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March 17, 2020

Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

10 CFR 50.4

**SUSQUEHANNA STEAM ELECTRIC STATION
SUBMITTAL OF UNIT 1 CYCLE 21 CORE
OPERATING LIMITS REPORT, REVISION 1
PLA-7848**

Docket No. 50-387

Susquehanna Steam Electric Station (SSES) Technical Specification Section 5.6.5 requires that the Core Operating Limits Report (COLR), including any mid-cycle supplements or revisions, be provided upon issuance to the NRC in accordance with 10 CFR 50.4. Pursuant to this requirement, the SSES Unit 1 Cycle 21 COLR, Revision 1, is provided in the attachment. This revision is a result of updated licensing analysis to account for greater core average exposure than was assumed to initially analyze the cycle.

There are no new or revised commitments contained in this submittal.

Should you have any questions regarding this submittal, please contact Ms. Melisa Krick, Manager – Nuclear Regulatory Affairs, at (570) 542-1818.

A handwritten signature in black ink, appearing to read "K. Cimorelli", written over a horizontal line.

K. Cimorelli

Attachment: SSES Unit 1 Cycle 21 COLR, Revision 1

Copy: NRC Region I
Ms. L. Micewski, NRC Sr. Resident Inspector
Ms. S. Goetz, NRC Project Manager
Mr. M. Shields, PA DEP/BRP

Attachment to PLA-7848

SSES Unit 1 Cycle 21 COLR, Revision 1

Susquehanna SES Unit 1 Cycle 21

CORE OPERATING LIMITS REPORT

**Nuclear Fuels
Engineering**

March 2020

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CORE OPERATING LIMITS REPORT REVISION DESCRIPTION INDEX		
Rev. No.	Affected Sections	Description/Purpose of Revision
0	ALL	Issuance of this COLR is in support of Unit 1 Cycle 21 operation.
1	9.0	Figure 9.1 is revised to account for the cycle achieving a greater core average exposure than what was assumed to initially analyze Unit 1 Cycle 21 (U1C21), addressing CR-2020-02163. Updated U1C21 licensing analysis results (Framatome, formerly AREVA, report ANP-3625, Rev. 1) at a bounding core average exposure only affects the Power / Flow Map Region II Stability Boundary.
	ALL	Removed Effective Date from footer to align formatting to current process.

SUSQUEHANNA STEAM ELECTRIC STATION
Unit 1 Cycle 21
CORE OPERATING LIMITS REPORT

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1.0 INTRODUCTION

This CORE OPERATING LIMITS REPORT for Susquehanna Unit 1 Cycle 21 is prepared in accordance with the requirements of Susquehanna Unit 1, Technical Specification 5.6.5. As required by Technical Specifications 5.6.5, core shutdown margin, the core operating limits, RBM setpoints, and OPRM setpoints presented herein were developed using NRC-approved methods and are established such that all applicable limits of the plant safety analysis are met.

2.0 **DEFINITIONS**

Terms used in this COLR but not defined in Section 1.0 of the Technical Specifications or Section 1.1 of the Technical Requirements Manual are provided below.

- 2.1 The AVERAGE PLANAR EXPOSURE at a specified height shall be equal to the total energy produced per unit length at the specified height divided by the total initial weight of uranium per unit length at that height.
- 2.2 The PELLET EXPOSURE shall be equal to the total energy produced per unit length of fuel rod at the specified height divided by the total initial weight of uranium per unit length of that rod at that height.
- 2.3 FDLRX is the ratio of the maximum LHGR calculated by the core monitoring system for each fuel bundle divided by the LHGR limit for the applicable fuel bundle type.
- 2.4 LHGRFAC_f is a multiplier applied to the LHGR limit when operating at less than 108 Mlbm/hr core flow. The LHGRFAC_f multiplier protects against both fuel centerline melting and cladding strain during anticipated system transients initiated from core flows less than 108 Mlbm/hr.
- 2.5 LHGRFAC_p is a multiplier applied to the LHGR limit when operating at less than RATED THERMAL POWER. The LHGRFAC_p multiplier protects against both fuel centerline melting and cladding strain during anticipated system transients initiated from partial power conditions.
- 2.6 MFLCPR is the ratio of the applicable MCPR operating limit for the applicable fuel bundle type divided by the MCPR calculated by the core monitoring system for each fuel bundle.
- 2.7 MAPRAT is the ratio of the maximum APLHGR calculated by the core monitoring system for each fuel bundle divided by the APLHGR limit for the applicable fuel bundle type.
- 2.8 OPRM is the Oscillation Power Range Monitor. The Oscillation Power Range Monitor (OPRM) will reliably detect and suppress anticipated stability related power oscillations while providing a high degree of confidence that the MCPR safety limit is not violated.
- 2.9 N_P is the OPRM setpoint for the number of consecutive confirmations of oscillation half-cycles that will be considered evidence of a stability related power oscillation.
- 2.10 S_P is the OPRM trip setpoint for the peak to average OPRM signal.
- 2.11 F_P is the core flow, in Mlbm / hr, below which the OPRM RPS trip is activated.

3.0 **SHUTDOWN MARGIN**

3.1 References

Technical Specification 3.1.1

3.2 Description

The SHUTDOWN MARGIN shall be equal to or greater than:

- a) 0.38% $\Delta k/k$ with the highest worth rod analytically determined

OR

- b) 0.28% $\Delta k/k$ with the highest worth rod determined by test

Since core reactivity will vary during the cycle as a function of fuel depletion and poison burnup, Beginning of Cycle (BOC) SHUTDOWN MARGIN (SDM) tests must also account for changes in core reactivity during the cycle. Therefore, the SDM measured at BOC must be equal to or greater than the applicable requirement from either 3.2.a or 3.2.b plus an adder, "R". The adder, "R", is the difference between the calculated value of maximum core reactivity (that is, minimum SDM) during the operating cycle and the calculated BOC core reactivity. If the value of "R" is zero (that is, BOC is the most reactive point in the cycle) no correction to the BOC measured value is required.

The SHUTDOWN MARGIN limits provided in 3.2a and 3.2b are applicable in MODES 1, 2, 3, 4, and 5. This includes core shuffling.

4.0 **AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)**

4.1 References

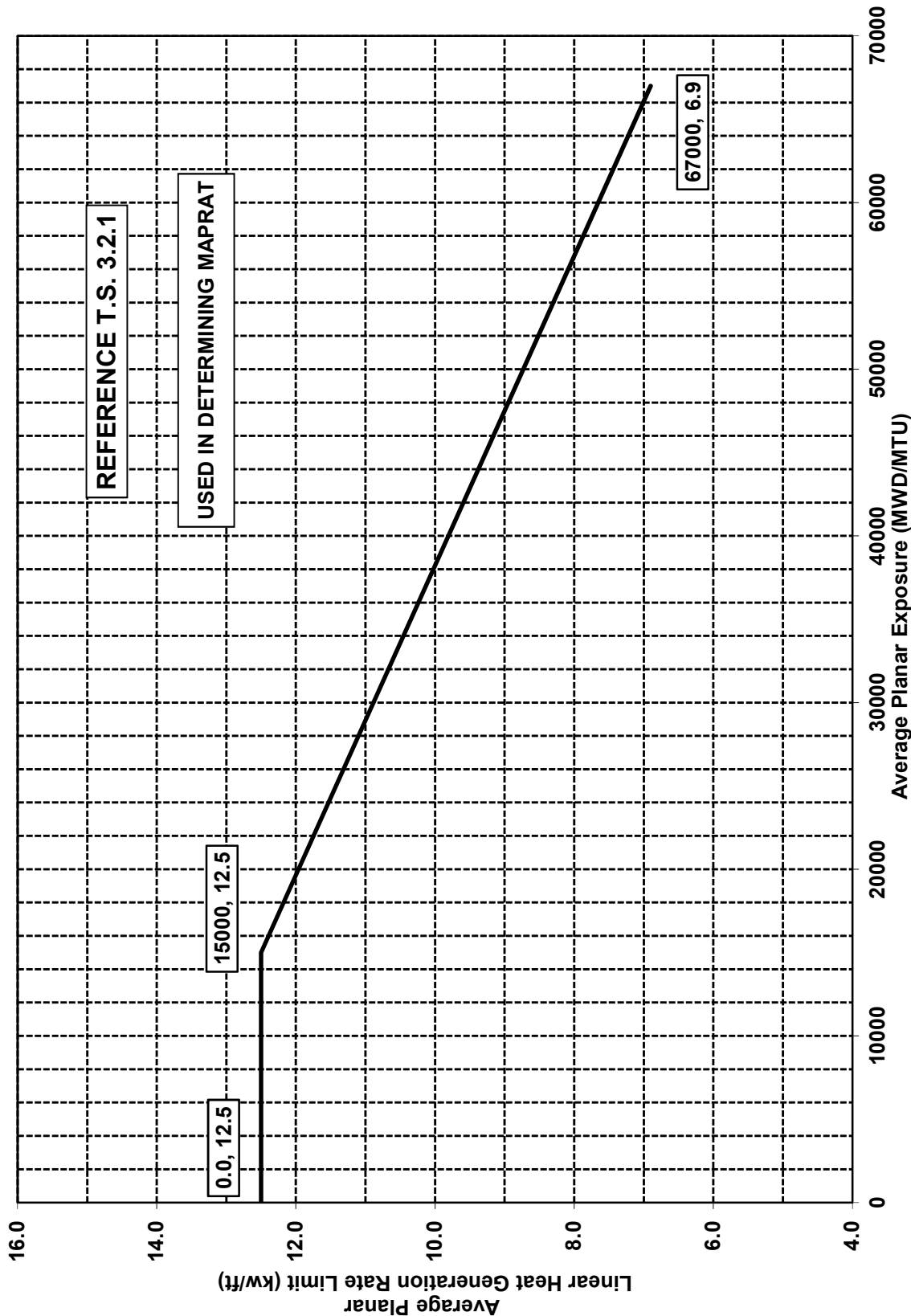
Technical Specification 3.2.1

4.2 Description

The APLHGRs for ATRIUM™-10 fuel shall not exceed the limit shown in Figure 4.2-1.

The APLHGR limits in Figure 4.2-1 are valid in Two Loop Operation for Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed. The APLHGR limits for Single Loop operation are provided in Section 8.0.

SSES UNIT 1 CYCLE 21



AVERAGE PLANAR LINEAR HEAT GENERATION RATE LIMIT VERSUS
AVERAGE PLANAR EXPOSURE - TWO LOOP OPERATION
ATRIUM™-10 FUEL
FIGURE 4.2-1

5.0 **MINIMUM CRITICAL POWER RATIO (MCPR)**

5.1 **References**

Technical Specification 3.2.2, 3.3.4.1, 3.7.6, and 3.7.8

Technical Requirements Manual 3.3.7

5.2 **Description**

The MCPR limit is specified as a function of core power, core flow, average scram insertion time per Section 5.3 and plant equipment operability status. The MCPR limits for all fuel types (ATRIUM™-10) shall be the greater of the Flow-Dependent or the Power-Dependent MCPR, depending on the applicable equipment operability status.

a) Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

Figure 5.2-1: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-2: Power-Dependent MCPR value determined from BOC to EOC

b) Main Turbine Bypass Inoperable

Figure 5.2-3: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-4: Power-Dependent MCPR value determined from BOC to EOC

c) EOC-RPT Inoperable

Figure 5.2-5: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-6: Power-Dependent MCPR value determined from BOC to EOC

d) Backup Pressure Regulator Inoperable

Figure 5.2-7: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-8: Power Dependent MCPR value determined from BOC to EOC

e) One Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) Closed

Figure 5.2-9: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-10: Power-Dependent MCPR value determined from BOC to EOC

The MCPR limits in Figures 5.2-1 through 5.2-10 are valid for Two Loop operation.

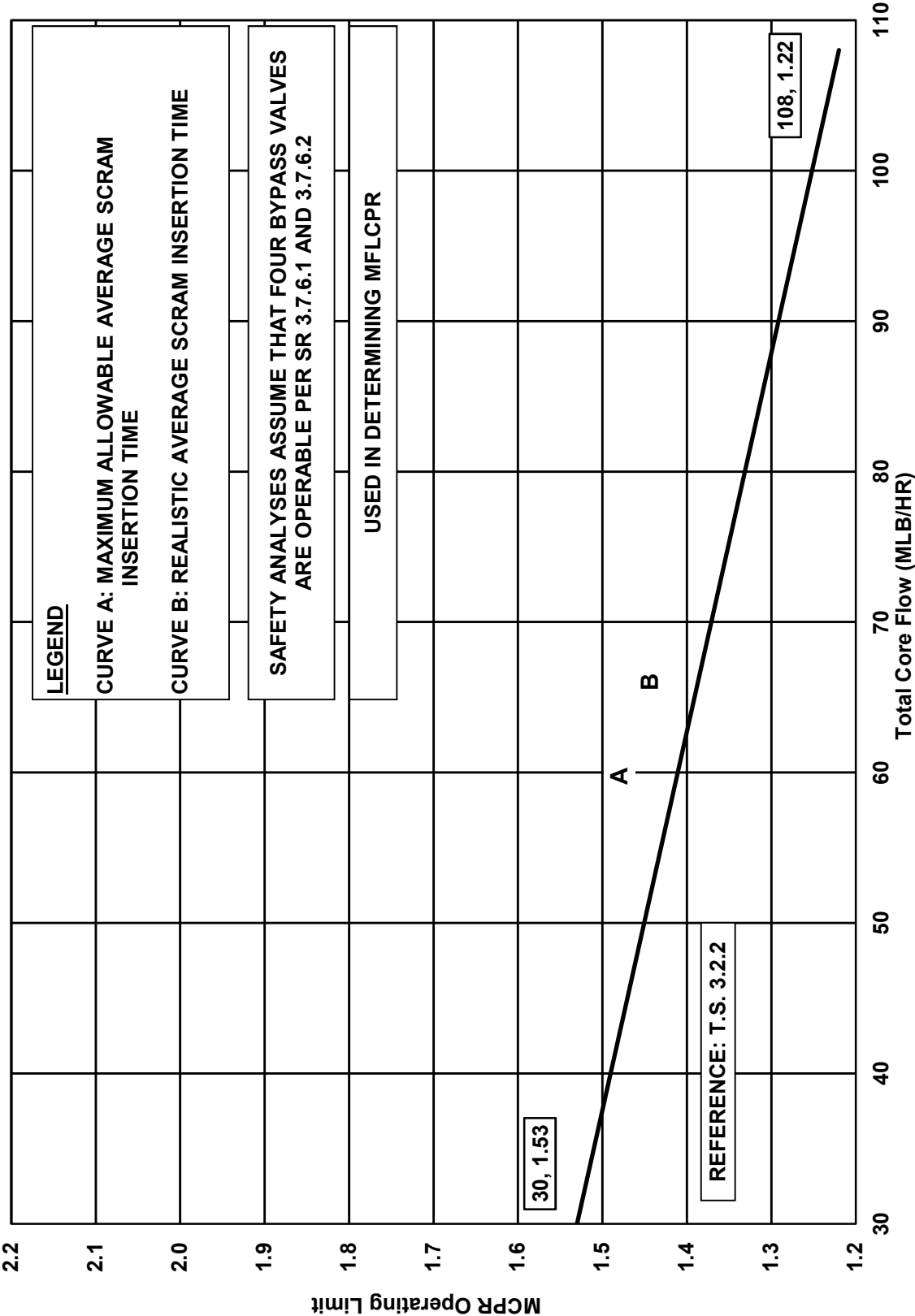
The MCPR limits for Single Loop operation are provided in Section 8.0.

5.3 Average Scram Time Fraction

If the average measured scram times are greater than the Realistic Scram times listed in Table 5.3-1 then the MCPR operating limits corresponding to the Maximum Allowable Average Scram Insertion Time must be implemented. Determining MCPR operating limits based on interpolation between scram insertion times is not permitted. The evaluation of scram insertion time data, as it relates to the attached table should be performed per Reactor Engineering procedures.

