

07-202-01

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT NUCLEAR STATION UNIT 2
OPERATING PROCEDURES

N2-OP-95A

REVISION 02

ROD WORTH MINIMIZER SYSTEM

THIS PROCEDURE IS SAFETY-RELATED

Approved By:
R. B. Abbott

~~FOR INFORMATION ONLY~~
R. B. Abbott
Plant Manager, Unit 2

11/14/90
Date

THIS REVISION IS A GENERAL REWRITE
THIS REVISION SUPERSEDES TCN-1 THROUGH 5

Effective Date: 11/20/90

NOT TO BE USED AFTER November 1992
SUBJECT TO PERIODIC REVIEW

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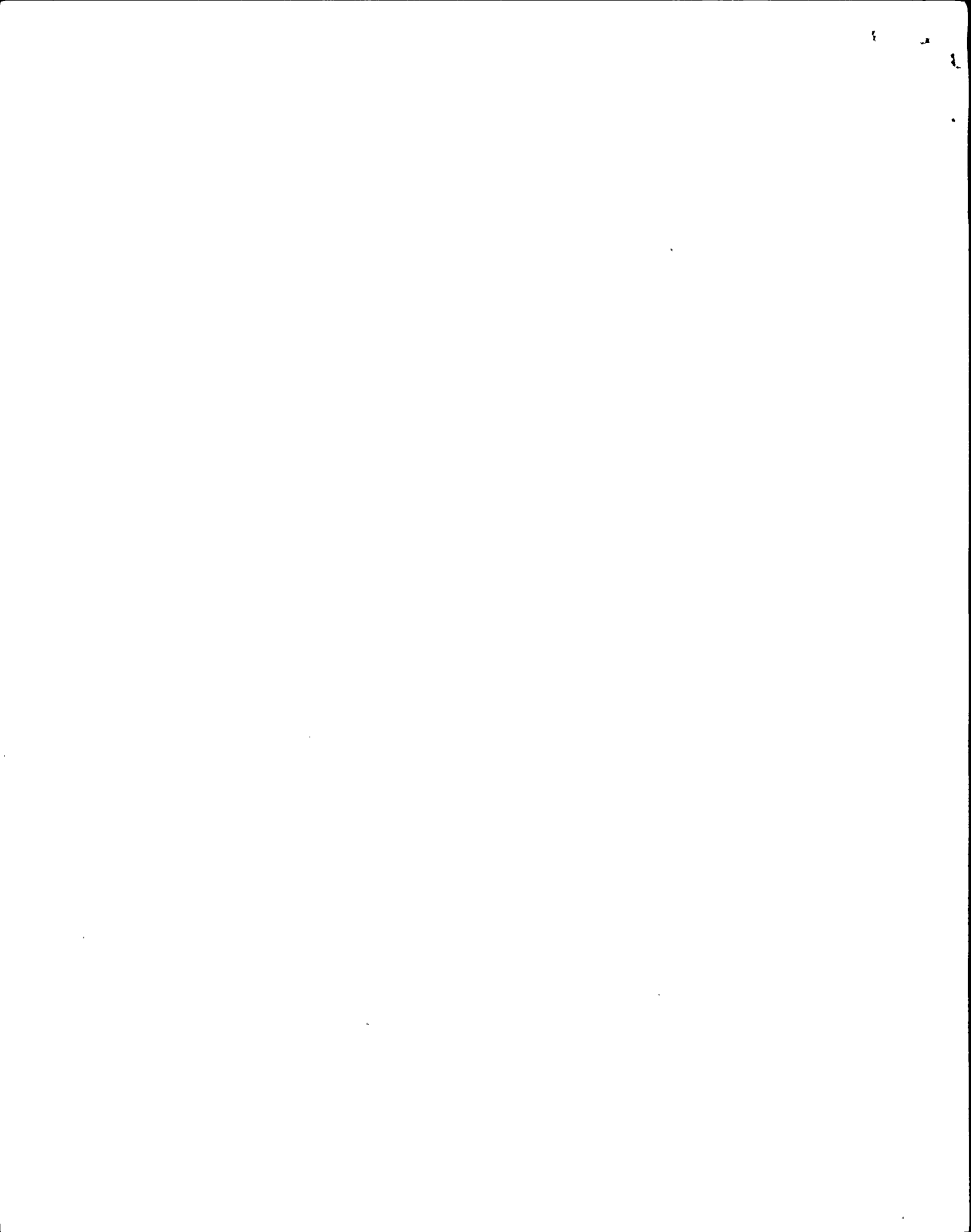


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A. REFERENCES AND COMMITMENTS

1.0 Technical Specifications

1.1 3.1.4.1, ROD WORTH MINIMIZER

2.0 Licensee Documentation

Updated Safety Analysis Report, USAR

2.1 Vol. 16, Section 7.7.1.1, Reactor Manual Control System -
Instrumentation and Control

2.2 Vol. 27, Section 15.4.1.2, Continuous Rod Withdrawal During
Reactor Startup

3.0 Standards, Regulations and Codes

None

4.0 Policies, Programs and Procedures

None

5.0 Technical Information

5.1 Flow Diagrams

None

5.2 Electrical Diagrams

General Electric Drawings:

791E406TY Sheet 1, Rev. (0007.221-001-01 2AA), React. Manual
Cont.

5.3 Vendor Manuals

5.3.1 GEK-83320A June 1985, Reactor Manual Control System,
Operation and Maintenance Instructions

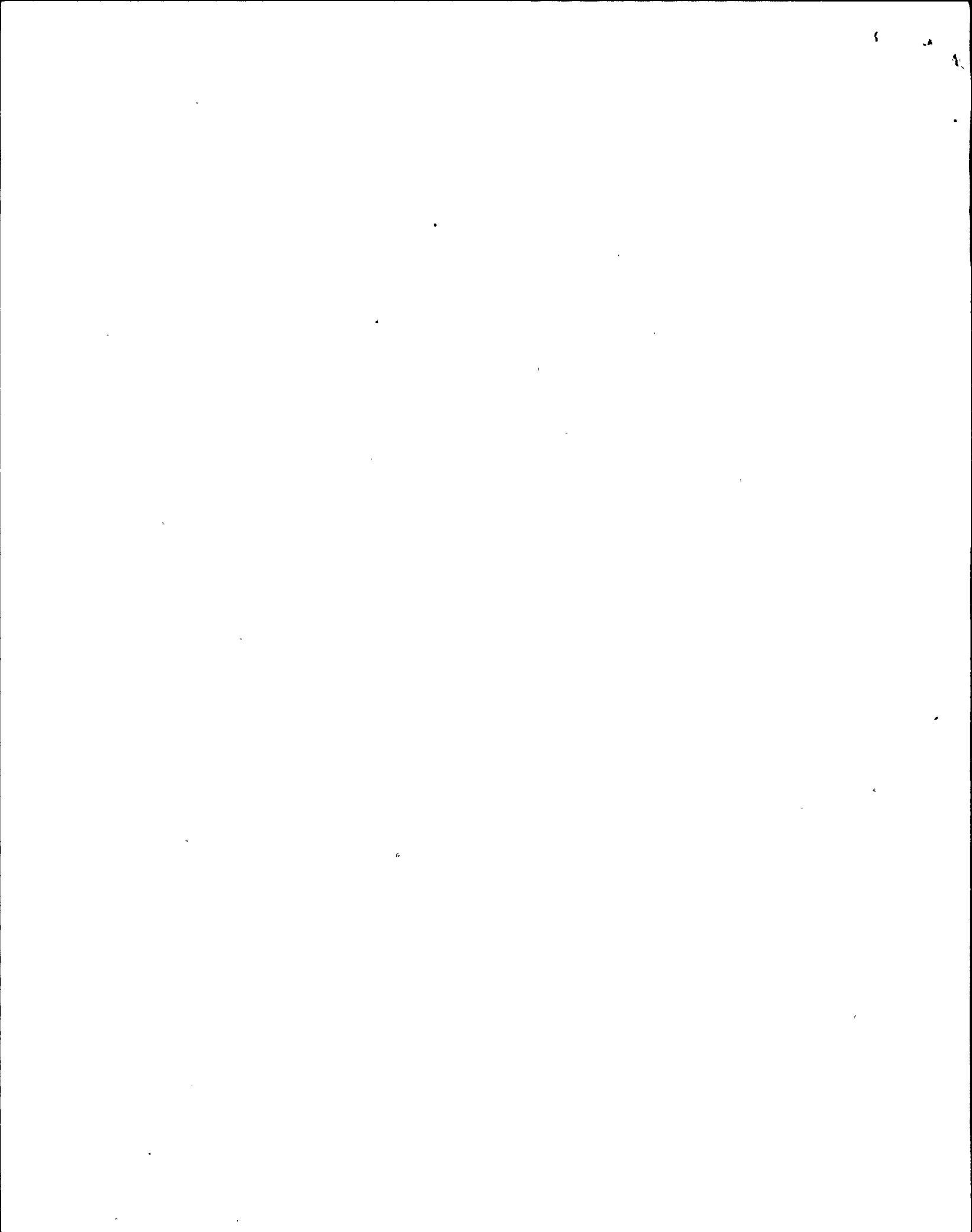
5.3.2 GEK-97082, Operation and Maintenance Instructions

5.4 System Instruction Manuals

None

6.0 Supplemental References

None



A. REFERENCES AND COMMITMENTS (Cont)

7.0 Commitments

<u>Sequence Number</u>	<u>NCTS Number</u>	<u>Description</u>
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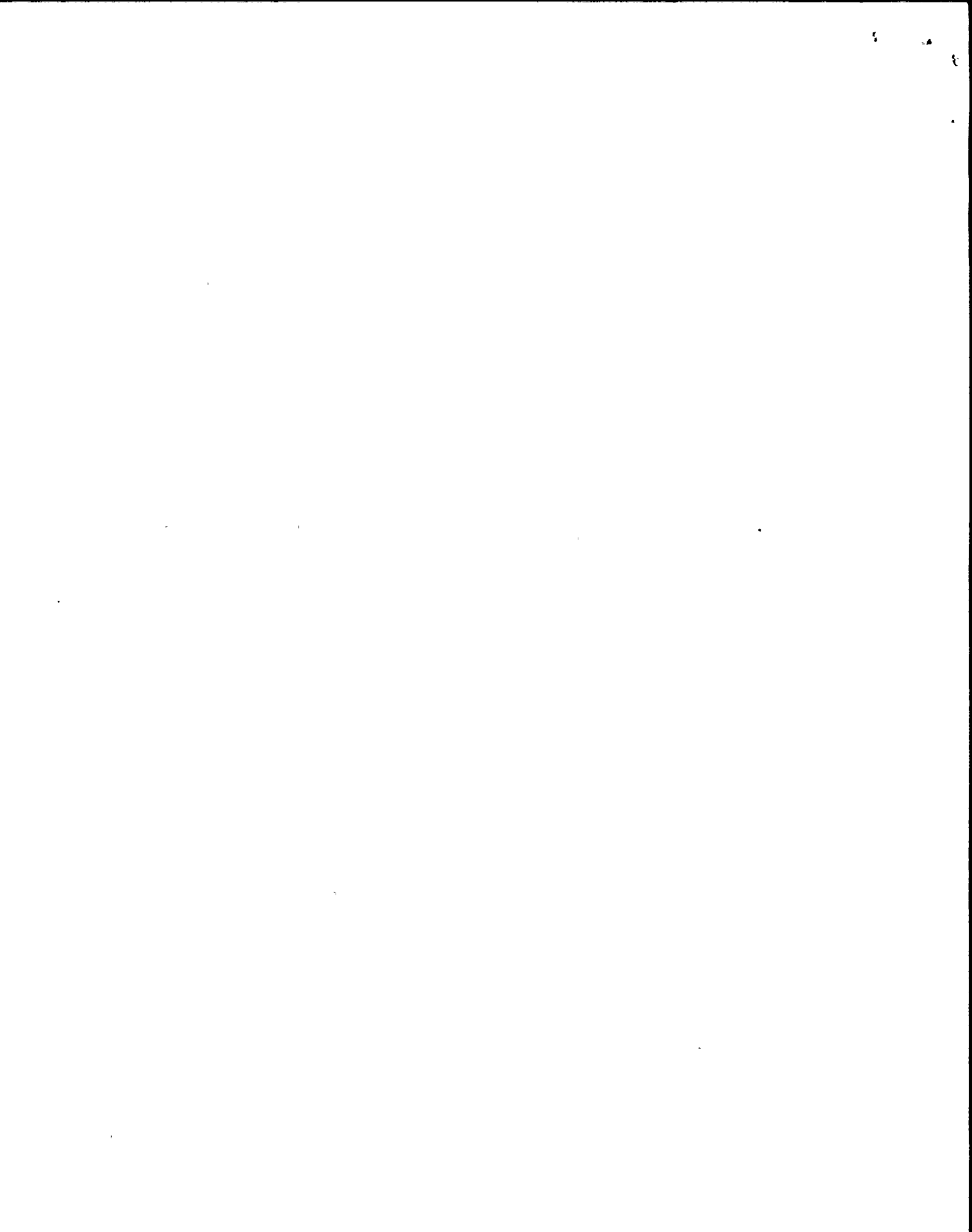
None

B. SYSTEM DESCRIPTION

The Rod Worth Minimizer (RWM) is intended to mitigate the effect of a postulated rod drop accident below the Low Power Set Point (LPSP) by limiting the peak fuel enthalpy to less than 280 cal/gram. A rod drop accident is defined as the unlikely event that a stuck control rod previously separated from its control rod drive, suddenly exits the core. To limit the worth of a control rod and improve fuel efficiency, specially designed motion sequences are formulated which designate the rod to be moved and positioned. The RWM monitors rod motion in the LPSP region, 0 to 20% Reactor power and if deviation from the selected sequence is detected, applies the appropriate constraint. A Low Power Alarm Point (LPAP) or transition region between 20 and 30% is provided to identify errors in approach to the LPSP but rod blocks are not applied. This is because at power levels above the LPSP the worth of a single rod is not large enough to generate fuel damaging heat flux.

Sequences are designed to conform to the Banked Position Withdrawal Sequence and other operating constraints. They define the movement of all rods from the full in to the full out position. Sequences are generated in the interfacing computer facility (3-D MONICORE) and are downloaded to the NUMAC RWM for operation. The maximum installed RWM sequences are 4. If a fifth sequence is desired the sequence being removed must first be identified. A RWM sequence includes up to 10 groups of rods and are usually divided into subgroups which are moved between insert and withdraw limits. Each group is uniquely defined and identified by a four letter alphanumeric name. The rods contained in the 10 RWM groups are the same as those in the 10 RSCS groups. (i.e. Group 1 RWM is the same as group 1 RSCS, group 2 the same as RSCS group 2) The 10 groups are each capable of containing 16 subgroups for a total of 160 subgroups. The step identifies the group or subgroup of rods which are to be moved and the insert and withdraw limits imposed in that step.

The systems supporting the RWM to enforce control rod motion conformance to a rod motion sequence are the interfacing computer facility. It provides a terminal interface for control rod sequence generation and loading. A power level input from the Feed Water Control System provides the signal for the LPSP and LPAP. Rod Position Information System (RPIS) provides required rod position information. Interfaces with the Rod Drive Control System (RDCS) provide status, insert and withdraw permissives and rod blocks by withholding permissives. It also applies rod blocks if the RWM is INOP. An Alarm Display provides operators with output messages and a printed hard copy.



B. SYSTEM DESCRIPTION (Cont)

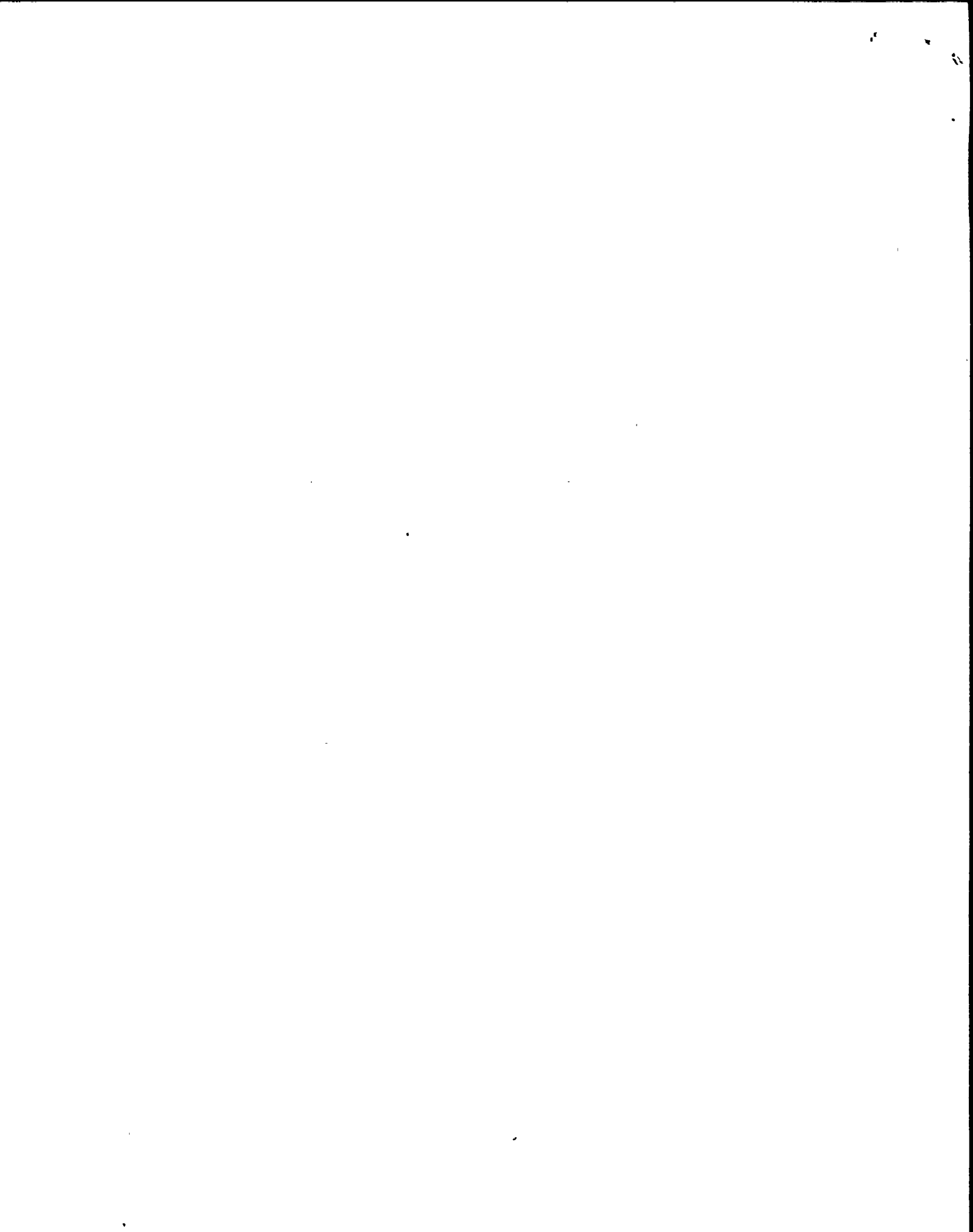
When the operator selects one of the sequences installed and proceeds to move any of the rods which conform to that sequence, the RPIS inputs position information to the RWM. When the selected rod reaches the RWM insert or withdraw limit rod motion is terminated by the RDCS. If an Operator selects a rod not a member of the group of rods to be moved in the current step, the RWM applies both insert and withdraw blocks. The RWM will allow correction of one notch error if a rod overruns a limit, the resulting rod motion error must be corrected as the next rod motion. By depressing the MESSAGES key, the RWM Operator Display will provide Error Messages to identify the Select Error (SE), Withdraw Block (WB) and/or Insert Block (IB) as appropriate. The RWM rod block is automatically bypassed above the LPSP but the RWM will continue to provide deviation display and annunciation until power exceeds the LPAP.

The two major RWM hardware components are the Computer Display (Computer Chassis) located at the RPIS rack and the Operator Display Assembly located at the Operators benchboard at panel P603. Both Computer Display and Operator Display have a keylock mode switch and a electroluminescent display screen. The Computer Display has a two position switch, OPER and INOP while the Operator Display has a three position switch, Operate, Test and Bypass. Both display screens are divided into three sections, upper, mid and lower level. The upper level provides computer information, Seq. selected, current step, number and type of error, etc. The Mid section provides identity of the errors, Seq. and step and responses to operator request, ALL RODS IN, etc. The lower level indicates the four Softkey functions. Because the functions of the keys vary with the RWM operating mode, the keys have no fixed name function, therefore, they are referred to as "Softkey". The Computer has two additional key pads, Cursor and Data, numerical which provide the ability to change the set parameters when the keylock switch is placed in INOP. The Operator Display is the only location substitute position can be installed and then only if conditions allow.

OPERATE MODE

The following shows the display that will be predominantly used and seen while in the Operate Mode.

SELF-TEST: OK		SEQUENCE: A1 BPWS	MODE: OPERATE
BLOCKS: INSERT WITHDRAW		STEP: 145	POWER: BELOW LPSP
S R	N O N E	I B	W B
		A 1	- 1 4 5
HELP	DISPLAY OFF	ETC	



B. SYSTEM DESCRIPTION (Cont)

The top of the display gives the self-test status, sequence name, Banked Position Withdrawal Sequence (BPWS) status of the sequence, the computer's mode of operation, present status of the rod motion permissives, step, and power level. The informational format of the top of the display will be the same, regardless of the display, mode, menu or mid-screen selected.

To alert the operator that he has passed the LPSP when going up in power, and that he has passed the LPAP when coming down in power, the power level between the LPSP and LPAP will be displayed as TRANSITION (and will always be displayed in inverse video characters).

The mid-display format shown above is the 'default' Operate mode mid-display. It will be displayed when entering the Operate mode and whenever the display turns on while in the Operate mode. If other displays are selected, this display will return to the screen after they are exited.

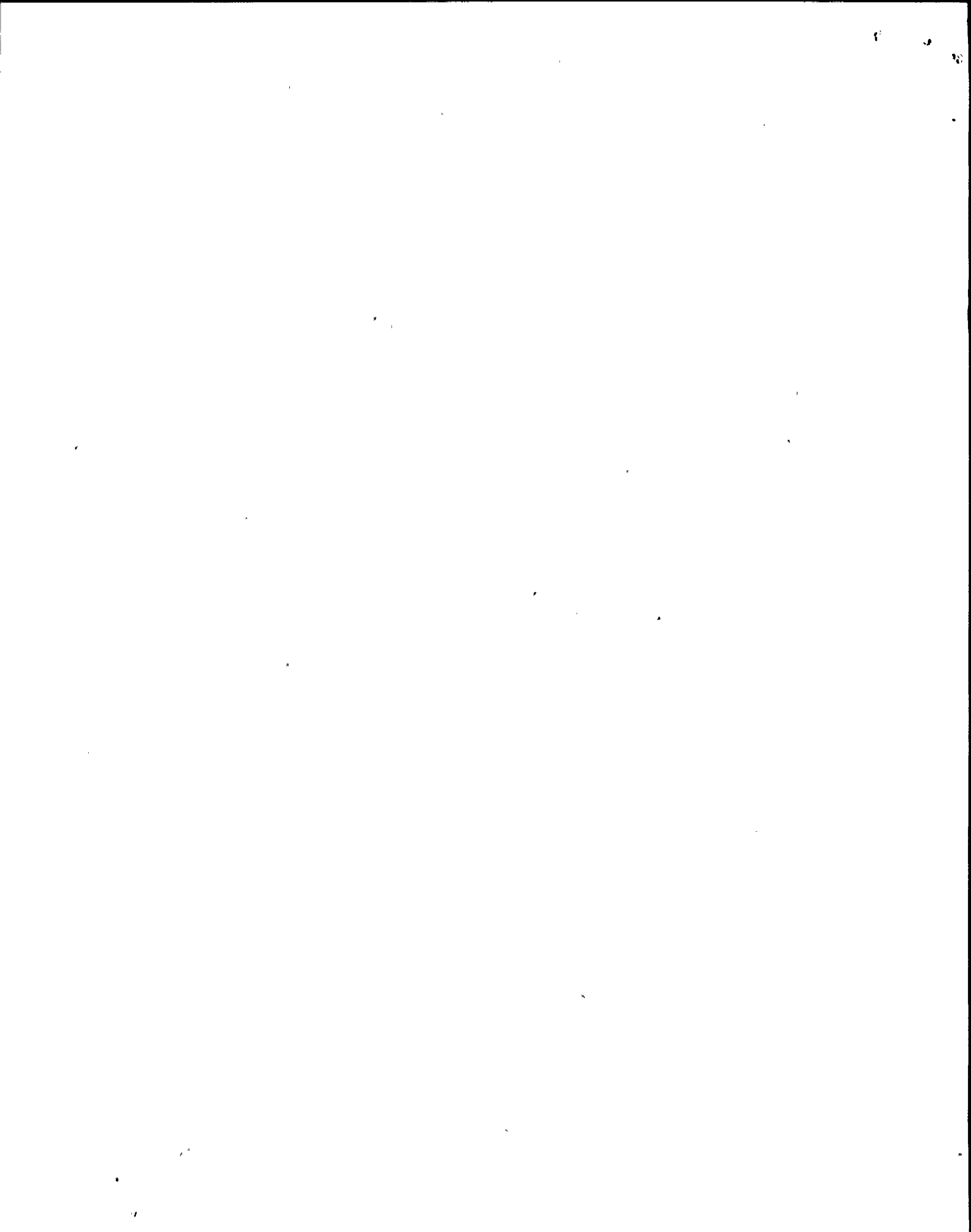
The following shows the 'worst case' Operate Mode display. This is shown to discuss the various display attributes and nomenclature.

SELF-TEST: OK		SEQUENCE: A1 BPWS		MODE: OPERATE	
BLOCKS: INSERT WITHDRAW		STEP: 145		POWER: BELOW LPSP	
SR	2 2 - 1 1 : 0 8	SE	IB	WB	
WE	2 6 - 1 5 : 1 2		A 1 -	1 4 5	
IE	3 4 - 1 9 : 1 4				
				IE 02-23:12	
				IE 30-27:24	
	HELP		DISPLAY OFF		ETC

SR defines the Selected Rod; the selected rod's coordinates and position (or the words NONE - if no rod is selected) will always follow the SR label. If the rod is at an invalid position and a substitute position has been provided the position indication will be in inverse video.

SE indicates that the selected rod is not contained in the current step. If the selected rod is in the current step then this field will be blank.

IB and WB define the status of the selected rod. IB and WB indicate an Insert Block or a Withdraw Block, respectively. If any of the conditions are not true, the symbol will not be there.



B. SYSTEM DESCRIPTION (Cont)

WE defines the rod with a Withdraw Error. If no withdraw error exists, the WE will not be displayed. If a Withdraw Error does exist, WE will be displayed followed by the coordinates and the position of the rod.

The large IE defines the most recent rod (if more than one) with an Insert Error. If no insert error exists the IE will not be displayed. If an Insert Error does exist, IE will be displayed followed by the coordinates and the position of the rod.

