

TMI-1 Cycle 9
Core Operating Limits Report

TOPICAL REPORT 083
Rev. 2

BA Number 135400

TMI-1 Cycle 9 Reload Task Force
November, 1992

APPROVALS;

Robert Jaffe 11/12/92
Originator Date

James D. McCarty 11/12/92
Cycle 9 Reload Task Force Chairman Date

John A. ... 11/13/92
Manager, TMI Fuel Projects Date

G.R. Bond 11-16-92
Director, Systems Engineering Date

Alfred Nelson 11/23/92
Plant Review Group Date

This COLR is Effective as of : Cycle 9 Initial Criticality

TITLE TMI-1 Cycle 9 Core Operating Limits Report

REV	SUMMARY OF CHANGE	APPROVAL	DATE
1	<p>Revised Error Adjusted Rod Insertion Limits Curves for 2, 3, and 4 Pump Operation from 105 +/- 5 EFPD to EOC to reflect the increase in rod position indication error from 1.5% WD to 2.0% WD.</p> <p>Similar curves for the 0-45 and 45-105 EFPD windows were not corrected as the identification of the larger error was not made until after 105 EFPD.</p>	<p><i>Robert Jaffe</i></p> <p><i>[Signature]</i></p>	<p>5/8/92</p> <p>6/12/92</p>
2	<p>Incorporated the LOCA limited maximum allowable linear heat rate (MALHR) curve into this report, aswell as bounding values for these limits as a function of cycle burnup and core monitoring system level. Removal of the LOCA limited MALHR curve from the Technical Specifications to the COLR has been reviewed per GPUN S.E. 135400-016, Rev. 0.</p> <p>Reorganized the COLR references based on this revision.</p> <p>This revision goes into effect upon NRC approval of TSCR-208 and TSCR-220.</p>	<p><i>Robert Jaffe</i></p> <p><i>[Signature]</i></p>	<p>11/12/92</p> <p>11/13/92</p>

ABSTRACT

This Core Operating Limits Report (COLR) has been prepared in accordance with the requirements of TMI-1 Technical Specification 6.9.5. The core operating limits were generated using the methodologies described in Technical Specification 6.9.5.2 and in References 1, 2 and 7, and were documented in References 3, 4, 6 and 10. The information in this COLR was reviewed for use at TMI-1 in References 5, 8 and 9.

COLR Figures 1 through 6 may have three distinctly defined regions:

1. Permissible Region
2. Restricted Region
3. Not Allowed Region (Operation in this region is not allowed)

Inadvertent operation within the Restricted Region for a period not exceeding four (4) hours is not considered a violation of a limiting condition for operation. The limiting criteria within the Restricted Region are potential ejected rod worth and ECCS power peaking. Since the probability of these accidents is very low, especially in a four (4) hour time frame, inadvertent operation within the Restricted Region for a period not exceeding four (4) hours is allowed.

COLR Figure 7 indicates the LO_x limited maximum allowable linear heat rates as a function of fuel rod burnup and fuel elevation. Bounding values for monitoring these limits for the current cycle in terms of cycle burnup and axial detector levels are listed in Table 2.

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References:

Main Body

1. Letter from J. H. Taylor (B&W) to J. A. Norberg (NRC), "Extended Lifetime Incore Detector Error Allowances", April 21, 1988, JHT/88-28.
2. BWFC Doc. No. 86-1172640-00, "Detector Lifetime Extension Final Report for TMI-1," September 1988.
3. BAW-2134 Rev. 1, "Three Mile Island Unit 1 Cycle 9 Reload Report," October 1991.
4. BWFC Doc. No. 86-1203799-00, "TMI-1 Cycle 9 Core Limits & Setpoints," May 1991.
5. GPUN Safety Evaluation 135400-014, Rev. 0, "TMI-1 Cycle 9 Reload Design," September 10, 1991.
6. GPUN Calc. No. C1101-202-5412-174, Rev. 0, "TMI-1 Cycle 9 Revised Error Adjusted Rod Insertion Limits," May 1992.
7. GPUN Safety Evaluation 000622-001, Rev. 1, "Control Rod API and RPI 24 Month Cycle Extension," April 16, 1992.
8. GPUN Safety Evaluation 135400-015, Rev. 0, "TMI-1 Cycle 9 Core Operating Limits Report," May 1992.
9. GPUN Safety Evaluation 135400-013, Rev. 0, "Tech Spec LOCA Limit Changes," June 28, 1991.
10. BWFC Doc. No. 62-1203848-00, "Power Escalation Test Specification TMI-1 Cycle 9," August 29, 1991.

Enclosure (Non-Tech. Spec. Required Operating Limits)

1. BAW-10143P-A, "BWC Correlation of Critical Heat Flux", April 1985.
2. BAW-10156A "LYNXT: Core Transient Thermal Hydraulic Program", February 1986.

Full Incore System (FIS) Operability Requirements

- The Full Incore System (FIS) is operable for monitoring axial power imbalance provided the number of valid Self Powered Neutron Detector (SPND) signals in any one quadrant is not less than 75 % of the total number of SPNDs in the quadrant.

Quadrant	SPNDs	75 %
WX	85.75	64.50
XY	99.75	75.00
YZ	89.25	67.00
ZW	89.25	67.00

- The Full Incore System (FIS) is operable for monitoring quadrant tilt provided the number of valid symmetric string individual SPND signals in any one quadrant is not less than 75 % (21) of the total number of SPNDs in the quadrant (28).

Quadrant	Symmetric Strings
WX	7, 9, 32, 35
XY	5, 23, 25, 28
YZ	16, 19, 47, 50
ZW	11, 13, 39, 43

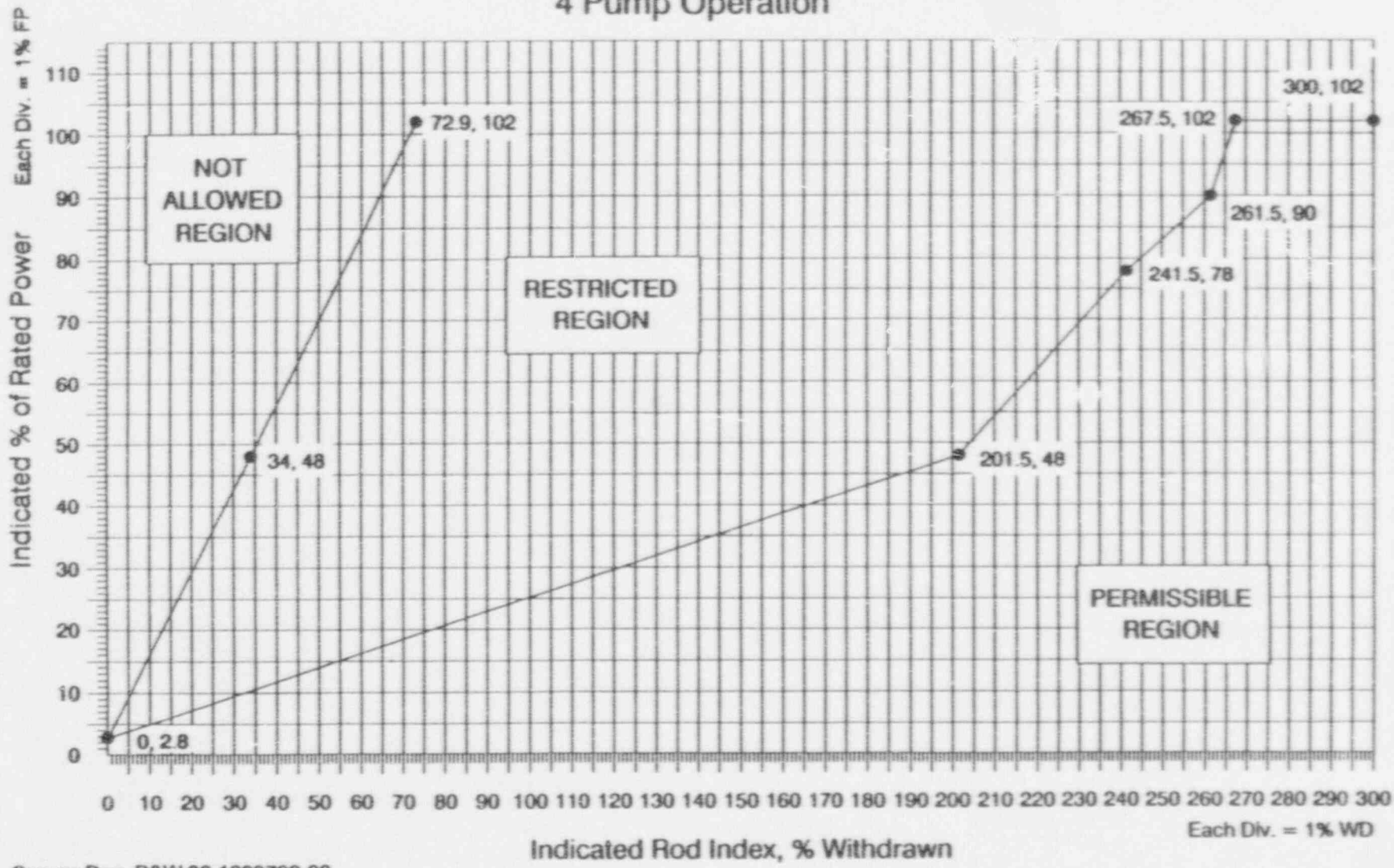
Source Doc. : B&W 86-1172640-00
 Referred To By : Tech. Spec. 3.5.2.4.a and 3.5.2.7.a

Table 1
Quadrant Tilt Limits

	Steady State Limit 15% < Power ≤ 50%	Steady State Limit Indicated Power >50%	Maximum Limit Indicated Power > 15%
Full Incore System (FIS)	6.83 %	4.39 %	16.8 %
Out-of-Core Detector System (OCD)	4.05 %	1.96 %	14.2 %
Minimum Incore System (MIS)	2.80 %	1.90 %	9.5 %

