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SUPERSEDING
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MILITARY SPECIFICATION

PROPELLANTS, U. S. NAVY GUNS; BALLISTIC APPENDIX

1. SCOPE

1.1 Scope. - This specification covers the ballistic requirements for all propellant powders procured for use in U. S. Navy guns except aircraft guns. The physical and chemical requirements of the various powders are covered by separate specifications.

2. APPLICABLE DOCUMENTS

2.1 Specifications. - The following specifications cover chemical and physical requirements for the manufacture of propellant powders for U. S. Navy guns.

MIL-P-231	- Powder, Smokeless, Pyrocellulose
MIL-P-270A	- Propellant, Artillery
JAN-P-309	- Powder, Propellant, Cannon, M-1, M-6 and M-14
MIL-P-17449 (Nord)	- Powder, Propellant, Cordite N
C-MIL-P-18254 (NOrd)	- Powder, Propellant, Picrite, "Cool"

3. REQUIREMENTS

3.1 Charges, Pressures and Velocities. - Weight of charge, muzzle velocity and pressure results obtained with the test powder according to Section 4 must conform to the requirements listed in Tables I and II for the gun caliber, propellant type and charge type involved.

4. QUALITY ASSURANCE PROVISIONS AND TEST REQUIREMENTS

4.1 DEFINITIONS

4.1.1 Master Powder. - A master powder is a lot of powder specifically so designated by the Bureau of Ordnance. It has well established ballistics near the center of the ballistic specification range for powders in its category. There is at least one master powder for each gun caliber and sometimes separate master powders for different nominal propellant compositions within a gun caliber. The master powder has an assigned service charge and an assigned standard pressure obtained either from a number of new gun firings or from matching a previous master powder.

4.1.2 Pressure and Velocity of the Occasion. - The mean of the maximum breech pressures and the mean of the velocities for master powder rounds observed in a single firing are called the pressure and velocity of the occasion (or day). A single firing is understood to mean a sequence of rounds uninterrupted by delays long enough for the gun to cool off.

4.1.3 Matched Powder Method of Powder Proof. - The matched powder method involves determination of the test powder charge in a firing which will give the velocity of the occasion, and determination of the algebraic difference between assigned master powder pressure and pressure of the day. This pressure difference is to be added algebraically to the test powder pressure which corresponds to the matching charge.

4.1.4 Maximum Packing Depth (MPD). - MPD is the distance to the nearest tenth of an inch from the case mouth to the upper level of any given powder charge in a cartridge case under the following conditions.

a. the charge is poured from a height thirty inches above the case mouth;

b. the charge is poured steadily over a time interval of one minute, and;

c. the outside of the case is lightly tapped with a soft mallet adjacent to the rising level of the powder during pouring. MPD varies with powder lot and charge weight.

4.1.5 Production Packing Depth. - For a charge of powder, PPD is defined as the MPD for that charge less some empirical constant determined for each cartridge case design. (Exception: the MPD minus PPD difference is not constant for

gradually necked down cartridge cases such as the 3"/70 case.) PPD is intended to give a powder density which is as tight as can be readily attained in production assembly of rounds. Established MPD-PPD values are tabulated in Table III.

4.1.6 Conditioning Rounds. - The first round fired in a gun during a firing is called a conditioning round. Conditioning rounds are also interposed between two rounds assembled with different types of powder charges or when there is a large pressure differential. Conditioning rounds are utilized between rounds assembled with any two of the following powder types: cordite N, pyro flashing, pyro flashless, M-6 flashing and M-6 flashless powder. Conditioning rounds are also used to obviate effects of large changes in ballistics. For example, conditioning rounds are fired when a charge is expected to give a velocity 100 f/s higher or lower than preceding rounds. Conditioning rounds may have unusual ballistics either because of propellant type interactions or gun condition, and ballistic results obtained with them are disregarded in powder proof.

4.2 Preparation of Charges and Rounds. - Propellants to be fired in ballistic testing for determination of charge weight shall be conditioned by being stored at a constant temperature of 90 degrees F for at least 7 days immediately prior to firing. It is important that the powder temperature be maintained as near to 90°F as possible until fired. Every round fired with the master powder is to be loaded to the exact charge weight and powder level (±0.1 inch) specified for the master powder. Standard service components as listed in Table III are to be used. Projectiles are to be inert loaded to the specified weight, and rounds assembled for a given powder proof firing should not include more than one lot number of any single component - case, primer or projectile. All near-service and service rounds for a given firing should be assembled in the shortest feasible time.

