

Messerschmitt Bf 109

Bf 109



The most famous survivor, Messerschmitt Bf109G-2/Trop "Black 6", Wk Nr 10639; photo taken 1997 Duxford Air Show.

Type Fighter

Manufacturer [Bayerische Flugzeugwerke](#)
[Messerschmitt](#)

Designed by [Willy Messerschmitt](#)

Maiden flight [28 May 1935](#)

Introduced 1937

Retired 1945, Luftwaffe
1965, Spain

Status Retired

Primary users [Luftwaffe](#)
[Spanish Air Force](#)

Number built more than 33,000.

Variants [Avia S-199](#)
[Hispano Aviacion Ha 1112](#)



German Airfield, France, 1941 propaganda photo of the Luftwaffe, Bf 109 fighters on the tarmac

The [Messerschmitt Bf 109](#) was a [German World War II fighter aircraft](#) designed by [Willy Messerschmitt](#) in the early [1930s](#). It was one of the first true modern fighters of the era, including such features as an all-metal [monocoque](#) construction, a closed canopy, and retractable landing gear. The Bf 109 was produced in greater quantities than any other fighter aircraft in history, with 30,573 units built alone during 1939-1945. Fighter production totalled 47% of all German aircraft production, and the Bf 109 accounted for 57% of all fighter types produced^[1].

The Bf 109 was the standard fighter of the [Luftwaffe](#) for the duration of World War II, although it began to be partially replaced by the [Focke-Wulf Fw 190](#) starting in 1941. The Bf 109 scored more aircraft kills in World War II than any other aircraft. At various times it served as an air superiority fighter, an escort fighter, an interceptor, a ground-attack aircraft and a reconnaissance aircraft. Although the Bf 109 had weaknesses, including a short range, and especially a sometimes difficult to handle narrow, outward-retracting undercarriage, it stayed competitive with Allied fighter aircraft until the end of the war.

The Bf 109 was flown by the three top scoring fighter aces of World War II : [Erich Hartmann](#), the top scoring fighter ace of all time with 352 victories, [Gerhard Barkhorn](#) with 301 victories, and [Günther Rall](#) with 275 victories. All of them flew with the [Jagdgeschwader 52](#), chiefly on the Eastern front, a unit exclusively flying the Bf 109 models and being credited with over 10,000 victories itself. Hartmann refused to fly any other aircraft in combat throughout the war. [Hans-Joachim Marseille](#), "The Star of Africa" also flew the Bf 109, and achieved all of his 158 victories on the [Western Front](#), chiefly against Allied pilots during the [North African Campaign](#), including 17 aircraft shot down in a single day.

The Bf 109 will always be compared to its adversary, the [Supermarine Spitfire](#); both were among the best of their day.

Designation

Bf 109 was the initial [Reichsluftfahrtministerium](#) (the German Air Ministry) designation, since the design was sent in by the [Bayerische Flugzeugwerke](#) company, and used exclusively in all official German documents dealing with this aircraft family. After the company was renamed to [Messerschmitt AG](#) after July 1938, when [Erhard Milch](#) finally allowed Willy Messerschmitt to acquire the company, from that date forward, all Messerschmitt aircraft were to carry the "Me" designation — at least in theory, as wartime documents from Messerschmitt AG, the RLM and others continued to

use both designations, sometimes even on the same page. **Me 109** is known to have been the name used in print by the [Luftwaffe](#) propaganda publications as well as by the Messerschmitt company itself after July 1938, and the [Luftwaffe](#) personnel, who pronounced it *may hundert-neun*. The **Me 109** (pronounced "emm ee one-oh-nine") designation was usually used in the English-speaking world. However, in both wartime and contemporary literature, both the "Bf" and "Me" prefixes are used, and both are considered valid and accurate — although some debate still occurs over this issue from time to time.

Contest history

During 1933 the Technisches Amt (or T-Amt, the technical department of the [RLM](#)) concluded a series of research projects into the future of air combat. The result of the studies was four broad outlines for future aircraft:

- *Rüstungsflugzeug I* for a multi-place medium bomber
- *Rüstungsflugzeug II* for a tactical bomber
- *Rüstungsflugzeug III* for a two-seat heavy fighter
- *Rüstungsflugzeug IV* for a single-seat fighter

The *Rüstungsflugzeug IV* was intended to be an all-metal monoplane single seat [fighter aircraft](#), or [interceptor](#) actually, replacing the [Arado Ar 64](#) and [Heinkel He 60](#) biplanes then in service. While it was intended the R-IV aircraft would best all others then flying, the requirements were nevertheless not terribly hard to meet.

The plane needed to have a top speed of 400 km/h at 6,000 m (250 mph at 19,500 ft) which it could maintain for 20 minutes, while staying in the air for a total of 90 minutes. It was to be powered by the new [Junkers Jumo 210](#) engine of about 700 hp (522 kW). It also needed to be armed with at least three 7.9 mm [machine guns](#) with 1,000 rounds each, or one 20 mm cannon with 200 rounds. One other interesting specification was that the plane needed to keep wing loading below 100 kg/m², which is a way of defining the plane's ability to turn and climb. The priorities for the plane were level speed, climb speed, and then manoeuvrability (in that order).

In fact the R-IV specifications were not actually thought up inside the T-Amt at all. In early 1933 both [Heinkel](#) and [Arado](#) had sent in privately-funded designs for a monoplane fighter, and the T-Amt simply collected the best features from both and sent them back out again, adding [Focke-Wulf](#) to the tender. In May 1934 the R-IV request was sent out and made official. Each was asked to deliver three prototypes to be delivered for head-to-head testing in late 1934.

[Willy Messerschmitt](#) was originally not invited to participate in the competition. This was mainly due to personal animosity between Messerschmitt and [RLM](#) director [Erhard Milch](#) (Hans Hackman, a close friend of Milch, was killed testing the prototype [Messerschmitt M20](#) light transport plane), after the M20 proved a disaster in [Lufthansa](#) use. Nevertheless Messerschmitt was on very good terms with many high ranking Luftwaffe officers based on the success of the [Messerschmitt Bf 108 Taifun](#) sports plane. After a delay of several months, [Bayerische Flugzeugwerke](#) (Bavarian Aircraft Manufacturers, or BFW) for which Messerschmitt was head designer, was invited to take part in early 1935, although Milch let it be known that they would never win the contract.

Design features

Messerschmitt had already designed much of the Bf 109 by this point. Like the Bf 108, the new design was based on Messerschmitt's "lightweight construction", which essentially aimed to reduce

the total number of strong parts in the aircraft as much as possible. One of the more notable examples of this was the mounting of all structural points to a strong firewall at the front of the cockpit, including the wing spars, engine mounts and landing gear. In more conventional designs these would be mounted to different points on the aircraft, with a framework distributing the load among them.

Another notable advantage of this design was that, since the landing gear was attached to the [fuselage](#) itself, it was possible to completely remove the wings of the aircraft for major servicing, if necessary, leaving the fuselage intact sitting on the landing gear. However, this had one major drawback — such a landing gear arrangement ensured a narrow track (the distance between the main tyres) which thus made the plane unstable in terms of balance while on the ground. In fact, the Bf 109 was notoriously difficult to take off and land, and many planes simply veered off or tipped over to one side during a seemingly perfect run. To make things worse, the landing gear struts were comparatively long. This left the nose pointing up at quite a steep angle with respect to the ground, making forward visibility during taxiing near zero.

The Bf 109 suffered from ground accidents due to "swing" on takeoff and landings throughout its life. It has been suggested that 5% of all 109s were lost this way, or even one third; the Luftwaffe's loss records on the other hand show that approximately 1% of the Bf 109s had suffered landing incidents or accidents at the beginning of its career, a figure comparable to the other monoplane fighters introduced at the time. This feature was, however, more of a problem with rookie pilots, especially during later stages of the war.^[2] The interesting fact is that Spitfire had a similar , narrow landing gear arrangement, but there hasn't been widespread talk about operational losses, and it has been speculated that the swing was due to the toe-in of the main landing gear wheels. Most Finnish pilots report that the swing was easy to control, but some of the less experienced pilots lost planes on startup.^[2]

Reflecting Willy Messerschmitt's belief in low-weight, low-drag simple monoplanes the armaments were placed in the main body of the plane; two machine guns were mounted above the engine and a third could be fired through the airscrew hub, with the engine buffering the recoil. Fitting with Willy's ethos, this kept his gun-free wings very thin and lightweight. When it was discovered that the RAF was producing eight-gun monoplanes it became clear that the Bf 109 would *have* to carry more guns and a new wing was designed holding a machinegun, later a 20 mm MG FF cannon.

