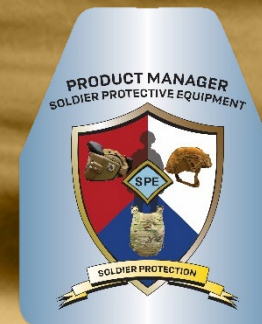




PdM SPE Body Armor Vital Torso Protection Update



**Product Manager
Soldier Protective Equipment**

**PRECISION
is the Standard**

Every Ounce Matters, Every Bullet Counts

Product Manager Soldier Protective Equipment (PdM SPE)

Joint Advanced Planning Brief to Industry *Body Armor Vital Torso Protection Update*

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CUI Category: Privacy Information
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16 November 2023



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Agenda



- **Opening Remarks**
- **Mission, Vision, and Priorities**
- **Vital Torso Protection (VTP) Purchase Description (PD) Development Overview**
- **VTP Plate Testing Overview**
- **X-Variant Discussion**

Please Note Change of Address:

Product Manager Soldier Protective Equipment (PdM SPE)

10125 Kingman Road, Bldg 317

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Mission, Vision, and Priorities



Mission

To increase Warfighter lethality, survivability, and mobility by delivering cutting edge Soldier protective equipment

Vision

To continuously optimize Soldier protective equipment based on operational threats and deliver the right equipment, to the right Soldier, at the right time

Principles

- Understand user needs
- Have a plan/roadmap
- Be responsive
- Simplicity matters
- Data supported decisions
- Fiscally Responsible

Priority 1 – People & Networks

- Build the team internally and externally
- Balance workload
- Recognize, reward, and promote
- Build predictability into the workplace
- Work across PM lines / integrate early
- Nurture stakeholder relationships

Priority 2 – Deliver Capability

- Right Soldier, right time, right place
- Support fieldings and RFI
- Maintain industrial base
- Understand supply chain risks
- Pursue flexible contract options
- Stay current on operating environment and threats

Priority 3 – Improve & Innovate

- Continuous optimization
- Transparency with roadmap
- Track Industry and S&T advancements to better manage technology transition
- Seek and incorporate User feedback
- Pursue inter-service efforts and collaboration



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Body Armor Team



Program Executive Office Soldier
peosoldier.army.mil



Product Manager Soldier Protective Equipment
Every Ounce Matters, Every Bullet Counts

APM: MAJ Pierre-Zamora



LARGE
STRIKE FACE

HANDLE WITH CARE

Ballistic Maintenance Checks and Services (BMC):
2207 plate is Conformed to the standards. If any of the following conditions are present:
- tear covers or damage exposing ceramic tile material or backing material
- tile is cracked and you hear loose pieces rattling around when shaken
- backing or covering or ceramic tile has been pulled away by hand
- excessive warping in determining backing material plate are separating
- edge of the ceramic tile is chipped or frayed as you flip the plate over 180 degrees of the plate
- tile has been hit by a bullet or fragment

Rep Procedure:
1. Call: 202-755-1234
2. Do not
3. Call: 202-755-1234
4. Call: 202-755-1234
5. Call: 202-755-1234
6. Call: 202-755-1234
7. Call: 202-755-1234
8. Call: 202-755-1234
9. Call: 202-755-1234
10. Call: 202-755-1234

STRIKE

STRIKE FACE

HANDLE WITH

HANDLE WITH CARE

CUI



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Soldier Protection System (SPS)





CUI Body Armor Torso Extremity Protection (TEP)



TEP and VTP Goals:

- Development of a light ballistic plate technology that matches or exceeds the current performance thresholds
- Establish production of hard and soft armor systems for small stature Soldiers
- Investigate improved soft armor material solutions aimed increasing mobility, flexibility and weight reduction
- Modular Scalable Vest (MSV) – Unisex**
 - System is modular enabling the operator to wear components together as a system or each component separately
 - 8 Sizes: Extra Small Short (XS-S), Extra Small (XS), Small Short (SS), Small Long (SL), Small (S), Medium (M), Large (L), Extra Large (XL)
 - Sized to fit virtually all Soldiers
 - Customizable from a concealable carrier to full Assault profile
 - Accepts soft armor and Shooter Cut ballistic plates
- Ballistic Combat Shirt (BCS)**
 - Provides ballistic fragmentation protection and flame-resistant protection to the Soldier
 - Multi-fabric design using three separate flame-resistant cloths for the main outer garment construction; one for the deltoid, yoke, and collar, and two for the sleeve components
 - There are five standard unisex and five standard female sizes (XS, SM, MED, LG, XL)
- Blast Pelvic Protector (BPP) – Unisex**
 - Six (6) core sizes (XS, SM, MD, LG, XL, XXL) available



Modular Scalable Vest (MSV)



Torso Extremity Protection (TEP)



Ballistic Combat Shirt (BCS)



Blast Pelvic Protector (BPP)

Female/Small Stature Specific Adjustments

- Female Ballistic Combat Shirt (FBCS)**
 - Five (5) sizes for female Soldiers: XS, SM, MED, LG, XL
 - Shorter arm lengths
 - Hair bun cut-out in the back of the collar
 - Flared sweep at hips and to prevent the shirt from riding up



Female Ballistic Combat Shirt (FBCS)



Modular Scalable Vest (MSV)

- Modular Scalable Vest (MSV) – Unisex**
 - Three (3) expanded sizes for female and small statured Soldiers are Small-Long, Small-Short, and X-Small-Short
 - Two (2) expanded size plate carriers (6x6, 6x8) to accommodate female and small statured Soldiers currently available



Vital Torso Protection (VTP) Plate Update



- Continued work with industry to refine the Improved Geometry (Shooter's Cut) Enhanced Small Arms Protective Insert (ESAPI)
 - Because of the success of industry and technology to meet or exceed our current threshold (7%), the Value Adjusted Total Evaluated (Unit) Price (VATEP) ceiling will increase for future fair opportunities to further incentivize weight savings.
- Fielding priority Close Combat Soldiers in accordance with HQDA
 - Plan is to transition VTP to Defense Logistics Agency (DLA) for sustainment in the next fiscal year
 - All future sustainment contracts will be modified to reflect the Shooter's Cut design
- Intent is to place X variants into a contingency stock
 - Army is reevaluating the X-Variant requirements



VTP Purchase Description (PD) Progress



Successful Director Operational Test and Evaluation (DOT&E) Touchpoint 1

- Held on 13 Oct 23
- Reviewed Sections 3 (Requirements) and 4 (Verification) of the proposed VTP PD
- Relevant action items:
 - PdM SPE will be requesting user input on operationally relevant environmental conditions for testing in PD
- Follow-on Touchpoints will review appendices and updates from due outs
- Next Touchpoint week of 13 Nov 23

Coming up:

- Meeting with Combat Capabilities Development Command (DEVCOM) to review their version of VTP PD
- JAPBI Brief/Industry Touchpoint and Release of Request for Information (RFI)
 - Pending outcome of DEVCOM meeting and implementation of DOT&E changes
- DOT&E Touchpoint 2

Ongoing:

