

Joint Safety Review Process Study

*10th Annual Systems Engineering
Conference*

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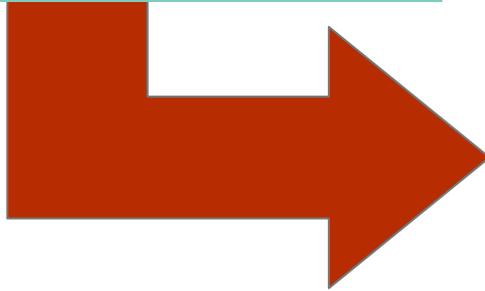
Agenda

- ▶ Background
- ▶ Phase I results
- ▶ Phase II efforts
- ▶ System Dependent vs. System Independent
- ▶ Results and Conclusions



Why Develop Service-Wide Safety Testing Standards?

- ▶ Moving forward, all weapons/ weapon systems will be developed as **joint systems** vis a vis JCIDS
- ▶ A joint approach promotes consistency and will get systems fielded sooner. Reduces (1) the overall number of tests, (2) time to fielding and (3) cost.




THE JOINT STAFF
WASHINGTON, D.C. 20316-8000

JROCM 102-05
20 May 2005

JOINT REQUIREMENTS
OVERSIGHT COUNCIL

MEMORANDUM FOR: Vice Chief of Staff, US Army
Vice Chief of Naval Operations
Vice Chief of Staff, US Air Force
Assistant Commandant of the Marine Corps

Subject: Safe Weapons in Joint Warfighting Environments

1. The Joint Requirements Oversight Council (JROC) approved the establishment of a Joint Weapons Safety Technical Advisory Panel (JWSTAP) to advise the Deputy Director for Force Protection, J-8, on joint weapons safety issues. The JROC also approved the institution of a Safe Weapons in Joint Warfighting Environments endorsement within the Joint Capabilities Integration and Development System (JCIDS) vetting process, upon the development and approval of a JWSTAP charter. The Joint Staff, J-8, Protection Assessment Division will develop and coordinate the JWSTAP charter for joint approval.

2. Because all weapons/weapon systems have the potential of being deployed together or employed in joint environments, weapons and weapon systems will be considered joint systems within the JCIDS process unless they are assigned the Joint Potential Designator of "Independent".


PETER PACE
General, United States Marine Corps
Vice Chairman
of the Joint Chiefs of Staff

