

INCH-POUND

MIL-DTL-62542C

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SUPERSEDING

MIL-PRF-62542B

25 June 1996

DETAIL SPECIFICATION

BALL SCREW LINEAR ACTUATOR (BSLA)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers a Ball Screw Linear Actuator (BSLA) for deployment of stabilizing outriggers for the M860A1 Patriot Semitrailer (see 6.1).

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 requirement documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E/BUE, Warren, MI 48397-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A

FSC 5945

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-DTL-62542C

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 listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplements thereto cited in the solicitation (see 6.2).

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-810 -Environmental Test Methods and Engineering Guidelines.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 are those cited in the solicitation.

DRAWINGS

ARMY

11686299 - Ball Screw Linear Actuators (BSLA).
12343383 - Relay Control Box Schematic Wiring Diagram.

(Copies of these drawings are available from the U.S. Army Tank-automotive and Armaments Command, AMSTA-TR-E/BUE, Warren, MI 48397-5000.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issue of the documents cited in the solicitation (see 6.2).

MIL-DTL-62542C

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A123	- Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products (DoD Adopted).
ASTM B633	- Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (DoD Adopted).
ASTM D522	- Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings (DoD Adopted).

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

GENERAL MOTORS CORPORATION

GM 9540P	- Accelerated Corrosion Test.
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(Copies of GM publications may be obtained from General Motors Corporation, c/o Global Engineering, 15 Inverness Way, Englewood, CO 80112.)

2.4 Order of precedence. 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

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Design, materials, and manufacturing processes. Unless otherwise specified (see 6.2), the design, materials, and manufacturing process selection shall be the prerogative of the contractor as long as all articles submitted to the government fully meet the operating, interface, ownership and support, and operating environmental requirements specified.

3.2.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Operating requirements. Each ball screw linear actuator shall provide the following functional, operational, and performance capabilities.

MIL-DTL-62542C

3.3.1 Drive motor. The motor shall be a 28 volt direct current (Vdc), reversible, electric drive motor, and shall operate with the relay control box (see 3.4.2) for changing rotation direction. The motor, when installed on the actuator, shall be water resistant, and shall meet the performance requirements over the full range of BSLA operating characteristics.

3.3.1.1 Current draw. During intermittent duty operation of 20 second increments in forward and reverse operation, the current draw of the drive motor shall not exceed 180 amperes (A) under all environmental conditions.

3.3.1.2 Thermal overload protection. A thermal overload switch or other self-resetting protective device shall be provided to prevent damage to the drive motor during operation.

3.3.2 Dynamic load. Actuator shall be capable of operating at a starting tensile load of 52 000 pounds (lb) (23 1 308 Newtons (N)) at any point along the full range of extension and/or retraction of the screw and operating for a period of not less than five (5) seconds.

3.3.3 Static load. The BSLA shall be capable of sustaining a 105 600 lb (469 732N) static tensile load for a minimum of five seconds duration without structural damage to the BSLA assembly. However, the slip clutch may slip and will not be cause for rejection.

3.3.4 Reverse drive. The BSLA shall hold and not reverse drive upon stopping a 52 000 lb (231 308) dynamic tensile load on the screw.

3.3.5 Slip clutch. The slip clutch setting shall be such that the BSLA shall retain a minimum 52 000 lb tensile load on the screw. The clutch shall be designed to prevent damage to the ball screw assembly when exceeding the 52 000 lb dynamic tensile load.

3.3.6 Mission essential functions (MEF). The BSLA's primary function is that of stabilizing outriggers for the M860A1 semitrailer. The BSLA shall provide the MEFs listed below to successfully complete its mission. These functions shall be accomplished without causing damage to the M860A1 semitrailer, the primemover, or the payload.

- a. Safely begin and continue movement under its own power without outside assistance.
- b. Raise and lower a weight of 52 000 lb for the last 18 inches (in.) (46 centimeters (cm)) of the 37 in. (94 cm) of retraction within 1.5 minutes extension or retraction.

MIL-DTL-62542C

3.4 Interface requirements.

3.4.1 BSLA interface. The BSLA shall conform to the envelope and interface dimensions as specified on Drawing 11686299.

3.4.2 Drive motor interface. The motor shall operate with the relay control box conforming to the envelope and the interface dimensions as specified on Drawing 12343383. The drive motor shall be an independent component which shall be bolted to the ball screw actuator assembly at the mounting interface, leaving the remaining ball screw actuator assembly as a complete, operational, independent component.

