Bf 109G-6 Pilot Handbook

BY FLYINGIRON SIMULATIONS

For Microsoft Flight Simulator

FLYINGIRON SIMULATIONS | WWW.FLYINGIRONSIMULATIONS.COM

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Foreword

Greetings Pilots! Guten Tag!

Welcome to the FlyingIron Bf 109G-6 experience! We are very excited & proud to present what is undoubtedly our most comprehensive simulation experience so far. The Bf 109 requires little introduction, being one of the most significant fighters in aviation history. The German aircraft holds the distinct achievement of being the most produced fighter aircraft of all time, with over 33,000 units produced - making up almost half of all German aircraft produced during the war.

You'll need your wits about you, a steady hand and active feet on the rudder in order to be successful in the 109. We have poured more man-hours into this module than any of our previous modules so far, and the result is a simulation experience that is more realistic than anything we've done before. You'll need to carefully manage your engine to avoid failures & oil blowouts, practise your landings to avoid collapsing and damaging the landing gear, manage spark plug fouling & much, much more!

With that being said, we want this to be an aircraft for everyone; to that end we have done our best to make as many realism features optional as we can. So if you are looking for a simpler, more carefree flight experience in the 109, you'll be able to find these options in the FlyingIron tablet (located inside the aircraft). Not all features can be toggled however, and the Bf 109 is by nature a very difficult aircraft to fly! Patience, persistence & practice is key to achieving mastery over this incredible aircraft.

We sincerely hope that you enjoy flying this aircraft as much as we have enjoyed producing it. The Bf 109 is an icon of aviation history, and its legacy will undoubtedly remain for centuries to come. We are blessed to live in a golden age of flight simulation - now get out there and enjoy flying!

Sincerely,
FlyingIron Simulations

About Us

FlyingIron Simulations is an Australian Flight Simulator development team - based in Sydney, Australia - that creates military & civilian aircraft simulations for Flight Simulator platforms, specialising in historic warbirds and military aircraft. FlyingIron was founded in 2018 by two brothers, Alex & Daniel Kassabian. The team has since expanded internationally with Raimond (Got Gravel) joining the team in 2021 and becoming an invaluable member of our core team ever since; bringing with him extensive MSFS development experience. Since then we've recruited a number of talented artists and programmers to our cause, including Iakov, Oleg & 'Cuper'; who between them have extensive experience working on AAA games & sims.

FlyingIron initially started developing for the X-plane 11 platform, with 4 aircraft releases between 2018-2020. Each aircraft was highly regarded by the community, with quality continuing to improve with every release and even featuring in several print magazines.

As of 2020, FlyingIron Simulations moved to the MSFS platform, beginning with the release of the Spitfire MkIX and followed by the P-38 Lightning, officially licensed by Lockheed Martin. The F6F Hellcat marked FlyingIrons 3rd aircraft release for Microsoft Flight Simulator; followed up with the Bf-109 in 2023.

Simultaneously in 2020, FlyingIron was officially licensed by Eagle Dynamics to develop the A-7E Corsair II for the prestigious DCS world, marking the teams first foray into military jets and study-level simulation. FlyingIron has been steadily working at developing the most realistic A7 simulator available, with development time over 3 years now and thousands of man hours poured into the project. As part of the development process, FlyingIron worked alongside 'Research in Flight' to develop software in the CFD world - this software was then presented at NASA's OpenVSP Workshop in 2022.

Work on the Corsair continues going strong and is highly anticipated by the DCS community.

Installation & Update Procedure

You can install the aircraft by extracting the download into your Community folder.

1. Open the downloaded .zip file with your Zip tool of choice (the default Windows ZIP tool will do, or else an up-to-date 7-Zip app for example).
2. Drag the “flyingiron-bf109” folder into the MSFS Community folder.
3. Restart Microsoft Flight Simulator.

How to find your MSFS Community folder

Default Location for Windows Store MSFS Installations

```
C:\Users\[ComputerName]\AppData\Local\Packages\Microsoft.FlightSimulator_8wekyb3d8bbwe\LocalCache\Packages\Community
```

Default Location for Steam MSFS Installations

```
C:\Users\[Computer Name]\AppData\Local\Packages\
Microsoft.FlightDashboard_8wekyb3d8bbwe\LocalCache\Packages\Community
```

Non-Default Locations

Please read our guide if you cannot find your Community folder: MSFS Where is the Community folder? : FlyingIron Simulations

Quick Start Notes

"Striving to master this most demanding of Second World War vintage aeroplanes is one of aviation's most rewarding challenges."

- John Romain

Eager to quickly try your newly purchased Bf 109G-6 but want to study the manual later? Before you do so, at least check out the **take-off jump start** and **essential pointers** below, they'll give you a fighting chance for a successful first experience.

Note: be sure to read these pointers also before reporting any issues as you may find an answer to what you're looking for. This is a complex aircraft and much is simulated, many "problems" you may be experiencing are by design.

Take-off Jump Start

- Make sure your tailwheel is in TIGHT mode (MSFS **TOGGLE TAIL WHEEL LOCK** keybind).
- Make sure you don't have a left crosswind.
- Flaps at 20° and Stabiliser Trim at -1° (nose-up / tail-down).
- Use the Clear Plug Fouling lever to remove any plug fouling.
- Start your take-off roll by VERY SLOWLY increasing throttle to NO MORE than 1.1ATA. Apply max right aileron and max right rudder at first, then reduce these slightly as you speed up…try to feel it by watching your heading (rudder) and roll (ailerons).
- Lift your tail GENTLY when you approach 100kph (make sure your feet are not on the brakes or a nose over is guaranteed).
- Further increase throttle to 1.3 or even 1.4ATA once your tail has lifted.
- Take-off around 170kph (if this is your first flight, do this WITHOUT those heavy drop tanks, they definitely make your life harder!).
- Expect to do a quick left/right roll correction immediately after you get airborne.
- Raise gear immediately.
- Raise flaps at 200kph.
- Adjust RPM and Stabiliser Trim as needed.

Special Keybinds

- **BEACON LIGHT:** Holds the Starter Inertia button if the battery is on and automatically releases it once at full flywheel RPM (18,000) or when you start the engine.
- **TAXI LIGHT:** Pulls the Clear Plug Fouling lever and automatically releases it once clearing is complete.

Essential Pointers

- **AUTO START:** CTRL-E (MSFS **AUTO START ENGINE** keybind) will start your engine. Prefer Cold & Dark? Follow the MSFS Interactive Checklist in your Toolbar menu. You will also find the same checklists in the FlyingIron Tablet and this manual.
- **ROLLING RIGHT:** Keep rolling right all the time no matter how much RPM (torque!) you have? Likely you have AUTO-RUDDER enabled in the MSFS Assistance / Piloting menu. When you do so it will essentially disable all torque. Your aircraft however has a default Aileron Trim set to compensate for this (torque is huge on a WWII warbird) so you'll either need to disable AUTO-RUDDER or set the Aileron Trim to 0 (Tablet / Settings page).
- **DEAD BATTERY:** Your generator only kicks in at 1,300rpm, so if you're idling on the ground, or your engine is off, the small battery will drain pretty fast if you did not disconnect it (Tablet's Settings tab under Ground Services).
- **GUNS:** Can't see the guns? If you bought your Bf 109 through the Marketplace, then guns are removed (a Microsoft requirement for all Marketplace products). If you bought it through the FlyingIron Simulations website you can toggle guns on or off in the Tablet's Settings page. Do note that guns have weight too, and it will be added to your aircraft.
- **PRIMING:** Don't prime too long (overpriming) or too short (underpriming). Your current prime level is visible as a mouseover tooltip on the primer switch as well as in your tablet's Live Data page. The prime lever will move slower once you are almost primed. Overprimed? De-prime as you would in a real engine: set magnetos or fuel selector to off, open throttle wide, and "start"...the blades will spin and excess fumes will be forced to escape from the cylinders. You can still start an overprimed DB 605 engine, but not when it's underprimed.
- **STRESSES AND FAILURES:** Your 1,475HP (1,800HP with injection) DB 605A-1 V-12 needs to keep its head cool or she'll blow after stuttering and complaining (don't ignore that). She's got in-depth thermodynamic modelling to make it happen. Want to skip that goodness for now? Simply disable "Stresses and Failures" in the tablet's Settings page and you will have the most reliable engine in aviation history. This feature enables or disables engine failures, plug fouling, oil ruptures, electrical failures (circuit breakers may pop out), gear failures and wear and tear.
- **OIL ON WINDSHIELD:** Got oil all over your windshield? You just blew an oil seal! Oil will leak and pressure drop, killing your engine in about one minute. This can easily happen when your oil is cold (high viscosity) and your RPM is high as your oil pressure will shoot through the roof. Fix your damaged oil system in the Tablet's Workshop page and try again, only this time gently warm up your engine (will take a few minutes to reach a minimum of 40C) and watch your oil pressure!
- **WEAR AND TEAR:** Your aircraft has wear and tear modelled for quite a few components, check out the tablet's Workshop tab for those. Also, your gear may fail if stressed too much (extended at high speeds) or even collapse during hard landings. For this too, if you don't want this level of realism, simply disable "Stresses and Failures" in the tablet's Settings page. You also can't retract your gear when pulling more than 1.5G or if you're going too fast…just like in the real aircraft. So right after take-off fly straight, retract, then accelerate further.

