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28
Mandala
2810

7052 W.O.F. H.C. FORTYONE

RANGE TABLE FOR *M2.E.L.*

'303-INCH

VICKERS MACHINE GUN

1937

W. J. Thompson
7052 W. O. F.

LONDON

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1937

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By Command of the Army Council,

H. J. Greedy

THE WAR OFFICE,
28th February, 1937

2032 *2032*
OFFICIAL COPY
RANGE TABLE
1445

1	2	3	4	5	6	7	8	9									
									Range	Tangent Elevation	Slope of descent		Depth of Lowest Shot below Centre of Cone	Total depth of Cone	Dimensions of Horizontal Beaten Zone		Time of Flight
											As an Angle	As a Gradient			Width	Length	
	yds.	° ' "	° ' "	One in	mins.	yds.	yds.	yds.	secs.								
100	0 3	0 4	800-0	—	—	—	—	—	—								
200	0 7	0 9	382-0	—	—	—	—	—	0-2								
300	0 11	0 15	230-0	—	—	—	—	—	0-4								
400	0 16	0 22	156-0	—	—	—	—	—	0-6								
500	0 22	0 30	115-0	7	2-2	2-3	700	—	0-8								
600	0 28	0 40	86-0	9	2-9	2-8	600	—	1-0								
700	0 35	0 52	66-0	9	3-7	3-3	525	—	1-25								
800	0 43	1 7	51-3	10	4-7	3-8	450	—	1-5								
900	0 52	1 25	40-4	12	6-1	4-3	375	—	1-73								
1000	1 2	1 46	32-4	14	8-0	5-0	300	—	2-0								
1100	1 14	2 10	26-4	15	9-7	6-0	270	—	2-3								
1200	1 27	2 38	21-7	15	10-7	7-0	240	—	2-65								
1300	1 41	3 11	18-0	15	11-3	8-0	210	—	3-0								
1400	1 57	3 49	15-0	15	12-0	9-0	180	—	3-4								
1500	2 15	4 32	12-6	15	12-8	10-0	160	—	3-8								
1600	2 35	5 20	10-7	15	13-9	11-3	150	—	4-2								
1700	2 57	6 14	9-2	16	15-4	12-7	145	—	4-7								
1800	3 21	7 14	7-9	17	17-4	14-0	140	—	5-2								
1900	3 47	8 21	6-8	18	20-0	15-3	135	—	5-8								
2000	4 16	9 36	5-9	20	23-5	16-7	130	—	6-4								
2100	4 48	10 59	5-1	23	28-1	18-0	140	—	7-1								
2200	5 23	12 31	4-5	27	32-9	19-3	150	—	7-8								
2300	6 1	14 13	4-0	31	40-0	20-7	160	—	8-6								
2400	6 42	16 8	3-5	35	49-2	22-0	170	—	9-3								
2500	7 27	18 11	3-1	41	59-1	23-3	180	—	10-5								
2600	8 16	20 30	2-7	47	71-0	25-0	190	—	11-7								
2700	9 10	23 6	2-4	54	85-4	26-7	200	—	13-0								
2800	10 10	26 3	2-1	63	103-0	28-3	210	—	14-4								

TABLE OF LIFTS, SAFETY ANGLES, MINIMUM CLEARANCES, AIR TEMPERATURE AND BAROMETER CORRECTIONS

1	2	3	4	5	6	7	8
Range	Tangent elevation	Lifts (100 yards)	Safety angle	Minimum clearance		Correction for 10° F. decrease in temperature of air (normal = 60° F.)	Correction for 1° decrease in barometer reading (normal = 30 in.)
yds.	° ' "	mins.	° ' "	yds.	metres	mins.	mins.
100	0 3	4	6 21	11	10	0	0
150	0 5	4	4 17	11	10	0	0
200	0 7	4	5 16	11	10	0	0
250	0 9	4	5 16	11	10	0	0
300	0 11	5	4 17	11	10	0	0
350	0 14	5	2 2	11	10	0	0
400	0 16	6	1 51	11	10	0	0
450	0 19	6	1 43	11	10	0	-1
500	0 22	6	1 38	11	10	0	-1
550	0 25	7	1 34	11	10	0	-1
600	0 28	7	1 32	11	10	0	-1
650	0 32	7	1 35	12	11	0	-1
700	0 35	8	1 39	13	12	+1	-1
750	0 39	8	1 43	14	13	+1	-1
800	0 43	9	1 47	15	14	+1	-1
850	0 47	9	1 52	16	15	+1	-1
900	0 52	10	1 57	17	16	+1	-1
950	0 57	11	2 3	18	17	+1	-1
1000	1 2	12	2 10	20	18	+1	-1
1050	1 8	12	2 17	21	19	+1	-1
1100	1 14	13	2 25	23	21	+1	-1
1150	1 20	14	2 34	25	23	+1	-1
1200	1 27	14	2 44	27	25	+1	-1
1250	1 34	15	2 54	29	26	+1	-1