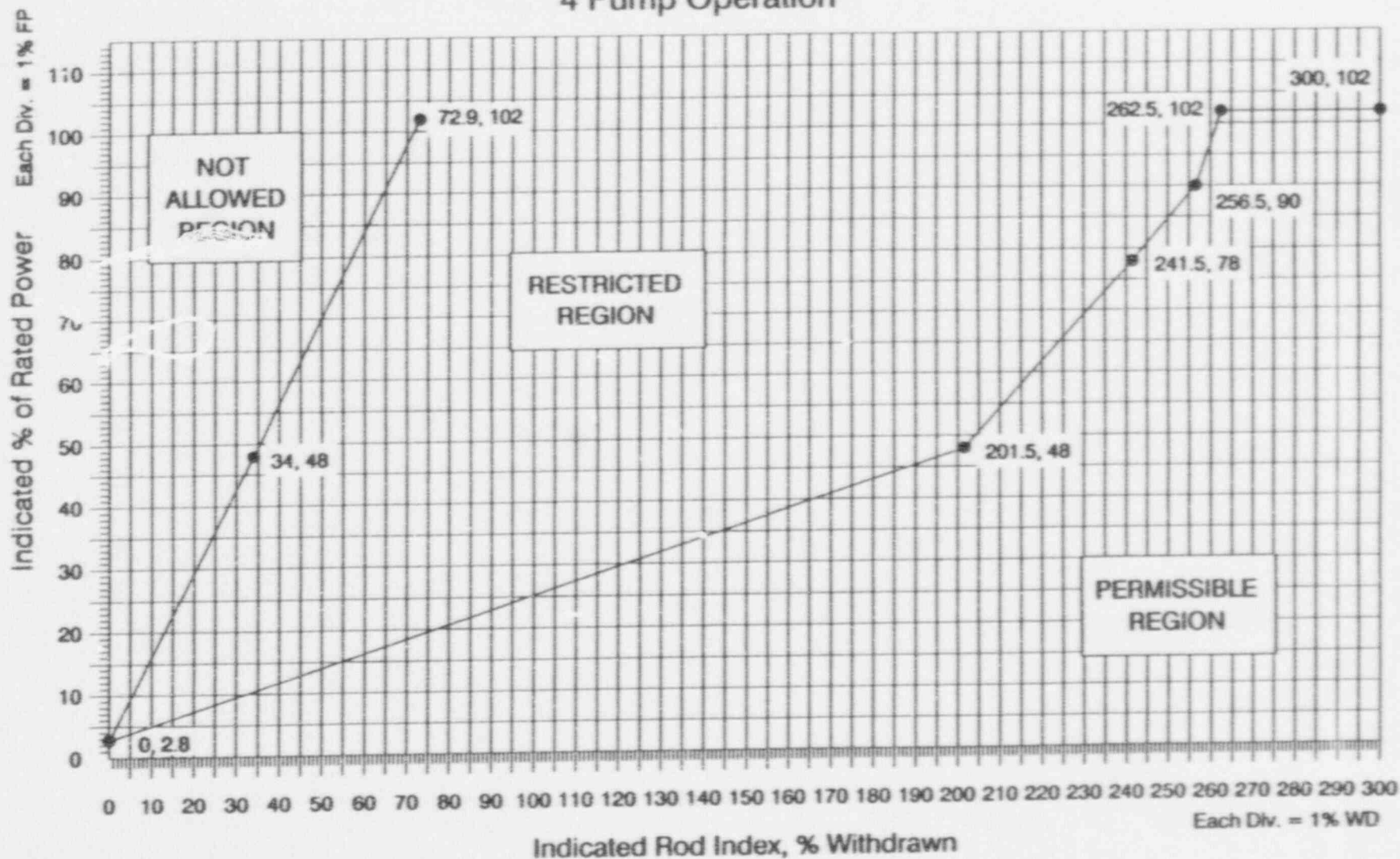
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 Referred To By : Tech. Spec. 3.5.2.4

Figure 1 (Page 1 of 3)
 Error Adjusted Rod Insertion Limits
 0 to 45 +/- 5 EFPD
 4 Pump Operation



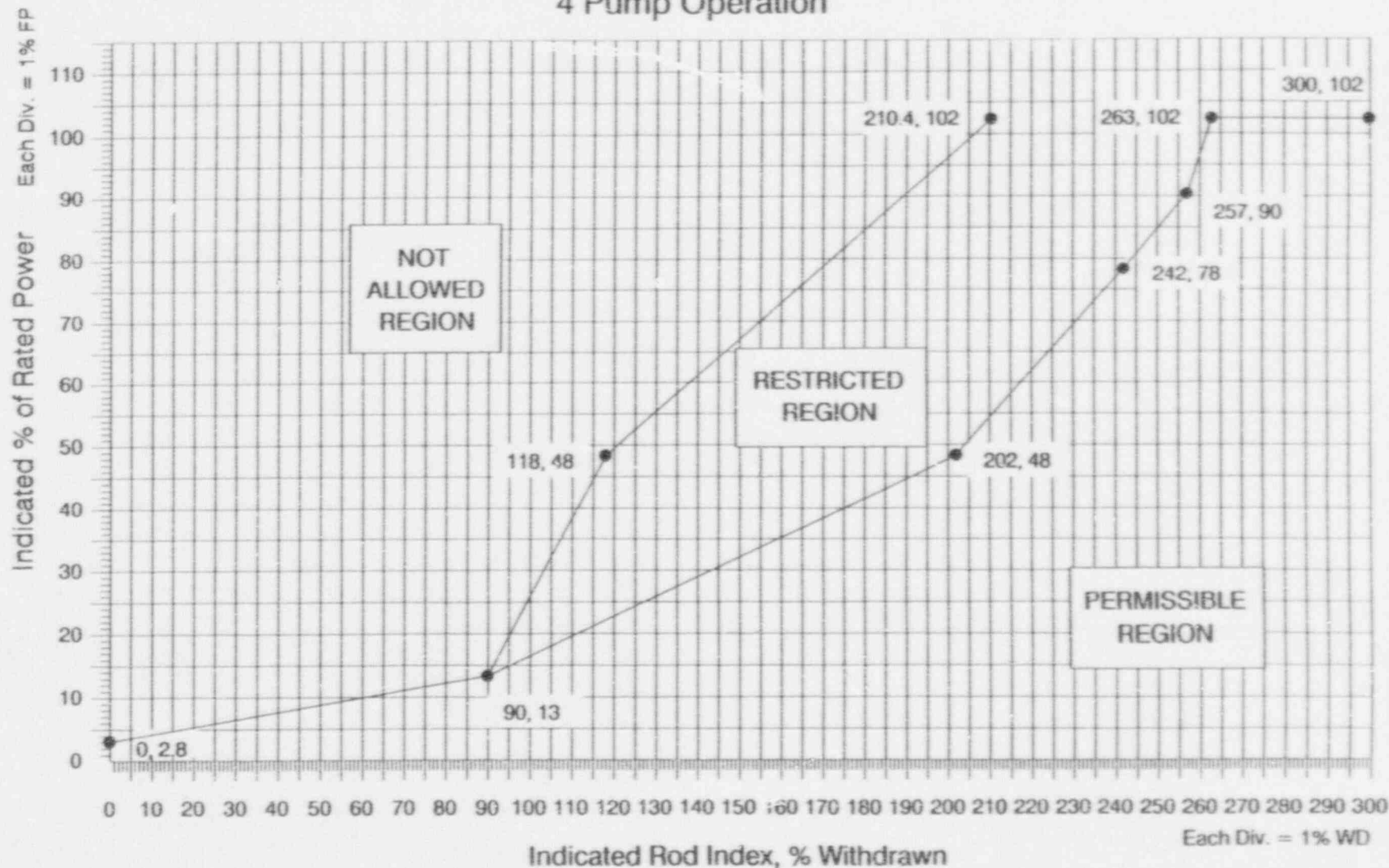
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Figure 1 (Page 2 of 3)
 Error Adjusted Rod Insertion Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD
 4 Pump Operation



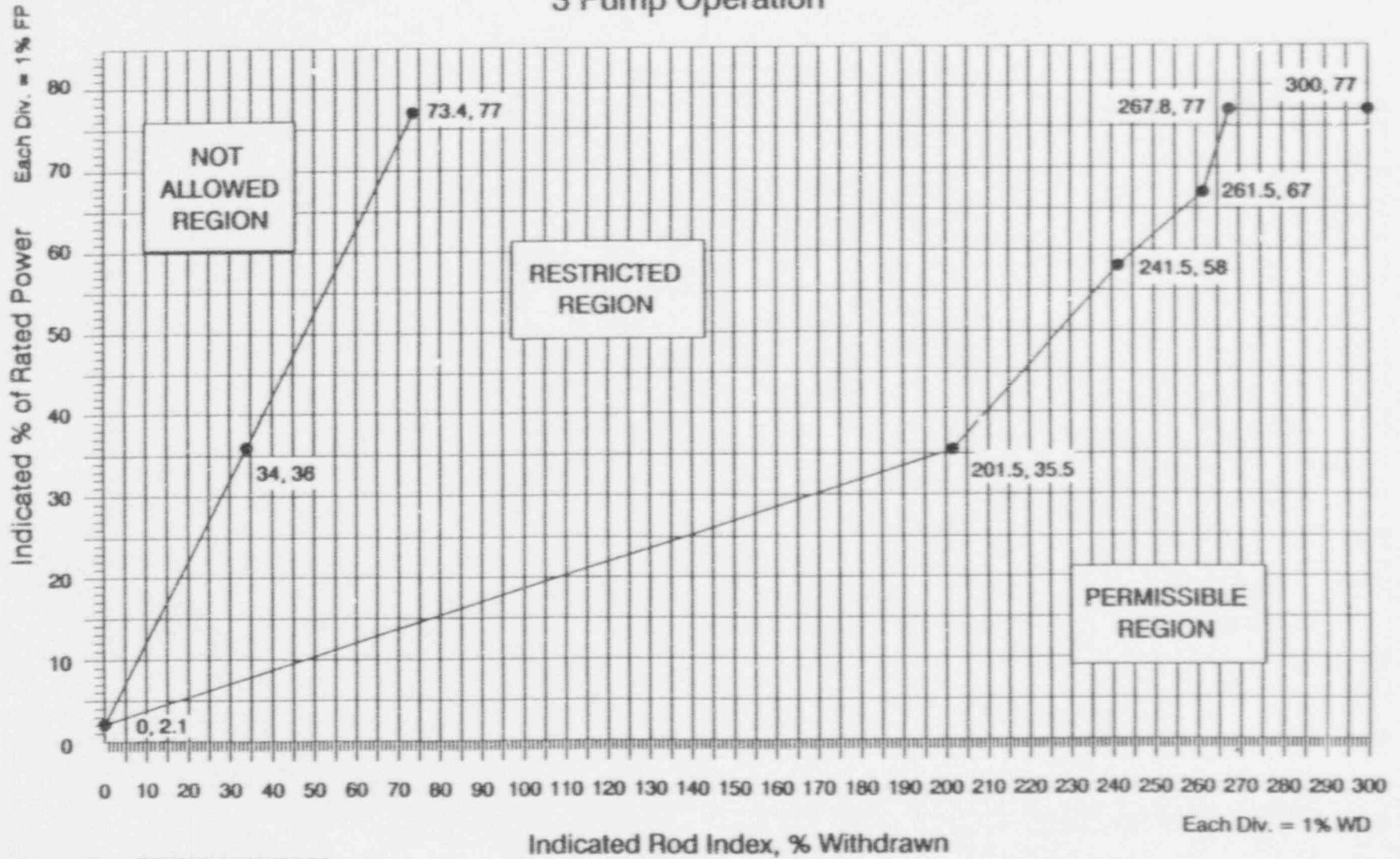
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Figure 1 (Page 3 of 3)
 Error Adjusted Rod Insertion Limits
 105 +/- 5 EFPD to EOC
 4 Pump Operation



