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SUBJECT: Forwards response to NRC 801215 questions re SEP Topic IV-2, reactivity control sys.Design features which limit reactivity insertion rates & rod malfunctions from single failure described.

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JOHN E. MAIER
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January 19, 1981

Director of Nuclear Reactor Regulation
Attention: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: SEP Topic IV-2, Reactivity Control Systems
R. E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Crutchfield:

Enclosed is the RG&E response to questions transmitted by the NRC via letter dated December 15, 1980 concerning this SEP topic.

Very truly yours,

John E. Maier

J. E. Maier

JEM:ng
Attachments

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Response to SEP Topic IV-2 Questions

1. Describe the single failures within systems used for reactivity control which can:

   a) Cause an inadvertent reactivity insertion.

   b) Cause a single or combination of rods to be positioned in other than the design sequence. For PWRs this should include consideration of single rod withdrawal/insertions which can result from a single equipment component failure.

Response: The two systems that could cause an inadvertent reactivity insertion are the Chemical Volume Control System (CVCS) and the Rod Control System (RCS).

The Ginna FSAR (Reference 1) evaluated the effect of inadvertent reactivity insertion resulting from a malfunction in the CVCS. The dilution rate was based on plant piping layout and maximum pump capacity. Another study of possible dilution paths was submitted to the NRC in a letter from RG&E dated April 30, 1979, "Postulated Boron Dilution". It is considered that all credible single failures have been accounted for in these analyses; the CVCS will thus not be further discussed.

An evaluation of the effect of single failures on the RCS has been done. The results of that evaluation indicate that there are only two possible single failures that could cause an inadvertent reactivity insertion.

1. A malfunction of the rod motion control switch.

2. Shifting of the bank overlap unit-digit causing banks to overlap improperly.

The study indicated that all other single failures cause an Urgent Alarm which prevents rod motion (other than scram).

In addition to our evaluation the following statements are made in the FSAR:

- Control banks can be moved only in their normal sequence with same overlap. Relay interlocks, designed to meet the single failure criteria, are provided to preclude simultaneous withdrawal of more than one group except in overlap regions.

- No possible failure in the power cabinet can cause more than one group of 4 control rod drive mechanisms (CRDM) to move at the same time.

- The CRDM's are wired into preselected groups and these group configurations are not altered during core life. Therefore, the rods are physically prevented from withdrawing in other than their respective groups.

2. Delineate those design features which limit reactivity insertion rates and rod malpositions resulting from a single failure. Provide the appropriate circuit schematics showing these design features.

Response: A failure within the RCS will generate an Urgent Alarm which will prevent rod motion. The Urgent Alarm does the following:

1. Signal AL-1 is generated and commands reduced power to the Stationary and Movable Gripper Regulation Cards (1051E05 sh. 9 & 12).

2. Signal AL-3 is generated and commands zero current on Lift Regulator Card (1051E05 sh. 10 & 12).

An Urgent Alarm is generated in response to:

1. Any card not in place - each card has an interlock circuit associated with the Urgent Alarm.

2. An abnormal change in phase or current returning from the coils (Ripple detector 1051E05 sheet 2 & 10).

3. Coil current remaining saturated too long (E Sat. Detector 1051E05 sh. 2).

4. Firing circuit error (1051E05 sh. 11 & 12).

5. Multiplexing error (1051E05 sh. 12).

6. Logic Error (1051E05 sh. 12).

Another feature which limits the reactivity insertion rate is the manner by which rod speed is controlled. A buffer memory accepts a command go signal. Another go signal is inhibited until a slave cycler finishes. (6056D01 sh. 4 and Figure 1-6).

Rod positioning is controlled by the bank overlap unit (6056D01 sh. 2 & 4). This unit keeps track of rods that move and rods to be moved sending a signal to the power cabinets. Thumb wheel switches with two diodes per switch per digit control bank overlap.

The referenced schematics are attached.

3. Provide or reference appropriate analyses to demonstrate that specified acceptable fuel damage limits are not exceeded in the event of any of the single failures identified in [Question] 1 above.

Response: The rod withdrawn transient and CVCS malfunction transient were presented in Reference 1 and updated in Reference 2. The most limiting rod withdrawal was also reevaluated in Reference 3. The reactivity insertion rates used in the rod withdrawal transient analyses envelope the actual possible reactivity insertion rates at Ginna. The insertion rate used in the transient was greater than that for the two highest worth banks both assumed to be at their highest differential worth region. Therefore, the reactivity insertion rates identified in question 1 above are enveloped by the analysis.

4. Identify the operating procedures, alarms, interlocks, or protection system actions which must be used in limiting the consequences following a single failure within systems used for reactivity control. Where equipment actions are required, indicate whether the equipment meets the criteria of IEEE-279.

Response: Should an inadvertent reactivity insertion occur, the transient response is presented in Reference 1, 2 and 3. The equipment required to operate is specified in the analyses. These transients require the reactor trip system to prevent fuel damage. This system meets the requirements of IEEE-279.

A description of the comparison of the Ginna Protection system to IEEE-279-1971 is provided in Section III.C.1 of Reference 4.

