

**FLORIDA POWER CORPORATION
CRYSTAL RIVER UNIT 3
DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72**

3F1199-04

ATTACHMENT

**CORE OPERATING LIMITS REPORT
CYCLE 12**

Florida Power Corporation
Crystal River Unit 3

Cycle 12
Core Operating Limits Report
Revision 0

Referencing
Improved Technical Specifications

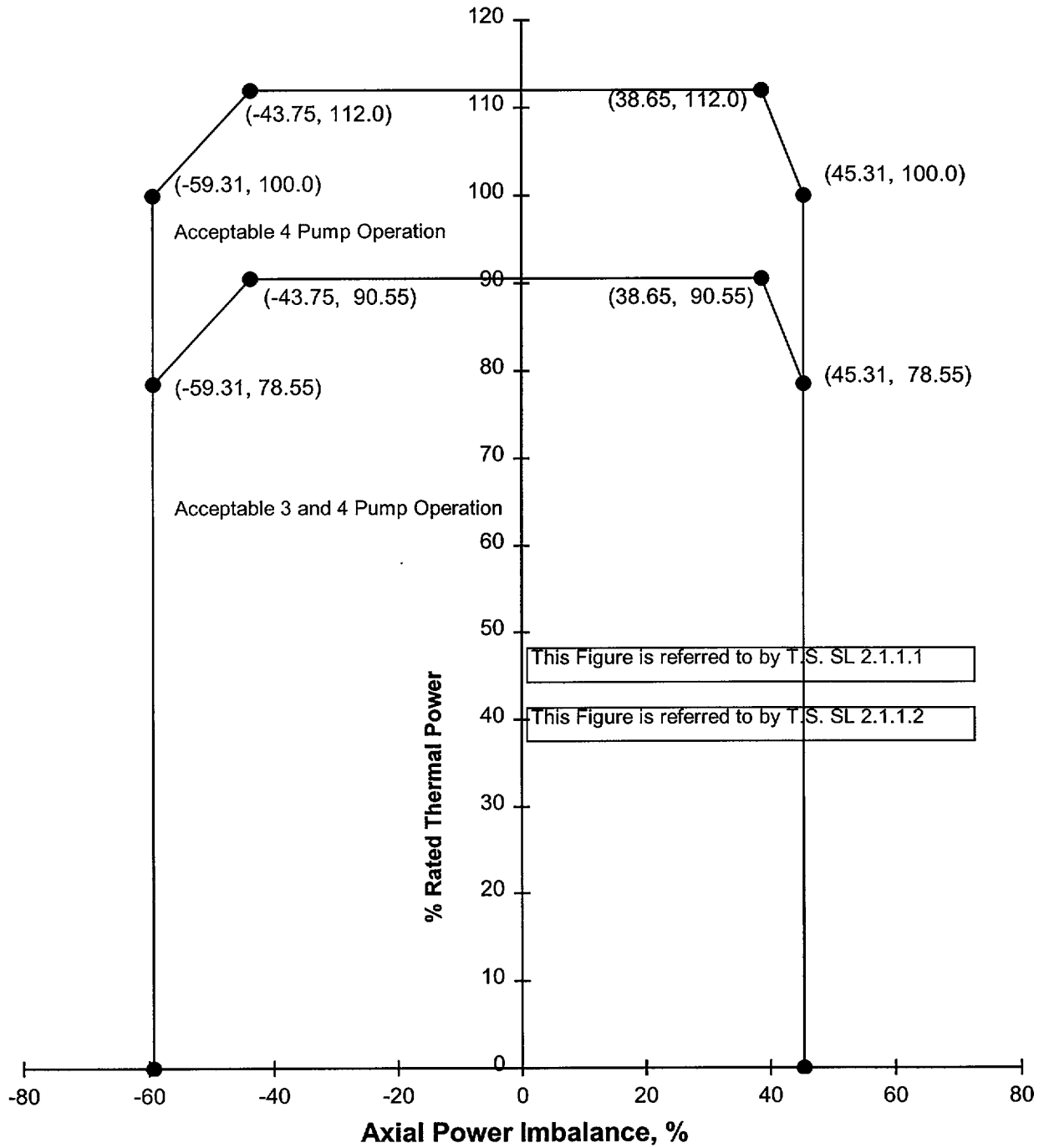
1.0 Core Operating Limits

This Core Operating Limits Report for CR3 Cycle 12 has been prepared in accordance with the requirements of Technical Specification Section 1.1 and 5.6.2.18. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC. These methods are documented in BAW-10179PA, Rev. 3 "Safety Criteria and Methodology for Acceptable Cycle Reload Analyses". The Cycle 12 limits generated using this methodology above are documented in BAW-2354, "Crystal River Unit 3 Cycle 12 Reload Report", dated August 1999.

The following limits are included in this report.

SL 2.1.1.1	AXIAL POWER IMBALANCE PROTECTIVE LIMITS
SL 2.1.1.2	AXIAL POWER IMBALANCE PROTECTIVE LIMITS
LCO 3.1.1	SHUTDOWN MARGIN
LCO 3.1.3	MODERATOR TEMPERATURE COEFFICIENT
SR 3.1.7.1	API/RPI POSITION INDICATION AGREEMENT
LCO 3.2.1	REGULATING ROD INSERTION LIMITS
LCO 3.2.2	AXIAL POWER SHAPING ROD INSERTION LIMITS
LCO 3.2.3	AXIAL POWER IMBALANCE OPERATING LIMITS
LCO 3.2.4	QUADRANT POWER TILT
LCO 3.2.5	POWER PEAKING FACTORS
LCO 3.3.1	REACTOR PROTECTION SYSTEM INSTRUMENTATION
LCO 3.9.1	REFUELING BORON CONCENTRATION

Axial Power Imbalance Protective Limits



Shutdown Margin (SDM)

Normal operating procedures require RCS boration to 1.0% $\Delta k/k$ Subcritical at 73°F prior to bypassing EFIC actuation on low steam generator pressure, or when high steam generator levels exist during secondary system chemistry control and steam generator cleaning in MODES 3, 4, and 5, therefore

Mode 3,4,5 SDM \geq 1.0% $\Delta k/k$

These limits are referred to by Technical Specification LCO 3.1.1

Reference: Improved Technical Specification Bases B3.1.1.