TABLE OF LIFTS, Etc.—continued.

1	2	3	4	5	6	7	8
Range	Tangent elevation	Lifts (100 yards)	Safety angle	Minimum clearance		Correction for 10° F. decrease in temperature of air (normal = 60° F.)	Correction for 1° decrease in barometer reading (normal = 30 in.)
yds.	° ' "	mins.	° ' "	yds.	metres.	mins.	mins.
1300	1 41	16	3 3	31	28	+1	-3
1350	1 49	17	3 13	33	30	+1	-3
1400	1 57	18	3 24	35	32	+1	-3
1450	2 6	19	3 35	37	34	+1	-3
1500	2 15	20	3 47	40	37	+1	-3
1550	2 25	21	4 0	43	39	+1	-4
1600	2 35	22	4 14	46	42	+3	-5
1650	2 46	23	4 28	49	45	+3	-5
1700	2 57	24	4 43	53	48	+4	-6
1750	3 9	25	4 59	56	51	+4	-6
1800	3 21	26	5 16	60	55	+4	-7
1850	3 34	27	5 34	64	59	+4	-7
1900	3 47	29	5 53	69	63	+5	-8
1950	4 1	31	6 13	74	68	+5	-8
2000	4 16	32	6 34	80	73	+6	-9
2050	4 32	33				+6	-10
2100	4 48	35				+7	-11
2150	5 5	37				+7	-12
2200	5 23	38				+8	-13
2250	5 42	39				+8	-14
2300	6 1	41				+9	-15
2350	6 21	43				+10	-17
2400	6 42	45				+11	-19
2450	7 4	47				+12	-20
2500	7 27	49				+13	-22
2550	7 51	51				+14	-24
2600	8 18	54				+15	-26
2650	8 42	57				+17	-28
2700	9 10	60				+18	-30
2750	9 39					+19	-33
2800	10 10					+21	-36

WIND VALUES

(Approximate.)5 m.p.h.
Flaps.
(Gentle breeze.)15 m.p.h.
Straight.
(Fresh.)10 m.p.h.
Does not fall.
(Moderate.)25-30 m.p.h.
Rises.
(High wind.)

50 m.p.h. (Gale.)

INSTRUCTIONS FOR USING WIND TABLE

To read the table :-

Estimate the strength of the wind in miles per hour. Note whether it is along the line of fire, or from a flank, *i.e.*, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or at a full right angle to the line of fire.

Note the readings in the table against the range and under the wind direction, for direction on the left half of the table, and for range on the right.

These are the allowances for a 20 m.p.h. wind, and they are reduced or increased in proportion to the actual strength of the wind.

Example :-

Range—1900 yards.

Wind—30 m.p.h. from left rear at $\frac{1}{4}$ right angle to the line of fire.

Correction for direction—

- $1\frac{1}{2}$ times 25 minutes.

= 35 minutes (to left).

Correction for range—

- $1\frac{1}{2}$ times 12 minutes.

= 18 minutes (subtract).

*Rule :-*For a **HEAD** wind **ADD**.For a **REAR** wind **DEDUCT**.

WIND TABLE
(WIND 20 M.P.H.)