References

1. Rochester Gas and Electric Corp. R.E. Ginna Final Facility Description and Safety Analysis Report.

2. Rochester Gas and Electric Corp. R.E. Ginna Technical Supplement Accompanying Application to Increase Power, February 1971.

3. Exxon Nuclear Co. Inc., XN-NF-77-40 "Plant Transient Analysis for the R.E. Ginna Unit 1 Nuclear Power Plant", November 1977.

4. RG&E "Technical Supplement Accompanying Application for a Full Term Operating License", August 1972.

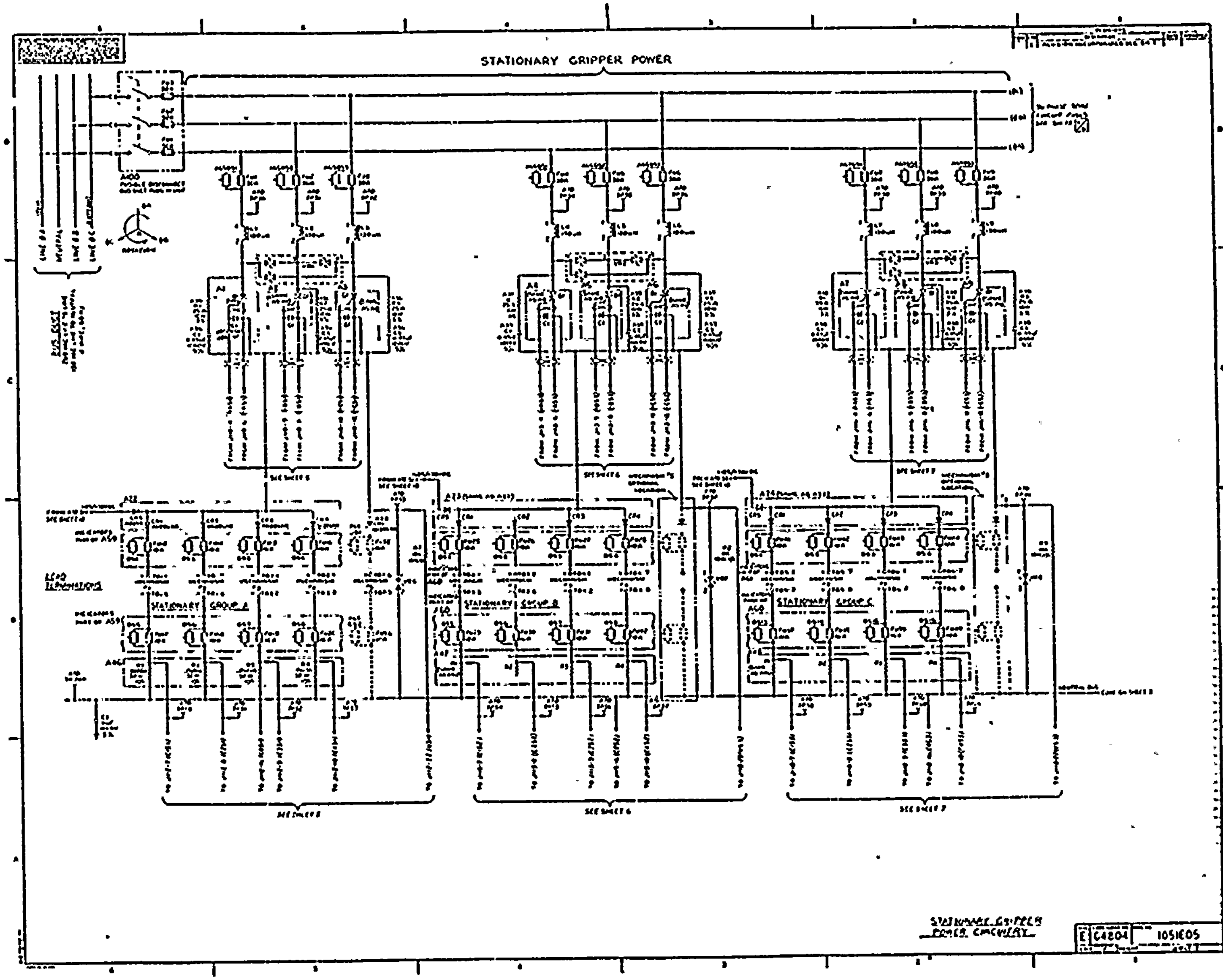

Figure 4-31. Power Cabinet, Schematic Diagram 1051E05
(Sheet 2 of 14)