- Non-Ballistic test procedure practice w/ ATC's non-ballistics team (bi-weekly)
- Aberdeen Test Center (ATC) review of PD
- Completed:
 - ATC touchpoint and handoff of PD draft
 - DOT&E Touchpoint 1



VTP PD Update Goals



- 1: Increase statistical significance of testing on behalf of the Soldier**
- 2: Improve operational relevancy of testing on behalf of the Soldier**
- 3: Improve alignment to directed requirements on behalf of all partners**
- 4: Improve usability on behalf of our industry partners and everyday users**



VTP PD Update Summary

CUI



- Removal of V_{50}
- New Acceptable Quality Limit (AQL)
- New fair hit criteria and velocity tolerance
- Backface Deformation (BFD) (Upper Tolerance Level (UTL) for First Article Test (FAT) and AQL for Lot Acceptance Test (LAT))
- Defect classification (Lower Confidence Level (LCL) for FAT and AQL for LAT)
- Shot patterns
- Environmental factors
- Dimensional evaluations
- Mass





Cancelled Changes



During a “3rd party” review conducted by DEVCOM of our first VTP PD draft, they reached out to their Research & Development (R&D) industry partners to share some of our initial test changes. The following changes are no longer being implemented.

- No ambient, unconditioned testing
- Combined environmental exposures





Removal of V_{50} Testing



V_{50} Ballistic Limit tests are great for measuring production variation but not necessarily for measuring armor protectiveness.

A meaningful V_{50} ...

- Must resolve to a value
- Cannot combine sizes
- Cannot combine shot locations
- Would require ~320 plates to be of high value

Current procedures do not uphold any of these requirements and, therefore, are worthless for quality control and protection verification





New Acceptable Quality Limit (AQL) – Why?



Why change the LAT AQL?

Old:

- The old PD used the following AQLs:
 - XSAPI Ballistics: no 1st shot complete system penetrations (CC) and second shot CCs held to an ANSI Z-1.4 2008 Special Inspection Level “S-4” AQL of 15%
 - ESAPI Ballistics: no 1st shot complete system penetrations (CC) and minor defects held to an ANSI Z-1.4 2008 Special Inspection Level “S-4” AQL of 10%
 - XSBI Ballistics: no 1st shot complete system penetrations (CC) and second shot CCs held to an ANSI Z-1.4 2008 Special Inspection Level “S-3” AQL of 15%
 - ESBI Ballistics: no 1st shot complete system penetrations (CC) and minor defects held to an ANSI Z-1.4 2008 Special Inspection Level “S-3” AQL of 10%
 - Non ballistics: General Inspection Level II AQL 4%

New:

- The new PD uses ANSI/ASQ Z1.4-2008 Special Inspection Level III throughout, except during ballistic testing where a more stringent sample size is used with the same accept/reject criteria.
- Reduces Government risk during small batch production
 - Maintains consistency throughout
 - Uses the longstanding office standardized defect limits by classification:
 - Maximum AQL of 4 for critical defects,
 - Maximum AQL of 10 for major defects.
 - Maximum AQL of 25 for minor defects.





Main Ballistic Matrix



Tells you how to test it

- Type, class, threat, plate sizes, shootpacks, shot locations, conditioning

Type I VTP Sizes	Pathfinder-S Shootpack			MSV B-100 Shootpack		
	Extreme Heat	Extreme Cold	Ambient after Exposure	Extreme Heat	Extreme Cold	Ambient after Exposure
XS-S	1 (CE ^[1])	1 (EC ^[2])	1 (CE) VIB ^[3] 1 (EC) F24 ^[4]	1 (EC)	1 (CE)	1 (CE) ALT 1 (EC) DUR
XS-R	1 (EC)	1 (CE)	1 (CE) ALT ^[5] 1 (EC) DUR ^[6]	1 (CE)	1 (EC)	1 (CE) F24 1 (EC) VIB
SM-S	1 (CE)	1 (EC)	1 (CE) F24 1 (EC) VIB	1 (EC)	1 (CE)	1 (CE) DUR 1 (EC) ALT
SM-R	1 (EC)	1 (CE)	1 (CE) DUR 1 (EC) ALT	1 (CE)	1 (EC)	1 (CE) DUR 1 (EC) VIB
SM-L	1 (CE)	1 (EC)	1 (CE) VIB 1 (EC) DUR	1 (EC)	1 (CE)	1 (CE) F24 1 (EC) ALT
MD-R	1 (EC)	1 (CE)	1 (CE) ALT 1 (EC) F24	2 (CE)	1 (EC)	1 (CE) VIB 1 (EC) F24
LG-R	1 (CE)	1 (EC)	1 (CE) DUR 1 (EC) VIB	1 (EC)	1 (CE)	1 (CE) ALT 1 (EC) F24
XL-R	1 (EC)	1 (CE)	1 (CE) F24 1 (EC) ALT	1 (CE)	1 (EC)	1 (CE) VIB 1 (EC) DUR

Notes: [1] Crown-Edge shot order (evenly distributed between left and right edge starting with Pattern 2: crown then right edge); [2] Edge-Crown shot order (evenly distributed between left and right edge starting with Pattern 1: left edge then crown); [3] Vibration; [4] Jet Aviation Fuel F-24 soak; [5] Altitude; and [6] Durability.

Tells you how to evaluate the results

- Type, class, threat, condition, LCL

	Factor	Shots	Accept	Reject	LCL
First Shot	All	65	3 CC 14 CP	4 CC 15 CP	90/90 70/90
	Extreme Heat	17	2 CC	3 CC	71/90
	Extreme Cold	16	2 CC	3 CC	70/90
	All Exposures	32	2 CC	3 CC	84/90
	Size	8	1 CC	2 CC	59/90
	Pathfinder-S	32	2 CC	3 CC	84/90
	MSV B-100	33	2 CC	3 CC	84/90
	Edge	33	2 CC	3 CC	84/90
	Crown	32	2 CC	3 CC	84/90
	Each Exposure	8	1 CC	2 CC	59/90
Second Shot	All	65	14 CC	15 CC	70/90
	Extreme Heat	17	5 CC	6 CC	58/90
	Extreme Cold	16	5 CC	6 CC	56/90
	All Exposures	32	10 CC	11 CC	59/90
	Size	8	2 CC	3 CC	46/90
	Pathfinder-S	32	10 CC	11 CC	59/90
	MSV B-100	33	10 CC	11 CC	60/90
	Edge	33	10 CC	11 CC	60/90
	Crown	32	10 CC	11 CC	59/90
	Each Exposure	8	2 CC	3 CC	46/90





Ballistic Test Operating Procedures (TOP)



OLD

Reference velocity tolerance: +50 ft/s -0ft/s
Fair hit criteria:

Table C-6: Fair Hit/No Test Criteria for Velocity Anomalies FAT Part B

Impact Velocity	Test Result		Evaluator Accepts or Rejects for Inclusion in Analysis		Proceed to next data point for that plate?
	Penetration	BFD	Penetration	BFD	
Acceptable	No Penetration (PP and CP)	Measured	Include as success	Include	Yes
Acceptable	Complete System Penetration (CC)	Not measured	Include as failure	Not measured	Yes
Too High	No Penetration (PP and CP)	Measured	Not included	Not included	No
Too High	Complete System Penetration (CC)	Not Measured	Not included	Not included	No
Too Low	No Penetration (PP and CP)	Measured	Not included	Not included if $\leq 58.0\text{mm}$ Included if $> 58.0\text{mm}$	No
Too Low	Complete System Penetration (CC)	Not measured	Include as failure	Not measured	No

NEW

Reference velocity tolerance: Higher value of ± 30 ft/s or $\pm 1.25\%$

Fair hit criteria:

- Use fair velocity impacts to calculate first shot Backface Deformation (BFD) UTL
- Use both first and second shot fair velocity impacts to calculate second shot BFD UTL
- When a contingency sample is used to get another shot 2 value and the first shot 1 is valid, the second shot 1 does not count for record. This follows the principle of the first valid data is what counts. In accordance with PdM SPE policy, test variance shall not cause a circumstance to expose a vendor to additional or less risk through testing them until they fail or pass.