The two smaller IEs define possible second (top) and third (bottom) rod Insert Errors. If they exist, either one or both IEs will be present, followed by the coordinates of the rods with their positions.

The present operating sequence and step are also displayed in the mid-display area. In this example the sequence name is 'A1' and the step is '145'.

OPERATE MODE CAPABILITIES

The following functions may be performed in the OPERATE mode:

ROD BYPASS OPTIONS: The Bypassed rods may be displayed at either display.

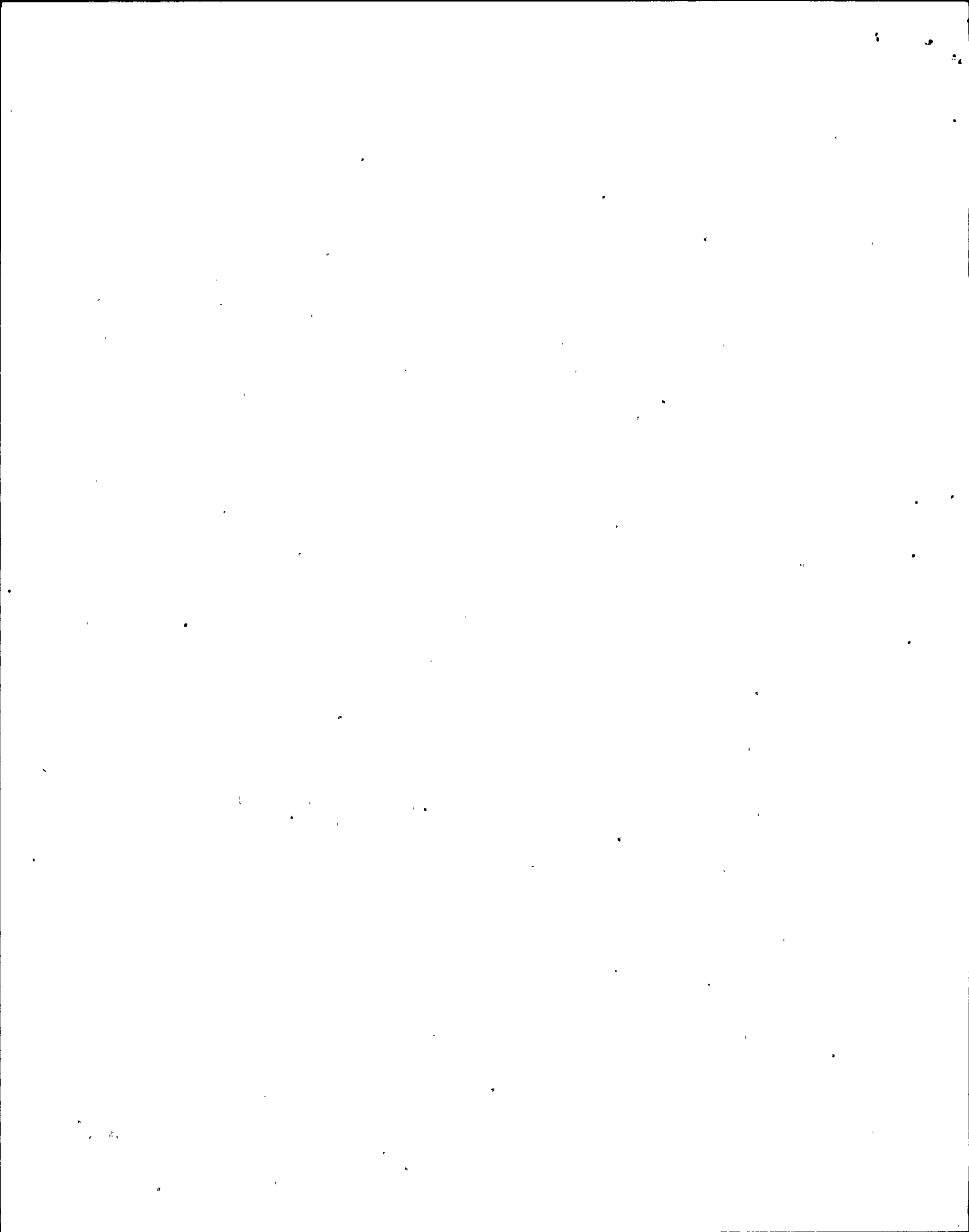
CONFIRM SHUTDOWN: This function determines if all control rods have been fully inserted into the core and if the shutdown confirmation criteria has been satisfied.

DISPLAY OFF: The display on either the RWM Computer of the Operator's Display Assembly may be turned off at any time. Under certain conditions, the display will automatically turn itself back on.

HELP: Displays information about the possible softkey selections.

MESSAGES: The last five status messages and the current reason for any block may be displayed.

RAPID POWER REDUCTION: This function displays the required control rod motions to quickly reduce power in response to an abnormal condition. This display is only available at the Operator display.



B. SYSTEM DESCRIPTION (Cont)

- ROD DRIFT: Provides a list of drifting rods and allows the drift to be reset if all rods are at a valid position. This function is only available at the operator's display in OPERATE and BYPASS modes.
- ROD TIMING MONITOR: Rod timing data is presented for the selected rod while it is driving. The timing data can also be recorded and a timing profile plotted on the NUMAC display. The function is available from the top level softkey menus in OPERATE and BYPASS mode. It is available as a sub-function to the ROD TEST function while in TEST mode.
- SELF-TEST: Self-Test operations may be observed only on the RWM Computer Display.
- SEQUENCE ALIGNMENT: This function displays the control rod motions required to obtain the rod pattern for a specific step in the operating sequence. This function is only available if the power level is above the LPSP at the Operator's display.
- SUBSTITUTE OPTIONS: Rods with substituted positions may be shown at both the RWM Computer Display and the Operator's Display. Rod positions may be substituted only at the Operator's Display Assembly.

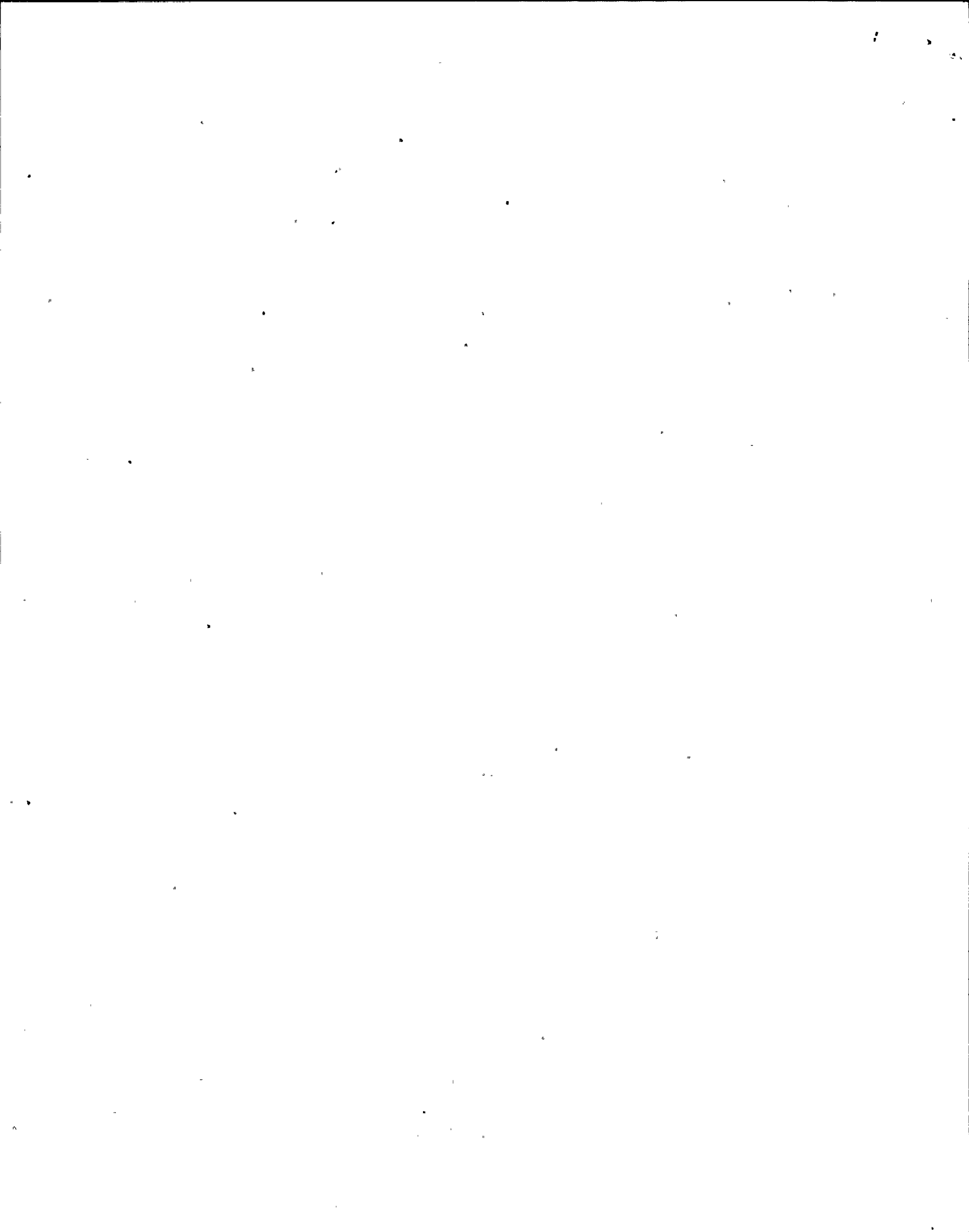
Attachment 4 is a list of first level menus for the Operate mode.

INOP MODE

The following shows the display when the INOP mode is selected.

SELF-TEST: OK	SEQUENCE: A1 BPWS	MODE: INOP
BLOCKS: INSERT WITHDRAW	STEP: 323	POWER: ABOVE LPAP
HELP	DISPLAY OFF	ETC

The format of the top of the display is identical to that seen in the other modes. The self-test status, power level, mode, sequence, step, and any blocks applied against the selected rod will be shown.



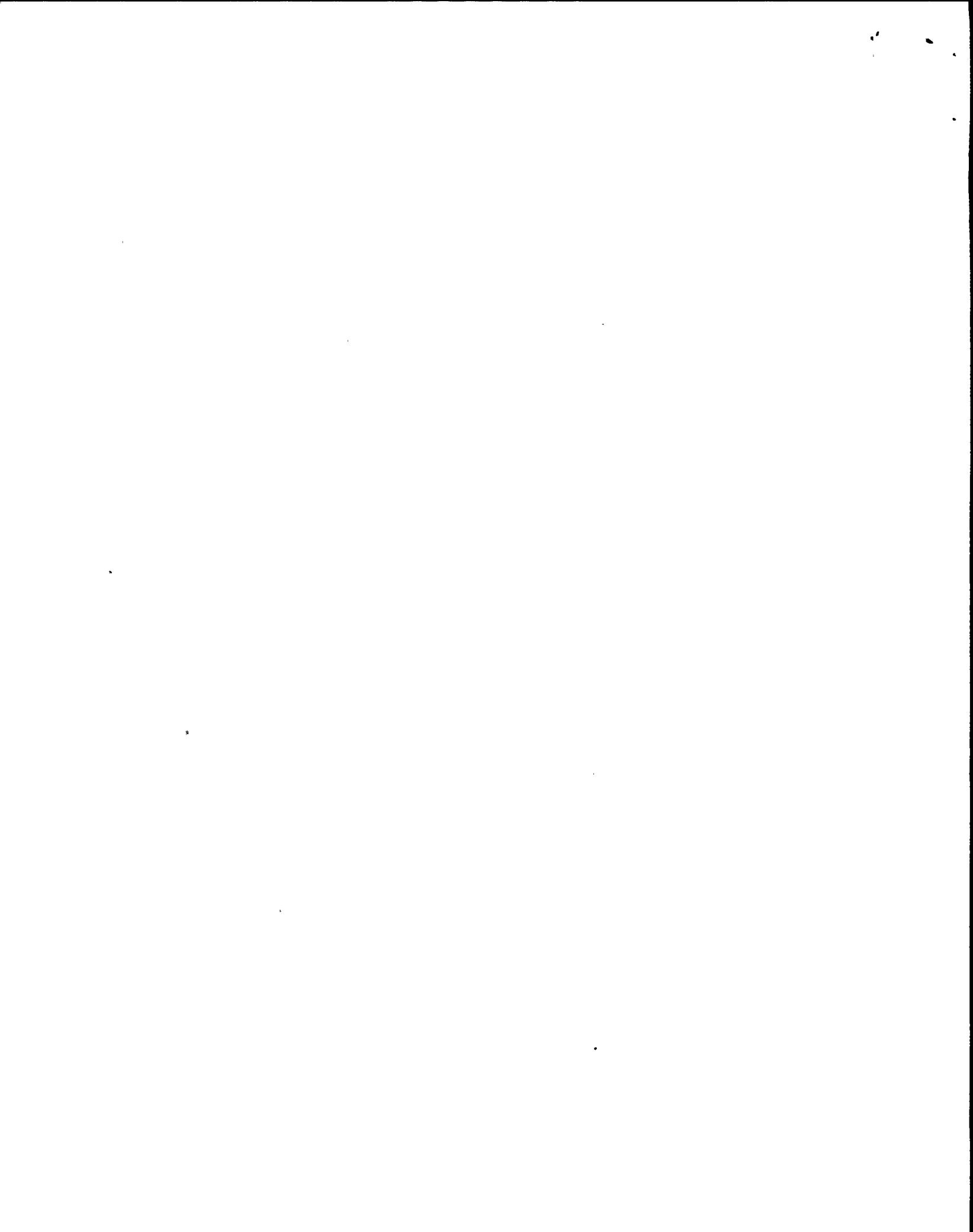
B. SYSTEM DESCRIPTION (Cont)

INOP MODE CAPABILITIES

The following functions may be performed in the INOP mode:

- ROD BYPASS OPTIONS: Bypassed rods may be shown at either display. Rods may be bypassed (removed from the RWM sequence enforcement calculations) or un-bypassed (returned to the RWM sequence enforcement calculations) from the Computer Display only.
- CHECK DISPLAY: The display may be checked via a user-interactive test.
- CHECK KEYS: The front panel pushbuttons may be tested via a user-interactive test.
- DISPLAY OFF: The display may be turned off at any time. Under certain conditions, the display will automatically turn itself back on.
- MESSAGES: The last five status messages and the current reason for any block may be displayed.
- HELP: Displays information about the possible softkey selections.
- SELF-TEST: Self-Test operations may be manually controlled and observed only from the Computer Display.
- SEQUENCE OPTIONS: The present sequence may be changed, new sequences may be downloaded, or the contents of available sequences may be displayed only from the Computer Display.
- SET PARAMETERS: The present user parameters may be displayed or altered at the Computer Display only.
- SUBSTITUTE OPTIONS: Rods with substituted positions may be shown at either display.

Attachment 4 is a list of first level menus for the INOP mode.



B. SYSTEM DESCRIPTION (Cont)

TEST MODE

The following shows the display when the TEST mode is selected.

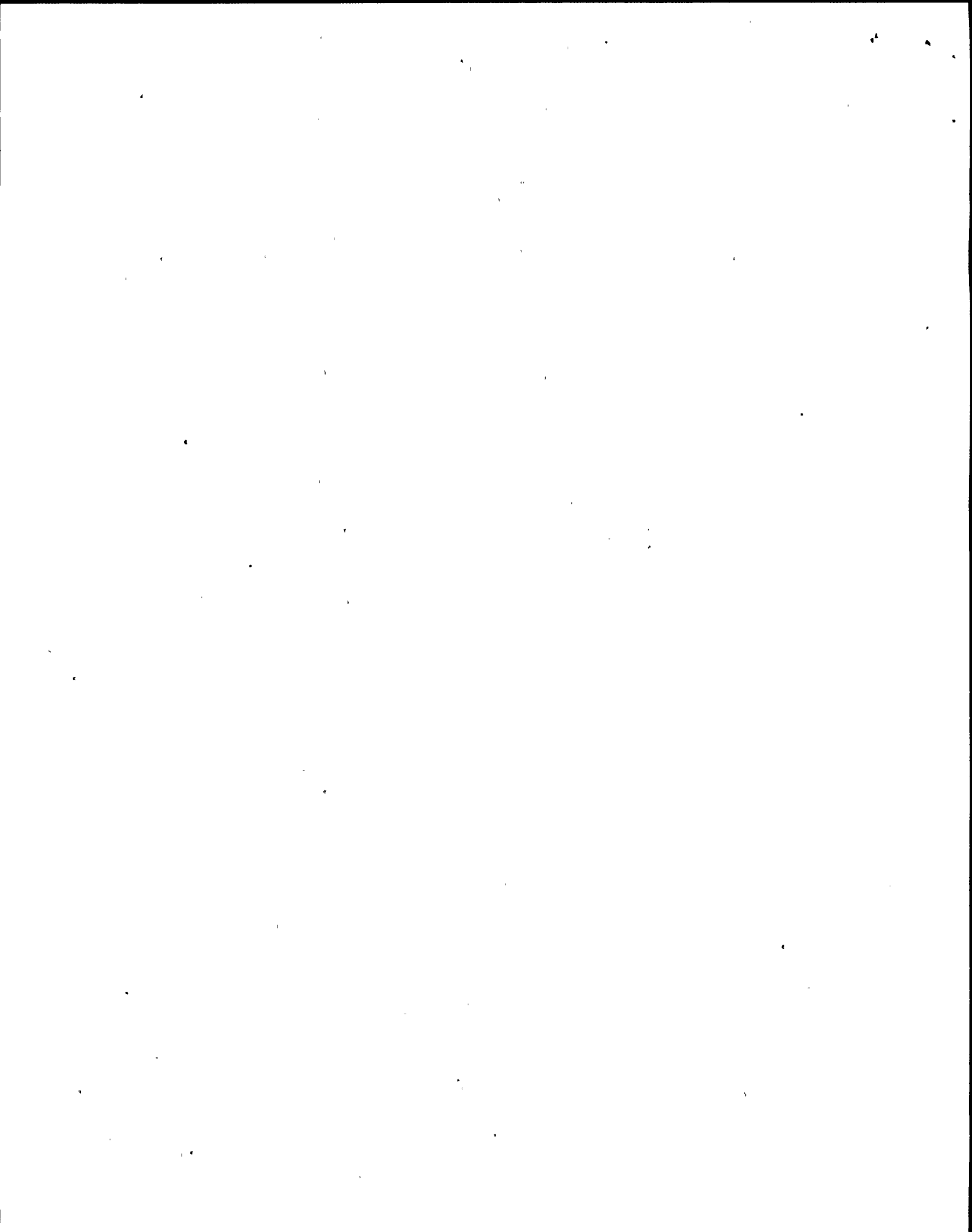
SELF-TEST: OK	SEQUENCE: A1 BPWS	MODE: TEST
BLOCKS: INSERT WITHDRAW	STEP: 323	POWER: ABOVE LPAP
HELP	DISPLAY OFF	ETC

The format of the top of the display is identical to that seen in the other modes. The self-test status, power level, mode, sequence, step, and any blocks applied against the selected rod will be shown.

TEST MODE CAPABILITIES

While in the TEST mode the following may be performed:

- ROD BYPASS OPTIONS: From either display the bypassed rods may be shown.
- CONFIRM SHUTDOWN: This function determines if all control rods have been fully inserted into the core and if the shutdown confirmation criteria has been satisfied.
- DISPLAY OFF: The display may be turned off at any time. Under certain conditions, the display will automatically turn itself back on.
- MESSAGES: The last five 'system' status messages and the current reason for any block may be displayed.
- HELP: Displays information about the possible softkey selections.
- ROD TEST: When permissible, the rod test may be performed from the Operator's Display only.
- SELF-TEST: The Self-test operations may be observed only at the Computer Display.



B. SYSTEM DESCRIPTION (Cont)

ROD TIMING MONITOR: Rod timing data is presented for the selected rod while it is driving. The timing data can also be recorded and a timing profile plotted on the NUMAC display. This function is only available at the operator's display in OPERATE, BYPASS and TEST modes. The function is available from the top level softkey menus in OPERATE and BYPASS mode. It is available as a sub-function to the ROD TEST function while in TEST mode.

SHUTDOWN MARGIN TEST: When permissible, the shutdown margin test may be performed from the Operator's Display.

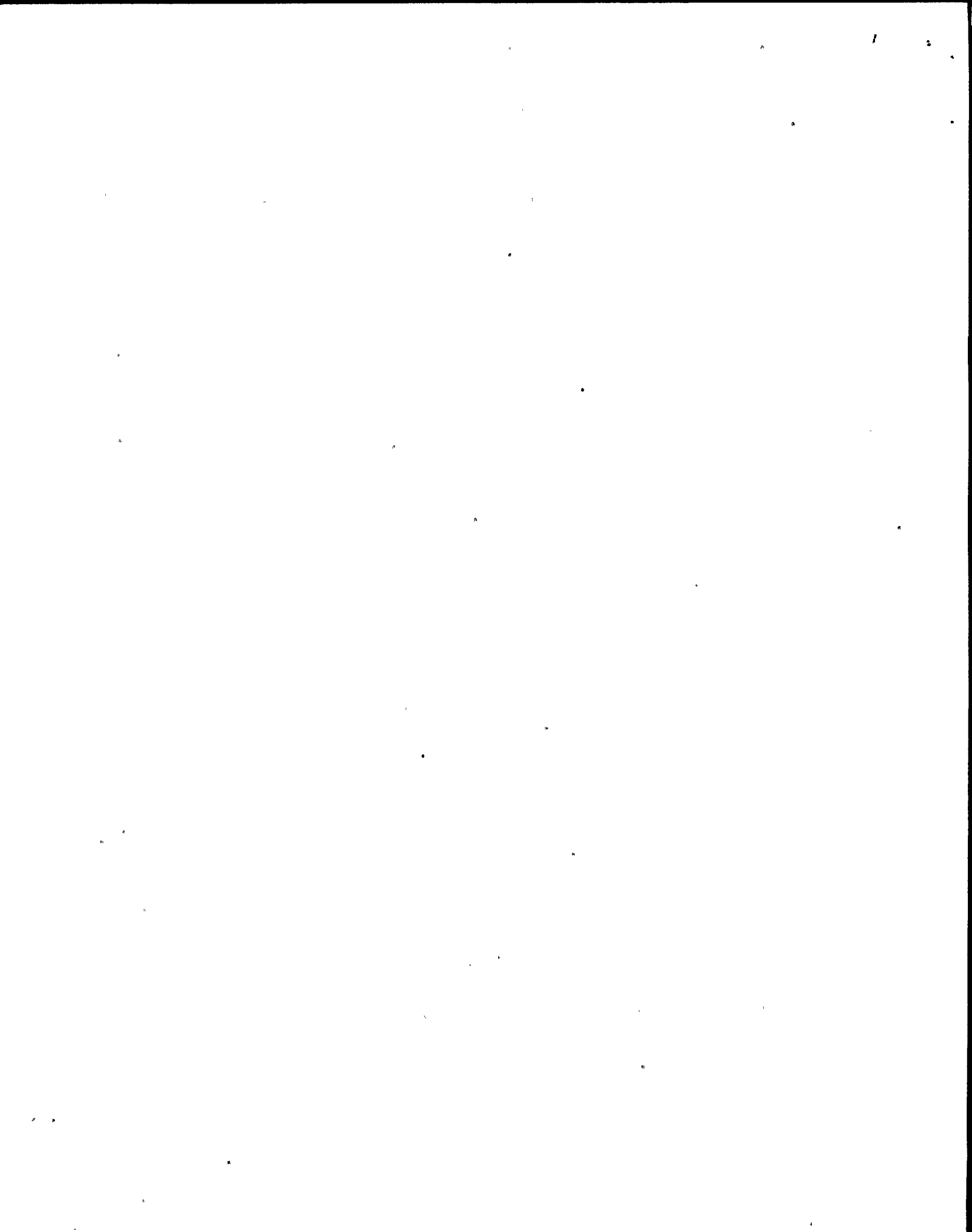
SUBSTITUTE OPTIONS: Rods with substituted positions may be shown at either display. Rod positions may be substituted from the Operator's Display only.

Attachment 4 is a list of first level menus for the TEST mode. The function will be dependent upon the Operator or Computer display and the mode of operation.

BYPASS MODE

The similarities and differences between the BYPASS mode and the OPERATE mode are listed below.

1. When the keylock switch is placed in the BYPASS mode, there are additional contacts from the NUMAC RWM that override the outputs in the Rod Select Module.
2. The BYPASS mode menus, displays and functions are identical to the OPERATE mode menus, displays and functions with the exception that the mode will be displayed as BYPASS.
3. The NUMAC RWM will continue to calculate, display and enforce sequence conditions - however the keylock switch contacts will prevent any actual rod blocks from occurring.
4. Self-Test will continue to automatically execute its array of tests.
5. If the keylock switch on the Computer chassis is in the INOP position and the keylock switch on the Operator's chassis is in the BYPASS position, then the computer mode is INOP mode. The Bypass switch provides a hardware bypass to the Rod Select Module so no blocks or annunciation are applied. All INOP mode functions are available in this keylock configuration.



C. OPERATING REQUIREMENTS

1.0 The following systems are required to be in service to support Rod Worth Minimizer operation:

- | | | |
|-----|-----------------------------------|-----------|
| 1.1 | 13.8KV/4160V/600V AC Distribution | N2-OP-71 |
| 1.2 | Process Computer | N2-OP-91 |
| 1.3 | Rod Sequence Control, RSCS | N2-OP-95B |
| 1.4 | Rod Position Information, RPIS | N2-OP-96 |
| 1.5 | Control Rod Drive Hydraulic, CRD | N2-OP-30 |

D. PRECAUTIONS AND LIMITATIONS

1.0 Rod Control Sequence must be loaded using the 3-D MONICORE.

2.0 Rod Insert/Withdraw Sequences should be implemented only with Reactor Analyst concurrence.

3.0 Operation with two insert errors or one withdraw error should be done only with the concurrence of the Reactor Analyst and the Station Shift Supervisor.

4.0 The following Technical Specifications limits apply:

CRD motion with the RWM INOP/Bypassed below 20% Reactor power is permitted provided requirements of Technical Specification Section 3.1.4.1 are met.

5.0 The Rod Worth Minimizer INOP mode can only be selected using the two position Computer Display keylock switch, all other mode selections are made using the three position Operator Display keylock switch.

