CHAPTER 10

SECTION 4

QUANTITY DISTANCES AND OTHER LICENSING CRITERIA FOR MILITARY EXPLOSIVES IN NAVAL OR MILITARY PORTS

CONTENTS

1 SECTION FOUR

1.1 Introduction

1.1.1 The principles detailed below set out the criteria to be observed for explosives licensing of berths, anchorages and moorings where military explosives may be present. This includes Naval and military ports and jetties associated with Armament Depots. They are designed to give the appropriate levels of protection to vessels, facilities and personnel working in the immediate environment as well as to the general public when explosives are not permanently present (certainly no more than 50% of the time) in these locations. In general, they are based on the advice used in Chapter 10 Section 1 and Section 2 for above-ground storage. They apply to an area of water (berths, anchorages, jetties etc) but not to the warships or RFAs berthed thereat (other than those defined at para 1.1.2, below), for which JSP 862 Vol 1 and Vol 2 apply. When the loading of a vessel with explosives has been completed, the master of the vessel shall ensure that the vessel is taken out of the harbour or harbour area as soon as is reasonably practicable. In situations where explosives are

present for more than 10% of the time the levels of protection given in section 2 should be applied.

1.1.2 Unless an Explosives Licence for activity to be undertaken exists, explosives must not be brought into a harbour or harbour area, or loaded or unloaded to vessels. Unless they are:

(1) Carried within a British or foreign warship and covered by the Warships in Harbour regulations.

(2) Self defence or SOLAS explosives carried for ready use.

1.1.3 For the purposes of 'Small Quantity or Limited 'Top Up' only, licensing arrangements and the conditions and Restrictions that apply to these operations are specifically detailed at Annex A.

1.2 **Warships**

1.2.1 Generally, foreign or British warships are not subject to JSP482 and may occupy unlicensed berths provided that they are governed by the Warships in Harbour Regulations and meet the conditions laid down in JSP862 (Naval Magazine and Explosives Regulations).

1.2.2 Royal Naval warships are subject to regulation under JSP430 (MOD Ship Safety Management).

2 **PORT SURVEYS AND CONSEQUENCE ANALYSIS**

2.1 **Introduction**

2.1.1 As an essential part of the assessment, a competent person, approved by the IE concerned or by CIE(MOD), must carry out a port survey in order to obtain the following information:

(1) The method of operation, and the position of the potential berths for handling explosives.

(2) The disposition of exposed sites, the nature of occupancy and occupancy levels (this should also take into consideration non-occupied sites such as pipelines, electrical sub-stations, etc).

(3) The access routes to the berth for explosives traffic and any stabling areas.

2.2 **Consequence Analysis**

2.1.2 A Consequence Analysis is to be conducted in order to identify potential consequences from an unplanned fire or explosion (see process in Chapter 9). The results of the CA are to be reviewed by the relevant Duty Holder, in conjunction with a competent person approved by the IE or CIE(MOD) or DOSG ST2, to establish their tolerability. It should be remembered that the potential consequences generated may be considered to be unacceptable.

3 **CALCULATION OF NET EXPLOSIVES QUANTITY**

3.1 **Aggregation**

3.1.1 In view of the close proximity of ship compartments and holds and the adjacent ship to shore transfer area, it is possible that an explosion could involve the whole cargo. For this reason, all the explosives on board a vessel are to be aggregated in accordance with the principles of Chapter 10, Section 1. The NEQ to be taken into account must therefore include all explosives:

(1) On jetties or in vehicles or vessels alongside the ship, and

(2) Being handled and fitted on the deck of the ship, and

(3) In the magazine or hold being worked, plus those in adjacent magazines or holds being worked, plus those present in any other adjacent magazines unless the risk of simultaneous propagation has been assessed as being negligible.