In 1938 the 'Emil' (see below) went into production, but to improve on the performance allowed by the rather small 600 to 700 hp Jumo engine the larger Daimler Benz DB 601A engine was used, yielding an extra 300 hp at the cost of an additional 400 lb.

Another aspect of this construction technique was the use of a single box-spar in the wing, mounted near the leading edge. Most planes of the era used two spars, near the front and rear, but the box was much stiffer [torsionally](#), and eliminated the need for the rear spar.

Another major difference was the much higher [wing loading](#) than the other designs. While the R-IV contract called for a wing loading of less than 100 kg/m², Messerschmitt felt that this was unreasonable; with the engines available to them, the fighter would end up slower than the bombers it was tasked with catching.

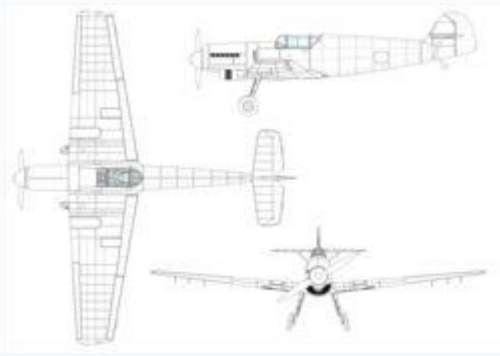
A wing generates two forms of drag, [parasitic drag](#) due to its form, and [induced drag](#) which is a side effect of generating lift. The former dominates at high speeds, when the airflow hitting the wing causes drag that rises with the square of the aircraft's speed. The latter dominates at lower speeds, where the lack of airflow requires the wing to be angled into the airflow at a higher [angle of attack](#).

Since the fighter was being designed primarily for high speed flight, a smaller wing would be optimised for high speed use.

The downside of such a trade-off is that low speed flight would suffer, the smaller wing would require more airflow to generate enough lift to stay flying. In order to address this, the Bf 109 included advanced high-lift devices on the wings, including automatically opening [slats](#) on the leading edge, and fairly large camber-changing [flaps](#) on the trailing edge. He also included ailerons that "drooped" when the flaps were lowered thus increasing total flap area when the flaps were deployed. When deployed, these devices effectively increase the coefficient of lift, making it better at low speeds and high angles of attack.

Another drawback of the high wing-loading is that the plane would require more energy to manoeuvre. Given the limited amount of power available, this effectively meant that the Bf 109 would not be able to turn as tightly as other designs with larger wings. The high lift devices would offset this to some degree, but they also increased drag and so slowed the plane further. Given that manoeuvrability was last on the RLM's wish-list, Messerschmitt was certain the benefits outweighed the drawbacks.

Prototypes



Messerschmitt Bf 109 V1

The first prototype (*Versuchsflugzeug 1* or *V1*), with civilian registration **D-IABI**, was completed by May 1935, but the [German](#) engines were not yet ready. In order to get the designs into the air, the RLM acquired four [Rolls-Royce Kestrel](#) VI engines by trading Rolls-Royce a [Heinkel He 70 Blitz](#) to test their engines on. Messerschmitt received two of these engines, and started work on adapting V1 to mount it. This work was completed in August, and V1 took flight tests in September 1935. It was then sent to the Luftwaffe Test Center at [Rechlin](#) to take part in the contest.

By the late summer the Jumo engines were starting to become available, and V2 was completed with the Jumo 210A of 610 PS (602 hp, 449 kW) in October 1935. V3 followed, being the first to actually mount guns, but another 210 was not available and it ended up delaying the flight of V3 until May 1936. Like V1, V2 and V3 were sent to Rechlin after acceptance tests at the factory.

The flight data of these three planes were very nearly identical. The maximum airspeed was about 470 km/h at 4000 m altitude, and the service ceiling was about 8300 m.

The contest

After Luftwaffe acceptance trials were completed at Rechlin, the planes were moved to Travemünde for the head-to-head portion of the contest. The Heinkel design arrived first, in early February 1936, and the rest of the V1s had all arrived by the beginning of March.

Because most of the fighter pilots of the Luftwaffe were used to good-natured biplanes with open cockpits, light [g-forces](#) and easy handling, they were very critical about the Bf 109 at first. However it was soon a front-runner in the contest, as the Arado and Focke-Wulf entries proved to be hopelessly outdated. Perhaps this isn't surprising, considering that those entries had actually been designed two years earlier, and given the rate of change in aircraft design at the time, they really had little chance against the much more modern 109.

The only serious competition to the 109 was the Heinkel entry. Based on a scaled down *Blitz*, the [He 112](#) proved to be similar but different. Positive aspects of the He 112 included the wide track and robustness of the landing gear, considerably better visibility from the cockpit, and a lower wing loading that led to easier landings and better maneuverability. But the Bf 109 was 30 km/h faster than the He 112 in level flight, and also was superior in climbing and diving. Still, the He 112 was the favourite of the Luftwaffe leaders.

On [11 November 1937](#) Messerschmitt regained some favour with [Erhard Milch](#) with the [Bf 109](#) V13 increasing the world's air speed record to 379.38 [mph](#). The 'V13' had been fitted with a special racing version of the DB 601 engine, as a result the power of the engine could reach 1,650hp for short periods^[1].

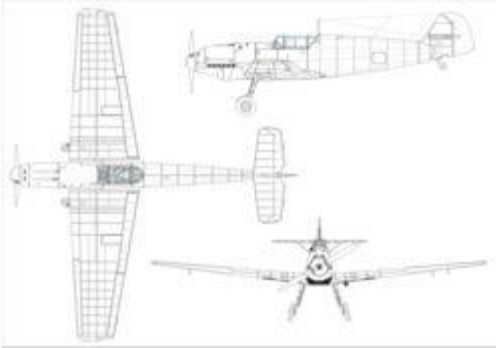
[Heinkel](#), having had the He 112 rejected began work on the [He 100](#). On [6 June 1938](#) the [He 100](#) V3, flown by [Ernst Udet](#), established a new record of 394.4mph, and later on 30 March 1939 surpassed that record reaching 463.92mph with the [He 100](#) V8. Messerschmitt soon regained the lead in this race. On [26 April 1939](#) Hans Dieterle, flying the Bf 209 V1, powered by the DB 601ARJ, producing 1,550hp but capable of reaching 2,300hp, raised the figure to 469.22mph. This world record was to stand until 1969^[1].

Orders for a further ten examples of both types were placed, and they started trickling in over the next few months. However by this point the Jumo-powered examples of both designs had arrived for testing, and the 109's better streamlining and lower drag meant that it was considerably faster given the lower-power engine.

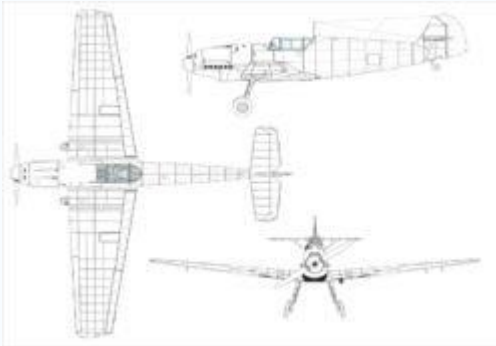
Even before the pre-production models arrived the contest was basically over. In March the RLM received news that the [Spitfire](#) had been ordered into production, and a form of mass panic broke out. On March 12 they released a document that basically contained the outcome of the contest, *Bf 109 Priority Procurement*. Nothing occurred over the summer to change their minds, and the RLM instructed Heinkel to re-design the He 112 radically, while ordering the Bf 109 into production.

