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U. S. Nuclear Regulatory Commission
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Duke Energy Carolinas, LLC
Oconee Nuclear Station (ONS) Unit 3
Docket Number 50-287
Renewed License Number DPR-55

Subject: Transmittal of Core Operating Limits Report (COLR) for Oconee Unit 3 Cycle 32
(Revision 0)

Pursuant to Oconee Technical Specification 5.6.5.d, attached is an information copy of the Core Operating Limits Report (COLR) for Oconee Unit 3, Cycle 32, ONEI-0400-578, Revision 0.

Any inquiries on this submittal should be directed to Sam Adams, Oconee Regulatory Affairs, at 864-873-3348.

Sincerely,

A handwritten signature in black ink, appearing to read "H. Todd Grant".

H. Todd Grant
General Manager
Nuclear Engineering
Oconee Nuclear Station

Attachment: ONEI-0400-578 Revision 0 – Oconee Unit 3 Cycle 32 COLR

cc (w/attachment):

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Orr, David S	Originator	3/22/2022
Forster, Joy D	Design Verifier	3/22/2022
Reed, James	Cross Disciplinary Review	3/22/2022
Washburn, Walter	EI Inspection - site	3/22/2022
Lambert, Brad	Approver	3/22/2022
Notes :		

Oconee 3 Cycle 32 Core Operating Limits Report

ONEI-0400-578

Revision 0

Reload 50.59 AR# 02418346

Prepared By:	D.S. Orr	All signatures were captured via Fusion E-signature. See the Fusion cover sheet for signature dates.
Design Verified By:	J.D. Forster	
Cross-Disciplinary Review By:	James Reed, Safety Analysis	
Stakeholder Inspection By:	Walter Washburn, ONS RES	The CDR was limited to pages 4, 6 and 20 only.
Approved By:	B.J. Lambert	

Revision Summary

Revision	Pages Revised	Pages Added	Pages Deleted	Comments
0	--	1 - 22	--	Original issue.

NOTES:

- The O3C32 COLR will cease to be effective during NO MODE between cycles 32 and 33.

Oconee 3 Cycle 32

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16.5.13 16.13.10	High Pressure Injection and Chemical Addition Systems	1, 3, 7, 8	Volume and Boron Concentration of Concentrated Boric Acid Storage Tank (CBAST)

Section 2.0 Core Operating Limits - Not Error Adjusted (NOT FOR PLANT USE)

TS Number	Technical Specification	NRC Approved Methodology Reference #	COLR Parameter
2.1.1	Safety Limits	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Variable Low RCS Pressure Protective Limits Axial Power Imbalance Protective Limits
3.2.1	Regulating Rod Position Limits	1, 3, 4, 5, 7, 8, 9, 10	Rod Index Limits
3.2.3	Quadrant Power Tilt (QPT)	1, 3, 7, 9, 10	Quadrant Power Tilt Limits

Oconee 3 Cycle 32

1.0 Error Adjusted Core Operating Limits

The Core Operating Limits Report for O3C32 has been prepared in accordance with the requirements of TS 5.6.5. The core operating limits within this report have been developed using NRC approved methodology identified in References 1 through 13. The RPS protective limits and maximum allowable setpoints are documented in References 14 through 16. These limits are validated for use in O3C32 by References 17 and 18. The O3C32 analyses assume a design flow of 108.5% of 88,000 gpm per RCS pump, radial local peaking ($F_{\Delta h}$) of 1.714, an axial peaking factor (F_z) of 1.5, and an EOC (< 100 ppmB) Tav_g reduction for up to 10°F provided 4 RCPs are in operation and Tav_g does not decrease below 569°F.

The error adjusted core operating limits included in Section 1 of the report incorporate all necessary uncertainties and margins required for operation of the O3C32 reload core.

1.1 References

1. DPC-NE-1006-PA, Oconee Nuclear Design Methodology Using CASMO-4 / SIMULATE-3, NRC SE issued August 2, 2011.
2. DPC-NE-1002-A, Oconee Nuclear Station Reload Design Methodology II, SE dated July 21, 2011.
3. NFS-1001-A, Oconee Nuclear Station Reload Design Methodology, SE dated July 21, 2011.
4. DPC-NE-2003-PA, ONS Core Thermal Hydraulic Methodology Using VIPRE-01, SE dated July 21, 2011.
5. DPC-NE-2005-PA, Thermal Hydraulic Statistical Core Design Methodology, SE dated October 29, 2008.
6. DPC-NE-2008-PA, Fuel Mechanical Reload Analysis Methodology Using TACO3 and GDTACO, SE dated July 21, 2011.
7. DPC-NE-3005-PA, UFSAR Chapter 15 Transient Analysis Methodology, SE dated January 26, 2021.
8. DPC-NE-3000-PA, Thermal Hydraulic Transient Analysis Methodology, SE dated July 21, 2011.
9. BAW-10192P-A, Revision 0, BWNT LOCA - BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants, SER dated February 18, 1997.
10. BAW-10164P-A, Rev. 4 and 6, RELAP5/MOD2-B&W - An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis, SERs dated April 9, 2002 and June 25, 2007, respectively.
11. BAW-10192P-A, Supplement 1P-A, Revision 0, BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants, SE dated November 2, 2017.
12. BAW-10227P-A, Revision 1, Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel, June 2003 (SER to BAW-10186P-A dated June 18, 2003).
13. BAW-10231P-A, Rev. 1, COPENIC Fuel Rod Design Computer Code, January 2004.
14. OSC-4048, Revision 6, RPS RCS Pressure & Temperature Trip Function Uncertainty Analyses and Variable Low Pressure Safety Limit.
15. OSC-5604, Revision 5, Power Imbalance Safety Limits and Tech Spec Setpoints Using Error Adjusted Flux-Flow Ratio of 1.094.
16. OSC-7265, Revision 1, ΔT_c and EOC Reduced Tav_g Operation.
17. OSC-11978, Revision 1, O3C32 Maneuvering Analysis.
18. OSC-11993, Revision 0, O3C32 Reload Safety Evaluation.

Oconee 3 Cycle 32 Miscellaneous Setpoints

100% rated thermal power, or RTP, is **2568** MWth. See TS 1.1, "Definitions."

