

APOLLO G&N Specification  
PS 2003982 Rev.: F

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Class A Release

PROCUREMENT SPECIFICATION

PRODUCT CONFIGURATION AND ACCEPTANCE TEST REQUIREMENTS

ERASABLE MEMORY SENSE AMPLIFIER MODULE B13

DRAWING NO. 2003982

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				MIT	NASA
6/1/66	A	208	1, 5, 7, 12		
9/1/66	B	30870	1, 7	WJL FA	WJL FA
10/13/66	C	31538	1, 5, 6	WJL FA	WJL FL
1/5/67	D	32546	1, 7, 8, 13	WJL FL	WJL FA
1/5/67	E	32557	1, 5, 6, 7	WJL FA	WJL FA
4-6-67	F	33542	1, 7, 13	WJL FA	WJL FA

This specification consists of pages 1 to 13 inclusive.

APPROVALS	A. G. METZGER	Ends C. Hall 4/24/66	WJL 4/24/66	RAY
	NASA/MSC	MIT/IL		

1. SCOPE

This specification establishes the detail requirements for complete identification and acceptance of the Erasable Memory Sense Amplifier Module B13 Part No. 2003982-011.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein.

2.1 EFFECTIVE ISSUES. Unless otherwise specified herein, Military and Government Standards and specifications shall be the issue in effect on the date of request for proposal or invitation to bid.

SPECIFICATIONS

APOLLO G&N

ND 1002214

General Specification for Preservation, Packaging, Packing and Container Marking of APOLLO Guidance and Navigation Major Assemblies, Assemblies, Subassemblies, Parts and Associated Ground Support Equipment.

DRAWINGS

APOLLO G&N

2003982

Erasable Memory Sense Amplifier Module B13

(Copies of Specifications, Standards, Drawings, Bulletins and Publications required by suppliers in connection with specific procurement functions should be obtained from the Procuring Activity or as directed by the Contracting Officer).

2.2 CONFLICTING REQUIREMENTS. In the event of conflict between the requirements of the contract, this Specification and the documents listed in this section the following order of precedence shall apply and the contractor shall notify MIT Apollo Management of the conflict as soon as it is determined.

- a. The contract
- b. This Specification
- c. Documents listed in this section

### 3. REQUIREMENTS

#### 3.1 PERFORMANCE

3.1.1 Thermal Conditioning. The module shall be subjected to two complete thermal cycles, as specified below prior to acceptance testing:

25°C down to -10°C + 3°C in NLT 20 minutes,  
held at -10°C + 3°C for NLT 30 minutes,  
raised to 70°C + 3°C in NLT 40 minutes,  
held at 70°C + 3°C for NLT 30 minutes,  
lowered to 25°C in NLT 20 minutes.

#### 3.1.2 Continuity

3.1.2.1 The resistance measured from each pin A to the corresponding Pin B, and from each pin D to the corresponding pin E, shall be 1350 ± 68 ohms.

3.1.2.2 The resistance measured from pin 139 to each of the following pins shall not be more than 0.5 ohm.

##### Pin Numbers

146	117
153	124
159	235
103	111

3.1.2.3 The resistance measured between chassis ground (pin 269) and the chassis shall be not more than 0.5 ohm.

#### 3.1.3 Insulation Resistance

3.1.3.1 There shall be not less than 100 megohms resistance between any one pin B and all other pin B's, and between any one pin E and all other pin E's.

3.1.3.2 There shall be not less than 100 megohms resistance between each pin B and all pins G, H, I, J, and pins 126, 128, 103, 229, 234, and 268.

3.1.3.3 There shall be not less than 100 megohms resistance between each pin E and all pins G, H, I, J, and pins 126, 128, 103, 229, 234, and 268.

3.1.3.4 The resistance between chassis ground (pin 269) and all other pins connected together shall be 100 megohms minimum.

3.1.4 Input Voltage. The assembly shall function as specified herein when supplied with 14.0 ± 0.1 VDC to pin 128, and 0 VDC to pins of section 3.1.2.2.

