CYCLE 3 STARTUP TEST REPORT

Cycle 3 operations commenced December 3, 1978 with the withdrawal of the first control rod. The startup test program was conducted from December 3, 1978 through February 23, 1979, in accordance with Reactor Analyst Procedure (RAP) 7.1.17, titled Refuel Startup Program Revision 1. When reference is made to values of core thermal power and core flow, these are nominal values rather than exact percentages.

CONTROL ROD DRIVE TESTS

Control rod drive coupling checks were satisfactorily completed for all rods on December 11, 1978. In addition, the insert and withdrawal times for all rods were checked and adjusted as required.

Prior to reaching 40% rated core thermal power, control rod scram time testing was conducted in accordance with RAP 7.3.10 titled Control Rod Scram Time Evaluation Revision 2. This test requires that each control rod be scrammed from position 48 (full out) with reactor pressure >950 psig. The results of these tests are tabulated below.

Results:

Control Rod Insertion (Percent)	Technical Specification (Seconds)	Average of 137 Rods (Seconds)
5	0.375	0.28
20	0.900	0.74
50	2.000	1.53
90	3.500	2.62

Since all times for each amount of insertion for individual rods were less than the maximum allowed by the technical specifications, calculations were not [illegible]med for 2 X 2 arrays.

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7907130439 10

SHUTDOWN MARGIN DEMONSTRATION

A shutdown margin (SDM) demonstration was performed December 5, 1978 in accordance with Reactor Analyst Procedure 7.3.9 Revision 1. The required SDM was 0.38% Δ k + R + temperature defect. The fuel vendor has calculated that the most reactive point is at the beginning of the cycle, hence the value of R is 0.0. After calculating the temperature defect, the required SDM was determined to be 0.47% Δ k. Sufficient control rods were withdrawn to demonstrate a SDM of 0.57% Δ k.

INSEQUENCE CRITICAL

In order to eliminate one control rod sequence exchange during Cycle 3, the startup was conducted in sequence B rather than sequence A. It was necessary to withdraw five control rods (one of which was a low worth peripheral rod) more than estimated. This difference can be attributed to criticality occurring at a reactor water temperature of 174^{o} F rather than 68^{o} F, and a critical eigenvalue of 1.0093 instead of 1.006.

REACTIVITY ANOMALY CHECK

A comparison of the expected and actual control rod density was performed at 100% core thermal power (CTP) and 100% rated core flow. The control rod inventory was 282 notches which was in close agreement with the predicted value of 315 notches. The ±1% reactivity boundaries were 35 to 595 notches.

POWER DISTRIBUTION MEASUREMENTS

Core power distribution was monitored throughout the startup using the process computer. Following significant changes in control rod pattern and power level, a complete power distribution measurement was performed using the Traversing In-core Probe (TIP) system. Core parameters were maintained within technical specification limits.

TIP REPRODUCIBILITY

Successive TIP plots taken on each machine indicate a maximum difference of approximately 5.[illegible]% This occurred adjacent to a fuel bundle spacer. In general, the plots were within 2% of each other.

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CORE POWER SYMMETRY

Core power symmetry was checked at 25%, 50%, 75%, and 100% CTP. Mirror symmetric fuel assemblies checked at 100% CTP and 100% core flow using the process computer indicate a maximum difference of 4% for peripheral assemblies and less than 1% for interior, high power assemblies. Total TIP uncertainty is ≈5%, well below the 8.7% assumed by the vendor in the statistical analysis performed for the licensing topical report (NEDE-24011-P-A) for the reload fuel application. The highest individual asymmetries were observed in locations where the rod pattern was not rotationally symmetric. If the pattern had been rotationally symmetric, the uncertainty would have been even lower.

CORE LOADING

A copy of the final core loading is attached as Figure 1. Irradiated fuel returned to the core is designated EA or LJ5 or LJ6. There were 136 new fuel assemblies, designated LJB, (100 2.83 w/o U-235, 36 2.65 w/o U-235) loaded during the refueling outage. The new fuel was of the 8 X 8 R design with an active fuel length of 150 inches and received 100 mil channels.

Figure 2 shows the approximate irradiated bundle average exposure following refueling. A blank indicates a new fuel assembly.

All new fuel assemblies contain burnable poison in the form of GdO_3. The concentration and location is proprietary to the fuel vendor.