- **WAR EMERGENCY POWER:** The Bf 109G-6 has War Emergency Power through MW50 (methanol/water) injection (up to 26 minutes water supply), opening up your maximum allowable manifold pressure from 1.42 ata to 1.70 ata, giving you another 325HP or so. However, use it for no more than 10 minutes (more or less) at a time to prevent engine damage (watch your pressures and temperatures). Use the cockpit switch for it or the MSFS **WAR EMERGENCY POWER** keybind.
- **PLUG FOULING:** The spark plugs of the DB 605A have a tendency to foul when it's running at low RPM below 1.00 ata (ground operations mostly). Ultimately, this will kill the engine. To prevent this either run it above 1.05 ata to clear, and/or use the Clear Plug Fouling lever and pull this until clear. This lever will adjust ignition timing to quickly burn away excess fouling. For your convenience you may use the MSFS **TAXI LIGHT** keybind to operate this lever as well.
- **ENGINE DIED DURING TAXI:** See above…heavy plug fouling.
- **TAILDRAGGER GROUND PHYSICS:** We have coded a custom Taildragger Ground Handling module as we wanted to give you a true-to-life taildragger experience (which is not what MSFS offers out of the box). Expect your aircraft to behave as such! This means amongst other things you will need airflow over that rudder (ground speed, propwash and wind all provide this) to get her to steer, and/or use differential braking using your rudder pedals. It's the real deal now, ground loops included. Don't have rudder pedal brakes? Go to your Tablet's Settings page and enable "Simplified Groundhandling" which will link your rudder deflection to your differential braking. Spend a few minutes on the ground. Once you're used to it, she's a great joy!
- **TAXIING:** Hard to steer while taxiing? Make sure your tailwheel is not in "Tight" mode, it should be in "Loose"! (there is a lever below the canopy handle). Also the Bf 109 has a relatively tiny rudder, it won't do much at taxi speeds. Differential braking is to be used instead when going slow, and **absolutely essential** when turning right against the direction of P-Factor induced yaw.
- **GEAR COLLAPSED:** You landed too hard which can result in one or both gears collapsing. Fix your gear in the Tablet's Workshop tab, and toggle Slew to restore your aircraft's position. Alternatively, disable Stresses and Failures in the Tablet's Settings page.
- **ONE OR BOTH GEAR NOT DEPLOYING:** You possibly damaged it by flying with gear extended at too high a speed. Use the Gear Emergency lever for a gravity-assisted drop of your mains and repair once on the ground. There is a small chance your gear can fail even if you don't go too fast with it extended so do check your gear indicators at all times!
- **RUDDER on TAKEOFF:** Applying full right rudder on take-off and you're still turning left? Happens when you give too much throttle at first when there is insufficient authority provided by the small rudder to counter P-Factor, just like in the real 109. It is VERY important to SLOWLY increase your throttle during take-off and balance rudder authority with power set. This is no Cessna! Practice practice practice.
- **CROSSWIND:** Crosswind pushed you off the runway (likely to the left)? Accept the new heading, don't try to correct (common practice in the 109) as you'll likely get a wing strike. Preferably take-off with a starboard crosswind…port is the worst due to

P-Factor. For this reason, during WWII, it was a common sight to see a pile of 109 wrecks near the left end of the runway. Don't be one of them!

This only covers the proverbial tip of the iceberg but will get you started. However, our Bf 109 simulation is full of juicy details great and small and really, to maximize enjoyment of this vintage aeroplane, some sofa time and reading of the entire manual is the best recommendation we can give you. Left hungry for more? There are tons of resources online and of course, come find us on our FlyingIron Simulations Discord server!

History & Design of the Bf 109G-6

The Bf 109G-6 is a variant of the renowned Bf 109, which was a German fighter aircraft widely used during World War II. The G-6 model was introduced in 1943 and became one of the most produced versions of the Bf 109 series.

Powered by a DB 605A-1 V-12 engine, the Bf 109G-6 boasted a maximum horsepower of 1,475 and could reach a top speed of around 640 km/h (398 mph). With the War Emergency Power feature, enabled through MW50 injection, the engine's performance could be temporarily increased to approximately 1,800 horsepower.

The Bf 109G-6 featured several advancements over its predecessors, including improved armament and increased firepower. It was typically equipped with a combination of machine guns and cannons, providing effective air-to-air combat capabilities.

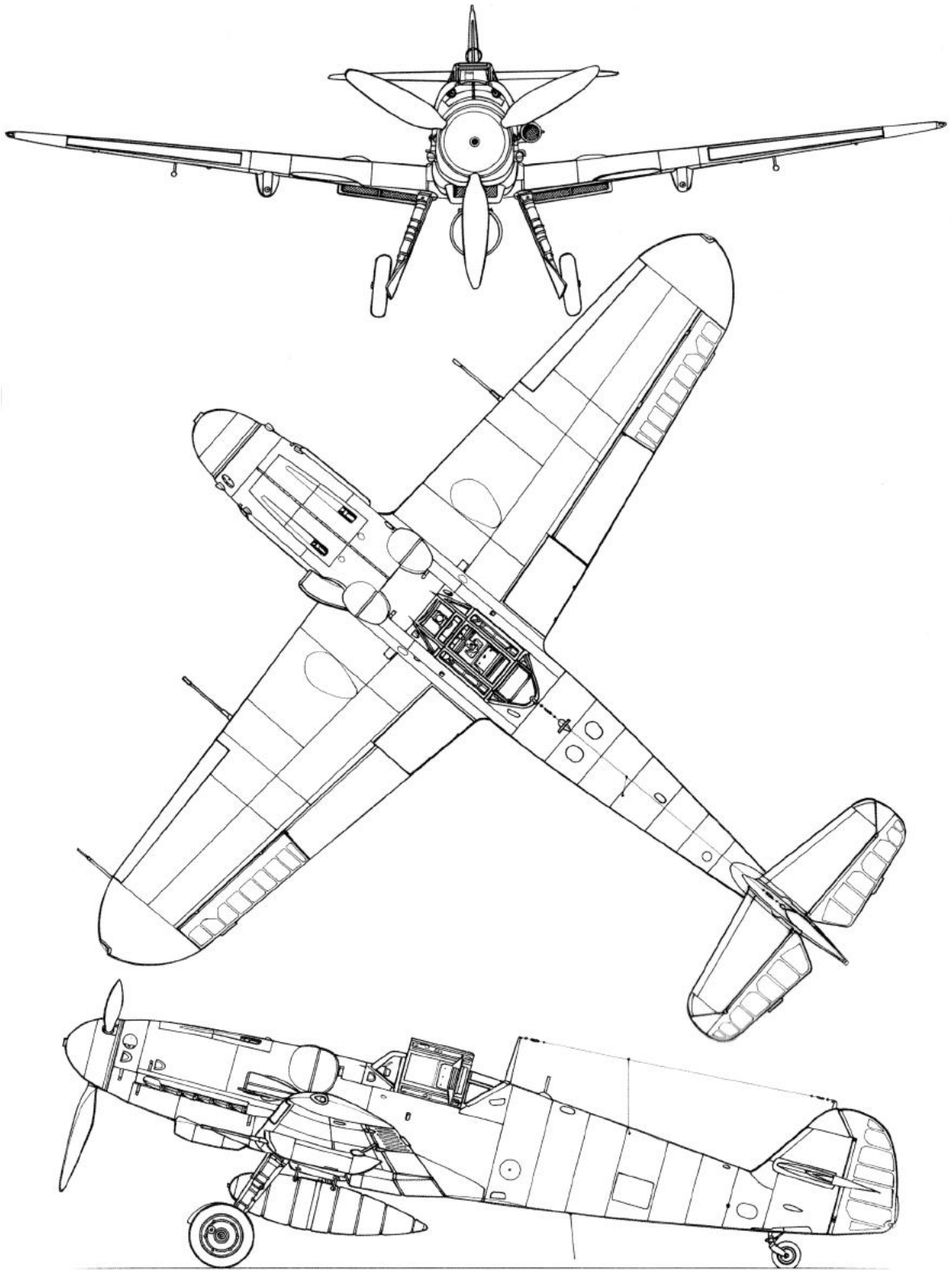
In terms of handling, the Bf 109G-6 was a nimble and highly manoeuvrable aircraft, making it well-suited for dogfights and aerial engagements. However, it required skilled pilots to manage its demanding flight characteristics, especially during takeoff and landing due to its taildragger configuration.