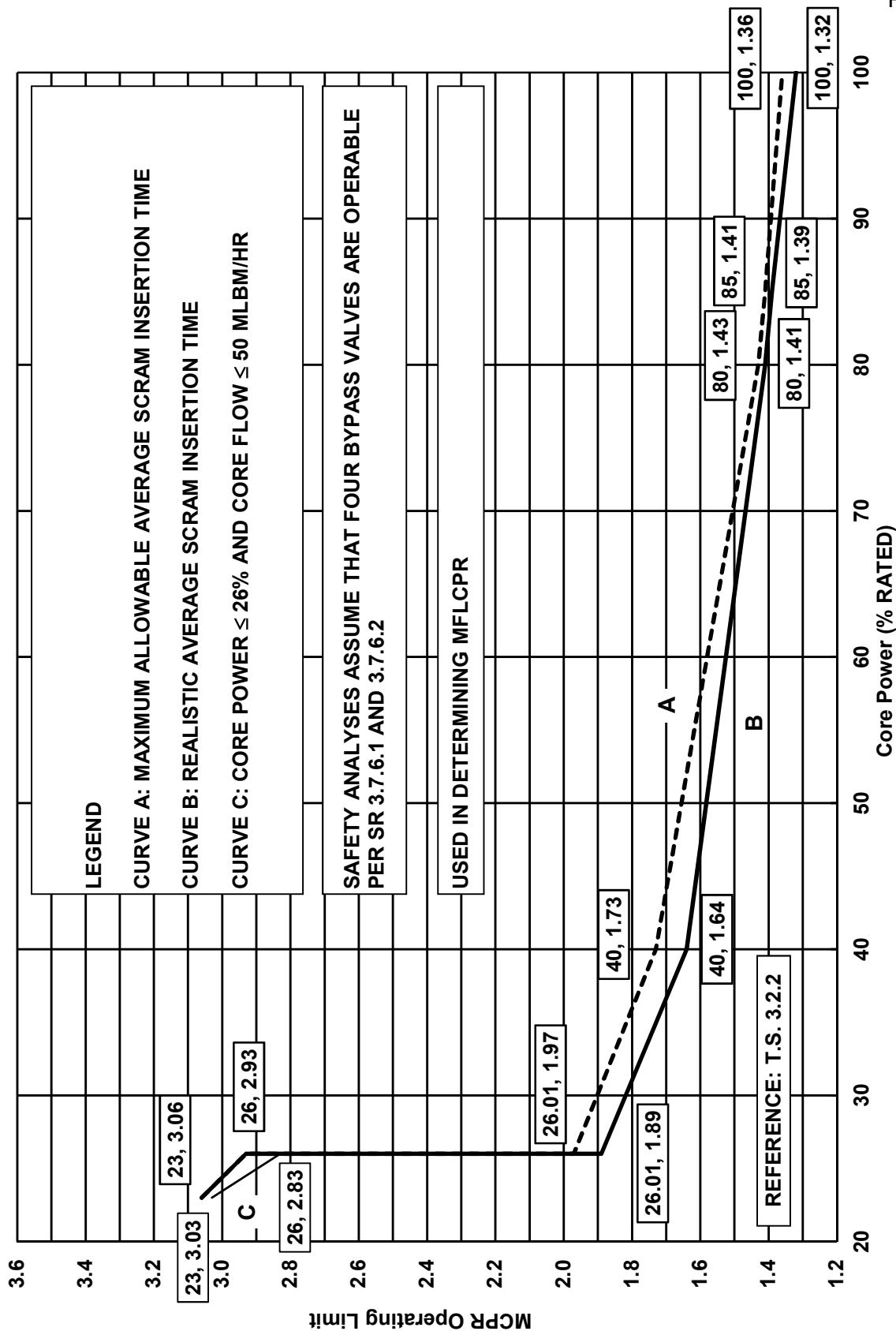
Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-1

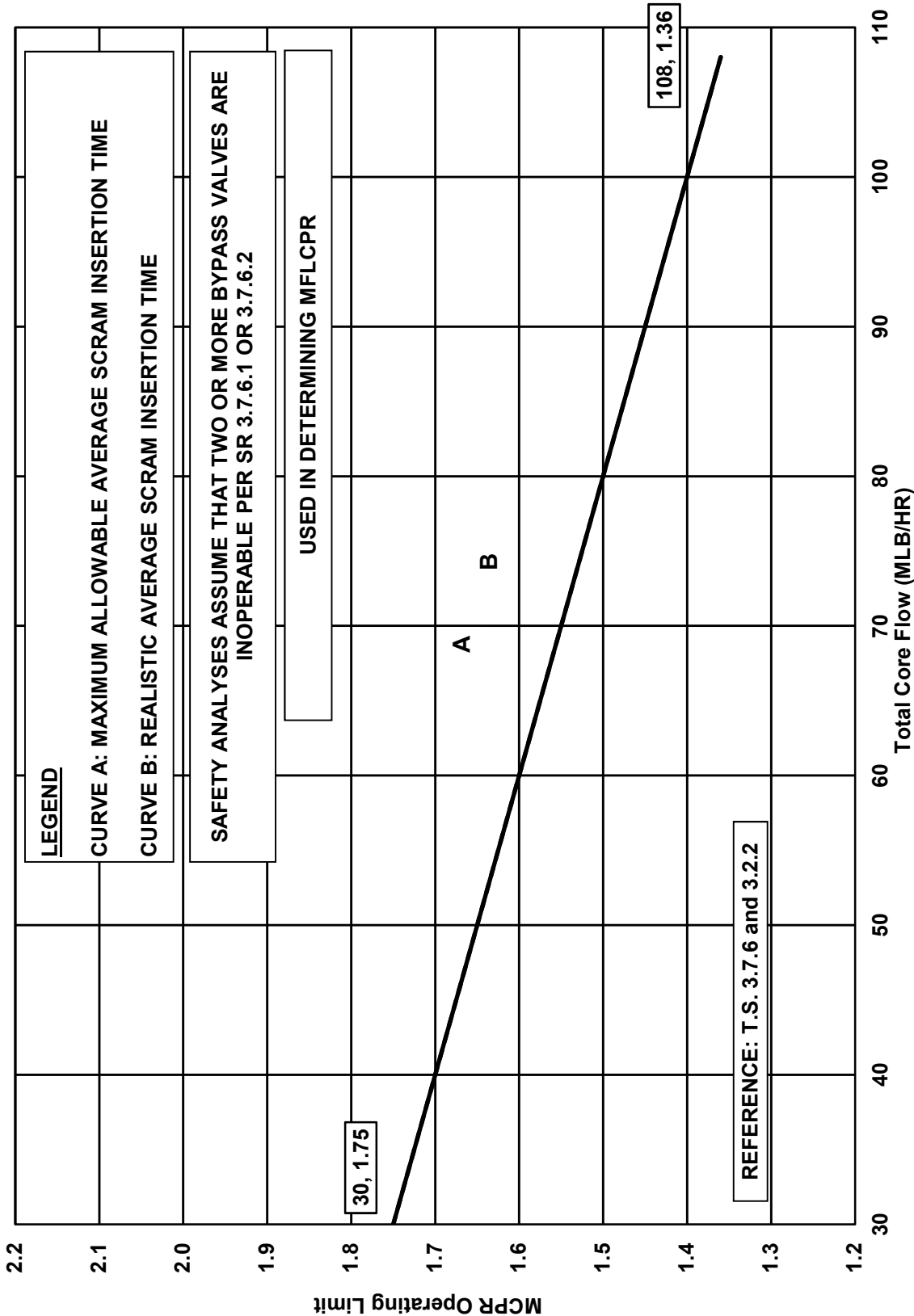
SSSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
 MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
 TWO LOOP OPERATION (BOC TO EOC)
 FIGURE 5.2-2

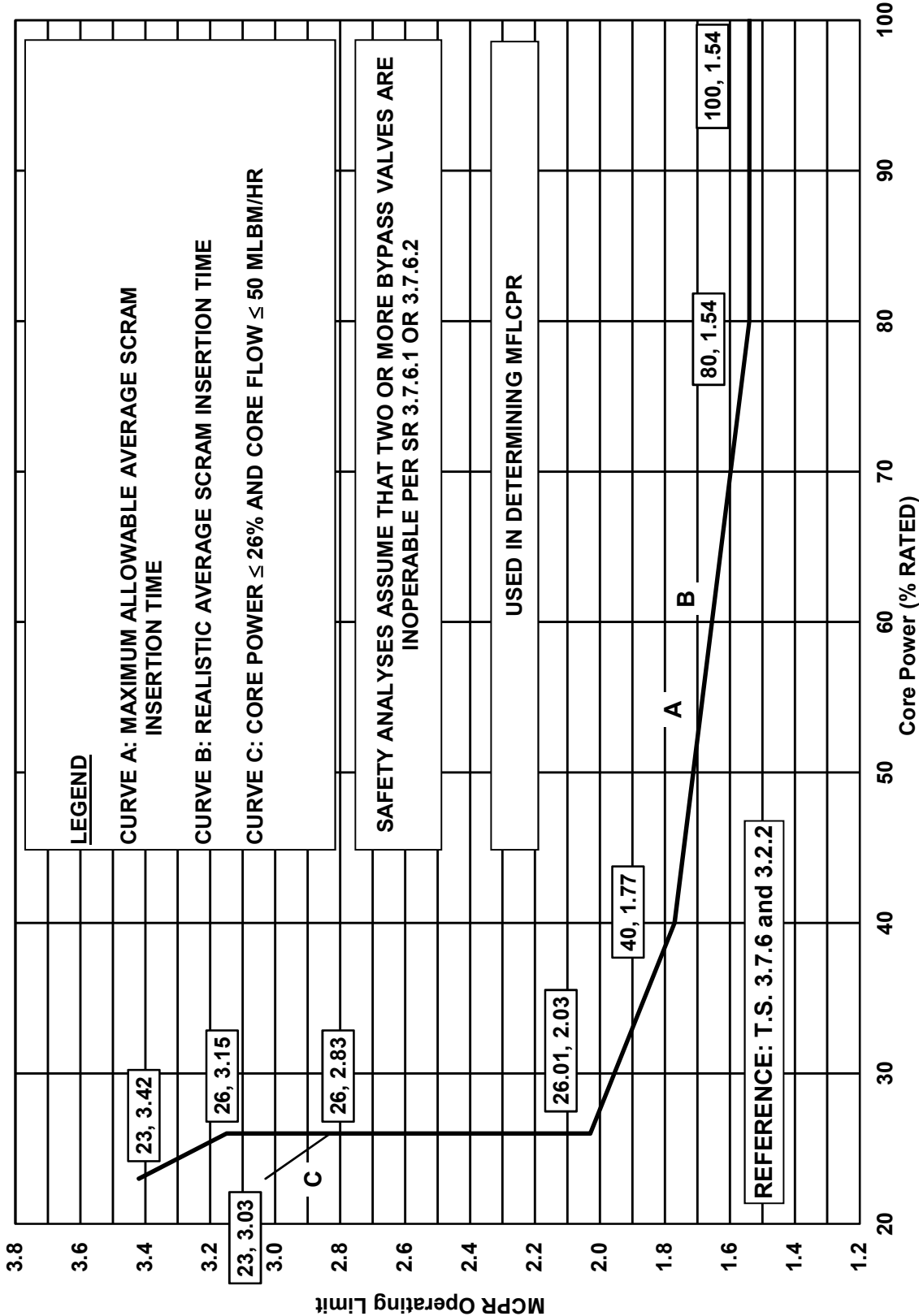
Main Turbine Bypass Inoperable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS INOPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-3

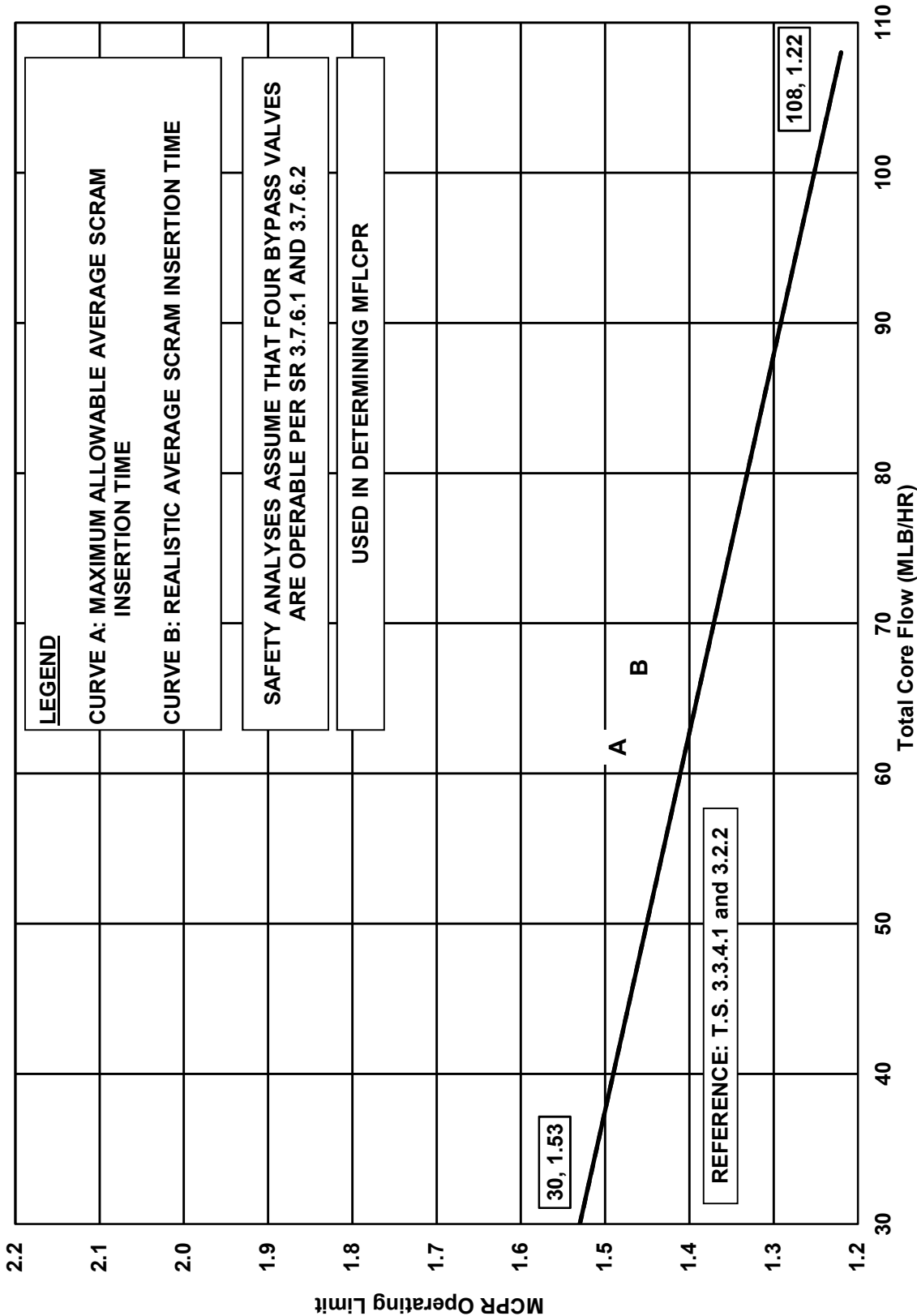
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS INOPERABLE
TWO LOOP OPERATION (BOC to EOC)
FIGURE 5.2-4

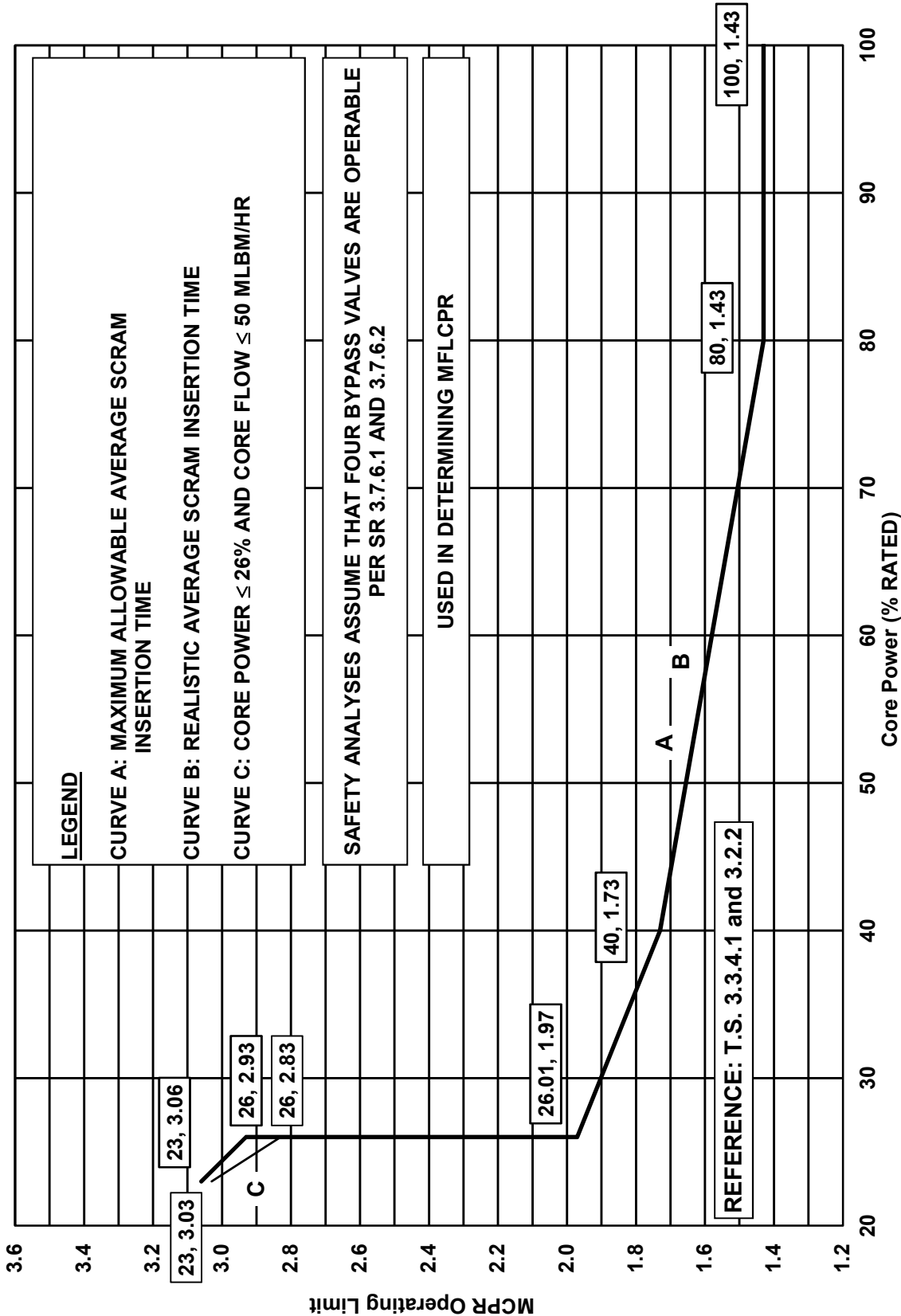
**EOC-RPT
Inoperable**

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MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
EOC-RPT INOPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-5