TABLE IX: Fair Hit Criteria Resolution Matrix.

Shot	Velocity	Defect	Shot 1								
			Over			Fair			Under		
			Critical	Minor	None	Critical	Minor	None	Critical	Minor	None
Shot 2	Over	Yes	Black	Black	Grey	Yellow	Yellow	Yellow	Yellow	Grey	Black
		None	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Fair	Yes	Green	Green	Green	Green	Green	Green	Green	Green	Green
		None	Green	Green	Green	Green	Green	Green	Green	Green	Green
	Under	Yes	Green	Green	Green	Green	Green	Green	Green	Green	Green
		None	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

Legend

Black	Shot 1 is invalid. Do not take shot 2. Re-test a new plate.
Green	Both shots are valid.
Yellow	Shot 1 is valid and shot 2 is invalid. Keep initial test shot 1 result and exclude shot 2 result. Re-test and only keep the re-test shot 2 result.
Grey	Shot 1 is valid. Do not take shot 2. Keep initial test shot 1 result. Re-test and only keep the re-test shot 2 result.





Backface Deformation (BFD) FAT



OLD

- BFD measured on all shots during FAT Part A
- Various threats

Acceptance Criteria: Pass/fail

- **FAT:**
 - Part A acceptance based off minor and critical defect quantities across multiple threats. Other portions use a 90/90 UTL on first shot and 80/90 UTL on second
 - ≥ 62.0 mm = critical ; ≥ 58.0 mm = minor
 - Part B acceptance based off a 90/90 UTL on first shot and 80/90 UTL on second

NEW

- Against primary threat of interest for the plate variant
- UTL must be less than 58.0 mm

Acceptance criteria:

- **FAT:** Pass/fail for meeting a 58.0 mm BFD UTL

TABLE V: Backface Deformation UTL Requirements [DR-042].

Plate	Threat	Shot Sequence #	58.0 mm BFD UTL (90% Confidence)
Type I Class I (ESAPI)	Primary Threat	1	90%
		2	80%
Type II Class I (ESBI)	Primary Threat	1	90%
Type I Class II (XSAPI)	Primary Threat 1	1	90%
		2	80%
	Primary Threat 2	1	90%
		2	80%
Type II Class II (XSBI)	Primary Threat 1	1	90%
	Primary Threat 2	1	90%



Backface Deformation (BFD)



OLD

TOP 10-2-210B

- BFD measured on all shots during LAT

Acceptance Criteria: Pass/fail

- **LAT:** 80/90 UTL on first shot and 70/90 UTL on second

NEW

TOP 10-2-210C

- Against primary threat of interest for the plate variant

Acceptance criteria:

- **LAT:** evaluated using AQLs

TABLE XLII: LAT BFD Acceptance Criteria.

Lot Size	Samples	Shot 1 > 58.0 mm		Shot 1 > 54.0 mm and ≤ 58.0 mm		Shot 1 > 50.0 mm and ≤ 54.0 mm	
		Shot 2 > 62.0 mm		Shot 2 > 58.0 mm and ≤ 62.0 mm		Shot 2 > 54.0 mm and ≤ 58.0 mm	
		(AQL 4)		(AQL 15)		(AQL 25)	
		Ac	Re	Ac	Re	Ac	Re
91 - 150	8	0	1	3	4	5	6
151 - 500	13	1	2	5	6	7	8
501- 1200	20	2	3	7	8	10	11
1201 - 3200	32	3	4	10	11	14	15



Defect Classifications - FAT



OLD

Ballistic penetration protection (CC, CP, PP):

- Minor vs critical based off threat, type of penetration, and BFD results.
- ESAPI FAT Part A: Reject on 17 minors, 1 critical
- ESBI FAT: Minor defect reject rate varies per threat

Non-ballistic protection:

- ESAPI & ESBI FAT: reject on 1 critical, minor defect reject rate uses General Inspection Level II AQL 4%

NEW

Ballistic penetration protection (CC, CP, PP):

- Not defined in terms of “defects”
- Acceptance using LCL

Non-ballistic protection:

- Acceptance criteria uses LCLs shown below

TABLE VI: Combined Defect FAT Acceptance Criteria.

VTP	FAT Samples	Critical 95/90 LCL		Major 90/90 LCL		Minor 75/90 LCL	
		Accept	Reject	Accept	Reject	Accept	Reject
Class I, Type I (ESAPI)	129	2	3	8	9	25	26
Class I, Type II (XSAPI)	178	4	5	12	13	36	37
Class II, Type I (ESBI)	110	2	3	6	7	21	22
Class II, Type II (XSBI)	169	4	5	11	12	34	35

- Workmanship defect classifications are largely unchanged.
- Drawing compliance expanded to minor, major, critical
- Fungus resistance expanded to minor, major, critical
- Magnetic influence expanded to major and critical
- Flammability expanded to minor, major, critical
- Spall penetration included as a minor (under discussion)



Defect Classifications – LAT



OLD

Ballistic penetration protection:

- Minor vs critical based off threat, type of penetration, and BFD results.
- ESAPI ballistic acceptance criteria:

Table C-9: Penetration Allowances Overall

Lot size	ANSI/ASQ Z1.4 Code Letter	Sample Size	First Shot System Complete Penetration		Second Shot System Complete Penetration	
			Accept	Reject	Accept	Reject
91 - 150	D	8	0	1	2	3
151- 500	E	13	0	1	3	4
501-1200	F	20	0	1	5	6
1201 - 3200	G	32	0	1	7	8

- ESBI ballistic acceptance criteria:

Table E-5: ESBI LAT Testing Protocol

Lot size	ANSI/ASQ Z1.4 Code Letter	Sample Size	Contingencies	Total ESBI Plates Required	LAT Minor Defect Reject Value
≤ 150	C	5	2	7	2
151 - 500	D	8	3	11	3
501 - 3200	E	13	5	18	4

Non-ballistic protection:

- Reject on 1 critical, minors use General Inspection Level II AQL 4.0

NEW

Ballistic penetration protection (CC, CP, PP):

- Acceptance using AQL

Lot Size	Samples	First Shot CC (AQL 4)		Second Shot CC (AQL 15)		First Shot CP (AQL 15)	
		Ac	Re	Ac	Re	Ac	Re
91 - 150	8	0	1	3	4	3	4
151 - 500	13	1	2	5	6	5	6
501- 1200	20	2	3	7	8	7	8
1201 - 3200	32	3	4	10	11	10	11

Notes: [1] This sampling method is more stringent than the minimum required by 3.1.2.1. Per ANSI/ASQ Z1.4-2003 (R2018), the sample size is three with an accept value of zero noted defects and a reject value of one noted defect when using Special Inspection Level III and an AQL of 4.0. This more stringent sampling method of eight with the same accept and reject criteria is selected on purpose to further reduce Government risk during small batch production.

