

ELECTRICAL GROUND SUPPORT EQUIPMENT (EGSE) QUALIFICATION TEST PLAN

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John F. Kennedy Space Center

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**KSC-NE-10074
REVISION BASIC**

**ELECTRICAL GROUND SUPPORT EQUIPMENT
(EGSE) QUALIFICATION TEST PLAN**

Approved by:

A handwritten signature in black ink, appearing to read "Erik Denson", written over a horizontal line.

Erik Denson,
Electrical Chief Engineer, Design & Development

This Revision Supersedes All Previous Editions of This Document

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ELECTRICAL GROUND SUPPORT EQUIPMENT (EGSE) QUALIFICATION TEST PLAN

1. INTRODUCTION

The Ground Systems Electrical Ground Support Equipment (EGSE) Qualification Test Plan will be used to coordinate and document the qualification of all EGSE components as detailed in KSC-STD-G-0003, Standard for Qualification of Launch Support and Facility Components. Appendix A lists the abbreviations and acronyms used in this document.

1.1 Purpose

This plan ensures that consistent methods are used in the qualification of all EGSE subsystem subassemblies and components and defines the process for verifying EGSE requirements for the GSE. The objective is to provide complete testing of requirements for any new component and abbreviated testing for previously approved subassemblies and components. Prior qualification, such as third-party testing and Shuttle Program qualification, can be used as proof of prior qualification for some or all requirements as indicated by KSC-STD-G-0003.

1.2 Scope

This document covers subassemblies and components for all EGSE.

2. REFERENCE DOCUMENTS

2.1 Applicable Documents

The following documents are applicable to the extent specified herein.

NASA Agency

NPR 7150.2	NASA Software Engineering Requirements
NPR 2810.1	Security of Information Technology

Kennedy Space Center, NASA

K0000132092-ANA	Space Launch System (SLS) Mobile Launcher, Rocket, Exhaust Plume Induced Environment, Acoustic and Vibration, Volume I of II
KDP-KSC-P-1865	Technical and Institutional Requirement Deviation/Waiver Process
KDP-P-2718	Engineering Documentation Electronic Approval, Release, and Revision Process

KSC-DE-512-SM	Facility System, Ground Support Systems, and Ground Support Equipment General Design Requirements
KSC-DF-107	Technical Documentation Style Guide
KSC-STD-164	Environmental Test Methods for Ground Support Equipment, Standard For
KSC-STD-E-0022	Bonding, Grounding, Shielding, Electromagnetic Interference, Lightning and Transient Protection, Design Requirements for Ground Systems
KSC-STD-G-0003	Qualification of Launch Support and Facility Components, Standards for

3. QUALIFICATION PLAN

This Ground Systems EGSE Qualification Test Plan defines the qualification documents, personnel, and resources that are required to qualify EGSE subassemblies and components.

3.1 Qualification Documentation

All qualification documents will be filed in the KSC Design Data Management System (KDDMS). The types of qualification documents include the qualification database for EGSE, component qualification form, qualification schedules, contact lists, test procedures, test reports and document templates, as described in the following subsections..

3.1.1 Subassembly and Component-Level Definition

Each subassembly or component will be assessed and documented with an environment level in the Component Qualification List form (Appendix C). Levels will be defined based on the intended location of use and will be determined based on the vibration level, environment, and exposure to hazardous fluids. Along with functional and performance requirements, this will be used to determine the required qualification testing and aid in component selection for use in each subsystem.

3.1.2 Qualification Database for EGSE

The qualification database for EGSE contains a list of all qualified EGSE components. The database will be maintained in KDDMS. Appendix B has a sample report from this database. The following section on Component Qualification List form has descriptions of the fields identified in the database.

3.1.3 Component Qualification Form

The Component Qualification List form (KSC Form 50-39) will be used to track the qualification of subassemblies and components. Each subsystem's subassemblies and components will be listed in the form and then reviewed to determine which items have been previously qualified in the qualification database for EGSE. Once the team has completed the list, it will be sent to the review panel (Section 3.2, Roles & Responsibilities). At that time the items will be placed in a prioritized list and scheduled for testing, if required. See Appendix C for a copy of the form. KSC Form 50-39 contains instructions for filling out the forms and is in the KSC online e-form library.