Models

Bf 109 A/B/C



Messerschmitt Bf 109 B



Messerschmitt Bf 109 C

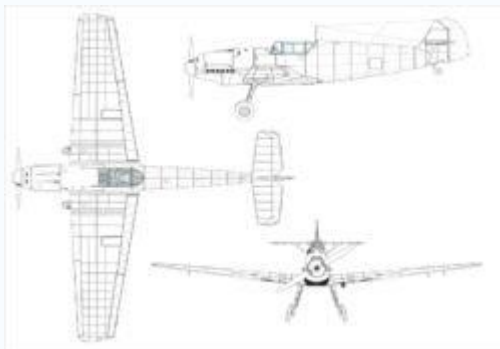
The Bf **109A** "Anton" was the first version of the Bf 109. According to RLM documentation ^[3] 22 aircraft were ordered and delivered with V4 as the A-series prototype. The armament, it was planned to have only two nose-mounted 7.92 mm [MG 17 machine guns](#), was found to be too weak but experiments with a third machine gun firing through the propeller shaft were unsatisfactory. V4 and some **A-0** were powered by a 640 PS Jumo 210B engine driving a two-bladed fixed-pitch propeller. As soon as the 670 PS Jumo 210D became available production was changed to this engine. The A-0 were not of a uniform type but saw several changes in their appearance. Visible changes include engine, cockpit and machine gun ventilation holes/slats as well as the oil cooler, changing it's location several times to prevent overheating. Many of those Bf 109 A-0 served with the Condor Legion and were often misidentified as B-series aircraft, they probably served in Spain with 6-1 to 6-16 tactical markings. One A-0, marked as 6-15, ran out of fuel and was forced to land behind enemy lines. It was captured by republican troops on November 11, 1937 and later transferred to the Soviet Union for a closer inspection ^[1]. 6-15 showed several improvements from the Bf 109B production program and was prepared to receive the variable-pitch propeller.

The first Bf 109 model that went into serial production, the Bf **109B** "Bruno", was fitted with the 670 PS (660 hp, 493 kW) Jumo 210D engine driving a two-bladed fixed-pitch propeller. During the B-1 production run a variable pitch propeller was introduced and often retrofitted to older aircraft, these aircraft were then unofficially known as B-2. Both versions saw combat with the [Condor Legion](#) during the Spanish Civil War, in the process demonstrating that the armament was still inadequate. Several aircraft were produced with an engine-mounted machine gun but it was very unreliable again, most probably due to engine vibrations and overheating. Thus the Bf 109 V8 was constructed to test the fitting of two more machine guns in the wings. In the following V9 prototype both wing guns were replaced by 20 mm [MG FF](#) cannons. 341 Bf 109B of all versions were built by Messerschmitt, Fieseler and Erla. ^[4]

The short-lived Bf **109C** "Caesar" was powered by a 700 PS Jumo 210G engine with direct fuel injection. Another important change was a strengthened wing now carrying two more machine guns giving four MG 17 in total. The **C-1** was the production version, the **C-2** an experimental version with an engine-mounted machine gun. The **C-3** was planned with 20 mm [MG FF cannons](#) replacing the two MG 17 machine guns in the wings but it's not known how many C-3 (if any) were built. The **C-4** was planned to have an engine mounted MG FF. 58 Bf 109C of all versions were built by Messerschmitt. ^[4]

The next model, the V10 prototype, was identical to the V8, except for its Jumo 210G engine . The V10, V11, V12 and V13 prototypes were built using Bf 109B airframes, and tested the DB600A engine with the hope of increasing the performance of the aircraft. However the DB600A was found to be unreliable, and as the improved [DB601A](#) was to become available soon and the DB600A was dropped.

Bf 109 D "Dora"

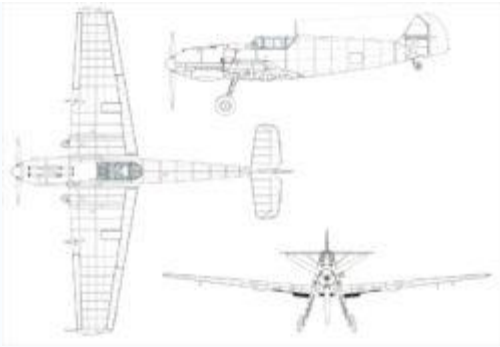


Messerschmitt Bf 109 D

Developed from the V10 and V13 prototypes, the Dora was the standard version of the Bf 109 in service with the [Luftwaffe](#) during the period just before World War Two. Despite this, the type saw only limited service during the war, as all of the 235 Doras still in service at the beginning of the Polish campaign were rapidly taken out of service and replaced by the Bf 109E, except in some [night fighter](#) units, where some examples were used into early 1940. Variants included **D-0** and **D-1** Models, both with a Junkers Jumo 210D engine and armed with two wing-mounted and two nose-mounted 7.92 mm [MG 17](#) machine guns. The **D-2** was an experimental version with an engine mounted machine gun but this installation failed again. The **D-3** was similar to the C-3 with two 20 mm MG FF cannon in the wings. 647 Bf 109D of all versions were built by Focke-Wulf, Erla, Fieseler, Arado and AGO. ^[4] Messerschmitt is listed as having only four Bf 109D produced, probably the D-0 preproduction series with the serial production transferred to license manufacturers. Several Bf 109D were sold to Hungary and Switzerland.

Bf 109E "Emil"

To test the new [DB601A](#) engine, with its 1,100 PS (1,085 hp, 809 kW), two more prototypes, the V14 and V15, were built, that differed in their armament. While the V14 was armed with the two [MG 17](#) above the engine and one 20 mm [MG FF](#) cannon in each wing, the V15 got the two MG 17s above the engine and a MG FF firing through the propeller axis. After test fights the V14 was considered more promising and a pre-production batch of 10 E-0 was ordered.



Messerschmitt Bf 109 E-3

The production version **E-1** kept the two 7.92 mm MG 17s above the engine and had two MG 17s in the wings. Later many were modified to the E-3 armament standard. The **E-1B** was a small batch of E-1s produced to be the first operational use of a Bf 109 as fighter bomber. They were fitted with either a ETC 250 bomb rack, carrying one 250kg bomb or two ETC 50 bomb racks, carrying a 50kg bomb under each wing. The E-1 was also fitted with the Reflexvisier "Revi" gunsight. The E-1 also carried the FuG 7 *Funkgerät 7* (radio set) short-range radio equipment, effective at ranges of 30-35 miles. 1,183 E-1 were built, 110 of them were E-1/B.^[4]

The **E-2** was not built for unknown reasons, probably another failed attempt to install an engine mounted machine gun or cannon.

To improve the performance of the Bf 109E, the last two real prototype planes were constructed, the V16 and V17. They got some structural improvements and stronger armament. These prototypes were the basis of the Bf **109 E-3** version. They were armed with the two MG 17's above the engine and one MG FF cannon in each wing.^[2] The E-3 also received additional armor, often self sealing fuel tanks and optional an improved [DB601Aa](#) with 1,175 PS (1,159 hp, 864 kW) respectively. 1,276 E-3 were built, 75 of them were **E-3a** export versions without equipment classified as secret.^[5]



Bf 109E



Bf 109E4



Bf 109E at [Deutsches Technikmuseum Berlin](#)

The E-3 was replaced by the **E-4** (with many airframes being upgraded to E-4 standards starting at beginning of the Battle of Britain) which was different in some small details, most notably by the modified [MG-FF/M](#) wing cannon and by improved head armor for the pilot. The MG FF/M fired a new and improved type of explosive shell, called Minengeschoß (or 'mine-shell') which was made by drawn steel (the same way brass [cartridges](#) are made) instead of being cast as was the usual practice. This resulted in a shell with a thin but strong wall, which hence had a larger cavity in which to pack a much larger explosive charge than was otherwise possible. The new shell required modifications to the MG FF's mechanism due to the different recoil characteristics, hence the MG FF/M.

The canopy was also revised to an easier-to-produce, "squared-off" design, and stayed fairly unchanged until the introduction of the 'Erla' canopy on the G-6 in the autumn of 1943. The E-4 would be the base for all further Bf 109 E developments. Some E-4 and later models got a further improved 1,175 PS [DB601N](#) high-altitude engine resulting in a slightly changed model number like E-4/N, first appearing in July 1940.