Copy to:
Under Secretary of Defense for Acquisition, Technology, and Logistics



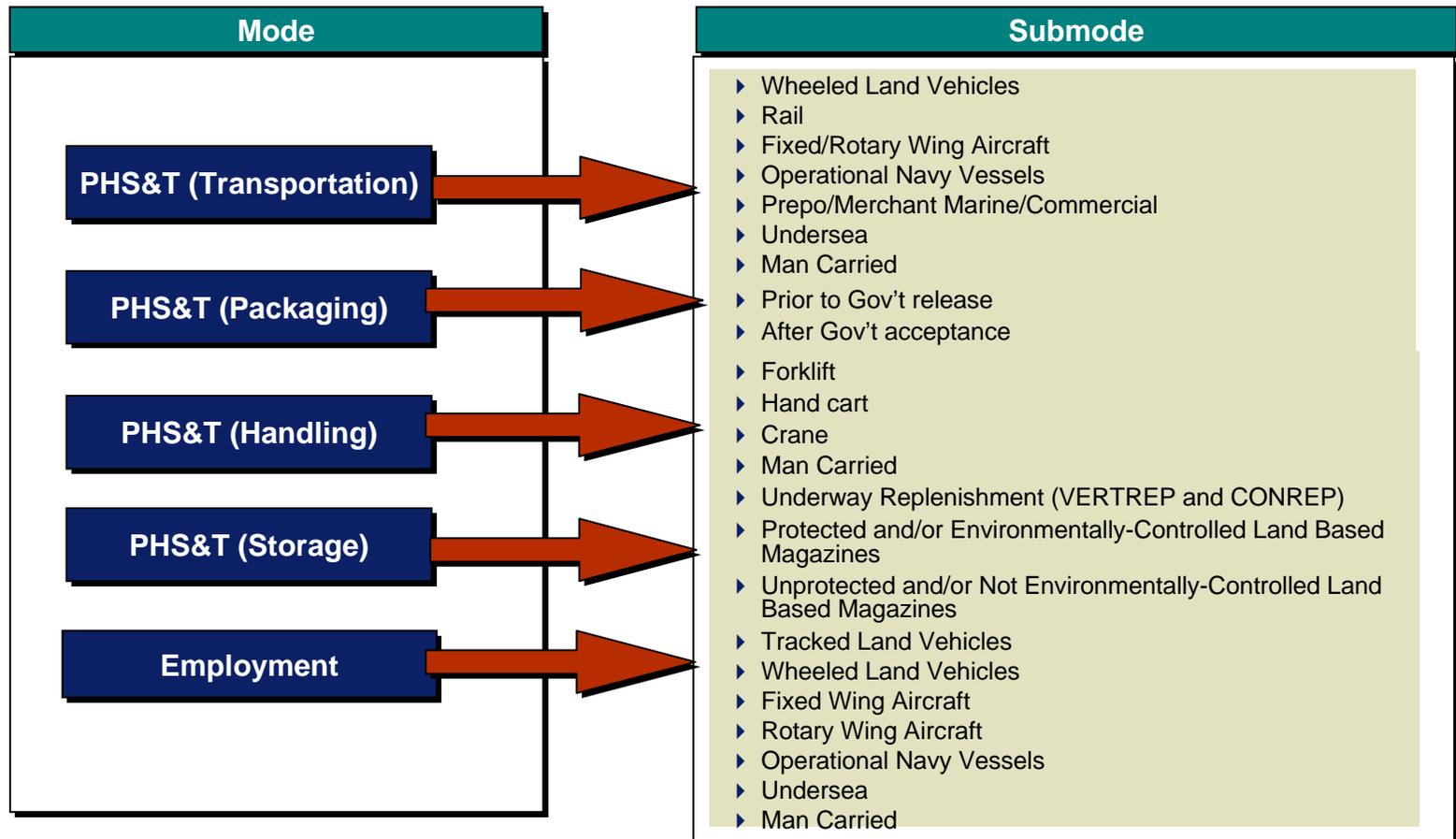
Phase I Results

- ▶ Collected over 80 documents resulting in nearly 650 safety tests
 - Weapon/explosive testing only
 - MIL-STDs, STANAGs, ITOPs, TOPs, AECTPs
 - System-level and subsystem/component-level tests
 - Service-unique tests and tests common to more than one Service
 - Many of the tests identified are used for other purposes other than safety
- ▶ Documents and associated tests captured and categorized in a Microsoft Access database
 - Service, type of natural or induced environment that the test simulates, life cycle phase that the test simulates, system/component
- ▶ Phase I clearly indicates that there are potential savings to support a Phase II effort



Phase I Results (cont'd)

- ▶ Joint Weapons Safety Technical Advisory Panel (JWSTAP), composed of all Service Safety Board Reps, agreed to use the following terms to define a mode of the weapon



Phase I Results (cont'd)

Mode Definitions

- ▶ **Packaging** – Configuration of item prior to transportation. Includes test requirements prior to government acceptance and repackaging requirements for shipping, e.g., Fleet Issue Unit Load
- ▶ **Handling*** – Applies to the use of devices, such as forklifts, hand carts, cranes, underway replenishment and man carried, for the breakout, lifting, or repositioning of ordnance or explosive devices in order to facilitate storage, assembly or disassembly, loading or downloading, or transporting.
- ▶ **Storage** – Placing ordnance or explosive devices in temporary (not to exceed 24 hours) and permanent land facilities that are either protected/ environmentally-controlled magazines or unprotected/open areas. This mode does not include storage on a ship.
- ▶ **Transportation*** – The capability of material to be moved by wheeled land vehicles, rail, fixed/wing aircraft, operational Navy vessels, prepo/merchant marine/commercial, undersea, and man carried
- ▶ **Employment*** – The strategic, operational or tactical use of weapons by tracked/wheeled land vehicles, fixed/rotary wing aircraft, operational Navy vessels, undersea, and man carried.

