

METRIC

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PERFORMANCE SPECIFICATION

ENERGY-ATTENUATING (EA) SEAT SYSTEMS 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-PLE, 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 prescribes performance requirements for Energy-Attenuating (EA) seat systems for use in Military ground vehicles and identifies reporting procedures to be used for requirements verification. Section 3 requirements provide a start point and general reference to begin the requirements tailoring process to meet the specific fit, form, function needs of the EA seat(s) to be purchased by the acquisition team.

1.2 Application. Section 3 requirements are generic in nature and will be modified and tailored in the contract to address the specific needs of a project or program acquiring EA seat systems.

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 SPECIFICATIONS

MIL-PRF-32548	-	Performance Specification Occupant Seat Belt Restraints for Use in U.S. Military Ground Vehicles
MIL-DTL-53072	-	Chemical Agent Resistant Coating (CARC) System Application Procedures and Quality Control Inspection

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-889	-	Dissimilar Metals
MIL-STD-1472	-	Human Engineering

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

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.

FEDERAL REGULATIONS

49 CFR 571 207	-	Seating Systems
49 CFR 571 302	-	Flammability of Interior Materials
29 CFR PART 1910Z	-	Toxic and Hazardous Substances

(Copies of these documents are available at: <http://www.ecfr.gov/cgi-bin/ECFR?page=browse>).

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

TR 27790	-	Occupant Centric Platform (OCP) TECD Enhanced Injury Assessment Reference Values
LQTM-14-2-01	-	Seat Comfort Test
LQP-25-02	-	Drop Tower Test

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

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 SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM D2261	-	Standard Test Method for Tensile Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine)
ASTM D4966	-	Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method)

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

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SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J826 - Devices for Use in Measuring Vehicle Seating and Accommodation

(Copies of these documents are available online at: <http://www.sae.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. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

Section 3 requirements are defined as threshold requirements that provide a start point and general reference to extract and begin the requirements tailoring process to meet the specific fit, form, function needs of the EA seat(s) to be purchased by the acquisition team. It is expected that the acquisition team shall tailor Section 3 requirements in the contract and shall build upon the Section 3 minimum threshold requirements as required by the acquisition program.

3.1 First article inspection and lot acceptance tests (LATs). The contract shall specify procedures for conducting first article inspection of sample items and requirements for conducting LATs.

3.2 Inspection conditions. Unless otherwise specified in the contract, all inspections shall be conducted under the following ambient environmental conditions:

Temperature: $20^{\circ}\text{C} \pm 15^{\circ}\text{C}$ ($68^{\circ}\text{F} \pm 27^{\circ}\text{F}$)

Barometric pressure: facility ambient

Humidity: Up to 95% relative humidity

3.3 General requirements.

3.3.1 Documentation. Documentation demonstrating requirements conformance verification as specified in Section 4, Table II shall be provided by the contractor to the government as specified in the contract.

3.3.2 Units of measure. All weights, distance, quantities, and measures contained in all applicable Military publications will be expressed in metric units with U.S. Standard units expressed in parenthesis after metric units (e.g., 2.54 cm (1.00 in.)). Exceptions to this requirement shall include documentation required in 3.4.1 of this specification and unless otherwise specified in the contract.

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3.3.3 Seat orientation. Seat orientation shall align with the seated occupant position. The right side of the seat shall be consistent with the right side of the seated occupant and the left side of the seat shall be consistent with the left side of the seated occupant. The seat back shall reference the portion of seat structure and cushion supporting the occupant spine.

3.3.4 Seat weight. The EA seat system shall weigh no more than the weight requirement as specified in the contract.

3.3.5 Space claim (size). The EA seat system shall be within the dimensional space claim specified in the contract.

3.3.6 Mounting attachments. The EA seat system shall be mounted to the vehicle interior IAW 49 CFR 571 207, Seating Systems or as specified in the contract.

3.4 Survivability.

3.4.1 Injury criteria. The SI (metric) System of units shall be used for Anthropomorphic Test Device (ATD) test data to assess injury responses for the 50th percentile male ATDs. 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 body regions listed below:

- a. Lumbar Compressive Force
- b. Vertical Dynamic Response Index (DRI)
- c. Upper Tibia Compressive Force (for EA seats with integrated foot rest)

For additional information on injury criteria, please refer to Section 6.2

3.4.2 Anthropomorphic test device (ATD). The EA seat system survivability assessment shall use, as specified in the contract, mission-specific gear-encumbered Hybrid III (5th percentile female, 50th percentile male, 95th percentile male ATD) with a total weight IAW acceptable weight ranges in Appendix A of this specification. The ATD shall be secured to the seat with seatbelt restraints and shall be in a normally-seated operational posture.

3.4.3 Vertical test conditions. The EA seat systems shall meet Hybrid III (5th percentile female, 50th percentile male, 95th percentile male ATD) injury criteria in requirement 3.4.1 resulting from a measured vertical impact velocity in the full range from 0.0 up to 8.0 meters/second and a vertical Delta-V in the full range of 0.0 up to 8.0 meters/second within 5.5±1.0 milliseconds, unless otherwise specified in the contract. Delta-V is derived from integrating the representative half-sine acceleration test pulse.