BWST boron concentration shall be greater than **2500** ppm and less than **3000** ppm.
Referred to by TS 3.5.4.

Spent fuel pool boron concentration shall be greater than **2500** ppm.
Referred to by TS 3.7.12.

The equivalent of at least **1100** cubic feet of **11,000** ppm boron shall be maintained in the CBAST.
Referred to by TS SLC 16.5.13 and SLC 16.13.10.

CFT boron concentration shall be greater than **2400** ppm. The average boron concentration in the CFT's shall be less than **4000** ppm. Referred to by TS 3.5.1.

RCS and Refueling canal boron concentration shall be greater than **2400** ppm and less than **3000** ppm.
Referred to by TS 3.9.1.

Shutdown Margin (SDM) shall be greater than **1%** $\Delta k/k$.
Referred to by TS 3.1.1.

Moderator Temperature Coefficient (MTC) shall be less than:
Linear interpolation is valid within the table provided.
Referred to by TS 3.1.3.

MTC x 10 ⁻⁴	
$\Delta p / ^\circ F$	% FP
+0.70	0
+0.525	20
0.00	80
0.00	100
0.00	120

Departure from Nucleate Boiling (DNB) parameter for RCS loop pressure shall be

Referred to by TS 3.4.1.

4 RCP:	measured hot leg pressure > 2125 psig
3 RCP:	measured hot leg pressure > 2125 psig

DNB parameter for RCS loop average temperature shall be:
Referred to by TS 3.4.1.

	Max Loop Tav _g (Incl 2°F unc)	
$\Delta T_c, ^\circ F$	4 RCP Op	3 RCP Op
0	581.0	581.0
1	581.4	581.2
2	581.8	581.4
3	582.1	581.7
4	582.5	581.9
5	582.9	582.1

The measured Tav_g must be less than COLR limits minus instrument uncertainty. ΔT_c is the setpoint value selected by the operators.

* This limit is applied to the loop with the lowest loop average temperature consistent with the NOTE in SR 3.4.1.2. All other temperature limits apply to the maximum loop Tav_g.

DNB parameter for RCS loop total flow shall be:

4 RCP:	Measured \geq 108.5 %df
3 RCP:	Measured \geq 74.7 % of 4 RCP min flow

Referred to by TS 3.4.1.

Regulating rod groups shall be withdrawn in sequence starting with group 5, group 6, and finally group 7.
Referred to by TS 3.2.1.

Regulating rod group overlap shall be 25% \pm 5% between two sequential groups.
Referred to by TS 3.2.1.

Misaligned, dropped, or inoperable rods may be excluded from control rod group average calculations when determining if overlap requirements are met as these situations are explicitly addressed by TS 3.1.4 (Control Rod Group Alignment Limits), TS 3.1.5 (Safety Rod Position Limits), and TS 3.2.3 (Quadrant Power Tilt).

Oconee 3 Cycle 32

Quadrant Power Tilt Setpoints

Core Power Level, %FP	Steady State		Transient		Maximum > 0
	0 - 30	> 30	0 - 30	> 30	
Full Incore	8.05	4.50	9.84	7.55	16.99
Out of Core	6.09	2.85	7.71	5.63	14.22
Backup Incore	3.86	2.42	4.81	3.62	10.06

Referred to by TS 3.2.3

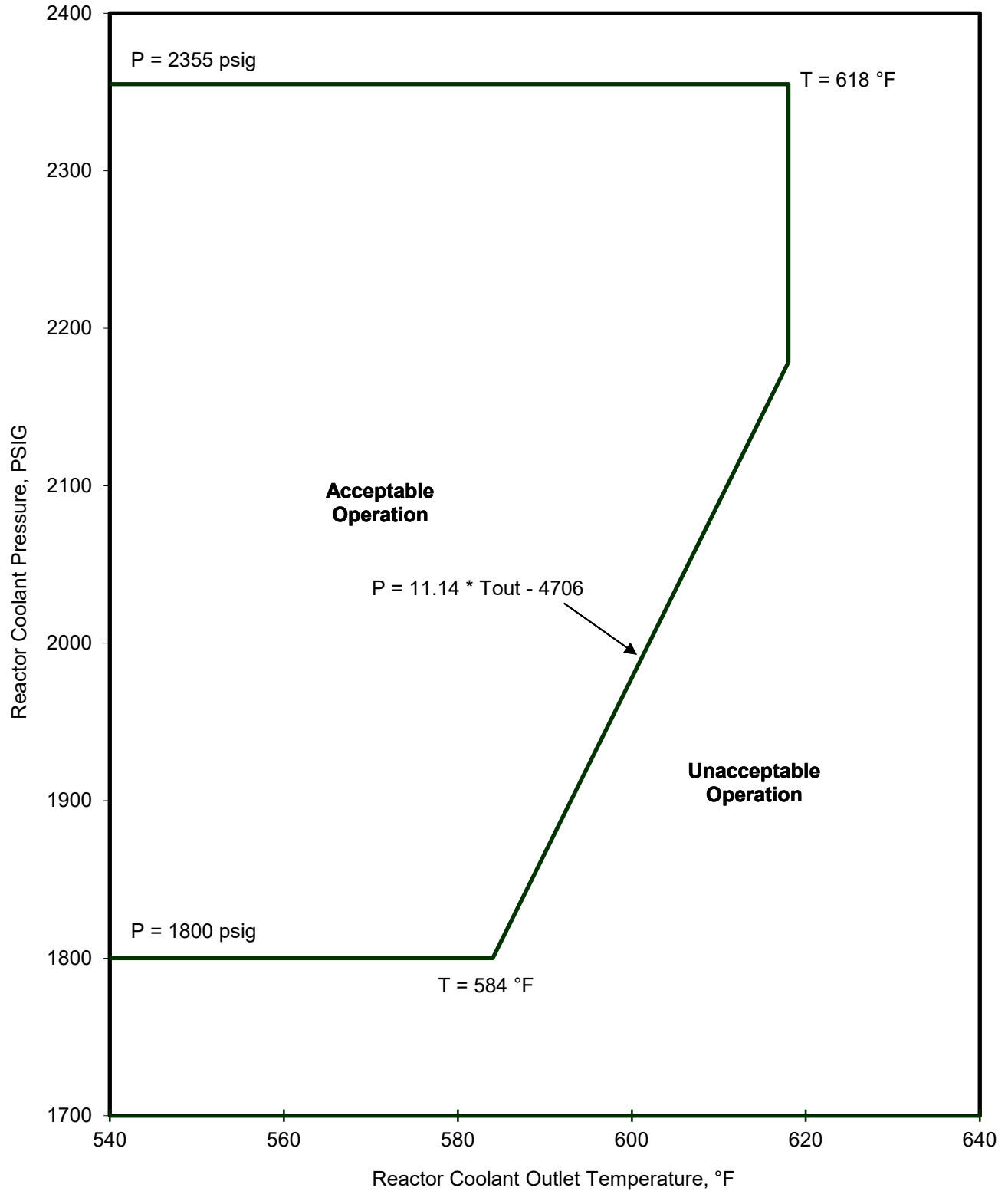
Correlation Slope (CS)

1.15

Referred to by TS 3.3.1 (SR 3.3.1.3).

