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DATA ON JAPANESE ARMY EXPLOSIVES

Compilation from Several Documentary Sources

EDITOR'S NOTE

This document comprises a tabular presentation of available documentary information on Japanese Army explosives. Table #1 is an arrangement of these explosives according to their functions and chemical bases; it was excerpted from C-C Item #10,008, "Manual of Explosives and Ordnance", issued by the Army Engineering School in 1938. Table #2 gives important characteristics of certain of the explosives and was extracted from two items: C-C Item #9936 A, B, and C, consisting of sheets from an ordnance manual, data and issuing authority unknown but presumably an authentic publication; C-C Item #13,664 B, a single sheet from a large binder containing various data on ordnance, some of which were issued by Army Ordnance School and dated 1942. Table #2 Supplement gives brief data on six explosives about which relatively little is revealed in available documents; it was also taken from C-C Item #13,664 B. Table #3 is a list of service smokeless powders with their uses, and was taken from C-C Item #12,490 "Information on Powder and Explosives" issued by 1st Company Training Unit, Dec 1942, classified "Restricted" (BUGAIHI).

In Tables #2, #2 Supplement, and #3, the KANJI have been supplied for identification purposes. In Table #2, for explosives whose Japanese designation is not the equivalent of our chemical terminology, we have given both, as Picric Acid (Yellow Powder), etc. Japanese designations not admitting of translation have been transliterated, as OKIYAKU.

For ready reference a numbered list of all explosives treated in Tables #2 and #2 Supplement is included.

List of Explosives Treated in Tables #2 and #2 Supplement

TABLE #2

1. Nitrocellulose Type (HENYAKU SEI)
2. Nitroglycerin Type
3. Mercuric Fulminate (RAIKŌ)
4. Lead Azide (CHIKKA NAMARI)
5. Mk 1 Exploding Powder (ICHIGŌ BAKUFUN)
6. Mk 2 Exploding Powder (NIGŌ BAKUFUN)
7. Mk 3 Exploding Powder (SANGŌ BAKUFUN)
8. Picric Acid (ŌSHOKUYAKU)
9. T.N.T. (CHAKATSUYAKU)
10. Tetryl (MEIAYAKU)

11. Nitrocellulose (MENYAKU)
12. Nitroglycerin
13. Cyclonite (SHOUYAKU)
14. Trinitrophenetole (HEINEIYAKU)
15. Gray Powder (KAISHOKUYAKU)
16. P.E.T.N. (SHOEIYAKU)
17. Black Powder (KOKUSHOKUYAKU)
18. Tea-yellow Powder (CHAOYAKU)
19. ONAYAKU
20. OSHIYAKU (Literally "Yellow-fat Powder")
21. MK 1 SHOTOYAKU
22. MK 2 SHOTOYAKU
23. SHONAYAKU
24. ENTOYAKU
25. ENNAYAKU

TABLE #2 SUPPLEMENT

26. MK 1 ANNAYAKU
27. MK 2 ANNAYAKU
28. MK 1 CHANAYAKU
29. MK 2 CHANAYAKU
30. MK 1 TANOYAKU
31. MK 2 TANOYAKU

TABLE #1

TYPES OF JAPANESE ARMY EXPLOSIVES

I. Powders or propellants

A. Non-smokeless powders

1. Black powder (KOKUSHOKUYAKU)

2. Brown powder (KASSHOKUYAKU)

B. Smokeless powders

1. "C" smokeless powder

2. "G" smokeless powder

a. Volatile solvent type

b. Non-volatile solvent type

II. Blasting explosives

A. Bursting charges

1. Single chemical compound explosives

a. Nitric esters

(1) Nitrocellulose (Cotton Powder-MENYAKU)

(2) Nitroglycerin

b. Nitro compounds

(1) Picric acid (Yellow Powder-ŌSHOKU YAKU)

(2) T.N.T. (Tea-brown Powder-CHAKATSU YAKU)

(3) Tetryl (MEIAYAKU)

(4) Cyclonite (SHŌUYAKU)

2. Mixed explosives

a. Picrate base mixtures

(1) CHAŌYAKU (Tea-yellow Powder)

(2) ŌNAYAKU

(3) ŌSHIYAKU (Yellow-fat Powder)

b. Nitrate base mixtures

(1) SHŌTOYAKU

(2) SHŌMAYAKU

(3) ANGAYAKU (安瓦薬)

