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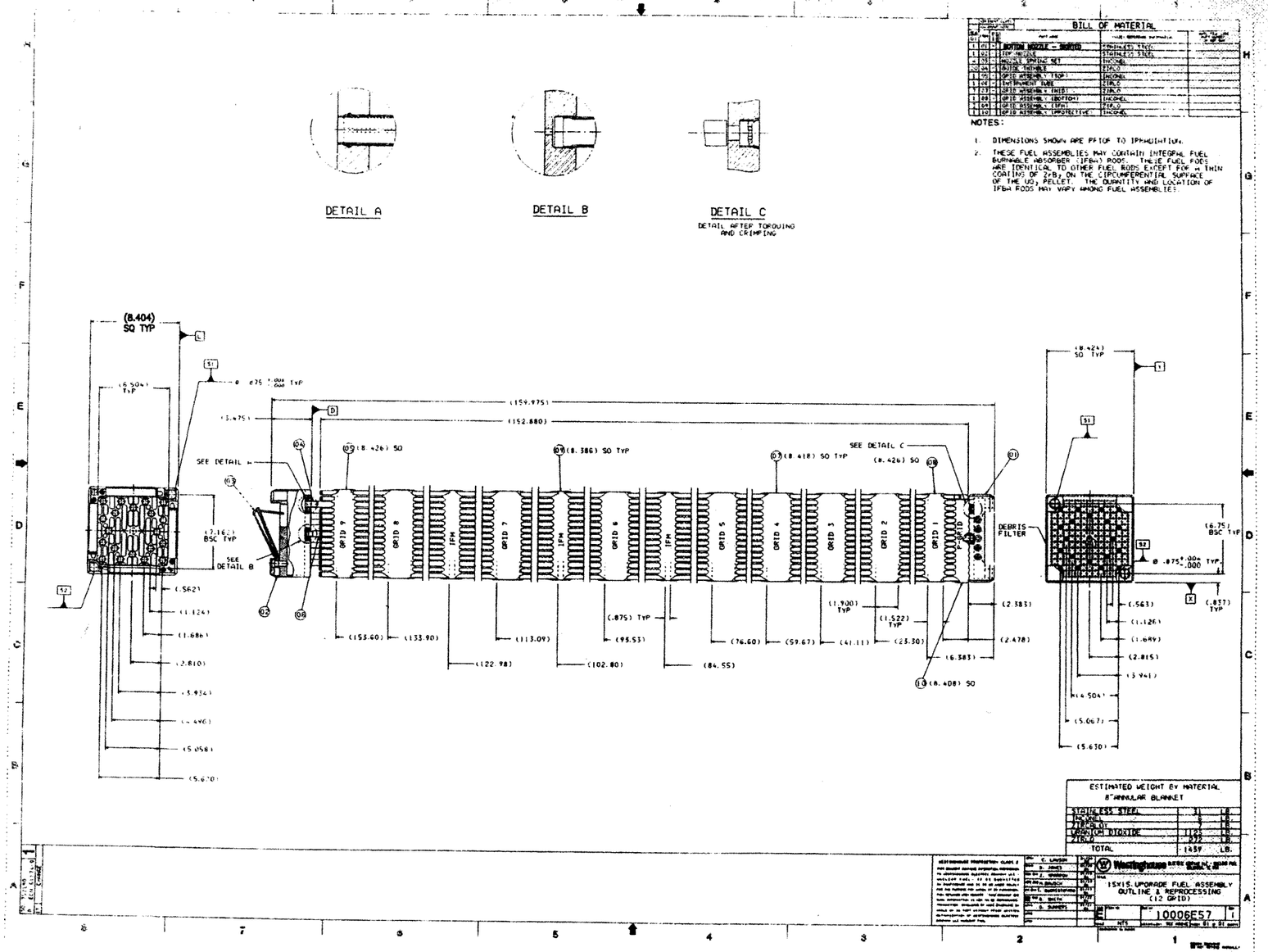
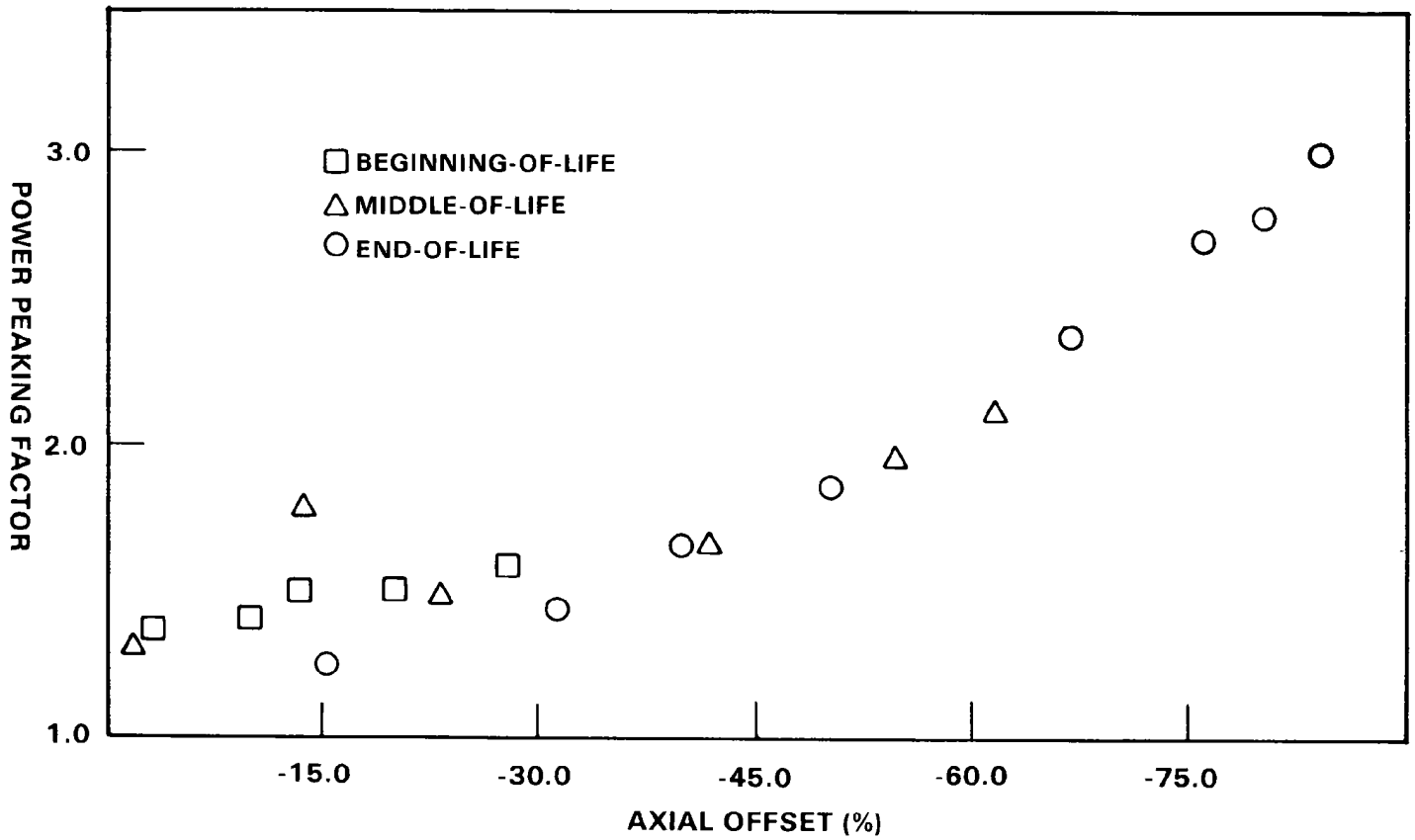


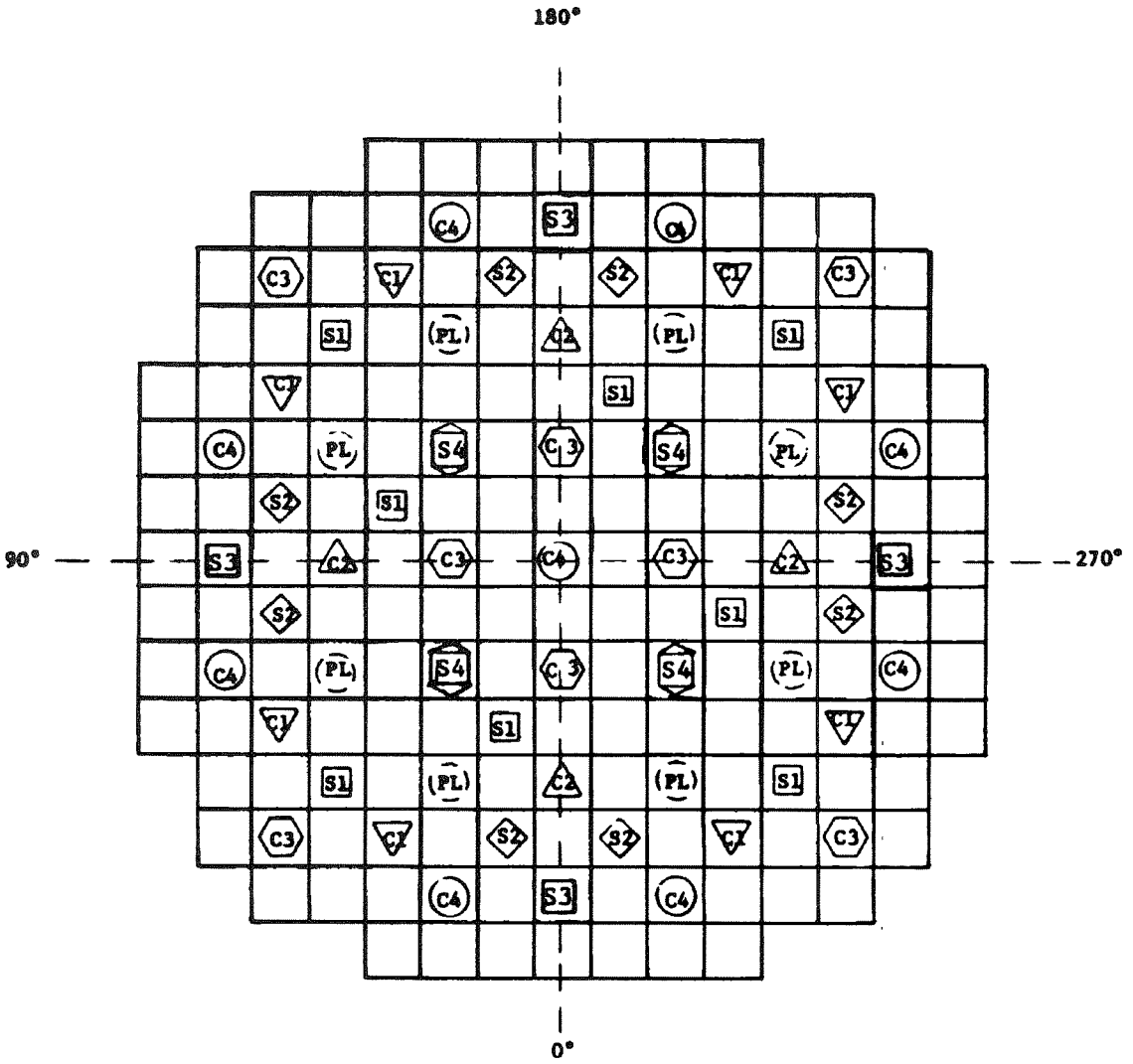
INDIAN POINT UNIT No. 2

15 X 15 UPGRADED FUEL ASSEMBLY

UFSAR FIGURE 3.2-61C | REV. No. 19



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-1 TYPICAL POWER PEAKING FACTOR VERSUS AXIAL OFFSET	
MIC. No. 1999MC3583	REV. No. 17B



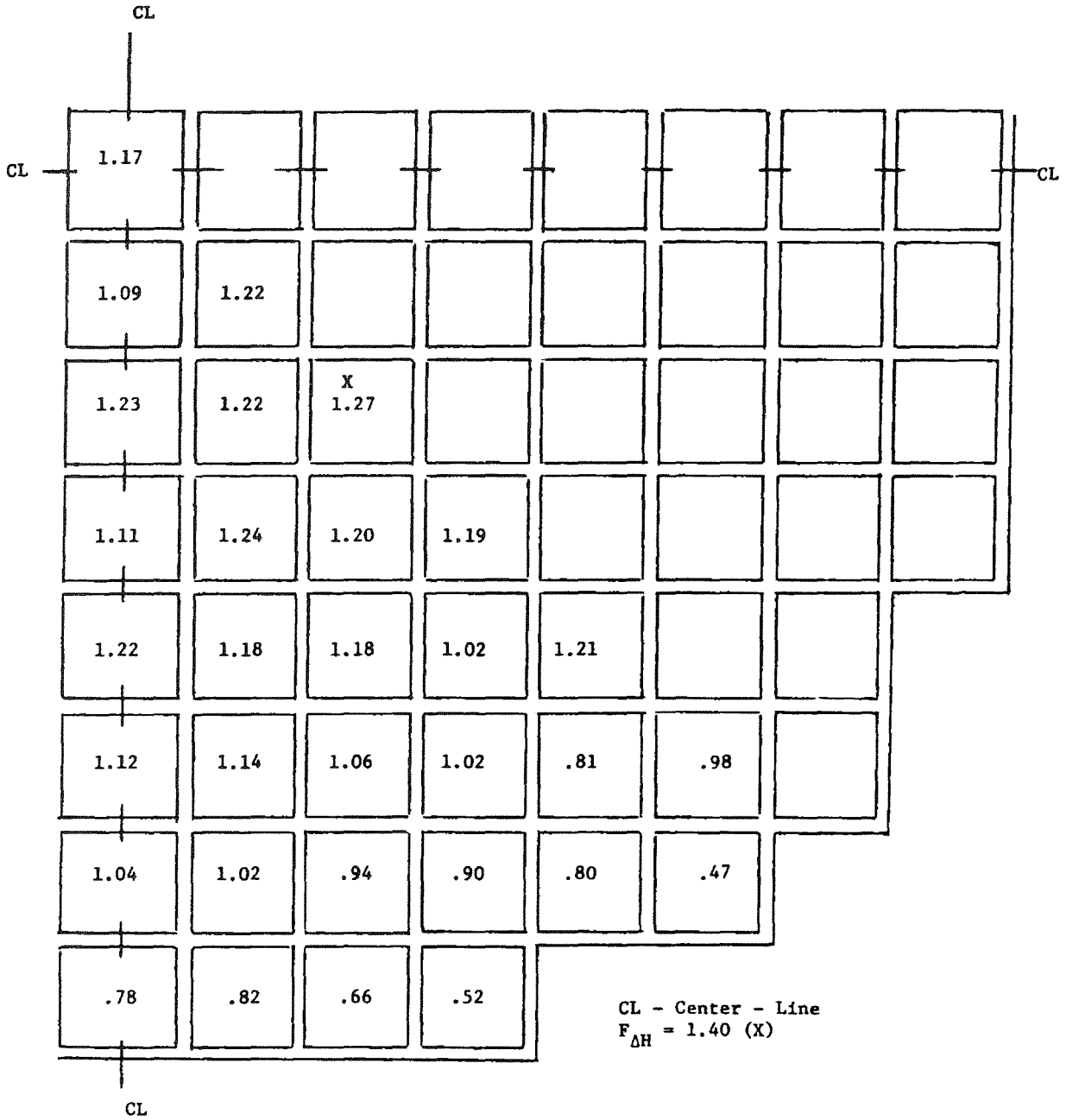
GROUP	SYMBOL	NUMBER OF ROD CLUSTERS
S1	□	8
S2	◇	8
S3	□	4
S4	⬢	4
C1	▽	8
C2	△	4
C3	⬡	8
C4	○	9
PL (Part Length)	◌	8
		61

INDIAN POINT UNIT No. 2

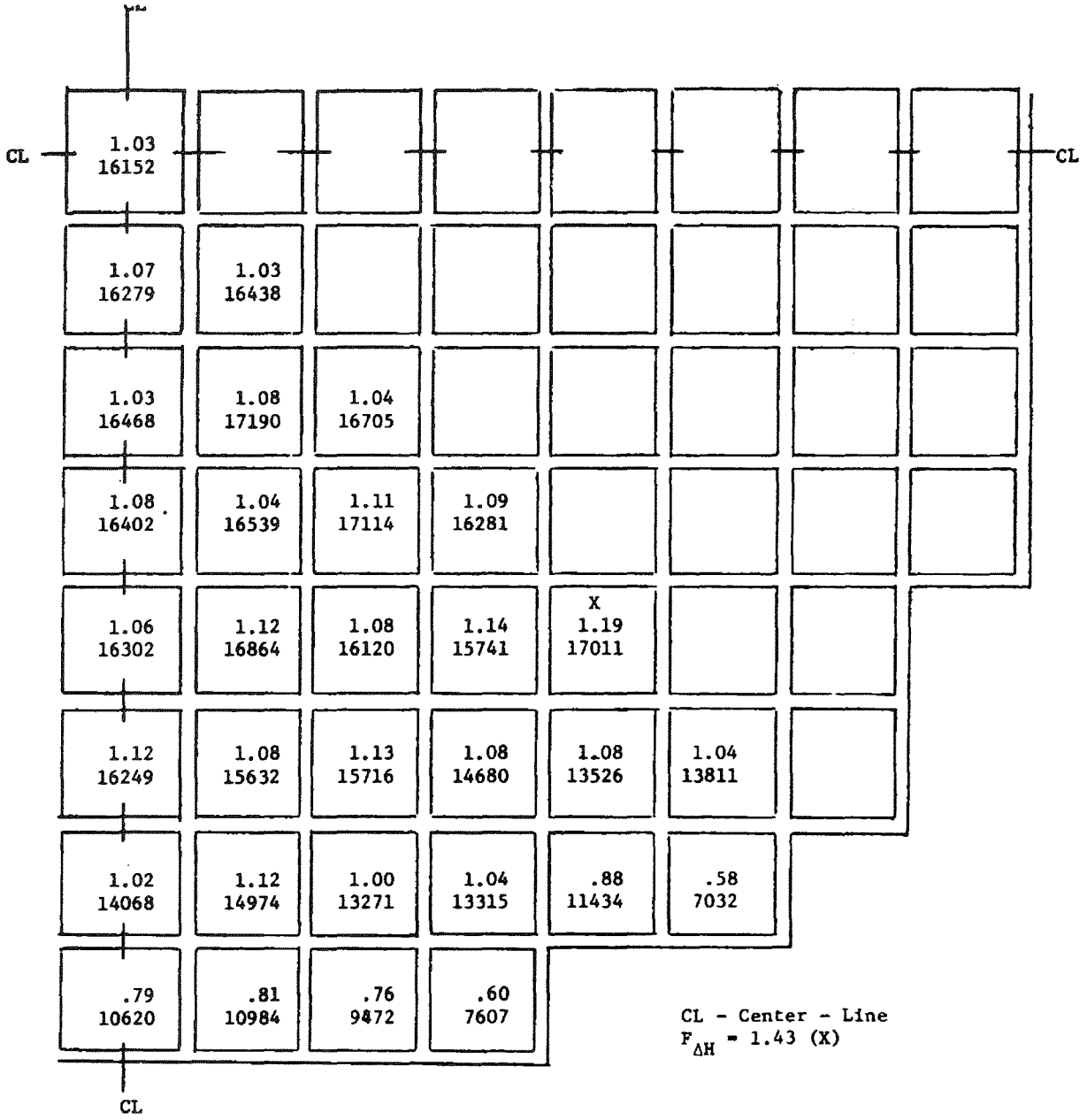
UFSAR FIGURE 3.2-2

ROD CLUSTER GROUPS – CYCLE 1

MIC. No. 1999MC3584 | REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-3 ASSEMBLY AVERAGE POWER & BURNUP, CYCLE 1 CALCULATIONS, BOL, UNRODDED CORE	
MIC. No. 1999MC3585	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-4 ASSEMBLY AVERAGE POWER & BURNUP, CYCLE 1 CALCULATIONS, EOL, UNRODDED CORE	
MIC. No. 1999MC3586	REV. No. 17A

0.671	1.090	1.439	1.343	1.362	1.113	0.882	0.603
1.090	1.340	1.447	1.487	1.309	1.088	0.777	0.579
1.439	1.447	1.544 ΔH → X N → X	1.437	1.308	0.944	0.424	0.401
1.343	1.487	1.437	1.407	1.160	1.010	0.701	0.374
1.362	1.309	1.308	1.160	1.367	0.948	0.812	
1.113	1.088	0.944	1.010	0.948	1.109	0.535	
0.882	0.777	0.424	0.701	0.812	0.535		
0.603	0.579	0.401	0.374				

INDIAN POINT UNIT No. 2

UFSAR FIGURE 3.2-5

ASSEMBLY AVERAGE POWER DISTRIBUTION
CYCLE 1 CALCULATIONS, BOL,
GROUP C4 INSERTED

MIC. No. 1999MC3587 | REV. No. 17A

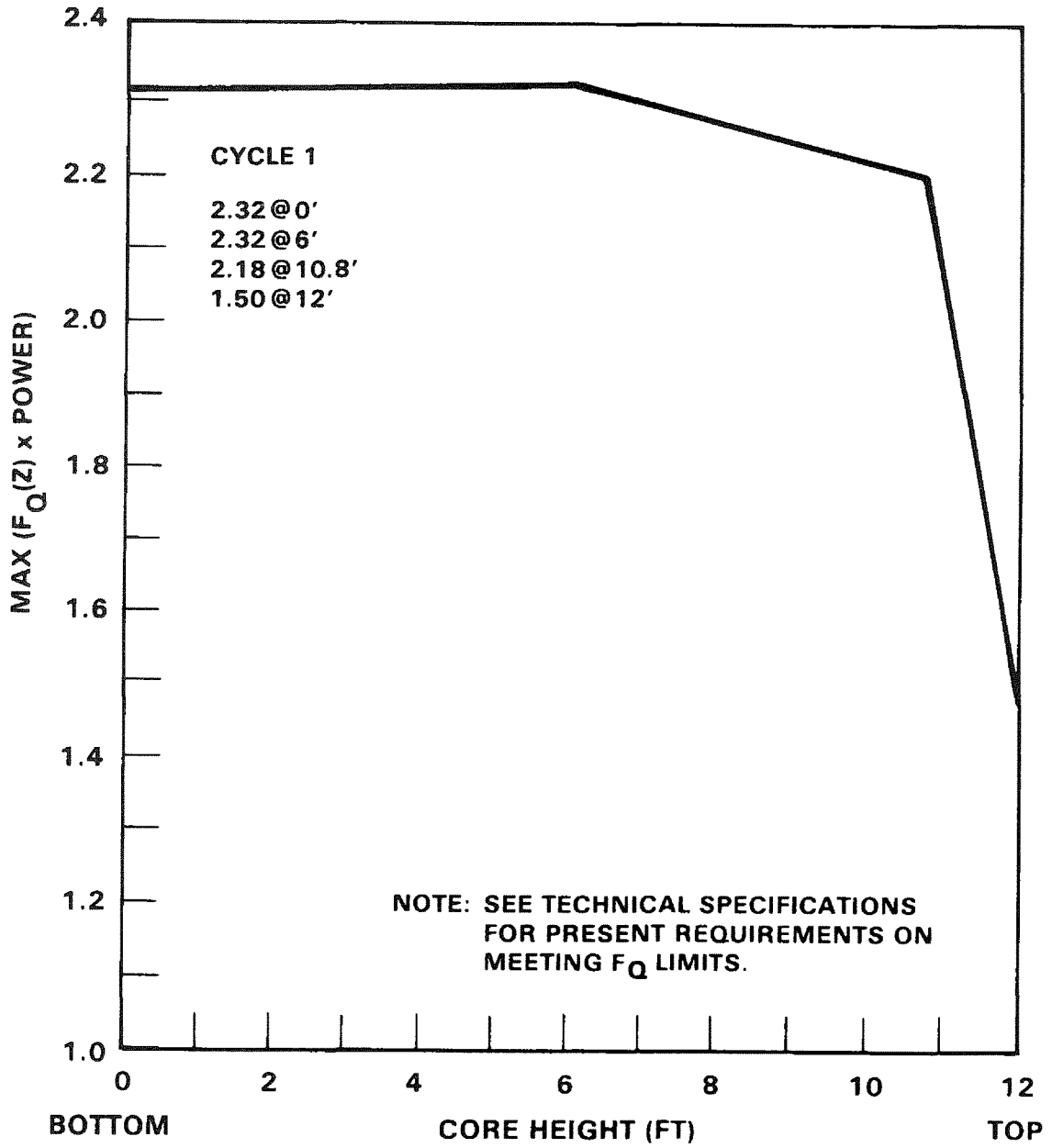
X X 1.402 X X	← $F^N_{\Delta H}$ 1.290	1.349	1.130	1.169	1.157	1.171	0.917
1.290	1.395	1.286	1.161	0.989	1.110	1.149	0.967
1.349	1.286	1.227	0.962	0.568	0.929	1.045	0.799
1.130	1.161	0.962	0.940	0.830	0.999	1.000	0.633
1.169	0.989	0.568	0.830	1.189	0.954	0.938	
1.157	1.110	0.929	0.999	0.954	1.159	0.584	
1.171	1.149	1.045	1.000	0.938	0.584		
0.917	0.867	0.799	0.633				

