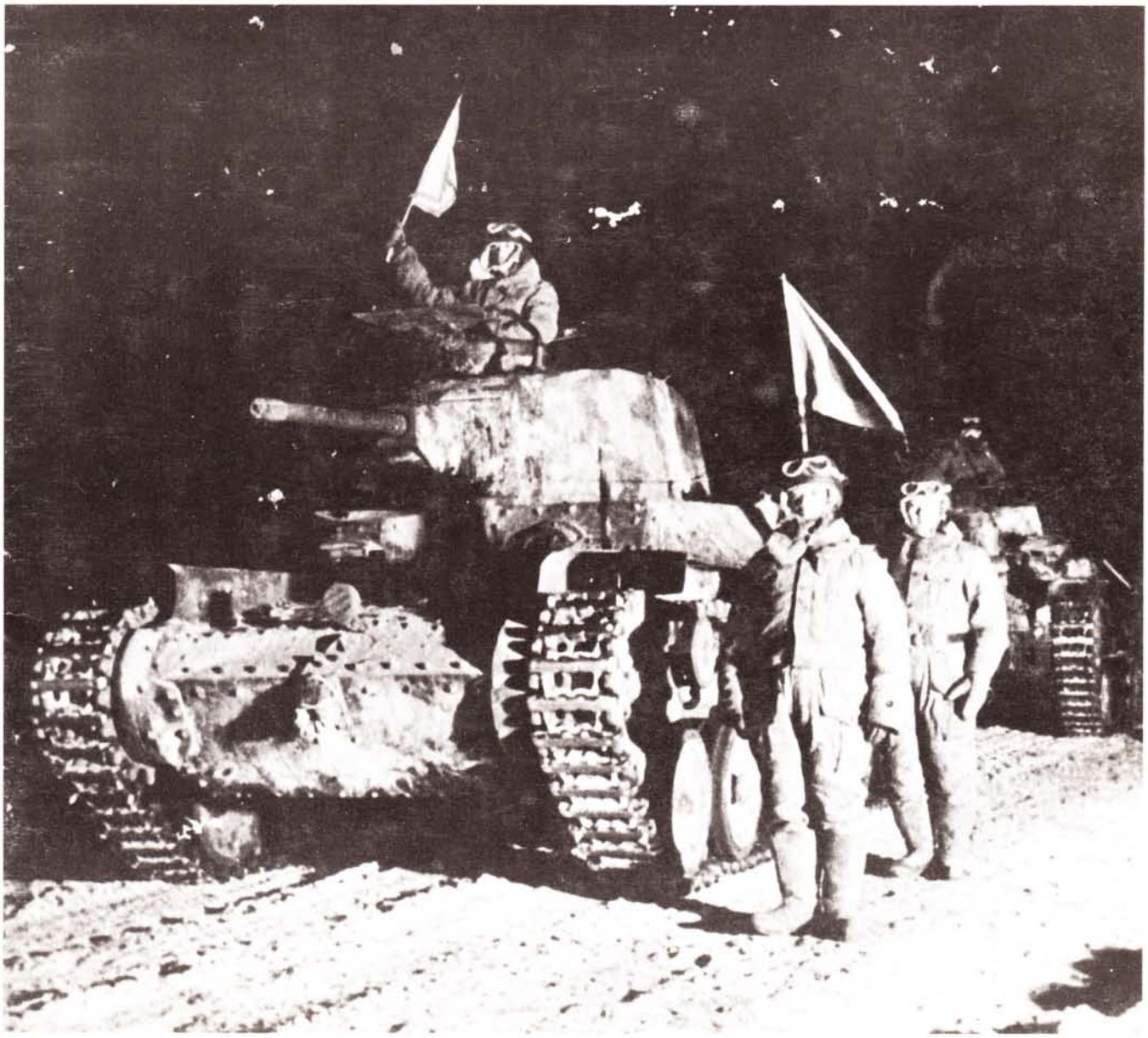
PROFILE AFV WEAPONS 49

40p

Japanese Medium Tanks

by Lieutenant-General Tomio Hara, Imperial Japanese Army Retd.



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Original model of Type 89 Medium Tank during road tests near Mount Fuji, which is seen in the background. Note the caterpillar shoe.

Japanese Medium Tanks

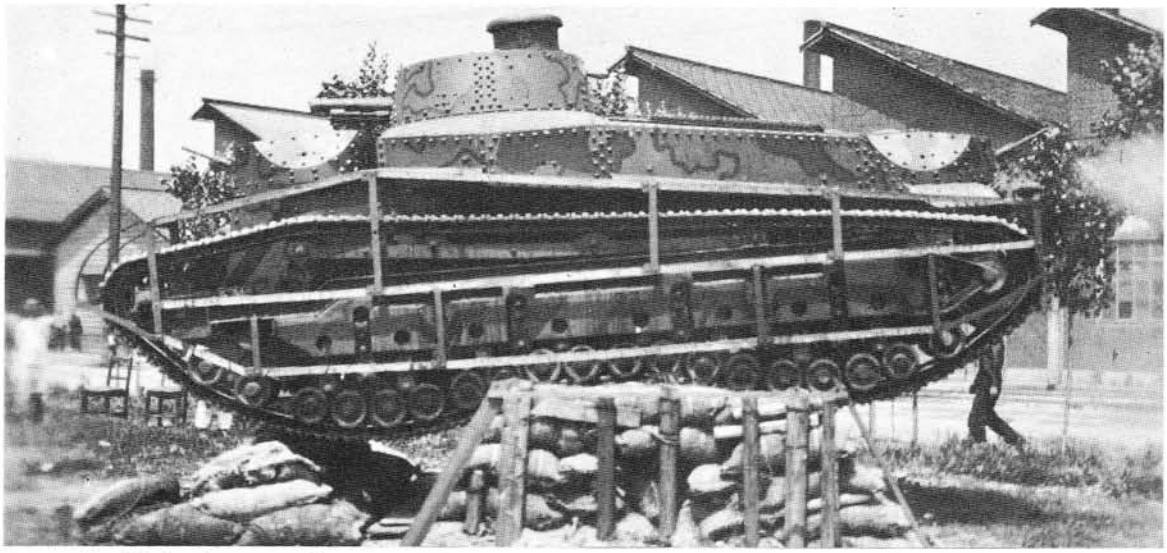
(from Prototype No. 1 to Type 5 CHIRI)

by Lieutenant-General Tomio Hara, I.J.A. Retd.

THE development of Japanese tanks started from 1925. The first tank on the agenda was a medium sized main battle tank; however, with the outbreak of the China Incident, requirements for a light tank with mobility, a tankette for scouting and liaison, heavily armed tanks for fire support, an amphibious tank for special missions, an engineering tank, etc., ranging into many varieties, all suddenly became necessary. Eventually, production was increased to meet the demand which ultimately made Japan into one of the leading tank producing nations in the world. Of these armoured vehicles, this Profile deals with the history of medium tanks.

MOTIVES FOR DEVELOPMENT OF MEDIUM TANK

After World War I (1919), the Imperial Japanese Army purchased a few British Medium Mark A Whippet tanks, one Mark IV 30-ton heavy tank, and a few small sized French Renault FT tanks as reference equipment. With a test and trial unit organized within the Infantry School, studies were made from the standpoints of tactics and engineering, but these did not arouse interest as to the tank's future possibilities. This negative attitude was completely reversed with the appearance of the high speed British Vickers tank in 1923. Soon after this, in 1925, a program for modernization of army equipment was initiated. Among other developments it established a tank unit. However, as it was impossible to manufacture tanks at such short notice, ordnance officers were sent to Europe and the United States to negotiate contemplated purchases. Because its own army was not completely equipped with the Vickers tank the British High Command refused to authorize sales of this tank; but this refusal was subject to the understanding that consideration would be given to sales sometime in the future. Christie of U.S.A. was also publicizing his new concept tank, but it turned out to be just an idea without the actual product. In France new type tanks were still undeveloped, but the French were very willing to sell Renault FT tanks of which they had a large number.



Prototype No. 1 Tank undergoing initial engineering trials at Osaka Army Arsenal soon after its completion in February 1927.

Prototype No. 1 Tank at Tokyo Army Technical Headquarters in 1927. The first tank built by Japan.

"It was indeed a spectacular sight to see the tank charging at high speed"—Prototype No. 1 Tank demonstrating its cross-country ability at Tokyo Army Technical Headquarters in 1927.

Since Army Technical Headquarters was aware of the outdated FT tanks from past studies, objections were raised which eventually resulted in putting forward a recommendation for Japan's own tank designing which had been prepared earlier (the present writer was a captain at this time and assigned to Army Technical Headquarters). Army High Command was sceptical about the success of this proposal because the Japanese automotive industry was still in its embryo stage; however, through the strong insistence of Army Technical Headquarters, prototype construction was authorized by readjusting the force equipping timetable to a slight degree. Parallel with this decision a very small quantity of FT tanks were purchased for training purposes.

It is interesting to note in passing that when the writer visited Aberdeen Proving Ground in U.S.A. in January 1932, the Christie tank had been constructed and was undergoing examination and trial by the U.S. Army. Although Mr. Christie again offered his tank to Japan, test results were very poor with many mechanical failures.

PROTOTYPE NO. 1 TANK

The ground was now ready for self-development in Japanese tank production. However, the issued performance requirements were severely limiting in scope. Namely, "for the convenience of peacetime tank force training, lightweight tank (under 10 tons and similar to French Renault tank) to be developed on priority basis, with heavyweight tank (under 20 tons and similar to British Medium Mark A tank) added for research purposes, and then gradually take up development of combat tanks for the future." Of course, Army Technical Headquarters was not satisfied with this limited project outline as it could mean a recurrence of the "buy foreign" policy when high performance tanks eventually appeared on the foreign commercial market. Thus it was decided by Army Technical Headquarters to develop an ideal tank illustrating the technical capabilities to assist in establishing a firm state policy.

For attaining this goal, the following design plans were laid for the tank and design work was started in accordance with them:

(a) Suited for attacking strong field positions and yet have road mobility.

(b) To enhance independent combat capabilities within field positions, maximum concentration of firepower around the tank. For this goal, equip it with a turret mounting 57 mm. gun and machine-guns mounted one forward and one aft, each within its respective machine-gun turret. Under this arrangement, gun and machine-gun can be fired to the front as well as towards the rear, while gun and two machine-guns can be concentrated on either flank. 57 mm. gun to be effective in destroying heavily protected machine-gun nests as direct support of infantry attacks.

(c) Armour plating to be able to resist standard 37 mm. antitank guns at close range.

(d) Road speed to be 25 km./h. Speed to be in unison with 24 km./h. standard army cargo truck for joint travelling. Off-the-road mobility being of prime importance, a suitable suspension system and steering mechanism must be designed.

(e) Trench crossing capability of 2·50 m., with climbing capability of a gradient of 2 in 3 (43°).

(f) Crew of 5 men.