6.0 When in the operate mode it is necessary to press the EXIT softkey to view available functions.

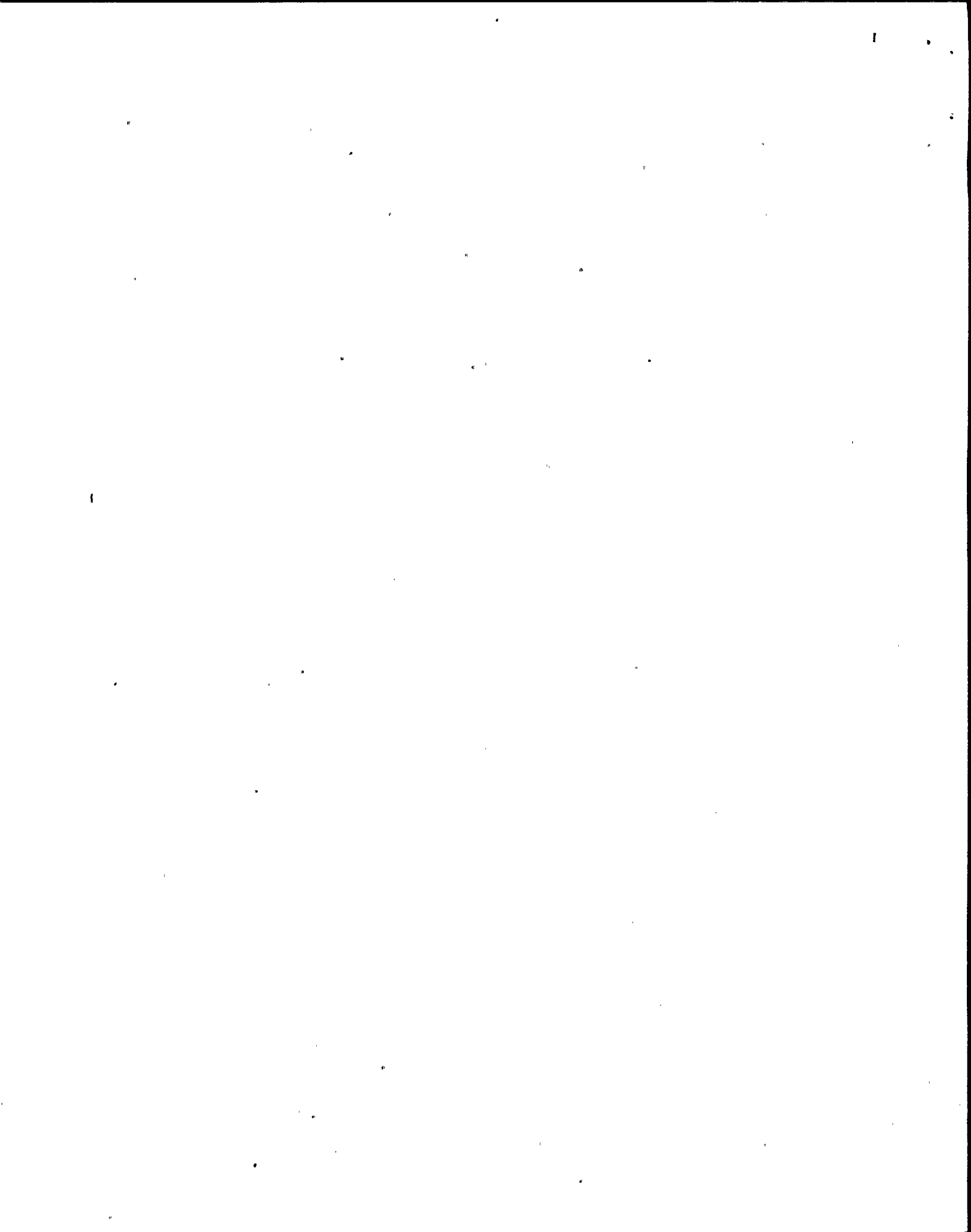
E. STARTUP

1.0 Placing System in Operate

1.1 Perform Attachment 2: Electrical Lineup

1.2 Place the two position Computer Display keylock switch in the OPER position at the RWM Computer Chassis at the Rod Position Information System panel.

TCN-7



E. STARTUP (Cont)

1.3 Place the three position Operator Display keylock switch in the OPER position at panel P603.

1.4 Observe the RWM in Operate using the following Operator Display information at panel P603:

SELF-TEST: OK

SEQUENCE: (selected sequence no.) BPWS

MODE: OPERATE

BLOCKS: INSERT WITHDRAW (if no rod selected)

SR: NONE (if no rod selected)

IB (insert block)

WB (withdraw block)

STEP: 1

POWER: BELOW LPSP

HELP

DISPLAY OFF

ETC

- NOTES:
1. The display automatically shuts off after 30 minutes of stable state conditions. It will automatically turn on when a front panel key is pressed, power going above/below the LPSP or LPAP, system Self Test, or Mode change.
 2. It is recommended the display remain off during periods of inactivity to prolong useful life and can be accomplished by pressing the Display Off softkey.

1.5 Refer to the following attachments as required for additional information:

1.5.1 Attachment 3: Operations Vs. Mode Display for display examples

1.5.2 Attachment 4: Softkey Option Menu for list of options available



E. STARTUP (Cont)

- 1.5.3 Attachment 5: Help Screens for description of Softkey Options Menu
- 1.5.4 Attachment 6: Rod Blocks in LPSP, Transition Region and LPA for list of interlocks

F. NORMAL OPERATIONS

1.0 Confirm Shutdown

NOTE: This SCRAM confirmation function provides indications of All Rods In and a Shutdown Confirmation following a Reactor SCRAM can be requested in the OPERATE, TEST or BYPASS modes using the appropriate softkeys at the Operator Display only.

1.1 Press CONFIRM SHUTDOWN softkey.

NOTE: If one rod is withdrawn to 01 or beyond the indication is NO.

1.2 Observe ALL RODS IN: YES or NO

NOTE: Shutdown is indicated if all rods are insert to or beyond the position N. Position N is any rod position (usually between 00 and 09) determined to be the Shutdown Confirmation Limit. These limits are installed as a SET PARAMETERS function.

1.3 Observe SHUTDOWN: YES or NO indication.

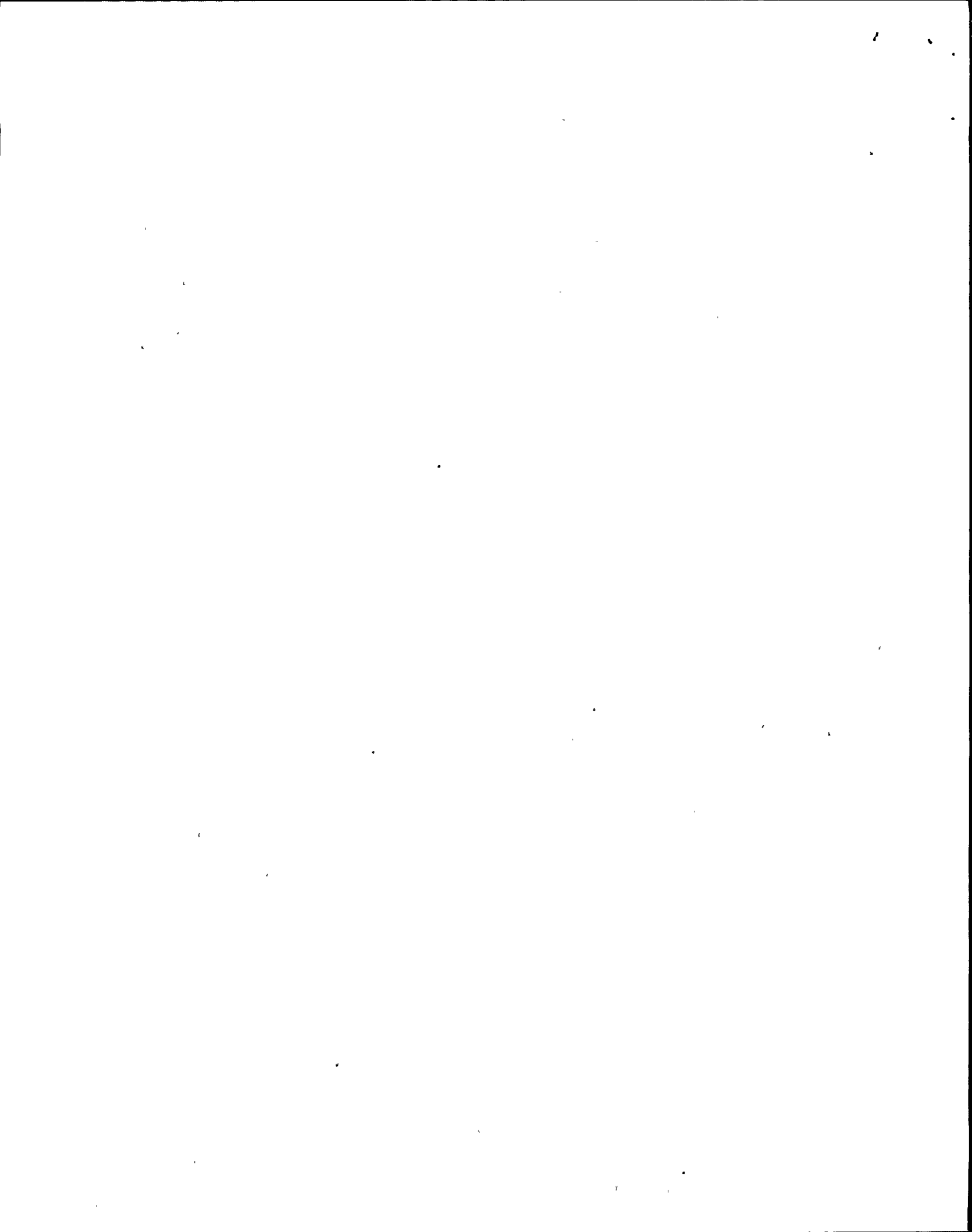
1.4 IF indication is NO THEN observe total number of RODS NOT FULL-IN:

1.5 Press LIST RODS to determine position and identification of rods not full in.

1.6 Notify SSS, refer to N2-EOP-RPV.

1.7 Attempt to insert the NOT FULL-IN control rods.

1.8 Return RHM to the OPERATE mode by pressing the EXIT softkey.



F. NORMAL OPERATIONS (Cont)

2.0 Substitute Position

- NOTES:
1. Substitute Position function is available at the Operator Display in all modes except INOP.
 2. Inferred Position is displayed as the recommended POS TO SUB based on the previous position, travel time and direction of motion.
 3. A total of eight control rods may have substitute positions installed when their position indication is invalid.

2.1 Press EXIT softkey.

2.2 If rod was moved to an invalid position, THEN observe Inferred Position (POS TO SUB) display.

2.3 Press Substitute Options softkey.

2.4 Observe the following information display:

2.4.1 SUBSTITUTE RODS - POSITIONS SUBSTITUTED

2.4.2 SR XX-YY :FF

2.4.3 A message display indicating if substitution will be allowed at this time.

2.4.4 EXIT softkey function available.

2.5 Press EXIT softkey.

2.6 Observe SUBSTITUTE OPTIONS softkey function available.

2.7 Press SUBSTITUTE OPTIONS softkey.

2.8 Observe the following function indications:

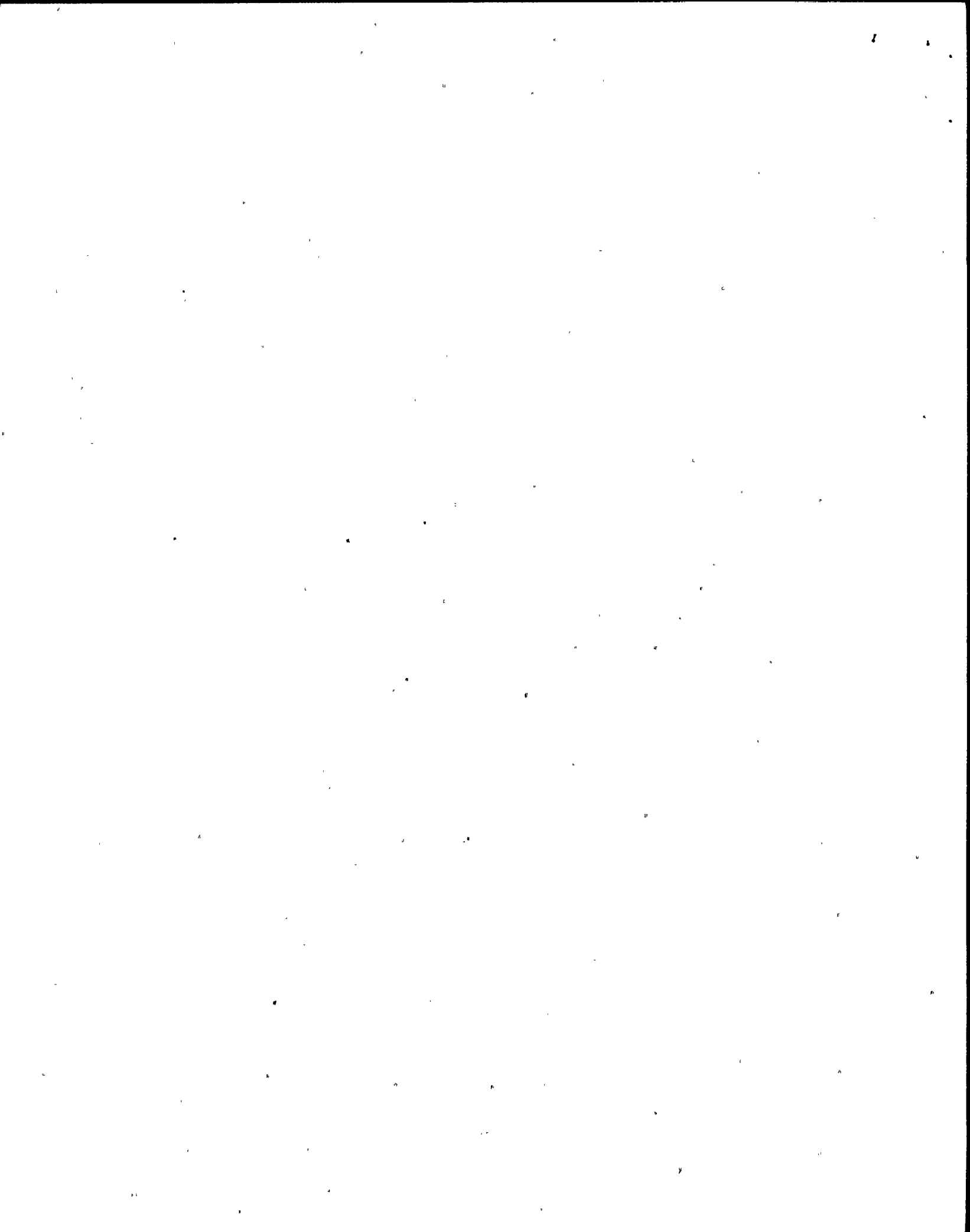
2.8.1 NEW POSITION TO SUBSTITUTE

2.8.2 INCREMENT POSITION

2.8.3 DECREMENT POSITION

2.8.4 ENTER SUBSTITUTE

2.8.5 EXIT



F. NORMAL OPERATIONS (Cont)

2.9 Select substitute position by using the Increment and Decrement softkeys until the desired position is indicated at NEW POSITION TO SUBSTITUTE.

2.10 Press ENTER SUBSTITUTE softkey.

2.11 Observe the following indications:

2.11.1 Selected rod listed in the SUBSTITUTE RODS.

2.11.2 Selected position listed in the POSITIONS SUBSTITUTED.

NOTE: New and correct position information will remove the substitute information when valid position information is obtained.

3.0 Rapid Power Reduction Sequence

- NOTES:
1. Rapid Power Reduction function is available in the OPERATE and BYPASS mode at the Operator Display only.
 2. Rapid Power Reduction is only available if a control rod sequence has been loaded into system.

CAUTION

The Rapid Power Reduction mode shall be terminated prior to reducing power below the Low Power Set Point.

3.1 IF required to activate Rapid Power Reduction softkey, THEN press the EXIT softkey.

3.2 Press the Rapid Power Reduction softkey.

3.3 Observe the following display on the mid screen:

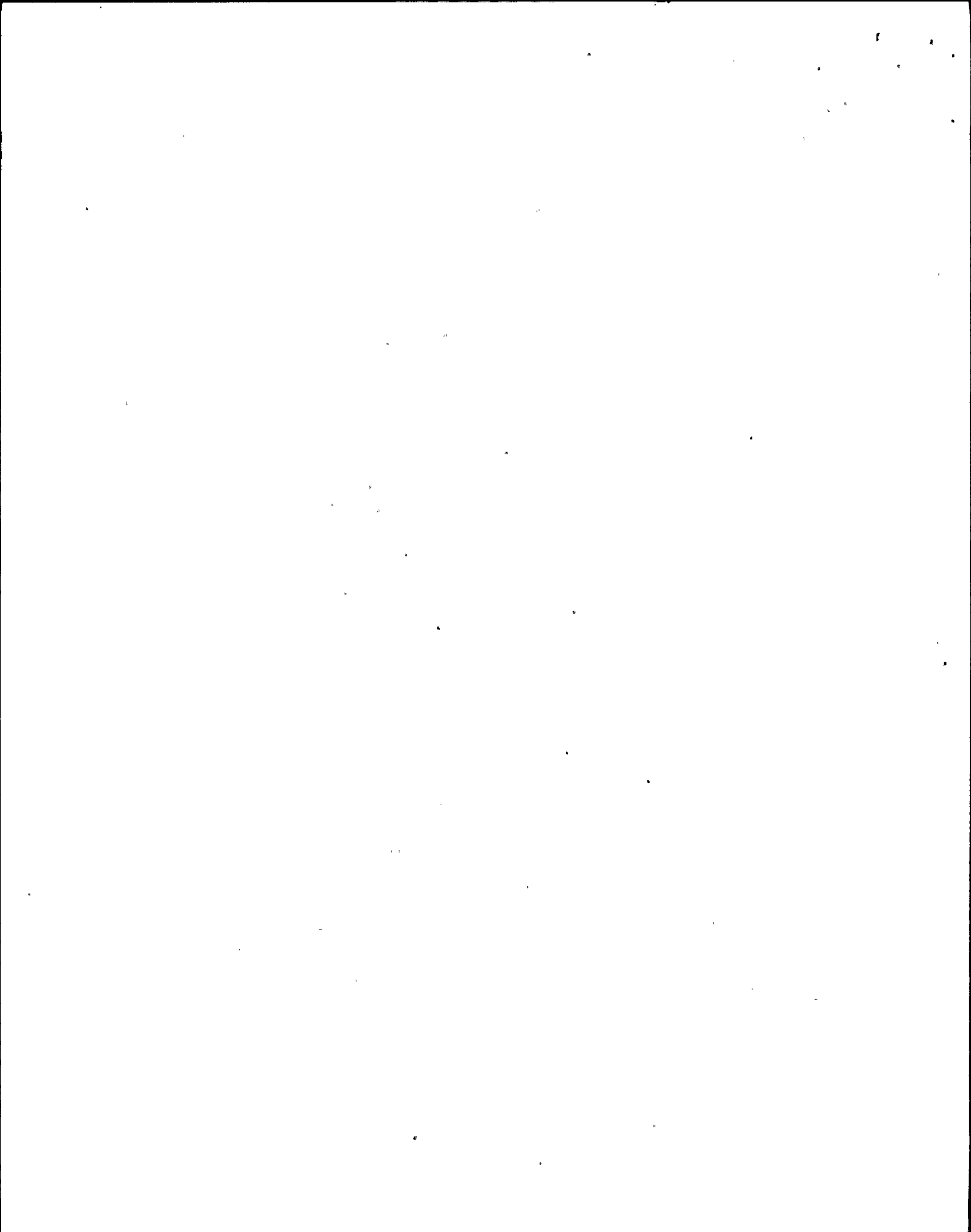
3.3.1 R P R display indicating Rapid Power Reduction has been selected.

3.3.2 SR indicating the selected rod.

NOTE: As rods are inserted, the screen is updated to display the next rod and its target position.

3.3.3 First and second rod to be inserted, their present latched positions and designated insert position.

3.4 IF desired to view the full Rapid Power Reduction Sequence THEN press NEXT PAGE.



F. NORMAL OPERATIONS (Cont)

4.0 Rod Drift Indication

- NOTES:
1. The rod drift display will automatically appear on a rod drift signal when power is above the LPAP.
 2. Function is available in the OPERATE, TEST and BYPASS mode at the Operator Display only.

4.1 Press the ROD DRIFT softkey.

4.2 Observe the following display on the mid screen:

4.2.1 SR, Selected Rod identification

4.2.2 DR, identity of one of the drifting rods

4.2.3 Number of RODS DRIFTING

4.3 Press LIST RODS to obtain the identity of all drifting rods.

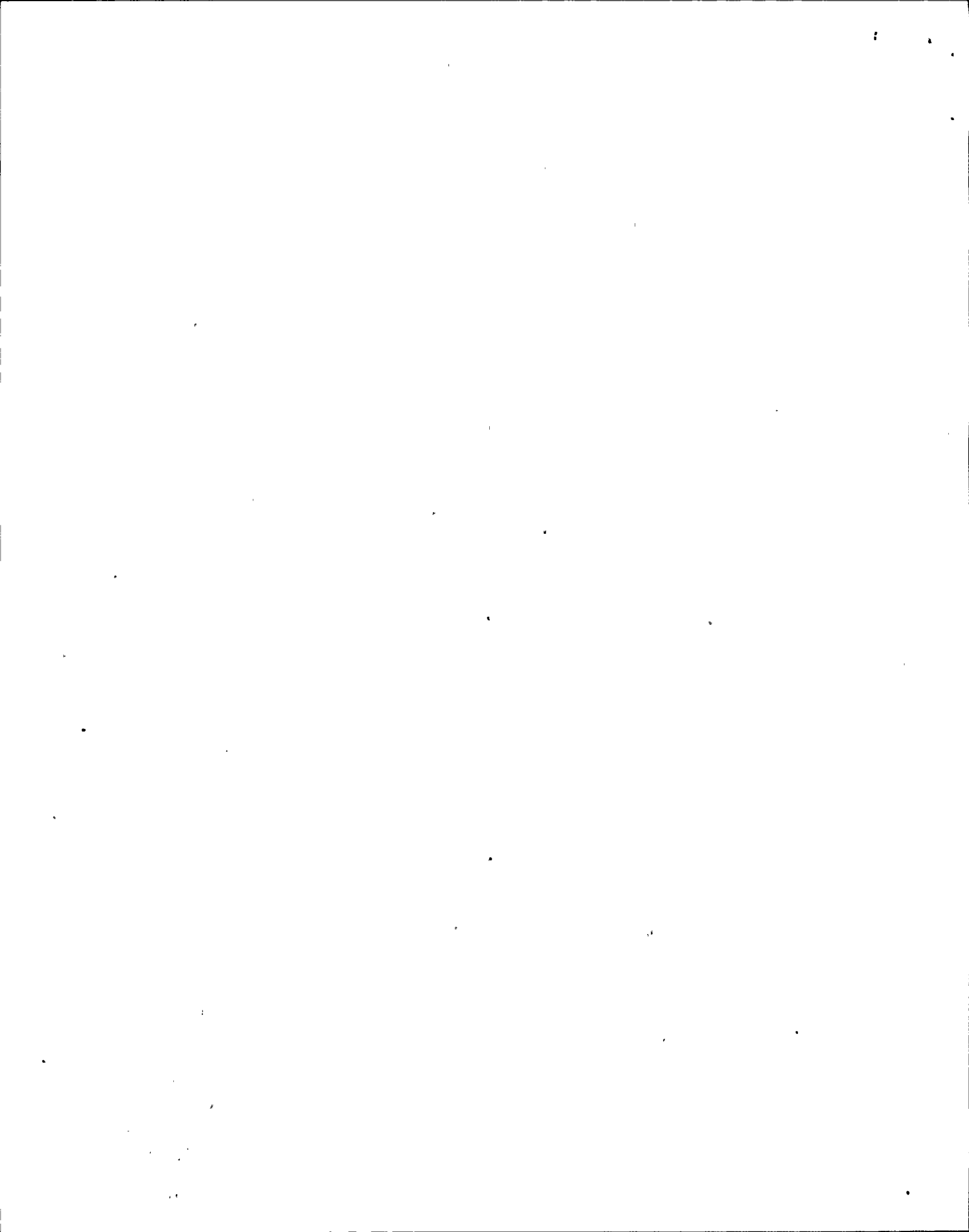
NOTE: If the number of drifting rods changes during paging the display will revert to the initial display to perform an update.

4.4 Press NEXT PAGE to obtain the identity of additional drifting rods.

4.5 Reset drifting rod indication by performing EITHER Step 8.5.1 OR Step 8.5.2 below:

4.5.1 Position the offending rod at a valid position.

4.5.2 Press Rod Drift Reset pushbutton at the RSCS panel when drifting rods are at valid positions.



F. NORMAL OPERATIONS (Cont)

5.0 Rod Test

* * * * *

CAUTION

Changing the position of any keylock mode switch during rod testing with a rod withdrawn will result in RWM rod blocks.

* * * * *

- NOTES:
1. This function allows one control rod at a time to be withdrawn and inserted without restriction if all other rods are fully inserted.
 2. Function is available in the TEST mode at the Operator Display only.

5.1 Place the RWM in the Test Mode at the Operator Display as follows:

5.1.1 Verify all control rods fully inserted.

5.1.2 Verify the two position Computer Display keylock mode switch is in OPER.

5.1.3 Place the three position Operator Display keylock mode switch in the TEST position.

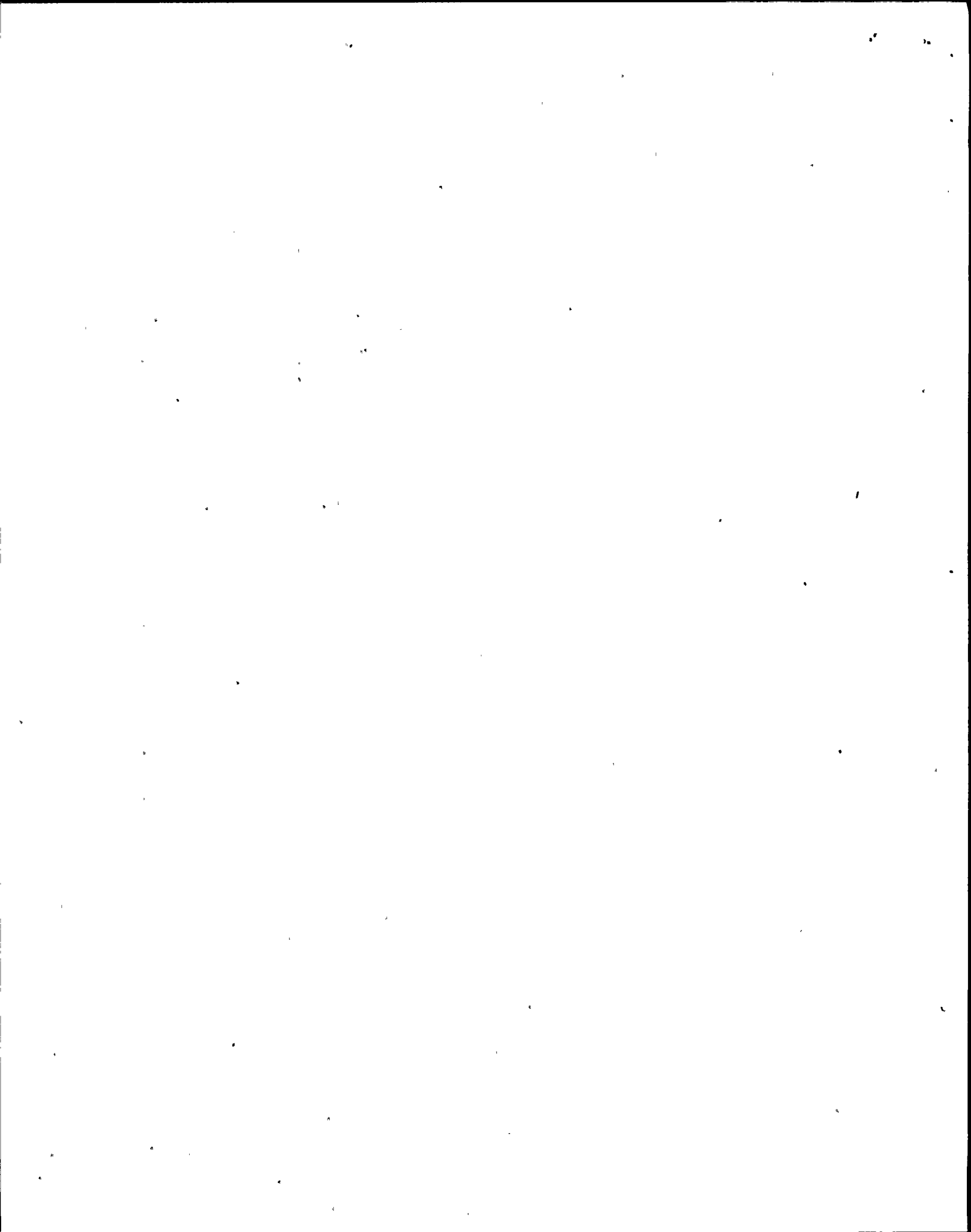
5.2 Press ROD TEST softkey.