The E-4 was also available as fighter-bomber with equipment very similar to the previous E-1/B. It was known as **E-4/B** (DB 601Aa engine) and **E-4/BN** (DB 601N engine). 496 E-4 of all versions were built, 250 E-4, 20 E-4/N, 211 E-4/B and 15 E-4/BN. ^[5]

The E-5 and E-6 were both recon versions with a camera installation behind the cockpit. The **E-5** was a recon version of the E-3, the **E-6** was a recon version of the E-4/N. Both were built in very low numbers with 29 E-5 built and 9 E-6 ordered. ^[5]

The **E-7** was the next major production variant. It was based on the E-4/B and was able to carry drop tank, which greatly increased their range, or a bomb to be used as fighter-bomber. As the DB 601N was still not available in large numbers many E-7 used a mix of DB 601A, Aa or N engines with the latter designated as E-7/N.

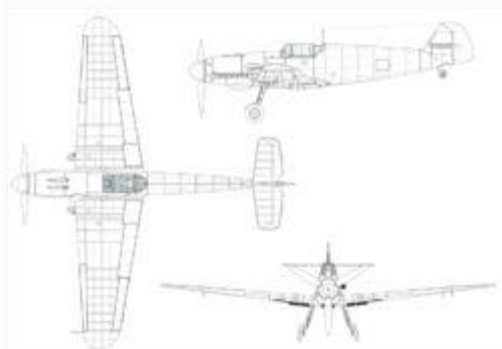
The E-1 and E-4 saw the most heavy action during the [Battle of Britain](#) — most of the E-3s were already converted to E-4 standard. The fuel-injected DB601 engine of the Bf 109 proved most useful against the British [Supermarine Spitfire](#) and [Hawker Hurricane](#) fighters, as the British fighters used gravity [carburetor](#) engines, which would cut out under negative [g forces](#) whereas the DB601 did not. The Bf 109s thus had the initial advantage in dives, either during attack or to escape it was able to get out of gun range. The Spitfire proved a formidable opponent, being approximately as fast and is claimed somewhat more maneuverable in turns at medium to high speeds than the Bf 109 (the latter due to the Bf 109's high wing loading). On the question of comparative [turning circles](#) in combat, Spitfires and Hurricanes benefited from their lower wing loading compared with the Bf109; 22 to 24 pounds per square foot on the RAF machines against 32 pounds per square foot for the Bf 109. [Royal Aircraft Establishment](#) tests with a captured Bf 109 showed the Spitfire's turning circle — without height loss — was 696 feet (212 m) in radius (the Hurricane's would be slightly tighter) while

the 109's was 885 feet (270 m) radius according to British calculations using assumed values as basis. According to the German manuals however, the smallest turning circle was 170 m, and fighter pilots on both sides claim they would out-turn their opponents in combat. In roll rates the Bf 109 enjoyed advantage at dogfight speeds, though at high speeds the maneuverability of all three fighters, especially the Spitfire was severely limited in this regard. The Bf 109 enjoyed good handling near stalling speeds as it was particularly forgiving then. Firepower between the antagonists was comparable, with the Spitfire and Hurricane having eight .303 inch machine guns versus the Bf 109's two 7.92 mm MG17 machine guns and two 20 mm MG FF cannon. However, the MG FF occasionally jammed and had a small (60-round) ammunition capacity. To be fair, when the Spitfires were later upgraded to two 20 mm [Hispano-Suiza](#) cannon, the British initially had serious jamming problems of their own with the new weapon. RAF pilots who tested captured Bf 109s liked the engine and throttle response but criticised the high speed handling characteristics, poorer turning circle, greater force required on the control column at speed and the thick framing of the cockpit glazing which they felt created blindspots in the pilot's field of vision.

Bf 109E variants and sub-variants

- **E-0** (Pre-Production Aircraft with four MG 17 7.92 mm machine guns)
- **E-1** (Similar to E-0)
 - **E-1/B** (Fighter-bomber version of E-1, usually with DB 601Aa)
- **E-2** (Not built)
- **E-3** (Armament; 2x MG 17s above the engine and a MG FF in each wing. Modified canopy)^[2]
- **E-4** (Armor and structural improvements, change of MG FF cannons to MG FF/M. Return to 'normal' canopy)
 - **E-4/B** (Fighter-bomber version of E-4, one 250 kg bomb, usually with DB 601Aa)
 - **E-4/Trop** (Version of E-4 modified to serve in tropical regions)
 - **E-4/N** (E-4 with DB601N engine)
 - **E-4/BN** (Fighter-bomber version of E-4/N, one 250 kg bomb)
- **E-5** (Recon version of E-3, camera equipment, two MG 17)
- **E-6** (Recon version of E-4/N, camera equipment, two MG 17)
- **E-7** (Similar to E-4 but with optional external fuel tank)
 - **E-7/N** (Similar to E-4/N but with optional external fuel tank)
 - **E-7/NZ** (also E-7/Z) E-7/N with additional [GM-1](#) injection system
 - **E-7/U2** (Ground attack variant of E-7)
- **E-8** (long range version of E-1 using drop tank installation of E-7, four MG 17)
- **E-9** (Recon version of E-7/N, drop tank, camera equipment, two MG 17)

Bf 109F "Friedrich"



Messerschmitt Bf 109 F-2

After February 1940 an improved engine, the Daimler-Benz [DB601E](#), was developed for use with the Bf 109. The engineers at the Messerschmitt facilities took a Bf 109E-1 airframe and installed this new powerplant, Luftwaffe marking VK+AB, its production number was 5604. The fuselage was cleaned up and the engine cowling modified to provide improved aerodynamics. The relationship to the standard E-1 version was obvious, because the [trapeziform](#) wings were taken from the E-1, although this was later changed in the production models of the F version. This adaptation became the prototype for the **Bf 109F** series. As the DB601E was not yet available in numbers the pre-production **F-0** (the only F variant to have a rectangular supercharger intake) and the first production series **F-1/F-2** received the 1,175 hp (875 kW) DB601N engine. The 1,350 hp (1,005 kW) DB601E was first used in the **F-3** model together with an enlarged propeller with improved performance.

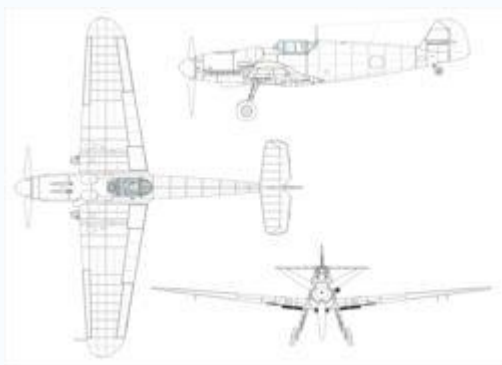
Externally the Bf 109F differed from the E-series, resulting from many aerodynamic improvements. The stabilizer struts were removed, the cowling was shaped to be more streamlined, the big underwing radiators were much smaller, the opening for the supercharger was improved to a round one from F-1 variants on, the flaps were completely changed, the wingspan was increased to 9.92 m, and the wing tips now were formed elliptically, which supposedly caused some confusions with the Spitfire. The redesigned wing made the internal mounting of guns impractical, so armament was revised. The armament of the Bf 109F consisted of the two MG 17 above the engine plus a cannon firing through the propeller hub: The early F versions were equipped with the MG FF/M cannon, the F-2 got the 15 mm [MG 151](#), and from **F-4** on the 20 mm MG 151/20 was used. Several aces, particularly Oberst [Adolf Galland](#), criticised the light armament as inadequate for the average pilot. Major [Walter Oesau](#) even refused to fly an F as long as 'Emil's were still available. Only after a lack of spare parts, did he accept an F. Later on, an attachment of underwing 20 mm cannons addressed the issue of fire-power, but at a price to performance. [Werner Mölders](#) on the other hand was very much pleased and saw the single centerline gun as an improvement. It is possible that the criticism of the Bf 109F's armament is based on the early F-2 version with the 15 mm MG 151/15 cannon, which was later replaced by the 20 mm version of the same weapon and was seen highly effective by aces like [Günther Rall](#).

The first Bf **109F** planes were not well tested, and so some planes crashed or nearly crashed, due to vibrations which caused either the wing surface to curve or break, or caused the stabilizer to break away. In one such accident, the commander of JG 2 "Richthofen", [Wilhelm Balthasar](#) lost his life when he was attacked by a Spitfire during a test flight. Making an evasive maneuver, his wings broke away and Balthasar was killed when his plane hit the ground. When the wreck was investigated, not a single bullet hole was found. However, the teething problems were subsequently solved, and pilots generally agreed that the F series were the best-handling of all the Bf 109 series.