1	2	3	4	5	6	7	8	9
Range	Correction for direction in minutes				Range correction in minutes			
	Right Angle	1	1	1	1	1	1	Head or rear
yds.								
500	13	12	9	8	0	0	0	0
600	15	14	11	6	0	0	0	0
700	18	17	13	7	0	0	1	1
800	22	20	15	8	0	1	1	1
900	24	22	17	9	0	1	1	1
1000	27	25	19	10	1	1	2	2
1100	30	28	21	11	1	2	2	2
1200	33	31	23	13	1	2	3	3
1300	36	34	26	14	1	3	3	4
1400	40	37	28	15	2	3	4	4
1500	43	40	30	16	2	4	5	6
1600	47	43	33	18	3	5	6	7
1700	51	47	36	20	3	6	8	9
1800	56	52	40	21	4	7	10	10
1900	61	56	43	23	5	9	12	13
2000	66	61	47	25	6	11	15	16
2100	71	66	50	27	8	14	18	20
2200	77	71	54	29	9	17	22	23
2300	84	78	60	32	11	21	28	30
2400	92	85	65	35	14	25	33	36
2500	100	91	71	38	17	32	42	45
2600	110	102	78	42	21	38	50	54
2700	121	112	85	46	26	49	64	69
2800	132	122	93	50	32	59	77	83

LENGTHS OF BEATEN ZONES ON SLOPING GROUND

Slope	Range												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Forward	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	
7° 1/8	40	50	60	70	80	90	100	110	120	130	140	150	160
8° 1/16	50	60	70	80	90	100	110	120	130	140	150	160	170
9° 1/32	60	70	80	90	100	110	120	130	140	150	160	170	180
10° 1/64	70	80	90	100	110	120	130	140	150	160	170	180	190
11° 1/128	80	90	100	110	120	130	140	150	160	170	180	190	200
12° 1/256	90	100	110	120	130	140	150	160	170	180	190	200	210
13° 1/512	100	110	120	130	140	150	160	170	180	190	200	210	220
14° 1/1024	110	120	130	140	150	160	170	180	190	200	210	220	230
15° 1/2048	120	130	140	150	160	170	180	190	200	210	220	230	240
16° 1/4096	130	140	150	160	170	180	190	200	210	220	230	240	250
17° 1/8192	140	150	160	170	180	190	200	210	220	230	240	250	260
18° 1/16384	150	160	170	180	190	200	210	220	230	240	250	260	270
19° 1/32768	160	170	180	190	200	210	220	230	240	250	260	270	280
20° 1/65536	170	180	190	200	210	220	230	240	250	260	270	280	290
21° 1/131072	180	190	200	210	220	230	240	250	260	270	280	290	300
22° 1/262144	190	200	210	220	230	240	250	260	270	280	290	300	310
23° 1/524288	200	210	220	230	240	250	260	270	280	290	300	310	320
24° 1/1048576	210	220	230	240	250	260	270	280	290	300	310	320	330
25° 1/2097152	220	230	240	250	260	270	280	290	300	310	320	330	340
26° 1/4194304	230	240	250	260	270	280	290	300	310	320	330	340	350
27° 1/8388608	240	250	260	270	280	290	300	310	320	330	340	350	360
28° 1/16777216	250	260	270	280	290	300	310	320	330	340	350	360	370
29° 1/33554432	260	270	280	290	300	310	320	330	340	350	360	370	380
30° 1/67108864	270	280	290	300	310	320	330	340	350	360	370	380	390
31° 1/134217728	280	290	300	310	320	330	340	350	360	370	380	390	400
32° 1/268435456	290	300	310	320	330	340	350	360	370	380	390	400	410
33° 1/536870912	300	310	320	330	340	350	360	370	380	390	400	410	420
34° 1/1073741824	310	320	330	340	350	360	370	380	390	400	410	420	430
35° 1/2147483648	320	330	340	350	360	370	380	390	400	410	420	430	440
36° 1/4294967296	330	340	350	360	370	380	390	400	410	420	430	440	450
37° 1/8589934592	340	350	360	370	380	390	400	410	420	430	440	450	460
38° 1/17179869184	350	360	370	380	390	400	410	420	430	440	450	460	470
39° 1/34359738368	360	370	380	390	400	410	420	430	440	450	460	470	480
40° 1/68719476736	370	380	390	400	410	420	430	440	450	460	470	480	490
41° 1/137438953472	380	390	400	410	420	430	440	450	460	470	480	490	500
42° 1/274877906944	390	400	410	420	430	440	450	460	470	480	490	500	510
43° 1/549755813888	400	410	420	430	440	450	460	470	480	490	500	510	520
44° 1/1099511627776	410	420	430	440	450	460	470	480	490	500	510	520	530
45° 1/2199023255552	420	430	440	450	460	470	480	490	500	510	520	530	540
46° 1/4398046511104	430	440	450	460	470	480	490	500	510	520	530	540	550
47° 1/8796093022208	440	450	460	470	480	490	500	510	520	530	540	550	560
48° 1/17592186444416	450	460	470	480	490	500	510	520	530	540	550	560	570
49° 1/35184372888832	460	470	480	490	500	510	520	530	540	550	560	570	580
50° 1/70368745777664	470	480	490	500	510	520	530	540	550	560	570	580	590
51° 1/140737491555312	480	490	500	510	520	530	540	550	560	570	580	590	600
52° 1/281474983110624	490	500	510	520	530	540	550	560	570	580	590	600	610
53° 1/562949966221248	500	510	520	530	540	550	560	570	580	590	600	610	620
54° 1/112589993242496	510	520	530	540	550	560	570	580	590	600	610	620	630
55° 1/225179986484992	520	530	540	550	560	570	580	590	600	610	620	630	640
56° 1/450359972969984	530	540	550	560	570	580	590	600	610	620	630	640	650
57° 1/900719945939968	540	550	560	570	580	590	600	610	620	630	640	650	660
58° 1/1801439891879936	550	560	570	580	590	600	610	620	630	640	650	660	670
59° 1/3602879783759872	560	570	580	590	600	610	620	630	640	650	660	670	680
60° 1/7205759567519744	570	580	590	600	610	620	630	640	650	660	670	680	690
61° 1/14411519135039488	580	590	600	610	620	630	640	650	660	670	680	690	700
62° 1/28823038270078976	590	600	610	620	630	640	650	660	670	680	690	700	710
63° 1/57646076540157952	600	610	620	630	640	650	660	670	680	690	700	710	720
64° 1/115292153080315904	610	620	630	640	650	660	670	680	690	700	710	720	730
65° 1/230584306160631808	620	630	640	650	660	670	680	690	700	710	720	730	740
66° 1/461168612321263616	630	640	650	660	670	680	690	700	710	720	730	740	750
67° 1/922337224642527232	640	650	660	670	680	690	700	710	720	730	740	750	760
68° 1/1844674489285054464	650	660	670	680	690	700	710	720	730	740	750	760	770
69° 1/3689348978570108928	660	670	680	690	700	710	720	730	740	750	760	770	780
70° 1/7378697957140217856	670	680	690	700	710	720	730	740	750	760	770	780	790
71° 1/14757395914280435712	680	690	700	710	720	730	740	750	760	770	780	790	800
72° 1/29514791828560871424	690	700	710	720	730	740	750	760	770	780	790	800	810
73° 1/59029583657121748448	700	710	720	730</									