3.2 NEQ Assessments

3.2.1 Normally the full aggregated NEQ of the vessel, lighters, lorries or packages at the berth should be assumed. It is also allowable to calculate the Effective NEQ (ENEQ) where this can be supported by a Technical Assessment and endorsed by the ENEQ WG.

4 NON-STANDARD SITUATIONS

4.1 Introduction

4.1.1 Where situations arise when the required minimum standards laid down in these Regulations cannot be met, these are to be subject to the Non-standard Licensing procedures laid down in Chapter 9.

5 QUANTITY DISTANCES TO OTHER VESSELS AND SITES

5.1 Introduction

5.1.1 QDs to be observed by vessels when carrying, loading or unloading military explosives at piers, jetties, wharves or anchorages are given at Annex B and are to be applied as detailed below for the NEQ concerned to ensure adequate protection of ES.

5.2 Measurements

5.2.1 On locations where many different classes of vessels are berthed a composite foot print should be assumed reflecting the maximum length and beam of each class of vessel that will use the berth. It is also allowable to measure from the nearest point of compartments in which military explosives are stowed in a berthed or anchored vessel to the nearest point of the ES where this distance is known. Swinging circles must be added to all measurements where applicable.

5.3 Swinging Circles

5.3.1 When QDs are calculated, due allowance is to be made for movement of ships due to tides when anchored or berthed at a single buoy. The radius of the swinging circle is to be taken into account when calculating the overall distance between the aftermost compartment in which military explosives are stored and the ES. Anchor chains are normally 40m for large vessels.

5.4 Multiple Vessels

5.4.1 It is not permissible to berth two vessels at a single berth for ammunitioning purposes (other than small quantity top ups) due to the additional risk presented to the crew, vessels and facilities involved.

5.5 Emergency Arrangements

5.5.1 Emergency arrangements must be decided on a case by case basis taking into account the conditions and operations that take place in different ports. The Duty Holder of each berth is responsible for producing, reviewing and checking adequate emergency plans that must include, but are not limited to:

(1) Actions to be taken in case of a fire:
(a) On the jetty
(b) On the ship
(c) In a lighter
(d) In a vessel associated with the operation (e.g. a tug or passenger (PAX) boat)

(2) Actions to be taken when a weapon is lowered in an uncontrolled manner or dropped:
(a) In to water
(b) Onto a ship or vessel, including a lighter
(c) Onto the jetty

(3) Actions to be taken if vessels associated with the ammunitioning suffer a collision.

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ANNEX A

SMALL QUANTITY AND LIMITED TOP-UP OPERATIONS FOR NAVAL VESSELS

CONTENTS

1 SMALL QUANTITY AND LIMITED TOP-UP OPERATIONS FOR NAVAL VESSELS

1.1 Introduction

1.1.1 There is an ongoing requirement for Naval vessels to load and unload small quantities of explosives, whist alongside berths in Naval Bases and Military Ports, for the purposes of 'top-up'. Designated alongside berths are specifically licensed only for these top-up operations, and permits the loading or off-loading of these small quantities of explosives without the application of the normal Quantity Distances given in Chapter 10, Section 4.

1.2 Conditions Of Handling

1.2.1 Small Quantity Top-up Licences are granted on the basis of an acceptance by ESTC Report No 3/92 that the risks involved in handling small quantities alongside are tolerable subject to conditions incorporated in JSP 862, and that relocation to an ammunitioning berth/buoy is not, in general, reasonably practicable.

1.2.2 The maximum quantities permitted for embarkation/disembarkation are:

(1) HD 1.1 - 25 kg,
or,
(2) HD 1.2 - 200 kg,
or,
(3) HD 1.3 - 200 kg,
and
(4) HD 1.4 - 200 kg

1.2.3 Normal aggregation rules are applicable in these circumstances, i.e. where explosives of more than one HD (except HD 1.4) are involved in loading or offloading, the total NEQ must not exceed the lowest limit for any of the HDs present.