4.3 Determination of PPD and MPD. - PPD as a function of charge weight must be determined for each lot of test propellant for 3" or larger guns, by pouring five 90°F conditioned charges at each of two weights covering the range expected to be used in powder proof under MPD conditions. A straight line is drawn through the MPD's thus obtained and a PPD line derived by subtracting the previously determined empirical value (or values) from the MPD line. The

same powder grains must not be poured twice to determine MPD since the level obtained might be affected by grains broken in previous pourings. For any weight of charge fired in case ammunition, PPD is determined from the PPD line, and the charge is poured to that level with further adjustment for the presence of crusher gauges. The effect of crusher pressure gauges on powder level is also determined empirically for each cartridge case design and the PPD altered accordingly to maintain the density of packing which would exist were the charge assembled to PPD without gauges. (Table III).

4.4 Ballistic Measurements. - Muzzle velocity and maximum breech pressure measurements are required for each round in this test except for conditioning rounds. Velocity measurements are to be at least as accurate as those obtainable with induction coils and chronograph. Velocities for all rounds in a firing are to be measured with the same instrumentation. Maximum breech pressures are to be measured with copper crusher gauges (used according to the best current practice) or any device of greater accuracy and precision.

4.5 Firing Schedule. - The order of firing in powder proof shall follow one of two general schemes as described below.

4.5.1 Firing Scheme I - This firing scheme shall be used for propellant powders for which established velocity and pressure vs charge slopes are tabulated.

4.5.1.1 Fire one test powder charge estimated to give about 75 percent of service velocity.

4.5.1.2 Fire two each master service charges and test powder charges estimated to give within 20 f/s of the velocity of the day (a test powder probing round may be used to estimate the near service charge accurately).

4.5.1.3 Fire one test powder charge estimated to give 100 f/s over the velocity of the day (first firing only, unless estimated service pressure exceeds the maximum limit - 0.5 tsi).

4.5.2 Firing Scheme II. - This firing scheme shall be used for all other propellants and charge types which do not meet the criteria for Firing Scheme I.

4.5.2.1 Fire three test powder charges near 75 percent of service velocity. The initial round fired is a conditioning round.

4.5.2.2 For service charges, fire five master service charges and six test charges to give within 20 f/s of the same velocity as the master powder (the velocity of the occasion). For reduced charges, fire three master reduced charges and four test charges estimated to give within 20 f/s of the same velocity of the master powder (the velocity of the occasion). One of the test charges shall be fired first and considered to be a conditioning round. It also serves as a check on the initial charge estimate.

4.5.2.3 Fire one test powder charge estimated to give a velocity 100 f/s over the velocity of the day.

4.5.3 Discussion of Firing Procedures.

4.5.3.1 General. - For every powder proof the firing scheme should be repeated in four guns with erosion characteristics representative of the range of service life. Those guns which give quickness corrected charge weights differing markedly from the means of other guns should be avoided. Firings should be conducted on four occasions with charges for the four firings being assembled on four different days. Firing in fewer than four guns is acceptable in 8"/55 caliber and larger guns provided, in the first scheme, that the number of rounds per firing is increased to three rounds in three guns or ten rounds in two guns. All propellant lots must be tested in at least two guns differing by at least 50 f/s in mean muzzle velocity and avoiding conditions of unusual velocity performance. (For example, 5"/38 caliber guns tend to yield considerably more scattered velocity results beyond a bore enlargement at the origin of 0.190 and guns eroded beyond this stage should be avoided.)

4.5.4 When the master powder and test powder are of the same type so that no conditioning round is required between them (see 4.1.6), the test and master powders are to be fired in sets of two. The individual rounds and the order in each set are to be determined randomly. In cases involving the concurrent testing of more than one test powder of the same type as the master (no more than 4 test powders shall be tested concurrently) the rounds in each set shall consist of one each from each test powder and one from the master with random selection of rounds and random distribution of the firing sequence.

4.5.5 When the test and master powders are of different types, the master powder rounds and test powder rounds must be fired consecutively in separate groups. Random selection should be used for the sequence of firing of the test and master groups from firing to firing. A conditioning round must be interposed between groups. Concurrent testing of test powders is not permissible under these conditions.

