

THE **RUSSIAN VIEW**



ANDREI ULANOV & DMITRY SHEIN



WORLD OF TANKS

THE

T-34

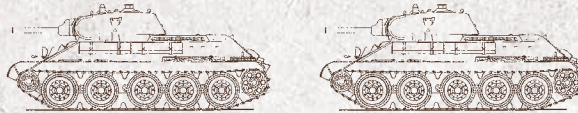
GOES TO WAR



**COMBAT
SERVICE**

MEDIUM TANK BATTALION

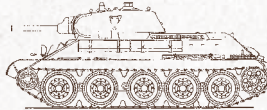
Organization Chart 010/16 of June 9, 1940



BATTALION COMMAND TANKS

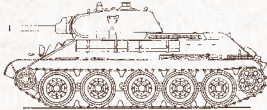
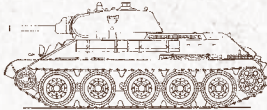
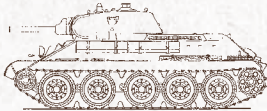
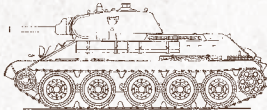
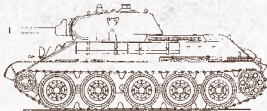
TANK COMPANY (3 PER BATTALION)

T-34

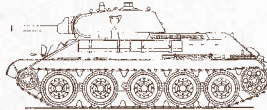
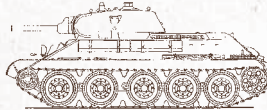
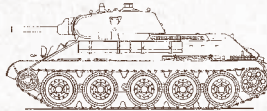
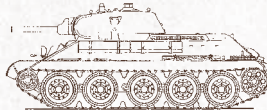
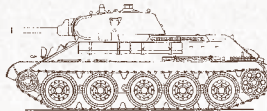


COMPANY COMMANDER'S TANK

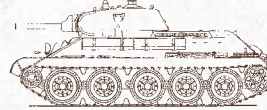
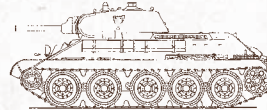
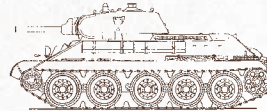
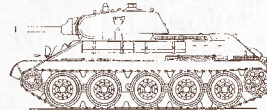
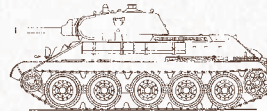
TANK COMPANY



TANK COMPANY



TANK COMPANY

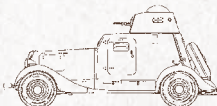
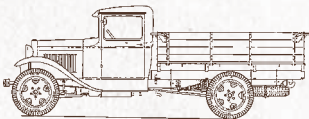


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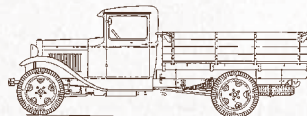
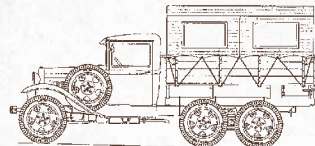
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HQ PLATOON



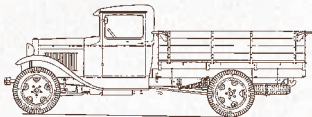
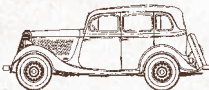
COMMAND & CONTROL ELEMENT



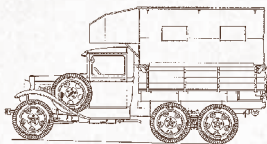
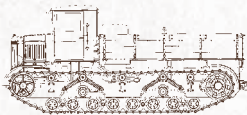
BATTALION OF HEAVY & MEDIUM TANKS

Organization Chart 010/67 of August 14, 1941

HQ

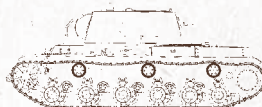


MAINTENANCE & RECOVERY SQUAD



HEAVY TANK COMPANY

KV



COMPANY COMMANDER'S TANK

TANK PLATOON

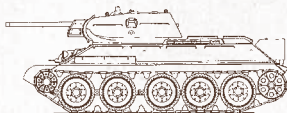


TANK PLATOON



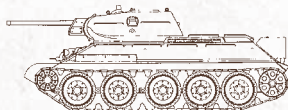
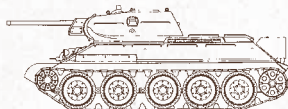
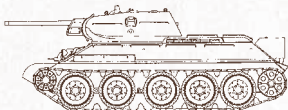
MEDIUM TANK COMPANY (3 PER BATTALION)

T-34

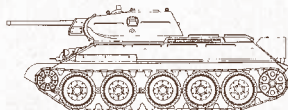
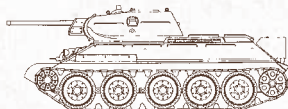
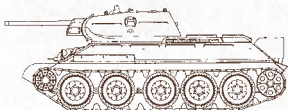


COMPANY COMMANDER'S TANK

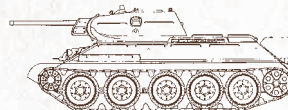
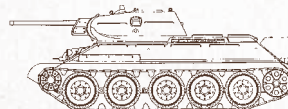
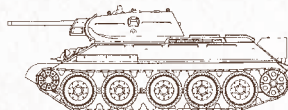
TANK PLATOON



TANK PLATOON



TANK PLATOON





Andrei Ulanov and Dmitry Shein

THE
T-34
GOES TO WAR



PUBLISHER'S PREFACE

This is the second book in the *World of Tanks* series that has been translated from the original Russian edition and made available in English. These books are an outgrowth of Wargaming.net's massive, multiplayer online game World of Tanks. At the time this book was published, World of Tanks had more than 80 million registered players worldwide.

There are two reasons why these books are important to readers interested in World War Two (the Great Patriotic War to Russians) and the armored fighting vehicles (AFV) that were the breakthrough weapons of that conflict:

- Russian documents, photos, and archival materials never before seen by outsiders were accessed to learn about the design, procurement, development, manufacturing, and combat employment of Soviet AFV before and during World War Two;
- English readers now get this information through the eyes and opinions of Russian researchers—which is why we added the obvious descriptor The Russian View to this series.

There are three categories of books: Combat Service (such as this T-34 book); Construction and Development; and Military Operations.