INSTRUCTIONS FOR USE OF CONVERSION TABLE

(pp. 9-11)

Against the oblique base (OG) in the left column, and under the angle TOG in the upper heading, read the range correction in yards. Correct the range OT by this amount to obtain the range GT.

Against the oblique base and under the angle TOG in the lower heading read the true base in yards.

Example :-

Oblique base — 95 yards.
 Angle TOG — 145 degrees.
 Range correction is 78 yards.
 True base is 54 yards.

INSTRUCTIONS FOR USE OF V.I. TABLE (pp. 12-13)

The angle is printed along the top of the table, the range (or H.E.) down the left side and the base (or V.I.) in the body of the table.

Examples :-

- Given—Range 800 yards and base 30 yards.
 Against 800 yards—28 yards is 2 degrees.
 2 yards is 10 mins.
 So —30 yards is 2 degs. 10 mins.
- Given—Range 1,300 yards and angle 7 degs. 20 mins.
 Against 1,300 yards— 7 degs. is 159 yards.
 20 mins. is 8 yards.
 So — 7 degs. 20 mins. is 167 yards.

Table for converting oblique to true bases

(Instructions for use on Page 8)

Oblique Base yards	Angle TOG for use in finding Range Correction																			Oblique Base yards
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
35	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	35
40	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	40
45	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	45
50	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	50
55	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	55
60	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	60
65	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	65
70	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	70
75	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	75

Table for converting oblique to true bases—continued.

