Letter L-04-153
Enclosure 2
Attachment E

Westinghouse Document Number 1TS2898, Revision 0
Time Response Failure Analysis
(for the Westinghouse 7300 5NRA Card)

Note: The attached document is Westinghouse non-proprietary

7300 NRA
6D30262
TIME RESPONSE FAILURE ANALYSIS

1TS2898
Revision 0

January 2004

Westinghouse Electric Company LLC
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TABLE OF CONTENTS

7300 Series RTD AMPLIFIER CARD (6D30262) NRA

1.0 Introduction and Purpose

There are several nuclear control and protection systems built using the 7300 series PC cards. During normal system maintenance, a portion of the system is taken offline and calibrated using a DC calibration method, and then a subsystem time response test is performed.

This report has two purposes. One purpose is to determine the component failures on the NRA card which could affect the system or card time response, and which are undetectable by the system DC calibration procedure. The second purpose is to provide a summary of the results from the test procedure [ ]^{a,c} and to compare those results with the previous NRA card [ ]^{a,c}, which are referenced in [ ]^{a,c}. The new NRA card will be shown in this analysis to have a quicker time response than the previous NRA card.

2.0 References

1. [ ]^{a,c}
2. [ ]^{a,c}
3. [ ]^{a,c}

3.0 Component Analysis Method

To identify failures that will result in an increase in the time response of the card, a Failure Modes and Effect Analysis (FMEA) was performed. For each component on the circuit card, failure modes and their associated effects were identified. From now on in this document the term failure is used to describe a component that is shorted, open or changed in value. The types of failures that were analyzed are listed for the following components that are used in 7300 cards.

Resistor – A resistor can fail [ ]^{a,c}.

Diode – A diode can fail [ ]^{a,c}.

Zener Diode – A zener diode can fail [ ]^{a,c}.

Transistor – Transistors can fail [ ]^{a,c}.

Op Amp or other linear IC – The input stage of op amps and other linear devices can [ ]^{a,c}.

the output losses part of its drive capability. They can also have a failure [ ]^{a,c}.

Digital IC – A digital IC can fail to [ ]^{a,c}.

Capacitor – A capacitor can fail [ ]^{a,c}.

Inductor – An inductor can fail [ ]^{a,c}.

4.0 Component Analysis Results

Components are in one of three categories. The first category is components that could fail or change in value and [ ]^{a,c} the time response of the card without being [ ]^{a,c}. If a component falls into this category, then the [ ]^{a,c}. The second category is components that could fail and have [ ]^{a,c}. Category two [ ]^{a,c} in the calculations of total time response because if the component fails there is still [ ]^{a,c} on the time response. The third category is components that could fail and have an [ ]^{a,c} the time response. Category three [ ]^{a,c} in the calculations of total time response because if the component fails then the [ ]^{a,c} will be changed by so much that the card will not be able to be [ ]^{a,c}.
[ ]^{a,c}.

Category 1:

Components that could fail and [ ]^{a,c} the card time response and are not [ ]^{a,c}:

Capacitors: [ ]^{a,c}
Resistors: [ ]^{a,c}

Category 2:

As previously mentioned, there are many components that [ ]^{a,c} the time response of the circuit. The [ ]^{a,c} the time response of this card because they are [ ]^{a,c} of the output. If a component is [ ]^{a,c} signal then there can [ ]^{a,c}. There could be a loss of [ ]^{a,c}, but there will [ ]^{a,c}.

The following is a list of components that are included in this category:

Capacitors: [ ]^{a,c}
Resistors: [ ]^{a,c}
Diodes: [ ]^{a,c}
Inductors: [ ]^{a,c}
IC: [ ]^{a,c}
Transistor: [ ]^{a,c}

The following is a list of components that [ ]^{a,c} in other parts of the NRA circuit:

Capacitors: [ ]^{a,c}
Resistors: [ ]^{a,c}
Inductors: [ ]^{a,c}

Category 3:

All other components are in this category. If these components fail [ ]^{a,c}. Therefore these components will [ ]^{a,c}. These components will [ ]^{a,c} card.

