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Rev. 13, 12/8/81

QUALIFICATION SPECIFICATION
For
REMOTE MULTIPLEXER UNITS
and ASSOCIATED SIGNAL CONDITIONER MODULES

1.0 SCOPE

This specification defines qualification requirements for the Remote Multiplexer Units including associated signal-conditioners and amplifier modules.

Equipment qualified under this specification shall be considered a Class-1E device per guidelines specified in documents listed under Section 2 of this document. This equipment will remain functional under conditions specified herein for functional qualification. Furthermore, under the more severe environment described for fail-safe qualification, this equipment will not malfunction in a manner which will degrade, below an acceptable level, any Class-1E circuit to which it is connected.

All failure modes encountered during qualification testing will be documented with specific reference to its effect on external input circuitry. This information should be sufficient to determine the expected extent of degradation to input circuitry under given application.

2.0 APPLICABLE DOCUMENTS, CODES AND STANDARDS

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

2.1 U.S. Nuclear Regulatory Commission (NRC)

a. 10 CFR21 - Reporting of Defects and Noncompliance

b. 10 CFR50, Appendix B - Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants

2.2 American National Standards Institute (ANSI)

a. ANSI N45.2 - Quality Assurance Program Requirements for Nuclear Power Plants

b. ANSI N45.2.13 - Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants

2.3 Institute of Electrical and Electronic Engineers (IEEE)

a. IEEE-384-1977: "Standard Criteria for Independence of Class-1E Equipment and Circuits (USNRC Regulatory Guide 1.75)"

b. IEEE-323-1974: "Standard for Qualifying Class-1E Equipment for Nuclear Power-Generating Stations"

c. IEEE-344-1975: "Recommended practices for Seismic Qualification of Class-1E Equipment for Nuclear Power-Generating Stations"

d. IEEE-472-1974: "IEEE Guide for Surge Withstand Capability (SWC) Tests"

3.0 DESCRIPTION

3.1 The Remote Multiplexer Unit is part of the HD310 High Speed Data Acquisition System and is designed to provide signal-conditioning for up to 25 analog signals and convert these signals into a single digital output stream for transmission to a single Master Receiver. Each unit accepts up to 25 signal-conditioners or amplifier plug-in module cards which provide the signal-conditioning for each individual input signal.

3.2 In certain nuclear power plant applications, the Remote Multiplexer Unit with its associated plug-in modules, will be mounted in Class-1E panels and connected to Class-1E circuits. In these applications, the unit and its associated modules will be considered Class-1E devices and must be qualified as per requirements of applicable documents listed in Section 2.0 of this document.

3.3 Equipment qualified under this specification shall include, but is not limited to, the following:

- MC170AD - - Remote Multiplexer Unit
- MC370AD - - Remote Multiplexer Unit
- CM249 - - Remote Carrier Modulator
- PS171 - - Power Supply
- PS324 - - Power Supply
- Signal Conditioner Plug-in Modules

3.3.1 The equipment is described in detail by Validyne Design Specification and appropriate Validyne documents and drawings as listed in Attachment A to this specification.

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Rev. 9, 6/18/81
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4.0 QUALIFICATION REQUIREMENTS

4.1 Functional Qualification

Functional Qualification shall mean that the system shall remain fully operational when subjected to the various qualification conditions specified in Section 5.0 of this document.

4.2 Fail-Safe Qualification - Remote Multiplexer Units and Associated Power Supplies

Fail-Safe Qualification shall mean that the system shall not malfunction in a manner which will degrade circuits to which it is connected when subjected to the various qualification conditions, but it does not have to remain functional.