Figure 3 shows the rod sequence control system (RSCS) designations for the A and B rod withdrawal sequences.

During the refueling operation, each fuel move was checked by an individual, other than the operator performing the move, and verified independently by a third individual. Two lines of communication were established between the refuel bridge and the control room. Following loading, a core verification was conducted (and video-taped and examined later by quality assurance personnel) to verify the correct placement and orientation of each assembly.

ADDITIONAL TESTS

1. Tests were performed in accordance with RAP 7.1.17 and F-ST-5C to verify that there is approximately one decade overlap between the source range monitor and intermediate range monitor (IRM) systems, and between the IRM and average power range monitor (APRM) systems.

2. Reactor core isolation cooling and high pressure coolant injection flow rate tests were performed in accordance with F-ST-24C and F-ST-4B and demonstrated compliance with the technical specifications.

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3. Both the rod worth minimizer and rod sequence control system functioned properly during the startup test program.

4. Since some TIP tubing were replaced, the TIP alignment and logic limits were checked and adjusted as required.

5. New computer software was installed during the outage. Extensive testing was performed prior to and during the startup in accordance with the vendor's recommendations.

6. The APRM system was calibrated to core thermal power and satisfactorily tracked power changes.

7. Heat balances were calculated manually and used to verify the process computer calculations.

8. Process computer calculations of fuel assembly parameters, maximum average planar linear heat generation rate, minimum critical power ratio, and maximum fraction limiting power density compared satisfactorily with results obtained using off-line computer calculations.

9. RAP 7.3.18, "Pressure Regulator Tests," was performed satisfactorily when it was verified that an induced pressure transient of 10 psi was controlled by the electro-hydraulic control system pressure regulator. In addition, transfer from the primary to back-up pressure regulator was demonstrated following a simulated failure of the primary regulator.

10. RAP 7.3.7, "Core Flow Evaluation and Indication Calibration," was performed satisfactorily at 75% CTP. However, when performing the test at 100% CTP on February 2, 1979, operations and instrumentation and control personnel noted a step increase in the indicated core flow. The absolute value of the step increase was approximately 1 1/2 to 3% of indicated flow and this step increase resulted in a total indicated core flow of between 101.5% and 103% of rated flow. Operations personnel immediately reduced the recirculation pump speed until the indicated core flow was below 100% of rated flow.

    Investigation revealed that the square root computation module for one of 20 jet pumps had failed at some earlier time. The first indication of this failure, however, was the step change in the output of the square root module which occurred when technicians "disturbed" the module by attaching test equipment to it. This disturbance caused the module output to return to its proper value, that is, the module began performing its square root function.

    The square root computation module was replaced with an identical unit from inventory and the Core Flow Evaluation test was completed without further difficulty. This event was previously reported to the Nuclear Regulatory Commission in LER-79-10.

    The test was repeated later at 100% CTP and 100% flow with satisfactory results.

