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U. S. NAVAL TECHNICAL MISSION TO JAPAN  
CARE OF FLEET POST OFFICE  
SAN FRANCISCO, CALIFORNIA

1 February 1946

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From: Chief, Naval Technical Mission to Japan.  
To : Chief of Naval Operations.  
Subject: Target Report - Japanese Muzzle Brakes and Flash Hiders.  
Reference: (a)"Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, covering Target O-49(N) of Fascicle O-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Lt. Comdr. R. V. Taborelli, USNR, and Lt. Comdr. R. A. Hay, USNR.



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Captain, USN

**RESTRICTED**

**O-49(N)**

**JAPANESE MUZZLE BRAKES  
AND FLASH HIDERS**

**"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945  
FASCICLE O-1, TARGET O-49(N)**

**FEBRUARY 1946**

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

# SUMMARY

## ORDNANCE TARGETS

### JAPANESE MUZZLE BRAKES AND FLASH HIDERS

In 1925 the Japanese Navy developed its first muzzle brake for the 12cm gun. The device was never adopted and the whole idea of muzzle brakes was discarded because: (1) this muzzle brake was unsatisfactory, and (2) muzzle brakes in general were considered unnecessary.

The Navy again studied the problem of muzzle brakes in 1942, when, in order to make the Type 96, 25mm AA gun adaptable for aircraft use, it had to develop a means of reducing the recoil energy. Among other modifications, a muzzle brake, which experimental tests indicated could reduce the recoil energy by 35%, was installed. The completed gun, designated Type 4 25mm aircraft machine gun, was never adopted; hence the muzzle brake remained untried in service.

In 1945, the Navy designed a muzzle brake of the simple ring type, in order to permit the use of the 12cm cannon and the 12cm howitzer with the Type 97 Medium tank. The assemblies were the results of a demand for a self-propelled cannon and a self-propelled howitzer. The muzzle brake was considered satisfactory for these assemblies, which, incidentally, never were used in service. Because of the severe blast diverted towards the breech, it was considered absolutely useless for shipboard installation.

The Japanese Navy did not design a satisfactory flash hider. It did adapt the German Rheinmetal design to the Type 96 25mm AA machine gun with fairly satisfactory results, and to the Type 5 (Bofors) 40mm machine gun with unsatisfactory results.

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## REFERENCES

### Location of Target:

Yokosuka Naval Arsenal

Kure Navy Yard

### Japanese Personnel who Assisted in Gathering Documents:

J. ICHINOI, Technical Commander, IJN. Chief of Fire Control Division, Gunnery Experimental Section, Kure Arsenal

### Japanese Personnel Interviewed:

T. YOKOYAMA, Technical Captain, IJN. Chief Designer, Machine Guns, Navy Technical Department, TOKYO

S. DATE, Technical Captain, IJN. Chief, Gunnery Section, Navy Technical Department, TOKYO

M. KASHIWABARA, Assistant Engineer, (civilian)

### Pertinent Reports of Other Intelligence Agencies:

Intelligence Report #1, Ordnance Intelligence Section, Office of the Chief Ordnance Officer, USASOS, APO 501, "20mm AA/AT (Mobile) Type 98, Oerlikon"

Intelligence Report #27, Ordnance Intelligence Section, Office of the Chief Ordnance Officer, USASOS, APO 501, "12.7cm Aircraft Machine Gun, Fixed"

## INTRODUCTION

All types of muzzle brakes and flash hiders used by the Japanese Navy were investigated. The study was made by inspecting the devices which were available, by studying the drawings recovered and by interrogating Japanese personnel who designed, or were familiar with the design of, the devices.

The material inspected included: (1) the flash hiders of the Rheinmetal type adopted for the 25mm and 40mm machine guns, and (2) the drawings of the muzzle brake of the Type 4 25mm aircraft machine guns and the flash hiders for the Type 96 25mm AA machine gun.

The personnel interviewed included the designer of the muzzle brake for the 12cm self-propelled gun, the designer of Rheinmetal type flash hider for the 25mm AA machine gun and a civilian technician well acquainted with the development of a flash hider for the Type 5 (Bofors) 40mm AA machine gun.