INDIAN POINT UNIT No. 2

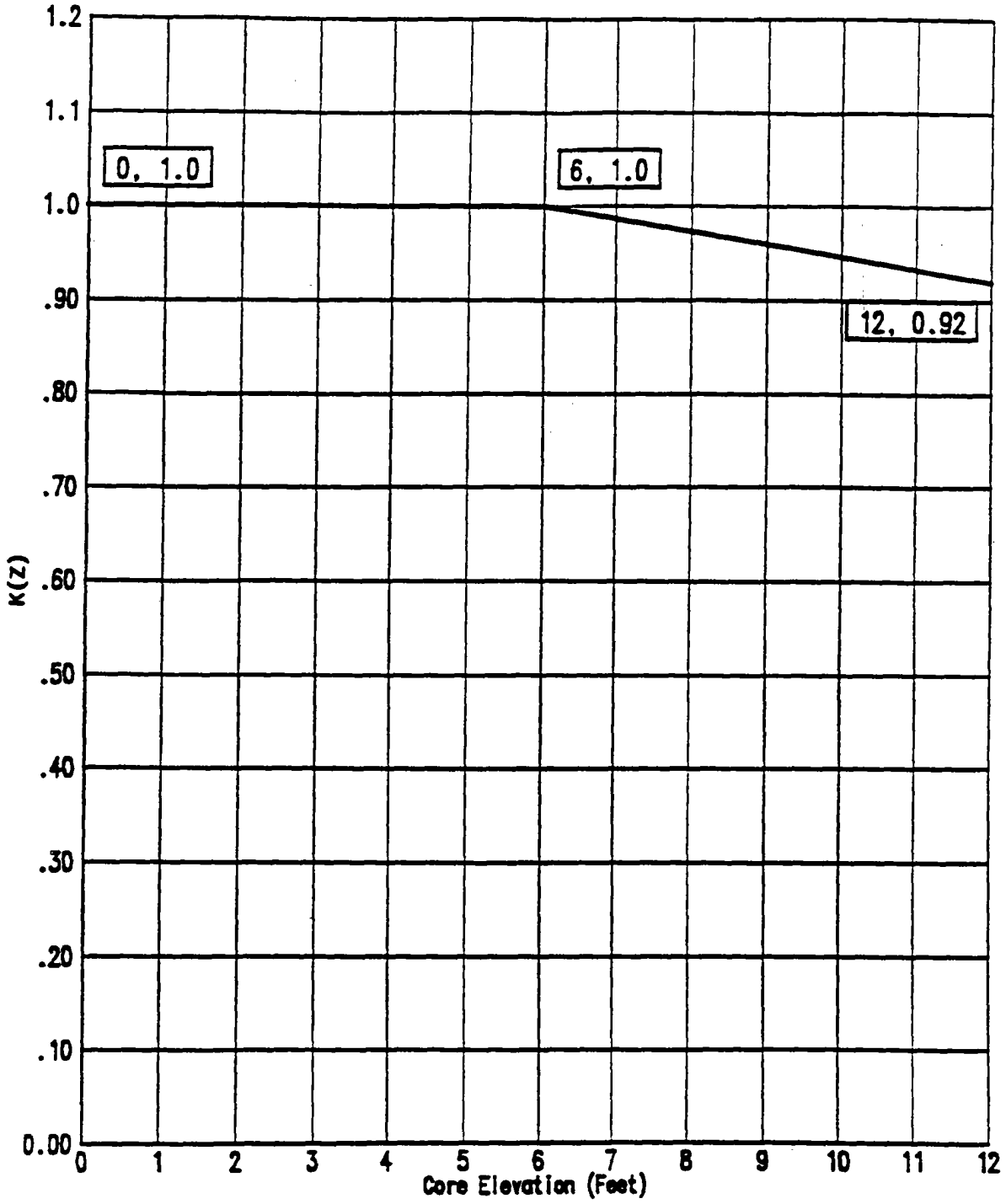
UFSAR FIGURE 3.2-6

ASSEMBLY AVERAGE POWER DISTRIBUTION
CYCLE 1 CALCULATIONS, BOL,
PART-LENGTH RODS IN

MIC. No. 1999MC3588 | REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2–7 CYCLE 1 MAXIMUM F_Q x POWER VERSUS AXIAL HEIGHT DURING NORMAL OPERATIONS	
MIC. No. 1999MC3589	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-7A NORMALIZED K (z) - Fq VERSUS AXIAL HEIGHT FOR CYCLE 16	
MIC. No. 1999MC3590	REV. No. 17B

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
					9		S 7		9					
		8		12		16		16		12		8		
	8		20		12		16		12		20		8	
		20		20		16		16		20		20		
	12		20		16		16		16		20		12	
9		12		16		20		20		16		12		9
	P 16		16		20		16		20		16		P 16	
7		16		16		16		16		16		16		7
	P 16		16		20		16		20		16		P 16	
9		12		16		20		20		16		12		9
	12		20		16		16		16		20		12	
		20		20		16		16		20		20		
	8		20		12		16		12		20		8	
		8		12		16		16		12		8		
					9		S 7		9		TOTAL 1412			

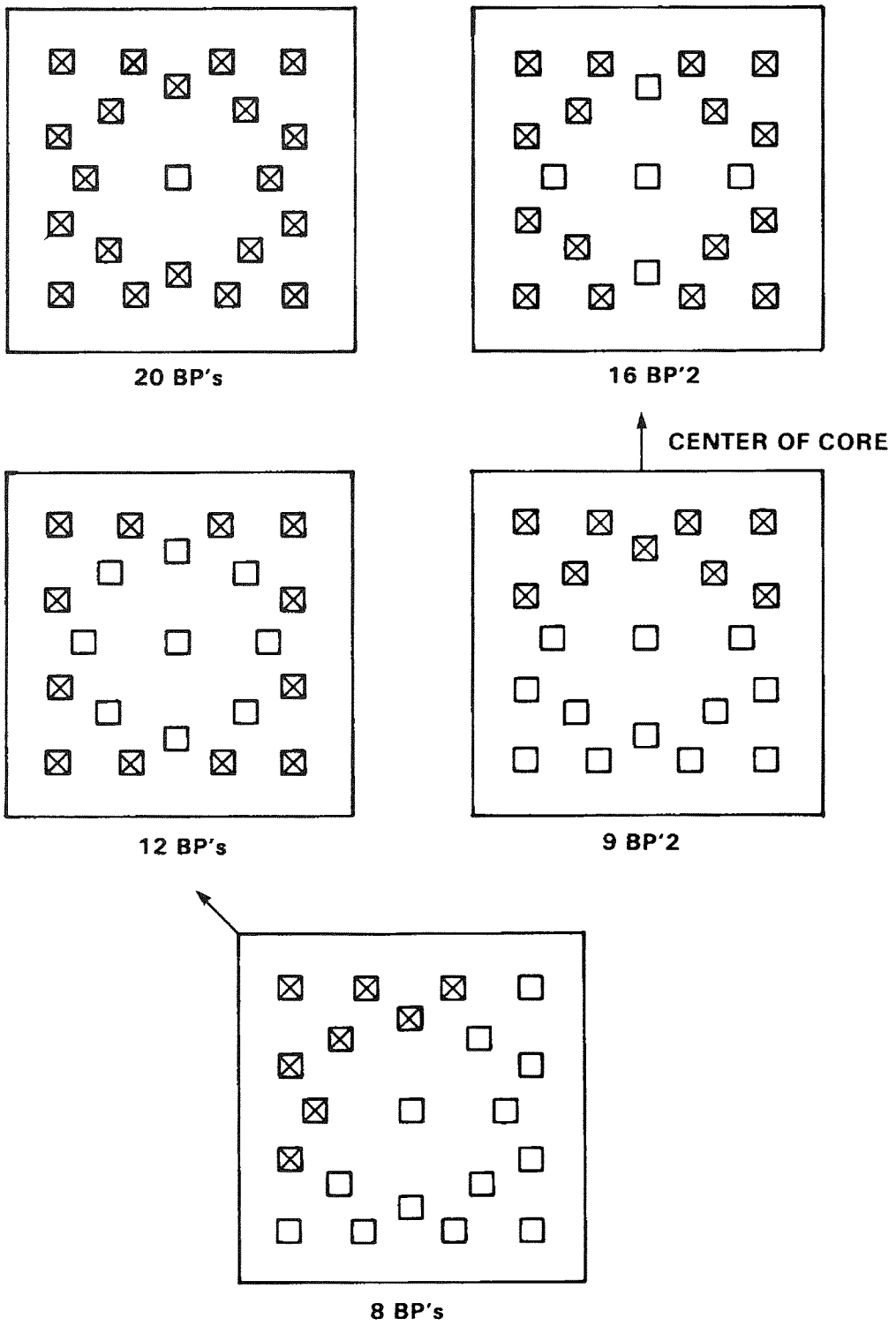
P - PRIMARY/SECONDARY SOURCE COMBINATION
S - SECONDARY SOURCE;

INDIAN POINT UNIT No. 2

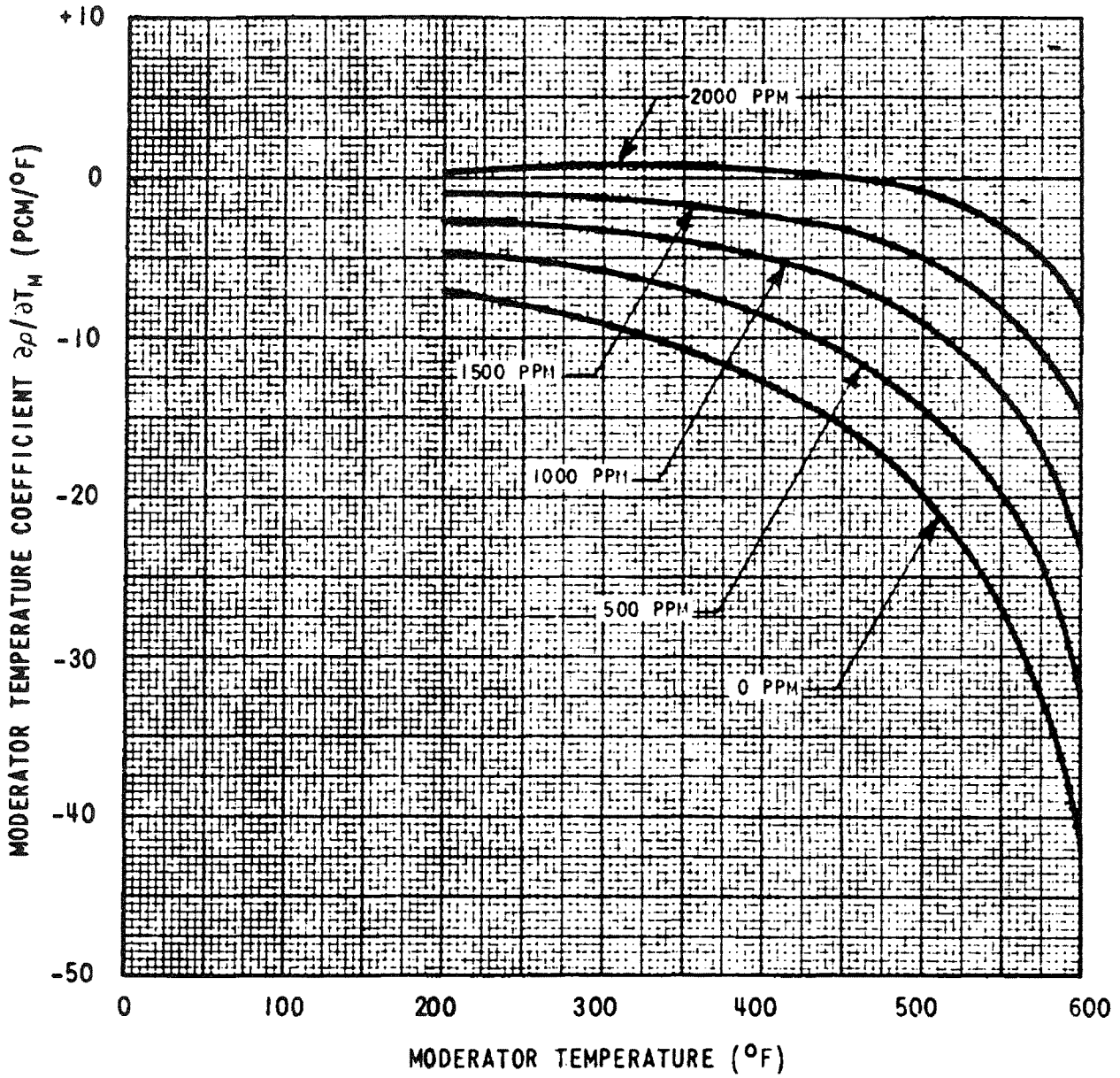
UFSAR FIGURE 3.2-8

BURNABLE POISON & SOURCE ASSEMBLY LOCATIONS – CYCLE 1

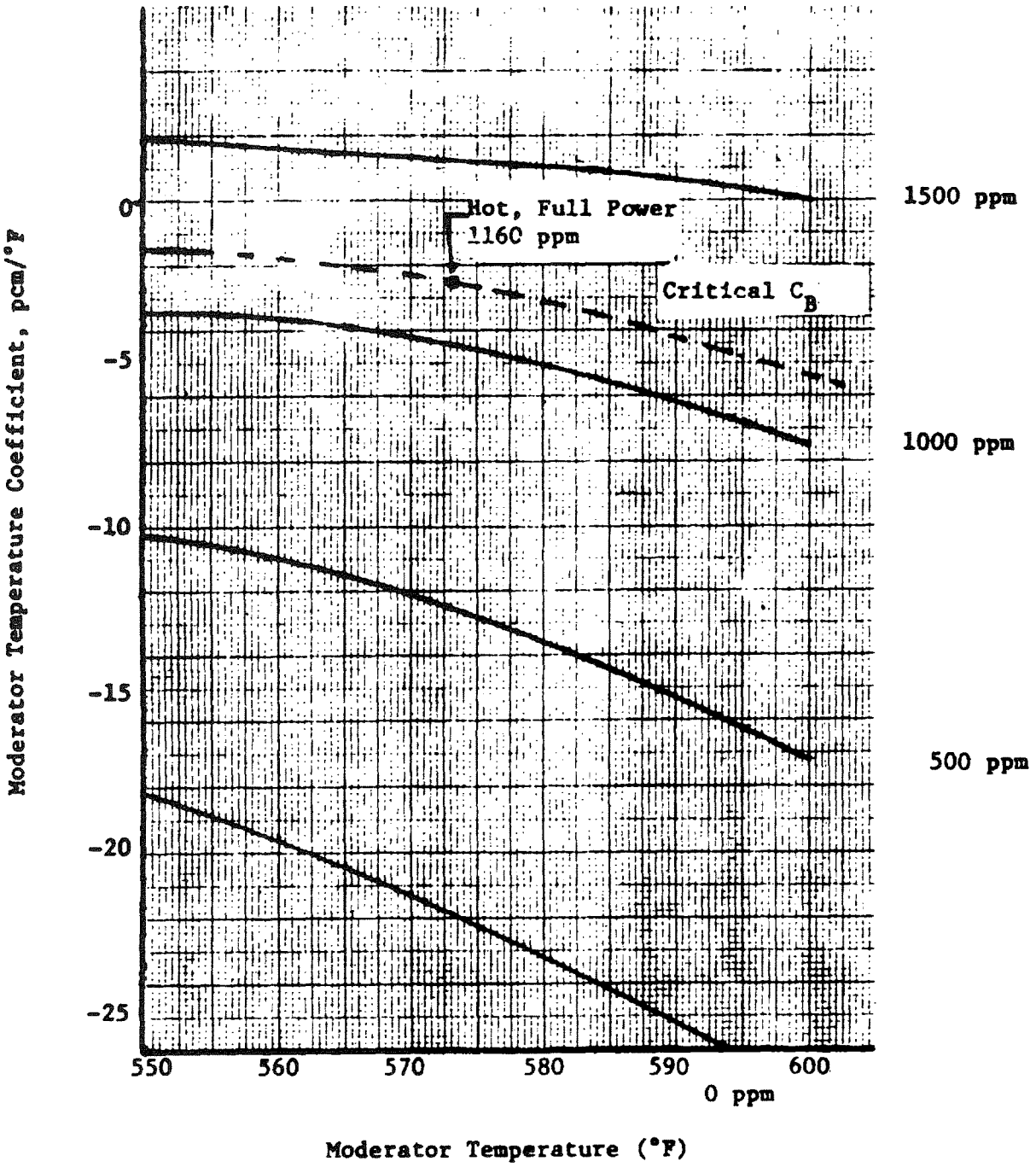
MIC. No. 1999MC3591 | REV. No. 17A



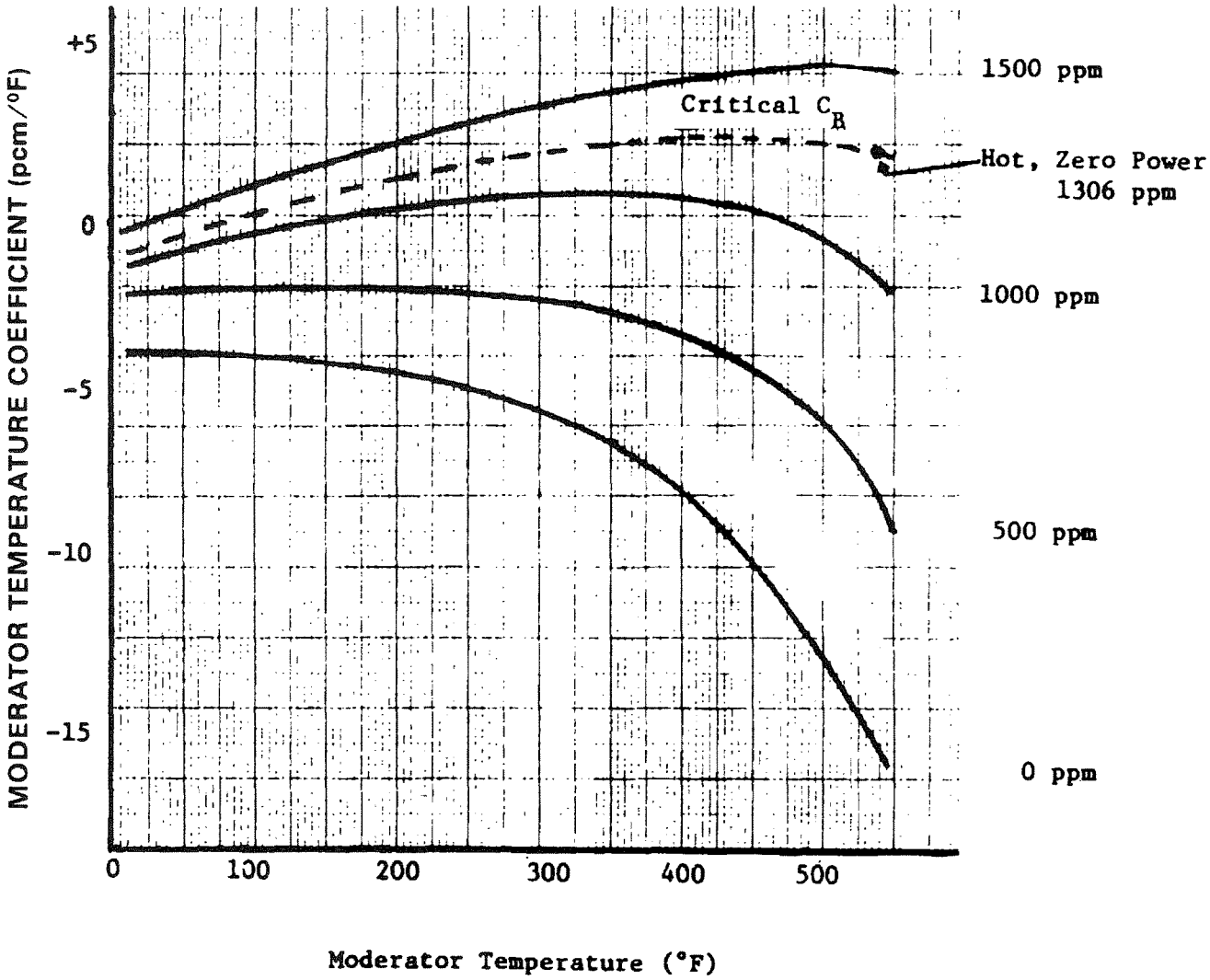
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2–9 BURNABLE POISON ROD LOCATIONS CYCLE 1	
MIC. No. 1999MC3592	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-10 MODERATOR TEMPERATURE COEFFICIENT vs MODERATOR TEMPERATURE – EOL, CYCLE 1	
MIC. No. 1999MC3593	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-11 MODERATOR TEMPERATURE COEFFICIENT vs MODERATOR TEMPERATURE – BOL, CYCLE 1 FULL POWER	
MIC. No. 1999MC3594	REV. No. 17A

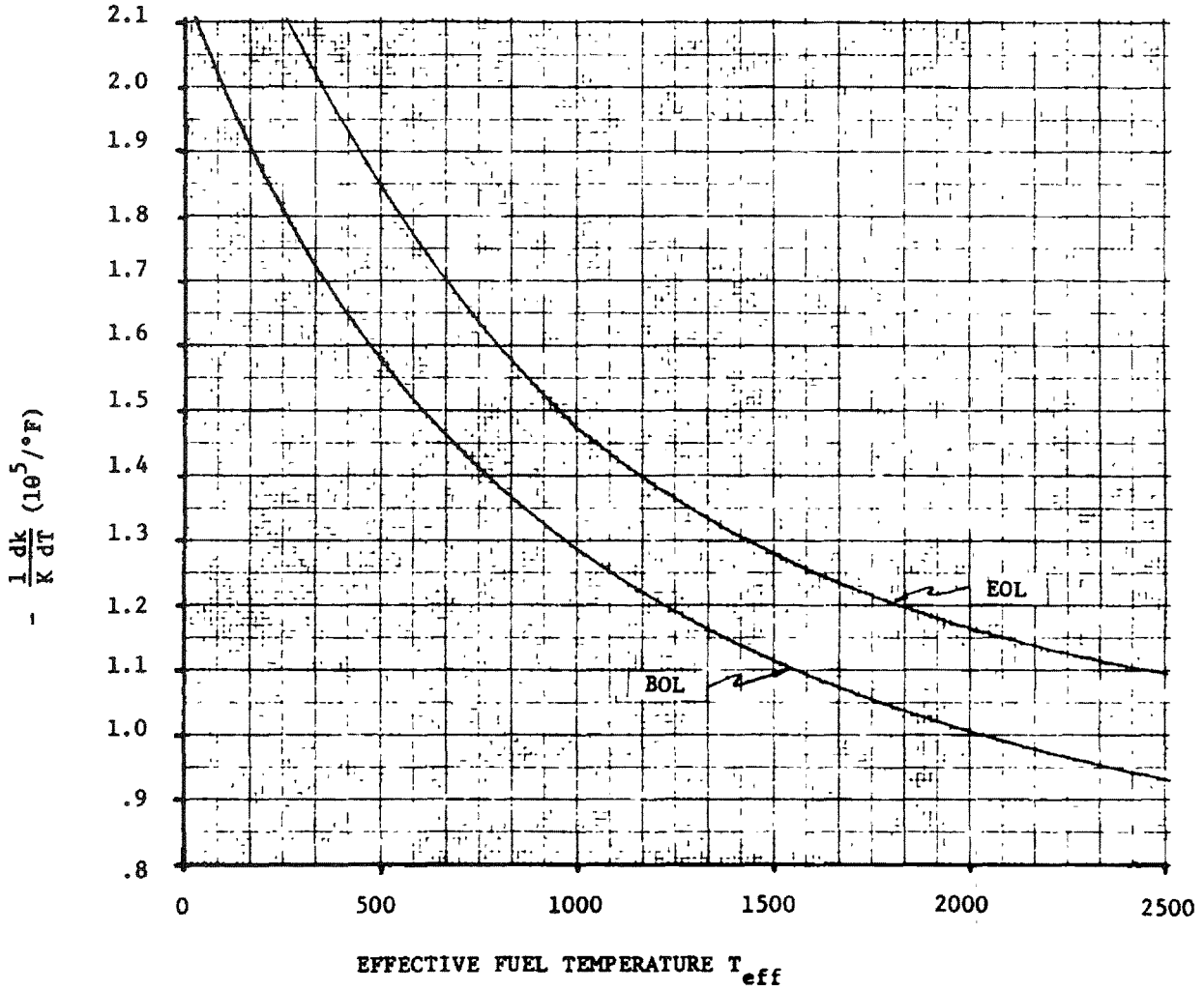


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-12 MODERATOR TEMPERATURE COEFFICIENT vs MODERATOR TEMPERATURE - BOL, CYCLE 1 ZERO POWER	
MIC. No. 1999MC3595	REV. No. 17A