Bf 109F variants and sub-variants

- **F-0** (Pre-Production Aircraft built from E series airframes, Adolf Galland was one of the few to fly one operationally)
- **F-1** (Armed with one MG FF/M 20 mm cannon and two MG 17 7.92 mm machine guns)
- **F-2** (Armed with one [MG 151](#) 15 mm cannon and two MG 17)
 - F-2/trop tropicalized version
- **F-3** (F-2 with 601E engine, small production and most upgraded to F-4 standard)
- **F-4** (Armed with one [MG 151/20](#) 20 mm cannon and two MG 17)
 - F-4 R1 (Two 20 mm cannon in underwing packs, special purpose variant, only in small numbers)
 - F-4/Z additional GM-1 injection system
- **F-5** (Recon version of F-4, only two MG 17)
- **F-6** (Recon version of F-4, improved camera equipment)

[\[edit\]](#) Bf 109G "Gustav"



Messerschmitt Bf 109 G-5



Bf 109G-6 on display in the Polish Aviation Museum in Kraków.



Gustav Rödel Bf 109-G2 remake in the [Luftwaffenmuseum](#) in Berlin



Bf 109G-2/Trop 'Black 6', Now on static display [RAF Hendon](#) London

When the 1,475 hp [Daimler-Benz DB 605](#) engine was available, a new Bf 109 series, the G-series, was developed. The early versions of the **Bf 109G** looked quite similar to the Bf 109 F-4, and at first carried the same armament. The G-series saw the appearance of the notorious bulges in the cowling (caused by the DB605 (additional cooling) and by replacing the 7.92 mm MG 17 with 13 mm [MG 131](#) machine guns (**G-5** onwards)) and on the wings (due to larger main gear wheels, **G-4** onwards), leading to the Bf 109G's nickname "The Bulge" (German: "Die Beule"). The DB605 suffered several reliability problems during the first year of operation forcing Luftwaffe units to lower max power to about 1,310 hp (975 kW) until October 1943. Other changes included an enlarged supercharger for the DB605 and an enlarged vertical stabilizer (G-5 onwards). All this was part of the continuous effort to increase the speed of the Bf 109, especially as the Allies deployed better and faster fighters like the P-51D and the later Spitfires. It has been suggested that the added weight of the new engines and heavier armaments badly affected the handling characteristics of the Bf 109, especially since it already had a high wing loading. While technically the statement is true, it is somewhat unfair as

analysis show only a modest increase in weight as a result of development, fairly compareable to the development trend with Western Allied fighters.

With the Gustav, a number of special versions were introduced to cope with special mission profiles. Here, long range fighter-reconnaissance and high-altitude interceptors can be mentioned. The former were capable carrying two 300 liter drop-tanks, one under each wing, the latter received pressurized cockpits for pilot comfort and GM-1 nitrous oxide 'boost' for high altitudes. The latter system was capable of increasing engine output for limited periods by 300 horsepower above rated altitude and high altitude performance above of that of any Allied fighter in service in 1942-43.

The **G-2** was the first of the G-series in production in early 1942 to be accomplished by the **G-1** with pressurized cockpit just some weeks later. In autumn 1942 production was changed to **G-4** and the pressurized version **G-3** (only 50 produced). As the weight increased again many late-production G-2 and all G-3/G-4 had larger main and tail wheels requiring the first small bulges on the wing. The larger tail wheel was only partially retractable causing more drag and a loss in speed of about 6 km/h occurred. In summer 1943 the **G-6** was introduced with even more bulges to cover the 13 mm [MG 131](#) cowling machine guns, replacing the smaller 7.92 mm MG 17. These bulges reduced speed by further 12 km/h. The **G-5** was a G-6 with pressurized cockpit, the **G-5/AS** was the first to be equipped with a DB 605AS engine for high altitude missions (sometimes even with [GM-1](#) injection).

The **G-6** model, the most produced Bf 109 version, had heavier armament. The **G-6/U4** variant with Rüstsatz R6 was armed with two 13 mm MG 131 above the engine, a 30 mm [MK 108 cannon](#) shooting through the propeller hub and one 20 mm MG 151/20 in a 'pod' under each wing. The G-6 was very often fitted with assembly sets, used to carry bombs or a drop tank, for use as nightfighter, or to increase fire power by adding rockets or extra guns. During 1943, a number of improvements were gradually introduced for the type's benefit : armoured glass head-rest ('Galland Panzer') (early 1943), and the introduction of the clear-view 'Erla Haube' canopy (autumn 1943) improved visibility - especially to the rear, and a taller tail unit improved stability at high speeds. The introduction of the WGr. 21cm under-wing mortar/rockets and the 30 mm [MK 108 cannon](#) increased firepower. Certain production batches of the Gustav were fitted with aileron Flettner tabs to decrease stick forces at high speeds. Advanced radio/navigational equipment was also introduced.

Subsequent Bf 109G versions were basically modified versions of the G-6. Early in 1944, new engines with larger superchargers for improved high-altitude performance (DB 605AS), or with MW-50 methanol-water injection for improved low/medium altitude performance (DB 605AM), or these two features combined (DB 605ASM) were introduced into Bf 109 G-6.

The **G-8** was a dedicated recon version based on the G-6. The G-8 had often only the engine cannon or the cowling machine guns installed and there were several subversions for short or long range recon missions with a wide variety of recon cameras and radios available for use.

The **G-14**, appearing in mid-1944 was basically a late-war Bf 109 G-6 with the aforementioned improvements standardized, and methanol injection increasing output to 1800 HP being a standard fitting. High-altitude models of the G-14 received the DB 605ASM engine and were named G-14/AS. There was increasing tendency to use wood on some less vital parts (e.g. the tailfin, pilot seat or instrument panel) - not because of the shortage of strategic materials like aluminium as often suggested, but as it allowed freeing up metalworking capacity by involving of the woodworking industry of more parts.

The **G-10** was an attempt to match the proven Bf 109 G-6/G-14 airframe with the new and more powerful DB 605D engine with minimal disruption of the production lines. Despite what the

designation would suggest, it appeared in service after the G-14 and somewhat the K-4 in November 1944. Early production G-10s used fuselages taken from the G-14 production lines, this was probably a source of confusion as many authors still believe many G-10 were based on recycled G-series fuselages. The most recognizable change was the use of the "ERLA-Haube" canopy, sometimes referred to (incorrectly) as the 'Galland' hood. This canopy improved the pilot's view by reducing the number of support struts, which was often criticized before. The G-10 was produced in very substantial numbers, with some 2600 G-10s produced until the war's end. The Bf 109 G-10, AS-engined G-5s, G-6s and G-14s as well as the K-4 saw a refinement of the bulges covering the breeches of the cowl mounted MG 131, these taking on a more elongated and streamlined form as the large engine supercharger required a redesign of the cowling.

A similar varying product was the Bf **109 G-12**. This was a two-seat trainer version of the Bf 109 and was rarely armed with anything more than the two cowling machine guns. The space needed for the second cockpit was gained by reducing the internal fuel capacity to only 240 l thus they nearly always used the 300 l drop tank as standard equipment. The G-12 was built using a wide variety of G-series fuselages, many were G-2 based but several were built of rebuilt/repaired G-1, G-4 and G-6.

Bf 109G variants and sub-variants Variants could be equipped with a "Rüstsatz" add-on kit (field modification) or a "Umrüst-bausatz", or **Umbau**, conversion kit (factory conversion). In either case, the modified aircraft were identified with either an /R or /U suffix, eg. Bf 109 G-10/**U4**.

