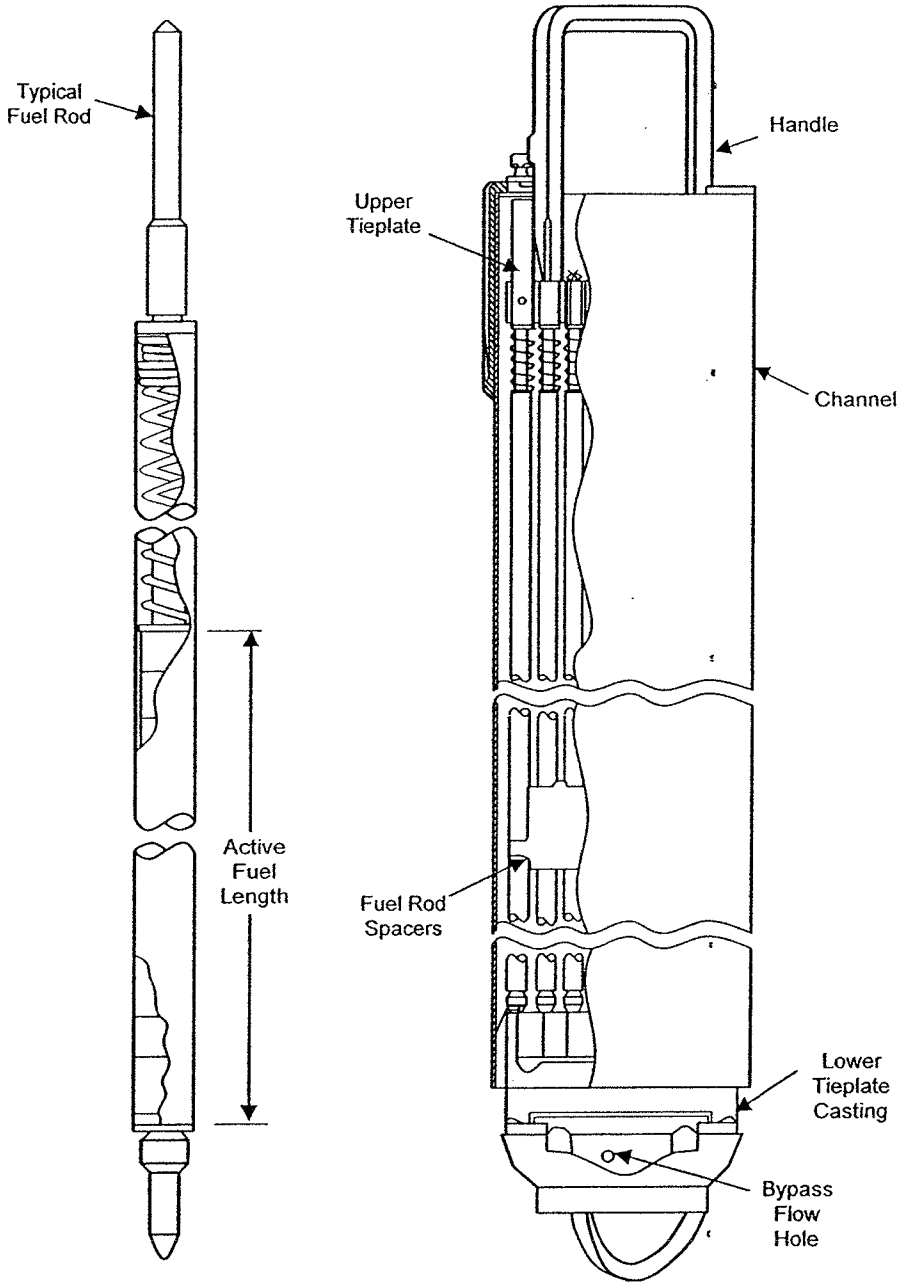

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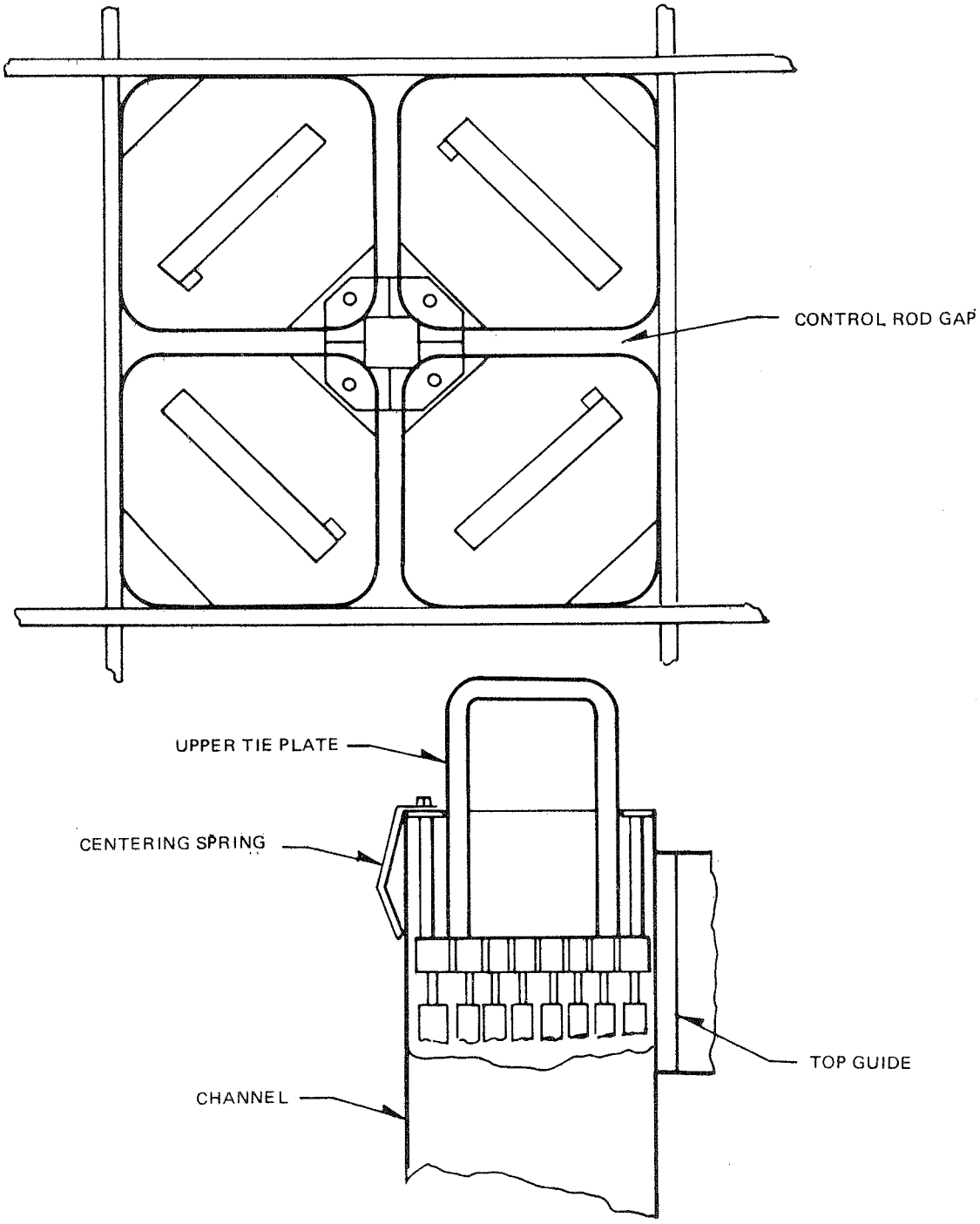
COOPER NUCLEAR STATION
UPDATED SAFETY ANALYSIS REPORT (USAR)

Typical GE BWR Fuel Assembly
Figure III-2-1
03/14/07



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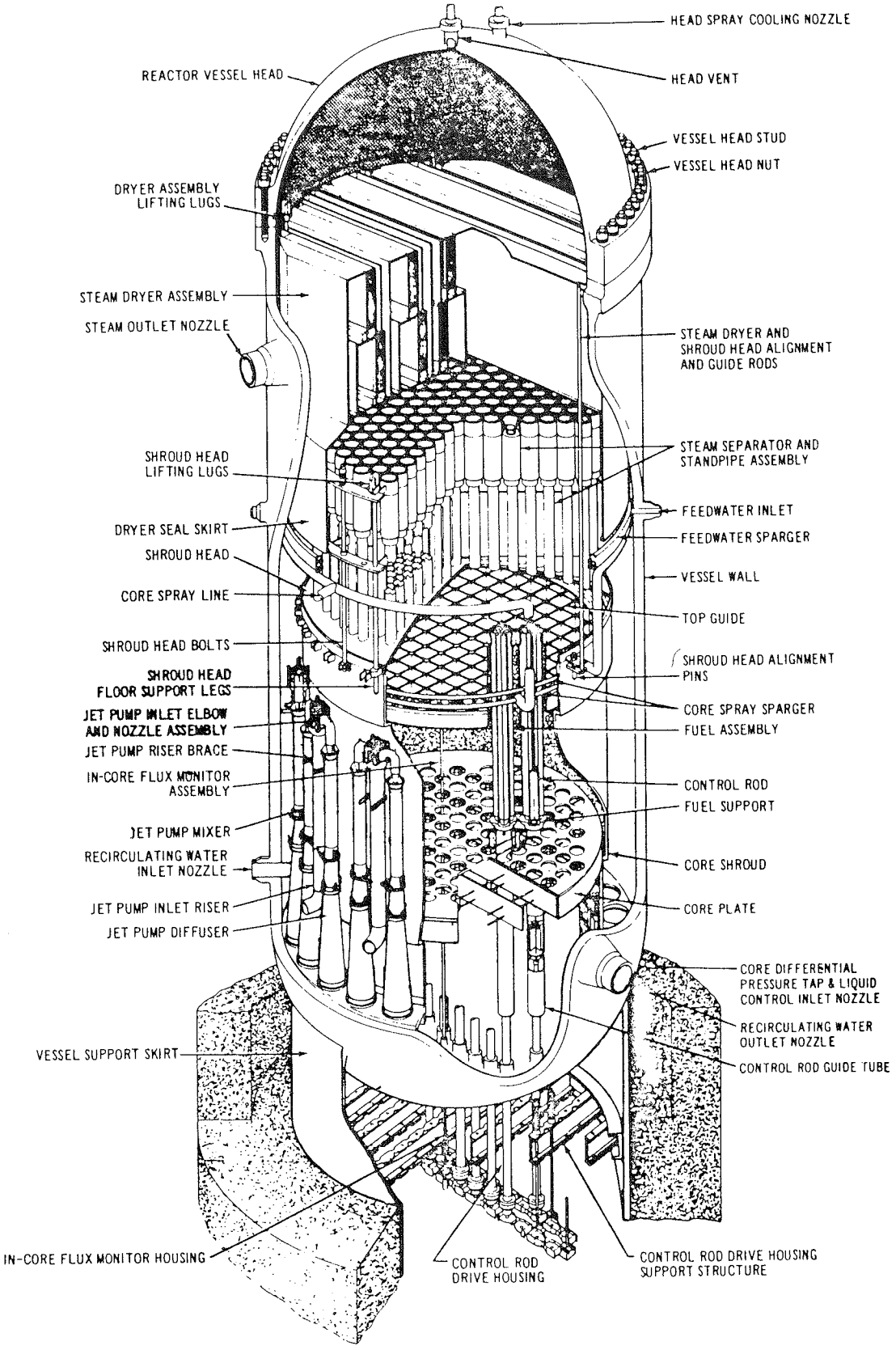
Schematic of Four Bundle
Cell Arrangement
Figure III-2-4



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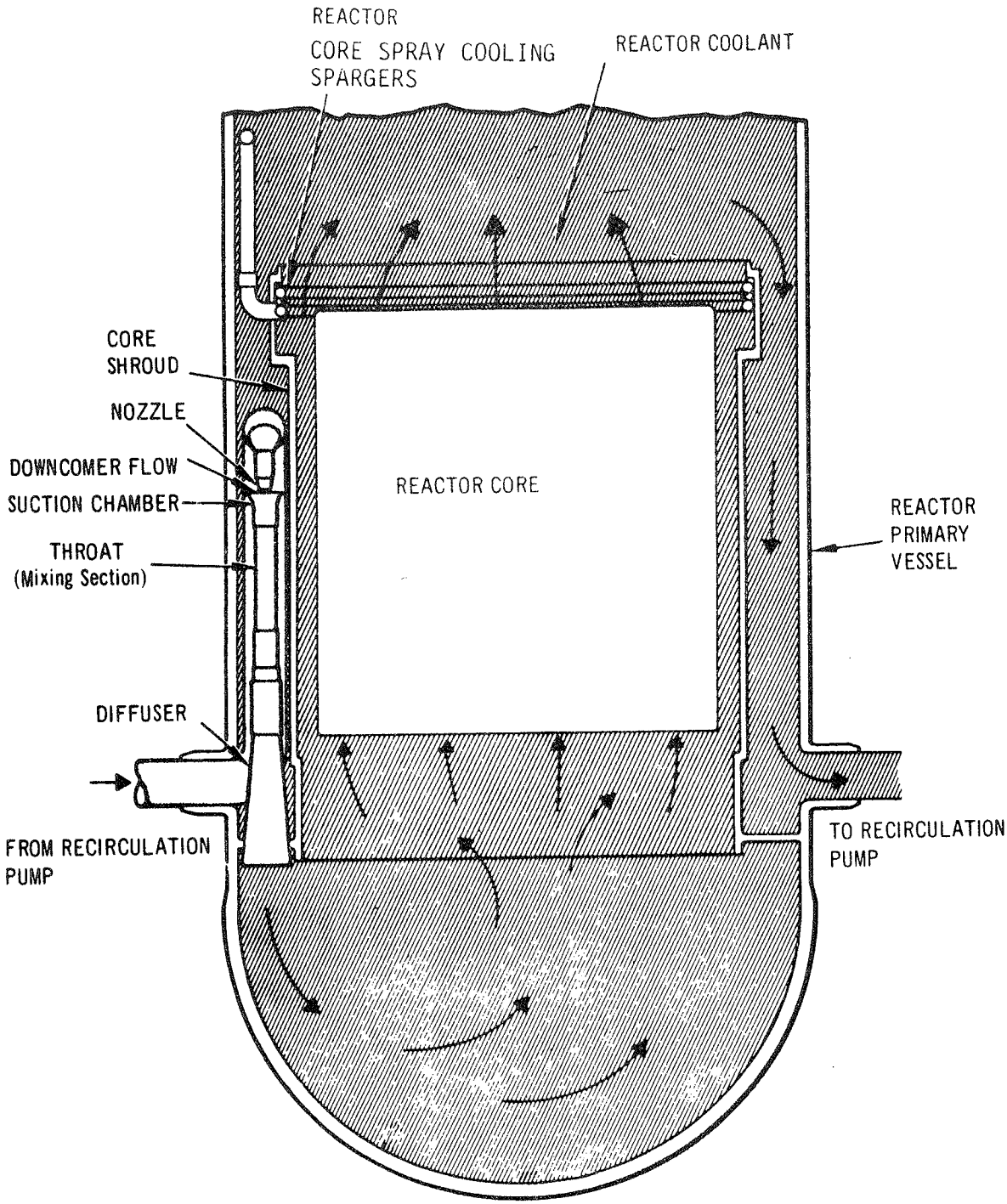
Reactor Internals Arrangement
Figure III-3-1



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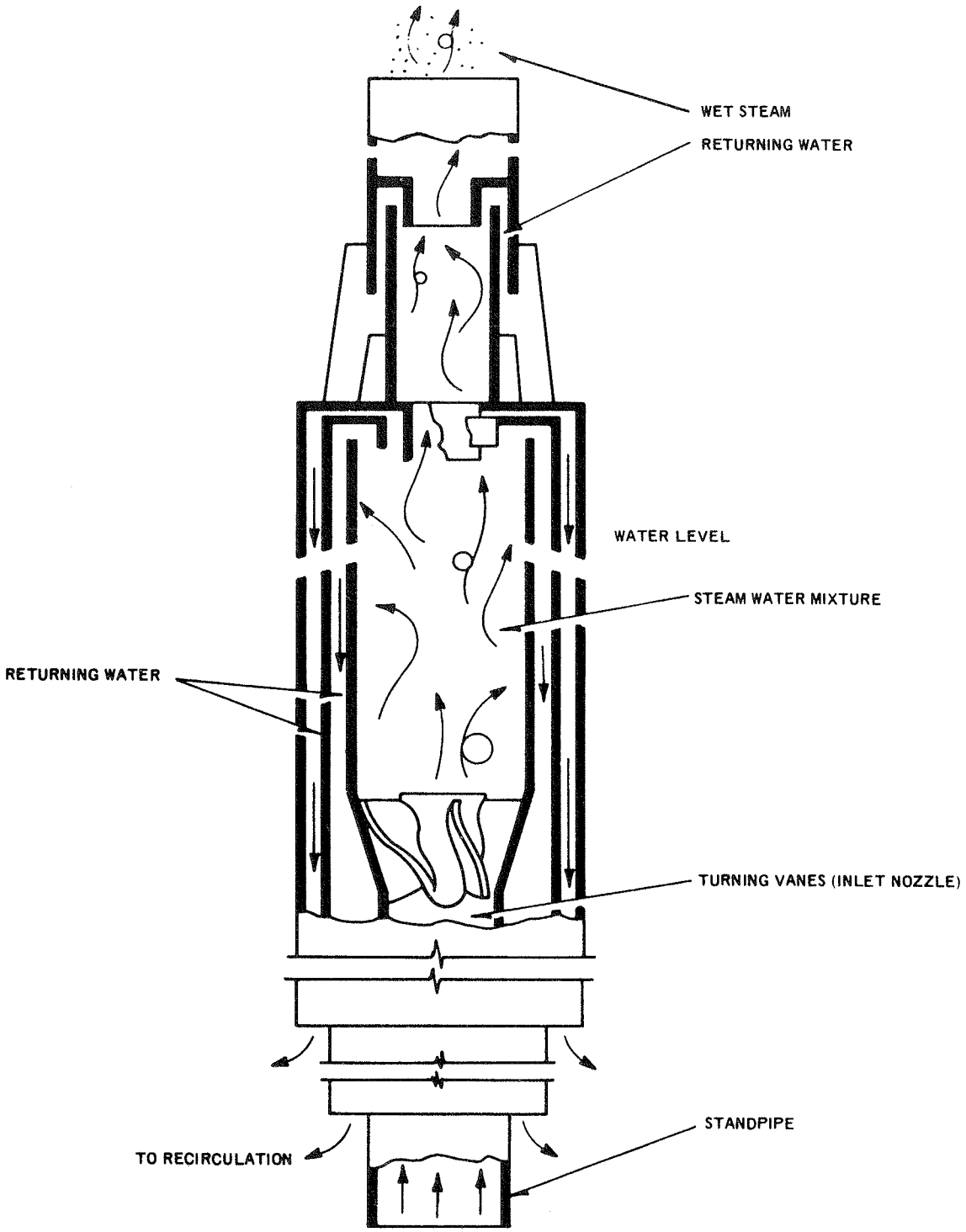
Reactor Internals Flow Paths
Figure III-3-2