Oconee 3 Cycle 32
Variable Low RCS Pressure RPS Setpoints

Referred to by TS 3.3.1



Oconee 3 Cycle 32

Referred to by TS 2.1.1 and TS Table 3.3.1-1

Maximum Allowable RPS Power Imbalance Limits

	% FP	% Imbalance
4 Pumps	0.0	-35.0
	90.0	-35.0
<i>P_{max}</i> =>	109.4	-14.4
<i>P_{max}</i> =>	109.4	14.4
	90.0	35.0
	0.0	35.0
3 Pumps	0.0	-35.0
	62.3	-35.0
<i>P_{max}</i> =>	81.7	-14.4
<i>P_{max}</i> =>	81.7	14.4
	62.3	35.0
	0.0	35.0

Oconee 3 Cycle 32

Operational Power Imbalance Setpoints

Referred to by TS 3.2.2

	%FP	Full Incore	Backup Incore	Out of Core
4 Pumps	0.0	-28.0	-28.0	-28.0
	80.0	-28.0	-28.0	-28.0
	90.0	-28.0	-27.8	-27.9
	100.0	-17.7	-17.7	-17.7
	102.0	-15.6	-15.6	-15.6
	102.0	15.6	9.7	10.3
	100.0	17.7	12.9	13.6
	90.0	28.0	28.0	28.0
	80.0	28.0	28.0	28.0
	0.0	28.0	28.0	28.0
3 Pumps	0.0	-28.0	-28.0	-28.0
	63.1	-28.0	-28.0	-28.0
	77.0	-13.2	-13.2	-13.2
	77.0	13.2	13.2	13.2
	63.1	28.0	28.0	28.0
	0.0	28.0	28.0	28.0

Referred to by TS 3.2.2

Oconee 3 Cycle 32

RPS / Operational Power Imbalance Setpoints

Operation with 4 RCS Pumps, BOC to EOC

Referred to by TS 3.2.2 and TS 3.3.1

% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	
107.9	-14.4	14.4				
106.0	-16.4	16.4				
105.0	-17.4	17.4				
104.0	-18.5	18.5				
103.0	-19.6	19.6				
102.0	-20.6	20.6	-15.6	15.6	-15.6	10.3
101.0	-21.7	21.7	-16.6	16.6	-16.6	11.9
100.0	-22.7	22.7	-17.7	17.7	-17.7	13.6
99.0	-23.8	23.8	-18.7	18.7	-18.7	15.0
98.0	-24.9	24.9	-19.7	19.7	-19.7	16.4
97.0	-25.9	25.9	-20.7	20.7	-20.7	17.9
96.0	-27.0	27.0	-21.8	21.8	-21.7	19.3
95.0	-28.0	28.0	-22.8	22.8	-22.8	20.8
94.0	-29.1	29.1	-23.8	23.8	-23.8	22.2
93.0	-30.2	30.2	-24.9	24.9	-24.8	23.6
92.0	-31.2	31.2	-25.9	25.9	-25.8	25.1
91.0	-32.3	32.3	-26.9	26.9	-26.8	26.5
90.4	-33.0	33.0	-27.6	27.6	-27.5	27.4
90.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
89.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
88.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
87.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
86.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
85.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
84.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
83.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
82.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
81.0	-33.0	33.0	-28.0	28.0	-27.9	28.0
80.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
0.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	