Andrei Ulanov and Dmitry Shein, the authors of this book about the T-34's pre-war development and combat service in 1941, uncovered fascinating facts and the mystery of why such a revolutionary design, far ahead of anything the invading German armies fielded, did so poorly in many of its first battles:

- The T-34's birth date of 19 December 1939, an advanced design intended to replace the numerous BT series as the "tank of independent mechanized units"
- Trials of the first two T-34 prototypes in January 1940 and subsequent field tests exposed flaws in the turret, vision devices, and sights; a radio that often failed; and a V-2 diesel engine that did not guarantee 100 hours of operational reliability
- Instead of 5–6 rounds per minute, the actual "deliverable" average rate of fire was only 2 rounds per minute, partly due to the restricted view from the tank
- Constant breakdowns occurred due to minor and major failures of the first mass-produced parts and systems
- The first "thirty-fours" did not reach Red Army front line units until April 1941, barely two months before the German Wehrmacht attacked the Soviet Union
- Rapid expansion of the Red Army armored force and a lack of manuals and training time led to poorly skilled tank commanders and T-34 crews in June 1941
- The most widely used German antitank gun—the small 37 mm PAK 36—proved lethal to the T-34 while leaving almost no significant mark of damage

This *World of Tanks* series provides English readers of World War Two history with a much better understanding and greater appreciation of Soviet AFV development and operations. I am extremely fortunate to be able to offer these innovative books for the first time in English.

Dana Lombardy
Lombardy Studios
March 2016

TABLE OF CONTENTS

Publisher’s Preface	iii
Table of Contents.....	iv
Authors’ Introduction.....	1
Chapter 1. Birth of the Legend.....	5
Chapter 2. The T-34: A Candid Portrait of the Tank During Development.....	15
Chapter 3. The Complicated Path to Mass Production	35
Chapter 4. Skillful Hands	42
Chapter 5. Baptism by Fire	63
Chapter 6. Mechanism of Disaster	110
Chapter 7. Under Operation Typhoon.....	141
Appendices	173
Sources.....	260
Index.....	261

BONUS!

Current *World of Tanks* players as well as new players who buy the printed version of this book can find a number on the inside back cover that provides a special Bonus Code they can immediately use in play.

This code provides:

- 7 days Premium
- 1,000 Gold
- 100,000 Credits
- SU-85i Soviet Tier V Tank Destroyer (2,300 Gold value)
- Total value: \$14 in virtual goods

To set up a new account, go to Wargaming.Net, or if you already have an account, login and enter the Bonus Code in your account profile. Your account may use only one code from *The T-34 Goes to War*, but you may also enter a code from *The SU-152 and Related Vehicles* to get two weeks of Premium, 200,000 Credits, 2,000 Gold, and two tanks. If you have a problem with a code, send a copy of your purchase receipt to: admin@worldoftanksbooks.com

CHAPTER 2. THE T-34: A CANDID PORTRAIT OF THE TANK DURING DEVELOPMENT

*I knew you in diapers, when you were just a drawing.
You traveled a straight path, unswerving,
Flying a flag of "Secret," on the waves of science.
The chief designer let you run wild from design bureau
to Quality Control—*

*But now you're in the tester's sights!*¹

Among the many misconceptions that befall the average person, the idea is prominent that the heroes of stories, whether outstanding historical figures, entire groups of people (Panfilov's 28 guardsmen or the 300 Spartans, for example), or inanimate objects (famous tanks, ships, and aircraft), are great, epic and legendary, not just in a narrow sense clearly described in the pages of a heroic story, but "throughout all and in every particular detail." The myth of the T-34 has not escaped that fallacy. Accordingly, when speaking of the T-34, out of delight for its "overall nature" (praising it as the "finest tank in the world" and "the most remarkable example of an offensive weapon"), its champions immediately carry that over to particulars, strongly praising the logical slope of its armor; the hitherto unprecedented power of its gun; its broad tracks; its powerful, fireproof diesel engine; and so forth. As we stated in the preface, however, this begs the question of why the thousand tanks that stood head and shoulders above the enemy's equipment both "overall" and in terms of "particulars" failed to have a noticeable impact on how the drama of 1941 played out on the strategic, or, at least, the operational level...

There was virtually no time to modify the vehicle—on January 23, 1940, G. I. Kulik, Deputy Peoples' Commissar of Defense, issued a directive ordering operational trials of two T-34 prototypes to begin on January 25, 1940.² The trials, which were to determine

Unfortunately, the reality was much more complicated than the beautiful legend. The first mention that the "best tank of the century" was not the very best appears in Defense Committee Decree No. 443ss—which we quoted in the first chapter. While approving the T-34 for service use, it required that "visibility from the tank" be improved.



M. I. Koshkin—Chief Designer of Factory No. 183's design bureau.

the tanks readiness, began after a three-week delay on February 13, 1940, and lasted until almost the end of April.

An April 27, 1940, report on operational trials noted major deficiencies in addition to the traditional listing of successful design solutions ("The armor protection, weapons, and mobility of the T-34 tank under winter conditions significantly exceed those of tanks currently in the inventory"):

The following are the main shortcomings of the T-34 tank:

- a) Flaws in the turret hinder use of the weapons, vision devices and sights, and ammunition, preventing full usage of the gun system.*
- b) The problem of radio communications in the T-34 has not been resolved.*
- c) The vision equipment installed on the T-34 tank does not provide reliable and sufficient visibility.*
- d) Measures to prevent flammable liquid from entering the tank have not been satisfactorily implemented...*

The mass-produced V-2 diesel engine installed in the tank does not guarantee 100 hours of operation or operational reliability.³

The list of needed changes and improvements to the T-34's design extended over more than a dozen pages and contained a number of hard-hitting assessments:



A. A. Morozov—Chief Designer of Factory No. 183's design bureau after M. I. Koshkin's death.

The main clutch does not function properly... The ammunition rack on the prototypes is unusable... The driver's hatch should be designed to allow entry into and exit from the vehicle with the turret in any position... The tank's turret is cramped. The gun and sights are mounted in such a way that they are difficult to use—this affects accuracy and rate of fire from both the main gun and the machine guns. The angles of elevation and depression provided by the sights are completely unused, which increases the dead zones and reduces the range of the tank's main gun... The turret must be enlarged for the crew's convenience and ease of operation. Increase the size of the turret without altering the hull or the slope of the armor... The gun laying devices are difficult to use, and the knob on the TOD sight cannot be used at all... Prevent scraping of the hands when the elevation and traversing mechanisms are operated simultaneously... The aim changes when the latching mechanism is engaged or released; prevent that from happening... Reduce the effort required on the lever to operate the turret mechanism by hand... The vision blocks installed on the T-34 tank do not support observation and driving of the tank (with the hatches closed)... The vision block design is unacceptable... The design of the all-round vision block is unsuitable... The external protective lenses on the vision blocks and some of their mirrors fracture during firing.⁴

The commission also noted that

because the tank was tested under winter conditions, the following issues have not been checked:

- a) The thermal behavior of the engine under summer conditions.*



- b) *Negotiation of natural and artificial obstacles under summer conditions.*
- c) *Tank performance.*
- d) *Reliable operation of tank mechanisms during long trips under summer road conditions.*

*One T-34 tank needs to undergo test-range trials on these points, followed by proof firing and ballistic testing.*⁵

Now that we have addressed some widespread historical myths, we would like to focus the reader's attention on a rather significant point. A very common misconception about the prewar Soviet Union was and remains the myth of the military's unlimited power and an extremely militarized country controlled from the top down: that as soon as the Red commanders in dusty helmets dreamed about something marvelous, ephemeral, and quasi-fictional in order to quickly bring about the world revolution, the economy, defying the boundaries of the possible and supplying inexhaustible bloody victims to the Moloch of the Gulag, would immediately assume a servile pose and ask, "What would you like, dear sir?" while offering the required numbers of technical wonders. However, the reality was strikingly different from this fantastic picture. The "dissenting opinion" appended to the troop test report by Factory No. 183 repre-

The commission's conclusion was harsh: "The T-34 Tank cannot begin mass production unless the deficiencies noted are corrected."