1.2.4 Small Quantity Top Up must only be undertaken on the basis that no other explosives handling takes place within 270m of this activity.

1.2.5 If only HD 1.4 is being embarked/disembarked then dispensation may be sought from NBC and NA Exp to embark/disembark up to 400kg.

1.3 **Restrictions**

1.3.1 With the exception of HD1.4, for surface ships, only upper deck magazines/magazine lockers or small quantity top-up magazines are used in order to avoid opening the main magazines, subject to the following:

(1) The Naval Magazine Safety Committee (NMSC) must specifically approve the arrangements.
(2) Only one upper deck magazine/magazine locker or small quantity top-up magazine is to be opened at any one time.
(3) During the loading or unloading, no explosives stores in the open magazine, other than those being loaded or unloaded, are to be handled in any way. Any stores requiring unloading must be segregated prior to entering port.
(4) Explosives so stored must be transferred to the main magazines once at sea (where appropriate).

1.4 **Compilation of Licences**

2.3.1 Although these licences are not Quantity Distances driven it is appropriate, for visibility, to record Exposed Sites in the vicinity of these explosives handling activities. Accordingly, Exposed Sites within 100 metres of the berth (measured from its extremities) are to be recorded on the back page of the MOD Form 1658 licence.

2.3.2 The Conditions detailed at para 1.2.4 and 1.2.5 above are to be recorded as Special Conditions on the Licence.

2. **Limited Top-Up at Unlicensed Berths**

2.1 Conditions

2.1.1 With the exception of explosives belonging to CG ‘L’ Limited Quantity Top Up may
also lawfully be undertaken at unlicensed berths providing the conditions laid down in JSP 862 Article 0513 para 7 are met. These operations are permitted under the Dangerous Goods in Harbour Regulations.

3.1.2 The maximum permitted quantities are:

(1) HD1.1 – 10kg
or,
(2) HD1.2 – 10kg
or,
(3) HD1.3 – 200kg
or,
(4) HD1.4 – 200kg.

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SECTION 4

ANNEX B

QUANTITY-DISTANCE MATRICES FOR NAVAL/MILITARY PORTS

CONTENTS

1 Pictographs

2 The pictographs in the following tables are to aide the presentation of information in the QD Tables. The pictographs are purely diagrammatic; their shapes do not imply that actual structures should have similar shapes and proportions. The orientation shown is intended to indicate the direction of principle concern for blast, flame, radiant heat and projections shown by arrows. In the actual situation, every direction must be considered in turn. At a PES, there are relatively few significant variations, but at an ES it is necessary to distinguish among different types of construction and among different functions of buildings. For these reasons, a given building may require one symbol when it is being considered as a PES and a different symbol when it is considered as an ES. The pictographs and their descriptions are based on those presented in the aboveground QD tables in Section 2 Annex A.

3 Notes

2 The notes within the QD tables give references to paragraphs. The short text of each note is not to be used as a substitute for proper study of the full text in Chapter 10, Section 4, to which they refer.

It is essential to study the text in Chapter 10, Section 4, when using this table since they are complementary.

