Performance Specification
Occupant Seat Belt Restraints
For Use in US Military Ground Vehicles

MIL-PRF-32548

(released 13JUN2016)

Introduction of MIL-PRF-32548

METRIC
MIL-PRF-32548
13 June 2016

PERFORMANCE SPECIFICATION

OCCUPANT SEAT BELT RESTRAINTS
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-PLEP-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.

AMSC N/A FSC 2540

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

MIL-PRF-32548

- What's driving the need for a Seat Belt Restraints Performance Specification (P-Spec)?

  - Seat Belt Restraints for military ground vehicles currently reflect a wide range of designs and applications:
    - Multi-point anchorages (e.g., 2-point, 3-point, 4-point, 5-point)
    - Anchorage points to seat frame, vehicle structure, and combination of both
    - Forward-facing, side-facing, rotating (pedestal) seat & restraint configurations
    - Single occupant, multi-occupant (bench) seat & restraint configurations
    - Multiple buckle types (e.g., end-release, side-release, swivel-release, multi-latch)
    - Tether restraints for standing occupants (e.g., standing gunner tether harness)
    - Multiple quick-release features
    - Range of operational scenarios (artic, desert, amphibious, high altitude, more)

MIL-PRF-32548

- What's driving the need for a Seat Belt Restraints Performance Specification (P-Spec)?
  - Seat belt restraints currently used in military ground vehicles are often customized to accommodate the unique seating requirements supporting a myriad of operational scenarios.
  - Federal Motor Vehicle Safety Standards (FMVSS) are typically cited in requirements; however, FMVSS are often are not applicable (e.g., multi-point restraints) or include test procedures for typical automotive applications not aligned with military ground vehicle applications.

MIL-PRF-32548

- The Seat Belt Restraints Performance Specification (P-Spec):
  - Provides a framework from which to tailor requirements to ensure form, fit, and function of the seat belt restraint system.
  - Does not specify a required solution but specifies tailorable performance requirements for a solution.
  - Shall be tailored by the Government as part of the contract. If the P-Spec is not tailored by the Government, the contractor shall determine any appropriate tailoring for the applicability of the system and shall request approval from the Government for recommended tailoring.
  - Provides the Army acquisition team, contractors (e.g., seats) and sub-contractors (e.g., restraints) a reference document from which to extract and tailor requirements to ensure components meet fit, form and function.
  - Is not intended to limit innovation in the design or selection of specific hardware, software, materials, and processes.

MIL-PRF-32548: Section 1 - Scope

1. SCOPE

1.1 Scope. The purpose of this seat belt restraint performance specification is to provide the necessary requirements of an occupant seat belt restraint for military ground vehicles and amphibious vehicles.

1.1.1 Application. This document applies only to the seat belt restraints that will be used in military ground vehicles or amphibious vehicles.

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.

FEDERAL STANDARDS

FED-STD-313	-	Material Safety Data, Transportation Data, and Disposal Data for Hazardous Materials Furnished to Government Activities

COMMERCIAL ITEM DESCRIPTIONS (CID)

A-A-52557	-	Fuel Oil, Diesel

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-2104	-	Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-1472	-	Design Criteria Human Engineering

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

2.2.3 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent

MIL-PRF-32548: Section 2 – Applicable Documents

1. SCOPE

1.1 Scope. The purpose of this seat belt restraint performance specification is to provide the necessary requirements of an occupant seat belt restraint for military ground vehicles and amphibious vehicles.

1.1.1 Application. This document applies only to the seat belt restraints that will be used in military ground vehicles or amphibious vehicles.

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.

FEDERAL STANDARDS

FED-STD-313	-	Material Safety Data, Transportation Data, and Disposal Data for Hazardous Materials Furnished to Government Activities

COMMERCIAL ITEM DESCRIPTIONS (CID)

A-A-52557	-	Fuel Oil, Diesel

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-2104	-	Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-1472	-	Design Criteria Human Engineering

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

2.2.3 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent

MIL-PRF-32548: Section 3 - Requirements

specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM D975	-	Standard Specification for Diesel Fuel Oils
ASTM D6210	-	Standard Specification for Fully-Formulated Glycol Base Engine Coolant for Heavy Duty Engines

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

FEDERAL REGULATIONS

29 CFR 1910.1200	-	Hazard Communication
29 CFR 1990	-	Identification, Classification, and Regulation of Carcinogens
40 CFR 355	-	Emergency Planning and Notification
40 CFR 372.65	-	Chemicals and Chemical Categories
49 CFR 571.207	-	Seating Systems
49 CFR 571.208	-	Occupant Crash Protection
49 CFR 571.209	-	Seat Belt Assemblies
49 CFR 571.210	-	Seat Belt Anchorages
49 CFR 571.302	-	Flammability of Interior Materials

(Copies of these documents are available at https://www.gpo.gov/).