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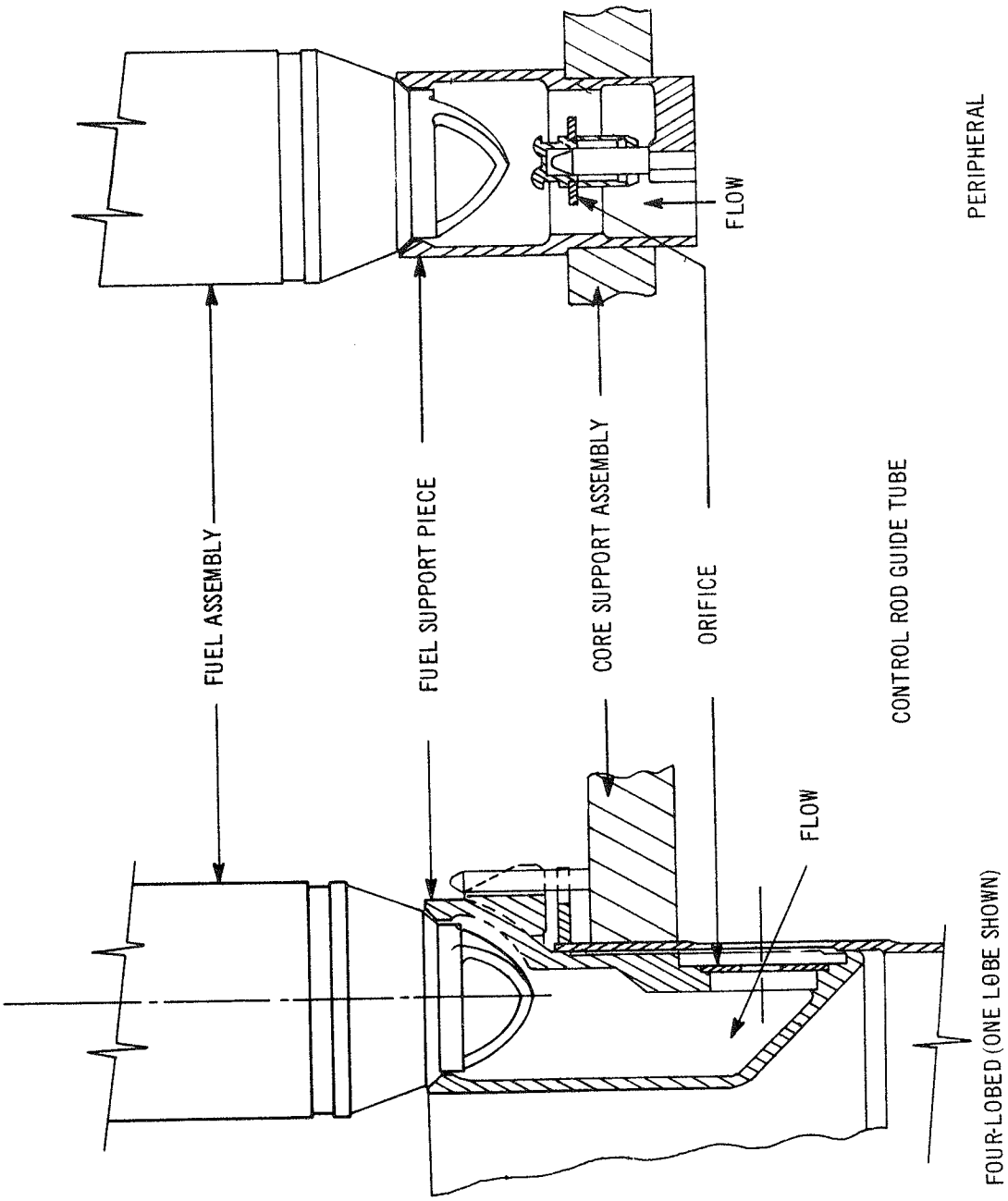
Axial Flow Steam Separator
Figure III-3-3



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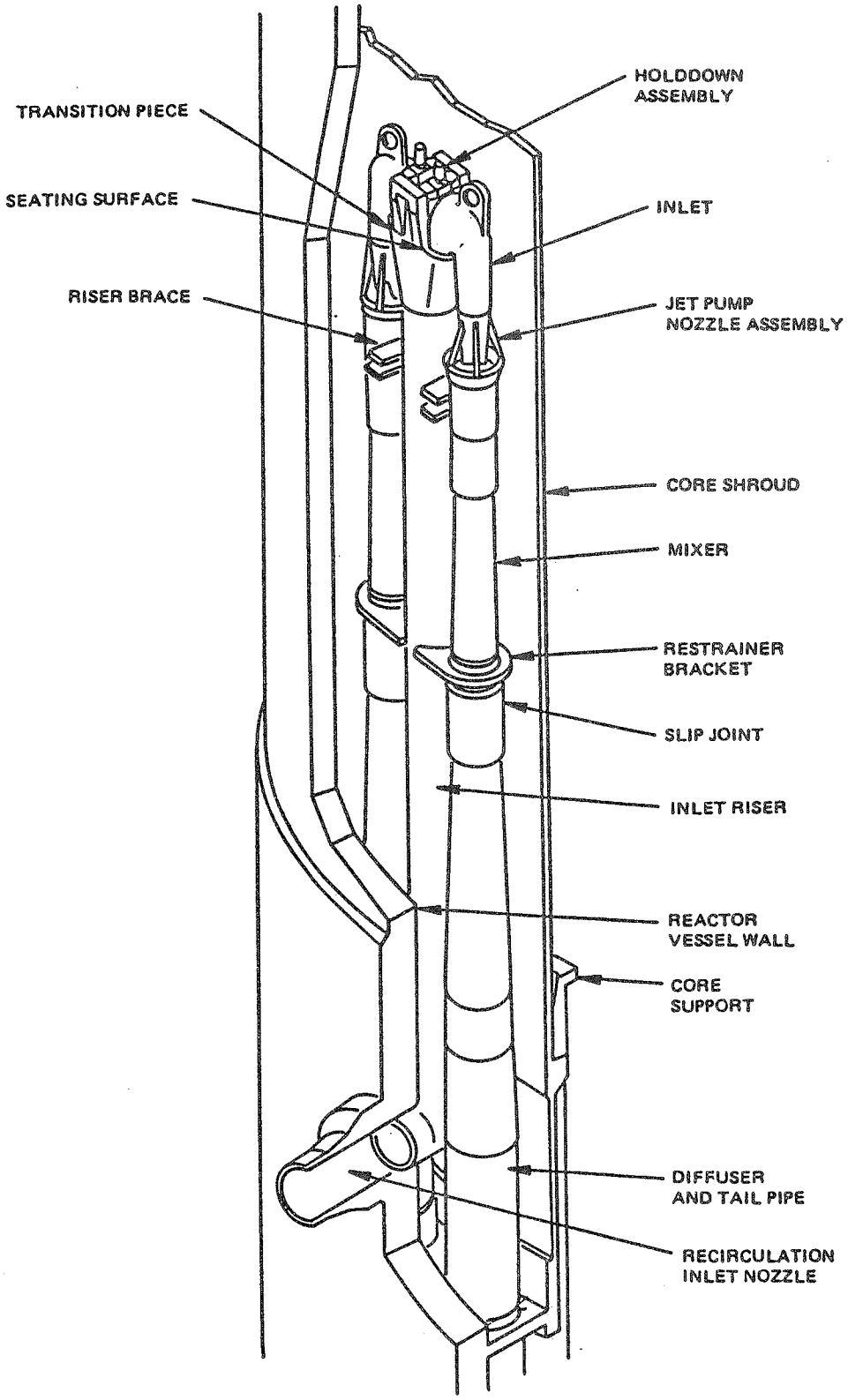
Fuel Support Pieces
Figure III-3-4



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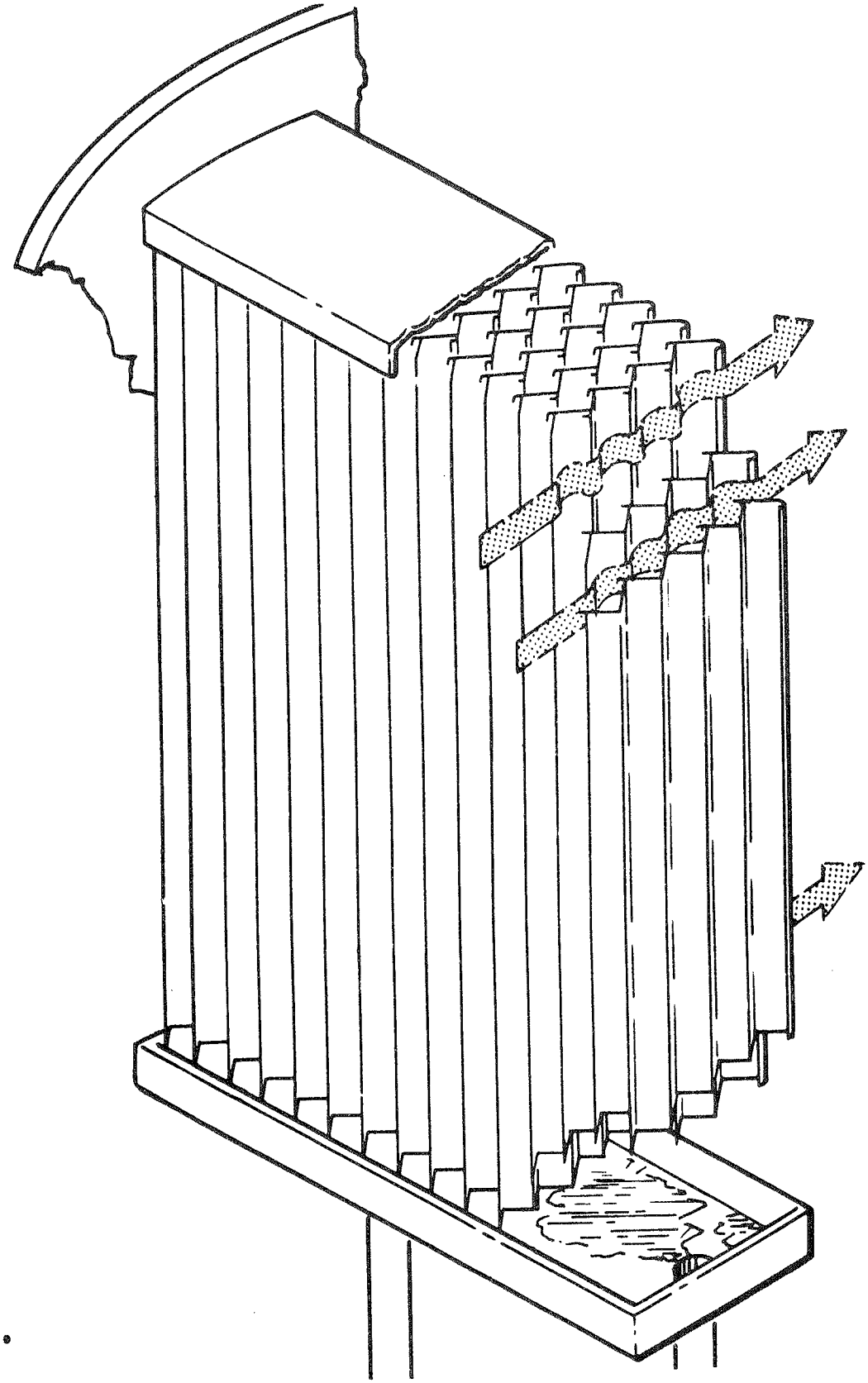
Jet Pump Assembly
Figure III-3-5

07/22/90



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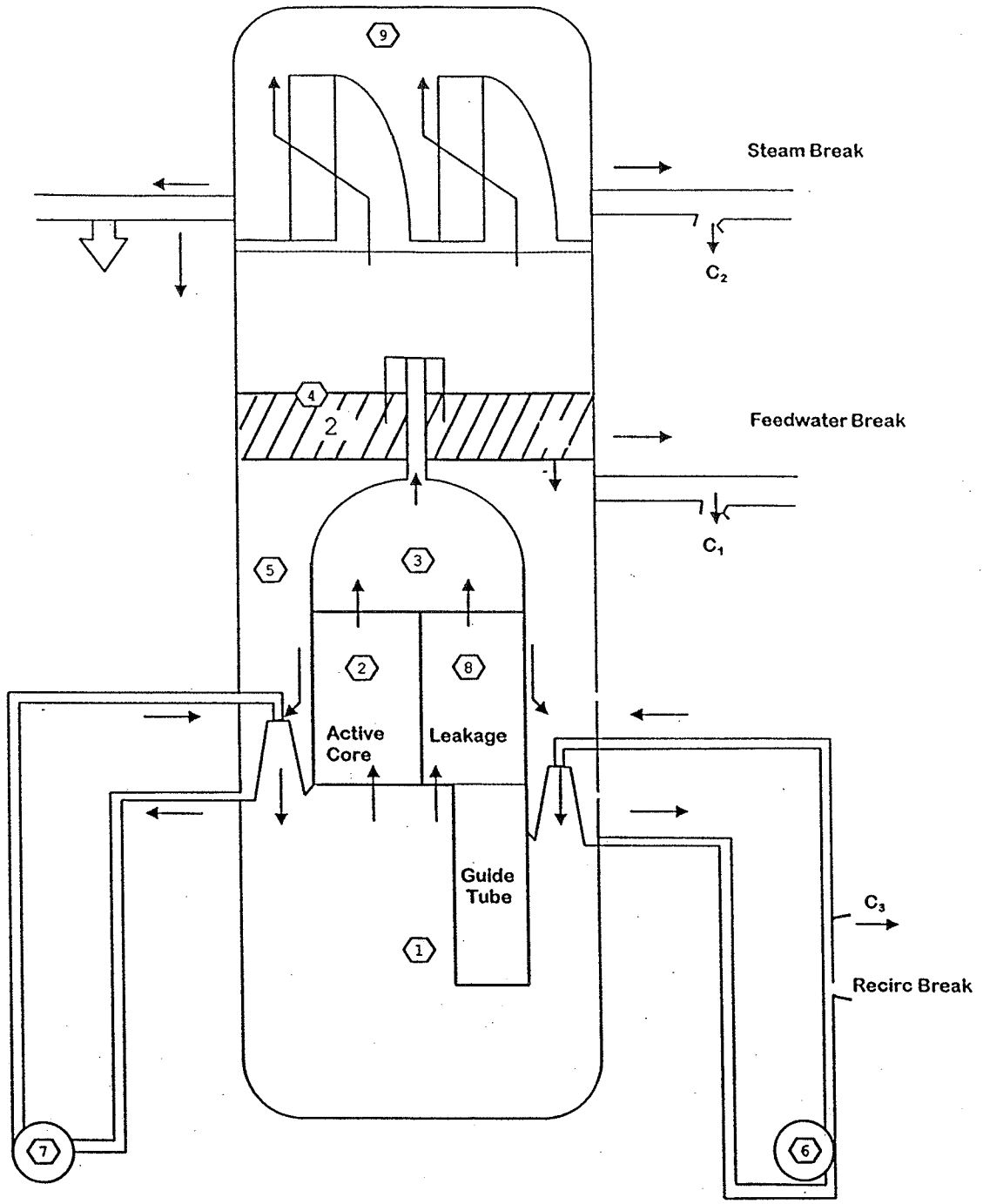
Steam Dryer
Figure III-3-6



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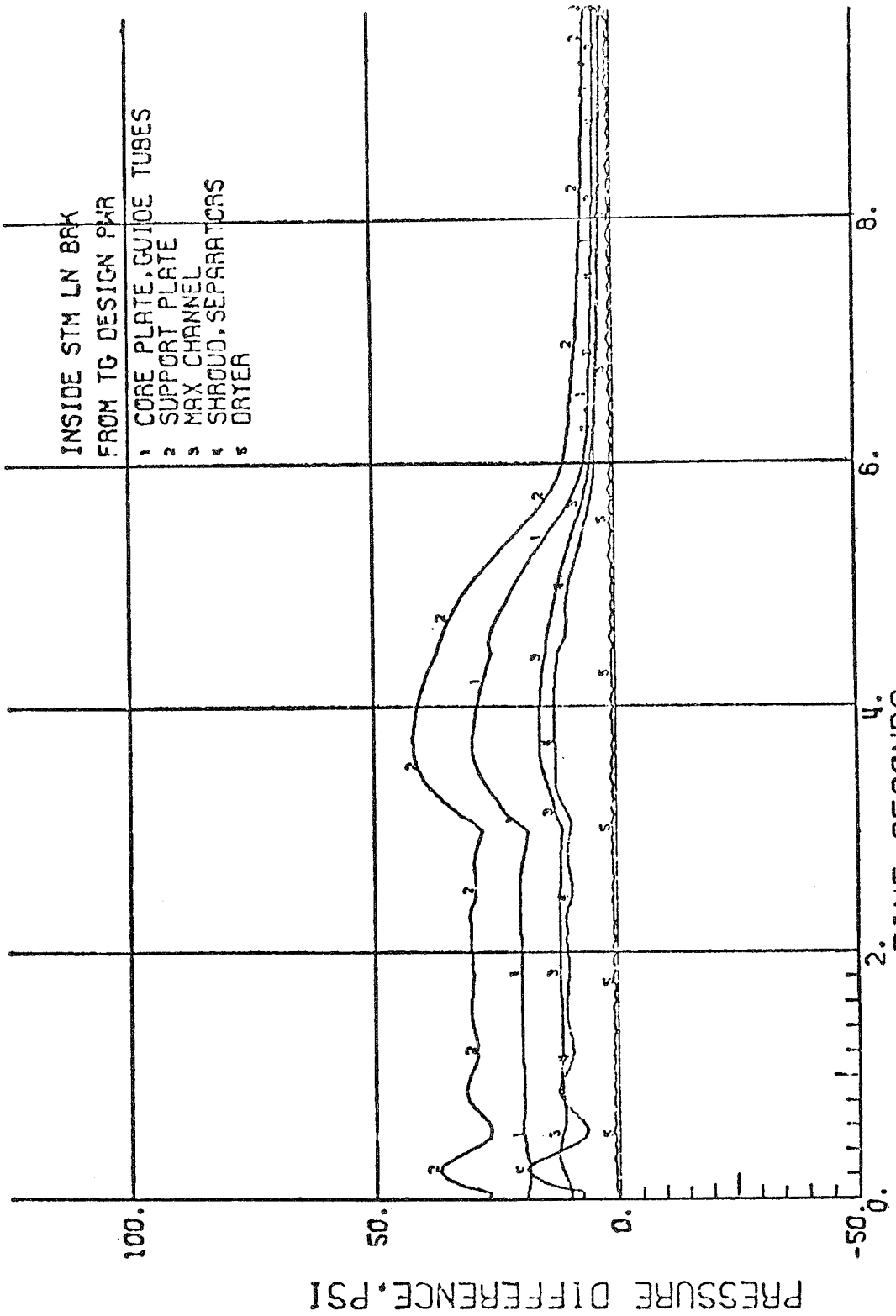
Pressure Nodes Used for
Depressurization Analysis
Figure III-3-7 09/19/00



Transient pressure differentials following a steam line break at TG Design Power.