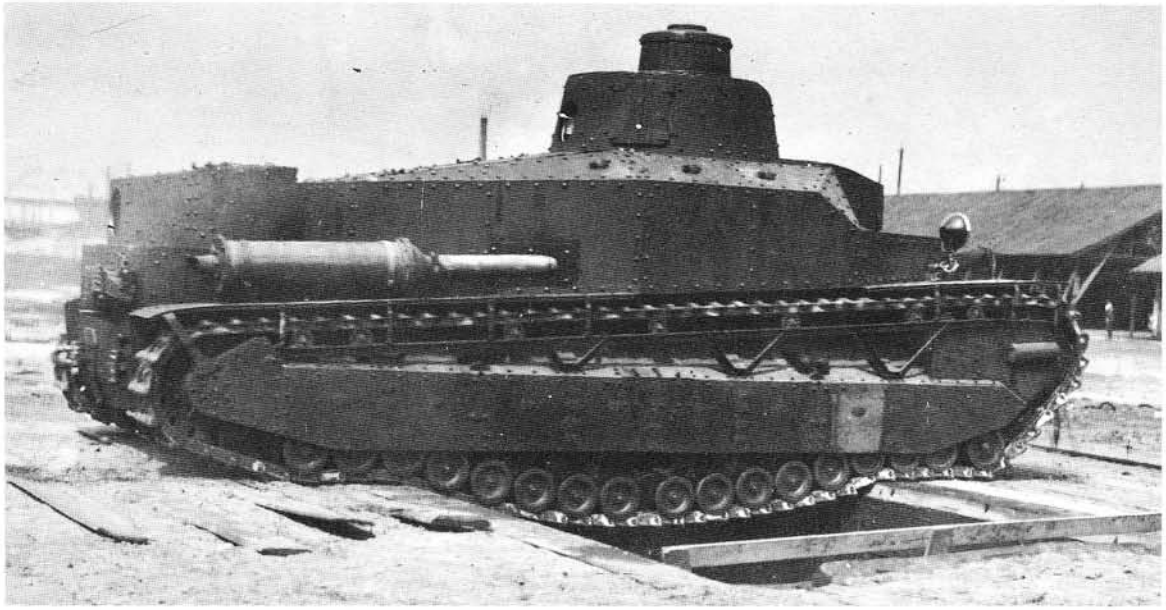
(g) Width and height to be limited for railway transportation.

(h) Driver to be able to control the vehicle fully by himself. (On the first World War I tanks, several men were required for this purpose.)

(i) Operating range of 10 hours. (Difficulties were encountered on World War I tanks.)

(j) For meeting above specifications, expected weight to be approximately 15 tons.

Prototype 91 Heavy Tank under test at Osaka Army Arsenal. This tank was the second phase modification of Prototype No. 1 Tank.



Prototype 91 Heavy Tank at Fuji Training Ground. After further modifications completed in 1935 it was designated Type 95 Heavy Tank. Only a few were built.

Prototype 91 Heavy Tank hill climbing at Fuji Training Ground.

Although the above stipulations indicate that the tank was close to heavy tank category, it was thought that the 2-man Renault tank was not suited for the task of a main battle tank. Since this prototype tank was conceived as testing out domestic manufacturing capabilities, Chief of Staff Operations did not interfere and left the details to the engineers.

In principle, designing should be done after completion of basic tests on components. However, such spare time was not available and design work was conducted in a groping about fashion. In addition, for budgetary reasons, the period from commencement to completion was limited to just 21 months. In accordance with this drastically limited period design work was started in June 1925 and the prototype was completed in February 1927 at Osaka Army Arsenal.

Although Osaka Army Arsenal enjoyed years of tradition in manufacturing various artillery equipment and possessed excellent engineering capabilities, machining facilities were too small to be suited for tank fabrication. Because of this, shipbuilding works and railroad engine factories located in the vicinity cooperated in producing components with assembly work done at the Arsenal.

Due to the various conditions described above, extreme hardship was encountered in preparing a thorough program and laying down guidance measures. Since production of armour plate was not complete in time, mild steel plate was used on the prototype.

First field testing took place at Fuji Training Ground in June 1927 with a great many high ranking officers attending from Army Headquarters. Results were good with various components functioning as hoped for. The tank showed that it had excellent mobility characteristics. It climbed a long incline of 2 in 3, crossed a trench 2·50 m. wide, surmounted a perpendicular wall 1·0 m. high, displayed its road capabilities by travelling at high speed over off-the-road terrain; driving was easy, with good riding quality through the suspension system, and with excellent stability characteristic as a firing platform. In short, for a first tank given birth to by Japan, it was a great success which far exceeded expectations—with one exception. Instead of meeting the original planned weight of 15 tons, the prototype turned out to be 18 tons, which somewhat reduced the 25 km./h. speed. However, compared with 8 km./h. for the Renault tank and 14 km./h. on the British medium tank, its speed was still considerably superior. It was indeed a spectacular sight to see the tank charging at high speed.

With the success of Prototype No. 1 which proved the

engineering capabilities of Japan, national policy for domestic production over the years to come was firmly established.

Specifications and performance data on Prototype No. 1 Tank are as follows:

Weight (empty) – roughly 18 metric tons
Length – 6·03 m.
Width – 2·40 m.
Height with observation cupola – 2·78 m.
Height without observation cupola – 2·43 m.
Ground clearance – 0·40 m.
Track width – 0·35 m.
Power plant – newly designed V-type 8-cylinder 140 h.p. gasoline engine
Maximum speed – 20 km./h.
Minimum speed – 2 km./h.
Speed gears – 6 forward, 2 reverse
Armament – one 57 mm. gun mounted in turret; two 7·7 mm. machine-guns mounted in independent machine-gun turrets
Ammunition capacity – 110 rounds 57 mm. shell; 5000 rounds 7·7 mm. cartridge
Armour thickness – 17 mm.
Crew – 5: commander, driver, gunner, 2 machine-gun gunners
Climbing capability – 2 in 3 (43°)
Trench crossing capability – 2·50 m.
Vertical obstacle capability – 1·00 m.
Fuel capacity – 10 hours operation
Turning radius – 11·00 m.
Spot-turn capability – yes
Suspension system was of parallelogram type (see sketch) using leaf spring with road rollers mutually connected for firm contact with surface indentures.
Steering mechanism was of originally designed epicyclic steering gear-box type, which combined regenerative fixed radius turn and spot-turn of clutch-brake type. This system was popular and became standard for all future tanks. With simultaneous operation of steering gearbox on both sides, it also acted as emergency reduction gear. As stroboscope type observation device, the tank commander was equipped with a revolving observation cupola. For the driver a revolving window viewer was used.

Convinced by the splendid results of this prototype tank, Operations Headquarters seriously re-evaluated the performance capabilities needed for a main battle tank and strongly recommended that the prototype of another operational tank should be built. Furthermore, the merit of Prototype No. 1 Tank as a heavy tank was recognized, and later, with modifications, it developed into the Type 95 Heavy tank.

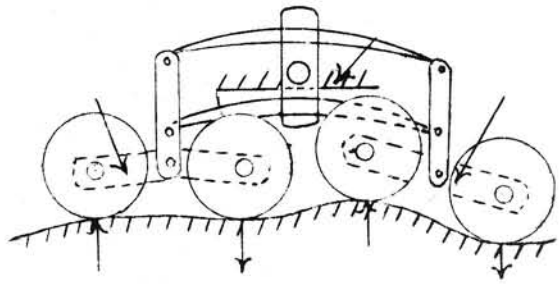
TYPE 89 MEDIUM TANK

The new prototype was of a tank to be used for the direct support of infantry units. With combat weight of 10 metric tons, the following performance and specifications were required:

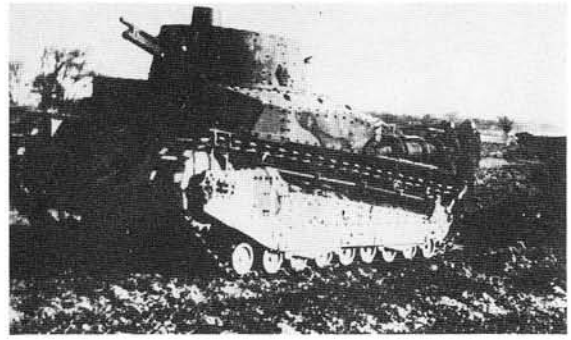
Maximum speed – 25 km./h.
Trench crossing capability – 2·00 m.
Climbing capability – 2 in 3 (43°)
Length – 4·30 m.
Width/height – within limitation of railway platform car for transportation
Armament – one 37 mm. gun and one or more machine-guns
Armour thickness – able to resist 37 mm. shell at medium range

Due to the weight limitation it was necessary to reduce dimensions and alter the armament. However, regarding the main gun, the 37 mm. gun being the same as in the Renault tank and just too small, the 57 mm. gun which had already proved itself in the past was adopted. Forward and aft machine-gun turrets were eliminated with one machine-gun located within the gun turret and facing rearwards while another was mounted forward on the hull. For the power plant the Daimler 6-cylinder aircraft engine was modified for tank application with 100 h.p. output.

Steering mechanism and emergency reduction gear were identical to Prototype No. 1 Tank. Suspension system was simplified with four road wheels moving independently in conjunction with bogies and semi-elliptic springs. The stroboscope was eliminated.



Parallelogram type of suspension of Prototype No. 1 Tank.



Three-quarter left front view of Type 89 "A" Medium tank. Initially the Type 89 was classified as a light tank but was later re-designated as a medium. Note the "saucepan" cupola.

Type 89 "A" Medium Tank with short front plate and vertical front plate above this. There is a door on the right of the lower plate with a bow machine-gun above it. The driver's position was on the left. Note opened "saucepan" cupola behind the shoulder of the left-hand crew member. There are five small return rollers mounted along a girder.

Type 89 Medium Tank with single sloping front plate and "saucepan" cupola. This model has been referred to sometimes as Type 92 Medium Tank.

Due to design knowledge and experience gained from Prototype No. 1 Tank and confidence about the reliability and performance of component parts, design work was relatively easy and there was rapid progress. Since Japan Steel Works Ltd. had succeeded in developing armour steel plate, it was adopted for this tank.

Construction was completed in April 1929 at Osaka Army Arsenal with satisfactory functional and performance results. Following trials and endurance tests, and after careful examination, Prototype No. 2 was standardized as Type 89 Medium tank.

At completion its specifications were as follow:

Weight – 9·8 metric tons (later, due to a number of modifications required by using units, final weight was 11·5 tons)
Length overall – 4·30 m. (later, tail was added to assist trench crossing which made it 5·75 m.)
Width – 2·15 m.
Height – 2·20 m.
Ground clearance – 0·35 m. (later modified to 0·50 m.)
Armour thickness – all important areas 17 mm.
Maximum speed – 27 km./h.
Trench crossing capability – 2·00 m. (later, 2·50 m. with tail added)
Turn radius – 4·60 m.; also capable of spot-turn
Crew – 4

Taking the opportunity offered by the mass production of Type 89 tanks, the policy was adopted of using commercial establishments as much as possible for tank production. As a starter, Mitsubishi Heavy Industries Ltd. constructed a factory specializing in tank manufacturing and commenced production.

