

METRIC

MIL-PRF-32566

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PERFORMANCE SPECIFICATION

ENERGY-ATTENUATING FLOOR MATS
FOR USE IN U.S. MILITARY GROUND VEHICLES



Comments, suggestions, or questions on this document should be addressed to U.S. Army RDECOM, Tank Automotive Research Development and Engineering Center, ATTN: RDTA-SIE-ES-PLDP-PLDE-DIS, MS #268, 6501 E. 11 Mile Road, Warren, MI 48397-5000 or sent by email to usarmy.detroit.rdecom.mbx.tardec-standardization@mail.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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1. SCOPE

1.1 Scope. This specification establishes minimum performance and operating requirements for Energy-Attenuation (EA) floor mats used for all U.S. Army military vehicles and reporting procedures to be used for requirements verification. EA floor mats reduce the risk of injury to occupants during mine blast accelerative loading events. This document should be used in conjunction with the vehicle program specific performance specification which entails requirements tailored to the intended vehicle specific design, protection location(s) and associated geometry. Unless otherwise specified by the Government, the EA floor mat (as defined in section 6.3(b)) should ensure threshold requirements are met (as defined in section 6.3(e)).

1.2 Application. Certain text found in this document are generic in nature but further elaboration can be found in section 6.3.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-810	-	Environmental Engineering and Laboratory Tests
MIL-STD-889	-	Dissimilar Metals
MIL-STD-1472	-	Human Engineering Design Guidelines
MIL-STD-3010	-	Test Procedures for Packaging Materials and Containers

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2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

CODE OF FEDERAL REGULATIONS

29 CFR 1910 Subpart Z	-	Occupational Safety and Health Administration; Toxic and Hazardous Substances
40 CFR 82	-	Environmental Protection Agency; Protection of Stratospheric Ozone
49 CFR 571.302	-	Federal Motor Vehicle Safety Standard; Flammability of Interior Materials
49 CFR 572	-	Anthropomorphic Test Devices

(Copies of these documents are available online at www.ecfr.gov)

ARMY PUBLIC HEALTH CENTER'S TOXICITY EVALUATION PROGRAM

Army Public Health Center's Toxicity Clearance

(A copy of this regulation is available online at <http://phc.amedd.army.mil/topics/workplacehealth/hha/Pages/HazardCategory-ChemicalSubstances.aspx>)

The pamphlet and regulation pertaining to Toxic Clearances are:

AR 40-5	-	Preventive Medicine
DA PAM 70-3	-	Army Acquisition Procedures

(Copies of these documents are available online at <http://www.apd.army.mil>)

U.S. ARMY TANK-AUTOMOTIVE RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER (TARDEC) TECHNICAL REPORTS (TR)

TR 27709	-	Subsystem Drop Tower Test Procedure
TR 27790	-	OCP TECD Enhanced Injury Assessment Reference Values

(Copies of these documents are available online at <http://www.dtic.mil>)

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U.S. ARMY ABERDEEN TEST CENTER DRAWINGS

Dwg. No. 11266-1A - LOFFI Assembly

(Copies of these documents are available from Ballistics Instrumentation Division /SL U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD 21005-5059).

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise indicated, the issues of these documents are those cited in the solicitation or contract.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/NFSI B101.1 - Test Method for Measuring Wet Static Coefficient of Friction of Common Hard-Surface Floor Materials

(A copy of this document is available online at www.ansi.org)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM D395 - Standard Test Method for Rubber Property - Compression Set
ASTM D6413 - Standard Test Method for Flame Resistance of Textiles (Vertical Test)
ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness
ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
ASTM E1354 - Rates for Materials and Products Using an Oxygen Consumption Calorimeter

(Copies of these documents are available online at www.astm.org)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. If a conflict exists between a metric measurement and an English (Imperial) measurement, the metric measurement should take precedence. If there is a conflict between references, the contractor is required to contact, in writing, the contracting activity for clarification. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 First article inspection. First article inspection shall be performed on one complete energy-attenuation (EA) floor mat when a first article sample is required. The completed EA floor mat shall conform to Section 3 requirements and the verification methods as listed in Table II.

3.1.1 Examinations and test. The EA floor mat system shall be verified to meet the requirements of this specification through one or more of the evaluation method(s) listed in Table II. This table determines the evaluation method(s) that apply for each requirement of this specification.