The fields in KSC Form 50-39 contain, but are not limited to:

- (a) **Subsystem:** Electrical or associated electrical subsystem under which the component(s) is designed to support.
- (b) **Revision and Date:** Enter revision number and letter for subsystem's submittal.
- (c) **Panel Approval Signature:** Identifies the date on which the component qualification form received the Panel's approval.
- (d) **Assembly # / Sub-Assembly #:** Drawing number of assembly or sub-assembly.
- (e) **Component:** Identifies the component.
- (f) **Description:** Simple description of the component.
- (g) **Location of Use:** Approximate location where the component(s) will be used or installed. The location should be specific, including a building, room number, and mounting location (floor, wall, etc.), if applicable. If the item will be located in multiple locations, list a representation of the locations of use. Ensure that the most severe environments are on the list and that they are listed first. Refer to K0000132092-ANA for the general locations of use.
- (h) **Level:** The qualification level is described by three digits. The first digit denotes its Hazardous Location level. The second digit denotes its Vibration/Acoustic level, and the third digit denotes its Environmental Control level. Each will be described by a letter as listed below:
 - (1) Hazardous Location
 - A – Class 1 Div 1
 - B – Class 1 Div 2
 - C – Nonhazardous

- (2) Vibration/Acoustic Level
 - A – Mobile Launcher, around exhaust well, no shock mount
 - B – Mobile Launcher, Launch Umbilical Tower
 - C – Mobile Launcher, Shock Mounted or minimal grms
 - D – Launch Pad
 - N – N/A
 - T – TBD

- (3) Environmental Control as defined by KSC-STD-164, except electromagnetic interference (EMI), acoustic, vibration, explosion and lift-off blast
 - A – Outdoor, extended temperature (–25C to +85C, humidity, rain, icing, fungus, salt fog, sand and dust)
 - B – Outdoor (0 to +70 C, humidity, rain, icing, fungus, salt fog, sand and dust)
 - C – Indoor (0 to +60 C, humidity)
 - D – Climate controlled

Note: All EGSE subassemblies and components will be required to meet EMI specification KSC-STD-E-0022.

- (i) **Method of Qualification:** List the method of qualification as defined by KSC-STD-G-0003. The methods include:
 - Qualification by Testing
 - Qualification by Similarity
 - Prior Qualification
 - Qualification by Usage and Analysis
 - Qualification by Higher Level Assembly Testing

- (j) **Qualifying Entity:** Entity or subsystem in charge of performing tests on the component(s).

- (k) **Qualified?:** Current qualification status

- (l) **Qualification Date:** If known, date of original qualification.

- (m) **Comments:** General use field. Include references to qualification test number, analysis documents, etc.

3.1.4 Schedules

Each shop and test lab that supports qualification testing will publish a schedule on KDDMS that lists all component and subassembly testing. Lab time will be allocated in the schedule for the test preparation, test run, and test documentation as listed in Section 3.2, Roles and Responsibilities.

In addition, each subsystem Lead Electrical Engineer will create a test schedule for their overall qualification testing. This schedule should be coordinated with each lab to ensure availability of resources.

3.1.5 Test Procedures and Reports

A Qualification Test Procedure (QTP) will be written for each component test. It will contain multiple types of tests or analysis covering performance, functional, and environmental requirements. Qualification test procedures and qualification test reports will be generated in accordance with KSC-DF-107, Technical Documentation Style Guide, and released in KDDMS in accordance with KDP-P-2718.

3.1.6 Test Software

Software used for qualification will be published to KDDMS with a description and revision number. The software description and revision will be included in the test report. Software documentation and validation and verification plan will be in accordance with NPR-7150.2, NASA Software Engineering Requirements. Information Technology (IT) requirements that are in accordance with NPR 2810.1, NASA Security of Information Technology, will be implemented where applicable.

3.2 Roles and Responsibilities

3.2.1 EGSE Qualification Review Panel

The EGSE Qualification Review Panel will be comprised of a Qualification subject matter expert (SME), the Branch Chief, and the Electrical Chief Engineer. This panel will be responsible for reviewing the component qualification forms to determine qualification priorities and ensure the qualification levels and methods are appropriate for the intended use. The review panel will also determine the impact and validity of deviations and waivers. The review panel has decision-making power to monitor the process as detailed in the flowchart (see Appendix D). The review panel has the authority to grant waivers in conjunction with the chief engineer and the Engineering Review Board (ERB). The waiver process is further detailed in KDP-KSC-P-1865, Technical and Institutional Requirement Deviation/Waiver Process.