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Transient Pressure Differentials
Following Steam Line Break at
105-Percent Rated Steam Flow
Figure III-3-8

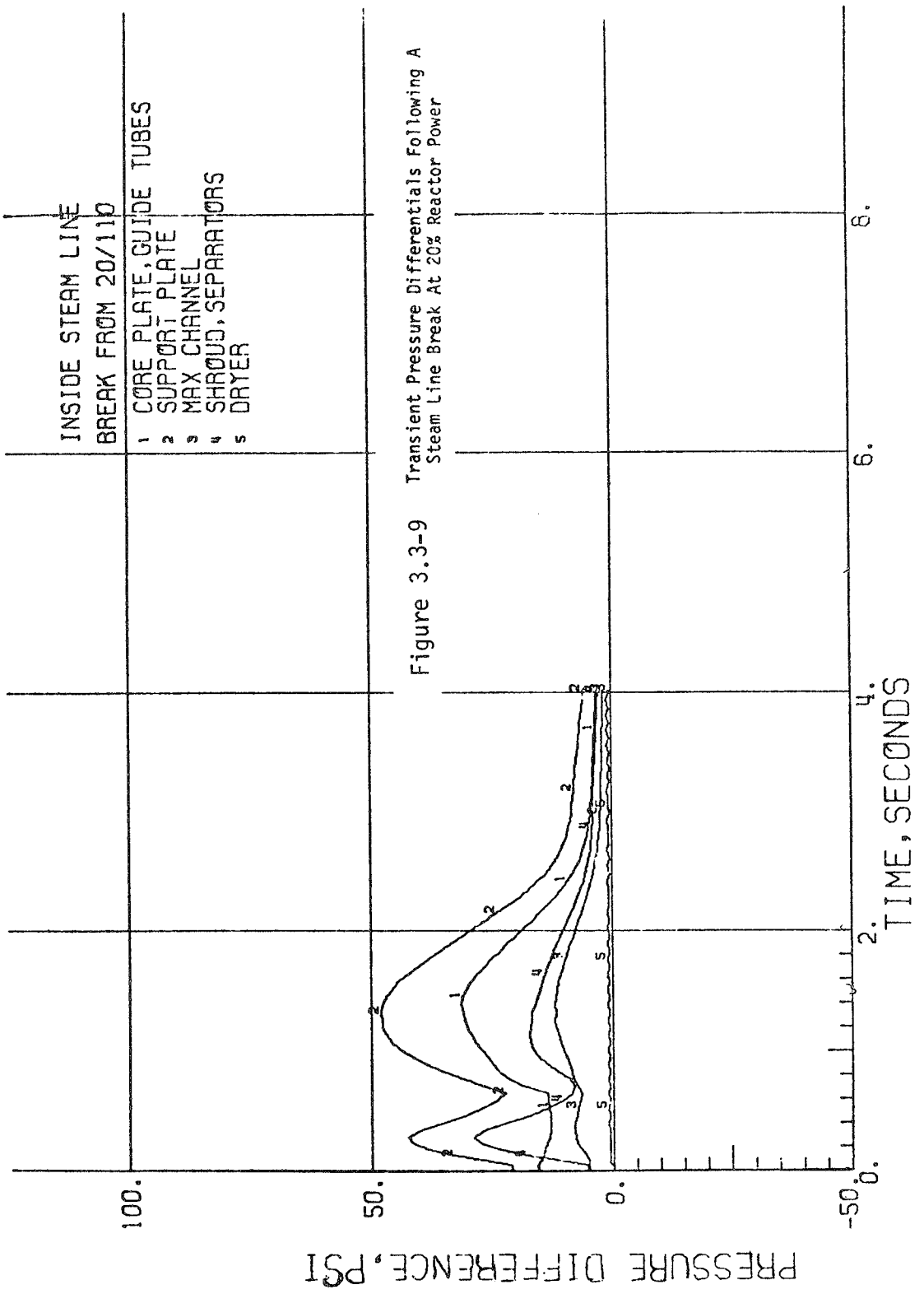

Figure 3.3-9 Transient Pressure Differentials Following A Steam Line Break At 20% Reactor Power

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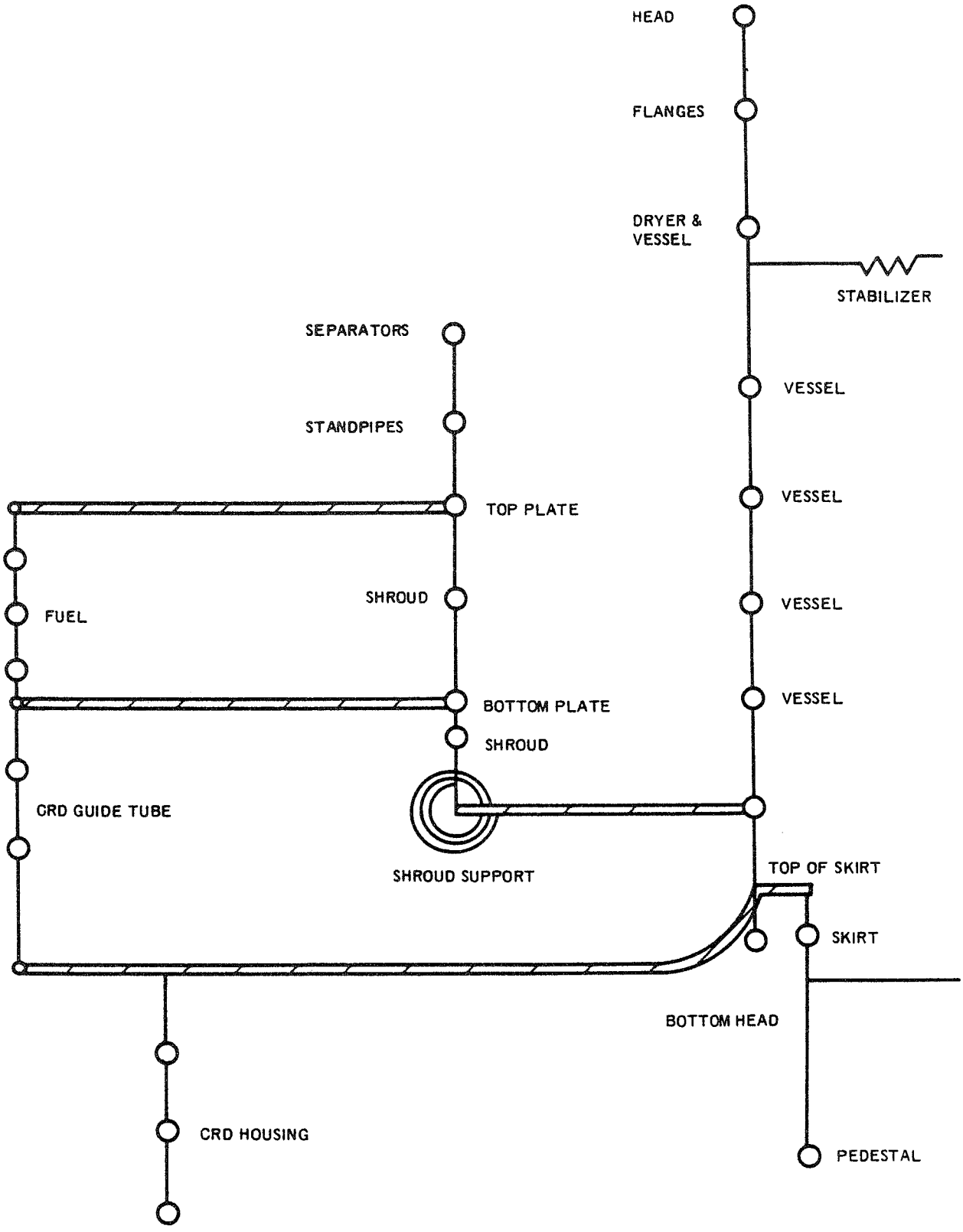
UPDATED SAFETY ANALYSIS REPORT (USAR)

Transient Pressure Differentials Following Steam Line Break at 20-Percent Rated Power and 110-Percent Rated Recirculation Flow
Figure III-3-9



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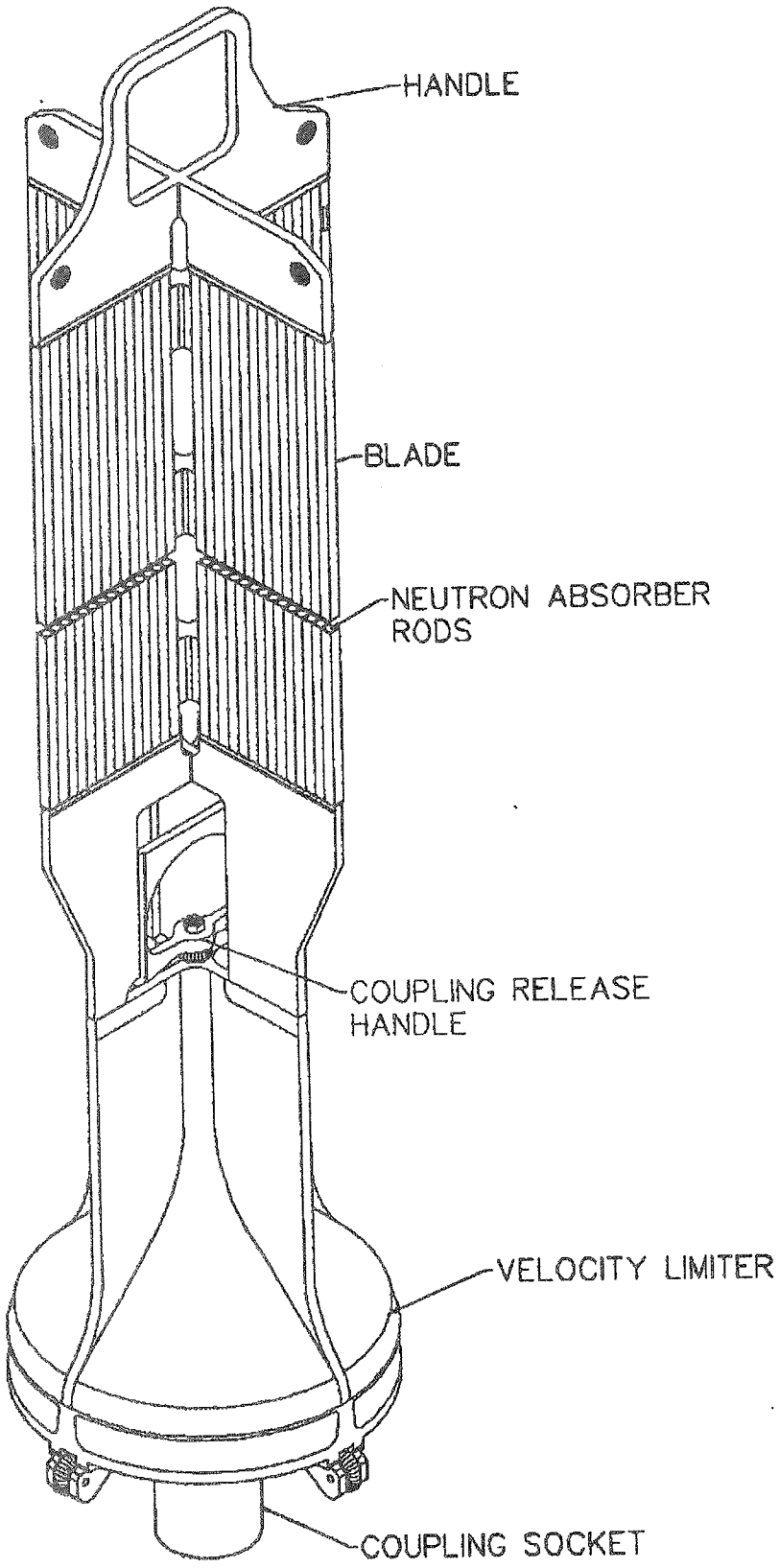
Analytical Model of Reactor
Vessel Internals
Figure III-3-10



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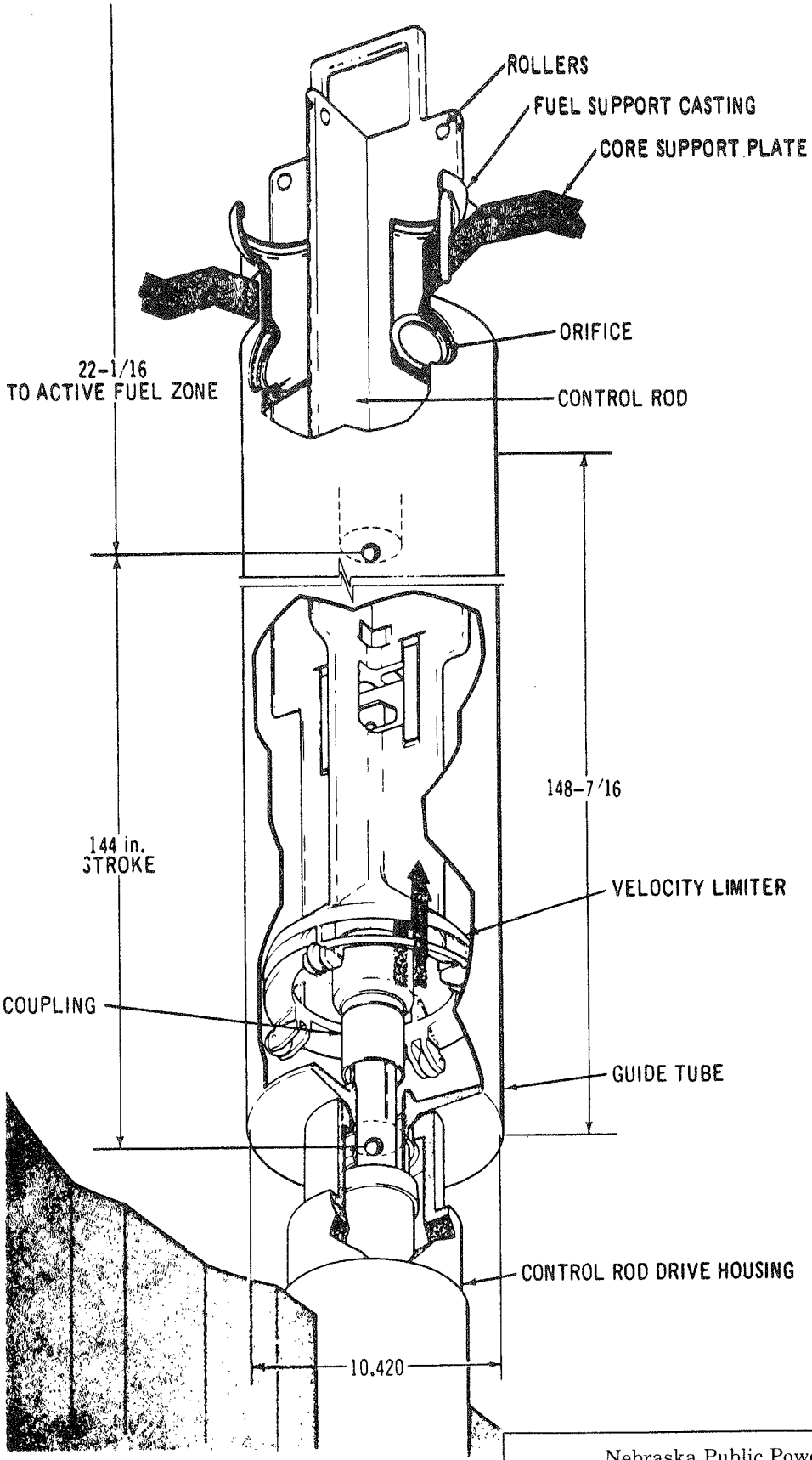
Marathon Control Rod Assembly
Figure III-4-1a
07/22/92



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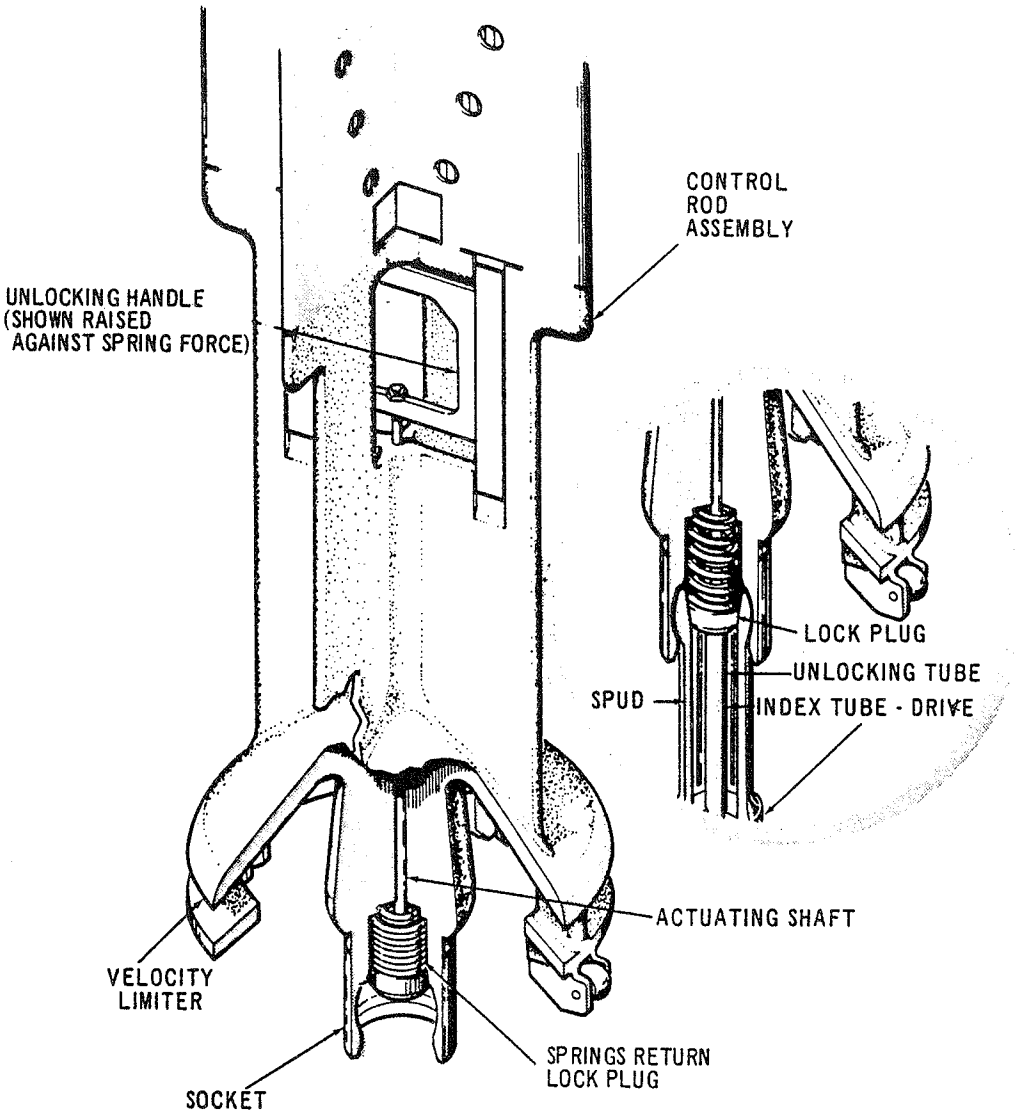
Control Rod Velocity Limiter
Figure III-4-2



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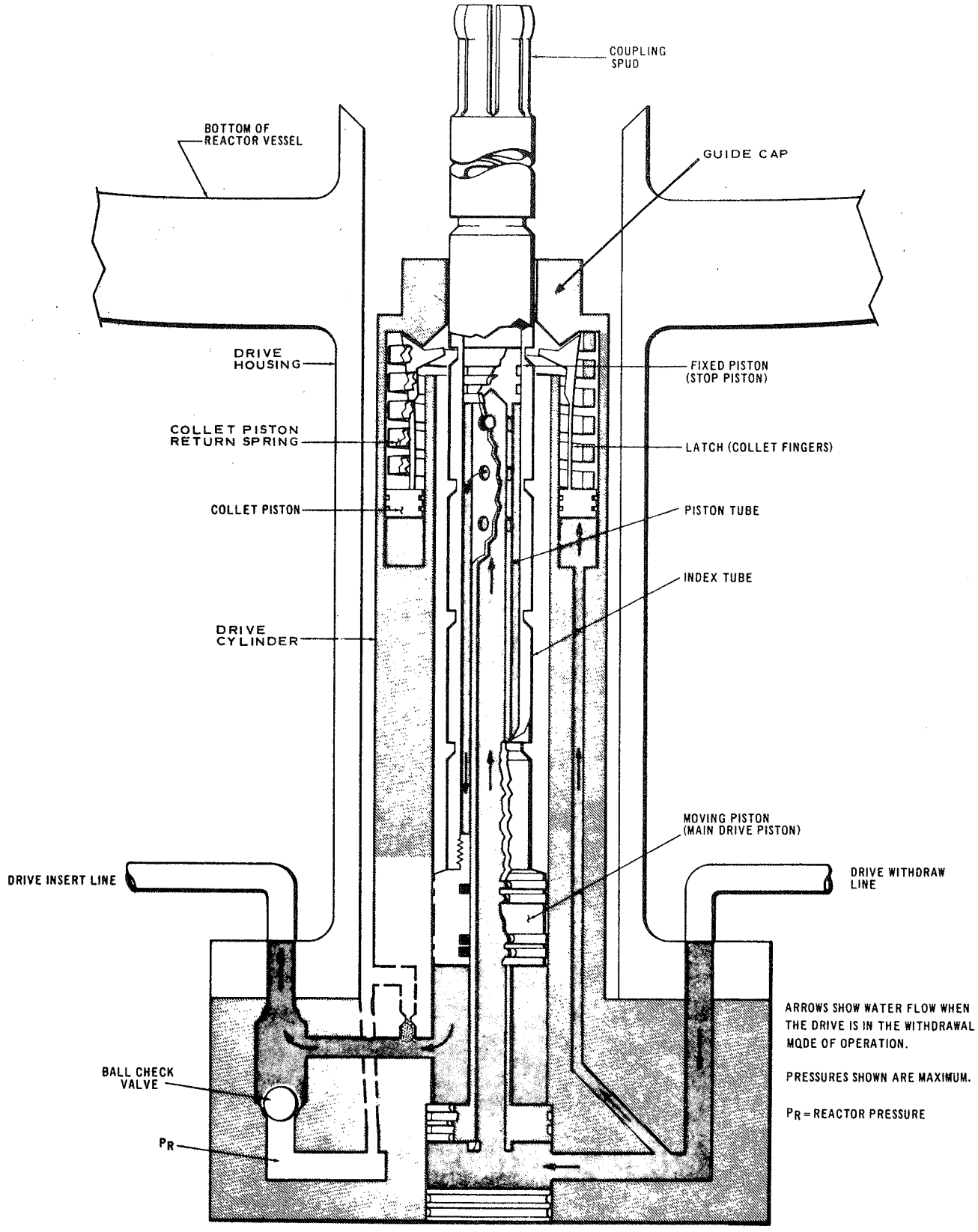
Control Rod to Control Rod
Drive Coupling
Figure III-5-1



