

TMI-1 Cycle 9
Core Operating Limits Report

TOPICAL REPORT 683
Rev. 1

BA Number 135400

TMI-1 Cycle 9 Reload Task Force
May 1992

APPROVALS:

Robert Joffa 5/8/92
Originator Date

Joseph D. McE... 5/11/92
Cycle 9 Reload Task Force Chairman Date

John A. X... 6/12/92
Manager, TMI Fuel Projects Date

G. R. Ford 6-16-92
Director, Systems Engineering Date

Mac Nelson 6/30/92
Plant Review Group Date

This COLR is Effective as of: Cycle 9 Initial Criticality

TITLE

TMI-1 Cycle 9 Core Operating Limits Report

REV

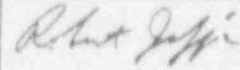
SUMMARY OF CHANGE

APPROVAL

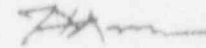
DATE

1

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.



5/8/92



6/12/92

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.

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 References 1, 2, 3, 4 and 9, and were documented in References 5, 6 and 8. The information in this COLR was reviewed for use at TMI-1 in References 7 and 10.

The COLR figures 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 interval, inadvertent operation within the Restricted Region for a period not exceeding four (4) hours is allowed.

TABLE OF CONTENTS

	<u>PAGE</u>
References	3
Full Incore System (FIS) Operability Requirements	4
Table 1 Quadrant Tilt Limits	5
Figure 1 Error Adjusted Rod Insertion Limits 4 Pump Operation	6
Figure 2 Error Adjusted Rod Insertion Limits 3 Pump Operation	9
Figure 3 Error Adjusted Rod Insertion Limits 2 Pump Operation	12
Figure 4 Full Incore System Error Adjusted Imbalance Limits	15
Figure 5 Out-of-Core Detector system Error Adjusted Imbalance Limits	18
Figure 6 Minimum Incore System Error Adjusted Imbalance Limits	21
Enclosure (Non-Tech. Spec. Required Operating Limits)	24

References:

Main Body

1. BAW-10152A. "NOODLE - A Multi-Dimensional Two-Group Reactor Simulator", June 1985.
2. BAW-10122A, Rev. 1, "Normal Operating Controls", May 1984.
3. Letter from J. H. Taylor (B&W) to J. A. Norberg (NRC), "Extended Lifetime Incore Detector Error Allowances", April 21, 1988, JHT/88-28.
4. BWFC Doc. No. 86-1172640-00, "Detector Lifetime Extension Final Report for TMI-1," September 1988.
5. BAW-2134 Rev. 1, "Three Mile Island Unit 1 Cycle 9 Reload Report," October 1991.
6. BWFC Doc. No. 86-1203799-00, "TMI-1 Cycle 9 Core Limits & Setpoints," May 1991.
7. GPUN Safety Evaluation 135400-014, Rev. 0, "TMI-1 Cycle 9 Reload Design," September 10, 1991.
8. GPUN Calc. No. C1101-202-5412-174, Rev. 0, "TMI-1 Cycle 9 Revised Error Adjusted Rod Insertion Limits," May 1992.
9. GPUN Safety Evaluation 000622-001, Rev. 1, "Control Rod API and RPI 24 Month Cycle Extension," April 16, 1992.
10. GPUN Safety Evaluation 135400-015, Rev. 0, "TMI-1 Cycle 9 Core Operating Limits Report," May 1992.

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

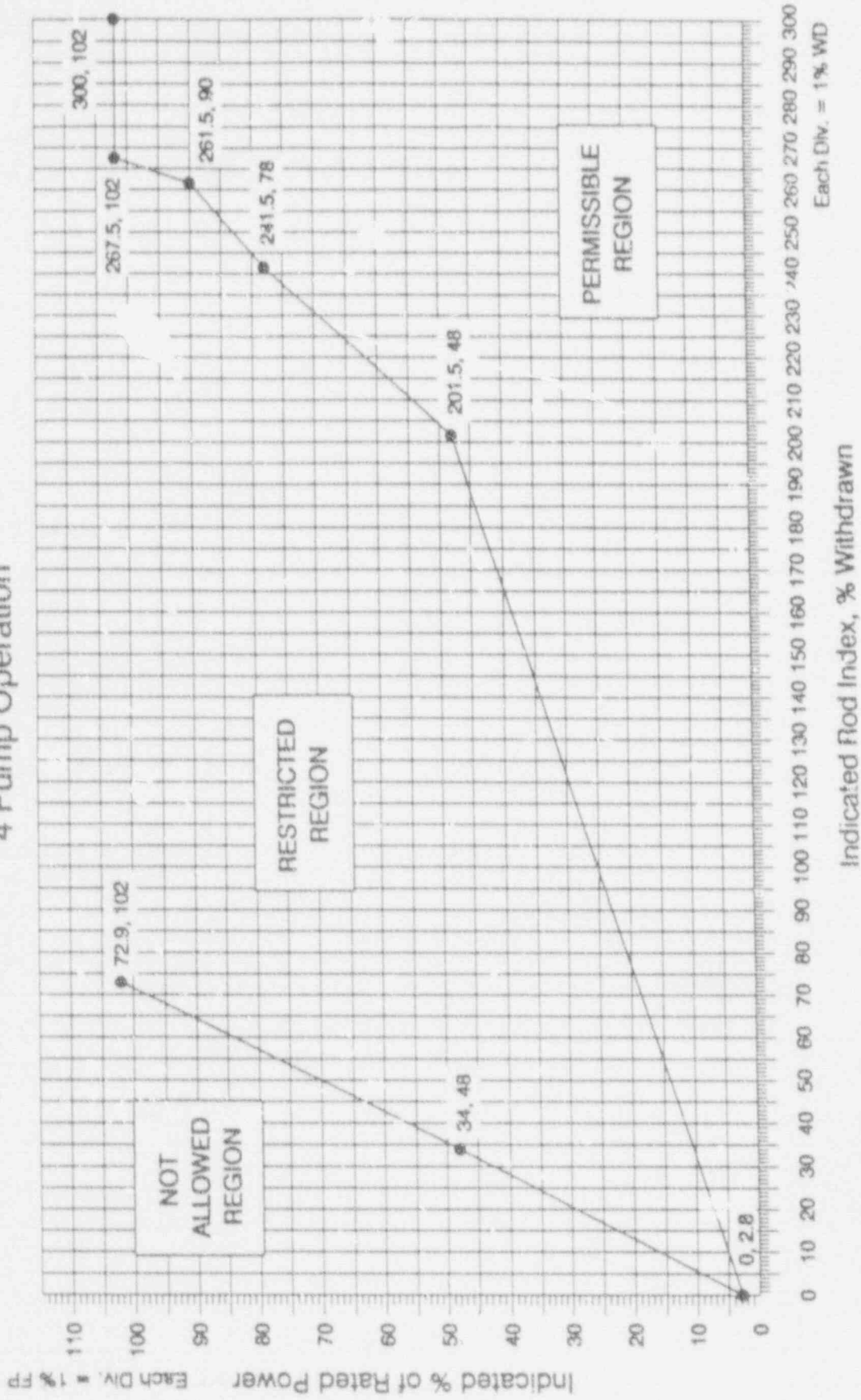
Source Doc. : B&W 86-11/2640-00
 Referred To By : Tech. Spec. 3.5.2.4.a and 3.5.2.7.a