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3.4.4 EA actuations for range of occupants. The EA seat system energy attenuation (EA) mechanism(s) shall actuate for the fully encumbered 5th percentile female ATD and shall not exceed maximum mechanism EA capacity for the fully encumbered 95th percentile male ATD IAW acceptable weight ranges in Appendix A of this specification.

3.4.5 Mounting bracket (s) loading. The EA seat system mounting bracket(s) shall be able to withstand and support, without material or mechanical separation failure, the dynamic vertical accelerative loading condition requirement in 3.4.3 and loading conditions IAW 49 CFR 571 207, Seating Systems or as specified in the contract.

3.4.6 Multi-occupant, bench-type seat, independent EA mechanisms. A multi-occupant, bench-type EA seat system shall have blast-mitigation EA mechanisms that provide protection meeting injury criteria in requirement 3.4.1 with vertical test conditions in 3.4.3 for the full range of seated ATDs in 3.4.2 or as specified in the contract.

3.5 System safety.

3.5.1 Metallic material edge radii. The EA seat system shall have no metallic material edges less than 0.75 mm radii and corners less than 4.0 mm radii in direct contact with the full range of seated ATDs in 3.4.2 or as specified in the contract.

3.5.2 Inadvertent actuation and EA functional readiness. Unless otherwise specified in the contract, the EA seat system shall have appropriate safety features to prevent inadvertent actuation of adjustment controls, seatbelts, EA features, or any equivalent use component of the EA seat system. The EA seat system shall have visual telltale(s) or other features to demonstrate the seat EA functional readiness.

3.5.3 Safety markings. The EA seat system and/or the Technical Manual (TM) shall have labels and/or markings and/or instructions to the operator and to the maintainer that indicate safety precautions and warnings appropriate for handling and functioning the seat unless otherwise specified in the contract.

3.5.4 Removable components. Any and all removable components shall have a self-contained storage and/or retention system to prevent loss of the removable component or injury to an occupant if the component shall become a projectile during a blast, crash, or rollover event unless otherwise specified in the contract.

3.5.5 Flammability. All EA seat system components shall meet flammability requirements IAW 49 CFR 571 302, Flammability of Interior Materials or as specified in the contract.

3.6 Human factors engineering (HFE).

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3.6.1 Best practices. The EA seat system shall be designed IAW MIL-STD-1472. If Section 3 requirements of this specification are in conflict with MIL-STD-1472, then Section 3 requirements shall have precedence over MIL-STD-1472 guidelines.

3.6.2 Range of accommodation. The EA seat system shall accommodate the full range of occupants without gear as per data in MIL-STD-1472 and with gear per acceptable weight ranges in Appendix A of this specification and/or as per data in TARDEC Technical Report “Design Studies, Lessons Learned, and Recommendations for Human Factors and Anthropomorphic Requirements to Support Occupant-Centric Design” unless otherwise specified in the contract.

3.6.3 Operability. The EA seat system shall accommodate operation and adjustment for the full range of occupants without gear as per data in MIL-STD-1472 and occupants with gear for the acceptable weight ranges in Appendix A of this specification and/or as per data in TARDEC Technical Report “Design Studies, Lessons Learned, and Recommendations for Human Factors and Anthropomorphic Requirements to Support Occupant-Centric Design” unless otherwise specified in the contract.

3.6.4 Seat reference point (SRP) and seat h-point. The EA seat system shall reference an SRP in proposal(s) IAW MIL-STD-1472 and/or shall reference an H-point in proposals IAW SAE J826 or as specified in the contract.

3.6.5 Seat location in vehicle environment. The seat location in the vehicle environment shall be defined by an SRP IAW MIL-STD-1472 and/or shall be defined by an H-point measurement IAW SAE J826 unless otherwise specified in the contract.

3.7 Maintainability.

3.7.1 General Mechanics Tool Kit (GMTK). The EA seat system shall use standard tools from a standard issue military GMTK for the purpose of installation, maintenance, and removal, unless otherwise specified in the contract.

3.7.2 Mounting attachments (torque). All EA seat system attachment hardware shall be torqued to the required specification as stated in the technical data package (TDP) and/or as specified in the contract.

3.8 Seats.

3.8.1 Seat pan. The EA seat system shall include a seat pan cushion to distribute body pressure over the occupant-to-seat pan cushion contact surface unless otherwise specified in the contract. The seat pan shall have a feature to allow water to drain and not entrap water when the seat pan is in a horizontal position.

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3.8.2 Seat back. Unless otherwise specified in the contract, the EA seat system shall have a seat back structure.

3.8.3 Foot rest (if so equipped). Unless otherwise specified in the contract, the foot rest shall support the boot heel of a seated 5th percentile female ATD, a seated 50th percentile male ATD, and a seated 95th percentile male ATD.