Moderator Temperature Coefficient Limit

Lower Limit

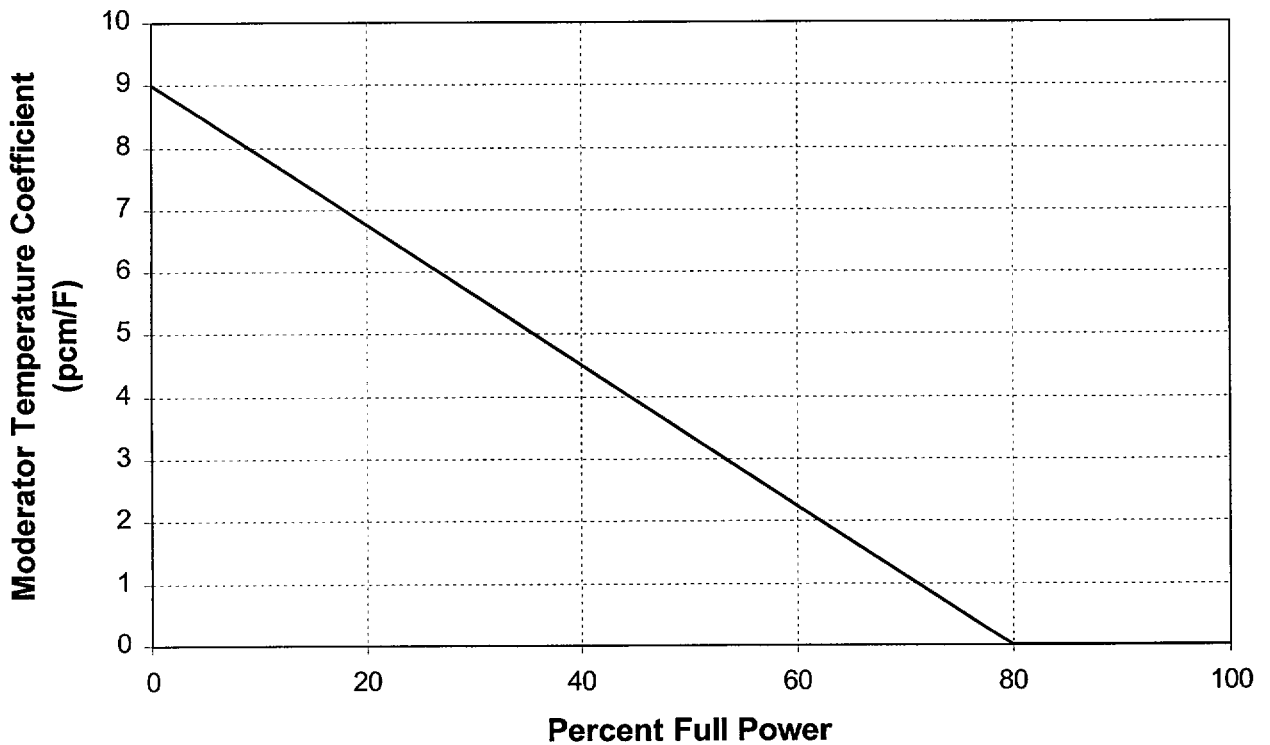
MTC at HFP > $-3.58 \times 10^{-4} \Delta k/k/^{\circ}F$

Upper Limit

MTC $\leq 0.9 \times 10^{-4} \Delta k/k/^{\circ}F$ when Thermal Power < 95% RTP

MTC ≤ 0.0 when Thermal Power $\geq 95\%$ RTP

The following Upper Limits may not be exceeded (Limits ensure the validity of the ECCS analysis is preserved) for operation in MODES 1 and 2:



These limits are referred to by Technical Specification LCO 3.1.3

Absolute Position Indicator / Relative Position Indicator Agreement Limits

2.7% when the comparison is performed using the plant computer, or

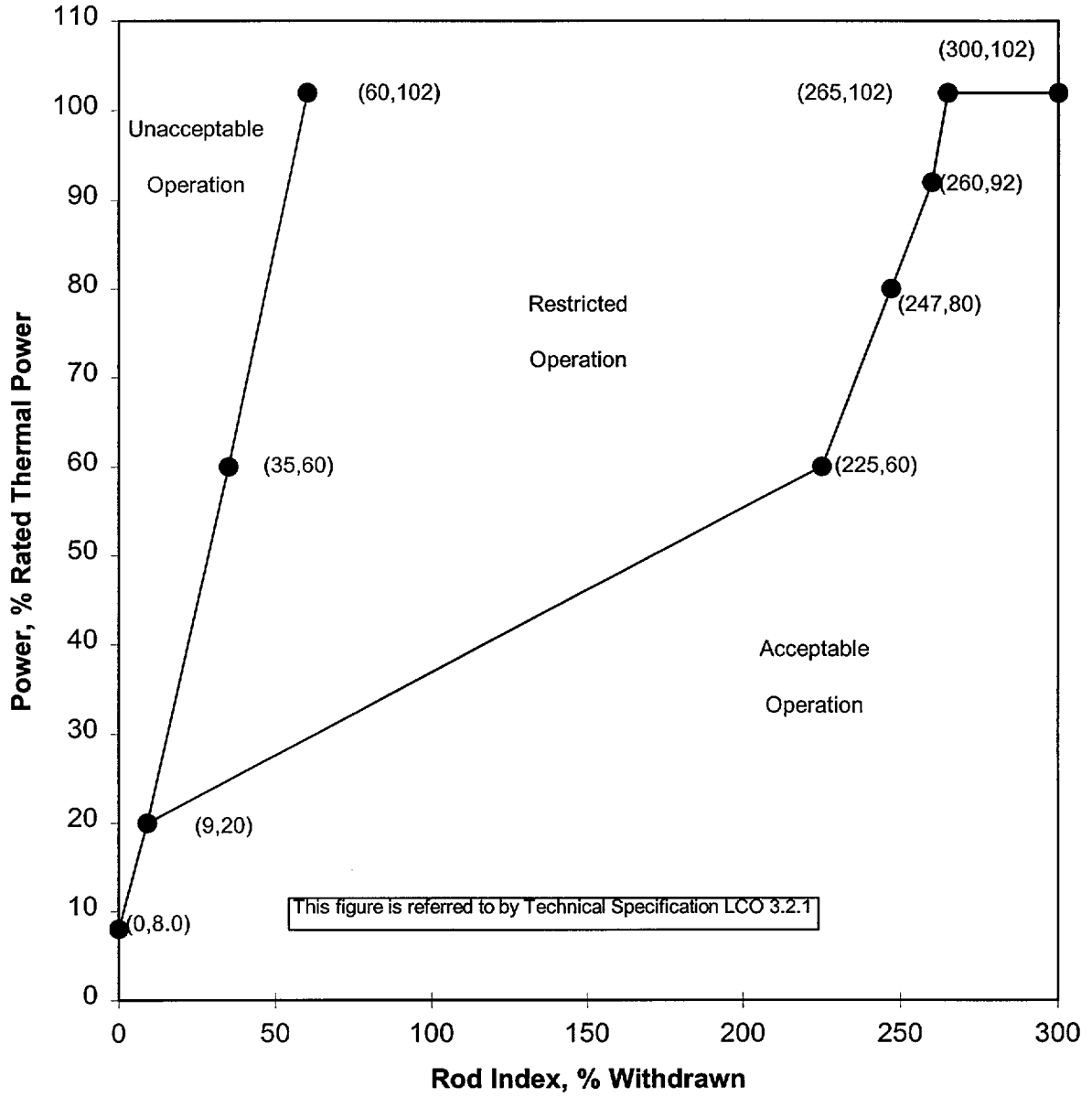
3.5% when the comparison is performed using the panel meters on the main control board.

These limits are referred to by Technical Specification SR 3.1.7.1
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Reference: "Crystal River Unit 3 - Issuance of Amendment Re: Dual Channel Control Rod Position Indication (TAC No. M82990)", Licensing Amendment No. 144, Letter form H.S. Silver to P.M. Beard, June 25, 1992.