4.5.6 Firing is to cease if at any time observed pressures indicate a danger of pressure in excess of proof. If, during testing by Firing Scheme I (4.5.1 and 4.5.4), either the two near-service test powder rounds or the two master rounds differ by more than 20 f/s in muzzle velocity, an additional round of the offending type is to be fired and averaged with the other two for the final result. (The instrumentation will also be checked with omission of rounds based on obvious instrumentation errors).

4.6 Service Charge Determination.

4.6.1 Propellants Tested Under Scheme I. - The service charge is determined by adding algebraically the following quantities:

the near-service charge fired;

the product of the reciprocal of the tabulated velocity-charge slope and the algebraic difference between the velocity of the day and the average near service test powder velocity;

the quickness correction, if any, calculated with the appropriate formula in Table IV.

This charge is the matching charge for that firing. The average of the matching charges for all firings of an index is taken as the assigned charge for the propellant under test.

4.6.2 Propellants Tested Under Scheme II. - The service charge is determined as follows:

Fit a straight line to the velocity versus charge weight results. From the fitted line select the charge corresponding to the velocity of the occasion. This is the matching charge for this firing. When the existence of ballistic powder quickness differences is suspected, fit a

least squares line to the matching charge versus velocities of the occasion for all firings of each lot. Examine this data statistically to determine if this line is a significant improvement over the average charge.

4.6.2.1 Assigned Test Powder Charge in the Presence of Ballistic Powder Quickness Differences. - If a significant correlation between matching charge and velocity of the occasion is observed, determine the test powder charge corresponding to the current average master powder velocity in new guns of the type involved. This is the assigned test powder charge.

4.6.2.2 Assigned Test Powder Charge When No Significant Ballistic Powder Quickness Difference Exists. - If there is no evidence of ballistic powder quickness differences, the average matching charge for all firings of the test powder shall be the assigned charge.

4.6.3 Accumulation of Powder Proof Data. - Powder proof data shall be accumulated and tabulated according to gun caliber and powder type. Parametric quickness corrections and charge velocity slopes shall be added to Table IV. When these have been reliably established and approved by the Bureau of Ordnance, subsequent propellant lots of the same category are to be tested under Scheme I.

4.7 Service Pressure Determination.

4.7.1.1 Propellants Tested Under Scheme I. - The test powder assigned pressure is determined by adding algebraically the following quantities:

the average observed near service test powder pressure;

the assigned master powder pressure minus the pressure of the occasion;

the product of the pressure-charge slope (tabulated in Table IV) and the algebraic difference between the matching charge for that firing and the near service charge fired;

the quickness correction determined using the appropriate formula listed in Table IV.

4.7.1.2 Assigned Test Powder Pressure. - The value determined in 4.7.1 is the corrected pressure for that firing. The average corrected pressure for all firings of the test powder is the assigned test powder pressure.

4.7.2 Propellants Tested Under Scheme II. - The test powder assigned pressure is determined as follows:

Draw a smooth curve through the three average pressure vs charge points for each firing (except that if the over-service point falls below a straight line through the other two points, that line through the other two points should be used.

From the matching charge for that firing read the corresponding pressure from the curve drawn above.

To the above pressure add algebraically the difference between the assigned master powder pressure and the pressure of the occasion.

4.7.2.1 Assigned Test Powder Pressure in the Presence of Ballistic Powder Quickness Differences. - Analyze the pressure data obtained against the pressure of the occasion in exactly the same manner as for velocities in 4.6.2.1. The test powder pressure corresponding to the average new gun master powder pressure is the assigned test powder pressure.

4.7.2.2 Assigned Test Powder Pressure When No Significant Ballistic Powder Quickness Exists. - When there is no evidence of significant ballistic powder quickness differences, the value found in 4.7.2 is the corrected pressure for that firing. The assigned test powder pressure is the average corrected pressure for all test powder firings.

4.8 Uniformity. - The unbiased sample standard deviations of the observed near service pressures and velocities about the sample means are computed as follows: Add the sums of the squares of the deviations from the corresponding sample means for the first, second, etc. firings. Divide this sum by the total number of rounds involved minus the number of firings. The square root of this value is the unbiased sample standard deviation.