Non-ballistic protection:

- Acceptance criteria uses Special Inspection Level III AQL

TABLE VIII: Minimum Combined LAT Sampling and Acceptance Criteria.

Lot Size	ANSI/ASQ Z1.4 Code	Critical AQL 4			Major AQL 10			Minor AQL 25		
		Samples ¹	Ac	Re	Samples	Ac	Re	Samples	Ac	Re
91 - 150	C	3	0	1	5	1	2	5	3	4
151 - 500	D	13	1	2	8	2	3	8	5	6
501 - 3200	E	13	1	2	13	3	4	13	7	8



Shot Patterns – Type I (Torso)



OLD

Crown-Edge

- Government reference 3rd shot (Part A)
- Durability/impacted plates shot at crack

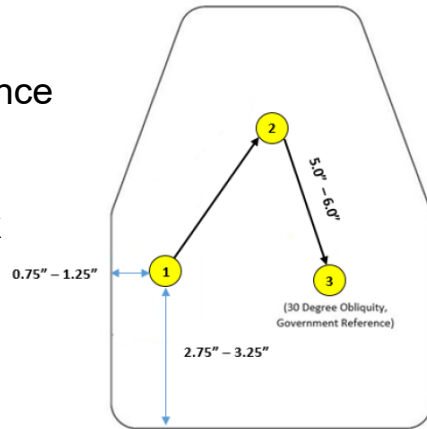
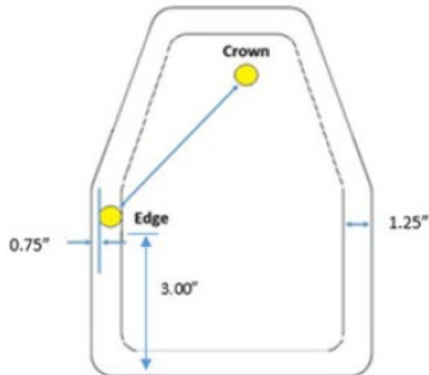
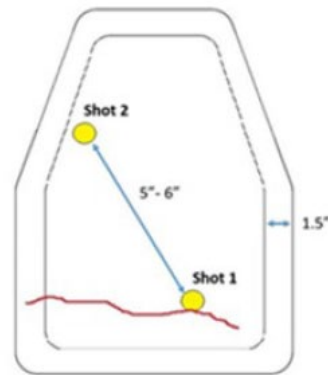


FIGURE C-1: General ESAPI FAT Part A shot pattern



Shot Locations for Most Plates



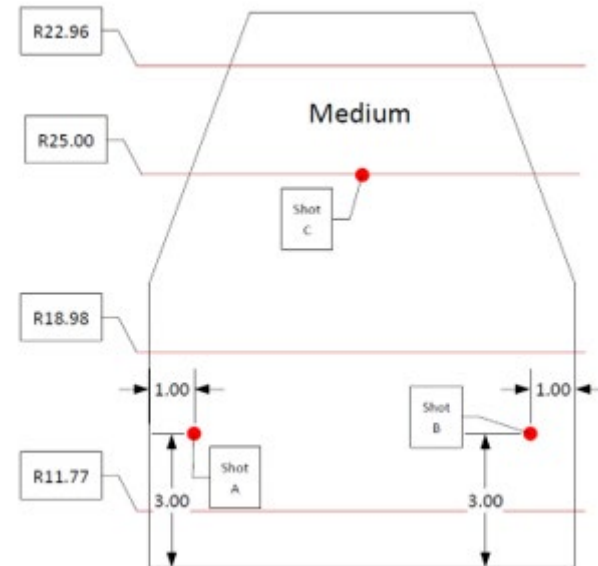
Example of Shot Locations for Impact-Conditioned Plates if a Crack is Observed

FIGURE C-2: Shot locations on ESAPI plates for FAT Part B

NEW

Crown-Edge – against primary threat of interest for the plate variant

- No 3rd shot (no Government reference)
- Durability/impacted plates NOT shot at crack. Will be shot wherever they fall per the 4 patterns
- Added verbiage to ensure equal distribution between left and right edge





New Shot Patterns



Example of primary threat matrix

Type I VTP Sizes	Pathfinder-S Shootpack			MSV B-100 Shootpack		
	Extreme Heat	Extreme Cold	Ambient after Exposure	Extreme Heat	Extreme Cold	Ambient after Exposure
XS-S	1 (CE ^[1])	1 (EC ^[2])	1 (CE) VIB ^[3] 1 (EC) F24 ^[4]	1 (EC)	1 (CE)	1 (CE) ALT 1 (EC) DUR
XS-R	1 (EC)	1 (CE)	1 (CE) ALT ^[5] 1 (EC) DUR ^[6]	1 (CE)	1 (EC)	1 (CE) F24 1 (EC) VIB
SM-S	1 (CE)	1 (EC)	1 (CE) F24 1 (EC) VIB	1 (EC)	1 (CE)	1 (CE) DUR 1 (EC) ALT
SM-R	1 (EC)	1 (CE)	1 (CE) DUR 1 (EC) ALT	1 (CE)	1 (EC)	1 (CE) DUR 1 (EC) VIB
SM-L	1 (CE)	1 (EC)	1 (CE) VIB 1 (EC) DUR	1 (EC)	1 (CE)	1 (CE) F24 1 (EC) ALT
MD-R	1 (EC)	1 (CE)	1 (CE) ALT 1 (EC) F24	2 (CE)	1 (EC)	1 (CE) VIB 1 (EC) F24
LG-R	1 (CE)	1 (EC)	1 (CE) DUR 1 (EC) VIB	1 (EC)	1 (CE)	1 (CE) ALT 1 (EC) F24
XL-R	1 (EC)	1 (CE)	1 (CE) F24 1 (EC) ALT	1 (CE)	1 (EC)	1 (CE) VIB 1 (EC) DUR

Notes: [1] Crown-Edge shot order (evenly distributed between left and right edge starting with Pattern 2: crown then right edge); [2] Edge-Crown shot order (evenly distributed between left and right edge starting with Pattern 1: left edge then crown); [3] Vibration; [4] Jet Aviation Fuel F-24 soak; [5] Altitude; and [6] Durability.



New Shot Pattern – Type I (Torso)



Second shot pattern is done against the non-primary threats under extreme heat, cold, and saltwater.