4.3 Fail-Safe Qualification - Signal Conditioner Plug-ins

4.3.1 The following plug-in modules will be qualified such that any failure of the plug-in module will not interfere with a 1E circuit which is connected directly to its input. Also, any failure of the module will not interfere with the fail-safe operation of any other plug-in module which may be physically located next to it in the Remote Multiplexer Unit or with the unit itself.

a. BA332 -- Buffer Amplifier
b. DI325 -- 4-Input Digital Encoder
c. PC202 -- Lanyard Potentiometer Conditioner
d. PT174 -- RTD Conditioner
e. TC292 -- Thermocouple Conditioner

4.3.2 The CM249/CD173 combination will be qualified as a pair such that any failure of either the CM249, CD173, or interconnecting cable will not interfere with a 1E circuit which is connected directly to the input of the CM249. Also, any failure of the CM249 or CD173 will not interfere with the fail-safe operation of any other plug-in module which may be physically located next to it in the Remote Multiplexer Unit or with the unit itself.

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5.0 QUALIFICATION SPECIFICATIONS

5.1 Environmental

The environmental qualification shall include current methods for conditioning components to an equivalent age equal to the design life, including appropriate margins as specified in IEEE-323-1974 and other applicable standards.

Design Parameters

. Temperature -	normal	40 - 122°F (continuous for life)
	abnormal	40 - 158°F (continuous for 1 year)
. Humidity		10 - 95% (non-condensing)

5.1.1 The item shall be tested for extreme temperature and humidity conditions, including applicable margins.

5.1.2 During environmental testing the input voltage shall be varied by ±10% from its nominal 115 VAC input.

5.1.3 The program shall, as a minimum, condition components based on the following age and stress relationships:

a. Age/Temperature: Arrhenius relationship for accelerated testing of such components as insulating materials, resistors, capacitors, integrated circuits.

b. Age/Relative Humidity: If the event life test data on components is not known, testing at elevated relative humidity shall be performed.

c. Age/Operating Cycles: Components shall be simulated to the equivalent 40 year life.

5.2 Radiation

5.2.1 Functional Qualification 1×10^5 RAD's (total Integrated Exposure)

Fail-Safe Qualification 1×10^6 RAD's (total Integrated Exposure)

5.2.2 Total integrated exposures include accident (Design Basis Event) doses.

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5.2.3 Qualification Values for radiation thresholds are on the outside surfaces of equipment enclosures.

5.3 Seismic

The item shall be subjected to seismic spectrum shown in Figures 1 and 2 for both functional and fail-safe qualification levels.

5.3.1 Exploratory Test

a. Low Level (approximately 0.5g) sine sweep from 1 to 60 Hz in each of the three orthogonal directions.

b. The sweep rate shall be one octave per minute.

c. If any resonances are detected they shall be recorded. If no resonances are detected the frequency range shall be extended to 100 Hz or until the first resonance is detected, whichever comes first.

5.3.2 Random Multifrequency Proof Test

a. The item shall be subjected to simultaneous horizontal and vertical inputs of random wave form motion consisting of frequency band-widths spaced one-third octave apart over the frequency range of 1 to 100 Hz as necessary to envelop the required response spectra (RRS).

b. Five (5) Operating Base Earthquakes (OBE) tests shall be completed prior to the application of one (1) Safe Shutdown Earthquake (SSE) tests in each test orientation. Demonstrate functionality of equipment during SSE test by performing Validyne Test Procedure No. 466.

c. The item shall be rotated as necessary to allow the application of inputs in all three orthogonal directions.

5.4 Fragility Testing

5.4.1 After completion of the multifrequency tests, a fragility test at resonate frequencies (if any) shall be performed.

5.4.2 If no resonate frequencies are detected, the test shall be run at 60 Hz.

5.4.3 Acceleration levels shall be increased until a maximum of 19 g's are reached or a non-destructive malfunction is observed.

5.4.4 Fragility tests will be performed in each of the three orthogonal directions.

5.5 Electromagnetic Interference (EMI)

5.5.1 The item shall be tested for the effects of electromagnetic interference.

5.5.2 During EMI testing the input voltage to the system shall be varied by ±10% from its nominal 115 VAC input.

6.0 METHODS & PROCEDURES

6.1 Qualification Test Procedures

6.1.1 Qualification Test Plans and Procedures shall describe to the extent required by IEEE-323-1974, the testing methods and procedures to be used in qualifying equipment.