3.4.3 Electromagnetic interference. Conducted and radiated emissions shall not exceed the levels as specified in figures 1 and 2.

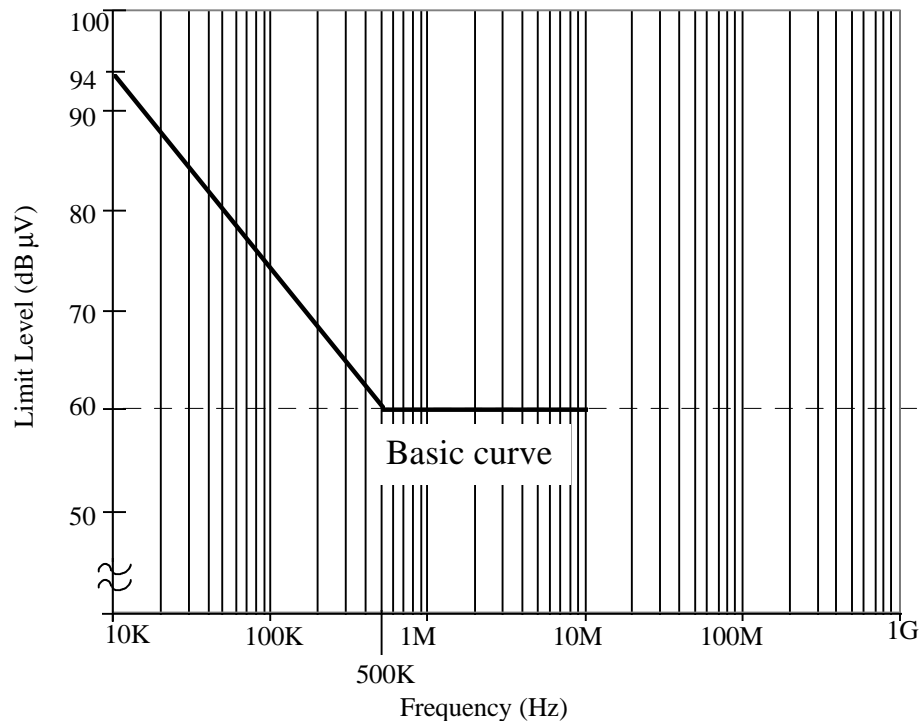
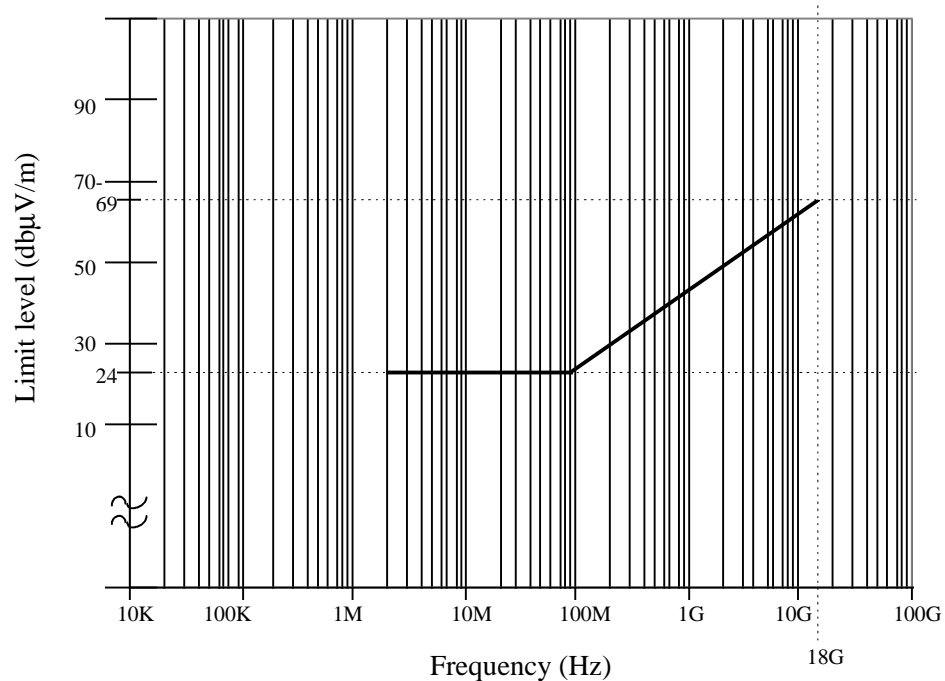


FIGURE 1. Conducted emission limit (power leads, ac and dc).