The following is a list of components that affect the [ ]^{a,c}:

Resistors: [ ]^{a,c}
IC: [ ]^{a,c}
Transistors: [ ]^{a,c}
Diodes: [ ]^{a,c}

5.0 Detailed Analysis & Results

[

]a,c

[a,c

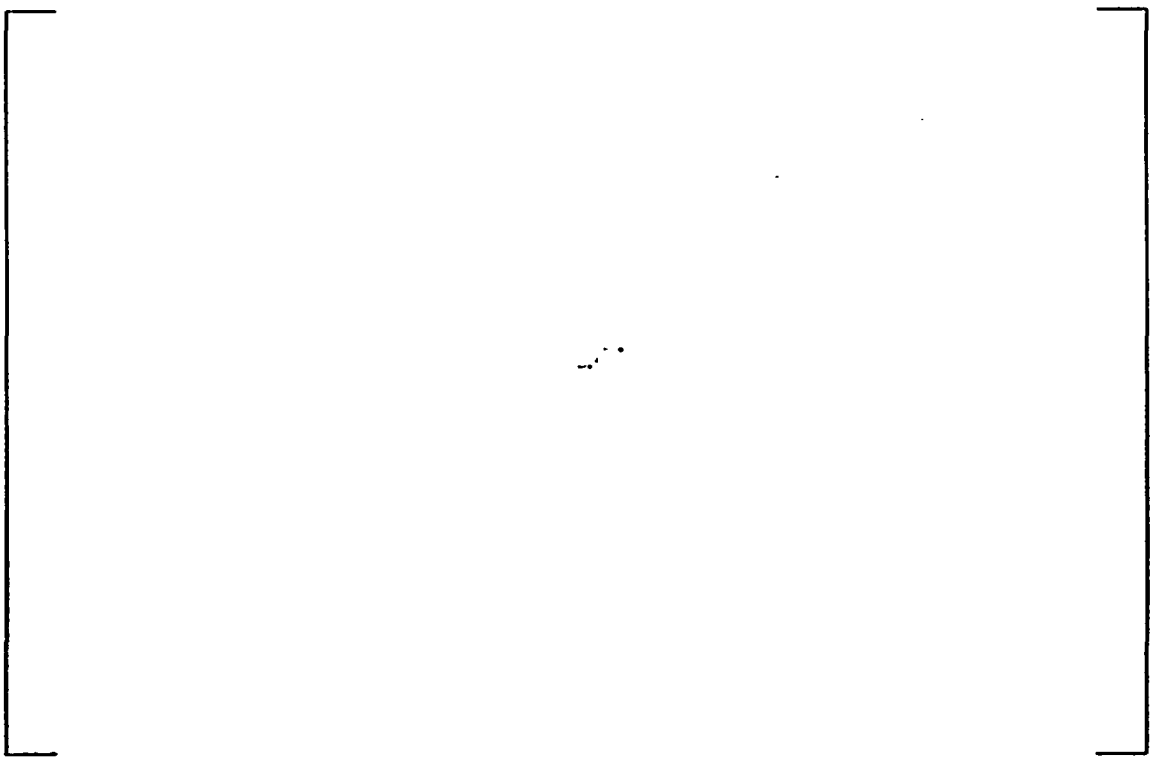

Figure 1 - NRA Card [ ]a,c

[ ] a,c

Figure 2 - NRA Card [ ]a,c

[ ] a,c

Figure 3 - NRA Card [ ]a,c

[a,c

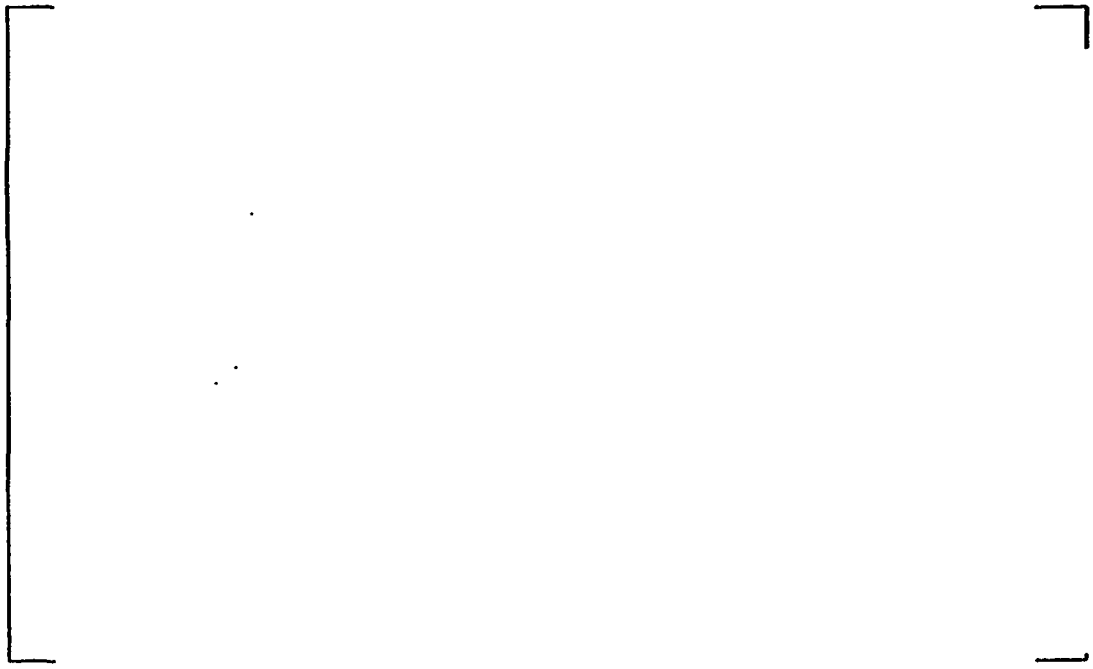

Figure 4 - NRA Card [ ]a,c

[a,c

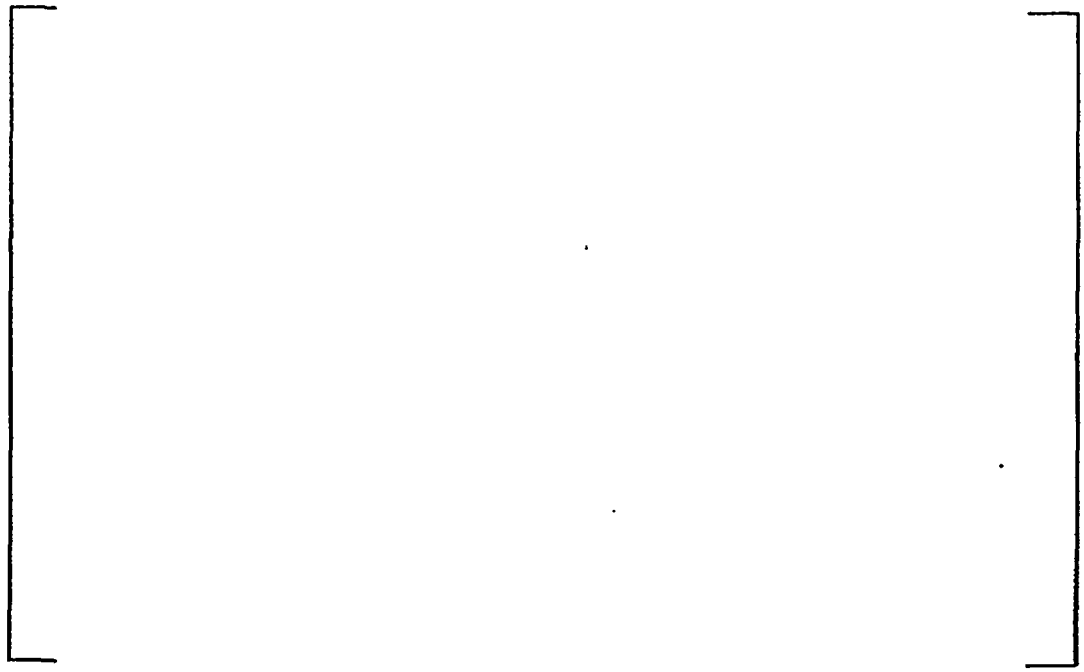

Figure 5 - NRA Card [ ]a,c

[ ] a,c

Figure 6 - NRA Card [ ]a,c

[ ] a,c

Figure 7 - NRA Card [ ]a,c

[]a,c

Figure 8 - NRA Card [ ]a,c

[]a,c

Figure 9 - NRA Card [ ]a,c

a,c

Figure 10 - NRA Card [ ]a,c

a,c

Figure 11 - NRA Card [ ]a,c

[ ] a,c

Figure 12 - NRA Card [ ]a,c

[ ] a,c

Figure 13 - NRA Card [ ]a,c

[ ]a,c

Figure 14 - NRA Card [ ]a,c

[ ]a.c

Figure 15 - NRA Card [ ]a,c

Figure 16 - NRA Card [ ]a,c