A T-34 during testing. A bottle with burning gasoline has been thrown on the engine compartment hatch.





sentative A. A. Morozov, who became chief designer of Factory No. 183 following the death of M. I. Koshkin, is revealing:

All parts of the main clutch functioned properly throughout the entire test... Only warping of the discs was observed during operation; the cause has not yet been determined... The existing 71-TK-3 radio cannot be moved to the bow of the tank... The factory cannot at present suggest a different design for the vision blocks... Although the all-round vision block does not provide a 360-degree view, it is an auxiliary vision instrument and does exactly what it is supposed to. Because the Commission has identified no other deficiencies with the vision block than the conclusion that it is unsuitable and the factory has no other design for it, we cannot offer a new vision block design for the 1940 program... The Commission's remark about expanding the turret is not specific.⁶

Instead of an obliging and fanciful “What would you like?” the factory recommended that its military customers avoid digging their feet in and be more willing to accept what the factories could give them.

But let's return to 1940. During the summer of 1940, tests to determine “engine thermal behavior, natural and artificial obstacle negotiation, tank performance, and tank-mechanism reliability under summer conditions” could not be carried out. On October 31, 1940, however, three mass-produced “thirty-fours” left Kharkov to drive the route Kharkov – Kubinka – Smolensk – Kiev – Kharkov. The tanks were required to travel two thirds of the 3,000 km route over dirt roads and off road. The tanks traveled 30% of the route at night and 30% over dirt roads and unbroken ground while in fighting order (with hatches closed). The test program was not limited just to travel—it again provided for testing of weapons, communications gear, and negotiation of natural and artificial obstacles, as well as for testing of the tank against antitank mines and for determining tightness “by pouring a flammable liquid over it.”

The report on these tests is of considerable interest, both from the standpoint of comparing the advantages and disadvantages of the vehicle that had already begun mass production and from the standpoint of evaluating the changes made to the tank design to correct deficiencies noted during the tests conducted in April.

Live firing to solve fire missions revealed the following shortcomings:

- 1) Cramped crew space in the fighting compartment caused by the small size of the turret.⁷*

It would have been hard to miss that—the turret that was developed initially for a tank armed with a 45 mm gun was obviously cramped after installation of the 76 mm gun, prompting a number of complaints from the crew. It is particularly noteworthy that no changes were made to the turret race ring between late April and late December 1940 (the “Report on Tests Conducted on Three T-34 Tanks During Extended Travel” was printed on December 20, 1940, and approved on December 24). It was only made larger on the T-34 armed with the 85 mm gun. Morozov's dissenting opinion became the Army's prevailing opinion.



- 2) *The ammunition stored in the fighting compartment floor is difficult to use.*
- 3) *There is a delay in shifting fire due to the inconvenient location of the turret traversing mechanism (manual and electric).*
- 4) *There is no visual communication between tanks when calculating a firing solution because the only instrument that provides all-round observation—the PT-6—is used only for sighting.*
- 5) *The TOD-6 sight cannot be used because the PT-6 overlaps its elevation scale.*
- 6) *Significant and slowly fluctuating oscillations by the tank during travel have a negative impact on accuracy of fire by the main gun and the machine gun.*

These shortcomings reduce the rate of fire and increase the amount of time needed to calculate a firing solution.

Determination of the rate of fire of the 76 mm gun....

Maximum rate of fire—5–6 rounds per minute.

Particular attention should be paid to that last point. This is the number usually cited in reference sources (especially in publications from the Soviet era). However, the report clearly stated how the number was obtained:

Firing from a stationary position. The rounds were placed in the most conveniently located canisters. The rubber mat and cover were removed from the canisters.

... The tank loses momentum when shifting from 2nd gear to 3rd during the rainy conditions of fall and spring and snow during winter, causing it to slow abruptly on dirt roads and off road...



... The mobility of the T-34 tank during autumn is unsatisfactory....

The results of the next test were much less optimistic—it determined the practical rate of fire from the move and from short halts:

The average deliverable rate of fire obtained was two rounds per minute. This rate of fire is insufficient....

The first item on the list tells us that a large part of the report was devoted to the vision devices (and their unsatisfactory condition). Once again, the ammunition storage rack in the prototypes, which was described as “unsuitable,” had not been significantly changed.

The all-round vision block.

Access to the vision block is very difficult, and observation is only possible in a limited sector no greater than 120 degrees... The limited field-of-view, complete inability to see the rest of the sector, and... the uncomfortable head position during observation make the vision block unsuitable for operation.

Turret vision blocks (side)

The vision blocks are in an inconvenient location. Shortcomings include a large dead space (15.5 m), a small angle of view, inability to clean the protective glass without exiting the tank, and low position relative to the seat.

**Driver's vision blocks...**

Significant shortcomings with the vision blocks when driving with the hatch closed were identified. After driving over a muddy dirt road and unbroken ground for 5–10 minutes, the vision blocks became covered with mud, completely blocking vision, resulting in a complete loss of vision. The wiper for the central vision block did not remove mud from the protective glass. It was very difficult to drive the tank with the hatch closed. The vision block protective lens shattered during firing...

By and large, the driver's vision blocks are unacceptable.

And we note again—eight months passed and the section concerning vision block deficiencies in the mass-produced tank was deleted from the carbon copy of the April report based on results of the operational trials on the two prototypes. And once again the factory design bureau's "dissenting opinion" prevailed over the Army's wishes.

But let us return to the report.

The overall conclusion drawn at this stage in the testing was a logical consequence of these findings:

The weapons, optics, and ammunition storage rack in the T-34 do not meet the requirements established for modern combat vehicles.

The main shortcomings are as follows:

- a) Cramped crew compartment;*
- b) Restricted vision from the tank;*
- c) Poorly designed ammunition storage rack.*

The following steps must be taken in order to properly position the weapons, firing devices, vision blocks, and crew:

Increase the overall size of the turret...