6.1.2 Testing organization shall certify that all methods and procedures meet applicable requirements of documents specified in Section 2.0 of this specification.

6.2 Test Procedures

6.2.1 Acceptance Test Procedures shall be prepared to adequately demonstrate the operability and function of all equipment qualified under this specification. Procedures applicable to each piece of equipment are listed in Attachment A of this specification.

6.2.2 Functional Test Procedure to be used for on-line testing of equipment during seismic and extreme conditions testing shall define the minimum level of equipment performance and the acceptance/rejection criteria for all equipment qualified.

6.3 Qualification Report

6.3.1 The Test organization shall submit a Qualification Test Report which will summarize the test performance, details and recommendations concerning deficiencies and repairs and photograghs of various test set-ups. The report will also contain a list of test equipment used, calibrations and instrumentation log sheets.

6.3.2 The report shall certify the equipment qualified is in compliance with the regulatory agency requirements for Class-1E safety-related systems.

6.3.3 The Qualification Report shall cover the required information as defined by IEEE-323-1974, Paragraph 8.3.

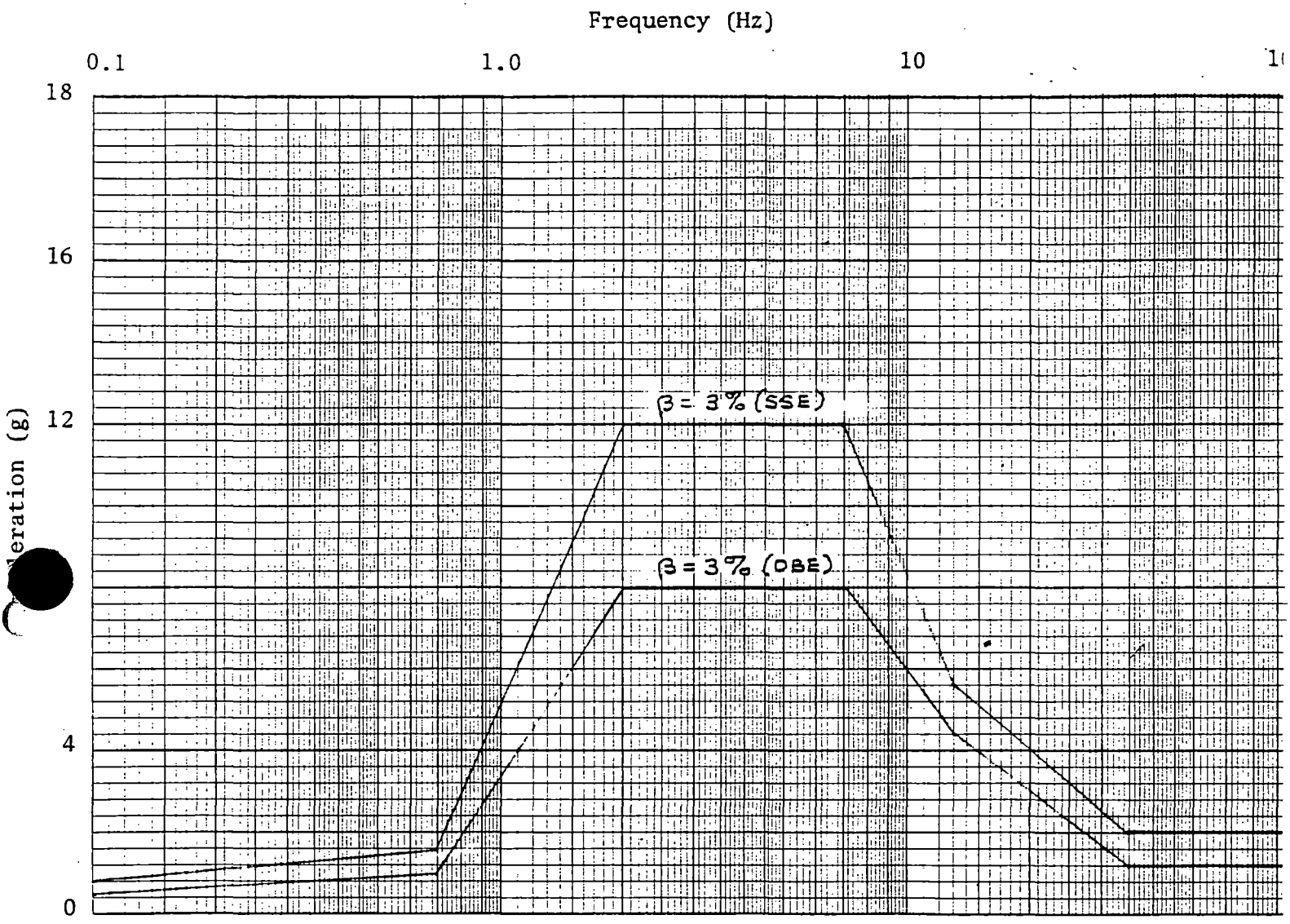

FIGURE 1

HORIZONTAL SPECTRUM

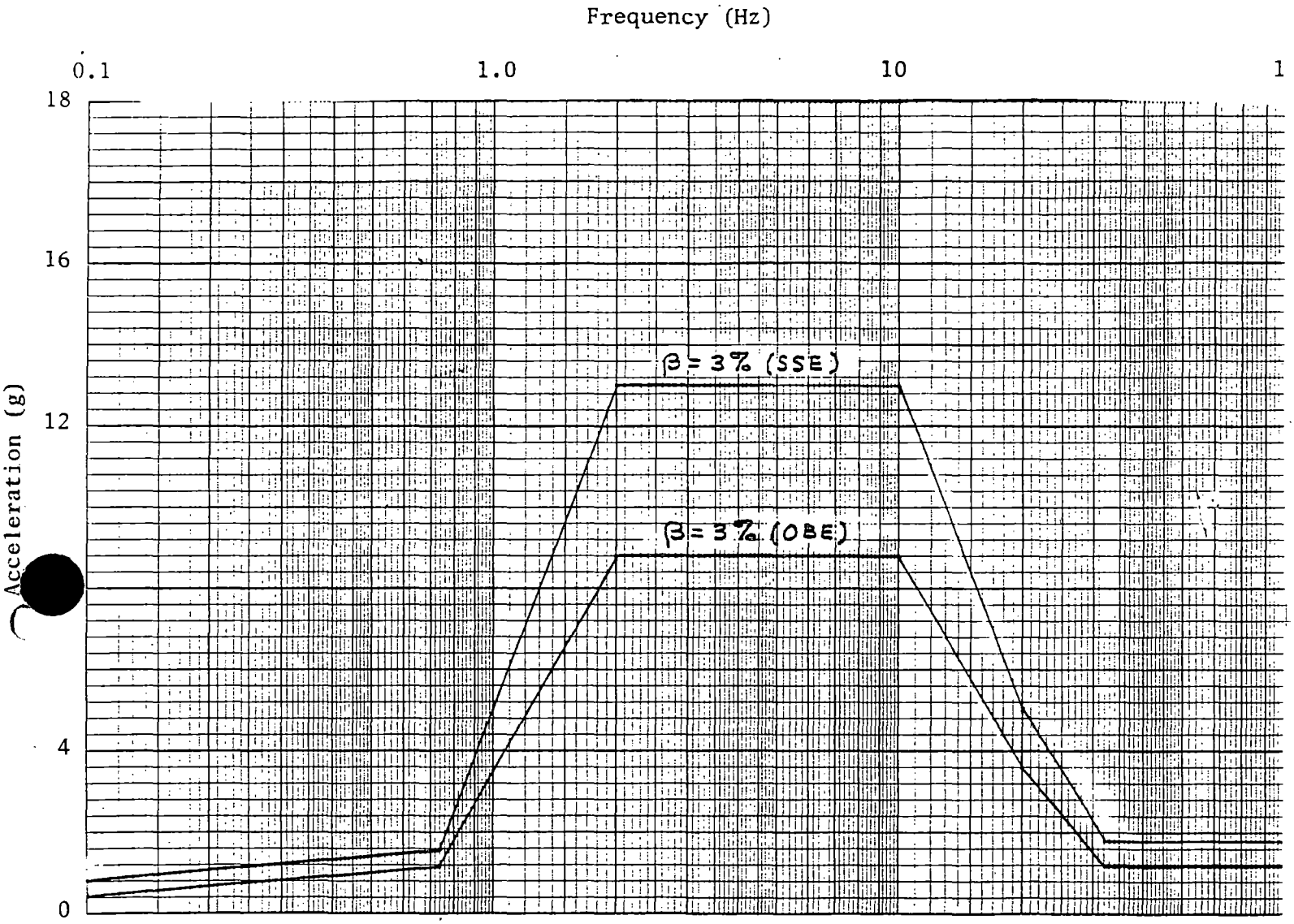

FIGURE 2

VERTICAL SPECTRUM

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ATTACHMENT A

EQUIPMENT SPECIFIC DOCUMENTATION

Model #	Description	Wir. Dia.	Sch. Rev.	Assy. Dwgs.	O/L Dwgs.	P/L	ATP
MC170AD-Q2 MC370AD-Q2	1)A. Module Case B. Module Case	C N/C		Q9802-C Q10351	Rev D N/C	Rev K N/C	ATP442 Rev E ATP464 Rev A
	2) AB295-Q2 Analog Board		C	Q9857-E	Rev N/C	Rev K	ATP448 Rev N ATP445 Rev N
	3) AD296-1-Q2 Digital Board without Fiber-Optic Transmitter		C	Q9864-H	Rev N/C	Rev R	ATP447 Rev A
	4) AD296-2-Q2 Digital Board with F.O. Transmitter		C	Q9864-H	Rev N/C	Rev E	ATP447 Rev A