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 (FIS)	2.80 %	1.90 %	9.5 %

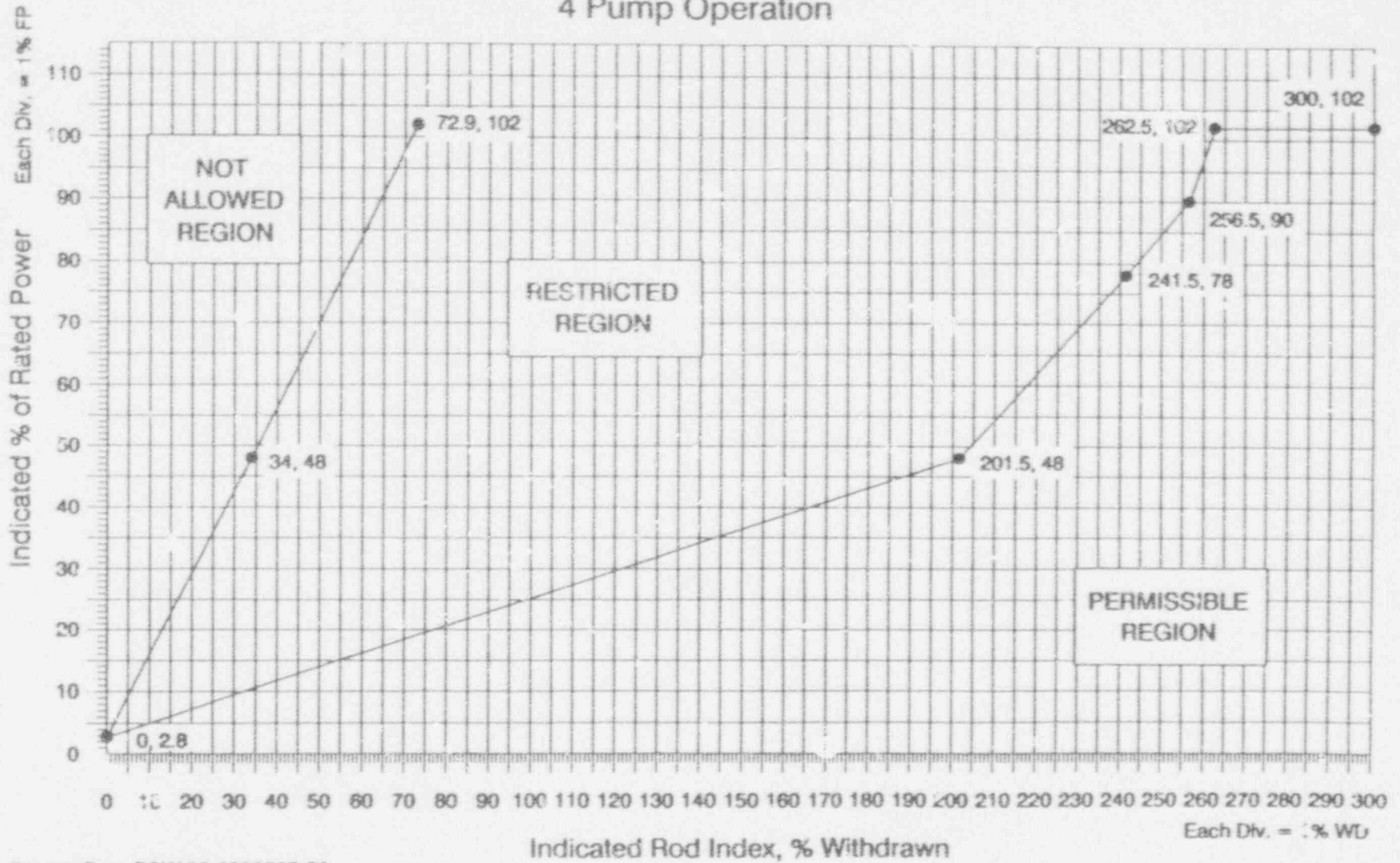
Source Doc. : B&W 86-1203799-00
 Referred To By : Tech. Spec. 3.5.2.4

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



Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

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



Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

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

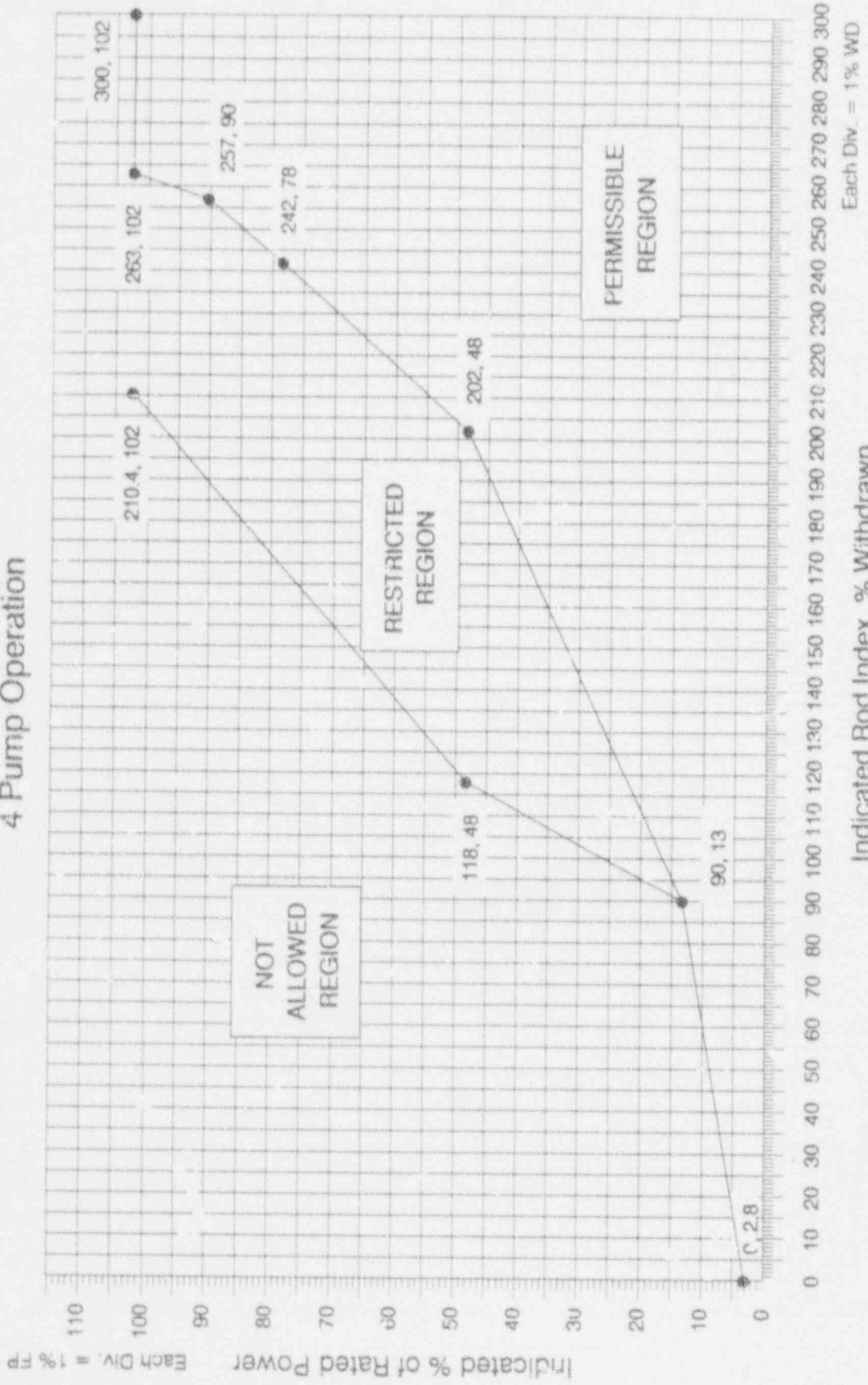
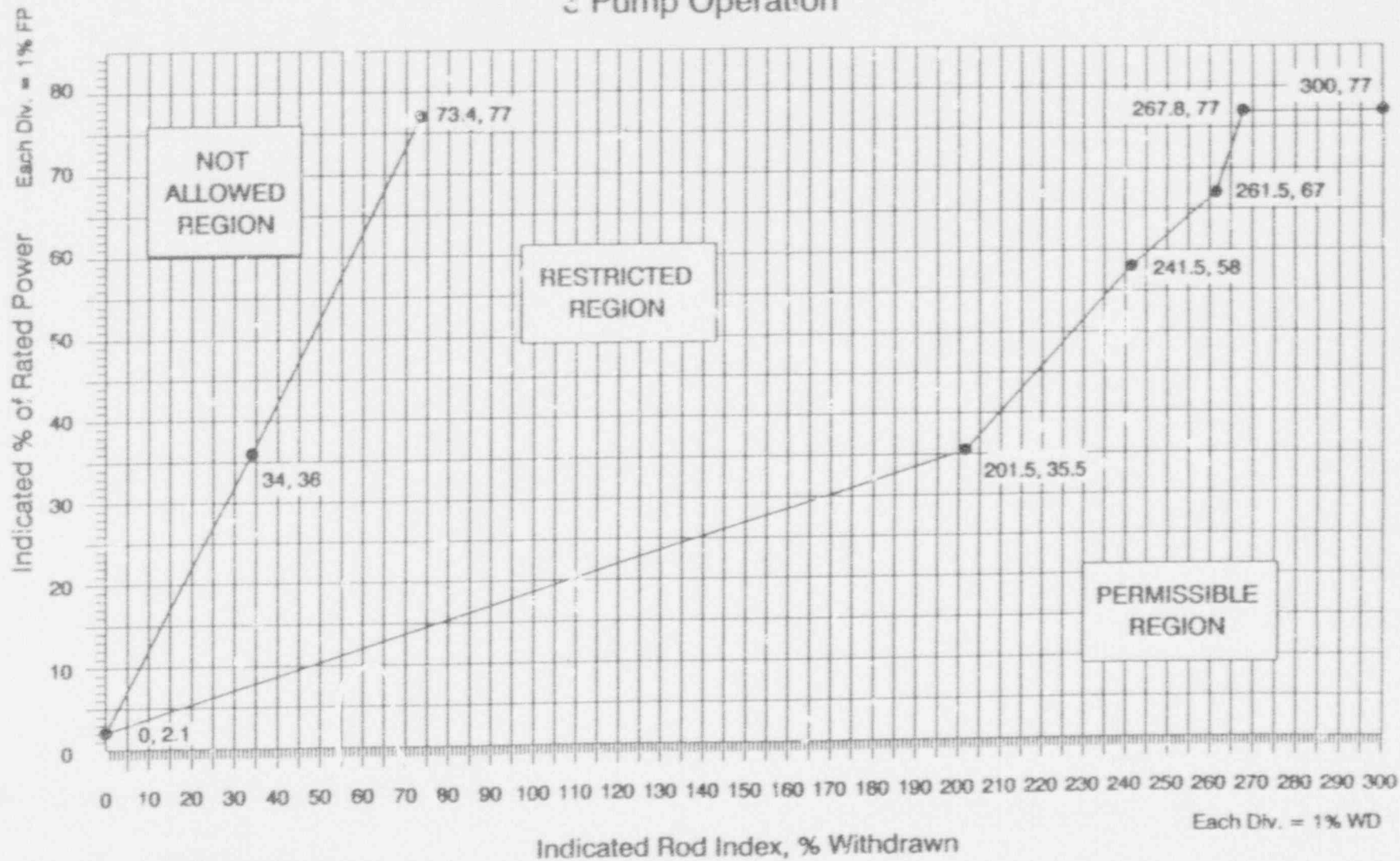
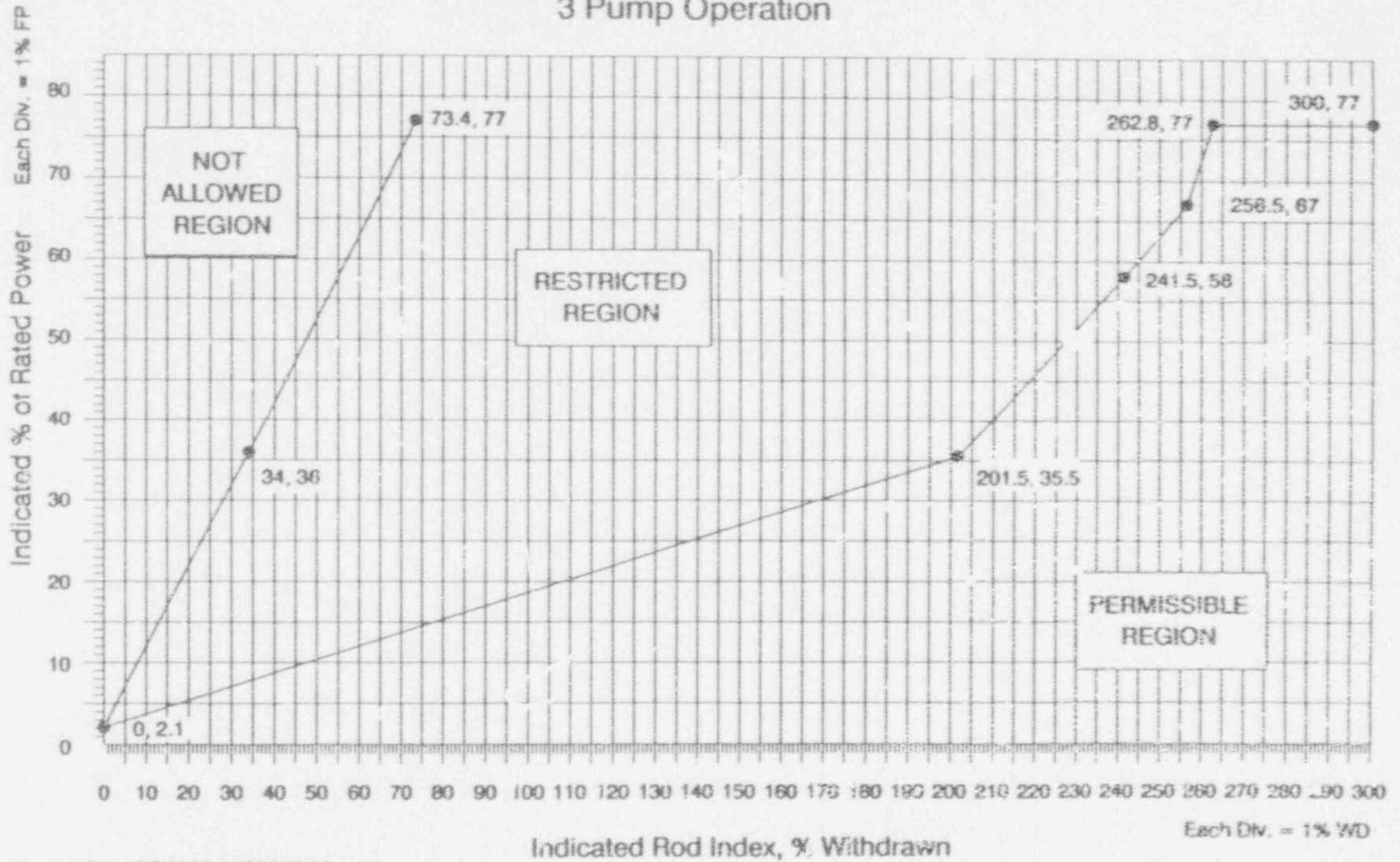