Oconee 3 Cycle 32

RPS / Operational Power Imbalance Setpoints

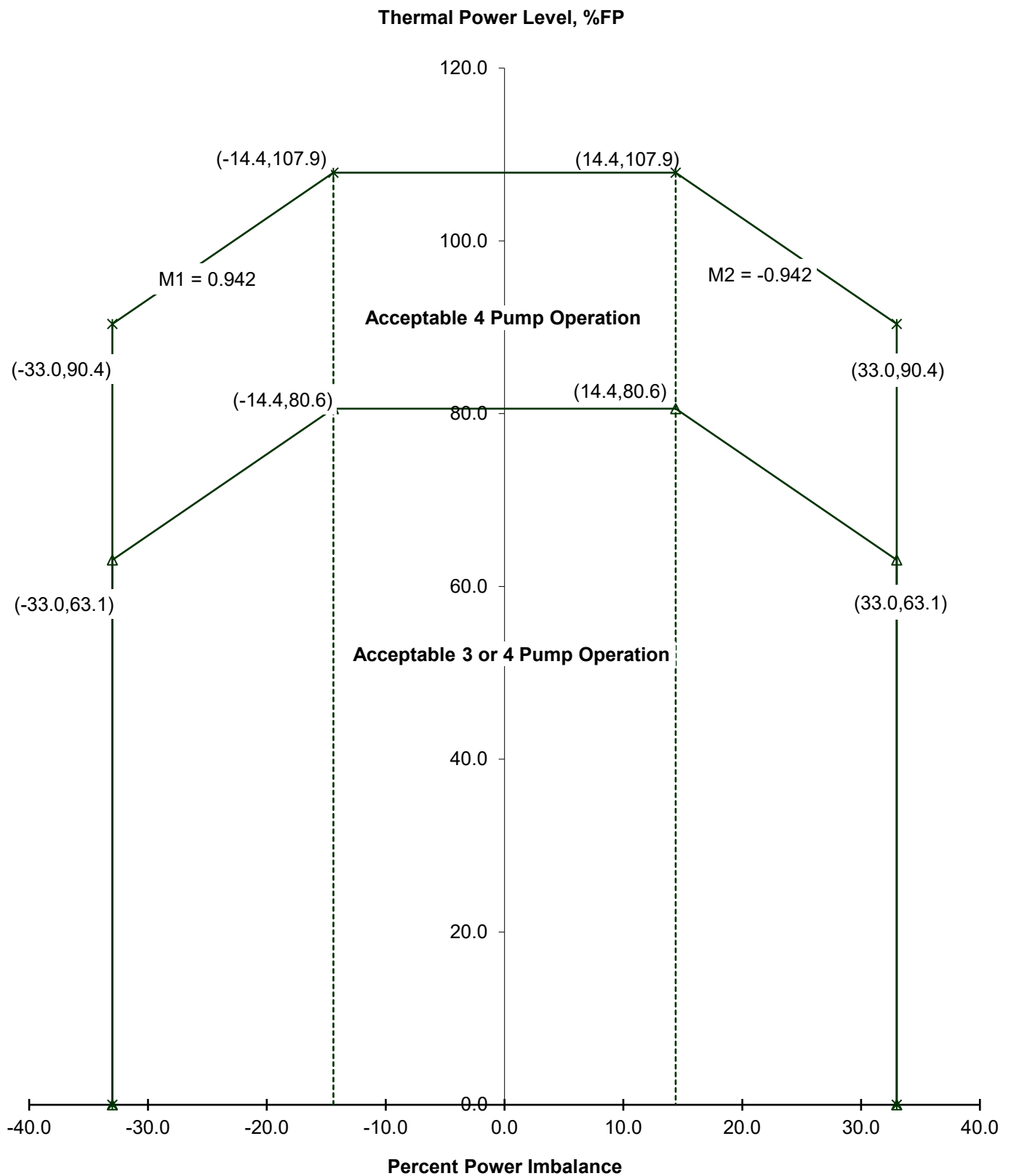
Operation with 3 RCS Pumps, BOC to EOC

Referred to by TS 3.2.2 and TS 3.3.1

% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	
80.6	-14.4	14.4				
80.0	-15.0	15.0				
79.0	-16.0	16.0				
78.0	-17.1	17.1				
77.0	-18.2	18.2	-13.2	13.2	-13.2	13.2
76.0	-19.2	19.2	-14.2	14.2	-14.2	14.2
75.0	-20.3	20.3	-15.3	15.3	-15.3	15.3
74.0	-21.4	21.4	-16.3	16.3	-16.3	16.3
73.0	-22.4	22.4	-17.4	17.4	-17.4	17.4
72.0	-23.5	23.5	-18.5	18.5	-18.5	18.5
71.0	-24.5	24.5	-19.5	19.5	-19.5	19.5
70.0	-25.6	25.6	-20.6	20.6	-20.6	20.6
69.0	-26.7	26.7	-21.7	21.7	-21.7	21.7
68.0	-27.7	27.7	-22.7	22.7	-22.7	22.7
67.0	-28.8	28.8	-23.8	23.8	-23.8	23.8
66.0	-29.9	29.9	-24.9	24.9	-24.9	24.9
65.0	-30.9	30.9	-25.9	25.9	-25.9	25.9
64.0	-32.0	32.0	-27.0	27.0	-27.0	27.0
63.1	-33.0	33.0	-28.0	28.0	-28.0	28.0
63.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
62.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
61.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
60.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
0.0	-33.0	33.0	-28.0	28.0	-28.0	28.0
% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	

Oconee 3 Cycle 32
RPS Power Imbalance Setpoints

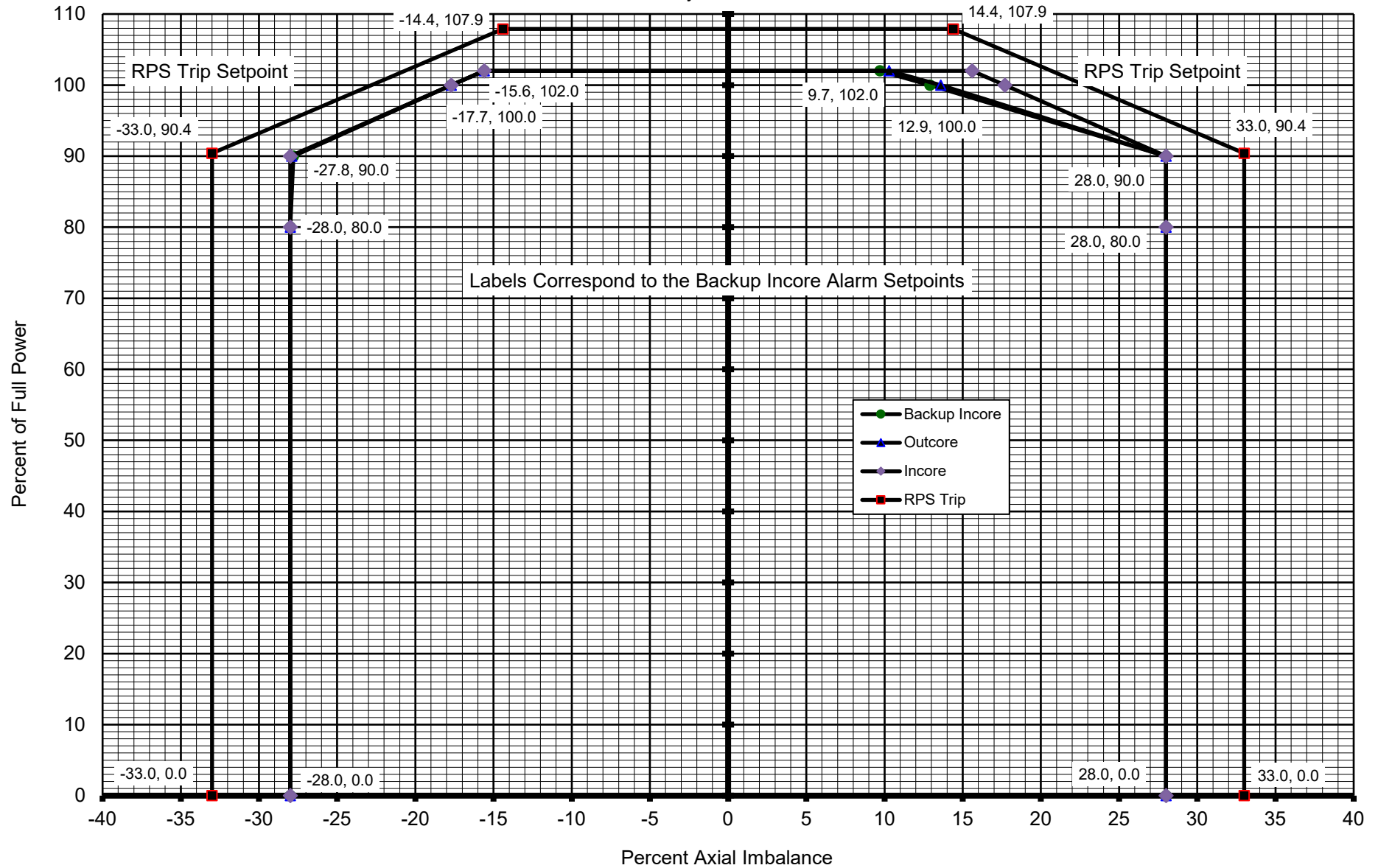
Referred to by TS 3.3.1 and TS Table 3.3.1-1