3.8.4 Seat cushion.

3.8.4.1 Seat cushion seams. The EA seat system seat cushion cover seams shall be located on the side(s) and/or back of the seat cushion and the seams shall not be in contact with a seated 5th percentile female ATD, a seated 50th percentile male ATD, and a seated 95th percentile male ATD unless otherwise specified in the contract.

3.8.4.2 Seat cushion tear resistance. The EA seat system seat cushion cover material shall be tear resistant IAW ASTM D2261 unless otherwise specified in the contract.

3.8.4.3 Seat cushion abrasion. The EA seat system seat cushion cover material abrasion resistance shall be greater than 50,000 cycles when tested IAW ASTM D4966 unless otherwise specified in the contract.

3.8.4.4 Seat cushion chemical resistance. The exposed surfaces of the seat cushion shall not absorb fluids listed in Table I IAW MIL-STD-810, Method 504, Procedure I or as specified in the contract.

TABLE I. Fluid chemicals

Fluid Chemicals		Source Fluid
1	Diesel Fuel	JP-8, kerosene type
2	Engine Oil	SAE 15W40
3	Sea Water (Simulated)	5% NaCl Solution
4	Hydraulic Fluid	Fire Resistant, Type I

3.8.4.5 Seat cushion compressibility and comfort. The EA seat system seat pan cushion shall compress to distribute body pressure for the full range of ATDs in the acceptable weight range in Appendix A of this specification. The seat pan cushion shall not fully compress and bottom-out against the seat pan structure for the fully encumbered 95th percentile ATD seated occupant as per data in Appendix A of this specification or as specified in the contract.

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3.9 Seat adjustment.

3.9.1 Manual adjustment (if so equipped). The EA seat system shall be manually adjustable by the full range of occupants when an electrical, pneumatic, or hydraulic power source is unavailable or as specified in the contract.

3.9.2 Adjustment mechanism ergonomics (if so equipped). The EA seat system adjustment mechanisms shall be readily accessible and shall actuate using a single hand, single action to engage and single hand, single action to disengage or as specified in the contract.

3.9.3 Seat back fold rearward release mechanism (if so equipped). The EA seat system shall have a releasing mechanism or feature using one hand to enable a seat back that folds rearward to a 180-degree fully reclined horizontal position or as specified in the contract.

3.9.4 Self-rising seat back (if so equipped). The EA seat system seat back shall be self-rising when adjusted from a fully reclined horizontal position to an operational upright seat back position or as specified in the contract.

3.9.5 Fore/aft adjustment (if so equipped). The EA seat system shall adjust horizontally from the fore-most to aft-most position with horizontal adjustment increments no greater than 38 millimeters (1.5 inches) with a total fore/aft travel window as specified in the TDP or contract.

3.9.6 Seat pan horizontal-to-vertical adjustment (if so equipped). The EA seat system shall have a seat pan which manually folds from the horizontal to vertical position via releasing a manual latching mechanism. The seat pan shall adjust from horizontal to vertical position using one hand or foot to release the latching mechanism. Once folded to a vertical position, the seat pan shall remain in position under static conditions without use of a latching mechanism unless otherwise specified in the contract.

3.9.7 Seat back fold forward release mechanism (if so equipped). The EA seat system shall have a releasing mechanism using one hand to enable a seat back that folds from vertical position to horizontal position over the seat pan. The seat back releasing mechanism or feature shall be readily accessible by the seated occupant or as specified in the contract.

3.9.8 Seat pan vertical-to-horizontal adjustment (if so equipped). The EA seat system shall have a seat pan which manually folds from vertical to horizontal position using one hand. Once folded to a horizontal position and released, the seat pan shall remain horizontal via a latching mechanism or as specified in the contract.

3.9.9 Seat back fold forward release mechanism (if so equipped). The EA seat system shall have a releasing mechanism or feature using one hand to enable a seat back which folds down, vertical position to horizontal position over the seat pan or as specified in the contract.

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3.9.10 Swivel rotation adjustment (if so equipped). The EA seat system shall have 360-degree rotational adjustment or as specified in the contract. The seat shall have equally-spaced lock positions as per the contract.

3.9.11 Vertical position adjustment increments (if so equipped). The EA seat system shall have designated vertical position adjustability increments as per requirements in the contract with a total up/down travel window as specified in the TDP or contract.

3.9.12 Seat back recline increments (if so equipped). The EA seat system shall have a reclining seat back with adjustment increments between seat back vertical position and seat back reclined as per the contract.

3.10 Seat belt restraints. The EA seat system shall accommodate and include restraints meeting specifications defined in MIL-PRF-32548 or as specified in the contract.

3.11 Seat system environmental exposure.

3.11.1 Low temperature. The EA seat system shall have no degradation in adjustability function and survivability protection after exposure to -51°C (-60°F) as tested IAW MIL-STD-810, method 502 using constant temperature method or as specified in the contract.

3.11.2 High temperature. The EA seat system shall have no degradation in adjustability function and survivability protection after exposure to $+52^{\circ}\text{C}$ (125°F) as tested IAW MIL-STD-810, method 501, procedure II, using constant temperature method or as specified in the contract.

