



# Ballistic Resistant Wall Solutions

Thermoplastic vs. Thermoset





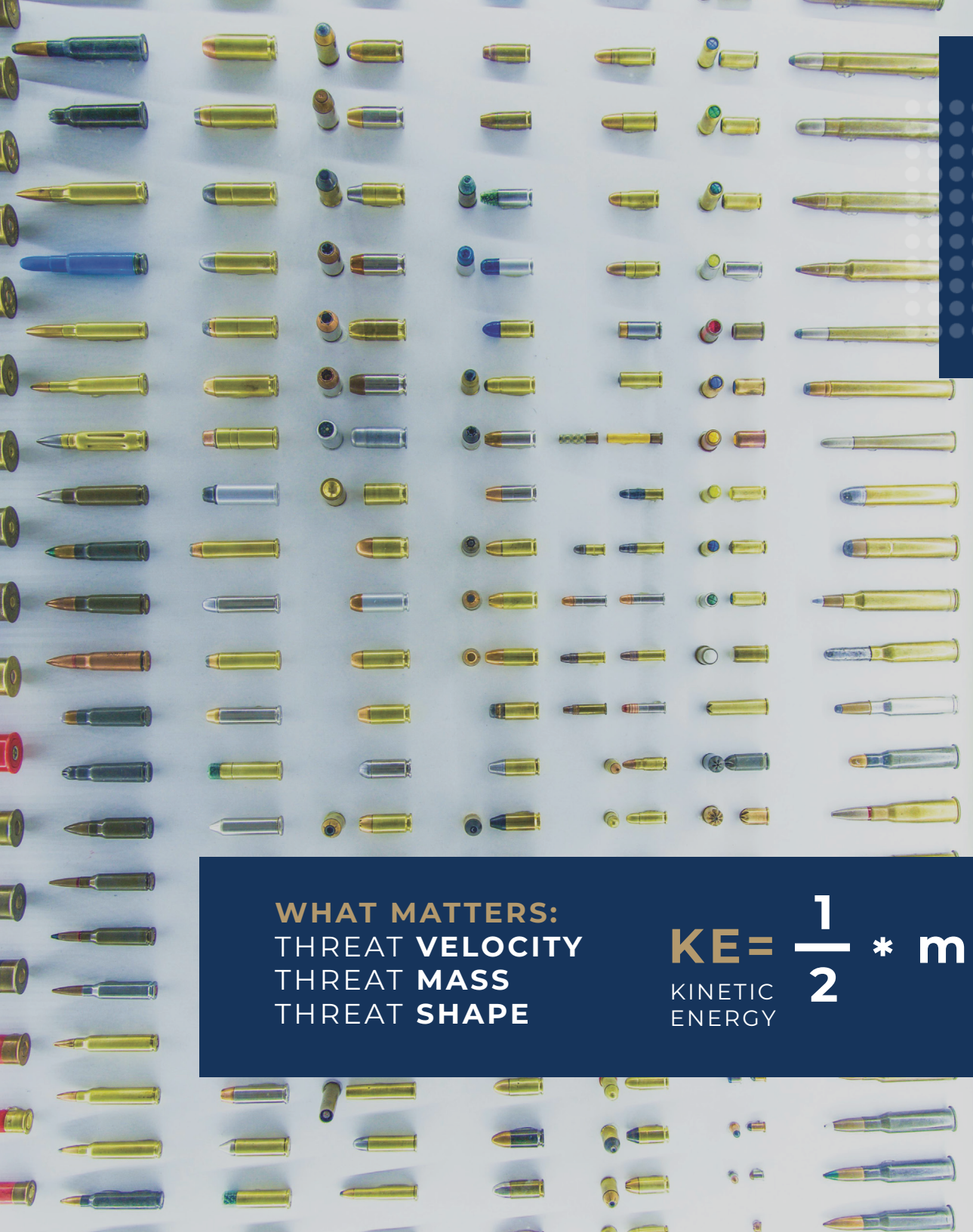


## ABOUT BALLISTIC RESISTANT MATERIALS

Bullet-resistant materials are also called **ballistic materials**, or equivalently, anti-ballistic materials.