Oblique Base	Angle TOG for use in finding Range Correction																	Oblique Base		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		18	19
85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5				
95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175				
80	79	77	75	72	69	66	63	57	51	46	40	34	27	21	14	7				
85	84	82	80	77	74	70	65	60	55	49	42	36	29	22	15	7				
90	80	87	85	82	78	74	69	64	58	52	45	38	31	23	16	8				
95	93	92	89	86	82	78	73	67	61	54	47	40	32	25	16	8				
100	100	98	97	94	91	87	82	77	71	64	57	50	42	34	26	17				
105	103	101	99	95	91	86	80	74	67	60	52	44	36	27	18	9				
110	108	106	103	100	95	90	84	78	71	63	55	46	38	29	19	10				
115	113	111	108	104	100	94	88	81	74	66	57	49	39	30	20	10				
120	120	118	116	113	109	104	98	92	85	77	69	60	51	41	31	21				
125	125	123	121	117	113	108	102	96	88	80	72	63	53	43	32	22				
130	130	128	126	122	118	113	106	100	92	84	75	65	55	44	34	23				
135	134	133	130	127	122	117	111	103	95	87	77	67	57	46	35	25				

Angle TOG for use in finding True Base

yards

yards

Instructions for

	1	2	3	4	5	6	7	8	9	10	11
Range	Minutes					Degrees					
	10	20	30	40	50	1	2	3	4	5	
yards											
100	0	1	1	1	1	2	3	5	7	9	
200	1	1	2	2	3	3	7	10	14	17	
300	1	2	3	3	4	5	10	16	21	26	
400	1	2	3	5	6	7	14	21	28	35	
500	1	3	4	6	7	9	17	26	35	44	
600	2	3	5	7	9	10	21	31	42	52	
700	2	4	6	8	10	12	24	37	49	61	
800	2	5	7	9	12	14	28	42	58	70	
900	3	5	8	10	13	16	31	47	63	79	
1000	3	6	9	12	15	17	35	52	70	87	
1100	3	6	10	13	16	19	38	58	77	96	
1200	3	7	10	14	17	21	42	62	84	105	
1300	4	8	11	15	19	23	45	68	91	113	
1400	4	8	12	16	20	24	49	73	98	122	
1500	4	9	13	17	22	26	52	79	105	131	
1600	5	9	14	19	23	28	56	84	112	140	
1700	5	10	15	20	25	30	59	89	119	148	
1800	5	10	16	21	26	31	63	94	126	157	
1900	6	11	17	22	28	33	66	99	133	166	
2000	6	12	17	23	30	35	70	105	145	175	
2100	6	12	18	24	31	37	73	110	146	183	
2200	6	13	19	26	32	38	77	115	154	192	
2300	7	13	20	27	33	40	80	120	161	201	
2400	7	14	21	28	35	42	84	126	168	209	
2500	7	15	22	29	36	44	87	131	174	218	
2600	8	15	23	30	38	45	91	136	182	227	
2700	8	16	24	31	39	47	94	141	188	236	
2800	8	16	24	33	41	49	98	147	195	244	
2900	8	17	25	34	42	51	101	152	202	253	
3000	9	17	26	35	44	52	105	157	209	262	

TABLE

use on page 8

	12	13	14	15	16	17
Range	Degrees					
	6	7	8	9	10	
yards						
100	10	12	14	16	17	
200	21	24	28	31	35	
300	31	37	42	47	52	
400	42	49	56	63	70	
500	52	61	70	78	87	
600	63	73	84	94	105	45 yards, degs. mins.
700	73	86	98	110	122	
800	84	98	112	126	140	
900	94	110	125	141	157	
1000	105	122	140	157	175	2 35
1100	115	134	154	173	192	2 20
1200	126	147	168	188	209	2 9
1300	136	159	182	204	227	1 59
1400	147	171	195	220	244	1 51
1500	157	183	209	236	262	1 43
1600	168	195	223	251	279	1 37
1700	178	206	237	267	297	1 31
1800	188	220	251	283	314	1 28
1900	199	232	265	298	332	1 21
2000	209	244	279	314	349	1 17
2100	220	257	295	330	367	1 14
2200	230	269	307	346	384	1 10
2300	241	281	321	361	401	1 7
2400	251	293	335	377	419	1 4
2500	262	305	349	393	436	1 2
2600	272	318	363	408	454	1 0
2700	283	330	377	424	471	57
2800	293	342	391	440	489	55
2900	304	354	405	456	506	53
3000	314	367	419	471	524	52

A FORMULA FOR DETERMINING ANGLE OF SIGHT

$$\text{Angle of sight (in minutes)} = \frac{(A_1 \times GO) + (A_2 \times OT)}{GT}$$

Where T is the target, G the gun line, O the O.P.