3.2 Materials. The contractor shall select materials capable of meeting all of the operational and environmental requirements as stated in the contract.

3.3 Environmental considerations. The use of toxic chemicals, hazardous substances, or ozone-depleting chemicals is prohibited.

3.3.1 Prohibited hazardous substances. Use of hazardous substances identified by 29 CFR 1910 Subpart Z such as asbestos, radioactive materials, beryllium, hexavalent chromium (electroplating and coatings processes), cadmium (electroplating), mercury, is prohibited and are not used in the subcontractor, vendor, or original equipment manufacturer (OEM) parts, or its manufacture, assembly, operation, or sustainment without prior approval from the Government.

3.3.2 Ozone-depleting substances. Materials defined by 40 CFR 82 as Class I and Class II ozone-depleting substances shall not be used.

3.4 Testing.

3.4.1 Test conditions. Unless otherwise specified in this document, all tests shall be documented and conducted under ambient environmental conditions:

Temperature: 19-26 C (66 - 78 °F).

Barometric pressure: Facility ambient.

Humidity: 10 – 70% Relative humidity.

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3.5 Critical performance requirements.

3.5.1 Occupant injury evaluation criteria. The SI (metric) System of units shall be used for ATD (Anthropomorphic Test Device) test data to assess injury responses for the TARDEC lower body fixture (see section 6.3(g)). The injury criteria documented in “ARL SLAD WSB, Injury Criteria for the Analysis of Soldier Survivability in Accelerative Events, April 2012, DIST D” shall be utilized for the Upper Tibia Compressive Force. For supplemental information on injury values, please refer to Section 6.4. If the injury criteria is specified to be a different value by the Government, the Government specified criteria shall meet the requirements specified herein. The floor mat shall be evaluated by the TARDEC Occupant Protection Lab IAW TR-27709 (also referred to as LQP-25-02) using the TARDEC lower body fixture. When the contract calls for floor mats of different thicknesses, each thickness must meet the requirement. This requirement verifies a floor mat only for the thickness(es) which are used during the verification of this requirement.

During test setup, mount two single axis accelerometers on the drop platform using an appropriate mount as defined by the TARDEC engineer (e.g. IAW Dwg. No. 11266-1A LOFFI Assembly), such that data will be recorded in the vertical direction. If using this LOFFI Assembly mount, a 0.5-inch thick EPDM foam (ethylene propylene diene monomer) shall be used for the LOFFI Assembly spacers. The pressure to compress this foam by 25% shall be 11 psi. The placement of the sensor mount assemblies shall be symmetric such that they are placed on each side of the floor mat, within 3 inches of the edge of the mat but without contacting the mat. These sensor assemblies shall be used to verify the floor response. The sampling rate shall be 20 kHz or greater.

High speed motion cameras used for these tests shall be capable of recording 1000 frames per second or greater. Additionally, adequate lighting shall be used to capture the event without image degradation. The cameras shall be positioned to record the drop event and the crushing of the blast mat. This shall include a front view capturing the entire test event, and a side view which shall have a closer, zoomed-in view of the floor mat sample, ATD feet, and the ATD lower leg.

When using LOFFI mounts, the load conditions provided in Table I shall be applied on the floor during these tests, defined by the peak velocity response of the floor and the corresponding time to reach peak velocity. The load profiles shall be applied such that the resulting acceleration pulse is half-sine in shape. The velocity profiles shall be obtained by integration of data obtained from the accelerometers mounted to the platform after a CFC 600 filter is applied to the data. When LOFFI mounts are not used, equivalent load cases shall be derived based on the load conditions which generate the results in Table I for LOFFI-mounted sensors as defined herein. Additional load cases shall be applied if stated in the contract. Because these values will change as the application and/or threat changes, this floor mat

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specification does not qualify floor mats for every application or threat, but only for the loading environments tested to herein.