3.2.2 Lead Design Engineers

The Lead Electrical Engineers will be responsible for performing the following tasks:

- a. Complete a component qualification form with all subassemblies and components that comprise their subsystem.
- b. Review the form with the component qualification contacts.
- c. Submit the form to the review panel for approval.
- d. Schedule any required fabrication, assembly, or lab testing.
- e. Submit procurements for any components that are required for testing.
- f. Provide technicians with documentation, drawings, and parts for the job.
- g. Approve all documents before use and ensure they have been reviewed for Export Control (SBU/ITAR) reviewed, as needed.
- h. Write and supervise performance and functional test procedures including basic functional tests that may need to be run during environmental testing.
- i. Compile overall qualification test procedures and reports and upload them to KDDMS.

3.2.3 Lab Test Engineers

Lab testing includes EMI, vibration, complex thermal testing, and transducer testing. The lab test engineers will be responsible for performing the following tasks:

- a. Provide and run environmental test procedures.
- b. Provide written analysis of lab results.
- c. Provide necessary expendable supplies for test activities.
- d. Provide up-to-date safety equipment and training for lab personnel.

For basic thermal testing, lab test engineers will assist the Lead Electrical Engineers in setting up their equipment, basic procedures, and explaining how to operate and read the measurements. Any complex thermal analysis or testing will be performed by lab test engineers.

3.2.4 Support Personnel

Support personnel include personnel for shop and lab scheduling, machining and prototyping, cable and rack assembly, and printed circuit board (PCB) assembly. All support personnel shall be responsible for ensuring their certification and safety training are current.

Scheduling personnel will be responsible for keeping the lab and shop schedules up to date and published in PDF format in KDDMS.

Technicians will be responsible for reporting any schedule changes to the schedule personnel (unexpected delays because of part or tool issues, etc.) and reviewing the current schedule to prepare for upcoming work.

3.2.5 Quality

Quality Assurance personnel will be used as determined by level of criticality of the component and by determination of subsystem Lead Electrical Engineers and the review panel.

Quality Assurance personnel will be required to witness testing that may be used to verify and “sign off” formal requirements.

3.2.6 Safety

Failure Modes and Effects Analysis (FMEA) and Reliability and Safety Assessment Reports (RSARs) assessments provided by Safety and Mission Assurance (S&MA) can be used by the subsystem Lead Electrical Engineers and the review panel to help determine component levels and test requirements. In addition, test procedures should be reviewed by S&MA.

3.2.7 Configuration Management

KDDMS will be used for configuration management. The subsystem Lead Electrical Engineer will coordinate with configuration management personnel to ensure proper configuration identification, control, verification, and audit required for the Ground Systems EGSE.

3.2.8 Flowchart

A typical process flow is depicted in Appendix D. It serves as a guideline to follow to ensure that subsystems qualify components in an orderly and informative manner.

3.2.9 Export Control

All documents that will be released for external use must be submitted for SBU/ITAR review.

3.3 Resources

3.3.1 Test Labs & Shops

Test labs and shops in the Engineering Development Laboratory (EDL) include the Transducer Development Lab (TDL), EMI Lab, Controls Lab, Power Lab, Prototype Shop, and Electronic Assembly Lab. Other KSC labs and shops include the Vibration Test Facility, Electromagnetic Lab (EML), Launch Equipment Test Facility (LETF), and Cable Shop. Contact information is listed on the qualification wiki page (located online at <https://wiki.ksc.nasa.gov/eipt/index.php?title=Qualification>).

3.3.2 Test Equipment

Test equipment used during qualification testing must have current calibration.

APPENDIX A. ABBREVIATIONS AND ACRONYMS

EDL	Engineering Development Laboratory
EGSE	Electrical Ground Support Equipment
EMI	electromagnetic interference
ERB	Engineering Review Board
FMEA	Failure Modes and Effects Analysis
grms	root mean square acceleration
GSE	ground support equipment
ITAR	International Traffic In Arms Regulations
KDDMS	KSC Design Data Management System
KSC	Kennedy Space Center
LETF	Launch Equipment Test Facility
N/A	not applicable
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
PCB	printed circuit board
RSARs	Safety Assessment Reports
S&MA	Safety and Mission Assurance
SBU	Sensitive But Unclassified
SLS	Space Launch System
SME	subject matter expert
STD	standard
TBD	to be determined
TDL	Transducer Development Lab

APPENDIX B. SAMPLE OF COMPONENT QUALIFICATION REPORT

Report of Qualification Tests sorted by Component -> SubAssembly-> Subsystem -> Installation Need Date