Throughout its operational service, the Bf 109G-6 saw action on multiple fronts, engaging in combat against Allied forces. It was involved in various significant air battles, including the defence of the German homeland and operations on the Eastern Front.

Despite its success as a fighter aircraft, the Bf 109G-6 faced challenges as the war progressed. It had to contend with increasingly advanced Allied fighters and the changing dynamics of air warfare. Nevertheless, it remained a vital asset for the German Luftwaffe until the end of the war.

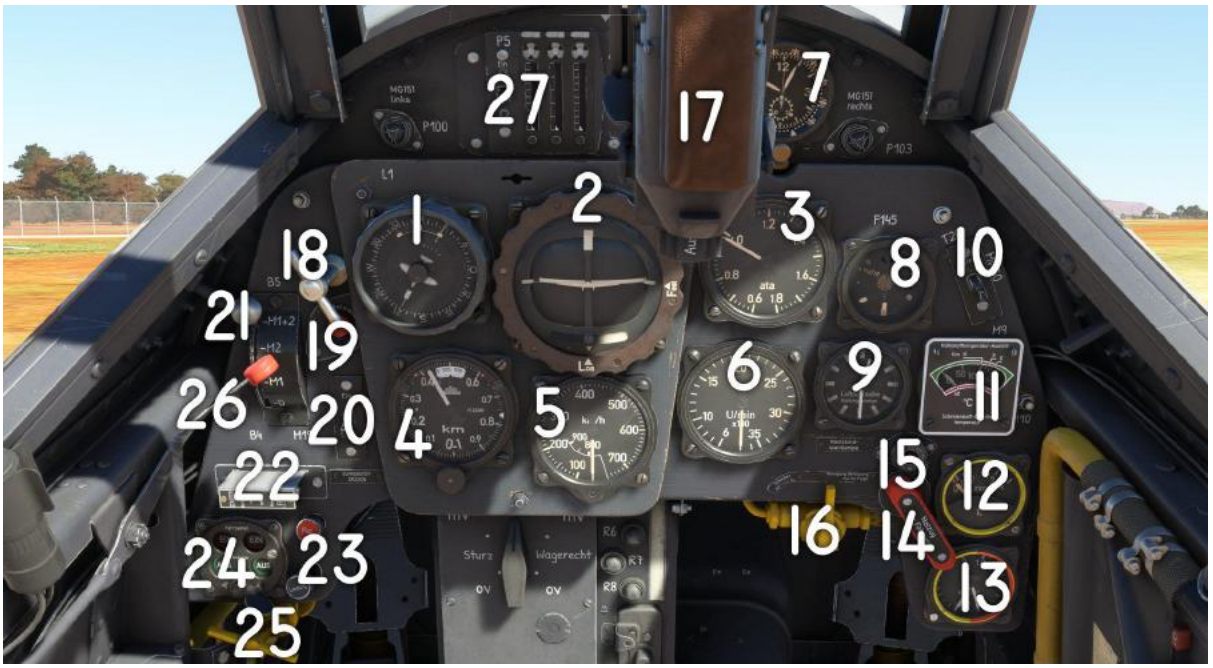
Today, the Bf 109G-6 stands as an iconic symbol of World War II aviation. Its historical significance, along with its distinctive design and performance characteristics, continue to captivate aviation enthusiasts and historians alike.

Aircraft 3-View Plan



Cockpit Familiarisation

Main Instrument Panel

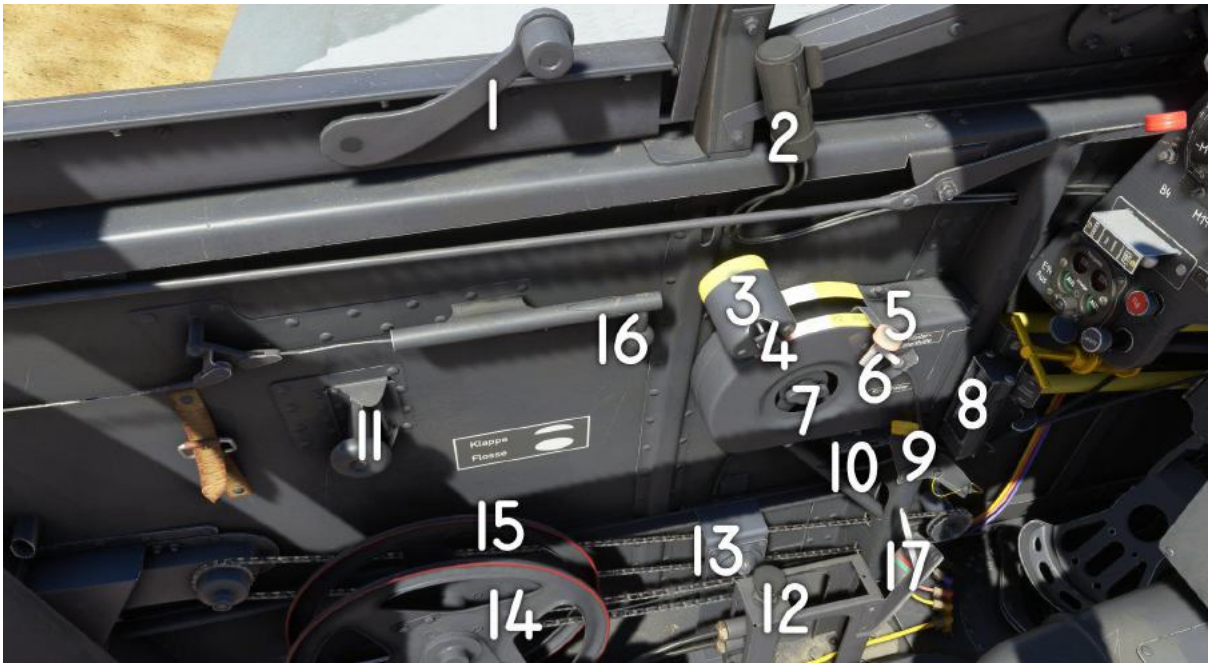


1. Compass (with AP HDG integration)
2. Artificial Horizon (with cage ring)
3. Manifold Pressure Gauge (Ata)
4. Altimeter (km)
5. Airspeed Indicator (kph)
6. Tachometer
7. Junghans J30BZ Chronograph
8. AFN-2 Radio Beacon Indicator
9. Propeller Pitch Gauge
10. MW50 Injection
11. Oil and Coolant Temperature Toggle Gauge
12. Fuel Quantity Gauge
13. Fuel and Oil Pressure Duo Gauge
14. Gear Emergency Release
15. Low Fuel Indicator
16. Windshield Deice (uses fuel)
17. Gunsight (with on/off + dimmer knob (bottom) and sunfilter (left))
18. Clear Spark Plug Fouling Lever
19. Starter Inertia
20. Oil and Coolant Gauge Toggle
21. Magnetos
22. Starter Ignition
23. Gear Up/Down Selector
24. Gear Extension Indicator
25. Tropical Filter Open/Close (if installed)
26. Canopy Eject Handle
27. Ammo Counter or GNS430 (swap using the tablet's Settings page)