Table 1A QD Matrix for Moorings for Explosives Vessels

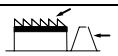
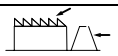
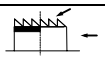
PES ➤ ES ▼	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.1**. **(a)**	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.2**. **(b)**	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.3**. **(c)**
 **1** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. Unmanned Vessel or lighter loaded with ammunition, traversed.	D4 High degree of protection No primary explosives No items vulnerable to spall or D7 High degree of protection	D8 Limited degree of protection	D1 (≥25m)
 **2** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. Unmanned Vessel or lighter loaded with ammunition, untraversed.	D9 High degree of protection No primary explosives No items vulnerable to spall or D19 High degree of protection	D8 Limited degree of protection	D1 (≥25m)
 **3** Manned Vessel, lighter or warship loaded with ammunition, traversed.	D9A Less than 10 personnel D10 More than 10 Personnel	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D2 (≥25m) High degree of protection for personnel
 **4** Manned Vessel, lighter or warship loaded with ammunition, untraversed.	D9A Less than 10 personnel D19 More than 10 Personnel	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D2 (≥25m) High degree of protection for personnel
 **5** Process Building with protective roof, traversed	D9A Less than 10 personnel D10 10 or more Personnel	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D2 (≥25m) High degree of protection for personnel
 **6** Process Building without protective roof, traversed	D9A Less than 10 personnel D10 10 or more Personnel	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D2 (≥25m) Limited degree of protection for personnel
 **7** Process Building with or without protective roof, untraversed	D19(>180m) Limited degree of protection for personnel	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D2 (≥60m) Limited degree of protection for personnel
8 Manned Vessel or lighter being loaded with ammunition, untraversed.	D19(>180m) Limited degree of protection for personnel	D9 or No QD If personnel can be evacuated promptly	D5 (≥60m)

Table 1A QD Matrix for Moorings for Explosives Vessels

PES / ES	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.1**. **(a)**	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.2**. **(b)**	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.3**. **(c)**
 **9** Very Low Density Usage Roads – Less than 20 vehicles per day Public Rights of Way or Recreational Facilities – Less than 20 users per day (See Sect 2 paras 11-17 for full definitions)	No QD	No QD	No QD
 **10** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 11-17 for full definitions)	0.5 x D19	0.5xD9 or No QD If controlled traffic can be stopped promptly	0.5 x D5
 **11** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 11-17 for full definitions)	0.5 x D12 (>180m)	0.5 x D2 or No QD If controlled traffic can be stopped promptly	0.5 x D4 (>60m)
 **12** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 11-17 for full definitions)	D19(>270m)	D9 or No QD If controlled traffic can be stopped promptly	D5 (≥60m)
 **13** Inhabited Building Places of Assembly	D19(>270m)	D9 or No QD If personnel can be evacuated promptly	D5 (≥60m)
14 Vulnerable Constructions (See Chapter 6 paras 48-52 & Chapter 10 sect 1 para 30 (2) for full definition)	2 x D19	2xD9	2 x D5

Table 1A QD Matrix for Moorings for Explosives Vessels

PES ➤ / ES ▼	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.1**. **(a)**	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.2**. **(b)**	 Vessel or lighter carrying, loading or unloading ammunition of **HD 1.3**. **(c)**
15 Passenger terminals or passenger vessel when occupied	D13(>400m)	D2	D4 (≥60m)
Areas over which passengers will transit to vessel	0.5 x D12 (>180m)	0.5 x D2	
16 Other Vessels			
Moored DG Carriers as defined in DSHAR	D19(>270m)	D9	D5 (≥60m)
DG Carriers loading / unloading	D13	D2	D4 (≥60m)
All other moored vessels	0.5 x D12 (>180m)	0.5 x D2	0.5 x D4
17 Transit Sheds			
Bulk Dangerous Goods, unmanned	D19(>270m)	D9	D5 (≥60m)
All other transit sheds, unmanned	0.5 x D12 (>180m)	0.5 x D2	0.5 x D4
Manned transit sheds	D19 (>270m)	D9	D5 (≥60m)
18 Office, Non-explosives workshop, Canteen or Amenity facility	D19(>270m)	D9	D5 (≥60m)
19 Overhead Power Grid Supergrid Network and associated substations	D19 (>270m)	60m	D5 (≥60m)
Normal Network and associated substations	D10	30m	D2
Minor Network and associated substations	D8	No QD	D1
20 POL Facilities inc pipelines Protected or Underground	0.5 x D7	25m	25m
Unprotected, aboveground	D19 (>270m)	60m	D5 (≥60m)
Small Quantities (Chapter 10 Sect 7 para 8)	10m	No QD	10m
21 Boiler Houses Manned	D19(>270m)	60m	D5 (≥60m)
Unmanned	D8	30m	D1
22 Essential Port Facilities	0.5 x D12 (>135m)	0.5 x D2	0.5 x D4

It is essential to study the text in Chapter 10, Section 4, when using these tables since they are complementary.