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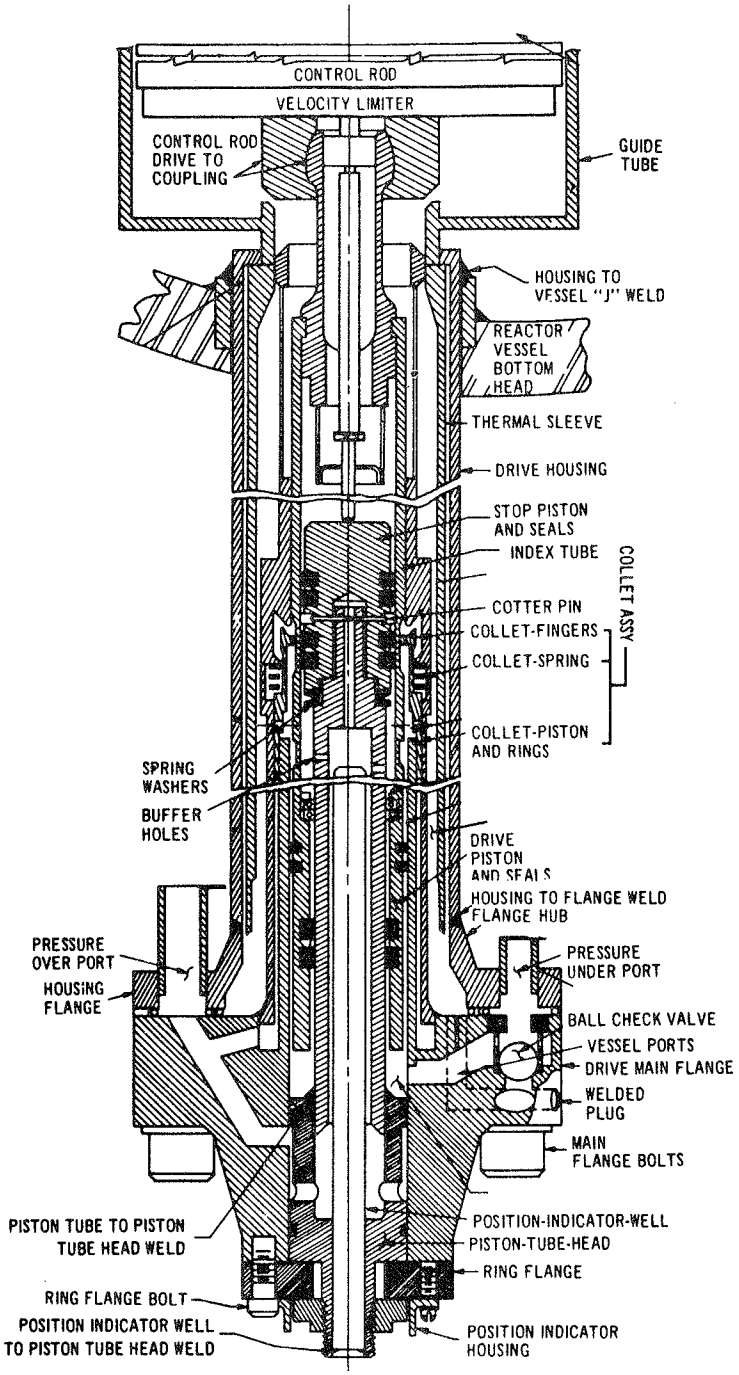
Control Rod Drive Unit
Figure III-5-2



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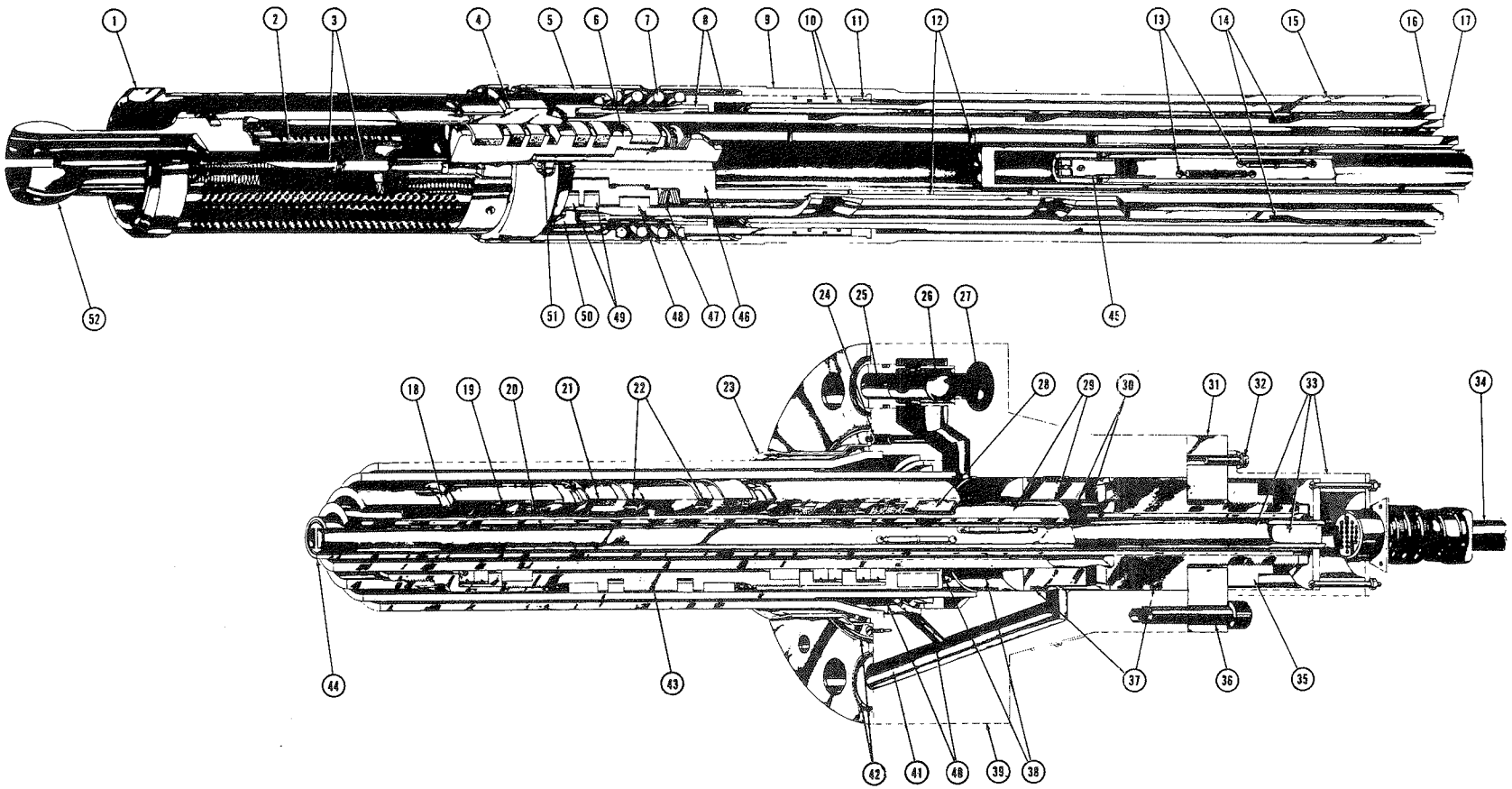
Control Rod Drive Unit
(Schematic)
Figure III-5-3



1. EXTERNAL FILTER ASSEMBLY
2. INTERNAL FILTER ASSEMBLY
3. UNCOUPLING ROD ASSEMBLY
4. GUIDE CAP
5. BARREL
6. STOP PISTON
7. COLLET SPRING
8. COLLET AND COLLET PISTON
9. COLLET HOUSING (Part of cylinder, tube and flange)
10. COLLET PISTON SEALS
11. SPACER (Part of cylinder, tube, and flange)
12. BUFFER ORIFICES (Typical)
13. POSITION INDICATOR SWITCHES (Typical)
14. LOCKING GROOVE (Typical)
15. OUTER TUBE (Part of cylinder, tube, and flange)
16. CYLINDER TUBE
17. INDEX TUBE
18. LOCKING BAND (Typical)
19. INTERNAL PISTON SEAL RINGS (Typical)
20. INTERNAL PISTON BUSHINGS (Typical)
21. EXTERNAL PISTON BUSHINGS
22. EXTERNAL PISTON SEALS
23. STRAINER
24. COOLING WATER ORIFICE
25. DRIVE-INSERT WATER INLET (Normal and scram; drive-withdrawal outlet)
26. BALL-SHUTTLE VALVE
27. REACTOR WATER INLET (Through drive housing)
28. SWITCH-ACTUATING MAGNET (Part of drive piston)
29. PISTON TUBE ASSEMBLY
30. DRIVE-WITHDRAW PORTS AND ANNULUS (Also scram outlet)
31. RING FLANGE
32. MACHINE SCREW (Typical)
33. POSITION INDICATOR PROBE
34. POSITION INDICATOR CABLE
35. PISTON TUBE NUT
36. CAP SCREW (Typical)
37. O-RING SEALS
38. DRIVE-INSERT PORTS AND ANNULUS
39. DRIVE FLANGE (Part of cylinder, tube, and flange)
40. UNLOCKING PORT AND ANNULUS (Withdraw pressure to collet piston)
41. DRIVE-WITHDRAW WATER INLET (Also outlet for scram water)
42. METAL O-RING SEAL (Drive to housing)
43. DRIVE PISTON
44. INDICATOR TUBE (Part of piston tube)
45. THERMOCOUPLE (Part of position indicator probe)
46. STUD (Part of piston tube)
47. SPRING WASHERS
48. STOP PISTON BUSHINGS(Typical)
49. STOP PISTON SEAL RINGS (Typical)
50. COLLET FINGER (Typical)
51. COTTER PIN
52. COUPLING SPUD

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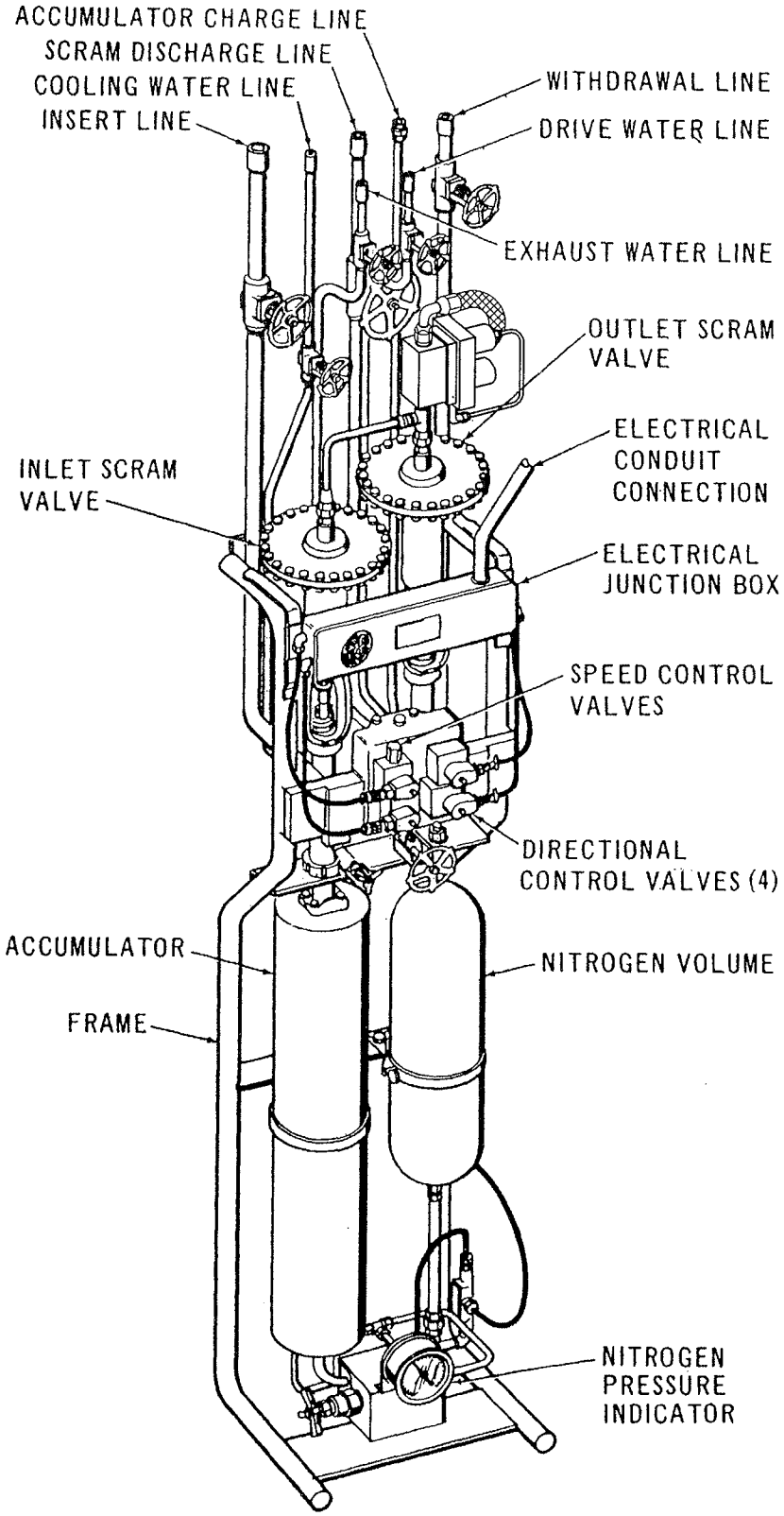
Control Rod Drive Unit
(Cutaway)
Figure III-5-4



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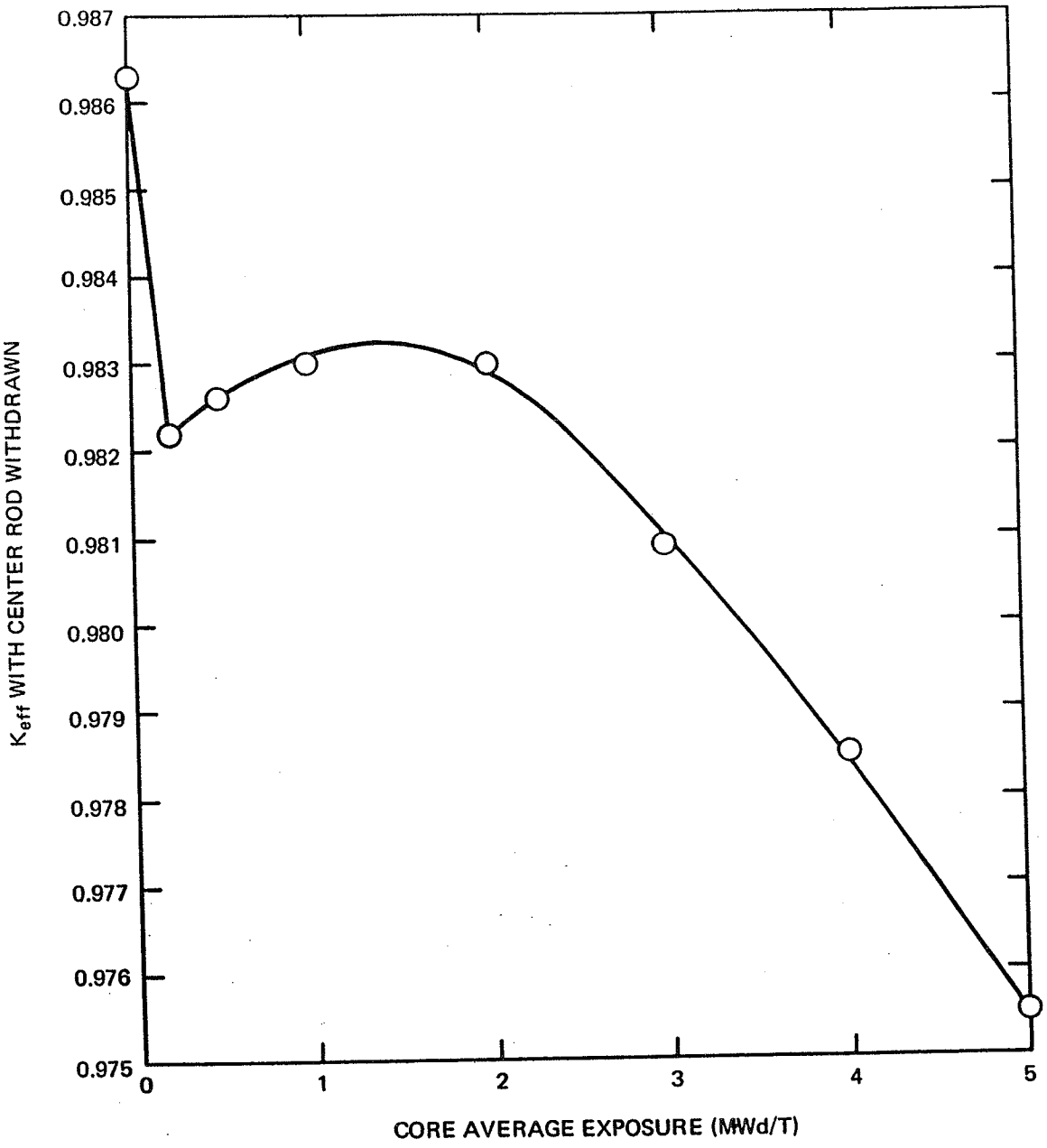
CONTROL ROD DRIVE HYDRAULIC CONTROL UNIT
Figure III–5–8
6/8/04