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

3.1 First article inspection. First article inspection shall be accomplished for each type of seat belt restraint in the military ground vehicle as specified in Table II (Section 4) or as specified in the contract.

3.1.1 Final inspection. Using a lot acceptance sample rate as specified in the contract, one (1) complete seat belt restraint system shall be tested to applicable requirements. Applicable requirements for acceptance testing shall be specified in the contract.

3.2 Materials. The contractor shall select materials capable of meeting all of the operational and environmental requirements as specified in section 3 or as specified in the contract.

Requirements

Recognizing that military ground vehicle seats are often multi-functional with unique design and performance characteristics to support complex crew missions, many of the requirement statements include specificity clauses allowing for requirements tailoring in the contract.

3.2.2 Flammability of interior materials. The seat belt restraint materials shall conform to applicable requirements in 49 CFR 571.302 or as specified in the contract.

3.7 Retractor package space claim. The maximum package space claim of the retractor shall be specified in the contract.

3.9.9 Contamination by fluids. Use MIL-STD-810, Method 504; Procedure I using fluids as listed in the contract or as listed in Table I.

TABLE I. Fluids Used in Testing

Fluids	Corresponding Source Documents
Motor Oil	MIL-PRF-2104
Dexron III	NSN 9150-00-698-2382
Antifreeze (Type I & II)	ASTM D6210
Soap, Detergent	ASTM D460
Gasoline	ASTM D4814-16
Diesel Fuel (DL-2)	A-A-52557, ASTM D975

MIL-PRF-32548: Section 4 - Verification

3.9.14 Inadvertent buckle release. The seat belt restraint buckle shall not inadvertently release when the vehicle is operating in prescribed vehicle mobility profiles as specified in the contract.

4. VERIFICATION

4.1 First article inspection. First article inspection of sample items shall be conducted as per the contract using one or all selected verification methods as listed in Table II. If any sample fails to comply with the specified requirements, the first article material lot shall be rejected.

TABLE II. Cross reference matrix

METHOD OF VERIFICATION 1 - Examination 3 - Demonstration 2 - Analysis 4 - Test		CLASSES OF VERIFICATION A - Design verification B - First article							
Requirement		Verification	Verification Methods				Class	
			1	2	3	4	A	B
3.1	First article inspection	4.1	X	X	X	X	X	X
3.1.1	Final inspection	4.1.1	X	X	X	X	X	X
3.2	Materials	4.2	X	X	X	X	X	
3.2.1	Hazardous material	4.2.1	X	X	X	X		
3.2.2	Flammability of interior materials	4.2.2	X	X	X	X		
3.3	Accommodation	4.3	X	X	X	X	X	
3.4	Integration with seats	4.4	X	X	X	X	X	
3.5	Anchorages	4.5	X	X	X	X		
3.6	Occupant protection	4.6	X	X	X	X		
3.7	Retractor packaging space claim	4.7	X	X	X	X		
3.8	Functional test	4.8		X		X	X	
3.9	Testing of seat belt restraint assemblies	4.9			X	X	X	
3.9.1	Temperature resistance testing	4.9.1			X	X	X	
3.9.2	Freeze/thaw cycling	4.9.2			X	X	X	
3.9.3	Freezing rain test	4.9.3			X	X	X	
3.9.4	Vibration resistance	4.9.4			X	X	X	
3.9.5	Ballistic shock test	4.9.5			X	X	X	
3.9.6	Solar radiation test	4.9.6			X	X	X	
3.9.7	Mud slurry exposure	4.9.7			X	X	X	
3.9.8	Sand exposure	4.9.8			X	X	X	
3.9.9	Contamination by fluids	4.9.9			X	X	X	
3.9.10	Buckle release force and operation	4.9.10			X	X	X	
3.9.11	Retractor lock-up sensitivity	4.9.11			X	X	X	
3.9.12	Webbing roping and snagging prevention	4.9.12			X	X	X	
3.9.13	Color of webbing	4.9.13	X		X	X	X	
3.9.14	Inadvertent buckle release	4.9.14			X	X	X	