They may be complex, such as Kevlar, ultra-high molecular weight polyethylene (UHMWPE) Lexan, or glass fiber composite materials; or they may be basic and simple, such as steel or titanium.





## BALLISTIC TESTING:

VELOCITY  
MASS  
SHAPE

Comparing ballistic data can be challenging due to the variety of threat considerations.

Velocity, mass, shape, and materials vary at each threat level.

Example: NIJ Level IIIA and UL Level 3 are roughly equal.

**WHAT MATTERS:**  
THREAT **VELOCITY**  
THREAT **MASS**  
THREAT **SHAPE**

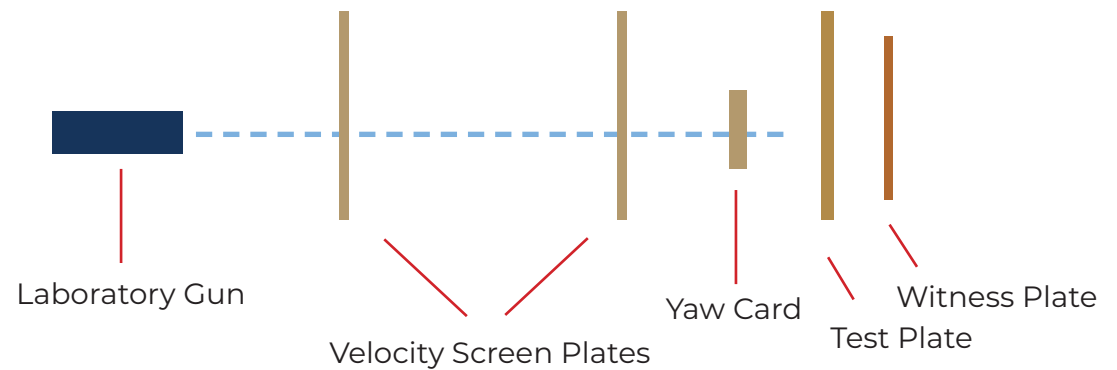
$$KE = \frac{1}{2} * \text{mass} * \text{velocity}^2$$

KINETIC ENERGY

# What is V0 Testing?

## V0 Ballistic Limit Testing

Determines the velocity at which the projectile has a 0% probability of perforating the armor.





# UL 752 TESTING

## V0 TESTING

UL THREAT LEVEL	PROJECTILE	MASS (GM)	NUMBER OF SHOTS	VELOCITY (FT/S)
Level 1	9mm FMJ RN	8.0	3	1205 +/- 30
Level 2	.357 JSP	10.2	3	1280 +/- 30
Level 3	.44 SGCWC	15.6	3	1380 +/- 30
Level 4	.30 LCSP	11.7	1	2570 +/- 30
Level 5	7.62 FMJ M80 Ball	9.7	1	2780 +/- 30
Level 6	9mm FMJ	8.0	5	1430 +/- 30
Level 7	5.56 FMJ	3.56	5	3110 +/- 30
Level 8	7.62 FMJ M80 Ball	9.7	5	2780 +/- 30

UL 752: Structural Armor



# Molecular Process: Thermoplastic vs. Thermoset



## THERMOPLASTIC MELTABLE

- Non-molecularly cross-linked
- Reversible process
- Reheating softens and allows for reshaping, rigid once cooled
- Re-processable or recyclable

## THERMOSET NON-MELTABLE

- Chemically cross-linked
- Non-reversible process
- Permanently rigid once cured
- Not re-processable or recyclable