	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51
52									EA 538	EA 412	EA 25[illegible]	EA 531	EA 168	EA 246	EA 549	EA 195	EA 519	EA 542								
50								EA 300	EA 275	LJ5 347	LJ5 354	LJ5 328	LJ5 339	LJ5 365	LJ5 345	LJ5 355	LJ5 369	EA 301	EA 326							
48					EA 536	EA 502	EA 140	EA 546	LJ8 303	EA 317	LJ8 305	EA 224	LJ8 333	LJ8 331	EA 276	LJ8 306	EA 306	LJ5 320	EA 540	EA 174	EA 438	EA 492				
46				EA 300	EA 152	LJ5 332	LJ6 283	LJ8 300	LJ5 327	LJ8 362	EA 555	LJ8 335	EA 247	EA 226	LJ8 279	EA 352	LJ8 298	LJ5 346	LJ8 409	LJ6 297	LJ5 350	EA 165	EA 351			
44			EA 520	EA 287	EA 145	LJ5 325	LJ8 286	EA 157	LJ8 382	EA 301	LJ8 353	EA 431	LJ8 301	LJ8 359	EA 366	LJ8 365	EA 354	LJ8 305	EA 217	LJ8 321	LJ5 349	EA 201	EA 283	EA 543		
42			EA 404	LJ5 334	LJ5 338	LJ8 201	EA 407	LJ8 361	EA 257	LJ6 277	EA 208	LJ6 278	EA 231	EA 178	LJ6 292	EA 161	LJ6 201	EA 237	LJ8 312	EA 367	LJ8 314	LJ5 357	LJ5 353	EA 386		
40			EA 138	LJ6 282	LJ8 340	EA 519	LJ8 336	EA 192	LJ8 308	EA 312	LJ8 302	EA 431	LJ5 341	LJ5 362	EA 332	LJ8 337	EA 237	LJ8 338	EA 146	LJ8 327	EA 308	LJ8 351	LJ6 206	EA 172		
38		EA 348	EA 528	LJ8 411	EA 221	LJ8 352	EA 162	LJ6 276	EA 213	LJ6 273	EA 292	LJ6 271	EA 253	EA 199	LJ6 286	EA 252	LJ6 288	EA 270	LJ6 239	EA 176	LJ8 354	EA 179	LJ8 397	EA 406	EA 455	
36	EA 508	EA 203	LJ8 325	LJ5 337	LJ8 379	EA 268	LJ8 316	EA 204	LJ8 391	EA 187	LJ8 373	EA 303	LJ8 381	LJ8 400	EA 327	LJ8 386	EA 161	LJ8 388	EA 142	LJ8 344	EA 137	LJ8 389	LJ5 349	LJ8 209	EA 236	EA 478
34	EA 503	LJ5 330	EA 521	LJ8 322	EA 316	LJ[illegible] 270	EA 434	LJ6 279	EA 173	LJ5 335	EA 223	LJ6 274	EA 153	EA 155	LJ6 287	EA 267	LJ5 352	EA 198	LJ6 293	EA 306	LJ6 284	EA 467	LJ8 356	EA 430	LJ5 359	EA 439
32	EA 147	LJ5 333	LJ8 347	EA 450	LJ8 284	EA 280	LJ8 310	EA 193	LJ8 401	EA 227	LJ6 272	EA 241	LJ5 342	LJ5 361	EA 136	LJ6 285	EA 248	LJ8 383	EA 223	LJ8 358	EA 158	LJ8 309	EA 505	LJ8 371	LJ5 354	EA 250
30	EA 472	LJ5 331	EA 244	LJ8 354	EA 359	LJ6 275	EA 413	LJ6 280	EA 432	LJ6 281	EA 196	LJ8 293	EA 182	EA 272	LJ8 367	EA 390	LJ5 295	EA 453	LJ6 294	EA 558	LJ6 299	EA 139	LJ8 376	EA 214	LJ5 348	EA 516
28	EA 156	LJ5 329	LJ8 342	EA 183	LJ8 348	EA 271	LJ5 326	EA 242	LJ8 402	EA 242	LJ5 336	EA 184	EA 219	EA 181	EA 232	LJ5 358	EA 194	LJ8 387	EA 392	LJ5 343	EA 273	LJ8 334	EA 235	LJ8 343	LJ5 351	EA 284