Oconee 3 Cycle 32
Imbalance Setpoints for 4 Pump Operation, BOC to EOC
Referred to by TS 3.2.2 and TS 3.3.1

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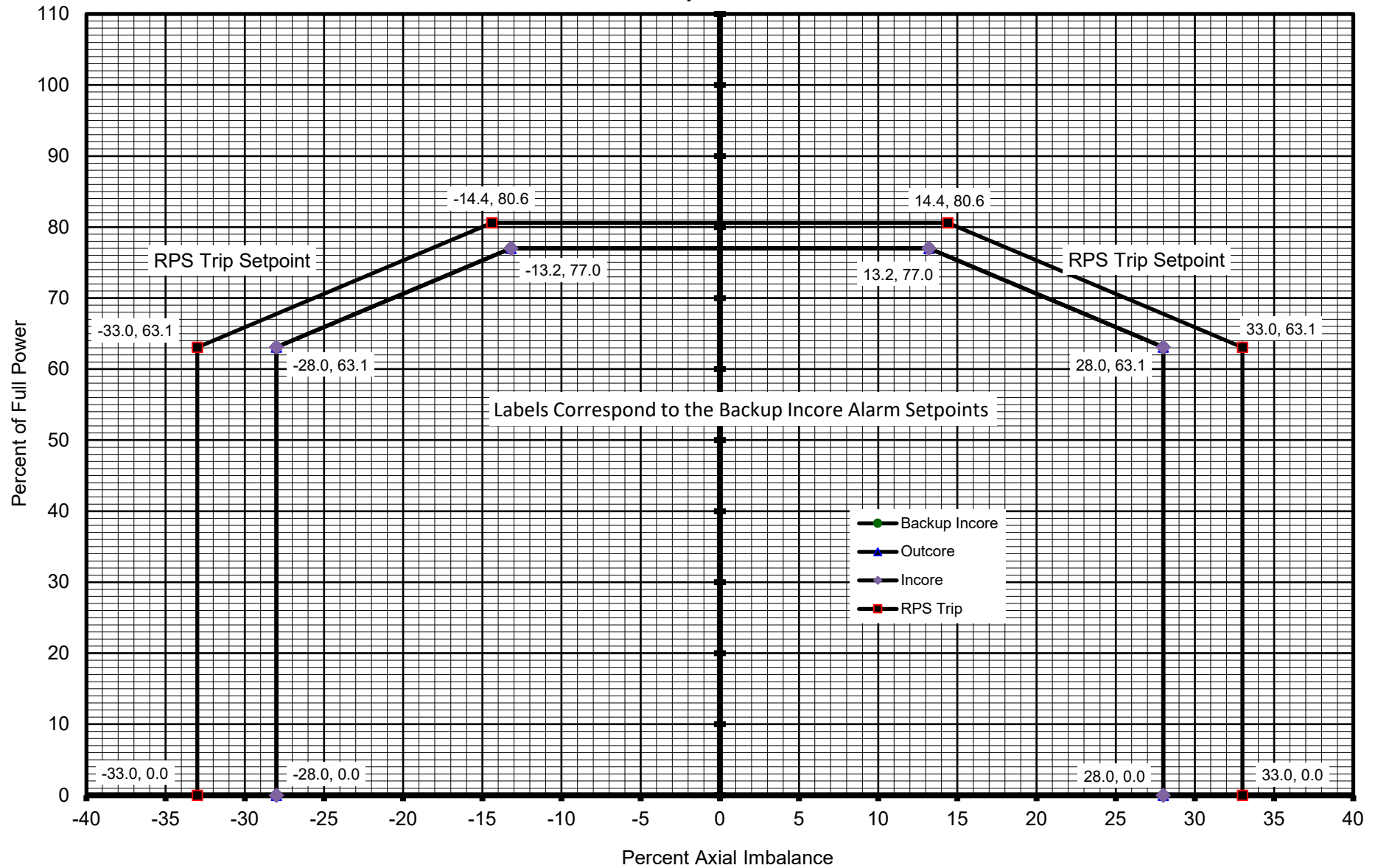
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Oconee 3 Cycle 32
Imbalance Setpoints for 3 Pump Operation, BOC to EOC
Referred to by TS 3.2.2 and TS 3.3.1