Table I. Test Load Cases (LOFFI Mounts)

Load Case	Peak Velocity (m/s)	Time-to-Peak (ms)
1	7.5 +/- 0.25	5.25 +/- 0.25
2	11 +/- 0.25	5.25 +/- 0.25

3.5.2 Sustaining EA at compression set. A 69 kPa (10 psi) load compression set of 10% or more under ambient conditions (see section 3.4.1) shall not hinder EA of section 3.5.1. Samples shall be untested, and at ambient temperature for 2 hours prior to test. Initial thickness (T_i) is measured IAW MIL-STD-3010 Method 1003. A specified load plate is applied to the walking surface IAW ASTM D395 Method A for 48 hours. Thirty (30) minutes after the load is removed, the final thickness (T_f) is measured IAW MIL-STD-3010 Method 1003. When the contract calls for floor mats of different thicknesses, each thickness must meet the requirement. This requirement verifies a floor mat only for the thickness(es) which are used during the verification of this requirement. If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

3.6 AIPH TEP toxicity clearance. A toxicity clearance shall be obtained from the Army Public Health Center (APHC), Toxicology Portfolio, Toxicity Evaluation Program (TEP) IAW AR 40-5 and DA PAM 70-3. The toxicity clearance shall include both a clearance of the EA floor mat materials final chemical formulations and a clearance of the EA floor mat materials final chemical formulations pyrolysis and combustion products. The toxicity clearance shall be obtained on each specific EA floor mat application or use condition, and new uses or change in EA floor mat formulations shall obtain a new toxicity clearance.

3.7 Additional performance requirements.

3.7.1 Surface operational load. The walking surface shall support an operational load of 159 kg (350 lbs) or greater secured in two combat boots, with boot soles contacting the walking surface for 30 seconds, followed by a 30 second no-load recovery period for five operational load cycles, with no adverse material effects. The boot soles shall be placed such that the center of the soles are 9 inches apart, and such that a minimum of 5 inches of walking surface exists around the perimeter of the boots. When the contract calls for floor mats of different thicknesses, each thickness must meet the requirement. This requirement verifies a floor mat only for the thickness(es) which are used during the verification of this requirement.

3.7.2 Wet surface traction. The walking surface wet static coefficient of friction shall be 0.50 or greater IAW ANSI/NFSI B101.1, utilizing a Neolite rubber pad with hardness 85 to 92, Type A IAW ASTM D2240 to assess the traction.

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3.7.3 Self-draining water immersion. After water immersion the mat shall be self-draining. The material shall not retain more than 10% of its weight on, below or within it after water immersion. Exposure to water shall have no adverse material effects to the walking surface operational load of section 3.7.1, and shall not hinder EA of section 3.5.1. Measure the initial weight (W_i) prior to test. Test IAW MIL-STD-810 Method 512 Procedure I. Condition the sample per section 2.3.2.2.a.(2) for 30-minutes, followed by complete immersion for 30-minutes, followed by self-draining on a 5° slope for 5-minutes, followed by the test in section 4 using seven immersion cycles. Measure the final weight (W_f) within 15 minutes, after exposure. The percent water retention ($WR_{\%}$) is calculated by subtracting the initial weight from the final weight and dividing by the initial weight and multiplying by 100%: ($WR_{\%} = \frac{W_f - W_i}{W_i} \times 100\%$). Allow the after exposure sample to dry. If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

3.7.4 High storage temperature. The high storage temperature shall be $71 \pm 2^{\circ}\text{C}$ ($160 \pm 4^{\circ}\text{F}$) IAW MIL-STD-810 Method 501 Procedure I. If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

3.7.5 Low storage temperature. The low storage temperature shall be $-51 \pm 2^{\circ}\text{C}$ ($-60 \pm 4^{\circ}\text{F}$) IAW MIL-STD-810 Method 502 Procedure I. If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

3.7.6 Fire resistance.

3.7.6.1 Fire related egress and mounted crew in-vehicle time. Egress time is the time allotted for the mounted Warfighter to safely exist a vehicle. Materials selected for use in floor mats shall be fire resistant; with the intent to achieve the mission and vehicle specific mounted Warfighter egress time requirements during a vehicle interior fire related event, in accordance with the vehicle specific detailed performance specification. Materials selected for use with vehicle interior head impact protective components shall not release sufficient flame spread, heat, smoke or toxic gases to the extent the Warfighter is incapacitated or hindered from exiting the vehicle. Materials shall also be selected which are fire resistant with the intent to provide the Warfighter, during a vehicle interior fire event, time to remain in the vehicle, up to five minutes of unmasked exposure and up to 15 minutes of masked exposure, when the AFES (Automatic Fire Extinguisher System) is disengaged. The Warfighter shall not be hindered from exiting the vehicle as a result of floor mat components or materials igniting and burning as a result of a vehicle fire related event. Fire resistant material selection shall be based upon the material requirements defined in section 3.7.6.

