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From: Chief, Naval Technical Mission to Japan.  
To : Chief of Naval Operations.

Subject: Target Report - Japanese Navy Ammunition Cases for  
5cm and Larger Caliber Guns.

Reference: (a) "Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, covering Target O-14 of Fascicle O-1  
of reference (a), is submitted herewith.
2. The investigation of the target and the target report  
were accomplished by Comdr. G.R. Dolan, RN, assisted by Lt.(jg) K.  
Lamott, who acted as interpreter.



C. G. GRIMES  
Captain, USN

RESTRICTED

O-14

**JAPANESE NAVY AMMUNITION CASES  
FOR 5CM AND LARGER CALIBER GUNS**

**"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945  
FASCICLE O-1, TARGET O-14,**

**DECEMBER 1945**

**U.S. NAVAL TECHNICAL MISSION TO JAPAN**

# SUMMARY

## ORDNANCE TARGETS

### JAPANESE NAVY AMMUNITION CASES FOR 5CM AND LARGER CALIBER GUNS

Japanese brass cartridge cases were of conventional design.

Owing to a shortage of brass supplies, experiments were carried out with steel cases. Long experiments proved that steel made by the open hearth method, which the Japanese wished to use, required particularly high grade coal and iron ore for production of the larger cases of the Model I type. Model III was designed after interruption of ore supplies from HAINAN made an alternative case essential. This type can be made of lower grade material than Model I.

No materials other than steel were tried as substitutes for brass for cartridge cases.

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## REFERENCES

### Japanese Personnel Interviewed:

Captain YAJIMA, IJN - 1926, Commissioned Lt.(jg); 1927 to 1930, at Kure Arsenal on loading equipment; 1930 to 1933, inspector of gun barrels; 1933 to 1938, head of projectile factory; 1938 to 1941, in New York inspecting machine tools; 1941 to 1943, projectile design; 1943 to present, Naval Technical Department in projectile design section.

## LIST OF ENCLOSURES

- (A) Cartridge Cases, Japanese (Outline)
- (B) Diagrams of Steel Cartridge Cases
- (C) List of Documents Forwarded to WDC via ATIS

## INTRODUCTION

The information presented in this report has been obtained from interrogation of Japanese personnel and from questionnaires given to Japanese personnel at these interrogations.

It was stated repeatedly by the Japanese that all drawings and documents were destroyed in August, 1945, on order of higher authorities.

Japanese reports listed on Enclosure (C) were seized by personnel of NavTechJap from a Technical Library at YOKOSUKA and have been forwarded to WDC via ATIS. Their translation may supply some detailed information which will provide more complete coverage of the subject of this report.

# THE REPORT

## 1. Brass Cartridge Cases

All brass cartridge cases (listed in Enclosure A) were made of 70/30 brass and were of conventional design. The only alternative material tried for cases was steel. Typical manufacturing process for brass cases was as follows:

<u>Step</u>	<u>Process</u>
1 } 2 }	Cupped
3	Annealed at 650°C.
4	Washed with weak solution of sulphuric acid.
5	Drawn about eight times.
6	Base pressed at 2000 tons.
7	Headed.
8	One third of case at mouth end annealed at 500-600°C.
9	Mouth pressed.
10	Machined.
11	Stress relieved at 350-400°C.
12	Tested for season cracking (one case in 500 by immersing in mercury nitrate for 30 minutes).

## 2. Steel Cartridge Cases

Shortage of copper led to tests of the manufacture of steel cases of the three types listed in Enclosure (A). (See Enclosure (B) for diagrams)

### a. Model I

The first attempts were made using a very low carbon steel, almost free from impurities. The ore for this steel came from HAINAN. Difficulties with this case (Model I) were experienced in drawing. A test of the steel was, therefore, introduced in which a test block was pressed to reduce it by 15% of its final length. It was then heated to 300°C for two hours before under going an impact test. As long as high quality low carbon steel could be manufactured the Model I steel case was made. Practically the same methods as for brass cases were employed except that drawing ratios were altered and annealing temperatures were about 50°C higher. The final anneal was not carried out, as results of firing tests had indicated it was not necessary. The supply of ore from HAINAN was interrupted, leading to the design of Model II.

### b. Model II

Model II was made in four parts, a cylinder, cup-shaped "former", and washer being secured to the base by a nut screwed down on a threaded pintle, part of the base of the cartridge case. The pintle was then drilled and threaded to receive the primer. The cylinder was made of commercial mild steel (no specification) rolled into shape and spot welded. Next, it was pressed cold to round the bottom of it to fit the "former" and the base. The base was drop-forged and heat-treated using steel SDgl specification:

C	Si	Mn	P	S	Ni	Cr	Mo
.45/.65	-	.45/.80	.05	.50	-	-	-



The washer was made of mild steel, and the cup shaped "former" of any steel available, pressed out of a disc with a hole in the center (final thickness 3mm).

