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NAVAL SURFACE WARFARE CENTER  
INDIAN HEAD DIVISION

# Overview of Proposed Method 530, Loose Cargo for MIL-STD-810

2026 NIPHLE Training Event

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# Acknowledgement and Purpose

- Presenter's Role:
  - I am presenting this draft on behalf of the ongoing revision effort.
  - While I am not the primary author of this new method, my goal today is to share this information between the draft developers and the packaging community.
- Principal Author & Subject Matter Expert:  
Randy Patrick  
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- Why We Are Here:
  - Looking for collective expertise.
  - The purpose of this briefing is to showcase the proposed changes, highlight where they intersect with our daily packaging standards, and gather your constructive feedback to ensure Method 530 is as robust and practical as possible.



- Background
- Current Packaging Practices
- Method 530
- Alignment
- Conclusion



- **Loose Cargo aka Repetitive Shock:** Simulates the complex, repetitive shocks experienced by cargo that is not tied down during transport.
- **Current Standard (MIL-STD-810H w/Change 1)**
  - Loose Cargo testing is currently embedded within the vibration method (Method 514.8C, Category 5)
  - The loose cargo testing lumped into the Vibration Method (514) has caused confusion.
  - The loose cargo testing in the current MIL-STD-810 does not align with many of the packaging tests and causes confusion.
- **Why are these changes being proposed?**
  - Creating a standalone method reduces confusion
  - Harmonizes with existing practices

- **The packaging community relies on several standards that are similar in principle but vary in detail.**
- **Commonly used Specifications**
  - MIL-STD-3010 (Method 5019) – Test method Standard Test Procedures for Packaging Materials and Containers
  - MIL-STD-648E (Appendix F) - Design Criteria Standard Specialized Shipping Containers
  - MIL-STD-1660B (Appendix A) - Design Criteria Standard Ammunition and Ordnance Unit Loads
  - MIL-STD-1904B (para 6.13) – Test Method Standard Design and Test Requirements for Level A Ammunition Packaging
  - ASTM D999 – Standard Test Methods for Vibration Testing of Shipping Containers
- **Two Primary Approaches Emerge**
  - Fixed Frequency Test
    - Used by MIL-STD-1904B and Current MIL-STD-810H
    - Uses a fixed frequency (5 Hz), 1 inch amplitude, circular motion, short duration (20 minutes)
  - Adjustable Frequency Test
    - Dominant method used in ASTM D999, MIL-STD-3010, MIL-STD-648, and MIL-STD-1660
    - Requires the operator to increase the frequency (2-5 Hz) until the package consistently “bounces”, verified with a feeler gauge.
    - Typically Vertical motion machine, but circular can be used.
    - Typically longer test durations (2-3 hours)



## Section 1: Scope

- **Purpose:**
  - Method 530 is a new, standalone section that formalizes and expands upon loose cargo testing.
  - It establishes three distinct procedures
  - Evaluate unrestrained cargo transportation environment
- **Application:**
  - Primarily to simulate ground transportation
  - Applies even to normally restrained material if restraints could fail
- **Limitations:**
  - Not a substitute for secure cargo transportation or transportation shock
  - Does not address shock from handling, dropping, or vehicle accidents



