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Serial No. 8

Blue Fire Effect Tables

Cancels Edition of June, 1932.

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DECLASSIFICATION OF WWII RECORDS

Naval War College
Newport, R. I.
Department of Operations
June, 1933

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S. A. Taffinder
S.A. TAFFINDER
Captain, U.S. Navy
Secretary.

NAVAL WAR COLLEGE
Newport, R.I.
1 June, 1933

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BLUE FIRE EFFECT TABLES

Naval War College
Newport, R.I.
June, 1933

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EXPLANATION OF TABLES

1. These tables give the effect of single guns, under normal conditions, in terms of equivalent 14" penetrative hits per three-minute move.

2. To use a table, in the case of the fire of a particular type of gun against a particular class of target ship, -

(1) determine whether shots are penetrative, for which purpose enter the armor penetration table for that gun with arguments:

- (a) armor of target ship
- (b) target angle, and
- (c) range.

(2) select appropriate fire effect for one gun from fire effect tables using as arguments:

- (a) size class of target
- (b) whether shots are penetrative
- (c) kind of spot, and
- (d) range.

(3) multiply this figure for the effect of one gun by the number of guns firing. The result is the aggregate normal fire effect of the battery with no allowance yet made for deck penetration.

3. Where a single set of figures are shown they apply to both plane spot and top spot.

4. When in fire, against armored vessels, with guns of 6" or larger caliber, there is either (1) deck penetration only, or (2) both side and deck penetration, the normal value of penetrative fire effect as given in the tables will be multiplied by the appropriate figure from the subjoined table:

Gun	Target size	Penetration	
		Deck	Deck & Side
12" plus	Large	1.2	1.3
12" plus	Int., Small	1.1	1.2
7.5 - 10"	Any	1.1	1.2
6"	Int., Small	1.1	1.2

No increase for deck penetration will be allowed for fire against unarmored vessels or for fire with guns smaller than 6".

5. Fire Effect Diagrams have been constructed from the Fire Effect Tables giving the normal effect of BLUE ships upon RED and ORANGE ships of similar type. These diagrams can be conveniently used in place of the Fire Effect Tables where applicable.

GUN DATA

The following data on BLUE guns is based on the latest information available.

Where two ranges are given, the first is the theoretical range - table range; the second, the figure used at the War College as representing the estimated practical range in thousands of yards.

<u>Caliber</u>	<u>Weight of Projectile</u>	<u>M.V.</u>	<u>Maximum Elevation</u>	<u>Maximum Range</u>	
				<u>Tables</u>	<u>Practical</u>
16"/45	2100	2600	30°	34400	33
14"/50	1400	2800	30°	35800	34
			15°	24000	23
14"/45	1400	2700	30°	34500	33
			15°	25100	22
12"/50	870	2900	(e) 30°	33800	33
			15°	23600	23
8"/55	260	3000	40°	35200	(c) 34
				31800	(d) 30
6"/53	105	3000	(a) 30°	22850	22
			(b) 20°	18700	18
			(f) 40°	28100	27
5"/51	50	3150	20°	17200	17
5"/50	50	3000	20°	16700	16
5"/40	54	2600	85° A.A.	17500	17
5"/25	50	2250	85° A.A.	15000	14
4"/50	33	2900	15°	13100	13
3"/50	13	2700	85° A.A.	13600	13
			15°	8700	8
3"/23	13	1650	85° A.A.	7800	7

- (a) Turret guns of CLs 4-13.
- (b) Other 6"/53 guns of CLs 4-13.
- (c) Guns of CA 24, 25, etc.
- (d) Guns of CV 2, 3.
- (e) Data for possible future increased elevation.
- (f) Guns of CLs 43-46 and CF's.

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BLUE 16"/45

FIGHTING STRENGTH COMPARISONS.

FIRE EFFECT TABLE - BLUE 16"/45

Muzzle Velocity 2600 f.s.
Weight of Projectile 2100 lbs.

Maximum Range 33.

B34-05

FIGHTING STRENGTH COMPARISONS
LIMITING RANGES FOR ARMOR PENETRATION

B 3406

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thickness	90° or 0°	75° or 15°	60° or 30°	45°
3"	---	---	---	---
4"	---	---	---	---
5"	---	---	---	---
5:75	---	---	---	30
6"	---	---	---	29
7"	---	---	---	27
8"	---	---	31	22
9"	---	32	27	19
10"	30	29	23	15
11"	27	26	21	12
12"	25	23	18	X
13"	23	21	16	X
13:5	22	20	15	X
14"	21	19	X	X
15"	19	17	X	X
16"	18	X	X	X

DECK ARMOR

Thickness	Range
1:00	4
1:25	6
1:50	8
2:00	12
2:25	14
2:40	15
2:75	17
3:00	18
3:65	21
3:68	21
3:75	22
4:00	23
4:13	23
4:39	24
4:57	25
4:82	26
5:18	27
6:25	31