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Oconee 3 Cycle 32

Operational Rod Index Setpoints

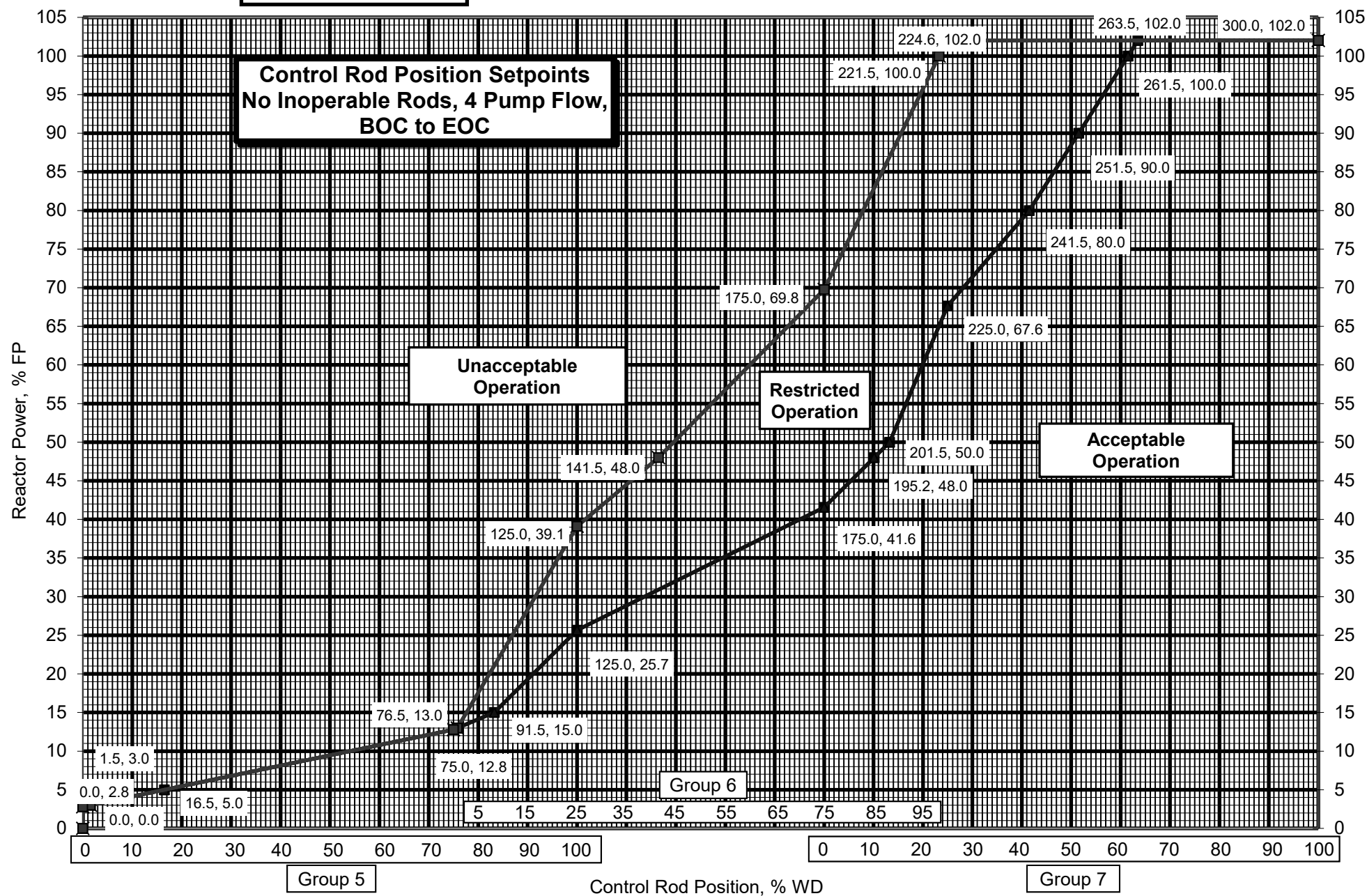
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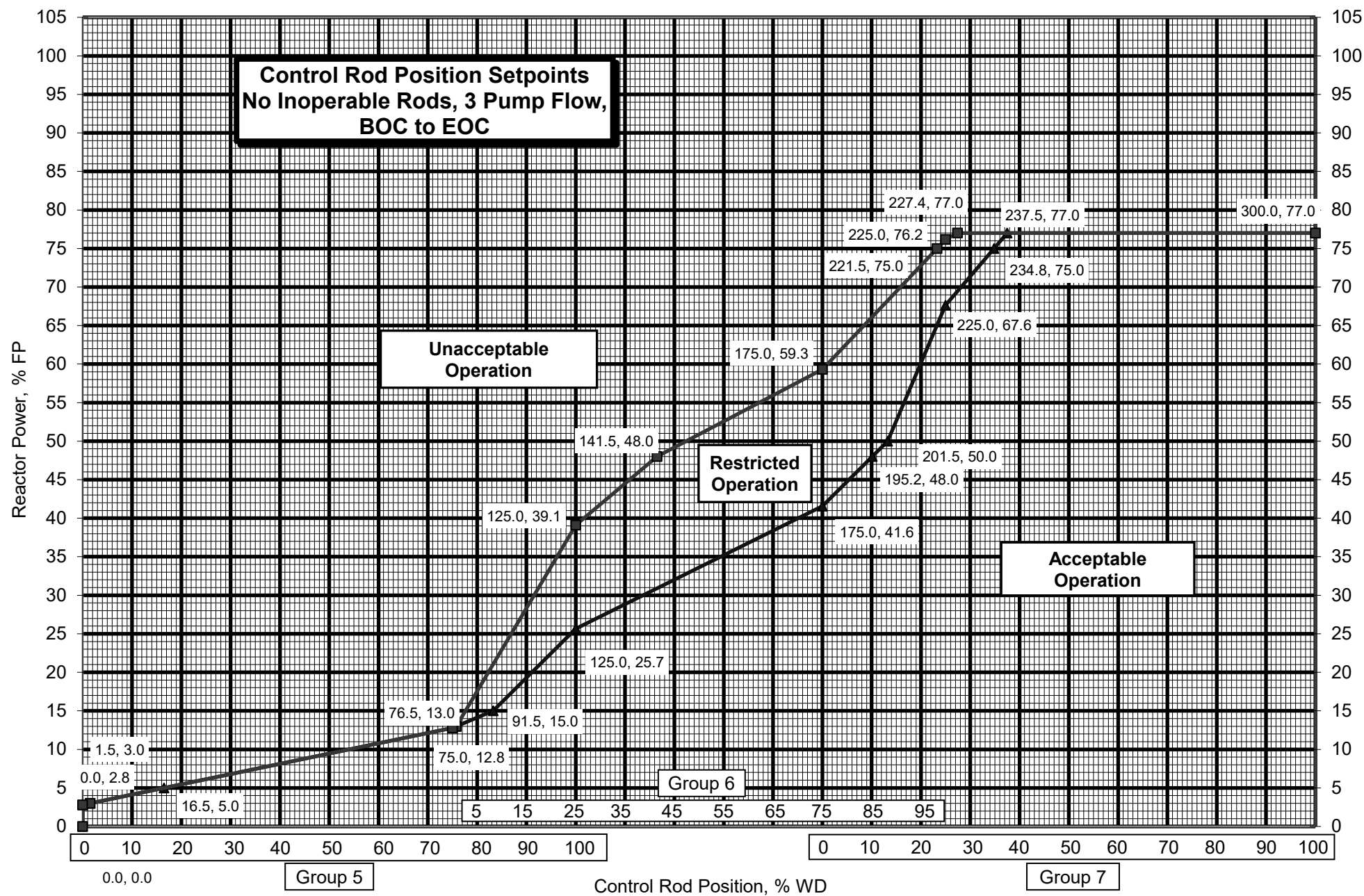
	%FP	RI Insertion Setpoint		RI Withdrawal Setpoint
		No Inop Rod	1 Inop Rod	
4 Pumps	102.0	263.5	283.4	300
	100.0	261.5	281.5	300
	90.0	251.5	271.9	300
	80.0	241.5	262.3	300
	50.0	201.5	233.4	300
	48.0	195.2	231.5	300
	15.0	91.5	165.5	300
	13.0	76.5	161.5	300
	5.0	16.5	93.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300
3 Pumps	77.0	237.5	285.2	300
	75.0	234.8	281.5	300
	50.0	201.5	235.2	300
	48.0	195.2	231.5	300
	15.0	91.5	165.5	300
	13.0	76.5	161.5	300
	5.0	16.5	93.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300