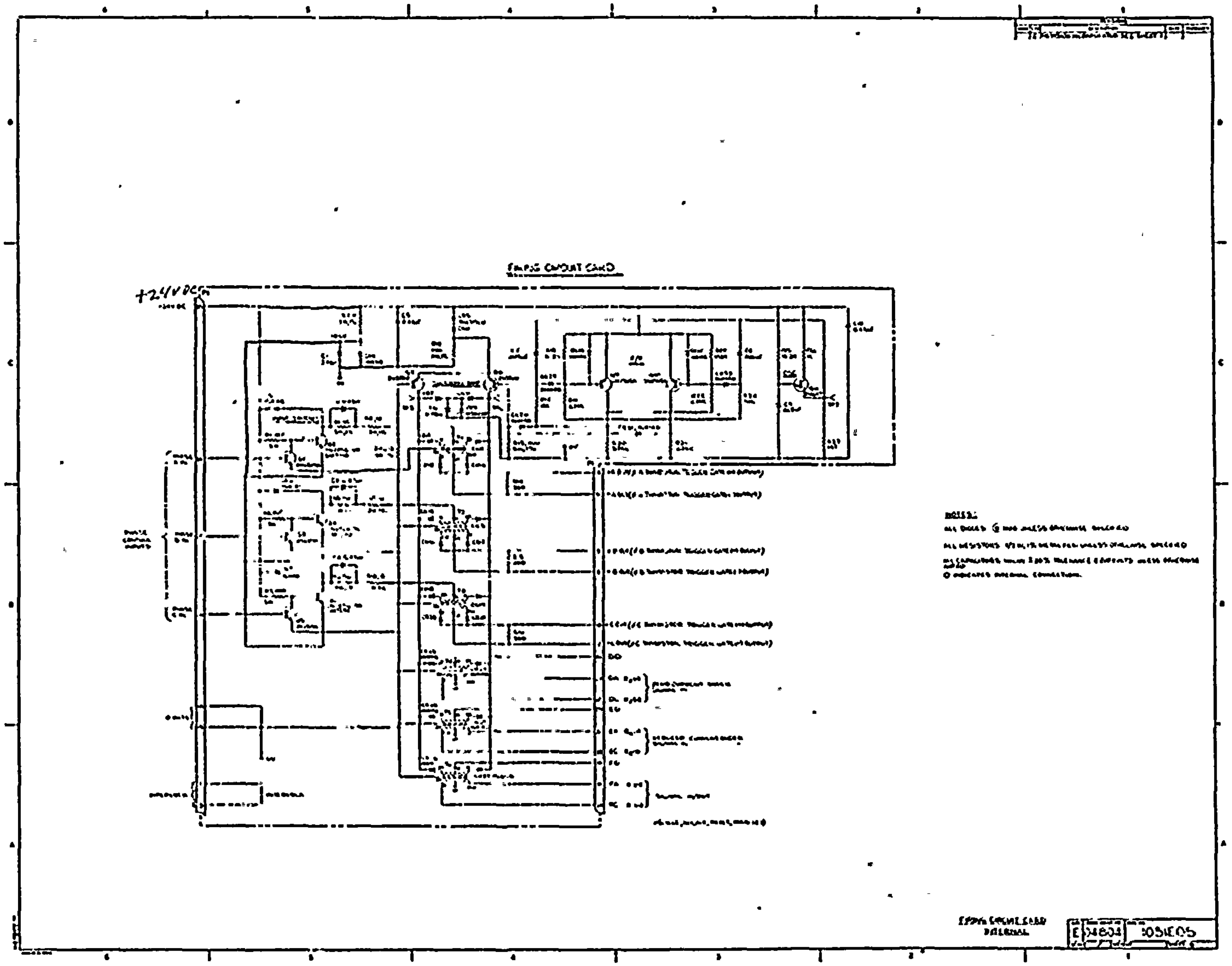

Figure 4-31. Power Cabinet, Schematic Diagram 1051E05
(Sheet 9 of 14)