4.1.1 Final inspection. Verify the seat belt restraint has met all requirements in section 3. Failure of any portion of the requirements on this single seat belt restraint system shall require

MIL-PRF-32548: Section 5 - Packaging

4.9.4 Vibration resistance. Verify requirements in section 3.9.4 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.5 Ballistic shock. Verify requirements in section 3.9.5 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.6 Solar radiation test. Verify requirements in section 3.9.6 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.7 Mud slurry exposure. Verify requirements in section 3.9.7 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.8 Sand exposure. Verify requirements in section 3.9.8 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.9 Contamination by fluids. Verify requirements in section 3.9.9 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.10 Buckle release force and operation. Verify requirements in section 3.9.10 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.11 Retractor lock-up sensitivity. Verify requirements in section 3.9.11 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.12 Webbing roping and snagging prevention. Verify requirements in section 3.9.12 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.13 Color of webbing. Verify requirements in section 3.9.13 are met. Document and report test results to the Government Procurement Agency (GPA).

4.9.14 Seat belt restraint buckle inadvertent release prevention. Verify requirements in section 3.9.14 are met. Document and report test results to the Government Procurement Agency (GPA).

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.

MIL-PRF-32548: Section 6 - Notes

6. NOTES

6.1 Definitions. This section defines the general terminology as it is used in this document. In certain cases, the terminology used may be somewhat different from its use in the general engineering community. This section is not complete, therefore limiting the glossary to terms found in this document and that are important to the application of this document. Terminology unique to a particular method is defined, as appropriate, in that method.

a. Anthropomorphic test dummy (ATD): a device used to replicate a human in order to evaluate occupant protection systems.

b. Attachment hardware: any or all hardware designed for securing the webbing or seat belt restraint components of a seat belt assembly to a seat.

c. Automatic-locking retractor (ALR): a retractor incorporating an adjustment device by means of a positive self-locking mechanism which is capable, when locked, of withstanding seat belt restraint forces.

d. Belt adjustment device: a device enabling the belt to be adjusted according to the requirements of the individual wearer and to the position of the seat. The adjusting device may be part of the buckle, or a retractor, or any other part of the safety belt.

e. Buckle: a quick release mechanism which connects seat belt restraints webbing.

f. Buckle pretensioner or web pretensioner, an energized device that can be added to the seat belt restraints to reduce webbing slack.

g. Chest clip: a device designed to keep the webbing of the upper torso seat belt restraint parallel and in position on the occupant's torso. This device generally connects two shoulder straps together.

h. Vehicle crash: an unintended dynamic vehicle event. Crash types include, but not limited to: frontal impact, side impact, rear impact, and rollover.

i. Emergency-locking retractor (ELR): a retractor incorporating an adjustment device by means of a locking mechanism that is activated by vehicle acceleration, webbing movement relative to the vehicle, or other automatic action during an emergency and is capable, when locked, of withstanding seat belt restraint forces.

j. Gear-load: the largest amount of burden of the fully-outfitted soldier that will be worn by an occupant for a particular mission. This includes full combat personal body armor (e.g., Interceptor Body Armor [IBA]), combat helmet (e.g., Advanced Combat Helmet [ACH]), and combat gear- carrying equipment (e.g., Modular Lightweight Load-carrying Equipment [MOLLE]). A fully encumbered ATD is defined as one with S.A.W. (Squad Automatic Weapon) gear unless otherwise specified in the contract.

