Appendix G. MSD Calculation Sheets

DODIC:

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	
Munition:	155 mm M107 (Composition B filled)	
Case Material:	Steel, Mild	
Fragmentation Method:	Naturally Fragmenting	
Secondary Database Category:	Projectile	
Munition Case Classification:	Robust	

Munition Information and Fragmentation Characteristics		
Explosive Type:	Composition B	
Explosive Weight (Ib):	15.448	
Diameter (in):	6.1024	
Maximum Fragment Weight (Intentional) (lb):	0.6641	
Design Fragment Weight (95%) (Unintentional) (lb):	0.1372	
Critical Fragment Velocity (fps):	3584	

Overpressure Distances		
TNT Equivalent (Pressure):	1.16	
TNT Equivalent Weight - Pressure (lbs):	17.920	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	47	
Public Traffic Route Distance (2.3 psi); K24 Distance:	63	
Inhabited Building Distance (1.2 psi), K40 Distance:	105	
Intentional MSD (0.0655 psi), K328 Distance:	858	

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	17.920
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	4.2663
Required Wall & Roof Sandbag Thickness (in)	36
Expected Maximum Sandbag Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

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Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	2/4/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances		
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	450	
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2630	
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2022	

Minimum Thickness to Prevent Perforation

	Intentional	<u>Unintentional</u>
4000 psi Concrete (Prevent Spall):	14.45	6.68
Mild Steel:	2.74	1.29
Hard Steel:	2.25	1.06
Aluminum:	5.30	2.61
LEXAN:	10.69	6.73
Plexi-glass:	9.43	5.10
Bullet Resist Glass:	8.58	4.39

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	17.920
Kinetic Energy 106 (lb-ft ² /s ²):	4.2663
Water Containment System:	1100 gal tank

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:	D571
Munition:	155 mm M107 (TNT filled)		
Case Material:	Steel, Mild	Date Record Created: Record Created By:	2/4/2010
Fragmentation Method:	Naturally Fragmenting	Last Date Record Updated:	
Secondary Database Category:	Projectile	Individual Last Updated Record:	
Munition Case Classification:	Robust	Date Record Retired:	

Munition Information and Fragmentation Characteristics		
Explosive Type:	TNT	
Explosive Weight (Ib):	14.6	
Diameter (in):	6.1024	
Maximum Fragment Weight (Intentional) (Ib):	1.0548	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.2710	
Critical Fragment Velocity (fps):	4035	

Overpressure Distances		
TNT Equivalent (Pressure):	1	
TNT Equivalent Weight - Pressure (lbs):	14.600	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	44	
Public Traffic Route Distance (2.3 psi); K24 Distance:	59	
Inhabited Building Distance (1.2 psi), K40 Distance:	98	
Intentional MSD (0.0655 psi), K328 Distance:	802	

Required Sandbag Thickness		
TNT Equivalent (Impulse):	1	
TNT Equivalent Weight - Impulse (lbs):	14.600	
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	8.5845	
Required Wall & Roof Sandbag Thickness (in)		
Expected Maximum Sandbag Throw Distance (ft):		
Minimum Separation Distance (ft):		

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Date Record Retired:	
Theoretical Calculated Fragment	nent Distances
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	389
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2894
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2208

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Minimum Thickness to Prevent Perforation

Intentional	<u>Unintentional</u>
14.62	7.33
2.82	1.43
2.31	1.17
5.39	2.85
11.10	7.30
9.91	5.69
9.14	4.99
	Intentional 14.62 2.82 2.31 5.39 11.10 9.91 9.14

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	14.600
Kinetic Energy 106 (lb-ft ² /s ²):	8.5845
Water Containment System:	N/A
Minimum Separation Distance (ft):	N/A

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:	D485
Munition:	155 mm M101		
Case Material:	Steel, Mild	Date Record Created:	12/8/2010
		Record Created By:	MMC
Fragmentation Method:	Naturally Fragmenting	Last Date Record Updated:	l
Secondary Database Category:	Projectile	Individual Last Updated Record:	
Munition Case Classification:	Robust	Date Record Retired:	

Munition Information and Fragmentation Characteristics		
Explosive Type:	TNT	
Explosive Weight (lb):	14.6	
Diameter (in):	6.1250	
Maximum Fragment Weight (Intentional) (lb):	1.0548	
Design Fragment Weight (95%) (Unintentional) (lb):	0.2710	
Critical Fragment Velocity (fps):	4035	