(4) Ammonium nitrate explosive
(過塩素酸塩爆薬)

(5) Ammonium nitrate dynamite
(過塩素酸塩ダイナマイト)

c. Chlorate base mixture

(1) ENTOYAKU

(2) ENNAYAKU

d. Perchlorate base mixture

(1) KĀRITTO (カーリット)

(2) Perchlorate explosive (爆薬パークロ)

e. Nitroglycerin base mixtures

(1) Dynamite (ダイナマイト)

B. Initiators

1. Mer uric fulminate (RAIKŌ)

2. Lead azide (CHIKKA NAMARI)

3. Exploding Powder (BAKUFUN)

TABLE # 2 CHARACTERISTICS OF THE PRINCIPAL JAPANESE ARMY EXPLOSIVES

Note: Since the values for the Heat, Velocity, Pressure, and Temperature of Explosion were obtained through actual tests on samples of these explosives whose specific gravity is inclined to vary, there will be different values for these factors. Those given in this table are on the whole standard values.

	Properties / Names	Composition	Color	Melting Point (°C)	Fire Point (°C)	Hygroscopicity	Toxicity	Solubility	Use	Chemical Properties: Ignited with Air (in a closed container)	Chemical Properties: Sensitivity to Initiators	Chemical Properties: Activity with Metals	POWER: Sensitivity (TN: Hammer Fall Test) Distance (cm) 2 kg hammer falls without detonating sample. Sample used: 200 mg. Sample used for values in brackets: 2 mg	POWER: Explosive Velocity (for specified SG) Specific gravity	POWER: Explosive Velocity (m/sec)	POWER: Temperature Generated at Explosion	POWER: Heat Generated at Explosion (Cal) (Sample: 1 kg. Sample for values in brackets: 40 gm)	POWER: Volume of Gas Generated at Explosion (liters/kg)	POWER: Pressure Generated at Explosion (kg/cm²) (Sample: 0.2 kg)
Propellants — Smokeless Powders	(1) Nitrocellulose Type (MENYAKU SEI) (綿藥性)	Single base						Insol in water; sol in alcohol-ether solution.	Propellants	Ignites easily; does not explode.	Explodes with difficulty.	None	30 - 40			2400	900 - 1100	830	
	(2) Nitroglycerin Type (NITOROGURISERIN SEI) (ニトログリセリン性)	Double base Nitroglycerin 40%						Ditto	Ditto	Ditto	Ditto	Ditto	20 - 35			2900	1290	850	
Initiators	(3) Mercuric Fulminate (RAIKO) (雷汞)	Same as left	white or light gray		Explodes at 150 - 165			Insol in cold water; slightly sol in hot water.	Fuses, initiators, detonators for demolitions	Explodes on heating	Explodes by conc H_2O_2, HNO_3, or spark. May misfire, if compressed.	Ditto	2 (93 mm using 120 gm hammer)	4.3 - 4.3	2450 - 4490	3530	430	330	43
	(4) Lead Azide (CHIKKA NAMARI) (窒化鉛)	Same as left	white or orange		327	Not hygroscopic		Practically insol in water	Substitute for mercuric fulminate	Fire point higher than that for mercuric fulminate.	Will not misfire even with SG raised by pressure.	Combines with copper or brass to form dangerous salts, when moist.	(133 - 287 mm with 120 gm hammer)	2.9 - 3.8	3500 - 4500		420	324	34
	(5) Mk 1 Exploding Powder (ICHIGO BAKUFUN) (イ一號爆粉)	Mercuric fulminate 37.5% Antimony trisulfide 20% Potassium chlorate 37.5% 10%				Very hygroscopic		Practically insol in cold water and alcohol; slightly sol in warm water; sol in ammonium hydroxide, potassium cyanide, nitric and hydrochloric acids.	Percussion caps				(Less than 60 mm using 120 gm hammer)						
	(6) Mk 2 Exploding Powder (NIGO BAKUFUN) (二號爆粉)	Mercuric fulminate 16.0% Antimony trisulfide 41.7% Potassium chlorate 41.7% 99.4%							Fuse primers										
	(7) Mk 3 Exploding Powder (SANGO BAKUFUN) (三號爆粉)	Mercuric fulminate 40.0% Antimony trisulfide 15.0% Potassium chlorate 28.0% Potash glass powder 20.0% 103%							Percussion caps for pistol ammo.										
Explosives	(8) Picric Acid (Yellow Powder) (CHOKUTAKU) (黃色藥)	Trinitrophenol	light yellow	121 - 122.5	300	Negligible	Toxic	Slightly sol in water; sol in alcohol, ether, & acetone.	Bursting charge in projectiles, bombs, & demolition charges. Boosters.	Produces black smoke, when heated slowly; explodes, when heated rapidly.	Exploded by mercuric fulminate.	Combines with lead, iron, etc. to form unstable salts.	35 - 65 (180)	1.0 - 1.6	5042 - 7813	2430 - 2498	810 (734)	980	86
	(9) TNT (Tea-brown Powder) (CHAKATSU-TAKU) (茶褐藥)	Trinitrotoluene	light brownish-yellow	79.5 - 80.8	Boils & decomposes at 300	Ditto	Ditto	Ditto	HE and other projectiles, bombs - bursting charge.	Ditto	Ditto	Does not combine with metals	75 - 90 (200)	1.0 - 1.6	4727 - 6757	2428	756 (663)	934	80