	5) PS294-Q2 Power Board		B	Q9854-B	Rev N/C	Rev H	ATP451 Rev A
PS[illegible]Q2	Power Supply Module	B	B	Q10139-B	Rev N/C	Rev D	ATP454 Rev A
CM249-Q2	Carrier Modulator (Isolator)		N/C	Q10020-A N/C	Rev N/C	Rev E	ATP440 Rev A
BA332-Q2	Buffer Amplifier Module		A	Q10056-C	Rev N/C	Rev A	ATP450 Rev A
DI325-Q2	Digital Encoder Module		C	Q10033-C	Rev N/C	Rev B	ATP452 Rev C
PT174-Q2-1 -2	RTD Conditioner Module " " "		E E	Q10013-E Q10013-E	Rev A Rev A	Rev B Rev G	ATP444-1 Rev ATP444-2 Rev
TC292-Q2	Thermocouple Conditioner Module		A	Q9936-A	Rev N/C	Rev D	ATP453 Rev N
PC202-Q2	Lanyard Potentiometer Conditioner Module		A	Q10026-C	Rev N/C	Rev A	ATP449 Rev A
CD173-Q2	Carrier Demodulator Module		A	Q10003-C	Rev B	Rev A	ATP443 Rev B
JC177-Q2	Jumper Card		N/C	Q10206-N/C	N/A	Rev N/C	ATP446 Rev N
PS3[illegible]2	Power Supply		A	Q10192-C	A	Rev C	ATP455 Rev N

Rev 7, 4/23/
8, 6/8/8
9, 6/18/
10, 8/25/
11, 10/1/
12, 11/12

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