## THE REPORT

### A. MUZZLE BRAKES

The Japanese Navy designed its first muzzle brake about 20 years ago (1925) for the 12cm high-angle gun. The idea of using a muzzle brake was not an original one. The Japanese had become acquainted with the use of muzzle brakes through their studies of foreign ordnance. The possibility of reducing the recoil energy of the 12cm gun and thereby permitting a lighter mount, was attractive but not necessary. The 12cm assembly was satisfactory enough to preclude any extensive projects on muzzle brakes. The muzzle brake designed for the 12cm high-angle gun was unsatisfactory in spite of its ability to reduce the recoil energy. The blast diverted back towards the breech by this device was prohibitive for shipboard use. The unsatisfactory results, together with the lack of a real need for the device, caused the Japanese to abandon all research on muzzle brakes for the following ten years.

In 1935, when the French Hotchkiss 25mm machine gun was being considered for adoption by the Japanese Navy, interest in barrel attachments was expressed again. Some measurements were made of the effect of the flash hider on the recoil length and energy but studies of the gun and mount absorbed most of the attention of the ordnance technicians.

Actual research work on muzzle brakes was resumed by the Navy in 1942. The Gunnery Section of the Navy Technical Department, TOKYO, was assigned the project of modifying the 25mm AA machine gun into a type suitable for a fixed installation in aircraft. The modified type, known as the Type 4 25mm aircraft machine gun (see Figures 1, 2 and 3), included a muzzle brake. The limited experimental firing done with the Type 4 gun indicated that the brake did reduce the recoil energy by 35%. The Gunnery Section, Navy Technical Department, planned to hold in abeyance the research on a muzzle brake for the 25mm AA gun until some reports on the Type 4 aircraft model had been received from forces using it. The plan was abandoned in 1943 when the Naval Aircraft Headquarters decided to use the 30mm aircraft gun, developed by the First Naval Technical Arsenal, rather than the Type 4 25mm. There were several reasons why further work on the muzzle brake for the 25mm AA gun was abandoned:

1. The model for the Type 25mm aircraft gun, not being tested in actual service, was lost as a guide for the design of the AA model.
2. The fire sustained by the AA gun was so much more severe than by the aircraft gun that erosion resistant materials, which were very scarce, undoubtedly would be needed.
3. The manufacturing technique necessary to produce rugged and interchangeable assemblies loomed as another difficulty, considered unwarranted under the restricted circumstances of the times.

At the close of 1944, the third and last research project on muzzle brakes was started when the Navy was assigned the project of designing a self-propelled gun for land use. The decision was made to use both the 12cm cannon and the 12cm howitzer. For the vehicle, the Type 97 medium tank was chosen. The tank, which in its original design, weighed 15 tons, was armed with the 47mm gun and two machine guns in the turret. The modification required the removal of the turret and the installation of a single 12cm cannon or howitzer. The tank, however, was considered too light and structurally weak for either of the 12cm guns, unless the recoil energy of the guns could be reduced. The design of the self-propelled gun assembly including the vehicle and muzzle brake was undertaken immediately by the Kure Navy Yard. The resulting brake design was a simple ring-type which reduced the recoil energy of the 12cm cannon 30% and left the length of recoil unchanged. The same brake was considered satisfactory for the 12cm howitzer, although in this case the recoil energy was reduced only