Figure 2 (Page 1 of 3)
 Error Adjusted Rod Insertion Limits
 0 to 45 +/- 5 EFPD
 3 Pump Operation



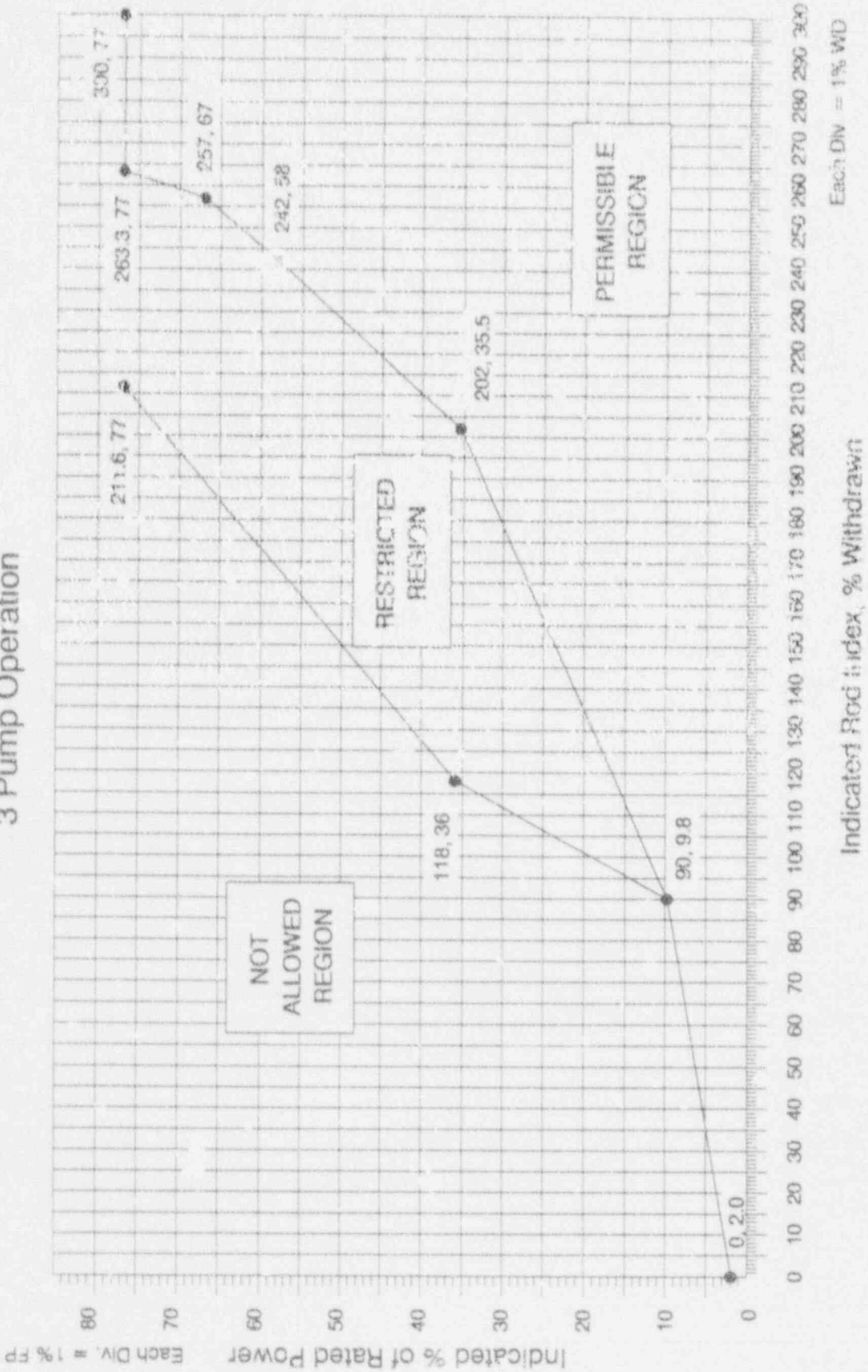
Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