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 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

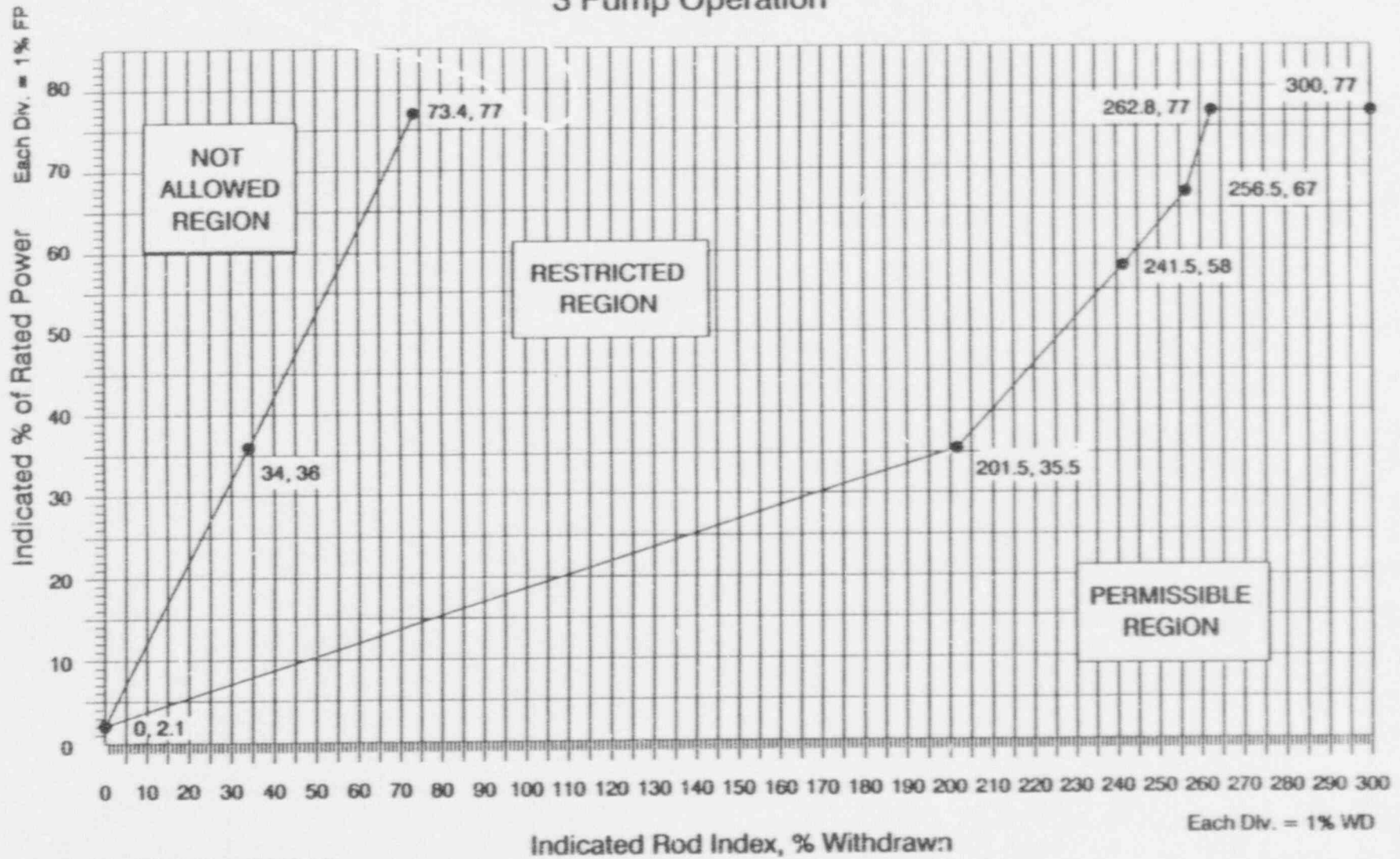
Figure 2 (Page 1 of 3)
 Error Adjusted Rod Insertion Limits
 0 to 45 +/- 5 EFPD
 3 Pump Operation



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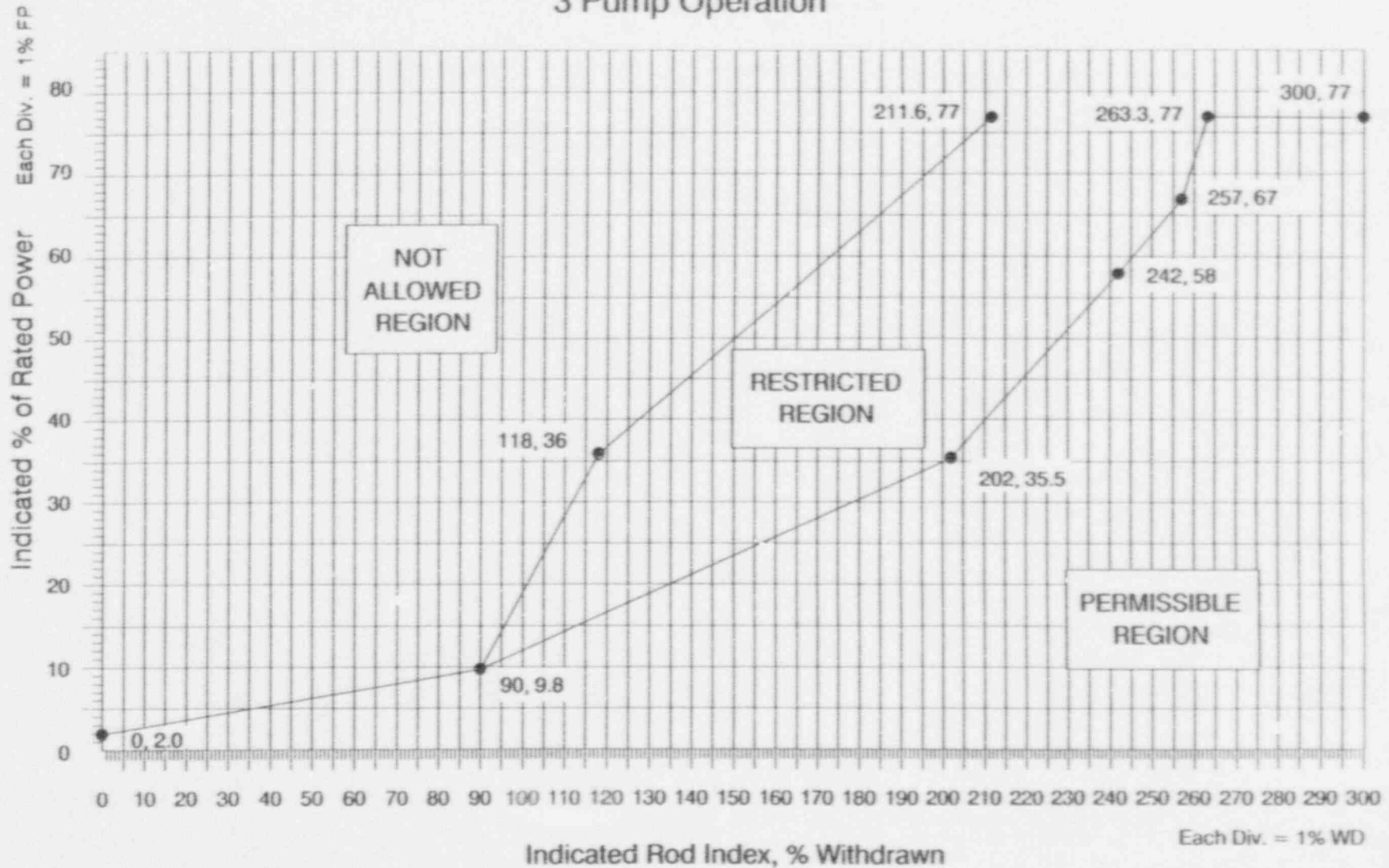
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Figure 2 (Page 2 of 3)
 Error Adjusted Rod Insertion Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD
 3 Pump Operation