MIL-DTL-62542C

FIGURE 2. Radiated emissions limit.3.5 Ownership and support requirements.

3.5.1 BSLA lubrication. The BSLA ballnut and screw shall be lubricated with high load carrying capacity grease. This grease shall be effective in the temperature ranges as specified in 3.6.2.

3.5.1.1 Ballnut lubrication. The ballnut shall have an external zerk fitting which shall permit the lubrication of the ballnut and screw assembly.

3.5.1.2 Lubricant leakage during operation. Actuator lubricant leakage past the external ball screw nut, the manual override drive seal, or at other locations of the ball screw shall not exceed three drops per hour. There shall be no (zero) leakage of lubricant into the drive motor. This leakage requirement applies to all orientations of the BSLA when mounted on the semitrailer. Damp spots created from acceptable leakage will not be cause for rejection.

3.5.1.3 Lubricant leakage during storage. There shall be no (zero) actuator lubricant leakage from the BSLA during packaging, shipping, or storage of the BSLA in horizontal position with pressure vent up, over a 24 hour period. Damp spots from accepted test procedure (ATP) are not cause for rejection.

MIL-DTL-62542C

3.5.2 Gear case lubrication. The gear case shall be filled with a petroleum based hydraulic fluid capable of operating in the temperature ranges as specified in 3.6.2. Provisions shall be made and shall be readily accessible to allow periodic maintenance to externally add/drain the hydraulic fluid.

3.5.2.1 Oil level indicator. An oil level indicator shall be provided to indicate a sufficient, safe operating lubricant level, visible in the BSLA gear box when the BSLA is in the stowed position of 20° from the vertical with the rod end up.

3.5.3 Ball and thread. The ball screw shall be provided with a safety stop to prevent exceeding the maximum limits of the BSLA in the fully extended or retracted position. The backlash shall not exceed 0.013 in. (0.033 millimeter).

3.5.3.1 Ball screw scoring. There shall be no evidence of scoring of the ball screw throughout its entire length after 1150 reliability/maintainability (R/M) duty cycles.

3.5.4 Manual override. An external shaft for manual extension and retraction of the BSLA shall be provided in the event of the drive motor failure, using a standard English-type six-point socket and/or a wrench.

3.5.5 Ventilation. The BSLA gear case shall be vented to atmosphere without allowing water entry by means of a relief valve installed on the BSLA casting. The valve shall be located approximately 11 in. (27.9 cm) vertically above the centerline of the hole in the mounting clevis of the BSLA when positioned 20° from vertical.

3.5.5.1 Water intrusion. The BSLA design shall be capable of meeting the vehicle fording requirement of 31 in. (78.7 cm). This design shall not allow water to enter the ball screw assembly in the area measured along the axis of the tube 11 in. (27.9 cm) up from the center of the hole of the lower mounting clevis pin when the BSLA is placed 20° from vertical.

3.5.6 Seals. Ice scraper and wiper seals shall be provided to prevent the entry of water or other foreign matter into the ball nut mechanism.

3.5.6.1 Water exclusion. The total accumulation of water in the ball screw tube shall not be more than 2 ounces (oz) (57 grams (g)). There shall be no water intrusion into the BSLA housing assembly.

3.5.7 Rod end sealant. A waterproof sealant shall be applied to the rod end threads, keyway, and face of screw prior to assembly into the screw to prevent the entry of water into the threaded insert-cavity of the screw.

MIL-DTL-62542C

3.5.8 Ease of installation and operation. The BSLA shall be capable of being easily installed and removed from the semitrailer and shall be free from installation interferences. While installed on the semitrailer, the BSLA shall be capable of operating smoothly under a 27 000 lbs (12 247 kg) payload along the full extension and retraction of the BSLA.

3.5.9 Rod end. The rod end shall provide means to hold the bearing cage in line with the interfacing clevis to prevent torque impact of the BSLA when installed on the trailer.

3.5.10 Steam and water jet cleaning. The BSLA shall be capable of being cleaned with high pressure steam and with a high pressure water jet without damage or leakage past the seals. There shall be no deterioration of the seals.