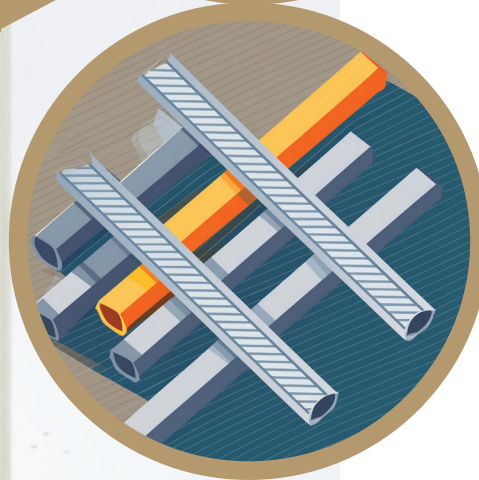
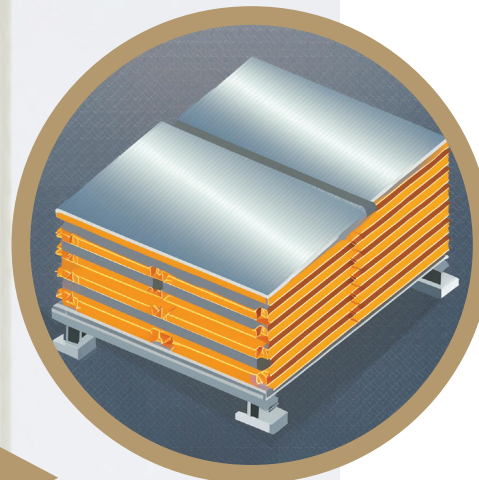
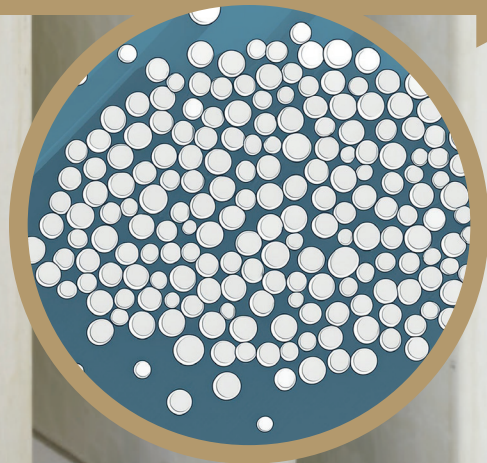



## USA MADE

Ultra-strong fiber joins various proprietary resins to create pliable thermoplastic or thermoset ballistic resistant composite panels, with aesthetic options for all types of installations.

### MATERIALS FUSION PROCESS

- > FIBER
- > RESINS
- > RESULTS



 **WALSHIELD™**  
THERMOPLASTIC  
COMPOSITE  
REVERSIBLE

 **WALSHIELD™+**  
THERMOSET  
COMPOSITE  
PERMANENT





# Composite Ballistic Panels

## APPLICATION

Protection to UL 752 levels 1, 2 & 3, and NIJ levels I, II & IIIA test standards for ballistic resistance

Additional protection against higher ammunitions can be achieved by layering multiple panels

Solutions customized to design and performance specifications including drilling, routing, machining, finishing, custom colors, unique panel sizes

## POSSIBILITIES

Indoor & outdoor use in commercial, governmental, industrial, and residential applications:

- Banks
- Courtrooms
- Police stations
- Detention facilities
- Safe rooms
- Storm shelters
- Military structures
- Infrastructure facilities