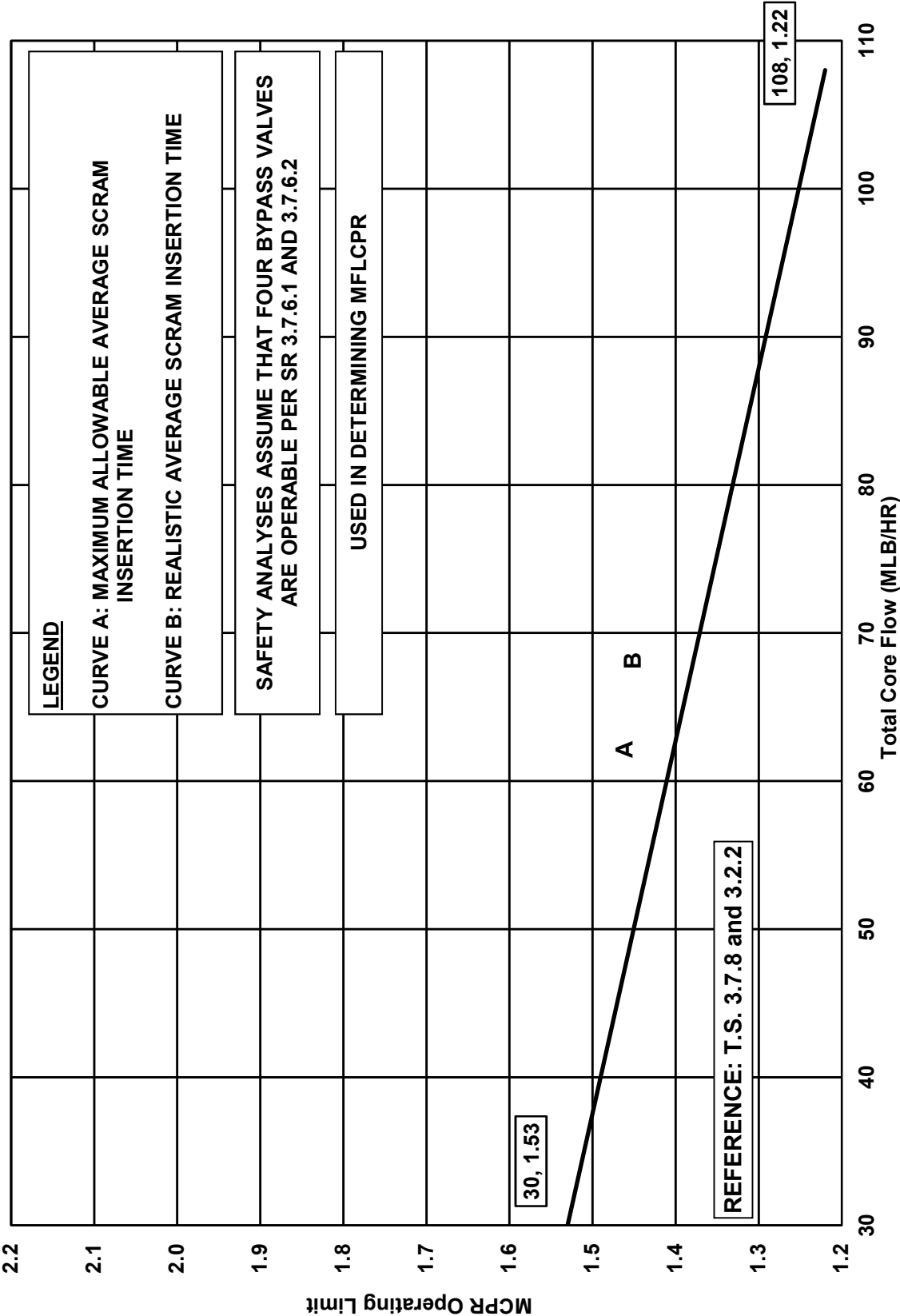
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MCPR OPERATING LIMIT VERSUS CORE POWER
EOC-RPT INOPERABLE
TWO LOOP OPERATION (BOC to EOC)
FIGURE 5.2-6

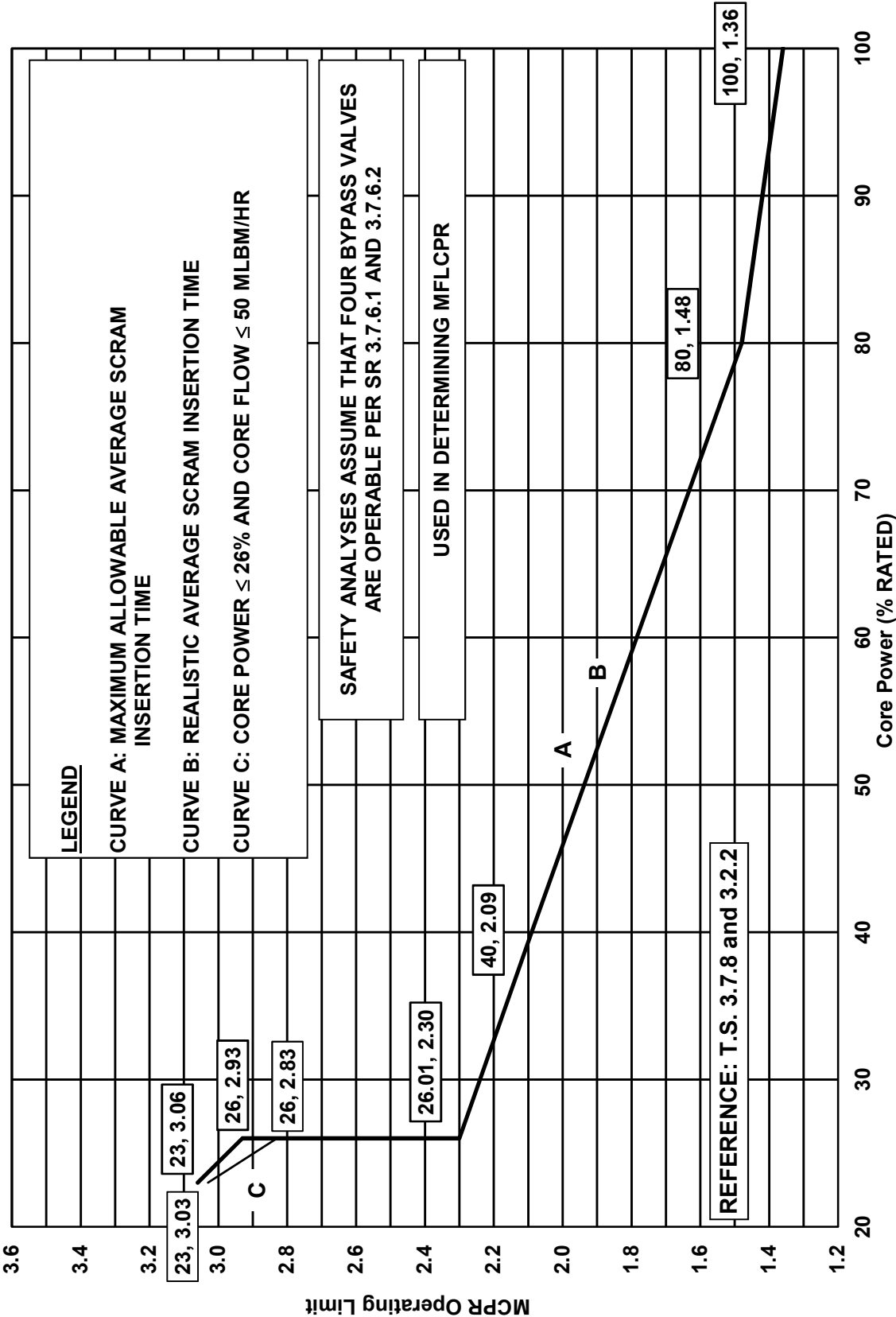
Backup Pressure Regulator Inoperable

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MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
BACKUP PRESSURE REGULATOR INOPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-7

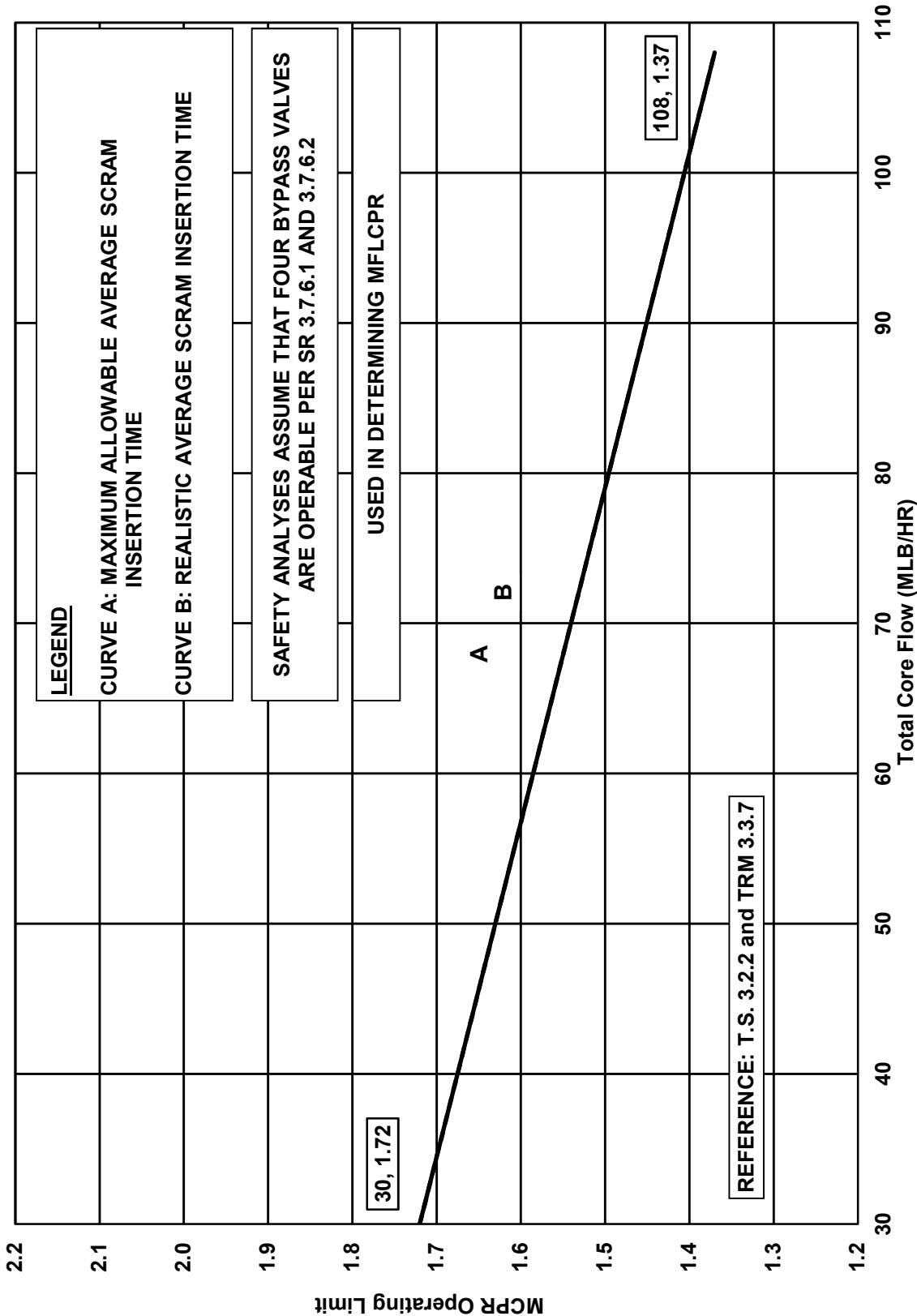
SSSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
BACKUP PRESSURE REGULATOR INOPERABLE
TWO LOOP OPERATION (BOC to EOC)
FIGURE 5.2-8

One TSV or TCV Closed

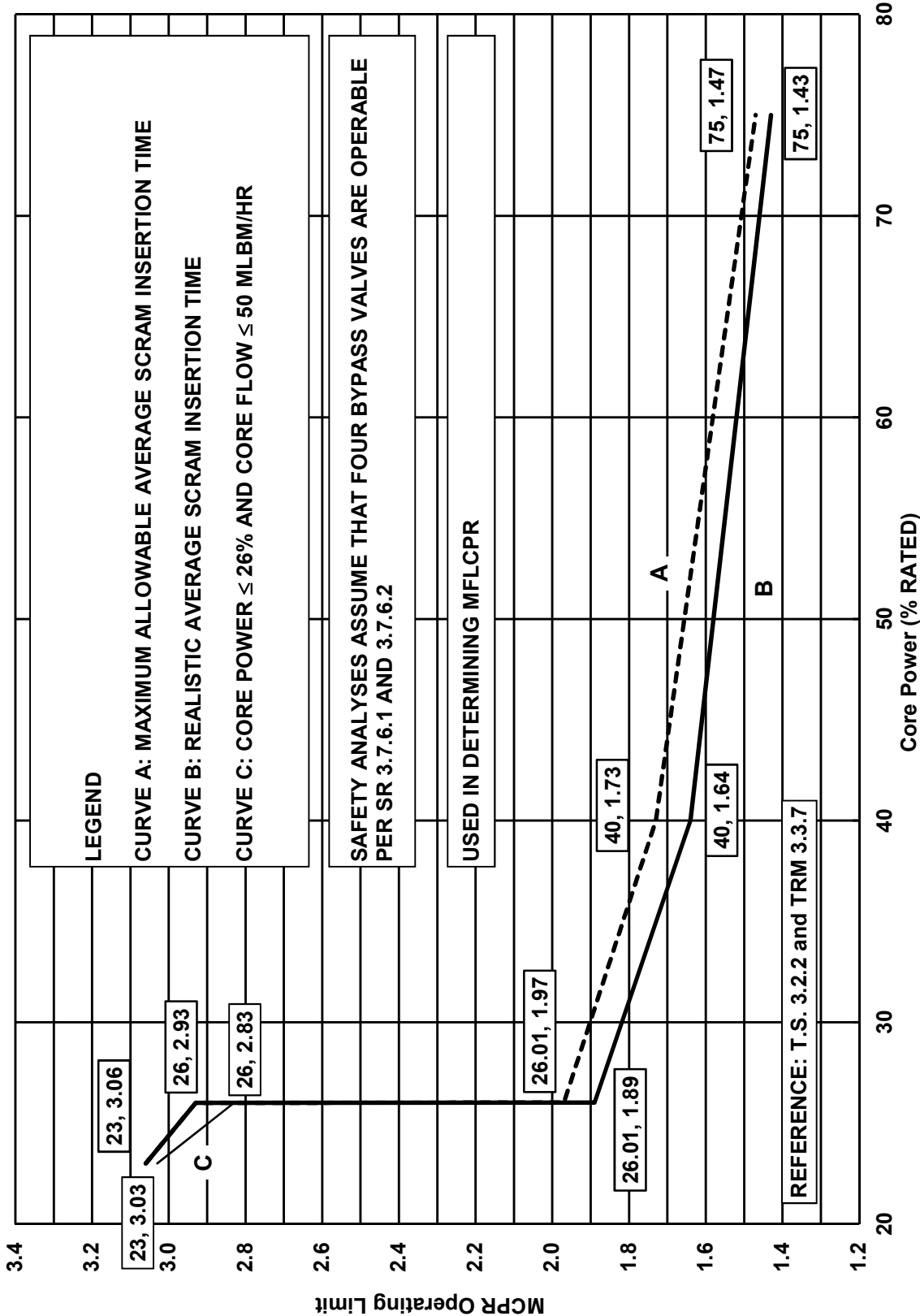
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
ONE TSV OR TCV CLOSED*
TWO LOOP OPERATION (BOC TO EOC)

FIGURE 5.2-9
*Operation with one TSV or TCV closed is only supported at power levels ≤ 75% rated power.