Regulating Rod Group Insertion Limits

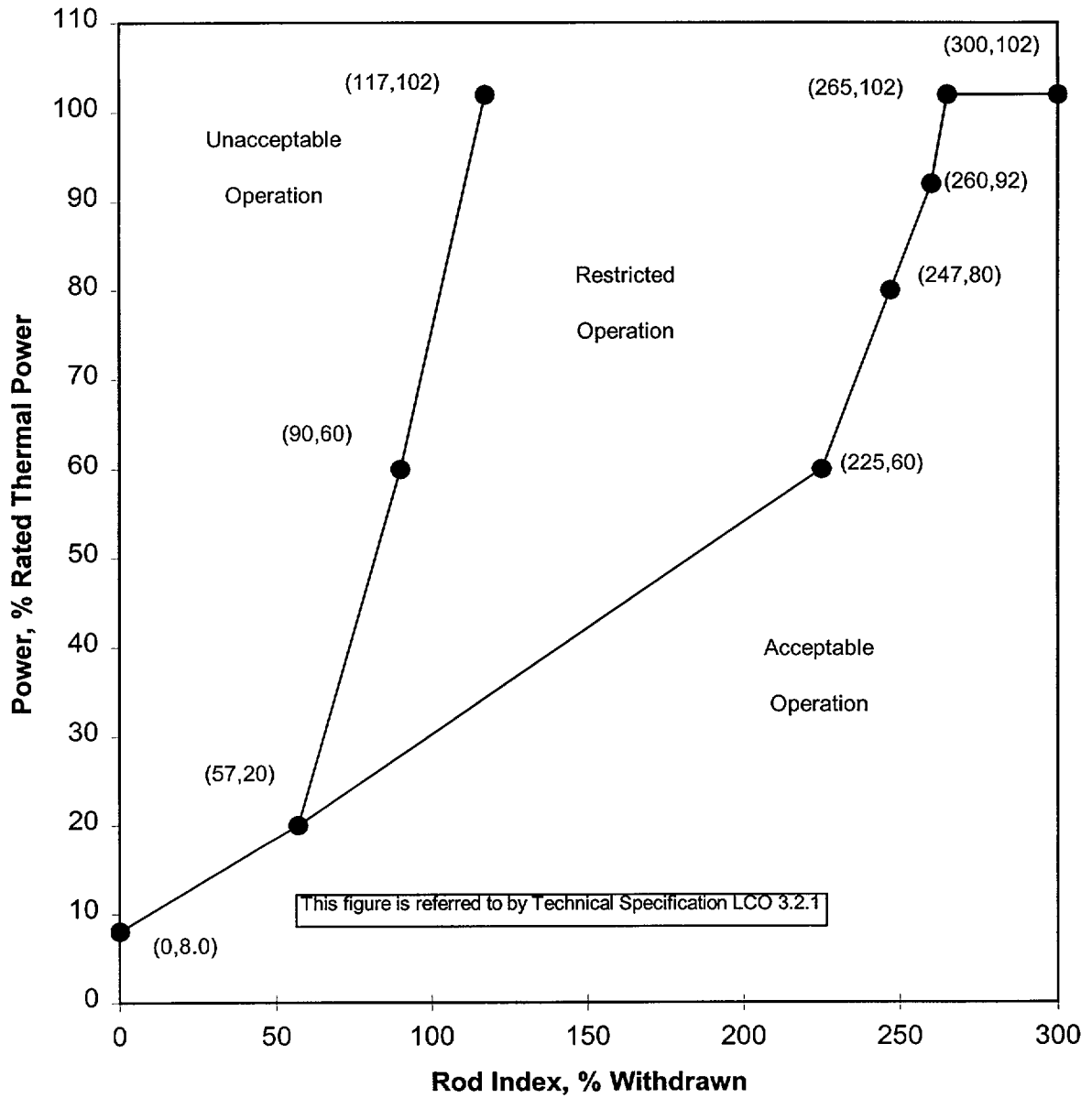
Four Pump Operation
0 to 300 ± 10 EFPD



Note 1: A Rod group overlap of 25 ± 5 % between sequential groups 5 and 6, and 6 and 7 shall be maintained

Regulating Rod Group Insertion Limits

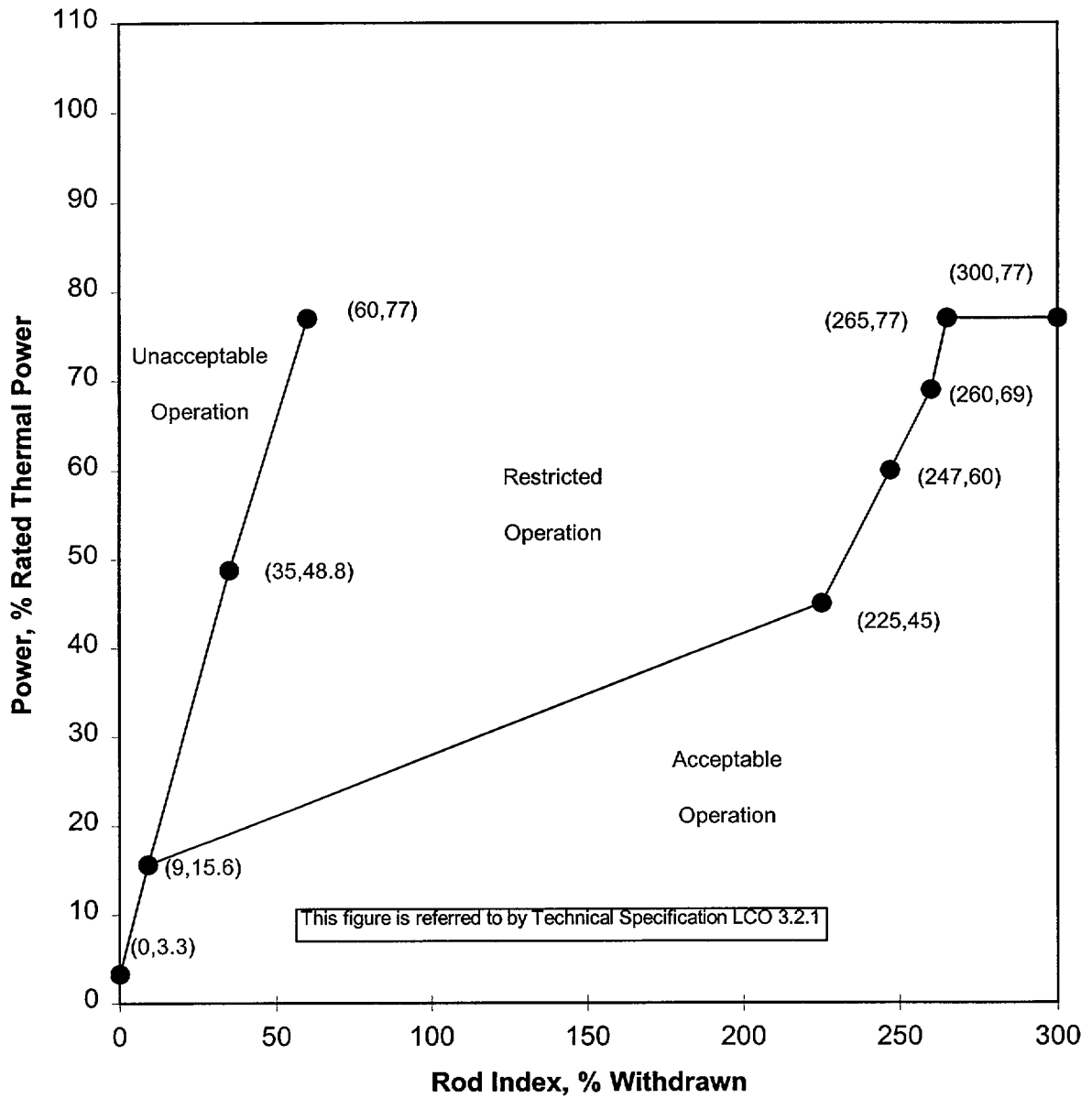
Four Pump Operation
after 300 \pm 10 EFPD



Note 1: A Rod group overlap of 25 \pm 5% between sequential groups 5 and 6, and 6 and 7 shall be maintained
 Note 2: This figure shall be used up to, during, and after APSR withdrawal per LCO 3.2.2