<...>

Vision blocks.

Replace the driver's vision block, which is clearly unacceptable, with a more modern design.

Install a vision block in the turret that provides all-round visibility from the tank.

Ammunition storage rack.

The ammunition storage rack for the 76 mm gun in canisters is unacceptable. The rounds must be stored such that all types are accessible simultaneously...

Somewhat fewer complaints were registered concerning the communications gear. Remarking on the successful placement of the radio in the tank hull rather than the turret (ignoring the factory's "dissenting opinion"), the testers stated that following the driving test *"The quality of the radio had deteriorated, and its range had dropped sharply."* They ascribed this to the poor quality of the radio's mount, damage sustained by the antennas during the test, and contamination with mud. The intercom was the only item that functioned properly.

Nor was everything rosy with the running gear. Although the tank was able to reach a maximum speed of 54 km/h, that speed was achieved on a flat asphalt highway—and as we know, tanks in combat generally travel over entirely different kinds of terrain.



Tank performance.

When shifting from 2nd to 3rd gear on difficult terrain, the tank loses so much inertia that it stops or the main clutch slips for an extended period. This makes it difficult to use 3rd gear over difficult terrain that should allow it.

This deficiency of the tank results in drastically reduced speeds when driving on country roads and off road during a rainy autumn and spring and during a snowy winter...

The sharp difference between the net travel speed and the speed while in motion results from frequent breakdowns of the main clutch and the tracks (track shoes breaking, pins coming out, etc.).

Conclusions.

Because 3rd gear, the gear most necessary for use under tactical conditions, cannot always be used, the tank's performance overall is considered unsatisfactory.

Travel speeds are low, which reduces the reliability of the main clutch and the running gear.

Mobility.

Conclusion.

The T-34's mobility during autumn is unsatisfactory for the following reasons:

The track shoe surface that engages the soil is not properly designed, and as a consequence the tracks slip on inclines even when the groundcover is only slightly damp. The effectiveness of the track shoe cleats is low.

The tracks are poorly secured on the support wheels....

The small number of support wheels causes reduced mobility on marshy terrain, despite the overall low ground pressure.

The ability of the T-34 tank to negotiate water obstacles should be considered completely satisfactory.⁸

The unreliability of the transmission and running gear reduced both the tank's speed and the distance traveled per day.

The maximum distance traveled in a day on highways was 255 km; over dirt roads it was 225 km.

These are the maximum distances obtained, because in most instances parts failures significantly reduced the distance traveled.

Conclusion.

The daily travel distance was limited by failures of parts, tracks, and the main clutch.

The data obtained for the daily travel distance fully supported the fuel and engine lubricant endurance.⁹

A rather shocking conclusion. It is difficult to imagine that the daily travel distance of a tank would be determined not by the amount of fuel and lubricant on board and the crew's skill and fatigue, but by the distance the tank could travel between breakdowns. The tests conducted during autumn produced even less favorable results than did the



springtime operational tests—at least, the mobility of the T-34 was seen as fully satisfactory in April, and track attachment was satisfactory. To continue...

Operational reliability of tank assemblies.

Engine, fuel system, lubricants, cooling, and instrumentation.

Conclusions.

Engine reliability over the warranty period (100 hours) is satisfactory. The engine's warranty period is too short, especially for a vehicle this heavily armored. It needs to be increased to at least 250 hours.

Constant oil leaks and instrumentation malfunctions were a feature of the lubrication system, and the gauge connections were unsatisfactory.

Main clutch.

Operation of the main clutch and fan was generally unsatisfactory.

Note: the unreliability of the main clutch and fan is also noted in the conclusions of the Military Commission.

At the risk of boring the reader, we once again point to the conclusions reached in the April tests conducted on the T-34 and the "dissenting opinion" expressed by Morozov, who failed to detect the poor performance of the main clutch parts.

Transmission.

A "loss of neutral" (gears remaining engaged while the gearshift lever is in neutral) and difficulty shifting were repeatedly noticed when all vehicles were driven...¹⁰

The incorrect choice of gear ratios results in unsatisfactory tank performance and reduces its tactical value.

Difficult shifting and "loss of neutral" make it hard to control the tank and result in emergency stops.

The transmission and its drive mechanism must be completely redone.

Steering clutches:

The steering clutches and brakes with ferodo linings and cast iron shoes functioned satisfactorily.

Note: Operation of the transmission, steering clutches, and final drives could not be completely checked for reliability because the main clutch failed first, functioning as something of a safety device in the tank's powertrain.

Once again, assessments were being revised for the worse: the transmission was perceived as functioning reliably during the April tests; its design was satisfactory, and its gear ratios were considered correct. By December, the customer had lost faith that the transmission was functioning properly.

Finally, the report ended with a disappointing conclusion.

Maintenance.

Time trade-offs between net travel, maintenance, and stops due to malfunctions on all three tanks:



Type of work	Time		Notes:
	Hours	%	
Total time required	922 hours 56 minutes	100	
Net travel time	350 hours 47 minutes	38	
Repairs	414 hours	45	Done by a 2-man repair team
Correction of malfunctions en route	158 hours 9 minutes	17	Done by the crew

Conclusion.

The ratio between net travel time and time spent on repairs (38% and 62%) is indicative of the tank’s poor engineering.

The volume and complexity of repairs mean that the crew cannot repair the tank and require the efforts of a repair and reconstruction brigade.

The occurrence of the above-listed repairs during the warranty period prevents the tank from operating separately from repair facilities, which is unacceptable for operation under field conditions.

Routine maintenance.

The large volume and extensive time expended for routine maintenance of the tanks due to the poor reliability of individual assemblies is unacceptable for field operations.

Far from singing enthusiastic praise about the “finest tank in the world,” the report’s conclusions were compounded by the fact that ordinary tank units completely lacked the resources to assign each tank section a maintenance team consisting of a tow truck on a 4-ton high-mobility ZiS-6 chassis, two 3-ton trucks with spare parts, and a bus for transporting the personnel of a trained factory repair team, much less to equip it with all of the necessary tools, materials, and spare parts (jumping ahead, we know that the situation with spare parts was not just bad, it was very bad). In addition, the ordinary tankers in line units were much less capable of dealing with breakdowns than were the hand-picked crews

used during the factory tests.¹¹ The tragic summer of 1941, with its encirclements and retreats, meant that many tanks with minor malfunctions were just as irrecoverable as tanks hit by a shell or a bomb in combat.