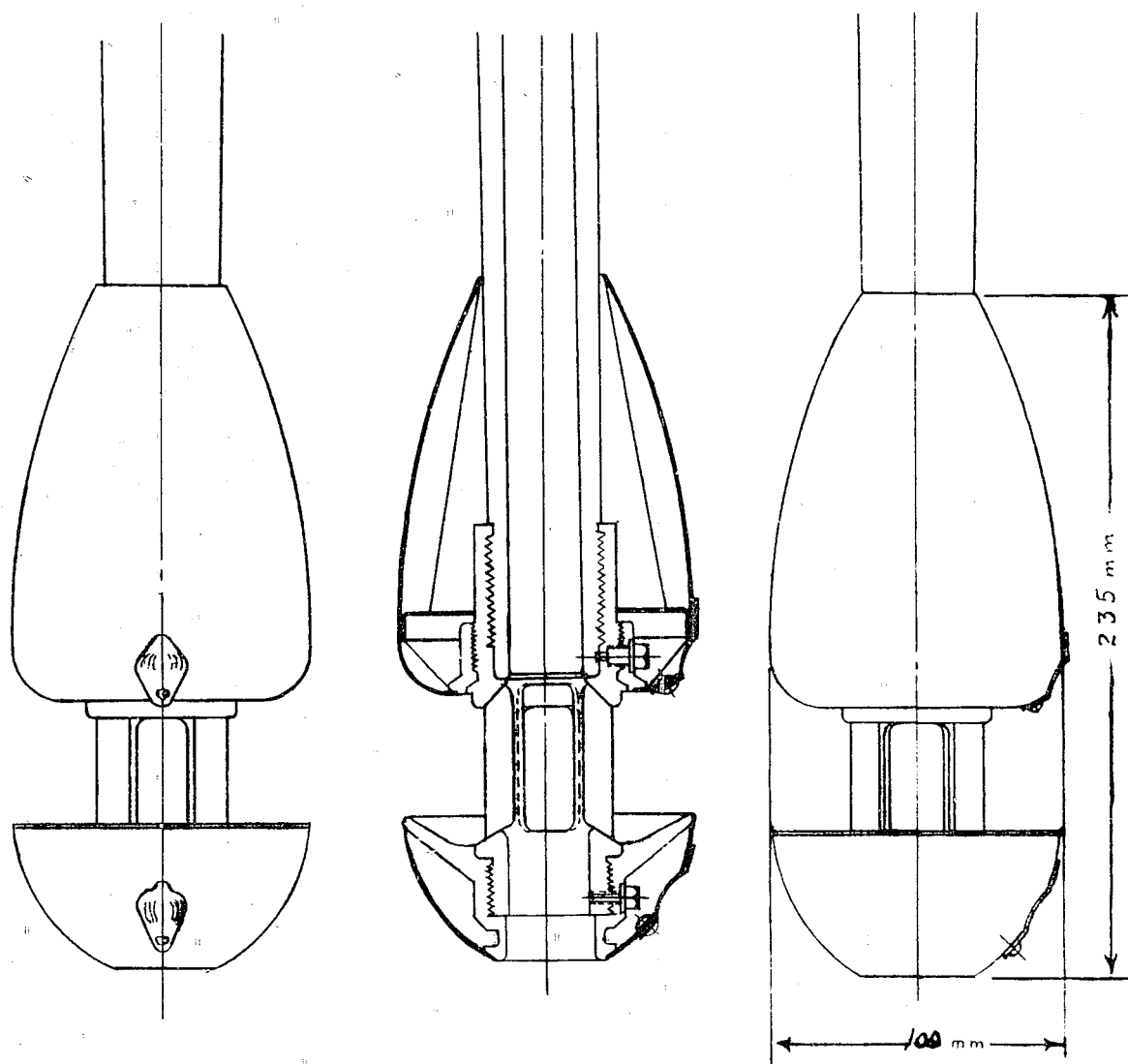


Figure 1  
MUZZLE BRAKE FOR TYPE 4.25mm AIRCRAFT MACHINE GUN

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O-49(N)