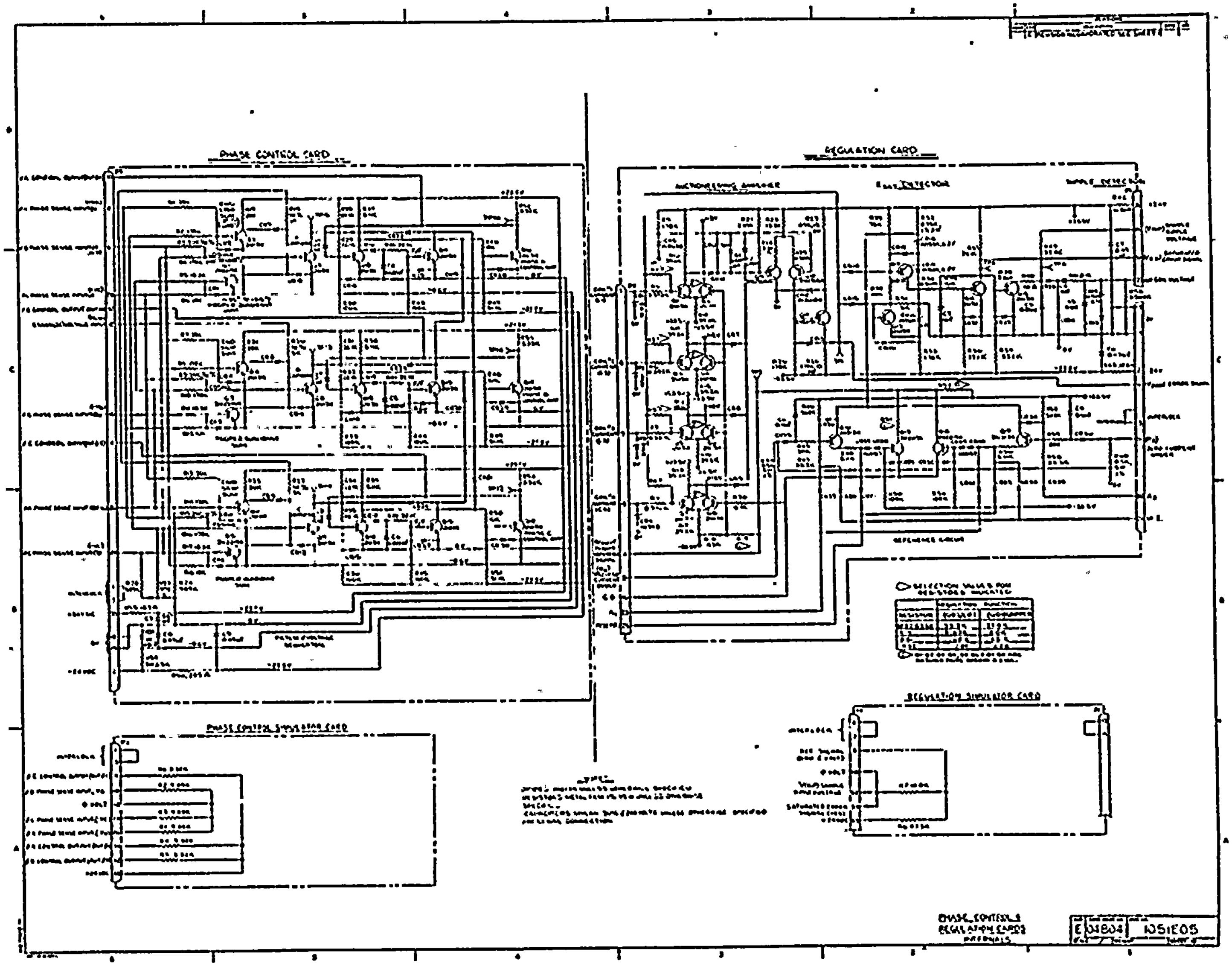

Figure 4-31. Power Cabinet, Schematic Diagram 1051E05
(Sheet 10 of 14)

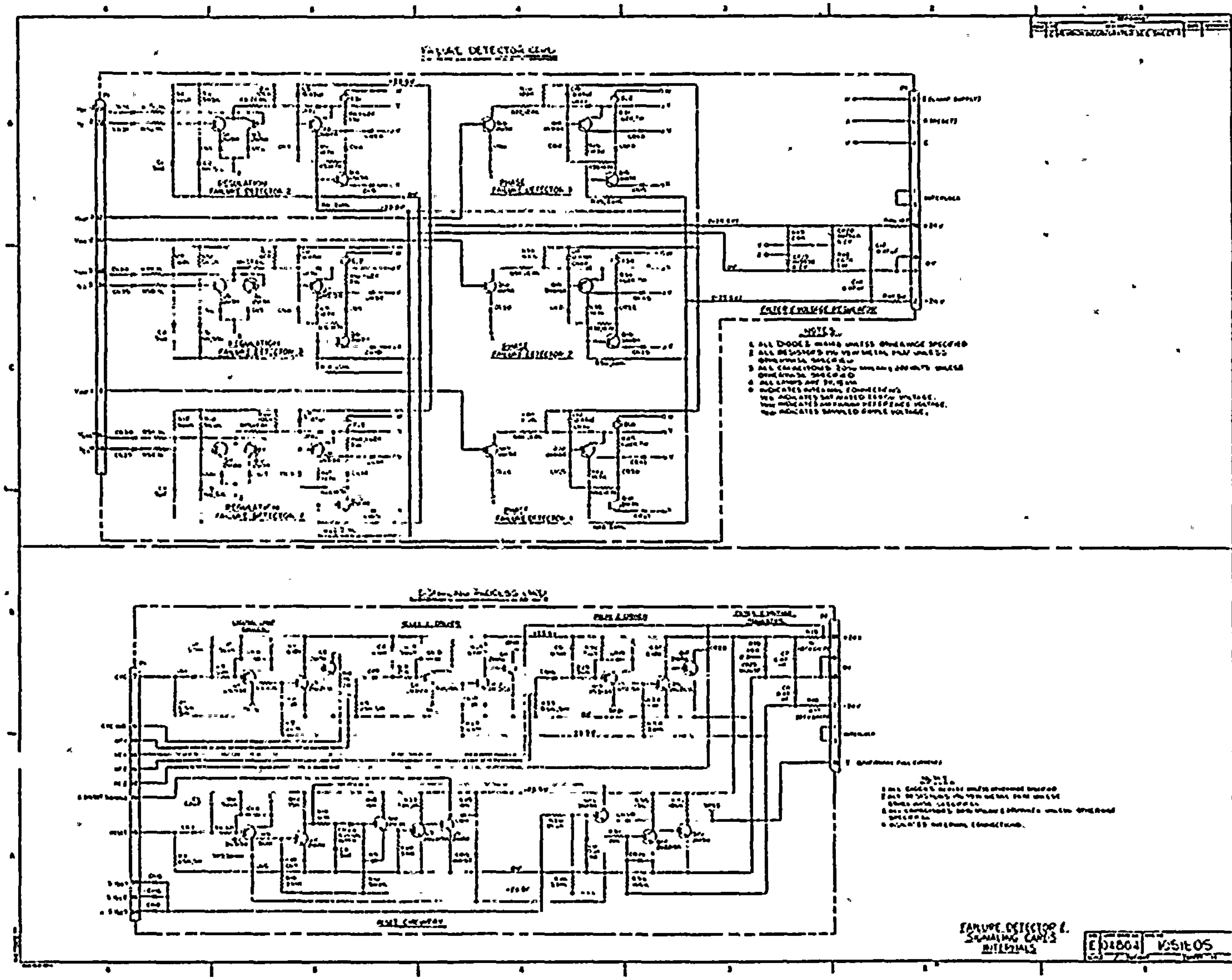

Figure 4-31. Power Cabinet, Schematic Diagram 1051E05
(Sheet 11 of 14)

