NUCLEAR DIVISION

C002-EC090179-F1
ENGINEERING CRITICAL COMPONENT SPECIFICATION

PERFORMANCE/DESIGN AND
PRODUCT CONFIRMATION REQUIREMENTS

FOR
WIRING HARNESS

FORMING A PART OF
CEI NUMBER 090290A

PRELIMINARY PROPOSAL ISSUE
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MASTER

AEROJET-GENERAL CORPORATION

SACRAMENTO, CALIFORNIA

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PERFORMANCE/DESIGN AND QUALIFICATION REQUIREMENTS

for

WIRING HARNESS

Replace page(s) with the latest revised page(s) noted below. Revised paragraph(s) are identified with the latest revision letter (or number) in the margin.

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1. SCOPE

1.1 Scope. - This specification establishes the performance, design, test, and qualification requirements for equipment identified as wiring harness.

2. APPLICABLE DOCUMENTS

2.1 Aerojet-General Corporation Documents. - The following documents, of the latest issue, form a part of this specification to the extent specified herein. In the event of conflict between documents referenced herein and other detailed control of Sections 3, 4, 5, and 10, the detailed requirements of Sections 3, 4, 5, and 10, shall be considered a superseding requirement.

SPECIFICATIONS

EC-90214

Instrumentation and Control Subsystem

CP-90290

Engine, NERVA, 75K, Full Flow

(Copies of above documents required by suppliers in connection with specific procurement functions should be obtained from the procuring activity.)

3. REQUIREMENTS

3.1 Performance. - Except as otherwise specified herein, performance requirements for wiring harness shall be in accordance with EC-90214 of which the wiring harness is a part.

3.1.1 Functional Characteristics.-

3.1.1.1 Operational Characteristics.- The wiring harness shall be capable of distributing electrical power and signals in compliance with the requirements specified in EC-90214.

3.1.1.2 Current Rating Continuous.- Each cable type in the wiring harness shall be capable of operating continuously at 1 ampere or at 3 times the highest current expected in that cable, which ever is greater.

3.1.1.3 Signal Erosion.- The signal degrading characteristics of the electrical conducting circuits shall be as specified below:

<u>Characteristics</u>	<u>Instrumentation</u>		
	<u>Control</u>	<u>Diagnostic</u>	<u>Actuators</u>
(a) Conductor Resistance (Copper)	0.1 ohms/ft	0.1 ohms/ft	0.1 ohms/ft
(b) Capacity to Ground, max	150 pico farads/ft	150 pico farads/ft	150 pico farads/ft
(c) Insulation Resistance, min	1 megohm	1 megohm	1 megohm

3.1.2 Operability.-

3.1.2.1 Reliability.- The reliability of control instrumentation signal distribution circuits, and actuation power distribution circuits shall be a minimum of 0.999996.

3.1.2.2 Maintainability.- Maintainability of the wiring harness shall conform to the requirements specified in EC-90214.

3.1.2.2.1 Maintenance and Repair Cycles.- Criteria for maintenance and repair cycles shall conform to the requirements specified in EC-90214.

3.1.2.2.2 Service and Access.- The wiring harness shall have the capability of allowing for check-out and maintainability to the extent specified in EC-90214. Harness cables which connect to valves, actuators or instrumentation requiring replacement capability shall be designed to accommodate the remote requirement.

3.1.2.3 Useful Life.- The wiring harness useful life shall be as specified in EC-90214.

3.1.2.4 Environmental.-

3.1.2.4.1 Natural Environment.- The environmental conditions to which the wiring harness shall be subjected shall be as specified in EC-90214.