Regulating Rod Group Insertion Limits

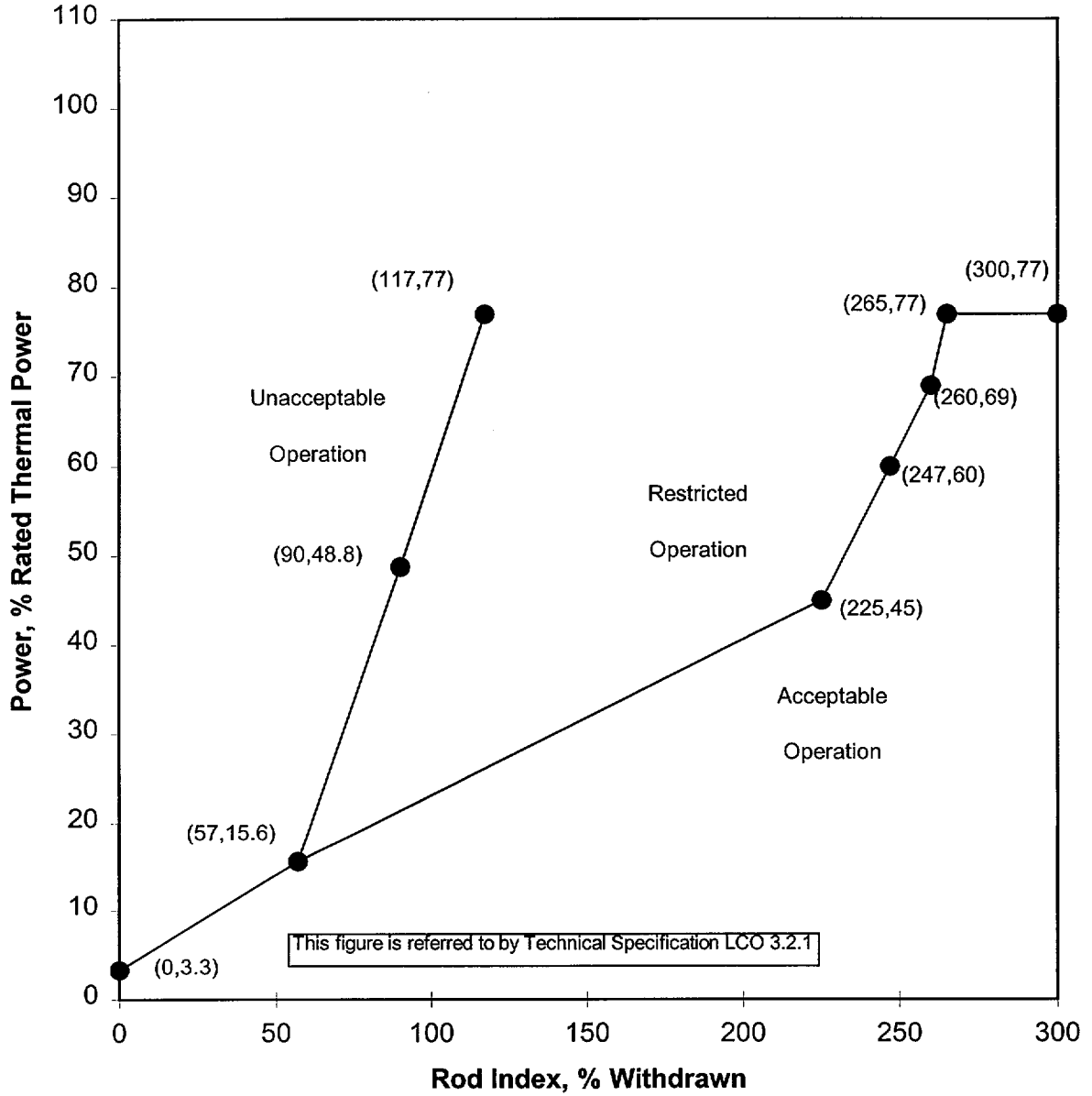
Three Pump Operation
0 to 300 \pm 10 EFPD



Note 1: A Rod group overlap of 25 \pm 5% between sequential groups 5 and 6, and 6 and 7 shall be maintained

Regulating Rod Group Insertion Limits

Three Pump Operation
after 300 \pm 10 EFPD



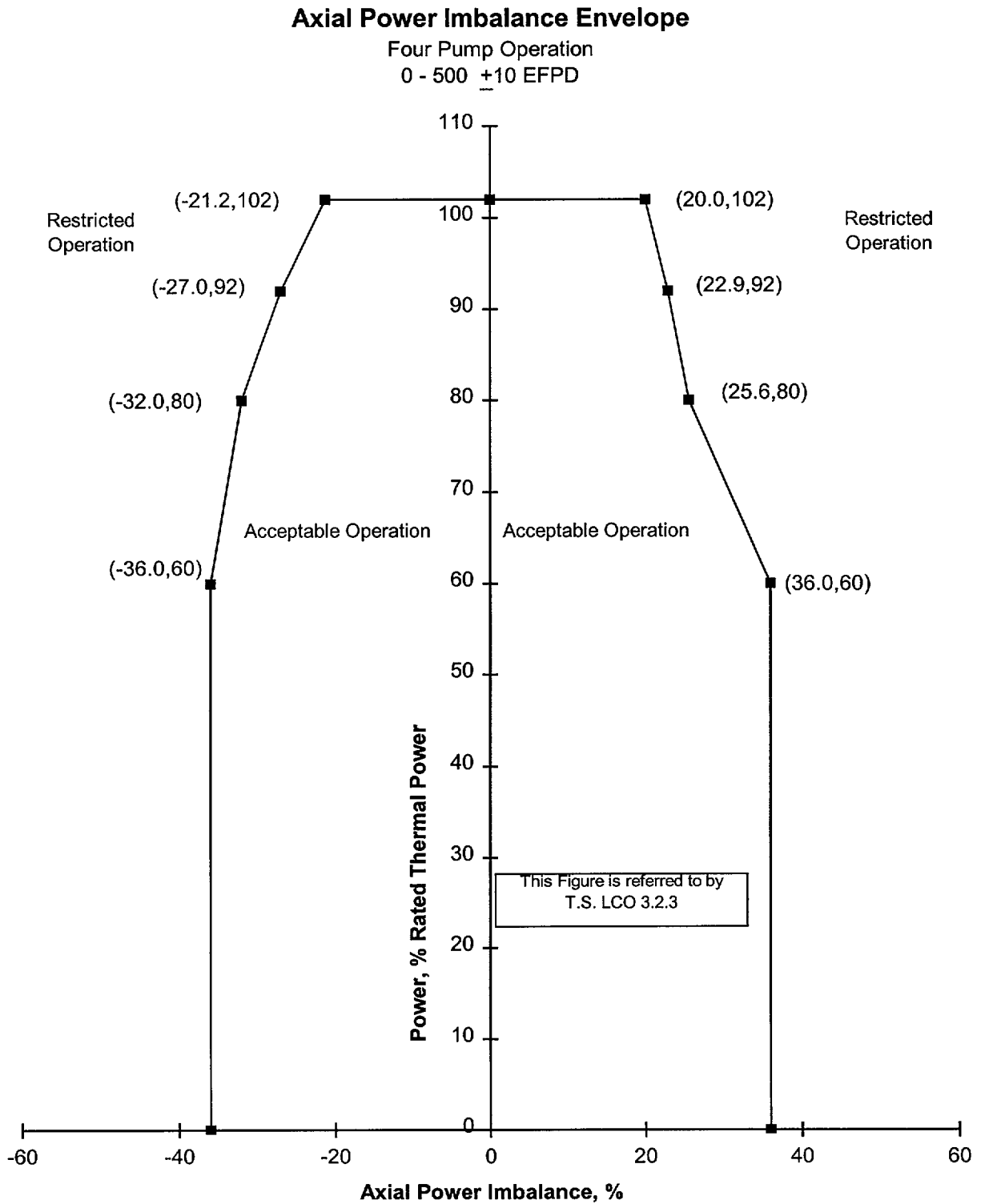
Note 1: A Rod group overlap of 25 \pm 5% between sequential groups 5 and 6, and 6 and 7 shall be maintained