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



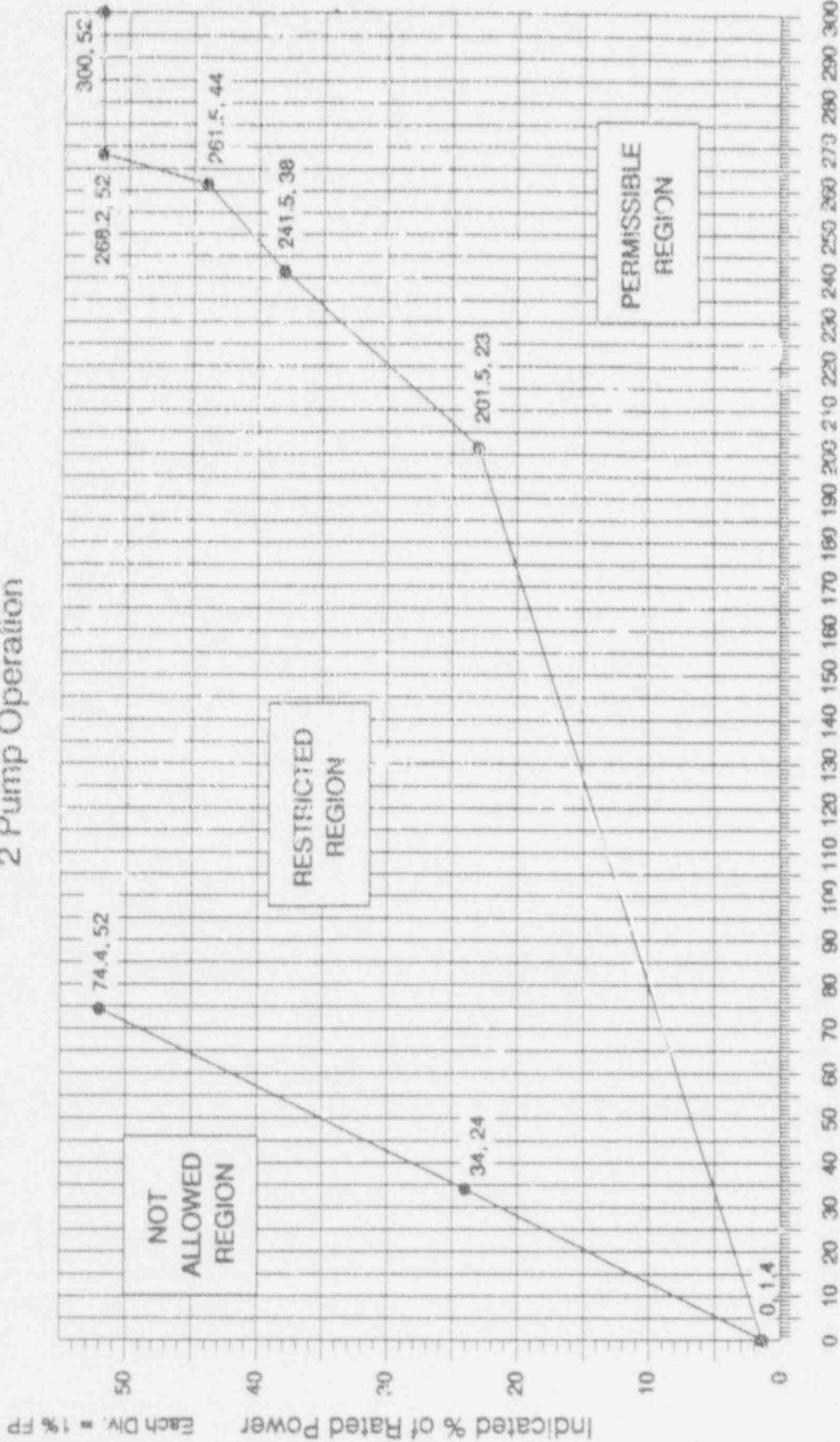
Source Doc. B&W 88-1203799-00
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

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



Source Doc. B&W 86-1203799-00/GPUN C1101-202-5412-174, Rev. 0
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

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

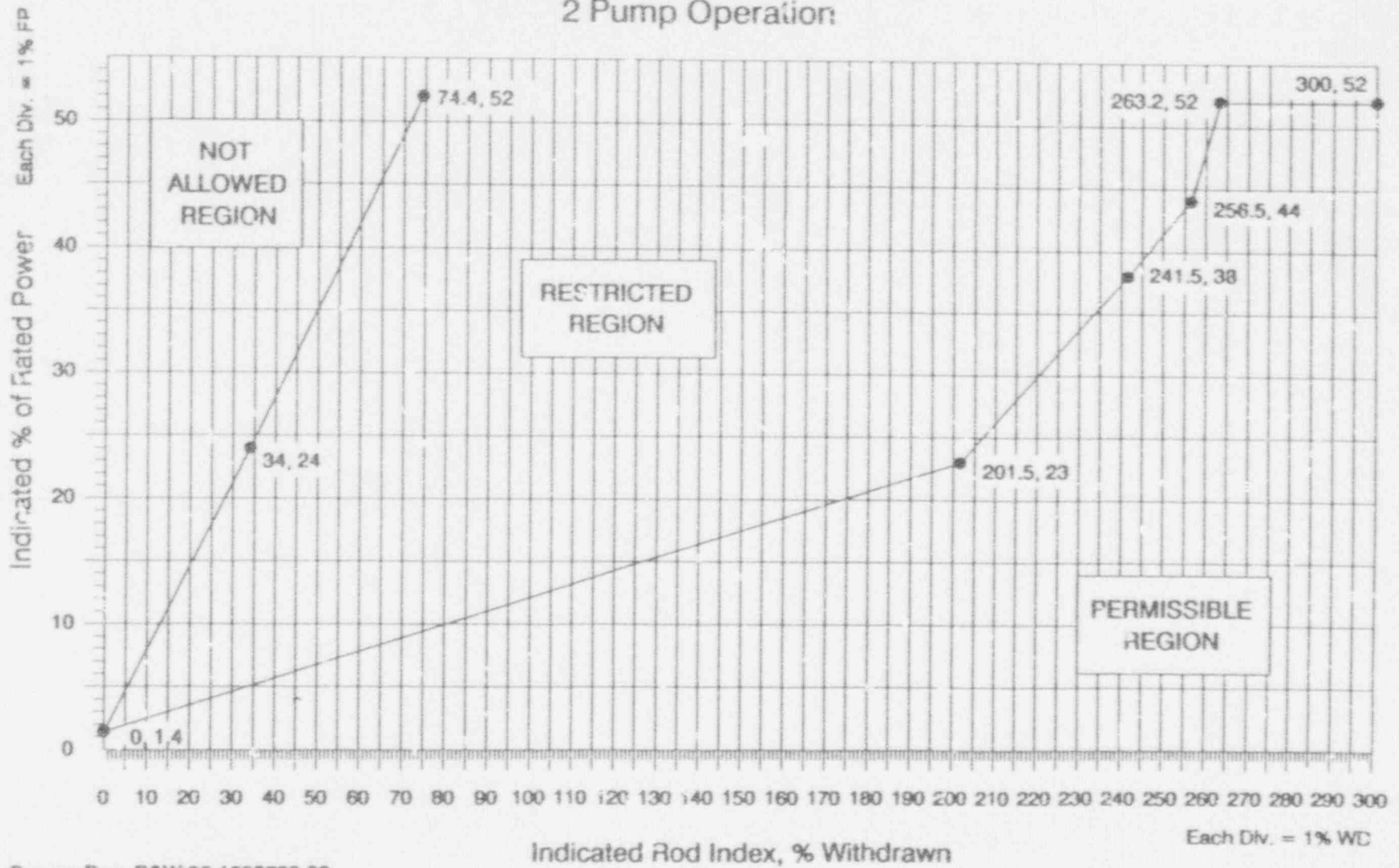


Each Div. = 1% WD

Indicated Rod Index, % Withdrawn

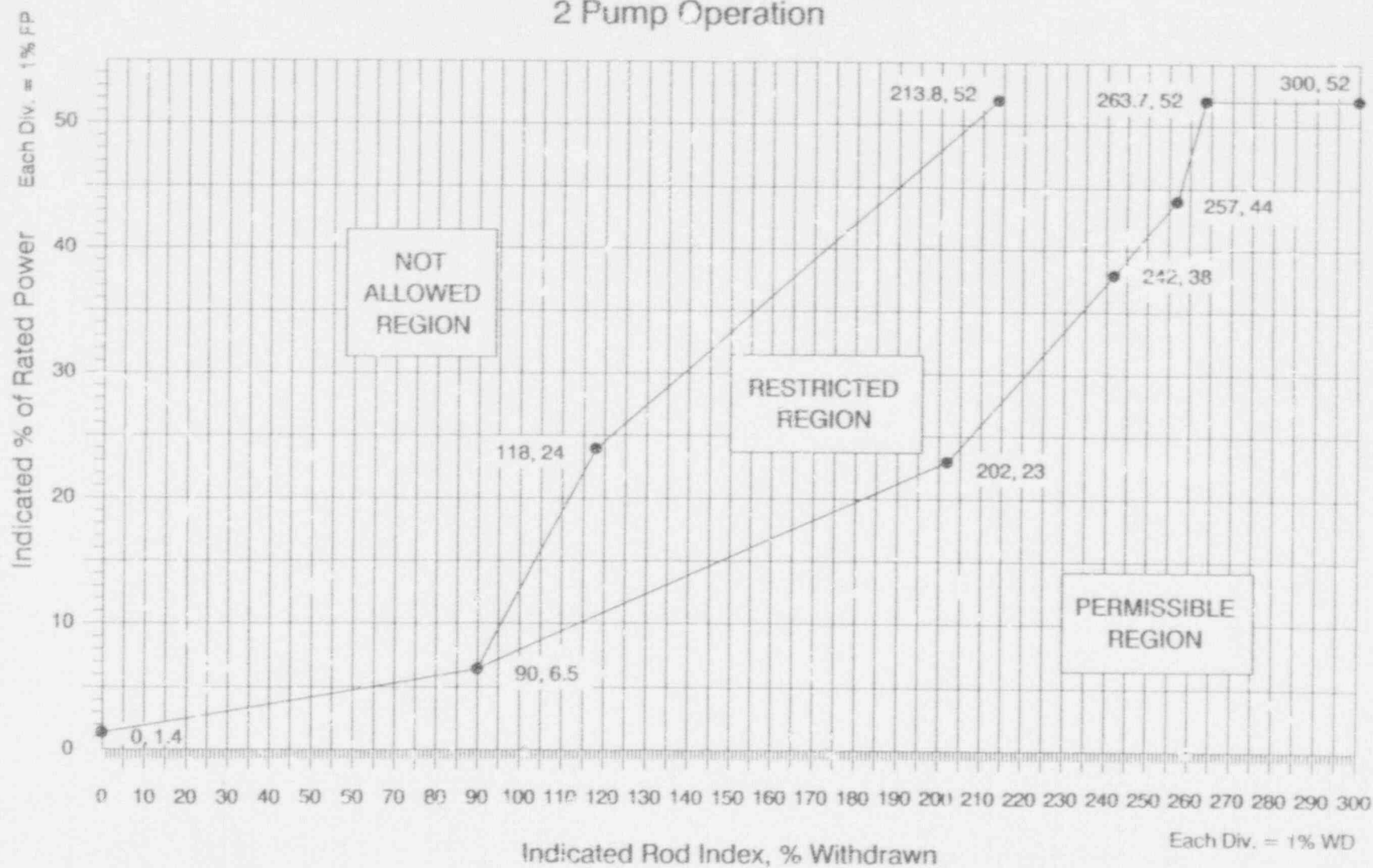
Source Doc. B&W 86-120G799-00
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