On firing, the cylinder spot welding broke and the cylinder was pressed out against the chamber of the gun, sealing any escape of gas. The collapse of the spot welding assisted in extraction of the cartridge case. Model II was not easy to manufacture owing to the number of parts and to the shape of the base. When good quality low carbon steel was available Model III was made.

c. Model III

In Model III the cylindrical part was made as for Model I up to the end of the drawing process, after which the cylinder was machined to fit the base, leaving a thickness of 10mm of metal at the bottom around a central hole. The base was drop forged from steel SDgl, but was of simpler shape than the base of Model II, having a hole in the center through which a rivet was passed to secure the base to the cylinder. After securing, mouth-annealing and mouth-pressing were carried out. The rivet was then drilled and threaded to receive the primer.

In all types of cases except the steel Model II, a graduation of hardness was obtained by altering the shape of the plunger for the last draw. The plunger was less tapered than the previous plungers so that more work was done on the base end of the case.

The following steel cases were being put into mass production at the end of the war:

20cm (8.02 in.) short gun	Model II
12.7cm (5.0 in.) 40 cal. gun	Model II
12cm (4.7 in.) 45 cal. AA gun	Models II and III
12cm (4.7 in.) short gun	Models I and II
8cm (3.0 in.) 40 cal. AA gun	Models I and II
8cm (3.0 in.) short AA gun	Model I
5cm (2.0 in.) gun	Model I

## ENCLOSURE (A)

CARTRIDGE CASES, JAPANESE  
(Outline)1. Brass Cartridge Cases

## a. Characteristics

Size and Type	Loading	Maximum Gun Pressure (T/O")
8" Howitzer*	Separate	4.1
6" 40 Cal. Type 41	Separate	16.5
5.5" 40 Cal. Type 11 year	Separate	16.5
5" 50 Cal. Type 1 (Experimental)	Fixed	18.4
5" 40 Cal. Type 89	Fixed	15.9
4.7" 45 Cal. Type 10 year*	Fixed	18.4
4.7" 45 Cal. Type 3 year**	Separate	18.4
4.7" 40 Cal. Type Armst. (Obsolescent)	Separate	15.2
4.7" Howitzer*	Fixed	44.5
4" Type 98, 4"/65 Cal.	Fixed	19.4
4" Type 88, 4"/50 Cal.	Fixed	18.4
3" Type 98, 3"/60 Cal.	Fixed	17.8
3" 40 Cal. Type 3 year	Fixed	15.2
3" Howitzer (Obsolescent)	Fixed	12
2" Type YAMANOUCHI	Fixed	11.4
1.8" Type YAMANOUCHI	Fixed	11.4

\*Steel cases also used.

\*\*Extraction difficulties.

b. Chemical Composition

Cu 70%, Zn 30%.

c. Drawing Processes

(1) Cupping - Cartridge cases are cupped from circular disc with hydraulic press.

(2) Drawing - After cupping, the cups are annealed and drawn about eight times.

(3) Pressing - The bases of the cartridge cases are formed by pressing with a 2000 ton hydraulic press.

(4) Squeezing - The mouths of the cartridge cases are pressed through dies.

d. Annealing Processes

(1) Annealing before drawing - The materials are annealed at a temperature of about 650°C in a muffled gas furnace for one to two hours.

(2) Annealing before mouth pressing - The part of the cartridge case to be pressed is annealed at a temperature of 500°--600° in an automatic feeding electric furnace.

## ENCLOSURE (A), continued

(3) Finish annealing - After drawing and machining processes are finished, the cartridge cases are annealed at a temperature of 350°-400°C in a muffled gas furnace.

e. Final Finish Coatings

(1) Outside - Polished and coated with lacquer.

(2) Inside - Water cleaned and coated with asphalt lacquer (i.e. asphalt thinned down with lacquer.)

f. Ageing Results

By the final annealing at low temperature, season cracking of the cartridge case when fired is avoided.

g. Final Hardness Figures (Shore's No.)

At mouth: 15-25

At 1" from base: 27-38

2. Steel Cartridge Casesa. Model I(1) Chemical Composition

C	Si	Mn	P	S
.08/.12	.1	3/.8	.025	.025

(2) Drawing Process

Same as for brass cartridge cases except that about 11 draws are necessary. Original disc thickness: 25mm.

(3) Annealing Process

Same as for brass cartridge cases except that annealing temperature before drawing is 700°C and before mouth pressing is 550°--650°C. The final annealing is omitted.

(4) Final Finish Coatings

Same as for brass cartridge cases.

b. Model II(1) Cylinder

Material: commercial quality mild steel.