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MCPR OPERATING LIMIT VERSUS CORE POWER
ONE TSV OR TCV CLOSED
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-10

Table 5.3-1

**Average Scram Time Fraction Table For Use With Scram Time Dependent
MCPR Operating Limits**

Control Rod Position	Average Scram Time to Position (seconds)		
45	0.470		0.520
39	0.630		0.860
25	1.500		1.910
5	2.700		3.440
Average Scram Insertion Time	Realistic		Maximum Allowable

6.0 LINEAR HEAT GENERATION RATE (LHGR)

6.1 References

Technical Specification 3.2.3, 3.3.4.1, 3.7.6, and 3.7.8

Technical Requirements Manual 3.3.7

6.2 Description

The maximum LHGR for ATRIUM™-10 fuel shall not exceed the LHGR limit determined from Figure 6.2-1. The LHGR limit in Figure 6.2-1 is valid for Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

To protect against both fuel centerline melting and cladding strain during anticipated system transients initiated from reduced power and flow conditions, power and flow dependent LHGR limit multipliers are provided in the following figures:

a) Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

Figure 6.2-2: Flow-Dependent LHGR Limit Multiplier

Figure 6.2-3: Power-Dependent LHGR Limit Multiplier

b) Main Turbine Bypass or EOC-RPT or Backup Pressure Regulator Inoperable

Figure 6.2-4: Flow-Dependent LHGR Limit Multiplier

Figure 6.2-5: Power-Dependent LHGR Limit Multiplier

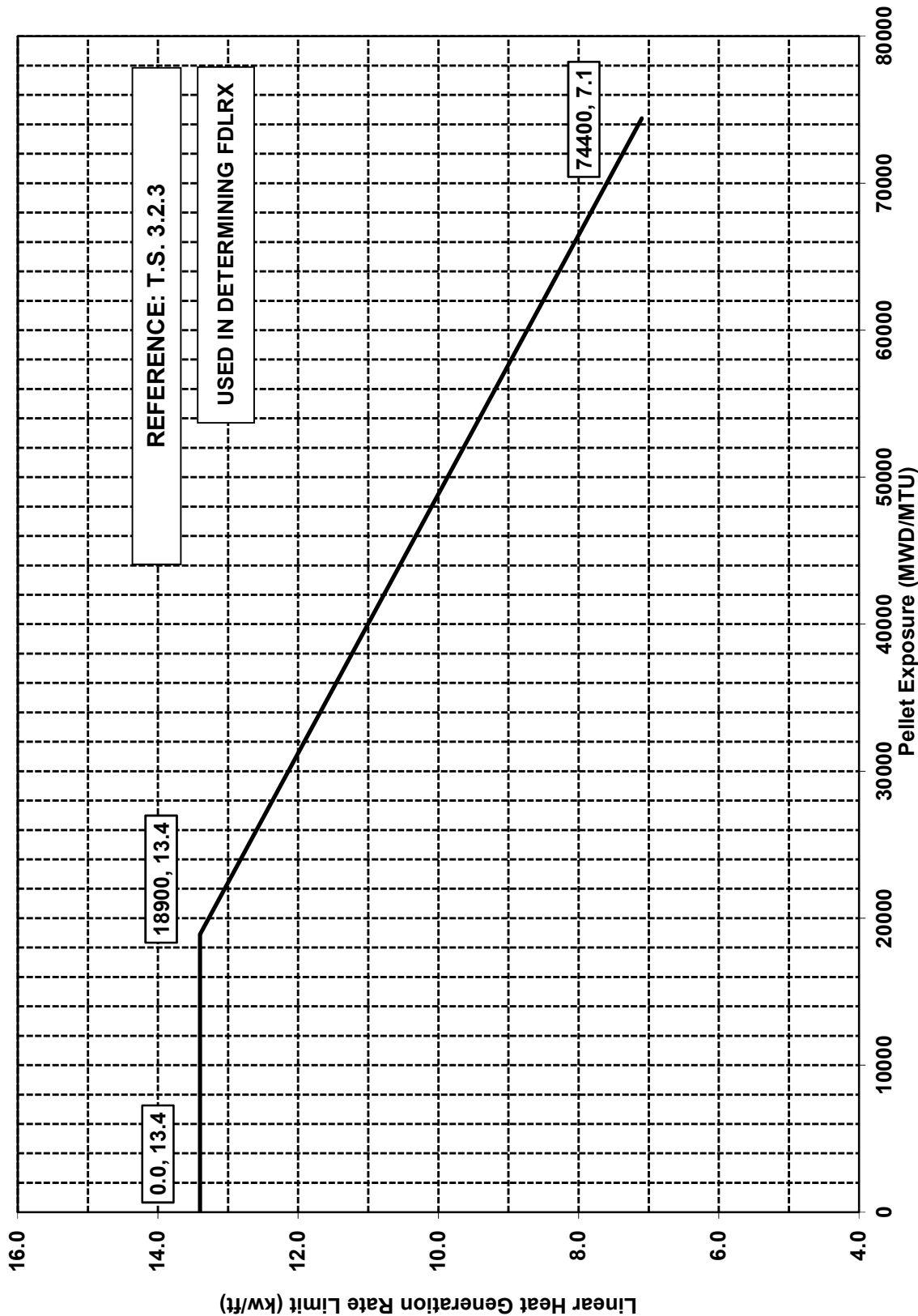
c) One Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) Closed

Figure 6.2-6: Flow-Dependent LHGR Limit Multiplier

Figure 6.2-7: Power-Dependent LHGR Limit Multiplier

The LHGR limits and LHGR limit multipliers in Figures 6.2-1 through 6.2-7 are valid for both Two Loop and Single Loop operation.

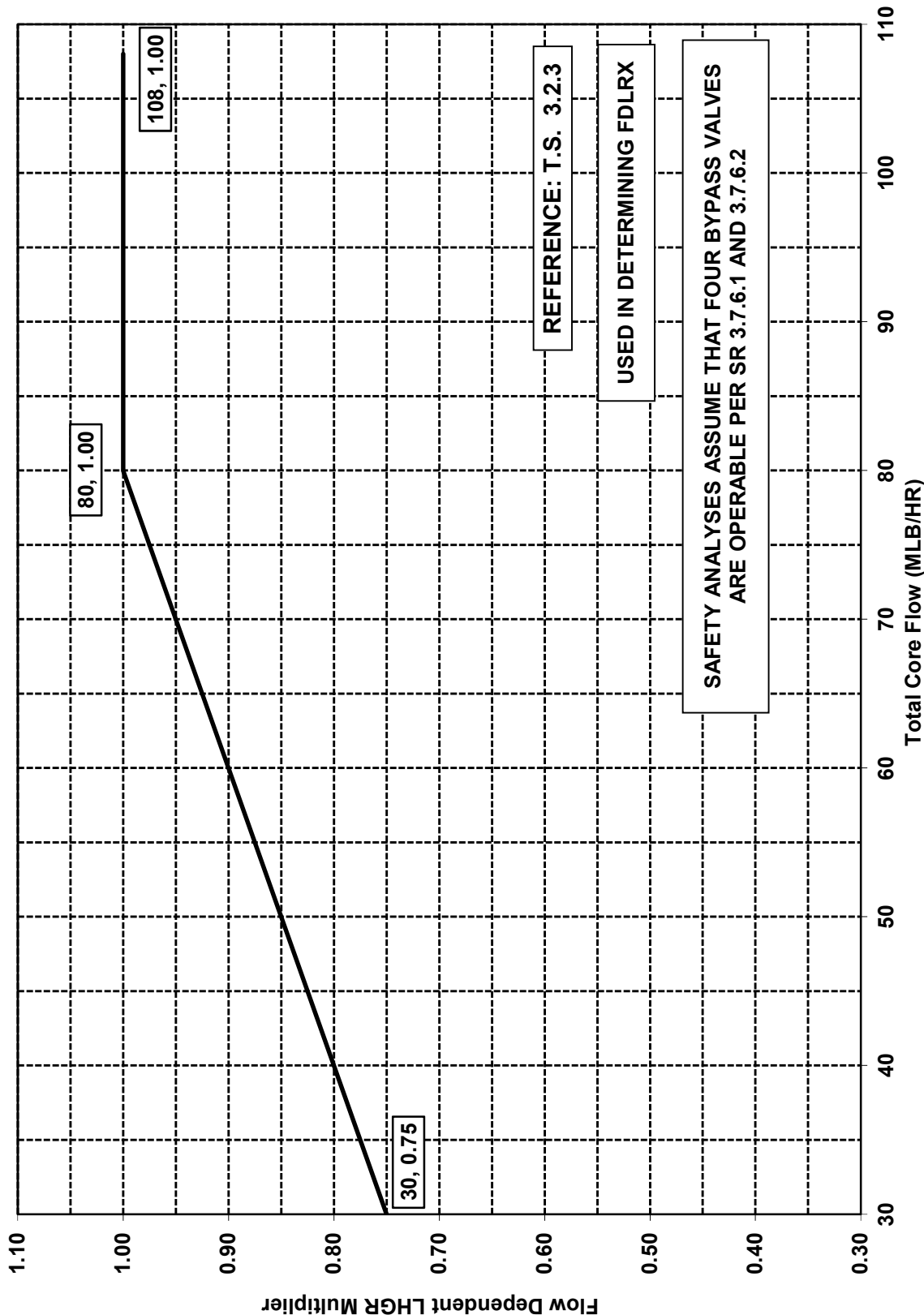
SSSES UNIT 1 CYCLE 21



LINEAR HEAT GENERATION RATE LIMIT VERSUS PELLETT EXPOSURE
ATRIUM™-10 FUEL
FIGURE 6.2-1

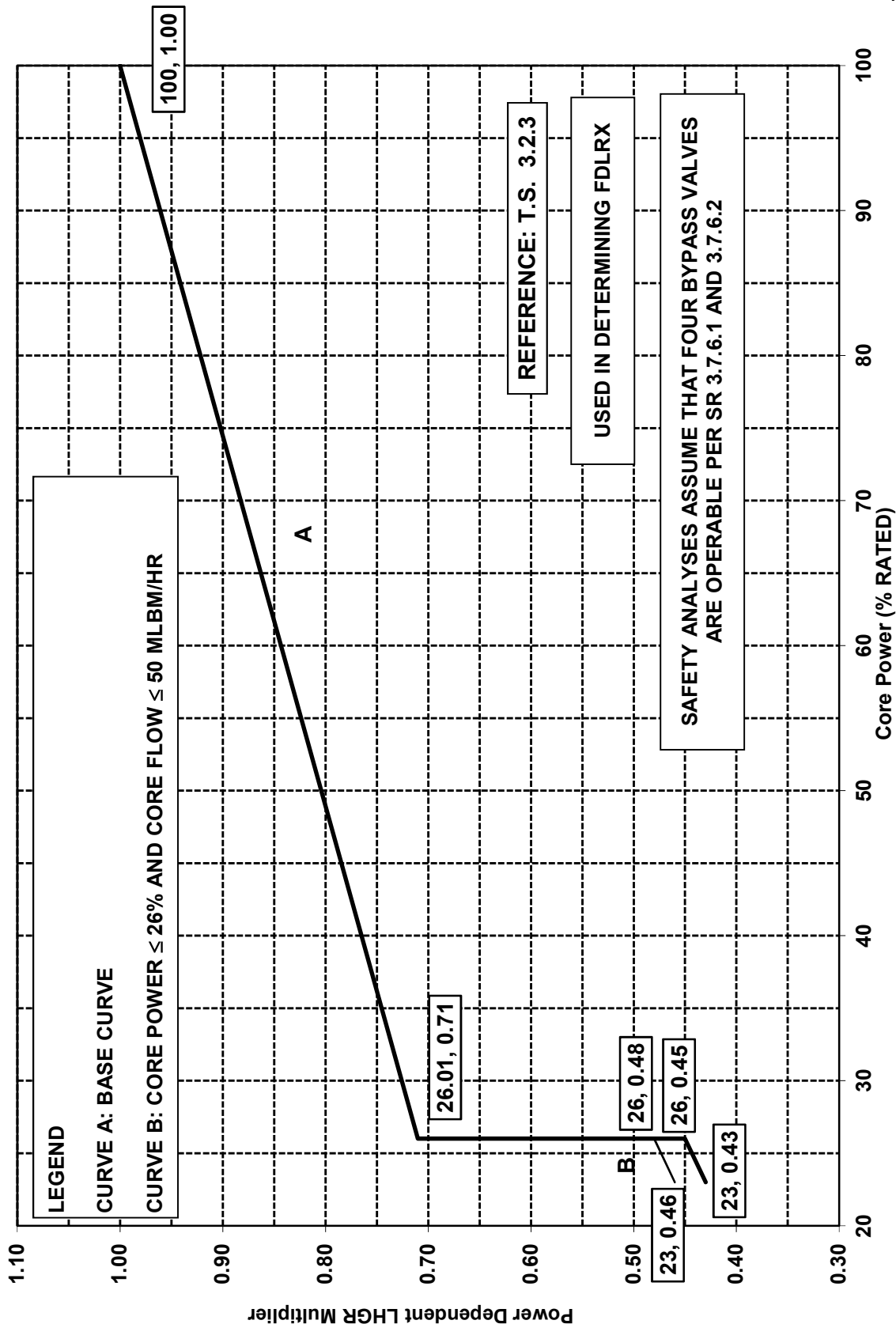
Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

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FLOW DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-2