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



Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.5.b and 3.5.2.4.e.2

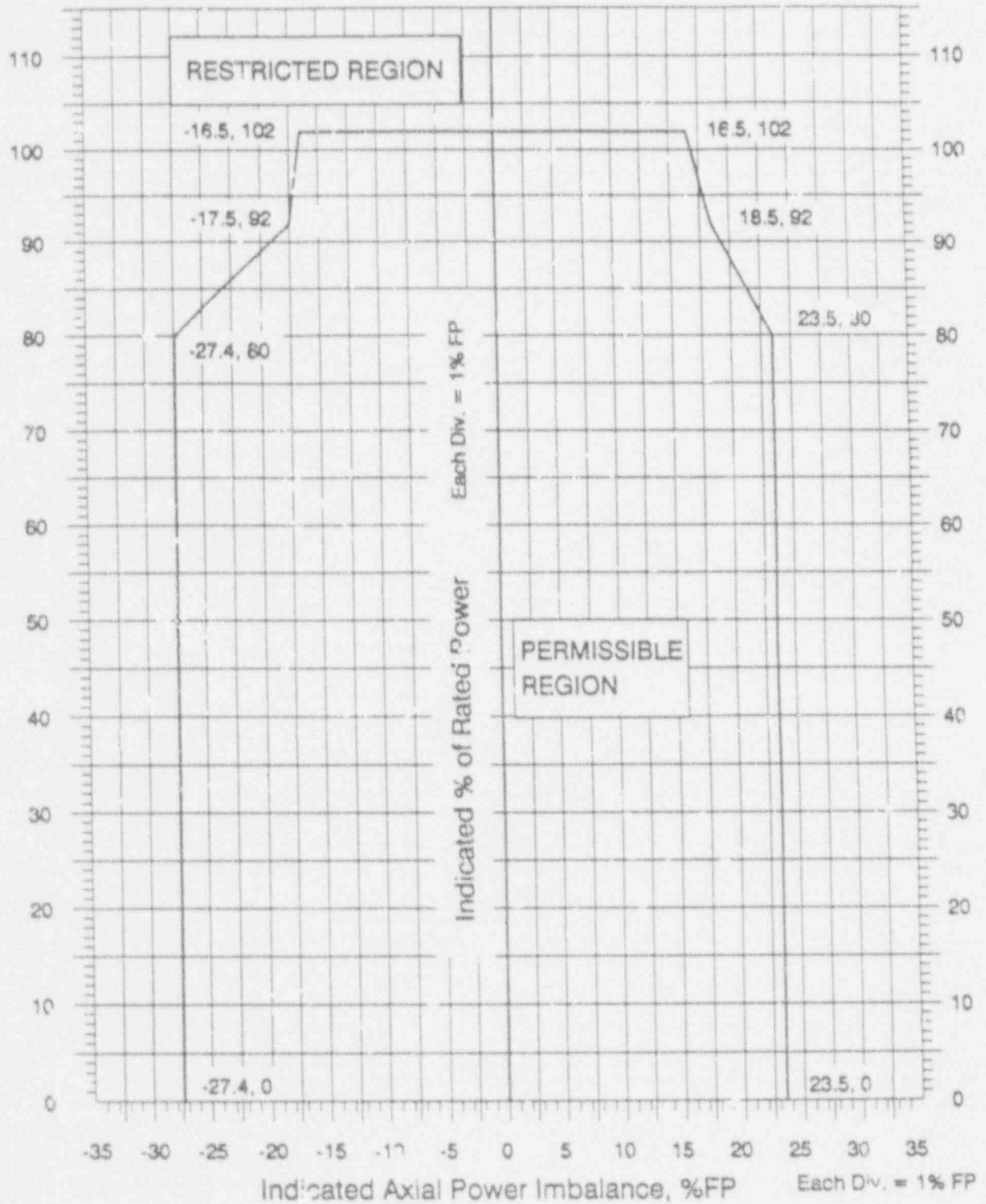
Figure 3 (Page 3 of 3)
 Error Adjusted Rod Insertion Limits
 105 +/- 5 EFPD to EOC
 2 Pump Operation



Source Doc. B&W 56-1203799-00/GPUN C1101-2-5412-171, Rev. 0
 Referred to by Tech. Spec 3.5.2.5.b and 3.5.2.4.e.2

