Ratings of Bullet-Resistant Materials

Underwriters Laboratories, Inc. ®

Rating	Ammunition	Grain	(g)	Velocity Min Max fps	mps	No. Of Shots
Level 1	9mm Full Metal Copper Jacket with Lead Core	124	8.0	1175 1293	358	3
Level 2	.357 Magnum Jacketed Lead Soft Point	158	10.2	1250 1375	381	3
Level 3	.44 Magnum Lead Semi-Wadcutter Gas Checked	240	15.6	1350 1485	411	3
Level 4	.30 Caliber Rifle Lead Core Soft Point	180	11.7	2540 2794	774	1
Level 5	7.62mm Rifle Lead Core Full Metal Copper Jacket Military Ball	150	9.7	2750 3025	838	1
Level 6	9mm Full Metal Copper Jacket with Lead Core	124	8.0	1400 1540	427	5
Level 7	5.56mm Rifle Full Metal Copper Jacket with Lead Core	55	3.56	3080 3388	939	5
Level 8	7.62mm Rifle Lead Core Full Metal Copper Jacket, Military Ball	150	9.7	2750 3025	838	5
Supple-mentary Shotgun	12-Gauge Rifled Lead Slug and 12-Gauge 00 Lead Buckshot (12 pellets)	437 650	28.3 42	1585 1744 1200 1320	483 366	3 3

WMFL Testing

Level III – 30 Minute Physical Attack

1. 2 lb. claw hammer, claw end; 5 minutes
2. Cold chisel/screwdriver; 5 minutes
3. 10 lb. sledge hammer; 5 minutes
4. Fire extinguisher dry chemical type for an NBC fire class with 4A-60DC UL rating; 5 minutes
5. Propane burner of temp. approximately 2,200 degrees F with tip of burner 4" from glass surface, and with nozzle diameter as required to result in heat source approximately 1" in diameter; 5 minutes.
6. 4 lb. hammer, 5 minutes

Level II – 60 Minute Physical Attack

1. 2 lb. claw hammer, claw end; 5 minutes
2. Cold chisel/screwdriver; 5 minutes
3. 10 lb. sledge hammer; 5 minutes
4. ASTM A500 grade B 1-1/2" diameter pipe 3 feet long along with ASTM 36 2" angle iron 3 feet long; 5 minutes
5. ASTM A615 grade 60 deformed #8 rebar for concrete reinforcement, 3 feet long; 5 minutes
6. 4" x 4" table leg/chair leg (oak) 3 feet long; 5 minutes
7. Fire extinguisher dry chemical type for ABC fire class with 4A-60BC U/L rating; 5 minutes
8. 10 lb. sledge hammer; 5 minutes
9. Heated clothes hanger along with heated knife 10" blade from ¼" thick cold chisel steel); 5 minutes
10. Propane burner of temperature approximately 2,200 degrees F with tip of burner 4"from glass surface, and with nozzle diameter as required to result in heat source approximately 1" in diameter; 5 minutes
11. 4 lb. hammer; 5 minutes
12. ASTM A500 grade B 3" diameter pipe 3 feet long or 1" x 1" angle iron 3 feet long; 5 minutes

Level 1 – 60 Minute Physical Attack Plus .44 Magnum

1. Same test as 60 minute above, plus 24 rounds from a .44 magnum at 30 yards.

HP White Testing

PROTECTION LEVEL TEST REQUIREMENTS

	Phase I - Ballistics				
	Level A	Level B	Level C	Level D	Level E
Caliber	.38 Special	9mm	.44 Mag.	7.62mm	.30-06 AP

After the sample has successfully resisted one the ballistic threat of the Phase I test, follow numerical sequence (1-54) below.

	Phase II - Forced Entry				
	Level I	Level II	Level III	Level IV	Level V
Blunt Impacting(impacts)					
Sledgehammer/Wedge(25)	1,4	8,10	18,24,26	29,32,39	42,45,48,51,54
4" Dia. Pipe/Sledge(25)	2	7	17	28	41
Ram(10)	na	6	16	27	40
Pinch Bar(a)					
Sharp Tool(impacts)					
Chisel/Hammer(25)	na	12	21,23	33,36,38	47,52
Angle Iron/Sledge(25)	na	13	22	na	na
1-1/2"Dia.Pipe/Sledge(25)	5	na	na	na	na
Fire Axe(25)	na	na	na	35	44,50
Wood Maul(25)	na	15	20	31	46,53
Keyhole Saw(b)					
Hacksaw(b)					
Thermal Stress(minutes)					
Extinguisher, CO_2 (1)	3	9	na	na	na
Propane Torch(5)	na	11	19	30	na
Acetylene(5)	na	na	na	na	43
Chemical Deterioration(Amount)					
Gasoline (1/2 pint)	na	14	na	na	na
Windshield Washer(1/2pint)	na	na	25	34	na
Acetone (1/2 pint)	na	na	na	37	49
Total Forced Entry					
Sequences	5	15	26	39	54

(a) Pinch or ripping bars may be substituted for any portion of Blunt Impacting Sequence at rate of 1 minute for each 5 impacts (Test Director option).