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 2003982 Rev. 1

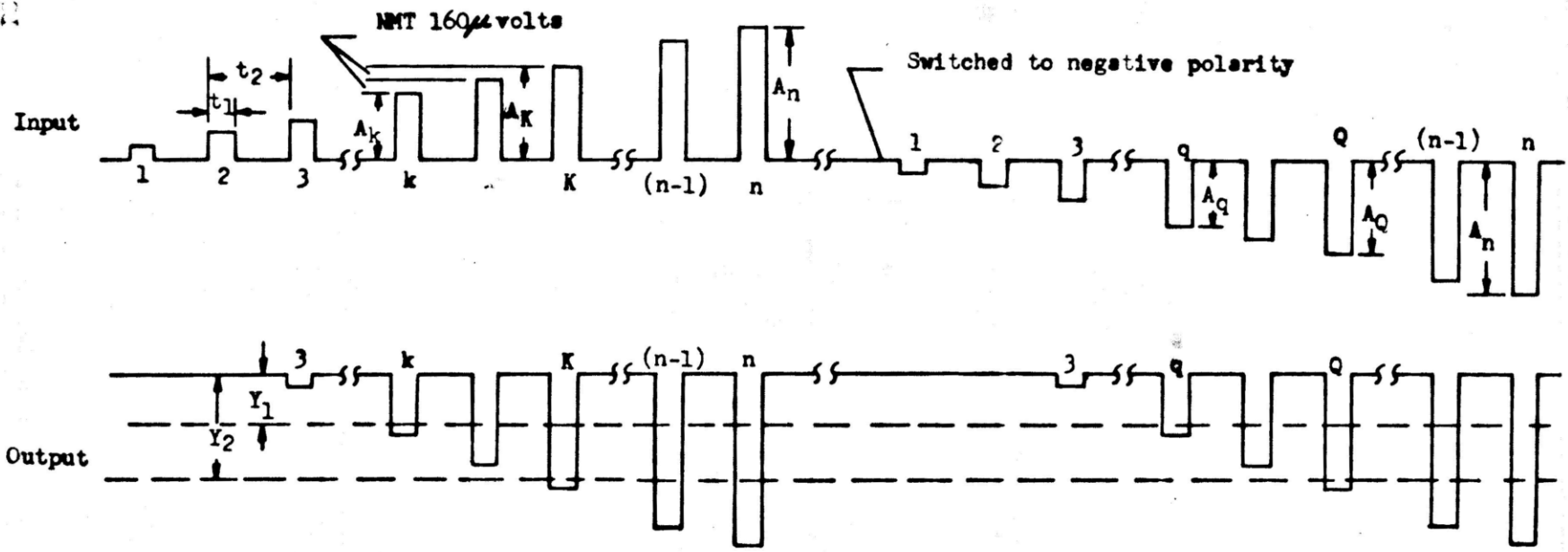


Figure 1

### 3.1.5 Threshold Voltage

3.1.5.1 Outputs. The output of each stage shall be measured as shown in Figure 1 when an input as specified in section 4.1.5.1 is applied.

3.1.5.2 Threshold Voltage ( $A_k$  and  $A_q$ ). Threshold voltage for each stage shall be  $18 \pm 4.0$  mv.

3.1.5.3 Gain Resolution. The gain resolution for each stage shall be not more than 3.5 mv.

### 3.1.6 Delay Time

3.1.6.1 Strobe Driver Output (STROBE, STROBF). The Strobe Driver output shall be as shown in Figure 2, and shall have the following characteristics when an input as specified in section 4.1.5.2 is applied.

Amplitude (high)	NMT 1.0V below B+
Amplitude (low)	8.0 + 0.5V below B+
Rise Time ( $t_r$ )	NMT 60 nanosec
$T_2$	70 $\pm$ 20 nanosec
T OFF	NMT 0.75 usec

3.1.6.2 Sense Amplifier Outputs. Each of the Sense Amplifier outputs shall be as shown in Figure 2, and shall have the following characteristics when an input as specified in section 4.1.5.2 is applied.

Amplitude (high)	NMT 0.3V below B+
Amplitude (low)	NLT 1.7V below B+
Rise Time ( $t_r$ )	NMT 100 nanosec
Fall Time ( $t_{f1}, t_{f2}$ )	NMT 125 nanosec
$T_4$	140 $\pm$ 40 nanosec
$T_5, T_6$	NMT 100 nanosec

3.1.6.3 PNP ( $Q_1$ ) Stage Output. Each PNP Stage Output shall be as shown in Figure 2, and shall have the following characteristics when an input as specified in section 4.1.5.2 is applied.