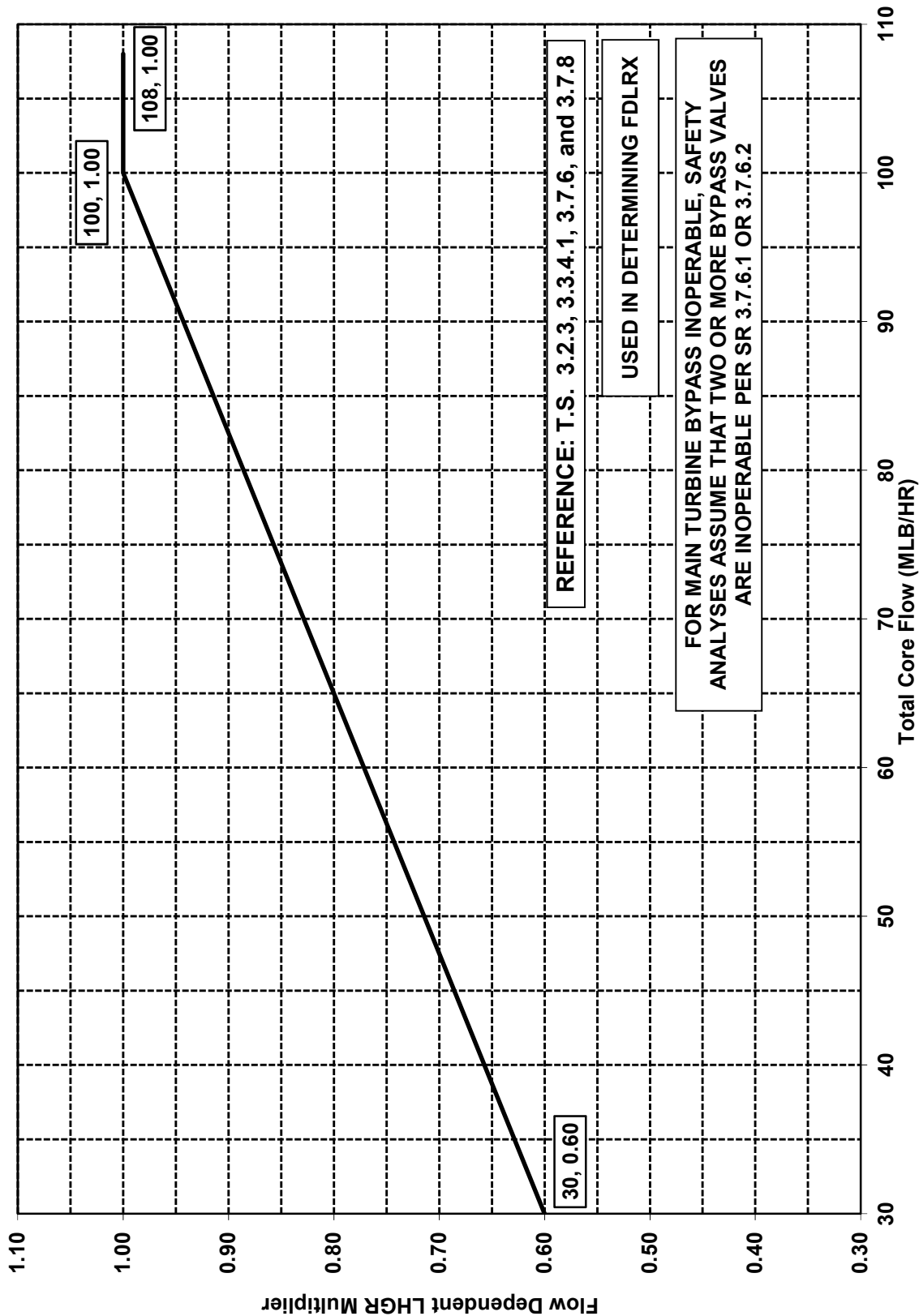
SSSES UNIT 1 CYCLE 21



POWER DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-3

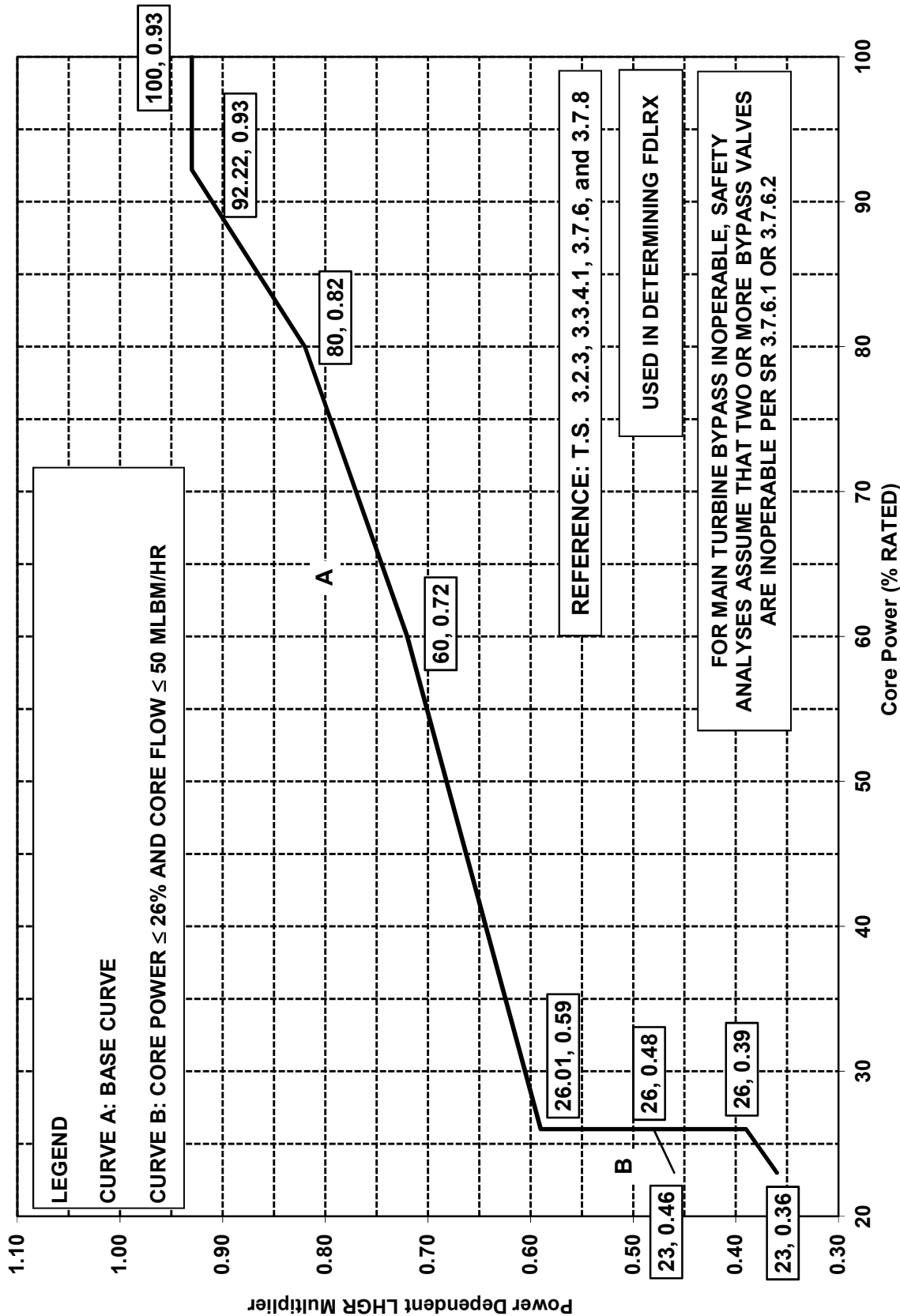
Main Turbine Bypass or EOC-RPT or Backup Pressure Regulator Inoperable

SSES UNIT 1 CYCLE 21



FLOW DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS OR EOC-RPT OR BACKUP PRESSURE REGULATOR INOPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-4

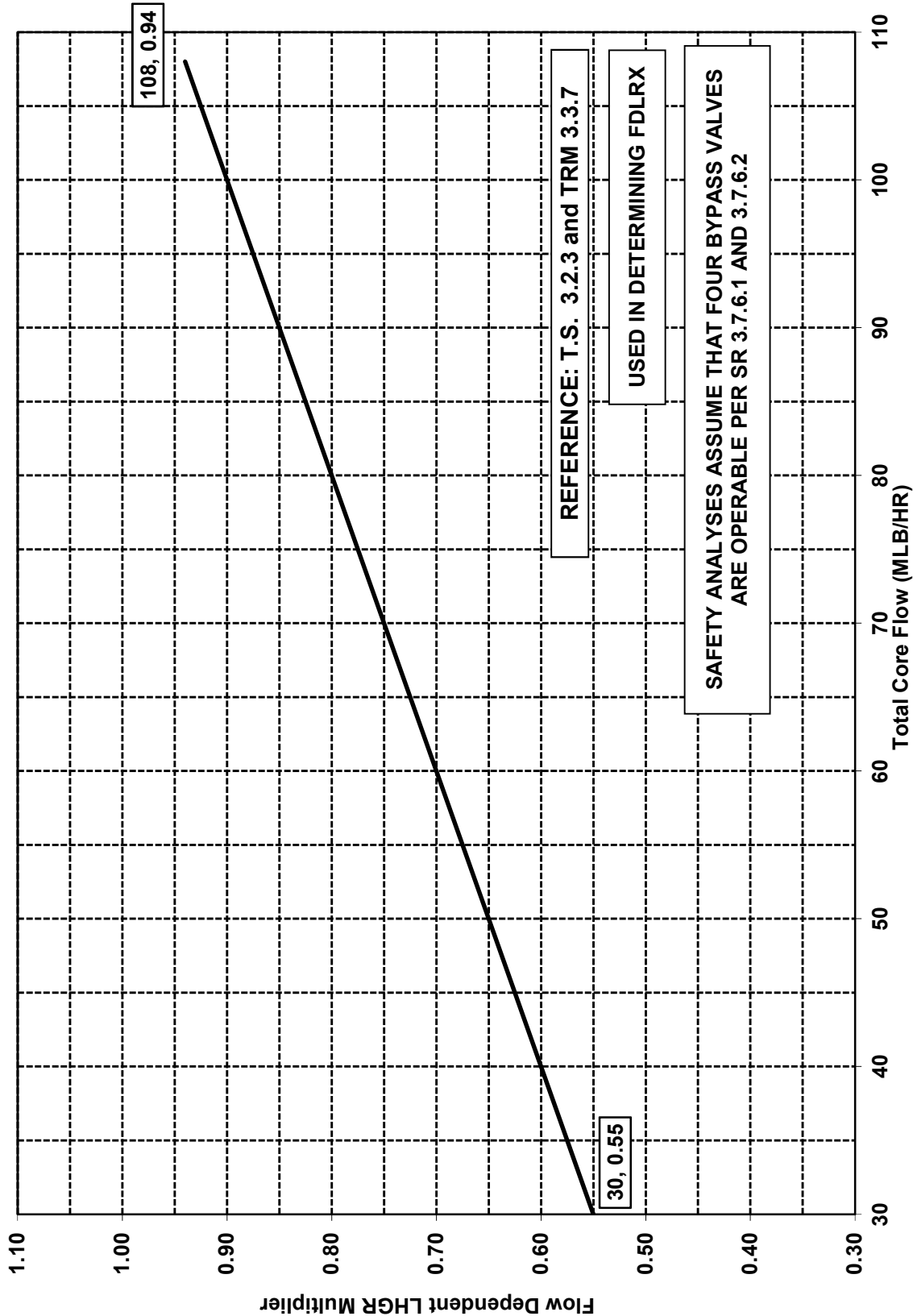
SSSES UNIT 1 CYCLE 21



POWER DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS OR EOC-RPT OR BACKUP PRESSURE REGULATOR INOPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-5

One TSV or TCV Closed

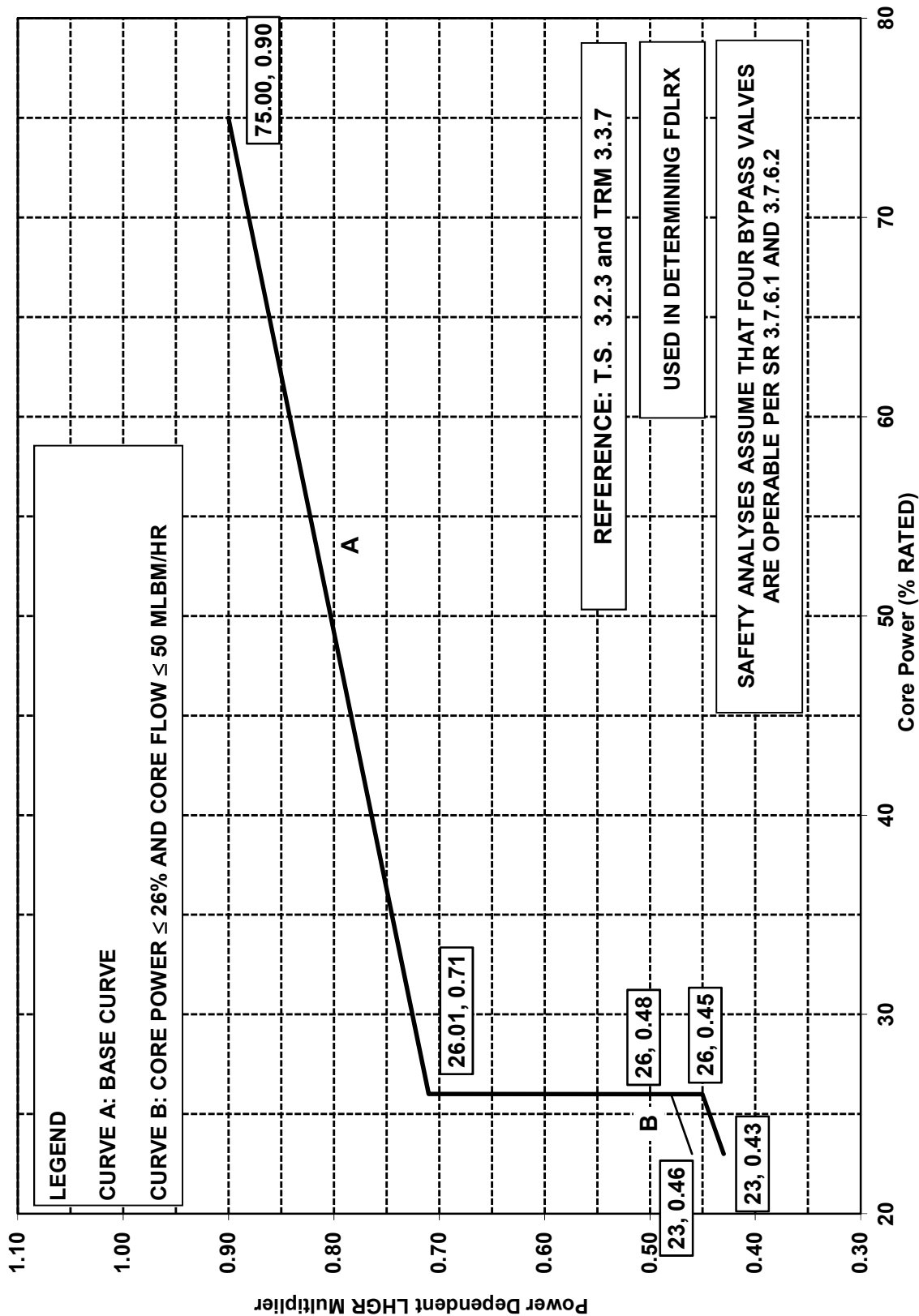
SSES UNIT 1 CYCLE 21



FLOW DEPENDENT LHGR LIMIT MULTIPLIER
ONE TSV OR TCV CLOSED*
ATRIUM™-10 FUEL
FIGURE 6.2-6

*Operation with one TSV or TCV closed is only supported at power levels ≤ 75% rated power.

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POWER DEPENDENT LHGR LIMIT MULTIPLIER
ONE TSV OR TCV CLOSED
ATRIUM™-10 FUEL
FIGURE 6.2-7

7.0 **ROD BLOCK MONITOR (RBM) SETPOINTS AND OPERABILITY REQUIREMENTS**

7.1 References

Technical Specification 3.3.2.1

7.2 Description

The RBM Allowable Value and Trip Setpoints for;

- a) Low Power Range Setpoint,
- b) Intermediate Power Range Setpoint,
- c) High Power Range Setpoint,
- d) Low Power Range - Upscale,
- e) Intermediate Power Range - Upscale, and
- f) High Power Range - Upscale

shall be established as specified in Table 7.2-1. The RBM setpoints are valid for Two Loop and Single Loop Operation, Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

The RBM system design objective is to block erroneous control rod withdrawal initiated by the operator before fuel design limits are violated. If the full withdrawal of any control rod would not violate a fuel design limit, then the RBM system is not required to be operable. Table 7.2-2 provides RBM system operability requirements to ensure that fuel design limits are not violated.

Table 7.2-1
RBM Setpoints

Function	Allowable Value ⁽¹⁾	Nominal Trip Setpoint
Low Power Range Setpoint	28.0	24.9
Intermediate Power Range Setpoint	63.0	61.0
High Power Range Setpoint	83.0	81.0
Low Power Range - Upscale	123.4	123.0
Intermediate Power Range - Upscale	117.4	117.0
High Power Range - Upscale	105.6	105.2

- (1) Power setpoint function (Low, Intermediate, and High Power Range Setpoints) determined in percent of RATED THERMAL POWER. Upscale trip setpoint function (Low, Intermediate, and High Power Range - Upscale) determined in percent of reference level.

Table 7.2-2
RBM System Operability Requirements

Thermal Power (% of Rated)	MCPR ^(2,3)
≥ 28 and < 90	< 1.76
≥ 90 and < 95	< 1.47
≥ 95	< 1.68

- (2) Applicable to Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.
- (3) Applicable to both Two Loop and Single Loop Operation.

8.0 RECIRCULATION LOOPS - SINGLE LOOP OPERATION

8.1 References

Technical Specification 3.2.1, 3.2.2, 3.3.4.1, 3.4.1, 3.7.6, and 3.7.8

Technical Requirements Manual 3.3.7

8.2 Description

APLHGR

The APLHGR limit for ATRIUM™-10 fuel shall be equal to the APLHGR Limit from Figure 8.2-1.

The APLHGR limits in Figure 8.2-1 are valid in Single Loop Operation for Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

Minimum Critical Power Ratio Limit

The MCPR limit is specified as a function of core power, core flow, and plant equipment operability status. The MCPR limits for all fuel types (ATRIUM™-10) shall be the greater of the Flow-Dependent or the Power-Dependent MCPR, depending on the applicable equipment operability status.

a) Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

Figure 8.2-2: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-3: Power-Dependent MCPR value determined from BOC to EOC

b) Main Turbine Bypass Inoperable

Figure 8.2-4: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-5: Power-Dependent MCPR value determined from BOC to EOC

c) EOC-RPT Inoperable

Figure 8.2-6: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-7: Power-Dependent MCPR value determined from BOC to EOC

d) Backup Pressure Regulator Inoperable

Figure 8.2-8: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-9: Power-Dependent MCPR value determined from BOC to EOC

- e) One Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) Closed

Figure 8.2-10: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-11: Power-Dependent MCPR value determined from BOC to EOC

The MCPR limits in Figures 8.2-2 through 8.2-11 are valid only for Single Loop operation.