# • Method 530: Tailoring

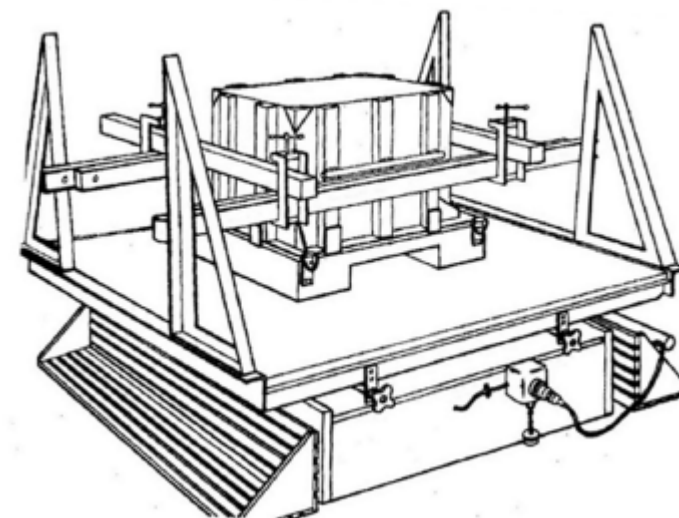
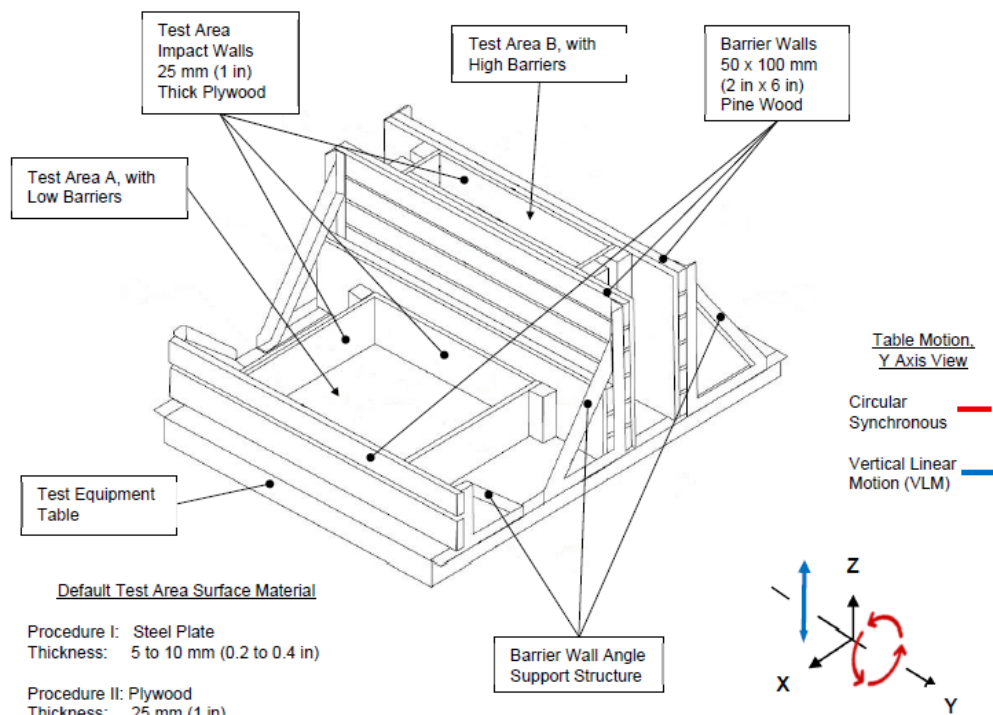
## Section 2: Tailoring

- **General:** Test sequence should mirror the anticipated life cycle sequence as a general guide.
- **Effects/failure modes:** Fatigue, deformation, loosening of connections, seals and threaded parts, degradation of surface and identification markings
- **Procedure Selection Considerations:**
  - Procedure I (Loose Cargo): common for personnel carried materiel or wheeled vehicle transportation.
  - Procedure IA (Alternate): Used when materiel size/weight (e.g., an 8x10' conex) exceeds table capacity. Uses a vibration system for vertical-only impacts.
  - Procedure II (Packaging): The standard for packaging/unit loads.

# Method 530: Tailoring

Procedure	Equipment	Table Motion	Frequency	Surface	Barriers	Duration
I (Loose Cargo)	Loose Cargo Table	Circular Synchronous (1-inch orbit)	Fixed 5 Hz (300 RPM)	Steel Plate (5-10 mm)	Determined from Annex A equations	20 minutes
IA (Alternate)	Vibration Test System (electrodynamic/ser vo hydraulic)	Vertical Sinusoidal (1-inch displacement)	Fixed 5 Hz	Steel Plate (5-10 mm)	Max 2 inches (50 mm) clearance	20 minutes
II (Packaging)	Loose Cargo Table or Vibration System	VLM or Circular Synchronous (1-inch)	Variable 2-5 Hz (Adjusted for bounce)	Plywood (Min 1-inch thick)	Max 2 inches (50 mm) clearance	120 mins (single axis) to 360 mins (multi-axis)

- Equipment





# • Method 530: Information Required

## • Section 3 – Information Required

### • Pre-Test:

- Define Test Plan (orientations, duration, RPM)
- Define Equipment (Deck, Barriers, Load Capacity)
- Define Materiel (Weight, CG, Instrumentation)

### • During Test:

- Record table motion and speed
- Record audio/video
- Other engineering instrumentation measurements such as temperatures (if required)