Below is a summary of the time response of each figure above. The longest time response will only be looked at when comparing [ ]a,c

Component	Total Time Response	Time Response due to the component change
[		

]a,c

6.0 Conclusion

[

]a,c

Letter L-04-153
Enclosure 2
Attachment F

Westinghouse Document Number 1TS2899, Revision 0
NRA Card Time Response Test Procedure
(for the Westinghouse 7300 5NRA Card)

Note: The attached document is Westinghouse non-proprietary

7300 NRA
6D30262
NRA Card Time Response Test Procedure
1TS2899
Revision 0

January 2004

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Pittsburgh, PA 15230-0355

Revision History:

1/2004 Initial Issue Daniel Shubert

7300 Series RTD AMPLIFIER CARD (6D30262) NRA

1.0 Test Objectives

This test procedure will provide numerical results on the time response for the 7300 Series RTD Amplifier (NRA) Card. It will evaluate the time response when [ ]^{a,c}. The [ ]^{a,c} in the value of the component. Time response results will be determined by [ ]^{a,c} and viewed by an oscilloscope. The [ ]^{a,c} will then be compared to measure how long it takes [ ]^{a,c}

2.0 References

1. [ ]^{a,c}
2. [ ]^{a,c}
3. [ ]^{a,c}

3.0 Test Equipment

3.1 The following test instrumentation, equipment and fixture are required in order to perform this test procedure:

-7300 universal test box

-Multichannel oscilloscope (capable of storing traces)

-Fluke Digital Multimeter or other high precision multimeter (with 4-1/2 digits and accuracy specified to +/- 0.01% of span.

-Capacitance Meter

-Resistance RTD Decade Box

-All other equipment used in the [ ]^{a,c} for the NRA card

4.0 Functional Test

4.1 Perform functional test procedure, [

]^{a,c}

4.2 After completing the functional test procedure [

]^{a,c}

[

]^{a,c}

Make the following connections to the universal test box pins:

[

]^{a,c}

4.3 [

]^{a,c}

4.4 [

]^{a,c}

4.5 [

]^{a,c}

4.6 [

]^{a,c}

4.7 [

]^{a,c}

4.8 [

]^{a,c}

4.9 [

]^{a,c}

4.10 [

]^{a,c}

4.11 [

]^{a,c}

4.12 [

]^{a,c}

5.0 Data Sheet

4.1 Passed _____ Failed _____

4.4 Time Response of NRA Card (+ step input) _____ms

4.5 Time Response of NRA Card (- step input) _____ms

4.6 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

4.7 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

4.8 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

4.9 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

4.10 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

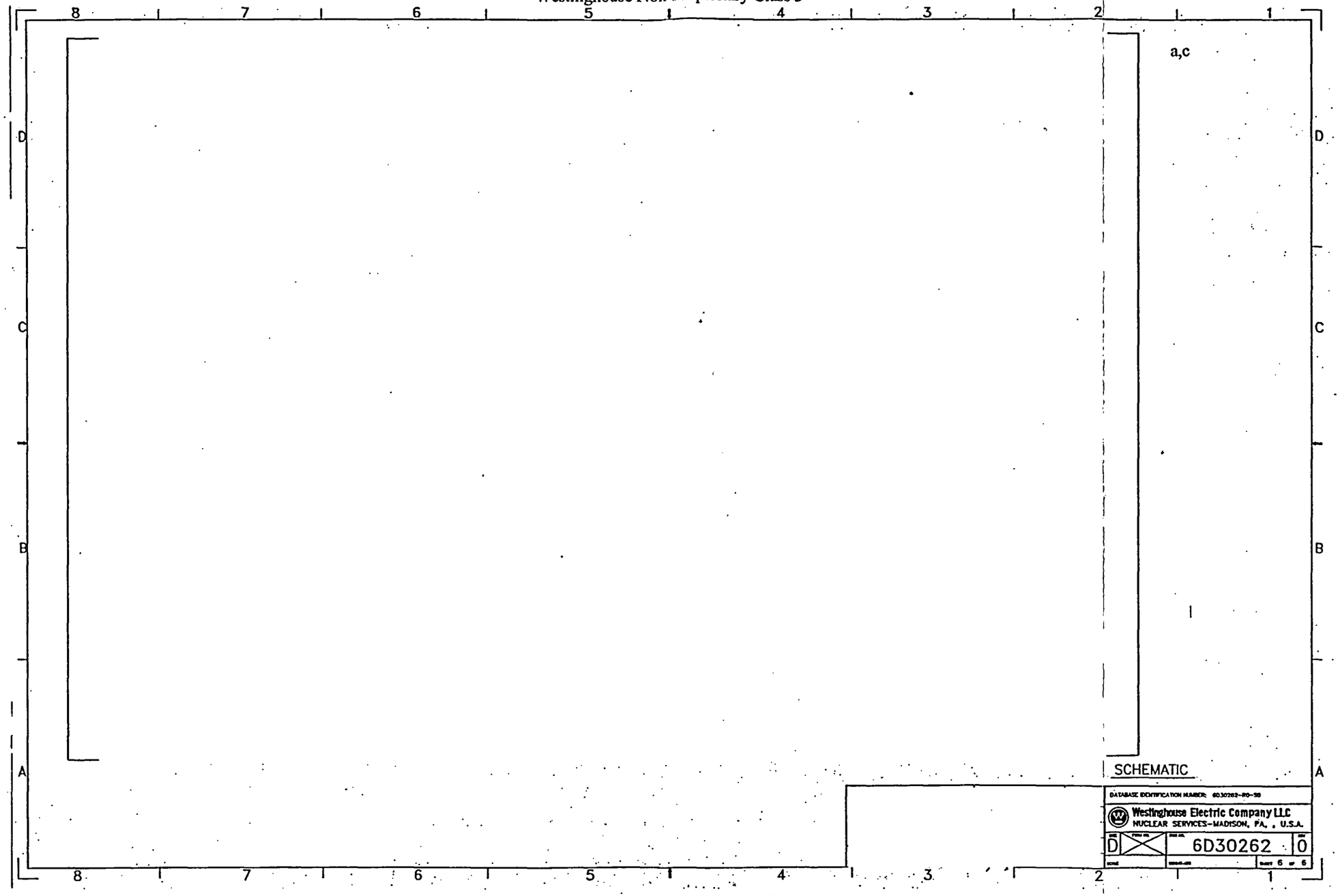
4.11 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

4.12 [ ]^{a,c} yes ___ no ___
Time Response of NRA Card (+ step input) _____ms
Time Response of NRA Card (- step input) _____ms

Letter L-04-153
Enclosure 2
Attachment G

Westinghouse Drawing 6D30262, Revision 0
(for the Westinghouse 7300 5NRA Card)