Drawing process: plate bent round into cylinder form; spot welded, then bottom end rounded by pressing cold to fit base. Mouth pressed after fitting to base.

(2) Base

Material: steel SDgl (see para. 11).

Drawing process: drop-forged, then heat treated.

## ENCLOSURE (A), continued

(3) Washer

Material: mild steel.

Drawing process: drop-forged, then heat treated.

(4) "Former"

Drawing process: disc with hole in it pressed to cup shape to fit bottom of cylinder and base.

(5) Final Finish Coatings

Same as for brass cartridge cases.

c. Model III(1) Cylinder

Material: same as Model I.

Drawing process: same as Model I up to end of 11 draws; then machined to fit base. Mouth pressed after fitting base.

(2) Base

Material: SDgl

Drawing process: drop-forged.

(3) Rivet

Drawing process: passed through base cylinder, then upset. Center of rivet then drilled and threaded to take primer.

(4) Annealing Process

Same as for Model I.

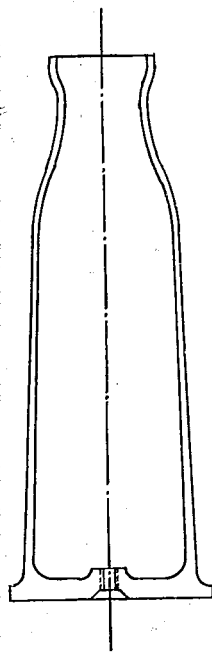
(5) Final Finish Coatings

Same as for brass cartridge cases.

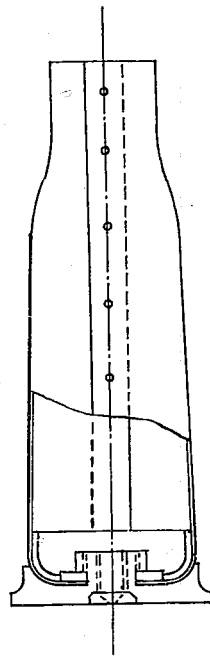
# ENCLOSURE (B)

## Steel Carridge Cases

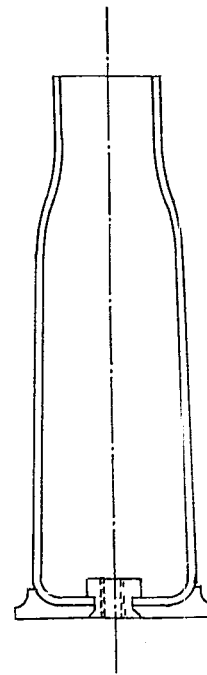
Model I



Model II



Model III



## ENCLOSURE (C)

## LIST OF DOCUMENTS FORWARDED TO WDC VIA ATIS

<u>NavTechJap No.</u>	<u>N a m e</u>	<u>ATIS No.</u>
ND50-3203	Result of test firings, experimental cartridge cases: 45 cal/12 cm Mark 1 Model 1 shell case.	3151
ND50-3204	Tests on experimental manufacture of steel cartridge cases for guns: 8 cm and 10 cm Short Gun steel cases, experimental.	3152
ND50-3503	Research on cartridge case lacquers.	3591
ND50-3504	Report on cartridge case for 45 cal 1935 Type 12 cm Gun.	3592
ND50-3505	Research on manufacture of cartridge cases: cartridge ejection.	3593
ND50-3506	Results of experiments on cartridge cases for guns.	3594
ND50-3507	Results of experiments on cartridge cases for guns.	3595
ND50-3508	Results of experimental research on cartridge cases for guns.	3596
ND50-3509	Results of experimental research on cartridge cases for guns.	3597
ND50-3510	Report on results of experimental research on cartridge cases for guns.	3598
ND50-3511	Report on modification methods of lacquering.	3599
ND50-3512	Research on cartridge case materials.	3600
ND50-3513	Results of experiments in firing cartridges ordered outside (naval factories).	3601
ND50-3514	Results of experiments with cartridge cases below 15 mm.	3602
ND50-3515	Results of experiments with cartridge cases.	3603

## ENCLOSURE (C), continued

<u>NavTechJap No.</u>	<u>N a m e</u>	<u>ATIS No.</u>
ND50-3516	Experiments on cartridge special filling.	3604
ND50-3517	Results of experiments with cartridge cases.	3605
ND50-3518	Results of experiments on cartridge cases for guns.	3606
ND50-3519	Tests on life of GE brass 12 cm AA cases.	3607
ND50-3520	Cartridge cases for 12 cm and 12.7 cm guns.	3608
ND50-3521	Steel cartridge cases for 5 and 6 cm guns.	3609
ND50-3522	Steel cartridge cases made in Germany.	3610