*Adapted from Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms



Phase II Project Goals

- ▶ Draft JWSTAP Manual with Mode Checklist and Tests for each Check
 - Follow this manual to receive “safe weapons endorsement”
 - Manual will most likely refer to an existing standard. Deviations from existing standards will be documented in manual.
 - Manual will clarify any test discrepancies including passing criteria
- ▶ System-independent tests only
- ▶ Need to identify benefit (e.g., cost savings) resulting from common tests
- ▶ Substantiate value to examine system dependent tests



Phase II Effort

- ▶ Refine Data Collected
 - Add new database fields
 - Review tests for appropriate categorizations
- ▶ Identify Key Stakeholders
 - Service Board reps
 - Service-specific Subject Matter Experts (SMEs)
- ▶ Conduct Analysis on System-Independent Tests
 - Identify apparent duplicate, inconsistent and Service-specific tests
 - Interview SMEs to validate initial findings
- ▶ Host stakeholder workshops to obtain joint agreement on a standard list of safety tests by mode
- ▶ Prepare final documentation



Phase II End Products

▶ Input to CJCSM 3170

- Defines modes
- Provide draft language in manual for ICDs, CDDs, CPDs

▶ JWSTAP Report

- Implementing guidance to CJCSM 3170 to include specific tests per mode
- Rationale for implementing guidance
- Contains details of Phase II effort

▶ Presentation

- Results of Study
- Summary of Report



Phase II End Products

▶ JWSTAP Report

- Purpose

- Outline

Executive Summary

1.0 Introduction

2.0 Approach (Phase I and II)

3.0 Definitions of Modes

4.0 Tests

5.0 Analysis of Tests

6.0 Required Tests by Mode

7.0 Proposed Language for
JCIDS Documents

8.0 Summary/Conclusions

▶ Presentation

- Results of Study

- Summary of Report

1.1 Background
1.2 Purpose
1.3 Scope
1.4 Assumptions

4.1 Test Documentation
4.2 Test Classification
4.3 System Independent vs.
System Dependent

5.1 Test Class I
5.2 Test Class II
5.3 Test Class XXX

7.1 CJCSI 3170
7.2 CJCSM 3170
7.2.1 Appendix E (ICD)
7.2.2 Appendix F (CDD)
7.3 ICD
7.4 CDD



Phase II Report Outline

▶ Scope

- Covers weapon and weapon container test procedures/requirements in all MIL-STDs, MIL-SPECs, STANAGs, ITOPs, AOPs
- Does not cover any commercial standards, developmental tests, system-tailored documents, IM tests or AECTPs
- Analysis covers system independent tests defined by established modes only
- Tests were included as long as the test simulated an environment in one of the established modes

▶ Assumptions

- Active standards are being used
- All proposed required tests follow system-independent test documents
- All weapons being transported by ship are in the “Transportation” mode; not the “Storage” mode
- Assignment of test classifications, based upon test documentation, is accurate



The vision...



- PHS&T (Transportation)
 - Wheeled Land Vehicles
 - Rail
 - Fixed Wing Aircraft
 - Rotary Wing Aircraft
 - Operational Navy Vessels
 - Prepo/Merchant Marine/Commercial
 - Undersea
 - Man Carried
- PHS&T (Packaging)
 - Prior to Government Release
 - After Government Acceptance (Single/Bulk)
- PHS&T (Handling)
 - Forklift
 - Handcart
 - Crane
 - Man Carried
 - Underway Replenishment (VERTREP, CONREP)
- PHS&T (Storage)
 - Protected/Environmentally-Controlled Land Based Magazines
 - Unprotected/Open Land Based Magazines
- Employment
 - Tracked Land Vehicles
 - Wheeled Land Vehicles
 - Fixed Wing Aircraft
 - Rotary Wing Aircraft
 - Operational Navy Vessels
 - Undersea
 - Man Carried

Drives System Independent Tests

- ### System Independent and Dependent Tests
1. Joint Shock Test
 2. Joint Vibration Test
 3. Joint Temperature Test
 4. Joint EEE Test
 5. ...