CADD FILE: C0051214



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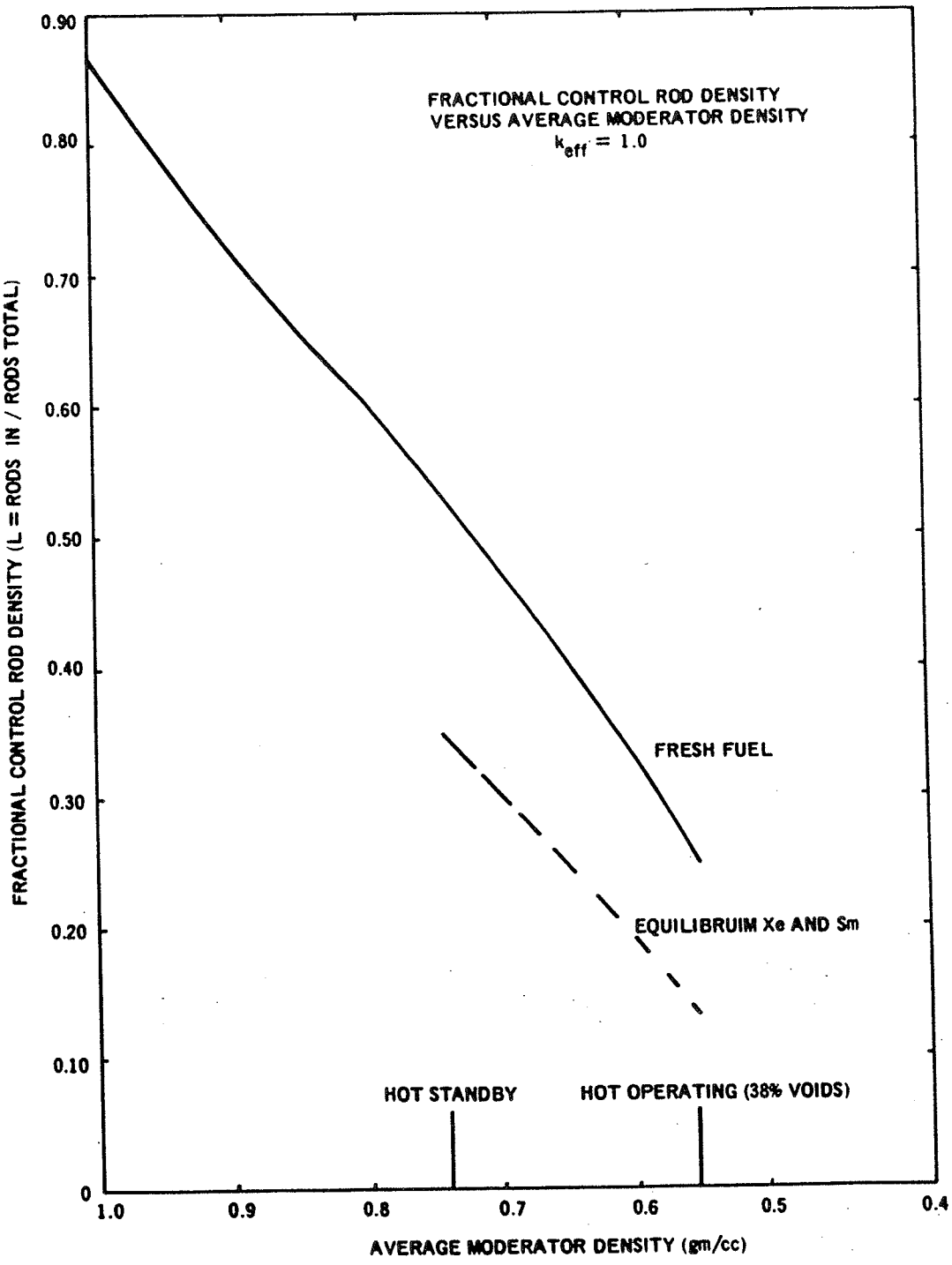
Generic Figure
Stuck Rod Margin as Function of
Core Average Exposure
Figure III-6-1 03/08/00



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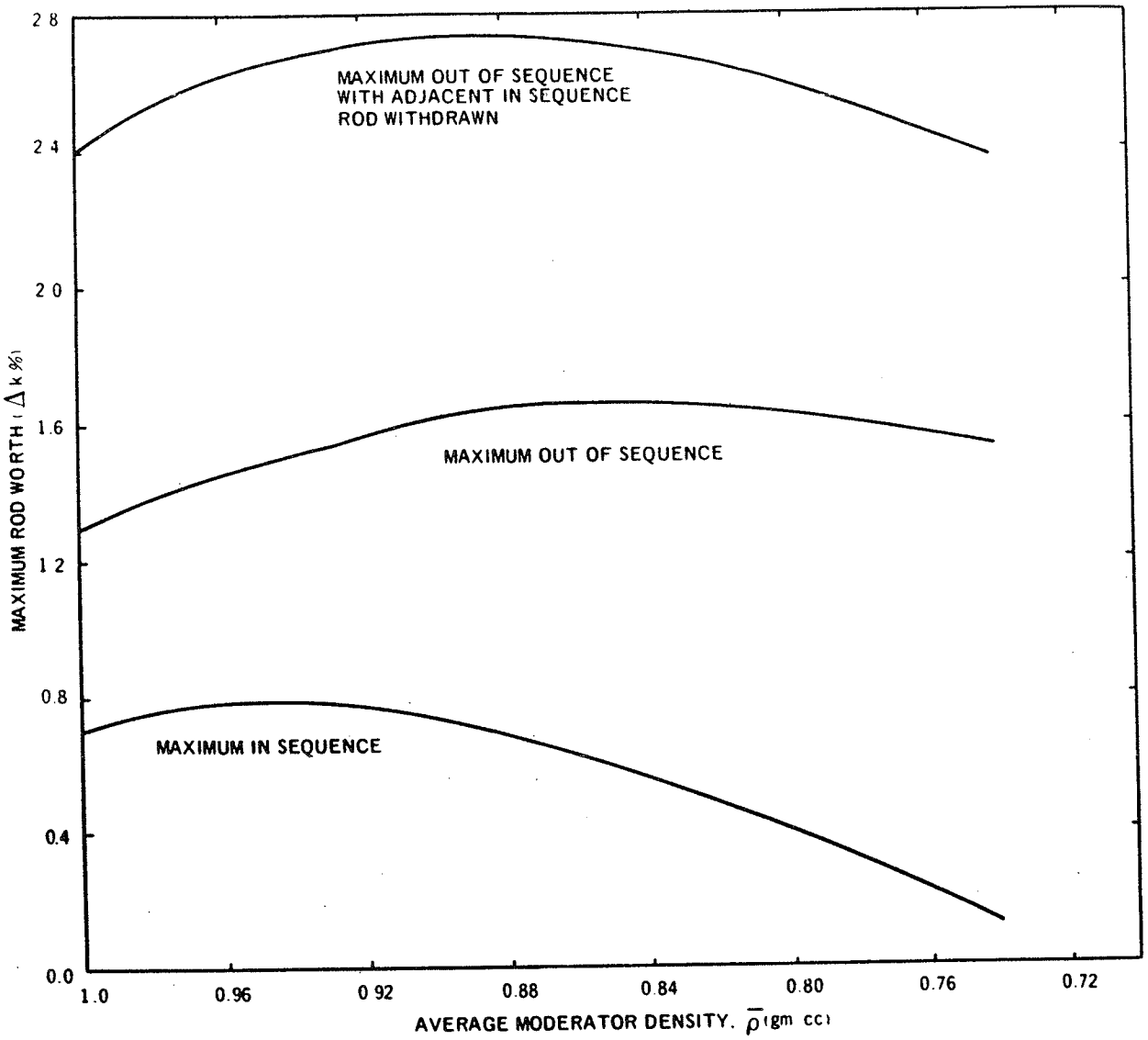
UPDATED SAFETY ANALYSIS REPORT (USAR)

Generic Figure
Fractional Control Rod Density
Versus Average Moderator Density
Figure III-6-2 03/08/00



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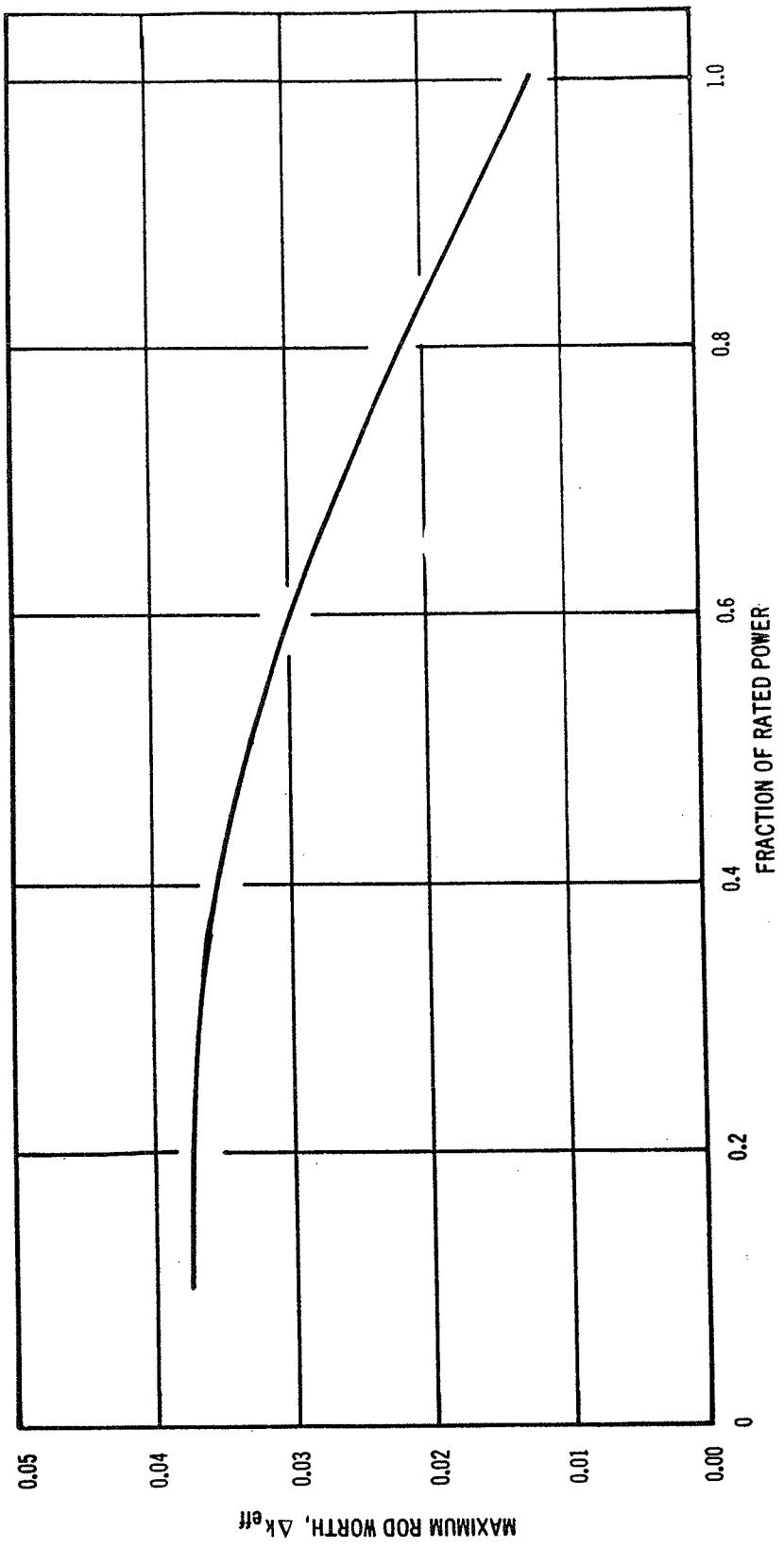
Generic Figure
Maximum Rod Worth
Versus Moderator Density
Figure III-6-3 03/08/00



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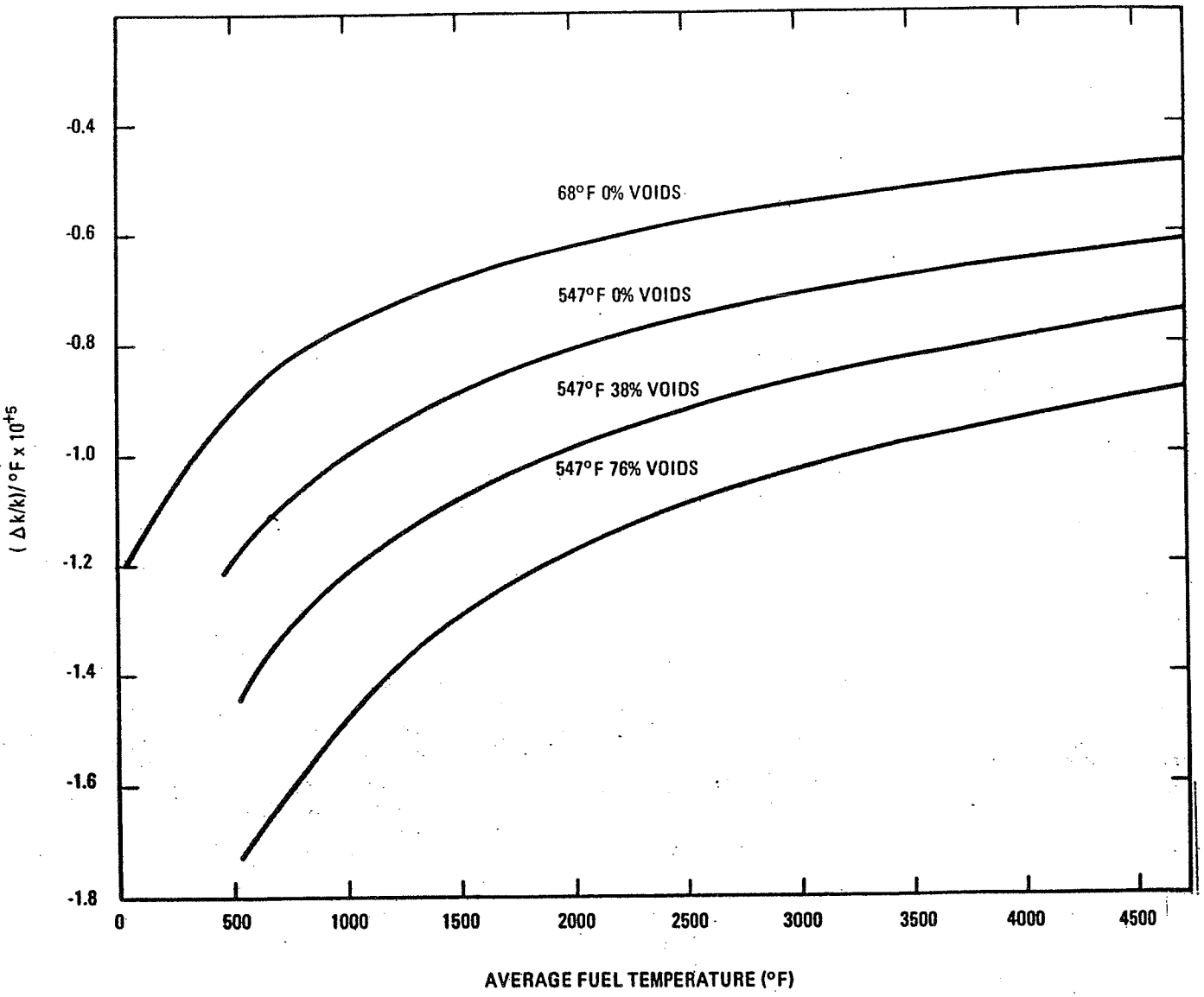
Generic Figure
Maximum Rod Worth
Versus Power Level
Figure III-6-4 03/08/00



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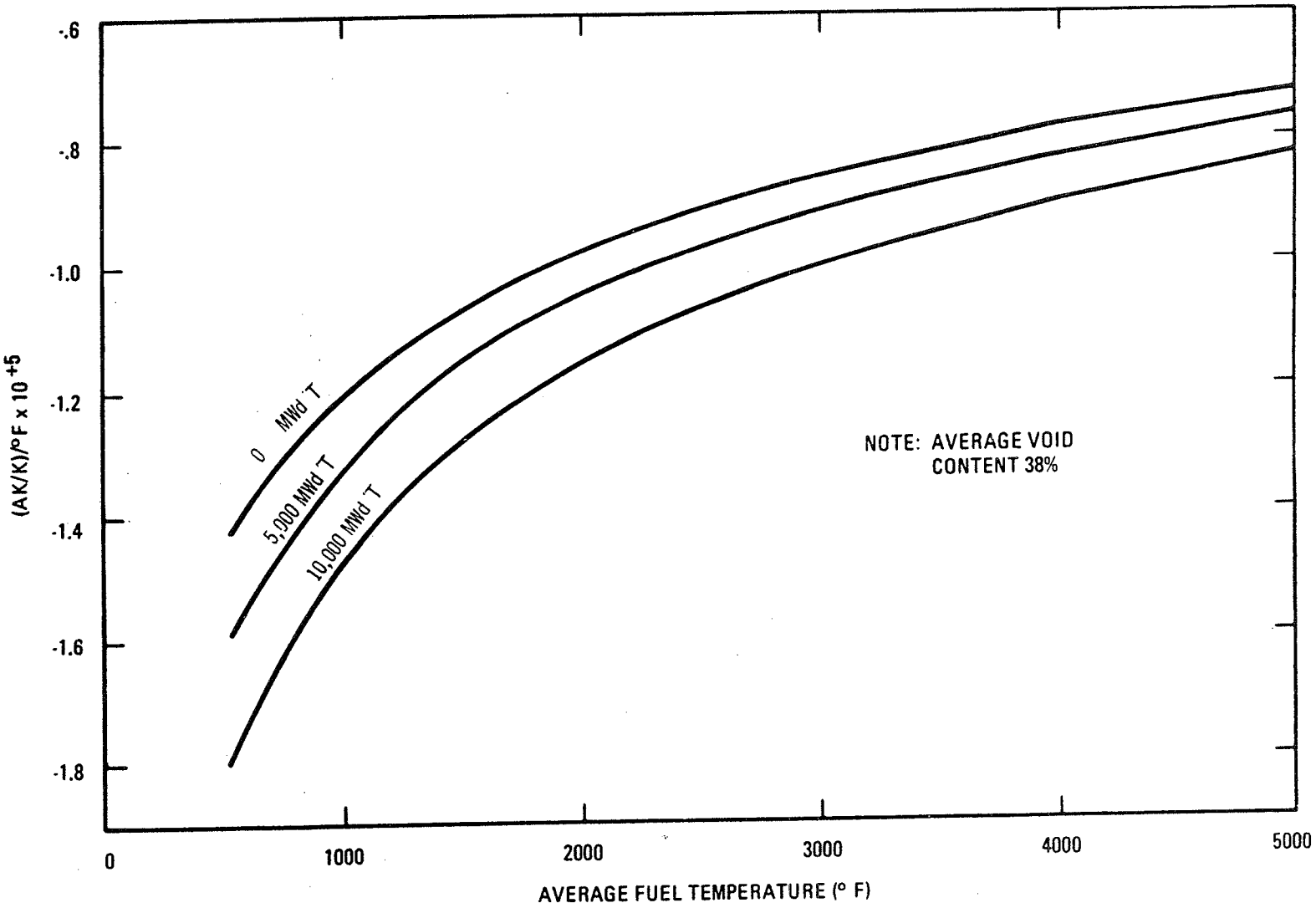
Generic Figure
Doppler Coefficient of Reactivity
Figure III-6-5 03/08/00