3.7.6.2 Heat release rate. Unless otherwise specified in the contract, the materials used for floor mats, with the exception of fabrics and textiles, shall be tested and evaluated IAW ASTM E1354. Heat release shall be in a 300-second period tested at heat flux of 50 kW/m^2 . Average (minimum 3 samples) heat release rates for each time interval: ignition-60sec, ignition-180sec

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and ignition-300 sec shall be less than 60 kW/m². The Average Peak Heat Release Rate of a minimum of 3 samples shall be less than 85 kW/m². No melting, dripping or pooling is permitted.

3.7.6.3 Surface flammability of materials. Unless otherwise specified in the contract, the materials of the floor mat other than fabrics and textiles shall comply with the Radiant Panel Index maximum of 35. Radiant Panel Index shall be calculated using ASTM E162.

3.7.6.4 Smoke density and obscureness. Unless otherwise specified in the contract, floor mat components and materials shall comply with Maximum Smoke Density $D_m < 200$ flaming and non-flaming modes in 240 seconds (4 minutes). The test shall be conducted for a total of 20 minutes and measurements taken at time intervals of: ignition (within 30 seconds), 1, 5, 10 minutes and at end of test (20 minutes). No dripping, melting or pooling shall be evident. ASTM E662 states the specific optical density of smoke generated by solid materials at 25 kW/m² heat flux, which shall be used for test and evaluation purposes. Fasteners are not required for this test.

3.8 Additional material requirements.

3.8.1 Fungal susceptibility. The material shall be fungus inert or the material fungus contamination rating shall be 1 or less (if not otherwise specified in the contract) for a twenty-eight (28) day minimum test period IAW MIL-STD-810 Method 508 Table-I.

3.8.2 Fluid contamination. The material shall be compatible with general fluids IAW MIL-STD-810 Method 504 Procedure II Table II, excluding items 19, 21, 22, 23, 24 and 26.

3.8.3 Salt fog inspection. The floor mat shall be salt fog tested IAW MIL-STD-810 Method 509 for two 48 hour cycles, and shall have no adverse material effects to the walking surface operational load of section 3.7.1, and shall not hinder EA of section 3.5.1. If inspection of material determines the exposure may have hindered EA, test the material after exposure of the sample IAW section 3.5.1 Load Case 2.

3.8.4 Integration requirements.

3.8.4.1 Mounting. The EA floor mat shall be mountable IAW MIL-STD-1472 and the TDP (Technical Data Package). Direct glue-down or permanent structural adhesive bonding methods shall not be used. Mounting provisions shall use standard tools (no special tools) used in the General Mechanics Tool Kit for the purpose of installation, maintenance, service, and removal. Mounting provisions shall implement safeguards and not become detached from the attachment points or become secondary projectiles when subjected to the range of vibration, acceleration, shock, blast, and other impact tests specified in the contract. If the joint at the attachment point is completely severed, the attachment point shall be considered detached.

3.8.4.2 Maintenance. The EA floor mat shall be maintainable IAW MIL-STD-1472.

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3.8.4.3 System safety. Ensure the EA floor mat is free of any projection points or sharp edges and burrs which could snag, jam, or damage clothing and equipment, trip or injure the occupant or maintenance personnel, or jeopardize service operations. The EA floor mat shall use labels and/or markings that indicate safety precautions and warnings to include a clear indication of which side is up to indicate the walking surface.

3.8.4.4 Service operations. The EA floor shall be dimensionally and physically compatible with the requirements in MIL-STD-1472.

4. VERIFICATION

4.1 First article inspection. If any sample fails to comply with the specified performance requirements in Section 3, the sample shall be rejected.