Penetration of INCLINED ARMOR

12"	21	20	17	X
-----	----	----	----	---

Inclined 10°

- (---) No limit within maximum range of gun.
- (X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

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BLUE 16"/45

FIGHTING STRENGTH COMPARISONS
LARGE TARGET

B34-07

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	5,930		3,925	
2	5,770		3,821	
3	4,669		3,088	
4	3,550		2,350	
5	2,701		1,787	
6	2,087		1,381	
7	1,640		1,034	
8	1,310		.866	
9	1,071		.709	
10	.838		.587	
11	.750		.496	
12	.635		.420	
13	.534		.354	
14	.450		.298	
15	.381		.252	
16	.324		.214	
17	.284		.188	
18	.248		.164	
19	.219		.145	
20	.193		.128	
21	.163	.170	.109	.113
22	.138	.152	.092	.101
23	.116	.136	.076	.090
24	.094	.122	.062	.081
25	.074	.111	.049	.073
26	.055	.101	.036	.067
27	.036	.091	.024	.060
28	.023	.083	.015	.055
29	.013	.075	.009	.050
30	.006	.070	.004	.046
31	.000	.064	.000	.041
32		.058		.038
33		.054		.036

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INTERMEDIATE TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	5.929		4.760	
2	5.524		4.435	
3	3.817		3.064	
4	2.551		2.050	
5	1.875		1.505	
6	1.427		1.145	
7	1.103		.886	
8	.881		.707	
9	.738		.593	
10	.618		.496	
11	.517		.415	
12	.433		.348	
13	.364		.292	
14	.305		.245	
15	.257		.206	
16	.218		.175	
17	.185		.148	
18	.162		.130	
19	.143		.115	
20	.128		.103	
21	.108	.114	.086	.091
22	.091	.101	.073	.081
23	.075	.089	.060	.072
24	.060	.080	.048	.064
25	.045	.071	.036	.057
26	.031	.064	.024	.051
27	.020	.058	.016	.047
28	.011	.053	.008	.042
29	.005	.048	.004	.039
30	.000	.045	.000	.036
31		.041		.033
32		.038		.031
33		.035		.028

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BLUE 16"/45

SMALL TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	5.930		5.010	
2	5.318		4.494	
3	3.150		2.660	
4	1.992		1.684	
5	1.447		1.221	
6	1.120		.946	
7	.866		.732	
8	.690		.584	
9	.574		.485	
10	.480		.406	
11	.405		.342	
12	.339		.287	
13	.287		.242	
14	.246		.208	
15	.207		.175	
16	.173		.146	
17	.146		.124	
18	.128		.108	
19	.112		.095	
20	.099		.084	
21	.084	.088	.070	.074
22	.071	.080	.060	.067
23	.058	.071	.049	.060
24	.045	.064	.038	.054
25	.033	.053	.028	.049
26	.021	.053	.018	.044
27	.012	.048	.010	.041
28	.005	.044	.004	.037
29	.000	.040	.000	.034
30		.037		.031
31		.033		.028
32		.030		.025
33		.027		.023

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BLUE 16"/45

PENETRATIVE

DESTROYER TARGET

SUBMARINE TARGET

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	5.929		1.650	
2	3.178		.789	
3	1.642		.443	
4	1.070		.280	
5	.775		.200	
6	.580		.147	
7	.450		.110	
8	.368		.084	
9	.298		.064	
10	.243		.050	
11	.197		.041	
12	.162		.033	
13	.131		.027	
14	.106		.023	
15	.085		.018	
16	.068		.014	.015
17	.055		.011	.012
18	.048		.009	.010
19	.041		.007	.009
20	.036		.006	.008
21	.029	.031	.005	.007
22	.025	.028	.004	.007
23	.020	.025	.003	.006
24	.015	.023	.002	.006
25	.010	.021	.001	.005
26	.006	.019	.000	.005
27	.002	.018		.005
28	.000	.016		.005
29		.015		.004
30		.013		.004
31		.012		
32		.011		
33		.009		

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BLUE 14"/50

FIRE EFFECT TABLE - BLUE 14"/50

Muzzle Velocity 2800 f.s.
Weight of Projectile 1400 lbs.