Amplitude (high)	1.25 $\pm$ 0.15V
Amplitude (low)	NMT 0.20V
Rise Time ( $t_r$ )	NMT 125 nanosec
Fall Time ( $t_f$ )	NMT 400 nanosec
$T_7$	180 $\pm$ 60 nanosec
$T_8$	NMT 1.3 usec

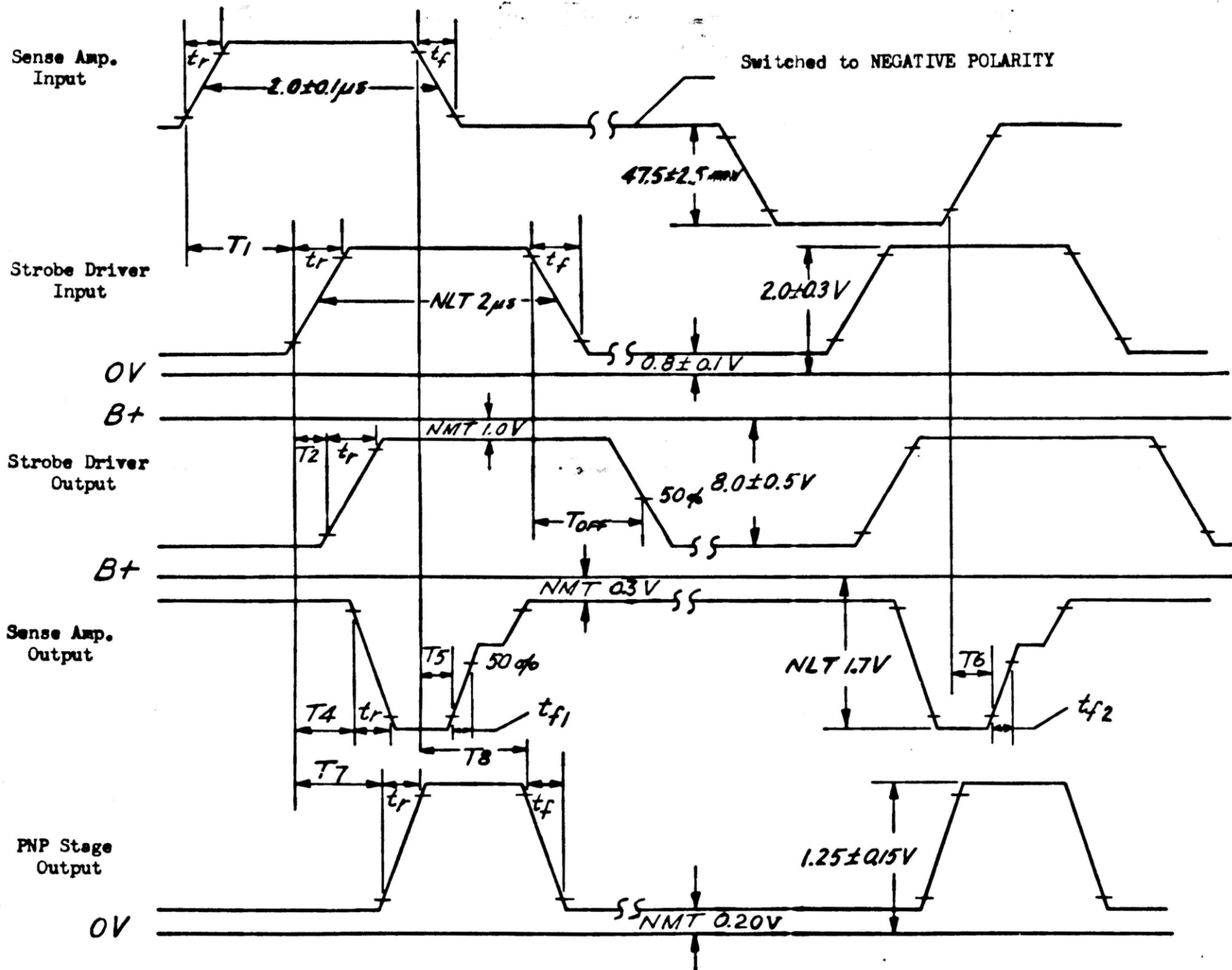


Figure 2

### 3.1.7 Marginal Voltage and Temperature Extremes.

3.1.7.1 With the input voltage adjusted to  $12.2 \pm 0.1$  VDC, and an ambient temperature of  $-10^{\circ}\text{C}$  to  $+0^{\circ}\text{C}$ , the module shall operate as specified in paragraphs 3.1.5 and 3.1.6, except threshold voltage shall be  $18 \pm 7$  mv, and PNP and STROBE output amplitudes may decrease by 20%. The only times measured shall be:

T <sub>2</sub>	70	+40	
		-20	ns
T <sub>4</sub>	140	+80	
		-40	ns
T <sub>7</sub>	180	+140	
		-60	ns
T <sub>5</sub> , T <sub>6</sub>	NMT	125	ns
T <sub>7</sub> , T <sub>8</sub>	NMT	1.125	μs
			T OFF NMT 0.45 μs

3.1.7.2 With the input voltage adjusted to  $16.5 \pm 0.1$  VDC, and an ambient temperature of  $-10^{\circ}\text{C}$  to  $+0^{\circ}\text{C}$ , the module shall operate as specified in paragraphs 3.1.5 and 3.1.6, except threshold voltage shall be  $18 \pm 7$  mv, and PNP and STROBE output amplitudes may increase by 20%. The only times measured shall be:

T <sub>2</sub>	70	+40	
		-20	ns
T <sub>4</sub>	140	+80	
		-40	ns
T <sub>7</sub>	180	+140	
		-60	ns
T <sub>5</sub> , T <sub>6</sub>	NMT	125	ns
T <sub>7</sub> , T <sub>8</sub>	NMT	1.125	μs
			T OFF NMT 0.45 μs

3.1.7.3 With the input voltage adjusted to  $16.5 \pm 0.1$  VDC, and an ambient temperature of  $70^{\circ}\text{C}$  to  $+2.8^{\circ}\text{C}$ , the module shall operate as specified in paragraphs 3.1.5 and 3.1.6, except threshold voltage shall be  $18 \pm 4$  mv, and PNP and STROBE output amplitudes may increase by 20%. The only times measured shall be:

T <sub>2</sub>	70	+40	
		-20	ns
T <sub>4</sub>	140	+80	
		-40	ns
T <sub>7</sub>	180	+140	
		-60	ns
T <sub>5</sub> , T <sub>6</sub>	NMT	125	ns
T <sub>7</sub> , T <sub>8</sub>	NMT	1.125	μs
			T OFF NMT 0.45 μs

3.1.8 Vibration. The module shall perform as specified in paragraphs 3.1.5.1 through 3.1.6.3 when installed in an operating computer which is being subjected to the vibration requirements specified in the applicable specifications for the computer subsystem. Acceptance criteria for the module shall be the compliance of the computer subsystem with its applicable specifications.

## 3.2 PRODUCT CONFIGURATION

3.2.1 DRAWINGS. The configuration of the assembly shall be in accordance with APOLLO G&N Drawing 2003982 and all drawings and engineering data referenced thereon.

3.2.2 Weight of the module shall be recorded.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. The contractor responsible for the manufacture of the assembly shall be responsible for the accomplishment of each test required herein. See Table I, Product Performance and Configuration Requirement/Quality Verification Cross Reference Index.

TABLE I

Requirements	Verification
3.1.1	4.2.2
3.1.2.1	4.2.3.1
3.1.2.2	4.2.3.2
3.1.2.3	4.2.3.3
3.1.3.1	4.2.4.1
3.1.3.2	4.2.4.2
3.1.3.3	4.2.4.3
3.1.3.4	4.2.4.4
3.1.5.1	4.2.5.1, 4.2.5.2
3.1.5.2	4.2.5.1, 4.2.5.2
3.1.5.3	4.2.6
3.1.6.1	4.2.5.5
3.1.6.2	4.2.5.3, 4.2.5.4
3.1.6.3	4.2.5.6
3.1.7.1	4.3.1.1
3.1.7.2	4.3.1.2
3.1.8	4.3.2
3.2.1	4.2.1
3.2.2	4.2.7

##### 4.1.1 Test Conditions

4.1.1.1 Environmental. Unless otherwise specified, the assemblies shall be tested under the following ambient conditions:

- a. Temperature  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- b. Relative Humidity 90% max.
- c. Barometric Pressure 28 to 32 inches of Hg



4.2.3.3 Measure the resistance between pin 269 (chassis ground) and the chassis, and verify that it is as specified in paragraph 3.1.2.3.