(b) Additional sequences of one minute intervals in conjunction with all Sharp Tool Sequences (see Paragraph 3.5.7-3.5.8, Section 3.0.)

Summary of Ballistic Threat Levels and Ratings

Table X1.1 ASTM F 1233

Handguns (Automatic Pistols and Revolvers

Standard	Threat Level, Rating	Weapon Calibar	Bullet Weight (Grains)	Bullet Velocity fps. Min.	Bullet Velocity fps Max	Number of Shots	Range, Feet
NU	I	.22LR. ©	40	1010	1090	5	16.0
HPW	A	.38 spec.	158	700	800	3 (d)	20.0
NIJ	I	.38 spec.	158	800	900	5	16.0
NIJ	II-A	9 mm by 19 LV	124	1050	1130	5	16.0
DIN	CI-SF	9 mm by 19 (HV)	124	1166	1199	3	9.84
HPW	B	9 mm by 19 (HV)	124	1100	1180	3 (d)	20.0
NIJ	II	9 mm by 19 (HV)	124	1135	1215	5	16.0
ANSI/UL	M.P.S.A.	.38 super auto.	130	1152	1344	3	15.0
ASTM	.38 super	.38 super auto.	130	1230	1330	3 (e)	25.0
NIJ	II-A	.357 mag. (LV)	158	1200	1300	5	16.0
HPW	B	.357 mag.	158	1250	1375	3	15.0
ANSI/UL	H.P.S.A.	.357 mag. (HV)	158	1305	1523	3	15.0
BSI	GI	.357 mag. (HV)	158	1378	1574	3	9.84
DIN	C2-SF	.357 mag. (HV)	158	1363	1396	3	9.84
ANSI/UL	S.P.S.A.	.44 mag.	240	1323	1544	3	15.0
ASTM	.44 mag.	.44 mag.	240	1400	1500	3 (e)	25.0
BSI	G2	.44 mag.	240	1451	1647	3	9.84
DIN	C3-SF	.44 mag.	240	1429	1461	3	9.84
HPW	C	.44 mag.	240	1350	1450	3 (d)	20.0
NIJ	III-A	.44 mag.	240	1350	1450	5	16.0

Carbines and Sub Machine Guns

Standard A	Threat Level, Rating	Weapon Caliber	Bullet Weight (Grains)	Bullet Velocity, fps Min.	Bullet Velocity, fps Max.	Number of Shots	Range, Feet
ASTM	sub. m.g.	9 mm by 19 (HV)	124	1350	1450	3 (e)	25.0
BSI	GO	9 mm by 19 (HV)	115	1247	1443	3	9.84
NIJ	III-A	9 mm by 19 (HV)	124	1350	1450	5	16.0
SD	minimum	9 mm by 19 (HV)	115	1350	1450	3 (f)	30.0

Rifles (Center Fire)

Standard A	Threat Level, Rating	Weapon Caliber	Bullet Weight (Grains)	Bullet Velocity, fps Min.	Bullet Velocity, fps Max.	Number of Shots	Range, Feet
ANSI/UL	H.P.R.	.30-06	220 SRP	2169	2531	1	15.0
SD	Rifle	5.56 by 45 mm	55 (M193)	3135	3235	3 (f)	30.0
ASTM	Rifle	7.62 by 51 mm	147 (M80)	2750	2850	3 (e)	25.0
BSI	G3	7.62 by 51 mm	147 (M80)	2609	2805	3	32.81
DIN	C4-SF	7.62 by 51 mm	147 SRP	2578	2611	3	32.81
HPW	D	7.62 by 51 mm	147 (M80)	2725	2825	3 (d)	20.0
NIJ	III	7.62 BY 51 mm	147 (M80)	2700	2800	5	16.0
SD	Rifle	7.62 by 51 mm	147 (M80)	2700	2800	3 (f)	30.0

Rifles (Center Fire Armor Piercing)

Standard A	Threat Level, Rating	Weapon Caliber	Bullet Weight (Grains)	Bullet Velocity, fps Min.	Bullet Velocity, fps Max.	Number of Shots	Range, Feet
DIN	C5-SF	7.62 by 51 mm	150 AP	2627	2660	3	82.02
SD	rifle, AP	7.62 by 51 mm	150 (AP,M61)	2700	2800	3 (f)	30.0
ASTM	rifle (AP)	.30-06	165 (AP,M2)	2725	2825	3 (e)	25.0
HPW	E	.30-06	165 (AP,M2)	2725	2825	3 (d)	20.0
NIJ	IV	.30-06	165 (AP.M2)	2800	2900	1	16.0
SD	rifle, AP	.30-06	165 (AP,M2)	2750	2850	3 (f)	30.0