Maximum Range 34.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
3"	---	---	---	---
4"	---	---	---	---
5"	---	---	---	29
5:75	---	---	---	26
6"	---	---	---	25
7"	---	---	29	23
8"	31	29	24	19
9"	27	26	22	16
10"	24	23	20	X
11"	23	21	X	X
12"	21	19	X	X
13"	19	18	X	X
13:75	19	17	X	X
14"	18	X	X	X
15"	17	X	X	X
16"	16	X	X	X

DECK ARMOR

Thick- ness	Range
1:00	7
1:25	9
1:50	11
2:00	15
2:25	16
2:40	18
2:75	20
3:00	21
3:65	25
3:68	25
3:75	25
4:00	26
4:15	27
4:39	28
4:57	29
4:82	30
5:18	31
6:25	X

Penetration of INCLINED ARMOR

12"	16	17	X	X
-----	----	----	---	---

Inclined 10°

- (---) No limit within maximum range of gun.
(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

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LARGE TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4.180		2.299	
2	4.140		2.279	
3	3.360		1.848	
4	2.660		1.462	
5	2.020		1.111	
6	1.560		.858	
7	1.220		.671	
8	.980		.539	
9	.806		.443	
10	.670		.368	
11	.560		.308	
12	.465		.256	
13	.395		.217	
14	.330		.182	
15	.278		.153	
16	.235		.129	
17	.204		.110	
18	.179		.099	
19	.158		.087	
20	.139		.076	
21	.116	.121	.064	.067
22	.096	.106	.053	.058
23	.080	.094	.044	.052
24	.065	.084	.035	.046
25	.051	.076	.028	.042
26	.038	.070	.021	.038
27	.026	.064	.014	.035
28	.016	.058	.009	.032
29	.009	.054	.005	.030
30	.004	.050	.002	.027
31	.000	.046	.000	.025
32		.043		.024
33		.040		.022
34		.038		.021

INTERMEDIATE TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4.180		2.926	
2	3.960		2.772	
3	2.760		1.931	
4	1.910		1.337	
5	1.430		1.001	
6	1.090		.763	
7	.845		.591	
8	.670		.469	
9	.545		.382	
10	.455		.318	
11	.380		.266	
12	.320		.224	
13	.270		.189	
14	.230		.161	
15	.191		.134	
16	.157		.110	
17	.130		.091	
18	.114		.080	
19	.100		.070	
20	.087		.061	
21	.073	.077	.051	.054
22	.061	.068	.043	.048
23	.050	.060	.035	.042
24	.041	.055	.029	.039
25	.032	.051	.023	.036
26	.023	.047	.016	.033
27	.015	.043	.010	.030
28	.008	.039	.005	.027
29	.004	.036	.003	.025
30	.000	.033	.000	.023
31		.030		.021
32		.028		.020
33		.025		.018
34		.023		.016

SMALL TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4,180		3,135	
2	3,800		2,850	
3	2,280		1,710	
4	1,480		1,100	
5	1,090		.825	
6	.840		.638	
7	.650		.488	
8	.520		.390	
9	.425		.319	
10	.350		.262	
11	.295		.221	
12	.250		.188	
13	.210		.158	
14	.180		.135	
15	.152		.114	
16	.129		.097	
17	.110		.083	
18	.096		.072	
19	.085		.064	
20	.075		.056	
21	.062	.065	.047	.049
22	.051	.057	.033	.043
23	.041	.050	.031	.038
24	.032	.045	.024	.034
25	.023	.041	.018	.031
26	.015	.038	.012	.029
27	.009	.035	.007	.026
28	.004	.032	.003	.024
29	.000	.030	.000	.022
30		.027		.020
31		.024		.018
32		.022		.017
33		.021		.016
34		.019		.014

PENETRATIVE

DESTROYER TARGET

SUBMARINE TARGET

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4.180		1.800	
2	2.500		.820	
3	1.290		.455	
4	.860		.279	
5	.610		.196	
6	.450		.144	
7	.350		.107	
8	.280		.080	
9	.230		.059	
10	.190		.046	
11	.152		.037	
12	.123		.030	
13	.099		.025	
14	.080		.020	
15	.064		.016	
16	.051		.012	.013
17	.041		.010	.011
18	.034		.009	.010
19	.029		.007	.008
20	.025		.005	.007
21	.020	.021	.004	.007
22	.017	.019	.003	.006
23	.012	.016	.002	.005
24	.009	.014	.002	.005
25	.006	.013	.001	.005
26	.003	.012	.000	.004
27	.001	.011		.004
28	.000	.010		.004
29		.009		.004
30		.008		.004
31		.008		
32		.007		
33		.007		
34		.006		

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BLUE 14"/45

FIRE EFFECT TABLE - BLUE 14"/45

Muzzle Velocity 2700 f.s.
Weight of projectile 1400 lbs.
Maximum Range, TEXAS and NEW YORK 22
Maximum Range all others 33

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
3"	---	---	---	---
4"	---	---	---	---
5"	---	---	---	27
5:75	---	---	---	23
6"	---	---	---	22
7"	---	---	29	19
8"	30	29	25	16
9"	27	25	21	X
10"	24	23	18	X
11"	22	20	16	X
12"	20	18	X	X
13"	18	16	X	X
13:5	17	15	X	X
14"	16	14	X	X
15"	15	X	X	X
16"	13	X	X	X