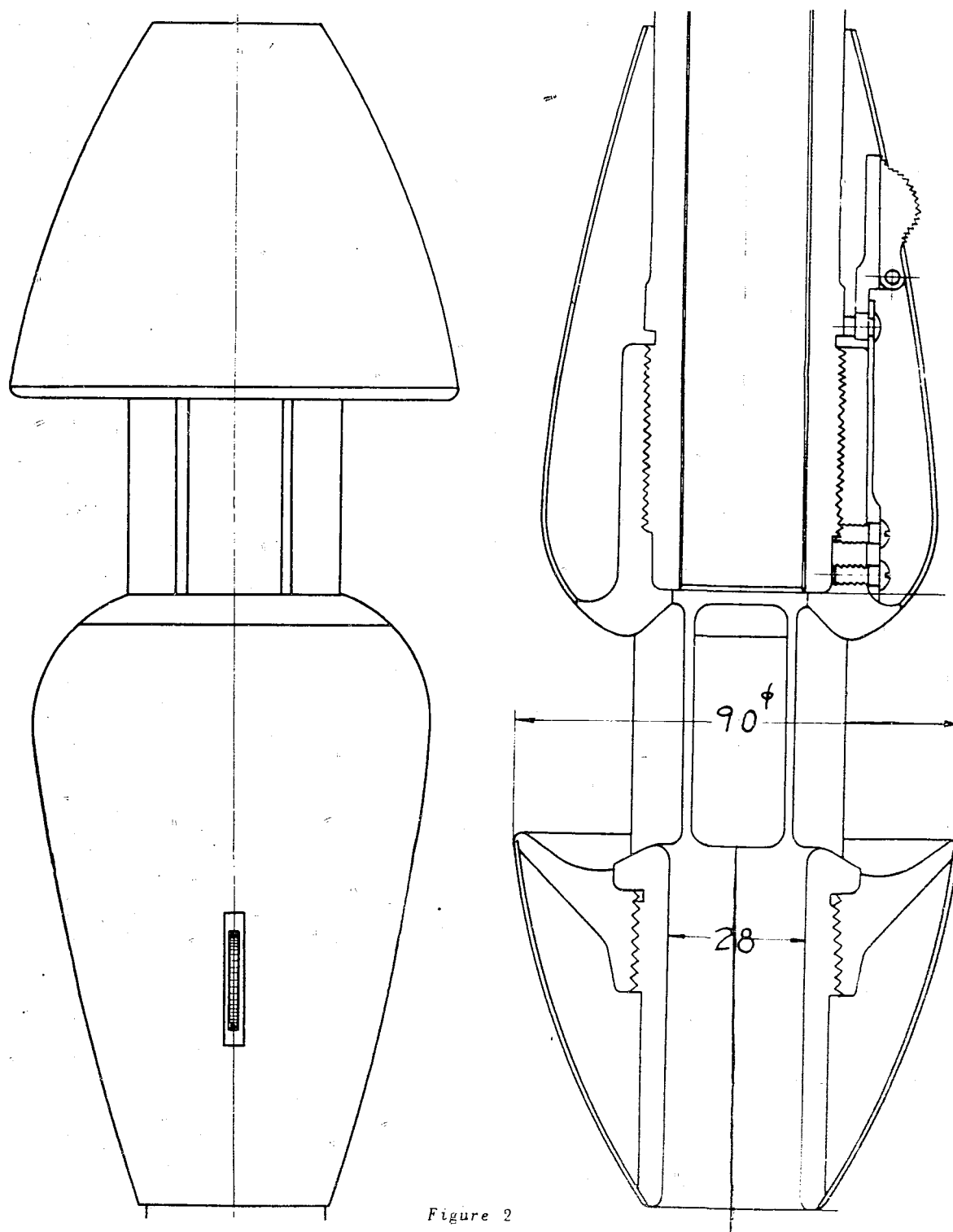


Figure 2  
MUZZLE BRAKE FOR TYPE 4.25mm  
AIRCRAFT MACHINE GUN, MODIFICATION 1

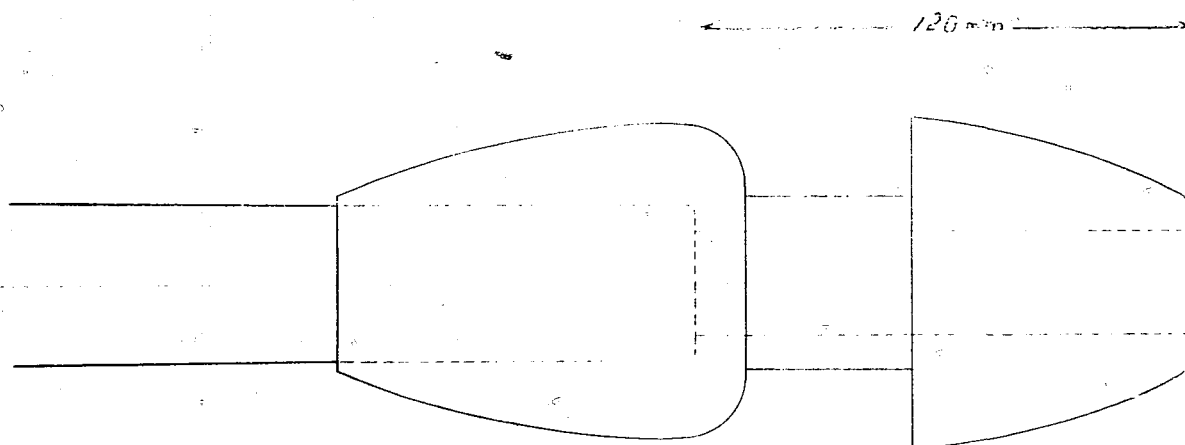


Figure 3  
MUZZLE BRAKE FOR 25mm AIRCRAFT MACHINE GUN  
(Extracted from Mock-up Assembly Drawing)

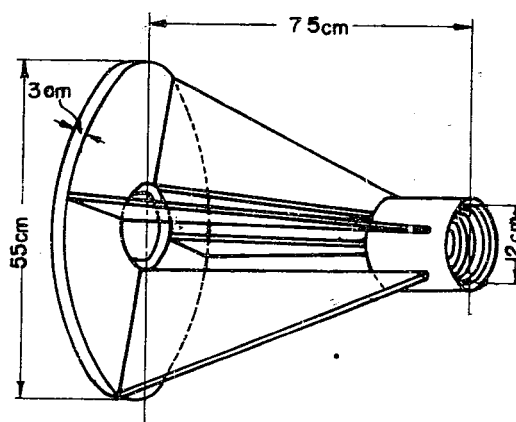


Figure 4  
GENERAL ARRANGEMENT OF MUZZLE BRAKE FOR 12cm GUN

20-25%. With each gun, the blast diverted towards the breech was severe, but unimportant for this type of assembly. The mount for the 12cm cannon included gunshields and that for the howitzer, a turret. The weights of the completed designs were: 12cm self-propelled cannon-22 tons (metric); 12cm self-propelled howitzer-16 tons (metric).