Note 2: This figure shall be used up to, during, and after APSR withdrawal per LCO 3.2.2

Axial Power Shaping Rod Insertion Limits

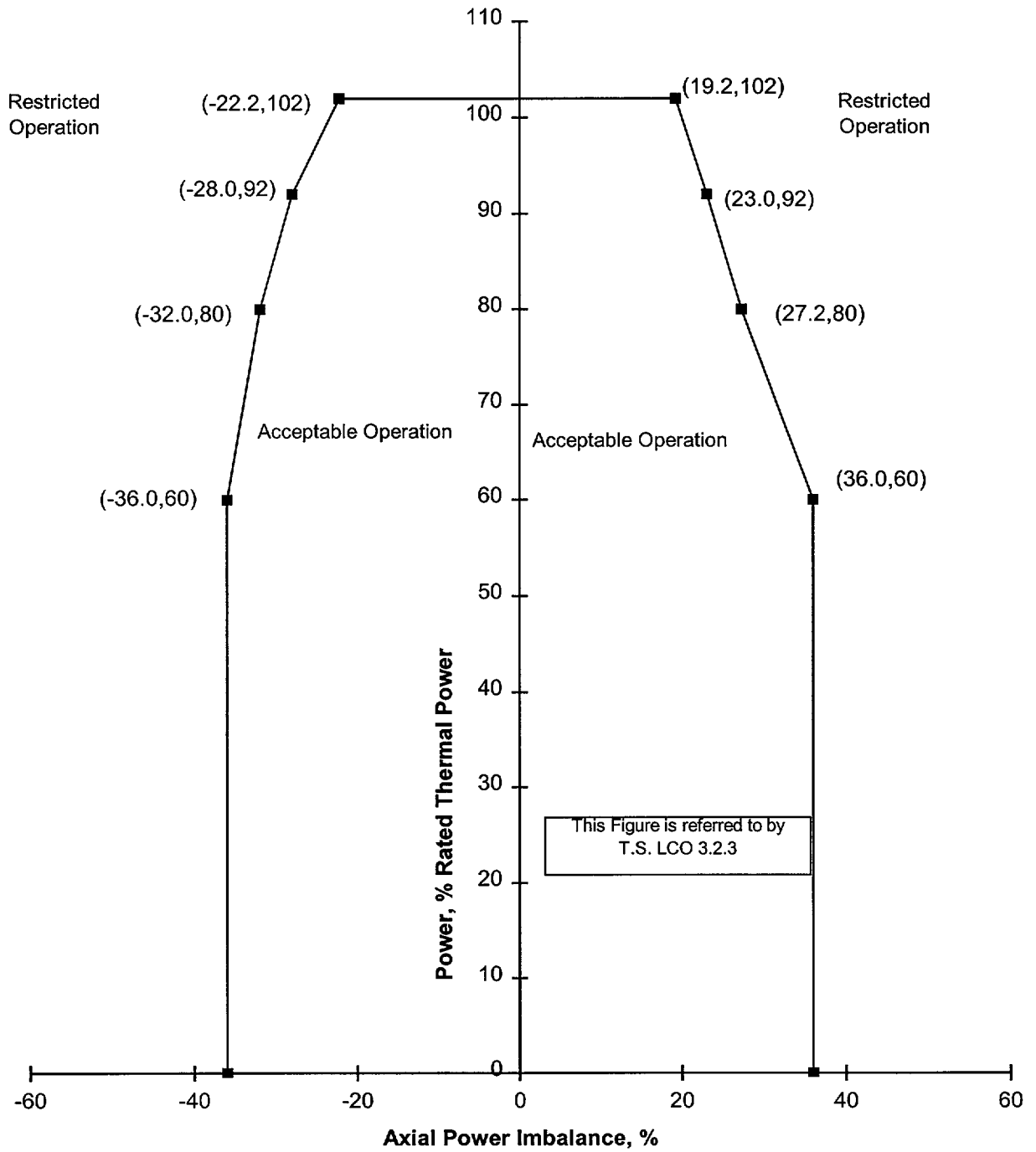
Up to 640 EFPD the APSRs may be positioned as necessary. The APSRs shall be completely withdrawn (100%) by 660 EFPD. Once withdrawn during this period, 640EFPD to 660EFPD the APSRs shall not be reinserted for the remainder of the cycle.

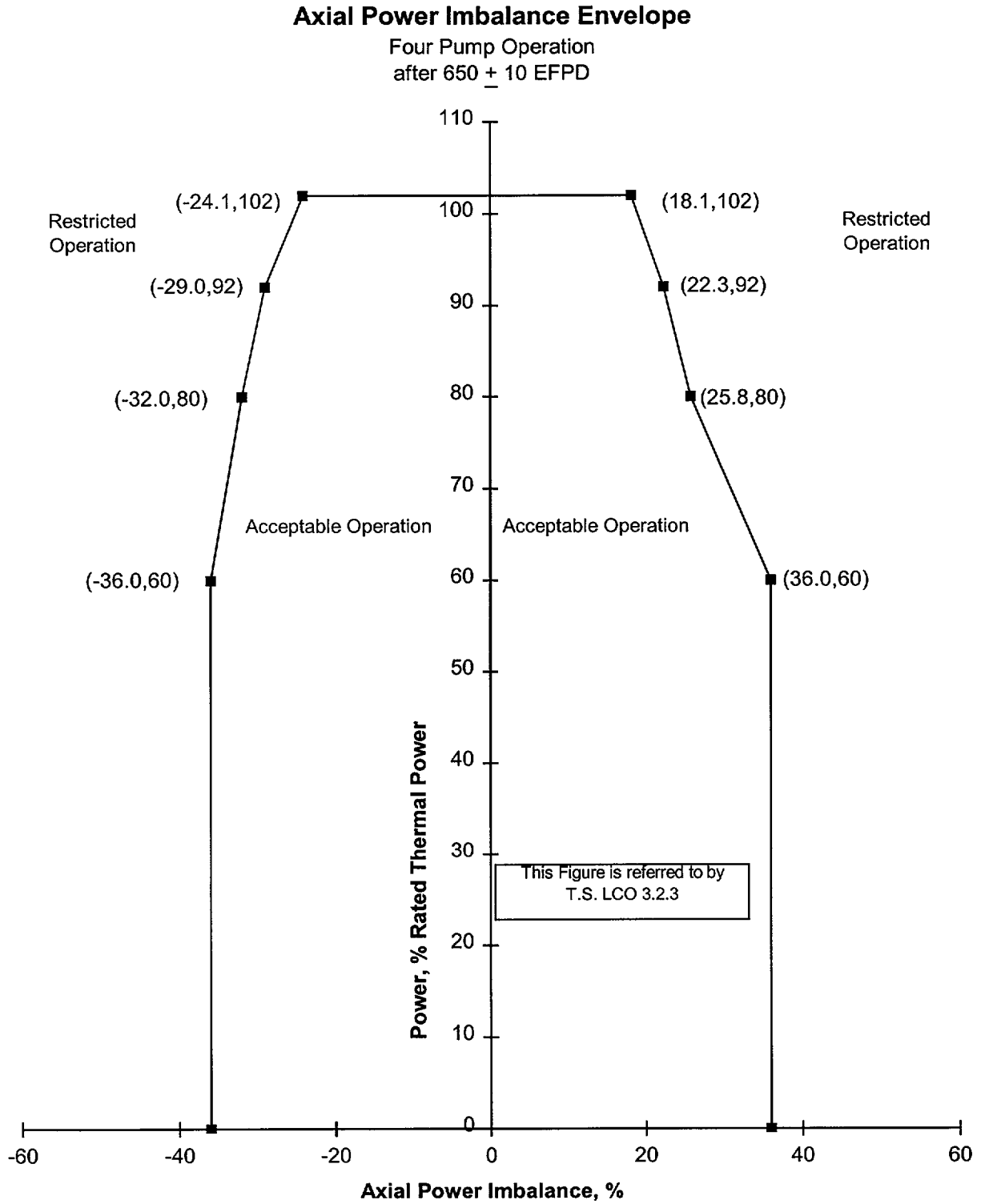
These limits are
referred to by
Technical
Specification
LCO 3.2.2