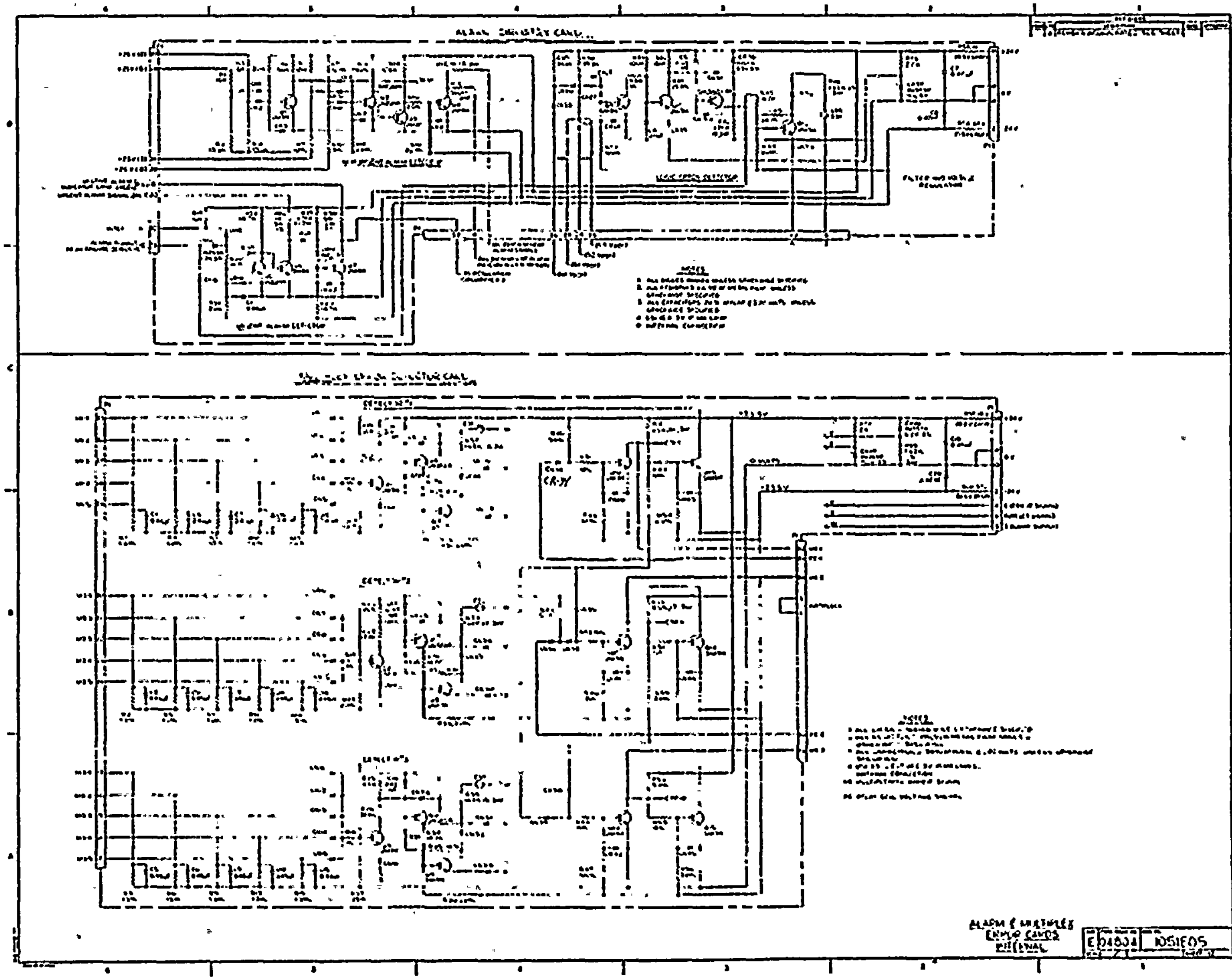

Figure 4-31. Power Cabinet, Schematic Diagram 1051E05
(Sheet 12 of 14)