In March 1945 the Navy Technical Department adopted the KURE design, and shortly thereafter manufacture was started. By the end of the war, the total number of gun assemblies manufactured was 11; 4 cannons and 7 howitzers. None of the assemblies were used in service.

The muzzle brake used on the 12cm guns is shown in Figure 1. This type of muzzle brake was used by the Japanese Army for the 20mm AA/AT Oerlikon type machine gun (See References-Intelligence Report, #1.)

A muzzle cup for the 12.7mm aircraft machine gun is described briefly in references, but information regarding its effect on the recoil and the rate of fire of the gun was not available. It is believed that a 12.7mm gun with this device installed was received at the U.S. Naval Proving Ground, Dahlgren, Va., in 1945, and is still available there. Figure 5 shows the cup whose most unusual feature is its adjustability.

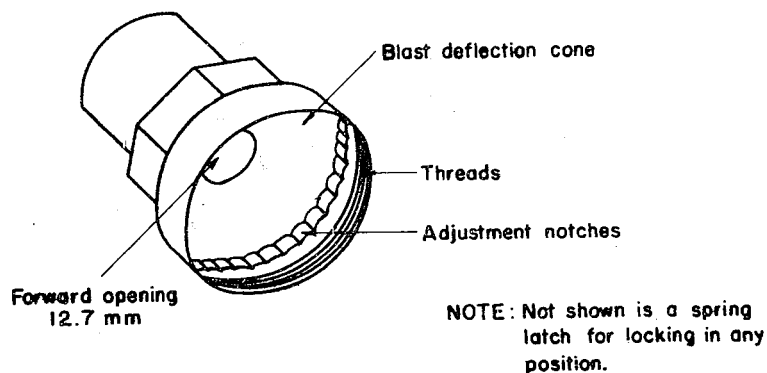


Figure 5  
MUZZLE CUP FOR 12.7mm AIRCRAFT MACHINE GUN

### Conclusions

The Japanese Navy never considered muzzle brakes as essential for shipboard installations, and consequently it fostered very little research on this device.

The type of muzzle brake developed for the Type 4 25mm aircraft machine gun appears worthy of manufacture and testing by the Bureau of Ordnance.

### B. FLASH HIDERS

The investigation by the Japanese Navy of flash hidens was limited to those

used on three types of AA machine guns: the 13.2mm, the 25mm, and the 40mm Bofors.

In the case of the 13.2mm gun, the original simple, conical flash hider was considered satisfactory. The consideration was weighted by the fact that the 13.2mm gun was classed as one of secondary importance.

The original French 25mm machine gun was equipped with a flash hider of simple conical design, which was unsatisfactory. Therefore, in 1940, paralleling the research in flashless powder, research on flash hidere was begun. A secondary consideration was to reduce the sound, because gun crews had reported the noise of firing as excessive.

The first modification consisted of drilling holes of 4mm diameter in the cone. The results of this change were:

1. Flash hiding ability remained unchanged.
2. Sound of the blast was softened a little.
3. Blast pressure effect remained unchanged.
4. Recoil energy was decreased slightly.

The first modification was considered unsatisfactory.

The next step was to try a copy of the Rheinmetal (German) design, (see Figure 6). The Rheinmetal design includes elongated slots near the apex of the cone and small holes distributed over the body of the cone. The results of testing the Rheinmetal design were:

1. Flash hiding ability was satisfactory for single fire, if flashless powder were used. In continuous fire, however, some flashes were observed at irregular intervals. The conclusion was reached that, theoretically, this phenomenon could not be cancelled by a flash hider because it was the result of compressive waves caused by the continuous fire.
2. Sound of the blast was softened appreciably.
3. Amount of blast striking the operator was increased, but was considered tolerable.
4. Length of recoil was decreased about 3mm but no effect on the functioning of the gun was observed.