Overpressure Distances		
TNT Equivalent (Pressure):	1	
TNT Equivalent Weight - Pressure (lbs):	14.600	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	44	
Public Traffic Route Distance (2.3 psi); K24 Distance:	59	
Inhabited Building Distance (1.2 psi), K40 Distance:	98	
Intentional MSD (0.0655 psi), K328 Distance:	802	

Required Sandbag Thickness		
TNT Equivalent (Impulse):	1	
TNT Equivalent Weight - Impulse (lbs):	14.600	
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	6.6543	
Required Wall & Roof Sandbag Thickness (in)	Not Permitted	
Expected Maximum Sandbag Throw Distance (ft):	Not Permitted	
Minimum Separation Distance (ft):	Not Permitted	

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Date Record Created:	12/8/2010
Record Created By:	MMC
ast Date Record Updated:	
ndividual Last Updated Record:	
Date Record Retired:	

Theoretical Calculated Fragment Dis	stances
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	389
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2894
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2208

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	14.62	7.33
Mild Steel:	2.82	1.43
Hard Steel:	2.31	1.17
Aluminum:	5.39	2.85
LEXAN:	11.10	7.30
Plexi-glass:	9.91	5.69
Bullet Resist Glass:	9.14	4.99

Water Containment System and Minimum Separation Distance: TNT Equivalent (Impulse): 1 TNT Equivalent Weight - Impulse (lbs): 14.600 6.6543 Kinetic Energy 106 (lb-ft²/s²): Not Permitted Water Containment System:

Minimum Separation Distance (ft):

Item Notes

This is the same as the TNT filled 155 mm M107 except that the M101 has a wider rotating band. Therefore the model for the TNT filled 155 mm M107 was used for this round.

Not Permitted

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:
Munition:	81 mm M362A1	
Case Material:	Iron, Pure	Date Record Created: Record Created By:
Fragmentation Method:	Naturally Fragmenting	Last Date Record Updat
Secondary Database Category:	Mortar	Individual Last Updated
Munition Case Classification:	Robust	Date Record Retired:

Munition Information and Fragmentation Characteristics		
Explosive Type:	Composition B	
Explosive Weight (Ib):	2.1	
Diameter (in):	3.1890	
Maximum Fragment Weight (Intentional) (lb):	0.0441	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0071	
Critical Fragment Velocity (fps):	5990	

Overpressure Distances	
TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	2.436
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	24
Public Traffic Route Distance (2.3 psi); K24 Distance:	32
Inhabited Building Distance (1.2 psi), K40 Distance:	54
Intentional MSD (0.0655 psi), K328 Distance:	441

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	2.436
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.7912
Required Wall & Roof Sandbag Thickness (in)	24
Expected Maximum Sandbag Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

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Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	2/18/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances		
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	247	
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1342	
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1066	

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	7.51	3.55
Mild Steel:	1.40	0.68
Hard Steel:	1.15	0.56
Aluminum:	2.87	1.45
LEXAN:	6.91	4.42
Plexi-glass:	5.23	2.89
Bullet Resist Glass:	4.40	2.28

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	2.436
Kinetic Energy 106 (lb-ft ² /s ²):	0.7912
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft):	200

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:
Munition:	81 mm M374	
Case Material:	Steel Mild	Date Record Created:
		Record Created By:
Fragmentation Method:	Naturally Fragmenting	Last Date Record Updated:
Secondary Database Category:	Mortar	Individual Last Updated Record
Munition Case Classification:	Robust	Date Record Retired:

Munition Information and Fragmentation Characteristics		
Explosive Type:	Composition B	
Explosive Weight (Ib):	2.1	
Diameter (in):	3.1890	
Maximum Fragment Weight (Intentional) (Ib):	0.0347	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0053	
Critical Fragment Velocity (fps):	6487	

Overpressure Distances		
TNT Equivalent (Pressure):	1.16	
TNT Equivalent Weight - Pressure (lbs):	2.436	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	24	
Public Traffic Route Distance (2.3 psi); K24 Distance:	32	
Inhabited Building Distance (1.2 psi), K40 Distance:	54	
Intentional MSD (0.0655 psi), K328 Distance:	441	

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	2.436
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.7301
Required Wall & Roof Sandbag Thickness (in)	20
Expected Maximum Sandbag Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