Common Umrüst-Bausatz [Umbau] numbers

- **U1** Messerschmitt P6 reversible pitch propellor to be used as air brake, only prototypes
- **U2** [GM-1](#) boost
- **U3** [MW 50](#) boost
- **U4** 30 mm [MK 108](#) engine-mounted cannon

Common Rüstsatz numbers

- **R1** belly bomb rack for 250 kg bomb
- **R2** wing bomb racks for 4x 50 kg bombs or 2x WGr21 rockets (or, for the G-1 to G-4 series, recon equipment)
- **R3** belly drop tank (300 l)
- **R4** two 30 mm MK 108 underwing gunpods (not in operational use)
- **R6** two 20 mm MG151/20 underwing gunpods

Known Variants

- **G-1** (Pressurized fighter)
 - G-1/R2 (Lightened high altitude fighter - GM1, and armor removed)
 - G-1/U2 (High altitude fighter with GM1)
 - G-1 Trop (Never actually existed a "made up" version)
- **G-2** (Light fighter)
 - G-2/R1 (Fighter-bomber- 2 underwing drop tanks, extra tail wheel)
 - G-2/R2 (Reconnaissance fighter)
 - G-2 Trop (Tropicalized fighter)
- **G-3** (Pressurized fighter based on G-1 with new radio equipment, only 50 built)
- **G-4** (Reconnaissance fighter)
 - G-4/R2 (Reconnaissance fighter)
 - G-4/R3 (Reconnaissance fighter)

- G-4 Trop (Tropicalized Reconnaissance fighter)
- G-4/U3 (Reconnaissance fighter with MW50)
- G-4y (Command fighter)
- **G-5** (Pressurized fighter)
 - G-5/U2 (High altitude fighter with GM1 boost)
 - G-5/U3 (Fitted with MW-50)
 - G-5/AS (High altitude fighter with DB605AS)
 - G-5y (Command fighter)
- **G-6** (Light fighter)
 - G-6/R2 4x 50 kg wing bombs (fighter bomber), or two Wfr.Gr. 21 rockets (heavy fighter)
 - G-6/R3 (Reconnaissance fighter)
 - G-6/R6 (Heavy fighter - two additional 20 mm guns)
 - G-6 Trop (Tropicalized fighter)
 - G-6/U2 (Fitted with GM-1)
 - G-6/U3 (Fitted with MW-50)
 - G-6/U4 (MK108 30 mm engine cannon)
 - G-6y (Command fighter)
 - G-6/AS (High altitude fighter with DB605AS)
 - G-6/ASy (High altitude command fighter)
 - G-6N (Night fighter, usually with R6 and [FuG 350Z Naxos](#))
 - G-6/U4 N (as G-6N but with 30 mm MK 108 engine cannon)
- **G-8** (Reconnaissance fighter as G-6, but with camera installation behind cockpit, reduced armament in some planes)
- **G-10** (Light fighter with DB605D/DM/DBM engine)
 - G-10/R5 (Reconnaissance fighter)
 - G-10/R6 (Heavy fighter - two additional 20 mm guns)
 - G-10/U4 (Fitted with MK 108 30 mm engine cannon)
- **G-12** (Two-seat trainer, built from older G-1/G-5)
 - G-12/R3 (300l drop tank)
- **G-14** (Light fighter, evolution of G-6)
 - G-14/R6 (Heavy fighter - two additional 20 mm guns);
 - G-14/AS (High altitude fighter with DB605ASM);
 - G-14/ASy (High altitude command fighter);
 - G-14y (Command fighter);
 - G-14/U4 (Fitted with MK 108 30 mm engine cannon)
- **G-16** (Fighter Bomber); based on G-14 with additional armor - production started but soon after war was over

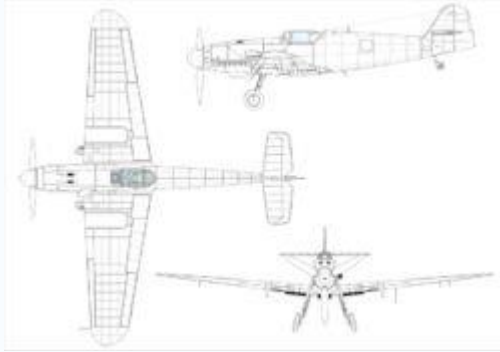
Bf 109H



Messerschmitt Bf 109 H-1

The Bf **109H** was intended to be a high-altitude fighter, developed from the Bf 109F series. The wingspan was increased to 11.92 m, the stabilizer again received a strut leading to the fuselage, and it was also widened. Maximum speed was 750 km/h at 10,100 m. A small number of Bf 109 H-1s were built, flying several sorties in France. *Bf 109 H-2* and *H-5* developments were also planned, before the entire H-series was scrapped because of wing flutter problems.

Bf 109K "Kurfürst"



Messerschmitt Bf 109 K-4

Most of the planes of the Bf **109K** "Kurfürst" series saw duty. This series was the last evolution of the Bf 109. The K series was a response to the bewildering array of series, models, modification kits and factory conversions for the Bf 109, which made production and maintenance complicated and costly — something Germany could ill-afford late in the war. The RLM ordered Messerschmitt to rationalise production of the Bf 109, consolidating parts, types etc to produce a uniform, standard model with better interchangeability of parts and equipment. This was to have started in the later models of the G series, but things went in quite the opposite direction. The RLM told Messerschmitt, in effect, to try harder, and the K series was born. Work on the new version began in 1943, and the prototype was ready by the autumn of that year. Series production started in August 1944 due to delays with continuous changes and the new DB605D powerplant. Operational service began in October 1944, and large numbers — approximately 200 — were delivered to frontline units by the end of the month. By the end of January 1945, despite continuous heavy fighting, over 300 K-4s — about every 4th 109 — were listed on hand with the 1st line Luftwaffe units.

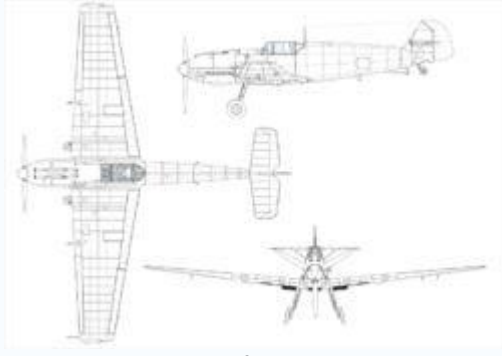
In the proposed K-6, K-8, K-10 and the K-14 the armament would have seen some changes. They retained the two MG 131 above its engine and added a built-in MK 108 in each wing and a MK 108 engine mounted cannon. The K-14 would have had the special performance DB605L and four bladed propeller.

Only the **K-4** saw action in numbers, approximately 1,700 being delivered by factories before the end of hostilities. Some sources point to limited use of the K-14, but the type was never actually built. K-4s with quasi-DB605Ls, a DB605 with the two-stage super-charger but not other improvements, and the standard three-bladed propellers, were assembled. Armament of the K-4 consisted of a 30 mm MK 108 engine-mounted cannon with 65 rounds and two 13 mm MG 131 in the nose with 300 rounds each, and there was the capacity to carry additional equipment such as a droptank, bombs up to 500 kg, underwing 20 mm gondolas or 210 mm rockets (as on the Gustav models); the latter two however were rarely used due to marauding Allied fighters calling for performance.

The Bf 109 K-4 was the fastest 109 of WWII reaching ~715 km/h (445 mph) at 7,500 m altitude; improved propellers were being developed when the war ended which would boost the speed to 727 km/h (452 mph), or even 741 km/h (460 mph). Rate of climb was outstanding, up to 5,800 ft/min at

1.98ata, and 5,500 ft/min at 1.8ata. With such improvements in performance, the Bf 109 remained comparable if not superior to the highest performance Allied or Soviet fighters until the end of the war. However, the deteriorating ability of the thousands of novice Luftwaffe pilots by this stage of the war meant the 109's strengths were of little value against the numerous and well-trained Allied fighter pilots.

Bf 109T "Trägerflugzeug" (carrier aircraft)



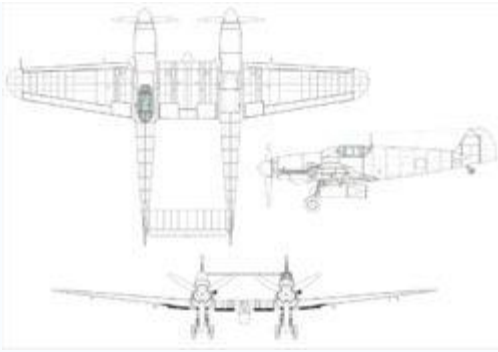
Messerschmitt Bf 109 T-1

Prior to the war the [German Navy](#) had become fascinated with the idea of the [aircraft carrier](#). Borrowing ideas from the [British](#) and [Japanese](#) (mainly the [Akagi](#)), they started the construction of the [Graf Zeppelin](#) (not to be confused with the [airship Graf Zeppelin](#)) as part of the rebuilding of the navy. The air group for the carrier was settled on Messerschmitt Bf 109T fighters and [Ju 87T](#) dive bombers. The suffix 'T' denoting carrier, 'Träger', in German use.