DOPPLER COEFFICIENT

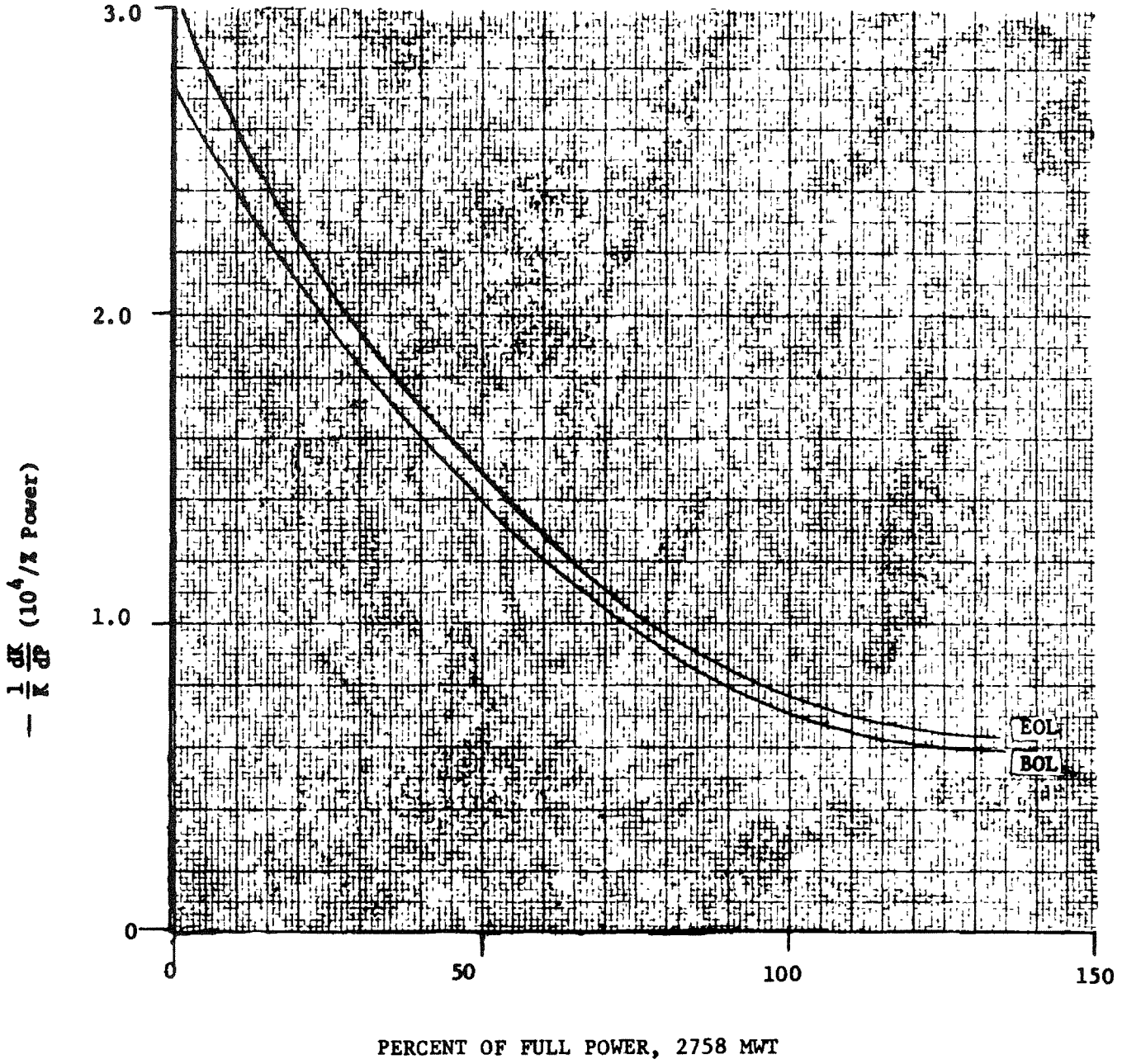
vs

EFFECTIVE FUEL TEMPERATURE

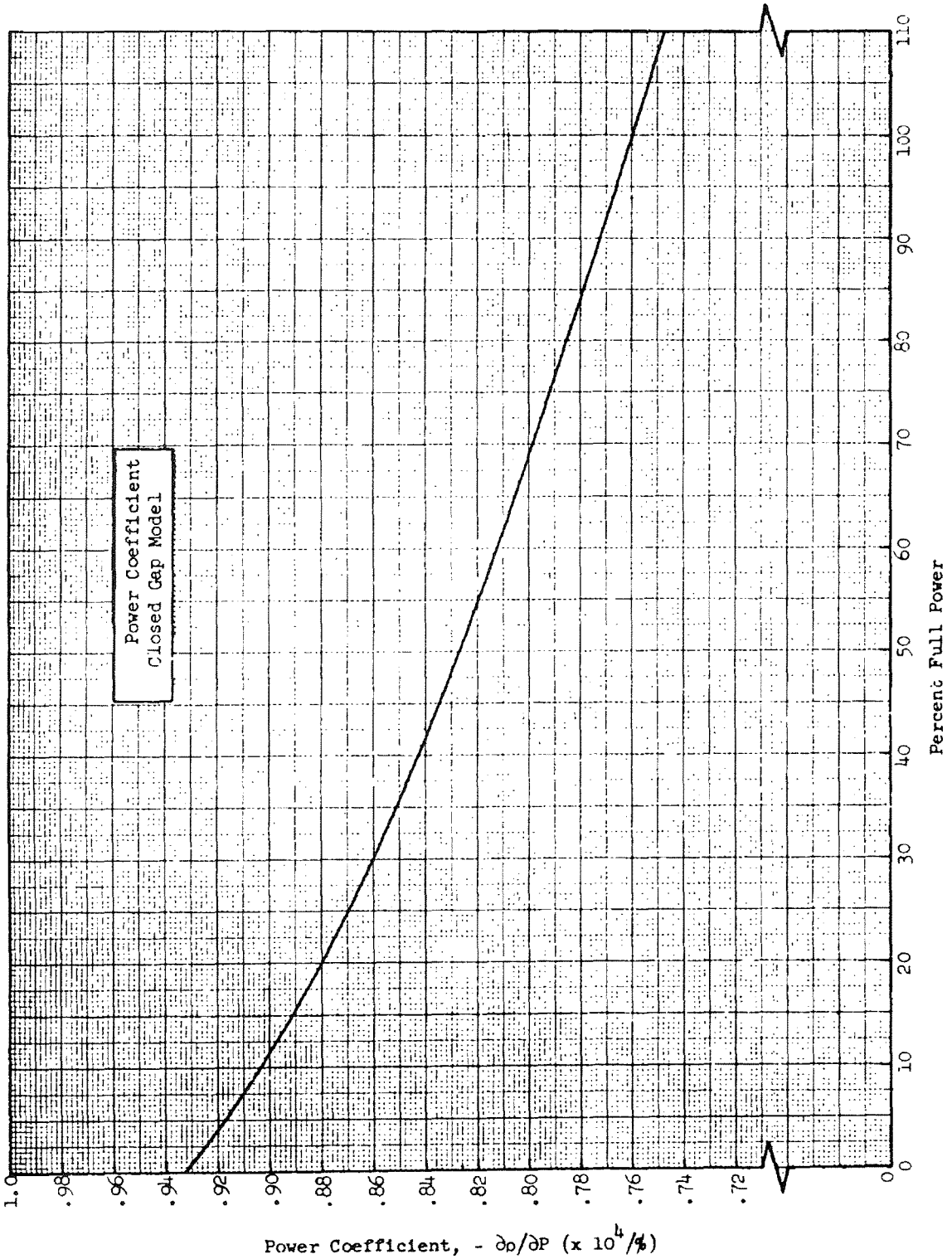


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-13 DOPPLER COEFFICIENT vs EFFECTIVE FUEL TEMPERATURE - CYCLE 1	
MIC. No. 1999MC3596	REV. No. 17A

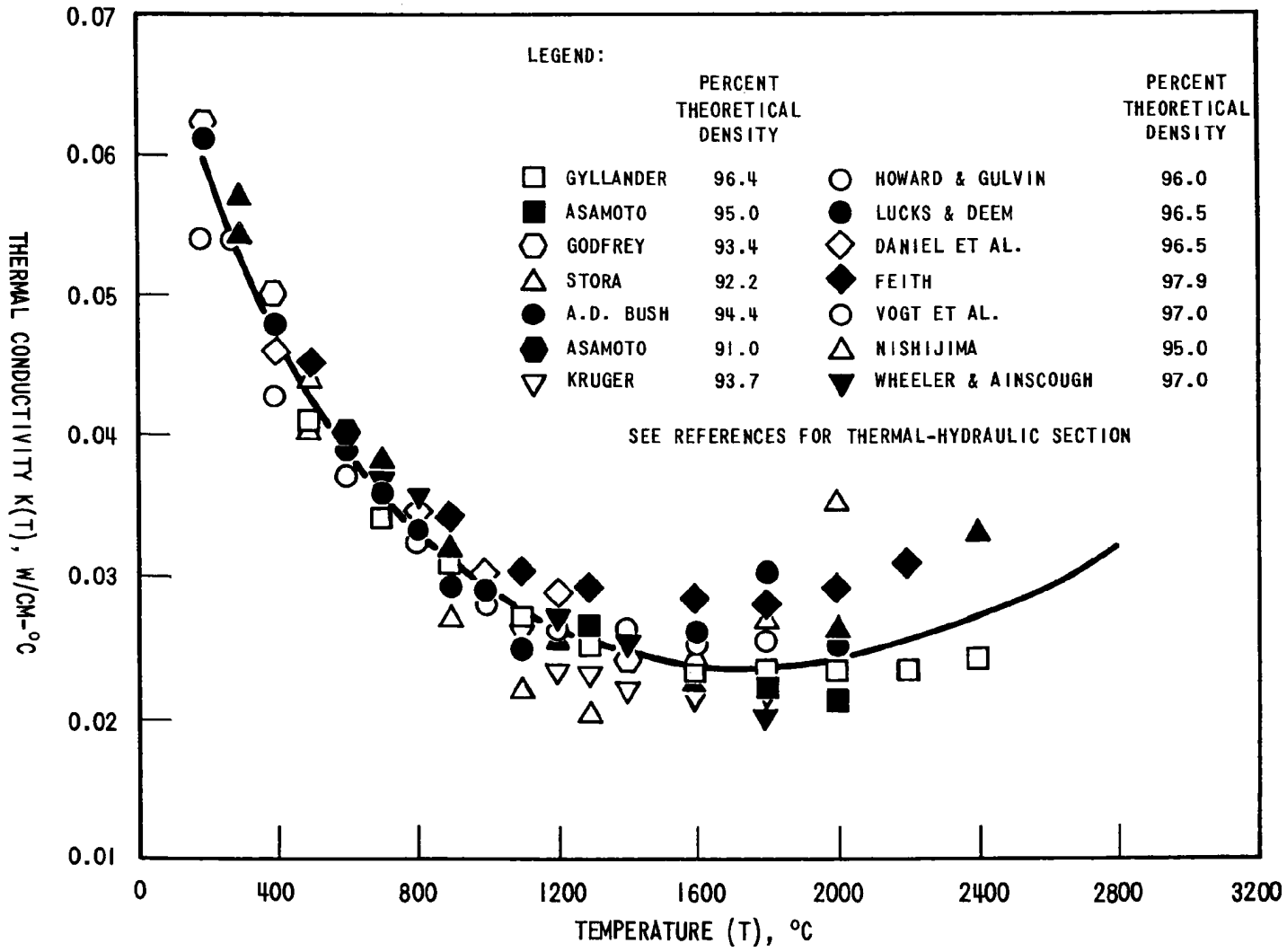
POWER COEFFICIENT VS PERCENT POWER
WITH T_{MOD} = 572. °F
E = 2.7 W/O
BOL = 2100 ppm



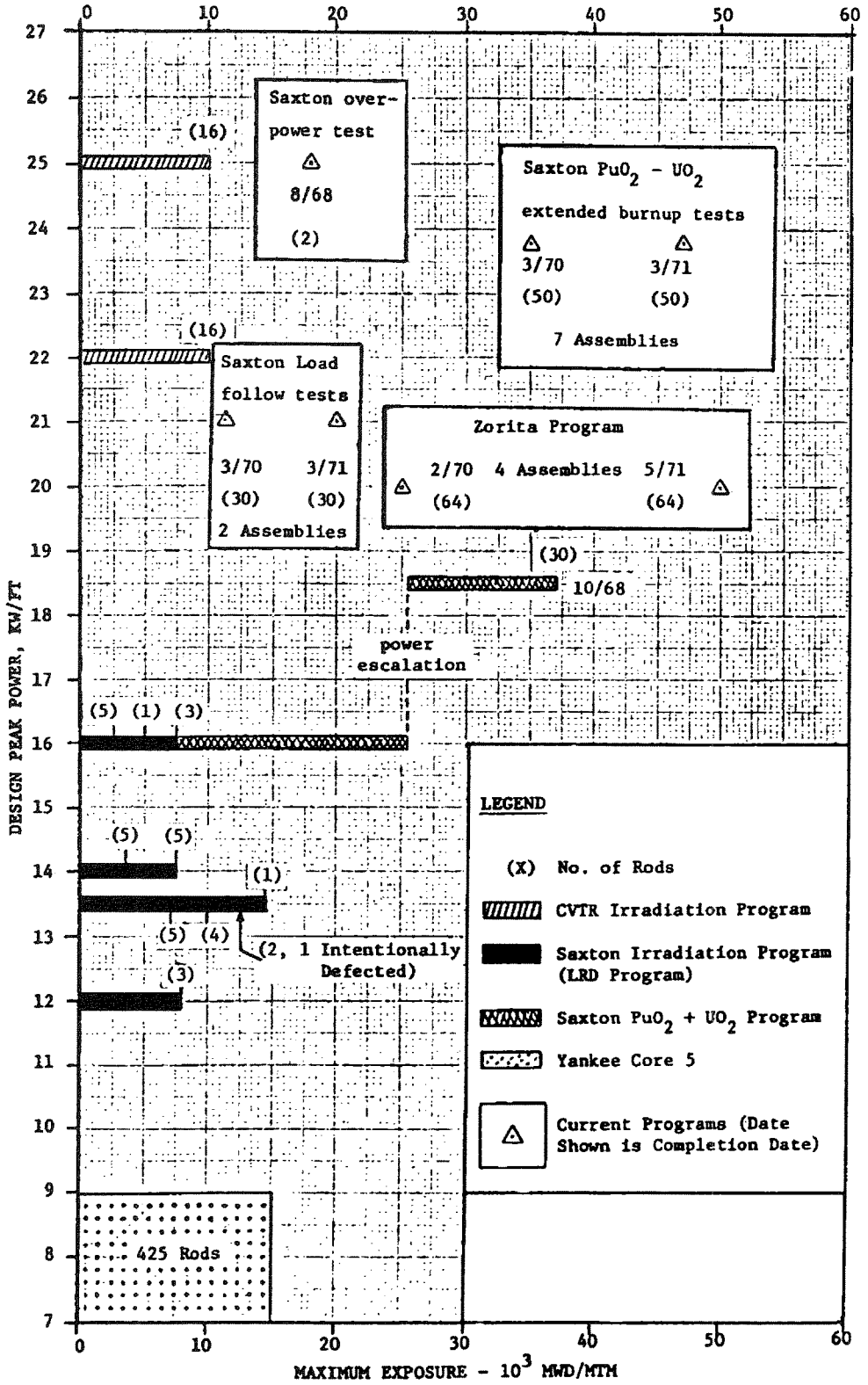
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-14 POWER COEFFICIENT vs PERCENT POWER CYCLE 1	
MIC. No. 1999MC3597	REV. No. 17A



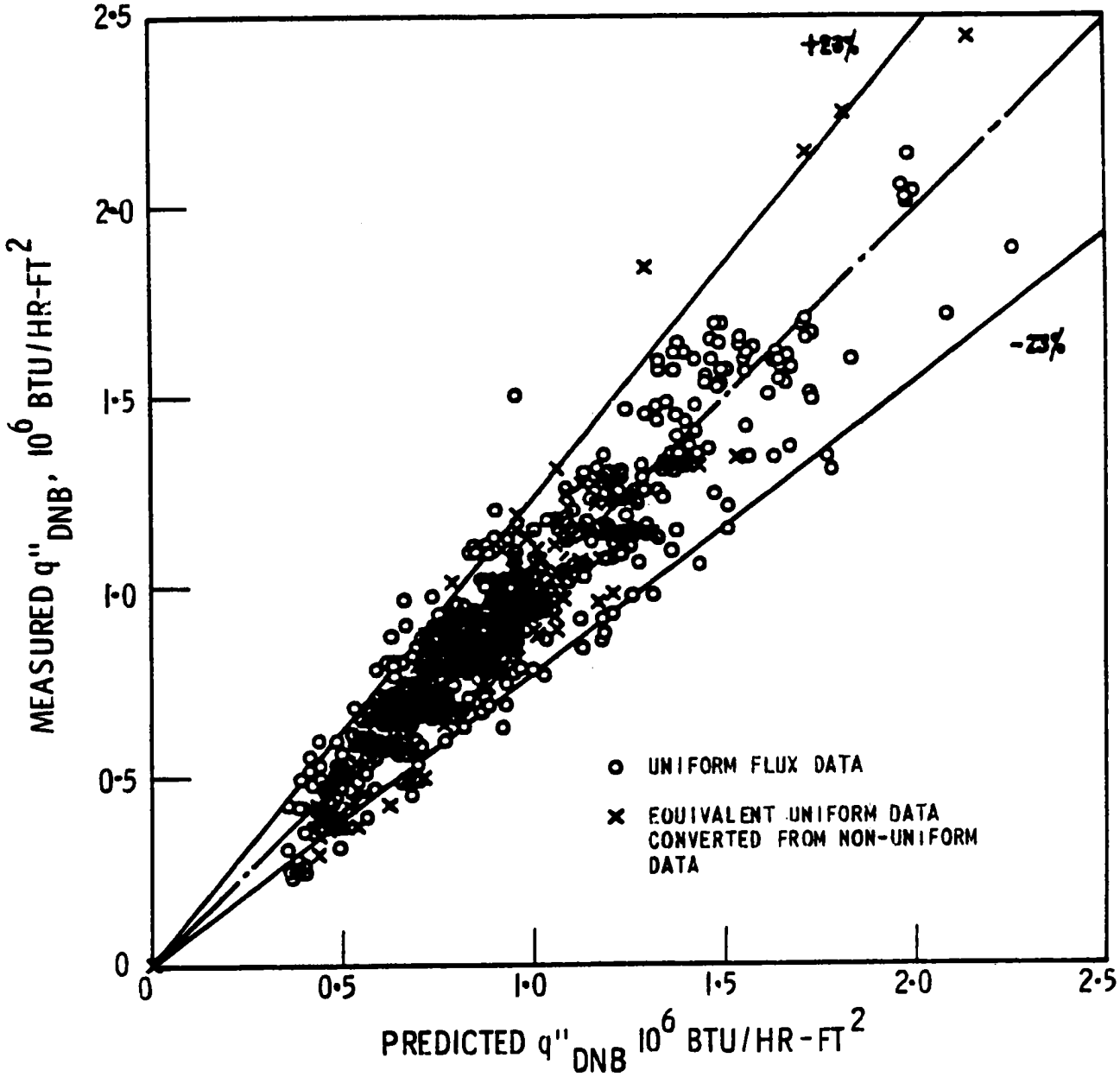
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2–15 POWER COEFFICIENT – CLOSED GAP MODEL	
MIC. No. 1999MC3598	REV. No. 17A



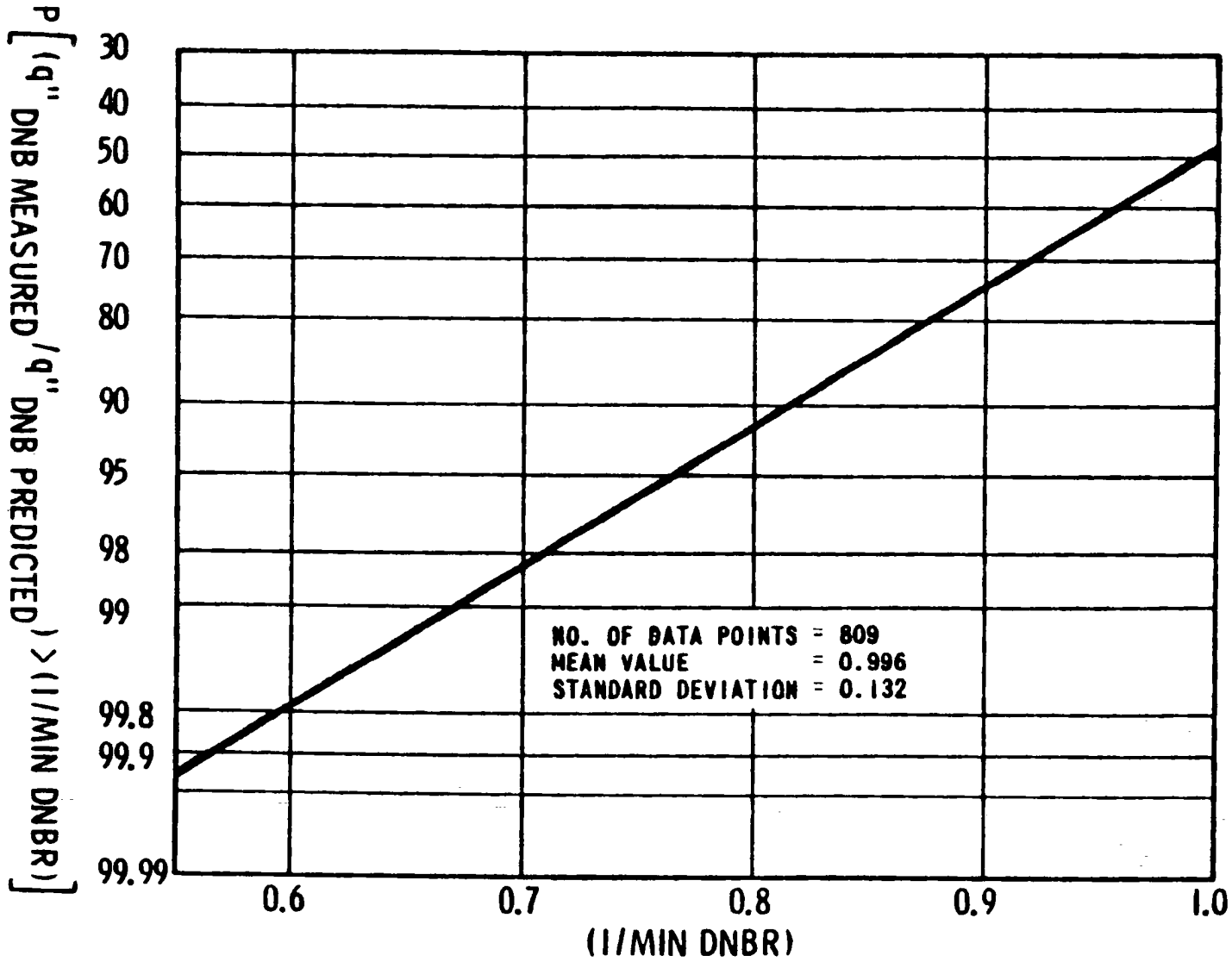
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-38 TYPICAL THERMAL CONDUCTIVITY OF UO_2	
MIC. No. 1999MC3643	REV. No. 17B



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-39	
HIGH POWER FUEL ROD EXPERIMENTAL PROGRAM	
MIC. No. 1999MC3644	REV. No. 17A

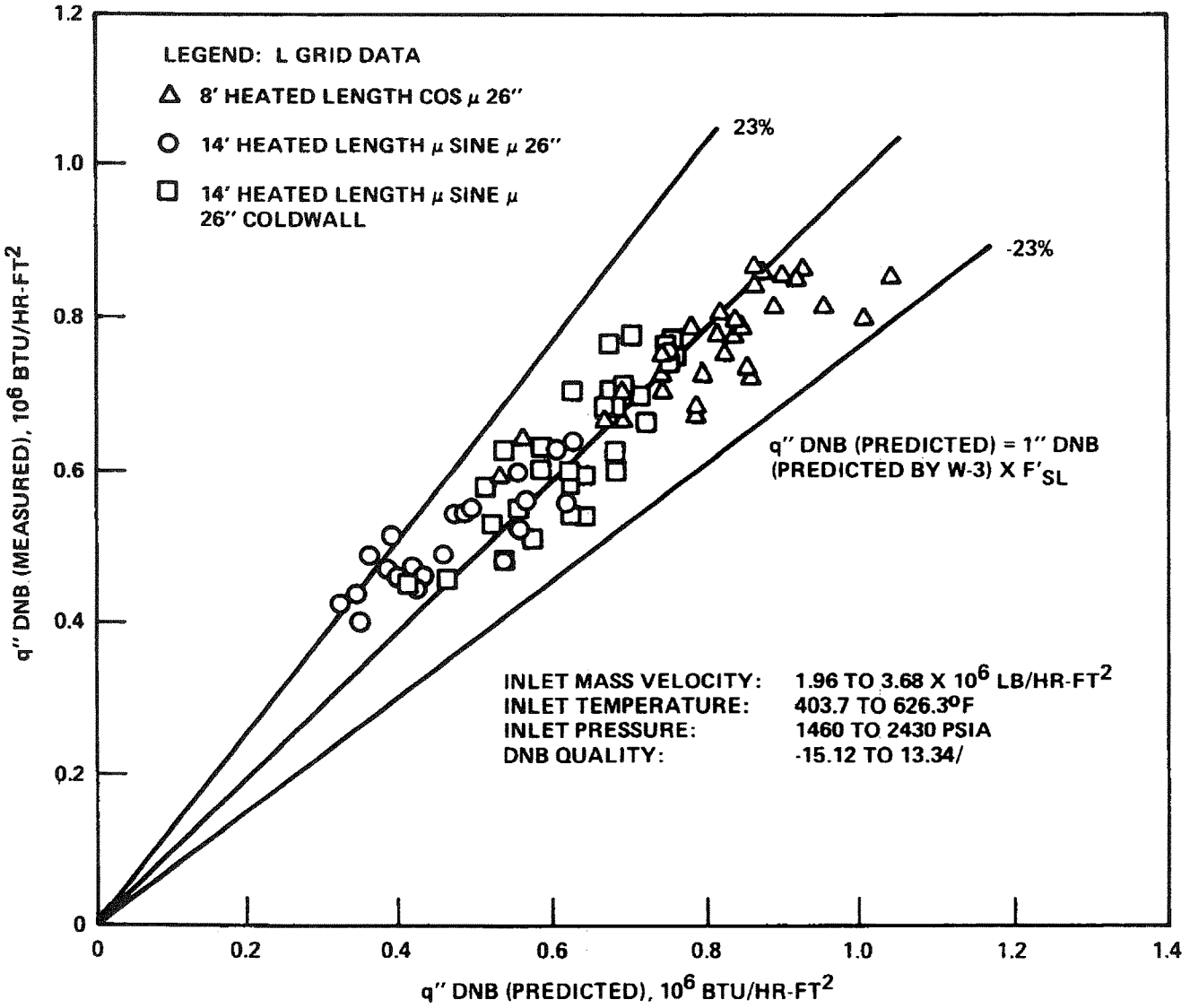


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-40 TYPICAL COMPARISON OF W-3 PREDICTION AND UNIFORM FLUX DATA	
MIC. No. 1999MC3645	REV. No. 17B