4.9 Application of Specification. - The assigned pressure is required to fall within the applicable limits of Table I and Table II. The standard deviation for velocity and pressure must not exceed the applicable limits of Table I and Table II. The assigned service charge weight is required to fall between the appropriate limits of Table I and Table II except that where no ballistic quickness differences have been previously observed in a category and statistical analysis accepts an hypothesis that no quickness difference between the test and master powder exists at a .10 level of confidence, this limit may be waived. A test propellant must satisfy all of these ballistic requirements to be judged acceptable.

In the absence of criteria for a new propellant category the uniformity requirement shall be that the test powder uniformity values not be significantly larger than those for the master powder at a .05 level of confidence. The assigned pressure corrected for the master powder pressure of the occasion plus four master or test powder sample standard deviations (whichever is larger) shall not exceed proof pressure for the gun. No appreciable ballistic quickness difference shall exist between different lots of the test powder. This last is, in effect, a charge weight limitation.

4.10 Retest. - A propellant lot failing the ballistic test may, at the discretion of the Bureau of Ordnance be retested in the same or different guns with respect to the failing attribute. Failure of the propellant to pass the retest is considered sufficient grounds for rejection of the lot.

4.11 Size of Ballistic Samples Required. - Powder proofs fired under Firing Scheme I will require propellant samples having a weight at least 15 times the corresponding maximum acceptable charge weight tabulated in 3.1. Those fired under Firing Scheme II will require a sample having a weight at least 40 times the same maximum single round value for determination of full charges and at least 20 times the single round value for determination of reduced charges. In general the samples furnished for ballistic test will be larger. At least one full box of powder is to be supplied from each section of a lot, and no partial boxes will be acceptable.

5. PREPARATION FOR DELIVERY
(Not applicable to this specification.)

6. NOTES

6.1 Safety Precautions. - Since ballistic propellant testing involves firing an unproved component, reasonable safety precautions, including sheltering personnel whenever test powder rounds are fired, should be observed.

6.2 Similar Specification. - MIL-P-17959 (NOrd) of 6 April 1954, "Powder, Propellant, Ballistics of; for 3"/50 Caliber Gun" is intended for use exclusively in offshore procurement contracts. Although the procedures in that specification differ in detail from those in paragraph 4 above, they can be expected to give equivalent results.

TABLE I

SPECIFICATION LIMITS ON PRESSURE, VELOCITY AND CHARGE WEIGHT (FOR CURRENT WEAPONS)

Gun Caliber	Mk No.	Propellant Symbols: Granulation Type	Propellant Symbols: Composition Type	Proj Mk No.	Nominal Velocity ft./sec.	Charge Type	Pressure: Max. tsi	Pressure: Min. tsi	Pressure: Std. Dev. tsi	Velocity Std. Dev. ft./sec.	Charge Weight: Max. lbs.	Charge Weight: Min. lbs.
					Case Guns							
20mm	4	Z	SPDN	3	2770	Full	22.0	19.7	1.8	28	.0631	.0589
40mm	1	U	SPDN	2(1)	2890	Full	19.5	17.5	1.0	21	.690	.630
			SPDN	M81	2890	Special	19.5	17.5	1.0	21	.700	.640
3"/50	21,22	PB	SPD,SPDN	27,33	2700	Full	17.0	15.0	.50	16	4.30	3.85
		PB	SPDF	27,33	2700	Full	17.0	15.0	.50	16	4.35	3.90
		PB	SPCG	27,33	2700	Full	17.0	15.0	.50	16	4.45	4.00
3"/70	26	PC	SPCG	34	3400	Full	22.5	20.5	.75	15	10.40	10.00
5"/25	13,17	BD	SPD,SPDN	36	2110	Full	16.7	15.2	.50	14	10.2	9.2
5"/38	12-1	BE	SPD,SPDN	35	2600	Full	18.0	16.0	.50	16	16.0	14.5
		BE	SPDF	35	2600	Full	18.0	16.0	.50	16	17.0	15.0
		U	SPDN	35	1200	Reduced	7.0	4.8	.25	8	3.75	3.50
		Y	SPDN	35	1200	Reduced	7.0	4.8	.25	8	3.60	3.40
5"/54	16,18	BF	SPD,SPDN	41	2650	Full	20.5	18.5	.63	13	19.5	17.5
		BF	SPDF	41	2650	Full	20.5	18.5	.63	13	19.3	17.8
		BF-NA	SPC,SPCF	41	2650	Full						
6"/47	16	CD	SPD,SPDN	36	2500	Full	18.5	16.5	.56	15	34.5	31.0
		CD	SPCG	36	2500	Full	18.5	16.5	.56	15	35.5	32.5
		BE	SPDN	34	2225	Reduced	14.0	11.5	.56	14	22.5	20.5
		BE	SPDF	34	2225	Reduced	14.0	11.5	.56	14	23.5	21.5
8"/55	16	DE	SPD,SPDE,SPDN	22	2500	Full	19.0	17.5	.63	10	79	73
		DE	SPCG	22	2500	Full	19.0	17.5	.63	10	85	79
		DE	SPDF	22	2500	Full	19.0	17.5	.63	10	83	75
		EE	SPDN	24	2200	Reduced	17.0	14.5	.63	9	46	43.5
		EE	SPDF	24	2200	Reduced	17.0	14.5	.63	9	48.5	46