Centre Console

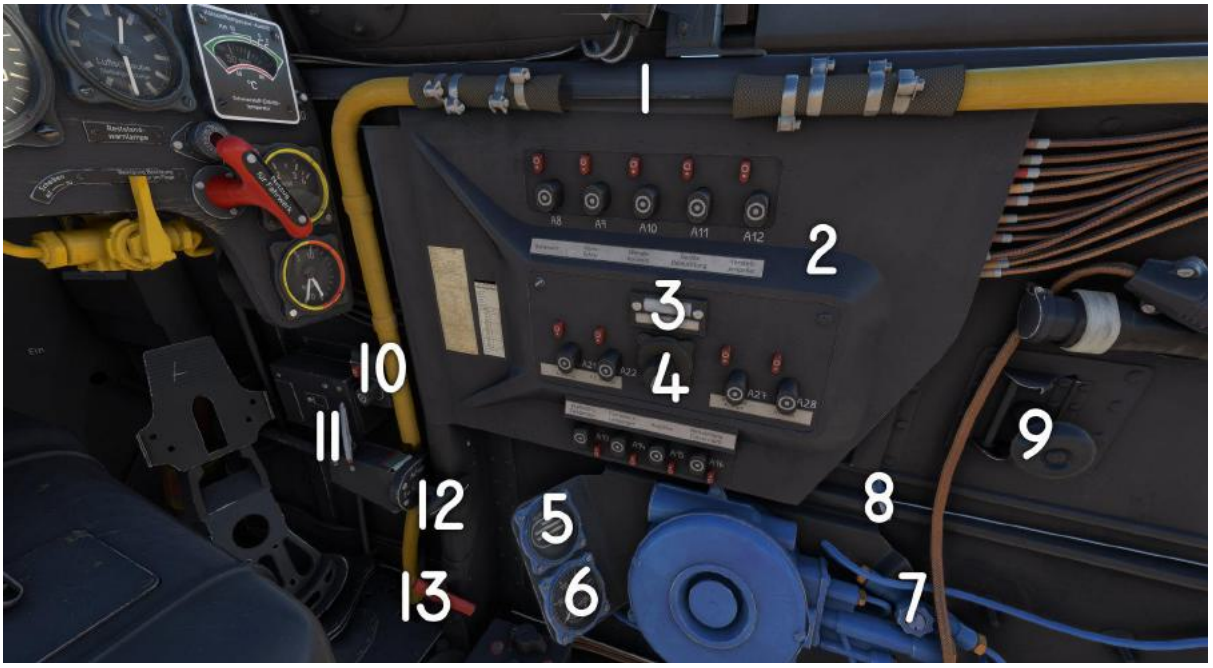
1. Bomb Mode Selector
2. Radio and Transponder (install thru tablet in the Settings page)
3. Wing Drop Tank Fuel Valves (this box only shows when the wing tanks are installed)

Left Side



1. Canopy open/close lever
2. Left UV lamp
3. Throttle
4. Manual Pitch Control (fine/coarse)
5. Fuel Valve Selector
6. Winter Start
7. Throttle Friction Knob (controls vibrations)
8. Gear Suspension Indicator
9. Engine Stop Lever
10. Automatic / Manual Propeller Pitch Selector
11. Port Air Vent
12. Primer
13. Stabilizer Trim Indicator
14. Stabilizer Trim Wheel
15. Flap Wheel
16. Tailwheel Tight/Loose
17. Port Radiator Disconnect

Right Side



1. Drop Tank Fuel Flow
2. Circuit Breaker Panel
3. Pitot Indicator
4. Cockpit Spot Light Rheostat
5. Oxygen Flow Blinker
6. Oxygen Pressure
7. Oxygen Valve
8. Battery On Switch (note: ON only, to turn OFF the battery, use the tablet's Settings page as this is a groundcrew-only operation)
9. Starboard Air Vent
10. All Circuit Breakers On or Off (a convenience switch for MSFS purposes)
11. Starboard Radiator Disconnect
12. Radiator Mode Selector
13. Emergency Tank Drop

Circuit Breakers

Circuit Breaker	Description		MSFS Keybinds
	English	German	
A8	Generator	Generator	**Toggle Master Alternator**
A9	Exterior Lights	Kennlichter	**Toggle Nav Lights**
A10	Artificial Horizon	Wendehorizont	
A11	Interior Indicator Lights	Geräte Beleuchtung	
A12	Propeller Pitch Control	Verstell-propeller	
A21	Starter Ignition	Anlass Zündung	
A22	Starter Inertia System	F.T. Anlage	
A27	Fuel Pump	Kraftstoff Pumpe	**Toggle Pump**
A28	Avionics	Avionik	**Toggle Avionics Master**
A13	Fuel and Temp Gauges	Kraftstoff u Temperatur	
A14	Gear System	Fahrwerk 4 Lampenger	
A15	Pitot Heat	Heizdüse	**Toggle Pitot Heat**
A16	Interior UV Lights	Beleuchtung Führerraum	**Panel Lights On** **Panel Lights Off**

FlyingIron Tablet

The FlyingIron Tablet provides additional information and features to your aircraft and flight experience. It has 8 pages available to you: Checklists, V-Speeds, Live Data, Stats, Loadout, Autopilot, Workshop and Settings. By default it is stowed on the right side in the cockpit, next to your seat, and can be accessed by clicking on it:

Alternatively, you may use the convenience click spot (a bolt) as illustrated below:

Once unstowed it will hover in front of you. Press the HOME button to stow it again:

The tablet also will tell you if an aircraft update is available. You will find the message “Update Available” in the top left if this is the case.

We encourage you to take some time and explore what this useful tablet has to offer:

Checklists

As it says on the tin. This list is the same as the built-in MSFS checklists and the ones in this manual.

V-Speeds

Know your aircraft, and how fast or how slow she should be flown at each stage of flight.

Live Data

Live and accurate digital feedback of the various internal aircraft systems and environment.

Stats

Graphical chart display of a select few data streams over a 10 minute period.

Loadout

One-button pre-configured fuel loadouts for a short, medium or long flight:

- Short = Full internal, no drop tanks (400L)
- Medium = Full internal, center drop tank (700L)
- Long = Full internal, 2 wing drop tanks (1000L)

Note: external tanks add considerable drag and decrease aircraft performance and agility in general, especially if you fly the double wing tank reconnaissance configuration which also notably increases Adverse Yaw. Also, the center drop tank and wing drop tanks are mutually exclusive…you cannot install 3 drop tanks.

Auto Pilot

The simplified but oh-so-handy FlyingIron Autopilot for those moments you want your hands free.

Note: the cockpit compass heading ring acts also as an autopilot heading bug. Very convenient…just adjust the ring to change heading when the AP is active, no need to open the tablet to do so.

Workshop

This simulates true-to-life wear and tear (based on careful research and actual experience from warbird pilots) as well as real-life inspection cycles of your aircraft.

It will matter for example for the inertia system how much you use it, or for the starter if you engage it when the engine already runs (that'll toast it quickly). Oxygen needs to be topped

up here as well, and the canopy can be replaced here if it's been ejected.

Collapsed one or both mains during a hard landing? That too needs workshop time! (toggle Slew after a gear repair to re-position the aircraft). Should you have excessive spark plug fouling and can no longer start your engine…you guessed it…the workshop is your friend.

As a first in our FlyingIron warbirds, any failure will have the expected impact as well. So if your starter has failed…it just won't spin your engine anymore.

Note: The workshop is only open for business when you're parked and your engine is off.

Settings

This is where you can toggle between your gunsight and GNS430, and enable or disable a number of features. A few notable options on this page:

Replace Original with Erla Canopy
The Erla canopy is a later model with less frame structure, offering increased visibility

Install Tropical Filter
Used for desert operations, keeping the dust out of your engine during ground operations. This option will add the filter, a lever to operate it, and also shows the parasol but only on a hot summer's day. Important to keep the pit cool!

Stresses and Failures
This will enable or disable Stresses (Ata, RPM, Oil T and Cool T) and Failures (any Workshop components). You can also see what your various engine stresses currently are in the black box, if anything (or did you blow it entirely). If you don't want any of this, just leave it Off and you can fly without breaking a thing.
Note: to reset a failed engine, toggle the Stresses and Failures off and on.

Simplified Groundhandling
This effectively links your rudder input to differential brakes, making turning easier (recommended if you don't have rudder pedals).
At all times will you experience the custom FlyingIron Taildragger Physics (this is **always** active and cannot be "turned off"), which is a highly realistic simulation of how a taildragger truly behaves on the ground, vastly different from the (rather incorrect) ground behaviour that MSFS offers out of the box.

Battery Connection
The battery switch in the pit in the 109 only pulls a cable attached to the battery in the rear of the aircraft. Once turned on, you cannot turn off your battery from the cockpit. In real life this is done by the ground crew. To turn it off in our simulation, use the tablet.