4.2.4 Insulation Resistance Tests. Using a resistance bridge or equivalent with a test potential of 50 VDC limited to a short circuit current of 50 microamperes, perform the following:

4.2.4.1 Measure the resistance between any one pin B and all other pin B's, and any one pin E and all other pin E's, and verify that they are as specified in paragraph 3.1.3.1.

4.2.4.2 Measure the resistance between each pin B and all pins G, H, I, J, and pins 126, 128, 103, 229, 234, and 268. Verify that they are as specified in paragraph 3.1.3.2.

4.2.4.3 Measure the resistance between each pin E and all pins G, H, I, J, and pins 126, 128, 103, 229, 234, and 268. Verify that they are as specified in paragraph 3.1.3.3.

4.2.4.4 Measure the resistance between pin 269 and all other pins on the module, and verify that they are as specified in paragraph 3.1.3.4.

#### 4.2.5 Functional Tests

4.2.5.1 With the input signal of paragraph 4.1.5.1 applied to pins A & C of each stage, and the output (pin G) loaded with the circuit shown in paragraph 4.1.4, measure the output at pin G and verify that it is in accordance with paragraphs 3.1.5.1 and 3.1.5.2.

4.2.5.2 With the input signal of paragraph 4.1.5.1 applied to Pins D & F of each stage, measure the output at pin J and verify that it is in accordance with paragraphs 3.1.5.1 and 3.1.5.2.

4.2.5.3 With the input signal of paragraph 4.1.5.2.1 applied to pins A & C of each stage, and the output (pin G) loaded with the circuit shown in paragraph 4.1.4, measure the output at pin G and verify that it is in accordance with paragraph 3.1.6.2.

4.2.5.4 With the input signal of paragraph 4.1.5.2.1, applied to pins D & F of each stage, measure the output at pin J and verify that it is in accordance with paragraph 3.1.6.2.

4.2.5.5 With the input signal of paragraph 4.1.5.2.2 applied to pin 268, measure the output at pin 126 and verify that it is in accordance with paragraph 3.1.6.1.

4.2.5.6 With the input signal of paragraph 4.1.5.2.1 applied to pins A & C and D & F of each stage, and pin I loaded with a 1000 ohm  $\pm$  5% resistor, measure the output at pin I and verify that it is in accordance with paragraph 3.1.6.3.

4.2.6 Gain Resolution. Using the following formula, calculate the gain resolution for each stage, and verify that they are in accordance with paragraph 3.1.5.3.

$$\begin{aligned}\text{GAIN RESOLUTION} &= A_K - A_k \\ &= A_Q - A_q\end{aligned}$$

NOTE: See paragraph 4.1.5.1 for definitions of symbols.

4.2.7 Weight. Weigh the module to the nearest .01 pound. Verify that the weight does not exceed the maximum allowable weight specified in paragraph 3.2.2.

4.3 WORKMANSHIP. The following tests shall be performed under the conditions specified as a verification of good workmanship.

4.3.1 Marginal Voltage and Temperature Extremes.

4.3.1.1 With the input voltage and ambient temperature as specified in paragraph 3.1.7.1, repeat tests 4.2.5.1 through 4.2.6. Verify that the module performs as specified in paragraph 3.1.7.1.

NOTE: The module shall be maintained at the specified temperature for not less than 30 minutes prior to start of tests.

4.3.1.2 With the input voltage and ambient temperature as specified in paragraph 3.1.7.2, repeat tests 4.2.5.1 through 4.2.6. Verify that the module performs as specified in paragraph 3.1.7.2.

NOTE: The module shall be maintained at the specified temperature for not less than 30 minutes prior to start of tests.

4.3.1.3 With the input voltage and ambient temperature as specified in paragraph 3.1.7.3, repeat tests 4.2.5.1 through 4.2.6. Verify that the module performs as specified in paragraph 3.1.7.3.

NOTE: The module shall be maintained at the specified temperature for not less than 30 minutes prior to start of tests.

4.3.2 Vibration. Install the module in an applicable computer. Subject the computer subsystem to the vibration tests specified in the applicable JDC. Verify that the computer subsystem meets the requirements of the applicable specification.

## 5. PREPARATION FOR DELIVERY

5.1 GENERAL. Preparation for delivery shall be in accordance with Specification ND 1002214.

6. NOTES: None