3.1.2.4.2 Induced Environments (Above Disk Shield).- The wiring harness shall be subjected to the following induced environments above the engine disk shield:

(a) Pressure: (Fluid System)	0 to 1468* psia
(b) Temperature:	140 to 860°R
(c) Nuclear Radiation:	
(1) Neutrons	
Integrated Fluence	7.2×10^{16} n/cm ² (E > 1 Mev)
Maximum Flux Rate	2.1×10^{12} n/cm ² -sec (E > 1 Mev)
(2) Gammas	
Total Dose	4.3×10^8 rads
Maximum Dose Rate	4.3×10^7 rads/hr.
(d) Vibration: Longitudinal	+ 6.75 g (3 to 35 Hz)
Lateral	+ 4.5 g (0.1 to 15 Hz)
(e) Acceleration: Longitudinal	+ 5.2 to -1.0 g
Lateral	+ 1.0 g

* Applicable only to those sheath cables which are integrally attached to instruments which probe into the engine fluid system.

3.1.2.4.3 Induced Environments (on the Engine, Below the Dome).- The wiring harness shall be subjected to the following induced environments on the engine below the dome.

(a) Pressure: (Fluid System)*	0 to 1426 psia
(b) Temperature:	130 to 2600°R
(c) Nuclear Radiation	
(1) Neutrons	
Integrated Fluence	$8.6 \times 10^{18} \text{ n/cm}^2 \text{ (E > 1 Mev)}$
Maximum Dose Rate	$2.4 \times 10^{14} \text{ n/cm}^2\text{-sec (E > 1 Mev)}$
(2) Gammas	
Total Dose	$3.5 \times 10^{10} \text{ rads}$
Maximum Dose Rate	$3.5 \times 10^9 \text{ rads/hr}$
(d) Vibration	See 3.1.2.4.1
(e) Acceleration	See 3.1.2.4.1

3.1.2.4.4 Induced Environments (Between Disk Shield and Engine Dome).- The wiring harness shall be subjected to the following induced environments between the engine shield and the pressure vessel dome.

(a) Pressure: Fluid System)*	0 to 1426 psia
(b) Temperature	140 to 860°R
(c) Nuclear Radiation	
(1) Neutrons	
Integrated Fluence	$7.2 \times 10^{18} \text{ n/cm}^2 \text{ (E > 1 Mev)}$
Max Dose Rate	$2.0 \times 10^{14} \text{ n/cm}^2\text{-sec (E > 1 Mev)}$
(2) Gammas	
Total Dose	$1.3 \times 10^8 \text{ rads}$
Maximum Dose Rate	$1.3 \times 10^7 \text{ rads/hr}$

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(d) Vibration: Longitudinal	+ 6.75 g (3 to 35 Hz)
Lateral	$\pm$ 4.5 g (0.1 to 15 Hz)
(e) Acceleration: Longitudinal	+ 5.2 to -1.0 g
Lateral	$\pm$ 1.0 g

3.1.2.5 Transportability.- The wiring harness shall be transportable within the limits specified in EC-90214.

3.1.2.6 Human Performance.- The wiring harness human performance features shall be as specified in EC-90214.

3.1.2.7 Safety.- Maximum effort shall be placed on design which eliminates single failures or credible combination of errors and/or failures which endanger the safety of space and/or ground personnel. The wiring harness shall be capable of conforming with all the safety requirements specified in EC-90214.

3.2 CEI Definition.- Not applicable.

3.3 Design and Construction.-

3.3.1 General Design Features.- Except as otherwise specified herein, design and construction of the wiring harness shall be in accordance with EC-90214. The configuration of the wiring harness (number, size and shielding of wires and connectors) shall be as specified on the applicable Aerojet-General Corporation (AGC) drawing.

3.3.2 Selection of Specifications and Standards.- As specified in CP-90290.

3.3.3 Materials, Parts and Processes.- As specified in CP-90290.

3.3.4 Standard and Commercial Parts.- As specified in CP-90290.

3.3.5 Moisture and Fungus Resistance.- As specified in CP-90290.

3.3.7 Interchangeability and Replaceability.- As specified in CP-90290.

3.3.8 Workmanship.- As specified in CP-90290.

3.3.9 Electromagnetic Interference.- As specified in CP-90290.

3.3.10 Identification and Marking.- As specified in CP-90290.

3.3.11 Storage.- The wiring harness shall be capable of performing as specified herein subsequent to storage while protected from the ground environmental conditions specified in 3.1.2.4 for a period not exceeding the ground storage life specified in 3.1.2.3.