PURCHASE OF VICKERS MODEL C TANK

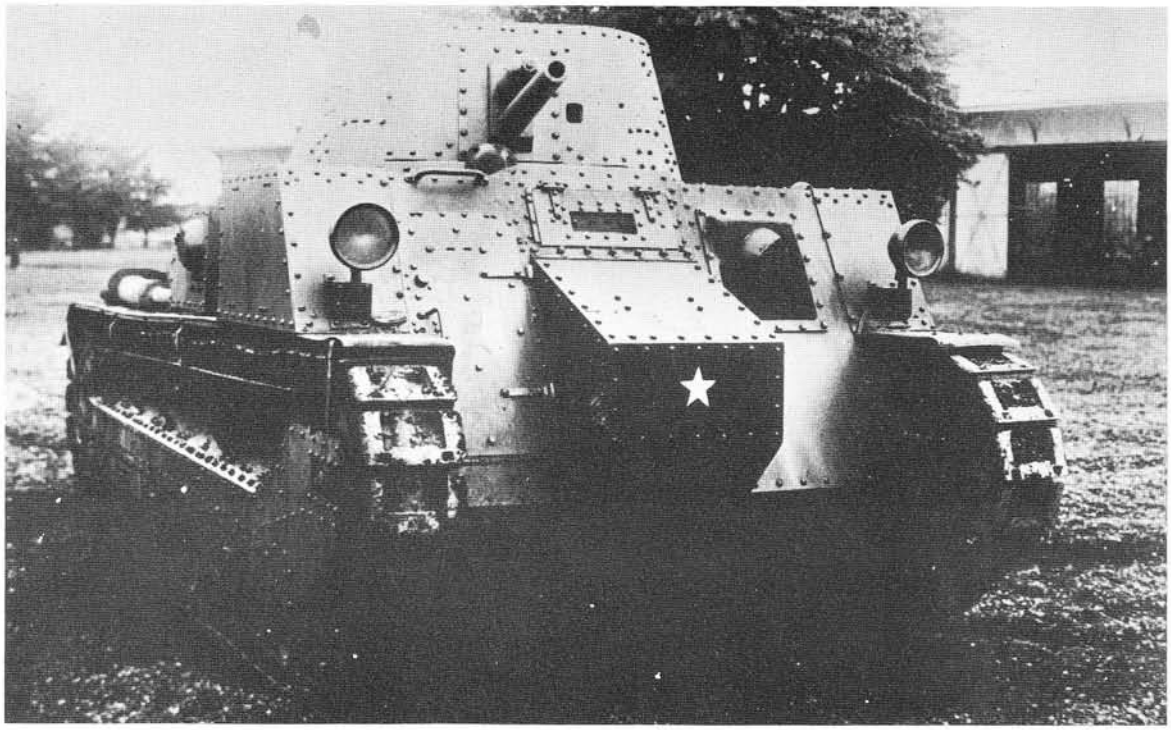
Vickers offered to sell one prototype Model C tank which was developed for the British Army and failed to be adopted. In Japan development work was already proceeding, but it was decided to purchase this prototype as engineering reference equipment. It was delivered to Japan a month after the completion date of Prototype No. 1 Tank in February 1927. Unfortunately, while preliminary trial runs were being conducted by two engineers from Vickers, gasoline fumes from carburettor overflow during a steep climb seeped inside the tank and ignited from engine backfire. The engine was burned out and both engineers were badly scalded. Replacement power plant arrived six months later. Although the accident was distressing, from the standpoint of safety it acted as an incentive in the adoption of diesel engines for military vehicles at a later date.

General characteristics of the Model C tank were as follow:

Weight – 10 metric tons
Power plant – 165 h.p. Sunbeam aircraft engine
Maximum speed – 32 km./h.
Minimim speed – 2km./h. by using epicyclic emergency reduction gear
Steering – clutch-brake type
Main armament – 57 mm. gun in turret
Secondary armament – one machine-gun aft in gun turret and three internal fixed machine-guns
Armour thickness – 6 mm.
Suspension system – Horstmann type with coil springs and flexible
Tracks – smooth on surface but slippery
Armour plate – due to thinness, tactically disadvantageous
Feature – it possessed excellent qualities as an automotive vehicle and offered good reference information.

Type 89 "B" Medium Tank with single sloping front plate, driver's position on right and bow machine-gun on left, four return rollers, girder removed, flattish cupola with split lid. The Type 89 "B" had a diesel engine, the Type 89 "A" had a petrol (gasoline) engine.

Type 89 "B" Medium Tank with ditching tail added. Note flattish cupola, four return rollers and absence of girder. This model has been referred to sometimes as Type 94 Medium Tank.



The Vickers Model C Tank which was imported by Japan as reference equipment in March 1927. It was the fire in this tank that stimulated Japanese development of diesel engines for tanks.

PURCHASE OF RENAULT NC TANK

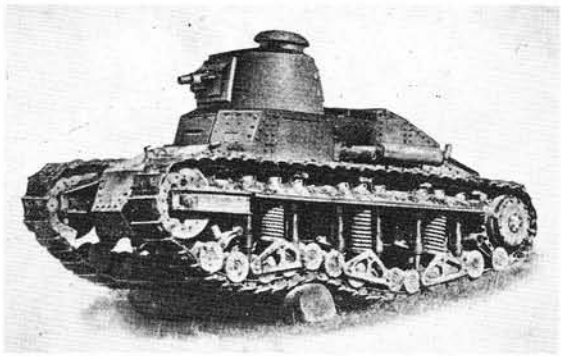
Based on Japanese performance requirements furnished earlier to the Schneider firm by the Japanese Purchase Mission, development work on the NC tank was voluntarily taken up by Renault; this was later followed by an offer. With the Type 89 tank already in production it was not necessary for Japan to purchase NC tanks. However, because of past courtesies and as part of the armoured force equipping program, several were procured in 1930. During the first Shanghai Incident these NC tanks were employed in operations together with Type 89 tanks. Results indicated inferior combat performance and the development of many mechanical failures; in consequence the tank acquired a bad reputation.

General characteristics of the NC tank were as follow:

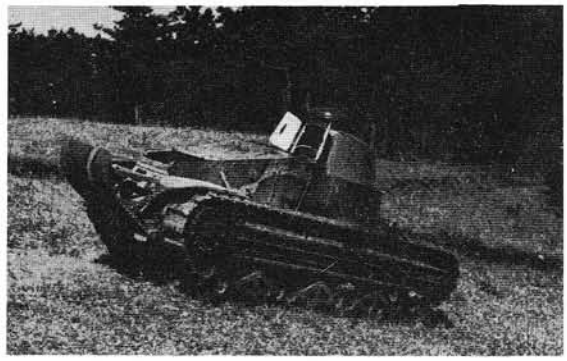
Weight – 7·9 metric tons
Power plant – 60 h.p.
Maximum speed – 18·5 km./h.
Armament – one 37 mm. gun or one machine-gun (same as FT Renault Tank)
Armour thickness – 20–30 mm.
Crew – 2
Steering mechanism – controlled differential

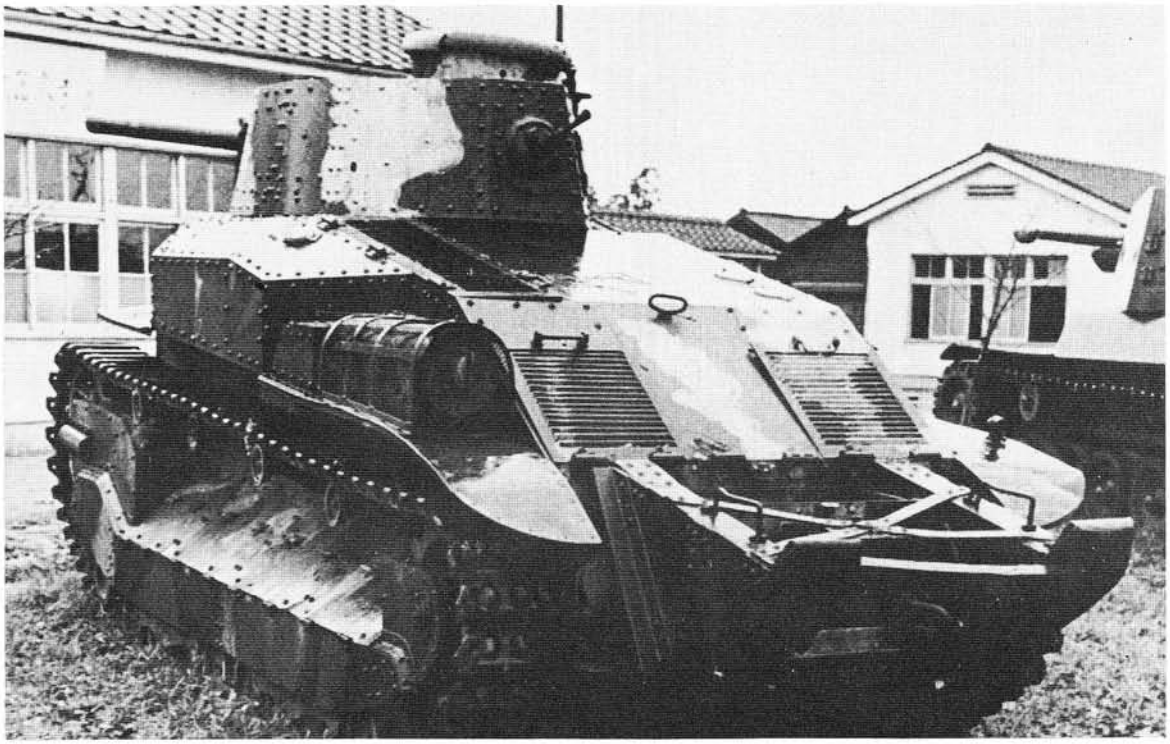
Principal failures were over-heating of engine, damaging of suspension system, and malfunction of power train. These faults were probably due to lack of thorough testing and trials. To ameliorate the severe weakness of the suspension reinforcement was applied to it before tanks were issued to units; but this modification was far from achieving perfection. Regarding tactical capabilities, with the exception of added speed the NC was only equal to the FT tank. It hardly offered satisfaction.

Original Renault NC Tank imported by Japan where it was called Renault B. The suspension was one of its weak points.



Three-quarter right rear view of Renault NC Tank with strengthened suspension. Even with this modification the tank did not prove satisfactory to the Japanese. Renault NC Tanks took part in the Shanghai Incident in 1932.





Three-quarter left rear view of Type 89 "B" Medium Tank with ditching tail. Fuel tanks were over the tracks.

Type 89 Medium Tank with short front plate and vertical front plate above it, but with flattish type cupola and no girder under the return rollers. The gun mount has also been modified with external mantlet.

Rear view of Type 89 "B" Medium Tank with ditching tail.

COMBAT HISTORY OF TYPE 89 MEDIUM TANK

(1) Example of break-through in trench warfare:
The first (1932) and second (1937) Shanghai Incidents were typical of fighting where strong positions have to be attacked and destroyed. Type 89 tanks proved their worth and showed their effectiveness. In comparison with the unsatisfactory showing of the NC tanks, especially during the first Shanghai Incident, the domestically produced tanks won the acclaim of officers and men through their mechanical and functional capabilities.

Even though positions in Shanghai were organized very strongly by the clever utilization of a complicated creek system as a barrier, Type 89 tanks forced their way through the obstacles, over-running trenches, destroying flanking defensive fire positions, and supported and guided the infantry units to victory.

(2) Example of mobile warfare:
During the Jeho Operation (Inner Mongolia) in 1934, a mechanized task force composed of combined arms of the Army was organized for the first time and carried out advancement orders. The Type 89 tank unit constantly acted as vanguard and verified the tank's superb worth of being able to maintain mobility over long distances.

During the China Incident in 1937, the fighting and sweeping advance along the Peking-Hankow railway was led by two battalions of Type 89 tanks which surmounted the muddy terrain features caused by seasonal rain.

After that, during the greater part of the China Incident and in the early phase of the Philippines operation Type 89 tanks operated as the main battle tanks of the Imperial Japanese Army.

Type 89 "B" Medium Tank of the Imperial Naval Landing Force in Shanghai.