### • Post-Test:

- Document damage
- Deviations
- Any functional test results

## • Section 4 – Test Process

- **Equipment Type:** Loose Cargo Table (Circular Synchronous or Vertical Linear Motion machine) or a standard Vibration Test System.
- **Deck Surface:** heavy steel plate (5-10 mm) for Procedure I/IA vs. thick plywood (min 1-inch) for Procedure II.
- **Controls:**
  - Procedure I/IA (Fixed): Table must be controlled to maintain a steady 5 Hz (300 RPM) with a fixed 1-inch displacement.
  - Procedure II (Variable): Operator must actively adjust frequency (between 2 to 5 Hz) until the required vertical decoupling (bounce) is achieved and maintained.
  - Bounce Verification: Active use of feeler gauges/shims (1/16" or 3/16" depending on table motion) to confirm separation from the deck.
- **Test Interruption:** Guidance on handling unplanned interruptions (e.g., equipment faults, test item failures, isolator heating).
- **Test Setup:** Gives guidance on installing barriers, equipment warm-up, motion verification, running a dynamic pretest, and gives warning about the influence of the material's CG and weight.
- **Test Tolerances:** Gives frequency tolerances (+/- 2 RPM)



# • Method 530: Test Process and Analysis of Results

## • Test Procedure - Procedure II (skipping procedure I and IA)

- Step 1: Verify the test system table, barriers, and controls meet test plan and requirements.
- Step 2: Position the materiel on the test equipment table (wait for temperature stabilization if required)
- Step 3: Start the test table at a low speed, ~ 120 RPM (2 Hz).
- Step 4: Increase the table speed until the materiel base vertically decouples from the table surface. Use a shim or other measurement device to verify the item base displacement distance is adequate to meet the test plan.
- Step 5: Operate the test equipment at the Step 4 RPM for the duration specified in the test plan and record required data
- Step 6: If authorized, return the table operation to a low speed and stop table motion for inspection, reorientation, or a rest period as necessary.
- Step 7: Return to step 3 to resume testing or shut down all test equipment and proceed to step 8.
- Step 8: Complete post-test inspections, functional or operational checks as required.

## • Section 5 – Analysis of Results



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# Alignment

Parameter	MIL-STD-810J Proc. II (Draft)	MIL-STD-1660B	MIL-STD-648E	MIL-STD-3010C	ASTM D999 (A1/A2)
Test Duration	120 mins (single axis) 360 mins (multi-axis)	2 hours (single) 3 hours (multi)	2 hours (single) 3 hours (multi)	2 hours (single) 3 hours (multi)	Predetermined by user (often via D4169)
Deck Surface	Minimum 1-inch plywood	Not specified	Not specified	Not specified	"Hard and smooth"
Barrier Clearance	Max 2 inches (50 mm) from material edge	~1/2 inch from centered position	~1/2 inch from centered position	~1/2 inch from centered position	2 to 4 inches (50 to 100 mm)
Bounce (VLM)	1/16 inch feeler gauge	1/16 inch feeler gauge	1/16 inch feeler gauge	1/16 inch feeler gauge	1/16 inch feeler gauge
Bounce (Circular)	3/16 inch feeler gauge	3/16 inch feeler gauge	3/16 inch feeler gauge	3/16 inch feeler gauge	1/16 inch feeler gauge
Displacement	1 inch (pk-pk)	1 inch (pk-pk)	1 inch (pk-pk)	1 inch (pk-pk)	1 inch (pk-pk)



Parameter	MIL-STD-810J Proc. I (Draft)	MIL-STD-1904B	Impact / Note
Table Motion	Circular Synchronous	Circular Synchronous	<i>Same</i>
Frequency	Fixed 5 Hz (300 RPM)	Fixed 5 Hz (300 RPM)	<i>Same</i>
Displacement	1-inch diameter	1-inch diameter	<i>Same</i>
Test Duration	20 minutes	20 minutes	<i>Same</i>
Deck Surface	Steel Plate (5-10 mm)	Steel / Table Surface	810J explicitly specifies the steel thickness to ensure consistency.
Barrier Setup	Calculated via Annex A equations	Standard wood impact walls	810J introduces Annex A to standardize the spacing



- The proposed Method 530 Loose Cargo resolves ambiguity by moving the loose cargo testing from Method 514 Vibration into its own method.
- Method 530 preserves the original MIL-STD-810 loose cargo test and incorporates the packaging tests into the standard by creating separate procedures:
  - Procedure I: For materiel survivability (aligns with MIL-STD-1904).
  - Procedure II: For packaging/unit load integrity (aligns with ASTM, MIL-STD-1660, 648, & 3010).
- The goal of this briefing is to gather your feedback to ensure the final method is robust, practical, and serves the needs of the entire packaging community.
  - Your feedback is critical.



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