5.3 Observe the following indications at the Operator Display:

5.3.1 TEST mode

5.3.2 SR identification and position

5.3.3 ROD TEST on mid screen



F. NORMAL OPERATIONS (Cont)

CAUTION

Changing the position of any keylock mode switch during rod testing with a rod withdrawn will result in RWM rod blocks.

- NOTES:
1. It is possible to select additional test functions with a control rod withdrawn by pressing the EXIT softkey and remain in the Test Mode.
 2. IF the EXIT softkey is pressed with all rods are at the full in position, THEN the rod test mode will be exited.

5.4 IF other test functions are to be performed in conjunction with Rod Test, THEN press EXIT softkey and proceed to the applicable test procedure.

5.5 Exit Rod Test by performing the following:

5.5.1 Verify all rods are fully inserted.

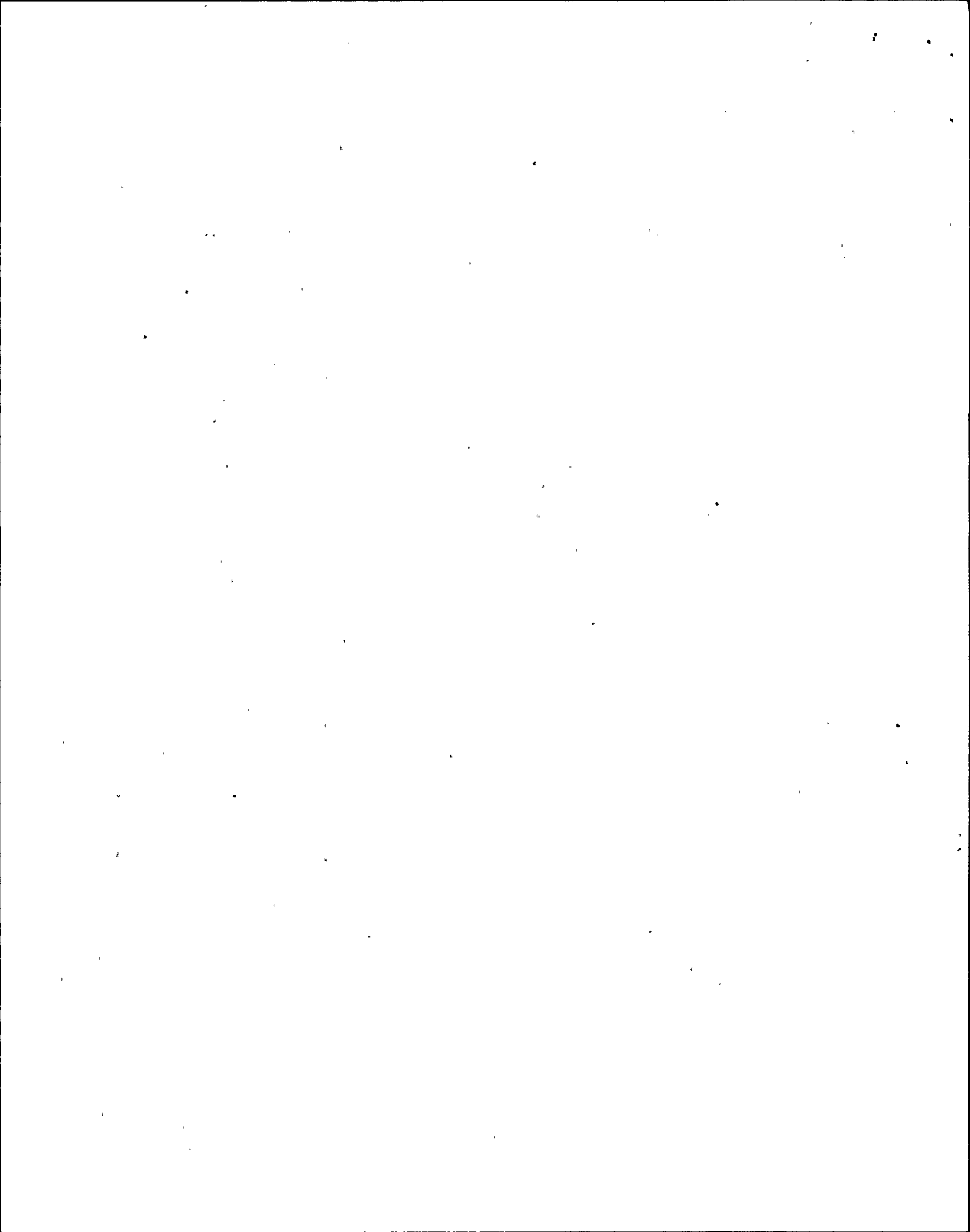
5.5.2 Press the EXIT softkey.

5.6 Place the RWM in the OPERATE Mode at the Operator Display as follows:

5.6.1 Verify the two position Computer Display keylock mode switch is in OPER.

5.6.2 Place the three position Operator Display keylock mode switch in the OPER position.

5.6.3 Observe Mode indicates OPERATE at the Operator Display.



F. NORMAL OPERATIONS (Cont)

6.0 Rod Timing Monitor

- NOTES:
1. Function is available in OPERATE, TEST and BYPASS modes at the Operator Display.
 2. Rod Timing will display the time it takes a rod to travel from one position to the next (reed switch to reed switch). This is referred to as switch time and is nominally 1 sec. (48 sec overall).
 3. The unlatch time is included in the withdrawal time except when withdrawal starts at position "00".

6.1 Verify the two position Computer Display keylock mode switch is in OPER.

6.2 Verify all control rods fully inserted.

6.3 Press the ROD TIMING MONITOR softkey at the Operator Display.

6.4 Observe the following display on the mid screen:

6.4.1 SR and present position for selected rod

6.4.2 SWITCH TIME: SEC

6.4.3 48 - TIME: SEC

NOTE: If the rod time has previously recorded, pressing the Arm Record softkey will erase previously recorded time.

6.5 Press ARM RECORD softkey if new time record is desired.

6.6 Observe Operator Display includes REC ARMED indication.

6.7 Perform rod motion in accordance with applicable procedure to obtain a record of rod motion time.

6.8 When rod motion is completed observe the following indications:

6.8.1 Rod initial and final positions

6.8.2 Total rod travel time

6.8.3 Last position switch travel time



F. NORMAL OPERATIONS (Cont)

6.9 IF a display of individual notch timing is desired THEN perform the following:

6.9.1 Press DISPLAY PLOT softkey.

6.9.2 Position cursor at notch desired using MOVE RIGHT or MOVE LEFT softkeys.

6.9.3 Observe position and switch time indication on mid screen at DATA POINT display.

6.9.4 Press EXIT softkey to return to previous ROD TIMING MONITOR display.

6.10 Press EXIT softkey when rod timing is completed.

6.11 IF required THEN place the RWM in the OPERATE Mode at the Operator Display as follows:

6.12 Verify the two position Computer Display keylock mode switch is in OPER.

6.13 Place the three position Operator Display keylock mode switch in the OPER position.

6.14 Observe Mode indicates OPERATE at the Operator Display.

G. SHUTDOWN

Not Applicable

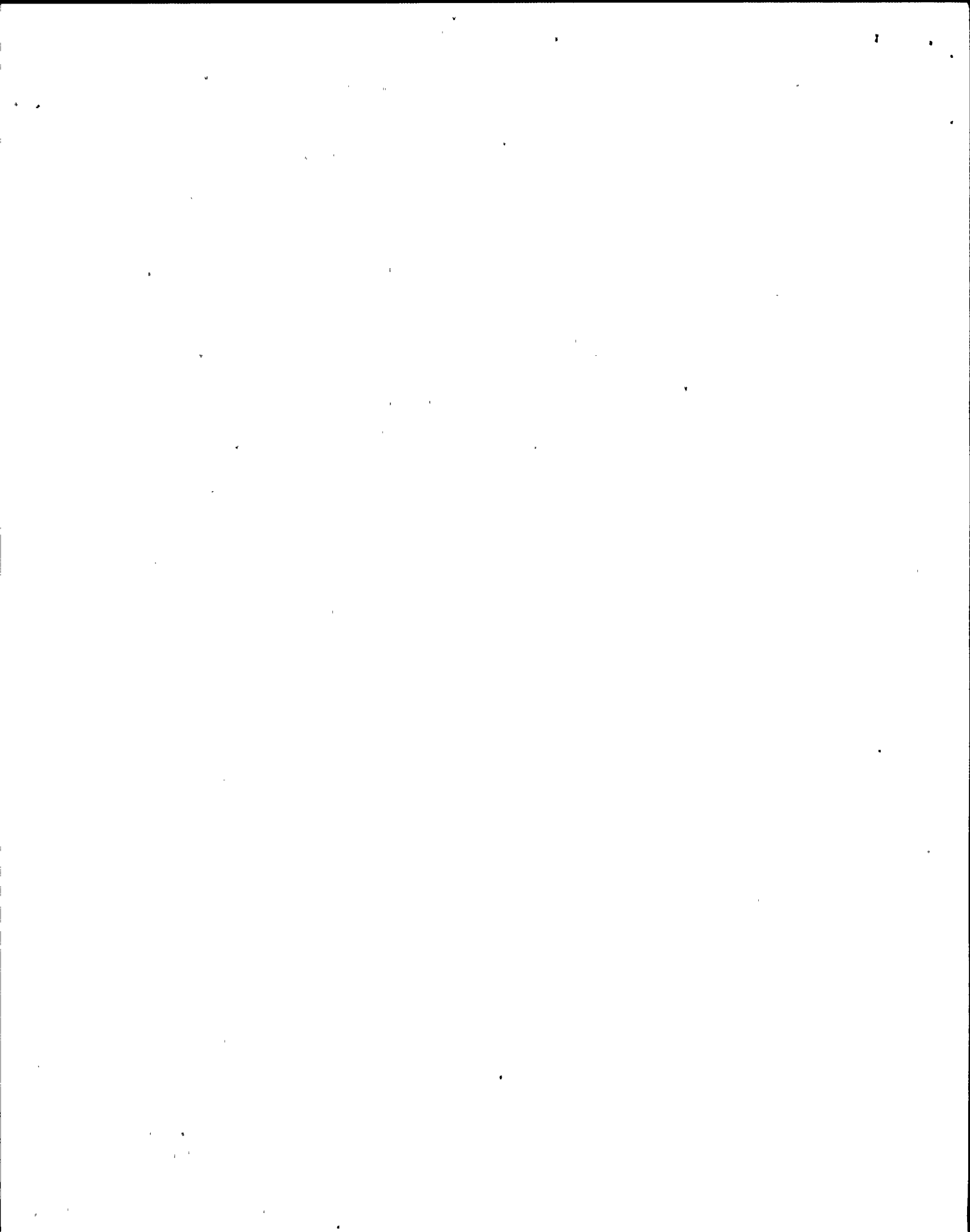
The Rod Worth Minimizer is not Shutdown by the operations personnel but is placed in bypass instead. Refer to Section H.1.0 of this procedure for operation when the RWM is INOP.

H. OFF-NORMAL

1.0 RWM Bypass

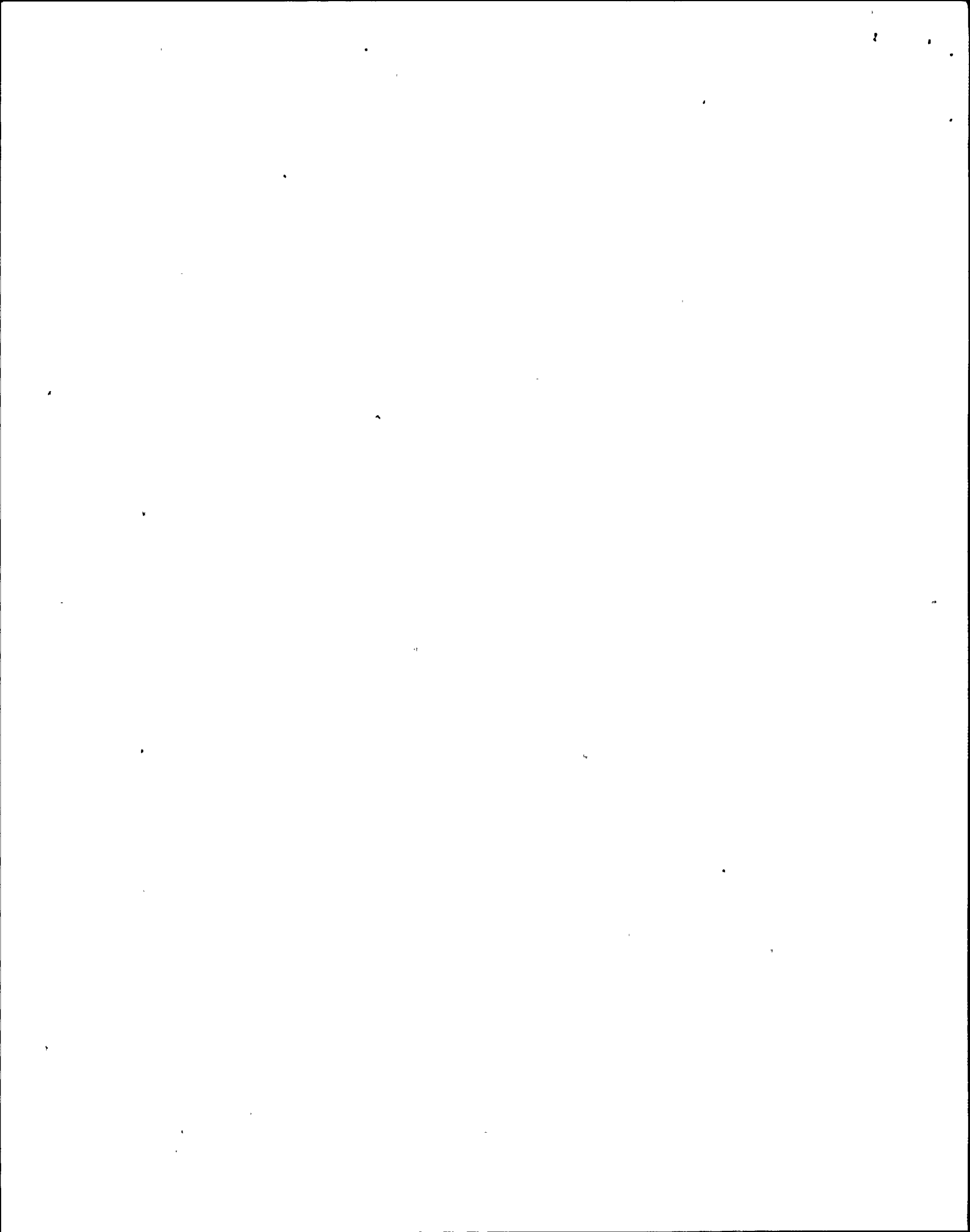
- NOTES:
1. Bypassing the Rod Worth Minimizer should be done as a last resort.
 2. When in bypass the RWM will continue to provide all its normal indications but the RWM rod blocks will be defeated.

1.1 IF the Reactor is in Operational Conditions 1 or 2 and the RWM is bypassed/inop in the LPSP region THEN the following limitations on control rod motion are applicable:



H. OFF-NORMAL (Cont)

- 1.1.1 Control rod positions shall be verified in compliance with control rod pull sheet prior to any rod motion.
- 1.1.2 A second licensed operator or other technically qualified member of the technical staff is designated by the Assistant Station Shift Supervisor (ASSS) to be present at the controls prior to any rod motion.
- 1.1.3 The name of the designee shall be entered into the CSO log.
- 1.1.4 Prior to any rod motion the designee shall perform the following:
 - a. Review this section of the procedure.
 - b. Demonstrate a knowledge of this section of the procedure to the ASSS.
 - c. Verify the operator at the control panel is following the proper sequence.
 - d. Verify the selected rod is next in sequence.
- 1.1.5 During rod motion the designee shall perform the following:
 - a. No other responsibilities or activities.
 - b. Maintain minimum communication with other personnel.
 - c. Inform the operator if he observes an error in rod selection or position.
 - d. Verify the selected rod has been withdrawn/inserted to the prescribed position.
 - e. Verify the actual rod pattern conforms to the rod pull sheet upon completion of movement of each group.
- 1.2 Verify the 2 position Computer Display keylock mode switch is in the OPER position locally at the RPIS panel.
- 1.3 Place the 3 position Operator Display keylock mode switch in the BYPASS position at panel P603.
- 1.4 Observe BYPASS mode indication at the Operator Display



H. OFF-NORMAL (Cont)

2.0 RWM Return to Normal

- 2.1 Verify the two position Computer Display keylock mode switch is in the OPER position locally at the RPIS panel.
- 2.2 Place the three position Operator Display keylock mode switch in the OPER position at panel P603.
- 2.3 Observe OPERATE mode indication at the Operator Display.

3.0 Control Rod Input Bypass

- NOTES:
1. Bypassing a control rod will require temporarily placing the RWM in the INOP mode.
 2. BYPASS ROD function is available in the INOP mode at the Computer Display only.

- 3.1 Notify the SSS of the need to bypass a control rod.
- 3.2 Consult the Reactor Engineer to bypass the affected rod.
- 3.3 Verify bypassing the control rod will be within the limits listed below:

3.3.1 Maximum of three rods bypassed in a single RWM group

3.3.2 Maximum of eight rods bypassed in all RWM groups

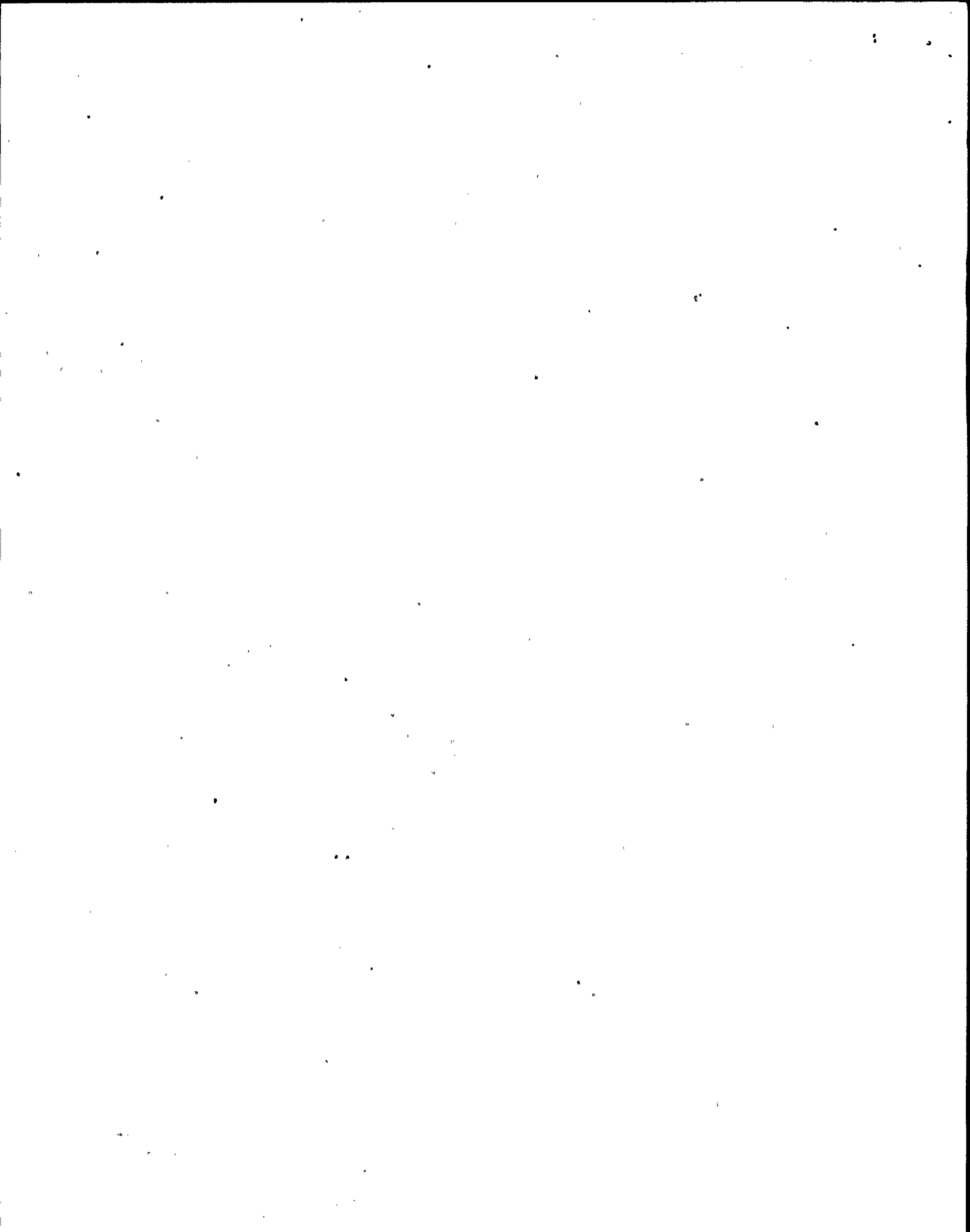
- 3.4 Suspend all control rod motion.

- NOTES:
1. Performing Step 3.5 below will place the RWM in the INOP mode.
 2. The following actions are performed locally at the Computer Display unless otherwise specified.

- 3.5 Place the two position Computer Display keylock switch in the INOP position.
- 3.6 Press the EXIT softkey.
- 3.7 Observe the BYPASS OPTIONS softkey menu appears.
- 3.8 Perform EITHER Step 3.8.1 OR Step 3.8.2

3.8.1 Select the rod to be bypassed at panel P603.

3.8.2 Select the rod to be bypassed using the up and down cursor keys.



H. OFF-NORMAL (Cont)

- 3.9 Verify SR indication as the rod to be bypassed.
- 3.10 Press the BYPASS ROD softkey. .
- 3.11 Observe the selected rod is display in the list of bypassed rods.
- 3.12 Complete Section A, Bypassing Control Rod of Attachment 8: RWM
BYPASSED CONTROL ROD TRACKING
- 3.13 Observe the UNBYPASS ROD softkey is indicated.
- 3.14 Press EXIT softkey.
- 3.15 Place the two position Computer Display keylock switch in the
OPER position.
- 3.16 Observe Computer display indicates OPER.

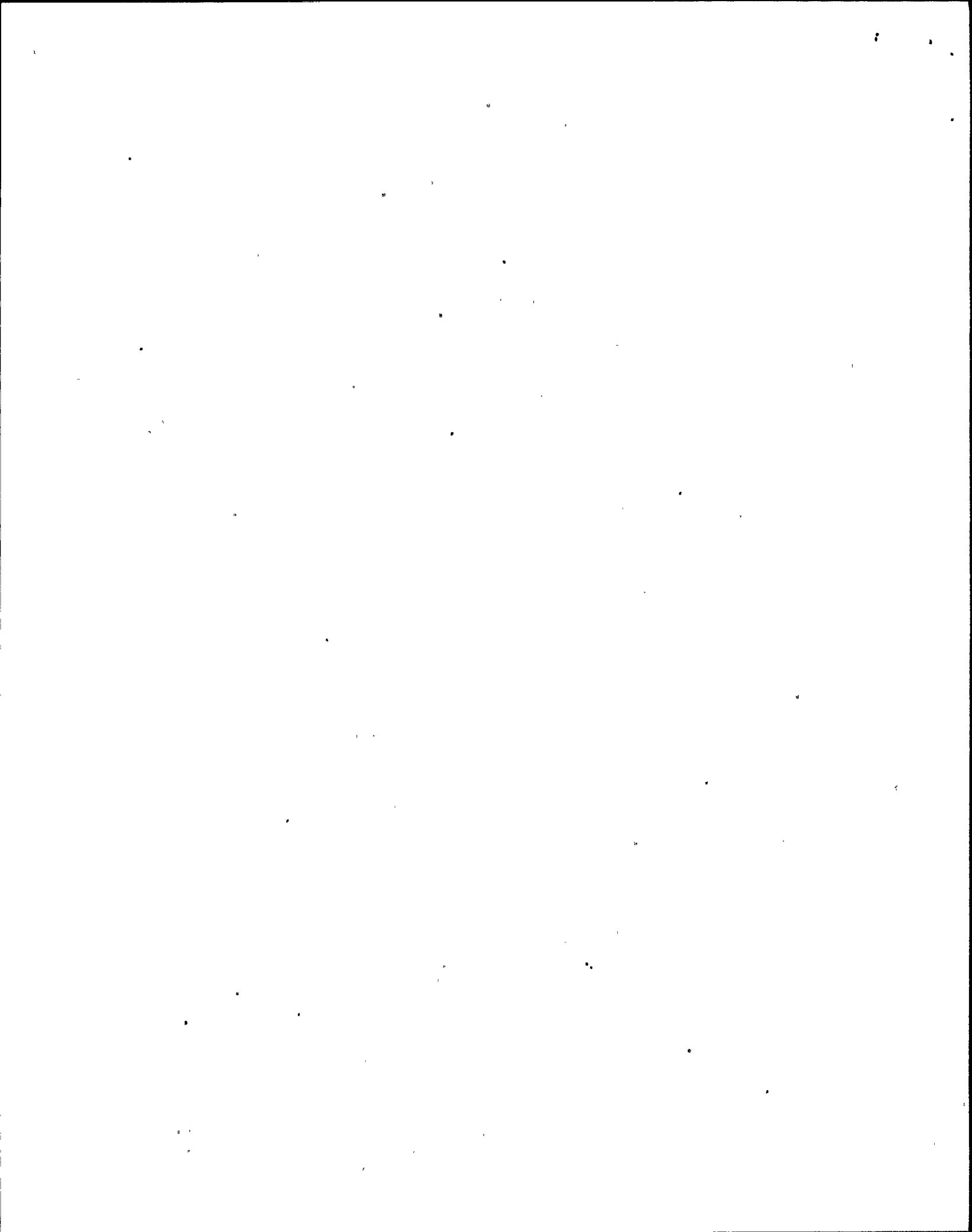
4.0 Control Rod Input Return to Normal

- NOTES:
1. Unbypassing a control rod will require temporarily placing the RWM in the INOP mode.
 2. UNBYPASS ROD function is available in the INOP mode at the Computer Display only.