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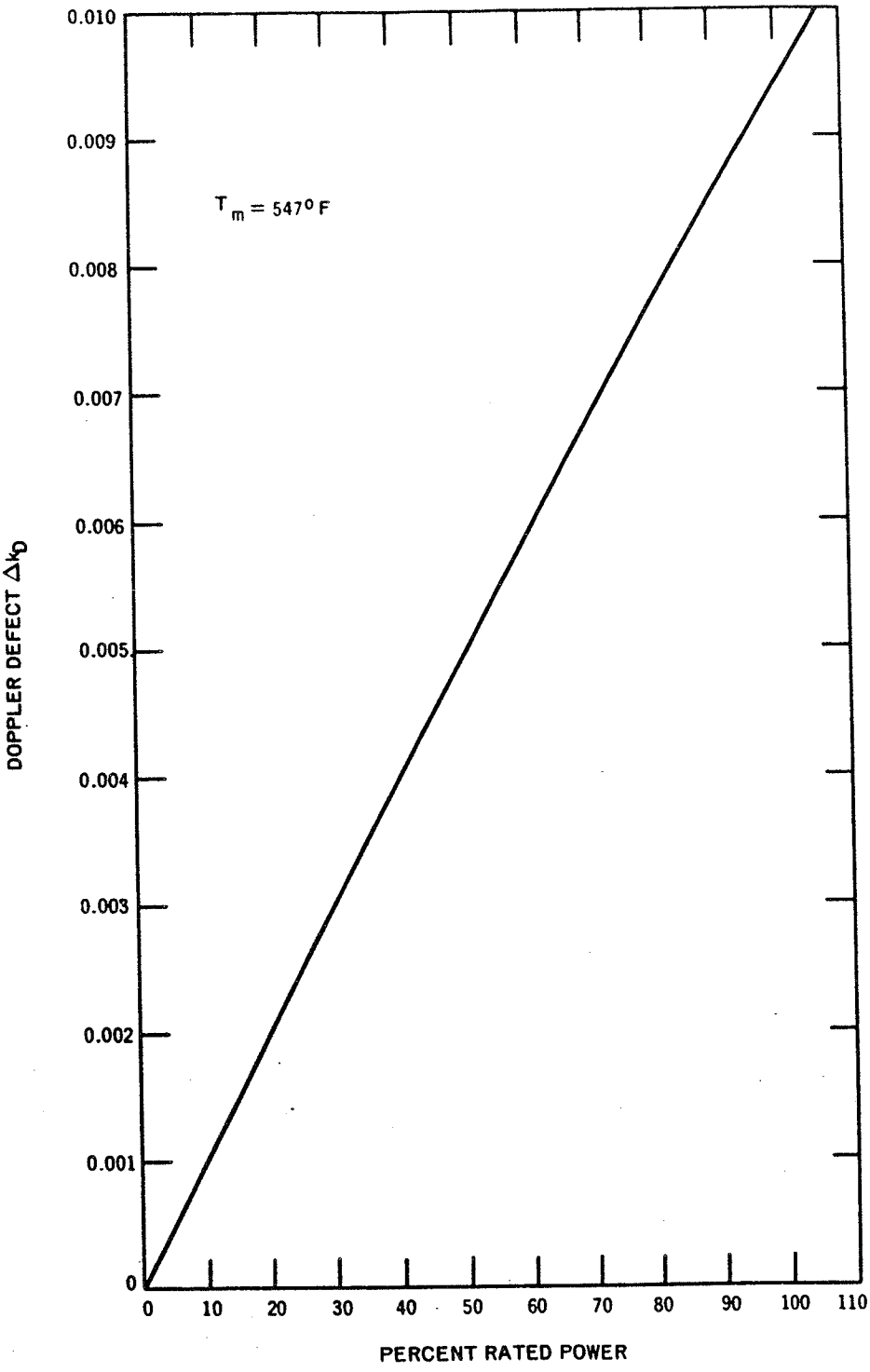
Generic Figure
Doppler Coefficient as
Function of Fuel Exposure
Figure III-6-6 03/08/00



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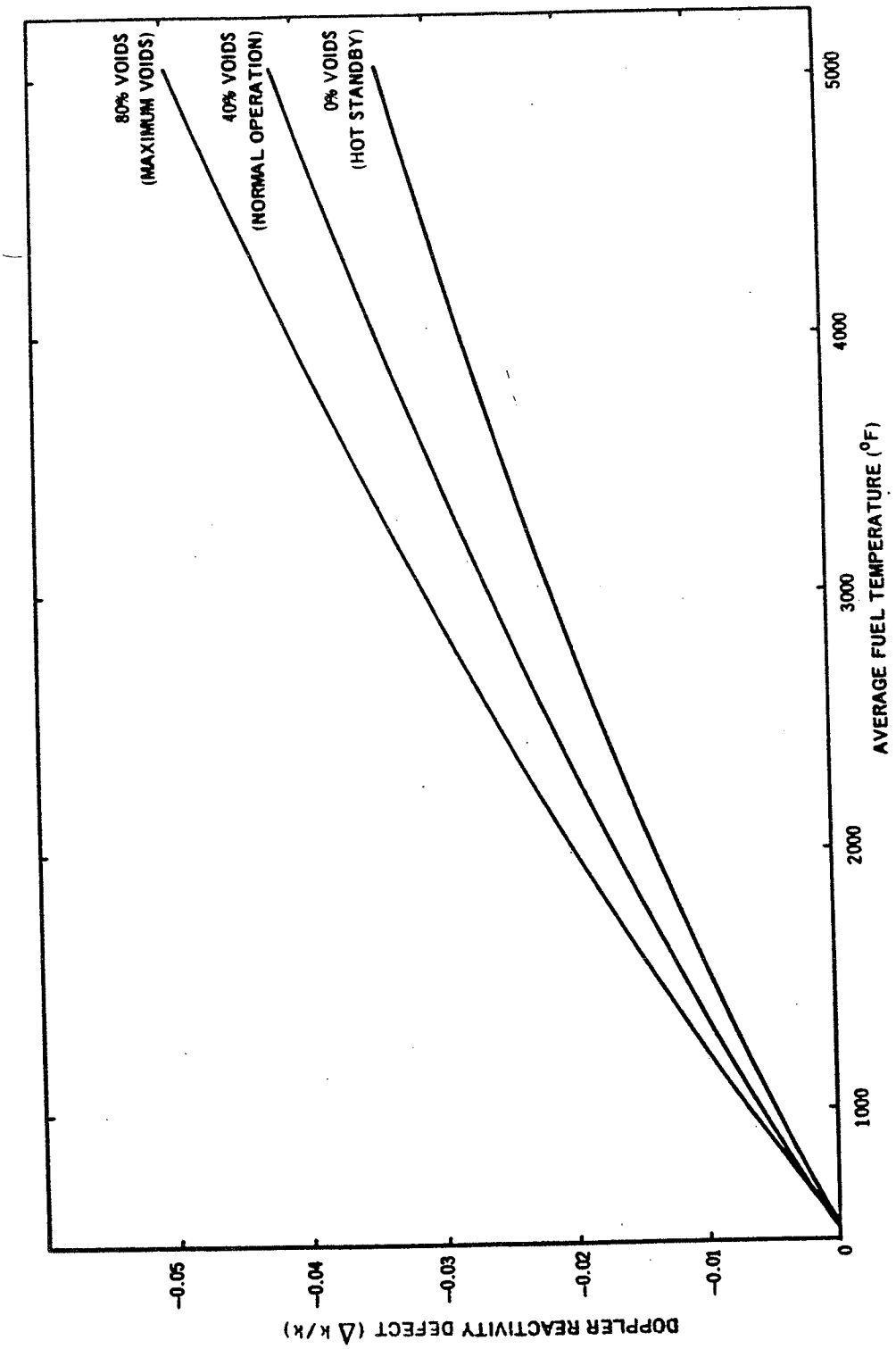
Generic Figure
Core Average Doppler Defect
Versus Core Power Level
Figure III-6-7 03/08/00



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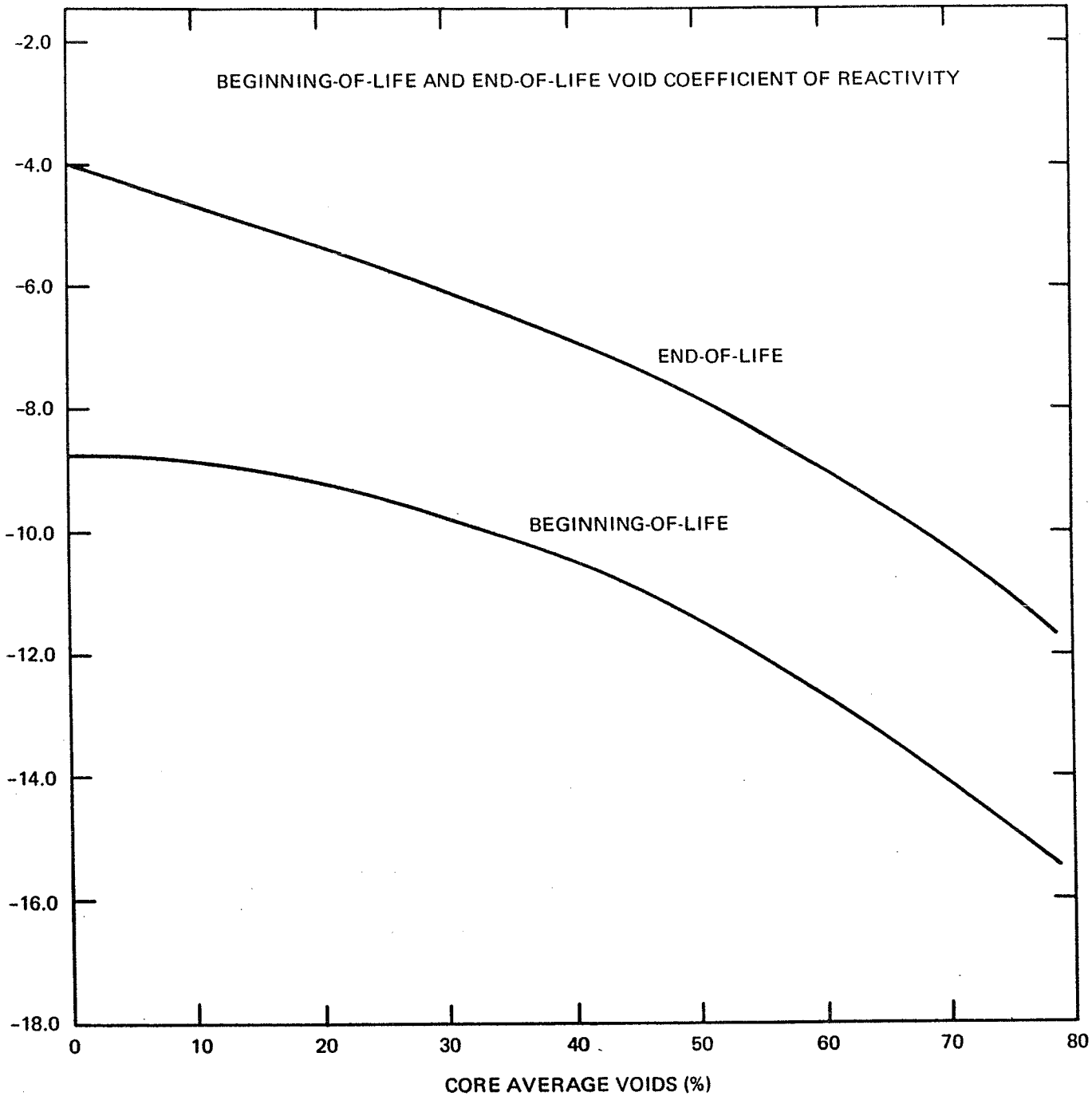
Generic Figure
Doppler Defect
Versus Fuel Temperature
Figure III-6-8 03/08/00



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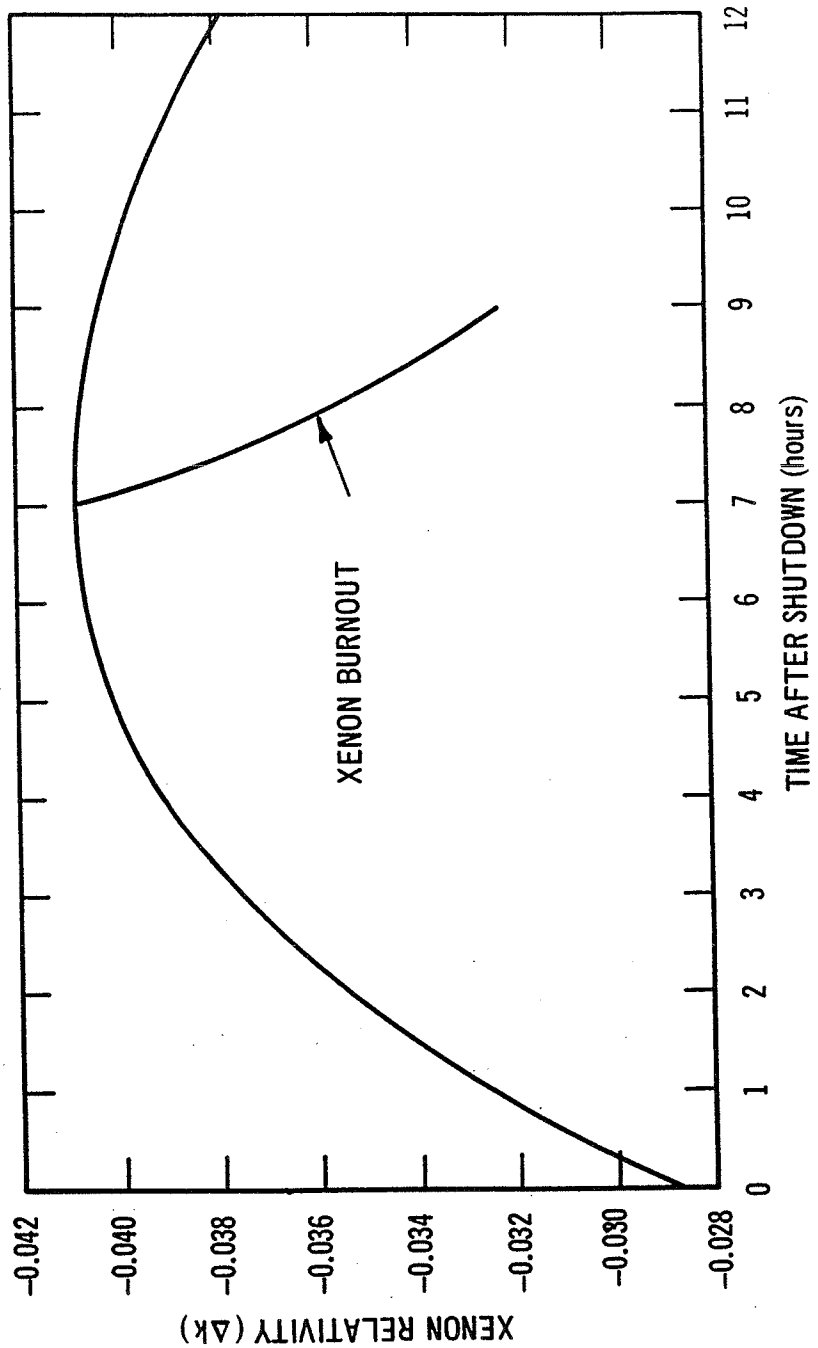
Generic Figure
Moderator Void Coefficient
of Reactivity
Figure III-6-9 03/08/00



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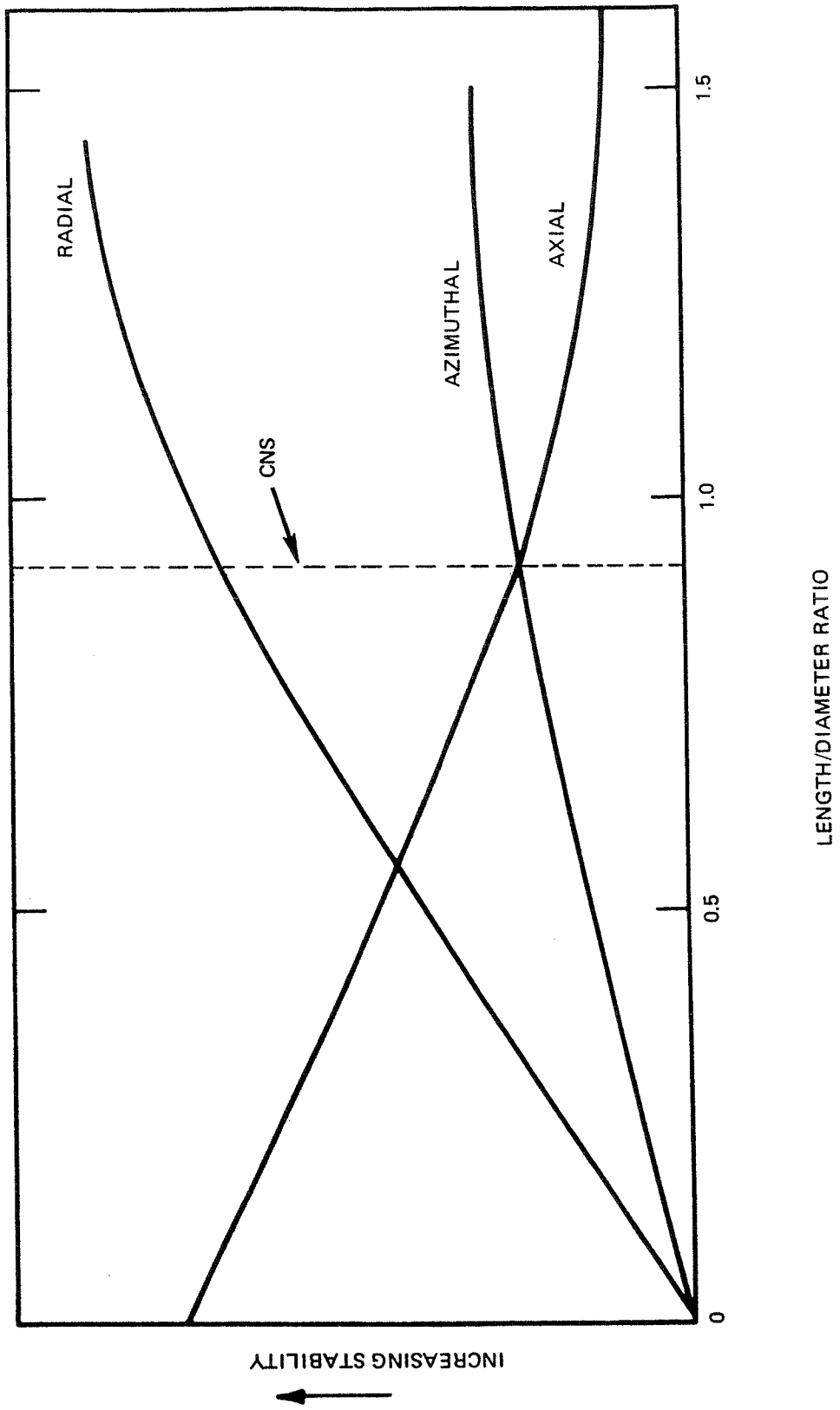
Generic Figure
Xenon Reactivity Buildup After Shutdown - Beginning of Life
Figure III-6-10 03/08/00



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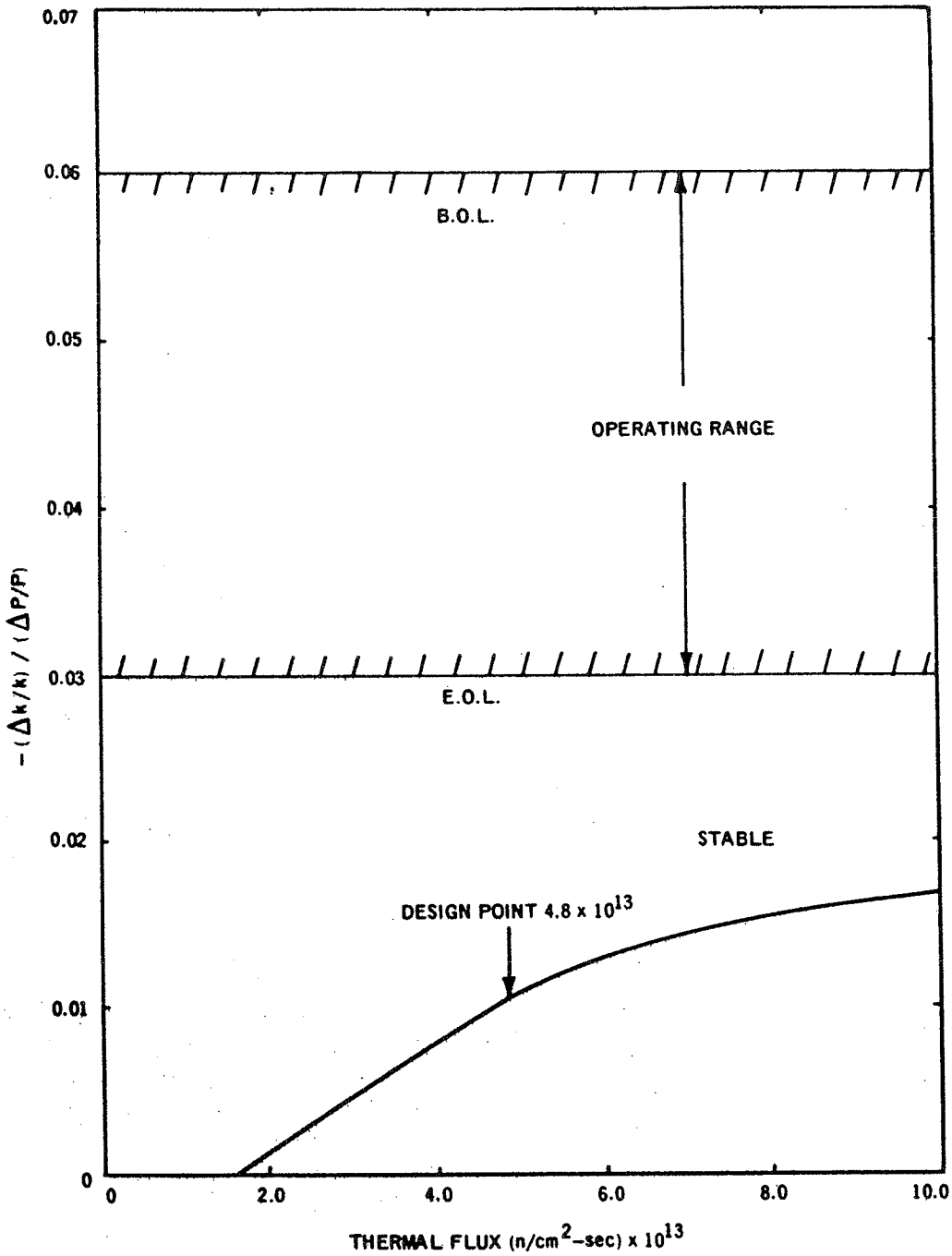
Generic Figure
Relative Xenon Stability with
No Flux Flattening
Figure III-6-11 03/08/00