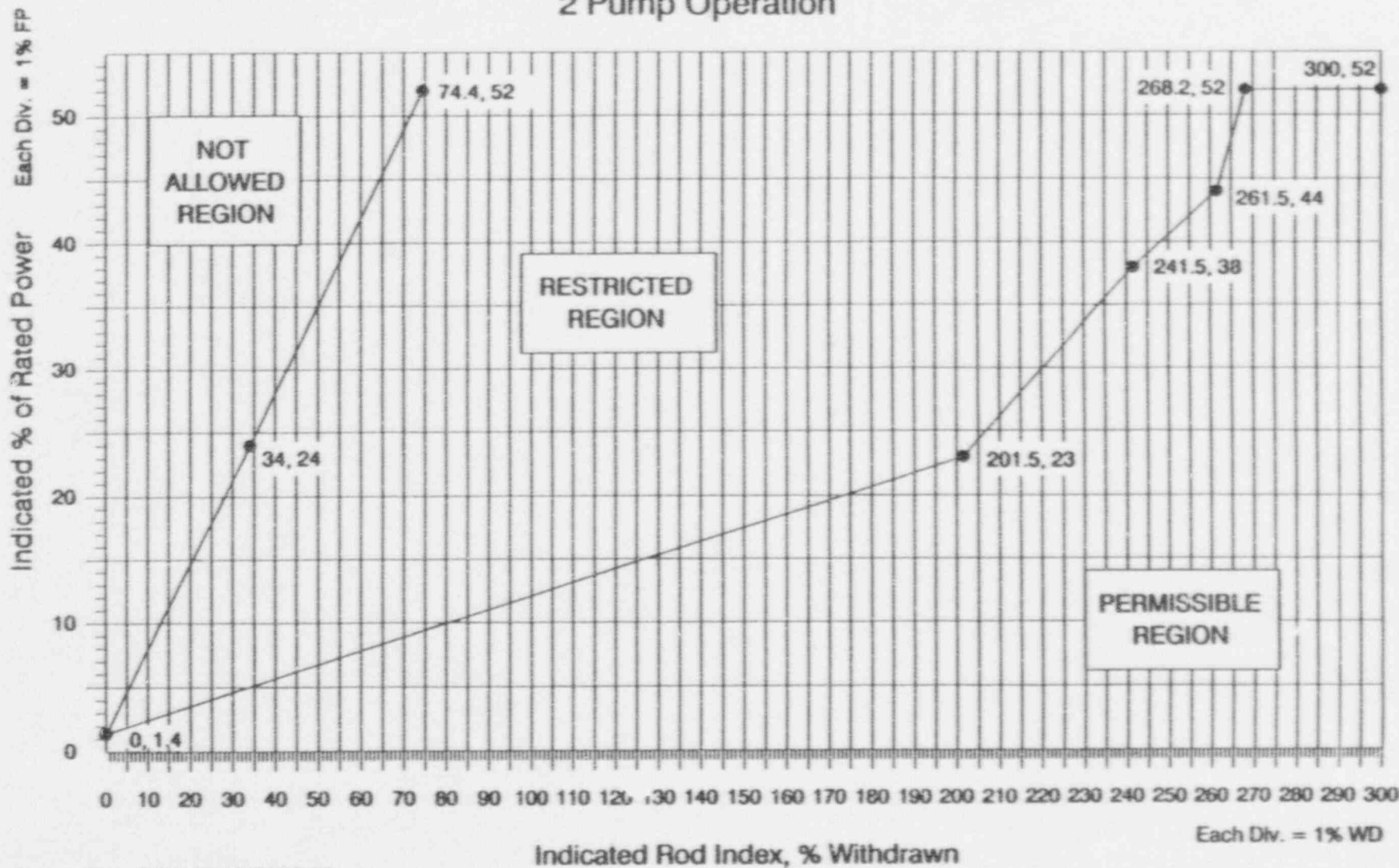
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 105 +/- 5 EFPD to EOC
 3 Pump Operation



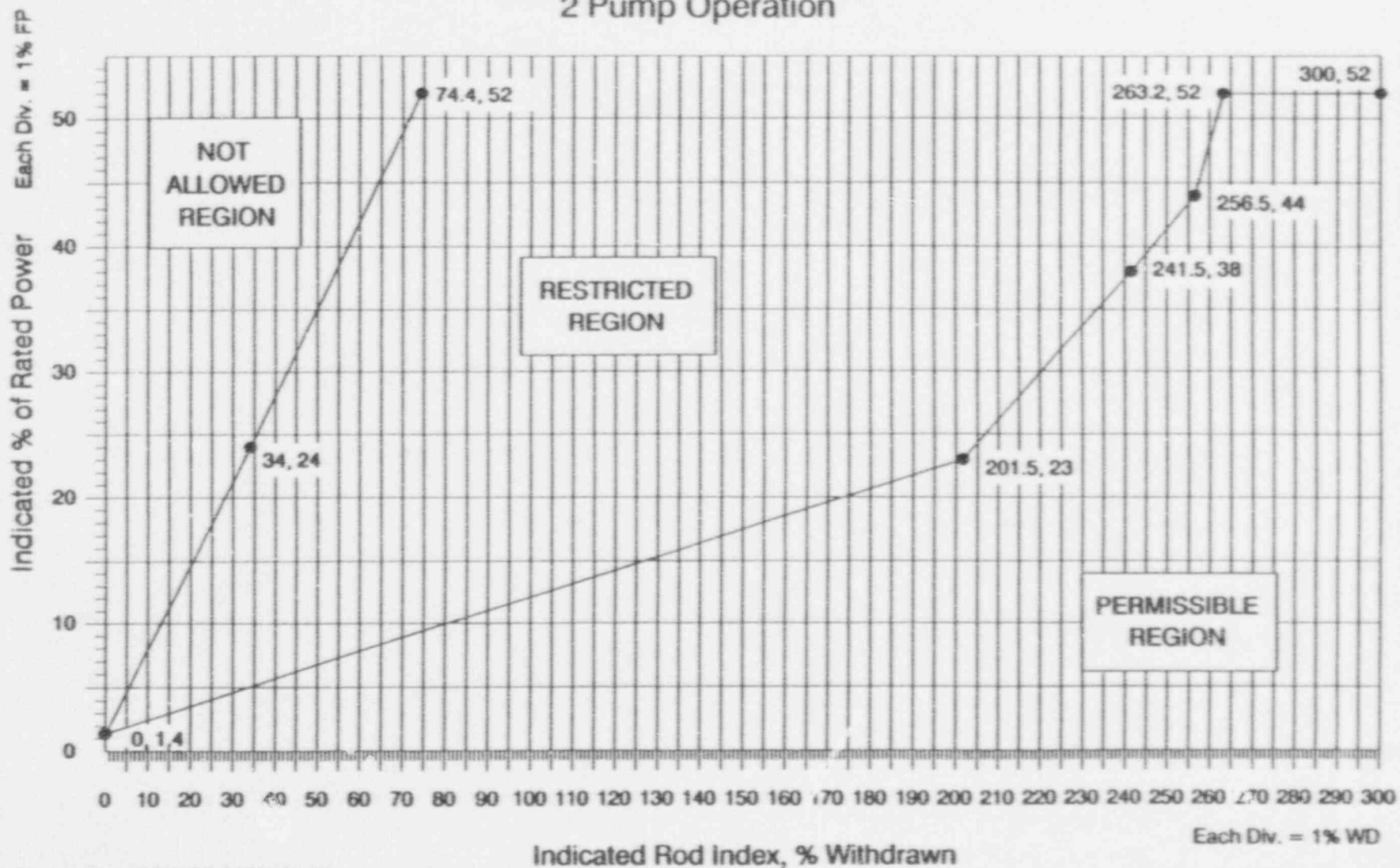
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Figure 3 (Page 1 of 3)
 Error Adjusted Rod Insertion Limits
 0 to 45 +/- 5 EFPD
 2 Pump Operation



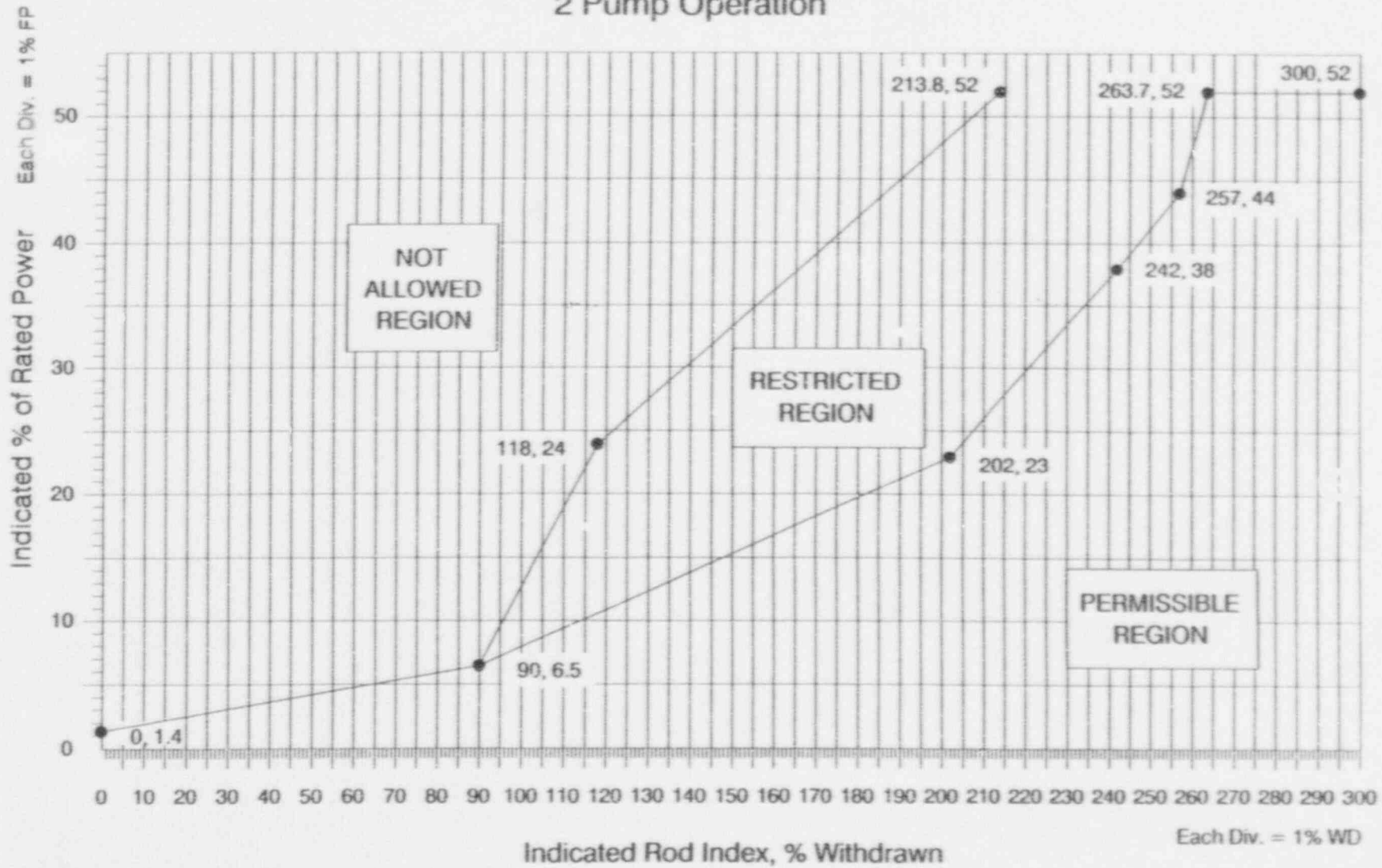
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Figure 3 (Page 2 of 3)
 Error Adjusted Rod Insertion Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD
 2 Pump Operation