Future Work

Develop a test procedure as a supplement to FMVSS 210 – Seat Belt Restraint Anchorage Integrity

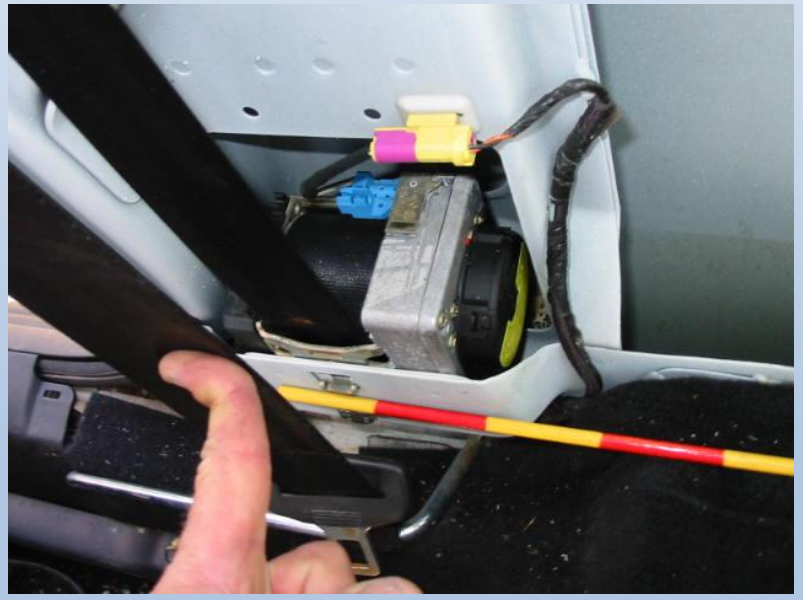
- Provides guidance to contractors to ensure test method uniformity throughout engineering development community
  - Body block geometry
  - Multi-point restraints
  - Vertical loading during underbody blast and roll-over events

Evaluate opportunities to standardize quick release features

- Eliminate entrapment concerns (e.g., seat belt web cutter used as back-up)
- Reduce time required to find quick release during emergency events