Utilizes 2 concepts:

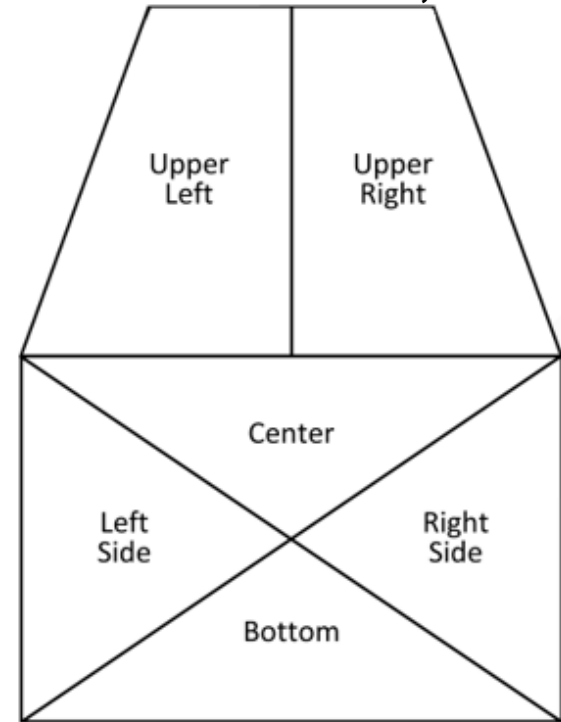
- 1. Interrogate entire allowable surface
- 2. Random Shot Pattern Generator

Original Proposed Idea: Envelope shot pattern - cancelled

- Edge spacing doesn't change

Type I VTP Sizes	Environmental Conditions		
	Extreme Heat	Extreme Cold	Salt Water
XS-S	<i>One sample for each pairwise size and environmental condition. Randomized shot locations using envelop pattern following specified constraints. See example to right. →</i>		
XS-R			
SM-S			
SM-R			
SM-L			
MD-R			
LG-R			
XL-R			

<i>example shot locations using randomization constraints</i>		
Center	Side Left	Bottom
Side Right	Bottom	Upper Right
Bottom	Upper Right	Center
Upper Right	Center	Side Right
Center	Side Right	Bottom
Side Left	Bottom	Upper Left
Bottom	Upper Left	Center
Upper Left	Center	Side Left



FAQ: What if Vendor 1 and Vendor 2 have two different FAT shot patterns? Doesn't this open the door for protests?

- No, the shot patterns are in the contract.
- HOWEVER, we agree it would be less optimal and not necessary. PdM SPE and Aberdeen Test Center (ATC) will work procedures to include the following: For any set group of contracts, ATC will run the generators once and apply the result to all vendors for FAT 1. If any Vendor has a FAT 2, ATC will run the generators again and apply the result to all vendors for FAT 2 (for if or when other submit second FATs) and so forth.



New Shot Patterns – Type II (Side)

OLD

- Alternate between pattern A and pattern B
- One edge shot, opposite non-edge shot

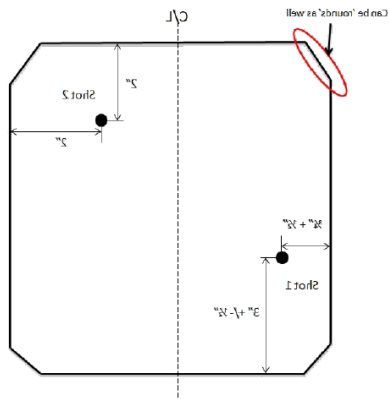


FIGURE E-1: Shot pattern "A" (not to scale)

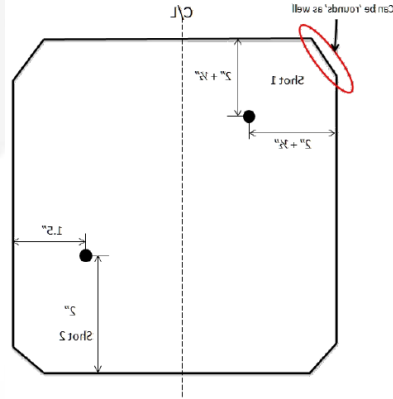


FIGURE E-2: Shot pattern "B" (not to scale)

NEW

Corner, edge, middle

- Primary threat of interest:
 - Shot locations assigned in table
- Non-primary threats
 - Shot locations assigned using random shot generators

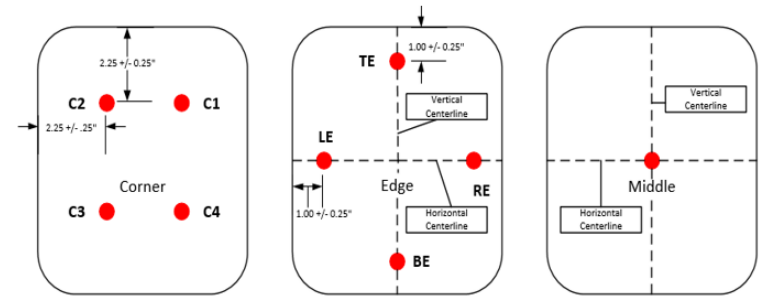


FIGURE VII - Type II, Class I VTP shot Locations.

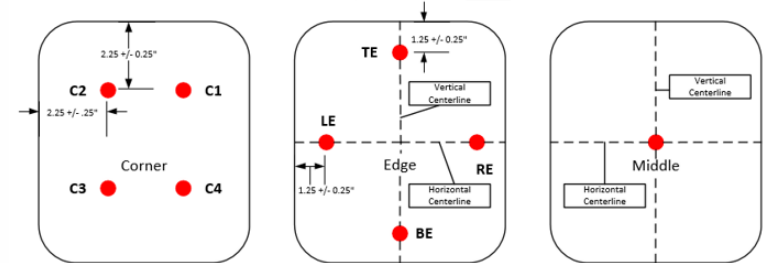


FIGURE VIII - Type II, Class II VTP shot locations.



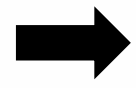
New Shot Patterns – Type II (Side)

Type II VTP Sizes	Pathfinder-S Shoot Pack			MSV B-100 Shoot Pack		
	Extreme Heat	Extreme Cold	Ambient after Exposure	Extreme Heat	Extreme Cold	Ambient after Exposure
SM	1 (C1) ^[1] 1 (TE) ^[2]	1 (C2) 1 (LE) 1 (BE)	1 (C3) VIB ^[3] 1 (RE) VIB 1 (TE) F24 ^[4] 1 (C4) ALT ^[5] 1 (LE) DUR ^[6]	1 (C4) 1 (BE) 1 (RE)	1 (C3) 1 (C2) 1 (TE)	1 (LE) VIB 1 (C1) F24 1 (BE) F24 1 (RE) ALT 1 (C4) DUR
MD	1 (C3) 1 (C2) 1 (TE)	1 (C1) 1 (LE)	1 (BE) VIB 1 (C4) F24 1 (RE) F24 1 (C3) ALT 1 (TE) ALT 1 (C2) DUR	1 (C1) 1 (C4) 1 (LE)	1 (C3) 1 (BE) 1 (RE)	1 (C2) VIB 1 (C1) F24 1 (TE) ALT 1 (C4) DUR 1 (LE) DUR
LG	1 (C3) 1 (BE) 1 (RE)	1 (C2) 1 (C1) 1 (TE)	1 (C4) VIB 1 (LE) F24 1 (C3) ALT 1 (C2) DUR 1 (BE) DUR	1 (C1) 1 (RE)	1 (C4) 1 (C3) 1 (TE)	1 (C2) VIB 1 (LE) VIB 1 (C1) F24 1 (C4) ALT 1 (BE) ALT 1 (RE) DUR

← Example of primary threat matrix

Notes: [1] C1 = Upper Right Corner, C2 = Upper Left Corner, C3 = Lower Left Corner, C4 = Lower Right Corner; [2] TE = Top Edge, LE = Left Edge, BE = Bottom Edge, RE = Right Edge; [3] Vibration; [4] Jet Aviation Fuel F-24 soak; [5] Altitude; and [6] Durability.