Axial Power Imbalance Envelope

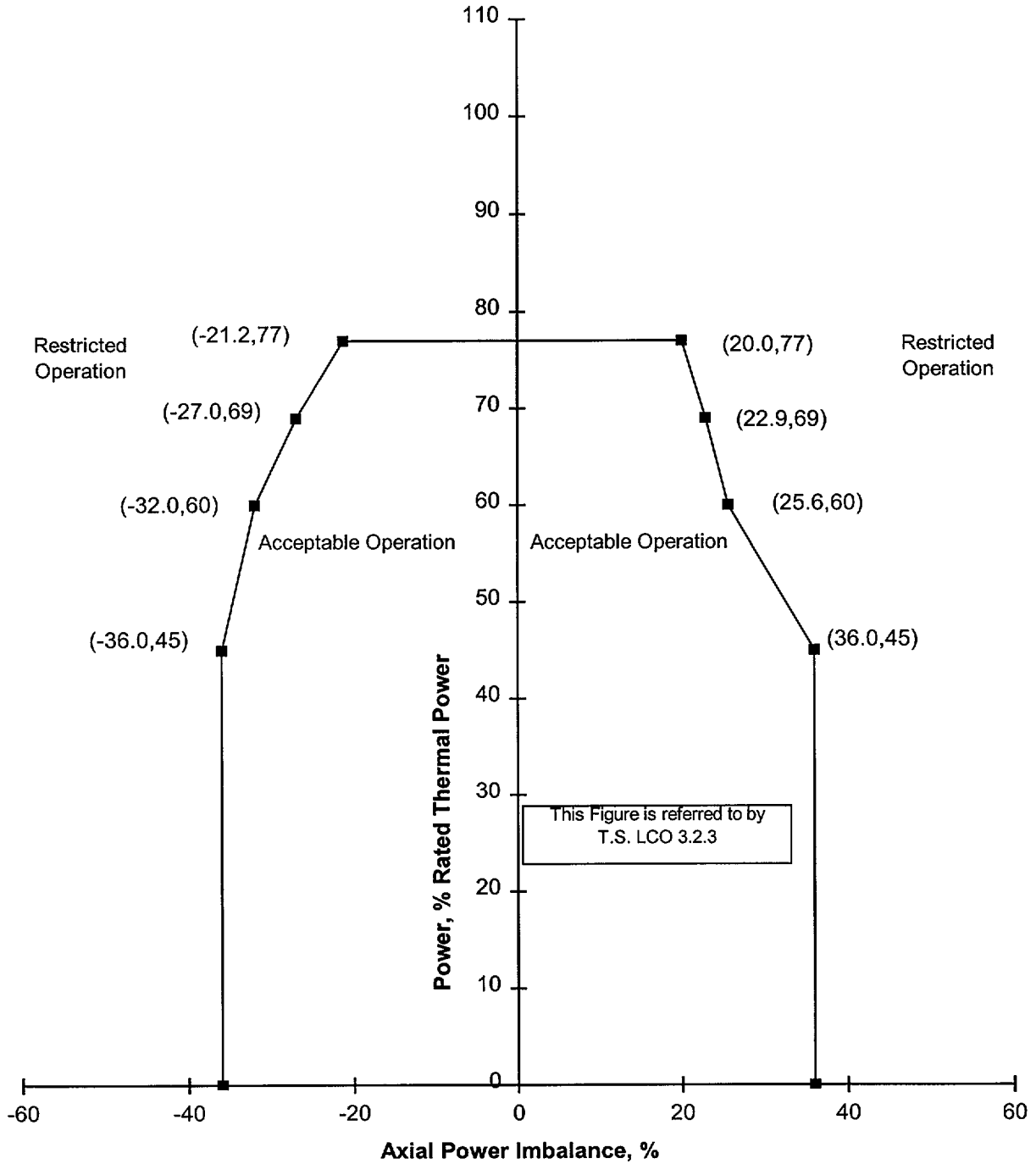
Four Pump Operation
500 \pm 10 to 650 \pm 10 EFPD