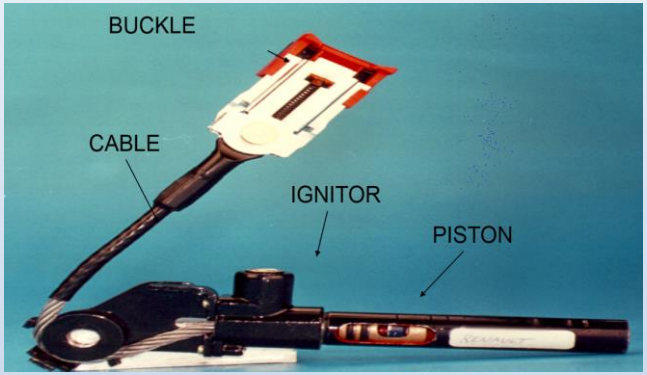
Traditional Pre-Tensioner Types

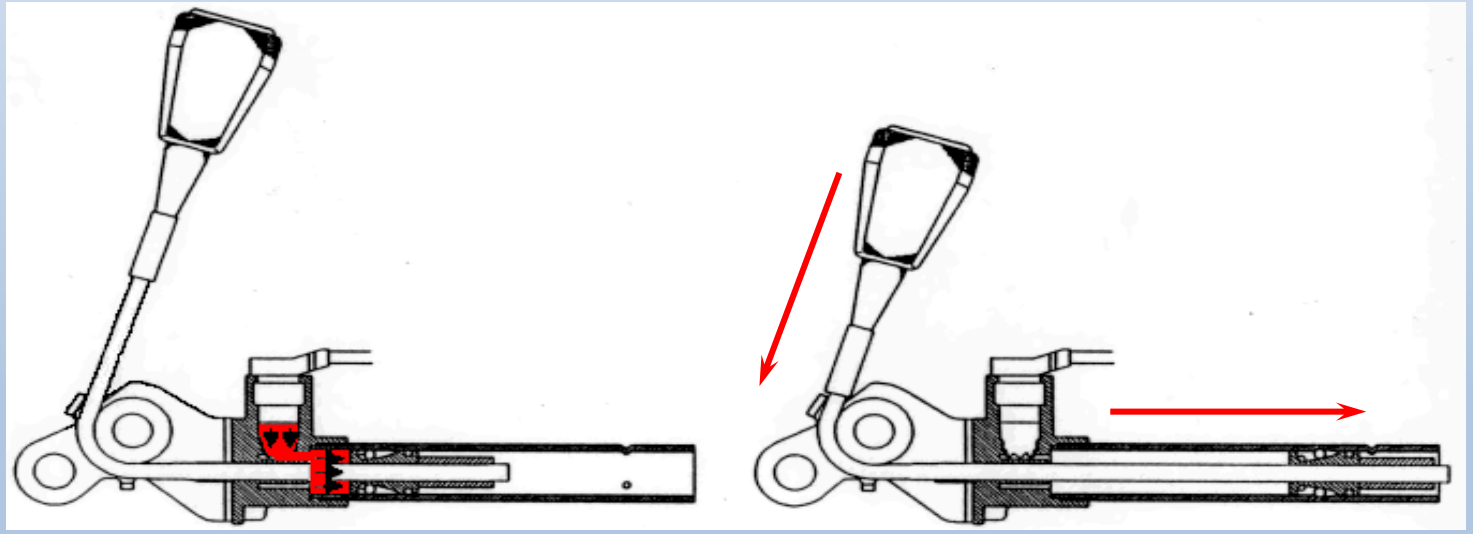
Retractor



Buckle

Buckle Pre-Tensioner Function/Activation



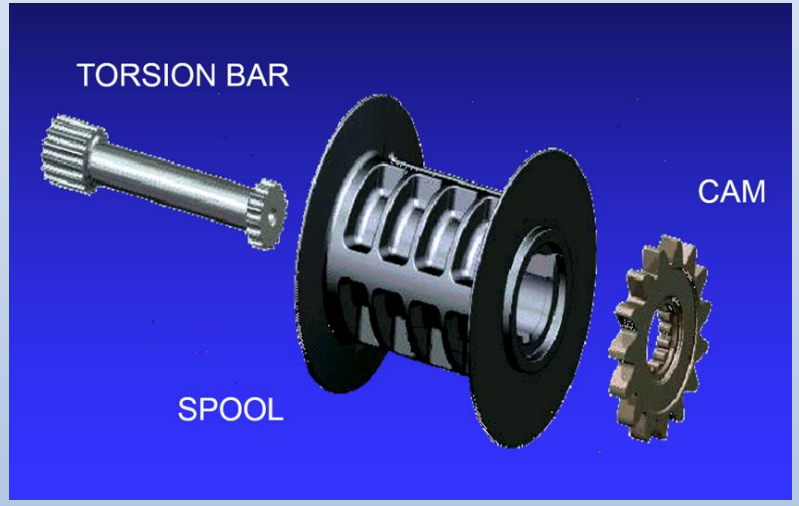


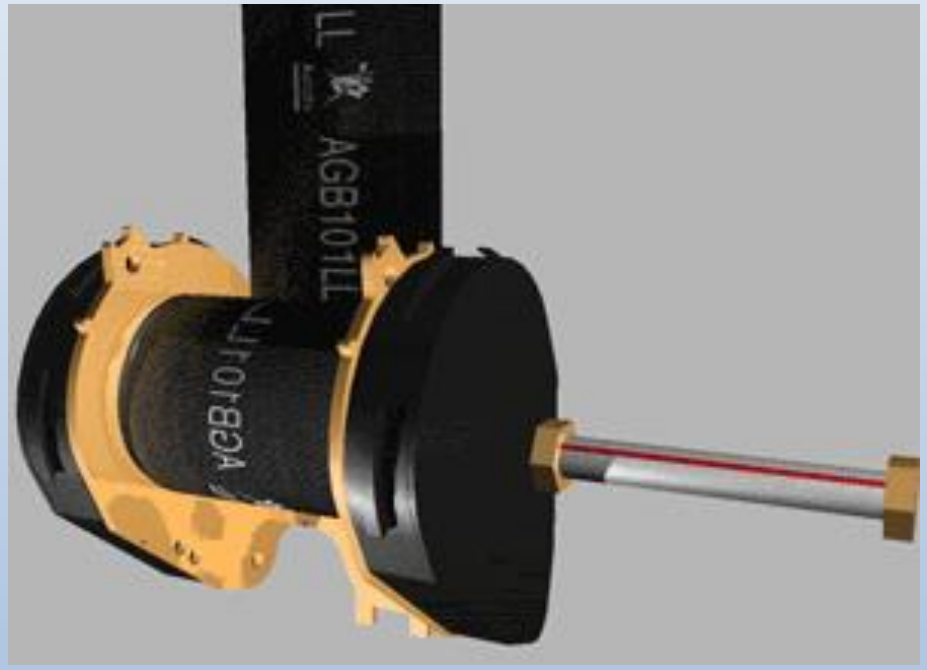
IGNITION

DEPLOYMENT