## IMPACT

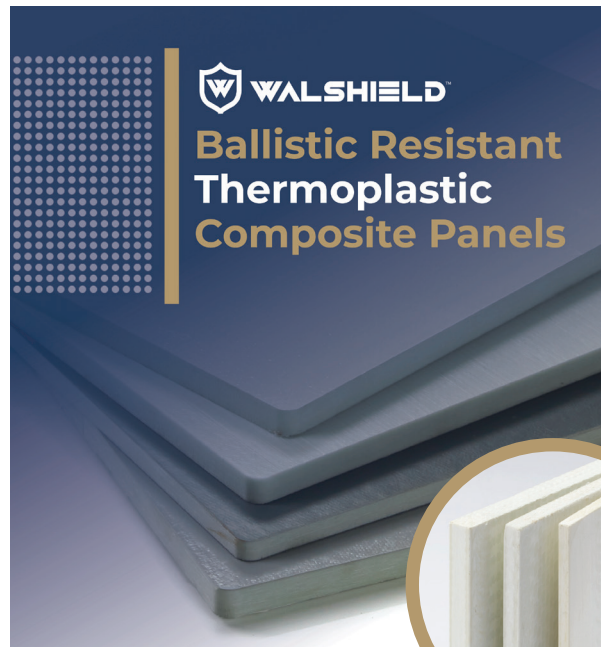
Military grade protection from armed attackers for any facility

Superior ballistic resistance at less than 25% the weight of comparable steel panel

Unique composite matrix allows for retention of projectile to avoid hazardous ricochet  
Durable, corrosion resistant, electrically non-conductive, low thermal conductivity

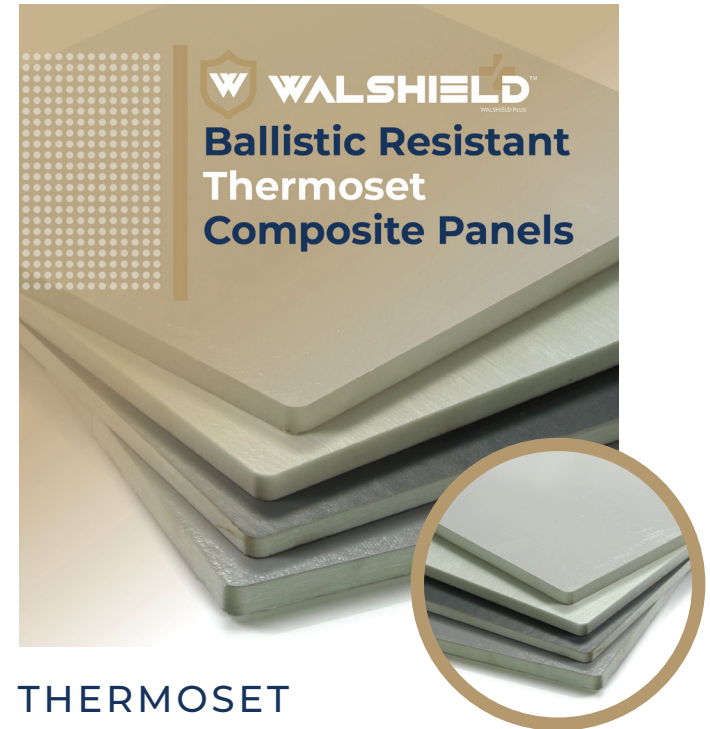


2024 FSJ Tactical  
US-Made Ballistic Resistance  
2 Solutions, 1 Manufacturer



## THERMOPLASTIC

- Layers of 0°/90° UD E-glass fiber reinforcements with polyolefin-based resin system
- Panel sizes from 24"x96" to 48"x144" (61 cm x 244 cm to 122 cm x 366 cm)