4.1.1 Examinations and test. The EA floor system shall be verified to meet the section 3 requirements of this specification through one or more of the following verification method(s) IAW Table II.

a. Examination: shall consist of activities using visual evidence or physical examination of the item for requirements verification.

b. Analysis: shall consist of technical or mathematical evaluations, mathematical models, simulations, algorithms, charts, diagrams, representative data, or other appropriate means to demonstrate compliance for requirements verification.

c. Demonstration: shall consist of proving, illustrating, or furnishing documents certifying compliance to relevant criteria to the standards or specifications referenced or other appropriate means to demonstrate compliance for requirements verification.

d. Test: shall consist of subjecting the item in a manner that verifies its performance under appropriate and specified conditions. Testing also includes the act of recording related measurements, and conducting analysis and evaluation of resulting data for requirements verification.

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Table II. Cross Reference Matrix

		METHOD OF VERIFICATION				
		1 - Examination	2 - Analysis	3 - Demonstration	4 - Test	
Requirement		Verify	Verification Methods			
			1	2	3	4
3.1	First article inspection	4.1	X	X	X	X
3.2	Materials	4.2			X	
3.3	Environmental considerations	4.3			X	
3.4	Testing	4.4				
3.4.1	Test conditions	4.4.1			X	
3.5	Critical performance requirements	4.5				
3.5.1	Occupant injury evaluation criteria	4.5.1		X		X
3.5.2	Sustaining EA at compression set	4.5.2	X	X		X
3.6	AIPH TEP toxicity clearance	4.6			X	
3.7	Additional performance requirements	4.7				
3.7.1	Surface operational load	4.7.1				X
3.7.2	Wet surface traction	4.7.2				X
3.7.3	Self-draining water immersion	4.7.3	X	X		X
3.7.4	High storage temperature	4.7.4				X
3.7.5	Low storage temperature	4.7.5				X
3.7.6.1	Fire related egress and mounted crew in-vehicle time	4.7.6.1	X	X		X
3.7.6.2	Heat release rate	4.7.6.2	X	X		X
3.7.6.3	Surface flammability of materials	4.7.6.3	X			X
3.7.6.4	Smoke density and obscuration	4.7.6.4	X	X		X
3.8	Additional material requirements	4.8				
3.8.1	Fungal susceptibility	4.8.1	X			X
3.8.2	Fluid contamination	4.8.2				X
3.8.3	Salt fog inspection	4.8.3	X	X		X
3.8.4	Integration requirements	4.8.4				
3.8.4.1	Mounting	4.8.4.1		X	X	X
3.8.4.2	Maintenance	4.8.4.2		X	X	X
3.8.4.3	System safety	4.8.4.3	X	X	X	
3.8.4.4	Service operations	4.8.4.4	X	X	X	

4.2 Materials. The contractor shall demonstrate the list of materials as complying with operational and environmental requirements and forward to the Government contracting officer.

4.3 Environmental considerations. The contractor shall demonstrate that no toxic chemicals, hazardous substances, or ozone-depleting chemicals were utilized in the floor mat.

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4.4 Testing.

4.4.1 Testing conditions. The contractor shall document test conditions specified in section 3.4.1 in this specification and forward the report to the Government Procuring Agency for approval.

4.5 Critical performance verification.

4.5.1 Occupant injury evaluation criteria. Verify the SI (metric) System of units is used for the ATD test data to assess injury responses for the TARDEC lower body fixture. Verify injury criteria for ATDs references the injury criteria documented in “ARL SLAD WSB, Injury Criteria for the Analysis of Soldier Survivability in Accelerative Events, April 2012, DIST D” for the Upper Tibia Compressive Force.

Test IAW TARDEC Occupant Protection Lab TR-27709: Subsystem Drop Tower Test Procedure floor mat testing using the TARDEC lower body fixture. Mount two single axis accelerometers IAW Requirement 3.5.1.

High speed motion cameras used for these tests shall be capable of recording 1000 frames per second or greater. Additionally, adequate lighting shall be used to capture the event without image degradation. The cameras shall be positioned to record the drop event and the crushing of the blast mat. This shall include a front view capturing the entire test event, and a side view which shall have a closer, zoomed-in view of the floor mat sample, ATD feet, and the ATD lower leg.

Load conditions shall be applied IAW Requirement 3.5.1. The load profiles shall be applied such that the resulting acceleration pulse is half-sine in shape. The velocity profiles shall be obtained by integration of data obtained from the accelerometers mounted to the platform after a CFC 600 filter is applied to the data. Additional load cases shall be applied if stated in the contract. Because these values will change as the application and/or threat changes, this floor mat specification does not qualify floor mats for every application or threat, but only for the loading environments tested to herein. When the contract calls for floor mats of different thicknesses, each thickness must meet the requirement. This requirement verifies a floor mat only for the thickness(es) which are used during the verification of this requirement.

