

5.0 RECOMMENDATION

None, data submittal only.

APPENDIX A

TEST CORRELATION TO HATCH UNIT 1

The CRD performance evaluation testing with driveline misalignment data can be used in the same manner as the previous allowable static core plate displacement.

From GENE-771-44-0894, the allowable dynamic displacement (DD) of the Hatch Unit 1 core plate is equal to:

$DD = 0.9 x 2.5 SD/SF_{min}$

SD=allowable static displacement from test $\geq$ 0.5"

SF_{min}=minimum safety factor

$DD = 1.125/SF_{min}$

$DD_{upset} \geq 0.5"$

$DD_{emergency} \geq 0.75"$

$DD_{fault} \geq 1.0"$

APPENDIX B

CRD OPERATING DATA

TABLE SCRAM DATA

TITLE *Core Deflection* TEST REQUEST *511-1590 Rev. A*

DRIVE MODEL *BWR/5* S/N *7341* ROD WT. (lb) ______

COOLING PRESS (PSIG) ______ TEST SYSTEM *30"* ______ GPM AT ______ PSIG

SCRAM COUNTER ______

LINE LOSS

PU *BWR 5 MAX* PSI

PD *BWR5 MAX* PSI

Victor B. [illegible]
TECHNICIAN

	CUMULATIVE SCRAM NUMBER	VESSEL PRESSURE (PSIG)	TEST STEP NO.	ACCUMULATOR PRESSURE H_2O/N_2 (PSI)	PROBE (°F) TEMPERATURE	START OF MOTION SCRAM SIG. LOSS TO DO-48 (SEC)	DO-48 TO DO-45	TRUE 5% STROKE START OF MOTION +0.75 (DO-48 TO DO-45)	10% STROKE SCRAM SIG. LOSS TO DO-43 (sec)	20% STROKE SCRAM SIG. LOSS TO PU-38 (sec)	50% STROKE SCRAM SIG. LOSS TO DO-24 (sec)	90% STROKE SCRAM SIG. LOSS TO DO-05 (sec)	BUFFER TIME (sec) DO-03 TO DO-GG	Peak PD Pressure / Peak PU Pressure		VESSEL WATER CONDUCTIVITY-(MEGOHM)	REMARKS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	1	20	6.1.5	575/1510	67	.160	.120	.250	.350	.520	1.090	1.870	.370	425/475			Baseline 1 of 2
	2	20	6.1.5	575/1510	67	.150	.120	.240	.340	.510	1.060	1.860	.370	420/465			Baseline
	3	1050	6.1.6	575/1510	68	.156	.166	.281	.422	.641	1.327	2.282	.620	1000/0			
	4	1050	6.1.6	575/1510	68	.150	.162	.272	.410	.621	1.303	2.252	.632	1000/0			
	5	20	6.1.7	575/1510	68	.159	.122	.251	.354	.528	1.101	1.950	.207	400/450			
	6	20	6.1.7	575/1510	68	.156	.122	.248	.348	.520	1.086	1.926	.209	415/450			
	7	20	6.2.6	575/1510	68	.161	.118	.250	.351	.526	1.099	1.951	.208	340/450			0.25'' Core Plate
	8	20	6.2.6	575/1510	68	.161	.119	.250	.341	.530	1.110	1.966	.206	415/450			
	9	1050	6.2.7	575/1510	69	.155	.160	.275	.412	.627	1.305	2.242	.612	1000/0			
	10	1050	6.2.7	575/1510	69	.153	.159	.272	.405	.620	1.293	2.228	.605	1000/0			
	11	20	6.2.8	575/1510	69	.153	.105	.233	.350	.520	1.082	1.910	.319	1040/0			
	12	20	6.2.8	575/1510	69	.164	.120	.243	.350	.520	1.081	1.915	.315	458/450			
	13	20	6.3.6	575/1510	71	.164	.120	.254	.357	.532	1.105	1.962	.325	–/440			0.500'' Core Plate
	14	20	6.3.6	575/1510	71	.158	.119	.247	.349	.523	1.091	1.938	.320	–/440			
	15	1050	6.3.7	575/1510	71	.155	.164	.278	.417	.632	1.313	2.284	.338	1050/–			
	16	1050	6.3.7	575/1510	71	.152	.161	.273	.409	.625	1.304	2.263	.330	1075/–			
20 {	17	~~1050~~	6.3.8	575/1510	71	.158	.120	.248	.349	.523	1.091	1.936	.320	400/435			
	18	~~1050~~	6.3.8	575/1510	71	.155	.119	.244	.345	.515	1.078	1.918	.318	425/445			
	19	20	6.4.6	575/1510	71	.166	.117	.254	.353	.524	1.087	1.922	.316	435/460			0.500 Core Plate 0.200 Upper Guide
	20	20	6.4.6	575/1510	71	.159	.116	.246	.347	.518	1.081	1.915	.318	430/455			
	21	850	6.4.7	575/1510	71	.150	.178	.281	.440	.672	1.420	2.445	.670	875/40			
	22	850	6.4.7	575/1510	71	.152	.175	.283	.435	.678	1.405	2.430	.670	835/45			
1050 {	23	~~850~~	6.4.7	575/1510	71	.158	.160	.278	.413	.622	1.300	2.258	.615	1050/–			
	24	~~850~~	6.4.7	575/1510	71	.152	.157	.270	.403	.610	1.289	2.246	.612	1050/–			
	25	20	6.4.8	575/1510	71	.164	.117	.252	.353	.524	1.068	1.928	.318	425/464			
	26	20	6.4.8	575/1510	71	.161	.116	.248	.347	.517	1.076	1.906	.314	440/475			
	27	20	6.5.6	575/1510	70	.164	.117	.252	.351	.523	1.091	1.933	.319	422/460			
	28	20	6.5.6	575/1510	70	.159	.118	.248	.348	.519	1.088	1.932	.319	420/464			0.625 Core Plate 0.200 Upper Guide
850 {	29	~~20~~	6.5.7	575/1510	74	.158	.180	.293	.440	.680	1.440	2.500	.680	862/–			
	30	~~20~~	6.5.7	575/1510	74	.150	.180	.285	.440	.675	1.435	2.600	.685	870/–			
1050 {	31	~~20~~	6.5.7	575/1510	74	.152	.161	.273	.409	.624	1.327	2.305	.681	1140/			
	32	~~20~~	6.5.7	575/1510	74	.158	.162	.280	.417	.634	1.338	2.326	.627	1135/			
	33	20	6.5.8	575/1510	72	.155	.115	.241	.340	.510	1.075	1.908	.315	422/450			
	34	20	6.5.8	575/1510	72	.160	.110	.243	.340	.510	1.055	1.870	.310	460/480			
HOT {	35	700	6.5.8.1	575/1510	176	.156	.170	.284	.429	.682	1.692	3.163	.751	450/100			(Recorder: E.W. Henderson)
	36	700	6.5.8.1	575/1510	154	.124	.184	.262	.407	.651	1.581	2.933	.616	750/110			
	37	850	6.5.8.1	575/1510	183	.155	.192	.299	.457	.711	1.594	2.758	.617	825/110			
	38	850	6.5.8.1	575/1510	168	.153	.189	.295	.451	.714	1.601	2.791	.132	870/110			
	39	1050	6.5.8.1	575/1510	180	.159	.176	.291	.433	.666	1.427	2.624	.554	1040/50			
	40	1050	6.5.8.1	575/1510	179	.157	.179	.291	.435	.667	1.468	2.586	.541	1012/25			

TABLE DRIVE DATA

TITLE Core Plate Deflection — CRD S/N 7341 — TEST VESSEL 30" — TPS11 1590 Rev "A"