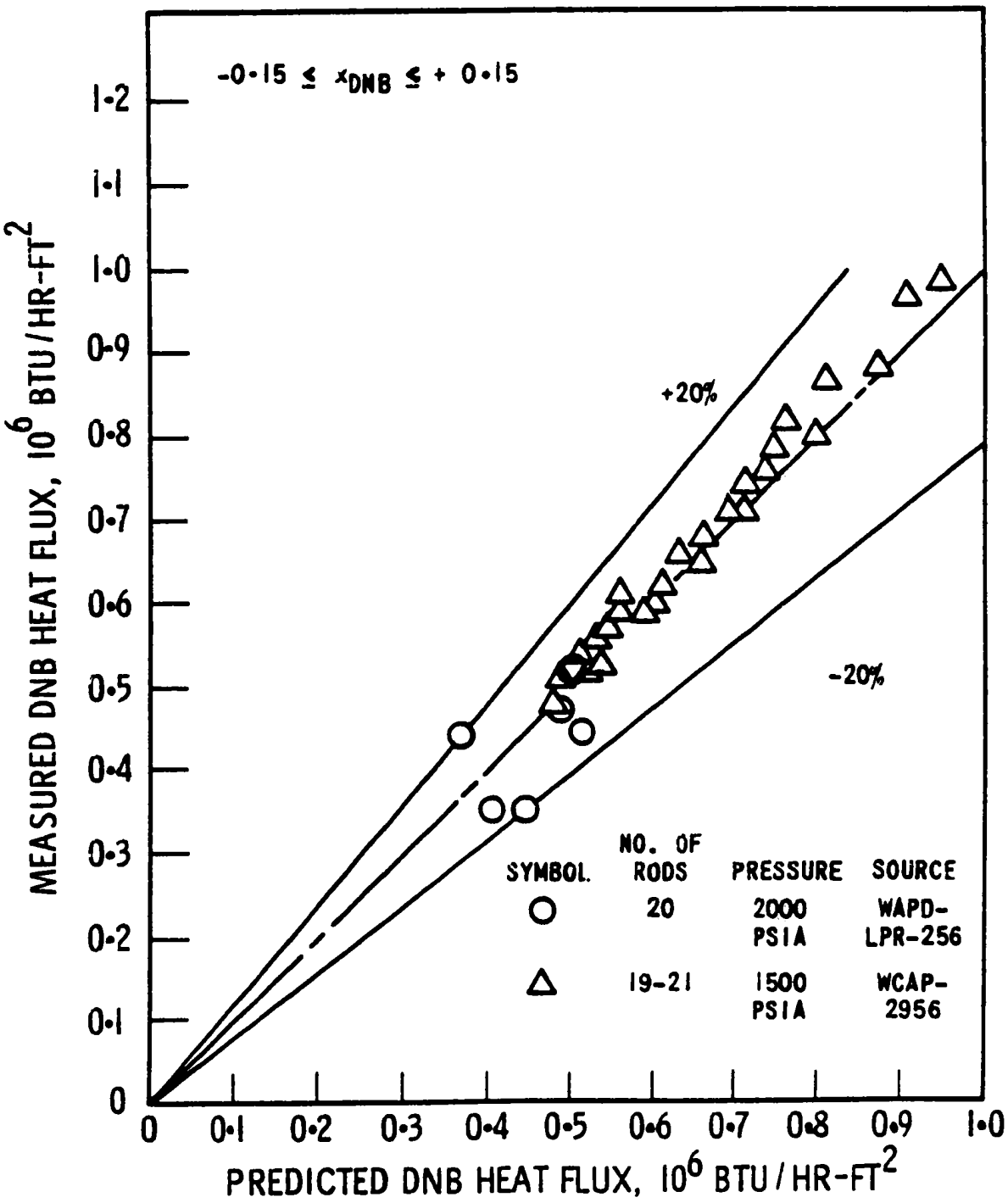


W-3 CORRELATION PROBABILITY DISTRIBUTION CURVE

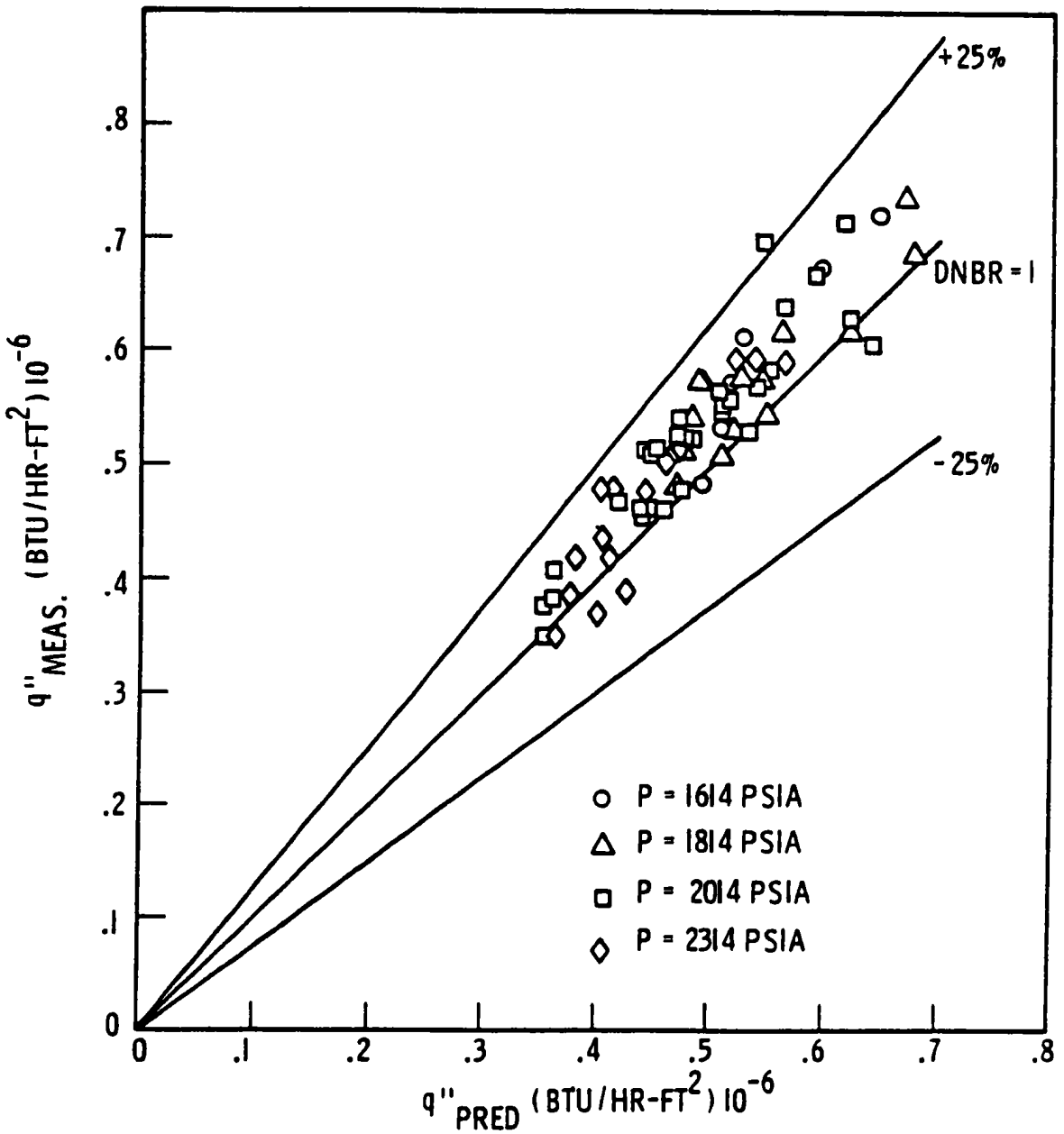
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-41 TYPICAL W-3 CORRELATION PROBABILITY DISTRIBUTION CURVE	
MIC. No. 1999MC3678	REV. No. 17B



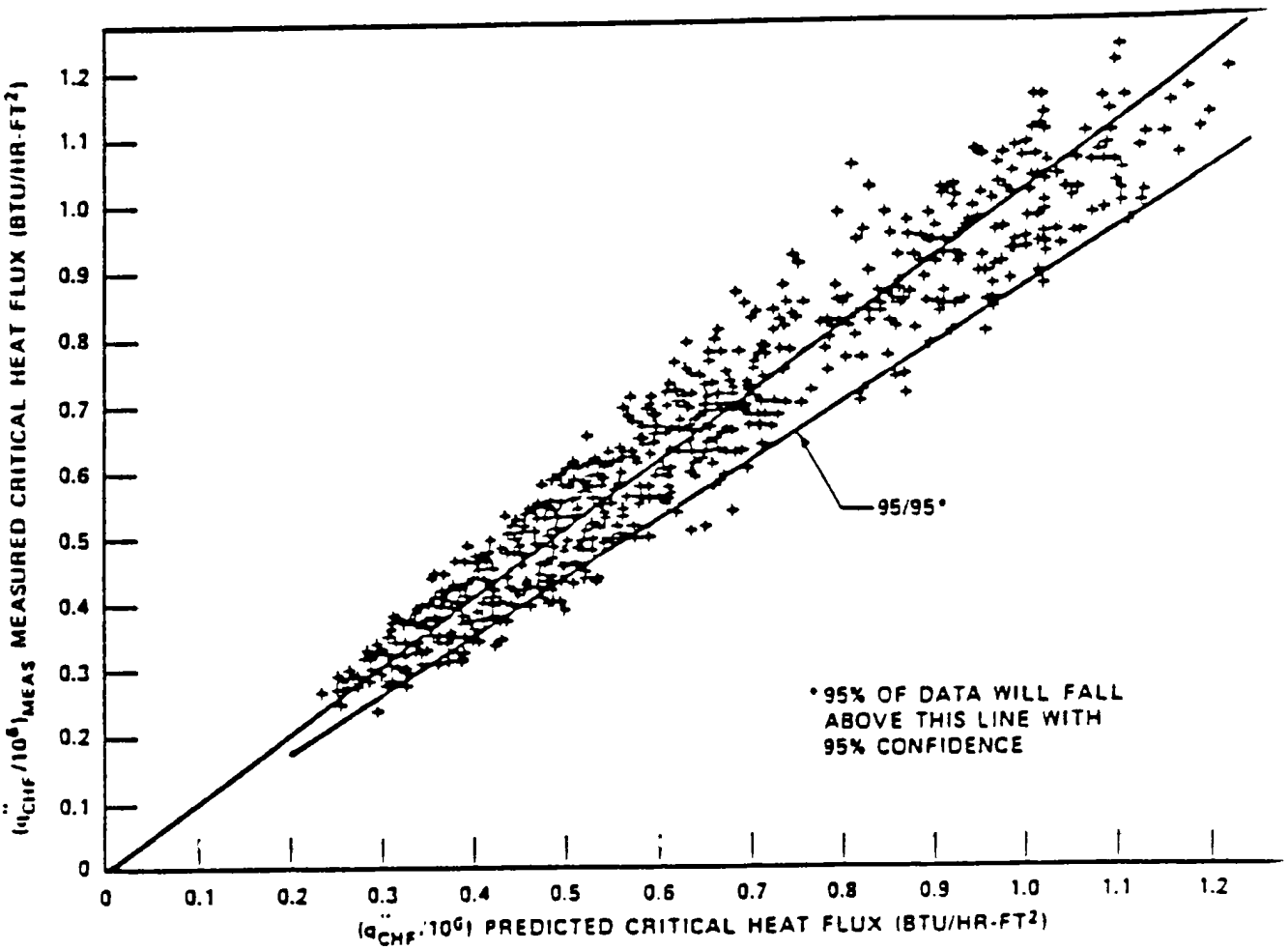
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-42 COMPARISON OF "L" GRID TYPICAL AND THIMBLE COLD WALL CELL ROD BUNDLE DNB DATA FOR NON-UNIFORM AXIAL HEAT FLUX WITH PREDICTIONS OF W-3 x F'_{SL}	
MIC. No. 1999MC3679	REV. No. 17A



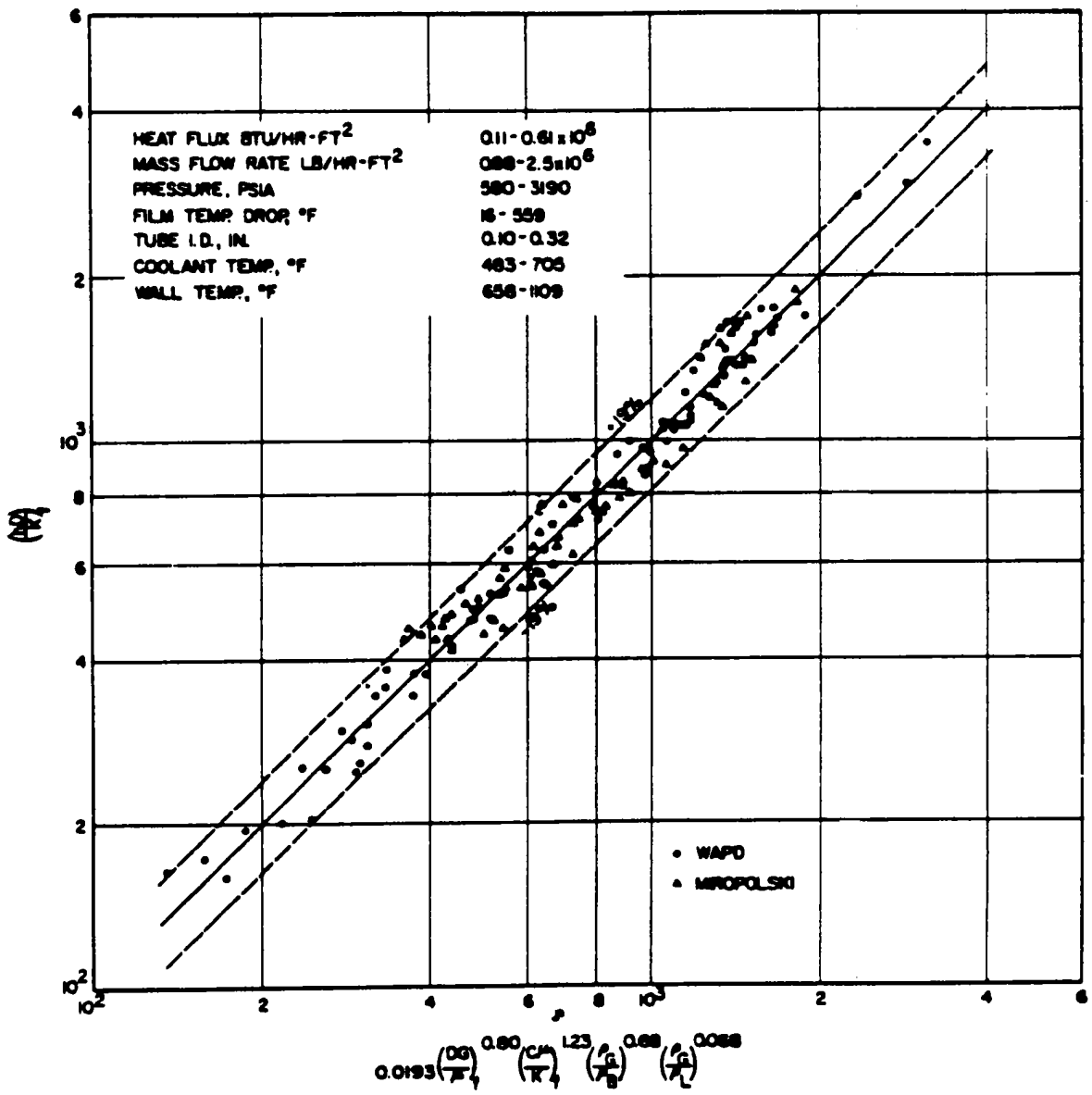
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-43 TYPICAL COMPARISON OF W-3 CORRELATION WITH ROD BUNDLE DNB DATA (SIMPLE GRID WITHOUT MIXING VANE)	
MIC. No. 1999MC3680	REV. No. 17B



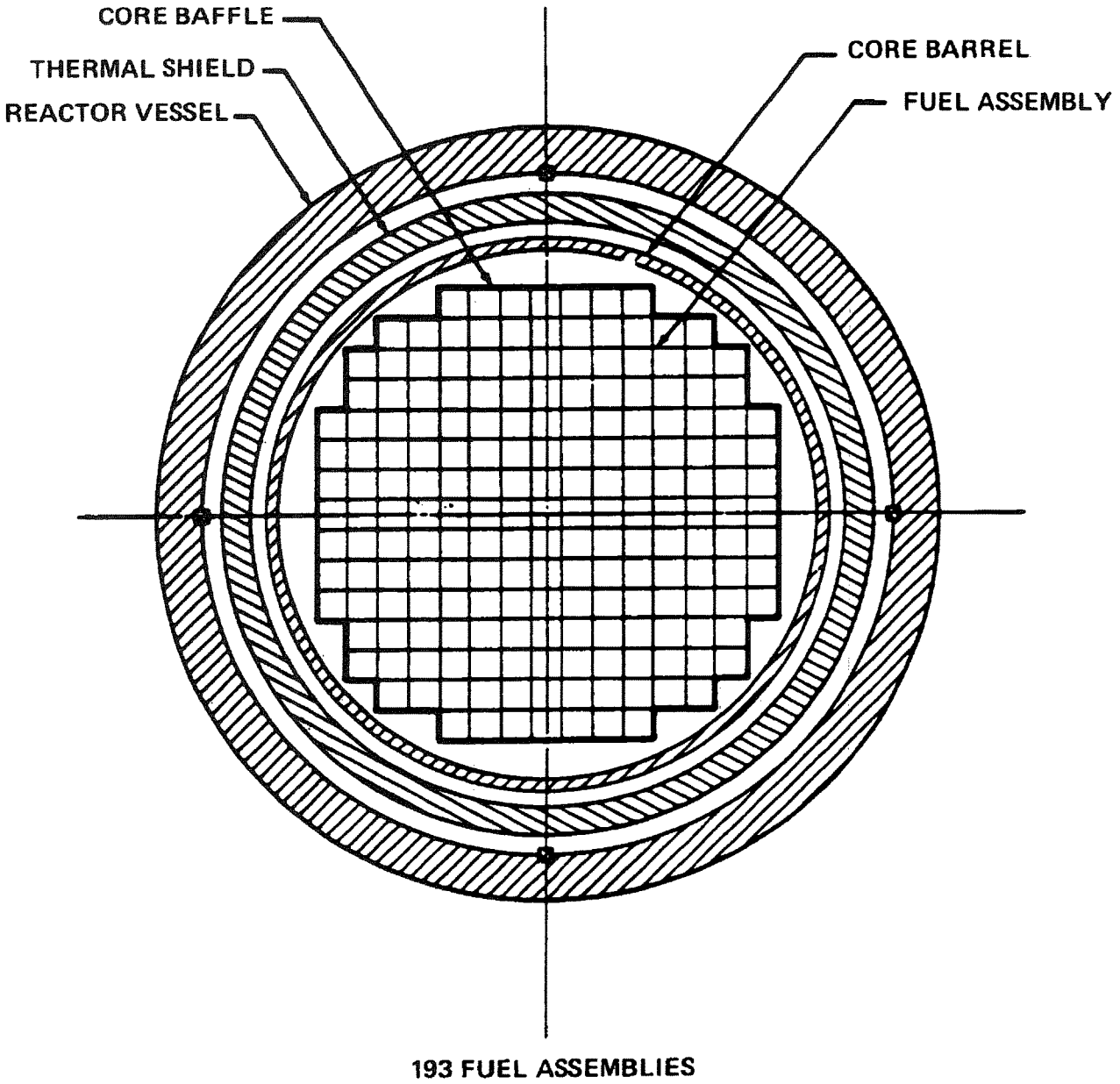
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-44 TYPICAL COMPARISON OF W-3 CORRELATION WITH ROD BUNDLE DNB DATA (SIMPLE GRID WITH MIXING VANE)	
MIC. No. 1999MC3681	REV. No. 17B



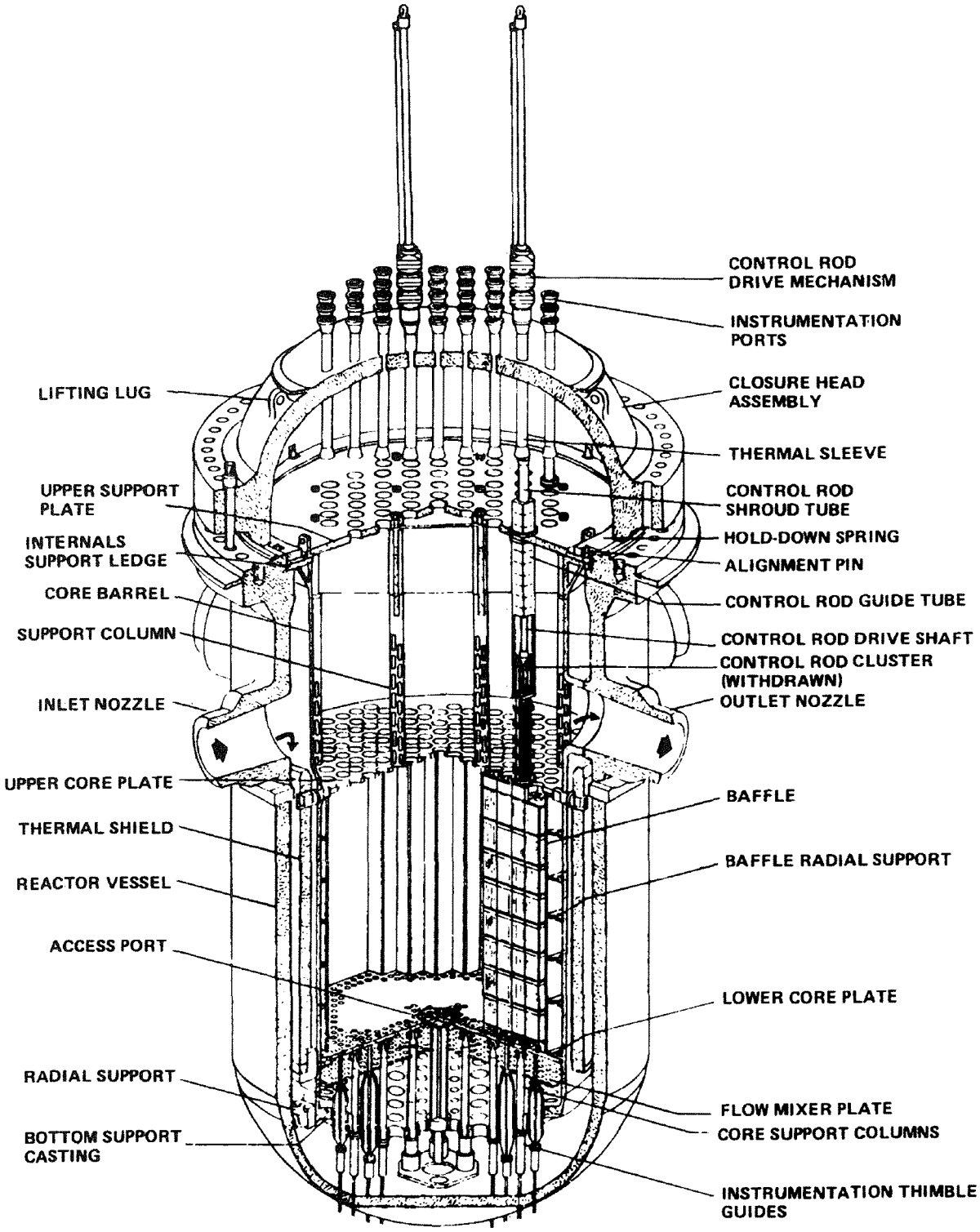
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-44A TYPICAL MEASURED VERSUS PREDICTED CRITICAL HEAT FLUX-WRB-1 CORRELATION	
MIC. No. 1999MC3682	REV. No. 17B



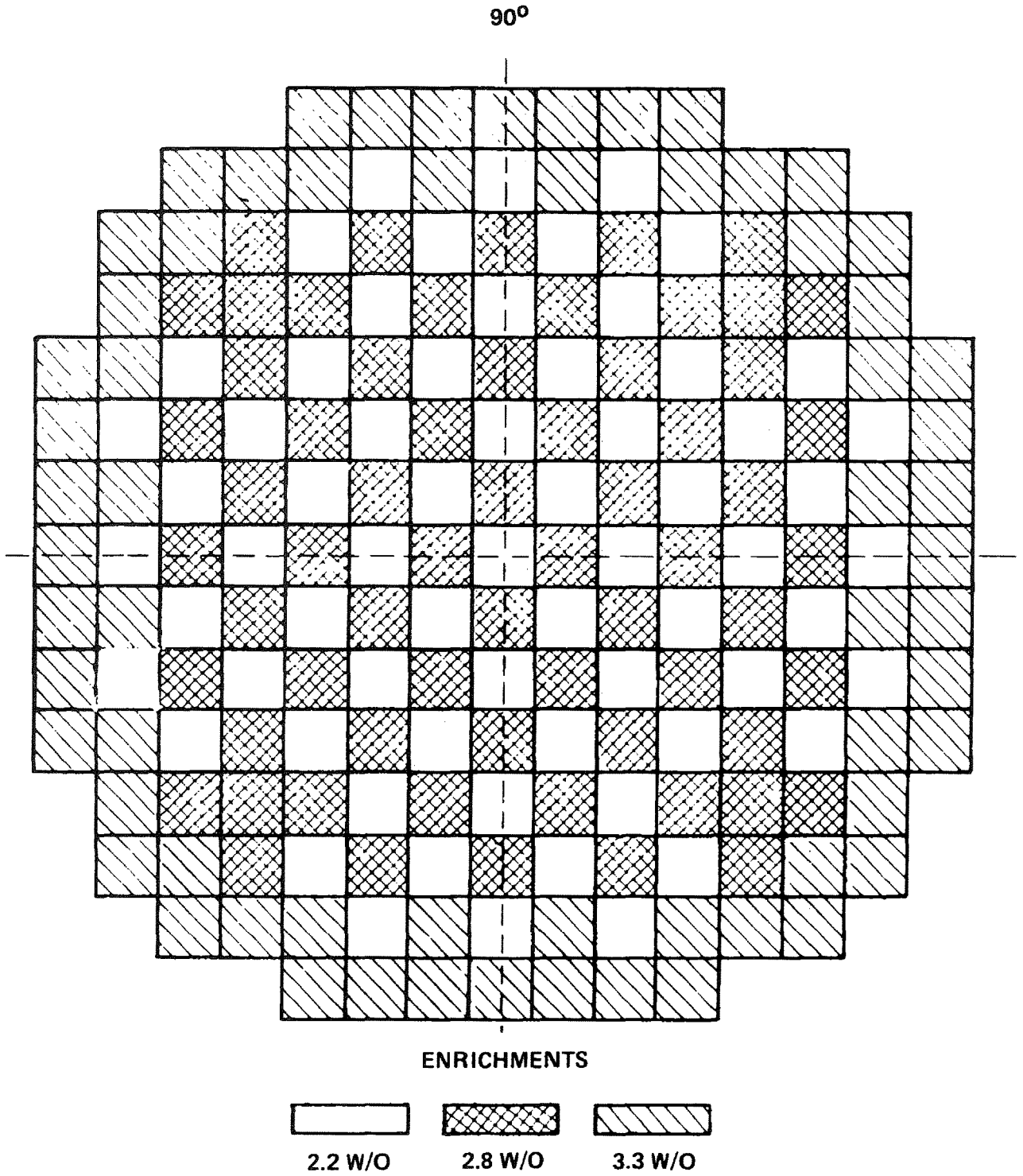
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-45 TYPICAL STABLE FILM BOILING HEAT TRANSFER DATA AND CORRELATION	
MIC. No. 1999MC3683	REV. No. 17B