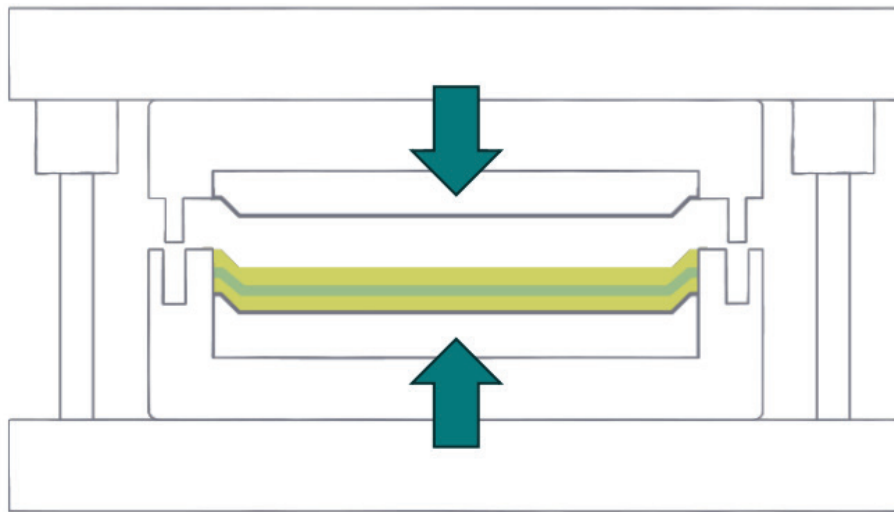


## THERMOSET

- Layers of 0°/90° woven E-glass fiber reinforcements with proprietary thermoset resin system
- Panel sizes from 36"x84" to 48"x120" (91 cm x 213 cm to 122 cm x 305 cm)



# Thermoplastic Ballistic Panels Materials Data



**Areal Weight:** 2 to 4 lb/ft<sup>2</sup> / 7 to 19.5 kg/m<sup>2</sup>

**Thickness:** 0.20 to 0.45 in / 4.5 to 11 mm

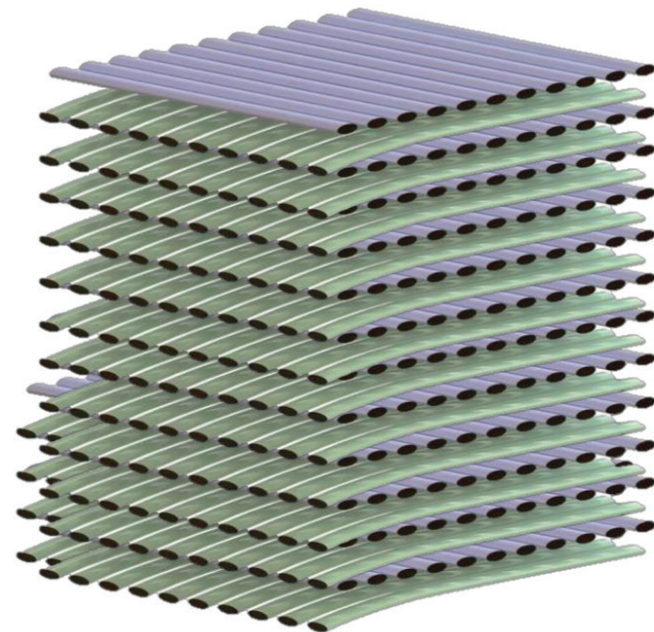
**Raw Materials:** TBE 7330 (PP), TBE 7320 (PE)

**Options:** Aesthetic films applied to outer layers, cut to size and pre-bored holes

**Manufacturing:** multiple vendors for compression molding

## STANDARD THERMOPLASTIC COMPOSITE PANEL

12 to 24 layers of X-Ply





# Thermoplastic Ballistic Panels Performance

## RECOMMENDED CONSTRUCTION TO ACHIEVE UL L3

Product	Layers of X-Plies	Thickness	Areal Weight
TBE 7330 PP	24	0.44 in 11.2 mm	3.90 lb/ft <sup>2</sup> 19.0 kg/m <sup>2</sup>
TBE 7320 PP	24	0.44 in 11.2 mm	3.90 lb/ft <sup>2</sup> 19.0 kg/m <sup>2</sup>



# UL 752 & NIJ Standards for Ballistic Resistance



THERMOPLASTIC COMPOSITE PANEL

UL Rating	NIJ Level	Ammunition	Velocity	No. Shots	Composite Panel	Nominal Thickness	Nominal Weight
Level 3	Level III-A	.44 magnum lead semi-wadcutter gas checked	1350 ft/sec 411 m/sec	3	Thermoplastic Composite Panel Level 3	0.440 in 11.2 mm	3.9 lb/ft <sup>2</sup> 19.0 kg/m <sup>2</sup>