And where—

A_1 is the angle of sight from G to O in minutes.

A_2 is the angle of sight from O to T in minutes.

A_1 and A_2 must be provided with their proper signs before being placed in the formula, *i.e.*, " + " for angles of elevation, " - " for angles of depression.

ALLOWANCE FOR MOVING TARGETS

At ranges between 800 and 2,000 yards :—

Multiply the target speed in miles per hour by 5.

This gives the angle in minutes through which the target will travel during the flight of the bullet.

Example :—

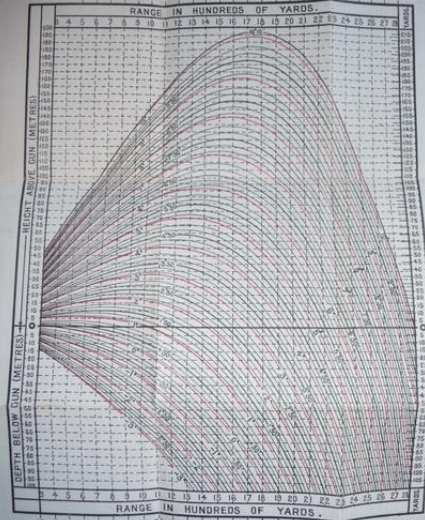
Target speed—12 m.p.h.

Fire ahead by 60 minutes (1 degree).

For targets moving obliquely across the line of fire, a proportion of this allowance should be given.

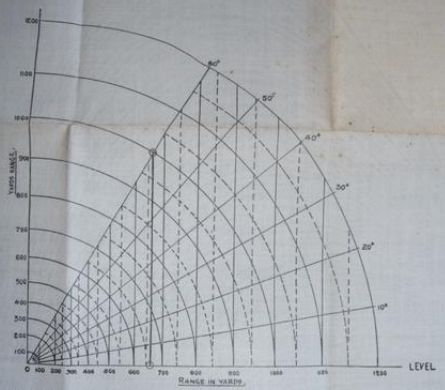
Below 800 yards, an allowance of 15 or 30 minutes will be sufficient.

(CURVES REPRESENT CENTRE SHOTS.)
 DEPTH OF LOWEST SHOT BELOW CENTRE OF GUN AT VARIOUS DISTANCES FROM GUN
 IN YARDS 11 15 19 24 31 40 48 54 57 60 64 70 77 87 100 118 141 160 205 24 29 35 42 51
 IN METRES 10 14 17 22 28 37 44 49 52 55 58 64 70 79 91 108 129 155 187 22 27 32 39 47



10 10 10 10 12 14 16 18 21 25 28 32 37 42 48 55 63 73 CLEARANCE IN METRES.
 11 11 11 13 15 17 20 24 27 31 35 40 46 53 60 68 80 CLEARANCE IN YARDS.
 MINIMUM SAFETY CLEARANCES REQUIRED AT VARIOUS DISTANCES FROM GUN.
 How TO USE THE GRAPH.—To FIND Q.E.—Take range and run up on vertical scale to height of target above or below gun. The curve cutting this point gives required Quadrant Elevation.
 To FIND CLEARANCE.—Follow this curve along, and ascertain at what height it passes vertically above a point plotted to show distance and height (above or below gun) of own troops (or obstacles). This gives clearance in yards (right-hand scale) or metres (left-hand scale), from centre shot to ground.

Chart for .303 Mark VII for Firing Up or Down Hill.



Example.—
 Range of target is 1,000 yards.
 Angle of sight is 60 degrees.
 Spot intersection of 60 degrees line and 1,000 yards circle at Mark ⊕ come down vertically on to line marked LEVEL and read range there at Mark ⊕ as 660.
 Set sight to 660 yards.
Note.—Corrections for barometer and thermometer should be applied before using the chart.