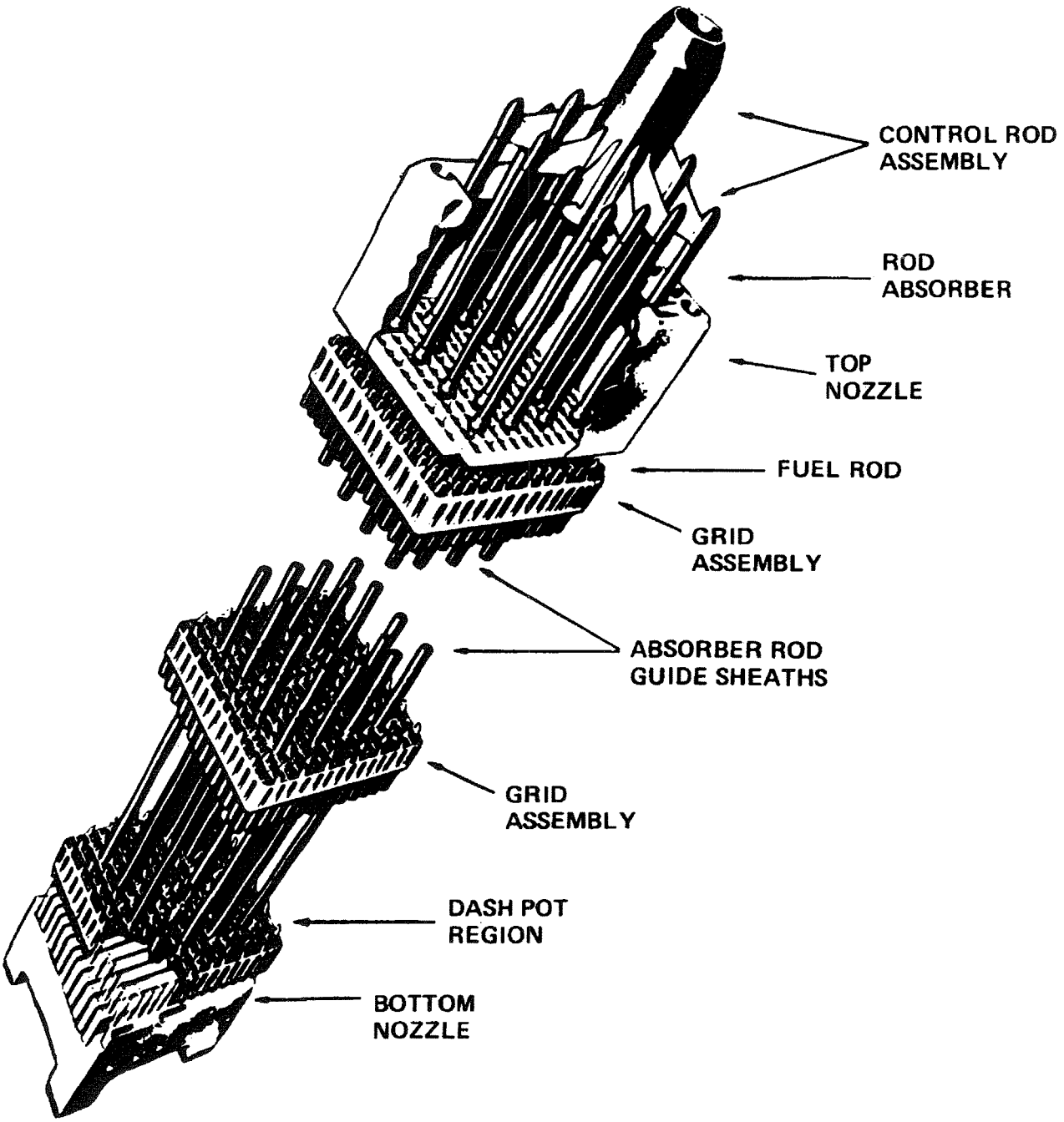
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-46 CORE CROSS SECTION	
MIC. No. 1999MC3684	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-47 REACTOR VESSEL INTERNALS	
MIC. No. 1999MC3685	REV. No. 17A

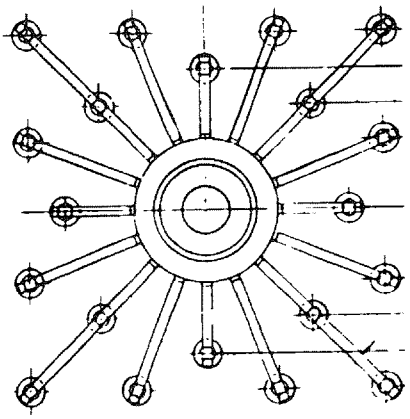


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-48 CORE LOADING ARRANGEMENT – CYCLE 1	
MIC. No. 1999MC3686	REV. No. 17A

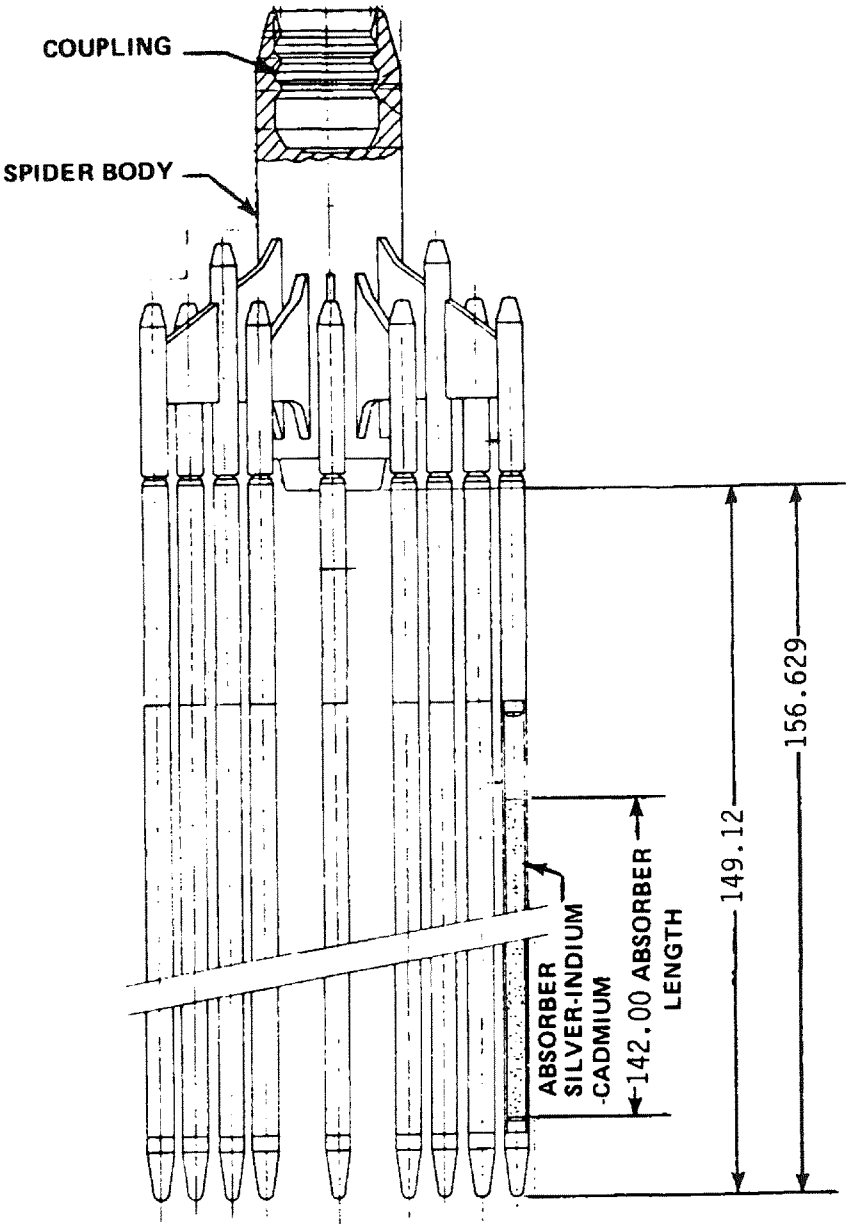


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-49 TYPICAL ROD CLUSTER CONTROL ASSEMBLY	
MIC. No. 1999MC3687	REV. No. 17A

2/0314

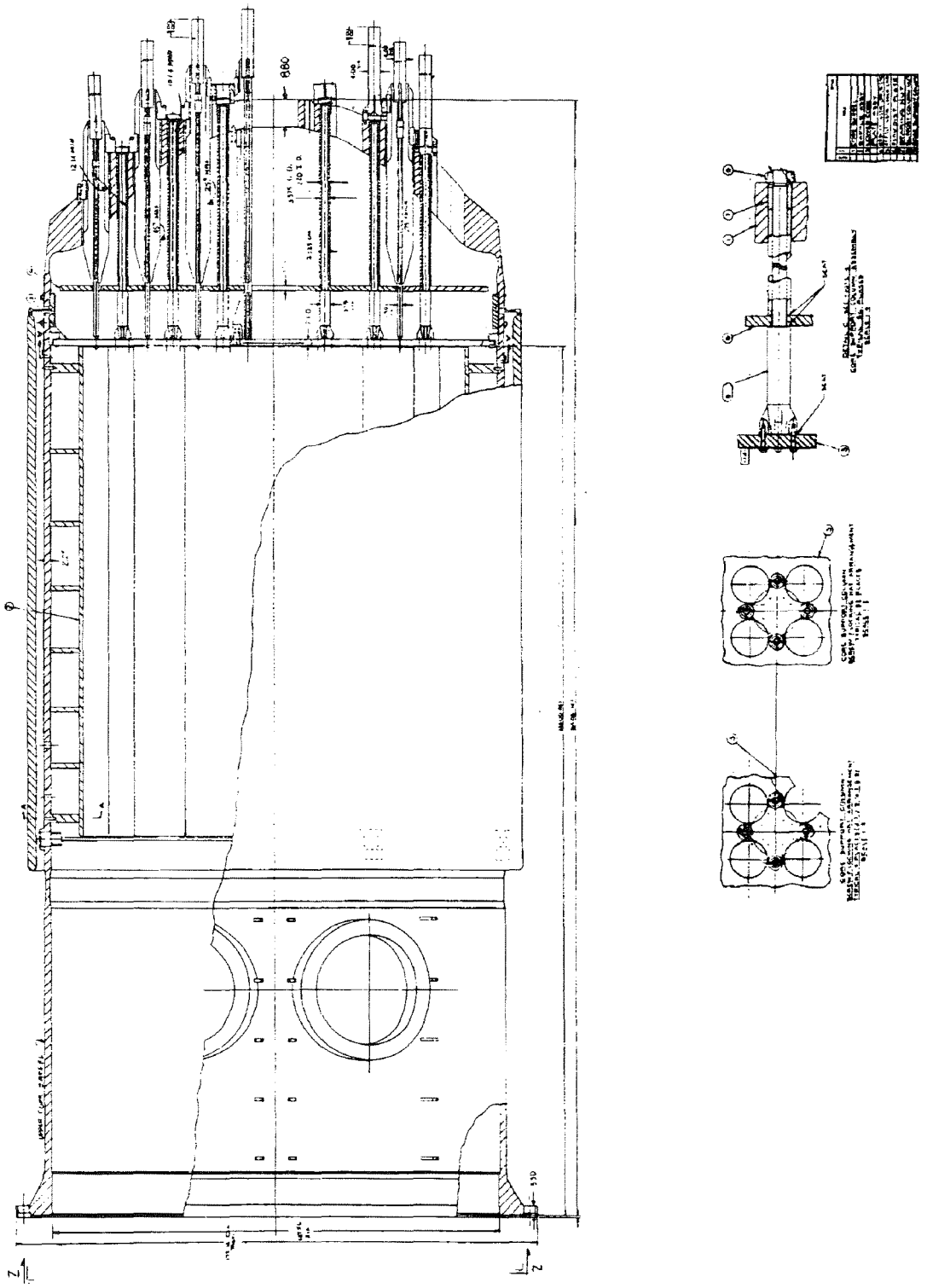


TOP VIEW

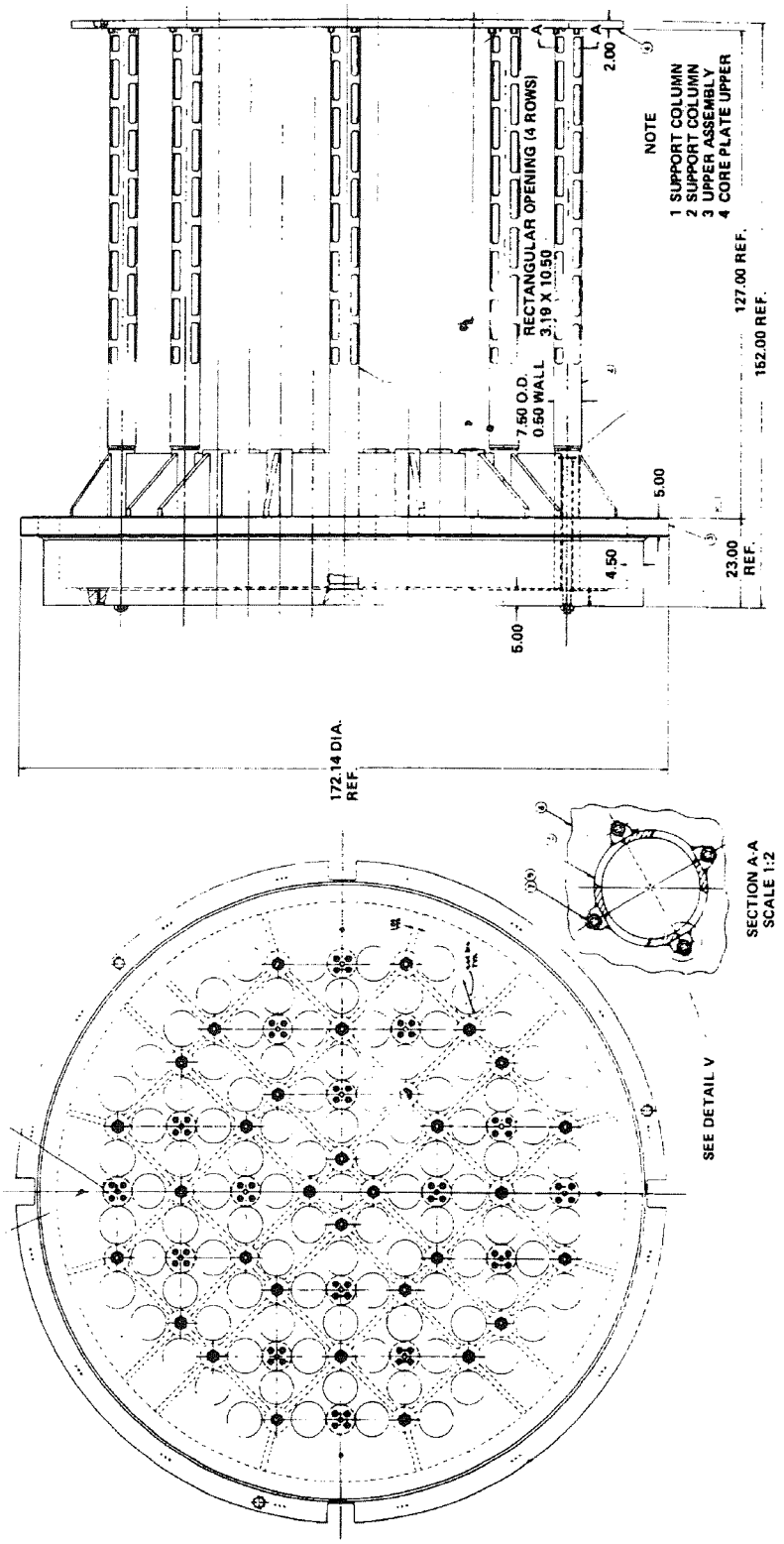


Note: Dimensions are expressed in inches.

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-50 ROD CONTROL CLUSTER ASSEMBLY OUTLINE	
MIC. No. 1999MC3688	REV. No. 17A

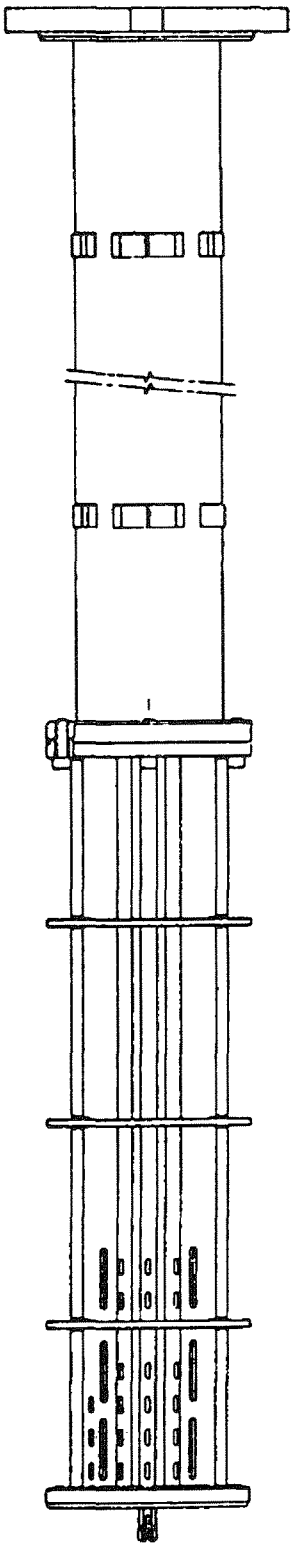


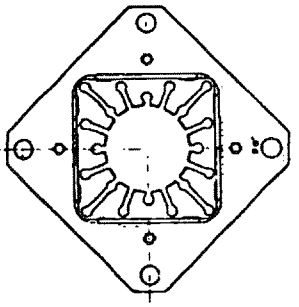
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-51 CORE BARREL ASSEMBLY	
MIC. No. 1999MC3705	REV. No. 17A



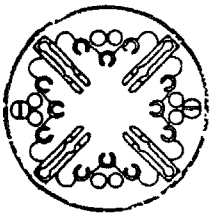
Note: Dimensions are expressed in inches.

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-52 UPPER CORE SUPPORT STRUCTURE	
MIC. No. 1999MC3706	REV. No. 17A



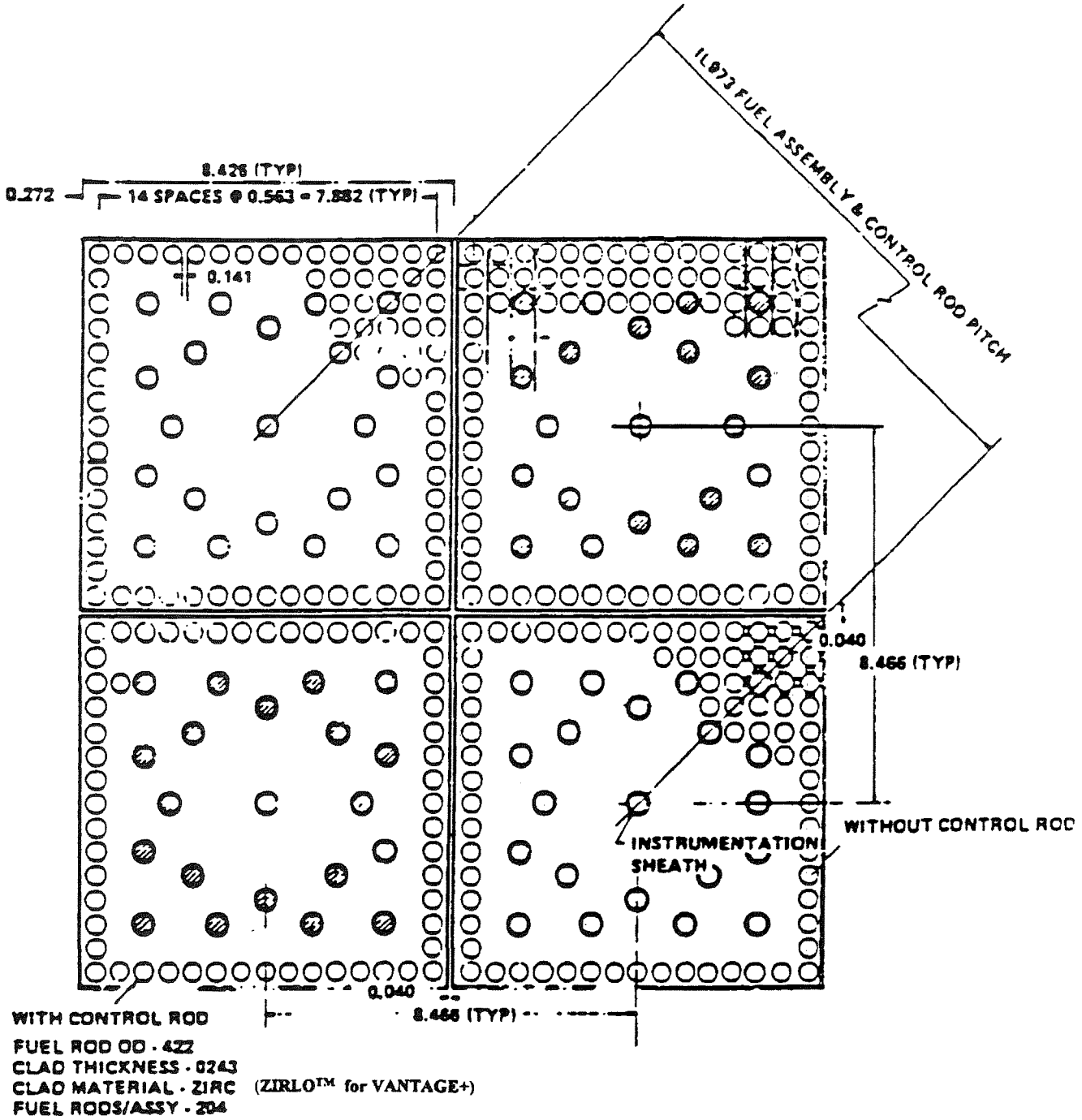


TOP VIEW



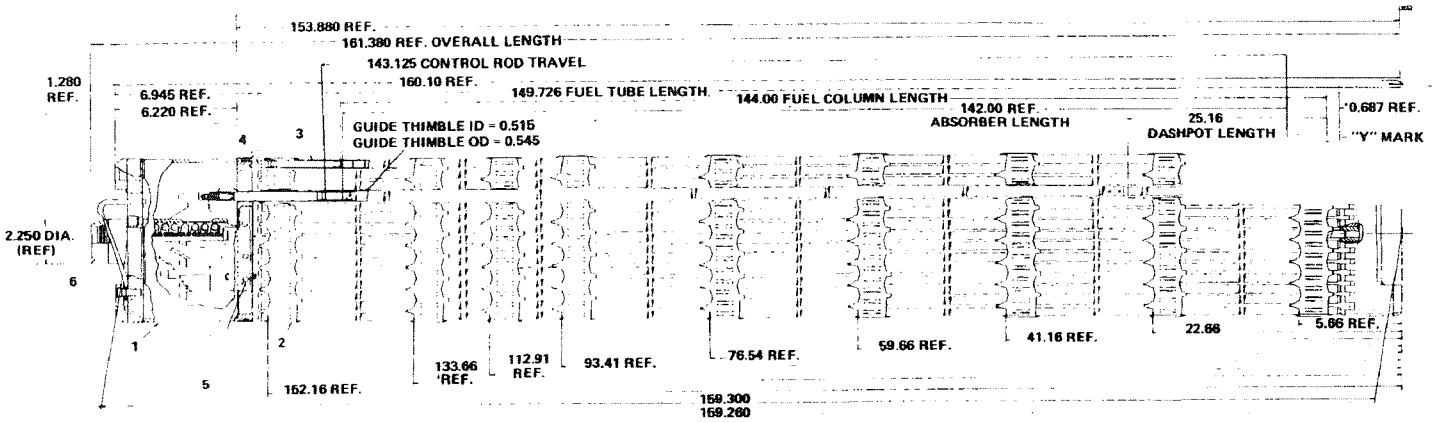
BOTTOM VIEW

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2–53 GUIDE TUBE ASSEMBLY	
MIC. No. 1999MC3707	REV. No. 17A



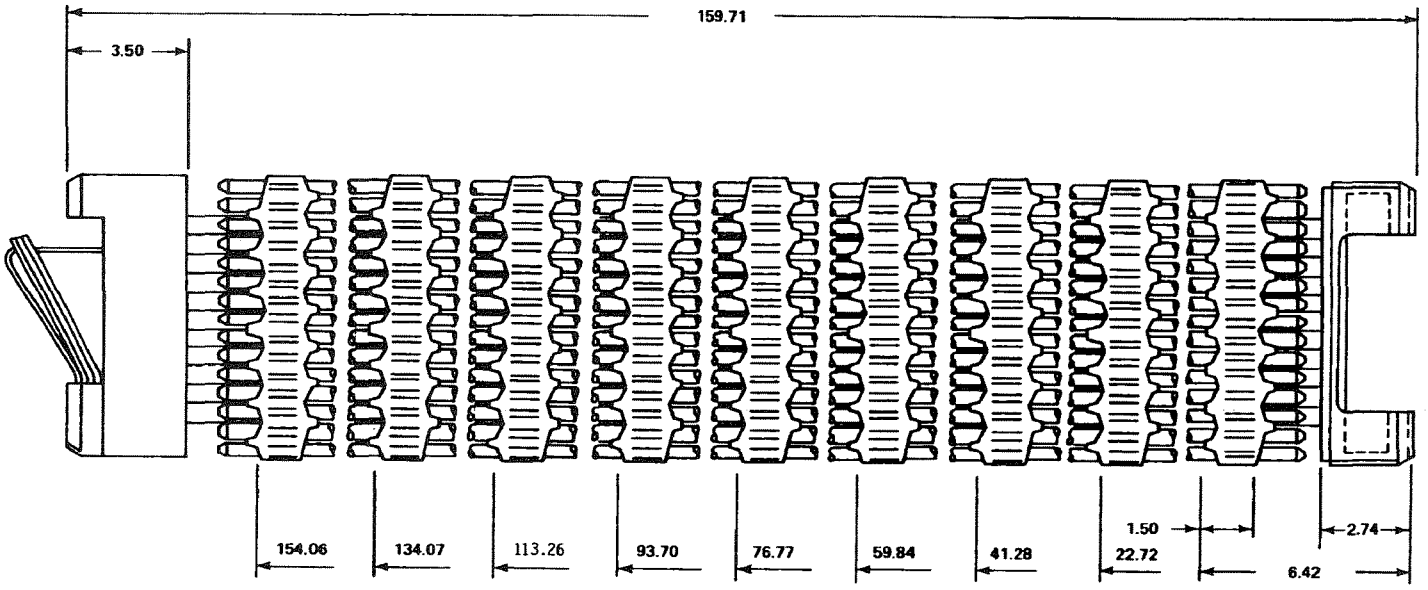
Note: (1) All dim. corrected to 68°F ± 2°
(2) Dimensions are expressed in inches

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-54 FUEL ASSEMBLY AND CONTROL CLUSTER CROSS SECTION – HIPAR, LOPAR, OFA AND VANTAGE+	
MIC. No. 1999MC3708	REV. No. 17A



Note: Dimensions are expressed in inches.