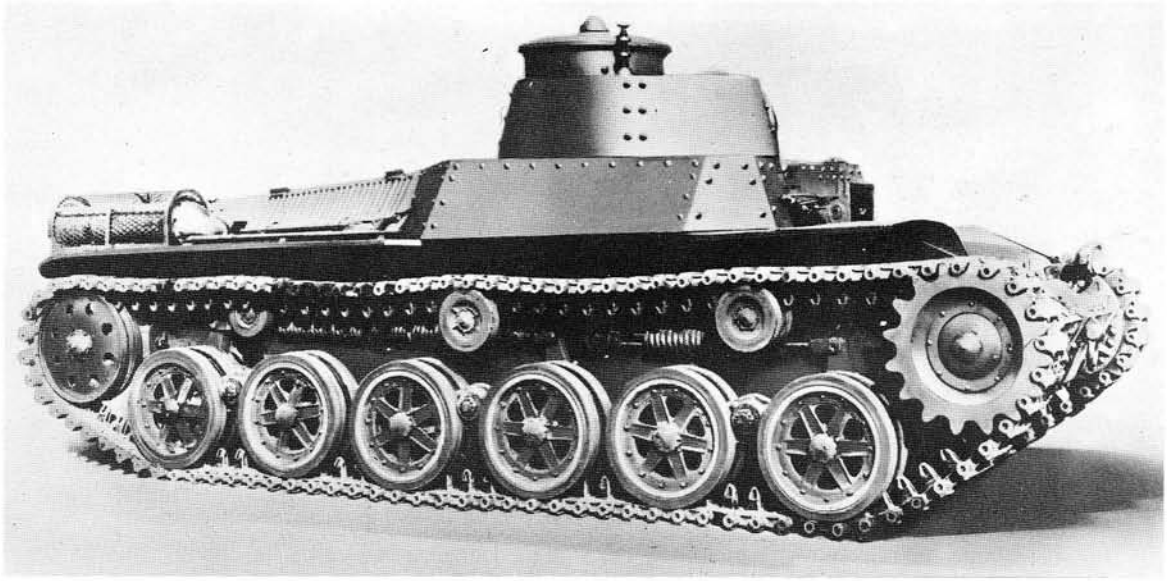
Type 89 "B" Medium Tanks of the Imperial Naval Landing Force travelling along a main street of Shanghai.

Column of Type 89 Medium Tanks with infantry moving forward after an attack. Of three tanks that are visible all have the modified suspension system with four return rollers and no girder, and all have the single sloping front plate. But whereas the front tank has the driver on the left the rear two have him on the right.

Type 89 "B" Medium Tanks advancing on Yanwangtsin during the Shanghai battle.

Type 89 "B" Medium Tank charging through jungle on the Bataan Peninsula, Philippines, 1942.

Type 89 "B" Medium Tank feeling its way across a partially destroyed bridge in the Shanghai fighting.



Early model of Type 97 Medium Tank (CHIHA).

TYPE 95 HEAVY TANK

Since Prototype No. 1 Tank possessed the favourable feature of superior firepower it was modified and completed as standardized equipment. On comparison with the Type 89 Medium tank it was designated as a heavy tank, although in reality it fell within the medium scope its mission being also that of a main battle tank. Main modifications were cutting its total weight and increasing its engine power. First phase modifications were completed in April 1930. Based on trial results, weight was slashed from various areas, making it total approximately 16 tons. By the adoption of aluminium pistons and related adjustments, power was increased to 150hp. With the various components functioning satisfactorily, generally speaking, first phase objectives were attained. In addition, the 57 mm. gun was replaced by a 70 mm. weapon.

Aiming for perfection as future equipment, design changes were incorporated as second phase modification. Work was started in March 1932 and was known as Prototype 91 Heavy tank with the following specifications:

Weight – roughly 18 metric tons
Length overall – 6·30 m.
Width – 2·47 m.
Height over cupola – 2·57 m.
Road clearance – 0·40 m.
Armour thickness – 20 mm.
Power plant – 224 h.p. modified BMW aircraft engine
Maximum speed – 25 km./h.
Trench crossing capability – 3·00 m.
Crew – 5
Turning radius – 5·20 m.
Spot-turn capability – yes

With further design changes taking place as third phase modification· Type 95 Heavy tank was completed in 1935 with the following characteristics:

Weight – 26 metric tons
Length overall – 6·47 m.
Width – 2·70 m.
Height – 2·90 m.
Road clearance – 0·50 m.
Main gun turret armament – Type 94 70 mm. Tank Gun and one machine-gun
Forward gun turret – Type 94 37 mm. Gun
Rear machine-gun turret – one machine-gun
Armour thickness – 30 mm.
Engine output – 290 h.p.
Road rollers – total of 9 with structure identical to Type 89 Medium Tank

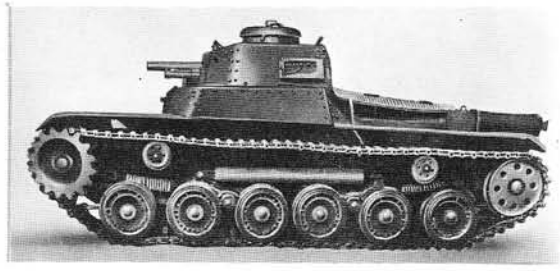
Type 95 Heavy tank being very heavy and its production costly, troop equipping was not extensive.

ADOPTION OF DIESEL ENGINE AND STANDARDIZED DIESEL ENGINES

The fire in the imported Vickers Model C tank engine was a highly cautionary experience, stressing the fact that fuel with a high flashpoint is desirable since the degree of fire hazard is thus decreased for a tank fighting in combat environment. Furthermore, since Japan lacks petroleum resources, it was recognized as being more advantageous to use the diesel engine which enjoys less loss in storage/replenishment and less degree of fuel consumption with high thermal efficiency. Thus, from 1932, development work on diesel engines was officially initiated.

For operations in northern regions under rigid winter conditions there are constant worries that breakdown will occur from freezing with water-cooled power plants. In addition, in barren districts it is very difficult to replenish with sufficient water. Consequently, the decision was taken to make an all-out effort to develop the existing diesel engine into an air-cooled version. Despite the engineering problems involved there was confidence that it could be done because of past experience with air-cooled gasoline engines. The prototype

Type 97 Medium Tank, later model. The style of the road wheels has been changed. The front and rear wheels are sprung independently to absorb shock.

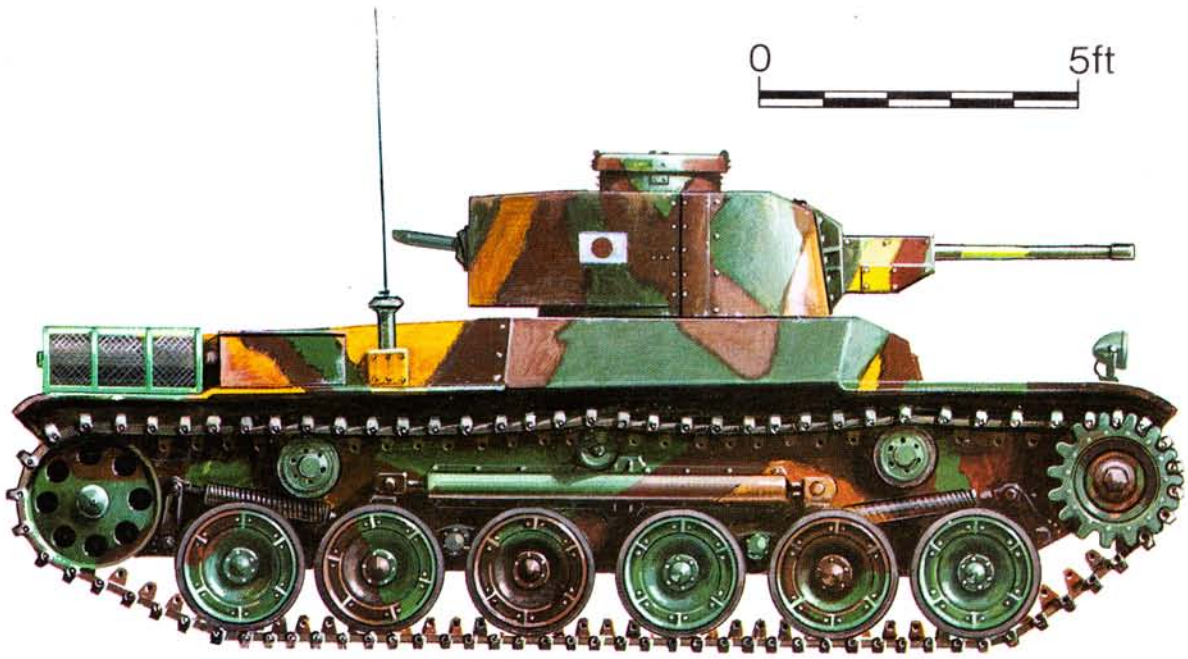


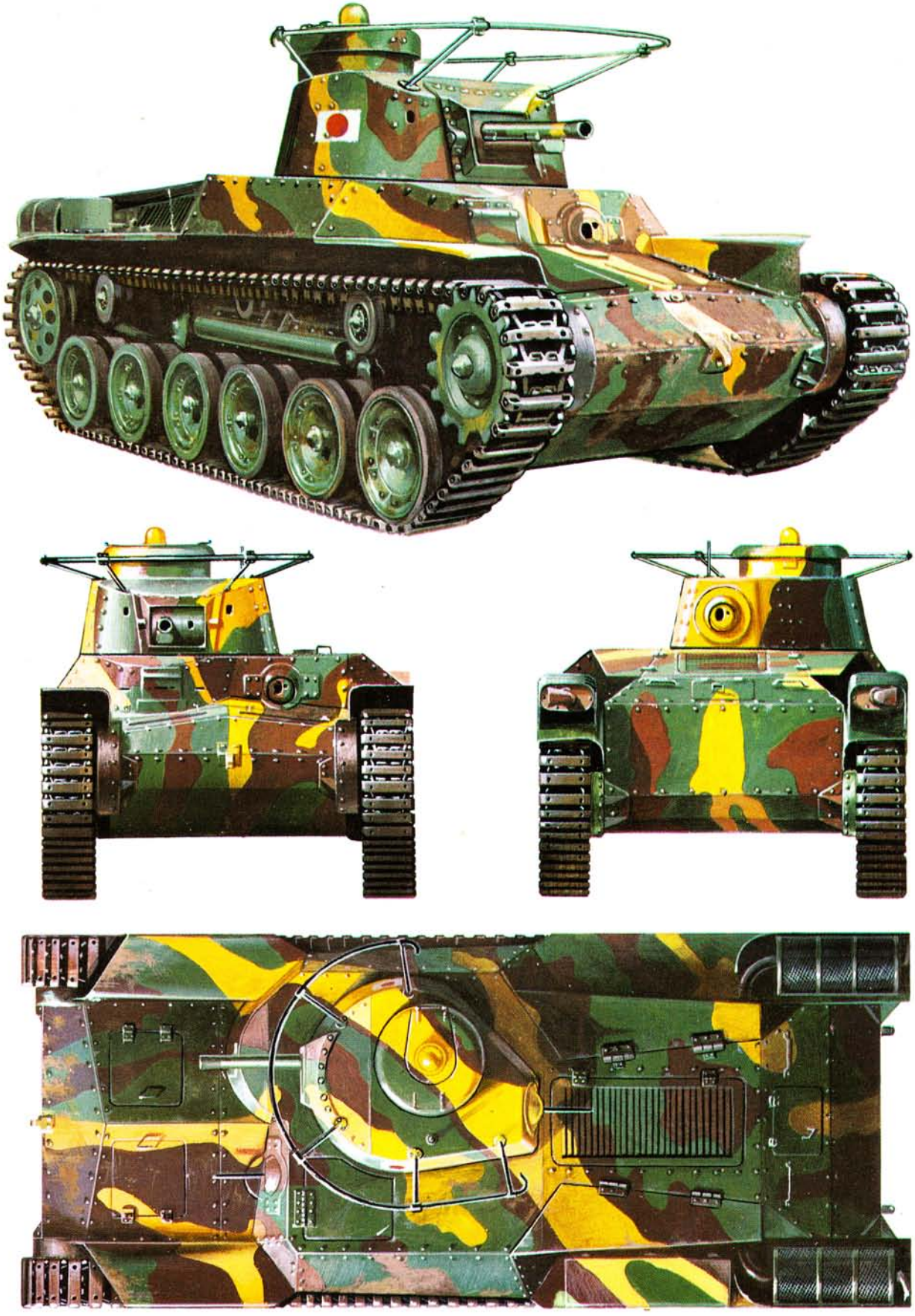
(Above) Side view of Type 89B Medium Tank CHIRO with ditching tail.