Component 0000_ASSEMBLY									
Assembly: 925E0300027									
Subassembly: 925E0300027-1									
Subsystem: WK									
Qualifying Entity: WK									
Levels:	Child Part Number:	Acoustic Test Number:	EMM Test Number:	Environmental Test #:	Qualification Method:	Earliest Test Date:	Installation Need Date:	Vibration Test Number:	
CD8	TBD				Testing	3/22/2010	5/14/2010		
Completed Reports-->									
Item Description: WX Terminal Distributor Assembly									
Location of Use: Pad 60' Weather Towers									
Comments: EMI and Temperature Testing is to be done on the Weather Station Assembly which includes the Meteorological Power Enclosure (925E0300003-2), the Meteorological Instrumentation Enclosure (925E0300004-2), the Meteorological Sensor Mount (925E0300002-1), Terminal Distributor Assemblies (925E0300027-1, -2, -3, -4) and their respective cable assemblies.									
Subassembly: 925E0300027-2									
Subsystem: WK									
Qualifying Entity: WK									
Levels:	Child Part Number:	Acoustic Test Number:	EMM Test Number:	Environmental Test #:	Qualification Method:	Earliest Test Date:	Installation Need Date:	Vibration Test Number:	
	N/A - Reference Parent Component				Similarity	3/22/2010	5/14/2010		
Completed Reports-->									
Item Description: WX Terminal Distributor Assembly									
Location of Use: Pad 60' Weather Towers									
Comments: Similarity to 925E0300027-1. Note that this enclosure is going to be used as part of the qualification tests of 925E0300004-2, 925E0300002-1, 925E0300027-1, -2, -3, -4.									
Subassembly: 925E0300027-3									
Subsystem: WK									
Qualifying Entity: WK, CABLE									
Levels:	Child Part Number:	Acoustic Test Number:	EMM Test Number:	Environmental Test #:	Qualification Method:	Earliest Test Date:	Installation Need Date:	Vibration Test Number:	
CD8	N/A - Reference Qualifying Entity				Testing	3/22/2010	5/14/2010		
Completed Reports-->									
Item Description: WX Terminal Distributor Assembly									
Location of Use: Pad 60' Weather Towers									
Comments: EMI and Temperature Testing is to be done on the Weather Station Assembly which includes the Meteorological Power Enclosure (925E0300003-2), the Meteorological Instrumentation Enclosure (925E0300004-2), the Meteorological Sensor Mount (925E0300002-1), Terminal Distributor Assemblies (925E0300027-1, -2, -3, -4) and their respective cable assemblies.									

Level's Legend:
 1) Hazardous Location
 2) Vibration/Seismic Level
 3) Mobile Launcher, Launch Umbilical Tower
 4) Mobile Launcher, Block Mounted or Integral Gms
 5) Launch Pad
 6) Class 1 Div 2
 7) Nonhazardous
 8) Hazardous Location
 9) Environmental Control as defined by FCC-ETD-146 (except B1A, seismic, vibration, explosion and dirt-off blast)
 A - Outdoor (0 to +70 C, Humidity, Rain, Snow, Pumping, Ball Fog, Sand and Dust)
 B - Outdoor (0 to +70 C, Humidity, Rain, Snow, Pumping, Ball Fog, Sand and Dust)
 C - Indoor (0 to +49 C, Humidity)
 D - Climate Controlled

2) Environmental Control as defined by FCC-ETD-146 (except B1A, seismic, vibration, explosion and dirt-off blast)
 A - Outdoor (0 to +70 C, Humidity, Rain, Snow, Pumping, Ball Fog, Sand and Dust)
 B - Outdoor (0 to +70 C, Humidity, Rain, Snow, Pumping, Ball Fog, Sand and Dust)
 C - Indoor (0 to +49 C, Humidity)
 D - Climate Controlled

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 Report Print Date: Tuesday, November 09, 2010
 Please contact Faha_A.Scrib-Ten@hks.com or call him at 407-746-0788 for questions/comments.

APPENDIX C. COMPONENT QUALIFICATION FORM

Submitted By	COMPONENT QUALIFICATION LIST	Submitted To
Date Mail Code		Mail Code
Subsystem	Revision	Panel Approval Signature
		Date

NOTE: This form is to be used in conjunction with KSC-NE-10074, Electrical Ground Support Equipment (EGSE) Qualification Test Plan

Item	Assembly # / Sub-Assembly #	Component	Description	Location of Use	Level Haz Loc	Level Vibrat / Acoust	Level Envir Cntrl	Method of Qualification Qualification by:	Qualifying Entity	Qualified ?	Qualification Date	Comments	Add or Delete Row
					▼	▼	▼	▼	▼	▼			▲▼
					▼	▼	▼	▼	▼	▼			▲▼
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KSC FORM 50-39 NS 07/13 (1.1) PREVIOUS EDITIONS ARE OBSOLETE. Validate prior to use.