Example of non-primary threat matrix with random shot generator



Type II VTP Sizes	Environmental Conditions		
	Extreme Heat	Extreme Cold	Salt Water
SM	Randomized shot locations and condition pairings following specified constraints. See example to right. →		
MD			
LG			

example shot locations using randomization constraints		
1 (M)	1 (C1)	1 (M)
1 (RE)		1 (LE)
1 (TE)	1 (M)	1 (M)
	1 (C2)	
1 (C3)	1 (BE)	1 (C4)



Environmental Conditioning

Probability of No Penetration Requirements.

Plate	Threat	Shot Sequence #	Total # of Shots	System P(nCC) LCL (90% Confidence)	P(nCP) LCL (90% Confidence)
Type I Class I (ESAPI)	Other threat	1	12 Max	75%	50%
		2	12 Max	60%	40%
	Other threat	1	22 Min	90%	60%
	Primary threat	1	65 Min	90%	70%
		2	65 Min	70%	N/A
	Other threat	1	12 Max	75%	60%
2		12 Max	60%	40%	
Type II Class I (ESBI)	Other threat	1	12 Max	75%	50%
	Other threat	1	22 Min	90%	60%
	Primary threat	1	65 Min	90%	70%
	Other threat	1	12 Max	75%	50%

Type I, Class I (ESAPI) Primary Threat FAT acceptance criteria.

	Factor	Shots	Accept	Reject	LCL
First Shot	All	65	3 CC	4 CC	90/90
			14 CP	15 CP	70/90
	Extreme Heat	17	2 CC	3 CC	71/90
	Extreme Cold	16	2 CC	3 CC	70/90
	All Exposures	32	2 CC	3 CC	84/90
	Size	8	1 CC	2 CC	59/90
	Pathfinder-S	32	2 CC	3 CC	84/90
	MSV B-100	33	2 CC	3 CC	84/90
	Edge	33	2 CC	3 CC	84/90
	Crown	32	2 CC	3 CC	84/90
Each Exposure	8	1 CC	2 CC	59/90	
Second Shot	All	65	14 CC	15 CC	70/90
			5 CC	6 CC	58/90
	Extreme Heat	17	5 CC	6 CC	56/90
	Extreme Cold	16	5 CC	6 CC	56/90
	All Exposures	32	10 CC	11 CC	59/90
	Size	8	2 CC	3 CC	46/90
	Pathfinder-S	32	10 CC	11 CC	59/90
	MSV B-100	33	10 CC	11 CC	60/90
	Edge	33	10 CC	11 CC	60/90
	Crown	32	10 CC	11 CC	59/90
Each Exposure	8	2 CC	3 CC	46/90	





Environmental Conditioning



- Petroleum, Oils, and Lubricants (POL) and DEET resistance
 - F-24 soaks
 - Oil (Certificate of Compliance (CoC))
 - DEET (CoC)
- Saltwater
- Altitude
- Temperature shock
- Vibration
- Durability
- Extreme Cold
- Extreme Heat
- Weathering resistance
- Sand and rain resistance (NEW)

We are currently investigating which conditions will be included. Hypothesizing including 4-6 of the above, rather than all of them. The remaining conditions may require a CoC. PdM SPE will be collecting input from users on environmental conditions of most concern.





DEET, Oil, and F-24 (Jet Aviation Fuel)



OLD

F-24 (Jet Aviation Fuel): Immersion for 2 hours
DEET and Oil: Immersion for 2 hours

Plate Count

Test	DEET		Oil		F-24		Total
	A	B	A	B	A	B	
Part							
ESAPI FAT	1	0	1	8	1	8	19
ESBI FAT	1	0	2	0	2	0	5

Acceptance Criteria:

- Part A acceptance based off minor and critical defect quantities across multiple threats. Other portions use a 90/90 P(nP) LCL
- Part B acceptance based off V0 LCL

NEW

F-24 (Jet Aviation Fuel): Immersion for 5-10 min
DEET and Oil: CoC evaluation

Plate Count

Test	F-24		Total
ESAPI FAT	8		8
ESBI FAT	8		8

Acceptance Criteria

Test	Shots		Accept	Reject	LCL
ESAPI FAT	First shot	8	1 CC	2 CC	59/90
	Second shot	8	2 CC	3 CC	46/90
ESBI FAT	First shot	8	1 CC	2 CC	59/90



Thickness



OLD

Thickness variation

Requirement:

- Cannot exceed 1 in
- Difference between any thickness measurement cannot exceed 0.130 in

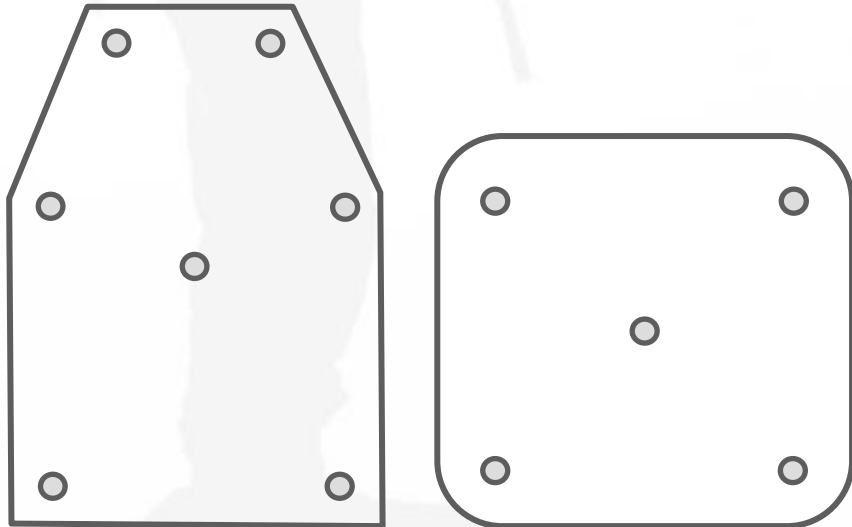
Acceptance Criteria:

- Thickness out of tolerance – **critical defect**

Edge material thickness

Requirement: none

Acceptance Criteria: none



NEW

Thickness Variation

Requirement:

- Limit the range of thickness to no more than 15% of the average thickness (per plate)
- No change to measurement locations

Acceptance Criteria

- Each measurement beyond the range = **1 Major defect**
- Evaluated using defect table