DECK ARMOR

Thick- ness	Range
1:00	7
1:25	9
1:50	10
2:00	14
2:25	16
2:40	17
2:75	19
3:00	20
3:65	24
3:68	24
3:75	24
4:00	26
4:13	26
4:39	27
4:57	28
4:82	29
5:18	30
6:25	X

Penetration of INCLINED ARMOR

12"	16	16	X	X	Inclined 10°
-----	----	----	---	---	--------------

- (---) No limit within maximum range of gun.
(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

LARGE TARGETPENETRATIVENON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4.180		2.299	
2	4.110		2.261	
3	3.310		1.820	
4	2.530		1.391	
5	1.920		1.056	
6	1.470		.809	
7	1.160		.638	
8	.938		.516	
9	.761		.419	
10	.627		.345	
11	.527		.290	
12	.442		.243	
13	.374		.206	
14	.314		.173	
15	.264		.145	
16	.222		.122	
17	.188		.103	
18	.165		.091	
19	.145		.080	
20	.129		.071	
21	.110	.115	.061	.063
22	.094	.103	.052	.057
23	.078	.092	.043	.051
24	.064	.083	.035	.045
25	.050	.075	.027	.041
26	.037	.068	.020	.037
27	.025	.062	.014	.034
28	.016	.057	.009	.031
29	.009	.052	.005	.029
30	.004	.048	.002	.026
31	.000	.044	.000	.024
32		.041		.023
33		.038		.021

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INTERMEDIATE TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4.180		2.926	
2	3.940		2.758	
3	2.710		1.899	
4	1.845		1.291	
5	1.362		.954	
6	1.040		.728	
7	.807		.564	
8	.643		.450	
9	.518		.362	
10	.426		.298	
11	.359		.251	
12	.300		.210	
13	.255		.179	
14	.213		.149	
15	.179		.125	
16	.149		.104	
17	.126		.088	
18	.110		.077	
19	.096		.067	
20	.085		.060	
21	.071	.075	.050	.053
22	.060	.067	.042	.047
23	.050	.061	.034	.041
24	.041	.055	.028	.038
25	.031	.049	.021	.034
26	.021	.044	.015	.031
27	.014	.040	.010	.028
28	.007	.036	.005	.025
29	.003	.034	.002	.024
30	.000	.031	.000	.022
31		.029		.020
32		.026		.018
33		.024		.017

SMALL TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	4.180		3.135	
2	3.775		2.830	
3	2.250		1.688	
4	1.415		1.060	
5	1.058		.794	
6	.798		.598	
7	.618		.464	
8	.496		.372	
9	.404		.303	
10	.333		.250	
11	.280		.210	
12	.234		.175	
13	.198		.148	
14	.166		.125	
15	.140		.105	
16	.118		.089	
17	.100		.075	
18	.088		.066	
19	.078		.059	
20	.069		.052	
21	.058	.061	.044	.046
22	.048	.054	.036	.040
23	.039	.048	.029	.036
24	.031	.044	.023	.033
25	.022	.039	.017	.029
26	.014	.035	.011	.026
27	.008	.032	.007	.024
28	.004	.029	.003	.022
29	.000	.027	.000	.020
30		.025		.019
31		.024		.018
32		.022		.017
33		.021		.016

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BLUE 12"/50

FIRE EFFECT TABLE - BLUE 12"/50

Muzzle Velocity 2900 f.s.
Weight of projectile 870 lbs.

Maximum Range 23.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thickness	90° or 0°	75° or 15°	60° or 30°	45°
3"	---	---	---	30
4"	---	---	32	24
5"	---	32	28	20
5!75	31	30	25	18
6"	30	29	24	18
7"	27	25	22	15
8"	23	22	19	X
9"	21	20	16	X
10"	19	17	X	X
11"	17	X	X	X
12"	16	X	X	X
13"	14	X	X	X
13!5	13	X	X	X
14"	X	X	X	X

DECK ARMOR

Thickness	Range
1!00	10
1!25	12
1!50	14
2!00	17
2!25	19
2!40	20
2!75	22
3!00	24
3!65	27
3!68	27
3!75	28
4!00	29
4!13	29
4!39	30
4!57	31
4!82	31
5!18	33
6!25	X

Penetration of INCLINED ARMOR

12"	13	X	X	X
-----	----	---	---	---

Inclined 10°

- (---) No limit within maximum range of gun.
(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

FIRE EFFECT TABLE - BLUE 8"/55

Muzzle Velocity 3000 f.s.
Weight of projectile 260 lbs.