	DATE	8/25/84	8/25/84	8/25/84	8/25/84	8/29/84	8/29/84	8/30/84	8/30/84	8/30/84	8/30/84	8/30/84	8/30/84	8/31/84	8/31/84	9/1/84	9/1/84	9/1/84	9/1/84	9/1/84	9/1/84					
	TF STEP	6.1.2	6.1.2	6.1.7	6.1.7	6.2.3	6.2.3	6.2.8	6.2.8	6.3.8	6.3.3	6.3.3	6.3.3	6.4.8	6.4.8	6.4.3	6.4.3	6.5.3	6.5.3	6.5.8	6.5.8					
	VESSEL PRESSURE (psig)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20					
	PROBE TEMPERATURE (°F)	67	67	68	68	69	69	75	75	71	71	70	70	71	71	71	71	70	70	73	73					
INSERT	HCU SUPPLY PRESSURE P11/PR ΔP (psi)	240	230	255	247	260	259	250	250	255	254	257	259	320	320	252	251	250	250	260	250					
INSERT	PRESSURE UNDER PISTON DRIVING UP – P13/PR ΔP (psi)	77	75	78	78	79	79	75	76	80	82	84	84	88	88	87	89	94	94	97	97					
INSERT	PRESSURE OVER PISTON DRIVING UP – P12/PR ΔP (psi)	5	4	5	4	5	5	5	4	8	3	5	5	3	3	2	7	4	9	5	5					
INSERT	SPEED DRIVING UP (in./sec)	2.97	2.97	3.17	3.17	3.19	3.17	3.17	3.21	3.23	3.10	3.12	3.12	3.18	3.18	3.11	3.10	3.01	2.99	3.06	3.08					
WITHDRAW	HCU SUPPLY PRESSURE P11/PR ΔP (psi)	240	240	247	244	252	251	250	250	250	250	251	251	245	247	255	251	245	248	248	250					
WITHDRAW	PRESSURE UNDER PISTON DRIVING DOWN – P13/PR ΔP (psi)	100	96	106	105	109	110	110	102	100	100	100	102	95	95	98	99	89	86	90	90					
WITHDRAW	PRESSURE OVER PISTON DRIVING DOWN – P12/PR ΔP (psi)	230	228	246	243	248	248	250	250	249	250	250	250	250	248	252	250	245	249	243	242					
WITHDRAW	SPEED DRIVING DOWN (in./sec)	2.86	2.86	2.92	2.91	2.90	2.86	2.90	2.90	2.88	2.91	2.89	2.90	2.84	2.84	2.91	2.91	2.78	2.80	2.73	2.74					
	DRIVE UP FLOW (GPM)	4.1	3.8	4.0	4.0	4.1	4.1	3.9	3.9	3.9	3.9	4.1	4.1	4.2	3.9	3.8	3.8	3.9	3.7	3.8	3.8					
	DRIVE DOWN FLOW (GPM)	1.6	1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.6	1.6	1.6	1.6	1.5	1.5	1.6	1.6	1.6	1.5	1.6	1.6					
	STALL UP FLOW (GPM)	1.4	1.4	1.5	1.5	1.4	1.4	1.5	1.5	1.5	0.8	1.6	1.6	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.5					
	STALL DOWN FLOW (GPM)	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	.95	.80	0.8	0.9	0.8					
	TEST TECH	V.B	V.B.	EWH	EWH	V.B	VB	VB	V.B.	V.B.	VB	V.B.	V.B.	V.B.	VB	VB	V.B.	V.B.	VB	VB	VB					
	Victor Bobnick – V.B. E.W. Henderson – EWH REMARKS	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2					
		Baseline				0.250				0.500				0.500 + 0.200				0.625 + 0.200								

TEST TITLE Core Plate Deflection

TEST SYSTEM BWR 4 TEST REQUEST NO. 511.1590 CRD SERIAL NO. 7341

DATE	8/25/84	8/25/84	8/29/84	8/30/84	8/30/84	8/30/84	8/31/84	8/31/84	9/1/84	9/1/84	9/2/84			
TIME	09:50	17:10	0850	17:20	14:40	09:30	09:35	14 25	14.30	09:30	11:00			
T.R. STEP	6.1.3	6.1.7	6.2.4	6.2.8	6.3.8	6.3.4	6.4.4	6.4.8	6.5.8	6.5.4	6.5.8.2			
PROBE TEMPERATURE (°F)	68	68	69	69	71	70	71	71	73	70	549			
VESSEL PRESSURE	20	20	20	20	20	20	20	20	20	20	1050			
TEST OPERATOR	V.B.	V.B.	V.B	B.F.	Ray Loui	Ray Loui	V.B.	V.B	V.B.	V.B.	V.B			
DATA RECORDER	B.F.	E.W.H.	E.W.H.	B.F.	B.F.	B.F.	B.F	E.W.H.	V.B.	B.F.	V.B.			
NOTCH														
48	45	45	48	37	35	35	42	42	41	42	No Settle			
46	45	45	48	44	45	45	46	47	45	45	50			
44	44	44	47	44	45	45	45	45	45	44	49			
42	44	44	47	43	45	45	45	45	45	43	50			
40	43	44	48	44	45	45	45	45	45	43	51			
38	43	44	47	44	44	44	45	45	45	43	51			
36	44	44	47	44	44	43	45	45	40	40	49			
34	43	43	46	45	43	43	44	44	35	35	35			
32	43	44	47	45	43	43	43	43	32	27	26			
30	43	44	46	45	42	42	37	38	31	29	18			
28	43	45	46	45	40	40	36	37	27	28	18			
26	43	44	46	46	38	40	35	35	27	28	25			
24	43	43	45	45	38	38	35	36	30	30	22			
22	44	44	45	44	38	38	36	37	30	30	24			
20	43	44	45	44	38	37	36	36	31	29	23			
18	44	44	45	44	38	37	37	37	31	30	23			
16	44	44	45	44	37	38	37	38	33	33	25			
14	44	44	46	44	38	36	37	38	33	33	28			
12	45	45	45	45	38	36	37	39	35	33	30			
10	45	45	45	45	38	37	37	39	36	34	38			
08	45	45	45	45	39	38	38	39	37	35	28			
06	45	46	45	44	39	38	38	40	37	35	30			
04	45	47	45	43	39	37	37	40	37	38	33			
02	45	47	45	43	38	38	39	41	37	35	35			
00	45	45	45	45	43	42	43	44	41	39	40			

CRD S/N

SETTLE FRICTION DATA

TABLE ______

COLLET RESEAT PRESSURE (–PSID)

TP511- 1590 REV "A"

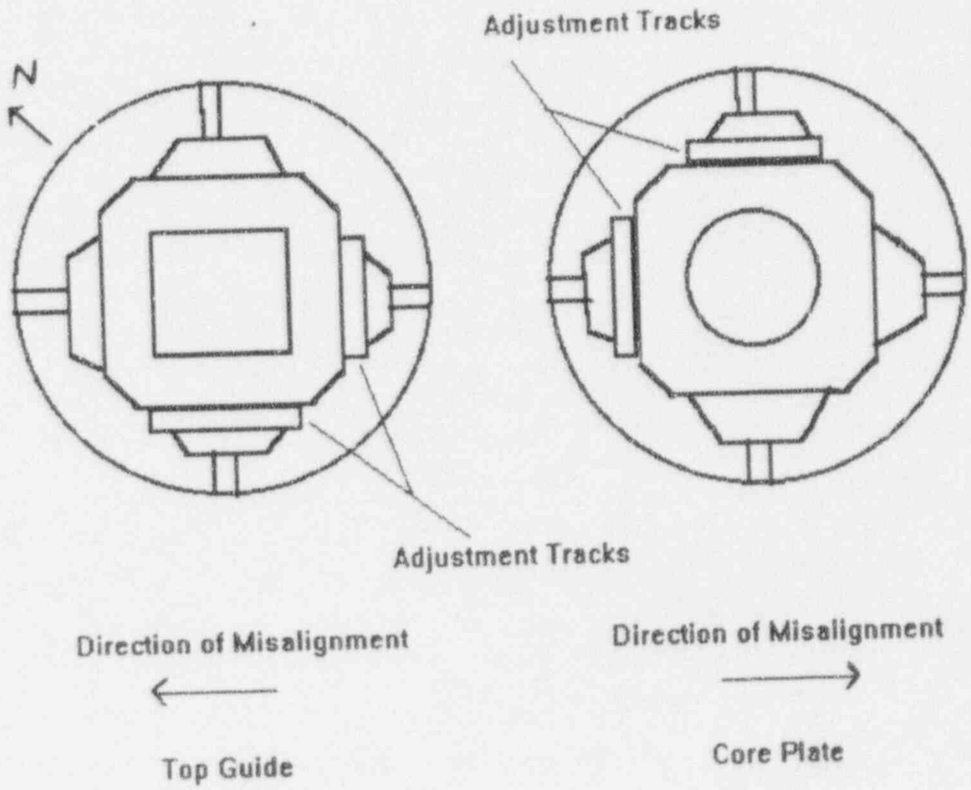
DATE	TP STEP	TECH	REMARKS	CYCLES 1	2	3	4	5	6	7	8	9	10
8/25/94	6.1.4		Baseline	54	54	54	54	54	54	54	54	54	54
8/25/94	6.1.7R 6.1.4			53	53	53	53	53	53	52	52	51	50
8/29/94	6.2.5		c.25cc	53	53	51	52	52	50	50	50	50	49
8/29/94	6.2.5			58	58	59	59	59	59	59	59	58	57
8/29/94	6.2.8			58	58	59	59	59	59	59	59	58	57
8/30/94	6.3.5		c.5cc	59	57	57	57	56	55	56	55	56	55
8/30/94	6.3.5			59	60	59	59	57	56	57	57	60	55
8/31/94	6.4.8		c.5cc + c.2cc	56	56	56	55	55	57	55	55	55	55
8/31/94	6.4.5			112	110	112	114	114	114	113	114	114	115
9/1/94	6.5.5		c.625 + c.2cc	51	51	51	51	53	51	51	50	51	50
9/1/94	6.5.8			56	55	55	55	56	55	55	55	55	55