Oconee 3 Cycle 32 Shutdown Margin Rod Index Setpoints

Referred to by TS 3.2.1

	%FP	RI Insertion Setpoint		RI Withdrawal Setpoint
		No Inop Rod	1 Inop Rod	
4 Pumps	102.0	224.6	283.4	300
	100.0	221.5	281.5	300
	48.0	141.5	231.5	300
	13.0	76.5	161.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300
3 Pumps	77.0	227.4	285.2	300
	75.0	221.5	281.5	300
	48.0	141.5	231.5	300
	13.0	76.5	161.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300





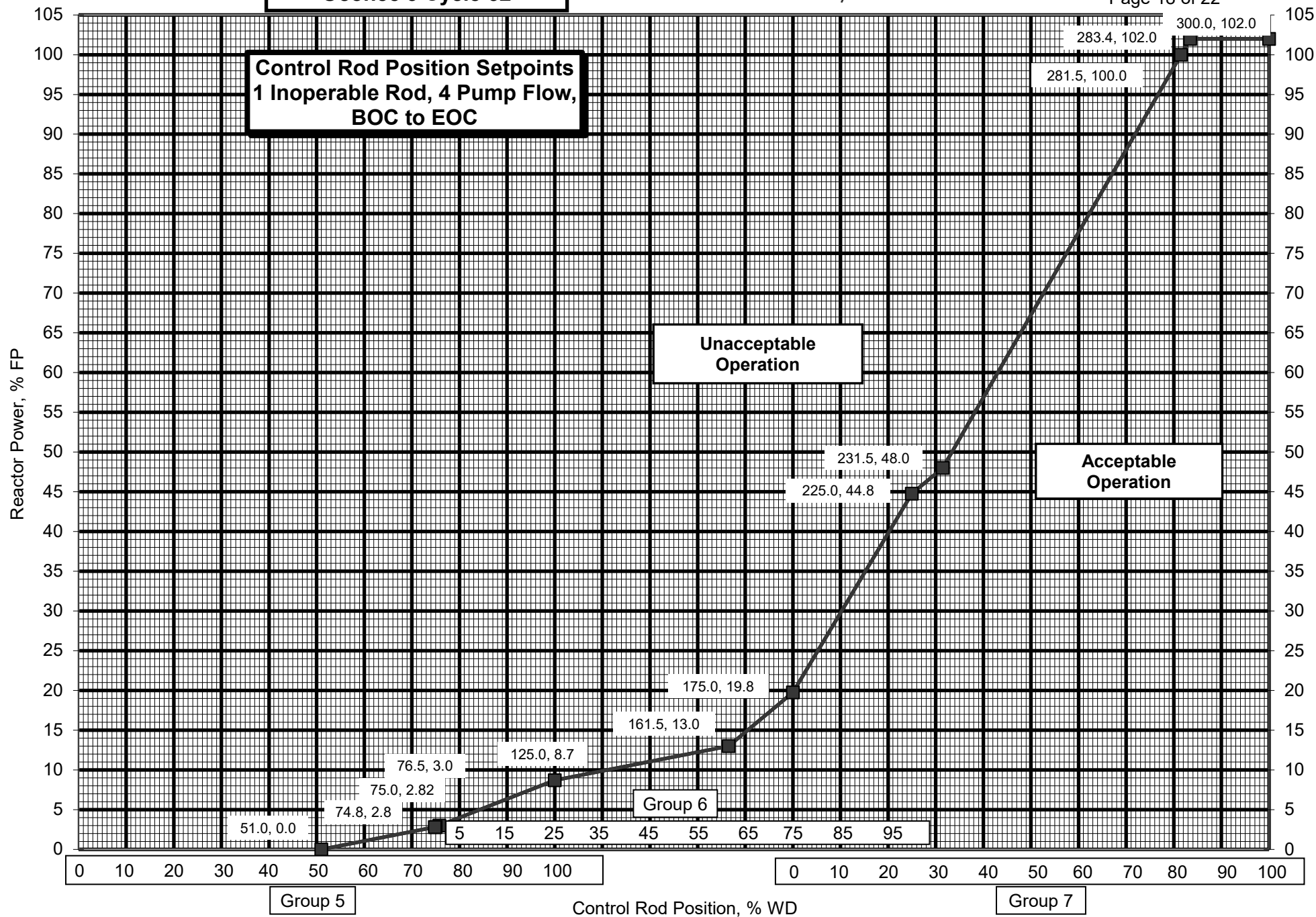
Oconee 3 Cycle 32

Referred to by TS 3.2.1

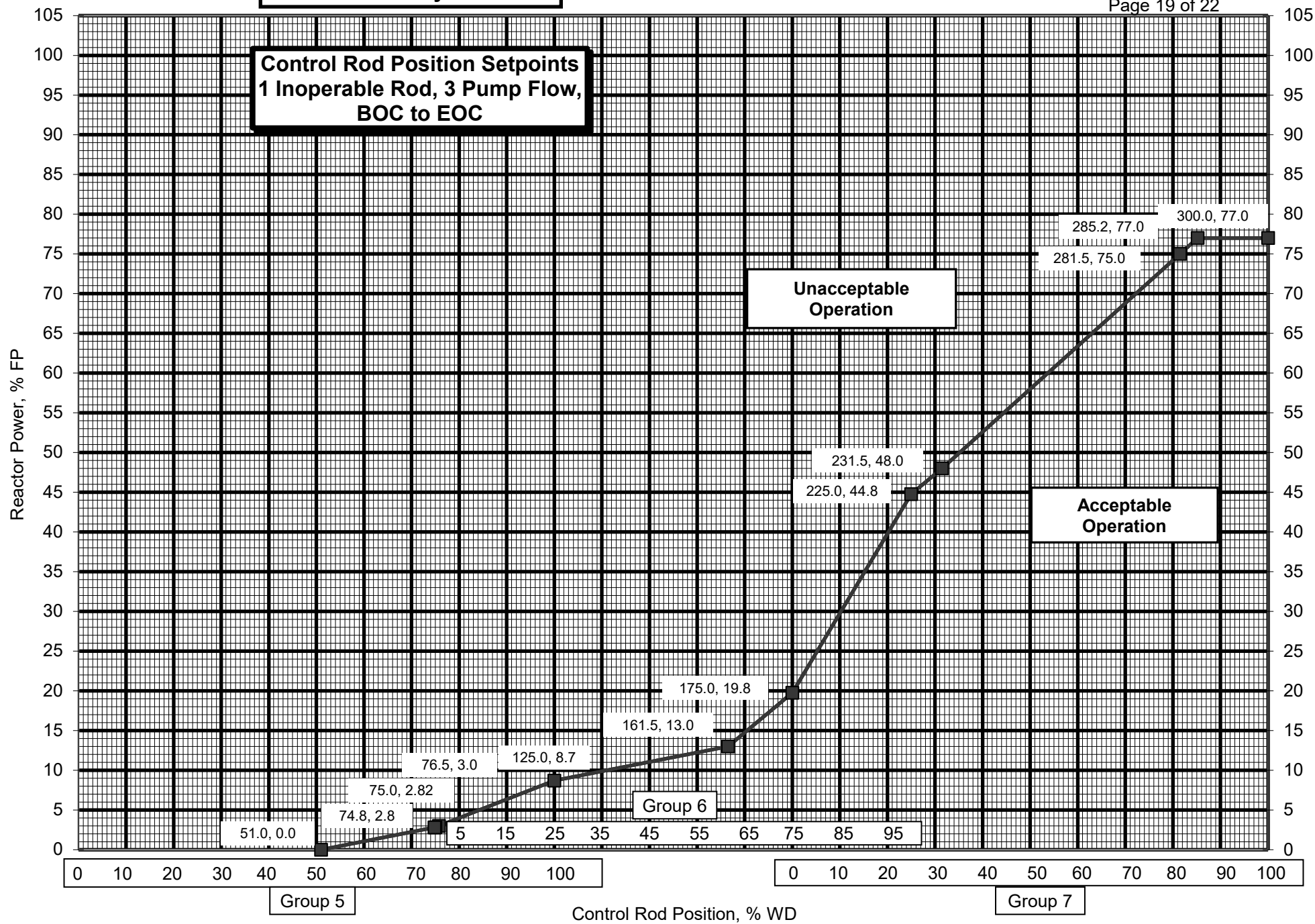
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Control Rod Position Setpoints
1 Inoperable Rod, 4 Pump Flow,
BOC to EOC



**Control Rod Position Setpoints
1 Inoperable Rod, 3 Pump Flow,
BOC to EOC**



Oconee 3 Cycle 32

2.0 Core Operating Limits -- Not Error Adjusted

The data provided on the following pages satisfies a licensing commitment to identify specific parameters before instrumentation uncertainties are incorporated.

References provided in section 1 of this COLR identify the sources for the data which follows.

Information provided in this section should not be used in plant procedures.

Quadrant Power Tilt Limits