TABLE I (Continued)

Gun Caliber	Mk No.	Propellant Symbols: Granulation Type	Propellant Symbols: Composition Type	Proj. Mk No.	Nominal Velocity Ft./sec.	Charge Type	Pressure: Max. tsi	Pressure: Min. tsi	Pressure: Std. Dev. tsi	Velocity Std. Dev. ft./sec.	Charge Weight: Max. lbs.	Charge Weight: Min. lbs.
					Bag Guns							
8"/55	12,14,15	DD	SPD	18	2800	Full	17.0	15.5	.56	18	92	85
		CC	SPCG	18	2800	Full	18.2	16.7	.56	18	96	88
		DD	SPD	18	2300	Reduced	—	—	See Note (2)	-	—	—
		CC	SPCG	18	2300	Reduced	—	—	See Note (2)	-	—	—
		DD	SPD	22	2500	Full	18.2	16.7	.56	13	88	81
		DD	SPCG	22	2500	Full	18.2	16.7	.56	13	95	87
		DG	SPDN	24	2220	Reduced	14.0	11.5	.56	9	56	53
		DG	SPDF	24	2220	Reduced	14.0	11.5	.56	9	57	54
		DG	SPD	24	2220	Reduced	14.0	11.5	.56	9	51.5	48.5
12"/50	8	FD	SPD	19	2500	Full	19.0	17.5	.56	10	282	262
		FD	SPCG	19	2500	Full	19.0	17.5	.56	10	353	313
		FD	SPD	19	2300	Special	—	—	See Note (2)	-	—	—
		FD	SPCG	19	2300	Special	—	—	See Note (2)	-	—	—
		DG	SPDN	17	1965	Reduced	15.5	13.5	.56	9	136	129
		DG	SPDF	17	1965	Reduced	15.5	13.5	.56	9	138.5	131.5
14"/50	11	HA	SPD	17	2700	Full	18.0	16.5	.56	11	438	400
		HA	SPCG	17	2700	Full	18.0	16.5	.56	11	475	435
		CD	SPDN	19	2065	Reduced	13.5	11.0	.56	9	198	188
		CD	SPCG	19	2065	Reduced	13.5	11.0	.56	9	206	194
16"/45	6,8	I	SPD	6	2300	Full	18.0	16.5	.56	10	560	515(3)
		I	SPCG	6	2300	Full	18.0	16.5	.56	10	600	555(3)
		DD	SPD,SPDN	13	2075	Reduced	14.5	12.0	.56	9	302	286(3)
		DD	SPCG	13	2075	Reduced	14.5	12.0	.56	9	325	308(3)
		IB	SPD	9	2520	Full	18.5	17.0	.56	10	550	505(4)
		IB	SPCG	9	2520	Full	18.5	17.0	.56	10	585	540(4)
		DD	SPD,SPDN	13	2075	Reduced	14.5	12.0	.56	9	302	286(4)
		DD	SPCG	13	2075	Reduced	14.5	12.0	.56	9	325	308(4)
16"/50	7	IC	SPD	9	2500	Full	18.5	17.0	.56	10	690	630
		IC	SPCG	9	2500	Full	18.5	17.0	.56	10	770	700
		DD	SPD,SPDN	13	2075	Reduced	13.5	11.0	.56	9	312	296
		DD	SPCG	13	2075	Reduced	13.5	11.0	.56	9	335	318