(Below) Side view of Type 1 Medium Tank CHIHE. The CHIHE was the Type 97 Medium Tank CHIHA with modifications including different main armament.

(Right) Four views of Type 97 Medium Tank CHIHA.

The tanks are shown in their original "workshop finish" camouflage colours, i.e. before these had faded through weathering and active service.





STANDARDIZED DIESEL ENGINES

Nomenclature	Cylinder Number & Type	Cooling System	Bore (mm.)	Stroke (mm.)	Displacement (litre)	Maximum HP	Super-charger	Example of Application
Type 100	12 V	air	120	160	21·7	240		Type 1 Medium Tank
Prototype	12 V	air	120	160	21·7	300	yes	Type 3 Medium Tank
Type 100	8 V	air	120	160	14·5	160		
Type 100	8 in-line	air	120	160	14·5	150		
Type 100	6 in-line	air	120	160	10·9	130		light tank
Prototype	6 in-line	air	120	160	10·9	150	yes	light tank
Type 100	4	air	120	160	7·2	80		
Type 100	12 V	water	120	160	21·7	200		heavy prime mover
Type 100	8 V	water	120	160	14·5	160		medium prime mover
Type 100	8 in-line	water	120	160	14·5	140		
Type 100	6 in-line	water	120	160	10·9	120		light prime mover
Type 100	4	water	120	160	7·2	80		
Type 4	12 V	air	145	190	37·7	400		Type 4 Medium Tank
Prototype	12 V	air	145	190	37·7	500	yes	
8-litre model	6	water	110	150	8·5	100		6-wheeled truck
5-litre model	6	water	95	120	5·1	85		6-wheeled truck
3-litre model	4	water	95	120	3·4	55		4-wheeled truck

Note: 1) All power plants are 4-cycle diesel version.
2) All power plants are pre-combustion chamber type.
3) 8, 5 and 3-litre models were also used as commercial engine and adopted as standardized version by Ministry of Commerce.

production order was placed with Mitsubishi Heavy Industries. It was hard work, with countless tests being conducted on combustion and cooling methods.

The completion of the first prototype in 1933 was followed by trial runs, the results of which were satisfactory and confirmed that the engine could be practically employed. Newly developed power plant was installed in a Type 89 Medium tank for trials and, during 1934, test runs were conducted in Northern Manchuria under the most severe winter conditions. After further practical and durability tests, it was officially adopted in 1936.

Type 89 tanks equipped with diesel power plant were known as Type 89 "B" tank while the gasoline model was designated Type 89 "A" tank.*

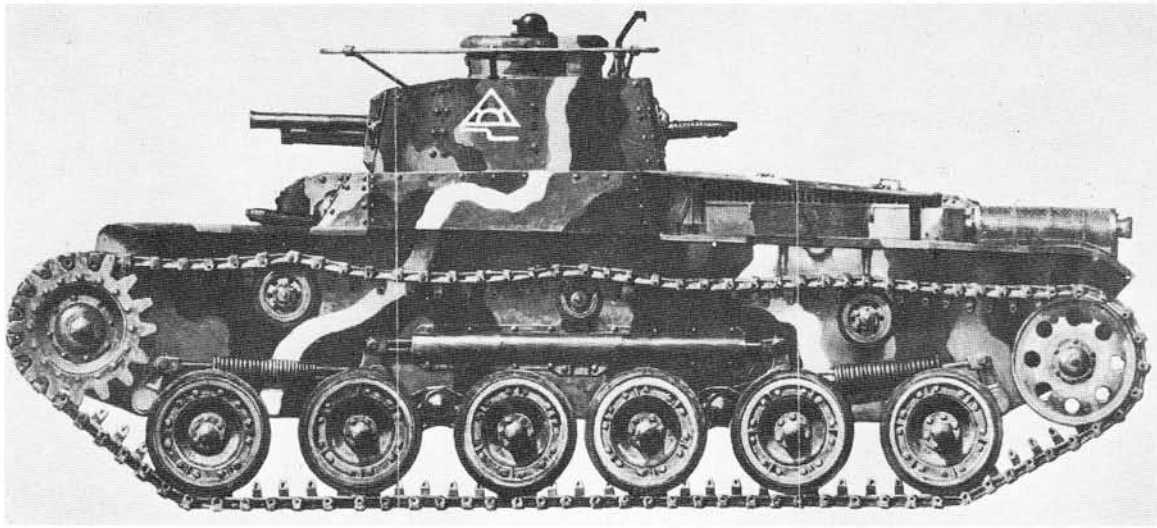
With the formal adoption of diesel power plant for tanks, Japan took the leadership as world pioneers in this field. Later, requirement from users developed over a wide range of combat and military vehicles, including trucks and prime movers, for dieselization. Naturally, with such a wide application of a variety of power plants, it became apparent that problems would develop in maintenance and logistics. Consequently, plans were made to standardize diesel engines into standardized models by standardizing piston diameter and stroke, number of pistons, arrangement of pistons, air-cooling methods, etc. On all new vehicular development programs it was mandatory that one of the standardized power plants be used. For instance, on one version, bore was 120 mm., stroke 160 mm., 4-cycle diesel of pre-combustion type. From the standpoints of production and logistics extensive benefits were derived under this arrangement. This also happens to be one of Japan's creditable policies of that time.

TYPE 97 MEDIUM TANK (CHIHA)

By 1935, Type 89 tanks after six years of use were still enjoying the trust and confidence of the troops and the tank crews. There had been hardly any changes in tank tactics and organization which seemed to indicate that there was no necessity to develop newer tanks. However, in Great Britain, considerable discussion was going on about the use of tanks in an independent rôle, the 16-ton A6 tank with 47 mm. gun and speed of over 50 km./h. being earmarked as the main battle tank. By comparison the Type 89 tank was at a disadvantage, and it was felt that both offensive and defensive capabilities had to be increased as well as the slow speed of 25 km./h. Just about this time a report was received from the newly organized self-contained mechanized combined brigade in Manchuria that it was difficult for Type 89 tanks to keep up with other vehicles. Thus the development of the fast moving Type 95 Light tank was promptly taken up.

In face of this situation, tank designers recommended that research work be started on a new tank with speed of over 35 km./h., weight of 15 tons, and stronger offensive/defensive capabilities, since the mission requirement of a brigade of this nature made it necessary that it should be equipped with main battle tanks. The attitude of Chief-of-Staff Operations, however, was very unenthusiastic, being based on peacetime requirements and the wish only for a lighter weight tank to lower production costs. Since it was highly regrettable that the efforts of the Engineering Department be limited to weight reduction with complete disregard for performance improvement, Engineering decided to take up

*There were a number of other modifications to the Type 89 Medium Tank during the course of its career. Originally it had a short front plate with a door on the right, a vertical front plate above this with a bow machine-gun on the right and the driver's visor on the left, a small "saucepan" cupola hinged to the top of the turret, and five small return rollers mounted along a girder. All these characteristics were subsequently modified. The two front plates were combined into one long sloping front, the turret was re-designed with a flattish cupola that had a split lid opening in two halves, the positions of the bow machine-gunner and the driver were interchanged so that the driver was on the right and the bow machine-gun on the left, the girder was removed and the return rollers reduced to four, the skirting was re-designed, and a ditching tail was added to improve the tank's trench crossing performance. Type 89 tanks which had been partially or wholly modified as described above have sometimes been referred to by other designations viz. Type 92 Medium Tank and Type 94 (or M2592 Medium and M2594 Medium). The various combinations of these modifications are shown in the illustrations. *Editor.*



Type 97 Medium Tank standardized model with headband type antenna for radio round the top of the turret.

concurrent research and development on two plans. Prototyping of the first plan was contracted to Mitsubishi Heavy Industries, while the second plan was assigned to Osaka Army Arsenal. The requirements were as follow:

1st Plan (CHIHA)
Speed – 35 km./h.
Trench crossing capability – 2·50 m.
Armour thickness – 25 mm.
Weight – 13·5 metric tons
Crew – 4
Armament – one 57 mm. gun; two machine-guns

2nd Plan (CHINI)
Speed – 27 km./h.
Trench crossing capability – 2·40 m. (with tail extension)
Armour thickness – 20 mm.
Weight – 10·0 metric tons
Crew – 3
Armament – one 57 mm. gun; one machine-gun

In the belief that the suspension system offered the largest area where weight could be economized, new suspension was designed for a start. Through the medium of coil spring, bogies of forward and rear road wheels were linked in see-saw fashion by means of bell-crank. With this new design ground contact performance

Type 97 Medium Tanks with radio antennae round turret tops. The cupola hatch was of a most unusual design. It had two flaps, one shaped like a crab's claw which fitted round the other when the hatch was closed.

Type 97 Medium Tank, Second Plan (CHINI), which was not adopted. In the author's opinion it should not have been totally rejected but should have been adopted as a light tank.

was good; yet it was light and eminently satisfactory from the crew's point of view. Eventually this new suspension system was standardized for tracked vehicles.

Hull structure was of monocoque design with the adoption of welding as much as possible by eliminating the framework. As means of protection from shells the exterior was streamlined, this becoming the forerunner of the standard tank silhouette of other nations during the postwar period.

As steering mechanism, the already well-tested standard type was used.

Army Technical Headquarters started design work in 1936 and the prototype construction was finished in 1937. Both plans materialized with very good results, as follows:

1st Plan (CHIHA)
Speed – 38 km./h.
Trench crossing capability – 2·50 m.
Armour thickness – 25 mm.
Engine power – 170 h.p.
Armament – one 57 mm. gun; two machine-guns
Weight – 13·5 metric tons
Length – 5·55 m.
Crew – 4

2nd Plan (CHINI)
Speed – 30 km./h.
Trench crossing capability – 2·50 m. (with tail extension)
Armour thickness – 25 mm.
Engine output – 135 h.p.
Armament – one 57 mm. gun; one machine-gun
Weight – 9·8 metric tons
Length – 5·26 m.
Crew – 3

Speed on both plans exceeded the original requirement, while armour thickness and trench crossing width were in line with requirements. In comparison with Type 89 tank, the weight of 2nd Plan was lighter with 1st Plan being just 2 tons heavier. Difference between the two plans were that 1st Plan had one machine-gun in the gun-turret and had a total crew of four with tank commander concentrating on his duties, while the 2nd Plan had the tank commander in dual capacity as gunner. From the user's point of view, separation of tank commander's from gunner's duties was a very important requirement. On the recommendation of Chief-of-Staff Operations the same short-barreled 57 mm. tank gun was employed, although in order to allow for any future up-gunning that might be required, the diameter of the turret ring was made as large as possible. This turned out to be a very wise arrangement.

While trials and discussions were being conducted as to which model to adopt, the equipping of forces with the new tank suddenly developed into a priority problem with the outbreak of the China Incident on July 7, 1937. With this emergency the budget was no longer restricted to a peacetime basis and the formal adoption of 1st Plan was decided unconditionally. In retrospect it may be said that the element of timing was perfect with CHIHA tank development. Although CHINI tank never saw the light as a main battle tank, it is felt it should have been adopted as a light tank.

Before CHIHA was standardized as Type 97 Medium tank a number of improvements were incorporated. Final combat weight totalled 15 metric tons with roller wheels modified into rubber, the addition of panoramic optical device and reflecting periscope, and installation of a wireless communications set. Initially, frontlet type antenna was used over the turret, but later this was changed to straight rod type. The structure of this tank became standard for all later tanks, self-propelled vehicles, recovery vehicles, prime movers, etc.