Table 1B Quantity Distances for Hazard Division 1.1 for Moorings for Explosives

NEQ	Quantity Distance (m)						
	D4	D7	D9A	D10	D12	D13	D19
50	3	9	18	30	82	13	62
60	4	10	19	32	87	23	66
70	4	10	20	33	92	26	69
80	4	11	21	35	96	28	72
90	4	11	22	36	100	31	75
100	4	12	23	38	105	33	79
120	4	12	24	40	110	37	83
140	5	13	25	42	120	41	90
160	5	14	27	44	125	45	94
180	5	14	28	46	130	48	98
200	5	15	29	47	130	52	98
250	6	16	31	51	140	60	105
300	6	17	33	54	150	68	113
350	6	17	34	57	160	75	120
400	6	18	36	59	165	82	124
500	7	20	39	64	180	95	135
600	7	21	42	68	190	110	143
700	8	22	45	72	200	120	150
800	8	23	48	75	210	130	158
900	8	24	50	78	215	140	162
1 000	8	24	53	80	225	150	169
1 200	9	26	58	86	240	170	180
1 400	9	27	63	90	250	190	188
1 600	10	29	68	94	260	210	195
1 800	10	30	73	98	270	225	203
2 000	11	31	78	105	280	240	210
2 500	11	33	90	110	305	280	229
3 000	12	35	105	120	325	305	244
3 500	13	37	115	125	340	330	255
4 000	13	39	130	130	355	350	267
5 000	14	42	140	140	380	380	285
6 000	15	44	150	150	405	405	304
7 000	16	46	155	155	425	425	319
8 000	16	48	160	160	445	445	334
9 000	17	50	170	170	465	465	349
10 000	18	52	175	175	480	480	360
12 000	19	55	185	185	510	510	383
14 000	20	58	195	195	540	540	405
16 000	21	61	205	205	560	560	420
18 000	21	63	210	210	590	590	443
20 000	22	66	220	220	610	610	458
25 000	24	71	235	235	650	650	488
30 000	25	75	250	250	690	690	518
35 000	27	79	265	265	730	730	548
40 000	28	83	275	275	760	760	570
50 000	30	89	295	295	820	820	615
60 000	32	94	315	315	870	870	653
70 000	33	99	330	330	920	920	690
80 000	35	105	345	345	960	960	720
90 000	36	110	360	360	1000	1000	750
100 000	38	115	375	375	1040	1040	780
120 000	40	120	395	395	1100	1100	825
140 000	42	125	420	420	1160	1160	870
160 000	44	135	435	435	1220	1220	915
180 000	46	140	455	455	1260	1260	945
200 000	47	145	470	470	1300	1300	975
250 000	51	155	510	510	1400	1400	1050
Distance Functions							
	$D4 = 0.8Q^{1/3}$	$D7 = 2.4Q^{1/3}$	D9A = D9 for Q≤500 (NEQ+1000)/39.37 for Q>500 and <4000 D10 for Q>4000	$D10 = 8Q^{1/3}$	$D12 = 22.2Q^{1/3}$	$D13 = 1.5Q^{1/3}$ for Q≤2500 $5.5Q^{1/2}$ for Q>2500 ≤4500 $22.2Q^{1/3}$ for Q>4500	$D19 = 0.75\ D12\ (16.7Q^{1/3})$