3.5.11 Operational reliability. The BSLA shall conform to the load, cycling rates, holding load, and temperatures as specified in 3.3.2, 3.3.4, 3.5.11.1, and 3.6.2 after 1150 cycles of operation.

3.5.11.1 Cycling rate. A cycle shall consist of one full extension and full retraction of the BSLA and shall be performed within the following time frames. A complete operating cycle shall not exceed three minutes.

Extension cycle	1.5 minutes maximum
Hold	6 minutes minimum
Retraction cycle	1.5 minutes maximum
Hold	21 minutes minimum
Complete cycle	30 minutes maximum

3.5.11.2 Reliability conformance. The BSLA shall demonstrate a combined mean cycle between failure (MCBF) of no less than 2000 cycles. Test incidents shall be assessed during operational reliability cycle testing as specified in 4.7.1.

3.5.12 Maintainability. During the reliability conformance testing, there shall be no more than one (1) manhour per BSLA of active scheduled/preventative maintenance performed.

3.5.13 Human engineering factors. The manual override shall not require operator forces that exceed the strength limits of the 5th percentile female as specified for high force controls for arm, hand, and thumb-finger controls when using the socket wrench as specified in 3.5.4.

3.5.14 Corrosion resistance. The component shall be able to operate in varying or extended periods in corrosive environments involving one or more of the following: high humidity, salt spray, road de-icing agents, gravel impingement, atmospheric contamination and temperature extremes. Only normal washing, scheduled maintenance and repair of accidentally

MIL-DTL-62542C

damaged areas (not a result of deficiency in design, material, manufacturing or normal wear) shall be necessary to keep the corrosion prevention in effect. During its intended service life, surface corrosion, which may include red, black and /or white corrosion products, shall be a maximum of 1% of the surface of any component. Base metal shall be sound with no loss of original thickness greater than 2% or 0.001 in., whichever is less. There shall be no effect on form, fit or function.

3.5.15 Protective finish and color. Unless otherwise specified (see 6.2), the BSLA shall be cleaned, pretreated and primed in accordance with the manufacturer's standard practice (see 6.7). The topcoat color shall be forest green (see 6.7.1).

3.5.16 Identification and marking. Identification and marking of the BSLA shall be permanent and legible, and shall include the following:

- a. Nomenclature
- b. Manufacturer's identification code (CAGE)
- d. National stock number (NSN)

3.5.17 Safety. The BSLA shall be free of defects which are detrimental to the appearance, serviceability, or capability of the BSLA such as cracks, dents, scratches, burrs, sharp edges, loose parts, foreign matter, misalignment, deformation, unauthorized use of used or reworked items, or improper assembly.

3.6 Environmental conditions.

3.6.1 Dust. The BSLA shall be capable of operating in a blowing dust environment.

3.6.2 Temperature. The BSLA shall be capable of operation in ambient air temperatures from -50 degrees Fahrenheit (°F) to +120°F (-46°C to +49°C). When in storage, the BSLA shall withstand temperatures from -50 to +160°F (-46 to 71°C) without deterioration that causes any BSLA component to fail.

4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

MIL-DTL-62542C

4.2 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

- a. Air temperature: $73 \pm 18^{\circ}\text{F}$ ($23 \pm 10^{\circ}\text{C}$).
- b. Barometric pressure: 28.5 ± 2 in. of mercury (Hg)
(96.5 ± 6.5 kiloPascals (kPa)).
- c. Relative humidity: $50 \pm 30\%$.

4.3 First article inspection. First article inspection shall be performed on preproduction and initial production samples as specified herein.

4.3.1 Preproduction inspection. When specified (see 6.2), the preproduction sample shall consist of four BSLAs which shall be subjected to the installation and operation check tests (see 4.3.1.1). Upon successful completion of the check tests, four of the BSLA shall be randomly selected and shall be subjected each to the conformance inspections specified in table I. Location of inspection shall be at the contractor's plant unless otherwise specified by the contracting officer.

4.3.1.1 Preproduction BSLA(s) samples. The contractor shall submit four (4) preproduction BSLA samples to ensure form, fit and functional operation on a fully loaded Patriot trailer, at a place to be determined by the Government. Form fit and function requirements shall be satisfied prior to first article testing. Each BSLA shall meet the following requirements (see 4.3.1).

- a. Each BSLA shall complete 25 cycles with max payload of 27 000 lbs on the M860A1 semitrailer.
- b. Each BSLA shall be inspected for ease of installation and removal.
- c. Each BSLA shall be inspected for smooth operation in extension retraction, and installation interferences.