The version of the T-34 tank submitted for testing does not meet modern requirements for this class of tanks for the following reasons:

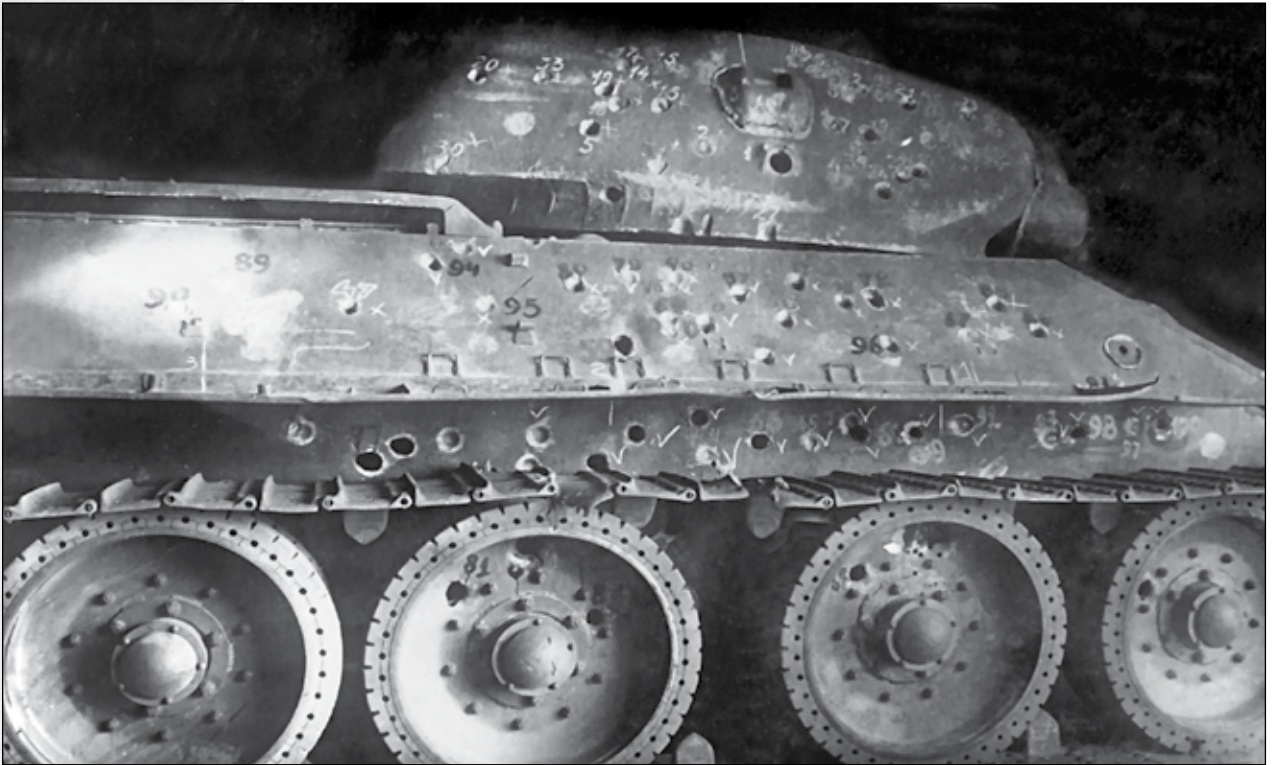
- a) The tank’s firepower cannot be fully utilized due to the unsuitability of the vision devices, flaws in the installation of the weapons and optics, the cramped crew compartment, and the difficult-to-use ammunition storage rack.*
- b) The tank’s performance characteristics were poorly chosen given the tank’s adequate engine reserve capacity and maximum speed, which reduce its speed and mobility.*
- c) The tank cannot be employed tactically when separated from repair facilities due to the unreliability of its main assemblies—the main clutch and suspension.*
- d) The characteristics of the 71 TK-3 radio and its poor installation in the T-34 tank make the range and reliability of communications seen during testing unsatisfactory for a tank of this class.*



After the fall road test, the “proving ground tests on two T-34 tank hulls with turrets” (as they were called on the official list) held in April 1941 at the Ilyich Mariupol Factory’s test range brought more bad news. Perhaps for the first time in the history of Soviet tank manufacture, a test range received not empty, odd-shaped armor boxes and individual armor plates but tanks that were “almost real”—the chassis had drive wheels, track adjusting wheels, and road wheels with suspensions. The tracks were tight, the final drives were armored, and the driver-mechanic’s hatches and the vision blocks were installed. The hulls had “almost completely real” turrets mounted on race rings, along with a mantlet and armor for the gun system, a traversing mechanism with a stop, hatches, vision blocks, and plugs in the firing ports intended for firing revolvers. Ballistic tests were conducted using a 37 mm antitank gun M1930 (a licensed Soviet copy of the German PaK 36 “door knocker” gun), a captured Polish 37 mm Bofors gun, a 45 mm gun, and a “three incher.”

The tests lasted three weeks and gave the Soviet tank designers rich food for thought—which they did not always accept. The front armor plates creditably withstood a 76.2 mm armor-piercing shell fired from close range, but the sloped 40 mm side was defeated even by the 37 mm sharp-pointed armor-piercing projectile from a range of 175–250 m, revealing that the much vaunted “sound angle of slope” of the 40 mm side armor plate was noticeably worse at withstanding projectiles than was the 45 mm vertical armor plate on the lower side. Another unpleasant discovery was the identification of a significant hazard to the crew and the tank’s mechanisms—armor plates defeated but not technically penetrated by a projectile:

The tank prior to ballistic testing at Mariupol during the spring of 1941.



The tank after ballistic testing.

It had previously been thought that a hull penetration smaller than a projectile's caliber would produce a single slug capable of killing or injuring only some of the crew or causing a small amount of localized damage within the tank that would not completely disable the tank. On the contrary, observations made during these tests established that shrapnel from a projectile's warhead that breaks apart when it passes through the armor enters the tank in addition to the cylindrical plug of armor. In addition, the slug frequently fractures into several pieces, and small pieces of shrapnel in addition to the slug spall off the armor. There were sometimes more than ten pieces of armor shrapnel and projectile fragments inside the hull when the hole was smaller than the projectile's caliber and most of the projectile remained outside the plate. Therefore, a hole smaller than the projectile's caliber is more dangerous for the crew inside the tank, its assemblies, etc., than previously thought; this type of defeat is relatively dangerous for the crew. Numerous cases of destruction within the hull caused by armor slugs were observed; for example, both of the soft carbon-steel side plates, which have a total thickness of 6 mm, were penetrated, as were oil tanks, radiators, fuel tanks, etc. These observations show that the slug travels at a high speed beyond the armor protection.