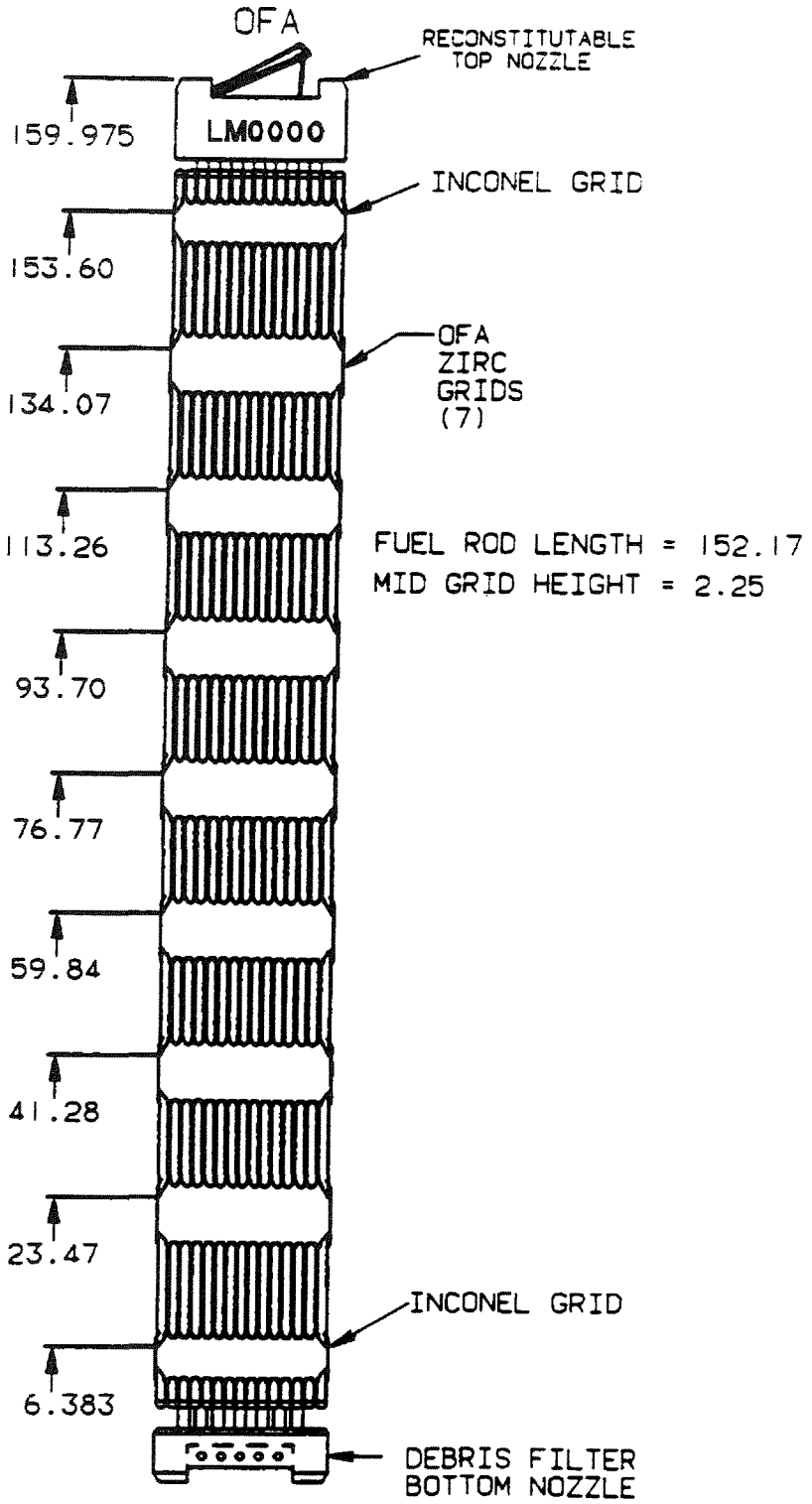
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-55 HIPAR FUEL ASSEMBLY	
MIC. No. 1999MC3709	REV. No. 17A



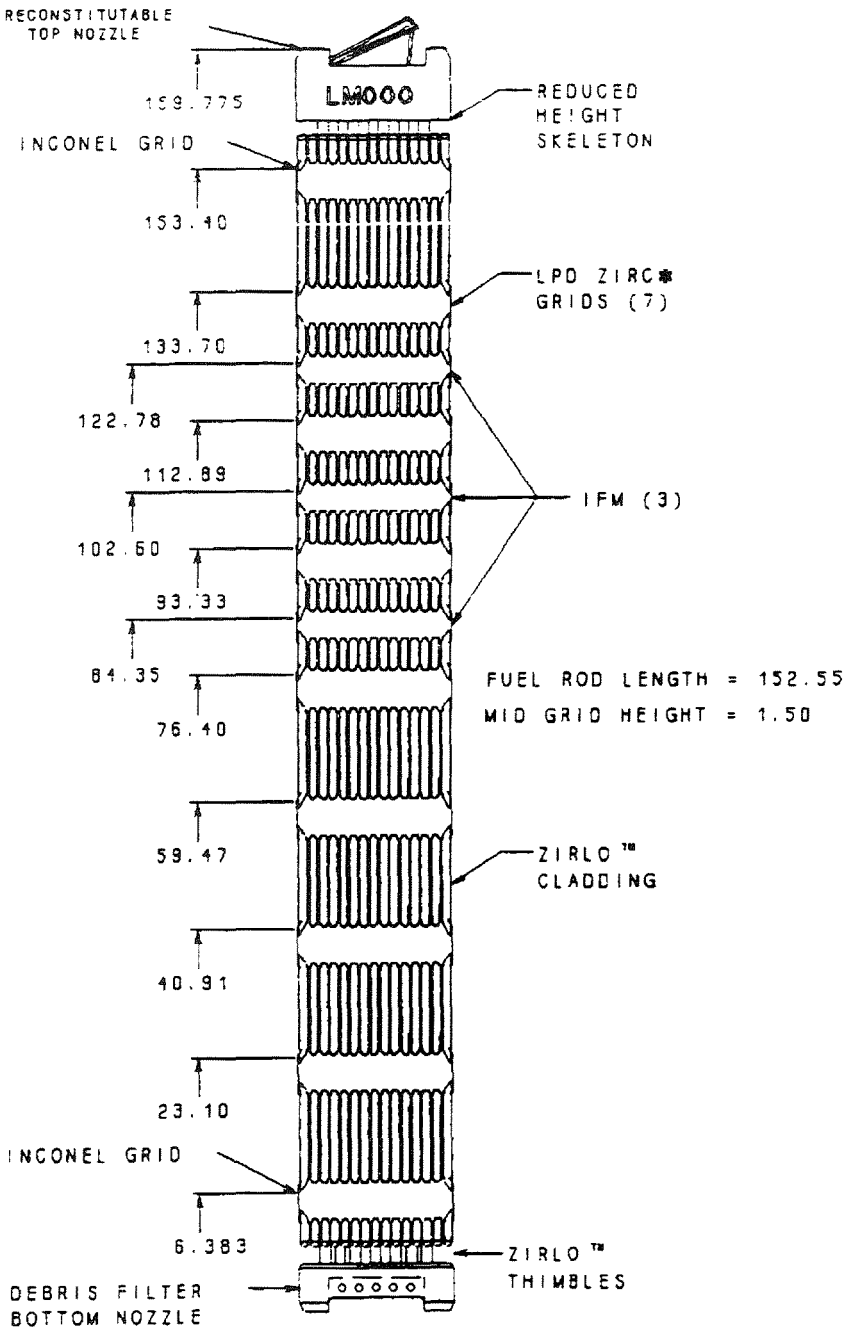
Note: Dimensions are expressed in inches.

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-56 LOPAR FUEL ASSEMBLY	
MIC. No. 1999MC3710	REV. No. 17A

OPTIMIZED (OFA) FUEL ASSEMBLY

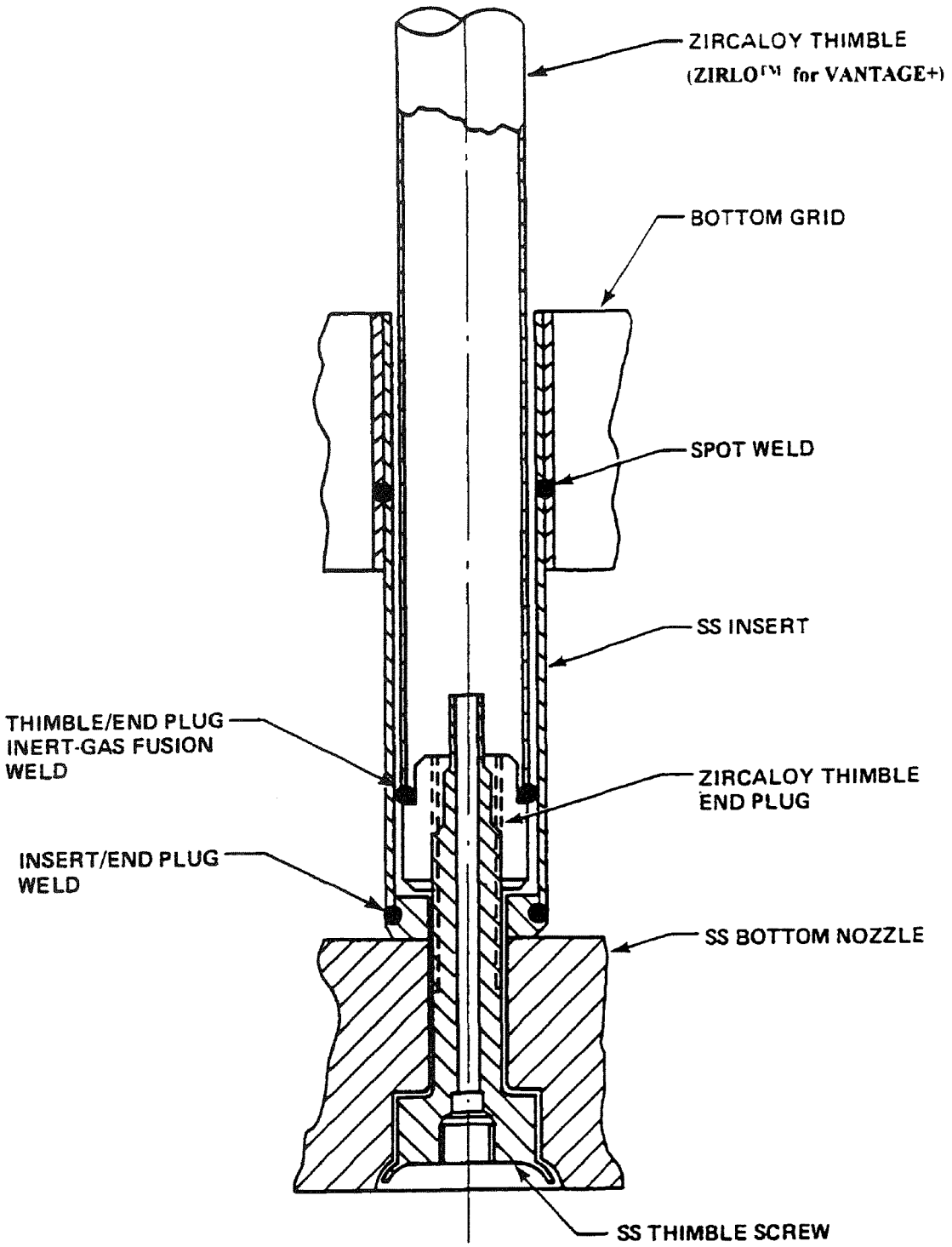


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-56A OFA FUEL ASSEMBLY	
MIC. No. 1999MC3711	REV. No. 17A

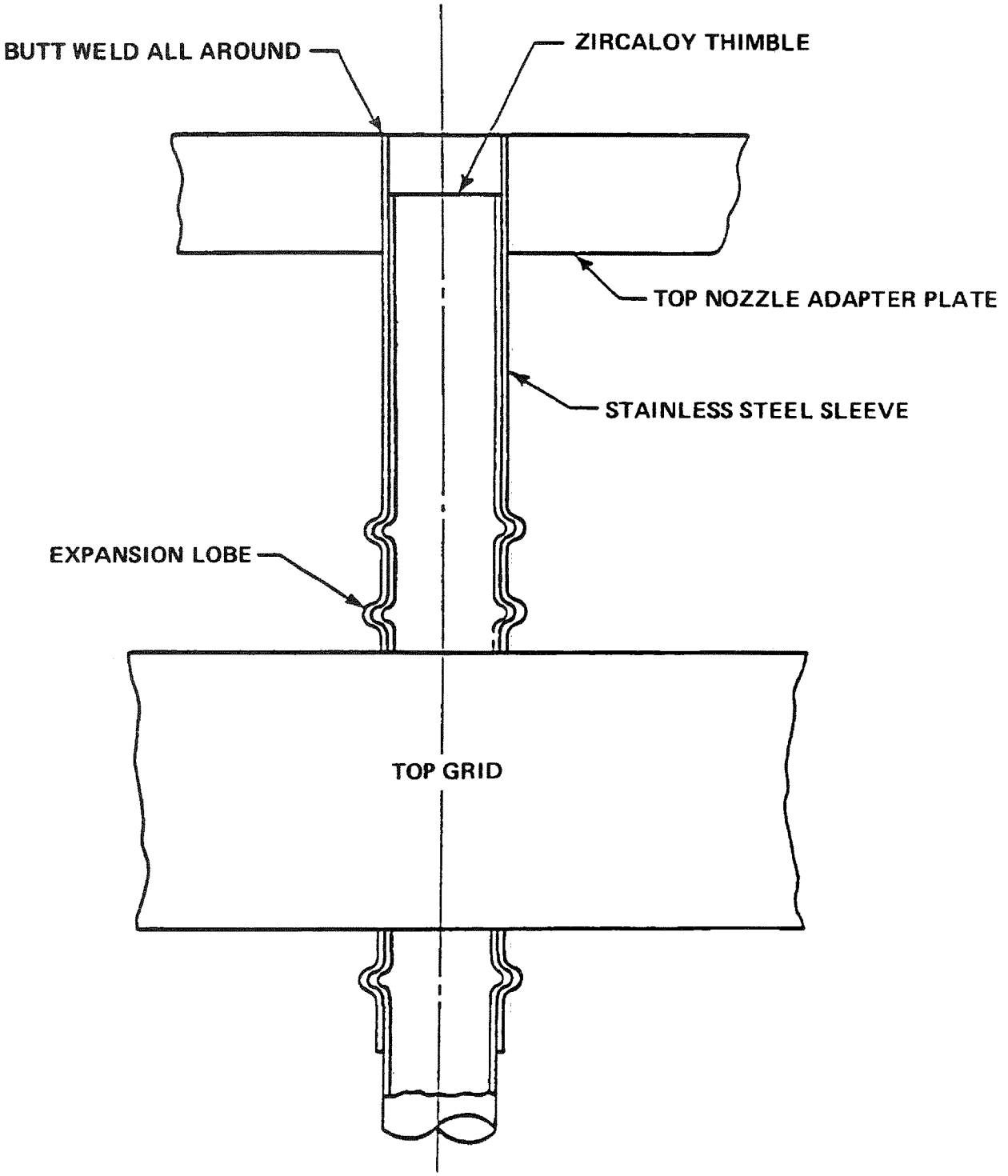


* VANTAGE+ FUEL WITH PERFORMANCE + FEATURES WILL HAVE ZIRLO™ MIDGRIDS.

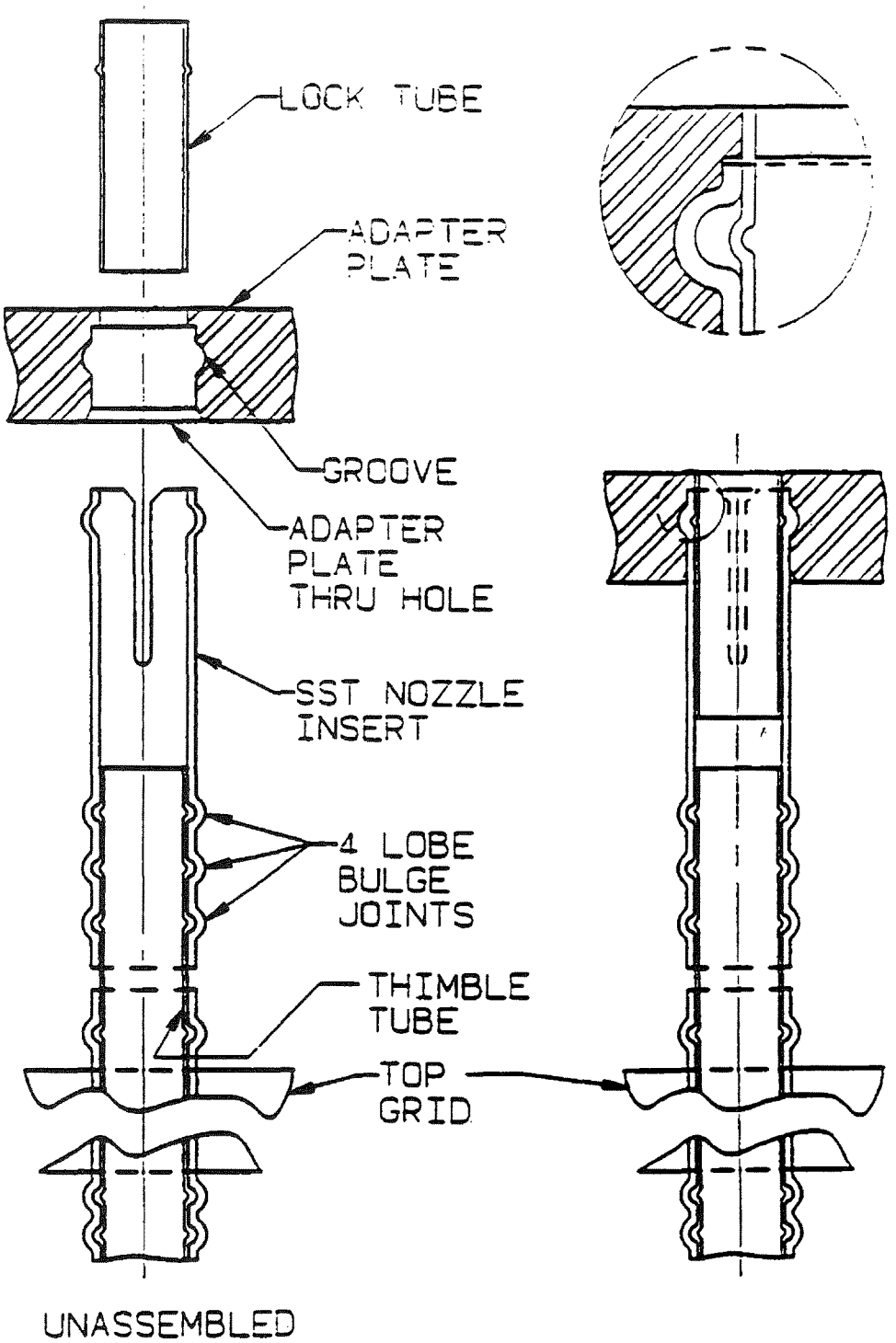
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-56B VANTAGE+ FUEL ASSEMBLY	
MIC. No. 1999MC3712	REV. No. 17A



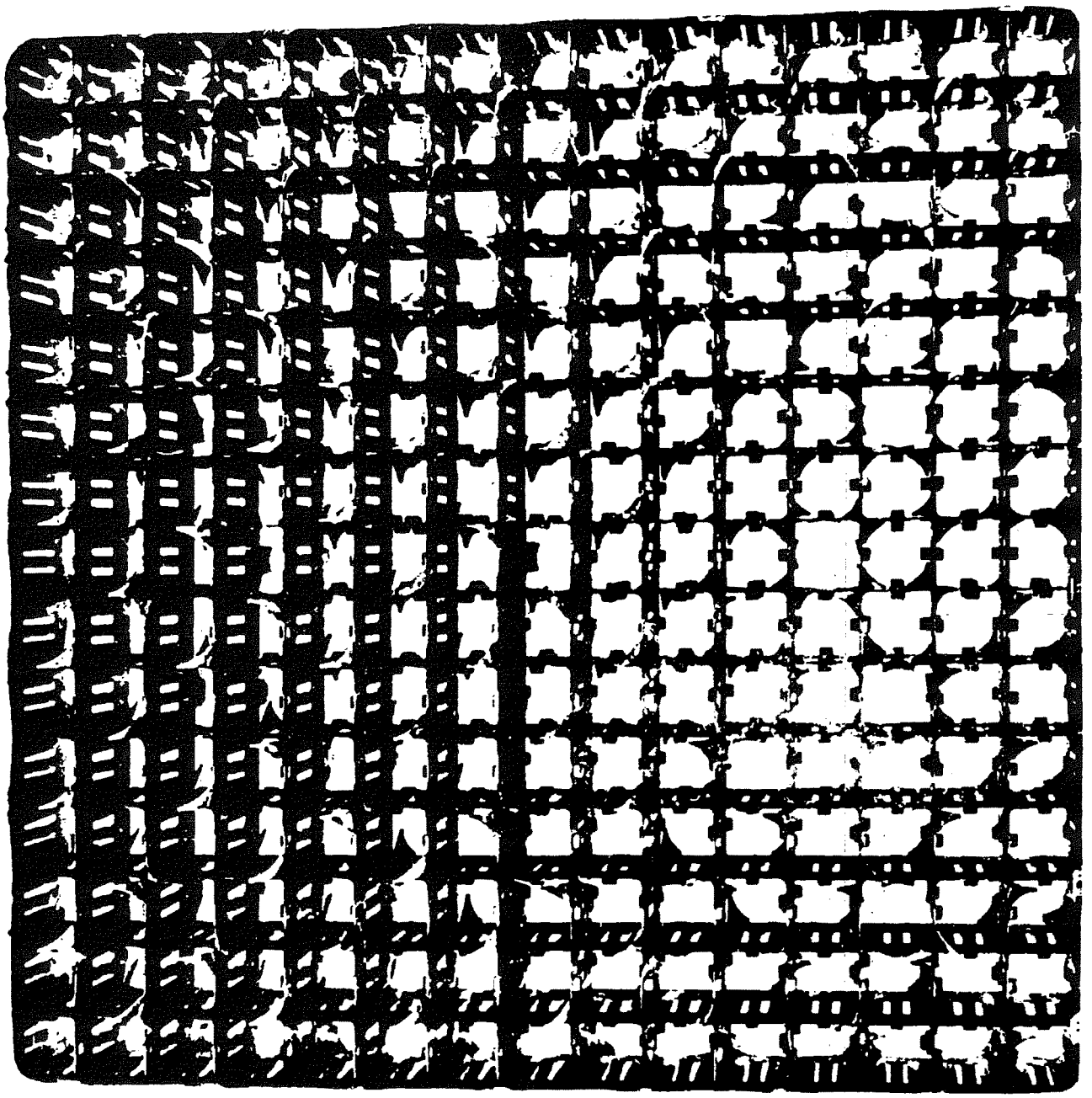
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-57 GUIDE THIMBLE TO BOTTOM NOZZLE JOINT	
MIC. No. 1999MC3713	REV. No. 17A



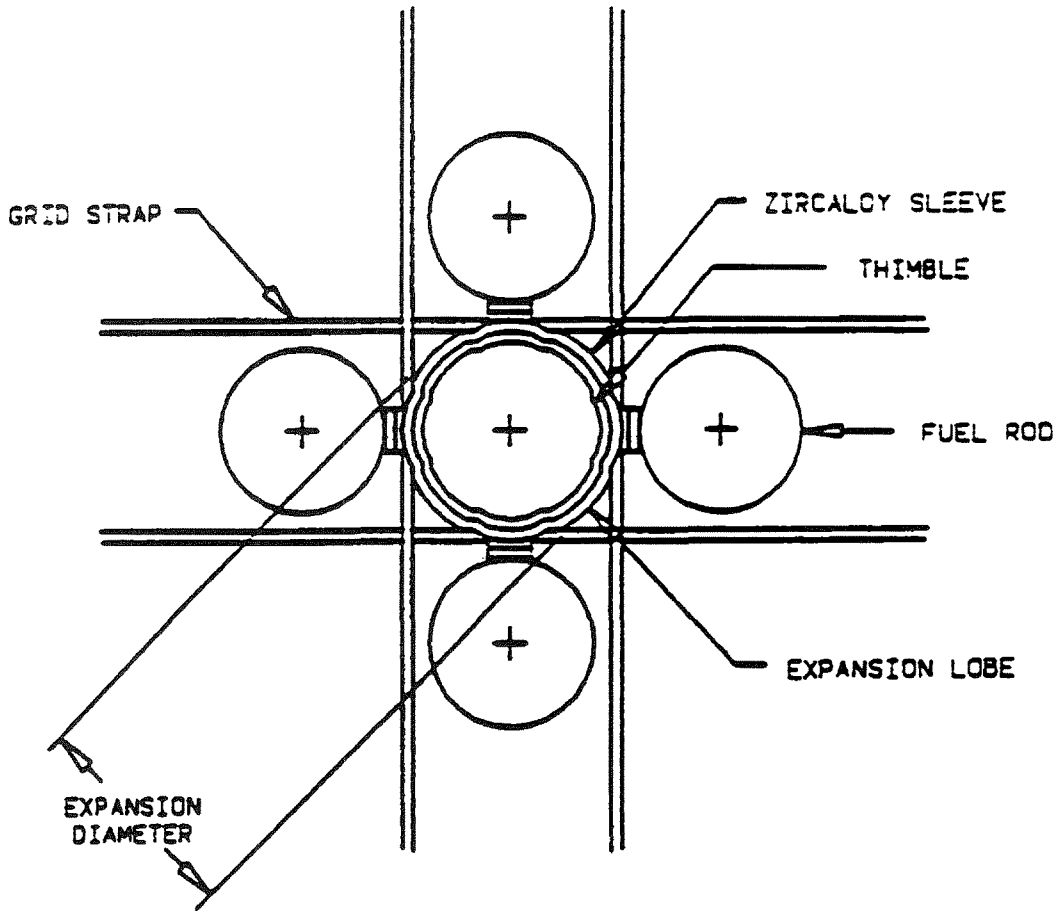
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2–58 LOPAR TOP GRID TO NOZZLE ATTACHMENT	
MIC. No. 1999MC3714	REV. No. 17A