Instrument Cameras

To maximize your enjoyment and cockpit accessibility we have carefully setup the following instrument cameras:

#1 Instrument Panel
#2 Pit View
#3 Left Controls
#4 Right Controls
#5 Throttle Quadrant
#6 Circuit Breaker Panel
#7 Oxygen System
#8 Open Canopy Handle
#9 Top Panel (GPS and Chronograph)
#10 Flaps and Trim wheels

The usual pilot Quickviews have been configured with correct pilot eye position in mind, and include head translations when looking in different directions for a natural and organic feel.

Aircraft Systems and Operations

Flight Controls

The wings of the Bf 109 are among the most complex of any WWII aircraft.
Engineers made them small so they have less drag since their focus was speed. Catching allied bombers quickly was top priority! Small wings however have a high wing loading and therefor less lift. To add whatever lift they still could, a unique automatic slat solution was designed into the wing and the radiator exhaust shutters work in concert with the wing flaps. For even more lift, ailerons droop when flaps are deployed.

Ailerons, Elevator and Rudder

All main control surfaces are controlled by a standard type stick using manual forces only. Since cockpit space and therefor arm movement in the 109 is rather restricted it requires pretty strong arms to move them when at speed. It was therefor common practice for Luftwaffe pilots to engage in daily sports and other physic-building activities.

- Ailerons: 4” left/right stick movement and +25/-12.5 degrees deflection
- Elevator: 5.6” front/aft stick movement and +/-31.6 degrees deflection
- Rudder: 6” +/- pedal travel and +/-32 degrees deflection

Due to the design of the 109, the elevator gets very heavy at high speeds. Near VNE (750kph) and at an 80° dive angle with +1.15 degree nose-down / tail-up trim, it takes about 1,100m (3,600ft) to pull out.

Horizontal Stabilizer Trim

Your aircraft uses a stabilizer trim, meaning the entire horizontal stabilizer pitches up or down, moving the elevator along with it. It has a deflection range of +2 (nose-down / tail-up) to -6 (nose-up / tail-down) degrees. Important to note that a negative deflection means the stabilizer points down, therefor trimming the nose up…and vice versa.

You can use your usual MSFS elevator trim controls, or use the inner wheel found on the left side of your seat. There is also a trim position indicator located left of the primer.

Typical settings are:

- -1 degrees for take-off (nose-up / tail-down)
- -3 degrees or more for landings (nose-up / tail-down)
- 0 degrees will be needed around 450kph (trim up below this, and down above this)

Flaps

Flaps are very much part of the complex wing lift mechanisms sported by the 109. They are manually operated using the outer wheel located left of the pilot’s seat, and require 8 full

turns to go from 0 to its full 40 degree deflection. Typically 4 full turns, or 20 degrees, is used for take-offs and 40 degrees for landings.
As a sim pilot you fortunately can opt to use your regular flap keybinds or spin the wheel manually. In real life, Luftwaffe pilots were trained to move both the flap wheel and the stabilizer trim wheel at the same time with one hand. The trim is designed to match the change in pitch created by the flap deployment. Pretty neat!

When you deploy flaps, the ailerons will also droop a little, and the exit top and bottom flaps of the radiators will also move along. Together, all 4 surfaces (8 if you count both sides of the wing) will move as one coherent flap system.

Slats

The relatively small wings of the 109, with their high wingloading - provide less than desirable lift on their own when flying slow. Flaps help of course, but engineers also added a unique automatic slat system, providing even more lift.

This automatic slat system was so successful it was later used in other famous aircraft as well, including the F-86 Sabre.

It is mechanically automatic and is purely operated by aerodynamic forces. It requires no power of any kind. They will pop-out when flying below 125kph or so, or at speeds up to 350kph when you have a significant Angle of Attack. The transition between in and out will be swift - near instant even - and produce a loud bang that often jolted pilots the first time they heard it.

Slats were used to great effect in dogfighting, when pulling a few G's increased AoA and the slats would pop-out, increasing turn rate notably. It would make for interesting Spit vs 109 aerial battles.

Be aware that the slats will no longer move in or out when they are iced over!

Landing Gear

The first thing you may notice about your landing gear is that it's angled outward. A lot.

A major design benefit and thinking here is that the wing can be replaced or repaired without ever touching the gear at all as the main struts are directly attached to the hull.

The downside though is a narrow wheelbase, as well as the tendency to induce yaw under asymmetric left/right suspension loading (caused by turns, crosswind, ailerons and P-Factor). All this happens because forces are transferred to the ground under an angle. This unique characteristic we simulated as part of our custom ground physics model, so be careful when turning or you may end up in a dangerous zig-zag motion.

Ground loops in the 109 were also a common sight, partly due to the small rudder, and partly due to the gear-induced yaw tendencies. A dangerous combo and we spared you, the sim pilot, none of it.

To continue our little rant of landing gear risks, the mains are also delicate and easily collapses one or both gears when landing too hard.

Next, on to hydraulics. They are not strong either and will be unable to retract the gear when you are pulling more than 1.5 G or when you're going faster than 300kph. At around 350kph damage will occur, and you may not be able to react or deploy one or both at all. And yes, you guessed it, we simulated everything.

Should you experience a damaged or collapsed gear, it may be repaired in the Tablet's Workshop.

Normal Operation

To raise or lower the mains, use the respective push rod buttons located right of the gear indicator. The tailwheel is not retractable. The gear indicator itself nicely shows the current state of each main gear as well, being in locked up or down position, or nothing at all if it's in between. The gear indicator also has a little lever. If switched to the right, it will always work, and if switched to the left, it will only work if the flaps are not fully up. Pretty handy as this saves precious electrical load as you really don't need the indicator to work at all if your flaps are up, nor will the bright lights distract you during fight or flight.

Emergency Operation

Damaged your gear during a landing or by flying too fast, or it simply broke? Fortunately there is a Gear Emergency handle found left of the fuel gauge. It will unlock the gear allowing a gravity-assisted drop.

Brake Control

The main wheel brakes are hydraulically activated and can be differentially controlled using your pedal's toe brakes. Due to the small rudder you will quickly find out you're gonna need those brakes a lot too when you taxi, as the rudder will be quite ineffective at low speeds.

Tail Wheel Lock

The free castering tailwheel can be set to either "loose" or "tight" using a lever to the left below the canopy handle. When set to "loose" it is in free castering mode; use this for taxi operations. When set to "tight" its range of motion will be severely restricted, greatly aiding in your ability to take-off and land successfully.
In other words, always check your tailwheel lock when transitioning between taxi and runway operations! It's in the checklists too.

If you find turning during a taxi hard, likely your tailwheel was set to "tight". Similarly for a take-off run or landing roll…swerving too much left and right? You may be in "loose" mode.

FlyingIron Taildragger Ground Handling Physics

Your aircraft comes with custom coded true-to-life free-castering taildragger ground physics, replacing the default MSFS ground physics (quite unrealistic). Want to master a taildragger? Now you can. Tested extensively by experienced taildragger pilots.

Note: the default MSFS physics for ground handling have been completely replaced and cannot be "turned on" in the Bf 109. You will always be using the FlyingIron ground physics instead.

A free-castering tailwheel cannot be steered with rudder input. Like in the real aircraft (or as it should be in any other free-castering taildragger), you will now steer with:

1) Lateral thrust created by air flowing over your rudder. This airflow can come from propwash, ground speed and wind.
2) Differential braking. Brake only left or right and you can steer quite effectively once you have a little speed.

Groundloops and other forces like p-factor are all simulated as well. We recommend you spend a few minutes on the ground the first time trying to taxi, unlearning what MSFS has taught you so far, and relearning how the real pilots did it. Use no more than 1,200 RPM for taxi operations. Due to the small rudder on the Bf 109, steering at low speeds is largely done with differential braking or a dab of propwash and rudder.

You'll be a master in no time, it's a great reward! It's actually not even that hard (realistic physics rarely are, they are more natural and predictable).

Due to this new level of realism we highly recommend using rudder pedals. Don't have them? Open the FlyingIron Tablet's Settings page and enable "Simplified Groundhandling" which will link your rudder to your differential braking.