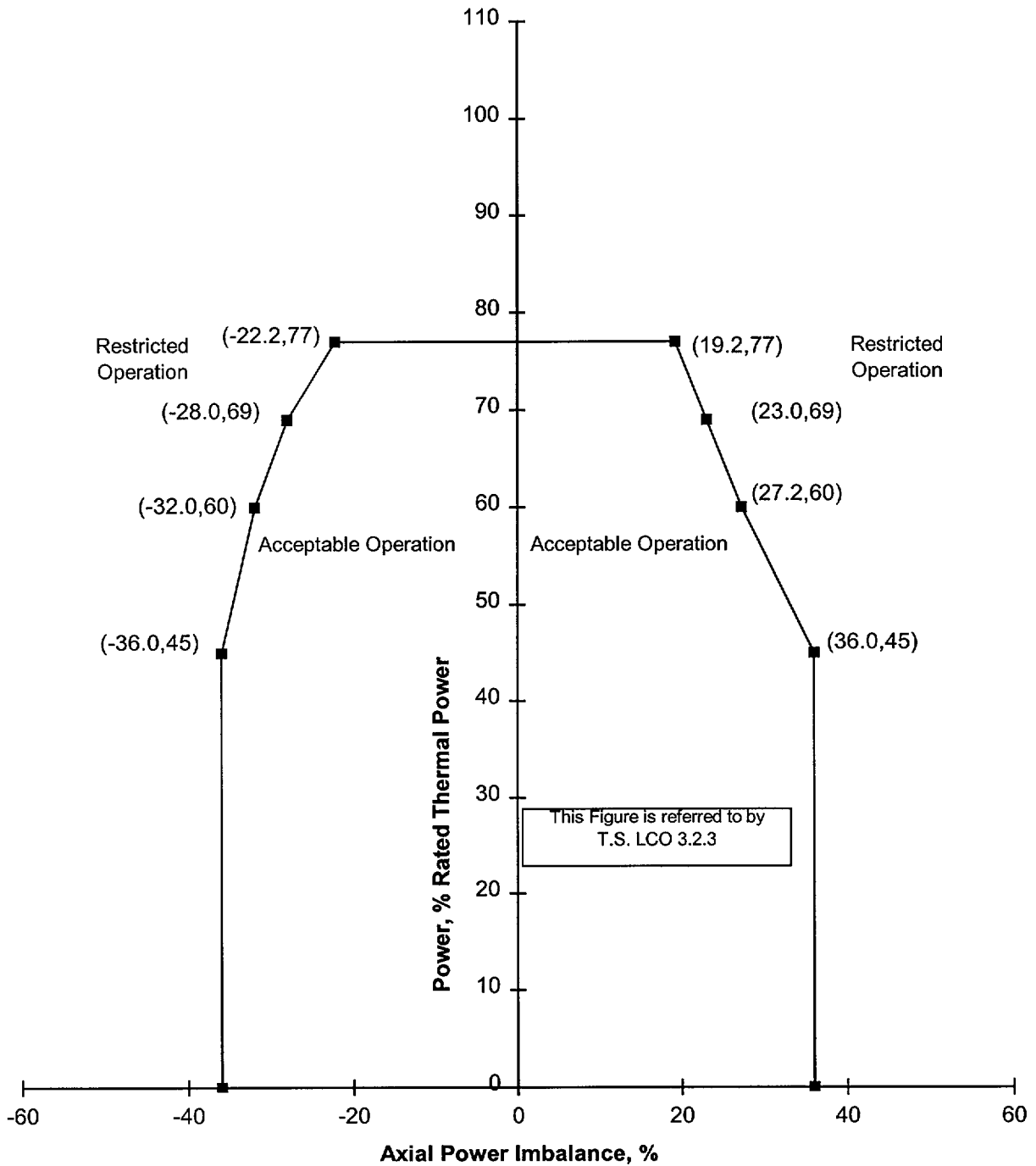
Axial Power Imbalance Envelope

Three Pump Operation
0 to 500 ± 10 EFPD



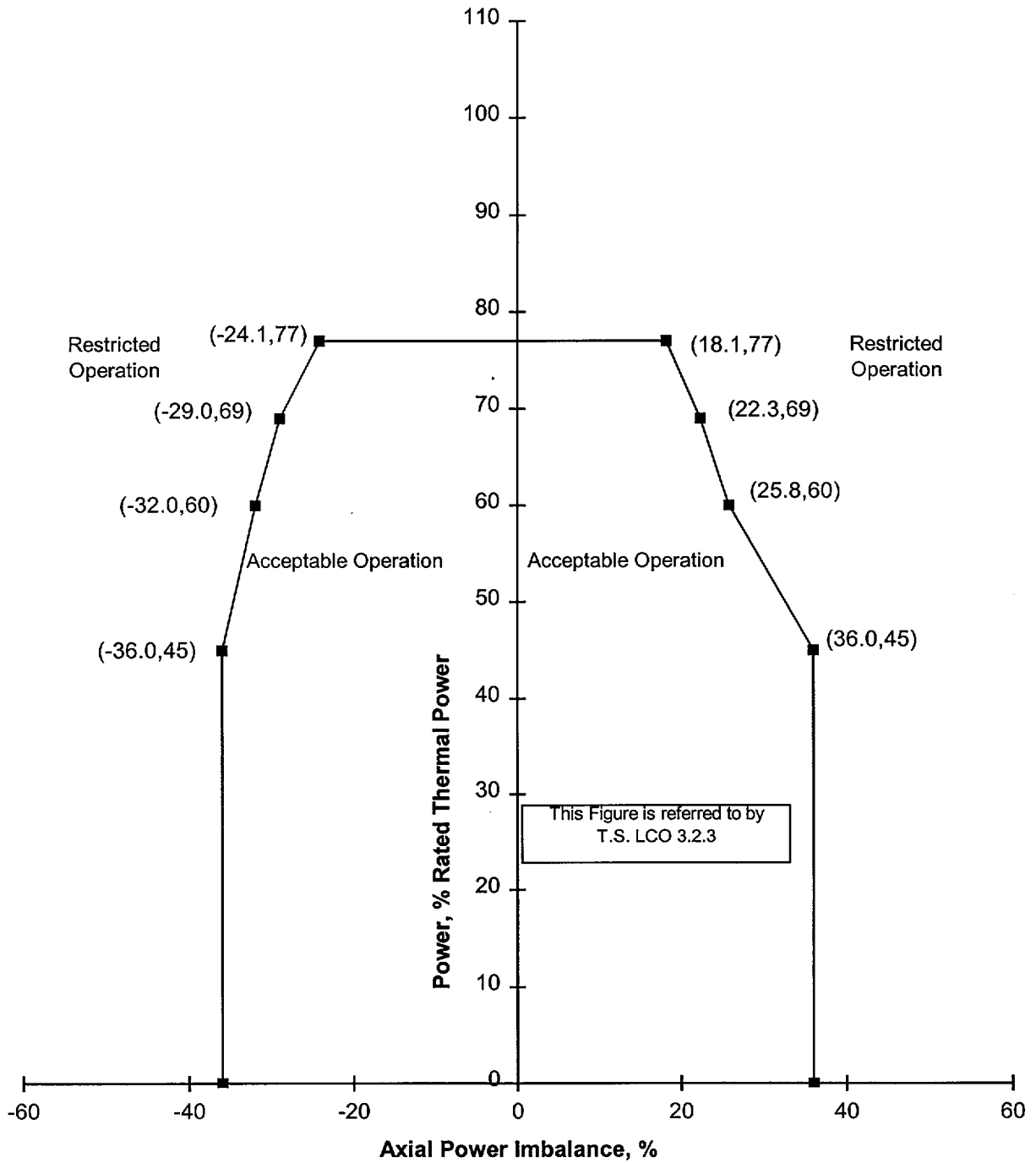
Axial Power Imbalance Envelope

Three Pump Operation
500 \pm 10 to 650 \pm 10 EFPD



Axial Power Imbalance Envelope

Three Pump Operation
after 650 \pm 10 EFPD



Quadrant Power Tilt Limits

For Operation from 0 EFPD to EOC

Thermal Power ≤ 60% RTP

0 EFPD - EOC

	Steady State	Transient	Maximum
Symmetrical Incore Detector System	7.50	10.03	20.00
Power Range Channels	4.94	6.96	20.00
Minimum Incore Detector System	3.07	4.40	20.00

Thermal Power > 60% RTP

0-300 EFPD

	Steady State	Transient	Maximum
Symmetrical Incore Detector System	4.47	10.03	20.00
Power Range Channels	1.96	6.96	20.00
Minimum Incore Detector System	1.90	4.40	20.00

For Operation After 300 EFPD

	Steady State	Transient	Maximum
Symmetrical Incore Detector System	4.40	10.03	20.00
Power Range Channels	1.96	6.96	20.00
Minimum Incore Detector System	1.90	4.40	20.00

<p>These limits are referred to by Technical Specification LCO 3.2.4</p>
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Power Peaking Factors

This Limit is referred to by Technical Specification LCO 3.2.5

Heat Flux Hot Channel Factor FQ

FQ shall be limited by the following relationships:

$$FQ \leq LHR^{allow} (Bu) / [LHR^{avg} * P] \quad (\text{for } P \leq 1.0)$$

$LHR^{allow}(Bu)$ = See the following Table

$$LHR^{avg} = 5.89 \text{ kW/ft for Mk-B10I fuel}$$

$$LHR^{avg} = 5.89 \text{ kW/ft for Mk-B10E fuel}$$

$$LHR^{avg} = 5.90 \text{ kW/ft for Mk-B10ZL fuel}$$

$$LHR^{avg} = 5.85 \text{ kW/ft for Mk-B4Z fuel}$$

P = ratio of THERMAL POWER/ RATED THERMAL POWER

Bu = Fuel Burnup (MWd/mtU)

CR-3 Cycle 12 Reload Allowable LHR Limits

Mk-B10ZL / Mk-B10I / Mk-B10E LHR^{allow}

Allowable Peak LHR for Specified Burnup, kW/ft*

Core Elevation ft	0 MWd/mtU	45000 MWd/mtU	60000 MWd/mtU
0.0	15.4	15.4	11.7
2.506	16.2	16.2	11.7
4.264	16.4	16.4	11.7
6.021	16.8	16.8	11.7
7.779	16.4	16.4	11.7
9.536	16.2	16.2	11.7
12.0	15.4	15.4	11.7

* Note: Non-Gd₂O₃ fuel LHR limits bound Gd₂O₃ fuel.