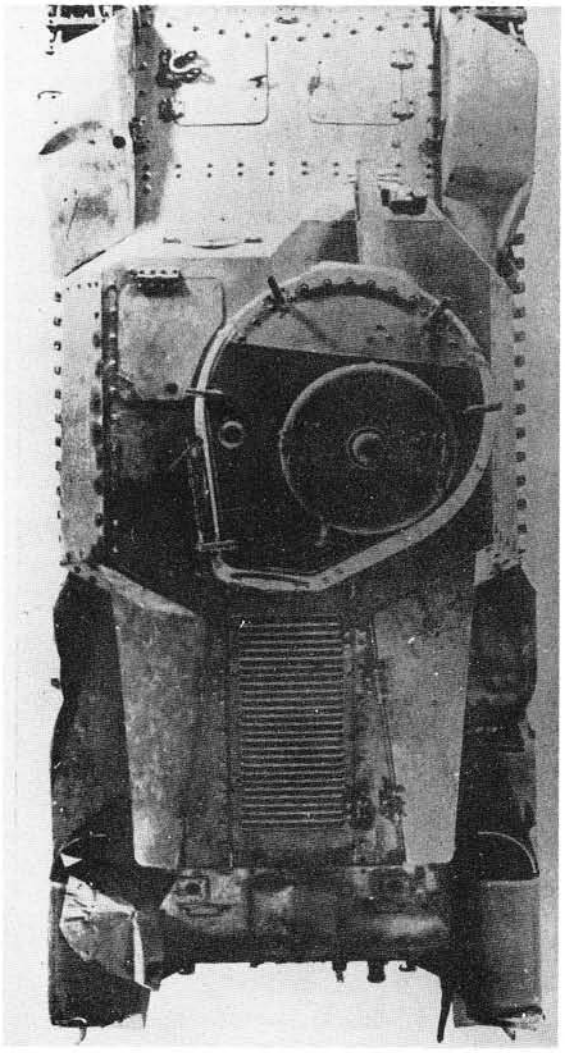
When three tank divisions were organized in 1942, Type 97 Medium tanks as mobile tanks were the primary MBTs of these divisions. During World War II the Type 97 Medium participated in many combat engagements as the main battle tank of the Imperial Japanese Army.

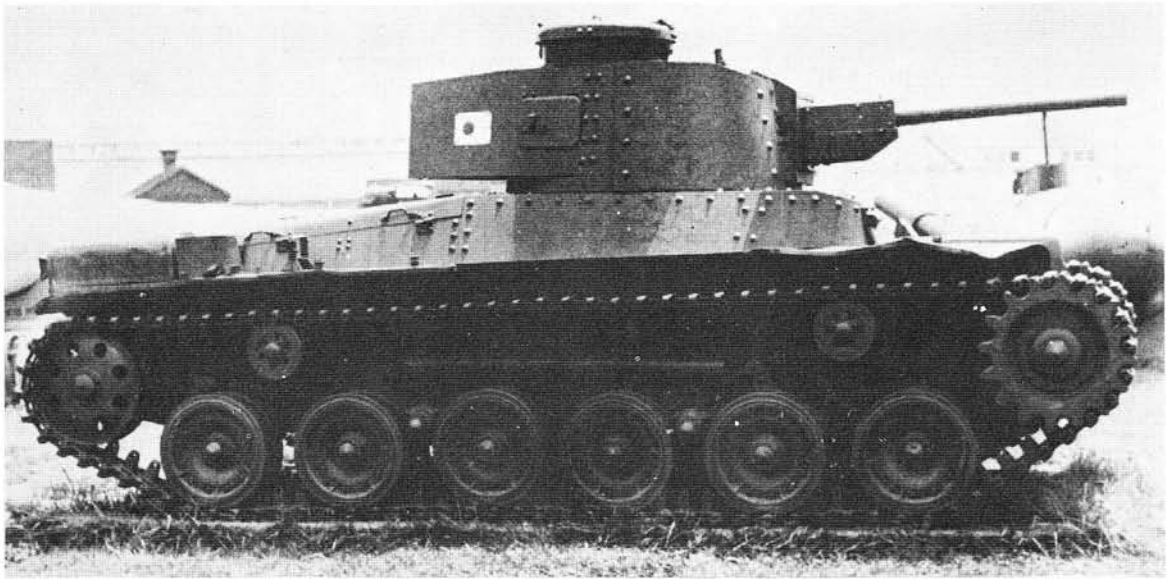
INCREASE OF TANK FIREPOWER

During the Nomonhan Incident (bordering Northern Manchuria and Mongolia) in 1939, a huge blow was received from Soviet armoured forces equipped with superior firepower. It became very necessary and urgent that changes in heretofore direct infantry support application be made to include effective anti-tank capability of tank guns. Also, about this time, blitzkrieg tactics of the German Army and engagement with American tanks acted as a stimulant in increasing tank firepower.

It was felt the short-barreled 57 mm. gun was insufficient as an effective anti-tank weapon and that

Top view of Type 97 Medium Tank showing how the turret was offset to the right.





Type 97 Medium Tank—Modified (new turret CHIHA). The CHIHA'S turret was changed to allow the mounting of the long-barreled Type 1 47 mm. gun instead of the 57 mm. gun. CHIHA also had two machine-guns.

improvement was definitely required in this area. First, armour piercing shells were developed for various tank gun calibers, followed by enlargement of propellant chamber for attaining more velocity, and finally enlargement of the caliber size. Muzzle velocity of Type 90 57 mm. gun was 350 m./sec. in comparison with 420 m./sec. for the new Type 97 gun. Comparison studies were made between 57 mm. gun with 830 m./sec. muzzle velocity and 47 mm. gun with 800 m./sec., but it was decided to adopt the 47 mm. gun as a tank gun because the ammunition was common with the anti-tank gun of the regular ground forces.

For meeting requirements that might develop for larger caliber it was decided to take a long stride right up to 75 mm. caliber. Tank gun calibers of field artillery and anti-aircraft classes were increased one after another but, unfortunately, timing was always late and they failed to be ready in time for combat applications.

Consequent on up-gunning, tank hull modifications also became urgently necessary. This accounts for the development of new tanks in succession as follows:

EVOLUTION OF MEDIUM TANKS IN RELATION TO GUN ARMAMENT

(1) Type 97 Medium Tank—Modified (new turret CHIHA).

Achieved by changing the gun turret of CHIHA tank and mounting the long-barreled Type 1 47 mm. gun in place of the 57 mm. gun. Fortunately the fighting compartment of CHIHA was designed with additional space from the beginning which made the modification relatively simple. Combat weight was increased by 4–500 kg. but did not affect the tank's mobility.

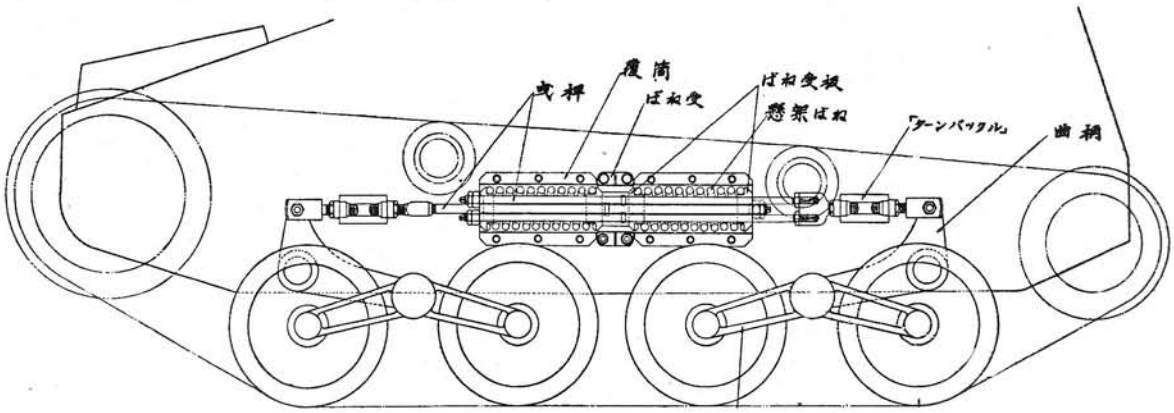
CHIHA tanks already assigned to units were called in on a piecemeal basis to have the modifications made.

Due to the far-sightedness of the designers, the users were able to maintain confidence in their tanks in meeting enemy tanks.

(2) Type 1 Medium Tank (CHIHE) (1940)

Type 1 Medium Tank came about by adding Type 1 47 mm. gun and other modifications to Type 97 Medium tanks that were slated for production. Gist of improve-

Diagram showing the suspension system designed for the two pairs of inner bogies of the Type 97 Medium Tank and which was eventually standardized for Japanese tracked vehicles. These inner bogies were sprung horizontally.



Three-quarter right front view of the Type 97 Medium Tank—Modified.

Three-quarter left rear view of the Type 97 Medium Tank—Modified.

Type 97 Medium Tank—Modified (left) with Type 4 (15 cm.) self-propelled gun (HORO). The HORO with its Type 38 15 cm. howitzer was one of several self-propelled weapons based on the CHIHA chassis. These are described in a separate Profile.

ments were: much greater employment of welding for armour plate, equipping with new Type 100 standardized diesel engine which increased the horsepower from 170 to 230, and armour thickness of important areas increased to 50 mm. Specifications are as follow:

Weight – 17·2 metric tons
Length – 5·73 m. (slightly increased from Type 97 tank)
Armament – one Type 1 47 mm. gun; one machine-gun in gun turret facing rearward; one fixed machine-gun facing forward
Armour thickness – 50 mm.
Powerplant – 230 h.p. air-cooled Type 100 standardized diesel engine
Speed – 40 km/h (slightly increased from Type 97 Tank)

(3) Type 3 Medium Tank (CHINU)

By mounting a 75 mm. gun on the chassis of Type 1 Medium tank it was designated Type 3 Medium tank in 1943. Initially, gun of Type 95 field artillery category was used, but later armament was strengthened to Type 90 field artillery class. Type 90 field artillery piece was developed for increasing firepower of divisional artillery; however, due to short life of its barrel Type 95 with lower muzzle velocity was developed and adopted. Application of Type 90 was limited to missions requiring lesser number of shells.

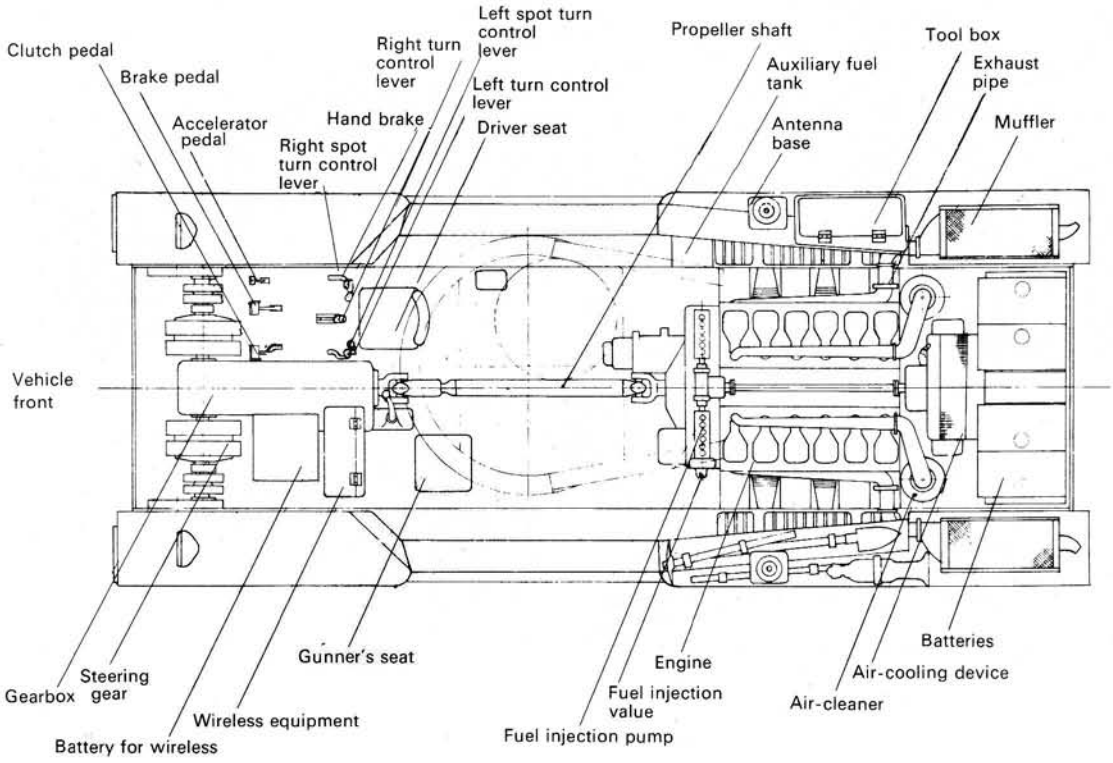
Weight – 19·0 metric tons
Armament – one Type 3 75 mm. tank gun (effectiveness greatly increased with adapted version of Type 90 field artillery with longer barrel)
Functional specifications – identical with Type 1 Medium tank

Offensive and defensive capabilities of Type 1 and 3 Medium tanks were greatly increased with superior features. These newly developed tanks were immediately put into production and assigned to combat units. However, due to lack of factory capacity, only small numbers were manufactured. Consequently they were unable to gain supremacy in combat areas.