Referred to by TS 3.2.3

	Steady State		Transient		Maximum
Core Power Level, %FP	0 - 30	> 30	0 - 30	> 30	> 0
Quadrant Power Tilt, %	10.00	6.02	12.00	9.44	20.00

Variable Low RCS Pressure Protective Limits

Referred to by TS 2.1.1

Core Outlet Pressure psia	Reactor Coolant Outlet Temperature, °F	
	3 RCS Pumps	4 RCS Pumps
1800	581.0	578.3
1900	590.0	587.3
2000	598.9	596.3
2100	607.9	605.2
2200	616.9	614.2
2300	625.9	623.2

Oconee 3 Cycle 32

Axial Power Imbalance Protective Limits

Referred to by TS 2.1.1

Not for Plant Use

	%FP	RPS	Operational
4 Pumps	0.0	-35.0	-39.5
	80.0	-	-39.5
	90.0	-35.0	-39.5
	100.0	-	-28.4
	109.4	-14.4	-
	109.4	14.4	-
	100.0	-	23.3
	90.0	35.0	39.5
	80.0	-	39.5
	0.0	35.0	39.5
3 Pumps	0.0	-35.0	-39.5
	62.3	-35.0	-
	77.0	-	-39.5
	81.7	-14.4	-
	81.7	14.4	-
	77.0	-	39.5
	62.3	35.0	-
	0.0	35.0	39.5

Oconee 3 Cycle 32

Rod Index Limits

Referred to by TS 3.2.1

Not for Plant Use

	%FP	Operational RI Insertion Limit	Shutdown Margin No Inop Rod	RI Insertion Limit 1 Inop Rod	RI Withdrawal Limit
4 Pumps	102	262	220	280	300
	100	260	-	-	300
	90	250	-	-	300
	80	240	-	-	300
	50	200	140	230	300
	15	90	75	160	300
	5	0	0	75	300
3 Pumps	77	236	220	280	300
	50	200	140	230	300
	15	90	75	160	300
	5	0	0	75	300