Maximum Range, Guns of CA 24, etc. 34
Maximum Range, Guns of CV 2, 3 30

Note: CAs use Common Projectile of 4.50 Cal.
CVs use AP Projectile of 3.52 Cal.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thickness	90° or 0°	75° or 15°	60° or 30°	45°
1"	---	---	---	---
1:5	---	---	---	32
2"	---	---	33	27
2:5	---	---	31	25
3"	32	31	28	22
4"	26	25	22	17
5"	22	21	18	13
5:75	20	18	16	X
6"	19	17	15	X
7"	17	14	X	X
8"	16	X	X	X
9"	14	X	X	X
10"	X	X	X	X

DECK ARMOR

Thickness	Range
1:00	13
1:25	17
1:50	20
2:00	23
2:25	25
2:40	26
2:75	27
3:00	29
3:65	32
3:68	32
3:75	32
4:00	33
4:13	X

Penetration of INCLINED ARMOR

12"	X	X	X	X
-----	---	---	---	---

Inclined 10°

(---) No limit within maximum range of gun.
(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thickness	90° or 0°	75° or 15°	60° or 30°	45°
1"	---	---	---	---
1½"	---	---	---	25
2"	---	---	28	21
2½"	27	26	24	18
3"	24	23	20	15
4"	20	19	16	12
5"	17	16	14	10
5¾"	15	14	12	X
6"	15	14	12	X
7"	13	12	X	X
8"	12	X	X	X
9"	11	X	X	X
10"	X	X	X	X

DECK ARMOR

Thickness	Range
1"00	14
1"25	16
1"50	18
2"00	20
2"25	22
2"40	22
2"75	24
3"00	25
3"65	28
3"68	28
3"75	28
4"00	29
4"13	30
4"38	X

Penetration of INCLINED ARMOR

12"	X	X	X	X
-----	---	---	---	---

Inclined 10°

(---) No limit within maximum range of gun.

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

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BLUE 8"/5.5

LARGE TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	2.171		.668	
2	2.145		.661	
3	1.834		.565	
4	1.500		.462	
5	1.190		.366	
6	.931		.286	
7	.720		.222	
8	.559		.172	
9	.442		.136	
10	.359		.110	
11	.291		.090	
12	.234		.072	
13	.198		.061	
14	.164		.050	
15	.135		.042	
16	.111	.114	.034	.035
17	.090	.096	.028	.030
18	.073	.081	.023	.025
19	.057	.068	.018	.021
20	.046	.060	.014	.018
21	.034	.049	.010	.015
22	.025	.042	.008	.013
23	.017	.036	.005	.011
24	.011	.031	.003	.010
25	.005	.027	.002	.008
26	.002	.023	.001	.007
27	.000	.021	.000	.006
28		.018		.006
29		.016		.005
30		.013		.004
31		.011		.003
32		.010		.003
33		.009		.002
34		.008		.002

INTERMEDIATE TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	2.171		1.002	
2	2.064		.953	
3	1.506		.695	
4	1.098		.507	
5	.845		.390	
6	.650		.300	
7	.496		.229	
8	.379		.175	
9	.302		.139	
10	.244		.113	
11	.198		.091	
12	.160		.073	
13	.133		.061	
14	.112		.052	
15	.094		.043	
16	.073	.075	.034	.035
17	.061	.065	.028	.030
18	.049	.055	.022	.025
19	.037	.044	.018	.020
20	.028	.037	.013	.017
21	.021	.031	.010	.014
22	.015	.029	.008	.013
23	.011	.023	.005	.011
24	.007	.021	.003	.010
25	.004	.018	.002	.009
26	.002	.016	.001	.007
27	.000	.013	.000	.006
28		.011		.005
29		.010		.005
30		.009		.004
31		.008		.004
32		.007		.003
33		.006		.002
34		.005		.002

SMALL TARGET

PENETRATIVE

NON-PENETRATIVE

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	2.171		1.111	
2	1.975		1.011	
3	1.246		.638	
4	.842		.431	
5	.655		.335	
6	.501		.257	
7	.380		.194	
8	.296		.152	
9	.234		.120	
10	.190		.097	
11	.153		.078	
12	.125		.064	
13	.104		.053	
14	.087		.044	
15	.073		.037	
16	.058	.060	.030	.031
17	.047	.050	.023	.025
18	.037	.042	.019	.022
19	.029	.036	.015	.019
20	.023	.031	.012	.016
21	.017	.026	.009	.013
22	.011	.021	.006	.011
23	.007	.018	.003	.009
24	.004	.016	.002	.008
25	.002	.013	.001	.007
26	.000	.011	.000	.006
27		.010		.005
28		.009		.004
29		.008		.004
30		.007		.004
31		.006		.003
32		.005		.003
33		.004		.002
34		.004		.002