Edge material thickness

Requirement:

- Limit the thickness to no more than 0.1 in
- FAT: Measure 12 samples of edge material of 6 in or more
- LAT: CoCs showing in process inspections sufficient to affirm compliance

Acceptance Criteria:

- Pass/fail



Critical Width and Height



OLD

Requirement:

- Cannot exceed specifications in drawings

Acceptance Criteria:

- Under tolerance – **critical defect**
- Over tolerance – **minor defect**

NEW

Requirement:

- No more than the maximum allowable (width or height) per the drawing
- No change to measurement locations

Acceptance Criteria:

- 90/90 UTL for FAT (pass/fail)
- 80/90 UTL for LAT (pass/fail)





OLD

Requirement:

- Not defined for torso plates

Acceptance Criteria:

- Over threshold – **critical defect**

NEW

Requirement:

- New thresholds: 7% (T) & 30% (O) lighter than legacy (using mass, not Areal Density (AD))

Acceptance Criteria

- FAT& LAT: pass/fail

TABLE II: VTP Mass Threshold and Objectives.

HAPI	Size	Threshold Mass (lb)	Objective Mass (lb)
Type I, Class I ESAPI	Extra-Small Short (XS-S)	3.14	2.37
	Extra-Small Regular (XS-R)	3.39	2.55
	Small Short (SM-S)	3.54	2.67
	Small Regular (SM-R)	4.17	3.14
	Small Long (SM-L)	4.32	3.26
	Medium Regular (MD-R)	4.77	3.59
	Large Regular (LG-R)	5.45	4.11
	Extra-Large Regular (XL-R)	6.18	4.65
Type II, Class II ESBI	Small (SM)	1.52	1.15
	Medium (MD)	2.03	1.53
	Large (LG)	2.37	1.79
Type I, Class II XSAPI	Extra-Small Short (XS-S)	3.45	2.60
	Extra-Small Regular (XS-R)	3.73	2.81
	Small Short (SM-S)	3.89	2.93
	Small Regular (SM-R)	4.59	3.46
	Small Long (SM-L)	4.75	3.58
	Medium Regular (MD-R)	5.25	3.96
	Large Regular (LG-R)	6.00	4.52
	Extra-Large Regular (XL-R)	6.79	5.12
Type II, Class II XSBI	Small (SM)	1.79	1.35
	Medium (MD)	2.39	1.80
	Large (LG)	2.79	2.10





Internal Workmanship



OLD

Acceptance Criteria:

- Minors and criticals use general inspection level II AQL 4.0

Defect	Critical	Minor	Anomaly (no defect)
Ceramic component			
Any crack	1		
Defects greater than 2.50 inches in length.	2**	101**	X**
Defects greater than 0.75 inch in length, but less than or equal to 2.50 in length		102	
Defects less than or equal to 0.75 inch in length			201
Defects greater than 0.0625 inches in width	3**	103**	X**
Defects greater than 0.030 inches in width, but less than or equal to 0.0625 inches in width		104	
Defects less than or equal to 0.030 inches in width			202
Defects greater than 0.0625 inches in depth	4		
Defects greater than 0.030 inches in depth, but less than or equal to 0.0625 inches in depth		105	
Defects less than or equal to 0.030 inches in depth			203
All components contained within the plate covering			
More than 10 delamination's, voids, or under adhered areas, in any combination, between components greater than .030 inches but less than or equal to 0.180 inches in any dimension	5		
Any delamination, void, or under adhered areas between components greater than .180 inches in any dimension	6		
Any delamination, void, or under adhered areas between components greater than .030 inches but less than or equal to 0.180 inches in any dimension		106	
Any delamination, void, or under adhered areas between components less than or equal to .030 inches in all dimensions			204
Foreign Object Debris			
Any item larger than 0.0625 inches in any dimension	7		
Any item greater than 0.030 inches and less than or equal to 0.0625 inches in any dimension		107	
Any item less than or equal to 0.030 inches in all dimensions			205
Four (4) or more shot peen media per insert		108	
Three (3) or less shot peen media per insert			206

NEW

TABLE IV: Internal Workmanship Defect Classifications.

Defect Type	Reference	Classification		
		Critical	Major	Minor
Cracks	3.3.3.1	Any		
Anomaly Depth (Main) [1]	3.3.3.2 (a)	≥ 0.063 inches	≥ 0.030 inches and < 0.063 inches	< 0.030 inches
Anomaly Depth (Edge) [2]		≥ 0.125 inches	≥ 0.030 inches and < 0.125 inches	
Anomaly Length	3.3.3.2 (b)	≥ 2.500 inches	≥ 0.750 inches and < 2.500 inches	< 0.750 inches
Anomaly Width	3.3.3.2 (c)	≥ 0.063 inches	≥ 0.030 inches and < 0.063 inches	< 0.030 inches
Delamination	3.3.3.3	Largest Dimension ≥ 0.180 inches	Largest Dimension ≥ 0.030 inches and < 0.180 inches	Largest Dimension < 0.030 inches
Voids	3.3.3.4			
Under-adhered Areas	3.3.3.5			
Foreign Object Debris	3.3.3.6	≥ 0.063 inches	≥ 0.030 inches and < 0.063 inches	< 0.030 inches
Shot Peen Media	3.3.3.7			Any

Notes: [1] Main is the area of the plate required to meet all ballistic requirements as described by 3.2.3.1 for Class I VTP and 3.2.3.2 for Class II VTP. [2] Edge is the edge region excluded from ballistic impact by 3.2.3.1 for Class I VTP and 3.2.3.2 for Class II VTP.



External Workmanship



OLD

Visual and x-ray inspection

<i>Finished End Item</i>			
Ease of insertion	8		
Weight above threshold	9		
Thickness out of tolerance	10		
Torque Test* (X-Ray and CT scan verification required)	11		
Orientation markings	12		
Performance markings	13		
Complete insert markings	14		
Unique Identification Label (UID)	15		
Magnetic influence	16		
Dimensional non-conformance for under length or width	17		
Dimensional non-conformance for over length or width		109	
Dimensional non-conformance for parallelism, perpendicularity, chamfers, and radii		110	
Any visible cut, hole, tear, or abraded area, peel, any mend, or patch greater than 0.030 inches in any dimension	18		
Shaded parts, shade bar, spots, or stains		111	
Any bubble or wrinkle greater than 0.5 inches in any dimension		112	
Any bubble or wrinkle less than or equal to 0.5 inches in any dimension			207

NEW

Visually examine all test samples

- Second visual external examination after Temperature Cycle followed by Weathering Conditioning (TCW) environmental conditioning and durability

TABLE III: External Workmanship Defect Classifications.