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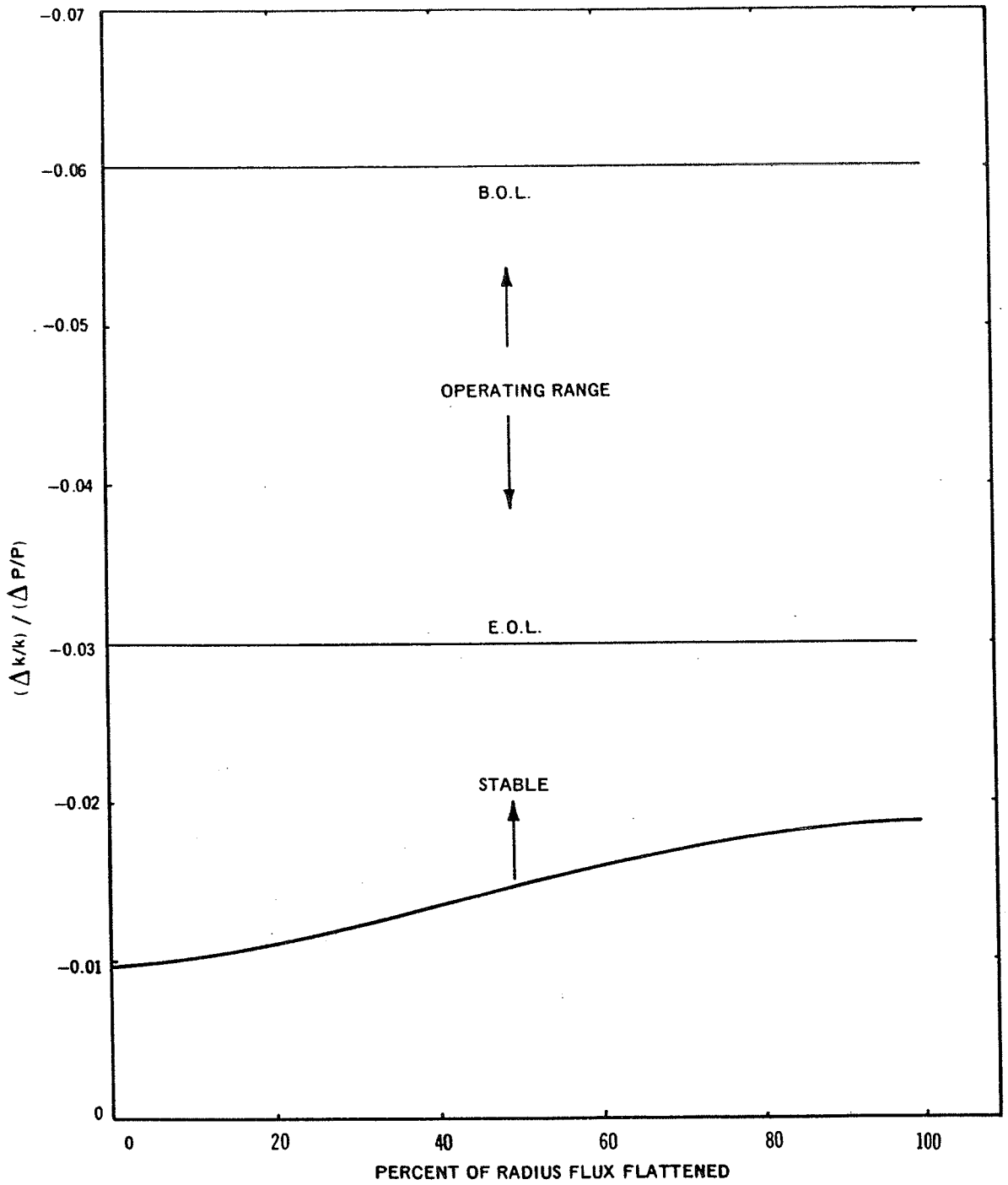
Generic Figure
Effect of Power Density on Axial Xenon
Stability Including Void Transport
Figure III-6-12 03/08/00



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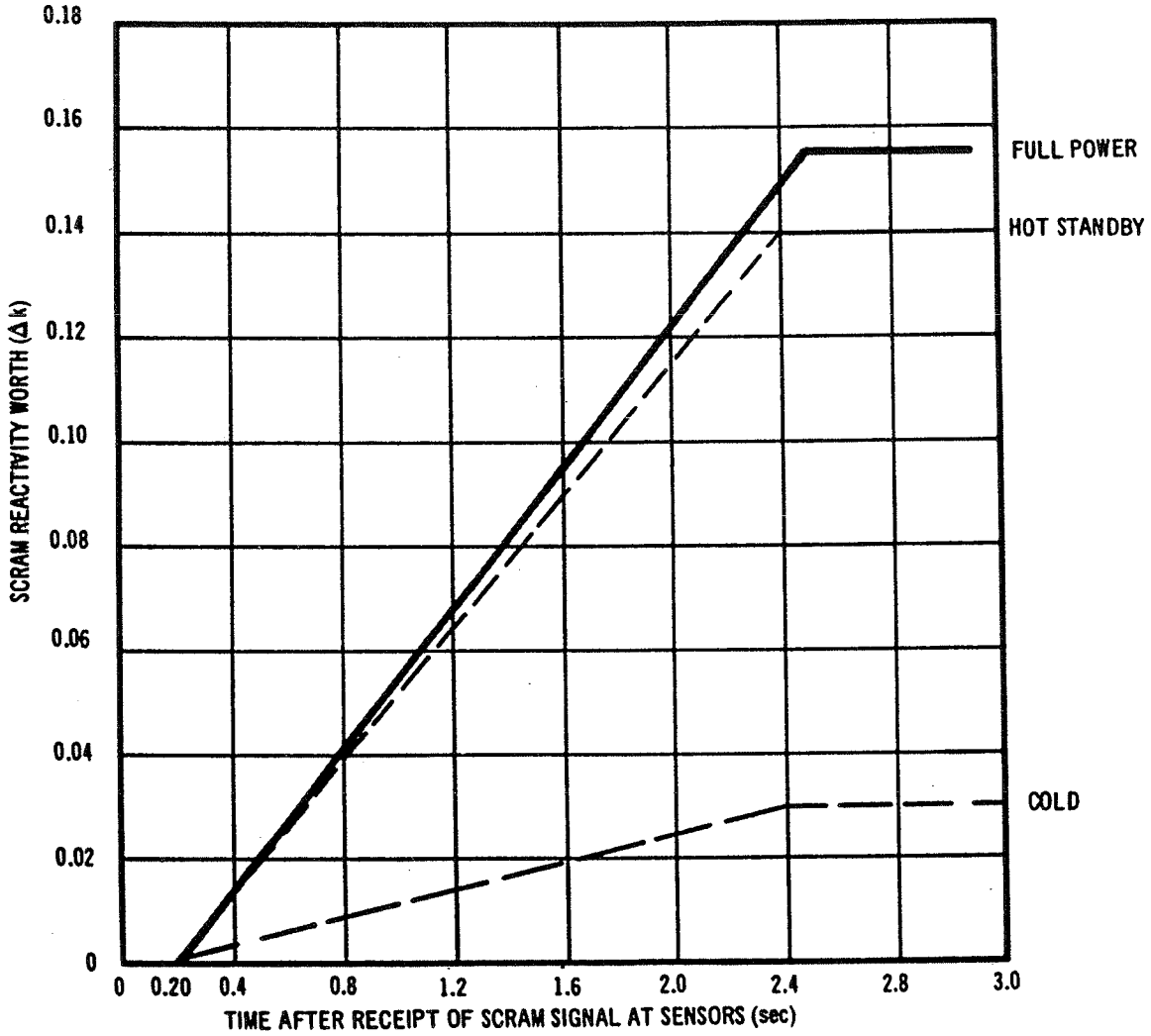
Generic Figure
Azimuthal Xenon Stability
Figure III-6-13 03/08/00



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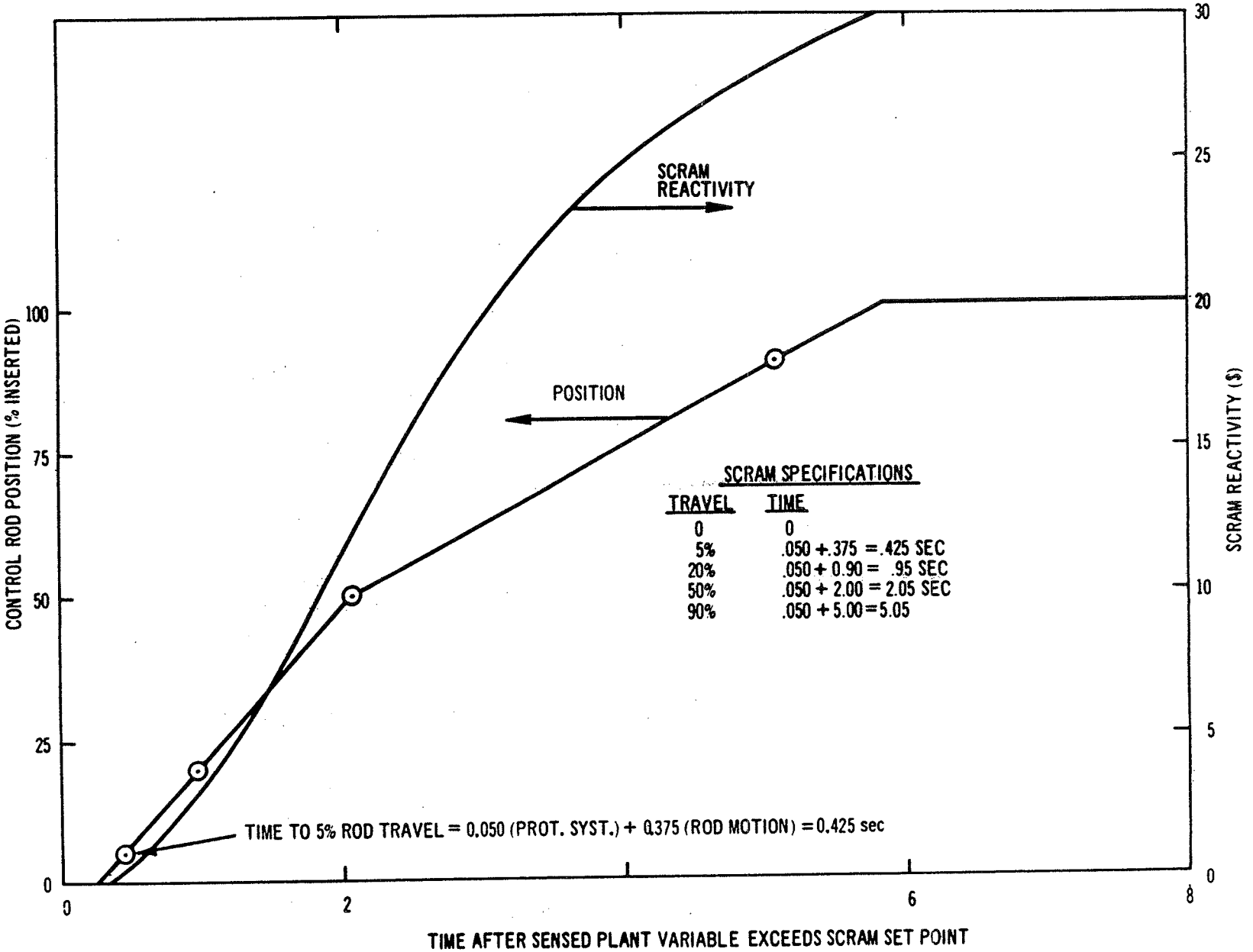
Generic Figure
Control Rod Scram Reactivity
Characteristics Excursion Analysis
Figure III-6-14 03/08/00



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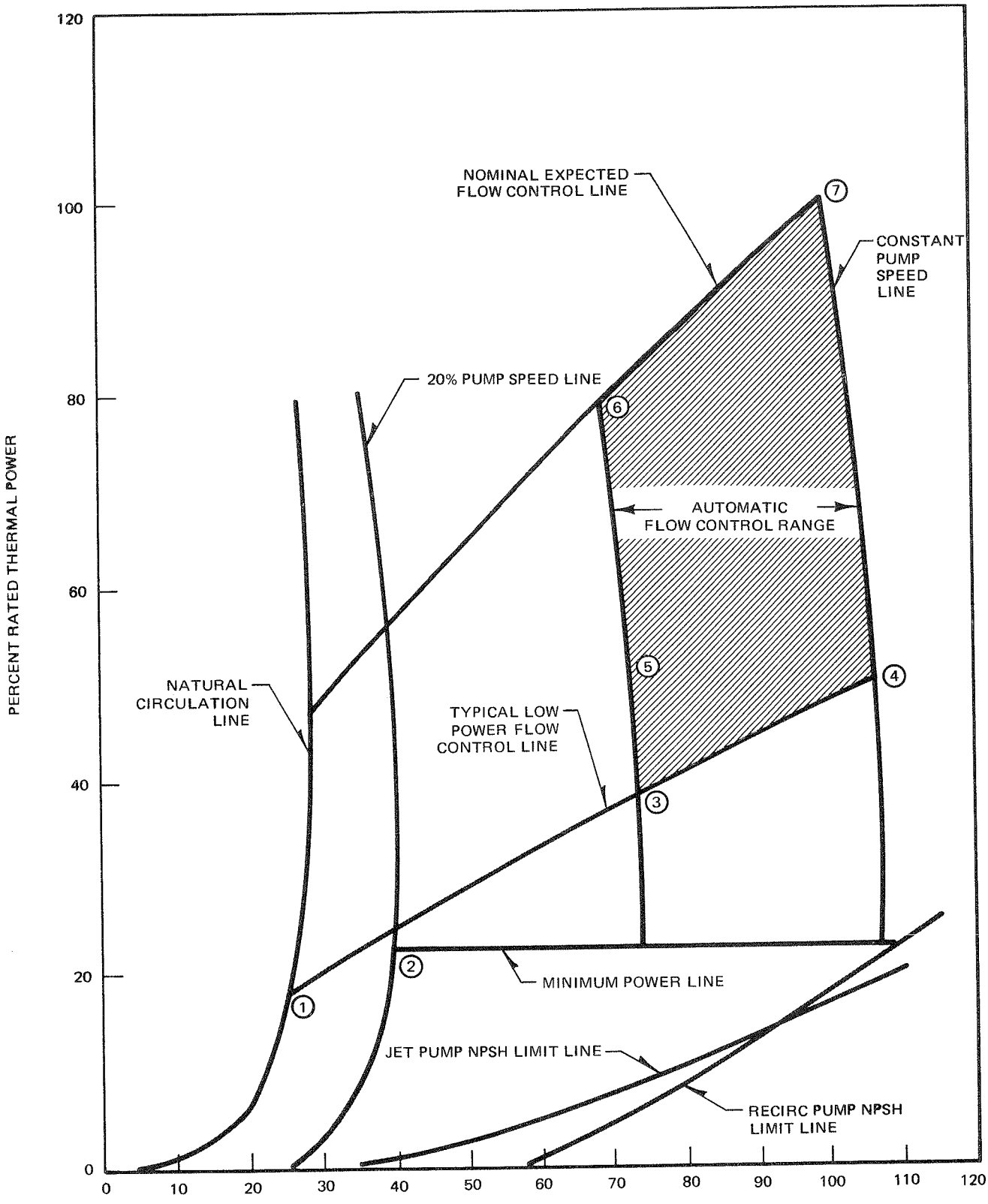
Generic Figure
Scram Characteristics Assumed
for Transient Analysis
Figure III-6-15 03/08/00



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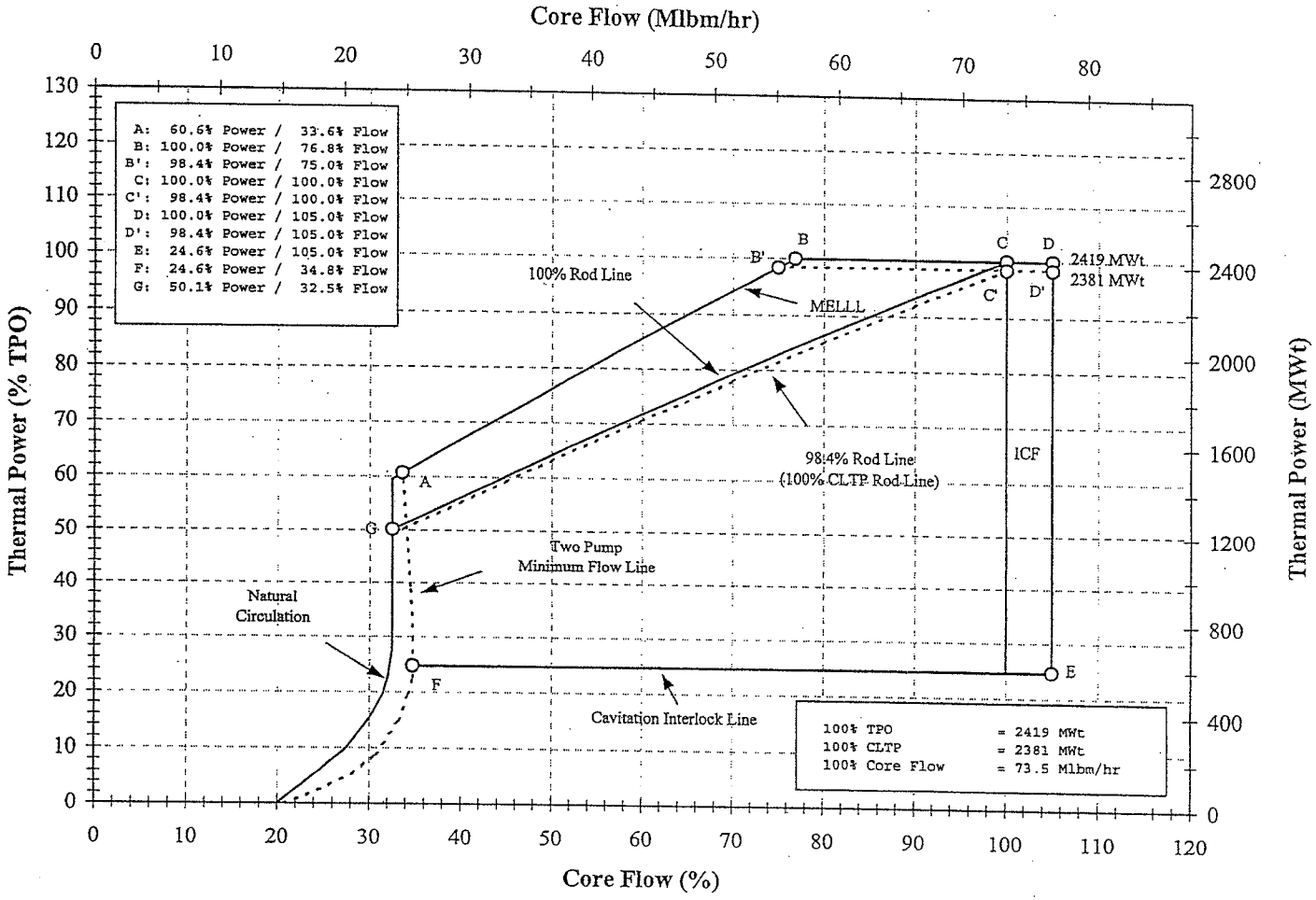
Operating Map
Figure III-7-1a