Engine Management

*Note: managing your aircraft's heating and cooling will only truly have an impact if you have the **Stresses and Failures** toggle enabled in the Tablet's Settings page. When this setting is off, you can go full throttle as much as you like.*

The DB 605A engine in the nose of your Bf-109 is a fuel-injected, supercharged twelve-cylinder four-stroke engine with a 35.7 litre / 2176 cubic-inch displacement in inverted V configuration, so basically the crankshaft is on top of the engine with the cylinder banks pointing downward. This helped in keeping the upper nose profile as slim as possible to ensure better visibility but came to the price of oil seeping down the cylinders, leading to higher consumption.
If you compare it to the infamous Rolls-Royce Merlin (which is nicely simulated in the FlyingIron Spitfire Mk.IX), you'll notice the much bigger displacement, lower Engine Revolution and Manifold Pressure levels although both engines are very close in external proportions and weight.
While the build quality of the Merlin got better letting the engine in turn become more and more powerful over the course of the war, the DB 605 from the start suffered from a lack of high-quality alloys and poor fuel and lubricant quality in Germany which led to numerous problems and a lower specific power output. You see, they simply needed the larger displacement to create similar amounts of power.

Today several DB 605 installed in airworthy Bf-109s are preserved in perfect running condition by dedicated companies like Vintage V12s of Tehachapi, California or Rinner Performance Engineering in Austria. Of course those magnificent craftsmen and engineers provide parts from high-quality materials and, by that, remedy most of the problems that were experienced during wartime. Mr.Rinner, whom we were consulting in the development of this product, ensured us that a well-maintained DB-605 today is a trustworthy and reliable powerplant and lives up to the high expectations the original design once arose.
Although today all of those engines are limited to 1310 horsepower at 1.3 ATA and 2600rpm (which is more than enough, you'll see!) to ensure maximum longevity, we've decided to simulate its whole potential, well exceeding 1700 hp on water-methanol injection – but more to that further down.

Mixture Control

This powerplant sports many features that were considered state-of-the-art or even ahead of its time in 1942, worth mentioning especially the fuel injection, which made startup a piece of cake, ensured proper running in all flight situations including inverted and basically rendered a Mixture Control lever unnecessary, that's why you won't find one.
A small downside is a tendency to run rich on lower settings than 1 ATA, so on the ground and on extended low-power operation the spark plugs tend to foul up which results in rough running and, if fouling worsenes, quitting altogether. As you are not able to lean the mixture the engineers installed a mechanism to burn any residue away. When pulling the correspondent handle you basically delay ignition timing on that mighty V12 in front of you – you will notice that this comes along with increased levels of noise and vibration as the

powerplant basically runs "wrong" during the application. Use this mechanism precautionarily before takeoff, after/during long descents and whenever you hear the engine sound to get unsteady.

The silver "Kerzenabbrennung" (spark plug cleaner) lever can be found on the top left of your main panel, above the red knob (MSFS Taxi Light keybind).

Propeller Control

As you may have noticed on your lookout for the Mixture control there is no Prop lever either on the console. In their ambition to simplify engine management an automatic prop governor was installed which provides the correct rpm for the throttle setting you're in. To supervise operation of that mechanism a clock-like gauge is provided on the main panel, displaying the prop pitch range from 12:30 indicating full fine to 04:30 for full coarse pitch.
There is a manual override which is helpful for extending your flight time (lowering rpms on reduced power settings, 1.0ATA @ 2000rpm or alike) and ensuring quick response on landing if a go-around is needed (recommended for approach is a 11:30 or 12:00 setting on the indicator), however for most situations it will work just fine. Just be careful on adding power in a dive – the engine should be able to endure up to 3,000rpm for a brief moment, but it is not looking forward to do so!

It's perhaps the weirdest of gauges, and warrants a little further explanation to appreciate it. Looks like a clock…but it really isn't. At the pictured position of 12:30, prop pitch is at full fine of 22°. Every "10 minutes less" will add 1° to your pitch, so 12:00 means 25°…ideal for take-off power. A full hour is therefor 6° change, and so on, all the way till fully coarse which you'll reach at 4:30, representing 70°.

A 1 hour change (6 degrees) takes the "hour hand" about 4 seconds.

The switch to enable manual prop control can be found below the throttle column. Control the manual mode with your Propeller Lever (0-30% is rocker down, 30-70% is rocker neutral and 70-100% is rocker up).

Supercharger

By your input on the throttle lever those mechanisms thus basically provide the correct mixture as well as a fitting propeller setting. This was a big relief to every pilot engaging in combat, imagine what advantage this gave in comparison to an opponent most likely being busy with at least three levers for the same results.

If you climb up in altitude you will notice constant Manifold Pressure levels as long as the supercharger can compensate for. This is due to a fluid coupling between engine and supercharger which works stepless and will, by another mechanism coupled to your throttle lever, always be set at the right ratio for maximum power.

Maximum Power

Basically the supercharger which creates the shrieking sound the Bf-109 is known for would be capable of delivering pressures in excess of 1.7ATA to the engine on sea level, which is around 50 inHg. Those pressure levels however would lead to pre-ignition (and consequently to total destruction of the engine) when the fuel has an insufficient knock rating, today standardized into "Octane". While the Allies produced fuels rated at 150 Octane at the end of the war, the German industries could only produce small amounts of 100 Octane fuel called C3. More commonly available was the B4 type, only rated to about 87 Octane, and the maximum pressure this fuel can safely be used on is around 1.42ata, the maximum emergency setting on this engine, putting out around 1,475hp.

Not bad at all in such a small airplane, but the Supermarine Spitfire as well as North American P51 were soon surpassing the 109.

MW50

This is why the German engineers pulled off a trick: They installed a Methanol-Water injection system called MW50 (german Methanol-Wasser, 50 stating the 50/50 ratio of water and methanol); Methanol increases the maximum possible Manifold Pressure without having to fear premature detonation ("knocking"). Water injected into the cylinders (as you will know from your FlyingIron F6F Hellcat) also creates an increase in power due to the big expansion in volume when water evaporates and on the other hand aids in cooling the whole affair down to acceptable levels.
MW50 enables the engine to run at pressure levels up to 1.7ata putting out around 1,800hp for a duration of up to 27 minutes in total, but only 10 minutes continuous.
Do not exceed this timespan as it will lead to hotspots in the engine, resulting in failures. After 10 minutes a throttle setting of 1.3ata or below should be held for about 5 minutes until you use the Emergency Power again.

The MW50 system can be enabled by the MW50 switch on the right of the main panel. Make sure you only use it on full throttle setting.

Temperatures

At all times you should keep an eye on your temperatures, especially when you are pushing it. The engine does not like to get hot, so adequate radiators are installed which need sufficient speed to work properly however. You'll find the oil cooler below the engine cowling while the two water radiators are embedded in the wing structure. Both circuits are constructed with an automatic system however the water radiator flaps can be put in a manual override.

Cold temperatures will lead to damage as Oil pressure gets above the maximum of 8kg/cm2 below 40°C, so let it warm up a little before running on higher rpms and watch the pressure gauge!
On the ground insufficient airflow through the radiators makes the temperatures rise quickly – on hot days the coolant temperature can get out of hand within as little as six minutes, so open the flaps manually, be quick on your way to the runway, take off as soon as possible and keep in mind that you need her a few degrees short of limit for the heat produced on takeoff. Limits are 105°C (sea level, it's less at altitude) for coolant and 80°C for oil, although exceeding towards max. 115°C (sea level) and 85°C are acceptable for up to 10 minutes. If temperatures get too hot, shut down immediately and wait approx. 10 minutes before starting up again (remember to switch all electric consumers off). Above those maximums there is no margin for error.

As soon as you're in the air things relax a bit, Speed is key on keeping the engine cool. Bring her up to speeds upwards of 400kph and in moderate climates the automatic mode will bring down the temps easily.
Notice that the radiator flaps induce an enormous amount of drag when fully opened.

The temperature gauge works for coolant as well as oil temperature. You can switch between the two with a small flip switch to the right of the Magneto Selector on the left of the Main panel. Up displays Coolant while Down will provide you with Oil temperature.

The four-way-switch for the radiator flaps is to be found on the right side of the cockpit floor. Besides the automatic mode you can set them to Open (right), Close (left) and Stop (down).

Note: managing your aircraft's heating and cooling will only truly have an impact if you have the Stresses and Failures toggle enabled in the Tablet's Settings page. When this setting is off, you can go full throttle as much as you like.

Priming and Winterstart

The DB 605 needs at least 4 strokes of the primer to inject sufficient fuel into the system. Then, depending on temperature, add at least 1 more stroke when it's warm, more when it's cold. You will know when you have primed enough when the prime lever moves slower. Important to note that you can still start an overprimed DB 605 engine, but not an underprimed one.

De-prime as you would in a real engine: set magnetos or fuel selector to off, open throttle wide, and "start"...the blades will spin and excess fumes will be forced to escape from the cylinders.