Initially ten Bf 109E-3 were ordered to be modified to Bf **109T-0** standard. This included, adding a tail-hook, catapult fittings, structural strengthening, manually folding wings and increased wingspan (to 11.08 m). Also the landing gear track was a little wider. Thus prepared, the Bf 109T probably would have been proven much better for carrier operations than the British [Supermarine Seafire](#), a hardly modified landplane that suffered from a bad accident rate flying from carriers.

Following the flight tests, especially the catapult tests, a series of 70 **T-1** with DB601N engine was to be produced at [Fieseler](#) in Kassel, but after seven T-1 were built, the carrier project was canceled. The remaining 63 of 70 T-1 were built as **T-2** without carrier equipment and some of the T-0 and T-1s may have been "upgraded" to T-2 standard. These planes were assigned to [I/JG.77](#), deployed in Norway. The decision to base them in Norway was made primarily by the conditions on the Norwegian landing strips. These landing strips being both short and subject to frequent, powerful cross-winds. Some time after the unit was ordered to turn over their aircraft to a test unit that was training on the Drontheim-Fjorde strip and received E-3s as replacements. The armament of the Bf 109T consisted of two MG 17 above the engine and one MG FF/M cannon in each wing.

Interest in the *Graf Zeppelin* returned when the value of aircraft carriers became obvious, and in 1942 the ship was back in the yards for completion. By this time the Bf 109T was hopelessly outdated and a new fighter would be needed. Messerschmitt responded with the updated [Me 155A](#) series, but work on the ship was again canceled and the Me 155 was later re-purposed as a high-altitude interceptor. Bf 109Z "Zwilling"



Messerschmitt Bf 109 Z-1

This experimental aircraft was essentially two Bf 109F airframes (together with outer wing panels) joined together by means of a new wing, and new tail section, in a manner that was paralleled by the USA's [F-82 Twin Mustang](#). Two variants of this aircraft were proposed, one being an interceptor armed with five 30 mm cannons, and the other a fighter-bomber with a 1,000 kg bomb load. Only one Bf 109Z was ever built, and it was never flown, having been destroyed in an Allied bombing raid while in hangar.

Bf 109W "Wasserflugzeug" projekt

Contrary to popular belief, the twin-pontoon **Bf 109W** floatplane was made up after the war and is entirely fictional.

- [\[2\]](#)
- [\[3\]](#)

Combat service with Finland

In 1943, the [Finnish Air Force](#) received its first Bf 109s. 162 aircraft of this type were to be purchased and the first aircraft landed in Finland on [13 March 1943](#). In total, 159 aircraft were taken into service, as two G-6s and one G-8 were destroyed en route to Finland. Of these, 48 were G-2s, 109 were G-6s and 2 were G-8s. Bf 109 is still the aircraft that has served in the largest numbers in the Finnish Air Force. The aircraft was called "Mersu" in popular speech (the same as the nickname for Mercedes-Benz cars, whose parent company Daimler-Benz produced the Bf 109 engine) and carried the designation MT and a 3-digit identification number. With the arrival of the 109s, the fight was anew more equal as they could match the latest Soviet fighters. The last of the purchased aircraft arrived in Finland on [20 August](#) 1944, just before the armistice with the Soviet Union.

During the Continuation War, Bf 109s were in service with fighter squadrons 24, 28, 30 and 34:

Finnish Bf 109G tally:^[6]

| | HLeLv 24 | HLeLv 28 | HLeLv 30 | HLeLv 34 |
|-------------------------|-----------------|-----------------|-----------------|-----------------|
| Victories | 304 | 15 | 3 | 345 |
| Losses in combat | 14 | 0 | 2 | 18 |

The Finns scored 667 confirmed victories with the type, while losing 34 Bf 109s to enemy fighters or AA-fire. A further 16 were lost in accidents and 8 aircraft were destroyed on the ground. 23 pilots were lost. ^[6]

102 Bf 109s survived the war and the aircraft was to be the main fighter of the Finnish Air Force for almost a decade after the end of the second World War. Due to the aircraft's short life span (it was built as a wartime aircraft and was calculated to last about 100-200 flight hours), it was taken out of service in spring 1954 and the FAF entered the jet age. The last flight was conducted on [13 March](#) 1954 by Major Erkki Heinilä in the aircraft MT-507.

Museum aircraft in Finland

Several Bf 109s are preserved in Finland. MT-452 is on display at the airfield in Utti^[7], and the [Central Finland Aviation Museum](#) displays the MT-507, which was the last flying Bf 109 of the FAF.^[8] The Finnish airplane constructor [Valtion Lentokonetehdas](#) also manufactured a fighter, called [VL Pyörremyrsky](#), whose appearance greatly resembled the Bf 109 but which also features some significant improvements, e.g. significantly easier handling, different wing construction and re-designed landing gear. One single aircraft was produced before the end of the war and that aircraft is today displayed at the Central Finland Aviation Museum. Further, the doctoral thesis by the productive Finnish aircraft expert Hannu Valtonen is called "Tavallisesta curiositeetiksi - Kahden Keski-Suomen Ilmailumuseon Messerschmitt Bf 109 -lentokoneen museoarvo" (From regular to a curiosity - The museal value of two Messerschmitt Bf 109s at the Central Finland Aviation Museum).

Combat service with Switzerland

[Switzerland](#) took delivery of its first Bf 109s in 1938 when ten Bf 109Ds were delivered. After this, 80 109E-3s were purchased which arrived from April 1939. During the war, a further four 109s (two Fs and two Gs) were acquired by the Swiss Air Force through internment. The 109Es were supplemented by eight aircraft licence manufactured by Doflug, at Altenrhein, from spare parts and delivered in 1944.

In April 1944, 12 further G-6 aircraft were acquired in exchange for the destruction of a highly secret [Messerschmitt Me 110G nightfighter](#) which made an emergency landing in Switzerland. The new 109Gs suffered from numerous manufacturing defects and after problematic service were withdrawn from use by May 1948. The 109Es continued in service until December 1949.^[9]

On [10 May](#) 1940, air combat between Switzerland and Germany was initiated. Several Swiss Bf 109s engaged a German [Dornier Do 17](#) near the border at Bütschwil; in the ensuing exchange of fire, the Dornier was hit and eventually forced to land near Altenrhein. The scene was repeated on [16 May](#) when a German [He 111](#) returned from France by way of Swiss airspace. Two Swiss fighters jumped the light bomber when it dropped below cloud cover to de-ice its wings. The German aircraft was hit by machine gun fire and was further damaged by anti-aircraft fire near [Zürich](#). Two injured flyers parachuted; the other two crew members went down with the plane and were captured.^[citation needed]

On [1 June](#) when the Germans sent 36 He 111s through Swiss airspace, Switzerland sustained its first casualty. Sub Lieutenant Rudolf Rickenbacher was killed when his Bf 109 caught fire after being hit in the fuel tank by enemy fire.^[citation needed]

On [8 June](#), a C-35 observation plane, a relic biplane, was attacked over the [Jura Mountains](#) by two German Bf 110s. The pilot and observer were killed. Later on the same day, Swiss Captain Lindecker led about 15 Swiss fighters against 28 German planes. The Swiss pilots again displayed their ability in air-to-air combat, knocking three of the German planes from the sky and severely wounding the crew in a fourth. A Swiss Bf 109 was hit and damaged in the dogfight.^[citation needed]

During the war, the Swiss aircraft were painted with red and white striped "neutrality markings" around the fuselage and main wings to avoid confusion with German 109s.

Combat service with Yugoslavia



Bf 109 E-3 from 6th fighter regiment of Royal Yugoslav Air Force, April 1941

In 1939, [Yugoslavia](#) received 73 Bf 109E-3s in exchange for iron, copper and chrome ore. However, the aircraft were grounded most of the time due to a lack of spares. The Yugoslav pilots were not happy with their new fighters as there were a lot of landing accidents due to the Messerschmitt's narrow landing gear. When the Germans invaded in April 1941, the Royal Yugoslav Air Force put up a fight but could do little to repel the invaders. On 6 April, during [Operation Punishment](#), 12 Yugoslav Bf 109s along with six other Yugoslav-made Icarus IK-3s downed 12 German Messerschmitts during the Battle of Yugoslavia. [\[citation needed\]](#).