- 4.1 Obtain the SSS approval to unbypass the control rod.
- 4.2 Consult the Reactor Engineer to unbypass the affected rod.
- 4.3 Suspend all control rod motion.

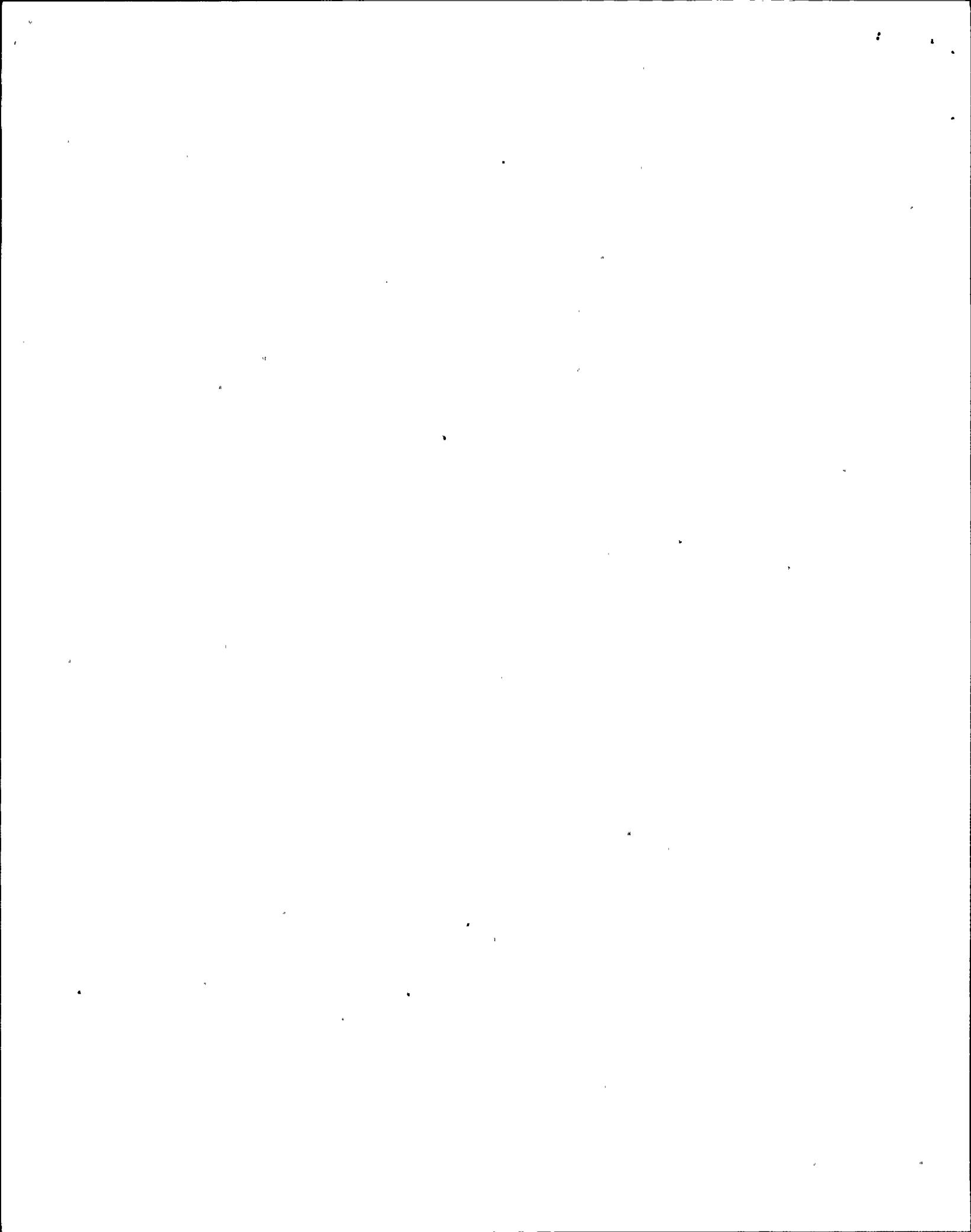
- NOTES:
1. Performing Step 4.4 below will place the RWM in the INOP mode.
 2. The following actions are performed locally at the Computer Display unless otherwise specified.

- 4.4 Place the two position Computer Display keylock mode switch in the INOP position.
- 4.5 Press the EXIT softkey.
- 4.6 Observe the menu for the BYPASS OPTIONS softkey appears.
- 4.7 Perform EITHER Step 4.7.1 OR Step 4.7.2.
 - 4.7.1 Select the rod to be unbypassed at panel P603.
 - 4.7.2 Select the rod to be unbypassed using the up and down cursor keys.



H. OFF-NORMAL (Cont)

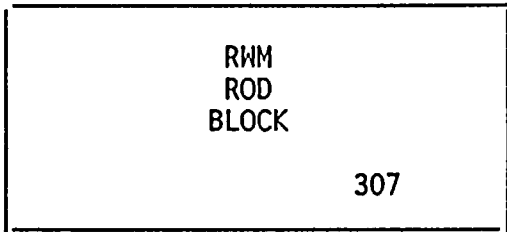
- 4.8 Verify SR indication as the rod to be unbypassed.
- 4.9 Press the BYPASS ROD softkey.
- 4.10 Observe the selected rod is displayed in the list of bypassed rods.
- 4.11 Observe the UNBYPASS ROD softkey is indicated.
- 4.12 Press the UNBYPASS ROD softkey.
- 4.13 Observe the rod indicating as SR has been removed from the list of rods bypassed.
- 4.14 Complete and remove Attachment 8, RHM CONTROL ROD BYPASS TRACKING sheet for the appropriate rod from the Equipment Status Log.
- 4.15 Press EXIT softkey.
- 4.16 Place the two position keylock mode switch in the OPER position.



I. PROCEDURES FOR CORRECTING ALARM CONDITIONS (Cont)

Refresh: No

603307



<u>Computer Point</u>	<u>Printout</u>	<u>Source</u>	<u>Setpoint</u>
RDSBC05	RWM Rod Block	RWM Computer Chasis	See Possible Causes

TCN-8

Automatic Response

Control Rod motion inhibited when Reactor power is below the Low Power Set Point.

Operator Actions

System display indicates the necessary corrective actions.

Possible Causes

At Any Power Level

- 1) Keyswitch on RWM in panel 2CEC-PNL615 in INOP position,
- 2) RWM Self-Test Fault

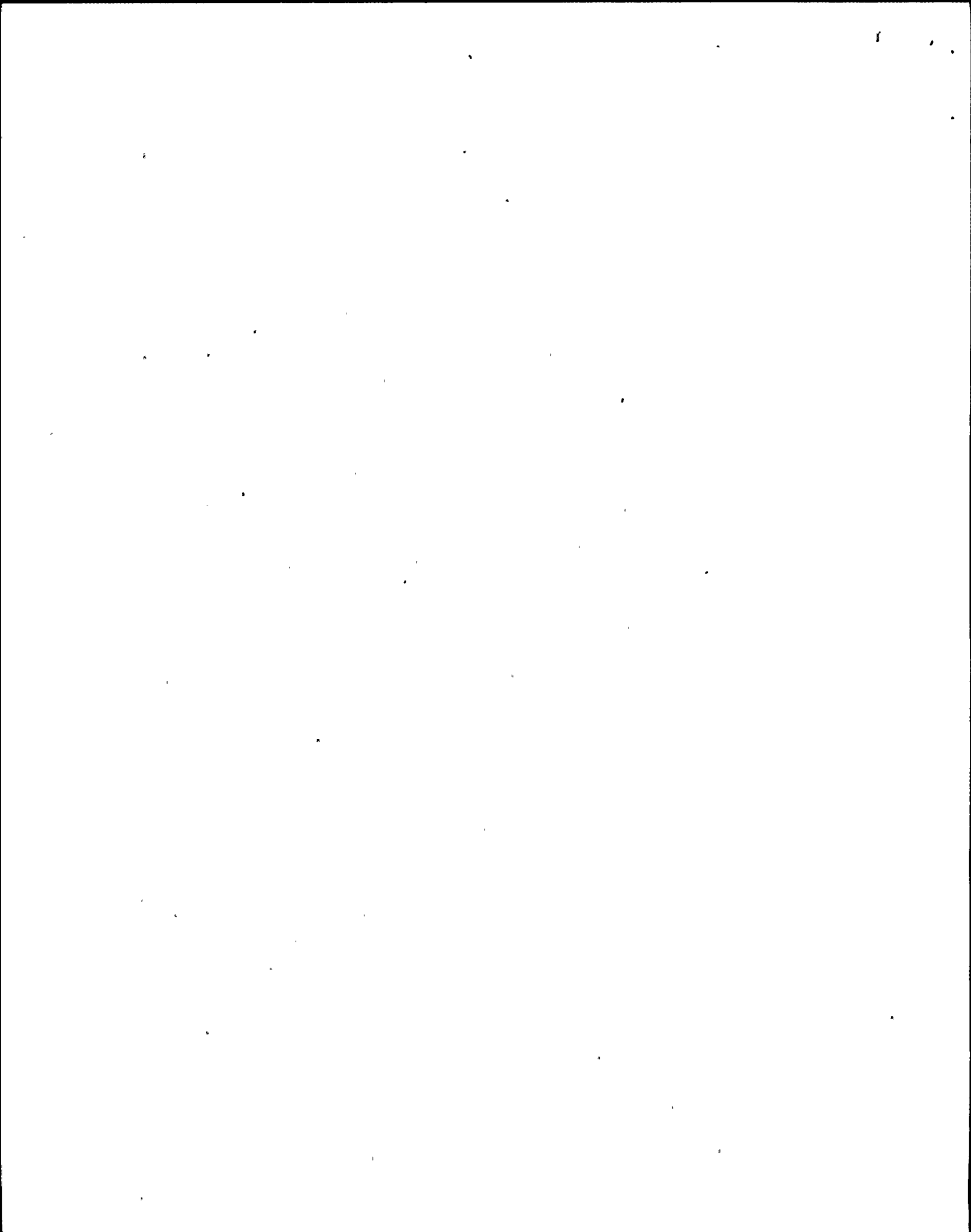
Below LPSP (20%)

- 1) Insert or Withdraw error exists and selected rod is not the error rod.
- 2) More than one Insert or Withdraw error exists.
- 3) Selected rod added to the Insert or Withdraw error list.

TCN-8

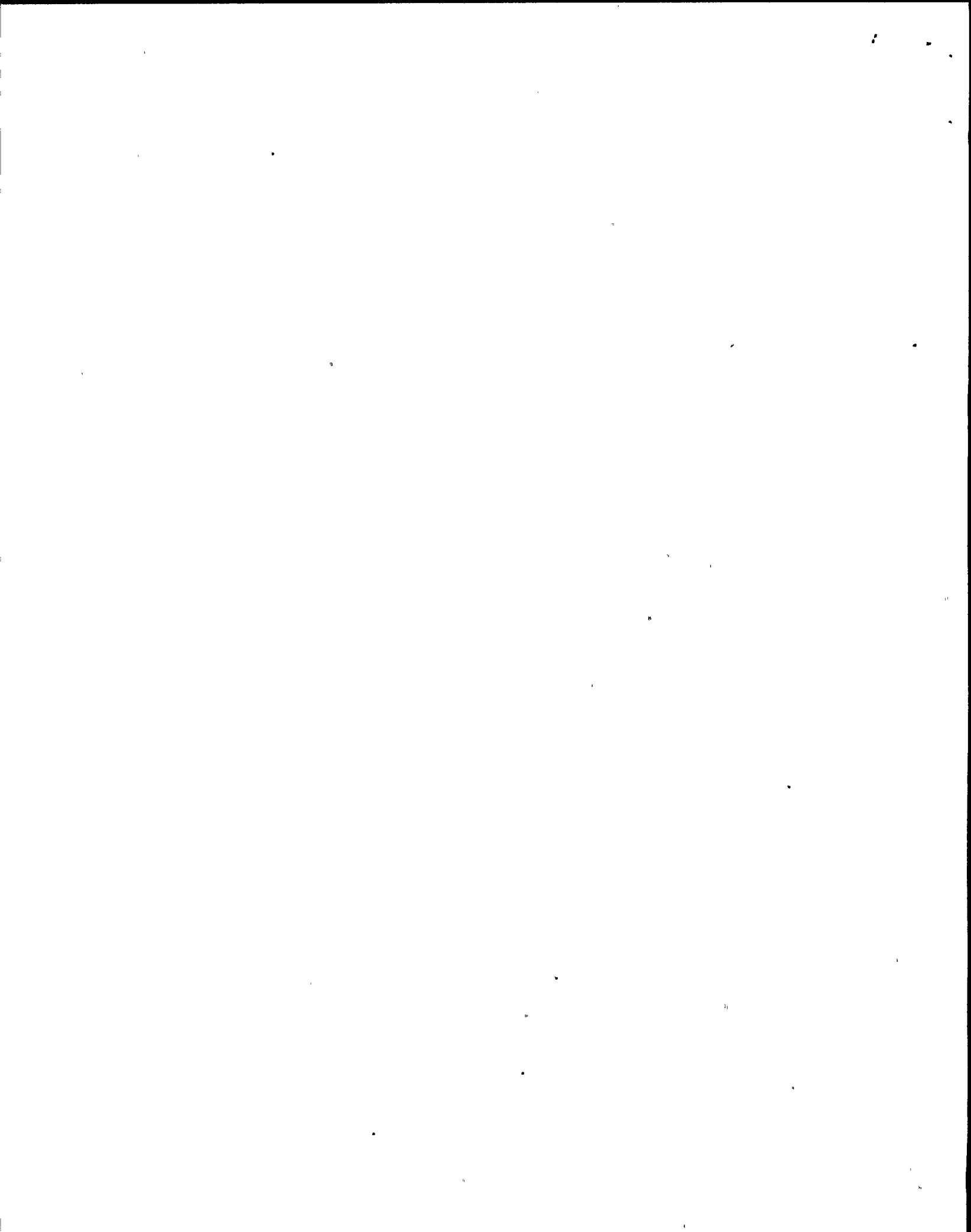
References

N2-OP-95A, Rod Worth Minimizer System



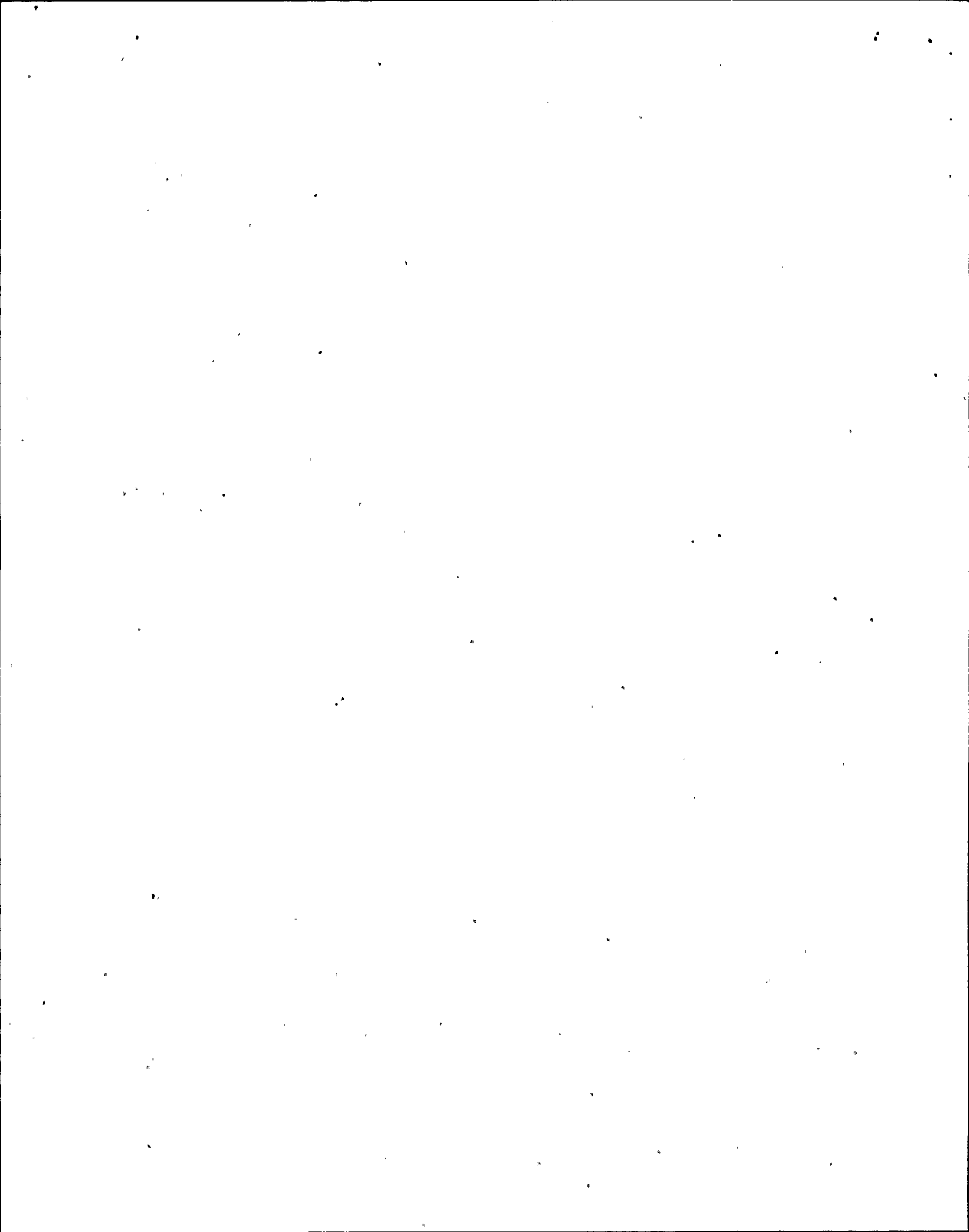
ATTACHMENT 1

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ATTACHMENT 2
ELECTRICAL LINEUP SHEET

COMPONENT NUMBERS	COMPONENT DESCRIPTION	BUS NUMBER	POWER SUPPLY CUBICLE/BREAKER	REQUIRED POSITION	INITIALS & DATE	Indep. Verif. Initial. & Date	REMARKS
C12-J600A	RWM Operator Display	2VBS-PNLA101	Ckt 37	Closed			
C12-J600B	RWM Computer Chassis	2VBS-PNLA101	Ckt 7	Closed			



**ATTACHMENT 3
FUNCTIONS VS. MODE**

NOTE: The modes for the various combinations of keylock configuration are listed below. Consult instructions to access functions.

**RWM COMPUTER
KEYLOCK SWITCH**

**OPERATOR'S DISPLAY
KEYLOCK SWITCH**

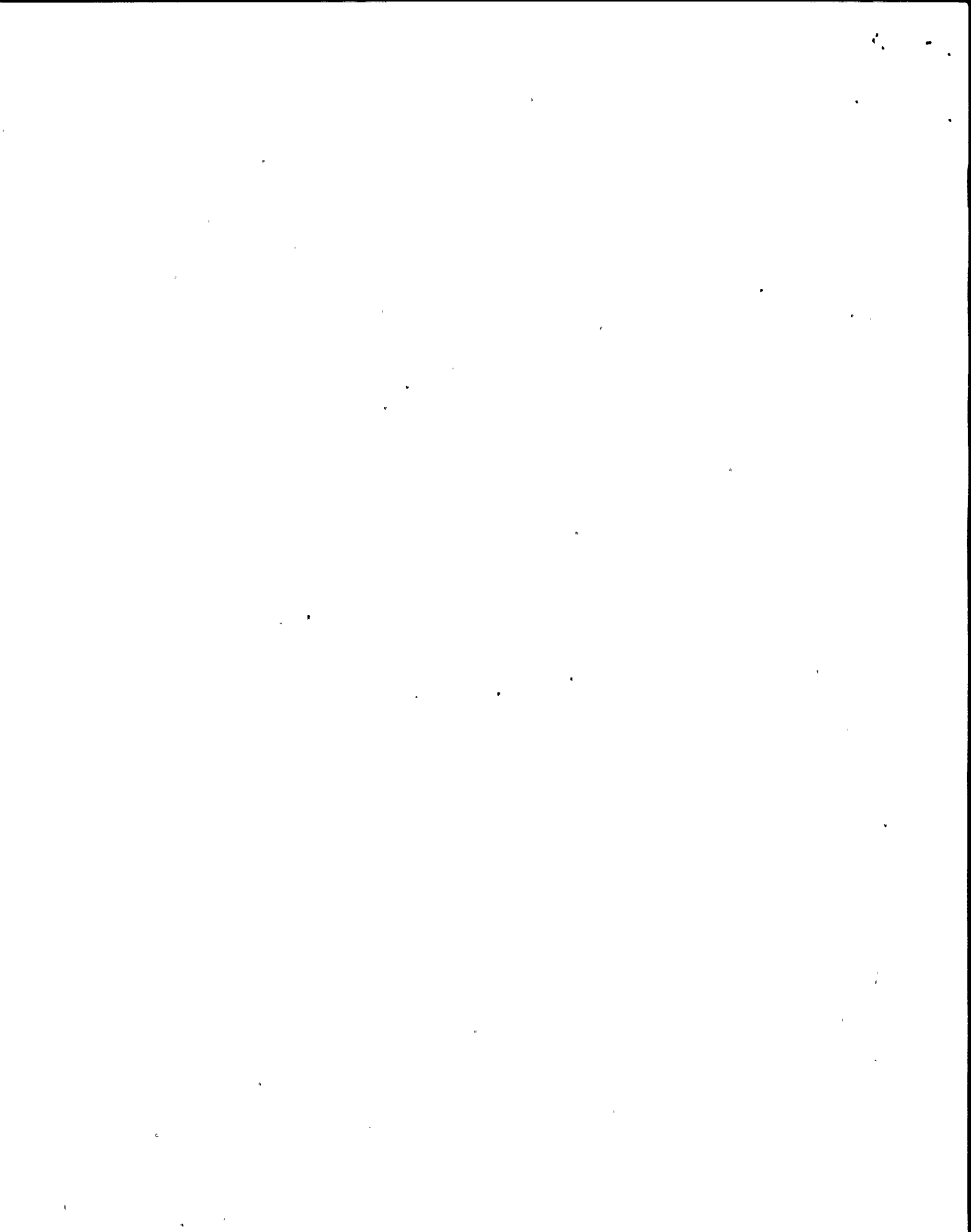
MODE

INOP
OPERATE
OPERATE
OPERATE

ANY POSITION
OPERATE
TEST
BYPASS

INOP
OPERATE
TEST
BYPASS

FUNCTION	OPERATOR'S DISPLAY				COMPUTER DISPLAY			
	OPER	INOP	TEST	BYP	OPER	INOP	TEST	BYP
ROD BYPASS OPTIONS (Disp)	X	X	X	X	X		X	X
ROD BYPASS OPTIONS (Byp)						C		
CHECK DISPLAY		X				X		
CHECK KEYS		X				X		
CONFIRM SHUTDOWN	X		X	X				
DISPLAY OFF	X	X	X	X	X	X	X	X
HELP	X	X	X	X	X	X	X	X
INFERRED POSITION	X		X	X	X		X	X
MESSAGES	X	X	X	X	X	X	X	X
ROD TIMING MONITOR	X		X	X				
RAPID POWER REDUCTION	C			C				
ROD DRIFT	X		X	X				
ROD TEST			X					
SELF-TEST (Show)					X		X	X
SELF-TEST (Run)						X		
SEQUENCE ALIGNMENT	C			C				
SEQUENCE OPTIONS						X		
SET PARAMETERS						X		
SHUTDOWN MARGIN TEST		X			X	X	X	X
SUBSTITUTE (Display)			X					
SUBSTITUTE (Substitute)	C		C	C				



FIRST LEVEL MENU LIST - OPERATE MODE

HELP	SELF-TEST	DISPLAY OFF	EXIT
------	-----------	-------------	------

 (1)

AND

MESSAGES	ROD BYPASS OPTIONS	SUBSTITUTE OPTIONS	EXIT
----------	--------------------	--------------------	------

AND

RAPID POWER REDUCTION	SEQUENCE ALIGNMENT	CONFIRM SHUTDOWN	EXIT
-----------------------	--------------------	------------------	------

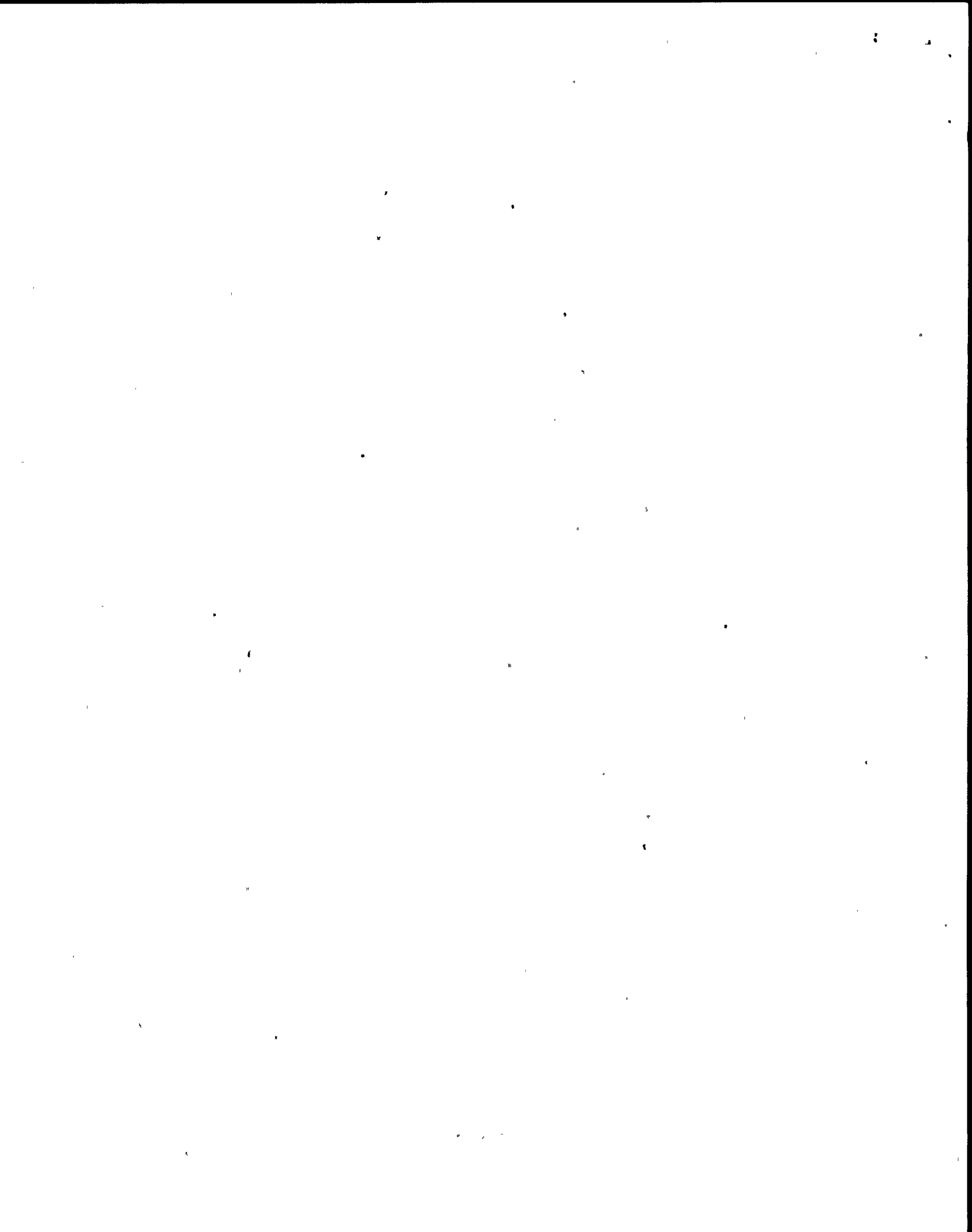
 (2)

AND

ROD DRIFT	ROD TIMING MONITOR	EXIT
-----------	--------------------	------

 (2)

- (1) - The SELF-TEST softkey is only available on the Computer Display.
- (2) - The RAPID POWER REDUCTION, SEQUENCE ALIGNMENT, CONFIRM SHUTDOWN, ROD DRIFT, and ROD TIMING MONITOR softkeys are only available at the Operator's Display.