26	EA 263	LJ5 374	LJ8 311	EA 295	LJ8 341	EA 239	LJ6 247	EA [illegible]	LJ8 406	EA 135	LJ6 244	EA 135	EA 240	EA 266	EA 150	LJ6 265	EA 289	LJ8 [illegible]	EA 260	LJ6 268	EA 296	LJ8 [illegible]	EA 265	LJ8 377	LJ6 249	EA 288
24	EA 356	LJ6 246	EA 225	LJ8 280	EA 517	LJ6 305	EA 330	LJ6 301	EA 350	LJ6 300	EA 279	LJ8 373	EA 220	EA 299	LJ8 285	EA 238	LJ6 314	EA 334	LJ6 315	EA 439	LJ6 320	EA 252	LJ8 359	EA 198	LJ6 263	EA 524
22	EA 200	LJ5 371	LJ8 317	EA 494	LJ8 355	EA 245	LJ8 372	EA 249	LJ8 404	EA 285	LJ6 310	EA 150	LJ5 364	LJ6 257	EA 154	LJ6 323	EA 215	LJ8 413	EA 201	LJ8 328	EA 171	LJ8 363	EA 451	LJ8 283	LJ6 269	EA 177
20	EA 552	LJ5 367	EA 539	LJ8 339	EA 433	LJ6 311	EA 470	LJ6 302	EA 144	LJ6 248	EA 293	LJ6 308	EA 133	EA 167	LJ6 321	EA 207	LJ6 266	EA 151	LJ6 316	EA 331	LJ5 325	EA 404	LJ8 313	EA 418	LJ6 252	EA 597
18	EA 368	EA 278	LJ8 279	LJ6 245	LJ8 497	EA 232	LJ8 296	EA 269	LJ8 405	EA 212	LJ8 396	EA 401	LJ8 380	LJ8 392	EA 471	LJ8 498	EA 261	LJ8 410	EA 218	LJ8 375	EA 236	LJ8 403	LJ6 254	LJ8 283	EA 190	EA 371
16		EA 486	EA 560	LJ8 393	EA 243	LJ8 232	EA 290	LJ6 306	EA 205	LJ6 307	EA 277	LJ6 309	EA 274	EA 209	LJ6 324	EA 255	LJ6 322	EA 281	LJ6 319	EA 206	LJ8 332	EA 163	LJ8 385	EA 438	EA 405	
14			EA 164	LJ6 299	LJ8 349	EA 330	LJ8 300	EA 183	LJ8 360	EA 340	LJ8 307	EA 533	LJ5 363	LJ6 253	EA 375	LJ8 205	EA 522	LJ8 345	EA 134	LJ8 346	EA 484	LJ8 359	LJ5 313	EA 234		
12			EA 323	LJ5 372	LJ5 368	LJ8 315	EA 343	LJ8 374	EA 250	LJ6 304	EA 140	LJ6 305	EA 216	EA 276	LJ6 317	EA 258	LJ6 318	EA 233	LJ8 330	EA 401	LJ8 324	LJ6 256	LJ6 260	EA 532		
10			EA 496	EA 298	EA 191	LJ6 250	LJ8 319	EA 197	LJ8 399	EA 556	LJ8 370	EA 403	LJ8 288	LJ8 357	EA 382	LJ8 294	EA 427	LJ8 412	EA 254	LJ8 287	LJ[illegible] 261	EA 160	EA 170	EA 551		
08				EA 419	EA 169	LJ5 370	LJ6 298	LJ8 308	LJ5 373	LJ8 290	EA 322	LJ8 326	EA 297	EA 229	LJ8 281	EA 428	LJ8 304	LJ6 267	LJ8 334	LJ6 312	LJ6 262	EA 250	EA 313			
06					EA 493	EA 504	EA 140	EA 483	LJ8 297	EA 379	LJ8 368	EA 211	LJ5 292	LJ8 329	EA 219	LJ8 366	EA 394	LJ8 318	EA 545	EA 254	EA 358	EA 512				
04								EA 304	EA 202	LJ5 356	LJ5 366	LJ6 258	LJ5 369	LJ6 255	LJ6 259	LJ6 254	LJ6 251	EA 159	EA 365							
02									EA 541	EA 305	EA 180	EA 527	EA 186	EA 175	EA 309	EA 256	EA 435	EA 355								