Drives System Dependent Tests

- System, Subsystem, All
- System-Specific
- Ammunition
- Cannon
- Electric Initiators
- Explosives
- Fuze
- Power Sources
- Rocket Motors
- Software
- Submunitions
- Unmanned Targets

Results of the safety tests will be detailed in the CPD

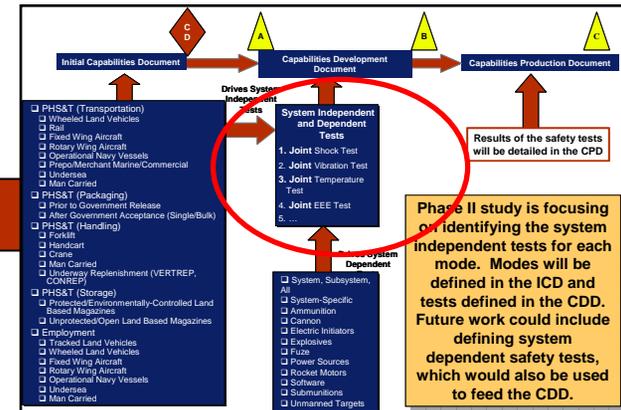
Phase II study is focusing on identifying the system independent tests for each mode. Modes will be defined in the ICD and tests defined in the CDD. Future work could include defining system dependent safety tests, which would also be used to feed the CDD.



Required Tests

Test Classifications

- ▶ High/Low Temperature
- ▶ High/Low Pressure
- ▶ Contamination and Corrosion
- ▶ Shock and Temperature
- ▶ Temperature and Humidity
- ▶ Temperature/Shock/Humidity
- ▶ EEE
 - ▶ ESD
 - ▶ Lightning
 - ▶ EMI
 - ▶ HERO
- ▶ Shock
 - ▶ Short and Long Drops
 - ▶ Vibration
 - ▶ Shock/Vibration
 - ▶ Acoustic
 - ▶ Thermal
 - ▶ Pyro



Every System going through development will be required to do standard joint tests. There will be a test for each test classification.



System Independent vs. System Dependent

▶ System Independent

- Certain tests you do regardless of what is in the weapon system.
- Example: Shock, Drop, Vibration.

▶ System Dependent

- Tests that are driven by specific components of a system.
- Tests are more clearly defined once the system is mature.
- Example: Fuze, Ammunition, Explosives.

Our findings show that Services use system-dependent tests for standard system independent tests.



System Independent Documents

Doc Type	TD Number	TD Name
49 CFR	178.6	Testing of Non-bulk Packagings and Packages
ITOP	1-2-511	Intersystem Electromagnetic Compatibility Requirements, System Testing
ITOP	4-2-601	Drop Tests for Munitions
ITOP	4-2-828	Ballistic Shock Testing
MIL-STD	461	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD	464	EEE Requirements for Systems
MIL-STD	648	Design Criteria for Specialized Shipping Containers
MIL-STD	810	Environmental Engineering Considerations
MIL-S	901	Shock Tests, High Impact Shipboard Machinery, Equipment, and Systems Requirements
STANAG	4239	Electrostatic Discharge Munitions Test Procedures
STANAG	4327	Lightning, Munition Assessment and Test Procedures
STANAG	4375	Safety Drop, Munition Test Procedure

We have reduced the number of documents from 86 to 12.



System Independent Tests by Test Classification

- ▶ Contamination & Corrosion - 6
- ▶ EEE - 40
- ▶ Icing - 1
- ▶ Impact - 5
- ▶ Leak (internal) - 5
- ▶ Lifting - 1
- ▶ Pressure – High - 2
- ▶ Pressure – Low - 1
- ▶ Shock - 4
- ▶ Shock – Acoustic - 2
- ▶ Shock – Mechanical - 3
- ▶ Shock – Pyro - 1
- ▶ Shock and Temperature - 2
- ▶ Shock/Vibration - 1
- ▶ Shock-Mechanical (long drop) - 6
- ▶ Shock-Mechanical (short drop) - 9
- ▶ Temperature – High - 3
- ▶ Temperature – Low - 1
- ▶ Temperature and Humidity - 1
- ▶ Temperature Shock Humidity - 1
- ▶ Tiedown - 2
- ▶ Vibration - 10

We have reduced the number of tests for analysis from 650 to 107.



Preliminary Findings

- ▶ JWSTAP members have little involvement with or knowledge of the test community
- ▶ Many active standards are not being used
 - No one that we have talked with are using AECTPs
 - Ratified STANAGs are not being used by US (e.g., STANAG 4239, Electrostatic Discharge Munitions Test Procedures)
 - There is a tendency not to use STANAGs at all
- ▶ System dependent tests are used for system independent tests
 - There is no system independent short drop tests
 - MIL-STD-464 ESD test refers to MIL-STD-331, a fuze standard



Preliminary Findings (cont'd)

▶ ESD Testing

- When testing Helicopter Borne ESD, the Navy and Army have different test procedures. The Navy tests bare systems whereas the Army tests systems in a packaged configuration.
- STANAG 4239, Electrostatic Discharge Munitions Test Procedures, is not the primary standard being used by the Services.
- The Army uses inert EEDs for testing whereas the Navy uses live EEDs for testing. The Navy will not accept the Army's test results in these cases.