Let's illustrate the report's dry conclusions with vivid examples of armor failures from the firing log: when a projectile was fired from a 45 mm gun at the right turret plate,



It became stuck in base part 30-018.¹² A slug penetrated the left side skirt in three places; the hole sizes were 120–100 mm, 50–120 mm, and 60–20 mm. The slug and shrapnel from the projectile were found within the left front fuel tank.¹³

This meant the armor slug flew completely through the left compartment and defeated the side skirt on the opposite side. It is unlikely that the crew members in the path of shrapnel from the 10 cm hole in the metal side skirt would have survived. Strictly speaking, the projectile did not pass through the armor—it caught in the armor plate.

Testing continued, and the turret's right-side plate was hit with a Polish 37 mm Bofors projectile:

Hole smaller than projectile caliber. The diameter of the entrance hole was 40–32 mm, and the diameter of the exit hole was 37–40 mm. The projectile located in front of the plate was in fragments. Shrapnel between the upper and lower race rings caused a dent that prevented the turret from turning. The shrapnel damaged the traversing mechanism gear housing.¹⁴

Note that the projectile was in fragments in front of the plate, and the tank turret no longer turned, even though the projectile technically did not penetrate and did not even enter the race ring.

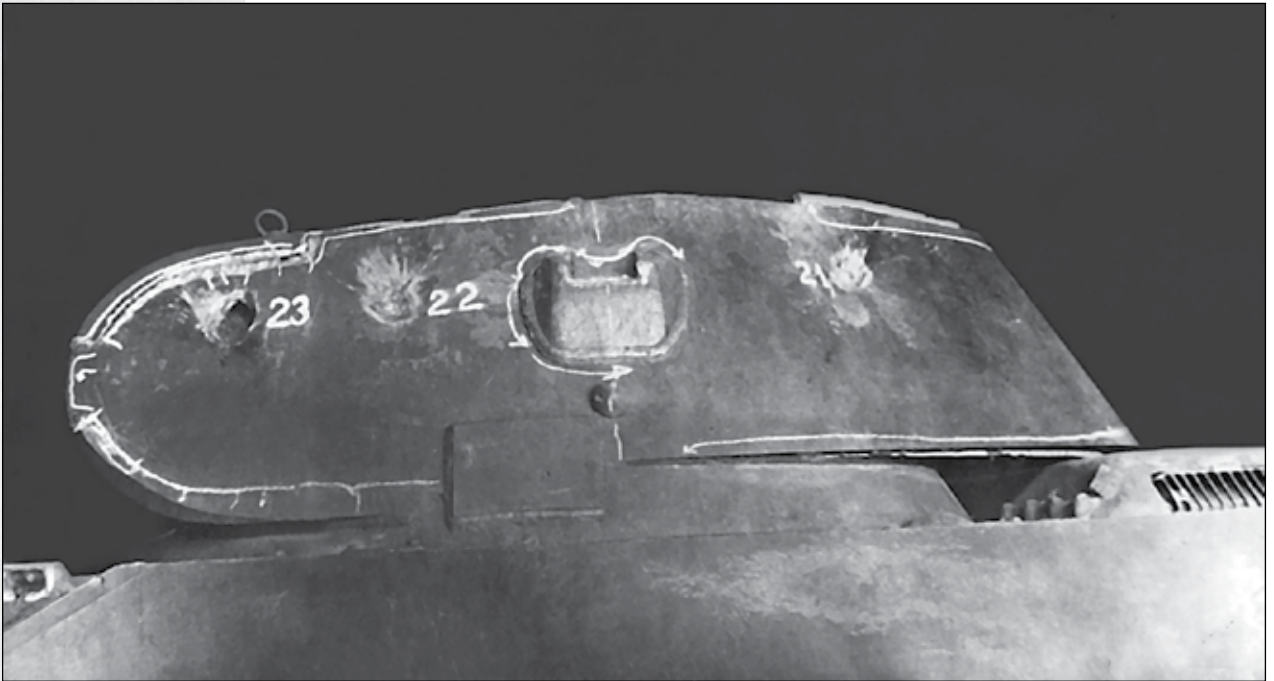
Now let's turn our attention to the upper right side plate, which was placed at the "sound angle of slope" of the 40 mm side armor plate. The vehicle was hit by a 45 mm projectile, producing

a 35–35 mm entrance hole and a 36–34 mm exit hole. A 60–70 mm slug penetrated the suspension spring housing. Along its flight path, the slug penetrated tanks, radiators, and other assemblies.¹⁵

Once again, there is a hole smaller than a projectile's diameter and a projectile that did not pass through the armor, yet deadly shrapnel spalled off behind the armor, destroying fuel tanks and radiators. Would the tank and crew be better off because the armor technically was not penetrated (the projectile failed to pass through the armor)?

Quite a few surprises resulted from cases where the armor was defeated without producing holes in the "armor's key assemblies." For example, it was learned that an armor-piercing projectile hitting the running gear could ricochet upward, penetrate the 15 mm upper side plate bottom, and enter the hull—which, naturally, was not observed during ballistic testing on the side of a hull without tracks mounted. It was also learned that the support wheels increased protection for the lower armor but left open the upper vertical part of the side, which was further weakened by milling for the joint with the upper side plate bottom. It was found that when a projectile struck a support wheel where the suspension arm passed through cut-outs in the side of the hull, it easily penetrated the armor through the wheel disk, the cut-out, and the suspension arm spring.

Three-inch high-explosive shells caused quite a headache—although the test reports record no penetration of 40–45 mm armor parts by a 76.2 mm HE shell:



... Weld disintegration following a hit by the first 76 mm projectile to the side of the [welded] turret...

a 76 mm HE projectile striking the running gear or the side near the tracks and wheels (up to 100–200 mm) destroys the track, drive wheel, idler wheel, and support wheels, causing the tank to stop...

and it also destroyed the upper side plate bottom. Explosions of three-inch HE shells caused extensive cracking of welds:

After the first impact by a 76 mm projectile on the side of the turret, the welds were badly fractured, and after the fourth 76 mm projectile hit, all of the welds on the side of the turret had come apart. Individual parts (vision block bases, roof plates, turret access hatch) broke away when struck by 45 mm and 76 mm shells due to the low rigidity of the welded turret.

Even shells that did not penetrate the armor caused serious damage to the tank:

The final drive housing lacks sufficient armor protection. Both 37 mm and 45 mm projectiles penetrate the 25 mm armor protection of the final drive housings and the housings themselves, causing the vehicle to stop.

The rear turret plate is not properly attached: the thread is crushed, and the plate moves out of position.

The turret traversing mechanism housing, which is made of cast iron, is unsuitable. The housing cracks and splits when it strikes the walls of the turret; the housing attachment lugs come off, and the traversing mechanism shifts out of position.



The upper access hatch has very weak hinges. The hinge pins broke in every test, and the hatch was thrown out of position. This left the top of the turret completely open.

The turret roof plates are too thin. As a result, their welds crack and separate.