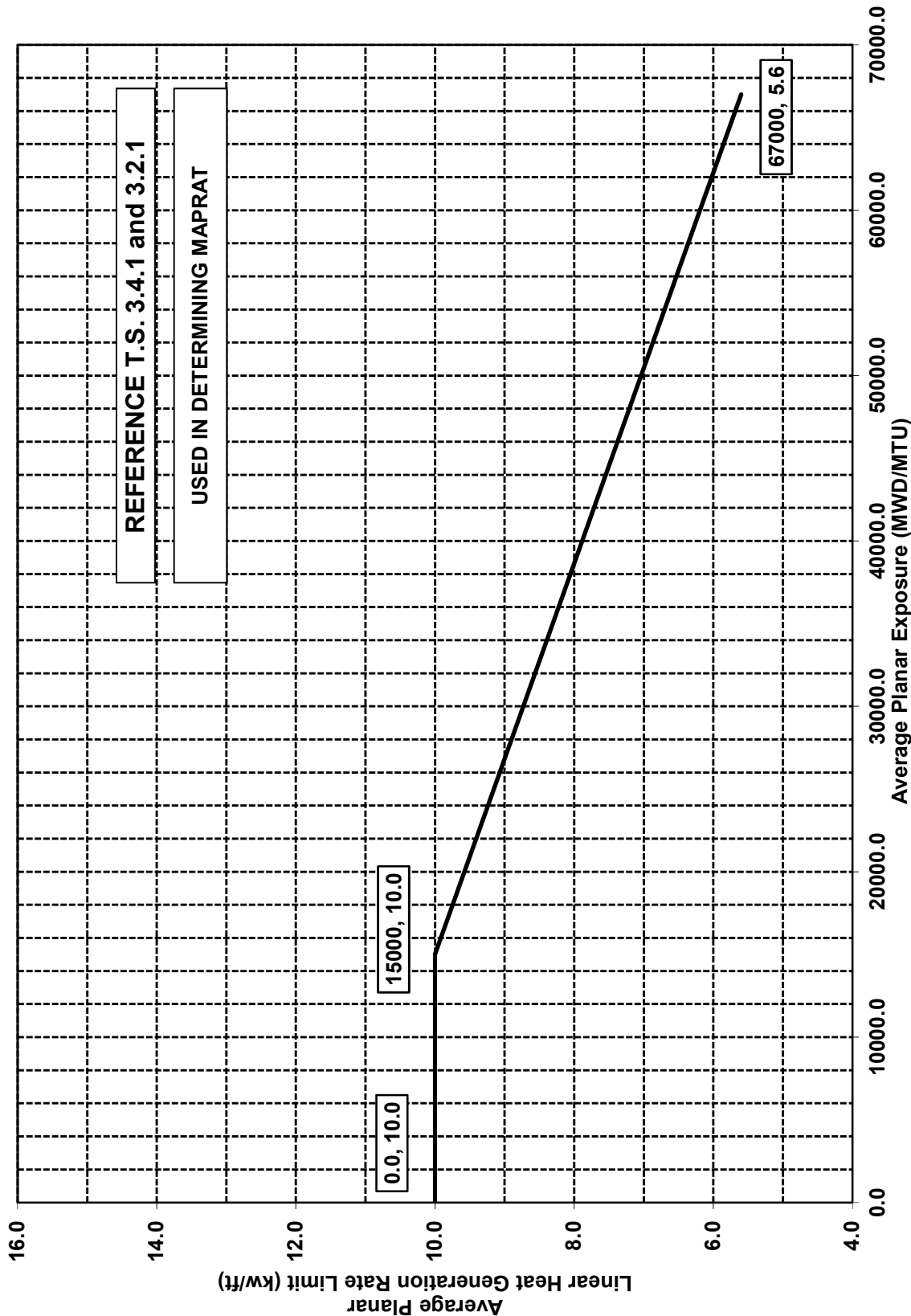
Linear Heat Generation Rate Limit

The LHGR limits for Single Loop Operation are defined in Section 6.0.

RBM Setpoints and Operability Requirements

The RBM setpoints and operability requirements for Single Loop Operation are defined in Section 7.0.

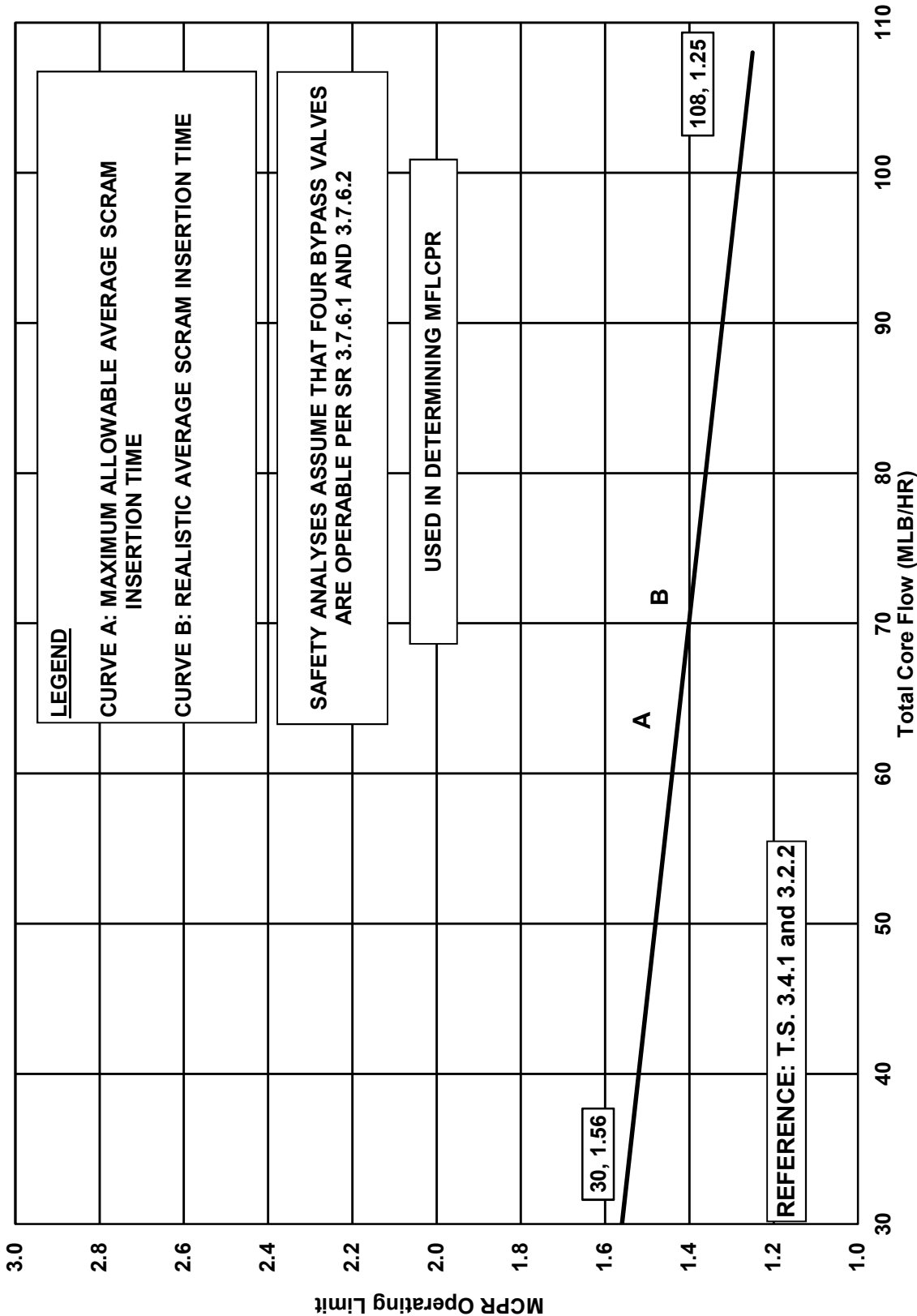
SSES UNIT 1 CYCLE 21



AVERAGE PLANAR LINEAR HEAT GENERATION RATE LIMIT VERSUS
AVERAGE PLANAR EXPOSURE - SINGLE LOOP OPERATION
ATRIUM™-10 FUEL
FIGURE 8.2-1

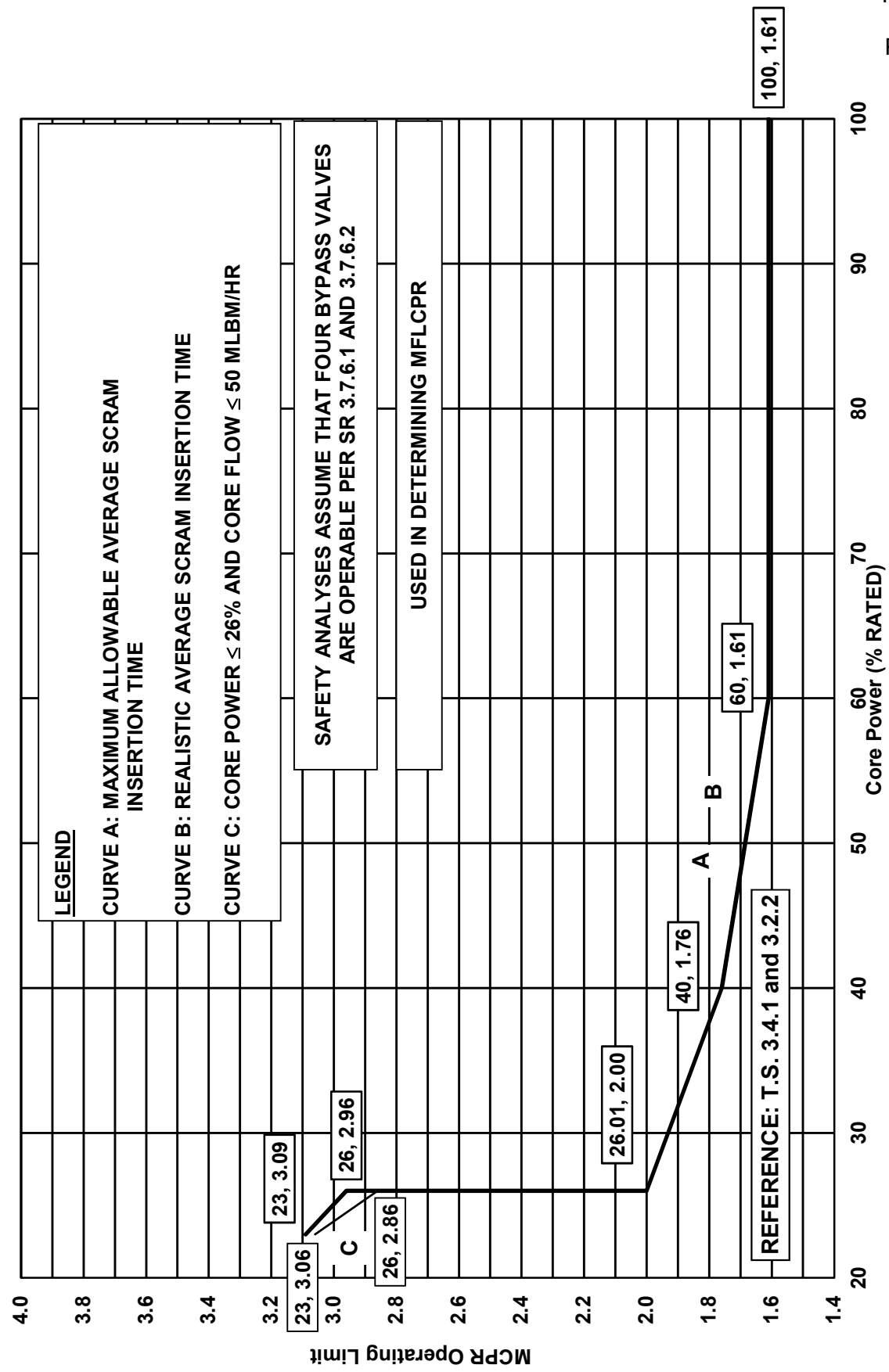
Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-2

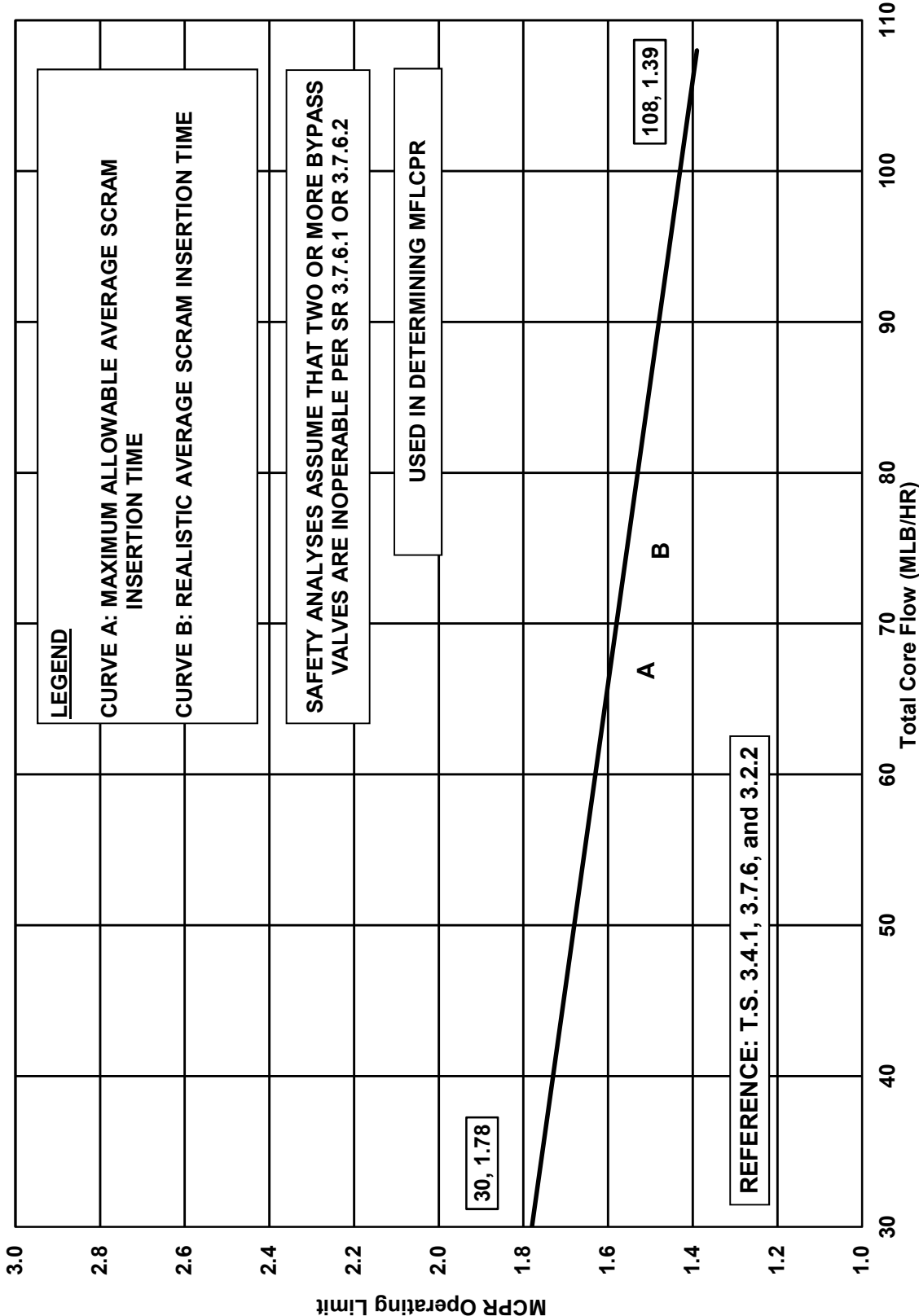
SSSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-3