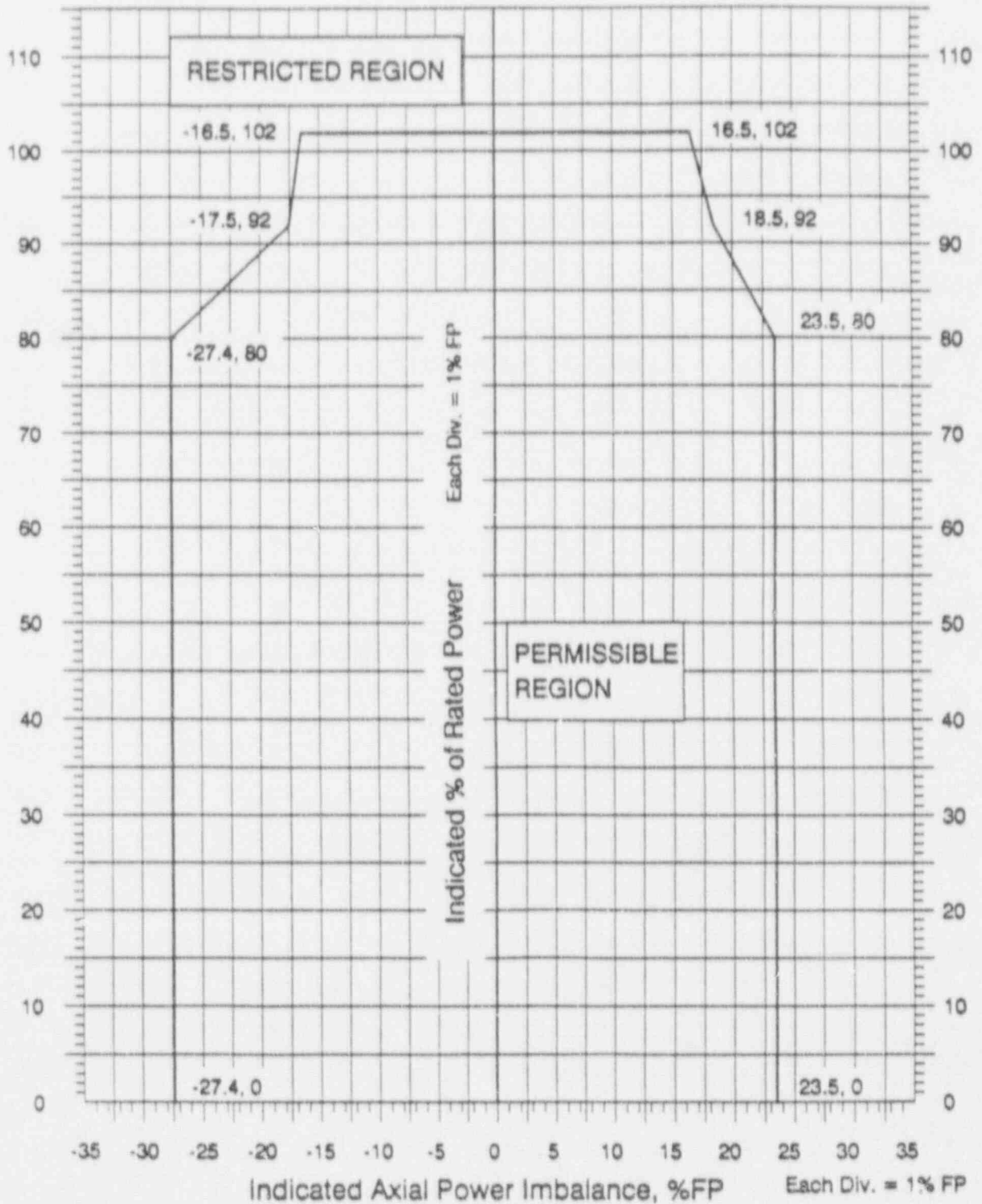
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Figure 3 (Page 3 of 3)
 Error Adjusted Rod Insertion Limits
 105 +/- 5 EFPD to EOC
 2 Pump Operation



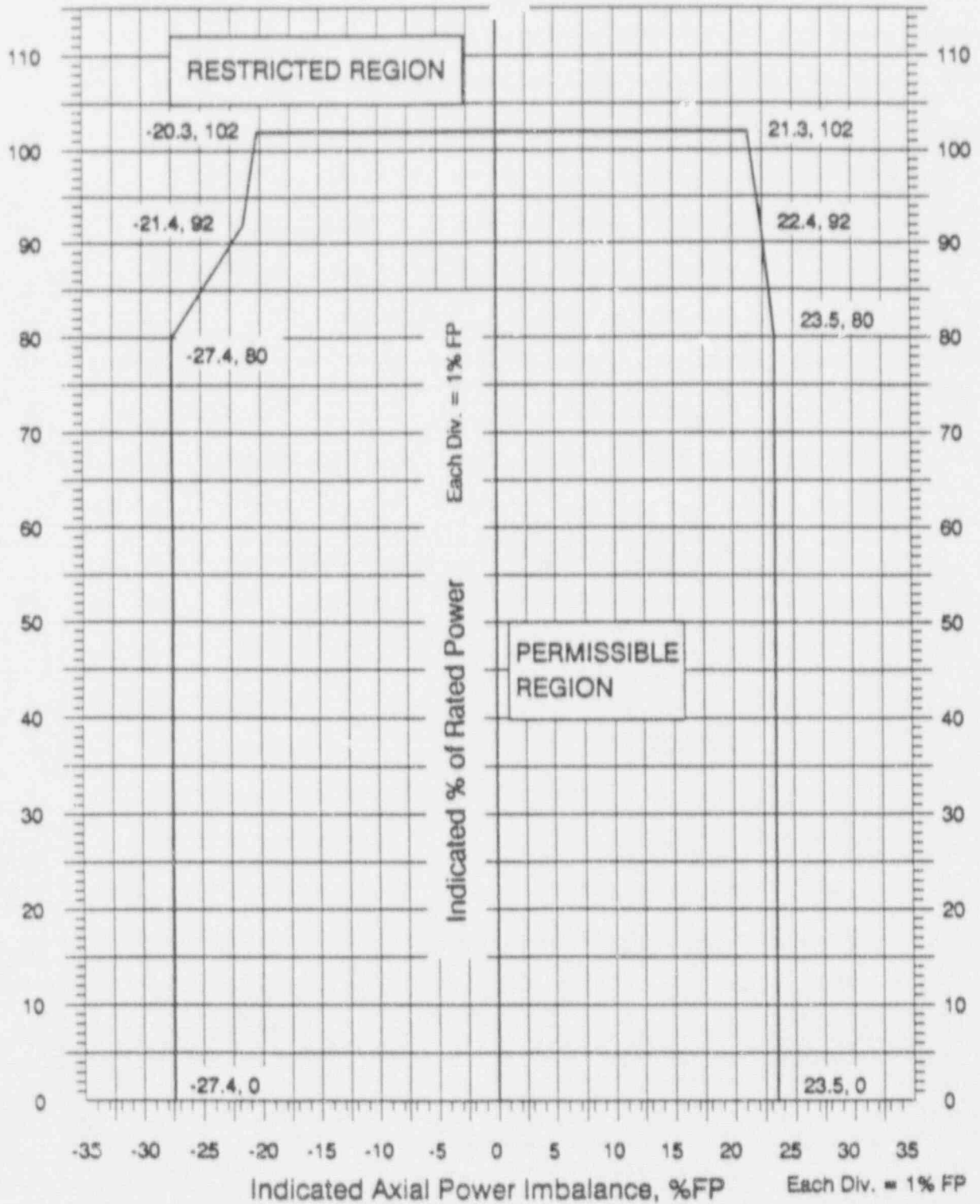
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Figure 4 (Page 1 of 3)
 Full Incore System
 Error Adjusted Imbalance Limits
 0 to 45 +/- 5 EFPD



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 Referred to by Tech Spec 3.5.2.7.a and 3.5.2.4.e.3

Full Incore System
Error Adjusted Imbalance Limits
45 +/- 5 EFPD to 105 +/- 5 EFPD