Defect Type	Reference	Classification		
		Critical	Major	Minor
Scaling	3.3.2.1		Any	
Burrs	3.3.2.2			
Frayed Edges	3.3.2.3			
Tears	3.3.2.4	Largest Dimension ≥ 0.500 inches	Largest Dimension ≥ 0.130 inches but < 0.500 inches	Largest Dimension < 0.130 inches
Holes	3.3.2.5			
Cuts	3.3.2.6			
Abraded Areas	3.3.2.7			
Peel and Under Adherence	3.3.2.8			
Mend	3.3.2.9	Any		
Patch	3.3.2.10			
Bubbles	3.3.2.11		Largest Dimension ≥ 0.500 inches	Largest Dimension < 0.500 inches
Wrinkles	3.3.2.12			
Excess Bonding Agent	3.3.2.13			
Visible Discoloration (not to include seams)	3.3.2.14			Any
Lack of Coverage	3.3.2.15			Any not otherwise noted in a defect above





OLD

- Visual inspection

Acceptance Criteria:

- Shade bar, shaded parts, spots, stains – **minor defect**

NEW

- Confirm CoC
- Visually match shade of 10% of all submitted samples
- Under artificial daylight and incandescent lamplight

Acceptance criteria:

- Any sample noted as not a good match – **minor defect**
- Evaluated using defect table





Fungus Resistance



OLD

MIL-STD-810 Test Method 508.8

- $\geq 80\%$ synthetic materials with proven natural fungal resistance, no test
- $<80\%$, test
 - Place sample of each material in test chamber for 28 days
 - Evaluate fungal growth

Acceptance Criteria:

- \leq grade of 3 = pass
- $>$ grade of 3 = fail

NEW

MIL-STD-810 Test Method 508.8

- $\geq 90\%$ synthetic materials with proven natural fungal resistance, no test
- $<90\%$, test 8 end item samples (same samples as durability)

Acceptance criteria:

- Growth rating of **1** = **minor defect**
- Growth rating of 2 or 3 = **major defect**
- Growth rating of 4 = **critical defect**





Magnetic Influence



OLD

- Test with magnetic and lensatic compasses

Acceptance Criteria: Pass/fail

- Needle deviates = **critical defect**

NEW

4.4.1.8 of MIL-PRF-10436N

- Random 10% of all FAT samples
- See PD for more info

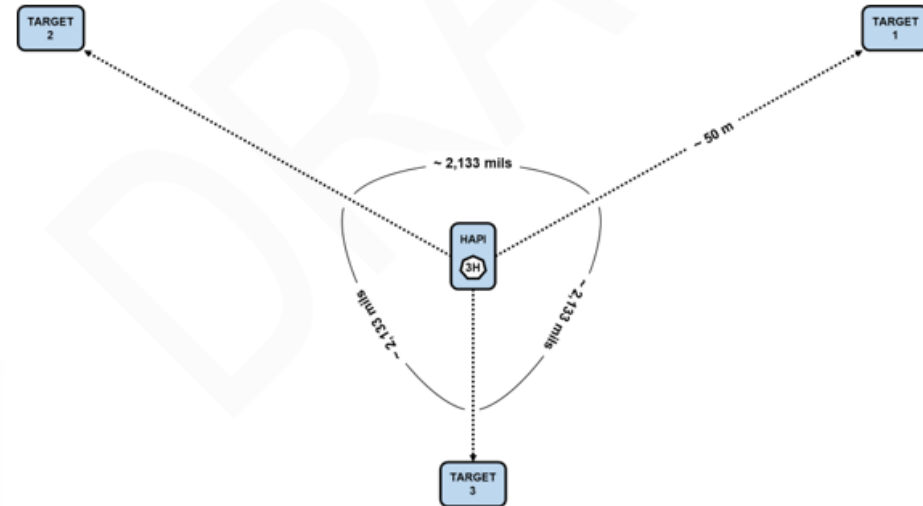


FIGURE XIV – Magnetic influence test set up.

Acceptance criteria:

- Each compass error > 40 mils = **major defect**
- All three targets record a compass error > 40 mils = **critical defect**





Non-hazardous and Neutrally Reactive



OLD

- Confirm Hard Armor Plate Insert (HAPI) design material is non-hazardous

Acceptance Criteria: Pass/fail

NEW

- Confirm HAPI design package is non-hazardous
- Test 20 samples for effective radiation dose
 - Contact for 25 hours
 - Findings greater than 50 mrem fail

Acceptance criteria:

- Pass/fail





Flammability



OLD

Flammability (FAT & LAT): observe during all ballistic testing

Elevated temperature flammability (FAT) : 250 °F for 10 min

Acceptance Criteria: Pass/fail for combustion, explosion, dripping, or melting

NEW

Ballistic flammability (FAT & LAT): Observe during all resistance to penetration testing

Elevated temperature flammability (FAT)

- After ballistic testing
- Take all extreme heat samples
- Subject to 260°F for 11 min

Acceptance criteria:

- Melting = **minor defect**
- Dripping = **major defect**
- Combustion = **critical defect**
- Explosion = **critical defect**
- Evaluated using defect table

PdM SPE is re-evaluating this aspect. We trialed the test after ballistic testing and it is clunky. We are thinking about moving this test before Extreme Heat (same samples), then return to ambient and then do the Extreme Heat soak and ballistics.





NDTE Interference



OLD

- Loose verbiage
 - Areal Density section states “material shall not cause interference with Non-Destructive Test Equipment (NDTE)”
 - ESBI FAT requires 3 samples for NDTE

Acceptance Criteria: Pass/fail

NEW

- Automated Inspection System (AIS) User Manual 8.2 (2 Jun 16)
 - Test all samples
- Acceptance criteria:
 - Qualitative evaluation of NDTE compatibility
 - Fully compatible - pass
 - Partially compatible - pass
 - Indeterminate compatibility - pass
 - Partially interfering - fail
 - Fully interfering - fail





Spall Protection



OLD

- Box configuration of aluminum alloy witness sheets
- Acceptance criteria:
 - Perforations counted as government reference

NEW

- TOP 10-2-210C, section 4.6
- Each sample with observed spall = **1 minor defect**
- Acceptance Criteria
- Evaluated using defect table





Other Changes (1 of 2)



- ❑ Added Table of Contents.
- ❑ Lined up Sections 3 and 4 such that nearly all have an exact analog in numeric order (e.g., 3.3.4 Durability corresponds with 4.3.4 Durability).
- ❑ Added paragraph hyperlinks from table of contents to all paragraphs, back and forth between Section 3 to all relevant Section 4, and on all pages to return to contents.
- ❑ Standardizes Appendices: A = FAT Grading and Scoring, B = LAT Grading and Scoring, C = Changes and Modifications, D = PdM, E = Threat Codes, F = Alternative Sampling Strategies. Anything after F is fair game to be PD specific. Removed exclusion for no metallic components



Other Changes (2 of 2)



- Added Types and Classes (similar to helmet PDs). This provides another tool for describing the VTP and for logistically managing it.
- Changed XSAPI acronym to improve overall security and support changing threat codes.
- Standardized size abbreviations to all have the following format AB-C.
- Included long-standing defect classification definitions to help increase consistency of application.
- Included long standing production variation requirements which were historically contained in Statement of Work (SoW) and FAT approval memorandums. This prevents future procurements by other DoD entities from procuring products with higher rates of variation.
- Separates Requirements into Critical Safety and Not to allow for an update to the Production Gap Policy with references to Critical Safety Testing that is currently not possible.
- Corrects misuse of terms "V0" and "V50"