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4.5.2 Sustaining EA at compression set. Calculate the compression set percentage ($CS_{\%}$); subtract the final thickness from the initial thickness, divide by the initial thickness and multiply by 100% ($CS_{\%} = \frac{T_i - T_f}{T_i} \times 100\%$). If the compression set percentage is met, test the after exposure sample within 30 minutes of final thickness measurement IAW section 3.5.1. When the contract calls for floor mats of different thicknesses, each thickness must meet the requirement. This requirement verifies a floor mat only for the thickness(es) which are used during the verification of this requirement. If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

4.6 AIPH TEP toxicity clearance. Verify a toxicity clearance is obtained IAW the Army Public Health Center's (APHC), Toxicology Portfolio, Toxicity Evaluation Program (TEP). Contractors shall provide all data and conduct all testing, including testing and data on pyrolysis and combustion products, required by the AIPH TEP, to the Government Procuring Agency.

4.7 Additional performance verification.

4.7.1 Surface operational load. Verify a 159 kg (350 lbs) load applied for five operational load cycles produces no adverse material effects as defined in section 6.3(d). When the contract calls for floor mats of different thicknesses, each thickness must meet the requirement. This requirement verifies a floor mat only for the thickness(es) which are used during the verification of this requirement.

4.7.2 Wet surface traction. Verify the walking surface wet static coefficient of friction is 0.50 or greater IAW ANSI/NFSI B101.1.

4.7.3 Self-draining water immersion. Verify mat is self-draining, the material does not retain more than 10% of its weight on, below and within it after water immersion, and exposure to water has no adverse material effects to the walking surface operational load of section 3.7.1, and does not hinder EA of section 3.5.1 Load Case 2.

4.7.4 High storage temperature. Verify IAW MIL-STD-810 Method 501 Procedure I, the high storage temperature is $71 \pm 2^{\circ}\text{C}$ ($160 \pm 4^{\circ}\text{F}$). If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

4.7.5 Low storage temperature. Verify IAW MIL-STD-810 Method 502 Procedure I, the low storage temperature shall be $-46 \pm 2^{\circ}\text{C}$ ($-51 \pm 4^{\circ}\text{F}$). If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

4.7.6 Fire resistance

4.7.6.1 Fire related egress and mounted crew in-vehicle time. Verify the material selection is in compliance to the requirements stated in this document, 3.7.6.1 through verification of test and evaluation documentation and supporting data.

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4.7.6.2 Heat release rate. Verify that the materials used in the floor mat are tested and evaluated IAW ASTM E1354. Verify heat release in a 300-second period test using a heat flux source of 50 kW/m². Average (minimum 3 samples) heat release rates for each time interval from ignition, and to 60 sec, and to 180 sec, and to 300 sec shall be less than 60 kW/m². Verify the average peak heat release rate with a minimum of 3 samples is less than 85 kW/m². Verify there is no melting, dripping or pooling of material when tested.

4.7.6.3 Surface flammability of materials. Verify that the test and evaluation methods are IAW ASTM E162. Verify no melting, dripping or pooling occurs and the sample does not exhibit rapid flame progression and flashing.

4.7.6.4 Smoke density and obscureness. Fasteners are not required for this test. Verify adhesives are tested as part of the sample assembly if applicable to vehicle specific application. Verify that the materials used for the floor mat comply with the following:

- a. Verify procedures in ASTM E662 at 25 kW/m² heat flux is used for test and evaluation purposes.
- b. Verify maximum smoke density for flaming and non-flaming modes of $D_m < 200$ in 240 seconds (4 minutes).
- c. Verify the test is conducted for a total of 20 minutes.
- d. Verify the smoke density measurements are taken at time intervals of; ignition (within 30 seconds), 1 minute, as specified in “a” above, then, 5, 10, and 20 minutes (the end of the test).
- e. Verify that no dripping, melting or pooling is evident on the material being tested.

4.8 Additional material verification.

4.8.1 Fungal susceptibility. Verify the floor mat material is fungus inert or the material fungus contamination rating is 1 or less (if not otherwise specified in the contract) for twenty-eight (28) day minimum test period IAW MIL-STD-810 Method 508 Table-I.