PENETRATIVEDESTROYER TARGETSUBMARINE TARGET

Range	Top Spot	Plane Spot	Top Spot	Plane Spot
1	2,171		2,603	
2	1,488		1,241	
3	.806		.650	
4	.492		.403	
5	.328		.273	
6	.242		.195	
7	.192		.143	
8	.156		.105	
9	.127		.083	
10	.101		.065	
11	.078		.049	
12	.062		.036	.037
13	.049		.027	.029
14	.039		.021	.023
15	.031		.017	.019
16	.024	.025	.013	.016
17	.018	.020	.009	.012
18	.014	.016	.007	.010
19	.010	.013	.005	.008
20	.007	.010	.003	.007
21	.005	.009	.002	.006
22	.003	.008	.001	.005
23	.002	.007	.000	.004
24	.001	.006		.003
25	.000	.005		.003
26		.004		.002
27		.003		.002
28		.003		.002
29		.002		.001
30		.002		.001
31		.002		.000
32		.001		
33		.001		
34		.001		

FIRE EFFECT TABLE - BLUE 6"/55

Muzzle Velocity 3000 f.s.
Weight of projectile 105 lbs.

Maximum Range	CLs 4-13,	Turrets:	22
(Length of Proj.		Broadside:	18
3.80 Cal.)			

Maximum Range	CLs 43, etc. & CFs	27
(Length of Proj.	4.50 Cal.)	

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

DECK ARMOR

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	---	---	---	---
1.5	16	15	14	11
2"	13	13	11	9
2.5	11	10	9	8
3"	9	8	7	6
4"	6	6	5	X
5"	4	4	3	X
5.75	3	3	2	X
6"	X	X	X	X

Thick- ness	Range
1.00	18
1.25	19
1.50	21
2.00	24

- (---) No limit within maximum range of gun.
(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	---	---	---	23
1:5	---	26	23	18
2"	24	23	20	16
2:5	21	20	17	13
3"	17	16	14	11
4"	14	13	11	X
5"	11	10	X	X
5:75	10	9	X	X
6"	9	X	X	X
7"	X	X	X	X

DECK ARMOR

Thick- ness	Range
1:00	16
1:25	18
1:50	20
2:00	24
2:25	25
2:40	27
2:75	X

(---) No limit within maximum range of gun.

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

Limiting ranges for penetration of deck armor are inner, or minimum, ranges at which penetration will occur.

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BLUE 5"/51
BLUE 5"/50

FIRE EFFECT TABLE - BLUE 5"/51

Muzzle Velocity 3150 f.s.
Weight of projectile 50 lbs.

Maximum Range 17.

FIRE EFFECT TABLE - BLUE 5"/50

Muzzle Velocity 3000 f.s.
Weight of projectile 50 lbs.

Maximum Range 16.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	---	---	13	9
2"	8	7	X	X
3"	X	X	X	X

- (---) No limit within maximum range of gun.
- (X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	---	---	11	9
2"	8	7	X	X
3"	X	X	X	X

- (---) No limit within maximum range of gun.
(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target	Destroyer Target	Submarine Target
1	1.193	1.193	1.193	1.193	2.884
2	1.183	1.137	1.090	.731	1.300
3	.936	.770	.636	.351	.649
4	.699	.511	.391	.208	.395
5	.475	.337	.261	.136	.253
6	.333	.233	.180	.086	.166
7	.244	.168	.130	.062	.110
8	.179	.125	.097	.045	.078
9	.142	.097	.075	.034	.060
10	.114	.078	.060	.026	.045
11	.093	.063	.050	.020	.033
12	.075	.050	.040	.015	.025
13	.057	.038	.030	.011	.019
14	.043	.030	.023	.008	.014
15	.034	.022	.018	.006	.011
16	.025	.017	.013	.004	.009
17	.019	.013	.010	.003	.007

NON-PENETRATIVE

Top Spot

Range	Large Target	Int. Target	Small Target
1	.269	.403	.477
2	.266	.384	.435
3	.211	.260	.255
4	.157	.172	.156
5	.107	.114	.104
6	.075	.079	.072
7	.055	.057	.052
8	.040	.042	.039
9	.032	.033	.030
10	.026	.026	.024
11	.021	.021	.020
12	.017	.017	.016
13	.013	.013	.012
14	.010	.010	.009
15	.008	.008	.007
16	.006	.006	.005
17	.004	.004	.004

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BLUE 5"/38 A.A.

FIRE EFFECT TABLE - BLUE 5"/38 A.A.

Muzzle Velocity 2600 f.s.
Weight of projectile 54 lbs.

Maximum Range 17

(Based on assumed characteristics)

LIMITING RANGES FOR ARMOR PENETRATIONPenetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	16	16	14	9
2"	8	8	7	5
3"	6	6	5	X
4"	5	4	3	X
5"	3	3	X	X
5!75	X	X	X	X

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

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BLUE 5"/38 A.A.

PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target	Destroyer Target	Submarine Target
1	1.904	1.904	1.904	1.904	4.600
2	1.882	1.810	1.731	1.163	2.065
3	1.490	1.224	1.013	.556	1.030
4	1.110	.809	.621	.329	.630
5	.754	.536	.414	.215	.400
6	.527	.368	.285	.137	.262
7	.386	.264	.204	.099	.180
8	.288	.195	.153	.071	.124
9	.217	.147	.114	.051	.087
10	.168	.114	.089	.038	.064
11	.130	.086	.067	.027	.046
12	.094	.064	.050	.019	.032
13	.069	.048	.038	.014	.023
14	.052	.035	.028	.009	.017
15	.039	.026	.021	.007	.013
16	.029	.019	.015	.005	.010
17	.019	.013	.010	.003	.007

NON-PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target
1	.428	.643	.762
2	.423	.610	.694
3	.336	.413	.405
4	.250	.273	.248
5	.169	.181	.166
6	.119	.124	.114
7	.087	.089	.082
8	.065	.066	.061
9	.049	.050	.046
10	.038	.039	.036
11	.029	.029	.027
12	.021	.021	.020
13	.016	.016	.015
14	.012	.012	.011
15	.009	.009	.008
16	.006	.006	.006
17	.004	.004	.004

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BLUE 5"/25 AA

FIRE EFFECT TABLE - BLUE 5"/25 AA

Muzzle Velocity 2250 f.s.
Weight of projectile 50 lbs.

Maximum Range 14

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	13	12	11	7
2"	7	6	4	2
3"	4	3	2	X
4"	2	2	X	X
5"	1	X	X	X
5#75	X	X	X	X

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target	Destroyer Target	Submarine Target
1	1.904	1.904	1.904	1.904	4.600
2	1.882	1.810	1.731	1.163	2.065
3	1.490	1.224	1.013	.556	1.030
4	1.110	.809	.621	.329	.630
5	.749	.532	.413	.214	.400
6	.523	.366	.282	.136	.262
7	.376	.260	.199	.097	.180
8	.276	.188	.146	.068	.120
9	.194	.132	.102	.045	.078
10	.138	.094	.074	.031	.054
11	.102	.070	.054	.022	.037
12	.074	.050	.039	.015	.025
13	.054	.036	.028	.011	.018
14	.038	.026	.020	.007	.013

NON-PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target
1	.428	.643	.762
2	.423	.610	.694
3	.336	.413	.405
4	.250	.273	.248
5	.169	.180	.165
6	.118	.124	.113
7	.085	.087	.080
8	.062	.063	.059
9	.044	.045	.041
10	.031	.032	.029
11	.023	.023	.022
12	.016	.017	.016
13	.012	.012	.011
14	.009	.009	.008

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BLUE 4"/50

FIRE EFFECT TABLE - BLUE 4"/50

Muzzle Velocity 2900 f.s.
Weight of projectile 33 lbs.

Maximum Range 13

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	13	12	X	X
2"	X	X	X	X

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target	Destroyer Target	Submarine Target
1	.896	.896	.896	.895	2.313
2	.881	.846	.810	.490	1.062
3	.650	.533	.442	.235	.508
4	.454	.332	.255	.120	.296
5	.305	.216	.167	.077	.194
6	.215	.151	.116	.052	.130
7	.160	.110	.085	.038	.092
8	.122	.083	.065	.028	.070
9	.095	.064	.050	.021	.054
10	.076	.052	.040	.016	.040
11	.060	.041	.032	.013	.029
12	.048	.032	.025	.010	.022
13	.037	.025	.020	.008	.016

NON-PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target
1	.209	.314	.373
2	.206	.296	.348
3	.152	.186	.184
4	.106	.116	.106
5	.071	.076	.070
6	.050	.053	.049
7	.037	.039	.035
8	.029	.029	.027
9	.022	.022	.021
10	.018	.018	.017
11	.014	.014	.013
12	.011	.011	.010
13	.009	.009	.008

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BLUE 3"/50
BLUE 3"/50 AA
BLUE 3"/23 AA

FIRE EFFECT TABLE - BLUE 3"/50

Muzzle Velocity 2700 f.s.
Weight of projectile 13 lbs.

Maximum Range 8

FIRE EFFECT TABLE - BLUE 3"/50 AA

Muzzle Velocity 2700 f.s.
Weight of projectile 13 lbs.

Maximum Range 13

FIRE EFFECT TABLE - BLUE 3"/23 AA

Muzzle Velocity 1650 f.s.
Weight of projectile 13 lbs.

Maximum Range 7

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	6	5	X	X
2"	X	X	X	X

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

LIMITING RANGES FOR ARMOR PENETRATION

Penetration of VERTICAL ARMOR
at Target Angles of

Armor Thick- ness	90° or 0°	75° or 15°	60° or 30°	45°
1"	3	3	X	X
2"	X	X	X	X

(X) No penetration at any range within maximum range of gun.