FIGURE 1

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BUNDLE IDS AND EXPOSURES MWD/STU

#	1	2	3	4	5	6	7	8	9	10	11	12	13
1									EA 536 16938.	EA 412 16850.	EA 251 16700.	EA 531 16899.	EA 168 15505.
2								EA 349 17503.	EA 275 15736.	LJ5347 6637.	LJ5344 6045.	LJ5328 6612.	LJ5329 6223.
3					EA 536 17061.	EA 502 16925.	EA 149 17075.	EA 546 15523.	HER010	EA 317 14515.	HER011	EA 224 9793.	HER012
4				EA 390 16989.	EA 152 16053.	LJ5332 6882.	LJ6283 6876.	MER001	LJ5327 7126.	HER014	EA 555 14508.	HER015	EA 247 10659.
5			EA 520 17046.	EA 287 16397.	EA 145 16375.	LJ5325 6280.	HER016	EA 157 11752.	MER002	EA 391 13964.	HER018	EA 481 13626.	HER019
6			EA 404 16878.	LJ5334 6617.	LJ5338 6225.	HER020	EA 407 15104.	HER021	EA 257 10287.	LJ6277 6436.	EA 208 10474.	LJ6278 5526.	EA 231 11229.
7			EA 138 16901.	LJ6282 6937.	HER022	EA 519 15001.	HER023	EA 192 10853.	HER013	EA 312 14259.	HER017	EA 421 14128.	LJ5341 6134.
8		EA 348 17096.	EA 528 15775.	MER003	EA 221 11400.	HER025	EA 162 10855.	LJ6276 7146.	EA 213 10944.	LJ6273 7130.	EA 292 11059.	LJ6271 6972.	EA 255 14378.
9	EA 308 16937.	EA 203 15362.	HER026	LJ5337 7036.	MER007	EA 268 10335.	HER024	EA 294 10858.	HER004	EA 167 15322.	MER005	EA 393 14492.	MER006
10	EA 503 16627.	LJ5330 6705.	EA 521 14?14.	HER028	EA 316 13744.	LJ6270 6496.	EA 434 14365.	LJ6279 7111.	EA 173 15248.	LJ5335 6593.	EA 228 14061.	LJ6274 7108.	EA 153 13309.
11	EA 147 16623.	LJ5333 6351.	HER029	EA 450 14515.	HER030	EA 280 10431.	HER027	EA 193 11090.	MER008	EA 227 14901.	LJ6272 7063.	EA 241 13633.	LJ5342 6734.
12	EA 472 16578.	LJ5331 6559.	EA 244 9905.	HER031	EA 359 13039.	LJ6275 5625.	EA 413 14135.	LJ6280 6976.	EA 432 14066.	LJ6281 7135.	EA 196 13717.	HER032	EA 182 15044.
13	EA 156 16540.	LJ5329 6151.	HER033	EA 189 10550.	HER034	EA 271 11107.	LJ5326 6?30.	EA 232 14221.	MER009	EA 242 11961.	LJ5336 6908.	EA 184 14006	EA 219 12062.
14	EA 263 17063.	LJ5374 6142.	HER097	EA 295 10572.	HER100	EA 239 11173.	LJ6247 6518.	EA 143 14426.	MER036	EA 185 11991.	LJ6244 6906.	EA 135 14789.	EA 240 13104.
15	EA 336 16677.	LJ6246 6561.	EA 225 9920.	HER091	EA 517 13764.	LJ6305 5616.	EA 330 13683.	LJ6301 6950.	EA 350 14289.	LJ6300 7147.	EA 279 13748.	HER094	EA 220 14935.
16	EA 200 16804.	LJ5371 6939.	HER085	EA 494 14599.	HER088	EA 245 10558.	HER079	EA 249 11068.	MER033	EA 235 14317.	LJ6310 7046.	EA 150 13703.	LJ5364 6734.
17	EA 552 17053.	LJ5357 6703.	EA 539 14635.	HER082	EA 433 13849.	LJ6311 6467.	EA 470 14369.	LJ6302 7133.	EA 144 15277	LJ6248 6591.	EA 293 13871.	LJ6308 7118.	EA 133 13457.
18	EA 368 16842.	EA 278 15476.	HER076	LJ6245 7045.	MER030	EA 232 10491.	HER070	EA 269 10729.	MER021	EA 21? 15256.	HER024	EA 491 14434.	MER027
19		EA 486 17239.	EA 560 15801.	MER018	EA 243 11664.	HER073	EA 290 10917.	LJ6306 7128.	EA 205 10979.	LJ6307 7149.	EA 277 11027.	LJ6309 6940.	EA 274 14814.
20			EA 164 16812.	LJ6239 6938.	HER064	EA 380 15180.	HER067	EA 183 10902.	HER037	EA 340 14151.	HER049	EA 530 14120.	LJ5330 6132.
21			EA 323 16819.	LJ5372 6624.	LJ5368 6223.	HER058	EA 343 14359.	HER061	EA 230 10228.	LJ6304 6471.	EA 140 10251.	LJ6303 5527.	EA 216 11160.
22			EA 406 16973.	EA 298 16306.	EA 191 16578.	LJ6250 6259.	HER045	EA 197 11710.	MER015	EA 556 14122.	HER052	EA 408 13368.	HER055
23				EA 419 16846.	EA 169 15951.	LJ5370 6360.	LJ5298 6830.	MER012	LJ5373 7092.	HER040	EA 322 14441.	HER043	EA 297 10790.
24					EA 493 16793.	EA 504 17003.	EA 149 17087.	EA 483 15725.	HER009	EA 370 14605.	HER006	EA 211 9809.	HER003
25								EA 394 17964.	EA 202 15679.	LJ6356 6643.	LJ6365 6754.	LJ6258 6580.	LJ5352 6240.
26									EA 541 16926.	EA 305 17049.	EA 130 16103.	EA 527 16830.	EA 186 15646.