By the end of the war, 17 Bf 109s were left. These were stored until 1959 while more were acquired from Bulgaria. The new Yugoslav Air Force used a mix of G-2, G-6, G-10 and G-12 aircraft until mid-1952.

Developments after World War Two



[Hispano Aviacion Ha 1112](#) *Buchon*, the second and last Spanish version built by [Hispano Aviacion](#)



Bf 109 G-2 no Dream of the Wings Museum in [São Carlos, Brazil](#)

Czechoslovak production

After the war, some Bf 109s were produced in [Czechoslovakia](#) as the [Avia S-99](#) and [Avia S-199](#). These were modified Bf 109G-14s, the latter with the inferior [Junkers Jumo 211F](#) engine, which resulted in an aircraft with remarkably poor handling characteristics and a tendency to crash during landings. As noted above, Czech pilots who had previously flown Spitfires for the RAF nicknamed the aircraft "the Mule."

Several of the S-199s were sold to [Israel](#), forming the basis of the nascent [Israeli air force](#). [4] These aircraft were used by [Israel](#) in its War of Independence till the end of 1948 under the [Hebrew](#) designation *Sakin* (= "knife"), some flying in combat against [Egyptian Spitfires](#) [5]. It was replaced by a mixture of [P-51 Mustang](#) and [Spitfires](#).

Spanish production

In [Spain](#), two versions of the Bf 109G-2, the [Hispano Aviacion Ha 1112](#) "Tripala" and "Buchon", [6] were built under license, the former with the [Hispano-Suiza](#) engine, and later with the same [Rolls-Royce Merlin](#) engines which had powered Spitfires. Many of these aircraft have been used for theatrical purposes, posing as Emils and Gustavs in [Battle of Britain](#) and [Tuskegee Airmen](#), respectively. These modifications were carried out in the [Hispano Aviacion](#) factory in [Seville](#).

The end of the Bf 109 era

The original Bf 109, produced before 1945, remained in service for many years after the war. The former German ally Romania used its Bf 109s until 1955. The Finnish Air Force did not retire their Bf 109Gs until March 1954. Hungarian 109s, conversely, were destroyed in Germany by their own crews on 6 May 1945. The Spanish Hispanos, however, flew longer. Some were still in service into the late 1960s. They appeared in films (notably *The Battle of Britain*) playing the role of the Bf 109. Some Hispano airframes were sold to museums, which rebuilt them as Bf 109s. The Swiss used their Bf 109Gs well into the 1950s.

Operators

[Bulgaria](#)

- [Bulgarian Air Force](#) operated 19 aircraft of the E-3 version and 145 of the G-2/-6/-10 versions.



- [Croatian Air Force](#) operated E-4, F-2, G-2/-6/-10 versions.

[Finland](#)

- [Finnish Air Force](#) operated 162 aircraft (48 aircraft of the G-2 version, 111 of the G-6 version and 3 of the G-8 version).
 - [No. 24 Squadron, Finnish Air Force](#)
 - [No. 28 Squadron, Finnish Air Force](#)
 - [No. 30 Squadron, Finnish Air Force](#)
 - [No. 34 Squadron, Finnish Air Force](#)

[Germany](#)

- [Luftwaffe](#) was main operator of the Bf 109.

[Hungary](#)

- [Hungarian Air Force](#) operated 3 aircraft of the D-1 version, 500 of the E-3/-4 versions, 20 of the F-4 version and 890 of the G-2/-4/-6/-10/-14 versions.

Italy

- [Regia Aeronautica](#) operated some F-4 version.

Italian Social Republic

- [Aeronautica Nazionale Repubblicana](#) operated 300 aircraft of the G-6/-10/-14 versions and 2 of the G-12 version.

• Japan

- [Imperial Japanese Army Air Service](#) received 2 aircraft of the E-3 version, 2 of the G version and 1 of other version.

Romania

- [Romanian Air Force](#) operated 69 aircraft of the E-7 version and 135 of the G-2/-6/-8 versions.

Slovakia

- [Slovak Air Force](#) operated 16 aircraft of the E-3 version, 14 of the E-7 version and 30 of the G-6 version.

Soviet Union

- [Soviet Air Force](#) operated 3 aircraft of the E-3a version.

Spanish State

- [Spanish Air Force](#) operated some D-1 and E-3 versions and 15 × F-4 version

Switzerland

- [Swiss Air Force](#) operated 10 aircraft of the D-1 version, 80 of the E-3a version, 12 of the G-6 version and some others.

Yugoslavia

- [Royal Yugoslav Air Force](#) operated 73 aircraft of the E-3a version.
- [SFR Yugoslav Air Force](#) operated several ex-Bulgarian G version fighters.

Specifications (Bf 109 G-6)

Data from The Great Book of Fighters^[10] and the Finnish Air Force Bf 109 Manual

General characteristics

- **Crew:** One
- **Length:** 8.95 m (29 ft 7 in)
- **Wingspan:** 9.925 m (32 ft 6 in)

- **Height:** 2.60 m (8 ft 2 in)
- **Wing area:** 16.40 m² (173.3 ft²)
- **Empty weight:** 2,247 kg (5,893 lb)
- **Loaded weight:** 3148 kg (6,940 lb)
- **Max takeoff weight:** 3,400 kg (7,495 lb)
- **Powerplant:** 1× [Daimler-Benz DB 605](#)A-1 liquid-cooled inverted V12, 1,475 PS (1,455 hp, 1,085 kW)

Performance

- **Maximum speed:** 640 km/h (398 mph) at 6,300 m (20,669 ft)
- **Cruise speed:** 590 km/h (365 mph) at 6,000 m (19,680 ft)
- **Range:** 850 km (528 mi) with droptank 1000 km (620 mi)
- **Service ceiling:** 12,000 m (39,370 ft)
- **Rate of climb:** 17.0 m/s (3,345 ft/min)
- **Wing loading:** 199.8 kg/m² (40.9 lb/ft²)
- **Power/mass:** 330 W/kg (0.21 hp/lb)

Armament

- 2×13 mm [MG 131](#) machine guns
- 1×20 mm [MG 151/20](#) cannon (or 1× 30 mm [MK 108](#), G-6/U4)
- 1×300 l (78 US gal) drop tank or 1×250 kg (550 lb) bomb or 4×50 kg (110 lb) bombs
- 2×WGr.21 rockets (G-6 with BR21)
- 2x 20 mm [MG 151/20](#) underwing cannon pods (G-6 with R6)

External links and sources

- *The History of German Aviation: Willy Messerschmitt - Pioneer of Aviation Design*, [ISBN 0-7643-0727-4](#)
- [Bf 109 Restoration](#)
- [Bf 109 Aircraft Variations](#)
- [Luftwaffe Archive](#)
- [The 109 Lair](#)
- [Bf 109 Pictures](#)
- [109F-4 documents](#)
- [Photo gallery of Messerschmitt Bf 109G-5](#)
- [Kurfürst! - Resource on Messerschmitt Bf 109 performance. Contains wartime performance trials, and other Bf 109 related documentation.](#)
- [Neil Page's web site - translated German pilot accounts and exclusive material on the leading Reich's defence Geschwader JG 300](#)
- [Messerschmitt 109 - myths, facts and the view from the cockpit. Extensive reviews from the pilots who actually flew the Bf 109.](#)
- [Japanese Army tests of Messerschmitt Bf 109 E in Japan.](#)

Related development

- [Me 209-II](#)
- [Me 109TL](#)

Comparable aircraft

- [Bell P-39](#)
- [Curtiss P-40](#)
- [Dewoitine D.520](#)
- [Focke Wulf Fw 190](#)
- [Hawker Hurricane](#)
- [Hawker Tempest](#)
- [Heinkel He 112](#)
- [Kawasaki Ki-61 Hien](#)
- [Macchi C.202 Folgore](#)
- [Macchi C.205 Veltro](#)
- [Martin-Baker M.B.5](#)
- [Mikoyan-Gurevich MiG-3](#)
- [North American P-51 Mustang](#)
- [Yakovlev Yak-9](#)

Designation sequence

[KI 106](#) - [KI 107](#) - [Bf 108](#) - **Bf 109** - [Bf 110](#) - [He 111](#) - [He 112](#)