▶ Other EEE Testing

- MIL-STD-461 tests are being used at the system/platform level rather than MIL-STD-464. Root issue is a standardize definition of “system.”



Preliminary Findings (cont'd)

▶ Vibration

- Some new programs develop Project Peculiar Documents (PPDs). The PPDs establish vibration requirements different from any MIL-STD or STANAG.

▶ Mechanical Drop

- There is no standard short test being used by the Services.



Conclusions

- ▶ Defined approach and methodology to conduct analysis.
- ▶ Currently interviewing Stakeholders and SMEs to validate test data and test classifications.
- ▶ Preparing for facilitated meetings with Stakeholders and SMEs to gain consensus on standard joint tests.
- ▶ On track to prepare manual and outline of final report to be presented to the JWSTAP in Nov 07.
- ▶ Phase II project is completed by Feb 2008.



BACK-UP



System Independent Tests by Test Classification Contamination & Corrosion

P	H	S	T	E	Test Name	Test Number	Doc Type	TD Number
X	X	X	X	X	Acidic Atmosphere	Method 518	MIL-STD	810
X	X	X	X	X	Contamination by Fluids	Method 504	MIL-STD	810
		X			Fungus	Method 508.5	MIL-STD	810
		X	X	X	Salt Fog	Method 509.4	MIL-STD	810
X	X	X	X	X	Salt Fog Test	5.4.1	MIL-STD	648
		X-U			Sand and Dust	Method 510.4	MIL-STD	810



System Independent Tests by Test Classification EEE

P	H	S	T	E	Test Name	Test Number	Doc Type	TD Number
				X	Conducted Emissions, Antenna Terminal 10khz to 40ghz	CE106	MIL-STD	461
				X	Conducted Emissions, Power Leads 10khz to 10mhz	CE102	MIL-STD	461
				X	Conducted Emissions, Power Leads 30hz to 10khz	CE101	MIL-STD	461
				X	Conducted Susceptibility, Antenna Port Rejection of Undesired Signals 30hz to 20ghz	CS104	MIL-STD	461
				X	Conducted Susceptibility, Antenna Port, Cross Modulation 30hz to 20ghz	CS105	MIL-STD	461
				X	Conducted Susceptibility, Antenna Port, Intermodulation 15khz to 10ghz	CS103	MIL-STD	461
				X	Conducted Susceptibility, Bulk Cable Injection 10khz to 200mhz	CS114	MIL-STD	461
				X	Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation	CS115	MIL-STD	461
				X	Conducted Susceptibility, Damped Sinusoidal Trans Cables and Power Leads, 10 kHz to 100 MHz.	CS116	MIL-STD	461
				X	Conducted Susceptibility, Power Leads 30hz to 150 kHz	CS101	MIL-STD	461
				X	Conducted Susceptibility, Structure Current	CS109	MIL-STD	461
				X	Electrical Bonding	5.1	MIL-STD	464
		X			Electromagnetic Pulse (EMP)	5.5	MIL-STD	464
X	X	X	X	X	Electromagnetic Radiation Hazards (EMRADHAZ)	5.8	MIL-STD	464
	X- MC		X- RWA	X- MC&RWA	Electrostatic Discharge (Personnel and Helicopter)	A-1	STANAG	4239



System Independent Tests by Test Classification EEE (cont'd)