FIRST LEVEL MENU LIST - INOP MODE

HELP	SELF-TEST	DISPLAY OFF	EXIT
------	-----------	-------------	------

(1)

AND

MESSAGES	ROD BYPASS OPTIONS	SUBSTITUTE OPTIONS	EXIT
----------	--------------------	--------------------	------

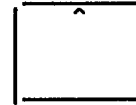
AND

CHECK DISPLAY	CHECK KEYS	EXIT
---------------	------------	------

AND

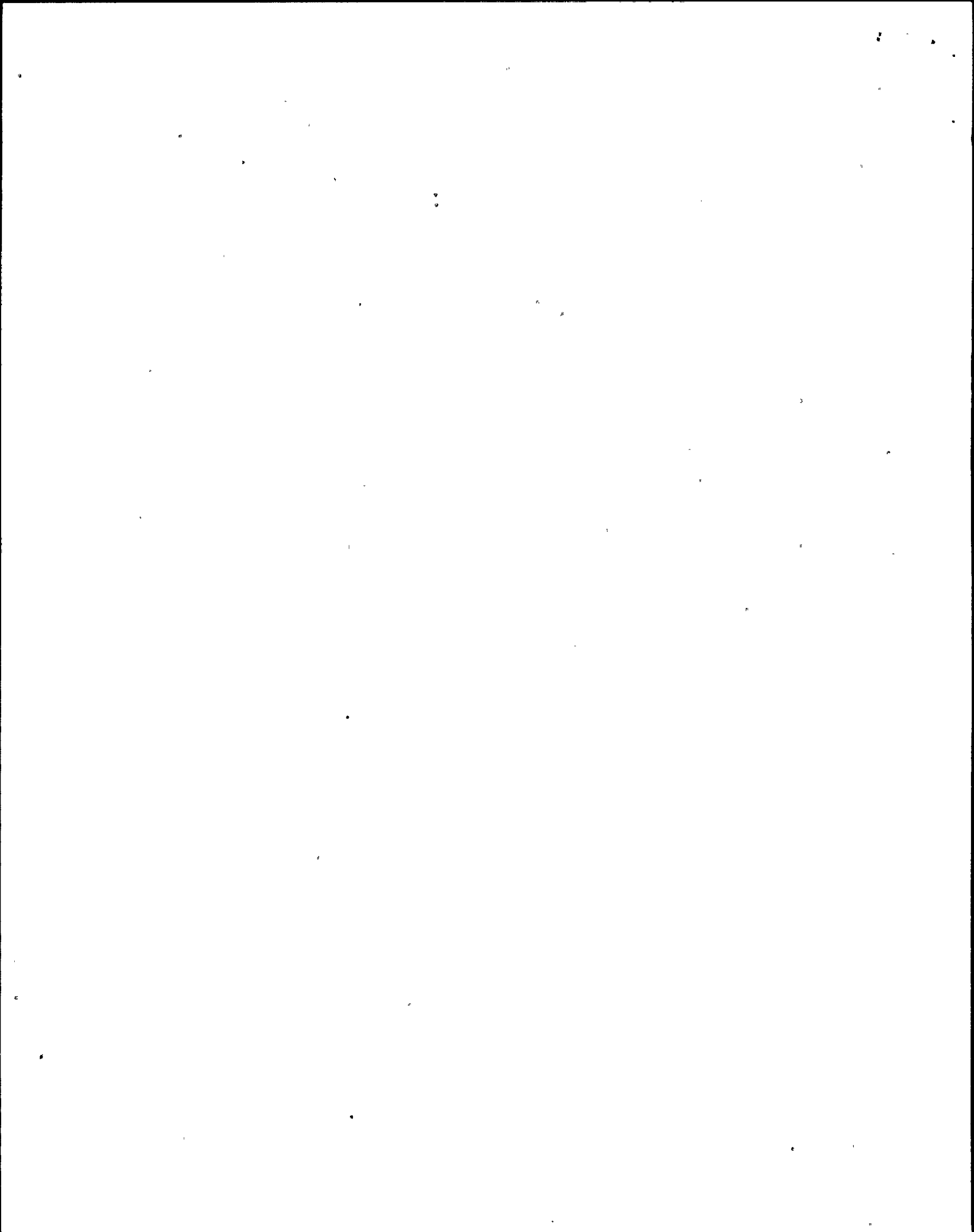
SET PARAMETERS	SEQUENCE OPTIONS	EXIT
----------------	------------------	------

(2)



(1) - The SELF-TEST softkey is only available on the Computer Display.

(2) - Available from Computer Display only.



FIRST LEVEL MENU LIST - TEST MODE

HELP	SELF-TEST	DISPLAY OFF	EXIT
------	-----------	-------------	------

(1)

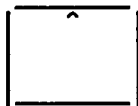
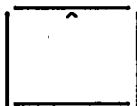
AND

MESSAGES	ROD BYPASS OPTIONS	SUBSTITUTE OPTIONS	EXIT
----------	--------------------	--------------------	------

AND

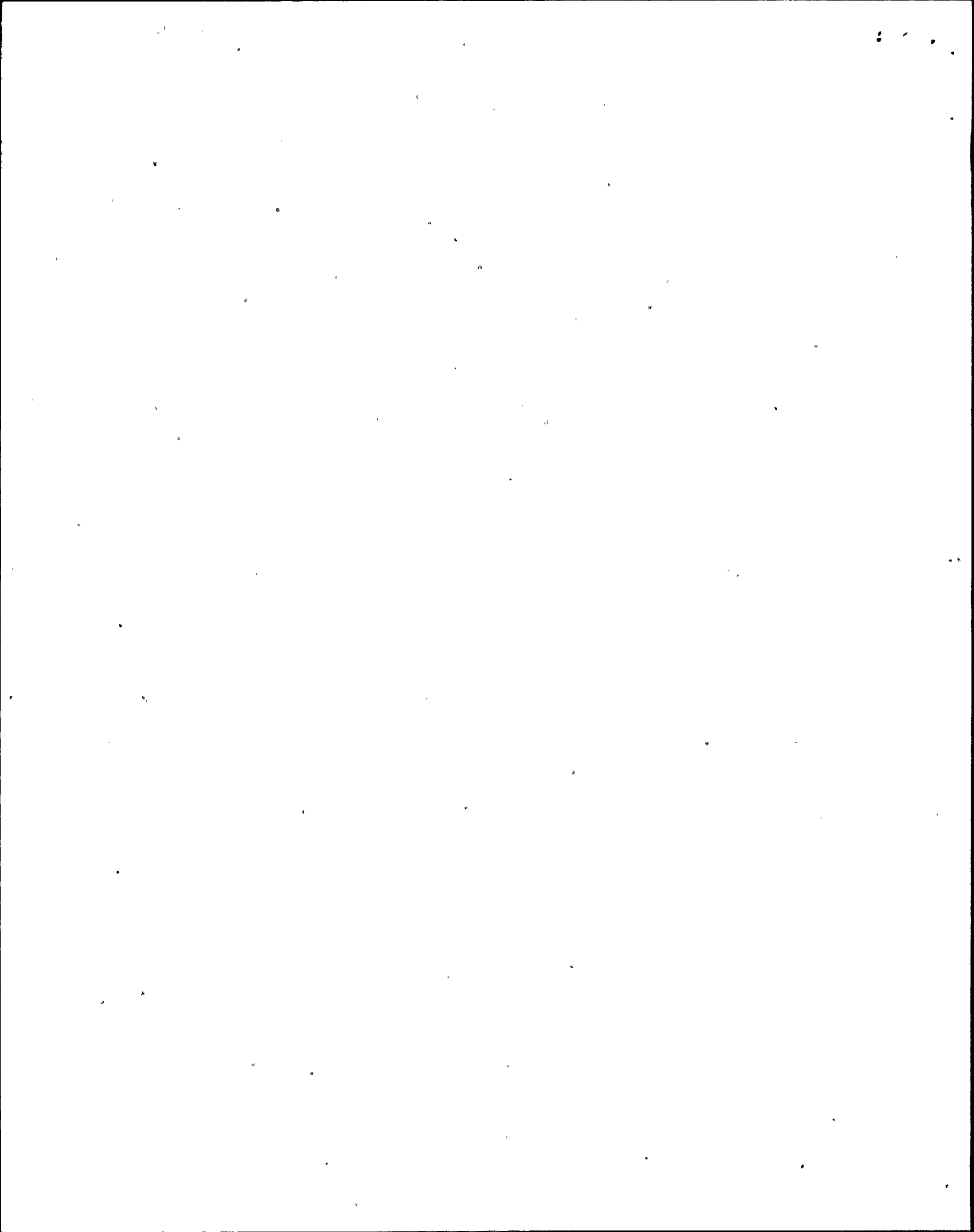
ROD TEST	CONFIRM SHUTDOWN	SHUTDOWN MARGIN TEST	EXIT
----------	------------------	----------------------	------

(2)



(1) - The SELF-TEST softkey is only available on the Computer Display.

(2) - Available from Operator's Display only.



The following show the HELP displays for the OPERATE mode:

OPERATE MODE - SCREEN #1

SELF-TEST: (COMPUTER DISPLAY ONLY) DISPLAYS SELF-TEST INFORMATION AND PROVIDES THE MEANS TO CLEAR THE SELF-TEST ERROR LOG. SELF-TEST OPERATIONS MAY BE MANUALLY CONTROLLED WHEN IN THE INOP MODE.

DISPLAY OFF: TURNS THE DISPLAY OFF. ANY CHANGE OF SELF-TEST STATUS, POWER LEVEL, OR MODE WILL CAUSE IT TO TURN BACK ON. ALSO, PRESSING ANY FRONT PANEL KEY WILL CAUSE THE DISPLAY TO TURN ON.

OPERATE MODE - SCREEN #2

MESSAGES: DISPLAYS REASONS FOR BLOCKS AND THE LATEST STATUS MESSAGES.

ROD BYPASS OPTIONS: DISPLAYS THE BYPASSED RODS. WHEN PERMITTED, RODS MAY BE BYPASSED AT THE COMPUTER DISPLAY IN THE INOP MODE.

SUBSTITUTE OPTIONS: DISPLAYS RODS WITH SUBSTITUTE POSITIONS. WHEN PERMITTED, RODS MAY BE SUBSTITUTED AT THE OPERATOR'S DISPLAY.

OPERATE MODE - SCREEN #3

RAPID POWER REDUCTION: DISPLAYS THE CONTROL ROD MOTIONS WHICH MAY BE USED TO QUICKLY REDUCE POWER IN RESPONSE TO AN ABNORMAL EVENT.

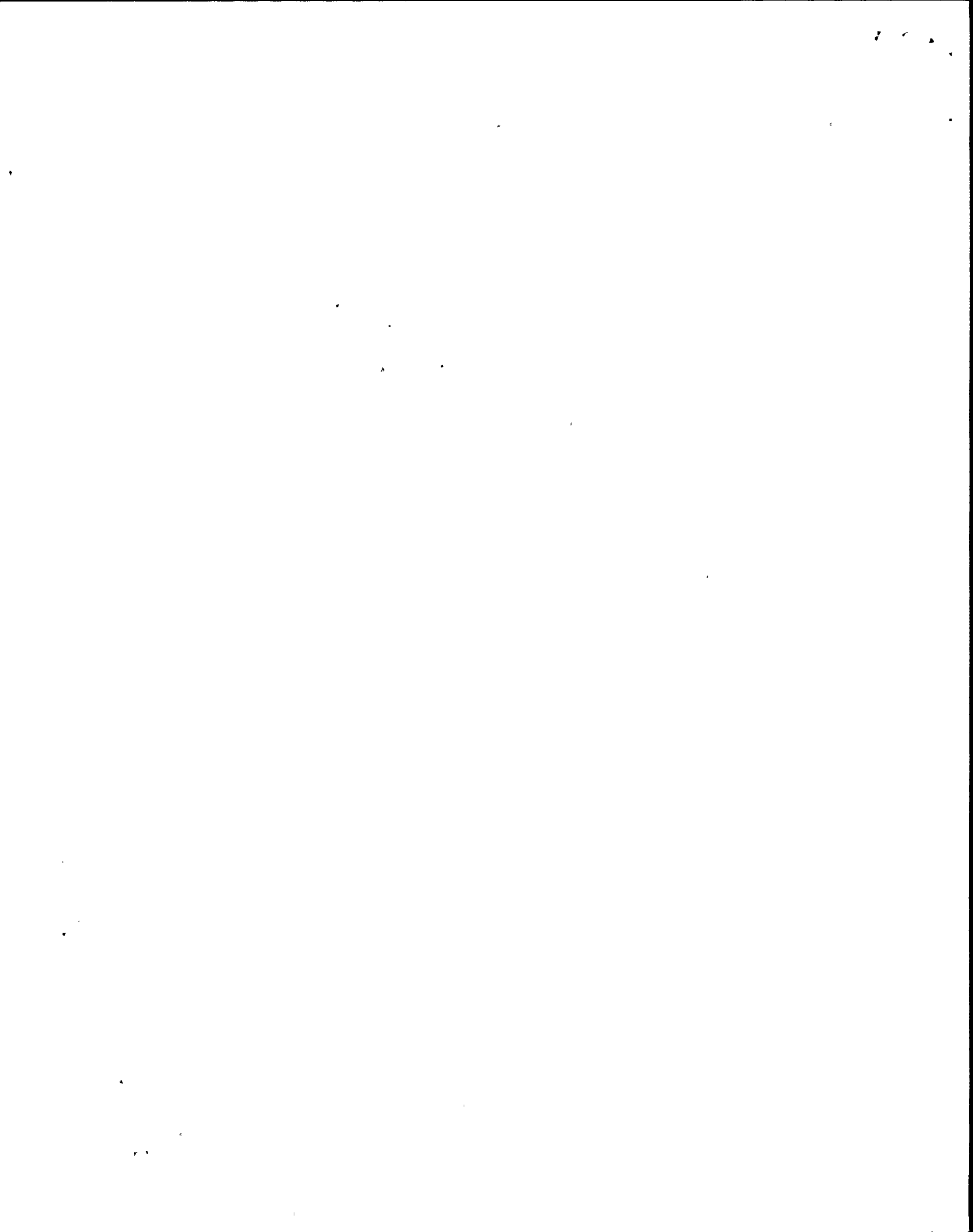
SEQUENCE ALIGNMENT: DISPLAYS THE CONTROL ROD MOTIONS REQUIRED TO OBTAIN THE ROD PATTERN FOR A SPECIFIED STEP IN THE OPERATING SEQUENCE.

CONFIRM SHUTDOWN: PROVIDES AN 'ALL RODS FULL-IN' AND A 'SHUTDOWN CONFIRMED' INDICATION. RODS NOT FULL-IN MAY BE DISPLAYED.

OPERATE MODE - SCREEN #4

ROD DRIFT: DISPLAYS THE PRESENT AND ORIGINAL POSITIONS OF ALL DRIFTING RODS.

ROD TIMING MONITOR: DISPLAYS THE SWITCH AND TOTAL DRIVE TIME FOR THE SELECTED ROD WHILE IT IS DRIVING. ALSO ALLOWS THE TIMING DATA TO BE RECORDED AND PLOTTED AT THE OPERATOR'S DISPLAY.



The following show the HELP displays for the INOP mode:

INOP MODE - SCREEN #1

SELF-TEST: (COMPUTER DISPLAY ONLY) DISPLAYS SELF-TEST INFORMATION AND PROVIDES THE MEANS TO CLEAR THE SELF-TEST ERROR LOG. SELF-TEST OPERATIONS MAY BE MANUALLY CONTROLLED WHEN IN THE INOP MODE.

DISPLAY OFF: TURNS THE DISPLAY OFF. ANY CHANGE OF SELF-TEST STATUS, POWER LEVEL, OR MODE WILL CAUSE IT TO TURN BACK ON. ALSO, PRESSING ANY FRONT PANEL KEY WILL CAUSE THE DISPLAY TO TURN ON.

INOP MODE - SCREEN #2

MESSAGES: DISPLAYS REASONS FOR BLOCKS AND THE LATEST STATUS MESSAGES.

ROD BYPASS OPTIONS: DISPLAYS THE BYPASSED RODS. WHEN PERMITTED, RODS MAY BE BYPASSED AT THE COMPUTER DISPLAY IN THE INOP MODE.

SUBSTITUTE OPTIONS: DISPLAYS RODS WITH SUBSTITUTE POSITIONS. WHEN PERMITTED, RODS MAY BE SUBSTITUTED AT THE OPERATOR'S DISPLAY.

INOP MODE - SCREEN #3

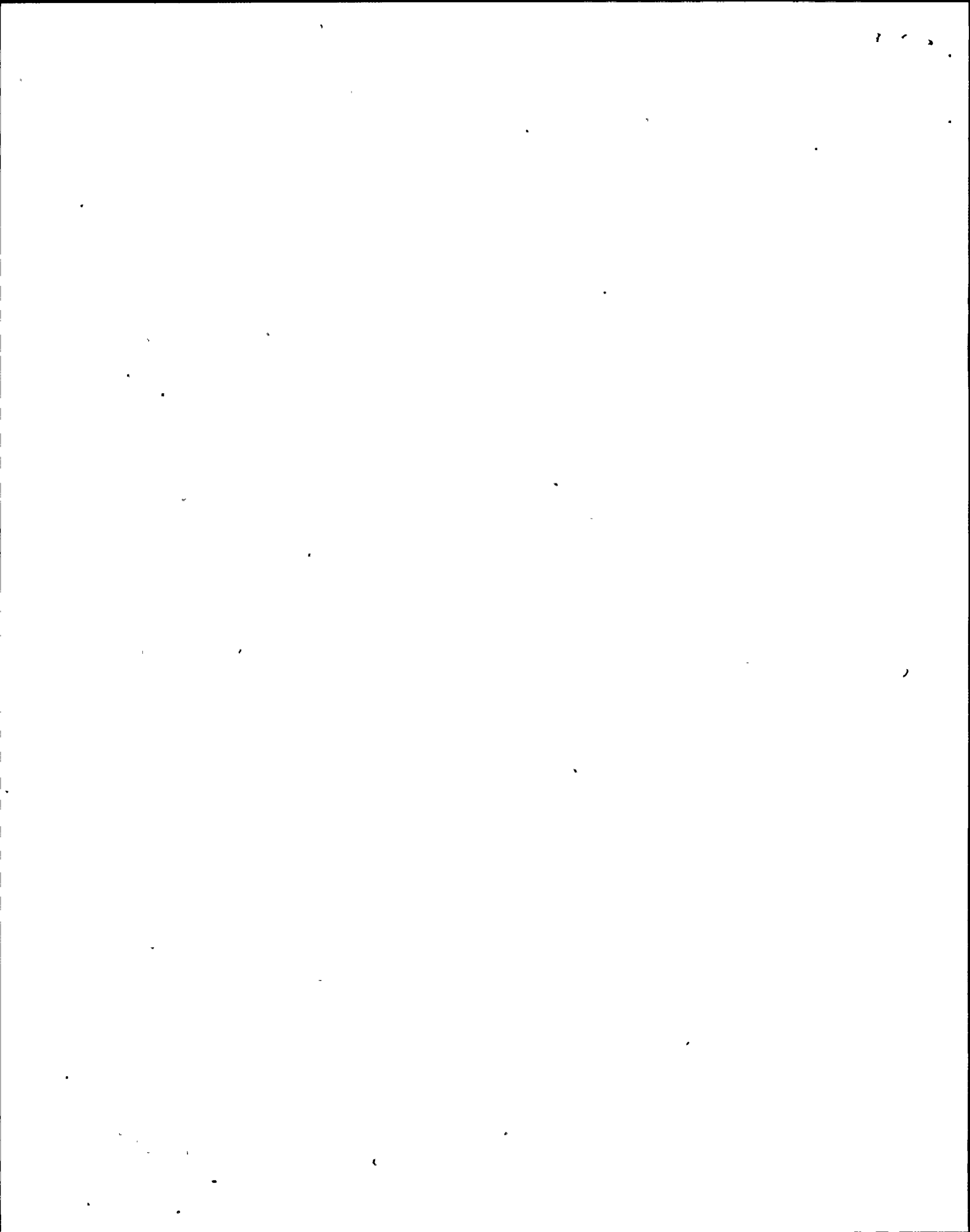
CHECK DISPLAY: FILLS THE DISPLAY - THEN CLEARS IT. THE USER MUST OBSERVE THE DISPLAY FOR ANOMALIES.

CHECK KEYS: INITIATES AN INTERACTIVE TEST TO CHECK THE FRONT PANEL KEYS.

INOP MODE - SCREEN #4

SET PARAMETERS: ALLOWS THE USER TO SET SELF-TEST OPTIONS, GEDAC PARAMETERS, AND THE PLANT UNIT NUMBER AT COMPUTER DISPLAY.

SEQUENCE OPTIONS: ALLOWS THE USER TO SELECT THE SEQUENCE, DISPLAY A SEQUENCE OR DOWNLOAD A SEQUENCE AT THE COMPUTER DISPLAY.



The following show the HELP displays for the TEST mode:

TEST MODE - SCREEN #1

SELF-TEST: (COMPUTER DISPLAY ONLY) DISPLAYS SELF-TEST INFORMATION AND PROVIDES THE MEANS TO CLEAR THE SELF-TEST ERROR LOG. SELF-TEST OPERATIONS MAY BE MANUALLY CONTROLLED WHEN IN THE INOP MODE.

DISPLAY OFF: TURNS THE DISPLAY OFF. ANY CHANGE OF SELF-TEST STATUS, POWER LEVEL, OR MODE WILL CAUSE IT TO TURN BACK ON. ALSO, PRESSING ANY FRONT PANEL KEY WILL CAUSE THE DISPLAY TO TURN ON.

TEST MODE - SCREEN #2

MESSAGES: DISPLAYS REASONS FOR BLOCKS AND THE LATEST STATUS MESSAGES.

ROD BYPASS OPTIONS: DISPLAYS THE BYPASSED RODS. WHEN PERMITTED, RODS MAY BE BYPASSED AT THE COMPUTER DISPLAY IN THE INOP MODE.

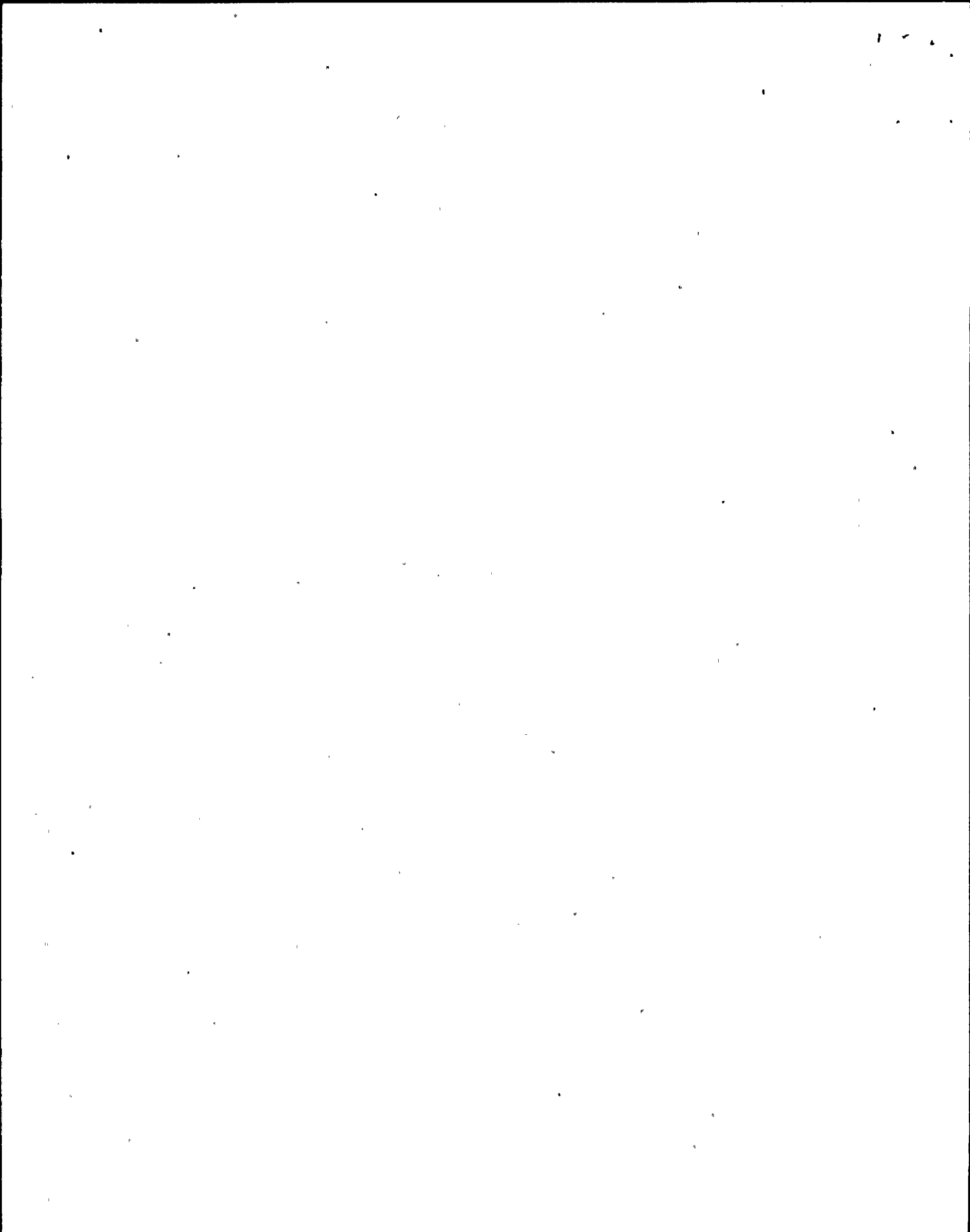
SUBSTITUTE OPTIONS: DISPLAYS RODS WITH SUBSTITUTE POSITIONS. WHEN PERMITTED, RODS MAY BE SUBSTITUTED AT THE OPERATOR'S DISPLAY.