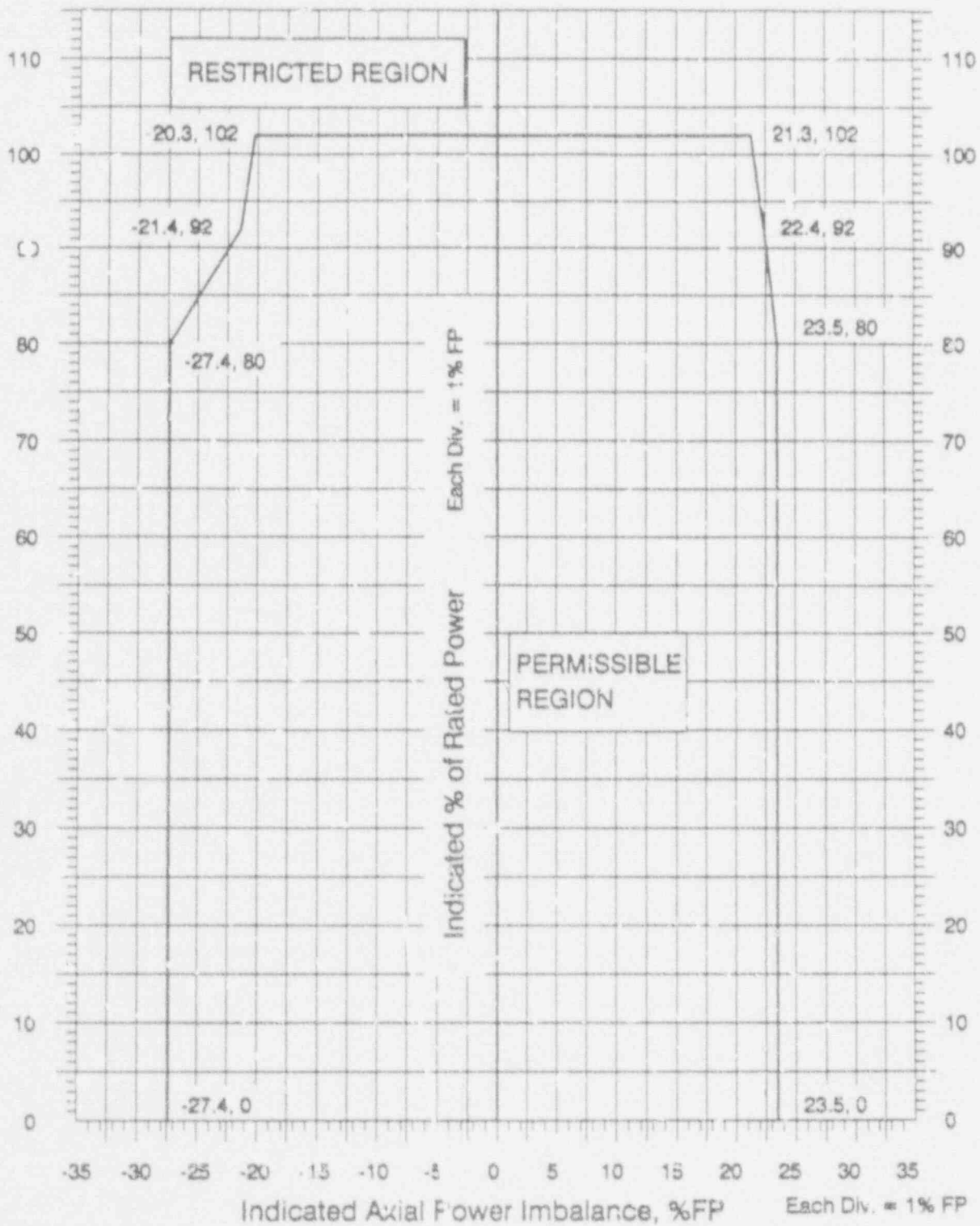
REV. 02/23
 0098 14 03 24

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



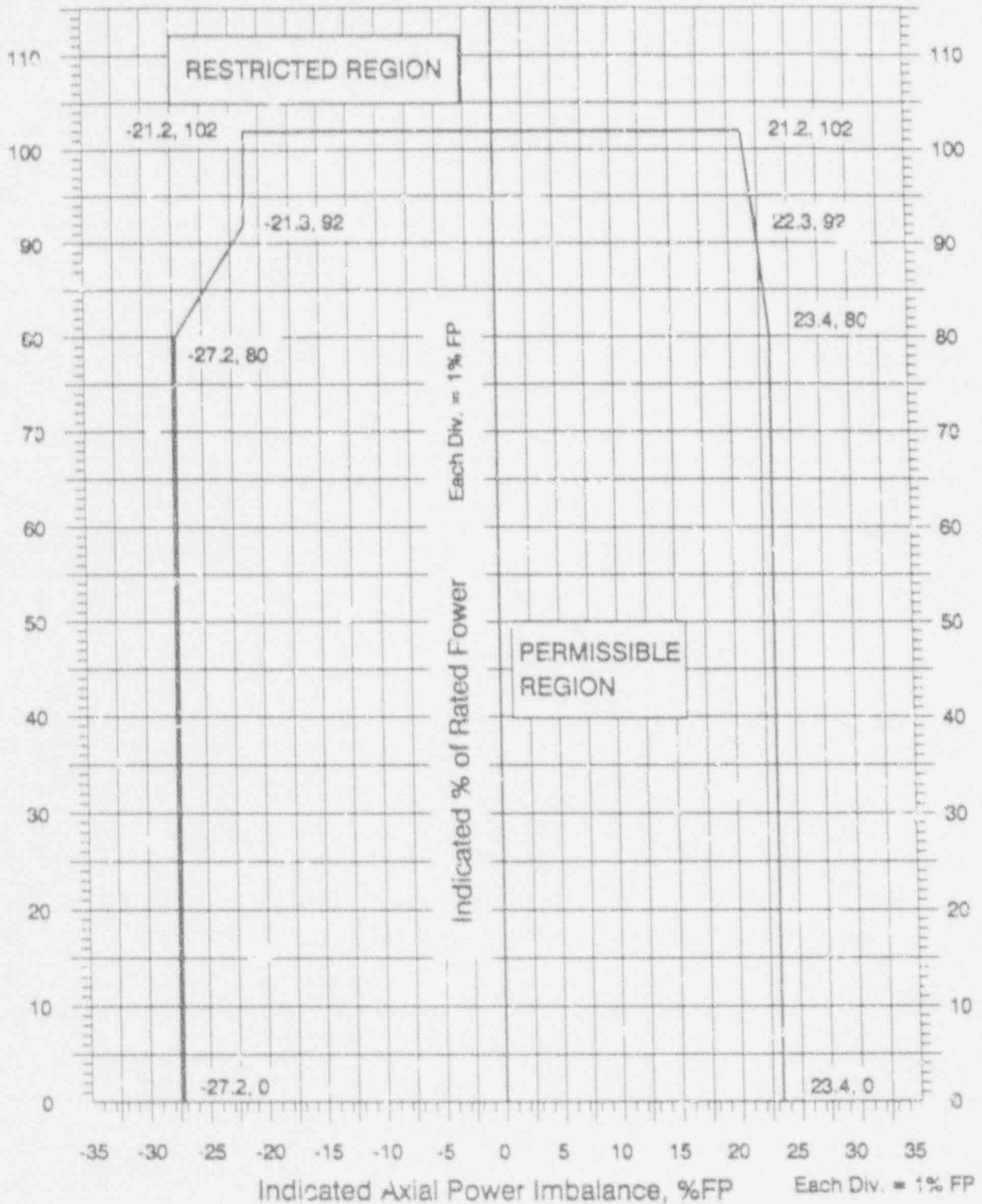
Source Doc. B&W 86-12C3799-00
 Referred to by Tech Spec 3.5.2.7.a and 3.5.2.4.e.3

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



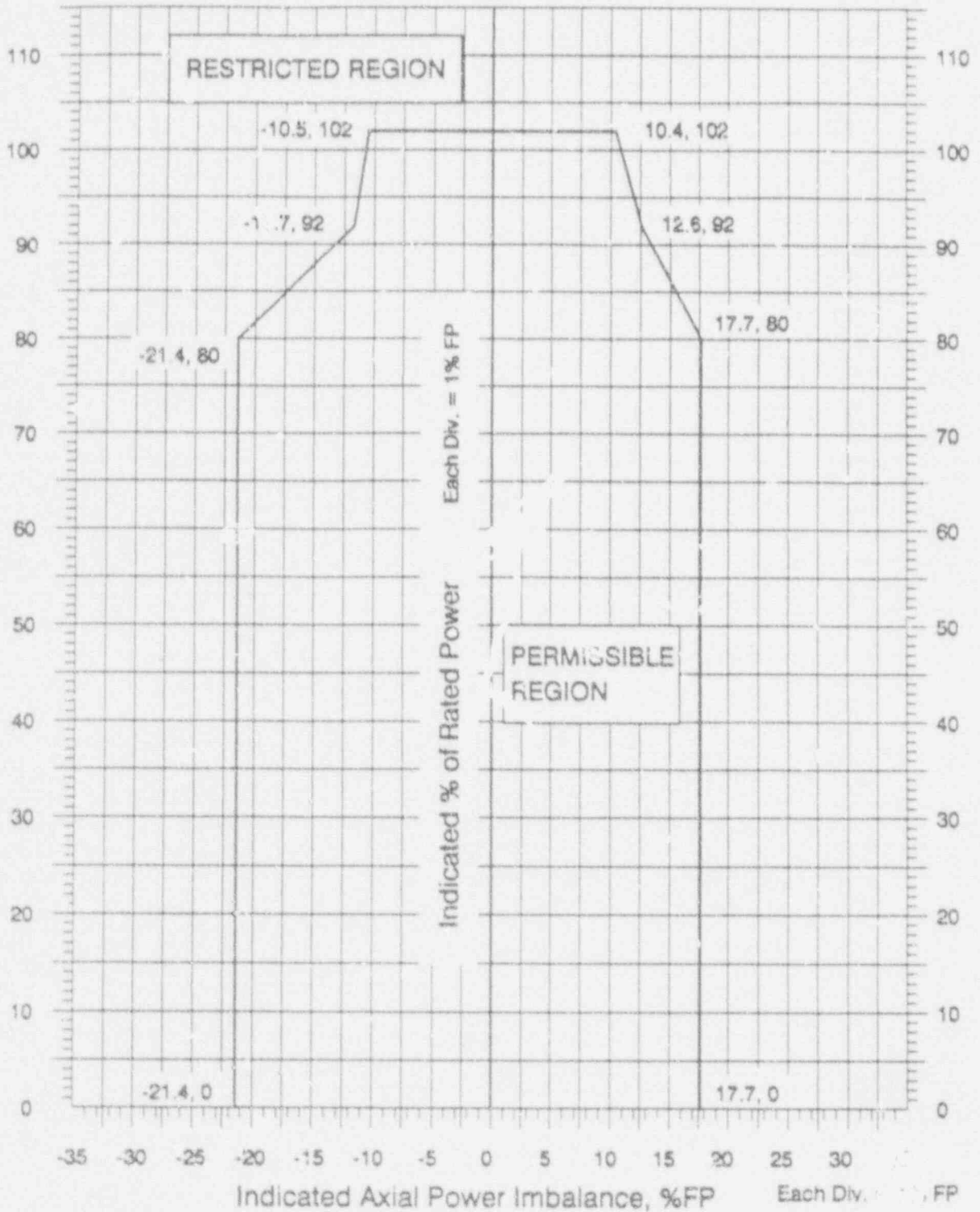
Source Doc. B&W 86-1203799-00
Referred to by Tech Spec 3.5.2.7.a and 3.5.2.4.e.3

Figure 4 (Page 3 of 3)
 Full Incore System
 Error Adjusted Imbalance Limits
 105 +/- 5 EFPD to EOC