Limiting ranges for penetration of vertical armor are outer, or maximum, ranges at which penetration will occur.

2577
6-31

BLUE 3"/50
BLUE 3"/50 AA
BLUE 3"/23 AA

PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target	Destroyer Target	Submarine Target
1	.636	.636	.636	.572	1.552
2	.529	.508	.487	.206	.737
3	.260	.213	.176	.076	.304
4	.178	.131	.100	.038	.156
5	.125	.088	.068	.022	.098
6	.091	.064	.049	.017	.066
7	.068	.046	.036	.013	.047
8	.053	.036	.026	.009	.035
9	.042	.028	.018	.006	.025
10	.033	.021	.012	.004	.018
11	.025	.015	.006	.002	.011
12	.017	.010	.001	.001	.006
13	.011	.005	.000	.000	.001

2577
6-3I

BLUE 3"/50
BLUE 3"/50 AA
BLUE 3"/23 AA

NON-PENETRATIVE

TOP SPOT

Range	Large Target	Int. Target	Small Target
1	.111	.175	.207
2	.093	.140	.158
3	.045	.059	.057
4	.031	.036	.032
5	.022	.024	.022
6	.016	.018	.016
7	.012	.013	.012
8	.009	.010	.008
9	.006	.007	.006
10	.004	.005	.004
11	.003	.003	.002
12	.001	.001	.000
13	.000	.000	

2578
6-8-32

Rate of Fire

B34-13

in

Rounds per Move

Range	16"/45	15"/42	14"/50	14"/45	12"/50	8"/55	6"/53	5"/51	5"/51	5"/38	5"/25AA	4"/7/50	4"/7/45	4"/7/45	4"/7/40	4"/50	4"/45AA	3"/50	3"/45	3"/40	3"/25	3"/23
	a = 6 b = 3	6 3	6 3	6 3	6 3	6 3	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10	10 10
0	4.20	4.20	4.20	4.20	4.20	8.40	15.00	12.00	15.00	15.00	24.00	24.00	24.00	15.00	15.00	24.00	16.00					
2	4.15	4.16	4.16	4.15	4.17	8.30	14.82	11.86	14.82	14.82	23.60	23.60	23.75	14.85	14.85	23.80	15.80					
4	4.10	4.10	4.10	4.10	4.11	8.21	14.63	11.70	14.63	14.62	23.20	23.20	23.40	14.64	14.64	23.43	15.42					
6	4.04	4.01	4.03	4.05	4.05	8.12	14.43	11.53	14.43	14.39	22.80	22.60	23.00	14.36	14.36	23.00	14.42					
8	3.89	3.88	3.92	3.92	3.97	7.89	14.21	11.33	14.21	14.12	22.20	21.30	22.50	14.06	14.03	22.46	12.33					
10	3.72	3.69	3.79	3.76	3.84	7.48	13.96	11.11	13.93	13.81	20.40	16.80	21.70	13.53	13.43	21.48	9.09					
12	3.56	3.51	3.62	3.59	3.64	7.04	13.69	10.82	13.62	13.46	16.90	13.30	20.20	12.57	12.20	19.55	6.75					
14	3.39	3.33	3.45	3.42	3.46	6.64	13.01	10.00	12.71	11.60	13.90	10.20	16.83	10.50	10.10	16.15	4.66					
16	3.23	3.15	3.28	3.26	3.30	6.20	11.71	8.68	11.23	9.89	11.10	---	14.06	8.79	8.40	13.40	---					
18	3.09	2.98	3.12	3.10	3.14	5.80	10.16	7.54	9.75	8.40	---	---	11.74	7.34	---	---	---					
20	2.94	2.81	2.96	2.95	2.99	5.40	8.95	6.69	8.00	---	---	---	9.80	6.13	---	---	---					
22	2.78	2.66	2.81	2.80	2.83	5.00	7.87	5.95	6.50	---	---	---	---	---	---	---	---					
24	2.64	2.50	2.67	2.65	2.68	4.60	6.93	5.36	---	---	---	---	---	---	---	---	---					
26	2.50	2.36	2.54	2.50	2.55	4.20	6.08	---	---	---	---	---	---	---	---	---	---					
28	2.36	2.22	2.41	2.37	2.42	3.80	5.31	---	---	---	---	---	---	---	---	---	---					
30	2.23	2.09	2.29	2.23	2.30	3.40	---	---	---	---	---	---	---	---	---	---	---					
32	2.10	1.98	2.17	2.11	2.18	3.04	---	---	---	---	---	---	---	---	---	---	---					
34	2.02	1.84	2.06	1.99	---	2.70	---	---	---	---	---	---	---	---	---	---	---					
36	1.89	1.73	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---					
38	1.79	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---					