The final conclusions reached in 1942 regarding flash in the 25mm gun were:

1. That the Rheinmetal design was as satisfactory a design as could be obtained.
2. That further efforts to eliminate flash should be towards the improvement of flashless powder. (In 1942, the Rheinmetal design was adopted for production, and all new guns were being equipped with it. Although it was intended to replace the flash hidere of the earlier design, no great number of replacements had been made by the end of the war).

The 40mm Bofors guns, which the Japanese had captured in Singapore, were equipped with the simple cone. Although the 40mm gun was never in service for the Japanese, sufficient tests had been conducted to indicate that the simple cone type flash hider was unsatisfactory. Guided by the results obtained in the case of the 25mm gun, the Navy next tried the Rheinmetal designed for the 40mm. The results were unsatisfactory, and the decision was made that a different type be designed. The end of the war precluded any work at all on the new design.

#### Conclusions

The Japanese Navy had not developed any original design for flash hidere which was satisfactory. Its copy of the Rheinmetal design for the 25mm machine gun was fairly successful but its copy for the 40mm gun was unsatisfactory.

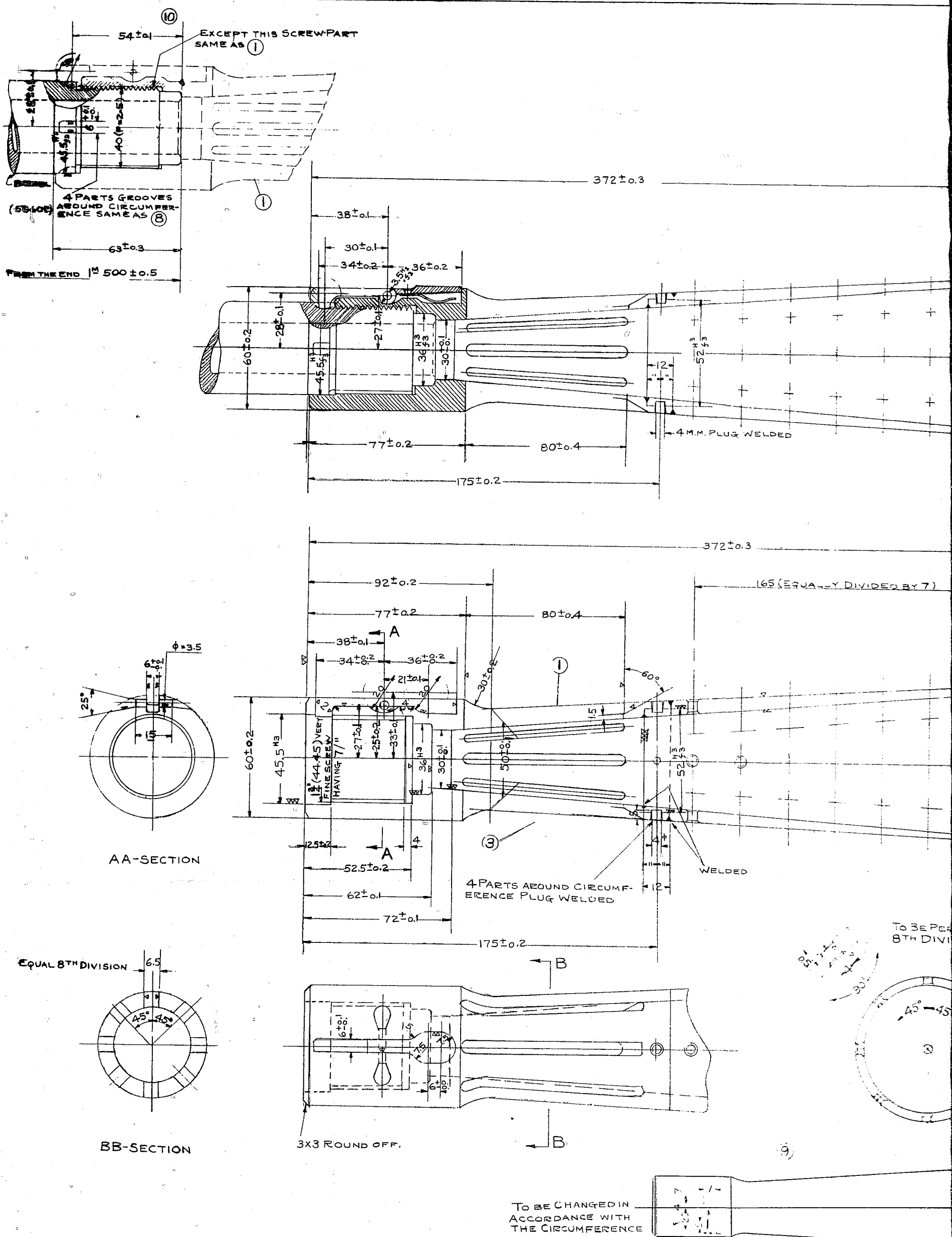
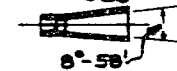