BUNDLE IDS AND EXPOSURES MWD/STU

#	14	15	16	17	18	19	20	21	22	23	24	25	26
1	EA 246 15925.	EA 54? 15670.	EA 195 16696.	EA 510 17118.	EA 542 17113.								
2	LJ5365 6222.	LJ5345 6583.	LJ5355 6342.	LJ5366 6636.	EA 301 15945.	EA 326 17958.							
3	HER007	EA 286 9642.	HER004	EA 396 14614.	HER001	EA 540 15503.	EA 174 17061.	EA 438 17100.	EA 492 16838.				
4	EA 226 10706.	HER041	EA 352 14401.	HER038	LJ5346 7100.	MER010	LJ6297 6861.	LJ5359 6668.	EA 165 16033.	EA 351 17133.			
5	HER053	EA 366 13778.	HER050	EA 354 13635.	MER013	EA 217 11656.	HER044	LJ5340 6266.	EA 291 16723.	EA 263 16407.	EA 543 17135.		
6	EA 178 11314.	LJ6292 5538.	EA 141 10455.	LJ6291 6440.	EA 237 10245.	HER059	EA 367 14922.	HER056	LJ5357 6234.	LJ5350 6507.	EA 366 16392.		
7	LJ5362 6135.	EA 332 14556.	HER047	EA 387 14276.	HER035	EA 146 10941.	HER065	EA 308 15278.	HER062	LJ5296 6940.	EA 172 16735.		
8	EA 159 11269.	LJ6236 6954.	EA 232 10999.	LJ6268 7161.	EA 270 10914.	LJ6289 7120.	EA 176 10819.	HER071	EA 179 11363.	MER01C	EA 406 15620.	EA 455 17225.	
9	ME[illegible]	EA 327 14549.	MER022	EA 161 15350.	MER019	EA 142 10781.	HER063	EA 137 10360.	MER023	LJ5346 7025.	HER074	EA 236 15580.	EA 478 16773.
10	EA 155 13401.	LJ6237 7131.	EA 267 13963.	LJ5352 6534.	EA 199 15445	LJ6293 7113.	EA 306 14210.	LJ6234 5468.	EA 467 13836.	HER080	EA 430 14522.	LJ5350 6704.	EA 489 17082.
11	LJ5361 6732.	EA 136 13539.	LJ6285 7063.	EA 248 14576.	MER031	EA [illegible] 11081.	HER077	EA 138 10338.	HER086	EA 306 14653.	HER093	LJ5354 6343.	EA 259 17029.
12	EA 272 15282.	HER092	EA 300 13902.	LJ6233 7139.	EA 453 14355.	LJ6294 6943.	EA 533 14119.	LJ6290 5615.	EA 139 13610.	HER089	EA 214 10010.	LJ5343 6545.	EA 516 16920.
13	EA 181 11979.	EA 262 15003.	LJ5339 6912.	EA 194 11926.	MER034	EA 302 14313.	LJ5343 6526.	EA 273 11152.	HER098	EA 235 10534.	HER095	LJ5351 6142.	EA 204 16935.
14	EA 266 11998.	EA 160 14990.	LJ6265 6903.	EA 289 11876.	MER035	EA 260 14437.	LJ6258 6517.	EA 204 11133.	HER099	EA 265 10483.	HER096	LJ6249 6145	EA 284 17040.
15	EA 299 15291.	HER093	EA 238 13634.	LJ6314 7145	EA 334 14265.	LJ6315 6952	EA 439 13966.	LJ6320 5613.	EA 262 13068.	HER090	EA 189 9923.	LJ6263 6539.	EA 524 16816.
16	LJ6257 6729.	EA 154 13502.	LJ6323 7046.	EA 215 14519.	MER032	EA 201 11053.	HER078	EA 171 10671.	HER087	EA 451 14583.	HER084	LJ6260 6338.	EA 177 16895.
17	EA 167 13380.	LJ6321 7116.	EA 207 13879.	LJ6266 6595.	EA 151 15331.	LJ6316 7135.	EA 331 14448.	LJ6325 6478.	EA 464 13606.	HER081	EA 418 14625.	LJ6252 6704.	EA 507 17047.
18	MER026	EA 471 14579.	MER023	EA 261 15293.	MER020	EA 213 10797.	HER069	EA 206 10510.	MER029	LJ6264 7053.	HER075	EA 190 15493.	EA 371 16842.
19	EA 209 14809.	LJ6324 6946.	EA 255 11088.	LJ6322 7158.	EA 281 11000.	LJ6319 7133.	EA 206 10842.	HER079	EA 103 11710.	MER017	EA 452 15393.	EA 465 17000.	
20	LJ6253 6132.	EA 375 14408.	HER043	EA 522 14336.	HER036	EA 134 10933.	HER086	EA 484 15054.	HER080	LJ6313 6976.	EA 234 16806.		
21	EA 276 11219.	LJ6317 5538.	EA 258 10270.	LJ6318 6465.	EA 233 10207.	HER060	EA 401 15286.	HER057	LJ6235 6237.	LJ6260 6835.	EA 532 15050.		
22	HER054	EA 382 13579.	HER051	EA 427 13598.	MER014	EA 204 11607.	HER045	LJ6261 6201.	EA 166 16629.	EA 170 16221.	EA 531 17023.		
23	EA 229 10790.	HER042	EA 428 14439.	HER029	LJ6267 7103.	MER011	LJ6312 6866.	LJ6262 6867.	EA 250 16031.	EA 313 17132.			
24	HER008	EA 210 9922	HER003	EA 394 14213.	HER002	EA 545 15790.	EA 254 17040.	EA 358 17146.	EA 512 16973.				
25	LJ6255 6238.	LJ6259 5593.	LJ6254 6352.	LJ6251 6633.	EA 159 15039.	EA 345 18006.							
26	EA 175 15687.	EA 309 16795.	EA 256 16680.	EA 435 17128.	EA 355 17106.								