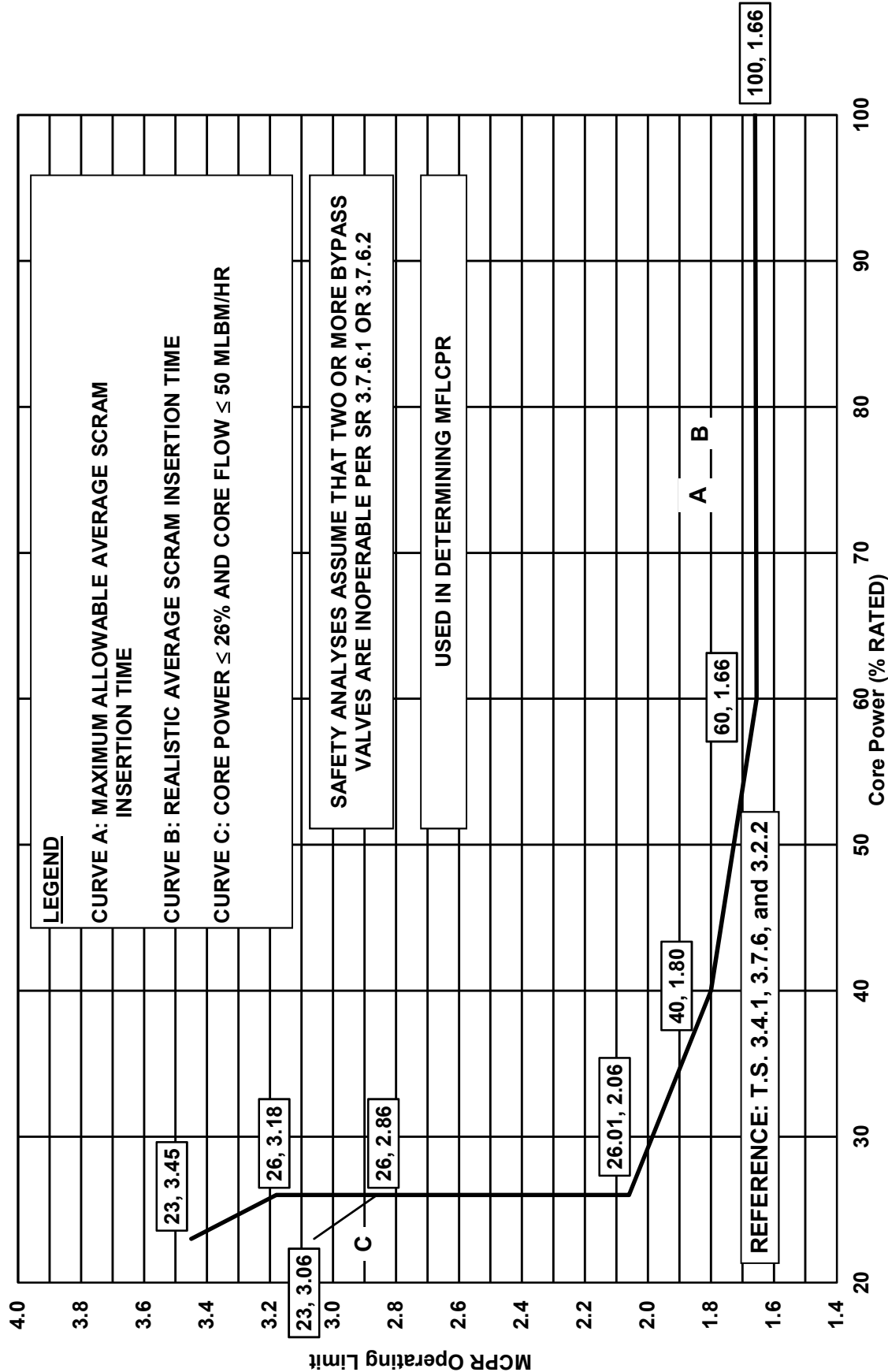
Main Turbine Bypass Inoperable

SSSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-4

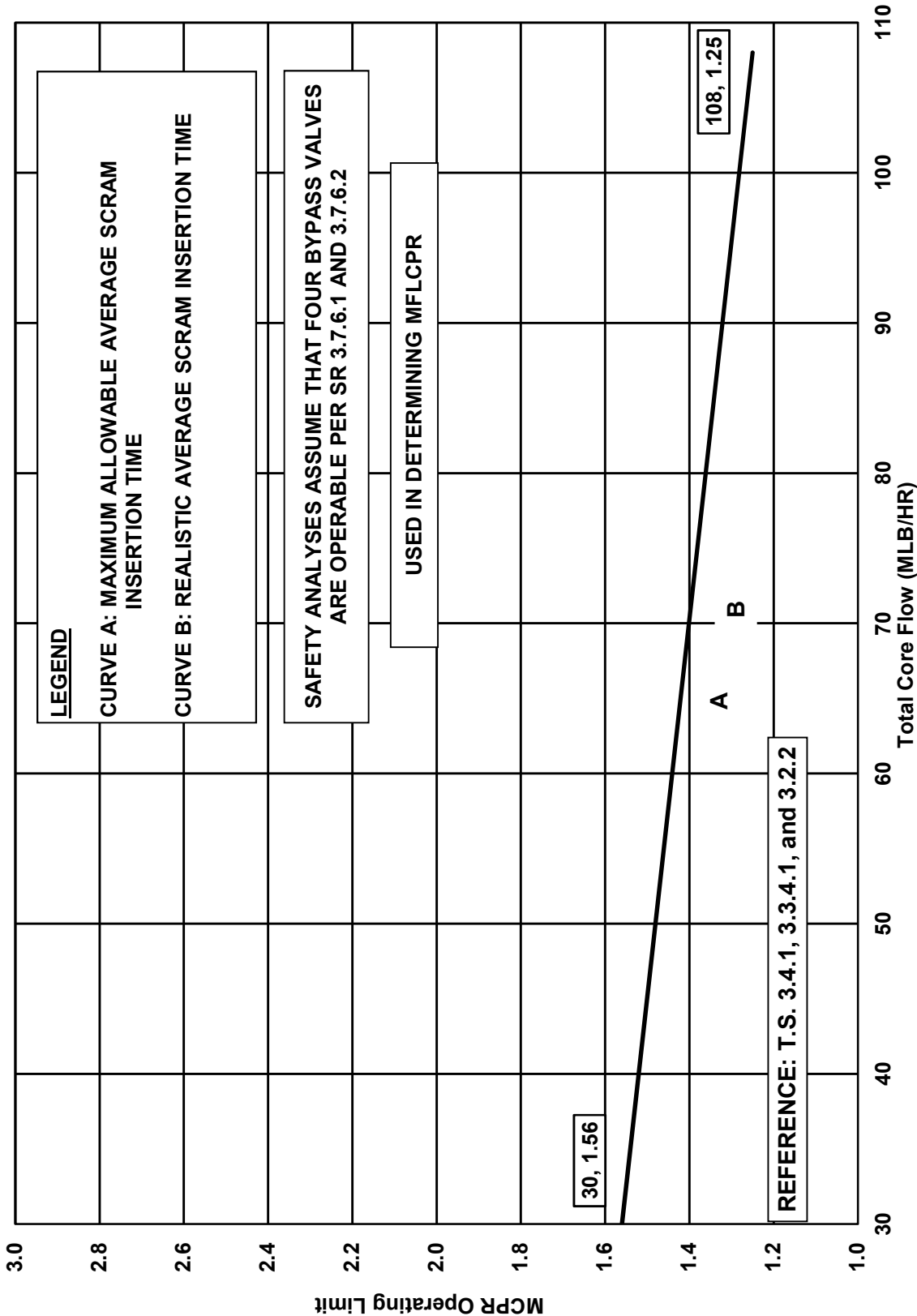
SSS UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
 MAIN TURBINE BYPASS INOPERABLE
 SINGLE LOOP OPERATION (BOC to EOC)
 FIGURE 8.2-5

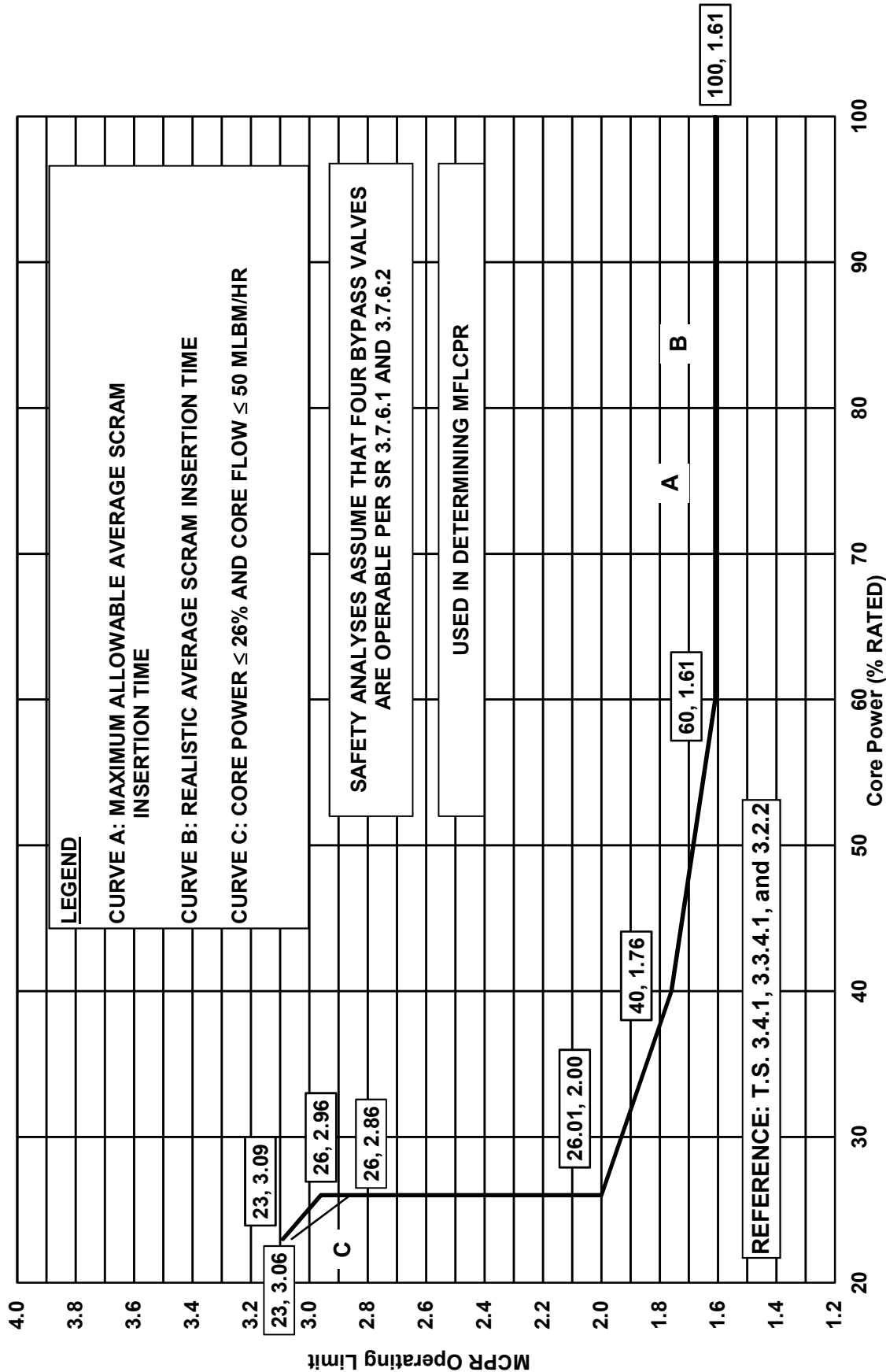
**EOC-RPT
Inoperable**

SSSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
EOC-RPT INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-6

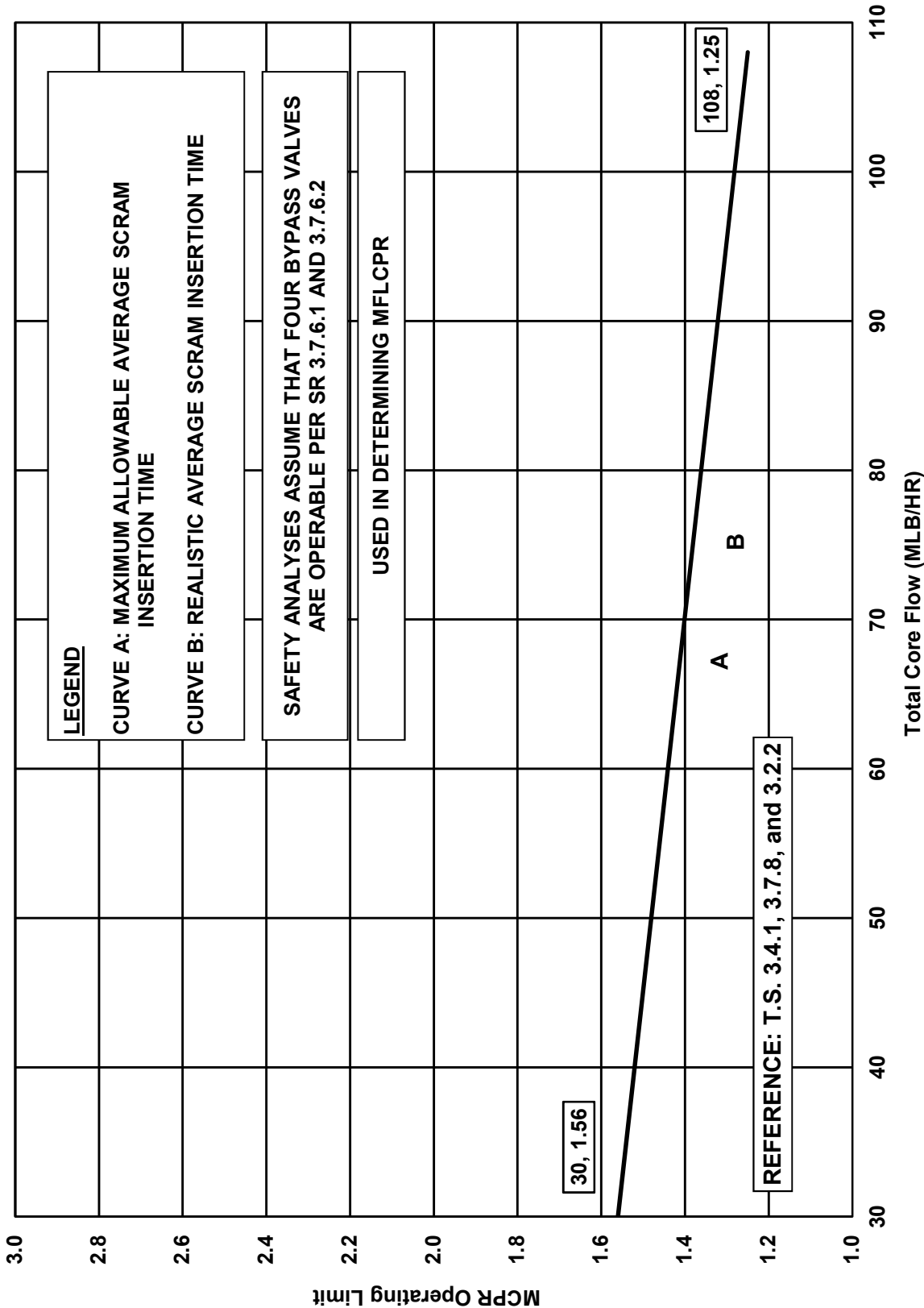
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
 EOC-RPT INOPERABLE
 SINGLE LOOP OPERATION (BOC to EOC)
 FIGURE 8.2-7

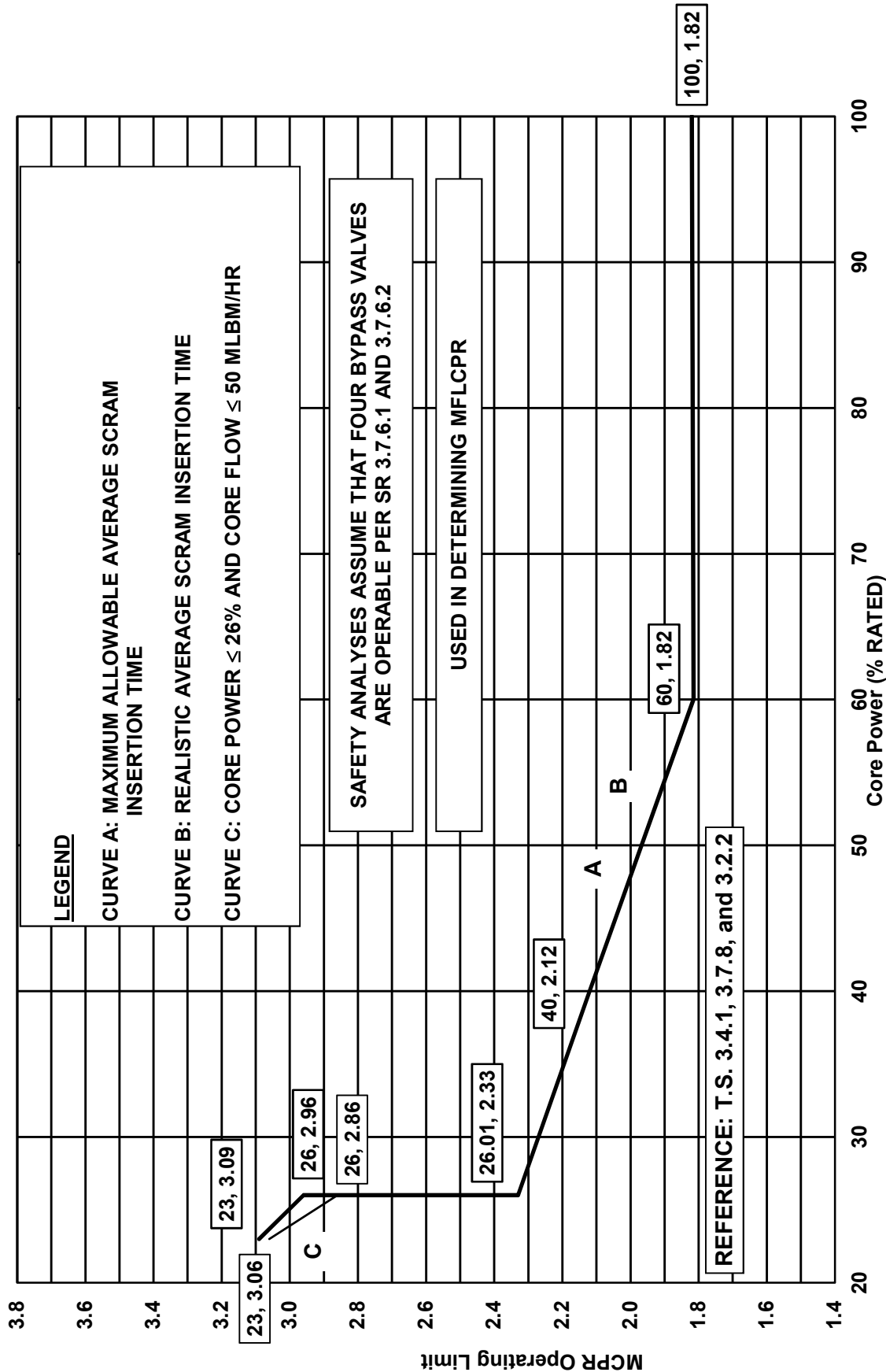
Backup Pressure Regulator Inoperable

SSS UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
BACKUP PRESSURE REGULATOR INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-8