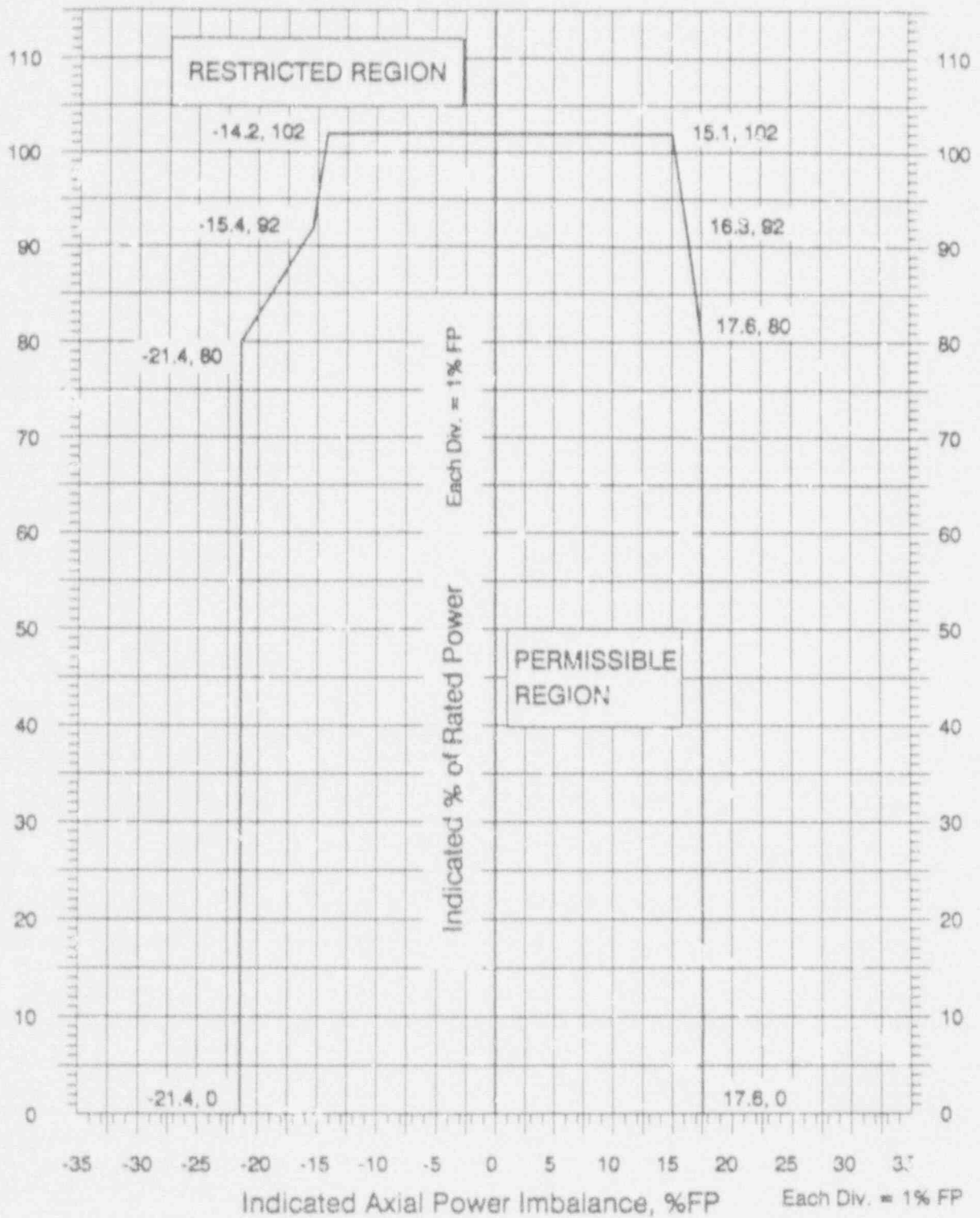
Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.7.a and 3.5.2.4.e.3

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



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

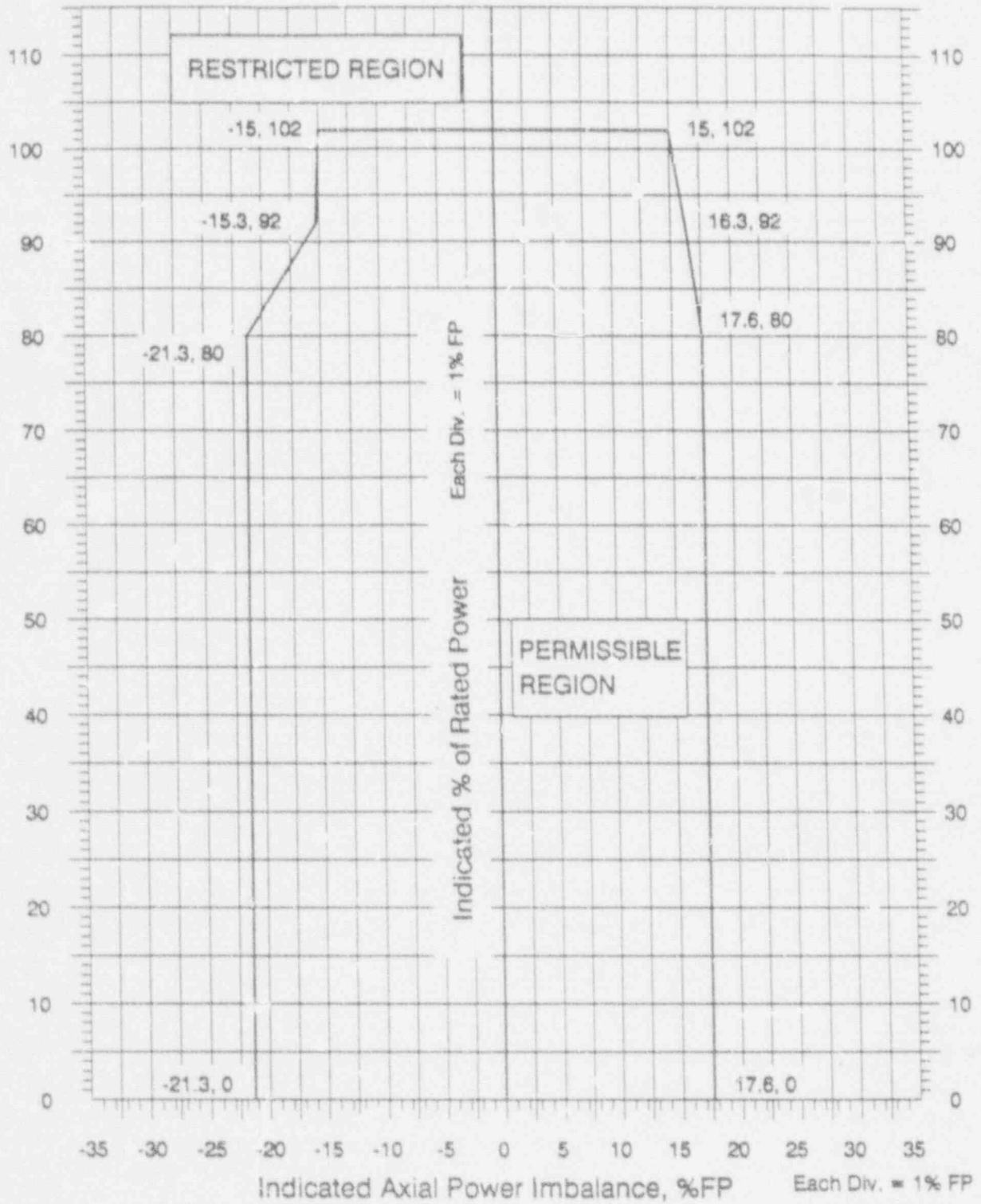
Figure 5 (Page 2 of 3)
 Out-of-Core Detector System
 Error Adjusted Imbalance Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD



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

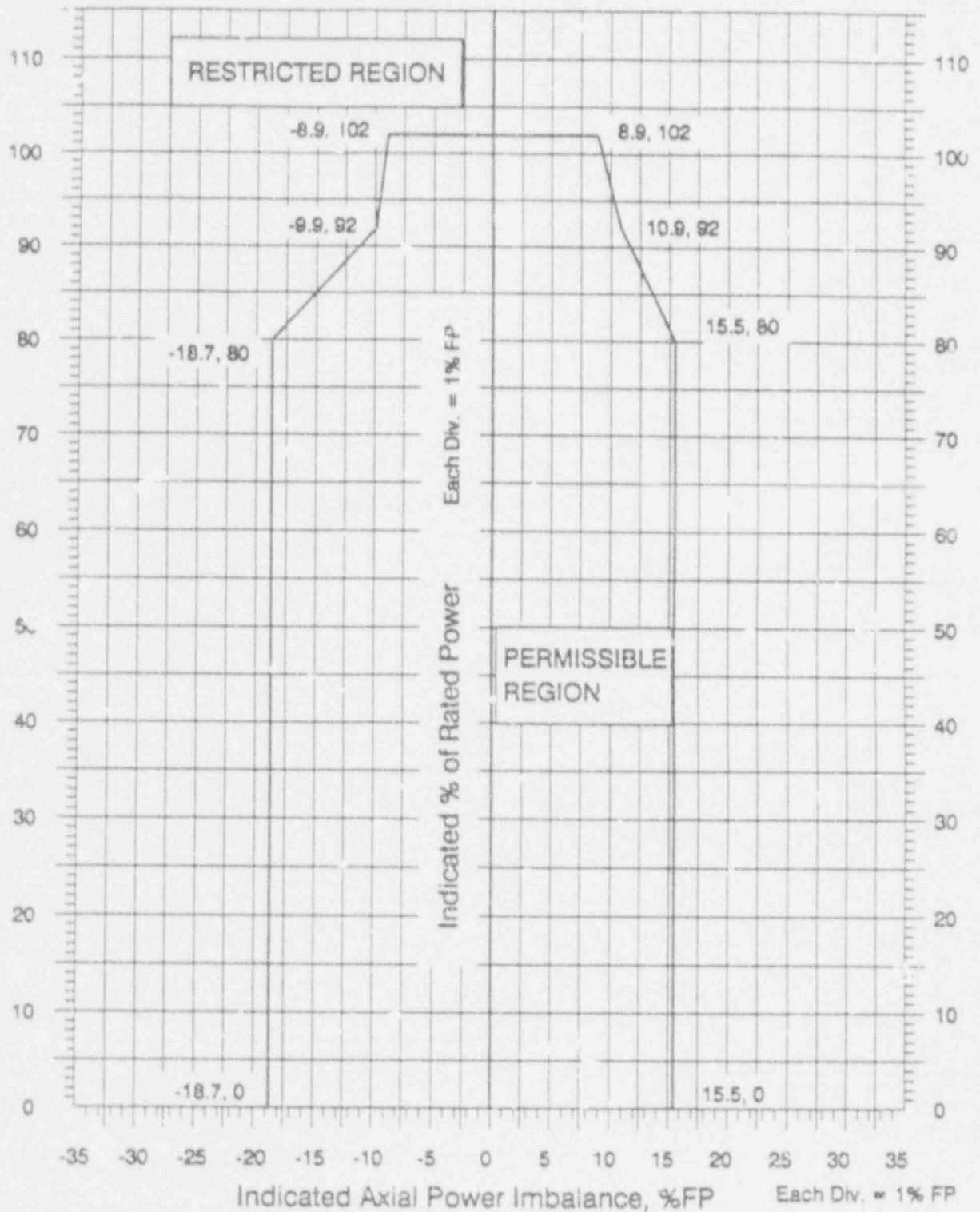
Figure 5 (Page 3 of 3)
 Out-of-Core Detector System
 Error Adjusted Imbalance Limits
 105 +/- 5 EFPD to EOC