3.11.3 Vibration. The EA seat system shall have no degradation in adjustability function and survivability protection after exposure to a vibration test using a representative ground vehicle vibration input per the TDP and the contract.

3.11.4 Humidity. The EA seat system shall have no degradation in adjustability function and survivability protection after exposure to relative humidity of 100% as tested IAW MIL-STD 810, procedure 1 of Method 507 for non-hazardous materials or as specified in the contract.

3.11.5 Corrosion resistance. The EA seat system shall have no degradation in adjustability function and survivability protection after tested IAW MIL-STD-810, method 509 using a 5 ± 1 percent salt fog for 48 hours or as specified in the contract.

3.11.6 Fungal resistance. The EA seat system shall be fungal resistant IAW MIL-STD-810, Method 508 or as specified in the contract.

3.11.7 Dissimilar metals. The EA seat system shall have dissimilar metals protected IAW MIL-STD-889 or as specified in the contract.

3.12 Toxic chemicals, hazardous substances, and ozone-depleting chemicals.

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3.12.1 Prohibited construction materials. The EA seat system shall not include materials or processes that contain cadmium, hexavalent chromium or other highly toxic and carcinogenic materials as listed in 29 CFR PART 1910Z, Toxic and Hazardous Substances or as specified in the contract.

3.12.2 Hazardous and environmentally harmful material. The EA seat system shall be manufactured and/or installed without use of processes using highly toxic or carcinogenic materials as listed in 29 CFR PART 1910Z, Toxic and Hazardous Substances or as specified in the contract.

3.13 Painting and colors.

3.13.1 Painting procedures. The EA seat system shall use painting procedures for primers and topcoats listed in MIL-DTL-53072 or as specified in the contract.

3.13.2 Color of components. The EA seat system components requiring color shall be IAW with the TDP and contract.

4. VERIFICATION

4.1 First article inspection and lot acceptance tests (LATs). The contract shall specify procedures for conducting first article inspection of sample items and requirements for conducting LATs.

4.2 Inspection conditions. Verify that all inspections shall be conducted under ambient environmental conditions as specified in 3.2.

4.3 General requirements.

4.3.1 Documentation. Requirements specified in Section 3 are defined as thresholds. Requirements in Section 3 shall be met by the EA seat system. Verify documentation demonstrating requirements conformance verification as specified in Section 4, Table II is provided by the contractor to the government as specified in the contract.

4.3.2 Units of measure. Verify all weights, distance, quantities, and measures contained in all applicable documentation as referenced in requirement 3.3.1 are expressed in both metric and U.S. standard units or as specified in the contract.

4.3.3 Seat orientation. Verify seat orientation aligns with the seated occupant position or as specified in the contract.

4.3.4 Seat weight. Verify the EA seat system weighs no more than the weight requirement as specified in the contract.

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4.3.5 Space claim (size). Verify the EA seat system is within the dimensional space claim as specified in the contract.

4.3.6 Mounting attachments. Verify the EA seat system is mounted to the vehicle interior IAW 49 CFR 571 207, Seating Systems or as specified in the contract.

4.4 Survivability.

4.4.1 Injury Criteria. Verify the SI (metric) System of units is used for Anthropomorphic Test Device (ATD) test data to assess injury responses for the 50th percentile male ATDs. 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 body regions listed below:

- a. Lumbar Compressive Force
- b. Vertical Dynamic Response Index (DRI)
- c. Upper Tibia Compressive Force (for EA seats with integrated foot rest)

4.4.2 Anthropomorphic test device (ATD). Verify the EA seat system survivability assessment uses, as specified in the contract, mission-specific gear-encumbered Hybrid III (5th percentile female, 50th percentile male, 95th percentile male ATD) with a total weight IAW Appendix A. Verify the ATD is secured to the seat with seatbelt restraints and shall be in a normally-seated operational posture.

4.4.3 Vertical test conditions. Verify the EA seat systems meet Hybrid III (5th percentile female, 50th percentile male, 95th percentile male ATD) injury criteria in requirement 3.4.1 resulting from a measured vertical impact velocity in the full range from 0.0 up to 8.0 meters/second and a vertical Delta-V in the full range of 0.0 up to 8.0 meters/second within 5.5 ± 1.0 milliseconds, unless otherwise specified in the contract. Delta-V is derived from integrating the representative half-sine acceleration test pulse.

4.4.4 EA actuations for range of occupants. Verify the EA seat system energy attenuation (EA) mechanism(s) actuates for the fully encumbered 5th percentile female ATD and shall not exceed maximum mechanism EA capacity for the fully encumbered 95th percentile male ATD IAW weight ranges in Appendix A of this specification.

4.4.5 Mounting bracket (s) loading. Verify the EA seat system mounting bracket(s) are able to withstand and support, without material or mechanical separation failure, the dynamic vertical accelerative loading condition requirement in 3.4.3 and loading conditions IAW FMVSS 207 or as specified in the contract.