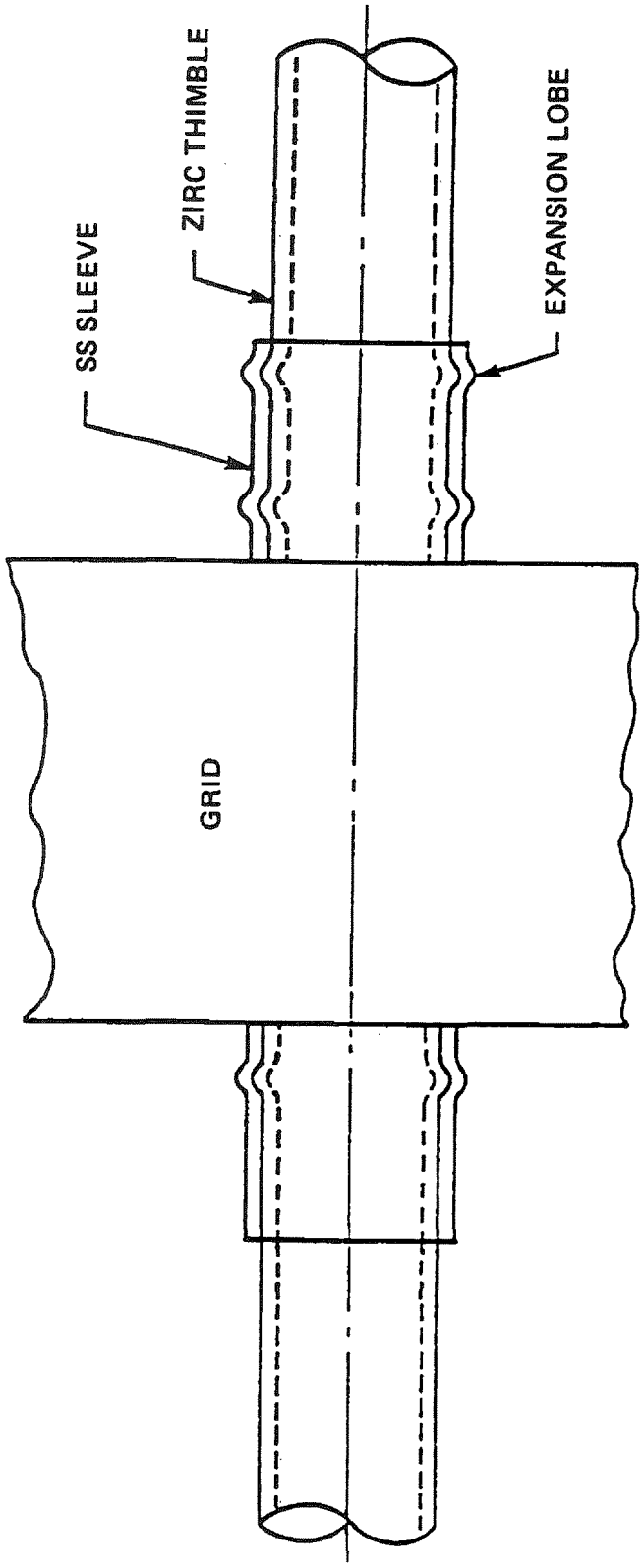
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-58A OFA and VANTAGE+ TOP GRID TO NOZZLE ATTACHMENT	
MIC. No. 1999MC3715	REV. No. 17A



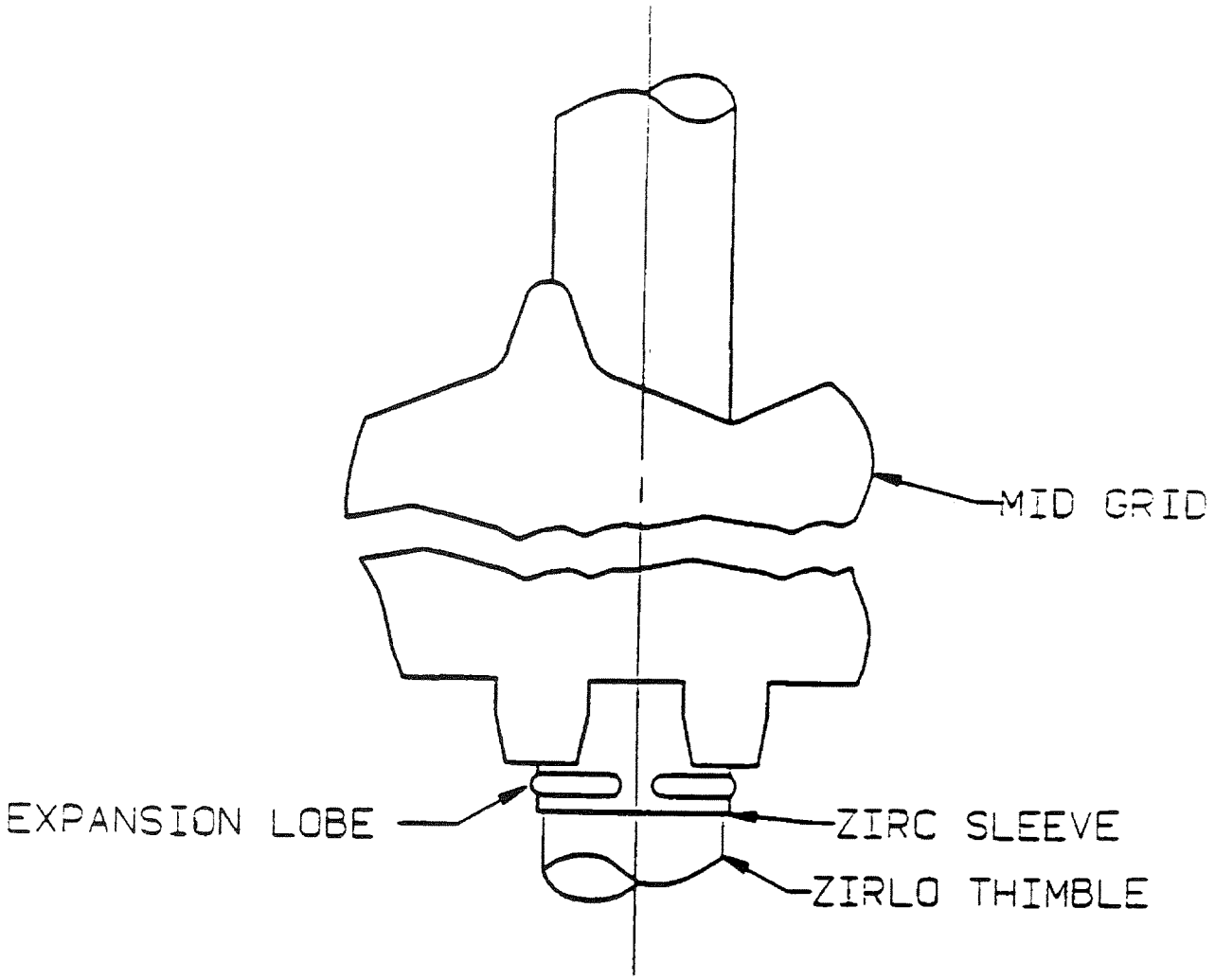
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-59 SPRING CLIP GRID ASSEMBLY	
MIC. No. 1999MC3716	REV. No. 17A



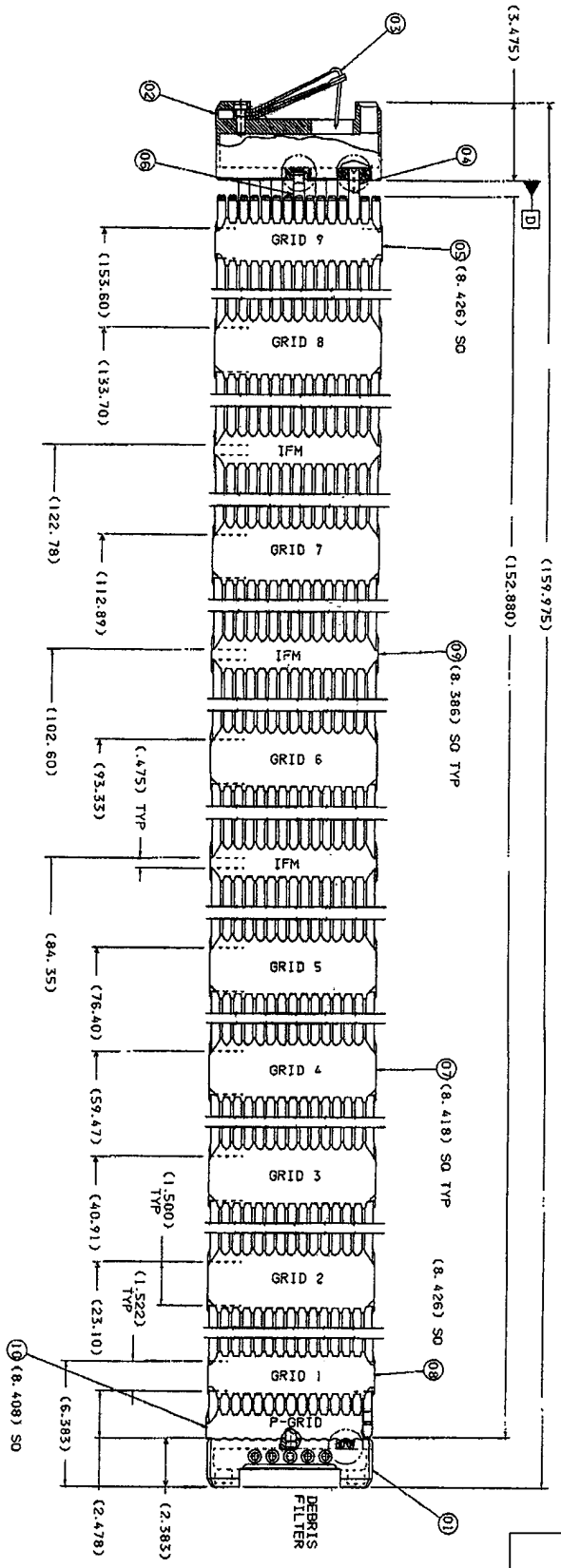
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-60 MID-GRID EXPANSION JOINT DESIGN PLAN VIEW	
MIC. No. 1999MC3717	REV. No. 17A



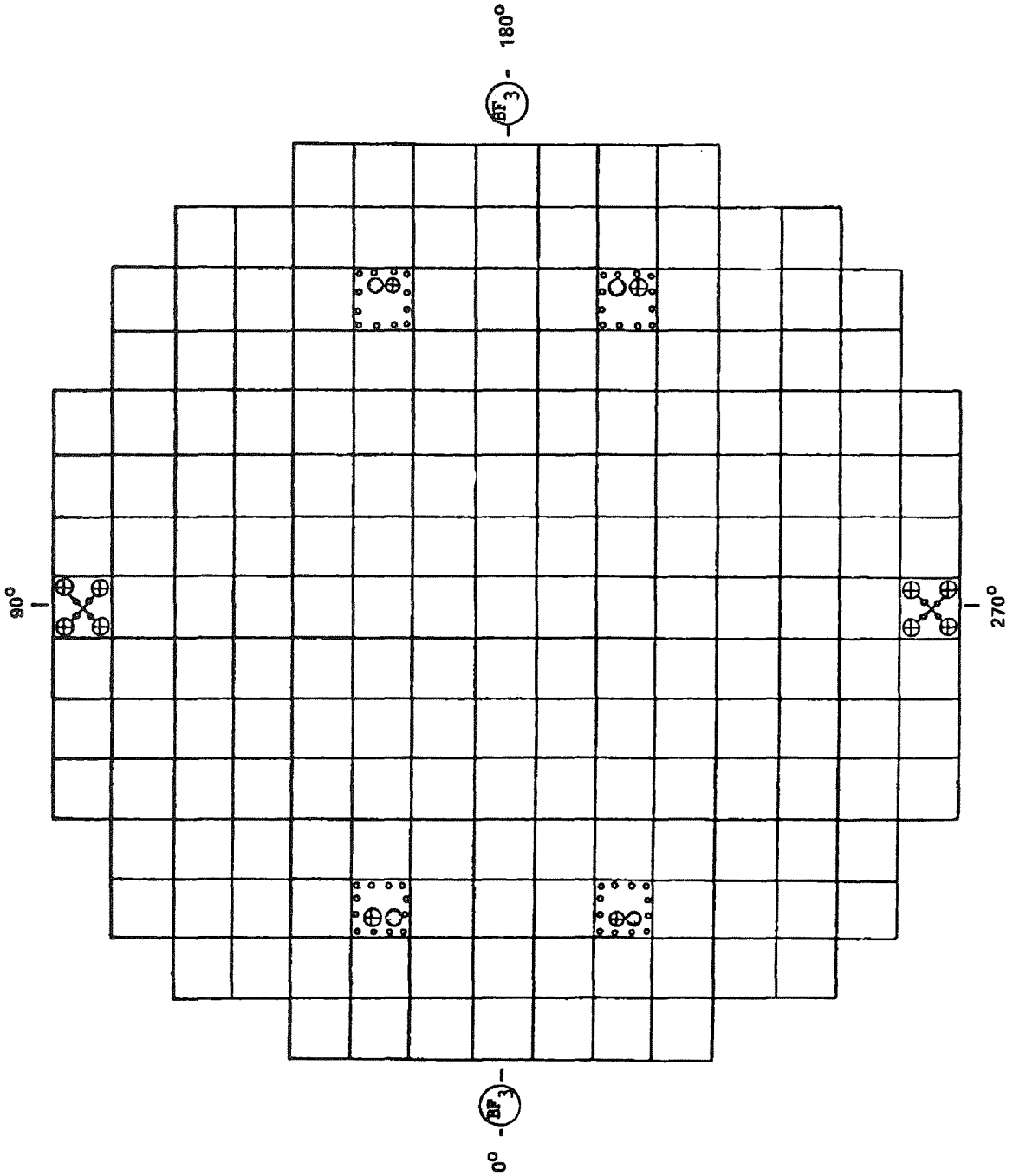
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-61 ELEVATION VIEW – LOPAR GRID TO THIMBLE ATTACHMENT	
MIC. No. 1999MC3718	REV. No. 17A

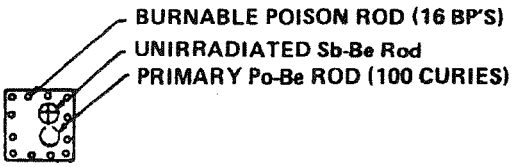


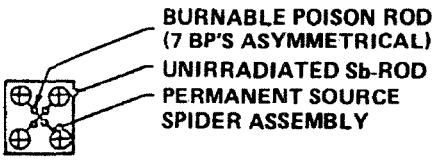
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-61A ELEVATION VIEW – VANTAGE+ GRID TO THIMBLE ATTACHMENT	
MIC. No. 1999MC3719	REV. No. 17A



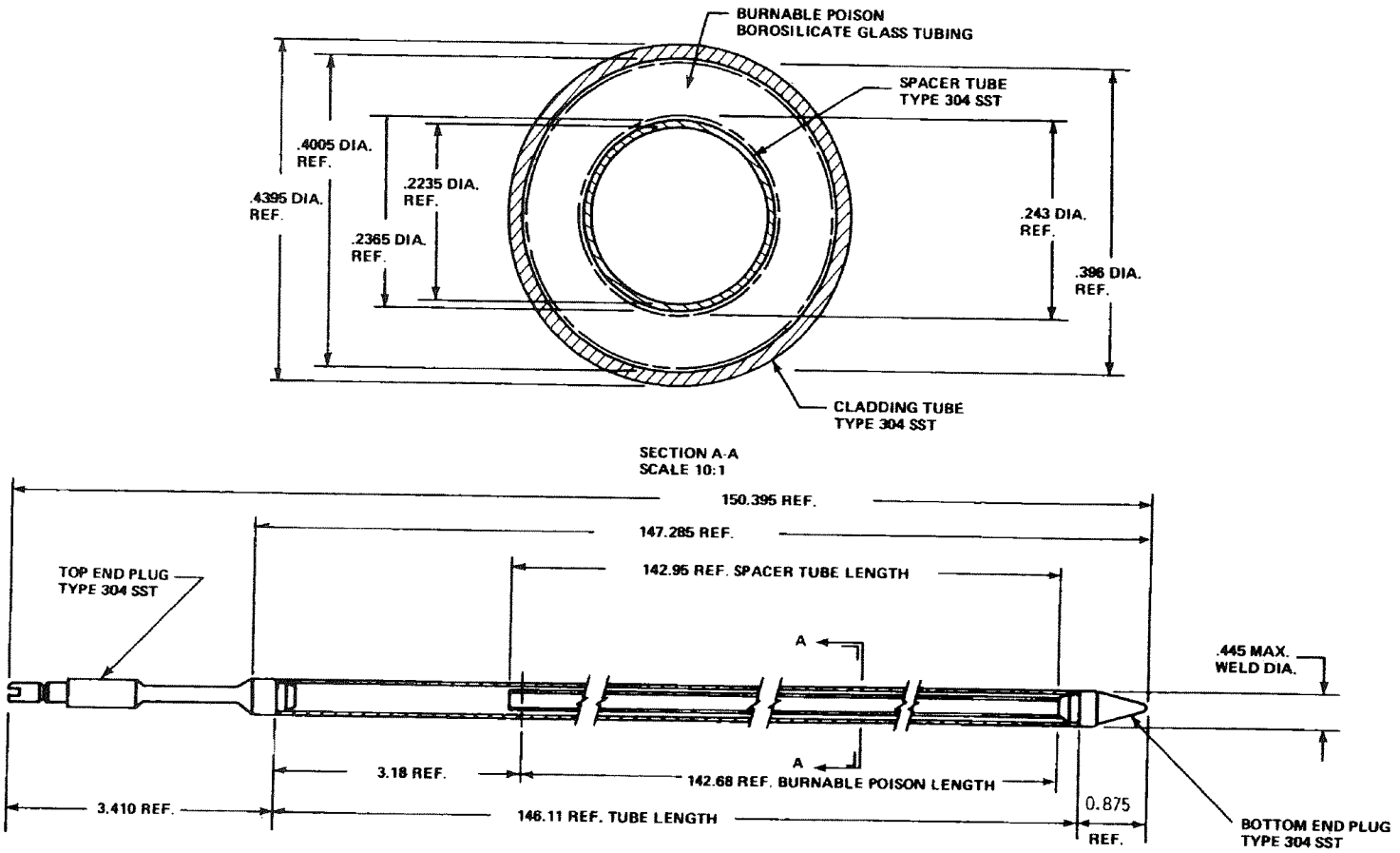
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-61B VANTAGE+ FUEL ASSEMBLY WITH PERFORMANCE+ ENHANCEMENTS	
MIC. No. 1999MC3720	REV. No. 17B





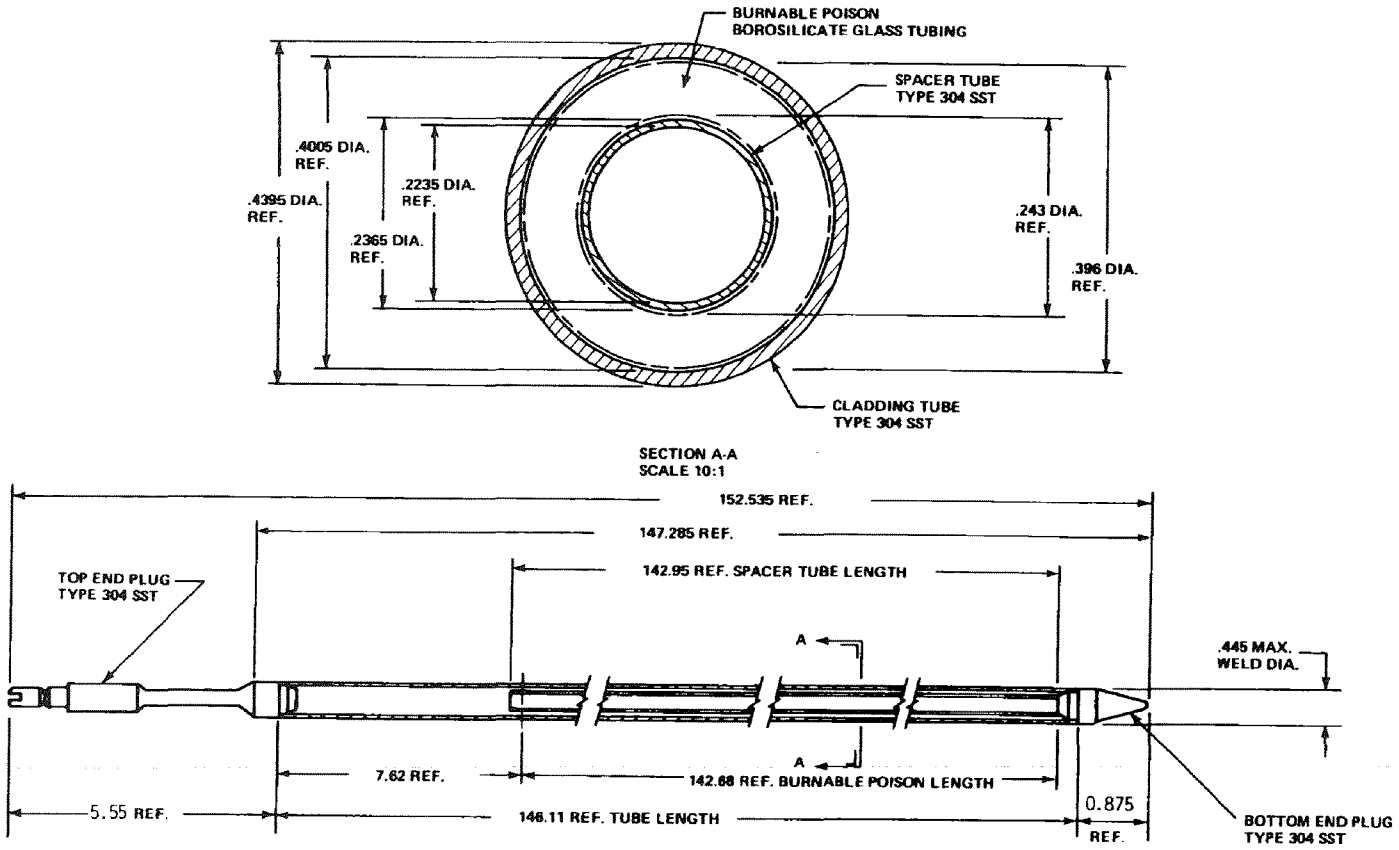


INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-62 CYCLE 1 – NEUTRON SOURCE LOCATIONS	
MIC. No. 1999MC3721	REV. No. 17A



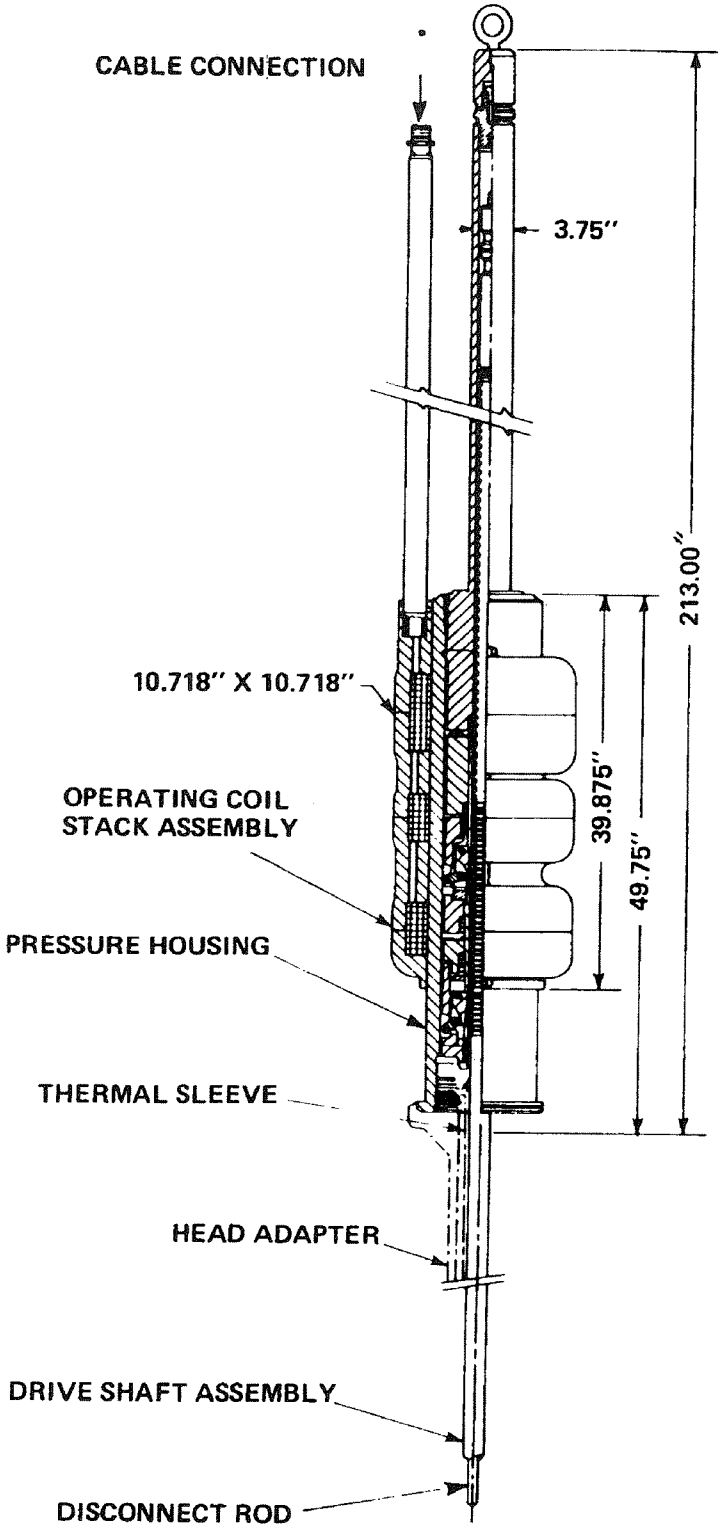
Note: Dimensions are expressed in inches.