4.3.2 First or initial production BSLA(s). Unless otherwise specified (see 6.2), the Government shall randomly select four (4) BSLAs from the first 10 BSLAs produced under the production contract for initial production inspection. The initial production sample shall be inspected as specified in table I. The BSLA(s) selected as first or initial production BSLA shall be furnished under the contract with all current modifications included. The BSLA(s) shall be submitted for inspection and tests to determine conformance to the contract and this specification. If submitted, BSLA(s) shall meet all requirements of the contract and of this specification, no modification shall be applied to subsequent BSLA(s) to be produced under contract without prior approval by the Government procuring activity.

MIL-DTL-62542C

4.4 Conformance inspection. When specified (see 6.2), conformance inspection shall be conducted by the contractor. Noncompliance with any of the specified requirements in sections 3 and 5 shall be cause for rejection of the item.

4.4.1 One hundred percent (100%) final inspection/examination. Each BSLA produced shall be subjected to one complete final inspection by the contractor as specified in 4.5. Conformance inspection shall be conducted at a site selected by the contractor.

4.5 Verification methods. The types of verification methods included in this section are visual inspection, measurement, sample tests, full-scale demonstration tests, simulation, modeling, engineering evaluation, component properties analysis, and similarity to previously-approved or previously-qualified designs.

4.5.1 Verification alternatives. The manufacturer may propose alternative test methods, techniques, or equipment, including the application of statistical process control, tool control, or cost-effective sampling procedures, to verify performance. See the contract for alternatives that replace verifications required by the specification.

4.5.2 Operating requirements verification.

4.5.2.1 Drive motor. Each drive motor shall be operated for not less than 20 seconds in forward and 20 seconds in reverse direction.

4.5.2.2 Current draw. The current draw shall be measured under a 52 000 lb (231 308 N) load at ambient room temperature.

4.5.2.3 Thermal overload protection. The thermal overload protection device shall be checked for malfunctions. A test shall be performed on the drive motor which shall cause the thermal device to open in accordance with its design. Failure of the switch or device to trip before drive motor damage occurs shall be cause for rejection.

4.5.2.4 Dynamic load. The BSLA shall be cycled three times at a 52 000 lb load, at the 10 in. (25.4 cm), 15 in. (38 cm), and 25 in. (63.5 cm) position along the screw.

4.5.2.5 Static load. The BSLA shall be subjected to a 105 600 lb tensile load. Structural and operating integrity shall not be degraded as determined by a visual inspection and two cycle operation. However, failure of the slip clutch to drive the BSLA will not be cause for rejection.

4.5.2.6 Reverse drive. The BSLA shall be held for ten seconds when subjected to a 52 000 lb tensile load. The BSLA shall not reverse drive at the specified load.

MIL-DTL-62542C

TABLE I. Verification methods.

Title	Requirement	Verification
Operating requirements	3.3	4.5.2
Drive motor	3.3.1	4.5.2.1
Current draw	3.3.1.1	4.5.2.2
Thermal overload protection	3.3.1.2	4.5.2.3
Dynamic load	3.3.2	4.5.2.4
Static load	3.3.3	4.5.2.5
Reverse drive	3.3.4	4.5.2.6
Slip clutch	3.3.5	4.5.2.7
Mission essential functions	3.3.6	4.7.1
Interface requirements	3.4	4.6
BSLA interface	3.4.1	4.5
Drive motor interface	3.4.2	4.6.1
Electromagnetic interface	3.4.3	4.5
Ownership and support requirements	3.5	4.7
BSLA lubrication	3.5.1	4.7.1
Ballnut lubrication	3.5.1.1	4.7.1
Lubricant leakage during operation	3.5.1.2	4.5
Lubricant leakage during storage	3.5.1.3	4.5
Gear case lubrication	3.5.2	4.7.1
Oil level indicator	3.5.2.1	4.5
Ball and thread	3.5.3	4.5 and 4.7.3
Ball screw scoring	3.5.3.1	4.7.3.1
Manual override	3.5.4	4.7.4
Ventilation	3.5.5	4.5
Water intrusion	3.5.5.1	4.5
Seals	3.5.6	4.5 and 4.7.1
Water exclusion	3.5.6.1	4.7.5
Rod end sealant	3.5.7	4.5
Ease of installation and operation	3.5.8	4.7.1.2
Rod end	3.5.9	4.5
Steam and water jet cleaning	3.5.10	4.7.7
Operational reliability	3.5.11	4.7.1.2
Cycling rate	3.5.11.1	4.5
Reliability conformance	3.5.11.2	4.7.1.3