CR-3 Cycle 12 Reload Allowable LHR Limits

Mk-B4Z LHR^{allow}

Allowable Peak LHR for Specified Burnup, kW/ft*

Core Elevation ft	≤ 20000 MWd/mtU	38706 MWd/mtU	40118 MWd/mtU	42941 MWd/mtU	45765 MWd/mtU	50000 MWd/mtU
0	14.1	14.1	14.1	14.1	14.1	12.9
2	14.9	14.9	14.9	14.9	14.1	12.9
4	15.7	15.7	15.7	14.9	14.1	12.9
6	16.1	16.1	15.7	14.9	14.1	12.9
8	15.7	15.7	15.7	14.9	14.1	12.9
10	14.9	14.9	14.9	14.9	14.1	12.9
12	14.1	14.1	14.1	14.1	14.1	12.9

* Linear interpolation for allowable linear heat rate limits between specified burnup points is valid for these tables.

These tables are referred to by Technical Specification LCO 3.2.5

Power Peaking Factors

This Limit is referred to by Technical Specification LCO 3.2.5

Enthalpy Rise Hot Channel Factor $F_{\Delta H}^N$

$$F_{\Delta H}^N \leq \text{ARP} [1 + (1/\text{RH})(1 - P/P_m)]$$

ARP = Allowable Radial Peak, See the following table

P = THERMAL POWER/RATED THERMAL POWER and $P \leq 1.0$

$P_m = 1.0$ for 4-RCP operation

$P_m = 0.75$ for 3-RCP operation

RH = 3.34

Cycle 12 Maximum Allowable Radial Peaks(MARP)**

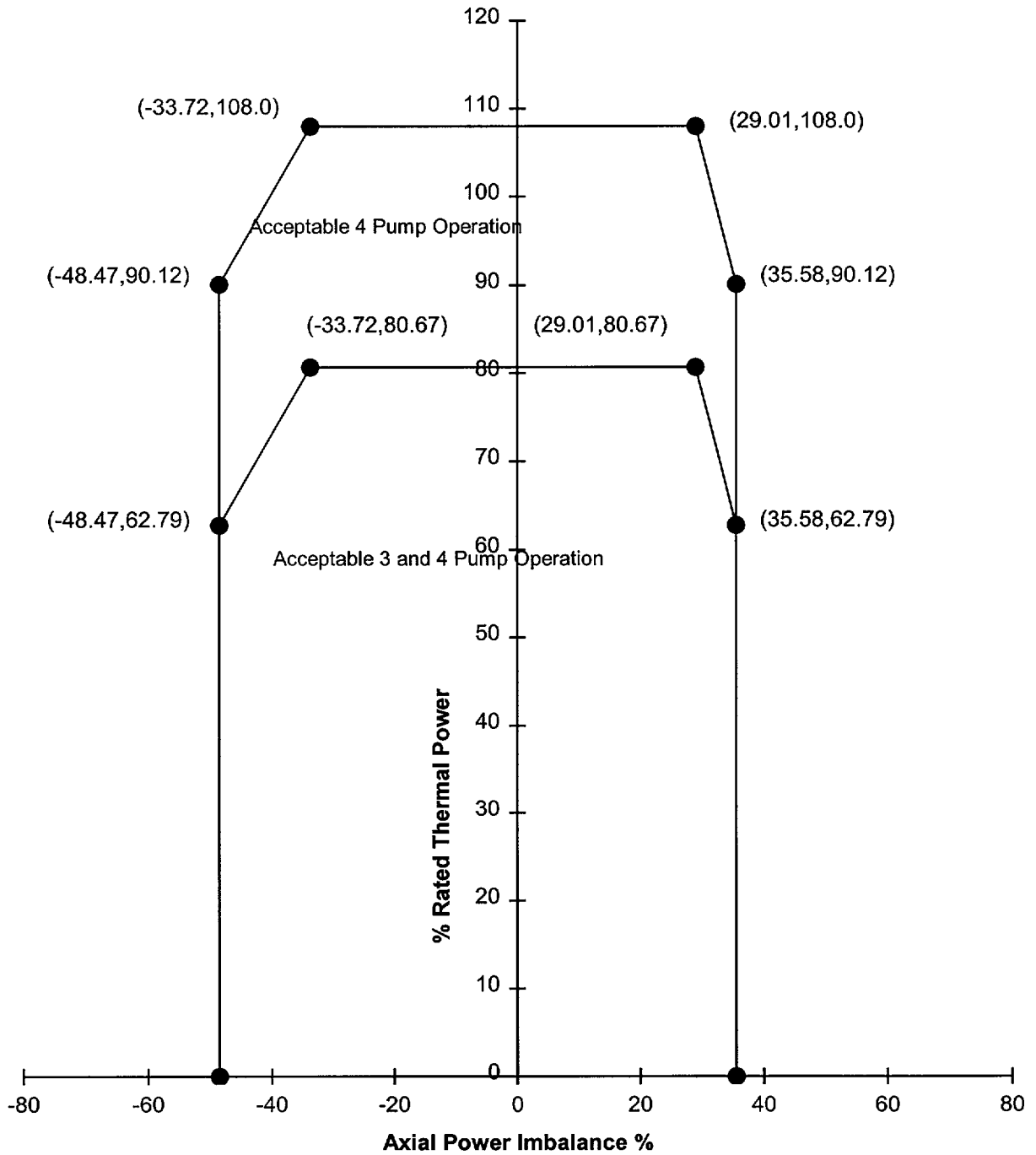
<u>Axial Peak</u>	<u>X/L*</u>	<u>MARP</u>
1.1	0.2	1.9156
1.1	0.4	1.9071
1.1	0.6	1.8929
1.1	0.8	1.8665
1.3	0.2	1.9898
1.3	0.4	1.9674
1.3	0.6	1.9283
1.3	0.8	1.8141
1.5	0.2	2.0462
1.5	0.4	1.9480
1.5	0.6	1.8234
1.5	0.8	1.7009
1.7	0.2	1.9337
1.7	0.4	1.8232
1.7	0.6	1.7023
1.7	0.8	1.5936
1.9	0.2	1.7837
1.9	0.4	1.6821
1.9	0.6	1.5799
1.9	0.8	1.4876

*Based on an active core height of 140.6 inches. Linear interpolation is acceptable; extrapolation above 112.48 inches and below 28.12 inches is acceptable.

**Reference: "CR-3 Cycle 11 Reload Report", Rev. 1, December 1997.

Allowable Nuclear Overpower and Axial Power Imbalance Setpoint Envelope

This Figure is referred to by T.S. LCO 3.3.1



Refueling Boron Concentration

The boron concentration must be greater than 2895 ppmb.

Note: The value includes 50ppm for uncertainties and is based on a 670 EFPD Cycle 11. The refueling boron concentration must be increased by 2 ppmb for every EFPD the final Cycle 11 burnup is less than 670 EFPD. The refueling boron concentration can be reduced 1.5 ppmb for every EFPD that the final Cycle 11 burnup exceeds 670 EFPD.

<p>This limit is referred to by Technical Specification LCO 3.9.1</p>

Reference: "CR-3 Cy12 Final Core Loading Plan", FCF calculation file: 86-5005424-01, August 1999.

Revision History

Revision 0 - Original Cycle 12 COLR