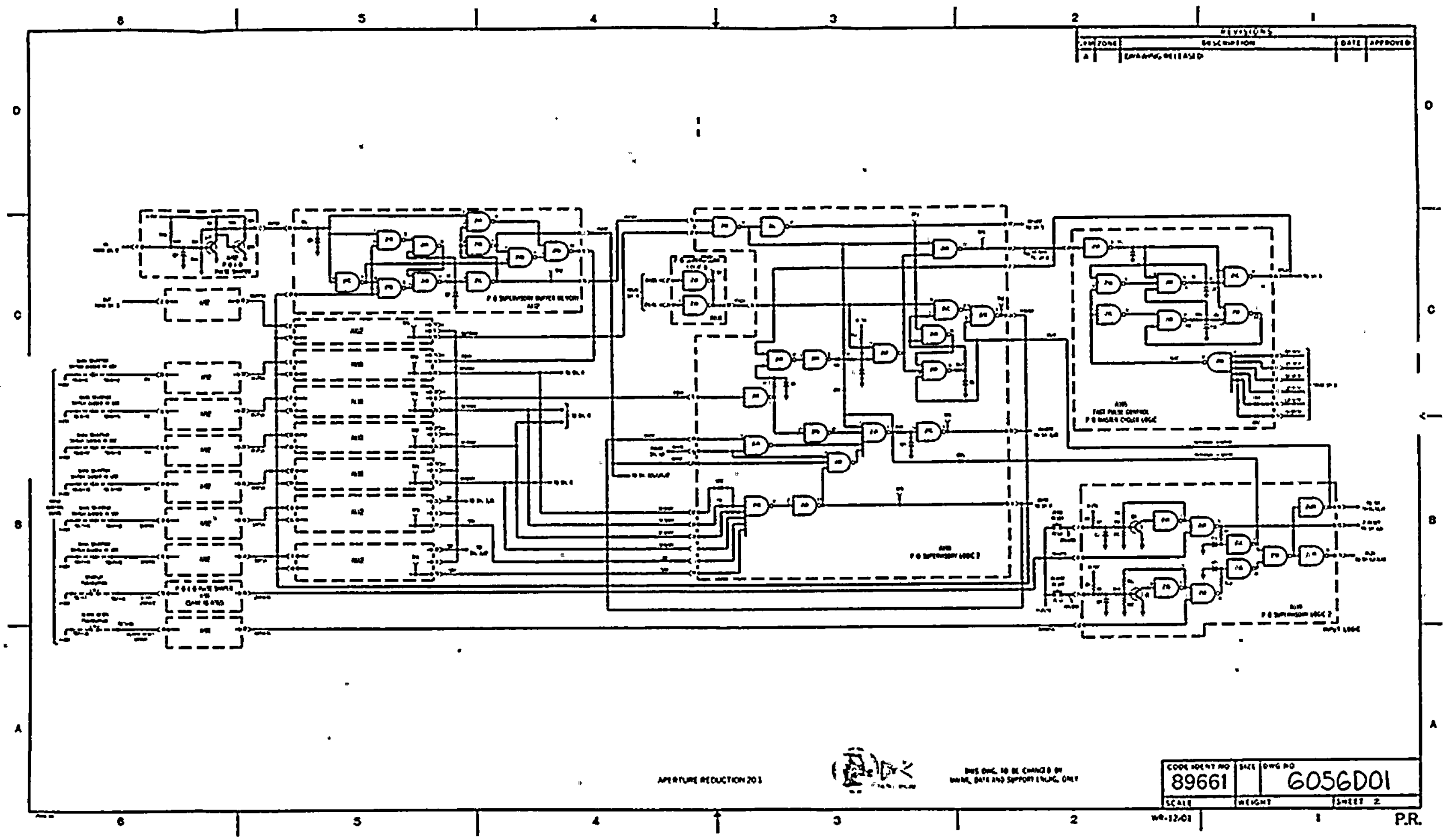

Figure 4-68. Logic Cabinet, Logic Flow, Maximum System 6056D01 (Sheet 2 of 15)