MIL-DTL-62542C

TABLE I. Verification methods. - Continued

Title	Requirement	Verification
Maintainability	3.5.12	4.7.2.3
Human engineering factors	3.5.13	4.7.8
Corrosion resistance	3.5.14	4.7.9
Protective finish and color	3.5.15	4.5
Identification and marking	3.5.16	4.7.10
Safety	3.5.17	4.7.11
Environmental conditions	3.6	4.8
Dust	3.6.1	4.8.1
Temperature	3.6.2	4.8.2

4.5.2.7 Slip clutch. The BSLA shall be subjected to a 52 000 lb dynamic tensile load for 2 minutes after testing in accordance with 4.5.2.4. The slip clutch shall not slip at the specified load after completion of the BSLA reliability test conforming to 4.7.1 through 4.7.1.3.

4.6 Interface requirements verification.

4.6.1 Drive motor interface. The motor shall be removed from the BSLA by removing standard fasteners and the motor drive shaft shall be separated at the mounting surface.

4.7 Ownership and support requirements verification.

4.7.1 R/M test. Each BSLA shall be subjected to an operational reliability test of 1150 cycles.

4.7.1.1 R/M duty cycles. The duty cycles for demonstrating R/M (see 4.7.1) shall be conducted under the following temperatures and in the order specified:

<u>Duty cycle no.</u>	<u>Temperature</u>
1 to 920 (operating)	65°F to 80°F (18°C to 27°C)
Storage, 24 hours (nonoperating)	-50°F
921 to 1035 (operating)	-50°F
Storage, 24 hours (nonoperating)	160°F
1036 to 1150 (operating)	120°F

4.7.1.2 Operational reliability. Starting from the fully extended position (overall length 86 in. (218 cm)), the BSLA shall be operated with a starting load of 10 000 lbs (44 482 N) tensile force over the initial 10 in. (25.4 cm) of retraction. During the next 20 in. (50.8 cm) of retraction, the load shall be increased linearly from 10 000 lbs to 27 000 lbs during the remaining length of the screw retraction. The load shall be maintained at 27 000 lbs load (overall length 49 in.

MIL-DTL-62542C

(124 cm)), the BSLA shall exert a 27 000 lb tensile force over 20 in. of extension, then the force shall be linearly reduced to a 10 000 lbs tensile force over the full range of extension. The BSLA shall be capable of stopping and starting at any position under load during the cycle tests. Auxiliary ambient air flow on the BSLA motor is permitted to meet the complete cycle time for reliability testing.

4.7.1.3 Reliability. To verify the Mean Cycle Between Failure (MCBF), each of the four BSLAs shall be tested for a total of 1150 operational reliability cycles, which equates to 4600 total operational reliability cycles (see 6.6). The testing shall verify requirements of 4.7.1, 4.7.1.1, and 4.7.2.2. Classification of all test incidents will be performed by Government personnel and will constitute official results of the test for contractual compliance, based upon 3.3.6 and 4.7.2.2. Failure of any one BSLA to meet the requirements specified shall constitute the failure of the entire test. If any modification is made to one test sample, each of the test samples will be required to undergo complete retest with the same configuration changes.

4.7.2 R/M failure criteria.

4.7.2.1 Reliability verification. For reliability verification, failures shall be categorized as follows:

- a. Malfunction. A malfunction is any occurrence that prevents further operation of a major BSLA component and requires that the component be replaced or repaired. The major components are the motor, drivetrain, screw, housing, rod end bearing, and ball return assembly.
- b. Incident. An incident is any occurrence which prevents or could prevent the BSLA from performing/completing one or more of its mission essential functions; which poses a safety hazard to personnel; or which causes or could cause catastrophic failure of the BSLA, semitrailer, or associated equipment.
- c. Examples of malfunctions/incidents:
 - (1) Lubricant leaks during operation and storage (see 3.5.1.2, 3.5.1.3, 3.5.6, and 4.5.2.4).
 - (2) Water in excess of two ounces in the ball screw (see 3.5.6.1).
 - (3) Ball screw shows evidence of scoring (see 3.5.3.1).
 - (4) Rod end sealant permits water to enter threaded insert-cavity of the screw (see 3.5.7).
 - (5) Slip clutch back drives in retraction or extension in less than 10 seconds (see 3.3.5).
 - (6) Safety stop does not prevent screw from damaging the ball screw (see 3.5.3).
 - (7) Drive motor is not water resistant or is inadequate (see 3.3.1).