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Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	3/8/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances		
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	239	
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1270	
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1012	

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	7.48	3.46
Mild Steel:	1.36	0.65
Hard Steel:	1.12	0.53
Aluminum:	2.81	1.40
LEXAN:	6.67	4.23
Plexi-glass:	5.03	2.74
Bullet Resist Glass:	4.21	2.14

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	2.436
Kinetic Energy 106 (lb-ft ² /s ²):	0.7301
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft):	264/200

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:
Munition:	81 mm M43	
Case Material:	Steel, Mild	Date Record Created: Record Created By:
Fragmentation Method:	Naturally Fragmenting	Last Date Record Updat
Secondary Database Category:	Mortar	Individual Last Updated
Munition Case Classification:	Robust	Date Record Retired:

Munition Information and Fragmentation Characteristics		
Explosive Type:	TNT	
Explosive Weight (Ib):	1.23	
Diameter (in):	3.1890	
Maximum Fragment Weight (Intentional) (lb):	0.1096	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0377	
Critical Fragment Velocity (fps):	3776	

Overpressure Distances		
TNT Equivalent (Pressure):	1	
TNT Equivalent Weight - Pressure (lbs):	1.230	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	19	
Public Traffic Route Distance (2.3 psi); K24 Distance:	26	
Inhabited Building Distance (1.2 psi), K40 Distance:	43	
Intentional MSD (0.0655 psi), K328 Distance:	351	

Required Sandbag Thickness		
TNT Equivalent (Impulse):	1	
TNT Equivalent Weight - Impulse (lbs):	1.230	
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.7813	
Required Wall & Roof Sandbag Thickness (in)	24	
Expected Maximum Sandbag Throw Distance (ft):	125	
Minimum Separation Distance (ft):	200	

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Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	3/10/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances		
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	209	
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1579	
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1215	

Minimum Thickness to Prevent Perforation

	Intentional	<u>Unintentional</u>
4000 psi Concrete (Prevent Spall):	6.61	3.98
Mild Steel:	1.27	0.77
Hard Steel:	1.04	0.63
Aluminum:	2.59	1.60
LEXAN:	6.62	5.05
Plexi-glass:	4.99	3.49
Bullet Resist Glass:	4.22	2.87

Water Containment System and Minimum Separation Distance:

INI Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	1.230
Kinetic Energy 106 (lb-ft ² /s ²):	0.7813
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft):	200

DODIC:

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds
Munition:	81 mm M45
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Mortar
Munition Case Classification:	Non-Robust

Munition Information and Fragmentation Characteristics		
Explosive Type:	TNT	
Explosive Weight (Ib):	4.48	
Diameter (in):	3.1890	
Maximum Fragment Weight	0.0245	
	0.0285	
Design Fragment Weight (95%) (Unintentional) (lb):	0.0034	
Critical Fragment Velocity (fps):	7384	

Overpressure Distances	
TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	4.480
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	30
Public Traffic Route Distance (2.3 psi); K24 Distance:	40
Inhabited Building Distance (1.2 psi), K40 Distance:	66
Intentional MSD (0.0655 psi), K328 Distance:	541

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	4.480
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.7224
Required Wall & Roof Sandbag Thickness (in)	24
Expected Maximum Sandbag Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	3/2/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances	
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	242
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1199
MFD-V [Maximum Fragment Distance, Vertical] (ft):	963

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	8.05	3.43
Mild Steel:	1.41	0.63
Hard Steel:	1.16	0.51
Aluminum:	2.93	1.37
LEXAN:	6.71	4.06
Plexi-glass:	5.06	2.60
Bullet Resist Glass:	4.21	2.01

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	4.480
Kinetic Energy 106 (Ib-ft ² /s ²):	0.7224
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft):	200

DODIC:

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	
Munition:	81 mm M56	
Case Material:	Steel, Mild	
Fragmentation Method:	Naturally Fragmenting	
Secondary Database Category:	Mortar	
Munition Case Classification:	Non-Robust	

Munition Information and Fragmentation Characteristics		
Explosive Type:	TNT	
Explosive Weight (Ib):	4.31	
Diameter (in):	3.1890	
Maximum Fragment Weight (Intentional) (lb):	0.0263	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0034	
Critical Fragment Velocity (fps):	7384	