	(10) Tetryl (KEIAYAKU) (鷄安藥)	Tetranitro-methyl-aniline	light yellow	120 - 130	190	Ditto	Ditto	Insol in alcohol, water; sol in acetone, benzene.	Fuses, boosters	Burns rather rapidly; explodes if heated quickly.	Ditto	Ditto	50 - 95 (160)	1.0	6181	2911	1090	813	94
	(11) Nitrocellulose (Cotton Powder) (KENYAKU) (綿藥)	Cellulose nitrate						Strong: insol in water alcohol, ether; sol in acetone. Weak: sol in alcohol, acetone, ether, mixture.	Smokeless powder	Dry: Burns Wet: Burns with difficulty	Ditto	Ditto	5 - 10	0.7 - 1.4	3700 - 6000	Strong: 2710 Weak: 1940	Strong: 1100 Weak: 730	Strong: 859 Weak: 830	94
	(12) Nitroglycerin ニトログリセリン	Glycerin trinitrate			Freezes at 8°C. Dissolves nitrocellulose at 50°C			Slightly sol in water; sol in alcohol, acetone, and ether.	Nitroglycerin type smokeless powder	Ignites with difficulty	Ditto	Ditto	4	1.6	7600	3470	1580	712	95
	(13) Cyclonite (SHOUTAKU) (硝宇藥)	Trimethylene-trinitramine	white or light gray	Above 199	220 - 230	Not hygroscopic	Non-toxic	Slightly sol in water; solubility increases with temp; sol in acetone. In alcohol solution, precipitates nitric acid.	Boosters, mixed powders	Burns rapidly with some white smoke; explodes, if heated quickly.	Ditto	Ditto	(140)	1.2	7879	4273	1270	920	
	(14) Trinitrophenetole (HEINITYAKU) (平寧藥)	Same as left	light brownish-yellow	77.5 - 78.3	295	Negligible	Toxic	Insol in water Sol in alcohol	HE and other projectiles	Than heated slowly, produces a black smoke; explodes if heated quickly.	Ditto	Ditto	(Above 540)	1.3	6275		680		
	(15) Gray Powder (KAISHOKUYAKU) (灰色藥)	NH_4ClO_4 48% Cyclonite 25% Guanidine nitrate 20% Paraffin 5% Graphite 2% 100%	gray		229 - 230	Ditto	Non-toxic	Fairly sol in water	Demolition charges	Burns like celluloid	Ditto	Ditto	(180)	1.6	6200		1290	640	
	(16) P.E.T.N. (ENKEITAKU) (鉛英藥)	Pentaerythrite tetranitrate	white	140	180 - 205	Not hygroscopic	Ditto	Insol in water; slightly sol in alcohol, ether; sol in acetone.	Boosters, etc.	Burns rapidly with white smoke; explodes if heated quickly.	Ditto	Ditto	(90)	1.4	8496	4725	1500	620	
	(17) Black Powder (KOKUSHOKUYAKU) (黑色藥)	Potassium nitrate 75% Charcoal 15% Sulfur 10%	black					Fairly sol in water	Bursting charge in shrapnel projectiles; demolition charges; powder trains; primers.	Ignites easily. (Will not explode, even if heated quickly)	Ditto	Ditto	30 - 40	1.1	300	2537	719	430	36
	(18) CHAOTAKU (Tea-yellow Powder) (茶色藥)	Picric acid 70% TNT 30%	brownish-yellow	67 - 86	316	Not hygroscopic	Non-toxic	Slightly sol in water; sol in alcohol, ether, acetone.	AP/HE projectile bursting charge	Same as for picric acid above.	Ditto	Same as for picric acid	(200)	Undetermined	5272 - 7079	2459	743	894	
	(19) ŌHAYAKU (黃鄂藥)	Picric acid 80% Dinitronaphthalene 20%	Ditto	95 - 109	315	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	(230)	Undetermined	5808 - 6682		(672)	1039	
	(20) ŌHEIYAKU (Yellow-fat Powder) (黃脂藥)	Picric acid 88% Paraffin 12%	yellow	Above 53	303	Ditto	Ditto	Ditto	AP projectiles	Ditto	Ditto	Ditto	Above 540	1.5	7142				
	(21) Mk 1 SHŌTOTAKU (一號鄂斗藥)	NH_4NO_3 70% TNT 30%	light brown		280	Hygroscopic	Toxic	Fairly sol in water; sol in alcohol	Mk 1 used as projectile bursting charge. Mk 2 used in projectile and bomb bursting charge.	Burns with black smoke, but does not explode.	Ditto	Does not combine with metals	57 - 70	1.0 - 1.2	2521 - 3521		1090 - 1372	484 - 572	92 - 109
	(22) Mk 2 SHŌTOTAKU (二號鄂斗藥)																		
	(23) SHŌGAYAKU (鄂鄂藥)	NH_4NO_3 90% Dinitronaphthalene 10%	brownish-yellow		Above 360	Ditto	Ditto	Ditto	Substitute for TNT or picric acid. Demolition charges; bursting charge for all types of projectile	Same as above, but burns less easily.	Ditto	Ditto	Above 200	1.0 - 1.2	3288 - 3761	2120	1125	537	90
	(24) ENTOYAKU (鹽斗藥)	Potassium chlorate 80% Dinitrotoluene 16% Castor bean oil 4%	light brown					Sol in water	Hand grenades and demolition charges	Burns with difficulty; explodes with quick heating.	Ditto	Ditto	30 - 40	1.2 - 1.4	2281 - 3012		1240	290	58
	(25) ENGAYAKU (鹽鄂藥)	Potassium chlorate 80% Nitronaphthalene 15% Castor bean oil 5%	light yellow					Ditto	Substitute demolition charge. Bursting charge for bombs, projectiles, hand grenades.	Ditto	Ditto	Ditto	35 - 45	1.2 - 1.4	2264 - 2315		953	301	60