TEST MODE - SCREEN #3

ROD TEST: ENTRY POINT AND PRIMARY DISPLAY FOR THE ROD TEST CONFIGURATION.

CONFIRM SHUTDOWN: PROVIDES AN 'ALL RODS FULL-IN' AND A 'SHUTDOWN CONFIRMED' INDICATION. RODS NOT FULL-IN MAY BE DISPLAYED.

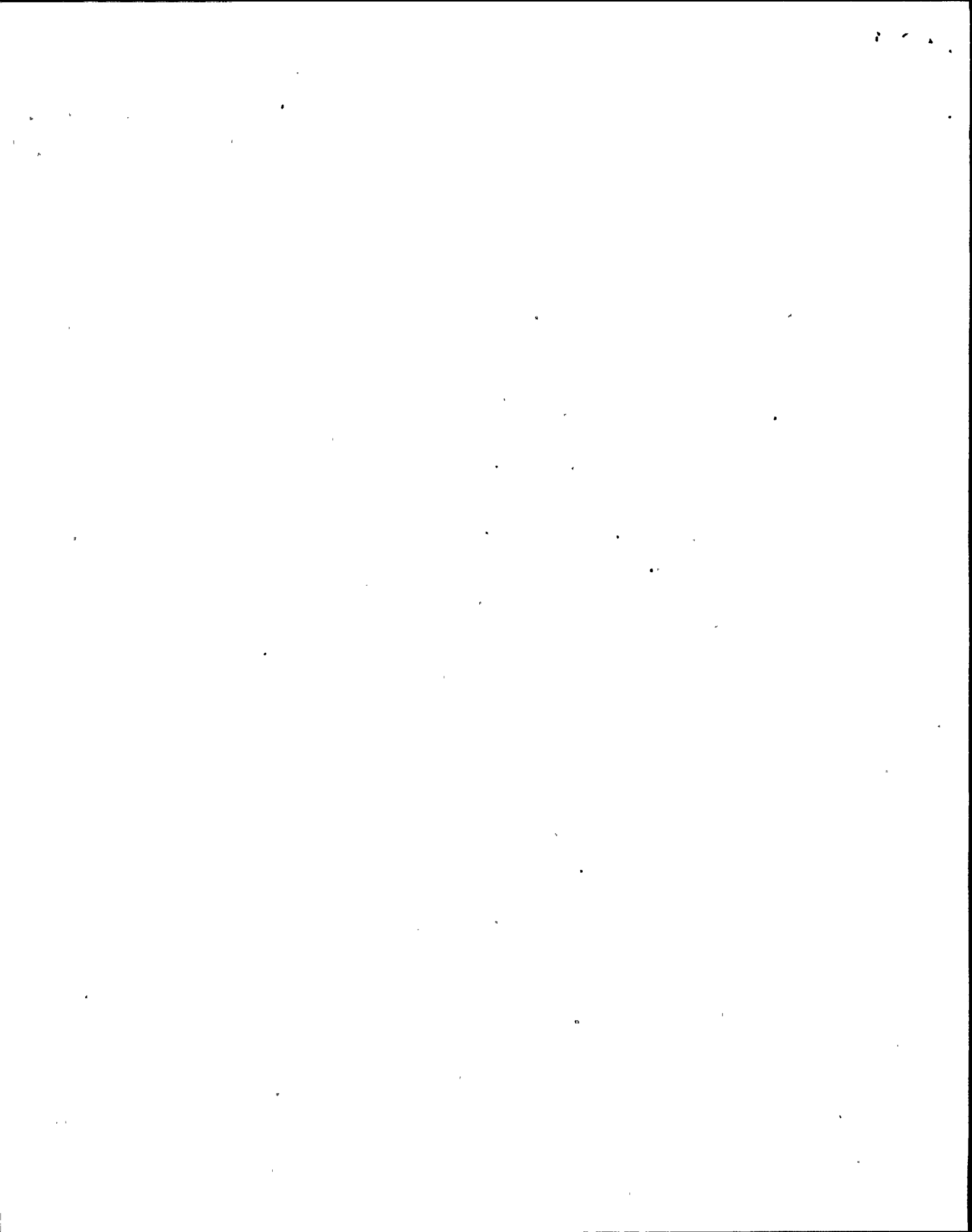
SHUTDOWN MARGIN TEST: ENTRY POINT AND PRIMARY DISPLAY FOR SM TEST.



**ATTACHMENT 6
ROD BLOCKS IN OPERATING REGIONS**

CONDITION	BELOW LPSP			TRANSITION REGION			ABOVE LPAP		
	IB	WB	A	IB	WB	A	IB	WB	A
1 No Rod Selected	X	X	O	O	O	O	O	O	O
2.1 Selected Rod at Insert Limit and Selected and Driving	X	O	O	O	O	O	O	O	O
2.2 Selected Rod Withdraw Limit and Selected and Driving	O	X	O	O	O	O	O	O	O
3.1 Selected Rod at Insert Limit, Not Driving and Not Full-in (D)	X	O	O	O	O	O	O	O	O
3.2 Selected Rod at Withdraw Limit, Not Driving and Not Full-Out (E)	O	X	O	O	O	O	O	O	O
4.1 Selected Rod has become an Insert Error Rod (AIEL)	X	O	M	O	O	M	O	O	O
4.2 Selected Rod has become a Withdraw Error Rod (AWEL)	O	X	M	O	O	M	O	O	O
4.3 An Insert or Withdraw Error Exists and Selected Rod is Not the Error Rod	X	X	X	O	O	O	O	O	O
4.4 Selected Rod has 1-notch Insert Error and is Driving	X	O	X	O	O	O	O	O	O
4.5 Selected Rod has 1-notch Withdraw Error and is Driving	O	X	X	O	O	O	O	O	O
5.1 Selected Rod has 1- or 2-notch Insert Error, Not Driving	X	O	O	O	O	O	O	O	O
5.2 Selected Rod has 1- or 2-notch Withdraw Error, Not Driving	O	X	O	O	O	O	O	O	O
6.1 Selected Rod has Greater than a 2-notch Insert Error, Not Driving	X	X	X	O	O	O	O	O	O
6.2 Selected Rod Has Greater than a 2-notch Withdraw Error, Not Driving	X	X	X	O	O	O	O	O	O
6.3 More than One Error	X	X	X	O	O	O	O	O	O
7.1 Selected Rod Position is Unknown	O	O	O	O	O	O	O	O	O
7.2 Critical Self-Test Fault	X	X	X	X	X	X	O	O	X
7.3 Non-Critical Self-Test Fault	O	O	X	O	O	X	O	O	X

LEGEND: A = Annunciation
 AIEL = Added to Insert Error List
 AWEL = Added to Withdraw Error List
 D = Insertion of Full-in Rod Permitted
 E = Withdrawal of Full-out Rod Permitted
 IB = Insert Block
 M = Momentary Annunciation
 O = No Action Required
 WB = Withdraw Block
 X = Block or Annunciate



ATTACHMENT 7
STATUS MESSAGES

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The messages contain variable fields for rod i.d. (XX-YY), rod position (NN), sequence name (ABCD) and sequence step number (NNN). These fields will be replaced with the relevant data at the time the message is generated. These messages are also sent to the plant computer where they are time tagged and logged.

ERROR
CODE

MESSAGE / REASON FOR BLOCK

20 RWM COMPUTER POWERING UP

This is an advisory message. It is generated when the RWM is powered on.

25 I OR W ERROR EXISTS AS LPAP CROSSED WHILE DEC IN POWER

This is an advisory message. It is used to inform the operator that there is at least one insert or withdraw error when the Low Power Alarm Point (approx. 30% power) was crossed while decreasing in power.

26 *** THE REACTOR IS SHUTDOWN ***

27 *** THE REACTOR IS NOT SHUTDOWN ***

These are advisory messages. They are generated when the shutdown confirmation status changes. For example, if all rods are full in and the first rod is withdrawn, message number 27 will be logged.

28 *** THE RWM HAS BEEN BYPASSED ***

This is an advisory message. It is generated when the Operator display keylock switch is turned to BYPASS.

29 *** THE RWM HAS BEEN UNBYPASSED ***

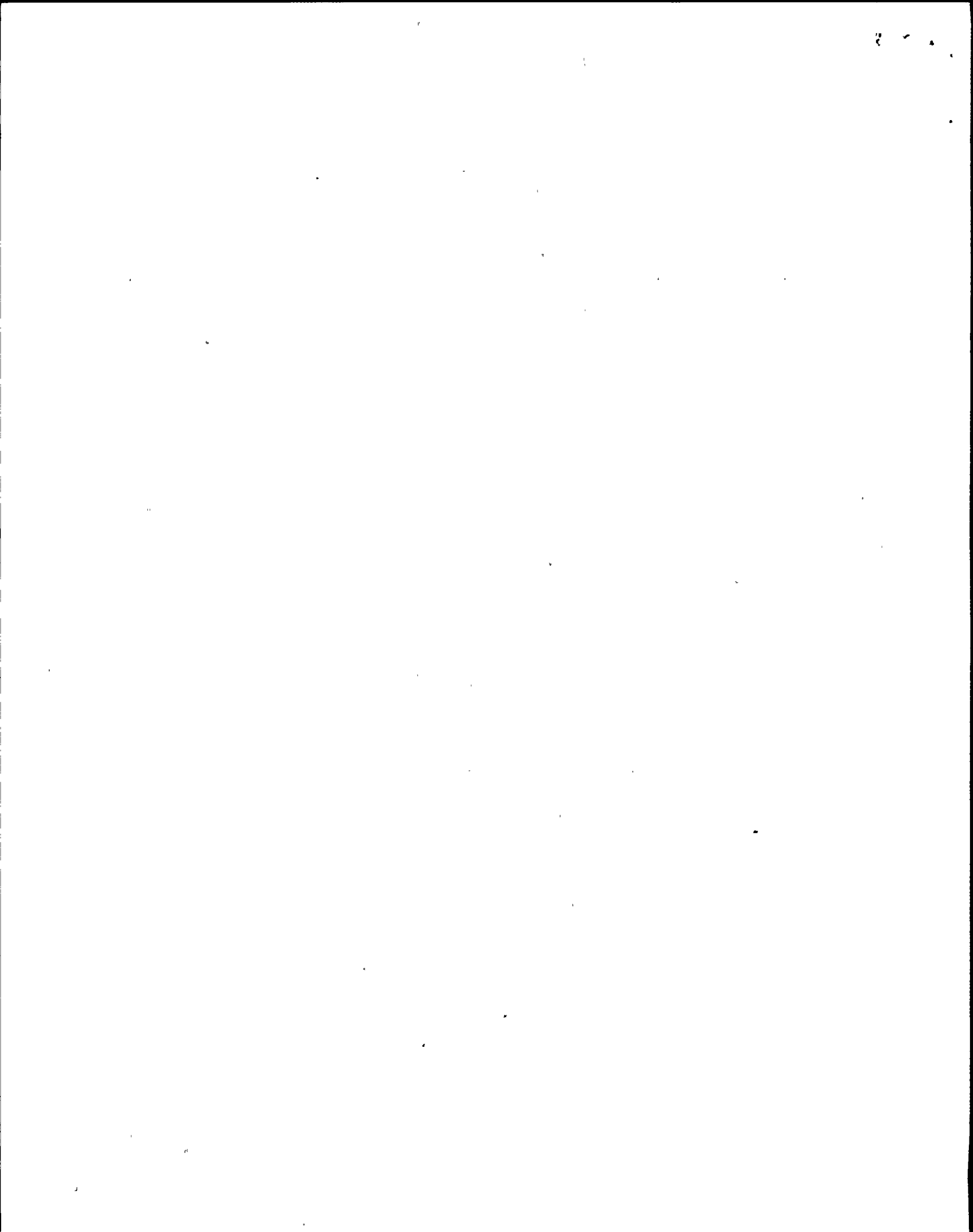
This is an advisory message. It is generated when the Operator display keylock switch is turned from BYPASS to UNBYPASS.

30 *** THE RWM HAS LATCHED TO STEP NNN ***

This is an advisory message. Whenever the RWM latches to a new step this message is generated.

35/36 SCRAM IN PROGRESS

While a scram is active the RWM will generate blocks indications. The reason for the blocks will be as shown above.



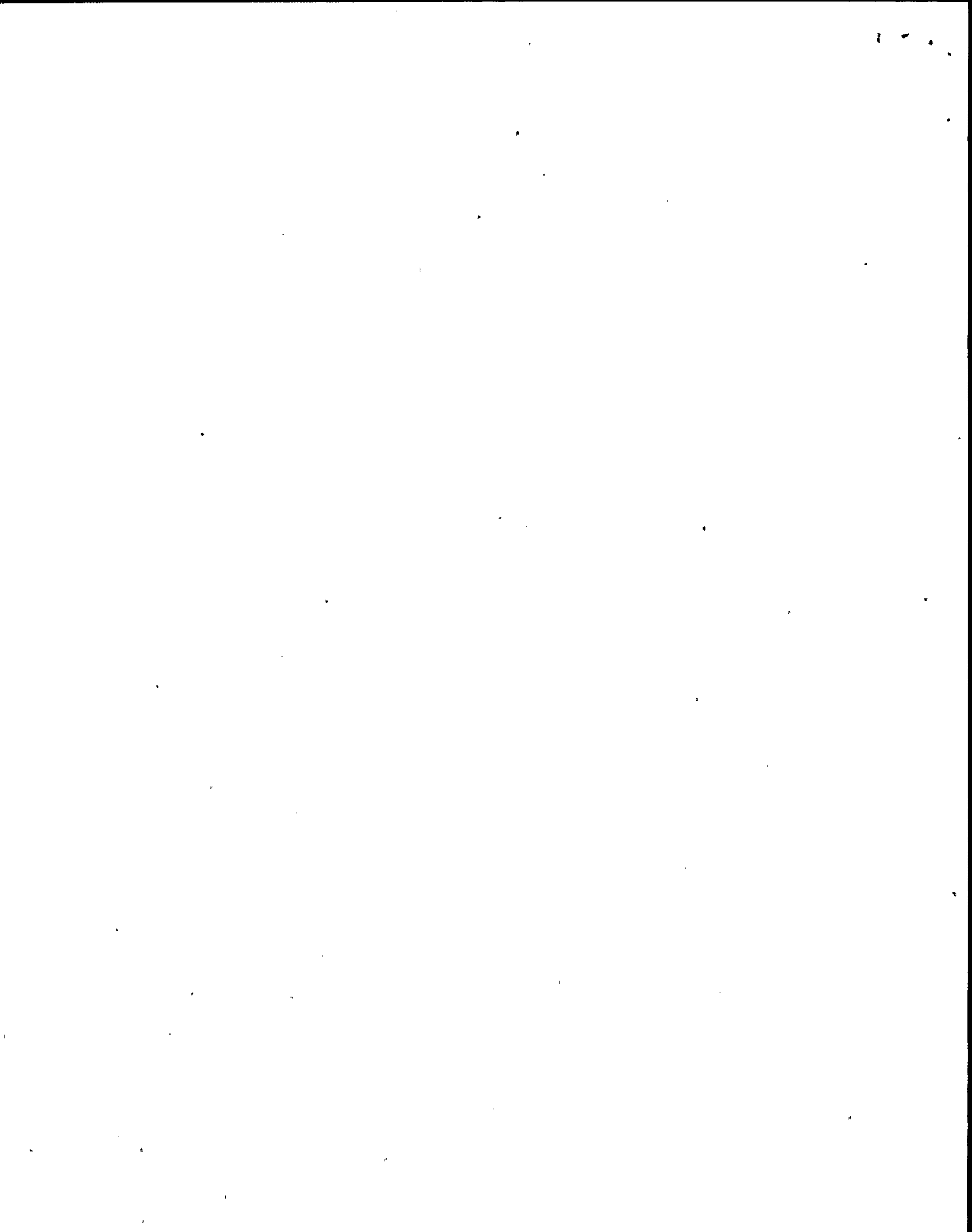
ATTACHMENT 7
STATUS MESSAGES

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ERROR
CODE

MESSAGE / REASON FOR BLOCK

- 41 **** THE POWER LEVEL HAS BEEN DECREASED BELOW THE LPSP ****
- This is an advisory message. It is generated when the power level has changed to BELOW LPSP while decreasing in power and has remained there for approximately 15 seconds.
- 42 **** THE POWER LEVEL HAS BEEN INCREASED ABOVE THE LPSP ****
- This is an advisory message. It is generated when the power level has changed to TRANSITION while increasing in power and has remained there for approximately 15 seconds.
- 46 SEQUENCE ABCD SATISFIES THE BPWS CRITERIA
- This is an advisory message. When a sequence is downloaded to the RWM from the plant computer, the RWM will validate the sequence against the BPWS criteria. This message will be generated if the sequence passes the BPWS checks.
- 47 STEP NNN SPECIFICATION OF SEQUENCE ABCD VIOLATES BPWS
- This is an advisory message. When a sequence is downloaded to the RWM from the plant computer, the RWM will validate the sequence against the BPWS criteria. This message will be generated if the sequence fails the BPWS step checks.
- 48 ROD XX-YY GROUP ASSIGNMENT OF SEQUENCE ABCD VIOLATES BPWS
- This is an advisory message. When a sequence is downloaded to the RWM from the plant computer, the RWM will validate the sequence against the BPWS criteria. This message will be generated if the sequence fails the BPWS group checks.
- 49 ROD XX-YY HAS MOVED FROM POSITION NN TO NN
- This is an advisory message. Whenever a rod is moved via the RMCS, the rod's initial and final position will be indicated.
- 50 CRITICAL SELF TEST FAILURE
- If the self-test software detects a hardware failure that prevents the RWM from performing sequence enforcement, insert/withdraw block indications will be applied. This message will be generated to describe the reason for blocks



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STATUS MESSAGES

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ERROR
CODE

MESSAGE / REASON FOR BLOCK

51 POSITION NN WAS NOT OBSERVED FOR ROD XX-YY

The RWM will verify that all valid positions are observed while a rod is driving. If a valid position is not observed, this message will be logged.

52 THE POWER LEVEL IS UNKNOWN, RWM ASSUMES BELOW THE LPSP

The RWM receives Low Power Set Point (LPSP - approximately 20% power) and Low Power Alarm Point (LPAP - approximately 35% power) contacts that allow it to know what power region the reactor is in. If there is an inconsistency between these two contacts (e.g., the LPAP contact indicates power is above the LPAP and the LPSP contact indicates the power is below the LPSP), then the RWM assumes the power level is below the LPSP.

53 THE POSITION WORD IS NOT BEING RECEIVED

If the RWM stops receiving information from the Rod Position Information System (RPIS), it will apply Insert/Withdraw block indications and generate this message to describe the reasons for the blocks.

54 THE STATUS WORD IS NOT BEING RECEIVED

If the RWM stops receiving the status word from the Rod Drive Control System (RDCS), it will apply Insert/Withdraw indications and generate this message to describe the reasons for the blocks.

55 THE REQUEST WORD IS NOT BEING RECEIVED

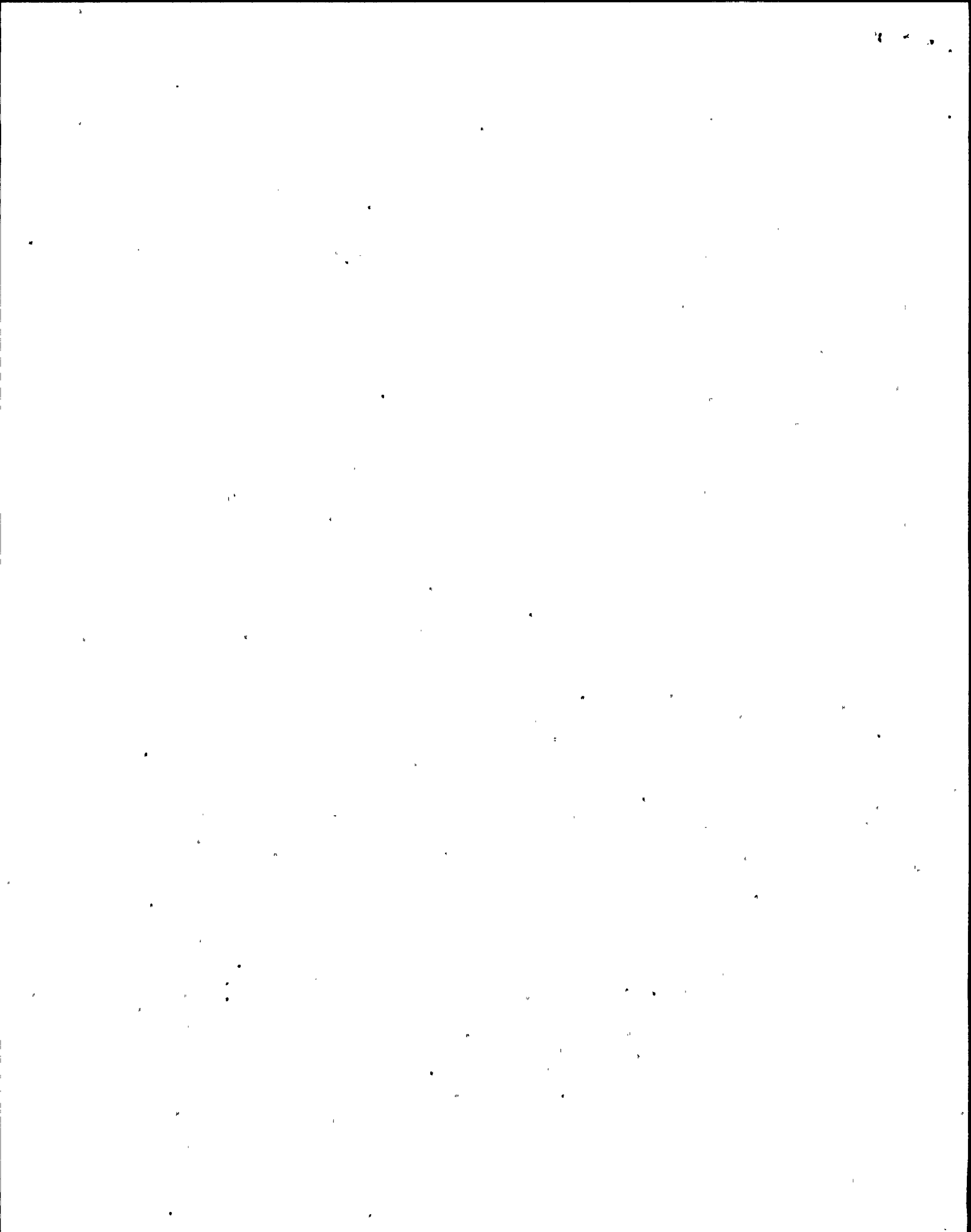
If the RWM stops receiving the request word from the Rod Drive Control System (RDCS), it will apply insert/withdraw block indications and generate this message to describe the reasons for the blocks.

56 ROD XX-YY HAS BEEN ADDED TO THE BYPASS ROD LIST

This is an advisory message. Rods may be bypassed from the computer display in INOP mode. This message is generated whenever a rod is bypassed.

57 ROD XX-YY HAS BEEN REMOVED FROM THE BYPASS ROD LIST

This is an advisory message. Rods may be unbypassed from the computer display in INOP mode. This message is generated whenever a rod is unbypassed.



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STATUS MESSAGES

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ERROR
CODE

MESSAGE / REASON FOR BLOCK

58 ROD XX-YY:NN HAS BEEN ADDED TO THE SUBSTITUTE ROD LIST

This is an advisory message. Rods may be given substitute position from the operator display in OPERATE, TEST or BYPASS mode if the rod is selected and has an invalid position. This message is generated whenever a rod position substitution occurs.

59 ROD XX-YY:NN HAS BEEN REMOVED FROM THE SUBSTITUTE ROD LIST

This is an advisory message. If a rod that has a substitute value is moved, then it is automatically removed from the substitute rod list and this message is generated.

60 ROD XX-YY IS DRIFTING

When the RWM determines that a rod is drifting, this message will be logged to identify the drifting rod.

61 ROD XX-YY HAS DRIFTED FROM POSITION NN TO NN

When a drifting rod has been at a valid position for five seconds, the RWM generates this message to indicate that the rod has stopped drifting.

62 ROD DRIFT HAS BEEN RESET

This message will be logged when a drift condition has been cleared (i.e., when the number of drifting rods observed has changed from $N > 0$ to 0).