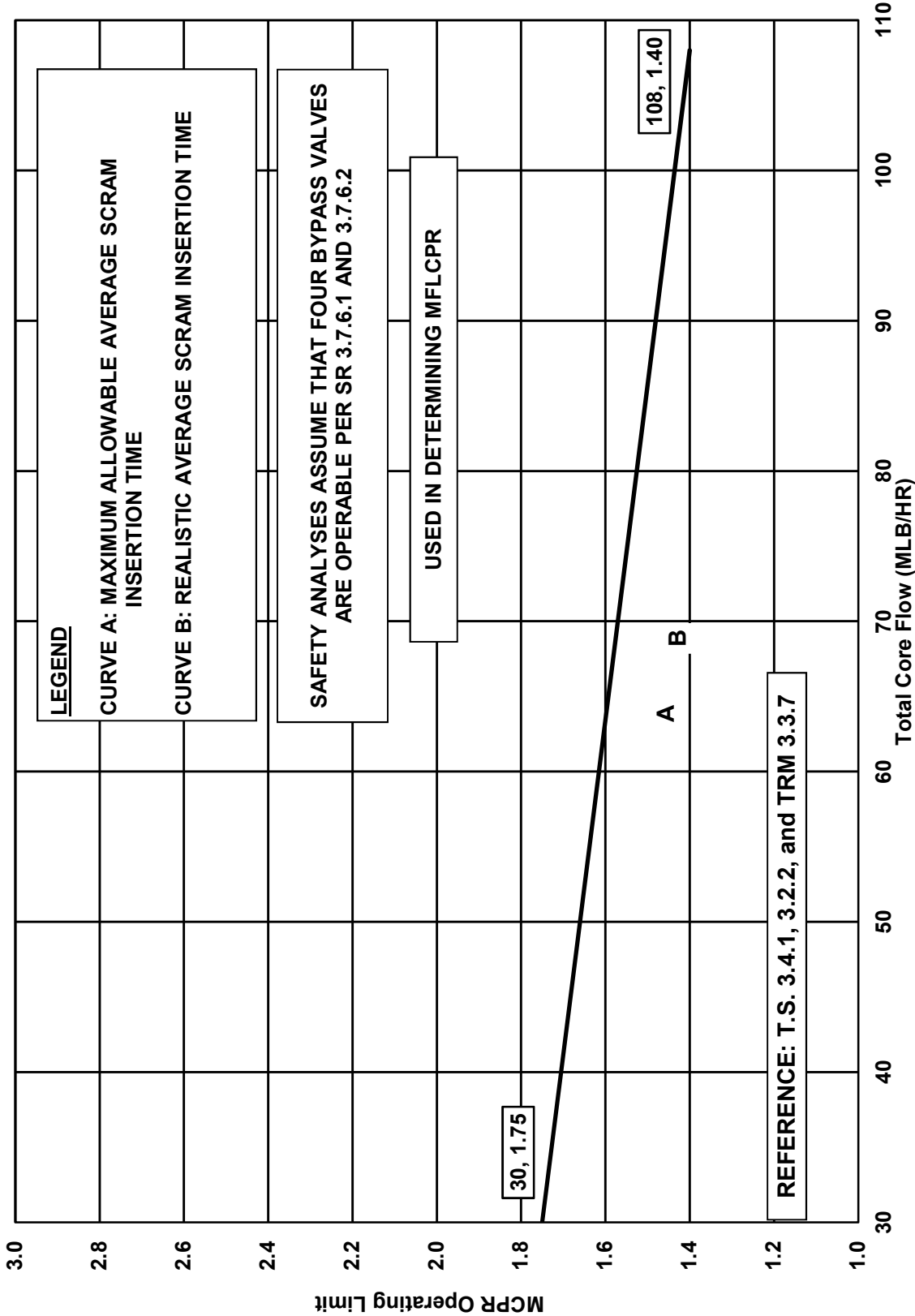
SSS UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
 BACKUP PRESSURE REGULATOR INOPERABLE
 SINGLE LOOP OPERATION (BOC to EOC)
 FIGURE 8.2-9

One TSV or TCV Closed

SSSES UNIT 1 CYCLE 21

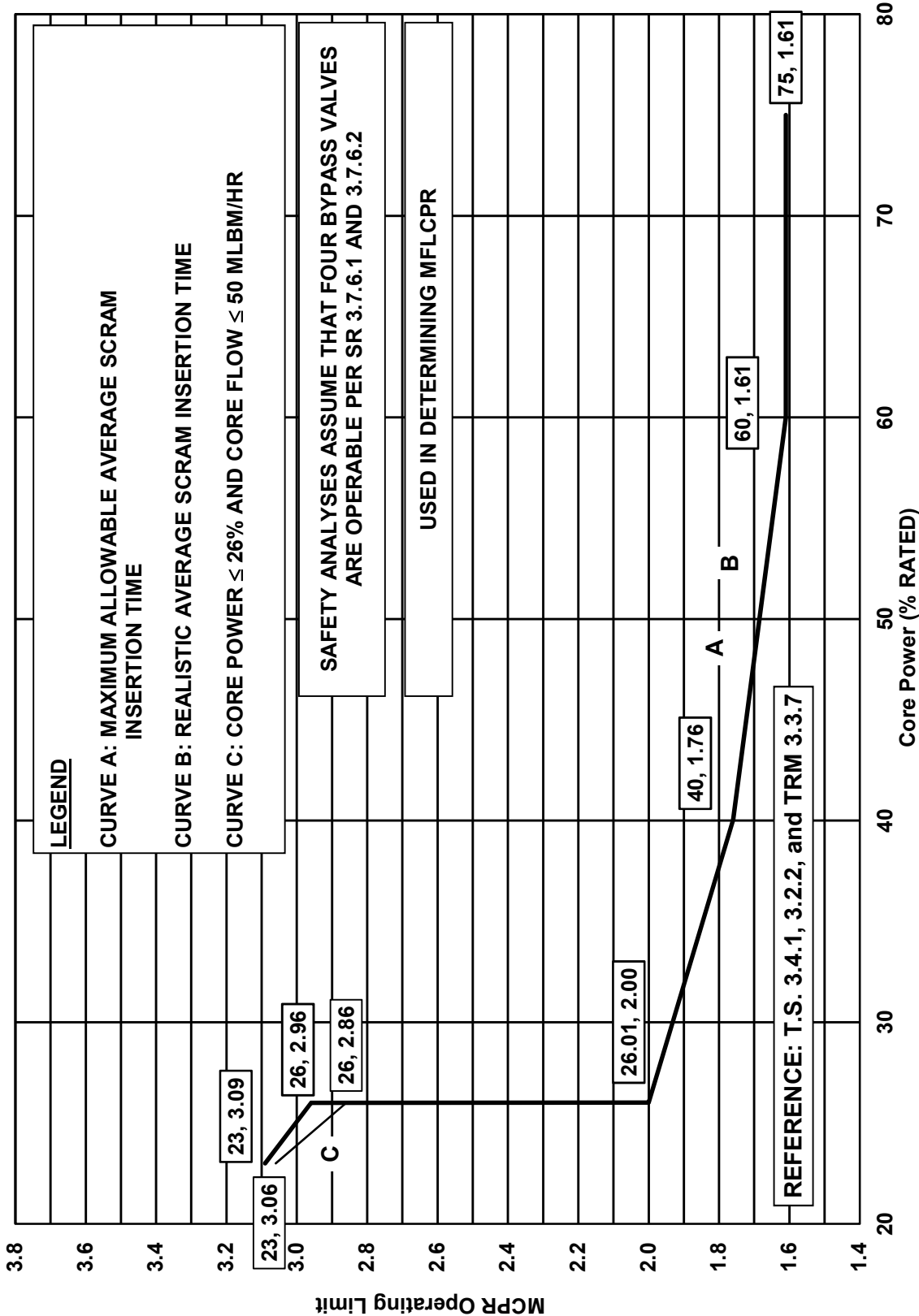


MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
ONE TSV OR TCV CLOSED*
SINGLE LOOP OPERATION (BOC to EOC)

FIGURE 8.2-10

*Operation with one TSV or TCV closed is only supported at power levels $\leq 75\%$ rated power.

SSSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
ONE TSV OR TCV CLOSED
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-11

9.0 **POWER / FLOW MAP**

9.1 References

Technical Specification 3.3.1.1

9.2 Description

Monitor reactor conditions to maintain THERMAL POWER / core flow outside of Stability Regions I and II of the Power / Flow map, Figure 9.1.

If the OPRM Instrumentation is OPERABLE per TS 3.3.1.1, Region I of the Power / Flow map is considered an immediate exit region.

If the OPRM Instrumentation is inoperable per TS 3.3.1.1, Region I of the Power / Flow map is considered an immediate scram region.

Region II of the Power / Flow map is considered an immediate exit region regardless of the operability of the OPRM Instrumentation.

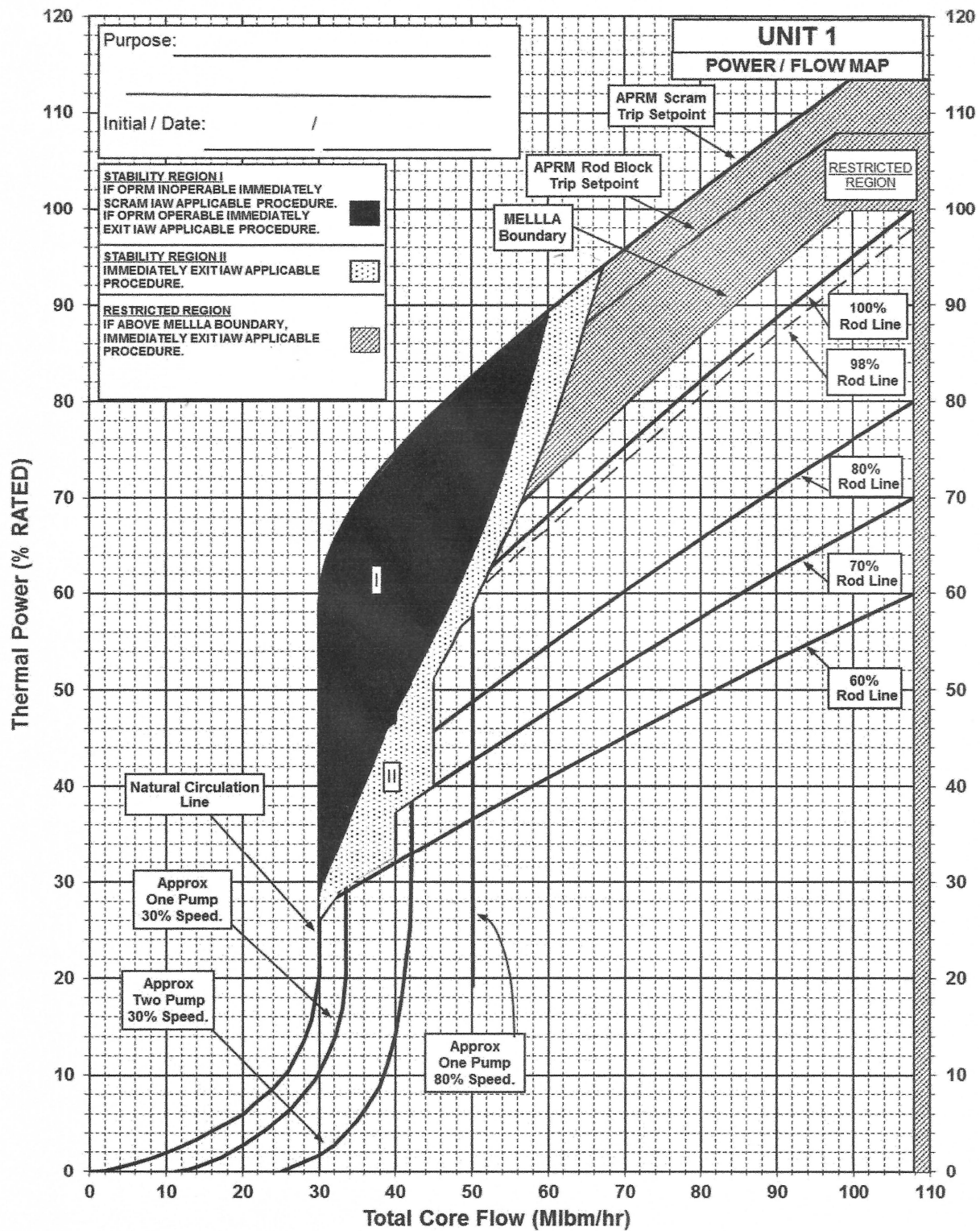


Figure 9.1
SSES Unit 1 Cycle 21 Power / Flow Map

10.0 OPRM SETPOINTS

10.1 References

Technical Specification 3.3.1.1

10.2 Description

Setpoints for the OPRM Instrumentation are established that will reliably detect and suppress anticipated stability related power oscillations while providing a high degree of confidence that the MCPR Safety limit is not violated. The setpoints are described in Section 2.0 and are listed below:

$$S_P = 1.11$$

$$N_P = 15$$

$$F_P = 60 \text{ Mlbm / hr}$$

11.0 REFERENCES

- 11.1 The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:
1. XN-NF-81-58(P)(A), Revision 2 and Supplements 1 and 2, "RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model," Exxon Nuclear Company, March 1984.
 2. EMF-2361(P)(A), Revision 0, "EXEM BWR-2000 ECCS Evaluation Model," Framatome ANP, May 2001.
 3. EMF-2292(P)(A), Revision 0, "ATRIUM™-10: Appendix K Spray Heat Transfer Coefficients," Siemens Power Corporation, September 2000.
 4. XN-NF-84-105(P)(A), Volume 1 and Volume 1 Supplements 1 and 2, "XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis," Exxon Nuclear Company, February 1987.
 5. XN-NF-80-19(P)(A), Volume 1 and Supplements 1 and 2, "Exxon Nuclear Methodology for Boiling Water Reactors: Neutronic Methods for Design and Analysis," Exxon Nuclear Company, March 1983.
 6. XN-NF-80-19(P)(A), Volumes 2, 2A, 2B, and 2C "Exxon Nuclear Methodology for Boiling Water Reactors: EXEM BWR ECCS Evaluation Model," Exxon Nuclear Company, September 1982.
 7. XN-NF-80-19(P)(A), Volume 3 Revision 2 "Exxon Nuclear Methodology for Boiling Water Reactors Thermex: Thermal Limits Methodology Summary Description," Exxon Nuclear Company, January 1987.
 8. XN-NF-80-19(P)(A), Volume 4, Revision 1, "Exxon Nuclear Methodology for Boiling Water Reactors: Application of the ENC Methodology to BWR Reloads," Exxon Nuclear Company, June 1986.
 9. XN-NF-85-67(P)(A), Revision 1, "Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel," Exxon Nuclear Company, Inc., September 1986.
 10. ANF-524(P)(A), Revision 2 and Supplements 1 and 2, "Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors," November 1990.
 11. NE-092-001A, Revision 1, "Licensing Topical Report for Power Uprate With Increased Core Flow," Pennsylvania Power & Light Company, December 1992 and NRC SER (November 30, 1993).
 12. ANF-89-98(P)(A) Revision 1 and Supplement 1, "Generic Mechanical Design Criteria for BWR Fuel Designs," Advanced Nuclear Fuels Corporation, May 1995.

13. EMF-2209(P)(A), Revision 3, "SPCB Critical Power Correlation," AREVA NP, September 2009.
14. EMF-85-74(P)(A), Revision 0, Supplement 1(P)(A) and Supplement 2(P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model," Siemens Power Corporation, February 1998.
15. EMF-2158(P)(A), Revision 0, "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/Microburn-B2," Siemens Power Corporation, October 1999.
16. EMF-CC-074(P)(A), Volume 4, Revision 0, "BWR Stability Analysis - Assessment of STAF with Input from MICROBURN-B2," Siemens Power Corporation, August 2000.
17. NEDO-32465-A, "BWROG Reactor Core Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996.
18. ANF-913(P)(A), Volume 1 Revision 1 and Volume 1 Supplements 2, 3, and 4, "COTRANSA2: A Computer Program for Boiling Water Reactor Transient Analyses," Advanced Nuclear Fuels Corporation, August 1990.
19. ANF-1358(P)(A), Revision 3, "The Loss of Feedwater Heating Transient in Boiling Water Reactors," Framatome ANP, September 2005.