TR 083
 Rev. 0
 Page 20 of 25



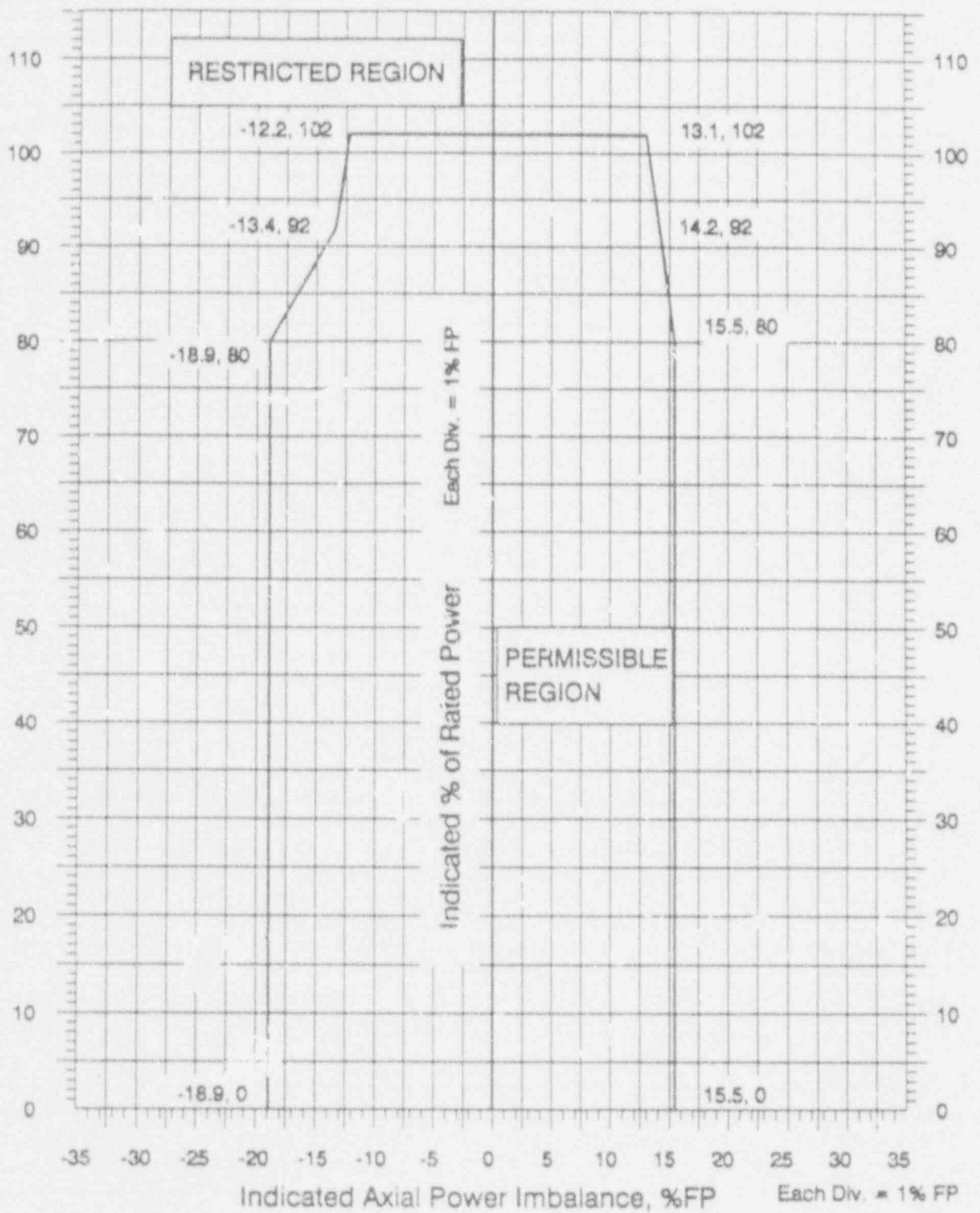
Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.7.b and 3.5.2.4.e.3

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



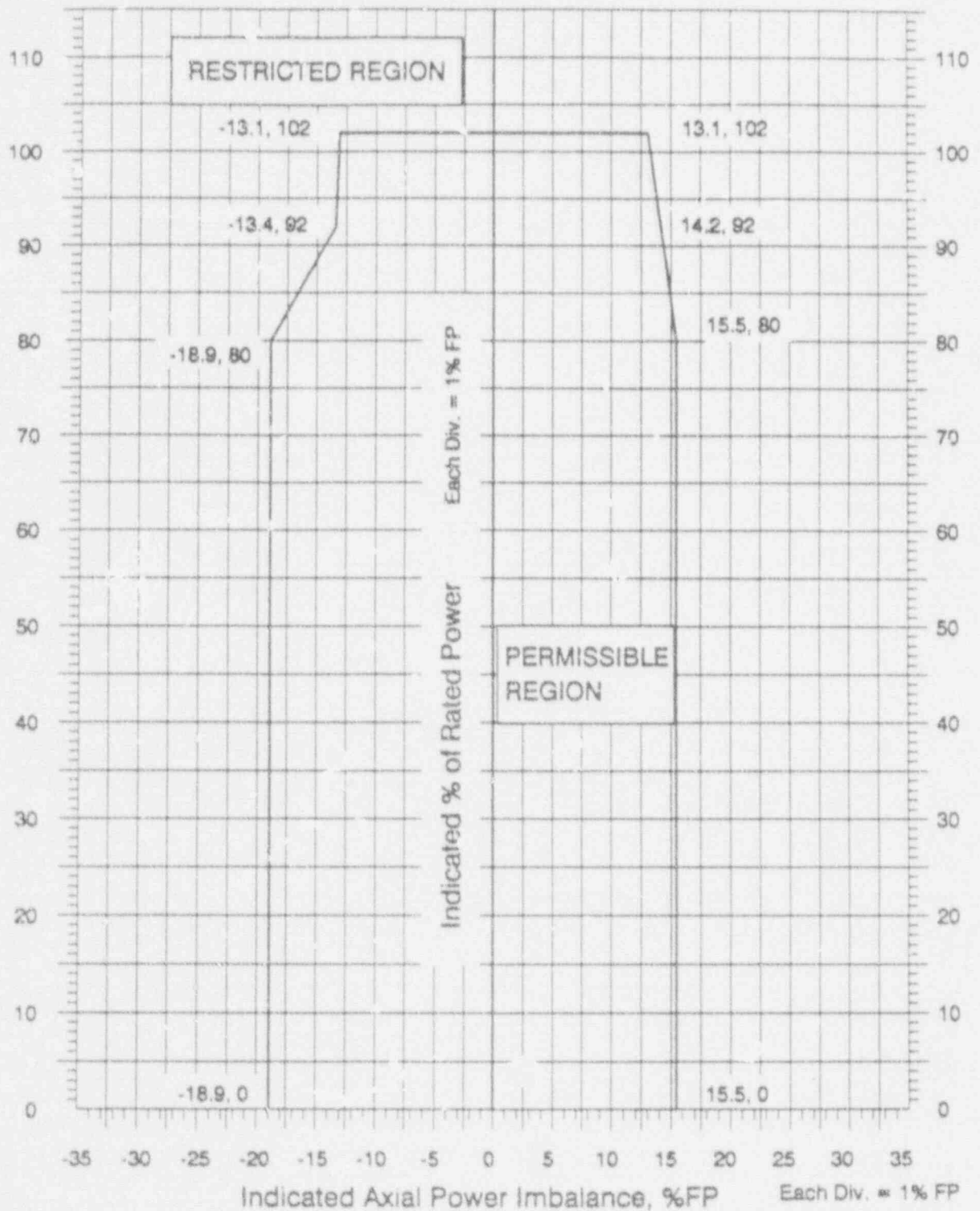
Source Doc. B&W 86-1203799-00
 Referred to by Tech Spec 3.5.2.7.c and 3.5.2.4.e.3

Figure 6 (Page 2 of 3)
 Minimum Incore System
 Error Adjusted Imbalance Limits
 45 +/- 5 EFPD to 105 +/- 5 EFPD



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



Source Doc. B&W F6-1203799-00
 Referred to by Tech Spec 3.5.2.7.c and 3.5.2.4.e.3

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 Dec. : DAW 2134