Note: Tooltips and the Tablet's Live Data page also will indicate your current prime status (underprimed, primed, overprimed).

If it's below 10° Celsius you won't be able to start no matter how much you prime…you will also need to pull the Winter Start lever next to the throttle.

Fuel System and Tanks

The Fuel System is in general uncomplicated with just one main 400 liter / 106 US Gal tank inside the fuselage. There is one electric fuel pump, engaged with the A27 circuit breaker, an engine driven vacuum pump, and a valve selector at the throttle quadrant to control the two valves, front and aft of the internal tank. You'd normally fly with both valves open (valve selector full forward).

To extend the range you may also opt to equip your 109 for the mission in mind with one 300 liter / 79 US Gal center drop tank or two 300 liter wing drop tanks for a total of 700 or 1000 liters respectively. Do this in the Tablet's Loadout page when parked with the engine off, and avoid using the MSFS Toolbar app for this.

There is an Emergency Tank Drop handle in front of the oxygen gauges.

Fuel flows from external drop tanks straight into the main internal tank. You can confirm this visually by checking out the transparent portion of the fuel tube at your right. You can also see the speed of the fuel flow, which will depend on fuel burn, and is correctly simulated.

If you opt for the two wing tanks, a new control box will appear right of the weapon selector box (below the RPM gauge). You will need to open the valves to each wing tank manually. The center drop tank needs no such control.

Finally the fuel gauge. It only shows the contents of the main tank, being 400 liters. There is also a Low Fuel warning light, to the left of it. It will flicker a bit at first as the sensor is still being sloshed a bit, before turning solid red. This happens around the 40 to 60 liter mark.

Garmin GNS 430

If you don't have the gunsight installed, you will see the Garmin GNS 430 equipped. It is the standard fully functional model that comes with MSFS.

Note: you may swap the Garmin GNS 430 with the gunsight using the Tablet's Settings page.

Gunsight

If you don't have the Garmin GNS 430 installed, you will see the REVI C12/D gunsight equipped.

At its bottom you'll find a knob allowing you to turn it on or off as well as set the brightness of the reticle. On the left you will find a lever for the sun filter.

Note: you may swap the gunsight with the Garmin GNS 430 using the Tablet's Settings page.

Weapons

The Bf 109G-6 has twin Mg151/20 “bulge” guns and one Mk108 nose cannon (shooting through the engine axis and propeller spinner). If installed, they add 143kg / 316lbs to your aircraft’s total weight. They are not operational.

Note: weapons are only an option (Tablet’s Settings page) if you purchased your aircraft through the FlyingIron Simulations website. They are not an option if you purchased your aircraft through the MSFS Marketplace (a Microsoft requirement and policy out of our control).

Tropical Modifications

The tablet’s Settings page allows the installation of the Tropical Filter. When installed, you will see a new golden “Trop Filter” lever in the cockpit below the gear indicator enabling you to open or close the filter’s mouth as seen left of the engine. Close it for dusty or sandy ground operations but open it at all other times.

When installed, you will also see a parasol fitted when you’re parked on the ground at over 25°C / 77°F with an open canopy and the engine turned off. The brackets for this parasol were an actual feature on the real 109 if the tropical filter was installed.

Note: the tropical filter will add additional drag to your aircraft

Light Systems

Internal Lights

In the cockpit you will see 2 UV spot lights. On the Circuit Breaker Board you will see a rheostat, allowing you to dim as needed. Use the A16 Circuit Breaker to turn them on or off (you may also use the **Panel Lights On/Off** keybinds).

External Lights

The 109 comes fitted with basic navigation lights only, being a red port light, blue starboard light and white tail light. They are operated by the A9 Circuit Breaker (you may also use the **Toggle Nav Lights** keybind). Together, they consume about 55W.

Canopy

The canopy opens sideways on hinges, and needs to be closed at all phases of flight and ground ops. It can also be jettisoned in case of emergencies using the jettison lever on the left-front, but only if you’re flying. If left open, the canopy will vibrate severely.
You will have two canopy options: equip the original canopy, which is quite heavy on metal and obstructs some view, and the newer Erla canopy. 'Erla' is short for 'Erla Haube', the name of a clearer three-panel canopy and is selectable in the Tablet’s Settings page.

Oxygen

A fully topped up oxygen supply maxes out at about 150 ATA, more than enough for even a long flight. Top-up happens in the Tablet's Workshop tab (remember to do this before each flight). Test the oxygen system by opening the Oxygen Valve, you should have no more than a 10 ATA drop in 20 minutes. The Oxygen Blinker will indicate if there is a flow or not.

Electrical System

The entire electrical system of your aircraft has been simulated to great detail for every single component, down to the actual voltage used by the smallest of light bulbs. In other words, everything you do will have an impact on electrical load. The Inertia Starter especially - clocking in at 1920W - is a heavy consumer. Also do not underestimate fuel pumps and navigation lights, they can draw quite a bit.

Battery

The Bf 109G-6 comes installed with one 24V 7.5Ah battery. That is not very much. It can be turned on from within the cockpit using a little lever at the right of the Circuit Breaker board. This lever will pull a cable attached to a switch on the battery at the rear of the aircraft. However you cannot turn the battery off from within the cockpit. For this, use the Tablet's Settings page "Battery Connection" toggle under Ground Services. In real life too turning the battery off had to be done by the ground crew. Weird, we know, but it's the way it is and simulated as such. Remember to turn off your battery after a flight when you park for a coffee break, or else you'll find you won't be able to start again.

Generator

The DB 605A-1 powers a 1000W 28V generator. It only kicks in above 1,300RPM so beware of electrical loads during taxi as your battery will not last long while idling. The generator can be turned on or off using the A8 Circuit Breaker (you may also use the **Toggle Master Alternator** keybind). Make sure it is on when it should be or you'll find yourself without power pretty soon before or after take-off!

Circuit Breakers

The circuit breakers on German warbirds are not just for failure management, they are also used as switches and are part of the checklists throughout many aspects of flight.
They are all labelled in either German or English, as are all other labels in the aircraft, a preference you can set in the Tablet's Settings page.

Note: breakers may pop out from time to time - when in use - if you have Stresses and Failures enabled in the Tablet's Settings page.

There is one special A1 Circuit Breaker found alone to the left of the circuit breaker board.

This one is a quality of life feature for MSFS purposes only, and simply turns all circuit breakers on or off in one go.

AFN-2 Radio Beacon Indicator

German warbirds conveniently came installed with this navigation instrument, allowing pilots to find the destination airport with ease. In MSFS, simply set the Nav (VOR) frequency using your GNS 430 and the AFN-2 will home in on its beacon.

There are three parts to this nifty instrument:

Vertical Needle

This needle indicates course deflection. It shows error, so to go to the beacon, move in the opposite direction (e.g. needle is left, turn right to intercept). The needle will slowly center near vertical as you turn. If instead it moves away from the center it means you're flying in the opposite direction. Make a U-turn!

Horizontal Needle

This needle indicates the distance to the selected VOR station. When at the bottom you're 60nm / 110km or more away, or there is no signal. Likewise, halfway (horizontal) means 30nm / 55km and at the top it means 0 distance.

Center White Light

When lit it simply indicates you're above the beacon (within a few km). Congrats, you've found your airbase!

Junghans J30BZ Chronograph

This beautiful vintage German WWII chronograph has been fully replicated, down to the smallest detail and little quirks. There are no tooltips as we found they get in the way of operating this device, so let us explain here:

1. Time Adjustment engage/disengage lever
2. Time Adjustment knob
3. Stopwatch Start/Stop/Reset button
4. Time ring
5. Minute hand
6. Hour hand
7. Stopwatch second hand
8. Stopwatch minute hand

Time Adjustment

Time is automatically adjusted based on local MSFS time, also when you change it through the MSFS Weather toolbar screen. You can also manually adjust it using the chronograph by pulling the Time Adjustment lever and turning the Time Adjustment knob.

Chronograph

Simply click the Stopwatch Start/Stop/Reset button and it will go through those three actions in order. The second hand will move, and the minute hand supports up to 15 minutes in the small clock below the center. Small details from the real Junghans are replicated as well, for example, the minute hand only slowly moves to the next minute during the last 55 to 60 second positions of the second hand.

Time Ring

The time ring can be rotated but does not “do” anything besides that, it is intended to help you memorize a given time start point by moving the triangle to where you want it to be. This can be very helpful during dead reckoning navigation.