MIL-DTL-62542C

Failures are defined as malfunctions or incidents that prevent the BSLA from successfully completing a mission essential function (see 3.3.6) or as otherwise identified in 4.7.2.2 (see 4.7.2.3).

4.7.2.2 Operational reliability failure (ORF). An ORF is any malfunction that prevents further operation of a major BSLA component and requires that the component must be replaced or repaired. The major components are the motor, drivetrain, screw, housing, rod end bearing, and ball return assembly. An ORF is also any incident or malfunction (actual, intermittent, or incident) of the BSLA system which causes or could have caused the inability to perform one or more mission essential functions, or is a critical or catastrophic hazard to personnel or equipment.

4.7.2.3 Maintainability verification. Failure occurs when the total maintenance manhours expended to perform active scheduled and unscheduled maintenance per BSLA exceeds one manhour or when safety hazards to personnel/unsafe conditions develop that require corrective (unscheduled) maintenance action.

4.7.3 Ball screw. The BSLA shall be fully extended and then retracted. The backlash shall be determined in each position.

4.7.3.1 Ball screw scoring. The test specified in 4.7.1 shall be completed. Subsequently, the entire length of the ball screw shall be checked for any evidence of scoring using 10X magnification inspection.

4.7.4 Manual override. The BSLA shall be extended and retracted one time and checked for smooth operation using a standard English size socket wrench which may be attached to a drill motor.

4.7.5 Water exclusion. Water seal test shall be performed after completion of the reliability test. The test shall be performed with the BSLA screw extended (exposed) 20 in. from the rod end of the ball screw actuator. The BSLA shall be placed in a vertical position with the rod end pointing up with all casting vents, lubrication fittings, plugs and access holes in a closed position. The BSLA shall be subjected to a constant flow of water running down the screw at a rate of one gallon per hour for a three hour period. Accumulation of water inside the ball screw actuator assembly in excess of two ounces is unacceptable. Water accumulation shall be determined by water extracted from the actuator by removing plugged holes from the chamber and disassembly of the BSLA.

4.7.6 Actuator lubricant. The zero lubricant leakage shall be verified in conjunction with the evaluation of the BSLA's reliability (see 4.7.2).

MIL-DTL-62542C

4.7.7 Steam and water jet cleaning. Using alkaline steam cleaning compound, the BSLA shall be cleaned for 10 minutes each as specified. Water exclusion as specified in 3.5.6.1 and performance shall not deteriorate due to cleaning. The procedure for steam and water jet cleaning shall be as follows: The jet shall be applied perpendicular to and not more than one foot from the surface to be cleaned for steam or water jet cleaning. The cleaning rate shall be 1 square foot per minute and the jet pressure not less than 100 psi (689.5 kPa) nor more than 110 psi (758.4 kPa).

4.7.8 Human engineering factors. The force required to operate the manual override shall not exceed 23 lbs.

4.7.9 Corrosion resistance. Component protection and coating adherence shall be equal to or exceed that provided by 1020 steel, hot-dip galvanized in accordance with ASTM A123, or electro-galvanized 0.75 mil minimum thickness in accordance with ASTM B633 (or minimum coating thickness of 0.75 mil on pre-galvanized sheet 0.063 in. or less), with zinc phosphate pre-treatment, epoxy prime, and CARC top coat. A proposed alternate design shall be compared to a galvanized sample (as described above) using ASTM D522 and accelerated corrosion test GM 9540P, method B, 120 cycles, or until prior failure of one of the items with defects such as extensive corrosion at scribe or significant penetration of base material.

4.7.10 Identification evaluation. The presence of the required markings shall be visually verified on the BSLA. After performing all environmental tests in 4.8, the BSLA marking shall be re-inspected for readability.

4.7.11 Safety. The BSLA shall be continuously evaluated for safety hazards throughout the R/M test.

4.8 Environmental conditions verification. The mission essential functions of the BSLA shall be verified under the dust and low and high temperature environmental conditions specified herein.