4.8.2 Fluid contamination. Verify the floor mat material shall be compatible with general fluids IAW MIL-STD-810 Method 504 Procedure II for the items listed in the requirement 3.8.2.

4.8.3 Salt fog inspection. Verify that mat is salt fog tested IAW MIL-STD-810 Method 509 for two 48 hour cycles, and has no adverse material effects to the walking surface operational load of section 3.7.1, and shall not hinder EA of section 3.5.1. If inspection of material determines the exposure may have hindered EA, test the after exposure sample IAW section 3.5.1 Load Case 2.

4.8.4 Integration verification.

4.8.4.1 Mounting. Verify that the requirements of 3.8.4.1 are met through demonstration, analysis, or the applicable tests specified in the contract.

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4.8.4.2 Maintenance. Verify through demonstration, analysis or test that the floor mat is maintainable in accordance with the requirements of 3.8.4.2.

4.8.4.3 System safety. Verify through inspection that the floor mat is free of any projection points or sharp edges and burrs, and has labels and/or markings that indicate safety precautions and warnings.

4.8.4.4 Service operations. Verify that the floor mats do not interfere with the applicable requirements of MIL-STD-1472.

5. PACKAGING

5.1 Packaging requirements. For acquisition purposes, the packaging requirements shall be as specified in the contract or order. When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

6.1 Intended use. Specifications covered by this standard are intended for use in acquisition to obtain military-unique items. Non-Government standards or commercial item descriptions should be used to describe the requirements for a commercially available item.

6.2 Administrative requirements.

6.2.1 Quality documents supporting inspection, test, and analysis. When requested, all quality documents supporting inspection will be made available to the Government. At the time of any Government request, legible design or manufacturing drawings and specifications will be made available. Such drawings and specifications should be annotated to reflect the latest Government approved revision incorporated with an updated cross-reference parts list for major subassemblies and size/grade specifications for common hardware. Upon completion of inspection(s) by the Government, all drawings and specifications should be returned. The Government reserves the authority to inspect end items or any parts/components during all manufacturing processes and reject any items not conforming to drawings and/or specifications. All deficiencies detected during any end item or in process inspection should be rejected and replaced with an item conforming to the drawing and/or specifications at no cost to the Government before acceptance. During any Government inspection, the contractor should provide inspection assistance upon request.

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6.2.2 Inspection and test equipment. The Contractor is responsible for ensuring all supplies and services conform to the contract requirements. If no other calibration specification and/or requirements are specified in this contract, then the inspection and test equipment should be calibrated in accordance with the suggested Contractor's guidelines traceable back to the National Institute of Science and Technology (NIST) standards.

6.2.3 Test and evaluation facilities. The Contractor should provide the government with a copy of test set-up procedures and test rig/equipment used to verify requirements in Table II, Verification of requirements, are met. The Government reserves the right to witness any or all of the inspections, demonstrations, tests and/or analysis.

6.2.4 Certifications. Where certification is required to verify material or component to contract requirements, the Contractor should furnish such certification along with applicable substantiating analytical data, documented test, and performance data. The certifications should be made available for Government review during Prototype Verification Inspection (PVI) / First Production Verification Inspection (FPVI), and copies of the certifications should be provided to the Government upon request. Certifications should include all documentation, examinations, and tests where applicable. Certification of verification to specific contract and/or specification requirements should be a statement signed by the Contractor's Program Manager, to the effect that the Contractor has complied.

6.2.5 Unacceptable certifications. If any certification is unacceptable to the Government, the Contractor should conduct additional examinations/tests to provide additional documentation as required to verify certification at no increase in contract price. The Government may conduct tests to verify certifications.

6.2.6 Process certifications. When a process certification is required, it should include a written description of the processes and all associated work instructions.

6.2.7 Material certifications. When a material certification is required, it should include a copy of the material analysis. If the material is purchased from a subcontractor, a copy of the purchase order is also required.