The signal hatch and ventilation hatch hinges are weak, and they are not properly attached to the hatches.

Hits by 45 mm projectile on the armor caused the welds at the base of the vision blocks to fracture.¹⁶

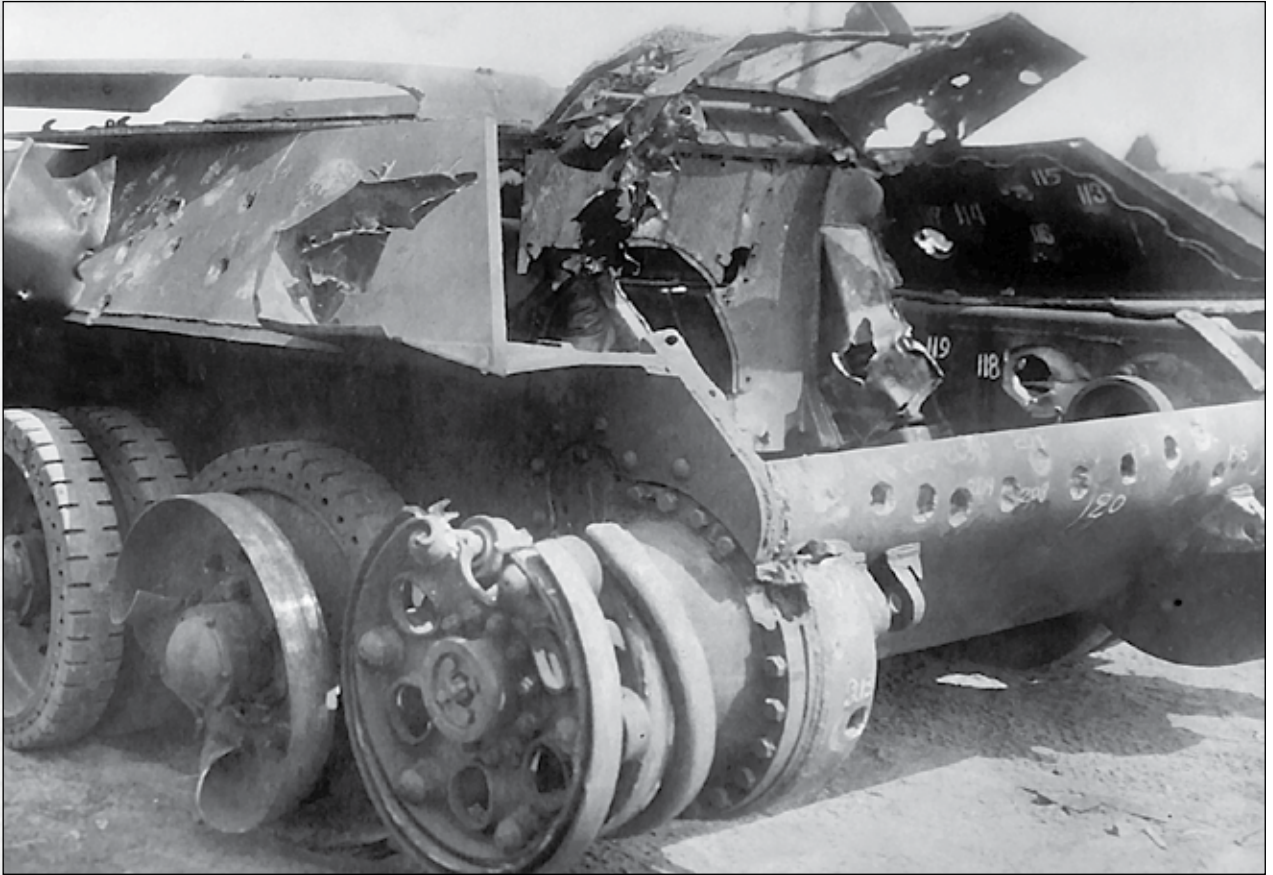
Incidentally, the ability of the vision blocks themselves to withstand projectile impacts was not impressive:

Also, the covers, latches, and headrests of the vision blocks are not securely attached. The outside protective lenses of the vision blocks cracked when the turret was struck by 45 mm projectiles a substantial distance from the vision block, and even when the opposite side of the turret was struck.¹⁷

Ballistic testing in which bullets were fired at the vision blocks on the driver-mechanic's hatch revealed that the protective lens could be penetrated by bullet fragments that would injure his eyes.

That, however, was a trifle when compared with the demonstrated weakness of the driver-mechanic's hatch design—the first impact by a projectile damaged the hinges, and the second impact caused the hatch to fall inside the tank (accordingly, the test report stipulated that:

... After four 76 mm projectile hits, the side of the turret had come loose at all of its seams...



... The armor protection of the final drive housings is unsatisfactory. Both 37 mm and 45 mm projectiles penetrate the 25 mm armor protection of the final drive housings and the housings themselves, causing the vehicle to stop moving...

in general, the presence of a hatch in the bow significantly weakens the vehicle's frontal armor; therefore, when designing new models it is imperative that the bow plate not have a driver's hatch.

Here, we would like to call the reader's attention to another fine point. The T-34's armor underwent ballistic testing during the spring trials: two rounds were fired from a 6-ton, 37 mm Vickers gun and a 45 mm BT-7 gun from a range of 100 m. Shell impacts on the turret only dented the armor; they did not penetrate. A comparison between these results and the results of the spring 1941 tests could support an argument that sub-standard armor parts were provided for the tests in Mariupol, that, therefore, the Mariupol ballistic tests could be considered unrepresentative, and that the authors retrieved them from archived obscurity solely in order to cast a shadow on the T-34's reputation. Unfortunately, archival documents prevent us from blithely dismissing the results of the Mariupol tests:

*To: Chairman of the Defense Committee
of the Council of People's Commissars
Marshal of the Soviet Union
Comrade K. Ye. Voroshilov
27 December 1940*



I hearwith report as follows:

In September of this year, by order of the Deputy Chief of the Main Artillery Directorate and Chief of the Main Armored Forces Directorate (GABTU) of the Red Army, ballistic tests were conducted at the Research Artillery Firing Range (NIAP) on a T-34 tank turret to check whether its systems and armor are securely attached.¹⁸

The tests showed that the turret armor was penetrated at a 30° angle of incidence by a 45 mm armor-piercing, blunt-nosed projectile from a range of 160 m, whereas the armor had not been penetrated during tests previously performed under the same conditions at the factory from a range of 50 m.

The People's Defense Commissariat (of the GABTU) jointly with the 3rd Main Directorate of the People's Commissariat of Shipbuilding and the Chief Directorate of Special Machine Building of the People's Commissariat of Medium Machine Building established a commission for ballistic testing of parts and turrets in order to establish the strength of the armor in accordance with specifications.