(4) Type 4 Medium Tank (CHITO)

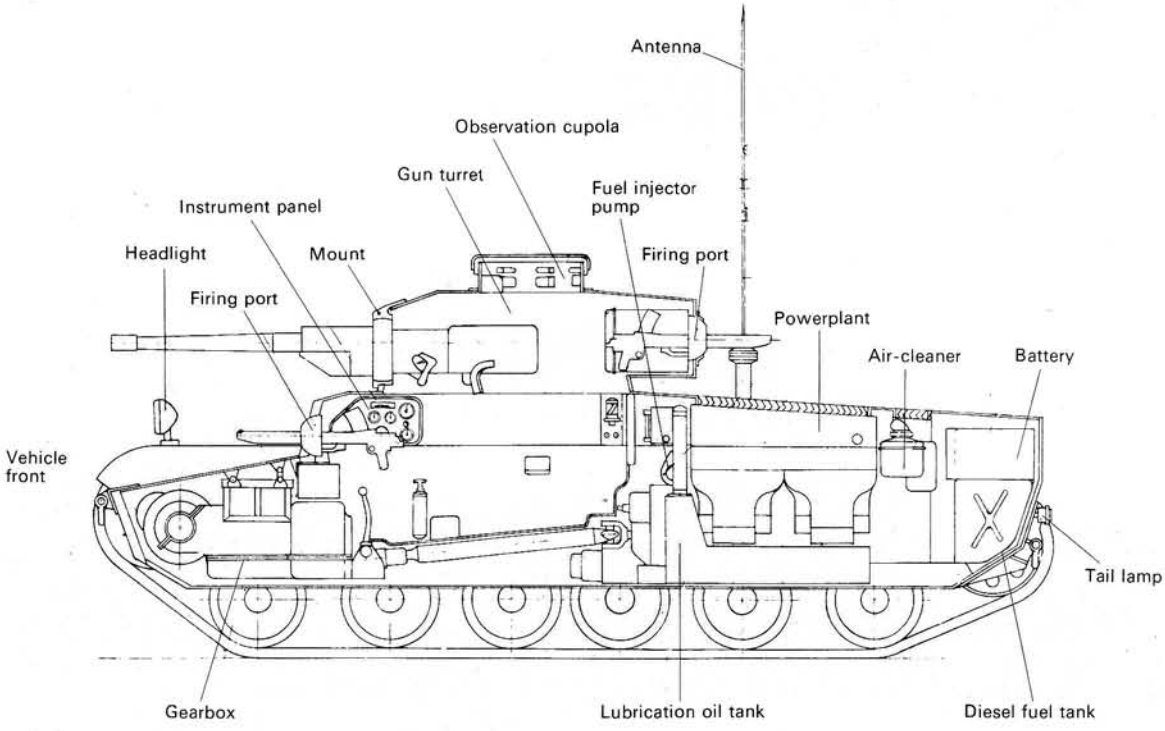
In 1943, Type 4 Medium tank was developed by mounting a 75 mm. anti-aircraft class of gun.

Weight – 30·0 metric tons
Armament – one Type 4 75 mm. tank gun (with a Type 88 38-caliber anti-aircraft class of gun, penetration of 75 mm. armour plate at 1,000 m.); two machine-guns
Armour thickness – important areas 75 mm.
Length – 6·30 m.
Trench crossing capability – 3·0 m.
Speed – 45 km./h.
Power plant – Type 4 V-12 air-cooled 400 h.p. supercharged standardized diesel engine

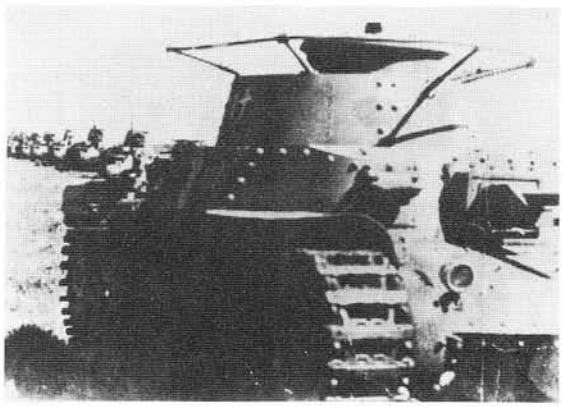


Top view of CHIHE Type 1 Medium Tank.

Side view of CHIHE Type 1 Medium Tank.

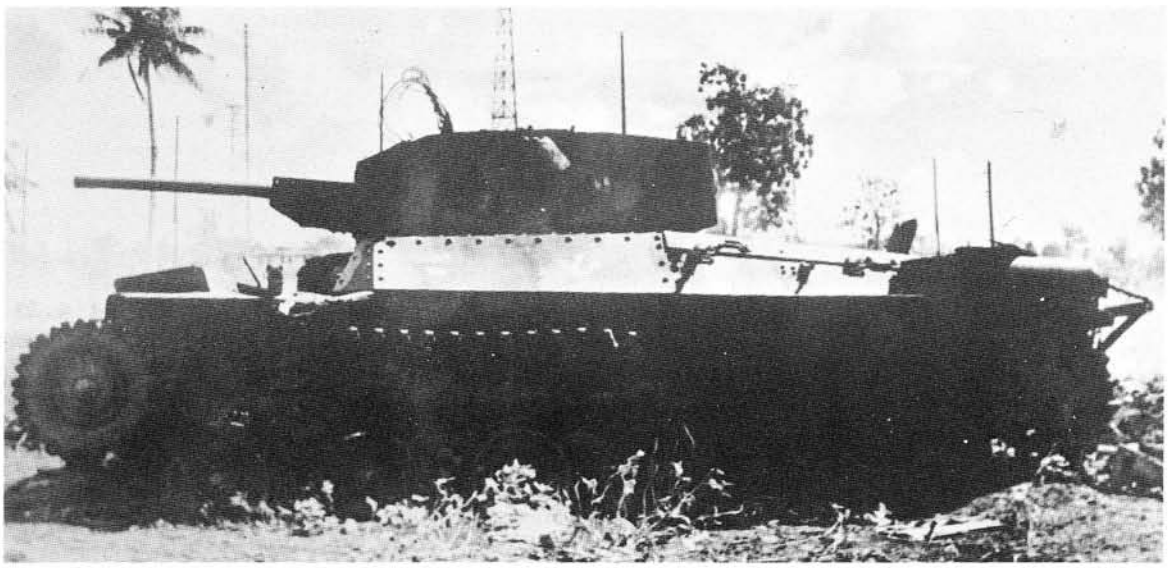


Type 97 Medium Tanks—Modified attached to units in Manchuria for winter night training.



Commander's model of the Type 97 Medium Tank (SHIKI) with turret reversed. In this variant, as well as the 57 mm. gun in the turret there was another one in place of the hull machine-gun.

Type 97 Medium Tank—Modified in action on Saipan Island in the Pacific.



This AFV was the most excellent tank developed by Japan during World War II. Although function and performance were highly satisfactory, time of production was late and the tank was not shipped to overseas battle areas. It was deployed in Japan proper for defending the Japanese Islands.

(5) Type 5 Medium Tank (CHIRI)

In 1944, Type 5 Medium tank with more might was developed. Since troop equipping required expediting, available BMW aircraft engines were to be used.

Weight – 37·0 metric tons
Armament – one Type 4 75 mm. tank gun (semi-automatic loading); one Type 1 37 mm. tank gun fixed mounted forward as a secondary gun; and two machine-guns
Armour thickness – important areas 75 mm.
Length – 7·30 m.
Trench crossing capability – 3·00 m.
Speed – 45 km./h.
Power plant – BMW 550 h.p. water-cooled gasoline engine

Production was not taken up in time for the War and CHIRI terminated as a prototype.

TANK GUN SPECIFICATIONS

Item	Type	Caliber	Barrel Length (calibre)	Muzzle Velocity	Remarks
37 mm. gun	Type 1	37 mm.		800 m./sec.	
47 mm. gun	Type 1	47 mm.	48	800 m./sec.	
57 mm. gun	Type 90	57 mm.		350 m./sec.	
	Type 97	57 mm.	18	420 m./sec.	
75 mm. gun		75 mm.		520 m./sec.	Type 95 field artillery class
	Type 3	75 mm.	38	680 m./sec.	Type 90 field artillery class
	Type 4	75 mm.		720 m./sec.	Type 88 anti-aircraft class gun

Type 1 Medium Tank (CHIHE). This was the Type 97 Medium Tank with a Type 1 47 mm. gun and other modifications including a Type 100 standardized diesel engine. Note the welded structure which was another feature of this tank. CHIHE had two machine-guns.

Type 3 Medium Tank (CHINU) at Mitsubishi Heavy Industries Ltd. The tank is armed with a long-barreled 75 mm. gun of the Type 90 field artillery class. Welded structure.

CONCLUSION

When reflecting on the development history of main battle tanks, it is regretted that the switch over of tactical thoughts always turned out to be late. Engineering proceeded ahead but tactics could not keep pace. For instance, the splendid imposing figure of Type 97 Medium tank was unbalanced with a short barreled 57 mm. gun. It is too bad but, if Type 4 Medium tank (CHITO) had been available during the typical tank warfare between Japanese Army 2nd Armoured Division and American armoured forces in the final battle in the Philippines, it could very well have altered the progress of the War.

There is no denying that Japanese military doctrine initially lacked enthusiasm in the tactical application of armour. On the China battlefields, the Japanese Army became accustomed to fighting badly equipped Chinese forces and could not rid itself of the direct infantry support concept which could have been handled more efficiently with many tankette type armoured vehicles. Under the circumstances it can be said that Japan completely lacked tactical and material preparations in fighting world powers. It was too late when shortcomings were realized and a belated changeover was attempted.

With tanks being distributed over extensive areas including small islands in the Pacific, the numbers of tanks were inadequate everywhere as industrial support could not maintain pace. In addition, since almost all tank guns were manufactured by Osaka Army Arsenal, production could not keep pace with CHIRI and CHITO tank bodies coming off the production line. Regarding vehicle production (including tanks less their armament), Sagami Army Arsenal was a mission arsenal for educating commercial factories; this was in contrast to gun production by Osaka Army Arsenal. This unbalance in production policy must be reconsidered in its true perspective.