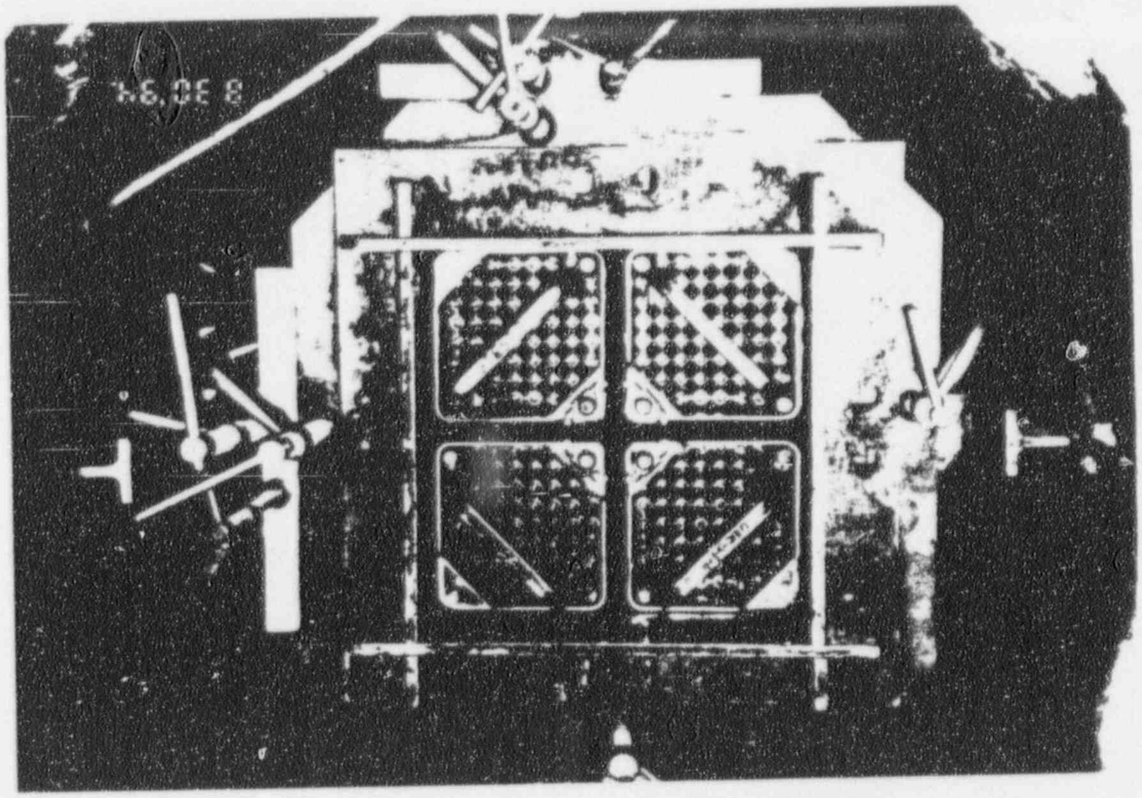
TABLE ______

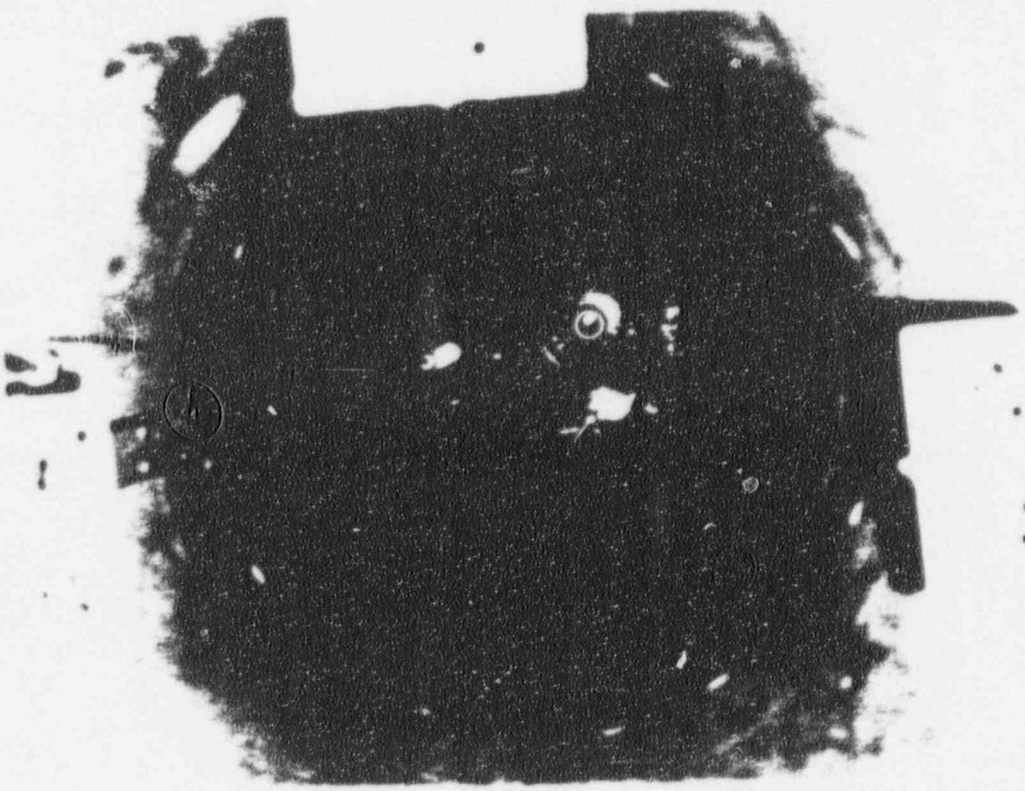
CRD S/N -34

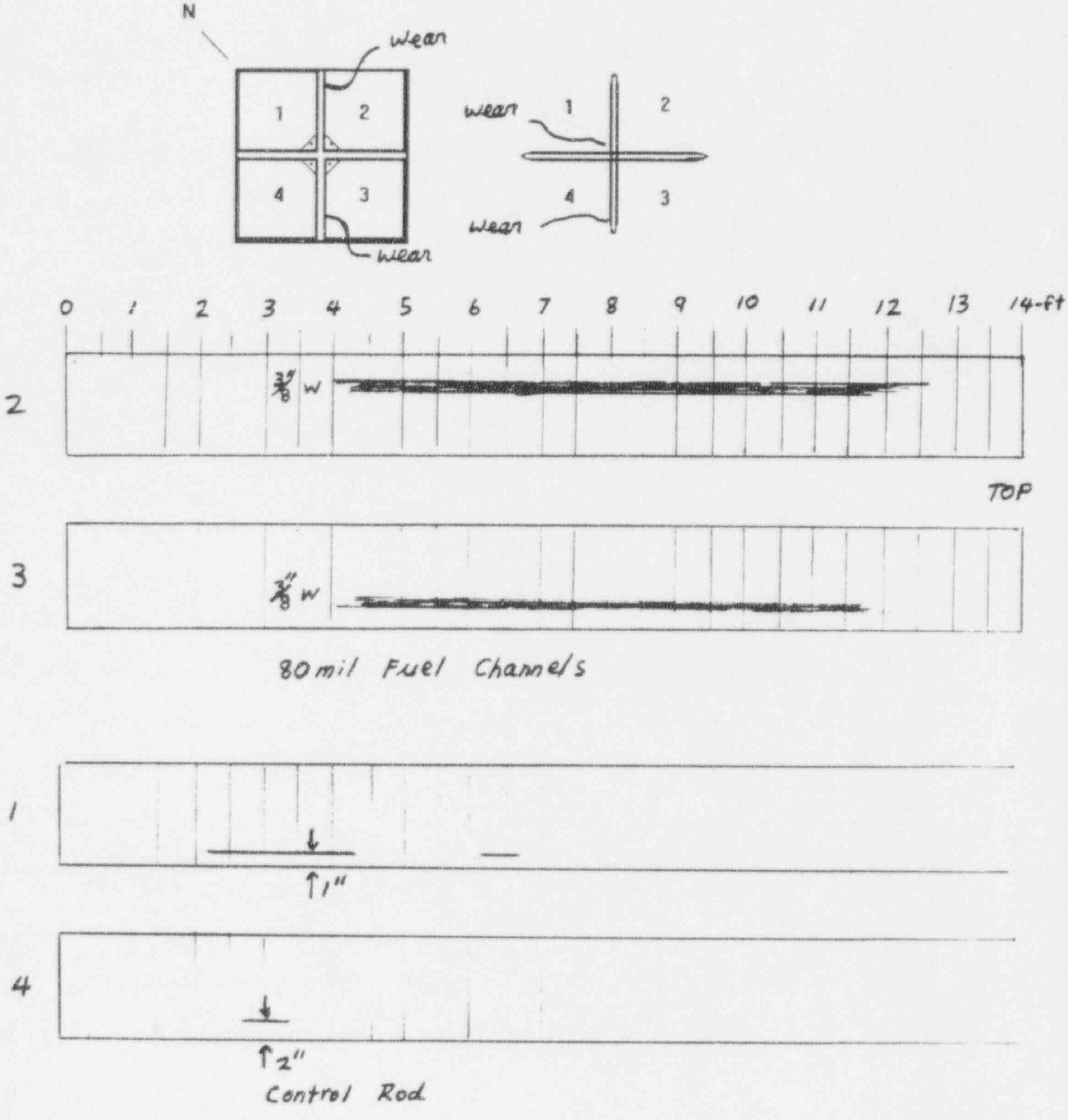
APPENDIX C

MISALIGNMENT AND WEAR RESULTS

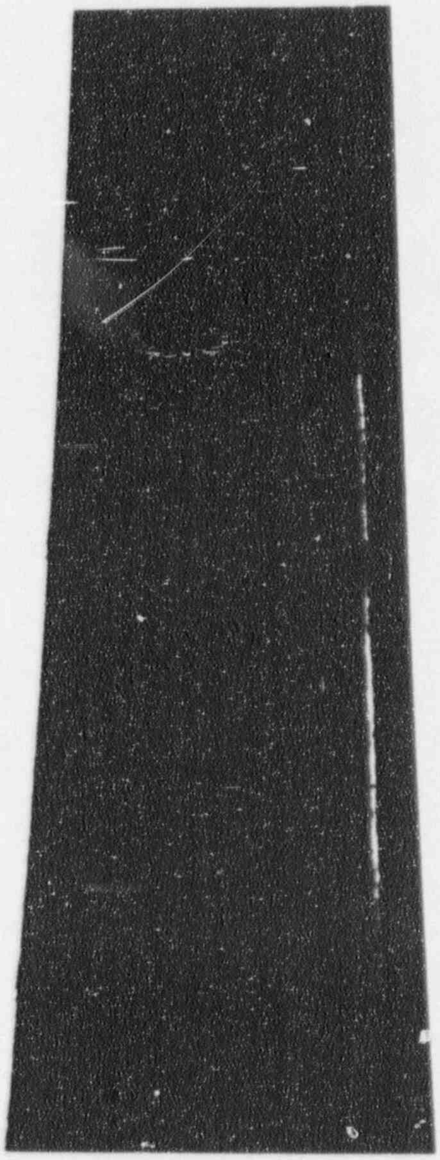

Adjustment Tracks
N
Adjustment Tracks
Direction of Misalignment
Direction of Misalignment
Top Guide
Core Plate

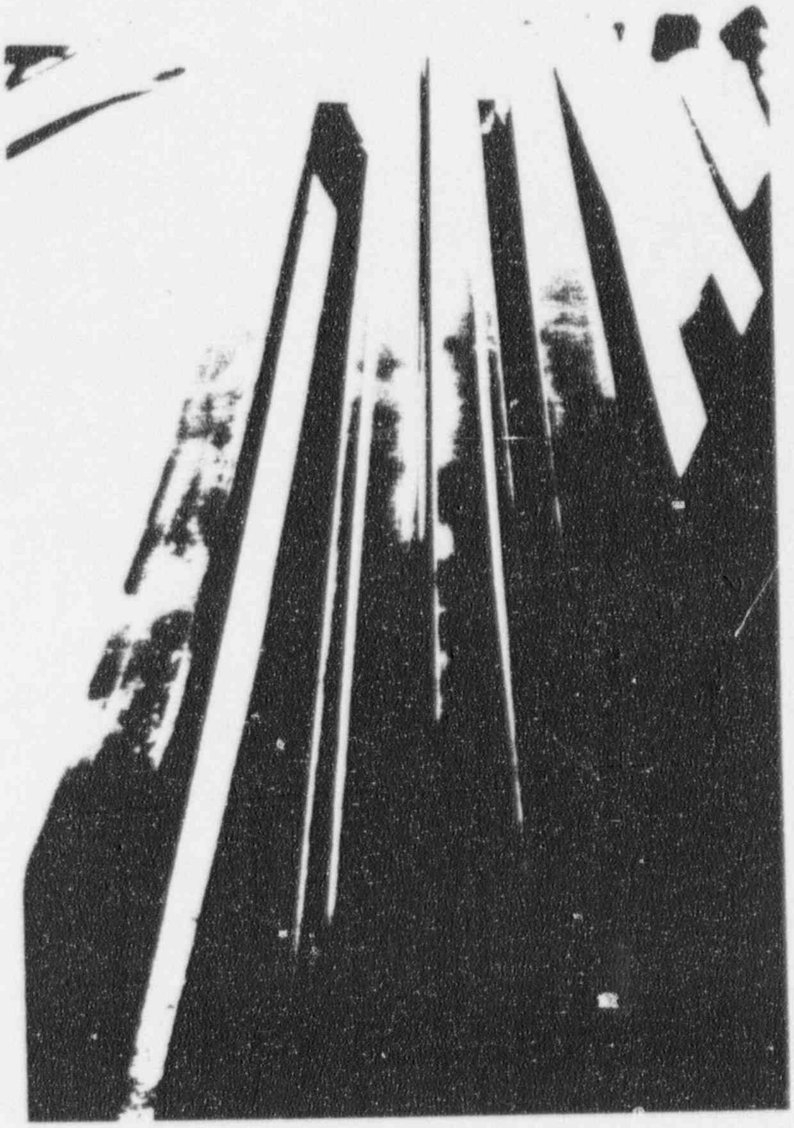






Wear After .5 + .2 Misalignment





Attachment 4

Hitachi Testing Report Summary

HITACHI TESTING REPORT SUMMARY

Testing was performed in the mid 1970's by Hitachi to determine the scram characteristics of a control rod during fuel channel deflections, which simulated seismic conditions. The testing is documented in HIGE-701-T8. This is a summary of that test report. The test facility is shown in Figures 3-a, 3-b, and 4. The actuator (Figure 3-b) was used to dynamically excite the four fuel assemblies, control rod, control rod drive and supports. The horizontal displacement of the fuel assemblies was measured during the excitation. The control rod was scrammed while the fuel was vibrating. The time versus control rod position was measured. Excitation both parallel to and at 45 degrees from the control rod principal axes was considered.

The control rod drive that was used in this test was a BWR/6 drive. A BWR/6 drive can be used to represent a BWR/4 by reducing the hydraulic control unit pressure. Test case II represents such a reduced pressure. Figures 15, 17, 19, and 21 give the test results for test case II. Figure 15 shows scram time versus % insertion for various fuel mid span (single sided) dynamic displacements in a direction parallel to control rod wing. Figure 19 shows the same information for displacement at a 45° angle to the control rod wings. Figure 17 shows the same information as Figure 15, except it is plotted differently. Only case II applies. Similarly Figure 21 is a replot of Figure 19. These results are judged to represent how a BWR/4 control rod would scram during a seismic event.