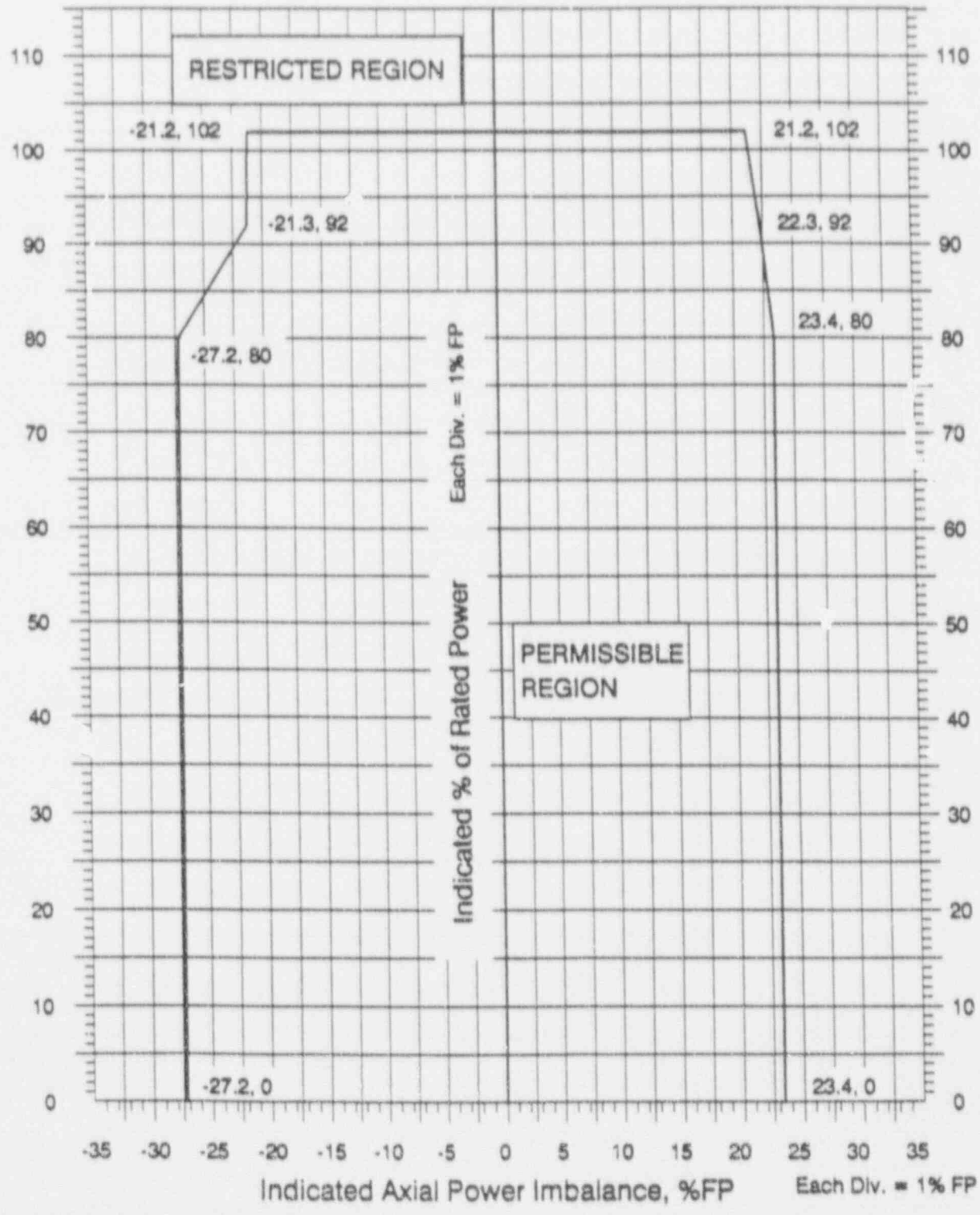


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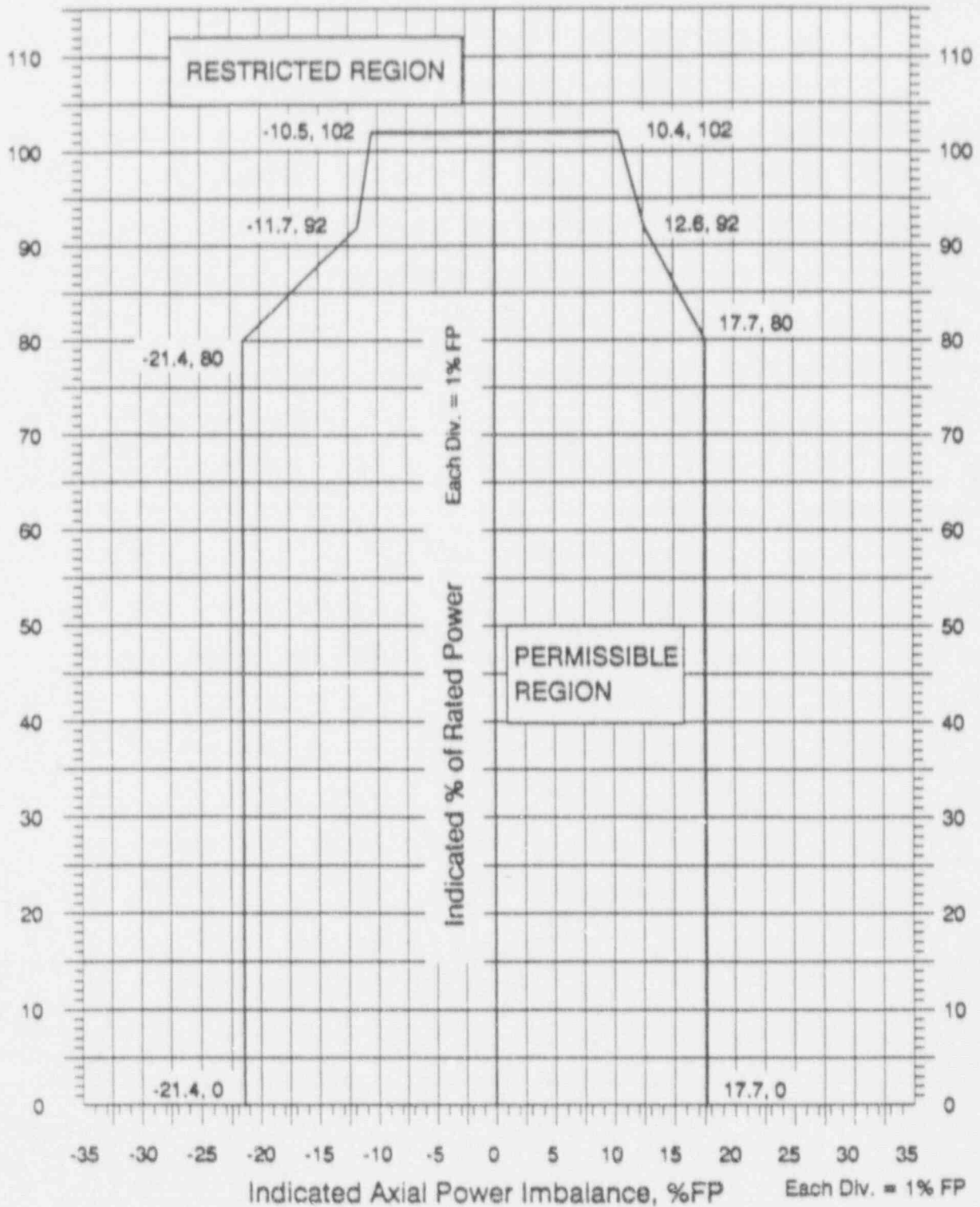
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Full Incore System
Error Adjusted Imbalance Limits
105 +/- 5 EFPD to EOC



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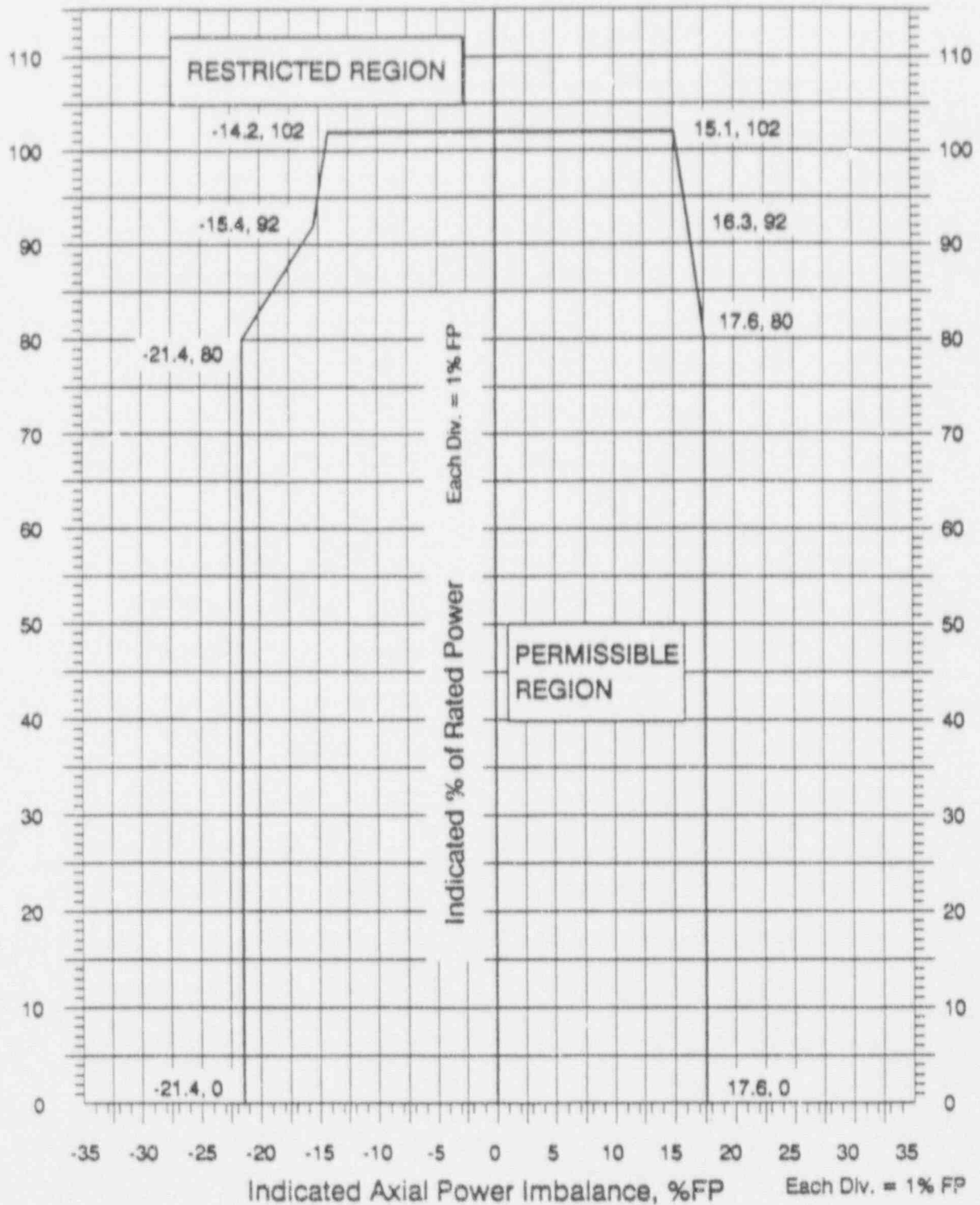
Figure 5 (Page 1 of 3)
 Out-of-Core Detector System
 Error Adjusted Imbalance Limits
 0 to 45 +/- 5 EFPD



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 Referred to by Tech Spec 3.5.2.7.b and 3.5.2.4.e.3

Figure 5 (Page 2 of 3)
 Out-of-Core Detector System
 Error Adjusted Imbalance Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD

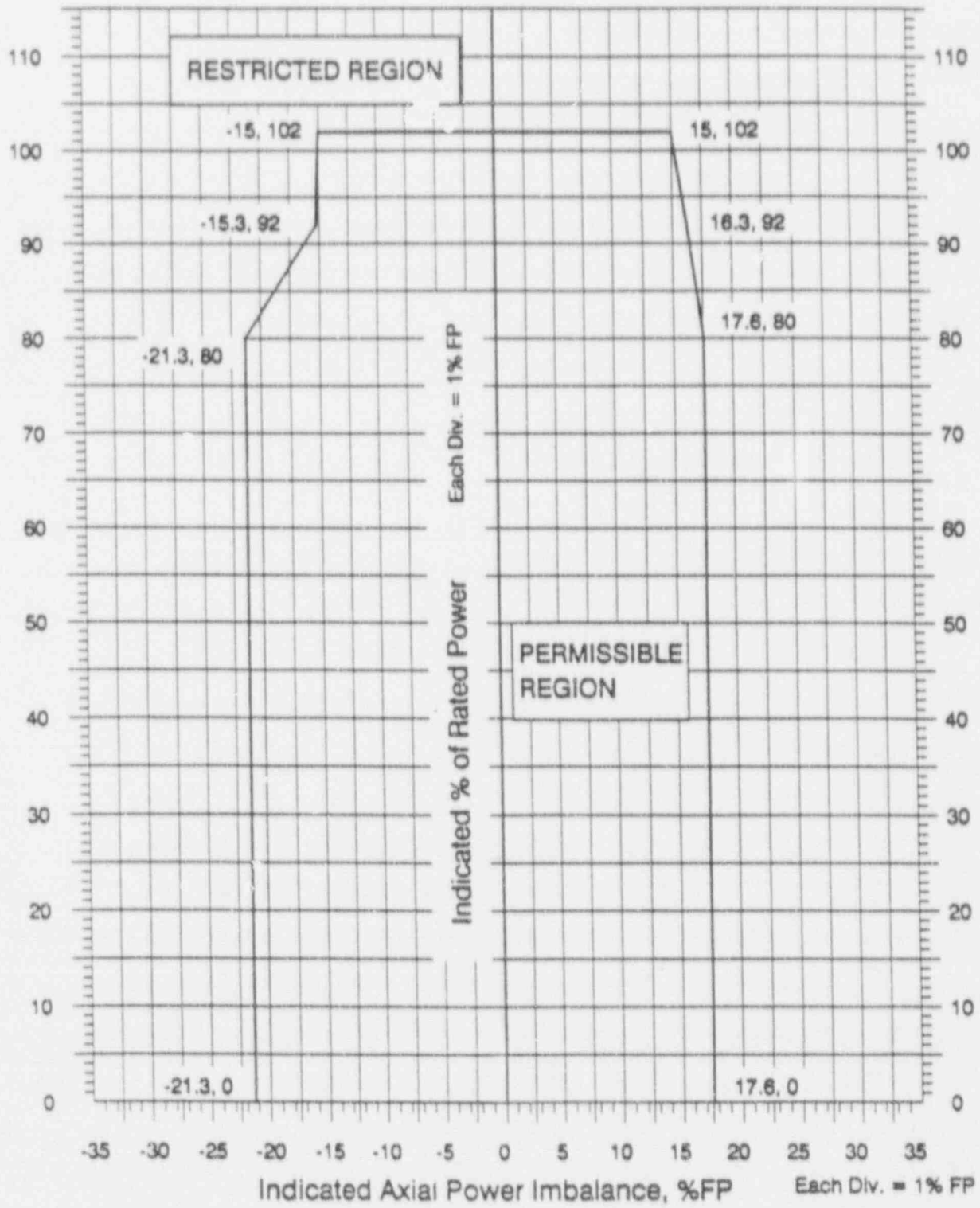
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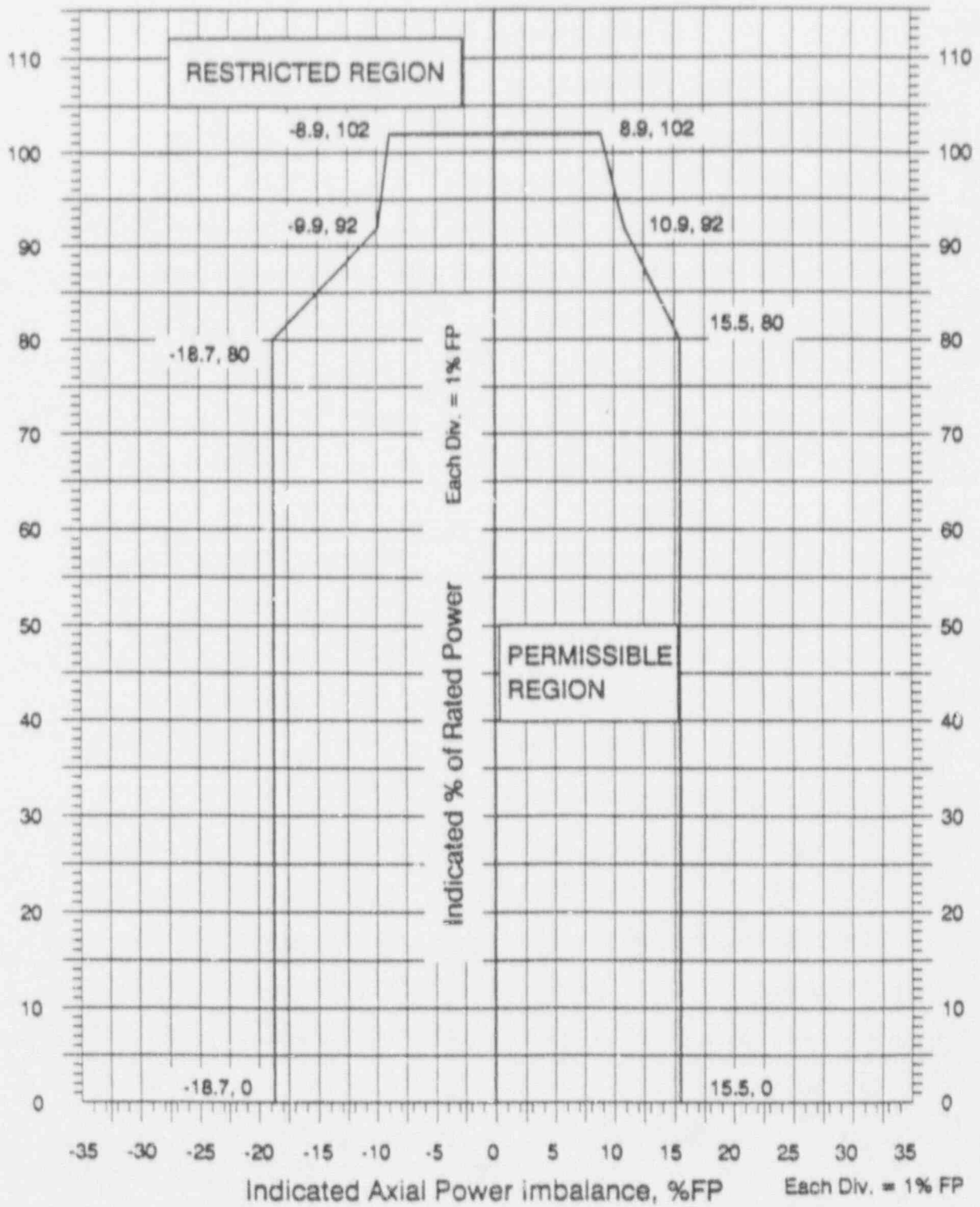
Figure 5 (Page 3 of 3)
 Out-of-Core Detector System
 Error Adjusted Imbalance Limits
 105 +/- 5 EFPD to EOC

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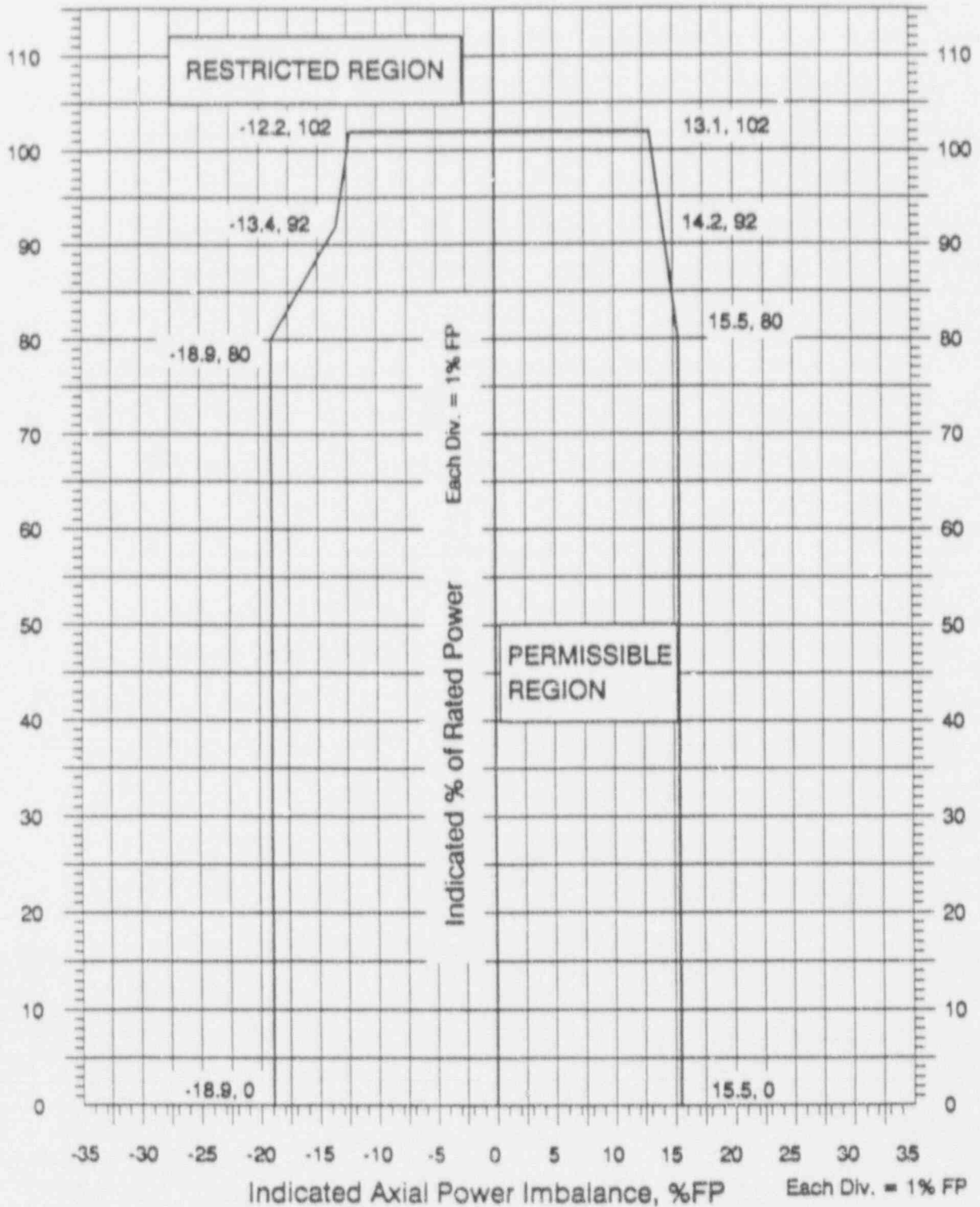
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Figure 6 (Page 1 of 3)
 Minimum Incore System
 Error Adjusted Imbalance Limits
 0 to 45 +/- 5 EFPD