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4.4.6 Multi-occupant, bench-type seat, independent EA mechanisms. Verify a multi-occupant, bench-type EA seat system has blast-mitigation EA mechanisms that provide protection meeting injury criteria in requirement 3.4.1 with vertical test conditions in 3.4.3 for the full range of seated ATDs in 3.4.2 or as specified in the contract.

4.5 System safety.

4.5.1 Metallic material edge radii. Verify the EA seat system has no metallic material edges less than 0.75mm radii and corners less than 4.0mm radii in direct contact with the full range of seated ATDs in 3.4.2 or as specified in the contract.

4.5.2 Inadvertent actuation and EA functional readiness. Unless otherwise specified in the contract, verify the EA seat system has appropriate safety features to prevent inadvertent actuation of adjustment controls, seatbelts, EA features, or any equivalent use component of the EA seat system. Verify the EA seat system has visual telltale(s) or other features to demonstrate the seat EA functional readiness.

4.5.3 Safety markings. Verify the EA seat system and/or the Technical Manual (TM) has labels and/or markings and/or instructions to the operator and to the maintainer that indicate safety precautions and warnings appropriate for handling and functioning the seat unless otherwise specified in the contract.

4.5.4 Removable components. Verify any and all removable components have a self-contained storage and/or retention system to prevent loss of the removable component or injury to an occupant if the component shall become a projectile during a blast, crash, or rollover event unless otherwise specified in the contract.

4.5.5 Flammability. Verify all EA seat system components meet flammability requirements IAW 49 CFR 571 302, Flammability of Interior Materials or as specified in the contract.

4.6 Human factors engineering (HFE).

4.6.1 Best practices. Verify the EA seat system is designed IAW MIL-STD-1472 or verify the EA seat system is designed according to Section 3 HFE-related requirements if conflicts exist unless otherwise specified in the contract.

4.6.2 Range of accommodation. Verify the EA seat system shall accommodate the full range of occupants without gear as per data in MIL-STD-1472 and with gear per acceptable weight ranges in Appendix A of this specification and/or as per data in TARDEC Technical Report "Design Studies, Lessons Learned, and Recommendations for Human Factors and Anthropomorphic Requirements to Support Occupant-Centric Design" unless otherwise specified in the contract.

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4.6.3 Operability. Verify the EA seat system shall accommodate operation and adjustment for the full range of occupants without gear as per data in MIL-STD-1472 and occupants with gear for the acceptable weight ranges in Appendix A of this specification and/or as per data in TARDEC Technical Report “Design Studies, Lessons Learned, and Recommendations for Human Factors and Anthropomorphic Requirements to Support Occupant-Centric Design” unless otherwise specified in the contract.

4.6.4 Seat reference point (SRP) and seat h-point. Verify the EA seat system references an SRP in proposal(s) IAW MIL-STD-1472 and/or references an H-point in proposals IAW SAE J826 unless otherwise specified in the contract.

4.6.5 Seat location in vehicle environment. Verify the seat location in the vehicle environment is defined by an SRP IAW MIL-STD-1472 and/or is defined by an H-point measurement IAW SAE J826 unless otherwise specified in the contract.

4.7 Maintainability.

4.7.1 General mechanics tool kit (GMTK). Verify the EA seat system uses standard tools from a standard issue military GMTK for the purpose of installation, maintenance, and removal, unless otherwise specified in the contract.

4.7.2 Mounting attachments (torque). Verify all EA seat system attachment hardware is torqued to the required specification as stated in the technical data package (TDP) and/or as specified in the contract.

4.8 Seats.

4.8.1 Seat pan. Verify the EA seat system includes a seat pan cushion to distribute body pressure over the occupant-to-seat pan cushion contact surface unless otherwise specified in the contract. Verify the seat pan has a feature to allow water to drain and not entrap water when the seat pan is in a horizontal position or as specified in the contract.

4.8.2 Seat back. Verify the EA seat system has a seat back structure or as specified in the contract.

4.8.3 Foot rest (if so equipped). Verify the foot rest supports the boot heel of a seated 5th percentile female ATD, 50th and 95th percentile male ATDs or as specified in the contract.

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4.8.4 Seat cushion.

4.8.4.1 Seat cushion seams. Verify the EA seat system seat cushion cover seams shall be located on the side(s) and/or back of the seat cushion and the seams shall not be in contact with a seated 5th percentile female ATD, 50th percentile male ATD, and 95th percentile male ATD or as specified in the contract.

4.8.4.2 Seat cushion tear resistance. Verify the EA seat system seat cushion cover material is tear resistant IAW ASTM D2261 or as specified in the contract.

4.8.4.3 Seat cushion abrasion. Verify the EA seat system seat cushion cover material abrasion resistance is greater than 50,000 cycles when tested IAW ASTM D4966 or as specified in the contract.

4.8.4.4 Seat cushion chemical resistance. Verify the exposed surfaces of the seat cushion do not absorb fluids listed in Table I IAW MIL-STD-810, Method 504, Procedure I or as specified in the contract.