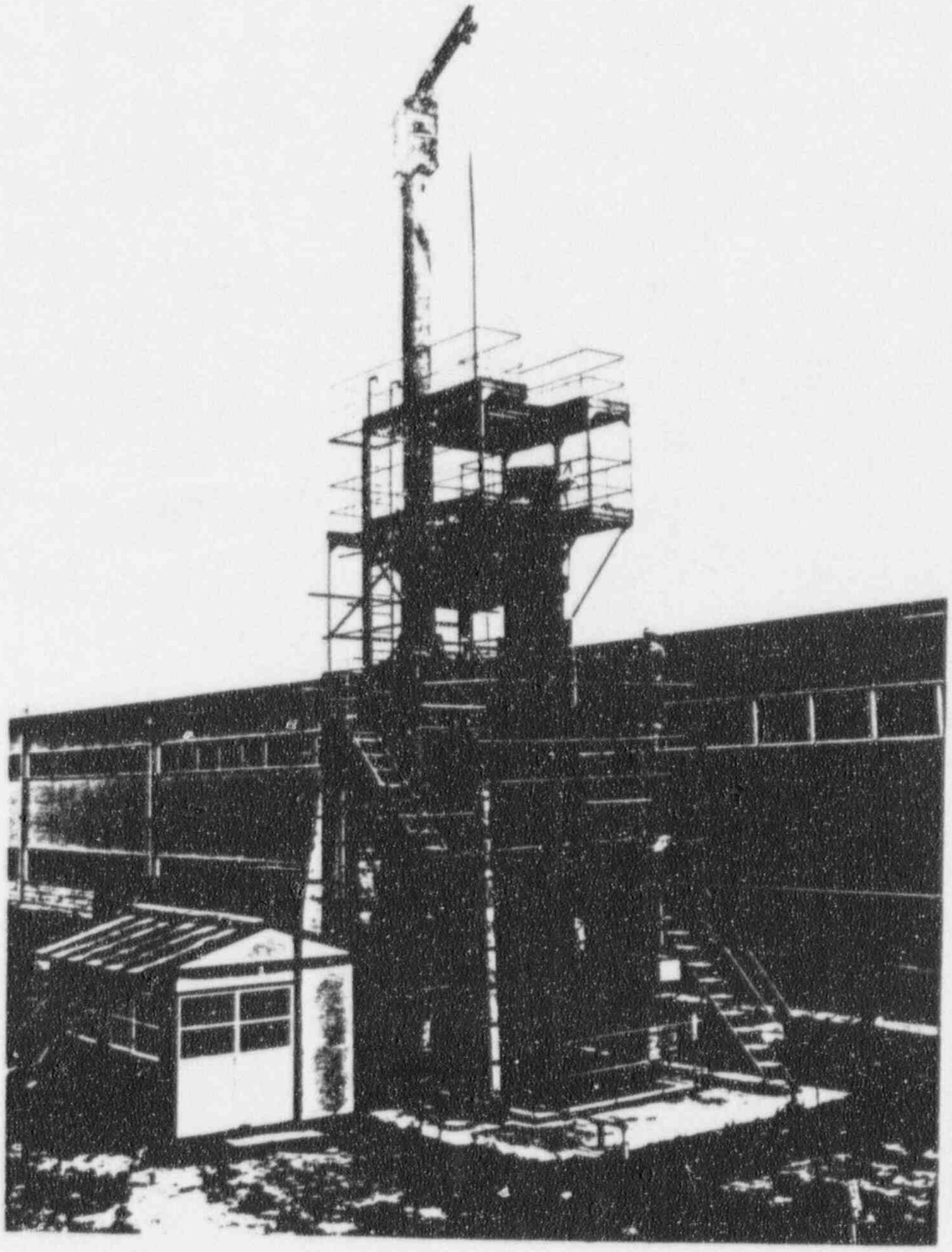


Fig. 3-a Whole View of Test Fixture

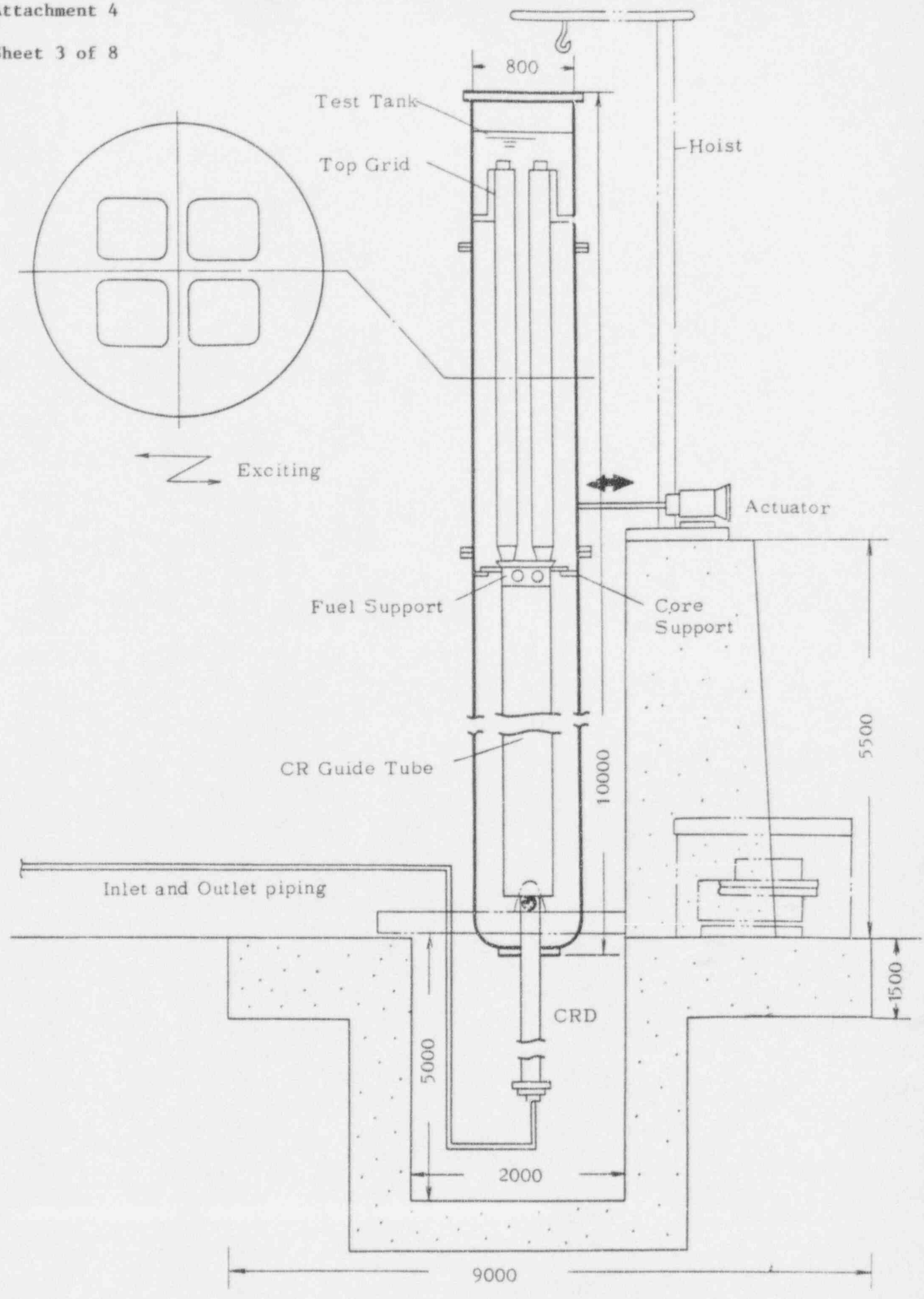


Fig. 3-b   Scrammability Test Fixture