P	H	S	T	E	Test Name	Test Number	Doc Type	TD Number
X	X	X	X	X	Emission Control (EMCON)	5.13	MIL-STD	464
X	X	X	X	X	EMRH	2.1	TOP	1-2-511
X	X	X	X	X	EMRO	2.2	TOP	1-2-511
	X	X	X	X	Evaluation of the Hazards Caused By Shock Excitation and Ground Voltage Transients	B-2-1	STANAG	4327
	X	X	X	X	Explosives and Fuel Hazards Assessment	B-3-1	STANAG	4327
X	X	X	X	X	External Ground	5.11	MIL-STD	464
				X	External RF EME	5.3	MIL-STD	464
	X	X	X	X	Group IV Test Methods	C-7-1	STANAG	4327
				X	Intra-System Electromagnetic Compatibility (EMC)	5.2	MIL-STD	464
	X	X	X	X	Lightning Test Method	C-1	STANAG	4327
	X	X	X	X	Lightning Test Waveforms for use with the Test Methods Given in Appendices C1-C7	B-4-1	STANAG	4327
	X	X	X	X	Methods for Detecting Sparking	C-8-1	STANAG	4327
				X	Radiated Emissions Magnetic Field	RE101	MIL-STD	461
				X	Radiated Emissions, Antenna Spurious & Harmonic	RE103	MIL-STD	461
				X	Radiated Emissions, Electric Field	RE102	MIL-STD	461
				X	Radiated Susceptibility, Electric Field	RS103	MIL-STD	461
				X	Radiated Susceptibility, Magnetic Field	RS101	MIL-STD	461
				X	Radiated Susceptibility, Transient Electromagnetic	RS105	MIL-STD	461



System Independent Tests by Test Classification EEE (cont'd)

P	H	S	T	E	Test Name	Test Number	Doc Type	TD Number
	X	X	X	X	Requirements for Energetic Material Hazard Assessment Tests-Solid Explosives	C-4-1	STANAG	4327
	X	X	X	X	Requirements for Equipment	C-3-1	STANAG	4327
	X	X	X	X	Requirements for Group II Tests on Parts of Weapon	C-2-1	STANAG	4327
	X	X	X	X	Requirements for Group II Tests on Whole Weapons	C-1-1	STANAG	4327
X	X	X	X	X	Static Electricity Hazard	2.1	TOP	1-2-511
X	X	X	X	X	Static Electricity Operational	2.2	TOP	1-2-511
				X	Subsystems and Equipment Electromagnetic Interference (EMI)	5.6	MIL-STD	464



System Independent Tests by Test Classification

Icing, Impact, Leak (internal), Lifting

P	H	S	T	E	Test Classification	Test Name	Test Number	Doc Type	TD Number
				X	Icing	Icing/Freezing Rain	Method 521.2	MIL-STD	810
			X-Rail		Impact	Impact Test (stacked)	5.2.7.1	MIL-STD	648
	X				Impact	Incline-Impact	Appendix L	MIL-STD	648
	X				Impact	Pendulum Impact Test	5.2.7	MIL-STD	648
	X		X		Impact	Rollover Test	Appendix K	MIL-STD	648
			X		Impact	Stacking Test	178.606	49 CFR	178.6
				X	Leak (internal)	Explosive Atmosphere	Method 511.4	MIL-STD	810
		X		X	Leak (internal)	Immersion	Method 512.4	MIL-STD	810
			X		Leak (internal)	Leak Proofness Test	178.604	49 CFR	178.6
	X		X		Leak (internal)	Leak Test	5.6.2	MIL-STD	648
X	X	X	X	X	Leak (internal)	Rain	Method 506.4	MIL-STD	810
	X-Forklift				Lifting	Forklift Truck (Fully Captive Fork Tine Enclosures) Compatibility Test	5.9	MIL-STD	648



System Independent Tests by Test Classification Pressure, Shock, Shock and Temp, Shock/Vibration

P	H	S	T	E	Test Classification	Test Name	Test Number	Doc Type	TD Number
			X		Pressure – High	Hydrostatic Pressure Test	178.605	49 CFR	178.6
	X				Pressure – High	Pressure test	5.5.2	MIL-STD	648
		X	X	X	Pressure – Low	Low Pressure (Altitude)	Method 500.4	MIL-STD	810
			X-ONV	X	Shock	Heavy Weight Shock	3.1.2c	MIL-S	901
			X-ONV	X	Shock	Light Weight Shock	3.1.2a	MIL-S	901
			X-ONV	X	Shock	Medium Weight Shock	3.1.2b	MIL-S	901
		X		X	Shock	Shipboard Shock Test	5.2.9	MIL-STD	648
				X	Shock – Acoustic	Acoustic Noise	Method 515.5	MIL-STD	810
				X	Shock – Acoustic	Ballistic Shock	4	ITOP	4-2-828
			X	X	Shock – Mechanical	Acceleration	Method 513.5	MIL-STD	810
			X	X	Shock – Mechanical	Ballistic Shock	Method 522	MIL-STD	810
	X		X	X	Shock – Mechanical	Shock	Method 516.5	MIL-STD	810
			X	X	Shock – Pyro	Pyroshock	Method 517	MIL-STD	810
X	X	X	X	X	Shock and Temperature	Temperature Shock	Method 503.4	MIL-STD	810
			X		Shock and Temperature	Vibro-Acoustic/Temperature	Method 523.2	MIL-STD	810
				X	Shock/Vibration	Gunfire Vibration	Method 519.5	MIL-STD	810