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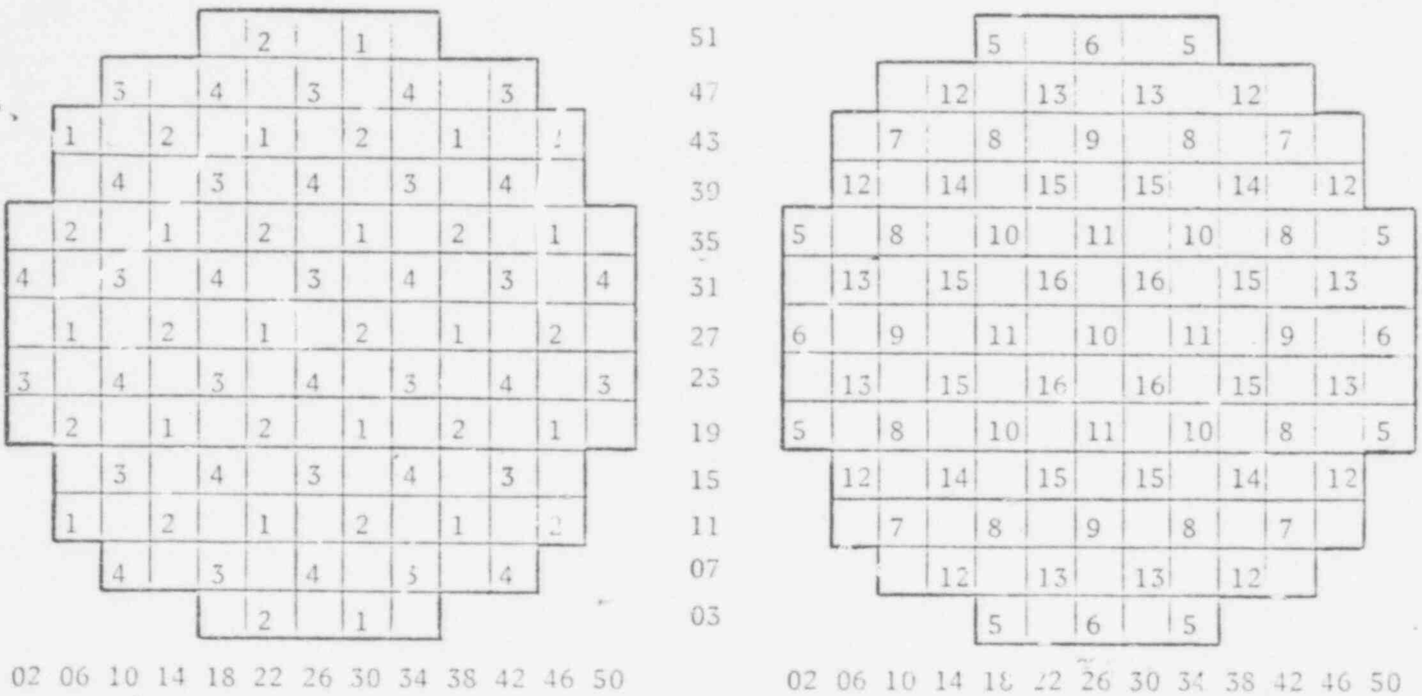
FIGURE 2