4.8.4.5 Seat cushion compressibility and comfort. Verify the EA seat system seat pan cushion compresses to distribute body pressure for the full range of ATDs in the acceptable weight range in Appendix A of this specification. Verify the seat pan cushion does not fully compress and bottom-out against the seat pan structure for the fully encumbered 95th percentile ATD seated occupant as per data in Appendix A of this specification unless otherwise specified in the contract.

4.9 Seat adjustment.

4.9.1 Manual adjustment (if so equipped). Verify the EA seat system is manually adjustable by the full range of occupants when an electrical, pneumatic, or hydraulic power source is unavailable or as specified in the contract.

4.9.2 Adjustment mechanism ergonomics (if so equipped). Verify the EA seat system adjustment mechanisms are readily accessible and actuate using a single hand, single action to engage and single hand, single action to disengage or as specified in the contract.

4.9.3 Seat back fold rearward release mechanism (if so equipped). Verify the EA seat system has a releasing mechanism or feature using one hand to enable a seat back that folds rearward to a 180-degree fully reclined horizontal position or as specified in the contract.

4.9.4 Self-rising seat back (if so equipped). Verify the EA seat system seat back is self-rising when adjusted from a fully reclined horizontal position to an operational upright seat back position or as specified in the contract.

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4.9.5 Fore/aft adjustment (if so equipped). Verify the EA seat system is adjustable horizontally from the fore-most to aft-most positions with horizontal adjustment increments no greater than 38 millimeters (1.5 inches) with a total fore/aft travel window as specified in the TDP or contract.

4.9.6 Seat pan horizontal-to-vertical adjustment (if so equipped). Verify the EA seat system has a seat pan which manually folds from the horizontal to vertical position via releasing a manual latching mechanism. Verify the seat pan shall adjust from horizontal to vertical position using one hand or foot to release the latching mechanism. Verify that once the seat pan is folded to a vertical position, the seat pan remains in position under static conditions without use of a latching mechanism unless otherwise specified in the contract.

4.9.7 Seat back fold forward release mechanism (if so equipped). Verify the EA seat system releasing mechanism is operable using one hand to enable a seat back that folds from vertical position to horizontal position over the seat pan. Verify the seat back releasing mechanism or feature is readily accessible by the seated occupant or as specified in the contract.

4.9.8 Seat pan vertical-to-horizontal adjustment (if so equipped). Verify the EA seat system has a seat pan which manually folds from vertical to horizontal position using one hand. Verify that once the seat pan is folded to a horizontal position and released, the seat pan shall remain horizontal via a latching mechanism or as specified in the contract.

4.9.9 Seat back fold forward release mechanism (if so equipped). Verify the EA seat system has a releasing mechanism operable by using one hand to enable a seat back which folds down, vertical position to horizontal position over the seat pan or as specified in the contract.

4.9.10 Swivel rotation adjustment (if so equipped). Verify the EA seat system has a 360-degree rotational adjustment or as specified in the contract. Verify the seat has equally-spaced lock positions or as specified in the contract.

4.9.11 Vertical position adjustment increments (if so equipped). Verify the EA seat system has designated vertical position adjustability increments with a total up/down travel window as specified in the TDP or contract.

4.9.12 Seat back recline increments (if so equipped). Verify the EA seat system has a reclining seat back with adjustment increments between seat back vertical position and seat back reclined as per requirements in the contract.

4.10 Seat belt restraints. Verify the EA seat system accommodates and includes restraints meeting specifications defined in MIL-PRF-32548 or as specified in the contract.

4.11 Seat system environmental exposure.

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4.11.1 Low temperature. Verify the EA seat system does not degrade in adjustability function and survivability protection after exposure to -51 °C (-60 °F) as tested IAW MIL-STD-810, method 502 using constant temperature method or as specified in the contract.

4.11.2 High temperature. Verify the EA seat system has no degradation in adjustability function and survivability protections after exposure to +52°C (125°F) as tested IAW MIL-STD-810, method 501, procedure II, using constant temperature method or as specified in the contract.

4.11.3 Vibration. Verify the EA seat system has no degradation in adjustability function and survivability protection after exposure to a vibration test using a representative ground vehicle vibration input per the TDP and the contract.

4.11.4 Humidity. Verify the EA seat system has no degradation in adjustability function and survivability protection after exposure to relative humidity of 100% as tested IAW MIL-STD 810, procedure 1 of Method 507 for non-hazardous materials or as specified in the contract.

4.11.5 Corrosion resistance. Verify the EA seat system has no degradation in function after tested IAW MIL-STD-810, method 509 using a 5±1 percent salt fog for 48 hours or as specified in the contract.

4.11.6 Fungal resistance. Verify the EA seat system is fungal resistant IAW MIL-STD-810, Method 508 or as specified in the contract.

4.11.7 Dissimilar metals. Verify the EA seat system has dissimilar metals protected IAW MIL-STD-889 or as specified in the contract.

4.12 Toxic chemicals, hazardous substances, and ozone-depleting chemicals.

4.12.1 Prohibited construction materials. Verify the EA seat system does not include materials or processes that contain cadmium, hexavalent chromium or other highly toxic and carcinogenic materials as listed in 29 CFR PART 1910Z, Toxic and Hazardous Substances or as specified in the contract.