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-63 HIPAR BURNABLE POISON ROD	
MIC. No. 1999MC3722	REV. No. 17A

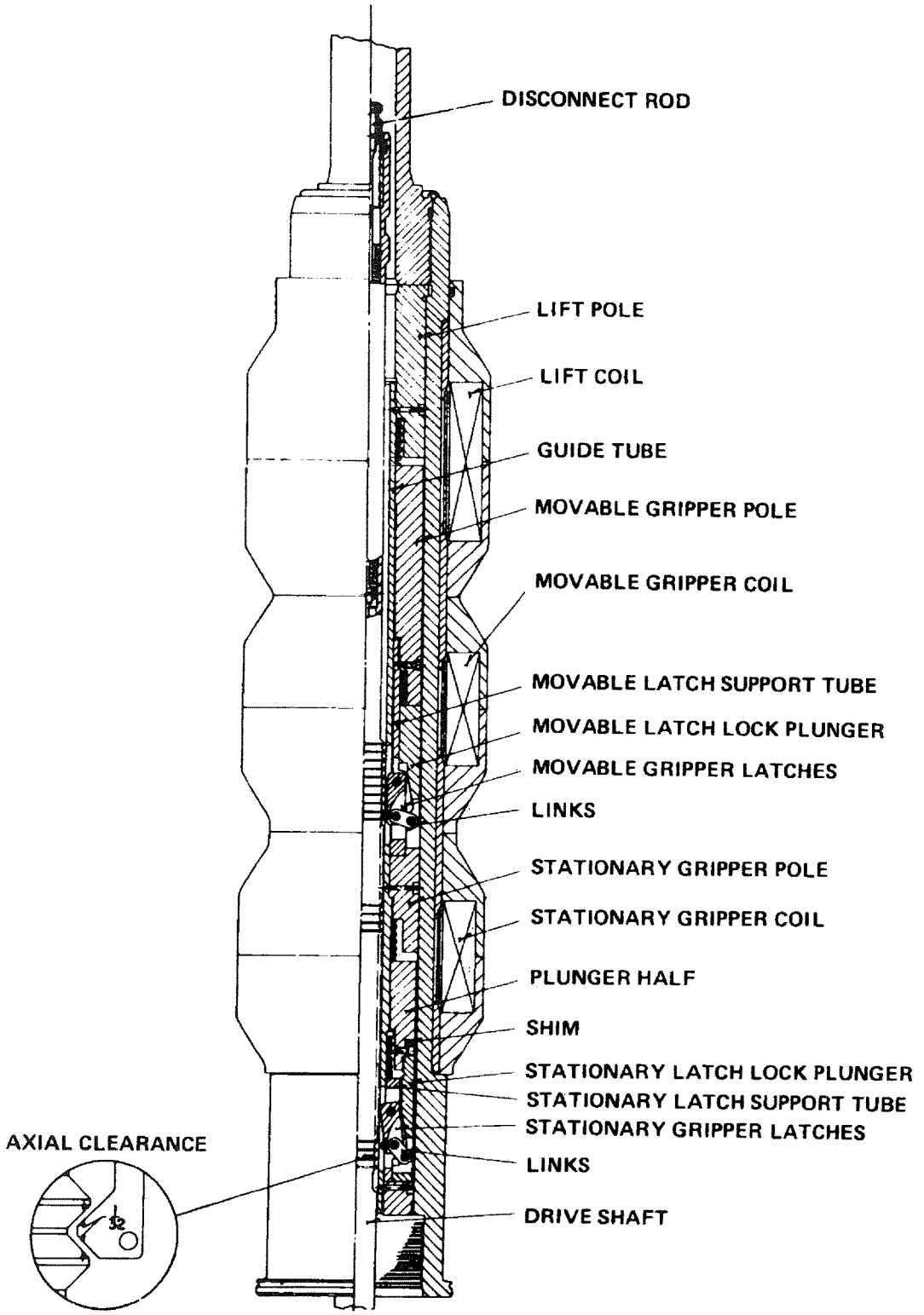


Note: Dimensions are expressed in inches.

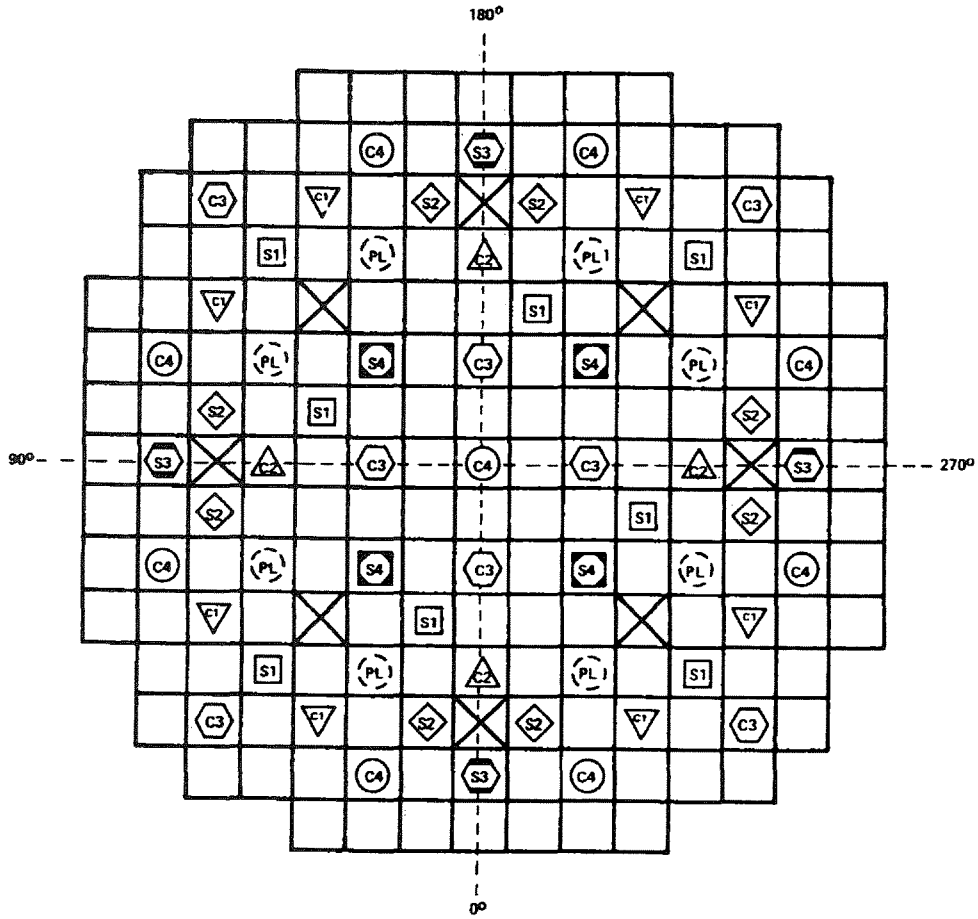
INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-64 LOPAR BURNABLE POISON ROD	
MIC. No. 1999MC3723	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-65 CONTROL ROD DRIVE MECHANISM ASSEMBLY	
MIC. No. 1999MC3724	REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2–66 CONTROL ROD DRIVE MECHANISM SCHEMATIC	
MIC. No. 1999MC3725	REV. No. 17A

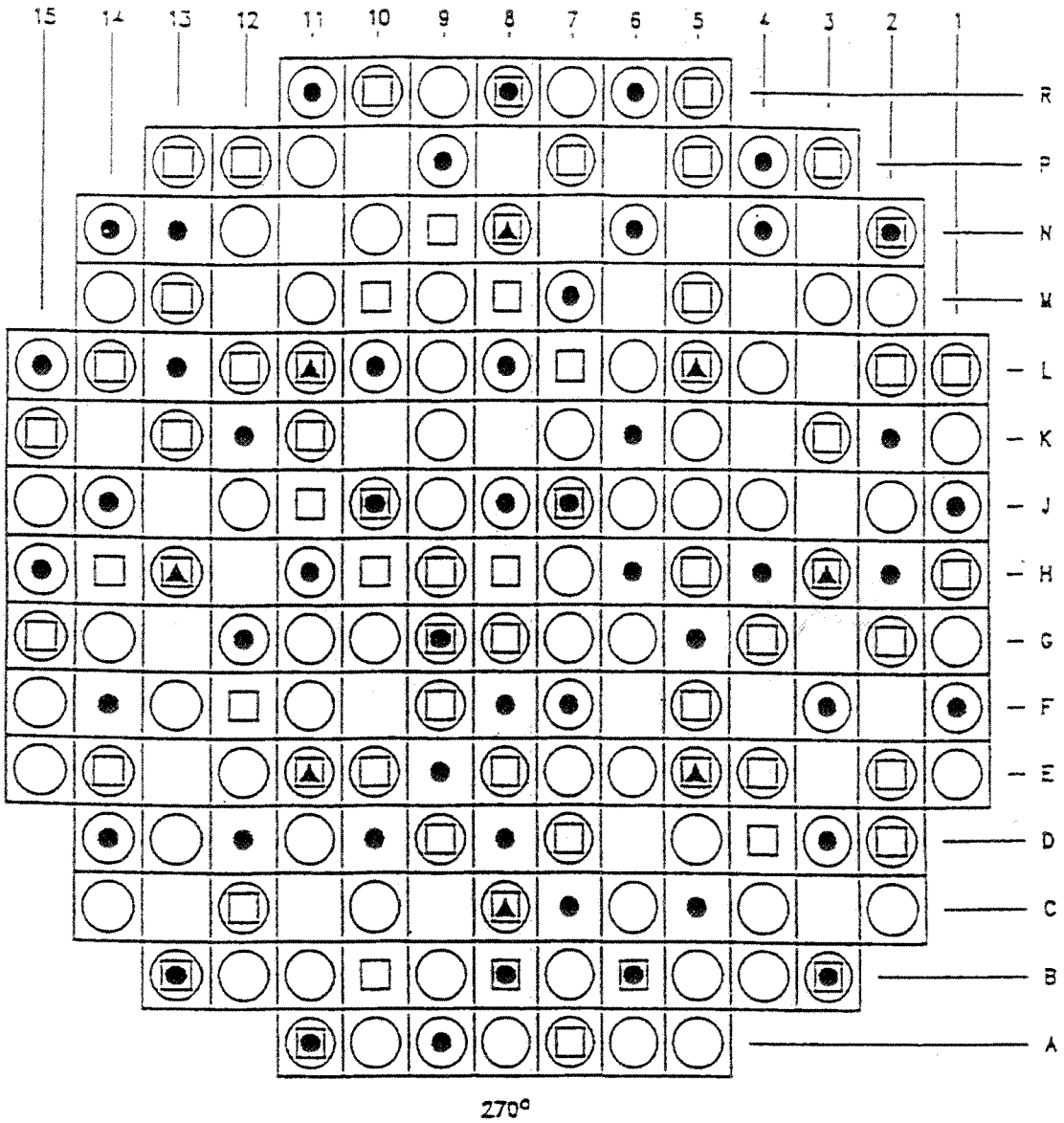


ROD CLUSTER CONTROL BANKS

BANK	SYMBOL
S1	□
S2	◇
S3	⬡
S4	□
C1	▽
C2	△
C3	⬡
C4	○
PL	◌
(PART-LENGTH ROD)*	
FIXED INCORE	×

Note: Part-length rods have been removed since the orginal design.

INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-67 THIMBLE LOCATIONS – FIXED INCORE DETECTORS	
MIC. No. 1999MC3726	REV. No. 17A



THERMOCOUPLE LOCATION..... 65

MOVABLE DETECTOR LOCATION.... 50

FLOW MIXING DEVICE LOCATION.. 132

FIXED DETECTOR LOCATION..... 8

INDIAN POINT UNIT No. 2	
INCORE DETECTOR, THERMOCOUPLE AND FLOW MIXING DEVICE LOCATIONS	
UFSAR FIGURE 3.2-68	REV. No. 19

FIGURE 2
INDIAN POINT UNIT 2, CYCLE 21
CORE COMPONENTS AND FRESH INTEGRAL BA LOCATIONS

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
R																R
P					100I	RCCA 148I	20W 148I	RCCA 148I	20W 148I	RCCA 148I	100I					P
N			RCCA	148I	RCCA	20W 116I	RCCA	20W 148I	RCCA	20W 116I	RCCA	148I	RCCA			N
M			148I	RCCA	16W 148I		20W 148I	RCCA	20W 148I		16W 148I	RCCA	6SSA 148I			M
L		100I	RCCA	16W 148I		20W 148I		20W 148I	RCCA	20W 148I		16W 148I	RCCA	100I		L
K		RCCA 148I	20W 116I		20W 148I	RCCA	20W 148I	RCCA	20W 148I	RCCA	20W 148I		20W 116I	RCCA 148I		K
J		20W 148I	RCCA	20W 148I	RCCA	20W 148I		20W 148I		20W 148I		20W 148I	RCCA	20W 148I		J
H	0°	RCCA 148I	20W 148I	RCCA	20W 148I	RCCA	20W 148I	RCCA	20W 148I	RCCA	20W 148I	RCCA	20W 148I	RCCA 148I		H
G		20W 148I	RCCA	20W 148I		20W 148I		20W 148I		20W 148I	RCCA	20W 148I	RCCA	20W 148I		G
F		RCCA 148I	20W 116I		20W 148I	RCCA	20W 148I	RCCA	20W 148I	RCCA	20W 148I		20W 116I	RCCA 148I		F
E		100I	RCCA	16W 148I		20W 148I	RCCA	20W 148I		20W 148I		16W 148I	RCCA	100I		E
D			6SSA 148I	RCCA	16W 148I		20W 148I	RCCA	20W 148I		16W 148I	RCCA	148I			D
C			RCCA	148I	RCCA	20W 116I	RCCA	20W 148I	RCCA	20W 116I	RCCA	148I	RCCA			C
B					100I	RCCA 148I	20W 148I	RCCA 148I	20W 148I	RCCA 148I	100I					B
A																A

270°

LEGEND

TYPE	COMPONENT TYPE
###I	NUMBER OF FRESH IFBA RODS

CORE COMPONENT TYPES

RCCA - CONTROL OR SHUTDOWN RCCA
##W - NUMBER OF RODLETS ON WABA ASSEMBLY
#SSA - NUMBER OF RODLETS ON SECONDARY SOURCE ASSEMBLY

Fuel Assembly Orientation

* Reference Hole
Core Pin Hole
Holdown Bar

NOTE: Figures are Top View
COMPONENT ORIENTATION SHOWN IN TABLE 2

INDIAN POINT UNIT No. 2
CYCLE 21 REGION AND FUEL ASSEMBLY LOCATIONS
UFSAR FIGURE 3.2-68A | REV. No. 23

WESTINGHOUSE PROPRIETARY CLASS 2

FIGURE 1

INDIAN POINT UNIT 2, CYCLE 21

REGION AND FUEL ASSEMBLY LOCATIONS

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
					22B X73	22B X18	22B X75	21A W11	22B X64	22B X14	22B X67					R
			21B W31	22B X31	23B 2A10	23B 2A29	23B 2A51	23A 2A02	23B 2A54	23B 2A70	23B 2A12	22B X27	21B W40			P
		21B W32	22B X48	23B 2A72	22B X23	23B 2A18	22B X30	23A 2A04	22B X28	23B 2A20	22B X35	23B 2A27	22B X22	21B W33		N
		22B X40	23B 2A83	22B X79	23B 2A36	22B X82	23B 2A63	22B X68	23B 2A65	22B X50	23B 2A59	22B X65	23B 2A61	22B X33		M
	22B X56	23B 2A13	22B X34	23B 2A50	22B X76	23B 2A53	22B X87	23B 2A25	22B X80	23B 2A69	22B X84	23B 2A48	22B X42	23B 2A14	22B X77	L
	22B X45	23B 2A38	23B 2A21	22B X93	23B 2A77	22B X19	23B 2A75	22B X96	23B 2A67	22B X37	23B 2A88	22B X78	23B 2A22	23B 2A66	22B X12	K
	22B X49	23B 2A62	22B X07	23B 2A74	22B X81	23B 2A37	22B X20	23B 2A79	22B X05	23B 2A35	22B X63	23B 2A52	22B X06	23B 2A73	22B X58	J
0°	21A W16	23A 2A05	23A 2A06	22B X89	23B 2A57	22B X51	23B 2A76	22A X03	23B 2A78	22B X60	23B 2A87	22B X85	23A 2A07	23A 2A01	21A W18	H
	22B X71	23B 2A30	22B X10	23B 2A86	22B X88	23B 2A31	22B X38	23B 2A43	22B X15	23B 2A34	22B X90	23B 2A44	22B X36	23B 2A56	22B X95	G
	22B X09	23B 2A55	23B 2A23	22B X54	23B 2A39	22B X17	23B 2A71	22B X91	23B 2A60	22B X41	23B 2A80	22B X69	23B 2A17	23B 2A58	22B X16	F
	22B X62	23B 2A15	22B X13	23B 2A40	22B X83	23B 2A49	22B X55	23B 2A33	22B X66	23B 2A32	22B X86	23B 2A41	22B X21	23B 2A09	22B X70	E
		22B X29	23B 2A68	22B X72	23B 2A81	22B X59	23B 2A42	22B X92	23B 2A28	22B X74	23B 2A26	22B X57	23B 2A47	22B X39		D
		21B W28	22B X26	23B 2A85	22B X25	23B 2A24	22B X43	23A 2A08	22B X46	23B 2A19	22B X24	23B 2A82	22B X32	21B W30		C
			21B W38	22B X47	23B 2A16	23B 2A84	23B 2A46	23A 2A03	23B 2A45	23B 2A64	23B 2A11	22B X08	21B W45			B
					22B X52	22B X44	22B X94	21A W19	22B X53	22B X11	22B X61					A

270°

LEGEND

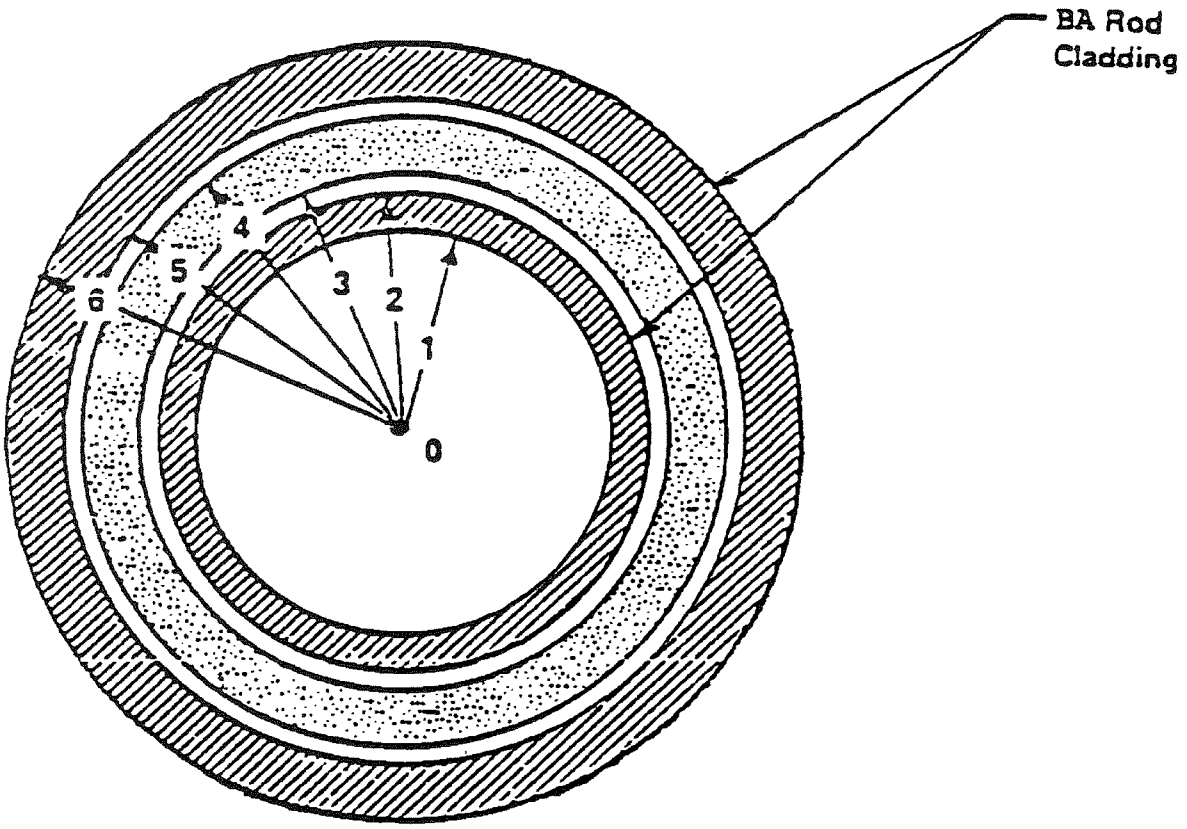
R ID	Region Identifier Fuel Assembly Identifier

Fuel Assembly Orientation

■ Reference Hole
○ Core Pin Hole
\ Holdown Bar

NOTE: Figures are Top View

INDIAN POINT UNIT No. 2
CYCLE 21 CORE COMPONENTS AND FRESH IFBA LOCATIONS
UFSAR FIGURE 3.2-68B | REV. No. 23



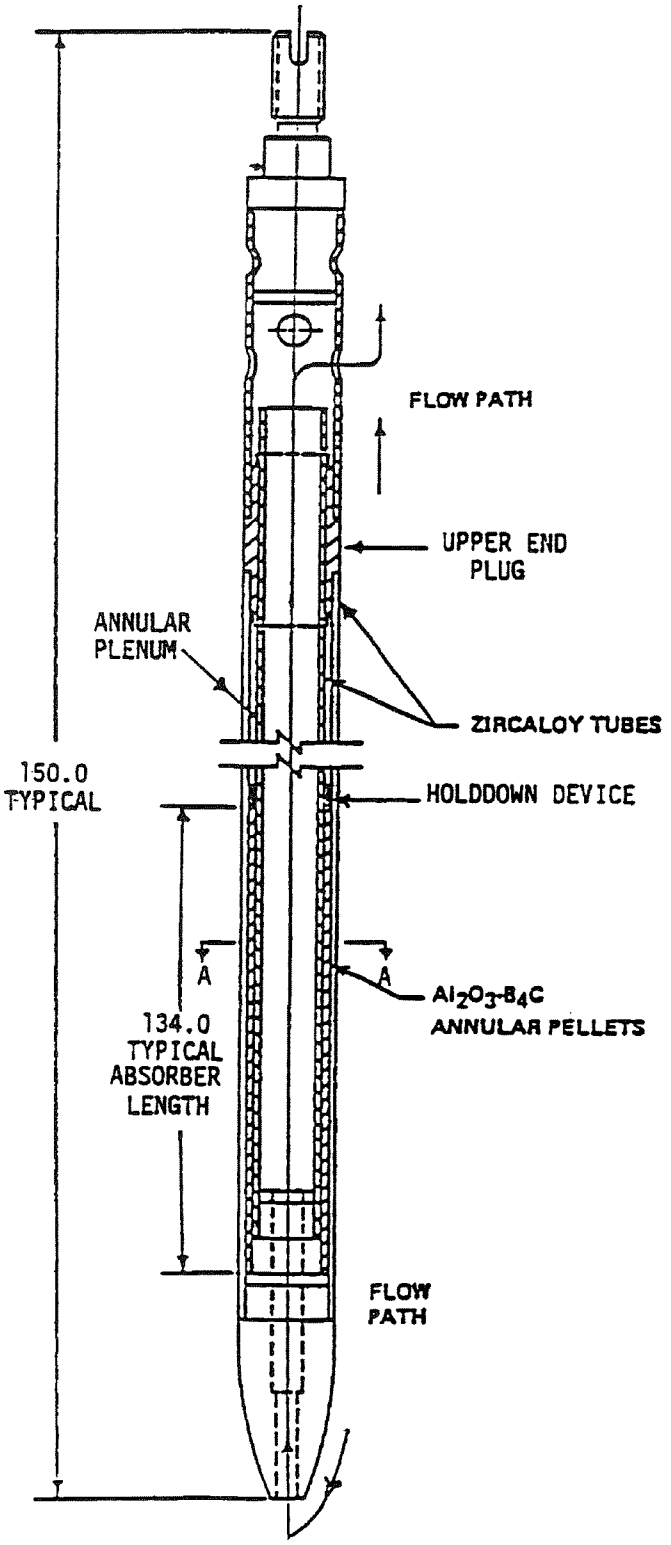
Zone Number	Previous Design BA	WABA Design
0 - 1	Air	Water
1 - 2	Stainless steel	Zircaloy
2 - 3	Air	Helium
3 - 4	Borosilicate glass	$Al_2O_3 \cdot B_4C$
4 - 5	Air	Helium
5 - 6	Stainless steel	Zircaloy

INDIAN POINT UNIT No. 2

UFSAR FIGURE 3.2-69

COMPARISON OF BOROSILICATE GLASS ABSORBER ROD WITH WABA ROD

MIC. No. 1999MC3730 | REV. No. 17A



INDIAN POINT UNIT No. 2	
UFSAR FIGURE 3.2-70 WET ANNULAR BURNABLE ABSORBER ROD	
MIC. No. 1999MC3732	REV. No. 17A