ROD SEQUENCE CONTROL SYSTEM GROUP DESIGNATIONS

A SEQUENCE



B SEQUENCE

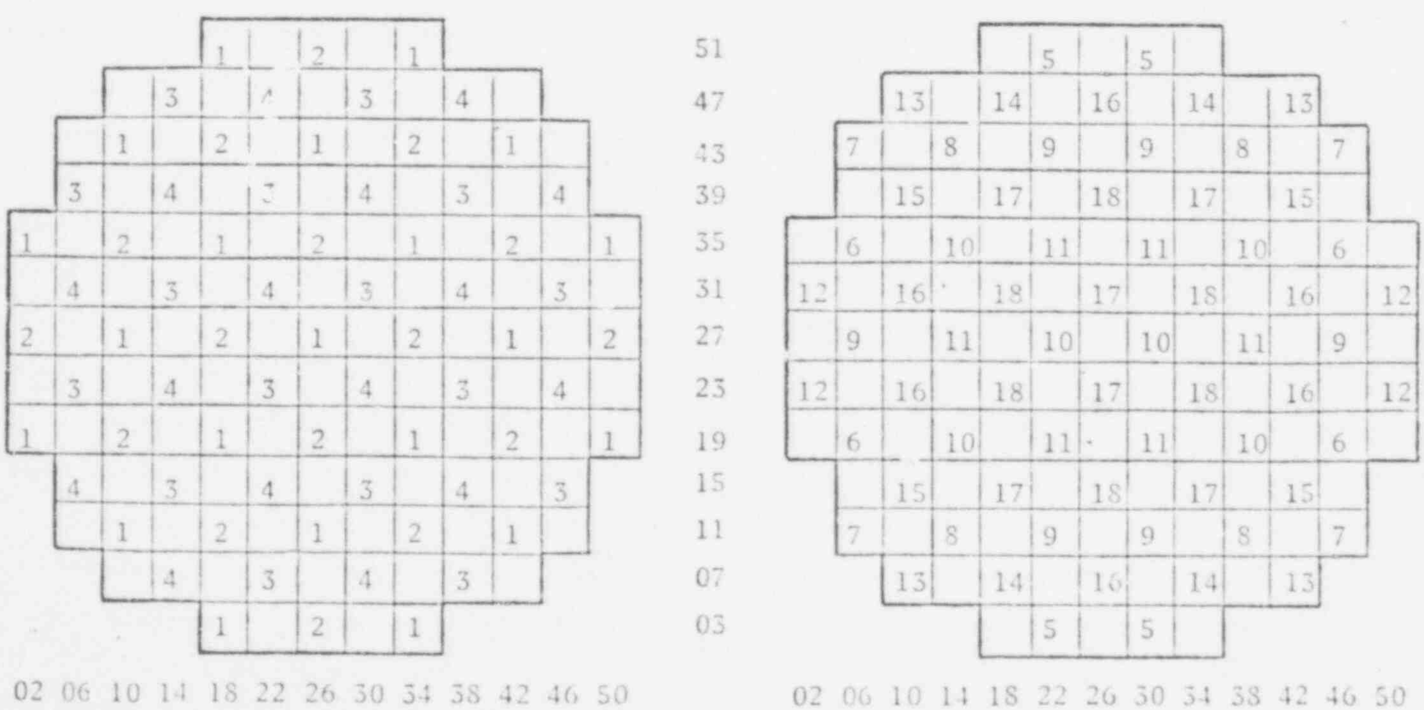


Fig. 3

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