TABLE #2 SUPPLEMENT

NAME	COMPOSITION (3)	USE	REMARKS
26) MK 1 ANGAYAKU (2) (一號安瓦藥)	Ammonium nitrate 51% Guanidine nitrate 34% Cyclonite 15%	Bursting charge in bombs and projectiles	(TN: "Secret" written in in ink); white color
27) MK 2 ANGAYAKU (二號安瓦藥)	Ammonium nitrate 48% Guanidine " 32% Cyclonite 20%	Bursting charge in bombs and projectiles	
28) MK 1 CHANAYAKU (2) (一號茶那藥)	TNT 80% Naphthalene 20%	Gas projectiles; WP projectiles	
29) MK 2 CHANAYAKU (二號茶那藥)	TNT 85% Naphthalene 15%	Gas projectiles; WP projectiles	
30) MK 1 TANŌYAKU (一號淡黃藥)	Cyclonite 60% Tetryl 10% TNT 30%	Demolition charges, bursting charges for bombs and projectiles	
31) MK 2 TANŌYAKU (二號淡黃藥)	Cyclonite 55% TNT 38% Tetryl 7%	Demolition charges, bursting charges for bombs and projectiles	

(1) TN: Blanks in columns above are as in original documents.
(2) TN: For further information on these items, see "Japanese Military Explosives" issued by MEIU #1 (c/o Fleet Post Office).
(3) TN: Composition figures from CINCPAC-CINCPOA #B-22,875.