4.12.2 Hazardous and environmentally harmful material. Verify the EA seat system is manufactured and/or installed without use of processes using highly toxic or carcinogenic materials as listed in 29 CFR PART 1910Z, Toxic and Hazardous Substances or as specified in the contract.

4.13 Painting and colors.

4.13.1 Painting procedures. Verify the EA seat system manufacturing processes use painting procedures for primers and topcoats listed in MIL-DTL-53072 or as specified in the contract.

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4.13.2 Color of components. Verify the EA seat system components that require color are IAW the requirements in the contract.

TABLE II. Verification matrix.

<u>METHODS OF VERIFICATION</u>						
1 - Examination		2 - Analysis		3 - Demonstration		4 - Test
An 'X' in the Verification Methods box indicates the selected method is acceptable for Verification.						
Requirement		Verify	Verification Methods			
Section	Requirement Description	Section	1	2	3	4
3.1	First article inspection and lot acceptance tests	4.1	X	X	X	X
3.2	Inspection conditions	4.2	X	X	X	X
3.3	General requirements					
3.3.1	Documentation	4.3.1	X			
3.3.2	Units of measure	4.3.2	X			
3.3.3	Seat orientation	4.3.3	X		X	
3.3.4	Seat weight	4.3.4		X		X
3.3.5	Space Claim (size)	4.3.5	X	X		
3.3.6	Mounting attachments	4.3.6		X		X
3.4	Survivability					
3.4.1	Injury criteria	4.4.1		X		X
3.4.2	Anthropomorphic Test Device (ATD)	4.4.2		X		X
3.4.3	Vertical test condition	4.4.3		X		X
3.4.4	EA actuations for range of occupants	4.4.4		X		X
3.4.5	Mounting bracket(s) loading	4.4.5		X		X
3.4.6	Multi-occupant, bench-type seat, independent EA mechanisms	4.4.6	X	X		X
3.5	System safety					
3.5.1	Metallic material edge radii	4.5.1	X		X	
3.5.2	Inadvertent actuation and EA functional readiness	4.5.2	X	X		X
3.5.3	Safety markings	4.5.3	X			
3.5.4	Removable components	4.5.4	X	X	X	X
3.5.5	Flammability	4.5.5		X	X	X
3.6	Human factors engineering					
3.6.1	Best practices	4.6.1	X	X	X	X
3.6.2	Range of accommodation	4.6.2	X	X	X	X
3.6.3	Operability	4.6.3	X	X	X	X
3.6.4	Seat SRP and seat H-point	4.6.4		X		X
3.6.5	Seat location in vehicle environment	4.6.5		X		X
3.7	Maintainability					
3.7.1	General mechanics tool kit (GMTK)	4.7.1	X		X	

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3.7.2	Mounting attachments (torque)	4.7.2	X	X		X
3.8	Seats					
3.8.1	Seat pan	4.8.1	X	X	X	X
3.8.2	Seat back	4.8.2	X		X	X
3.8.3	Foot rest	4.8.3	X	X	X	X
3.8.4	Seat cushion					
3.8.4.1	Seat cushion seams	4.8.4.1	X		X	
3.8.4.2	Seat cushion tear resistance	4.8.4.2		X		X
3.8.4.3	Seat cushion abrasion	4.8.4.3		X		X
3.8.4.4	Seat cushion chemical resistance	4.8.4.4		X		X
3.8.4.5	Seat cushion compressibility and comfort	4.8.4.5	X	X	X	X
3.9	Seat adjustment					
3.9.1	Manual adjustment	4.9.1	X	X	X	
3.9.2	Adjustment mechanism ergonomics	4.9.2	X	X	X	
3.9.3	Seat back fold rearward release mechanism	4.9.3	X	X	X	
3.9.4	Self-rising seat back	4.10.4	X	X	X	
3.9.5	Fore/aft adjustment	4.9.5	X	X	X	
3.9.6	Seat pan horizontal-to-vertical adjustment	4.9.6	X	X	X	
3.9.7	Seat back fold forward release mechanism	4.9.7	X	X	X	
3.9.8	Seat pan vertical-to-horizontal adjustment	4.9.8	X	X	X	
3.9.9	Seat back fold forward release mechanism	4.9.9	X	X	X	
3.9.10	Swivel rotation adjustment	4.9.10	X	X	X	
3.9.11	Vertical position adjustment increments	4.9.11	X	X	X	
3.9.12	Seat back recline increments	4.9.12	X	X	X	
3.10	Seat belt restraints	4.10	X	X	X	X
3.11	Seat system environmental exposure					
3.11.1	Low temperature	4.11.1		X		X
3.11.2	High temperature	4.11.2		X		X
3.11.3	Vibration	4.11.3		X		X
3.11.4	Humidity	4.11.4		X		X
3.11.5	Corrosion resistance	4.11.5		X		X
3.11.6	Fungal resistance	4.11.6		X		X
3.11.7	Dissimilar metals	4.11.7	X	X	X	X
3.12	Toxic chemicals, hazardous substances, and ozone-depleting chemicals					
3.12.1	Prohibited construction materials	4.12.1	X	X	X	
3.12.2	Hazardous and environmentally harmful material	4.12.2	X	X	X	
3.13	Painting and colors					
3.13.1	Painting procedures	4.13.1	X	X	X	
3.13.2	Color of components	4.13.2	X	X	X	