Figure 6  
TYPE 96 FLASH HIDER FOR 25  
(All dimensions in mm)

1	FLASH HIDER (REAR)	5F48B	1
2	" (FORWARD)	"	1
3	CONNECTING PIN	"	4
4	FIXING PIN	"	1
5	PIN	"	1
6	PLATE SPRING	SS	1
7	STOPPING RIVET	SMR4H	1
8	BARREL	W No 3	1
9	LETTER TO BE ENGRAVED		
10	FLASH HIDER (REAR)		1

ONLY REFERENCE

FOR 25 MM.



FOR RHEINMETAL

(37)

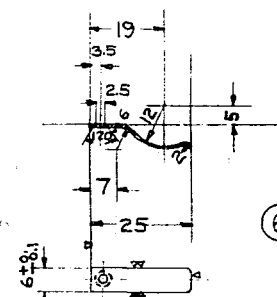
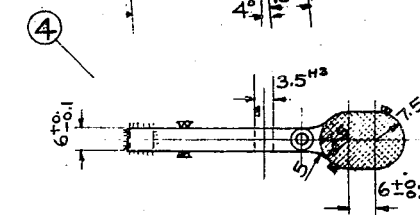
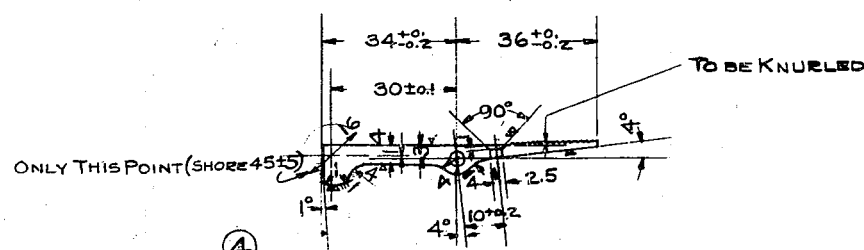
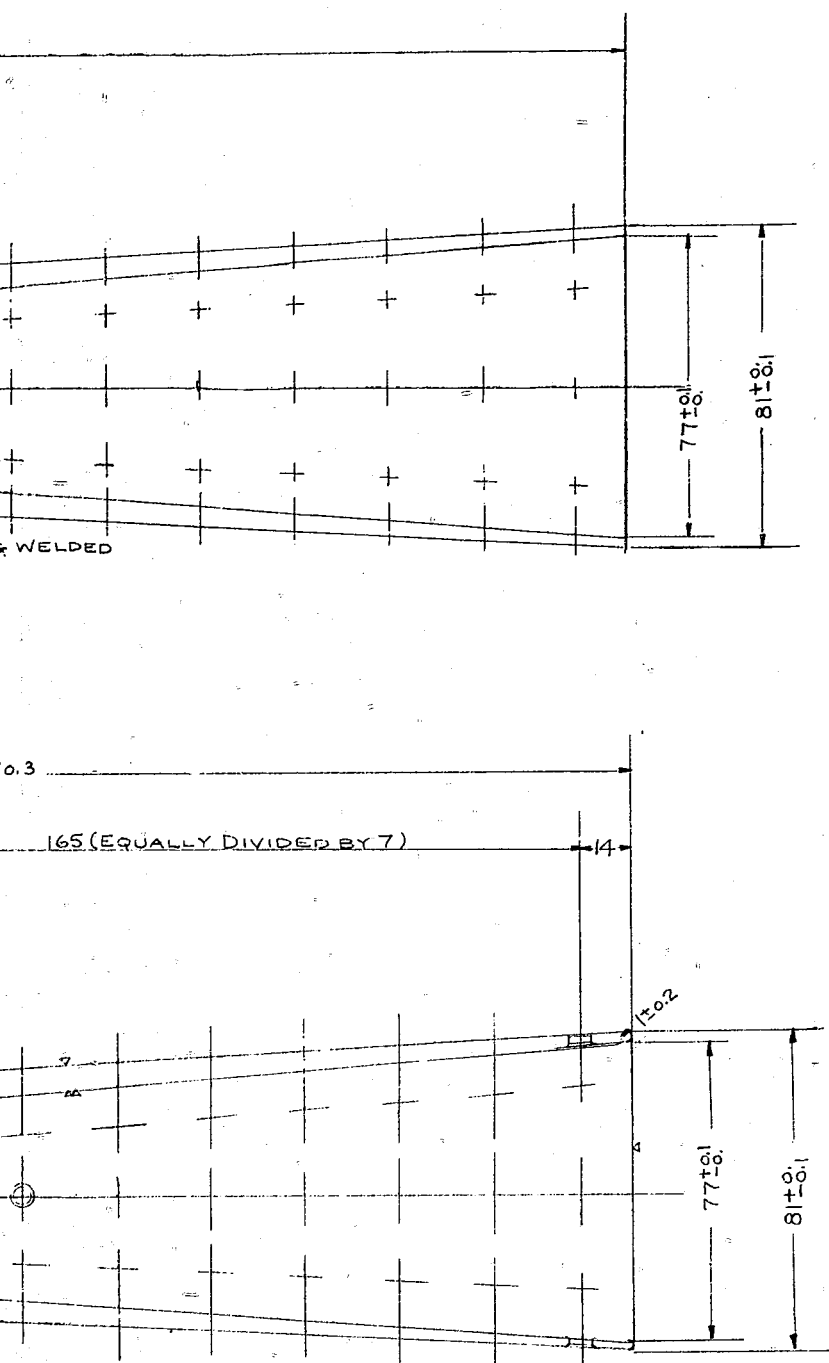
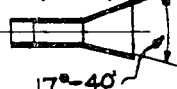
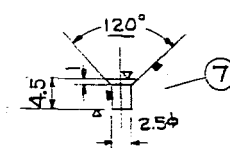