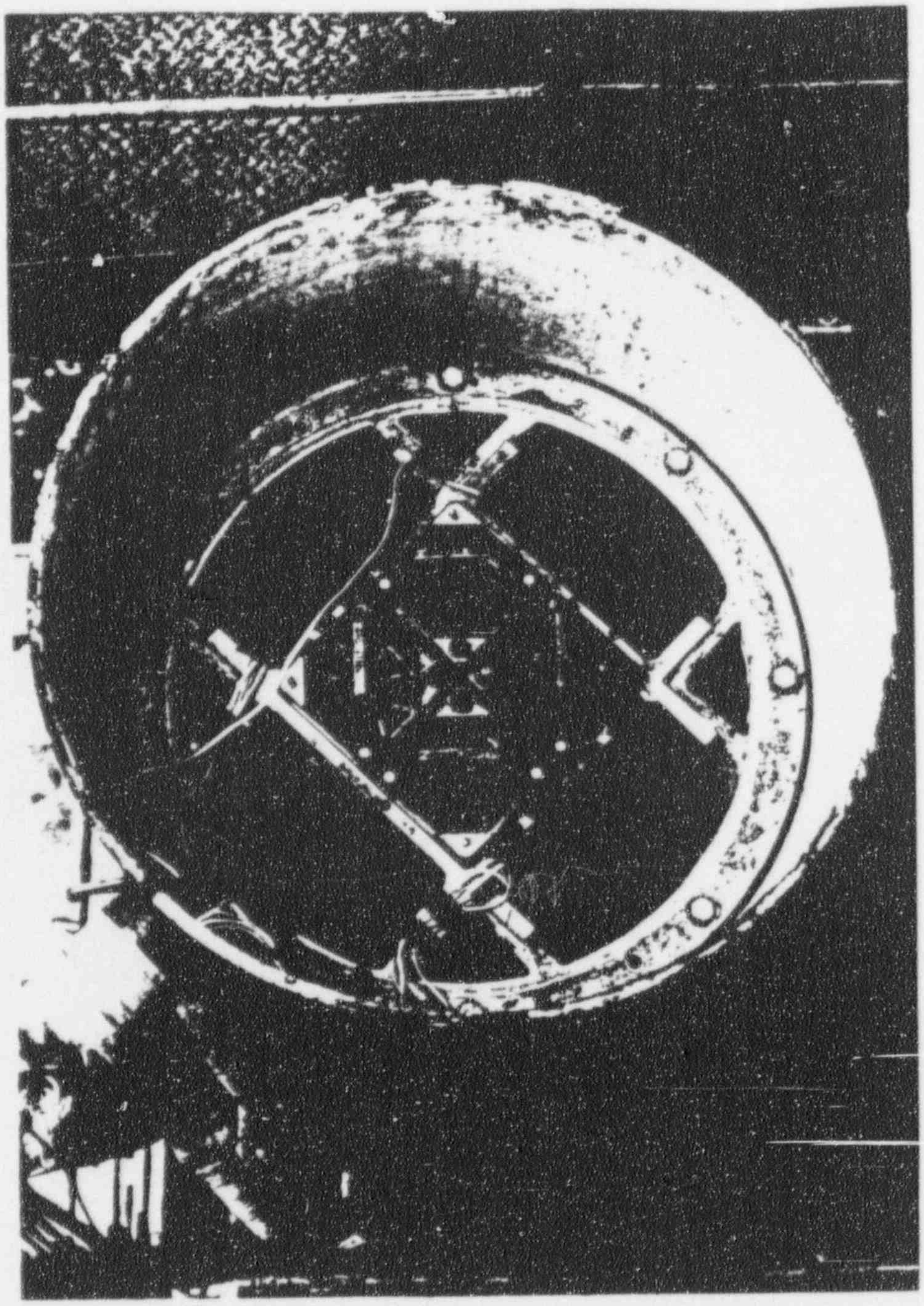


Fig. 4 Fuel Assemblies and Top Grid

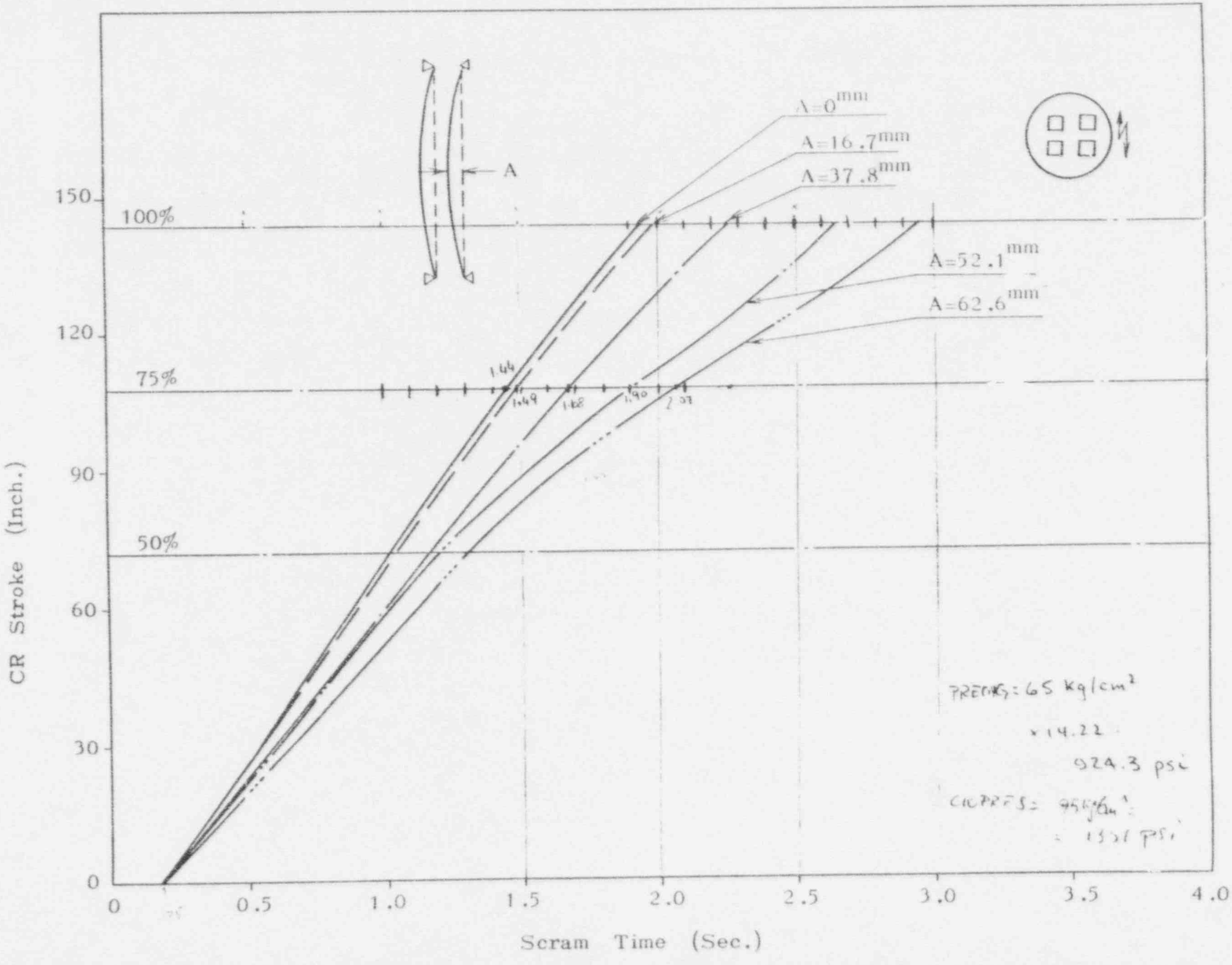


Fig. 15 Scram Locus (Case II)