Note: The attached document is Westinghouse non-proprietary



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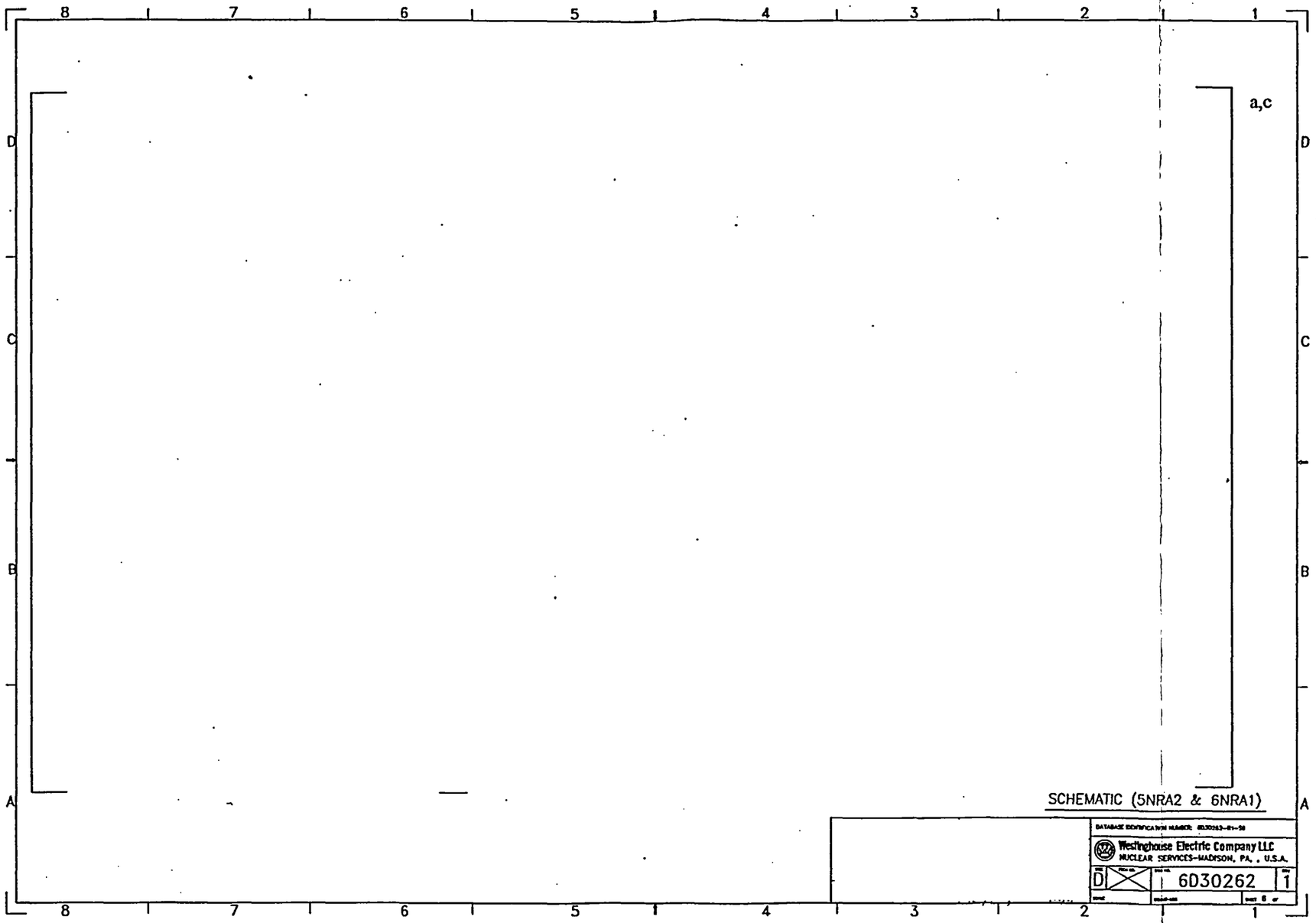
Letter L-04-153
Enclosure 2
Attachment H

Westinghouse Drawing 6D30262, Revision 1
(for the Westinghouse 7300 6NRA Card)

Note: The attached document is Westinghouse non-proprietary



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