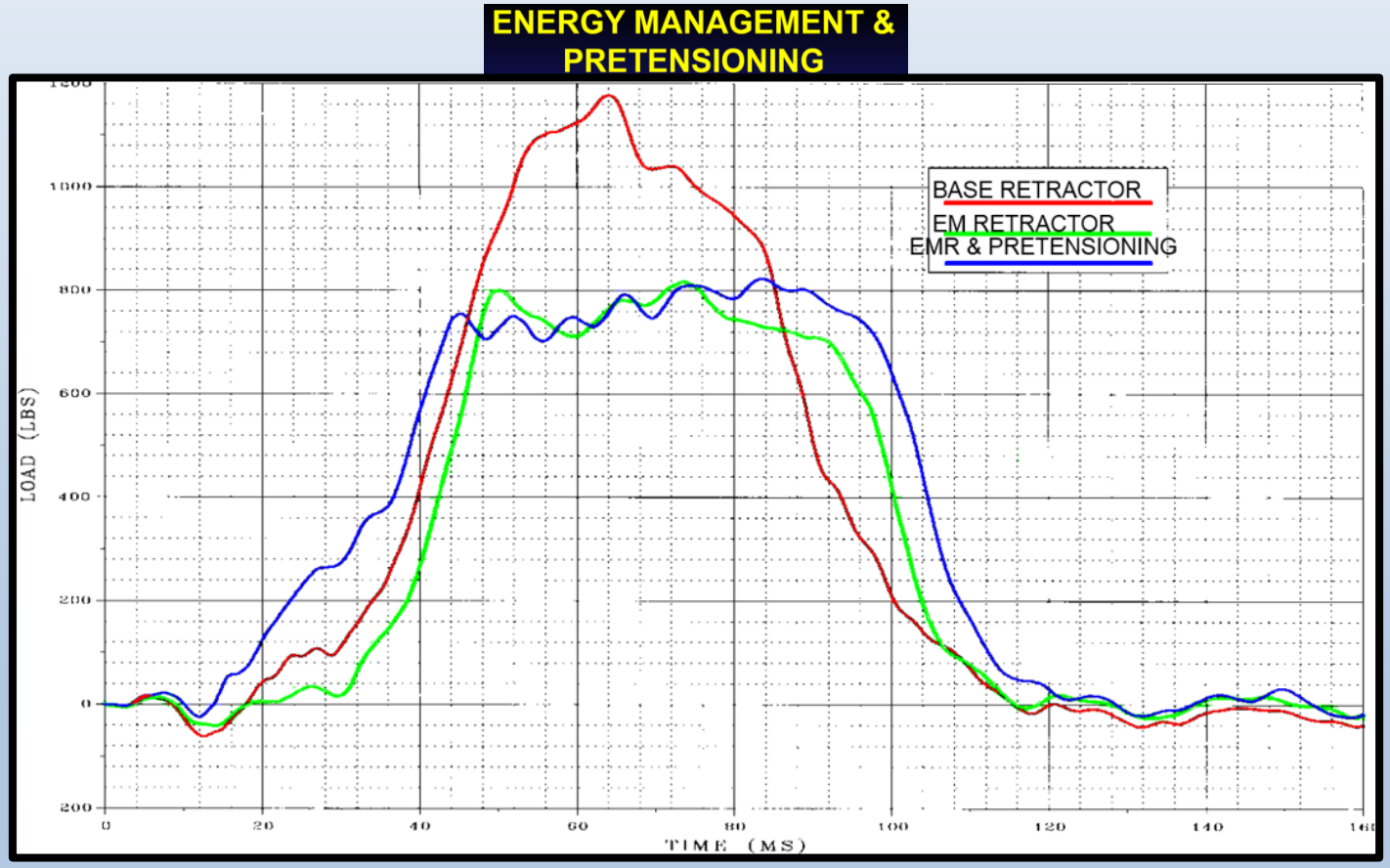
Retractor Pre-Tensioner Function/Activation

Energy Management Retractor with Torsion Bar





Shoulder Belt Force (lbs.) vs. Time (milliseconds)



Questions/Discussion

Thank you!

Celia Staniak
Email: celia.m.staniak.civ@mail.mil
Phone: (586) 571-3419