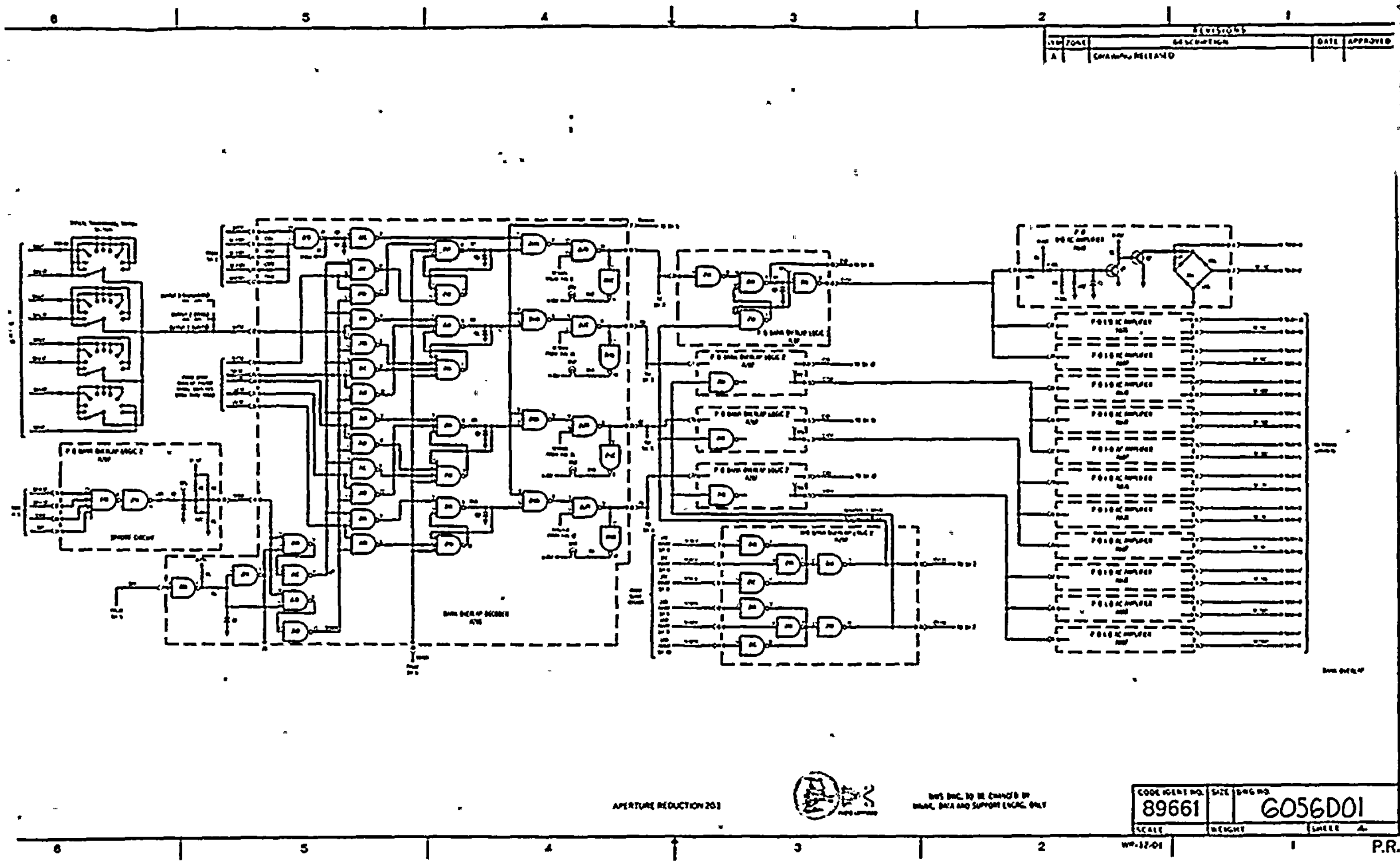

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Figure 4-68. Logic Cabinet, Logic Flow, Maximum System 6056D01 (Sheet 4 of 15