Overpressure Distances	
TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	4.310
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	29
Public Traffic Route Distance (2.3 psi); K24 Distance:	39
Inhabited Building Distance (1.2 psi), K40 Distance:	65
Intentional MSD (0.0655 psi), K328 Distance:	534

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	4.310
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.7170
Required Wall & Roof Sandbag Thickness (in)	24
Expected Maximum Sandbag Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	3/2/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances	
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	240
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1196
MFD-V [Maximum Fragment Distance, Vertical] (ft):	960

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	8.02	3.43
Mild Steel:	1.41	0.63
Hard Steel:	1.15	0.51
Aluminum:	2.92	1.37
LEXAN:	6.69	4.06
Plexi-glass:	5.05	2.60
Bullet Resist Glass:	4.20	2.01

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	4.310
Kinetic Energy 106 (lb-ft ² /s ²):	0.7170
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft):	200

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:
Munition:	60 mm M49A2	
Case Material:	Steel, Mild	Date Record Crea Record Created B
Fragmentation Method:	Naturally Fragmenting	Last Date Record
Secondary Database Category:	Mortar	Individual Last Up
Munition Case Classification:	Robust	Date Record Retir

Munition Information and Fragmentation Characteristics			
Explosive Type:	TNT		
Explosive Weight (Ib):	0.34		
Diameter (in):	2.3622		
Maximum Fragment Weight			
(Intentional) (lb):	0.0570		
Design Fragment Weight (95%)	0.0150		
(Unintentional) (lb):	0.0159		
Critical Fragment Velocity (fps):	3982		

Overpressure Distances		
TNT Equivalent (Pressure):	1	
TNT Equivalent Weight - Pressure (lbs):	0.340	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	13	
Public Traffic Route Distance (2.3 psi); K24 Distance:	17	
Inhabited Building Distance (1.2 psi), K40 Distance:	28	
Intentional MSD (0.0655 psi), K328 Distance:	229	

Required Sandbag Thickness			
TNT Equivalent (Impulse):	1		
TNT Equivalent Weight - Impulse (lbs):	0.340		
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.4519		
Required Wall & Roof Sandbag Thickness (in)	20		
Expected Maximum Sandbag Throw Distance (ft):	125		
Minimum Separation Distance (ft):	200		

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	3/23/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances		
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	152	
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1322	
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1025	

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	4.96	2.99
Mild Steel:	0.97	0.58
Hard Steel:	0.79	0.48
Aluminum:	1.97	1.23
LEXAN:	5.75	4.21
Plexi-glass:	4.14	2.74
Bullet Resist Glass:	3.47	2.19

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	0.340
Kinetic Energy 106 (Ib-ft ² /s ²):	0.4519
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft):	264/200

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:	B632
Munition:	60 mm M49A3		
Case Material:	Iron, Pearlitic Malleable	Date Record Created: Record Created By:	9/21/20 MC
Fragmentation Method:	Naturally Fragmenting	Last Date Record Updated:	3/25/20
Secondary Database Category:	Mortar	Individual Last Updated Record:	SDH
Munition Case Classification:	Robust	Date Record Retired:	

Munition Information and Fragmentation Characteristics		
Explosive Type:	Composition B	
Explosive Weight (Ib):	0.42	
Diameter (in):	2.3622	
Maximum Fragment Weight (Intentional) (Ib):	0.0354	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0081	
Critical Fragment Velocity (fps):	4788	

Overpressure Distances	
TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	0.487
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	14
Public Traffic Route Distance (2.3 psi); K24 Distance:	19
Inhabited Building Distance (1.2 psi), K40 Distance:	31
Intentional MSD (0.0655 psi), K328 Distance:	258

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	0.487
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.4058
Required Wall & Roof Sandbag Thickness (in)	12
Expected Maximum Sandbag Throw Distance (ft):	25
Minimum Separation Distance (ft):	200

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Theoretical Calculated Fragment Distances		
Date Record Retired:		
Individual Last Updated Record:	SDH	
Last Date Record Updated:	3/25/2010	
Record Created By:	MC	
Date Record Created:	9/21/2004	

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Theoretical valculated Tragment Dis	ances
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	162
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1156
MFD-V [Maximum Fragment Distance, Vertical] (ft):	910

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	5.24	2.89
Mild Steel:	1.02	0.57
Hard Steel:	0.84	0.47
Aluminum:	2.12	1.22
LEXAN:	5.92	4.13
Plexi-glass:	4.24	2.63
Bullet Resist Glass:	3.51	2.06