TABLE II

SPECIFICATION LIMITS ON PRESSURE, VELOCITY AND CHARGE WEIGHT (FOR INACTIVE WEAPONS)

Gun Caliber	Mk No.	Propellant Symbols: Granulation Type	Propellant Symbols: Composition Type	Proj. Mk No.	Nominal Velocity ft./sec.	Charge Type	Pressure: Max. tsi	Pressure: Min. tsi	Pressure: Std. Dev. tsi	Velocity Std. Dev. ft./sec.	Charge Weight: Max. lbs.	Charge Weight: Min. lbs.
					Case Guns							
1"/1	1	Y	SPDN	2	2700	Full	18.0	15.5	1.00	34	.273	.251
1 PDR	5,8,13	V	SPD,SPDN	2	2000	Full	12.5	10.0	.50	15	.160	.140
3 PDR	4,10	T	SPD,SPDN	2	2200	Full	13.8	12.0	.50	14	.700	.630
6 PDR	8,11	S	SPD,SPDN	3	2240	Full	14.0	12.5	.50	14	1.15	1.05
3"/23	14	PA	SPD,SPDN	26	1650	Full	13.0	11.5	.50	14	1.32	1.19
4"/50	9 Mods 5 thru 24	AC,BB	SPD	15,16	2900	Full	17.0	15.5	.63	18	15.00	13.75
		AC,BB	SPDN	15,16	2900	Full	17.0	15.5	.63	18	15.75	14.30
		AC,BB	SPDN	15,16	2900	Full	17.0	15.5	.63	18	15.75	14.30(5)
		AC,BB	SPDF	15,16	2900	Full	17.0	15.5	.63	18	17.50	15.90(6)
5"/51	9 Mod 6,7,8	BB,AC	SPD,SPDN	15,14	3150	Full	17.0	15.5	.56	19	26.0	23.0
		BB,AC	SPDF	15,14	3150	Full	17.0	15.5	.56	19	28.0	25.0
		BB,AC	SPDN,SPD	15,14	2300	Reduced	—	See Note (2)	—	—	—	—
		BB,AC	SPDF	15,14	2300	Reduced	—	See Note (2)	—	—	—	—
					Bag Guns							
5"/50	5 Mod 1,2,3 6 Mod 0,2	BE	SPD,SPDN	15,14	3000	Full	16.5	15.0	.56	19	21.75	20.25
5"/51	15	BB,AC	SPD,SPDN	15,14	3150	Full	17.0	15.5	.56	19	26	23
		BB,AC	SPDF	15,14	3150	Full	17.0	15.5	.56	19	27	24
		BB,AC	SPD,SPDN	15,14	2300	Reduced	—	See Note (2)	—	—	—	—
		BB,AC	SPDF	15,14	2300	Reduced	—	See Note (2)	—	—	—	—
6"/47	17	CD	SPD,SPDN	29	2800	Full	18.5	16.5	.56	18	35	32
		CD	SPCG	29	2800	Full	18.5	16.5	.56	18	37	34
		CD	SPD,SPDN	29	2300	Reduced	—	See Note (2)	—	—	—	—
		CD	SPCG	29	2300	Reduced	—	See Note (2)	—	—	—	—

TABLE II (Continued)

Gun Caliber	Mk No.	Propellant Symbols: Granulation Type	Propellant Symbols: Composition Type	Proj Mk No.	Nominal Velocity ft./sec.	Charge Type	Pressure: Max. tsi	Pressure: Min. tsi	Pressure: Std. Dev. tsi	Velocity Std. Dev. ft./sec.	Charge Weight: Max. lbs.	Charge Weight: Min. lbs.
Bag Guns (Continued)												
6"/50	8, 8-2	CB, CD	SPD,SPDN	20	2800	Full	17.0	15.5	.56	18	40	36
		CB, CD	SPD,SPDN	20	2100	Reduced	—	See Note (2)	—	—	—	—
6"/53	12,14, 18	CC	SPD,SPDN	29	3000	Full	17.5	16.0	.56	19	45	42
		CC	SPCG	29	3000	Full	17.5	16.0	.56	19	48	44.5
		CC	SPD,SPDN	29	2300	Reduced	—	See Note (2)	—	—	—	—
		CC	SPCG	29	2300	Reduced	—	See Note (2)	—	—	—	—
7"/45	2	X	SPD	11	2700	Full	17.0	15.5	.56	16	60	55
12"/50	7 Mods 15 thru 18	FD	SPD	15	2900	Full	17.5	16.0	.56	18	345	320
		FB	SPD	16	2125	Reduced	8.0	6.5	.50	13	225	210
14"/45	12	H	SPD	17	2600	Full	18.0	16.5	.56	11	438	400
		H	SPCG	17	2600	Full	18.0	16.5	.56	11	475	435
		CD	SPDN	19	2065	Reduced	14.0	11.5	.56	9	209	199
		CD	SPCG	19	2065	Reduced	14.0	11.5	.56	9	217	205