THERMOSET COMPOSITE PANEL

UL Rating	NIJ Level	Ammunition	Velocity	No. Shots
Level 8	Level III	7.62mm rifle lead core full metal copper jacket, military ball	2750 ft/sec 838 m/sec	5



# Performance Comparison

CHARACTERISTIC	WALSHIELD™	WALSHIELD+™
PERFORMANCE / LB	EXCELLENT	GOOD
BALLISTIC RESISTANCE – PISTOLS	EXCELLENT	EXCELLENT
BALLISTIC RESISTANCE – RIFLES	N/A <sup>1</sup>	GOOD
TEMPERATURE PERFORMANCE	GOOD <sup>2</sup>	EXCELLENT
UV RESISTANCE	GOOD <sup>3</sup>	GOOD
ELECTRICAL CONDUCTIVITY	EXCELLENT	EXCELLENT
FLAME RETARDANCE	FAIR <sup>4</sup>	GOOD <sup>5</sup>

<sup>1</sup> Ballistic resistance to rifle fire can be achieved by layering both panel types – contact FSJ Tactical for more information

<sup>2</sup> ThermoBallistic panels made with polypropylene resin systems

<sup>3</sup> UV resistance is achieved using surface polymeric films

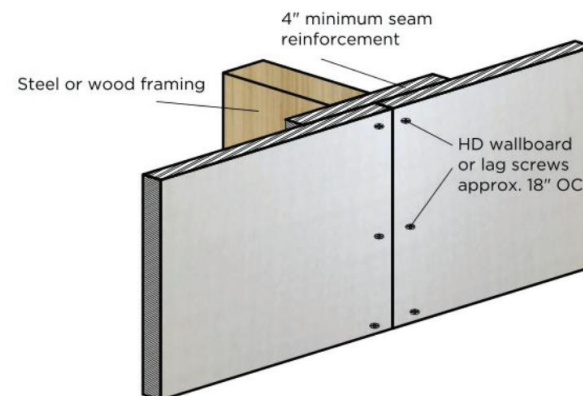
<sup>4</sup> Flame retardant additives can be incorporated upon request under some circumstances

<sup>5</sup> Fire rated for 1-hour per ASTM E-119-09c when tested in an interior wall system



## EXTEND QUALITY CRAFTSMANSHIP TO EVERY STEP IN THE FIELD

1. Lay out the project to utilize the largest panel sizes to minimize the number of seams.
2. Fabricate panels to the desired size by cutting with a circular saw equipped with a diamond abrasive blade. Panels should be cut using a wood cutting blade with  $\pm 45^\circ$  teeth. Be sure to wear appropriate safety equipment including safety glasses and dust masks when fabricating.
3. Secure the panels to steel or wood framing by mechanically fastening with heavy-duty wallboard or lag screws.
4. When constructing walls, rest the initial course of panels firmly on the floor to avoid any unsupported panel weight on the wall framing.
5. Reinforce all panel seams with a minimum 4 inch (10.16 cm) batten of additional ballistic panel material. Position these batten strips to cover the seam and attach to both panels using appropriate wallboard screws (see diagram).
6. Use overlapping butt joints when installing panels into corners.
7. Panels expand to absorb ballistic impact. When covering a sensitive substructure such as glass, shim the panels  $\frac{3}{8}$  inch (9.5 mm) to prevent impact shock damage.
8. Panels can be finished by covering with drywall, paneling, painting, or wall covering. Painting or wall covering will require the use of a suitable primer. When applicable, fire tests shall be performed on a finished wall system.



TYPICAL PANEL JOINT DETAIL

FSJ Tactical is proud to provide a ballistic resistant wall panel solution unlike anything in the world - delivering the industry's best protection for our clients. Contact us for more information or to request a live-fire demo.



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