4.8.1 Dust. The BSLA shall be subjected to dust contamination for one exposure cycle in accordance with Method 510.3 of MIL-STD-810 or equivalent and tested without being cleaned in conjunction with the R/M tests. Prior to conducting the mission essential functions of 3.3.6, the BSLA in the fully extended position shall be tested for dust contamination. The BSLA shall not be cleaned until the R/M verification is completed. An evaluation shall then be made to verify that the BSLA's mission essential functions and reliability/maintainability are not adversely affected by exposure to a dust laden environment.

4.8.2 Temperature. The BSLA shall be subjected to the specified operating and storage temperatures in conjunction with the R/M tests. An evaluation shall then be made to verify that

MIL-DTL-62542C

the mission essential functions and reliability/ maintenance are not adversely affected by exposure to operating and storage temperature ranging from -50°F to +160°F in accordance with Methods 501.3 and 502.3 of MIL-STD-810 or equivalent.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The intended use of the BSLA covered by this specification is to raise and lower the stabilizing outriggers of the M860A1 semitrailer outfitted with the PATRIOT Radar and Launcher System. This is accomplished by retracting and extending the (ball) screw over a range of 37 in. (94 cm) under a load of 52 000 lbs. This item is military unique because it must be able to operate satisfactorily under terrain conditions typically found on the battlefield. The BSLA is specially designed to withstand the types of high shock that would be experienced from nearby or direct munitions explosions.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- c. If first article inspection is required (see 3.1).
- d. If design, materials, and manufacturing processes should be other than as specified (see 3.2).
- e. If protective finish is other than as specified (see 3.5.15).
- f. If inspection conditions should be other than as specified (see 4.2).
- g. If preproduction inspection is required (see 4.3.1).
- h. If initial production inspection is not required (see 4.3.2).
- i. If conformance inspection is required (see 4.4).
- j. Packaging requirements (see 5.1).

MIL-DTL-62542C

6.3 First article. When requiring a first article inspection, contracting documents should provide specific guidance to offerors. This guidance should cover whether the first article is a first article sample, a first production item, or the number of test items. These documents should also include specific instructions regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Pre-solicitations documents should provide Government waiver rights for samples for first article inspection to bidders offering a previously acquired or tested product. Bidders offering such products who wish to rely on such production testing must furnish evidence with the bid that prior Government approval is appropriate for the pending contract.

6.4 Conformance inspection. Affordable conformance inspection with confidence varies depending upon a number of procurement risk factors. Some of these factors include: Contractor past performance, government schedules and budget, product material and design maturity, manufacturing capital equipment and processes applied, the controlled uniformity of those processes, labor skill and training, and the uniformity of measuring processes and techniques. During the solicitations, contracting documents should indicate those tests desired from table I and their designated frequency based on a risk assessment for the procurement.

6.5 Subject term (key word) listing.

M8601 semitrailer	Return assembly
Outriggers	Rod end bearing
Patriot	Stabilizing

6.6 Reliability. Test plan 10-1 of MIL-HDBK-781 may be used to verify the Mean Cycle Between Failure (MCBF) for the BSLA.

6.7 Protective finish. If Chemical Agent Resistant Coating (CARC) paint is required, it should be specified in the contract or order (see 6.2). Historically, CARC paint in accordance with MIL-C-46168 has been provided on this item.

6.7.1 Color. Historically, color chip 383 of FED-STD-595 has provided a close match to the required color.

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army - AT
Navy - MC

Preparing Activity:
Army - AT

(Project 5945-1023)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER		2. DOCUMENT DATE (YYMMDD)	
	MIL-DTL-62542C		980515	
3. DOCUMENT TITLE				
Ball Screw Linear Actuator (BSLA)				
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)				
5. REASON FOR RECOMMENDATION				
6. SUBMITTER				
a. NAME (Last, First, Middle Initial)		b. ORGANIZATION		
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code)		7. DATE SUBMITTED (YYMMDD)
		(1) Commercial (2) AUTOVON (If applicable)		
8. PREPARING ACTIVITY				
a. NAME		b. TELEPHONE (Include Area Code)		
		(1) Commercial (810) 574-8745		
c. ADDRESS (Include Zip Code)		(2) AUTOVON 786-8745		
Commander U.S. Army Tank-automotive and Armaments Command ATTN: AMSTA-TR-E/BUE Warren, MI 48397-5000		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403 Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340		