Shotguns

Standard	Threat Level, Rating	Weapon Caliber/Gauge	Bullet/Load Weight (Grains)	Bullet Load Velocity, fps Min.	Bullet Load Velocity, fps Max.	Number of Shots	Range, Feet
ANSI/UL	AJI (g)	20 (2-3/4 in.)	# 7-1/2 LD,Shot	1115	1215	1	15.0
SD	AJI (g)	12 (2-3/4 in.)	#4 buck shot	1275	1375	3 (f)	30.0
ASTM	shotgun (m)	12 mag. (3 in)	#00 buck shot	1265	1365	3 (e)	25.0
BSI	S/	12 mag. (3 in)	#6 lead shot	1295	1395	2	9.84

Testing Definitions

a Standards:

ASTM – American Society for Testing and Materials. Test Method for Security Glazing Materials and Systems. F 1233

NIJ – National Institute of Justice, U.S. Department of Justice, Ballistic Resistant Protective Materials, NIJ Standard – 0108. 01, September 1985.

ANS/UL – American National Standards Institute/Underwriters Laboratories, Inc., Standard for Bullet-Resisting Equipment, ANS/UL 752-1985, Rev. 13 May 1988.

SD-U.S. Department of State, Ballistic Resistance of Structural Materials (Opaque and Transparent) Test Procedures and Acceptance Criteria, SD-STD-02.01, March 1986.

HPW-H.P.White Laboratory, Inc. Transparent Materials and Assemblies for Use in Entry or Containment Barriers, HPW-TP-Q 0100.00 Rev. B, December 10, 1983.

BSI-British Standards Institution, Security Glazing, Part 1. Specification for Bullet-Resistant Glazing for interior Use, BS 5051, October 1973.

DIN-Deutches Institute for Normung e.V., Security Glazing, DIN 52 290, Part 2, May 1981.

b – The various standards specify different locations to measure the bullet velocity. They are as follows: ASTM-15 ft. from weapon muzzle. ANS/UL-at muzzle; BSI-strike face of the target; DIN-8.20 ft. from weapon muzzle; HPW-15 ft. from weapon muzzle; NIJ-6.60 ft from weapon muzzle; and SD-10 ft. from strike face of the target. For meeting the various velocity measurement requirements, the use of custom (special) powder loads may be required.

c – Abbreviations:

AP	Armor Piercing
HV	Higher Velocity
LD	Lead
LR	Long Rifle
LV	Lower Velocity
Mag.	Magnum
Spec.	Special
SRP	Soft Round Point

M2, M61, M80, M193 -U.S. Military Ammunition, Full Metal Jacket, Spire Point

d – Three shots required for the base materials and twelve shots required for assemblies.

e - Minimum number of shots.

f - Minimum of three shots required for the glazing and six shots required for other parts of the assembly.

g – All ratings require the use of a shotgun in addition to the other specified weapons.

h - The shotgun is only used in an adjunct role and is non-rated weapon in this mode.

Forced Entry Sequence of Testing

Table 2
ASTM F1233

Test Implements	Class II Sequence	Class II Sequence	Calss III Sequence	Class IV Sequence	Calss V Sequence
Blunt Impacting (Impacts)					
Sledge Hammer (25)	A	5	10, 16	19,22,27	30,33,36,39
4" (10cm) Diameter Pipe/Sledge (25)	A	A	9	18	29
Ram (10)	A	A	8	17	28
Ball Peen Hammer (10)	1	2	A	A	A
Sharp Tool (Impacts)					
Ripping Bar (10)	A	7	12	23	A
Chisel/Hammer (25)	A	A	13	25	35,40
Angle Iron/Sledge (25)	A	A	15	A	A
1-1/2" (4cm) Diameter Pipe/Sledge (25)	A	3	A	A	A
Fire Axe (25)	A	A	A	24	32,38
Wood Splitting Maul (25)	A	A	A	21	34,41
Thermal Stress (Minutes)					
Extinguisher, CO2, (1)	A	4	A	A	A
Propane Torch (5)	A	6B	11C	20C	31C
Chemical Deterioration (Amount)					
Gasoline (1/2 Pint) (1/4 L)	A	A	14	A	A
Methylane Chloride (1/2 Pint) (1/4 L)	A	A	A	26	37
Total Forced Entry Sequences	1	7	16	27	41

A = Not Applicable.

B = For Class II, The flame shall be extinguished with a fine mist of water immediately after the propane torch application.

C= For Classes III, IV, and V, if the sample continues to burn after removal of the flame (self-sustaining), it shall be allowed to burn an additional 10 minutes and then extinguished with a fine mist of water.