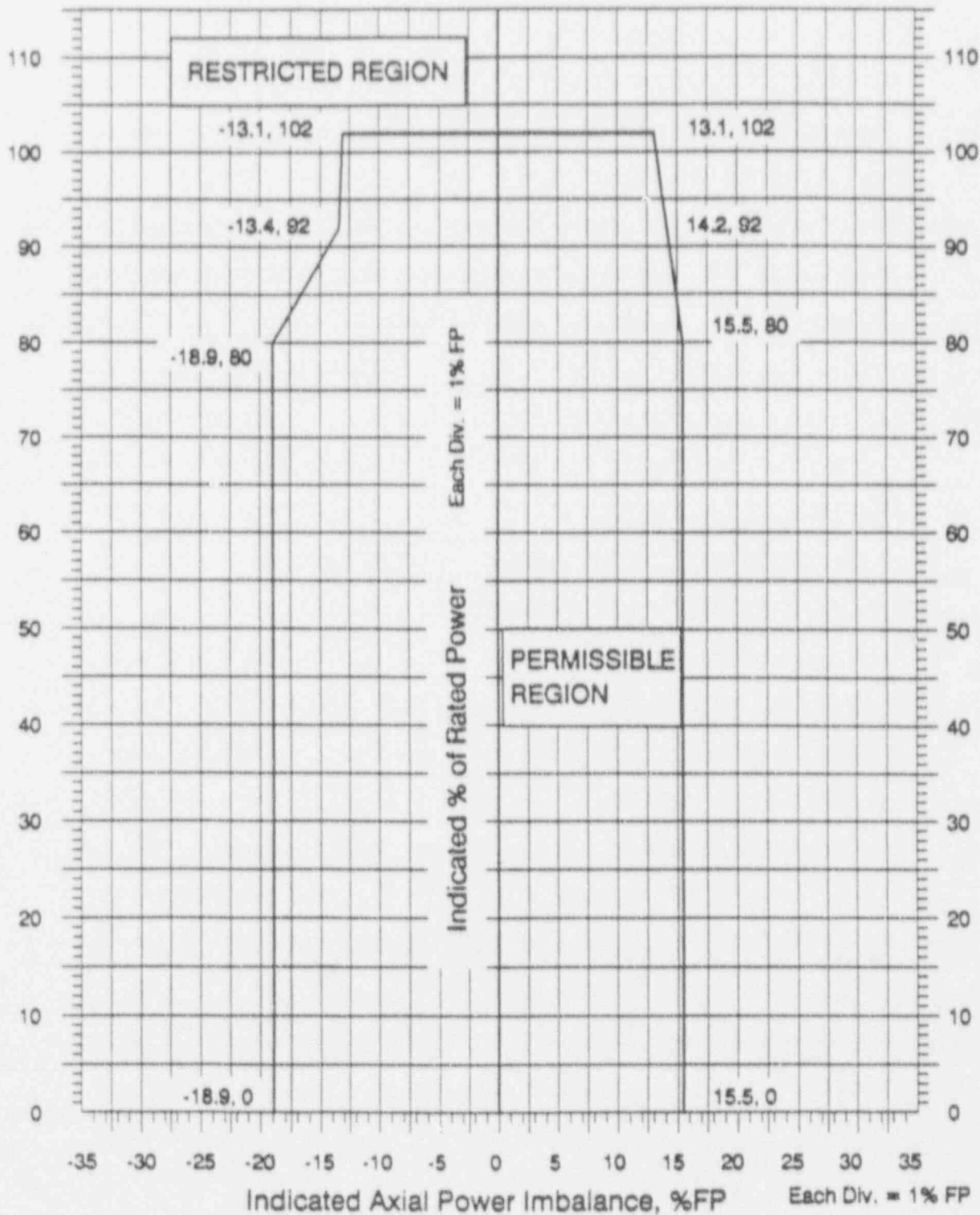
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 Minimum Incore System
 Error Adjusted Imbalance Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD



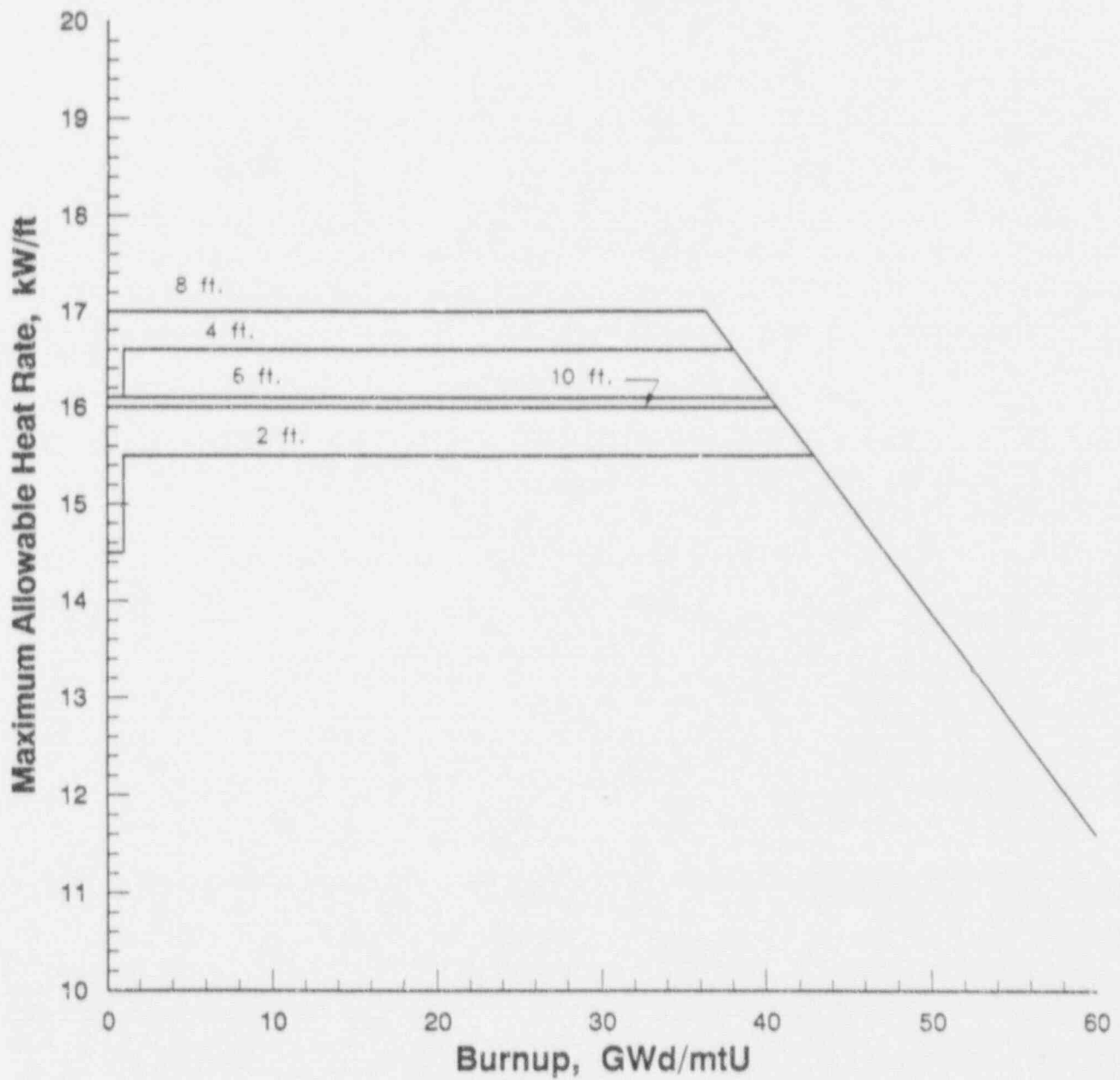
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Figure 6 (Page 3 of 3)
 Minimum Incore System
 Error Adjusted Imbalance Limits
 105 +/- 5 EFPD to EOC



Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.7.c and 3.5.2.4.e.3

FIGURE 7 LOCA Limited Maximum Allowable Linear Heat Rate



Source Doc. BAW-2134, Rev. 1
Referred to by Tech Spec 3.5.2.8

Table 2
Core Monitoring System Bounding Values for
LOCA Limited Maximum Allowable Linear Heat Rate
(kW/ft)

CMS Level	0-40 EFPD	40-438 EFPD	438-511 EFPD	511-572 EFPD	572-590 EFPD
8	15.0	15.4	16.0	15.5	15.0
7	15.4	15.6	16.0	15.5	15.0
6	16.2	16.1	16.0	15.5	15.0
5	16.1	16.1	16.0	15.5	15.0
4	16.1	16.1	16.0	15.5	15.0
3	14.9	15.7	15.6	15.5	15.0
2	14.5	15.5	15.5	15.5	15.0
1	14.5	15.5	15.5	15.5	15.0

The maximum linear heat rate for each CMS level, as measured with the NAS Thermal Hydraulic Package (Display 4), should be less than the corresponding bounding value from Table 2 above.

Enclosure

Non-Tech. Spec. Required Operating Limits

Core Minimum DNBR Operating Limit

The core minimum DNBR value as measured with the NAS Thermal Hydraulic Package (Display 1 or 4) should not be less than 2.01 (102% ICDNBR).

Source Doc. : BAW 2134