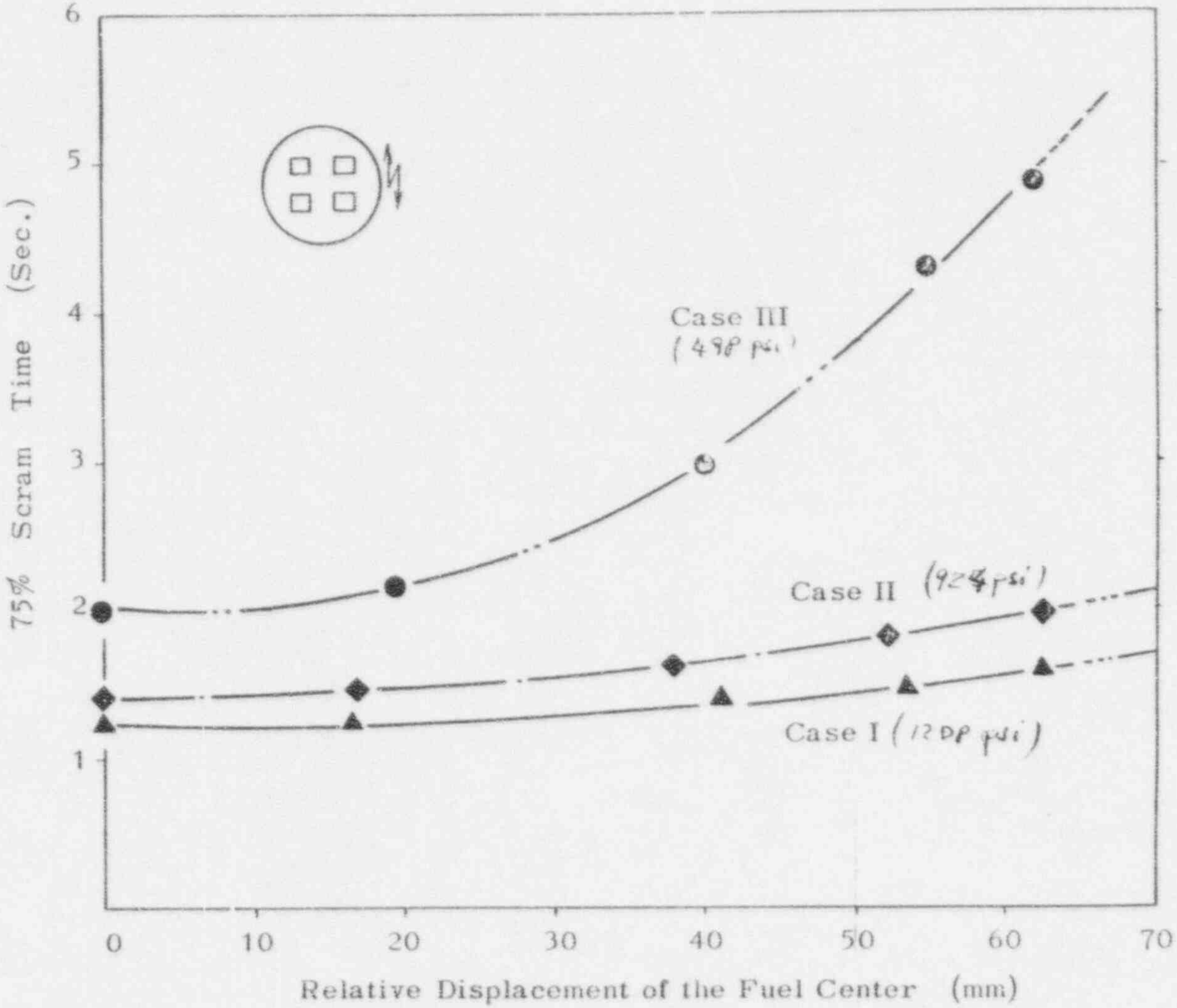


Fig. 17 Scram Time Required 75% Insertion (Parallel Excitation)

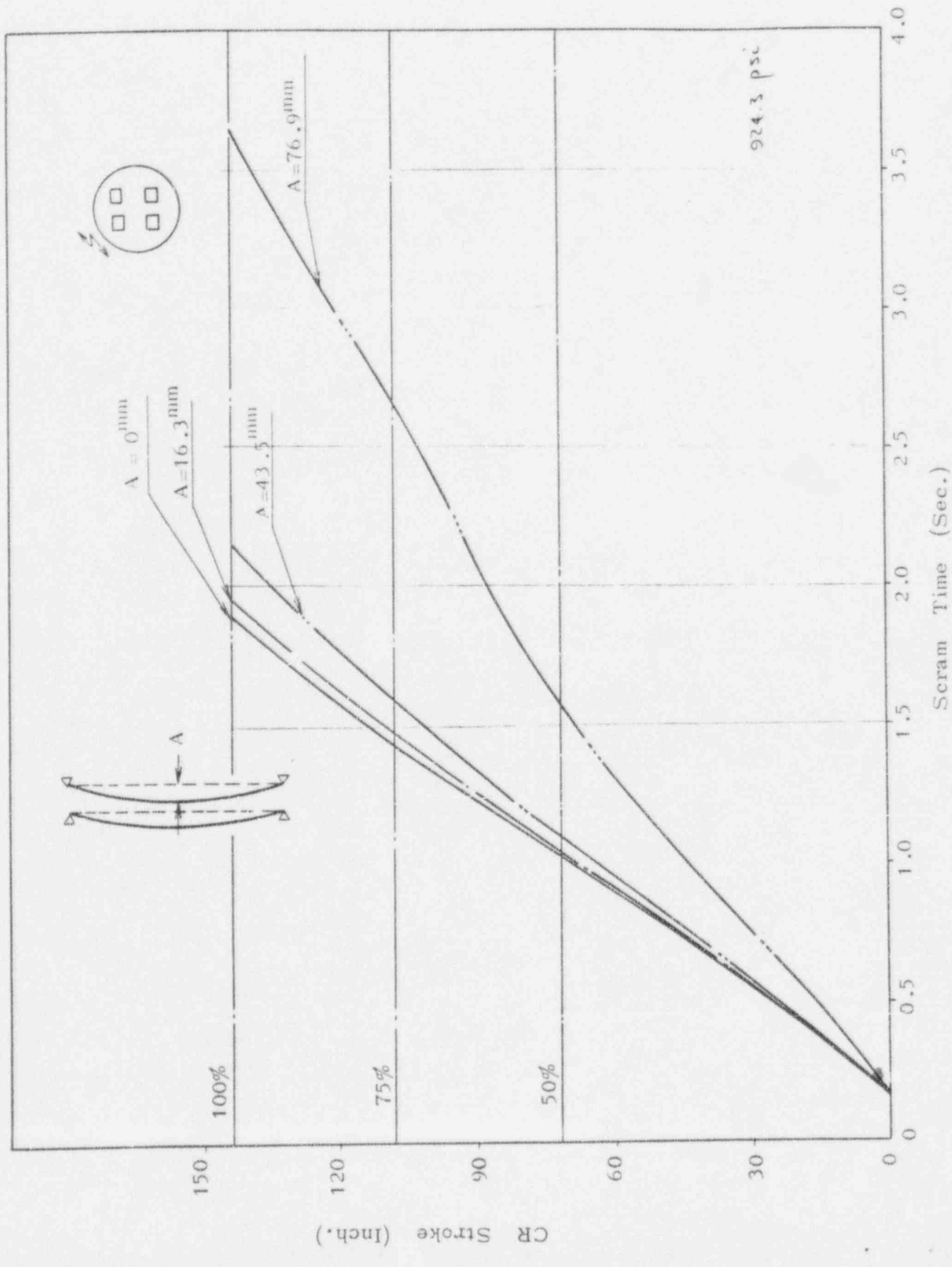


Fig. 19 Scram Locus (Case II)