EXPLANATION OF YEAR/MODEL DESIGNATION

(1) For a piece of ordnance equipment developed during the Eras of the Emperor Meiji and the Emperor Taisho it was customary to give it a model number corresponding to the year of the Emperor's reign in which it was adopted. For example:

Meiji Era (Western Years 1868–1912)
Type 38 Field Artillery (38th Year of Meiji=1905 Western Year)
Type 41 Mountain Gun
Type 45 24 cm. Howitzer
Type 45 15 cm. Cannon
Type 38 Infantry Rifle
Type 44 Cavalry Carbine

Taisho Era (Western Years 1912–1926)
3rd Year Type Heavy Machine-gun (1914 Western Year)
4th Year Type 15 cm. Howitzer
11th Year Type Light Machine-gun
14th Year Type 10 cm. Cannon

There were, however many instances where the year designation was not employed, such as, 4-ton cargo truck.

Since tanks and armoured cars were developments

during the Showa Era (current reign, beginning in 1926 Western Year), they are not included in the above illustrations.

(2) Ordnance developments in the Showa Era have been numbered from the first year of the Emperor Jinmu, who was the first emperor of Japan. Up to Western Year 1940 the last two digits only of this number were used. For instance, Type 89 Medium Tank was standardized 2589 years (1929 or 4th year of Showa Era) after enthronement of the Emperor Jinmu. It was initially known as a light tank, but during research and development of Type 95 Light Tank it was designated as main battle tank Type 89 Medium Tank.

When diesel power plant was adopted, those Type 89 Tanks equipped with diesel were designated Type 89 "B" while the gasoline version was known as Type 89 "A". This principle was practiced with prime movers and cargo trucks also. Thus, as an illustration, Type 92 5-ton Prime Mover had "A" and "B" versions, while Type 94 6-Wheeled Cargo Truck also had both models.

As an exception to the "A" and "B" designations, the imported Renault FT tank was known as Renault "A" Tank while the Renault NC was designated Renault "B" Tank.

Models adopted in the Year 2600 (2600 years after the enthronement of Jinmu=1940 Western Year), for the purpose of simplified designation were known as Type 100, followed by Type 1 (Year 2601), Type 2 (Year 2602), Type 3, etc. For instance, Type 100 Standardized Diesel Engine, and Types 1, 3, 4 and 5 Medium Tanks.

(3) Regarding prototype equipment, the year of the prototype starting date was assigned, such as Prototype 92, etc. It was customary to designate a new year type on formal adoption and drop the word "prototype". For instance, Prototype 91 Heavy Tank became known as Type 95 Heavy Tank on standardization.

During the course of development, until the completion of the program, there were occasions when modifications were incorporated. Each major modification was not separately identified as with American tanks e.g. M4A3.

(4) **Abbreviations.** For the purpose of simplifying nomenclatures some equipment was purposely abbreviated by the project officer or commercial contractors. There are some that have been systemized but, generally speaking, no rules apply. In the case of medium tanks (chugata sensha in Japanese), first character "chu" is abbreviated as "chi" with Japanese katakana syllables added in succession.

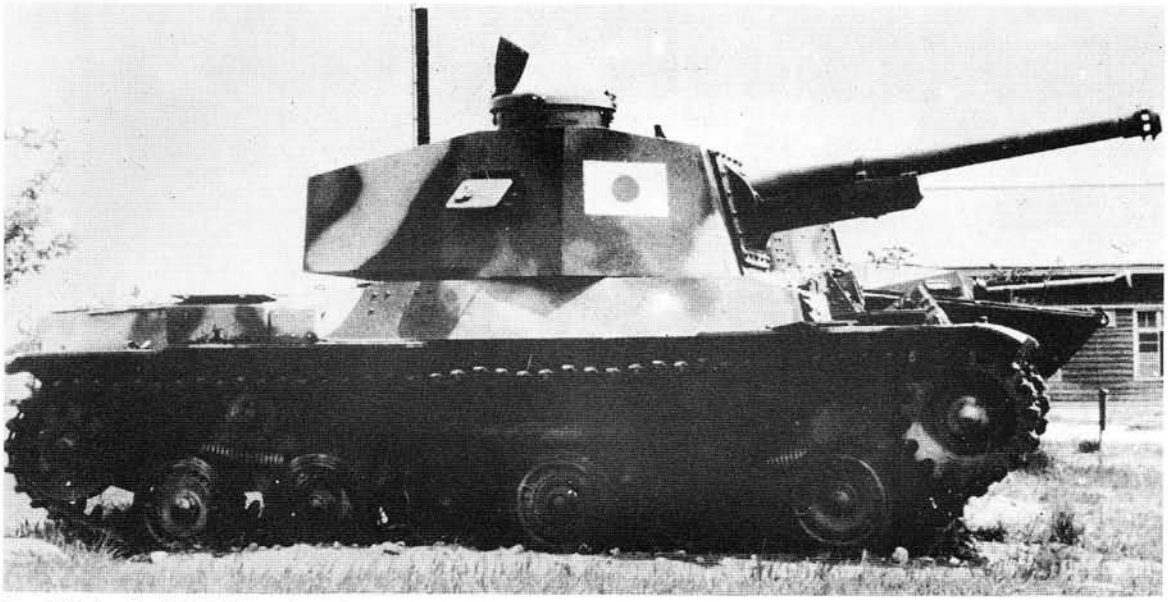
Official Nomenclature	*Abbreviation*
Prototype No. 1 Tank	CHI-I
Type 89 Medium Tank	CHI-RO
Type 97 Medium Tank	CHI-HA
Prototype Medium Tank	CHI-NI
Type 1 Medium Tank	CHI-HE
Type 3 Medium Tank	CHI-NU
Type 4 Medium Tank	CHI-TO
Type 5 Medium Tank	CHI-RI

Three-quarter left front view of Type 4 Medium Tank (CHITO) which was the most powerful tank produced for the Imperial Japanese Army during World War II. It was armed with a 75 mm. gun of the anti-aircraft class and two machine-guns.

Type 5 Medium Tank (CHIRI). Three-quarter left front view with turret reversed. As well as its Type 4 75 mm. tank gun in the turret the CHIRI had a Type 1 37 mm. tank gun (seen here) mounted forward in a fixed position. It also had two machine-guns. CHIRI did not progress beyond the prototype stage.

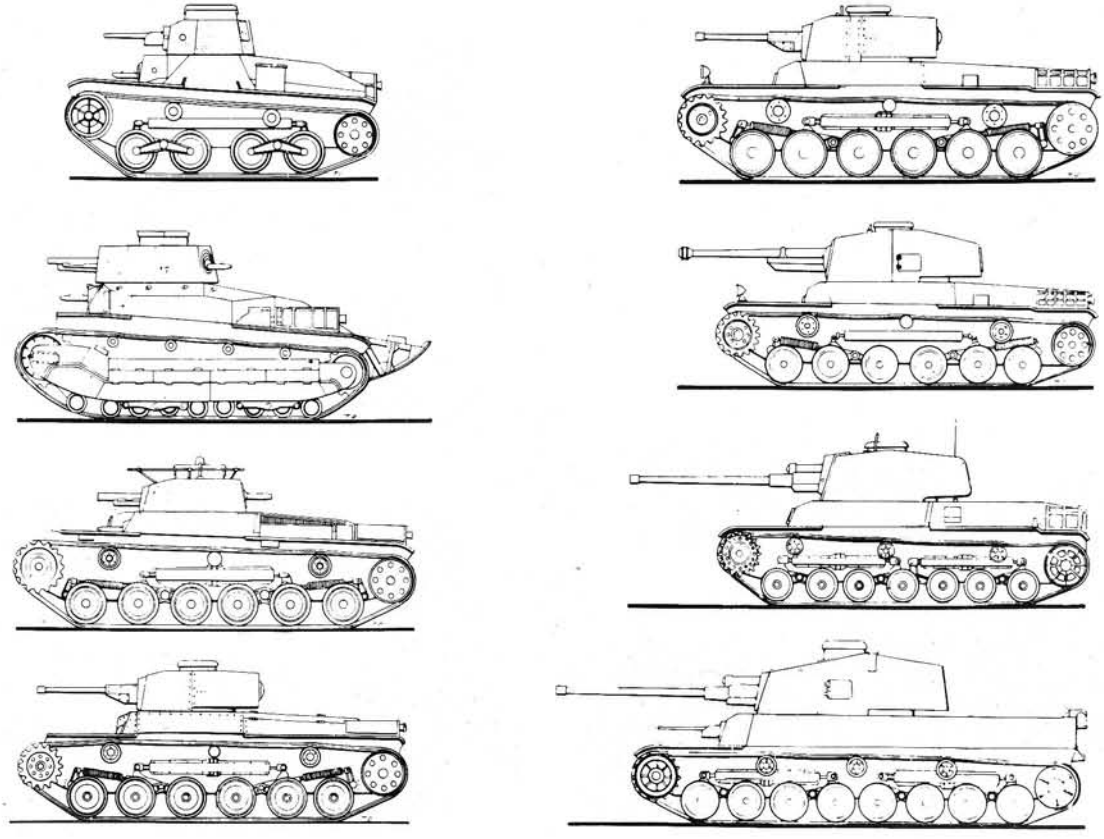
Three-quarter left front view of Type 3 Medium Tank (CHINU).

Type 4 Medium Tank (CHITO) with turret reversed: three-quarter left rear view. The CHITO was retained in Japan for defence of the Japanese Islands and did not serve in overseas battle areas.



Type 3 Medium Tank (CHINU) at the Ordnance School of the Japanese Ground Self-Defence Force some years after World War II.

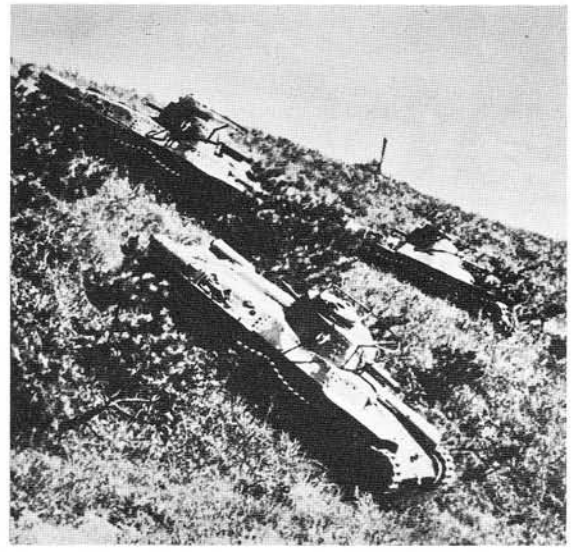
Comparison sketches of Japanese tanks, all to the same scale. Left column, top to bottom: Type 95 Light Tank (HAGO), Type 89 "B" Medium Tank, Type 97 Medium Tank (CHIHA), Type 97 Medium Tank—Modified (new turret CHIHA). Right column, top to bottom: Type 1 Medium Tank (CHIHE), Type 3 Medium Tank (CHINU), Type 4 Medium Tank (CHITO), Type 5 Medium Tank (CHIRI).



As for the light tanks (keigata sensha), first character "kei" is written under katakana syllable as "ke" and "i". Thus, "ke" is used as abbreviation with one syllable taken from katakana alphabet added on.

Type 95 Light Tank	HA-GO (common calling name that was given by Mitsubishi Heavy Industries and generally accepted)
Type 98 Light Tank	KE-NI
Type 2 Light Tank	KE-TO
Type 3 Light Tank	KE-RI
Type 4 Light Tank	KE-NU
Prototype 5 Light Tank	KE-HO

Command tank (shiki sensha) was known under the abbreviation SHI-KI while engineering tank (rikisaku sensha) was known as RI-KI.



Type 97 Medium Tanks. Note the rearward facing machine-gun in the turret. The CHIHA was the main medium tank of the Imperial Japanese Army during World War II.

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Column of Type 97 Medium Tanks halted during an approach march on active service. One crew member has his hand on the "crab's claw" flap of the cupola hatch.