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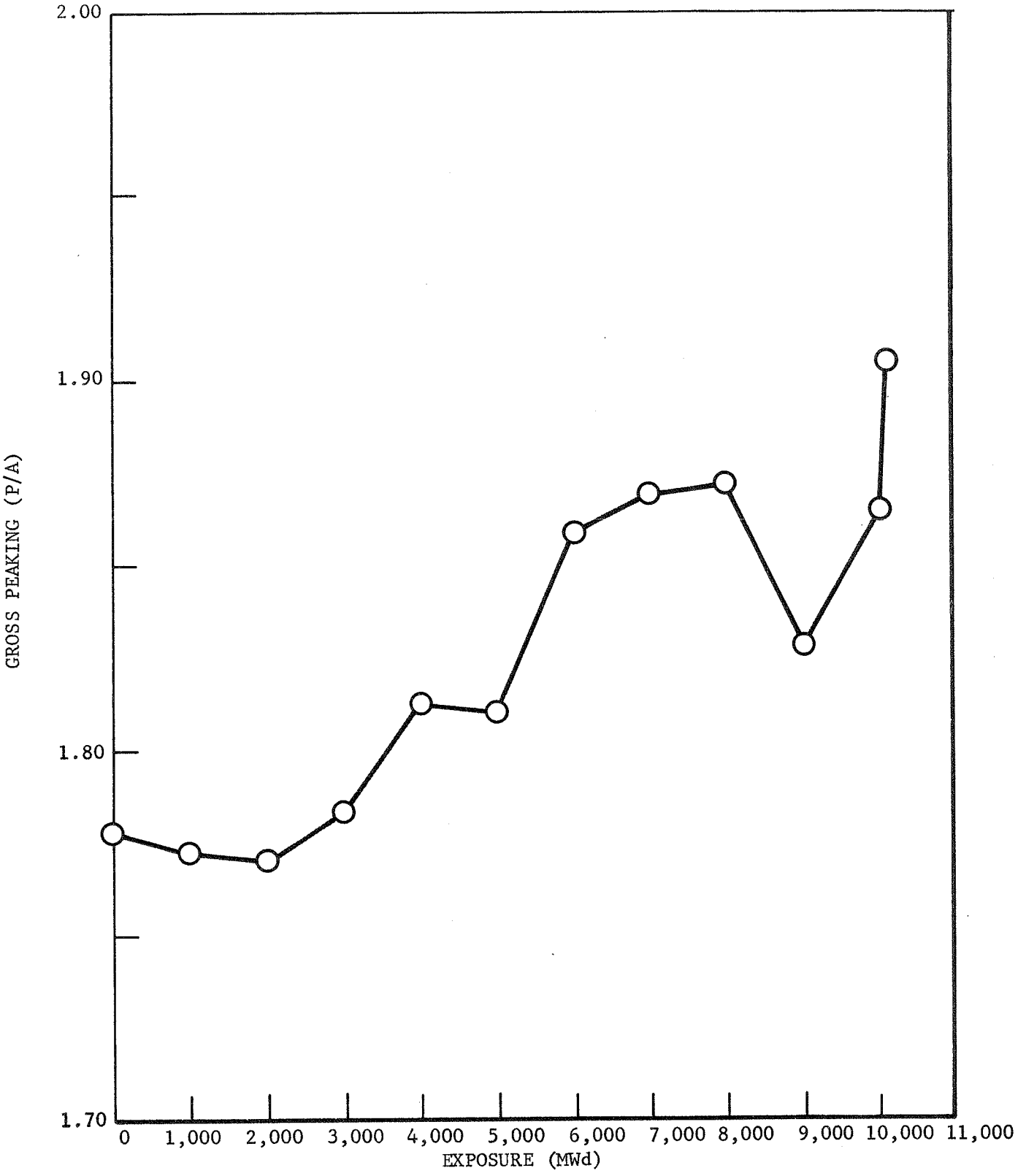
Power/Flow Map
MELLL and ICF
Figure III-7-1b 08/07/08



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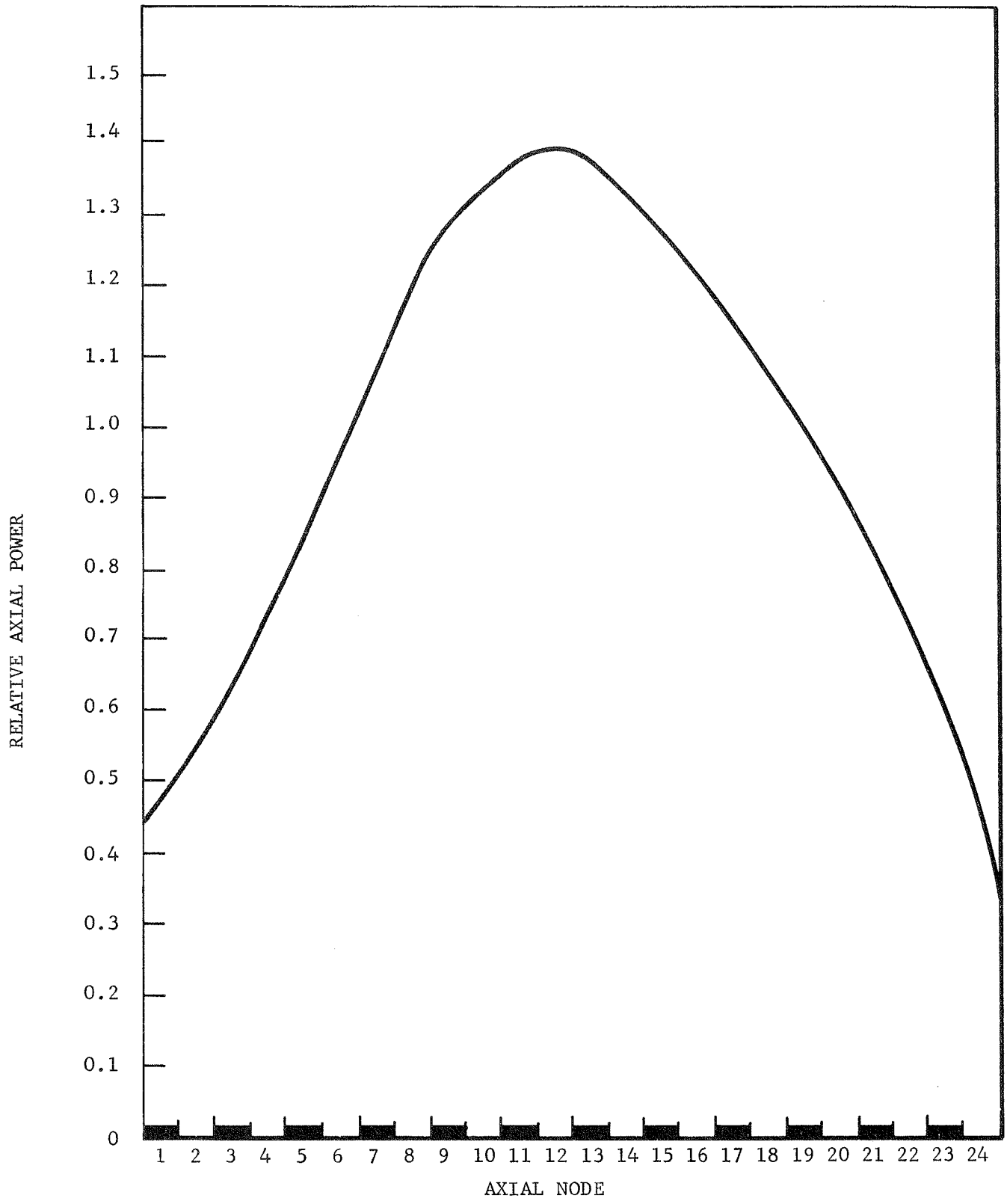
Gross Power Peaking
versus Exposure
Figure III-7-3



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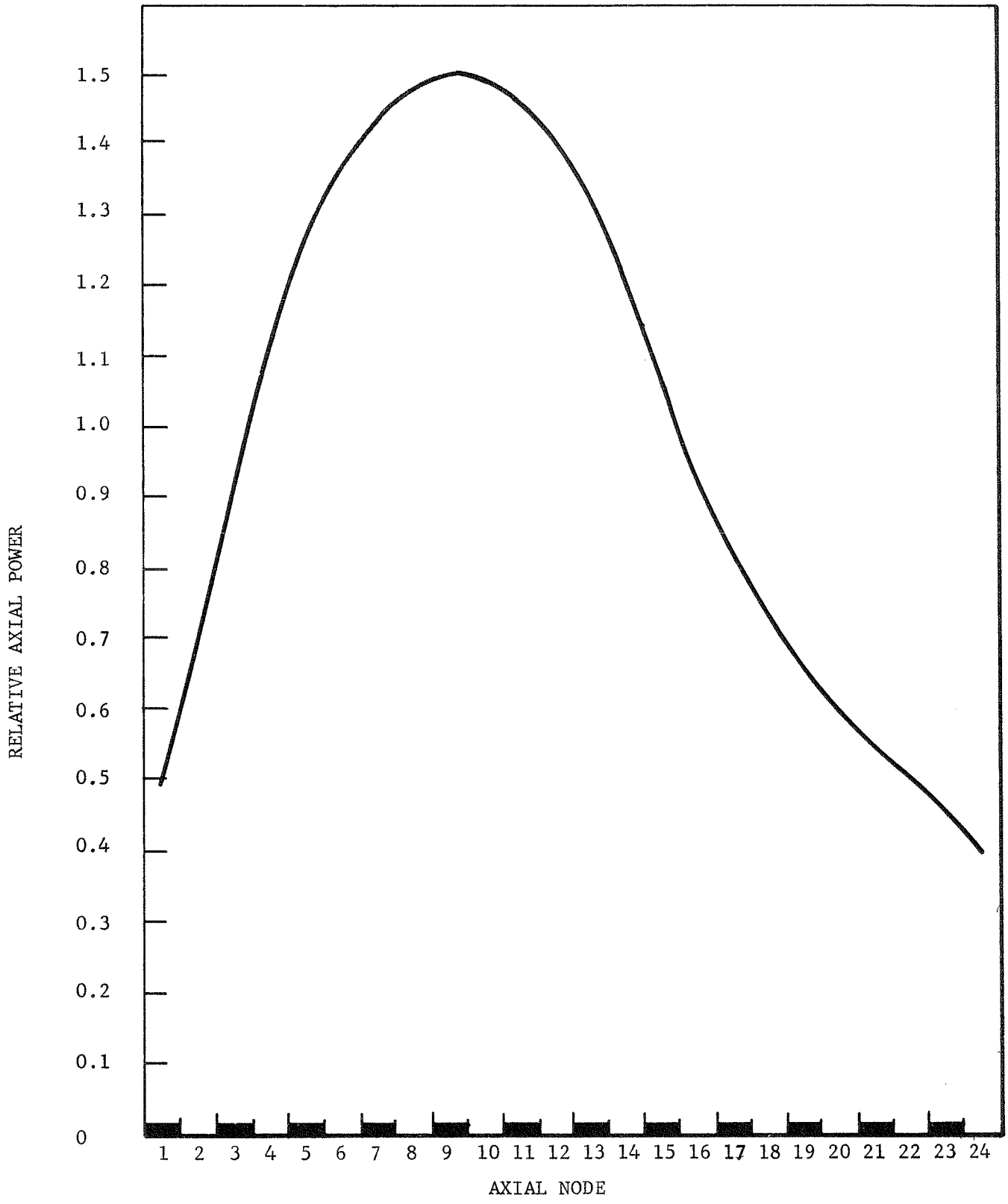
Axial Power Distribution
(Case 1)
Figure III-7-4a



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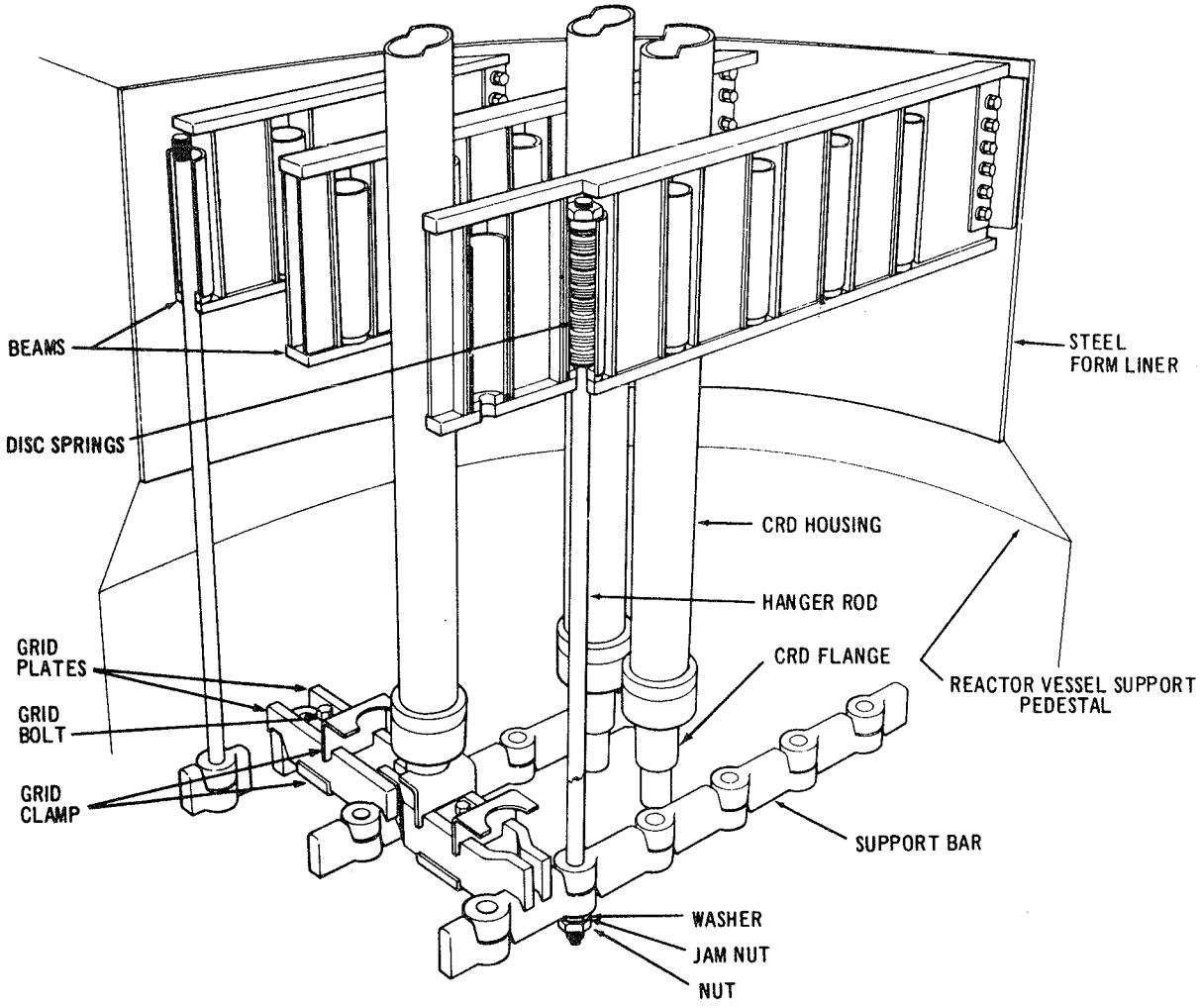
Axial Power Distribution
(Case 2)
Figure III-7-4b



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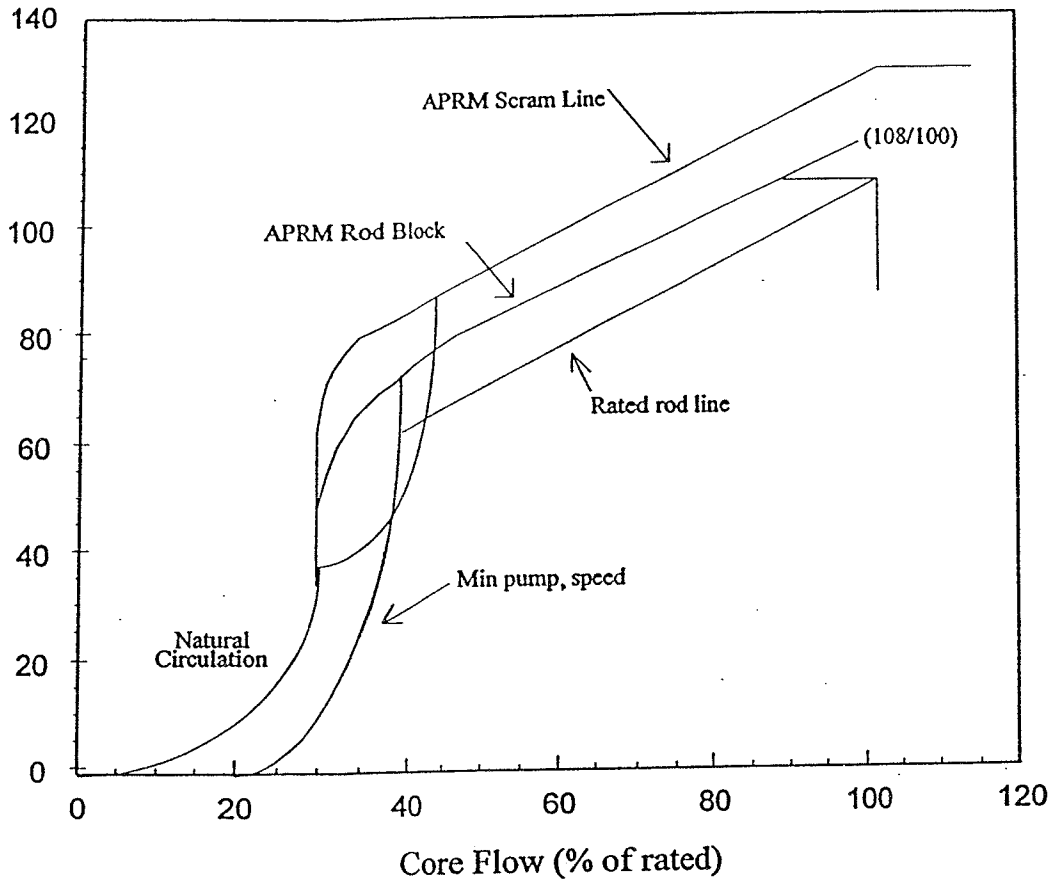
Control Rod Drive Housing Support
Figure III-8-1

Figure 10.1



$$P = P_B\left(\frac{P_A}{P_B}\right)^{\frac{1}{2}\left[\frac{W-W_B}{W_A-W_B}+\left(\frac{W-W_B}{W_A-W_B}\right)^2\right]}.$$

where,

P = a core thermal power value on the Exclusion Region boundary (% of rated),

W = the core flow rate corresponding to power, P, on the Exclusion Region boundary (% of rated),

P_A = core thermal power at State Point A (% of rated),

P_B = core thermal power at State Point B (% of rated),

W_A = core flow rate at State Point A (% of rated),

W_B = core flow rate at State Point B (% of rated),

Coordinates of Exclusion Region Boundary

Point #	Power (%)	Flow (%)
A	75.4	43.8
B	36.3	30.0

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Power to Flow Operating Map
Figure III-10-1
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