Notes: (1) Mk 11 Tracers are used.
(2) Acceptability is based entirely upon acceptability as full charges on preceding lines.
(3) 3 Section charge.
(4) 6 Section charge.
(5) Powder, cannon, smokeless, or pyro, with flashless ingredients incorporated.
(6) Powder, cannon, smokeless, M1 or M6, with flashless ingredients incorporated.

TABLE III

DESIGNATION OF COMPONENTS FOR POWDER PROOF

Gun	Mk	Propellant: Granulation Symbol	Propellant: Composition Symbol	Type of Charge	Projectile (1) Used in Powder Proof: Mk	Projectile (1) Used in Powder Proof: Weight (lbs.)	Cartridge Components: Case Mk	Cartridge Components: Primer Mk	Remarks
16"/50	7	IC	SPD	Full	9, 10, 18	2700	—	15 Mod 1,2	—
		IC	SPCG	Full	9, 10, 18	2700			
		DD	SPD,SPDN	Reduced	13	1900			
		DD	SPCG	Reduced	13	1900			
16"/45	6,8	IB	SPD	Full	9	2700	—	15 Mod 1,2	6 Section Charge
		IB	SPCG	Full	9	2700			6 Section Charge
		DD	SPD,SPDN	Reduced	13	1900			6 Section Charge
		DD	SPCG	Reduced	13	1900			6 Section Charge
		I	SPD	Full	6	2240			5 Section Charge
		I	SPCG	Full	6	2240			5 Section Charge
		DD	SPD,SPDN	Reduced	13	1900			5 Section Charge
		DD	SPCG	Reduced	13	1900			5 Section Charge
14"/50	11	HA	SPD	Full	17	1500	—	15 Mod 1,2	—
		HA	SPCG	Full	17	1500			
		CD	SPDN	Reduced	19	1275			
		CD	SPCG	Reduced	19	1275			
12"/50	8	FD	SPD	Full	19	1140	—	15 Mod 1,2	—
		FD	SPCG	Full	19	1140			
		DG	SPDN	Reduced	17	940			
		DG	SPDF	Reduced	17	940			
8"/55	12-1	DD	SPD	Full	18	260	—	15 Mod 1,2	—
	14-1	CC	SPCG	Full	18	260			
		DD	SPD	Reduced	18	260			
		CC	SPCG	Reduced	18	260			
		DD	SPD	Full	22, 27	335			
		DD	SPCG	Full	22, 27	335			
		DG	SPDN	Reduced	24	260			
		DG	SPDF	Reduced	24	260			
		DG	SPD	Reduced	24	260			

TABLE III (Continued)