Submit by Email

KSC-NE-10074
Revision Basic

Qualification Form 50-39 Instructions

Subsystem - Enter name or acronym of requesting subsystem. Example: CMASS

Revision - Enter revision number & letter for the subsystem's submittal. Example: 1-A

Assembly # / Sub-Assembly # - List the name of the component or subassembly. Example: 90E0000432 / 90E0000432-01

Component - Example: Pressure Transducer

Description - Simple description of the component or subassembly. Example: Digital Pressure Transducer

Location of Use - The location should be specific, including a building, room number and mounting location (floor, wall, etc.), if applicable. If the item will be located in multiple locations, list a representation of the locations of use. Ensure that the most severe environments are on the list and that they are listed first. Example: MPPF, Mobile Launcher

Level - The qualification level is described by three digits. The first digit denotes Hazardous Location, the second Vibration/Acoustic Level and the third Environmental Control. Each will be described by a letter as listed, below. See Examples following the listings.

1. Hazardous Location

- A - Class 1 Div 1
- B - Class 1 Div 2
- C - Non-hazardous
- N - N/A
- T - TBD

2. Vibration/Acoustic Level

- A - Mobile Launcher, around exhaust well, no shock mount
- B - Mobile Launcher, Launch Umbilical Tower
- C - Mobile Launcher, Shock Mounted or minimal grms
- D - Launch Pad
- N - N/A
- T - TBD

3. Environmental Control as defined by KSC-STD-164 (except EMI, acoustic, vibration, explosion and lift-off blast)

- A - Outdoor, extended temperature (-25C to +85C, Humidity, Rain, Icing, Fungus, Salt fog, Sand and Dust)
- B - Outdoor (0 to +70 C, Humidity, Rain, Icing, Fungus, Salt fog, Sand and Dust) C - Indoor (0 to +60 C, Humidity)
- D - Climate Controlled

All items will be required to meet NASA/KSC EMI specifications.

Example of format for entering Level:

If Hazard Location is B and if Vibration/Acoustic Level is D, and if Environmental Control is TBD, then Level would be input as Example: B, D, T

Qualification Form 50-39 Instructions - continued

Qualification Level

			Level Description	LEVEL A	LEVEL B	LEVEL C	LEVEL D	
HL			Hazardous Location	Class 1 Div 1	Class 1 Div 2	None	N/A	
	VL		Vibration -root-mean-square acceleration (grms) and overall sound pressure level OASPL (dB)	Mobile Launcher, around exhaust well, no shock mount	Mobile Launcher, Launcher Umbilical Tower	Mobile Launcher, Shock Mounted or minimal grms	Launch Pad	
		EL	Environmental Control (KSC-STD-164)	Outdoor/Ext temp (-25 to +85 C)	Outdoor (0 to +70 C)	Indoor (no climate control)	Indoor (climate controlled)	
A	A	A	<--Three Letter Qualification Level (Example 1)					Level Examples: Example 1, AAA qualified part will be qualified to: A - Class 1 Div 1 A - Vibration > 20 Grms and Acoustic level > 160 dB OASPL A - Outdoor (Extended temp -25C to +85C, Humidity, Rain, Icing, Fungus, Salt fog, Sand and Dust) Example 2, BAA qualified part will be qualified to: B - Class 1 Div 2 A - Vibration > 20 Grms and Acoustic level > 160 dB OASPL A - Outdoor (Extended temp -25C to +85C, Humidity, Rain, Icing, Fungus, Salt fog, Sand and Dust)
Hazard Level								
Vibration/Acoustic Level								
Environmental Control Level								

Method of Qualification - List the method of qualification as defined by KSC-STD-G-0003B. Please see KSC-STD-G-003B for a description of these methods. The methods include: Qualification by Testing, Qualification by Similarity, Prior Qualification, Qualification by Usage and Analysis, Qualification by Higher Level Assembly Testing

Qualifying Entity - Name or acronym of team or subsystems that has/will be qualifying this item. Example: Transducers, KGCS

Qualified ? - Determine current qualification status of item.

Qualified = Yes
Not yet Qualified = No
Example: No

Qualification Date - If known, insert date of qualification. Use format: dd/mm/yyyy

Comments - General use field. Use this field to include references to qualification test or analysis documents.