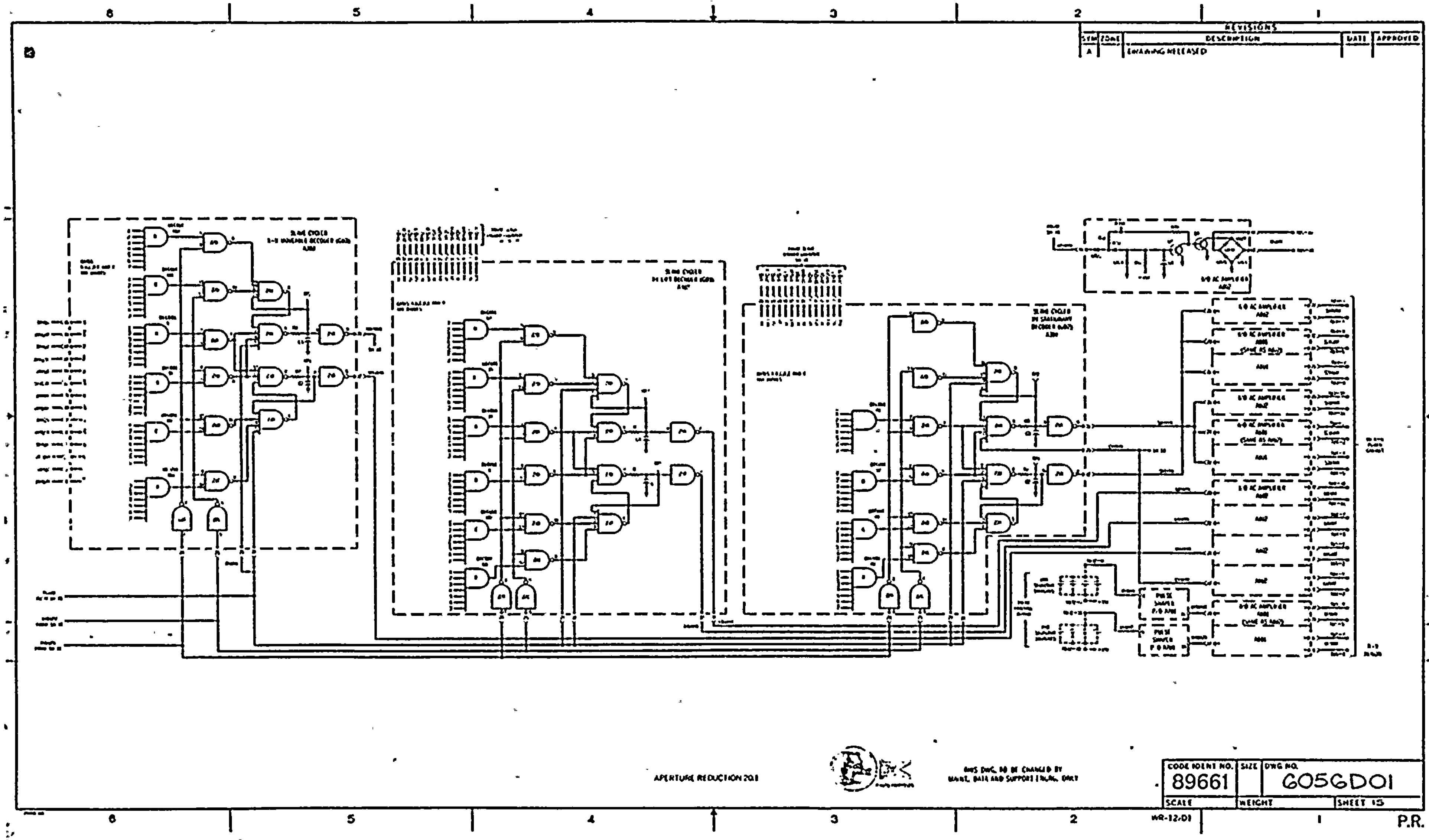

Figure 4-68. Logic Cabinet, Logic Flow, Maximum System 6056D01 (Sheet 15 of 15)

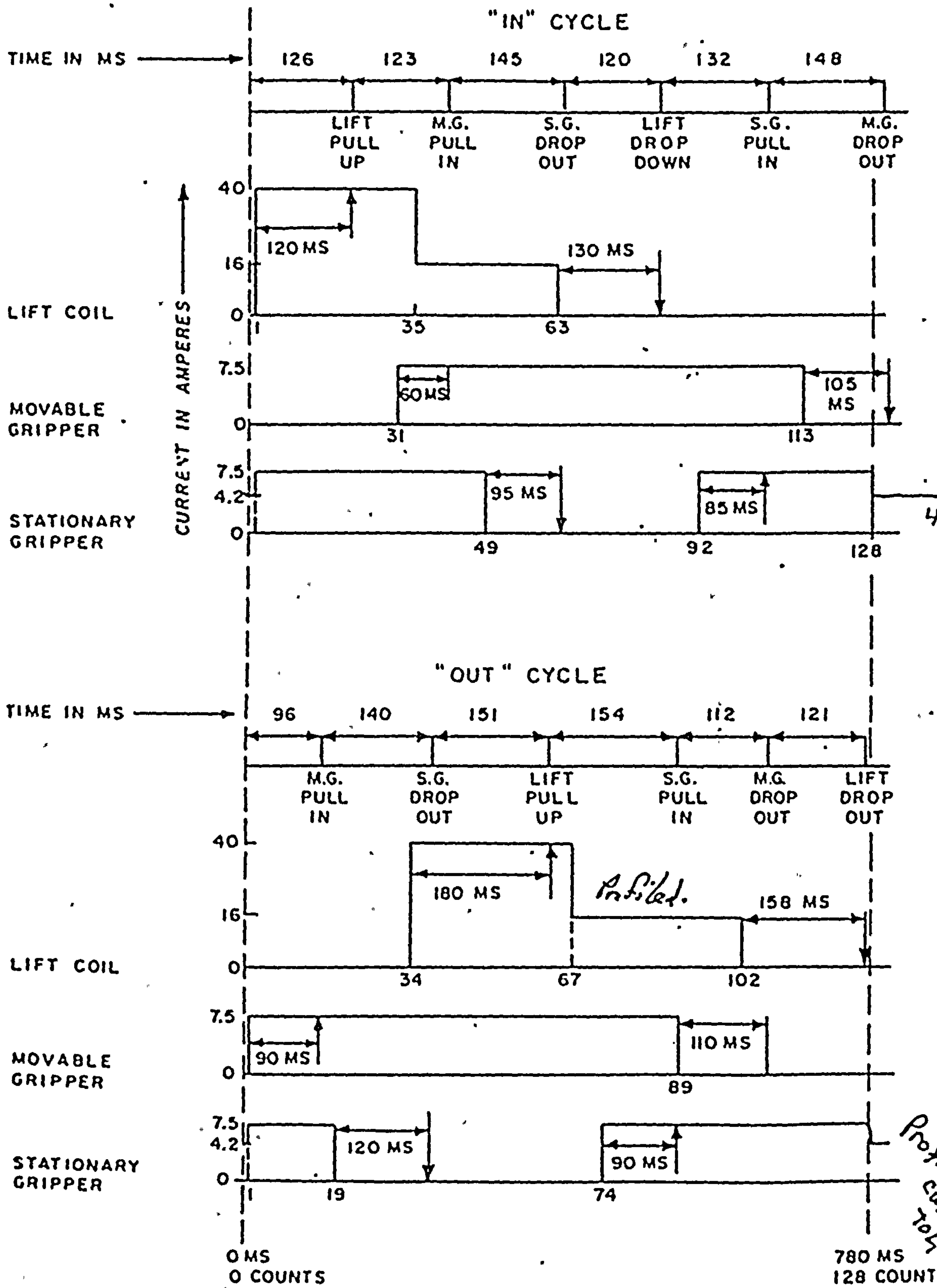

Figure 1-6. L-106 Rod Control Drive Mechanism, Timing Diagram