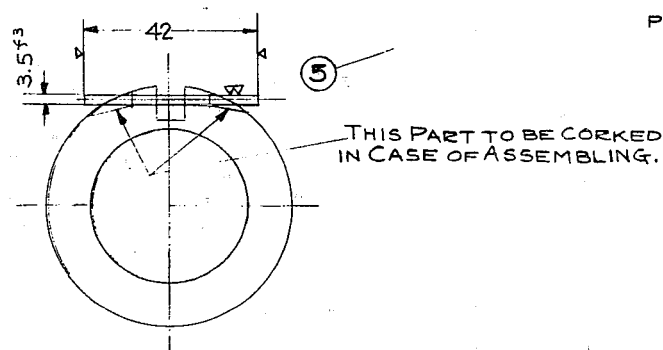
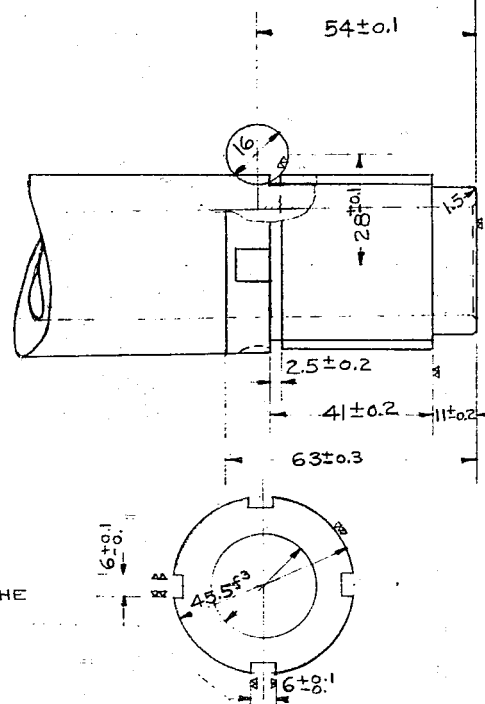


PLATE SPRING OF 1 M.M. THICKNESS



### ⑧ SMALL MODIFICATION OF GUN BARREL

FROM THE END IN 500±0.5



### NOTES

- 1-①② ARE MADE OF TWO DIFFERENT PARTS IN CASE OF EXPERIMENT, ACTUAL THING MUST BE ONE BODY.  
2-② MUST BE USED ONLY IN CASE OF EXPERIMENT.

Figure 6

TYPE 96 FLASH HIDER FOR 25mm MACHINE GUN  
(All dimensions in mm)

## ENCLOSURE (A)

## LIST OF DOCUMENTS FORWARDED TO WDC VIA ATIS

<u>NavTechJap.</u> <u>Document No.</u>	<u>Title</u>	<u>ATIS No.</u>
ND21-3419	"Muzzle Flash" - 25mm Automatic Cannon" , 1940	4225