Table 1C Quantity Distances for Storage Sub Division 1.2.1 and 1.2.2 for Moorings for Explosives				
NEQ (kg)	Quantity Distance (m)			
	D2	D4	D8	D9
10	60	20	10	45
20	60	20	19	45
50	88	32	21	66
70	110	39	23	83
80	120	42	25	90
90	125	45	26	94
100	130	47	28	98
120	140	51	30	105
140	150	54	32	113
160	160	57	33	120
180	165	59	35	124
200	170	61	36	128
250	185	66	39	139
300	195	70	41	147
350	200	72	42	150
400	210	75	44	158
500	220	80	47	165
600	230	83	49	173
700	240	86	50	180
800	245	89	52	184
900	255	91	53	192
1 000	260	93	54	195
1 200	270	96	56	203
1 400	275	99	58	207
1 600	285	105	60	214
1 800	290	105	61	218
2 000	295	110	62	222
2 500	305	115	64	229
3 000	315	115	66	237
3 500	320	120	68	240
4 000	330	120	69	248
4 500	335	120	70	252
5 000	340	125	71	255
6 000	350	125	73	263
7 000	355	130	75	267
8 000	360	130	76	270
9 000	365	135	77	274
10 000	370	135	78	278
12 000	380	140	80	285
14 000	390	140	82	293
16 000	395	145	83	297
18 000	400	145	84	300
20 000	405	145	85	304
25 000	415	150	87	312
30 000	420	155	89	315
35 000	430	155	90	323
40 000	435	160	91	327
45 000	440	160	92	330
50 000	445	160	93	334
60 000	450	165	95	338
70 000	455	165	96	342
80 000	465	170	97	349
90 000	470	170	98	353
100 000	470	170	99	353
120 000	480	175	105	360
140 000	485	175	105	364
160 000	490	180	105	368
180 000	495	180	105	372
200 000	500	180	105	375
250 000	510	185	110	383
500 000	540	195	115	405

Distance Functions	
$D2 = -167.648+70.345*LN(NEQ)-1.303*((LN(NEQ))^2)$	D8 = 0.21*D2
D4 = 0.36*D2	D9 = 0.75*D2

Table 1D Quantity Distances for Storage Sub Division 1.3.3 and 1.3.4				
NEQ (kg)	Quantity Distance (m)			
	D1	D2	D4	D5
50	10	12	25	19
60	10	13	26	20
70	10	14	27	21
80	10	14	28	21
90	10	15	29	22
100	10	15	30	23
120	10	16	32	24
140	10	17	34	26
160	10	18	35	27
180	10	19	37	28
200	10	19	38	29
250	10	21	41	31
300	10	22	43	33
350	10	23	46	35
400	10	24	48	36
500	10	26	51	39
600	10	27	54	41
700	10	29	57	43
800	10	30	60	45
900	10	31	62	47
1 000	10	32	64	48
1 200	10	34	69	52
1 400	10	36	72	54
1 600	10	38	75	57
1 800	10	39	78	59
2 000	10	41	81	61
2 500	11	44	87	63
3 000	12	47	93	70
3 500	13	49	98	74
4 000	14	51	105	79
5 000	16	55	110	83
6 000	18	59	120	90
7 000	19	62	125	94
8 000	20	64	130	98
9 000	21	67	135	102
10 000	22	68	140	105
12 000	25	74	150	113
14 000	27	78	155	117
16 000	28	81	165	124
18 000	30	84	170	128
20 000	32	87	175	132
25 000	35	94	190	143
30 000	39	100	200	150
35 000	42	105	210	158
40 000	44	110	220	165
50 000	50	120	240	180
60 000	54	130	255	192
70 000	59	135	265	199
80 000	63	140	280	210
90 000	66	145	290	218
100 000	70	150	300	225
120 000	77	160	320	240
140 000	83	170	335	252
160 000	88	175	350	263
180 000	94	185	365	274
200 000	99	190	375	282
250 000	110	205	405	304
Distance Functions				
$D1 = 0.22Q^{1/2}$			$D4 = 6.4Q^{1/2}$	
$D2 = 3.2Q^{1/3}$			D5 = 0.75*D4	

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