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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 of 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. The EA seat system covered by this specification is intended for use in all wheeled and tracked vehicles developed after 1995. They are not for use with vehicles developed prior to this date. The EA seat system is military unique since it must be designed to withstand the high levels of shock and vibration that may be encountered in a battlefield environment. Non-Government standards or commercial item descriptions should be used to describe the requirements for commercially available items.

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6.2 Injury criteria. Injury criteria for the 5th percentile female 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 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 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.

6.3 Contractual and administrative provisions.

6.3.1 Quality inspections and supporting documents. 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 will 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 will 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 will 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 will provide inspection assistance upon request.

6.3.2 Inspection equipment. The contractor is responsible for providing and maintaining all inspection equipment necessary to assure supplies and services conform to contract requirements. If no other calibration specification and/or requirements are specified in the contract, then the inspection equipment will be calibrated IAW the suggested contractor's guidelines traceable back to the National Institute of Science and Technology (NIST) standards.

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6.3.3 Certifications. Where certification is required to verify material or component to contract requirements, the contractor will furnish such certification along with applicable substantiating analytical data, documented test, and performance data. The certifications will be made available for Government review during prototype verification inspection (PVI)/first production verification inspection (FPVI), and copies of the certifications will be provided to the Government upon request. Certifications will include all documentation, examiner's qualifying documents, examinations, and tests where applicable. Certification of verification to specific contract and/or specification requirements will be a statement signed by the contractor's program manager, stating the contractor has complied.

6.3.4 Unacceptable certifications. If any certification is unacceptable to the Government, the contractor will conduct additional examinations/tests and provide additional documentation as required to verify certification at no increase in contract price or cost to the Government. The Government may conduct random sampling tests to verify certifications.

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

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

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

- a. Drawing Number (if applicable)
- b. Specification title, number, edition
- c. Number of specimens tested
- d. Requirements and actual results obtained
- e. Purchase orders for subcontracted products

6.3.8 Qualified products. In the event that a particular specification referenced in this document has a qualified products list (QPL), the contractor will utilize items only from vendors specified in the applicable QPL. The contractor will make available to the Government, documentation of each item acquisition from the QPL. The document will include the QPL date and identification of the supplier, purchase order, and quantity. In the event procurement of product is not possible or products are not available, substitute products will be identified and subject to approval of use by the procurement contracting officer (PCO).

6.4 Test facilities. The contractor will provide the government with a copy of test set-up procedures and test rig/equipment used to verify requirements of the "Survivability" section in this specification are met. The Government reserves the right to witness any or all of the inspections, demonstrations, tests and/or analysis.

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6.5 Examinations and test for requirements verification. The EA seat system will be certified to meet the requirements of this specification by inspection, analysis, demonstration, or test during the verification evaluations. Table II determines the verification method(s) for each requirement of this specification. The four verification methods are defined below:

- a. Analysis method is performed by calculating the interaction of observable variables on the item under test and the operational environment for requirement verification
- b. Test method is performed by utilizing measurement instruments on the item under test and operating the item in a manner allowing the instrumentation to collect data to show requirement verification
- c. Inspection method uses measurements or visual evidence for requirement verification
- d. Demonstration method is performed by operating the item under evaluation in a manner that will allow the test personnel to observe requirement verification

6.6 Definitions.

Anthropomorphic test device (ATD)	A test device that simulates the dimensions, weight proportions and articulation of the human body. The anthropomorphic test device or ATD is typically instrumented to record a wide variety data in dynamic events such as vehicle impacts or rollovers. The 50th percentile male ATD is the accepted human surrogate test device to verify Survivability requirements are met.
Full range of seated occupants	Central 90% of Soldier population.
EA seat system	The seat, EA mechanism, seatbelt, mounting bracket(s), attaching hardware.
H-Point	Hip point dimensional reference coordinate used as part of SAE J826 to package a seated occupant to a seat.

6.7 Subject term (key word) listing.

Accommodation
 Adjustment
 Anthropomorphic test device (ATD)
 H-point
 Mounting
 Restraints
 Survivability

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APPENDIX A

TABLE A. Acceptable Weight Ranges

Acceptable Test/Analysis Weight Range for Gear-Encumbered ATDs
5 th percentile female gear-encumbered ATD = 69.5-87.7 kg, (153-193 pounds)
50 th percentile male gear-encumbered ATD = 98.2-116.4 kg, (216-256 pounds)
95 th percentile male gear-encumbered ATD = 121.8-137.7 kg, (268-308 pounds)

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Custodian:

Preparing Activity:

Army – AT

Army – AT

(Project 2540-2016-003)

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>.