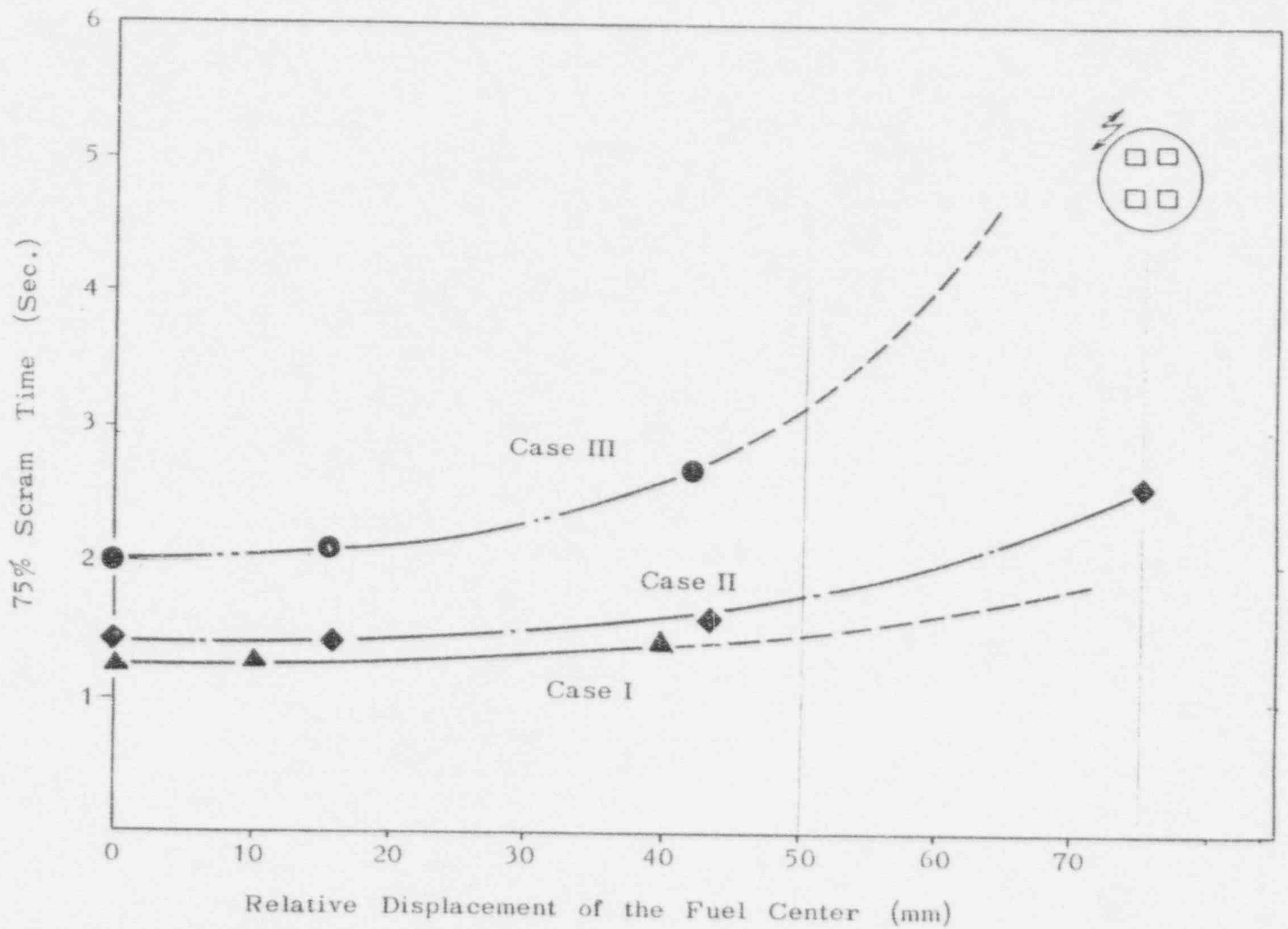


Fig. 21 Scram Time Required 75% Insertion (Diagonal Excitation)

Attachment 5

Final Stress Intensities and Displacement

Attachment 5

Hatch Unit 1
Final Stress Intensities and Displacements
Sheet 1 of 4

Classification	Load Combinations	Component	Pm	Pm allow	Pm + Pb	Pm + Pb allow
Upset	OBE + P + T + W	Lower Spring	35,500	Sm = 47,500	67,500	1.5Sm = 71,250
Emergency	DBE + P + W	Lower Spring	32,100	1.5Sm = 71,250	90,900	2.25Sm = 106875
Emergency	1/2 SME + P + W	Lower Spring	39,600	1.5Sm = 71,250	99,400	2.25Sm = 106875
Faulted	1/2 SME + MSL LOCA + W	Lower Spring	39,600	2.0Sm = 95000	99,400	3Sm = 142,500
Upset	OBE + P + T + W	Upper Bracket	14,300	Sm = 47,500	35,200	1.5Sm = 71,250
Emergency	DBE + P + W	Upper Bracket	18,300	1.5Sm = 71,250	44,900	2.25Sm = 106875
Emergency	1/2 SME + P + W	Upper Bracket	29,200	1.5Sm = 71,250	71,800	2.25Sm = 106875
Faulted	1/2 SME + MSL LOCA + W	Upper Bracket	33,500	2Sm = 95,000	94400	3Sm = 142,500
Upset	OBE + P + T + W	Tie Rod	14,600	Sm = 22,800	14,600	1.5Sm = 34,200
Emergency	DBE + P + W	Tie Rod	18,600	1.5Sm = 34,200	18,600	2.25Sm = 51,300
Emergency	1/2 SME + P + W	Tie Rod	26,400	1.5Sm = 34,200	26,400	2.25Sm = 51,300

Attachment 5

Hatch Unit 1
Final Stress Intensities and Displacements
Sheet 2 of 4

Classification	Load Combinations	Component	Pm	Pm allow	Pm + Pb	Pm + Pb allow
Faulted	1/2 SME + MSL LOCA + W	Tie Rod	36,600	2Sm = 45,600	36,600	3Sm = 68,400
Emergency	LOCA ONLY	Tie Rod	24,000	1.5Sm = 34,200	24,000	2.25Sm = 51,300
Upset	OBE + P + T + W	Upper Spring	19,900	Sm = 47,500	47,600	1.5Sm = 71250
Emergency	DBE + P + W	Upper Spring	39,600	1.5Sm = 71,250	94,700	2.25Sm = 106875
Emergency	1/2 SME + P + W	Upper Spring	45,300	1.5Sm = 71,250	106,300	2.25Sm = 106875
Faulted	1/2 SME + MSL LOCA + W	Upper Spring	45,300	2.0Sm = 95000	106,300	3Sm = 142,500
Upset	OBE + P + T + W	Shroud	4000	Sm = 16900	10,800	1.5Sm = 25350
Emergency	DBE + P + W	Shroud	9200	1.5Sm = 25350	21,300	2.25Sm = 38000
Emergency	1/2 SME + P + W	Shroud	7,800	1.5Sm = 25350	20,000	2.25Sm = 38000
Faulted	1/2 SME + MSL LOCA + W	Shroud	18,700	2Sm = 33800	46,200	3Sm = 50700

Attachment 5

Hatch Unit 1
Final Stress Intensities and Displacements
Sheet 3 of 4

Classification	Load Combination	Component	Transient Radial Calculated	Displacements Allowable	Permanent Radial Calculated	Displacements Allowable
Upset 2	OBE + P + T + W	Lower Spring	0.27	0.75	0	0.33
Emergency 1	DBE + P + W	Lower Spring	0.56	1.12	0	0.5
Emergency 2	W + MSL LOCA	Lower Spring	0	1.12	0	0.5
Emergency 3	1/2 SME + P + W	Lower Spring	0.95	1.12	0.4	0.5
Emergency 4	W + RL LOCA	Lower Spring	0	1.12	0	0.5
Faulted 1	1/2 SME + MSL LOCA + W	Lower Spring	0.95	1.49	0.4	0.66
Faulted 2	1/2 SME + RL LOCA + W	Lower Spring	0.52	1.49	0	0.66

Attachment 5

Hatch Unit 1
Final Stress Intensities and Displacements
Sheet 4 of 4

Classification	Load Combination	Component	Transient Radial Calculated	Displacements Allowable	Permanent Radial Calculated	Displacements Allowable
Upset 2	OBE + P + T + W	Upper Spring	0.27	N/A	0	0.93
Emergency 1	DBE + P + W	Upper Spring	1.5	N/A	0	1.4
Emergency 2	W + MSL LOCA	Upper Spring	0	N/A	0	1.4
Emergency 3	1/2 SME + P + W	Upper Spring	2.0	N/A	0.2	1.4
Emergency 4	W + RL LOCA	Upper Spring	0	N/A	0	1.4
Faulted 1	1/2 SME + MSL LOCA + W	Upper Spring	2.0	N/A	0.2	1.86
Faulted 2	1/2 SME + RL LOCA + W	Upper Spring	2.0	N/A	0.2	1.86

Attachment 2

GENE-771-44-0894 Rev. 1
Justification of Allowable Displacements
of the Core Plate and Top Guide
Shroud Repair

GE Nuclear Energy

175 Curtner Ave., San Jose, Ca., 95125

C.W. Dillmann
Manager
Reactor and Plant Design Engineering

M/C 571
Phone (408)-925-1842
Fax (408)-925-4533

September 7, 1994

Mr. Bruce McLeod
Georgia Power Co.

SUBJECT: GE Nuclear Energy Report Number GENE-771-44-0894 Rev 1,"Justification for Allowable Displacements of the Core Plate and Top Guide Shroud Repair" Dated 9/2/94

Dear Mr. McLeod:

For your information and use GE is submitting the subject document. This incorporates and addresses the comments from the VIP Repair Committee.

It should be noted that one comment that is not addressed is the one relative to the basis of the safety factors. These factors were set by the FSAR's and are beyond the scope of this report.

This report is being provided under the Terms and Conditions of the agreement between the Electric Power Research Institute and the General Electric Co., version EPRI/GE93 930120.

Please free to call the writer at (408) 925 1842 should you have any questions.

Very Truly yours,

C.W. Dillmann

cc. Robert Thomas EPRI
J.E. Charnley
J.R. Isaacs
M.A. Quirin
B.A. Mc Allister