Out of 180 turret sets manufactured by the Mariupol Factory, the commission tested three turrets taken from Factory No. 183 (of the People's Commissariat of Medium Machine Building) and six hull armor parts of the T-34 tank selected from current production at the Mariupol Factory (of the People's Commissariat of Shipbuilding).

Damage to the side and turret of a T-34 struck by 37 mm and 45 mm armor-piercing projectiles during testing in the spring of 1940.



A T-34 disabled near Dubno.

The tests yielded the following results:

- a) Six T-34 hull armor parts passed ballistic protection tests, but the damage (penetration by a 45 mm projectile) sustained by two parts resulted in shrapnel larger than stipulated by the specification.*
- b) Of the three turrets, one completely passed the tests and met the specifications. The two other turrets did not fully pass; individual parts were found to have uneven ballistic protection.*

For example, one part from these tanks was penetrated when struck by a 45 mm projectile at a 30° angle of incidence fired from a range of 50 m.

- c) The strength of the weld joints was unsatisfactory.*

The first projectile caused the welds to crack, and they were completely destroyed by subsequent impacts.

The reduced armor protection of these turret parts is due to improper heat treatment. The turret parts were tempered in a device that does not provide even cooling during tempering.

Based on the test results and inspection of armor-production technology and quality control, the Commission decided to leave the manufactured T-34 tank turret on the tanks and task Factory No. 183 (People's Commissariat of Medium Machine Building) and the Ilyich Factory (People's Commissariat of Shipbuilding) with a number of requirements intended to improve their manufacturing process and quality control so as to produce armor of uniform quality that meets the specification.



I hereby request that a commission be established to develop the basic specifications for tank armor.

*Marshal of the Soviet Union G. Kulik.*¹⁹

This was not the first time nor, alas, the last time we will see a sad story develop: product quality deteriorated noticeably in the transition from a one-off, carefully prepared prototype to mass production. Equally importantly, armor parts with lower ballistic protection were approved for installation on tanks. Furthermore, only one of the three turrets tested met the specification. Therefore, we have no reason to assume that armor parts with lower ballistic protection ended up being tested by unlucky happenstance in Mariupol and were the exception. On the contrary, there is every reason to believe that the tanks tested in Mariupol were fully representative of the majority of the “thirty-fours” produced prior to the war.

We believe that the documents quoted above suffice for an understanding of the situation—during the last year before the war, opinions about the T-34 in no way resembled a friendly chorus of praise or unmitigated enthusiasm for its sloped armor, powerful gun, diesel engine, and wide tracks. The first “thirty-fours” were still very “crude” machines. Nevertheless, orders continued being placed for the tank, it was still in production, and demand for it was growing. This phenomenon is not all that rare for military hardware, especially when the military customer is insistent about seeing large numbers of a new system by this evening or, better yet, by yesterday morning. The outcome of this kind of haste is completely foreseeable: the unsuccessful debut of the German Tigers at Leningrad is well known. Two out of four vehicles broke down immediately upon arrival; three broke down during the second attack; and a fourth vehicle burned up.²⁰ Then there was the Panther debut in the Battle of Kursk. The engines of two vehicles caught fire and burned while being driven from the railroad station, and another 44 (of the 200 present) broke down for technical reasons over five days of fighting. A similar fiasco occurred with the famous American B-29 Superfortress bombers during their first attack on Japan—18 of the 75 bombers assigned to take part in the attack were unable to get off the ground due to malfunctions and ill-prepared crews. One B-29 crashed on takeoff, one was shot down by anti-aircraft fire, and engine fires downed another six. Only one bomb was dropped in the vicinity of the target, and it exploded 1.2 km from its aim point. A tarnished introduction did not prevent the Tigers and Panthers from becoming symbols of the German Panzerwaffe during World War II, nor did it stop the B-29 from becoming America’s main strategic bomber in the Pacific.

Nor did the bleak results during prewar testing prevent the T-34 from becoming the most important tank of World War II. The Kharkov designers’ focus on continuity with existing tanks completely justified itself.²¹

The decision to crank up production of the T-34 was very straightforward and hardly an example of the “totalitarian volunteerism of the powers that be”: although the T-34 had a number of serious shortcomings, it also had many advantages. Chief among them from the standpoint of the Soviet leadership was the fact that mass production of a modern medium tank with ballistic protection was getting underway at factories that previously had mass-produced only light tanks. Before the advent of the T-34, the Red Army’s sole medium tank was the T-28, which was produced by only one factory—the



A T-34 disabled in combat in Ukraine during June 1941. Despite its outward appearance, this tank had burned—the rubber tire on the front left road wheel is burned.

Leningrad Kirov Factory, which had switched to production of the heavy KV. The country could not patiently wait for engineers to design new tanks without flaws and for factories to master their production gradually—even a T-34 that was “crude,” blind, and unreliable from the standpoint of its technical characteristics was much more attractive than older tanks with anti-bullet armor. And they were definitely better than no modern medium tank at all.

NOTES

- ¹ From Vladimir Vysotsky's poem, “Test Pilot.”
- ² RGVA, f. 31811, op. 3, d. 2165, pp. 71–85. Cit. ex: A. Makarov, *Chronicles of the First T-34s*, *Tekhnika i vooruzheniye*, No. 1, 2011, p. 6.
- ³ RGVA, f. 31811, op. 3, d. 2165, pp. 71–85; RGVA, f. 31811, op. 3, d. 2115, pp. 39–48. Cit. ex: A. Makarov, *Chronicles of the First T-34s*, *Tekhnika i vooruzheniye*, No. 2, 2011, p. 9–10; No. 2, 2011, p. 20.
- ⁴ RGVA, f. 31811, op. 3, d. 2165, pp. 71–85; RGVA, f. 31811, op. 3, d. 2115, pp. 38–48. Cit. ex: A. Makarov, *Chronicles of the First T-34s*, *Tekhnika i vooruzheniye*, No. 2, 2011, p. 9–10; No. 2, 2011, pp. 20–23.
- ⁵ RGVA, f. 31811, op. 3, d. 2165, pp. 71–85; RGVA, f. 31811, op. 3, d. 2115, pp. 39–48. Cit. ex: A. Makarov, *Chronicles of the First T-34s*, *Tekhnika i vooruzheniye*, No. 2, 2011, p. 9–10; No. 2, 2011, p. 20.
- ⁶ RGVA, f. 31811, op. 3, d. 2165, pp. 71–85; Cit. ex: A. Makarov, *Chronicles of the First T-34s*, *Tekhnika i vooruzheniye*, No. 2, 2011, p. 9–10; No. 2, 2011, p. 23.
- ⁷ Cit. ex: RGVA, f. 31811, op. 3, d. 2116 (Report on long road test performed on three T-34 tanks).