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TABLE #3

SERVICE SMOKELESS POWDERS

TYPE	PRINCIPAL USE
Smokeless Powder, Pistol (MUEN KENJUYAKU) (無煙拳銃藥)	Propellant for various pistol ammo
Smokeless Powder, Small Arms (MUEN SHOJUYAKU) (無煙小銃藥)	Propellant for various 6.5 mm rifle and MG ammo
"B" Smokeless Powder, Small Arms (MUEN SHOJUYAKU OTSU)	Propellant for various 7.7 mm MG ammo
0.5 mm HŌKEI Powder (square grain powder) (REIMIRIMETORU GO HŌKEIYAKU) (零粍五方形藥)	Propellant for grenade discharger ammo
0.6 mm HŌKEI Powder	Propellant for Type 92 Infantry Gun and 11th Year Type Mortar ammo.

	TYPE	PRINCIPAL USE
	5 mm HŌKEI Powder	Propellant for small caliber guns
"C" Smokeless Powder	Mk 1 HŌKEI Powder (ICHIGŌ HŌKEIYAKU) (一號方形藥)	Propellant for Type 41 mountain gun and small and medium caliber howitzer ammo
	Mk 2 HŌKEI Powder	Propellant for medium and large caliber howitzer ammo
	Mk 1 Strip Powder (ICHIGŌ TAIJŌYAKU) (一號帶狀藥)	Propellant for 7.5 cm class gun ammo
	Mk 1, B Strip Powder	Propellant for 7.5 cm class AA gun ammo
	Mk 2 Strip Powder	Propellant for small and medium caliber gun ammo
	Mk 3 Strip Powder	Propellant for small and medium caliber gun and large caliber howitzer ammo
	Mk 4 Strip Powder	same
	Mk 5 Strip Powder	same
	Mk 6 Strip Powder	Propellant for large caliber gun ammo
	Mk 1 Blank Powder (ICHIGŌ KUHOYAKU) (一號空包藥)	Blank charge for various rifle and small caliber gun ammo
	Mk 2 Blank Powder	Blank charge for various MG ammo
	Mk 3 Blank Powder	Blank charge for medium caliber howitzer ammo
	Mk 4 Blank Powder	Blank charge for field gun and 10 cm gun ammo
	Smokeless Powder for simulated fire (MUEN GIHOYAKU) (無煙擬砲藥)	For various simulated firing

		TYPE	PRINCIPAL USE
"C" Smokeless Powder		No. 3 Cylindrical Powder (SANBAN KANJOYAKU) (三番官扎薬)	Propellant for various 7.7 MG ammo
		No. 5 Cylindrical Powder	Propellant for 13 mm class MG ammo
		Water-proof Powder Bag (TAISUISEI YAKUNO) (耐水性薬嚢)	Propellant-charge bag for mortar ammo
"G" Smokeless Powder	A	No. 1 HŌKEI Powder (ICHIBAN HŌKEIYAKU) (一番方形薬)	Propellant for infantry mortar ammo
		No. 2 HŌKEI Powder	same
		No. 3 HŌKEI Powder	Propellant for light mortar ammo
		No. 5 HŌKEI Powder	Propellant for medium mortar ammo
		No. 8 Cylindrical Powder	Propellant for Type 94 37 mm gun ammo
	B	No. 9 Cylindrical Powder	Propellant for small caliber gun and Type 94 37 mm gun ammo
		No. 20 Cylindrical Powder	Propellant for medium caliber gun and large caliber howitzer ammo
		No. 26 Cylindrical Powder	same
		No. 30 Cylindrical Powder	same
		No. 110 Short Cord Powder (HYAKUJUBAN CHUJO TANYAKU) (百十番社扎短薬)	Propellant for large caliber gun ammo

	TYPE	PRINCIPAL USE
"G"Smokeless Powder	B	No. 110 Long Cord Powder (HYAKUJUBAN CHUJOCHOYAKU) (百十番紐状長薬)	Propellant for large caliber gun ammo
		No. 16 Long Cylindrical Powder (十六番管状長薬)	Propellant for medium caliber gun ammo, large caliber howitzer ammo