Gun	Mk	Propellant: Granulation Symbol	Propellant: Composition Symbol	Type of Charge	Projectile (1) Used in Powder Proof: Mk	Projectile (1) Used in Powder Proof: Weight (lbs.)	Cartridge Components: Case Mk	Cartridge Components: Primer Mk	Plug(Mk)	MPD Minus PPD (in.)
8"/55	16	DE	SPD,SPDN	Full	22.27	335	1-1	37	1	1.0
		DE	SPCG	Full	22,27	335		37		
		BE	SPDN	Reduced	24	260		38		
		BE	SPDF	Reduced	24	260		38		
		DE	SPDF	Full	22	335	37	37		
6"/47	16	CD	SPD,SPDN	Full	36	130	6	39	4-1,3	0.7
		CD	SPCG	Full	36	130				
		BE	SPDN	Reduced	34	105	6	40	4-1,3	
		BE	SPDF	Reduced	34	105				
5"/54	16,18	BF	SPD,SPDN	Full	41	70	7	45	6	0.7
		BF	SPDF	Full	41	70				
5"/38	12-1	DE	SPD,SPDN	Full	35,49	55.18	5,8,10	13,48	2	0.7
		BE	SPDF	Full	35,49	55.18				
		U	SPDN	Reduced	35,49	54.				
		Y	SPDN	Reduced	35,49	54.				
5"/25	13,17	BD	SPD,SPDN	Full	36	53.85	4	13	—	0.7
3"/70	26	PC	SPCG	Full	34	15.	10	49	—	Variable
3"/50	21,22 Mod 1-5	PB	SPD,SPDN	Full	33	13.	7,9	42	—	0.4
		PB	SPDF	Full	33	13.				
		PB	SPCG	Full	33	13.				
40mm	1	U	SPDN	Full	2	1.985	2,3	22	—	—
	1	U	SPDN	Special	M81	1.96				
20mm	4	Z	SPDN	Full	3	.269	2	30	—	—

(1) Established tolerances on projectile weights for powder proof are as follows:

8" to 16" inclusive	±0.25 lb.
5" and 6"	±0.10 lb.
3"	±0.01 lb.
40mm	±0.005 lb.
20mm	±0.001 lb.

TABLE IV

FIRING SCHEMES, REQUIREMENTS AND QUICKNESS FACTORS

Gun Caliber	Powder Type	Master Powder Type	Previous Round Effect	No. Pairs of Service Rounds in	No. of Guns	Velocity vs Charge f/s/lb	Pressure Slope tsi/lb	Quickness Formula and Remarks
3"/50	M-6	M-6	No	2	4	490	7.6	None
	Cordite-N	Cordite-N	No	2	4	440	6.0	None
	Pyro(IHPB)	M-6	Yes	2	4	473	6.3	$\Omega = W - .00043(V_o - V_M)$; $P(\Omega) = P(W) \neq .79 (P_o - P_M)$
5"/38	M-6	M-6	No	2	4	138	1.8	$\Omega = \frac{W \neq .0232 (V_o - V_M)}{1 \neq .0014 (V_o - V_M)}$; $P(\Omega) = (W)$
	Pyro-Flashless	M-6	Yes	2	4	132	2.3	$\Omega = \frac{W \neq .0124 (V_o - V_M)}{1 \neq .0007 (V_o - V_M)}$; $P(\Omega) = P(W) \neq .81 (P_o - P_M)$
	M-6	Pyro-Flashless	Yes	5	4	-	-	Quickness correction to be determined for each lot.
	Pyro-Flashing	Pyro-Flashless	Yes	5	4	-	-	Quickness correction to be determined for each lot.
5"/54	Pyro-Flashless	Pyro-Flashless	No	2	4	107	1.8	Either keep $\lvert V_o - V_M \rvert \leq 10$ or apply quickness correction for each lot.
6"/47	M-6 Reduced	M-6	No	2	4	74	1.2	None
	M-6	M-6	No	2	4	60	1.0	None
	Pyro	M-6	Yes	2	4	59	1.2	$\Omega = W - .0043 (V_o - V_M)$; $P(\Omega) = P(W) \neq 1.254 (P_o - P_M)$
8"/55 Case	Pyro	Pyro	No	2	4	26	0.5	None
	Cordite-N	Cordite-N	No	2	4	24	0.5	Quickness correction to be determined for each lot.
	M-6 Reduced	M-6	No	2	4	32	0.8	None
8"/55 Bag	Pyro	Pyro	No	2	4	20	0.4	None
	Cordite-N	Cordite-N	No	2	4	19	0.3	Quickness correction to be determined for each lot.
	M-6 Reduced	M-6	No	2	4	25	0.4	None
16"/50	Pyro	Pyro	No	2	4	3.23	0.04	None
	Cordite-N (Reduced)	Cordite-N	No	2	4	3.93	0.07	Quickness correction to be determined for each lot.
All other full charges				5	4	-	-	Each category to be examined for quickness effects.
All other reduced charges				3	2	-	-	Each category to be examined for quickness effects.

Ω = quickness corrected charge

W = matching charge

V_o = average new gun velocity

V_M = master powder velocity

P = pressure

P_o = average new gun pressure

P_M = master powder pressure

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4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

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