6.2.8 Test certifications. When a test certification is required, it should include the following information as substantiation:

- a. Drawing Number (if applicable)
- b. Specification Title, Number, Edition
- c. Number of Specimens Tested, Requirements
- d. Actual Results Obtained, and Purchase Orders for Subcontracted Products

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6.2.9 Government verification. All verification may be accomplished by analysis, demonstration, examination, testing, or any combination thereof. The contractor operations performed should be subject to Government verification at unscheduled intervals. Surveillance by the Government may occur to determine if practices, methods, and procedures of the contractor's approved (by the Government Procurement Contracting Officer), written Quality Assurance System Plan are being properly applied. The Government reserves the right to witness any or all of the inspections, demonstrations, tests and/or analyses.

6.3 Definitions. When using this document, refer to this section for guidance on terminology.

a. Combat boot is used to reference the following boot designation: Desert, Hot Weather NSN series 8430-01-514-5157 equipped with the military specification compliant Vibram® three layer sole (Size 11R for 50th percentile ATD, 9.5R for 5th percentile ATD, and 12W for the 95th percentile ATD).

b. EA floor mat is the final chemical formulation containing: a walking surface (for conducting service operations and maintenance), energy attenuation materials (for protecting against injuries due to accelerative forces during blast events), coating materials (for performance), adhesive bonding materials (for construction), and all other materials (for requirements compatible characteristics) contained within the mat.

c. Hinder EA identifies an inspection technique for determining unacceptable immediate or potential long-term energy attenuation material characteristics including, but not limited to: degrading tibia axial compressive force performance or tibia bending moment performance due to obstructing, clogging, jamming, loosening, weakening, binding, sticking, or deforming from differential rates of expansion or contraction of materials.

d. No adverse material effects identifies an inspection technique for determining unacceptable immediate or potential long-term EA floor characteristics including, but not limited to: hindered EA performance; abrasion or erosion of walking surfaces; penetration, deformation, or rupture of seals; oxidation or galvanic corrosion; chemical reactions or incompatibility interactions; cracking, blistering, peeling, buckling, de-laminating or separation of plies; coating, adhesive or fiber failure; curling or twisting tendencies; melting, softening, sweating, or swelling; fading or discoloration; hardening or embrittlement; shortening of operating life; or conditions that create safety hazards, repair problems, or maintenance issues.

e. Threshold requirements are the minimum acceptable performance levels that should be met by the EA floor, below which performance fails. Requirements specified in section 3 are defined as threshold requirements.

f. Previously untested sample is used to reference an EA floor that has not been previously tested under the conditions of section 4.5.1.

g. TARDEC lower body fixture identifies a test device used in TR-27709 with the following characteristics:

- a. The fixture should be capable of being mounted to the drop platform such that the input impulse transfers to the fixture without loss or degradation of the impulse.

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- b. The fixture should be capable of supporting the weight of the lower portion of a 5th, 50th or 95th ATD. The lower portion should include all parts and instrumentation from the pelvis down IAW 49 CFR 572. The fixture should have the means to mount the ATD pelvis using the four (4) screws which are designed to hold the lumbar load cell.
- c. The fixture should be capable of shifting the ATD mount location from 16 inches to 24 inches from the platform, in 0.5 inch increments to allow for testing of floor mats of multiple thickness while maintaining a posture in which the hip, knee and ankle pivots are each fixed to 90°.

6.4 Injury Criteria. Injury criteria for the 5th, 50th, and 95th percentile male can be evaluated IAW TR 27790. The OCP TECD Report TR-27790 “Enhanced Injury Assessment Reference Values” was created to meet the OCP TECD program challenge statement of “designing for and protecting the Soldier population”. The OCP Enhanced IARVs (e-IARVs) have not been adopted by US Department of Defense (DoD) Live Fire Testing & Evaluation (LFT&E), Army Evaluation Command (AEC), nor the Office of the Director, Operational Test and Evaluation (DOT&E), as of 19-September-2016, for use in current and/or new acquisition programs. As described in the report, the injury criteria developed for the OCP TECD program utilized existing biomedical research for the 5th percentile female, 50th percentile male, and 95th percentile male. This report recommends that PEOs, PMs, and RDECs may integrate these e-IARVs or extract information into contracting documents as appropriate in conjunction with the currently accepted injury criteria. These values are to be utilized for informational and developmental purposes only.

6.5 Subject term (key word) listing.

Accelerative forces
Blast events
Fixture
LOFFI
Materials

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Custodian:

Army – AT

Preparing Activity:

Army – AT

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NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.