63 NON-CRITICAL SELF TEST FAILURE

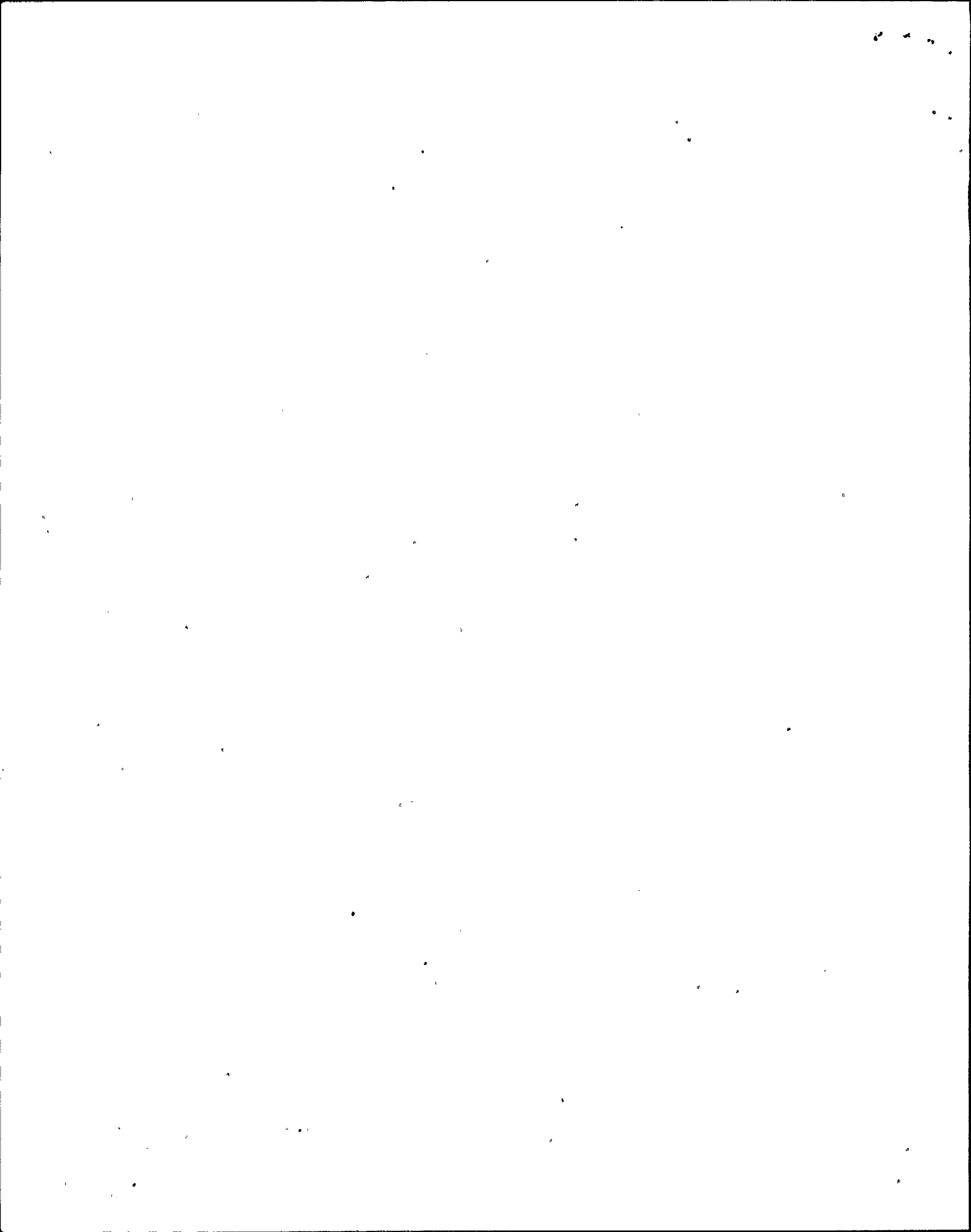
This is an advisory message. If the self-test software detects a hardware failure that doesn't prevent the RWM from performing sequence enforcement then this message will be generated.

65 THE SELECTED ROD (XX-YY) HAS AN INFERRED POSITION OF NN

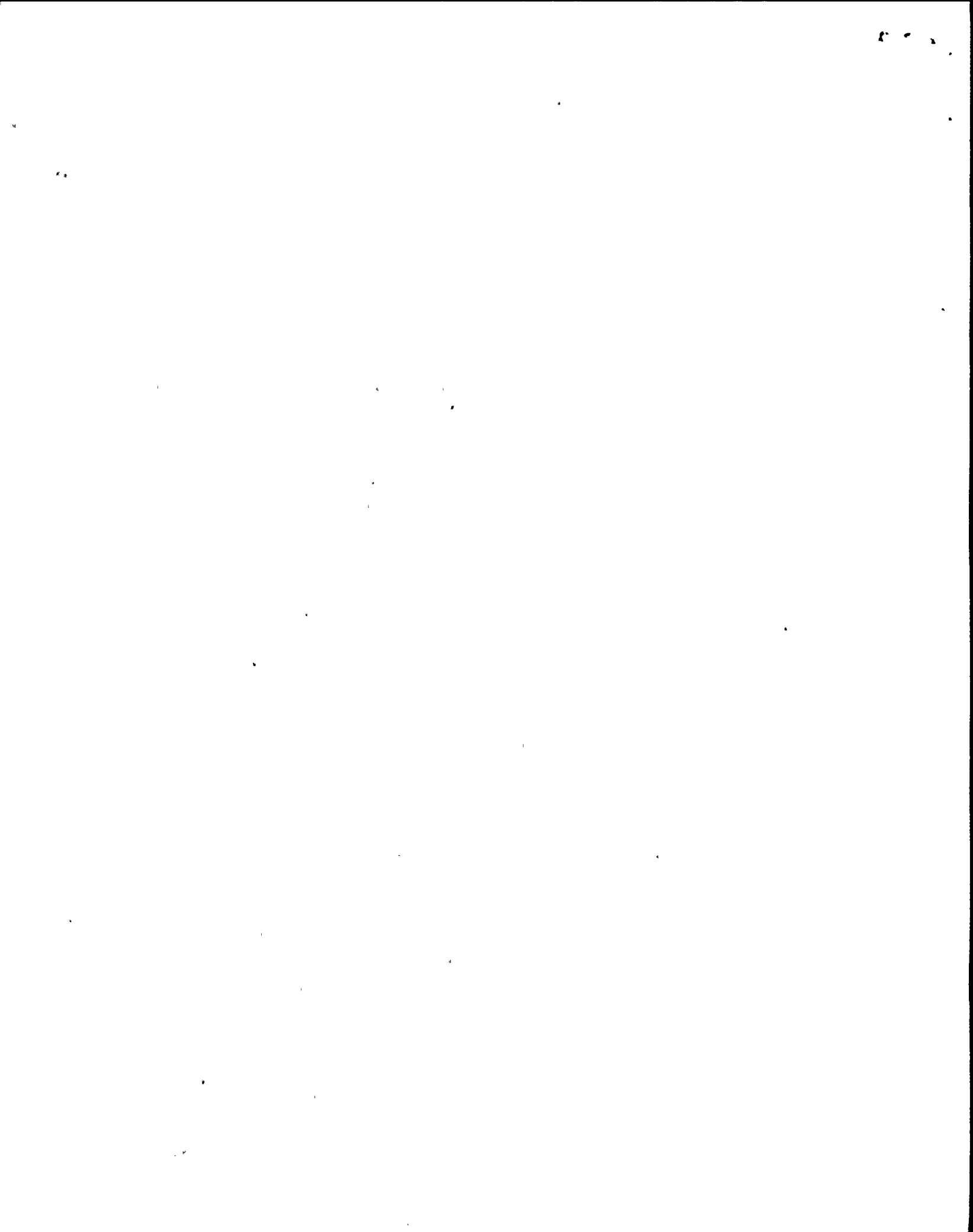
This is an advisory message. When a Rod that has finished driving and settles to an invalid position, the RWM will infer a position for the rod and generate this message.

66 INVALID POSITION FOR ROD XX-YY

If invalid rod position information (i.e., a position greater than 49) is received from the RPIS, the RWM will apply insert/withdraw block indications and generate the message shown above to describe the reasons for blocks.



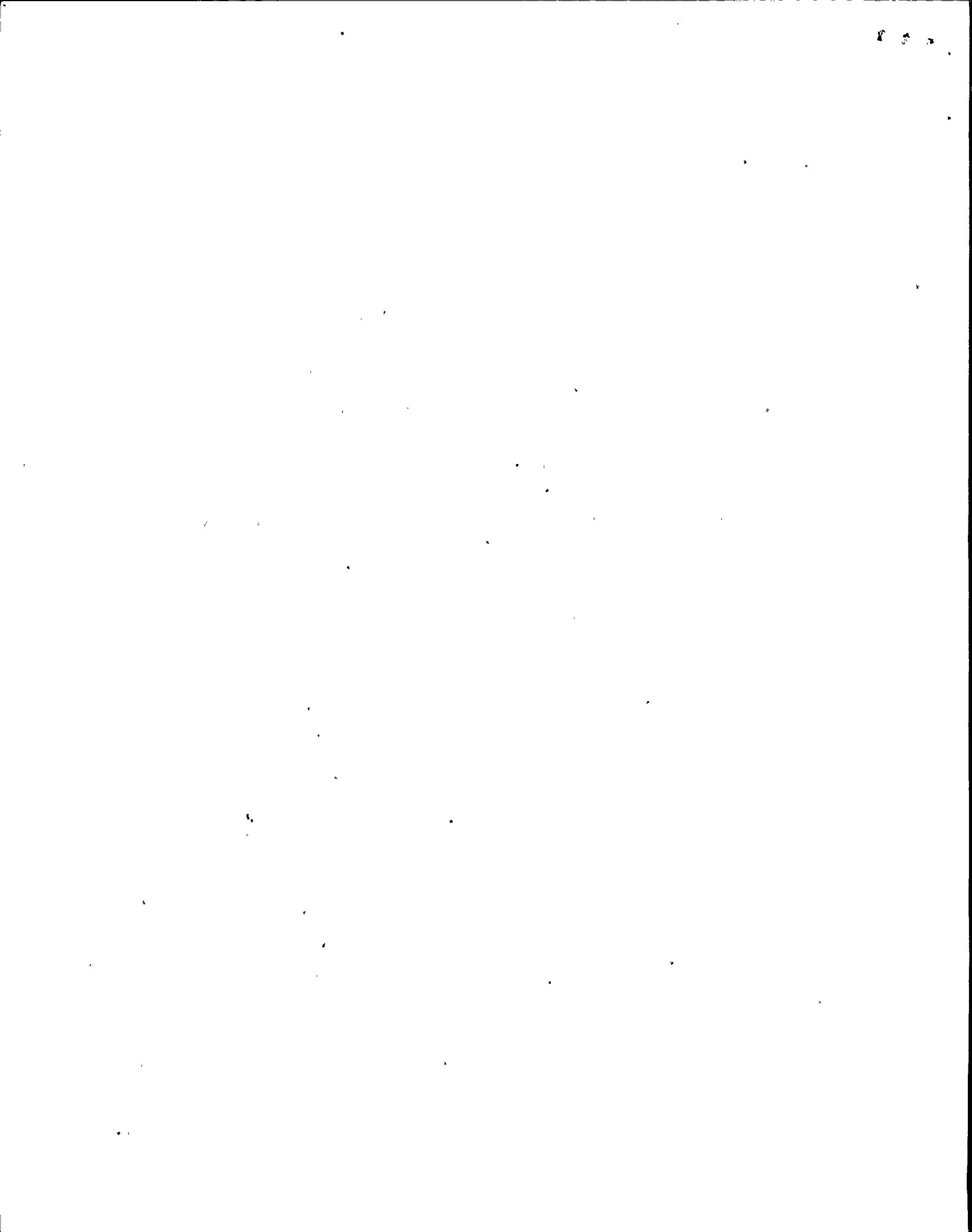
<u>ERROR CODE</u>	<u>MESSAGE / REASON FOR BLOCK</u>
68	<p>INVALID ROD I.D. FOR ROD XX-YY</p> <p>If position word information is not received for a rod, the RWM will apply insert/withdraw block indications and generate this message to describe the reasons for blocks.</p>
70	<p>RMCS INDICATES THAT ROD XX-YY IS BEING INSERTED AND WITHDRAWN</p> <p>When an insert and withdraw signal is received from the Request Word, the RWM will apply Insert/Withdraw block indications and generate this message to describe the reasons for the blocks.</p>
72	<p>RWM BLOCKS DISAGREE WITH THE ECHOES BLOCKING CONDITIONS</p> <p>If the power level is below the LPSP, the operator keylock switch is not in the BYPASS position, the RWM is applying an insert/withdraw block, and the corresponding echo does not indicate a block is being applied, then this message will be generated.</p>
80	<p>SELECTED ROD (XX-YY) IS A BYPASSED ROD</p> <p>This is an advisory message. If a rod is on the bypass rod list and it is selected, the RWM will generate the message shown above.</p>
81	<p>SELECTED SEQUENCE (ABCD) DOES NOT SATISFY THE BPWS CRITERIA</p> <p>This is both used as an advisory message and an explanation of blocks. If the LPAP is crossed while decreasing in power and the selected sequence does not satisfy the BPWS criteria, this message will be generated. It will be accompanied with a 30 second annunciation. If the selected sequence does not conform to the BPWS criteria, then the RWM will apply insert/withdraw block indications and generate the message shown above as the reason for blocks. This message will not be logged by the Plant Computer when the power level is above the LPAP.</p>
82	<p>INVALID SEL ROD (XX-YY) POS, MAX. SUBS ALREADY MADE</p> <p>If the RPIS is sending an invalid position (i.e., a value greater than 49) for the selected rod and the maximum number of rod position substitutions have already been made, then the RWM will generate this message.</p>
86	<p>INVALID SEL ROD (XX-YY) POS, MAX. NUM. RODS ALREADY BYP</p> <p>If the RPIS is sending an invalid position (i.e., a value greater than 49) for the selected rod and the maximum number of rods have already been bypassed, then this message will be generated.</p>



ATTACHMENT 7
STATUS MESSAGES

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<u>ERROR CODE</u>	<u>MESSAGE / REASON FOR BLOCK</u>
90	<p>INVALID POSITION FOR SELECTED ROD (XX-YY)</p> <p>If the RPIS is sending an invalid position (i.e., a value greater than 49) for the selected rod, and less than the maximum number of rods have been bypassed, and less than the maximum number of rods have been substituted, then this message will be generated.</p>
100	<p>NO SEQ LOADED, RWM UNABLE TO PERFORM SEQUENCE ENFORCEMENT</p> <p>If no sequence is selected, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for blocks. This message will not be logged above the LPAP.</p>
102	<p>OUT OF SEQUENCE CONDITION EXISTS</p> <p>If there is more than one insert error, more than one withdraw error, one insert and one withdraw error, or a single error that is more than two notches, then the current control rod pattern is considered out of sequence with the selected sequence. Blocking indications will be applied. The block reason will be as shown above. This message will not be logged above the LPAP.</p>
104	<p>WITHDRAW ERROR MUST BE CORRECTED BEFORE CONTINUING</p> <p>If a withdraw error exists and a rod other than the withdraw error rod is selected, then the RWM will apply blocking indications and generate this message to describe the reason for blocks. This message will not be logged above the LPAP.</p>
108	<p>INSERT ERROR MUST BE CORRECTED BEFORE CONTINUING</p> <p>If an insert error exists and a rod other than the insert error rod is selected, then block indications will be applied and the message shown above will be generated to describe the reason for blocks. This message will not be logged above the LPAP.</p>
112	<p>SELECTED ROD XX-YY IS NOT CONTAINED IN THE CURRENT STEP</p> <p>If the selected rod is not contained in the current step (as indicated by the RWM), then insert/withdraw block indications will be applied, and the message shown above will be generated to describe the reason for blocks. This message will not be logged above the LPAP.</p>



ATTACHMENT 7
STATUS MESSAGES

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ERROR
CODE

MESSAGE / REASON FOR BLOCK

116 SELECTED ROD (XX-YY) IS AN INSERT ERROR ROD

If the selected rod is on the insert error list, then an insert block indication will be applied, and the message shown above will be generated to describe the reason for the block. This message will not be logged above the LPAP.

120 SELECTED ROD (XX-YY) IS AT THE STEP INSERT LIMIT

If the selected rod is at the step insert limit, then an insert block indication will be applied, and this message will be generated to describe the reason for the block. This message will not be sent to the plant computer.

124 SELECTED ROD (XX-YY) IS A WITHDRAW ERROR ROD

If the selected rod is on the withdraw error list, then a withdrawn block indication will be applied, and this message will be generated to describe the block. This message will not be logged above the LPAP.

128 SELECTED ROD (XX-YY) IS AT THE STEP WITHDRAW LIMIT

If the selected rod is at the step withdraw limit, then a withdraw block indication will be applied, and this message will be generated to describe the reason for the block. This message will not be sent to the plant computer.

130 NO ROD IS SELECTED

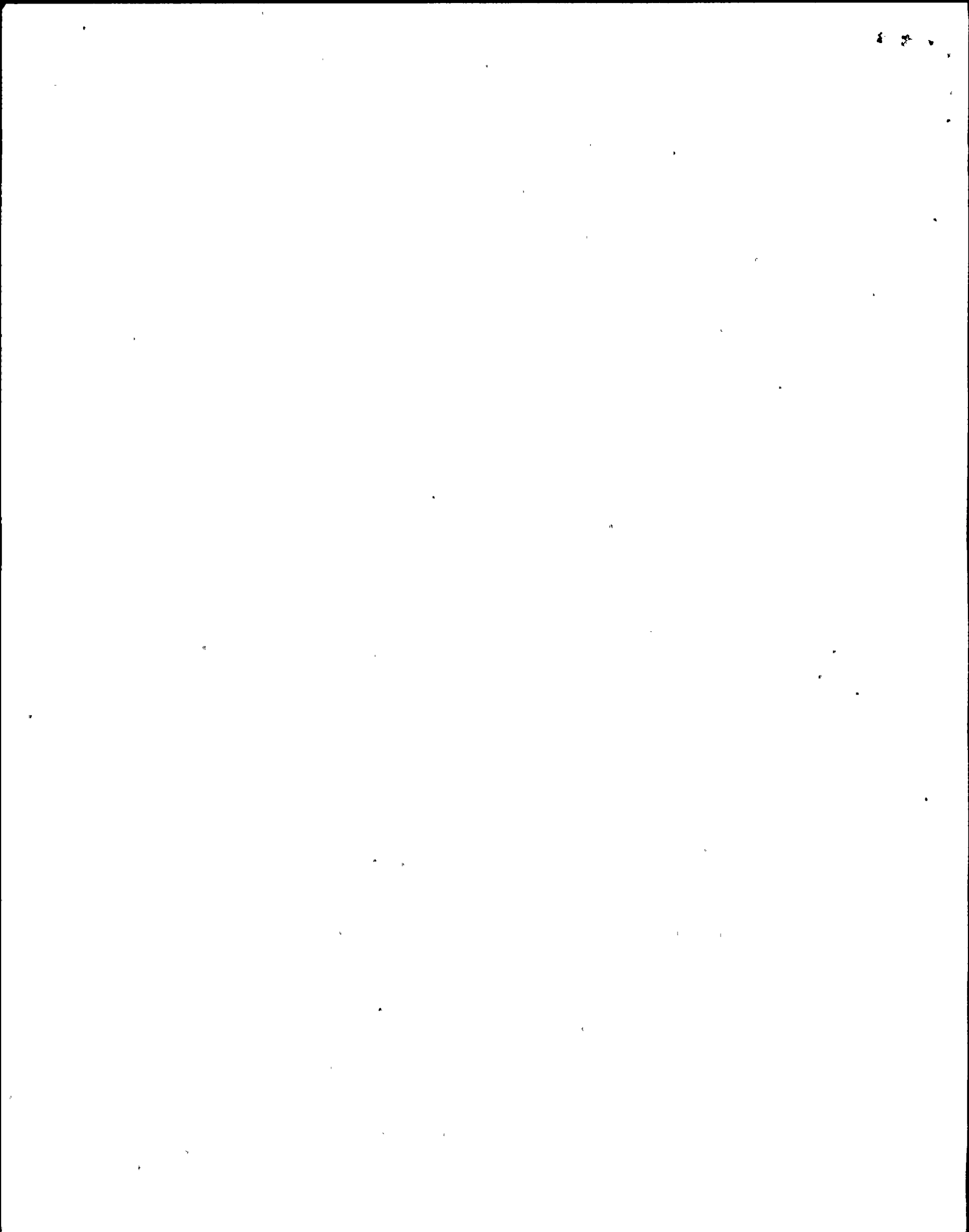
If no rod is selected, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks. This message will not be logged above the LPAP.

150 NO SM TEST LOADED, TEST REQUEST IGNORED

If the Shutdown margin test is requested while in TEST mode and no Shutdown Margin sequence is available, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.

152 ALL RODS NOT FULL IN, ROD TEST REQUEST IGNORED

All rods must be full in before the Rod test function can be entered. If the Rod test function is requested and all rods are not full in, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.



ERROR
CODE

MESSAGE / REASON FOR BLOCK

154 ALL RODS NOT FULL IN, SM TEST REQUEST IGNORED

All rods must be full in before the Shutdown margin test function can be entered. If the Shutdown margin test function is requested and all rods are not full in, the insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.

156 ROD TEST NOT COMPLETED, NEW TEST REQUEST IGNORED

All rods must be fully inserted before Rod test is exited and another TEST mode function is selected. If the Rod test function is active, all rods are not full in, and Shutdown Margin is selected then, insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.

158 SM TEST NOT COMPLETED, NEW TEST REQUEST IGNORED

All rods must be fully inserted before SM test is exited and another TEST mode function is selected. If the SM test function is active, all rods are not full in, and Rod test is selected, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.

159 NO TEST CHOSEN IN TEST MODE

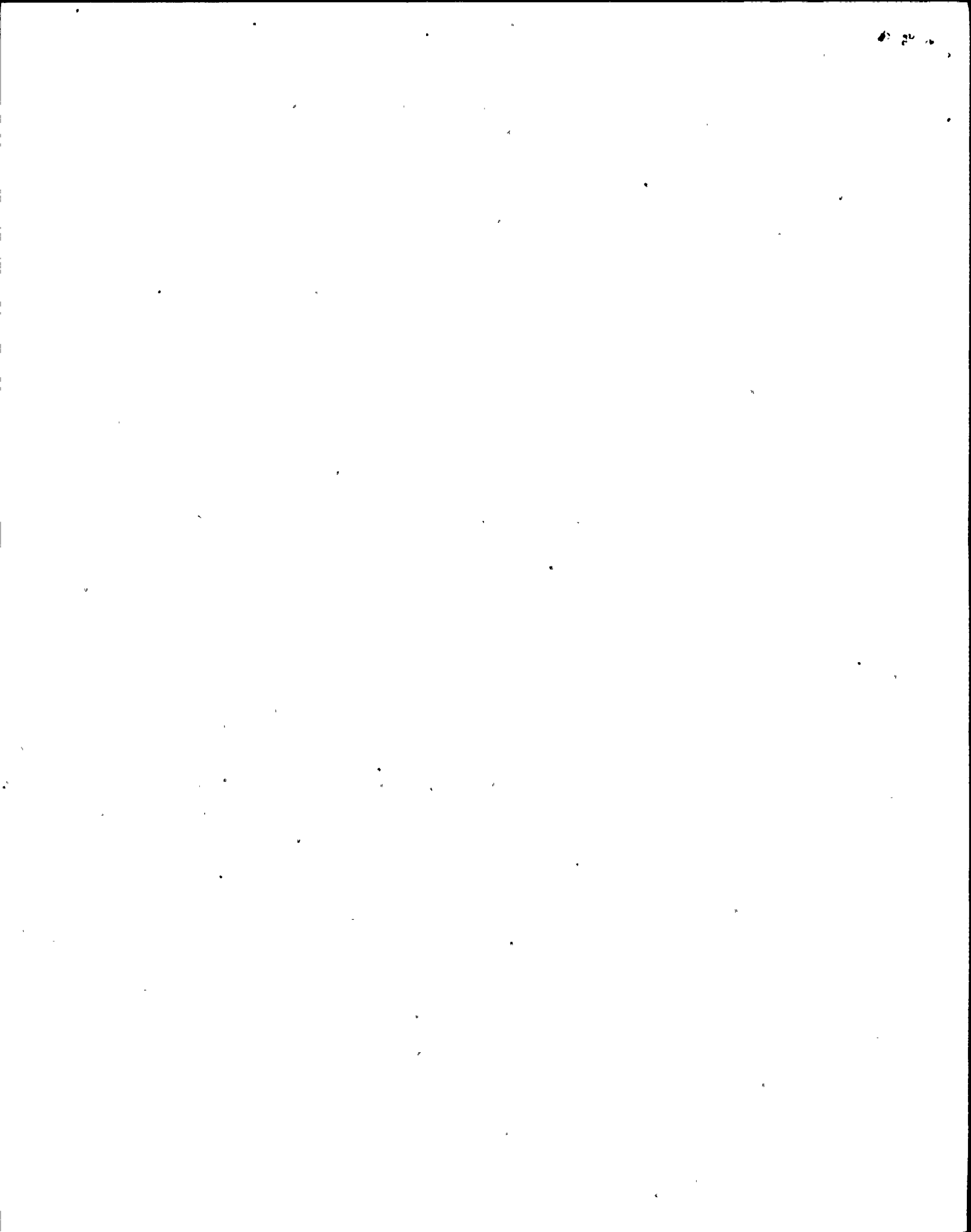
If the RWM mode is TEST and no test function (i.e., Rod test) is active; then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.

160 MUST FIX WITHDRAW ERROR ON SECOND SM ROD BEFORE CONTINUING

If the second Shutdown margin rod is withdrawn past the SM limit and the selected rod isn't the second SM rod, then block indications will be applied, and this message will be generated to describe the reason for the block.

162 RODS OTHER THAN SM TEST RODS WITHDRAWN IN SM TEST

If any rods other than the two Shutdown margin rods are not fully inserted while the SM test is active, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.



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STATUS MESSAGES

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ERROR
CODE

MESSAGE / REASON FOR BLOCK

164 IMPROPER SM TEST ROD SELECTED

If any rod other than the two Shutdown margin rods are selected, then insert/withdraw block indications will be applied, and this message will be generated to describe the reason for the blocks.

168 SECOND SM TEST ROD BEYOND SM TEST LIMIT

If the second Shutdown margin rod is withdrawn past the Shutdown margin limit, then withdraw block indications will be applied, and this message will be generated to describe the reason for the block.

170 SECOND SM TEST ROD AT SM TEST LIMIT

If the second Shutdown margin rod is withdrawn to the Shutdown margin limit, then withdraw block indications will be applied, and this message will be generated to describe the reason for the block.

180 MORE THAN ONE ROD WITHDRAWN IN ROD TEST

If more than one rod is withdrawn while the Rod test function is active, then withdraw block indications will be applied, and this message will be generated to describe the reason for the block.

182 ANOTHER ROD STILL WITHDRAWN IN ROD TEST

If the Rod test function is active and a rod other than the one that is withdrawn is selected, then withdraw indications will be applied, and this message will be generated to describe the reason for the block.

200 COMPUTER KEYSWITCH TURNED TO INOP

If the computer keylock switch is turned to the INOP position, then insert/withdraw indications will be applied, and this message will be generated to describe the reason for the blocks.

255 NO ERRORS

If there is no block indication, then the block reason will be as shown above.

ATTACHMENT 8
RWM CONTROL ROD BYPASS TRACKING

Section A: Control Rod Bypass

Control Rod Identification	_____	
Control Rod position	_____	
Reason for bypassing	_____	

Reactor Engineer approval	_____	
Tech Specs reviewed for LCO and Station Shift Supervisor approval	_____	
Control Rod bypassed	_____	_____
	Initials / Date	Indep. Verif. Initials / Date

Section B: Control Rod Return to Normal

Control Rod Identification	_____	
Control Rod position	_____	
Reactor Engineer approval	_____	
Station Shift Supervisor approval	_____	
Control Rod unbypassed	_____	_____
	Initials / Date	Indep. Verif. Initials / Date

NOTE: Maintain this sheet in the Equipment Status Log until Control Rod Return to Normal has been completed.

10/10/10