System Independent Tests by Test Classification

Shock-Mechanical (long and short drops)

P	H	S	T	E	Test Classification	Test Name	Test Number	Doc Type	TD Number
	X				Shock-Mechanical (long drop)	Drop	8a	STANAG	4375
	X				Shock-Mechanical (long drop)	Safety drop test	5.2.10	MIL-STD	648
	X				Shock-Mechanical (long drop)	Simulated High Velocity Parachute Drop	4.4	ITOP	4-2-601
	X				Shock-Mechanical (long drop)	Simulated Low Velocity Parachute Drop	4.3	ITOP	4-2-601
	X				Shock-Mechanical (long drop)	Twelve Meter Drop	4.1	ITOP	4-2-601
	X				Shock-Mechanical (short drop)	Cornerwise-drop (rotational) test (12-15 in drop)	5.2.4	MIL-STD	648
			X		Shock-Mechanical (short drop)	Drop Test	178.603	49 CFR	178.6
X	X	X	X	X	Shock-Mechanical (short drop)	Drop Test (free fall)	5.2.3	MIL-STD	648
X	X	X	X	X	Shock-Mechanical (short drop)	Edgewise-drop (rotational) Test	5.2.5	MIL-STD	648
	X				Shock-Mechanical (short drop)	Mechanical Handling Test	Appendix P	MIL-STD	648
	X		X		Shock-Mechanical (short drop)	Shock Test	5.10.3	MIL-STD	648
	X				Shock-Mechanical (short drop)	Three Meter Drop	4.2	ITOP	4-2-601
	X				Shock-Mechanical (short drop)	Tipover test	5.2.6	MIL-STD	648
	X-UR				Shock-Mechanical (short drop)	Transfer-at-sea Shock Test	5.2.8	MIL-STD	648



System Independent Tests by Test Classification

Temp, Temp and Humidity, Temp-Shock-Humidity, Tiedown, Vibration

P	H	S	T	E	Test Classification	Test Name	Test Number	Doc Type	TD Number
		X			Temperature – High	Fire test, external source.	5.11	MIL-STD	648
X	X	X	X	X	Temperature – High	High Temperature	Method 501.4	MIL-STD	810
		X-U			Temperature – High	Solar Radiation (Sunshine)	Method 505.4	MIL-STD	810
		X		X	Temperature – Low	Low Temperature	Method 502.4	MIL-STD	810
		X		X	Temperature and Humidity	Humidity	Method 507.4	MIL-STD	810
			X-A		Temperature Shock Humidity	Temperature, Humidity, Vibration and Altitude	Method 520.2	MIL-STD	810
			X-Road		Tiedown	Hoisting Fitting and Tiedown Attachment Points	5.8	MIL-STD	648
			X-Road		Tiedown	Tiedown Strength Test	5.8.4	MIL-STD	648
		X		X	Vibration	Endurance	5.2.1.4.6	MIL-STD	167-1
		X		X	Vibration	Endurance Test for Mast Mounted Equipment	5.1.2.4.7	MIL-STD	167-1
		X		X	Vibration	Exploratory Vibration	5.1.2.4.2	MIL-STD	167-1
X	X	X	X	X	Vibration	Random Vibration	5.3.4	MIL-STD	648
			X		Vibration	Repetitive Shock Test	5.2.2	MIL-STD	648
			X		Vibration	Repetitive Shock Test (stacked)	5.2.2.1	MIL-STD	648
		X			Vibration	Variable Frequency	5.1.2.4.3	MIL-STD	167-1
			X		Vibration	Vibration	178.608	49 CFR	178.6
	X		X		Vibration	Vibration	5.3	MIL-STD	648
X	X	X	X	X	Vibration	Vibration	Method 514.5	MIL-STD	810