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	0.487
Kinetic Energy 106 (Ib-ft ² /s ²):	0.4058
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft):	200/200

Database Revision Date 9/30/10

Category:	Surface-Launched HE Rounds	DODIC:
Munition:	60 mm M49A5	
Case Material:	Steel, Mild	Date Record Crea Record Created B
Fragmentation Method:	Naturally Fragmenting	Last Date Record
Secondary Database Category:	Mortar	Individual Last Up
Munition Case Classification:	Robust	Date Record Retir

Munition Information and Fragmentation Characteristics		
Explosive Type:	Composition B	
Explosive Weight (Ib):	0.79	
Diameter (in):	2.3622	
Maximum Fragment Weight (Intentional) (lb):	0.0206	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0036	
Critical Fragment Velocity (fps):	6044	

Overpressure Distances	
TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	0.916
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	17
Public Traffic Route Distance (2.3 psi); K24 Distance:	23
Inhabited Building Distance (1.2 psi), K40 Distance:	39
Intentional MSD (0.0655 psi), K328 Distance:	319

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	0.916
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.3763
Required Wall & Roof Sandbag Thickness (in)	20
Expected Maximum Sandbag Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

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Theoretical Calculated Fragment Distances	
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	184
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1070
MFD-V [Maximum Fragment Distance, Vertical] (ft):	845

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	5.47	2.68
Mild Steel:	1.02	0.51
Hard Steel:	0.84	0.42
Aluminum:	2.14	1.12
LEXAN:	5.65	3.69
Plexi-glass:	4.03	2.29
Bullet Resist Glass:	3.30	1.76

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1.16
TNT Equivalent Weight - Impulse (lbs):	0.916
Kinetic Energy 106 (lb-ft ² /s ²):	0.3763
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft):	264/200

Database Revision Date 9/30/10

Category:	Grenades & Mines	DODIC:
Munition:	Mk II Grenade	
Case Material:	Cast Iron, Grey, CL35	Date Record Cr Record Created
Fragmentation Method:	Pre-formed Fragmenting	Last Date Reco
Secondary Database Category:	Hand Grenade	Individual Last
Munition Case Classification:	Robust	Date Record Re

Munition Information and Fragmentation Characteristics		
Explosive Type:	TNT	
Explosive Weight (Ib):	0.125	
Diameter (in):	2.2600	
Maximum Fragment Weight (Intentional) (lb):	0.0129	
Design Fragment Weight (95%) (Unintentional) (Ib):	0.0043	
Critical Fragment Velocity (fps):	578	

Overpressure Distances		
TNT Equivalent (Pressure):	1.00	
TNT Equivalent Weight - Pressure (lbs):	0.125	
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	9	
Public Traffic Route Distance (2.3 psi); K24 Distance:	12	
Inhabited Building Distance (1.2 psi), K40 Distance:	20	
Intentional MSD (0.0655 psi), K328 Distance:	164	

Required Sandbag Thickness	
TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	0.125
Kinetic Energy 10 ⁶ (lb-ft ² /s ²):	0.0022
Required Wall & Roof Sandbag Thickness (in)	12
Expected Maximum Sandbag Throw Distance (ft):	25
Minimum Separation Distance (ft):	200

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Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	3/29/2010
Individual Last Updated Record:	SDH
Date Record Retired:	

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Theoretical Calculated Fragment Distances		
HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	62	
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	521	
MFD-V [Maximum Fragment Distance, Vertical] (ft):	397	

Minimum Thickness to Prevent Perforation

	Intentional	<u>Unintentional</u>
4000 psi Concrete (Prevent Spall):	1.15	0.79
Mild Steel:	0.07	0.05
Hard Steel:	0.06	0.04
Aluminum:	0.16	0.10
LEXAN:	1.61	1.23
Plexi-glass:	0.73	0.51
Bullet Resist Glass:	0.55	0.37

Water Containment System and Minimum Separation Distance:

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	0.125
Kinetic Energy 106 (lb-ft ² /s ²):	0.0022
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft):	200/200

Item Notes

Fragment sizes, number of fragments and HFD came from test information. These numbers were used to calculate MFD-H using TP 16 Eq 4-34 & iterating using TRAJ to calculate the intial velocity. With this information, standard TP 16 methods were used to calculate MFD-V and thicknesses to prevent perforation.