Checklists

For your convenience, checklists can be found in 3 places, all identical:

1. The Pilot Handbook (this one)
2. The MSFS Toolbar Checklists (interactive)
3. The FlyingIron Tablet

Before Engine Start

- Canopy: Closed
- Gear: Ensure Down
- Throttle: Open 1 Inch
- Prop Control: Auto
- Radiator Control: Open
- Battery: On
- Generator Circuit Breaker: A8 In
- Propeller Circuit Breaker: A12 In
- Starter Circuit Breakers: A21 and A22 In

Engine Start

- Engine Stop: Off
- Prime: 5 when warm, more when cold
- Winter Start: Pull below -10C OAT
- Fuel Pump Circuit Breaker: A27 In
- Fuel Valves: Both On
- Magnetos: Both On
- Inertia Starter: 20 Seconds
- Engine Starter: Pull Strongly

After Engine Start

- Circuit Breakers: All In
- Oil Pressure: 6 to 8 for cold engine
- Fuel Pressure: 1.2 at 1,000RPM
- Warm up at 1,000RPM max: Keep oil press below 8
- Fuel Valves: Test individually
- Radiator Control: Test all modes
- Radiator Control: Open
- Altimeter: Set
- Test Magnetos at 20C oil rise: 2,300 with 70RPM drop
- Brief Throttle runup test: 2,500-2,600RPM at 1.3ATA
- Clear Plug Fouling: As Needed

Taxi

- Prop Control: Manual
- Propeller Lever: Set pitch to 12:00
- Tailwheel: Loose
- Brakes: Test immediately
- Taxi: Brisk S-turns
- Flaps: 20°
- Stabiliser: -1° (nose-up / tail-down)

Run-up Check

- Canopy: Ensure Closed
- Tailwheel: Ensure Tight
- Stabiliser: Ensure -1° (nose-up / tail-down)
- Flaps: Ensure 20°
- Prop Control: Ensure Manual 12:00
- Radiator Control: Automatic
- Clear Plug Fouling: As Needed

Take-Off

- Aileron: Strong right deflection
- Rudder: Strong right deflection
- Throttle: Very slowly increase to 1.3
- Lift-off: 170kph
- Gear: Raise immediately
- Propeller: 2,300RPM
- Flaps: Retract above 200kph
- Prop Control: Auto

Flight

- Stabiliser: Around 0°
- Cross Country Cruise: 1.1ATA
- Oxygen: Open

Descent & Approach

Descent List

- Clear Plug Fouling: As Needed

Approach List

- Fuel Valves: Both On
- Radiator Control: Open
- Gear: Lower below 300kph
- Flaps: 40° below 250kph
- Stabiliser: Around -3° (nose-up / tail-down)
- Clear Plug Fouling: As needed
- Glide airspeed: 200-220kph
- Threshold airspeed: 180kph

Landing

Touchdown List

- Landing: Three point touchdown

Groundroll List

- Fast groundroll: Keep straight with rudder
- Slow groundroll: Keep straight with brakes

Taxi In

- Tailwheel: Loose
- Flaps: Retract to 0° or 20°
- Stabiliser: 0°
- Radio Circuit Breakers: A27 and A28 Pull
- Clear Plug Fouling: As Needed

Stopping the Engine

- Radiator Control: Closed
- Throttle: Idle for 30 seconds
- Clear Plug Fouling: As Needed
- Engine Stop: Pull till Stop
- Throttle: Closed
- Magnetos: Both Off
- Fuel Valves: Both Off
- Circuit Breakers: All Pulled
- Oxygen: Closed
- Canopy: Open

Specifications and Reference Data

General Data

Max Gross Weight	7,496 lbs / 3,400 kg
Empty Weight	4,954 lbs / 2,247 kg
CG Limits	25% forward to 31% aft of root chord
Pax	1
Max Fuel Capacity (with wing tanks)	264 US gal / 1,000 litres
Internal Tank	106 US gal / 400 litres
Center Drop Tank (not with wing tanks)	79 US gal / 300 litres
Wing Drop Tanks (not with center tank)	2 x 79 US gal / 2 x 300 litres
Wingspan	32.45 feet / 9.89 metres
Wing area	172.76 sqft / 16.05 sqm
Wing root chord	7.03 feet / 2.14 metres
Wing dihedral	5.75°
Wing incidence	1.70°
Wing sweep	4.25°
Length	29.33 feet / 8.94 metres
Trim availability	• Cockpit-adjustable pitch control • Groundcrew-adjustable fixed aileron and rudder trim tabs
Flaps	Manual and variable between 0° and 40° • 0° for cruise • 20° for take-off • 40° for landing
Slats	Mechanically automatic
G Limits	+7 (flaps up) / +4 (flaps down) to -2.0
Critical Altitude	19,029 feet / 5,800 metres
Service Ceiling	39,698 feet / 12,100 metres
Absolute Ceiling	41,000 feet / 12,497 metres

Engine

Model	DB 605A-1
Configuration	V-12 Inverted
War Emergency Power	MW50 (3 x 10min)
Horsepower	1,475 (1,800 with MW50)
Displacement	35.7 liters / 2,178.6 cu Inch
Cylinders	12
Turbo	No
Supercharger	Barometrically controlled hydraulic clutch (variable)
Cooling	Water (with pilot controlled shutters for the radiators, and automatic shutters for the oil cooler)
Fuel System	Injection
Negative G	Capable

Propeller

Model	9-12087
Blades	3
Diameter	3.00m / 9’10”
Type	Constant speed
Max RPM	3,000 rpm +
Feathering	No
Beta min	22°
Beta cruise	46°
Beta max	70°

V-Speeds

Code	Description	Speed (IAS)	
		kph	*knots*
VBG	Best glide speed	209	113
VC	Design cruise speed	593	320
VD	Design diving speed	750	405
VNE	Never exceed speed	750	405
VFE	Max flaps extended	250 (40°)	135 (40°)
VLO	Max gear extended	300	162
VNO	Max speed normal operations	400	216
VR	Rotation speed	180	97
VREF	Threshold cross speed	180	97
VS	Stall speed in cruise configuration	180	97
VS0	Stall speed in landing configuration	165	89
VTO	Take-off speed	180	97
VX	Best angle of climb speed	241	130
VY	Best rate of climb speed	270	146
	Loop (aerobatic)	480 min	259 min
	Roll (aerobatic)	380 min	205 min
	Half-roll off loop (aerobatic)	550 min	297 min
	Climbing roll (aerobatic)	530 min	286 min

Power Settings

Power	Setting
Idle	400-500RPM
Starting and Warm-Up	1,000RPM
Taxi	1,200RPM
War Emergency Power (combat emergency)	2,800RPM / 1.75ATA
Take-Off	2,800RPM / 1.42ATA
Military Power (non-combat emergency)	2,600RPM / 1.30ATA
Normal Rated Power (max. cont.)	2,300RPM / 1.15ATA
Maximum Cruise (fly this normally)	2,100RPM / 1.00ATA
Economy Cruise	1,900RPM / 0.90ATA
Dive (Max)	2,800RPM
Landing Approach	

Speeds

Power	Altitude (m)	Speed (TAS)	
		kph	*knots*
Climb	Sea level	270	146
Cruise	Sea level	420	227
Max	Sea level	540	292
Max	5,000	650	351
Max	8,000	620	335

Climb Times (3,310kg / 7,297lbs)

To Altitude		Time
Meter	*Feet*	
1,000	3,281	1:00 +/-
3,000	9,843	3:00 +/-
5,000	16,404	5:15 +/-
10,000	32,808	10:00 +/-
11,000	36,089	17:00 +/-

Runway Performance (3,310kg / 7,297lbs)

Runway	Distance	
	Meters	*Feet*
Take-off	429	1,407
Landing	504	1,654

Roll Rates (3,048m / 10,000ft)

Speed (TAS)		Degrees per second
kph	*knots*	*Ailerons only*
200	108	45
300	162	68
400	216	83
500	270	88
600	325	91
700	378	56
800	432	23

Fuel Burn

Power	Fuel Consumption (sea level)	
	Liter/Hr	*US Gal/Hr*
2,800RPM / 1.70ATA with MW50 (MW50 consumption 150l/hr)	660	174
2,800RPM / 1.42ATA	480	127
2,600RPM / 1.30ATA	400	106
2,300RPM / 1.15ATA (max cont)	320	85
2,100RPM / 1.00ATA	255	67

Reference Diagrams

Oil System

Anlage 3

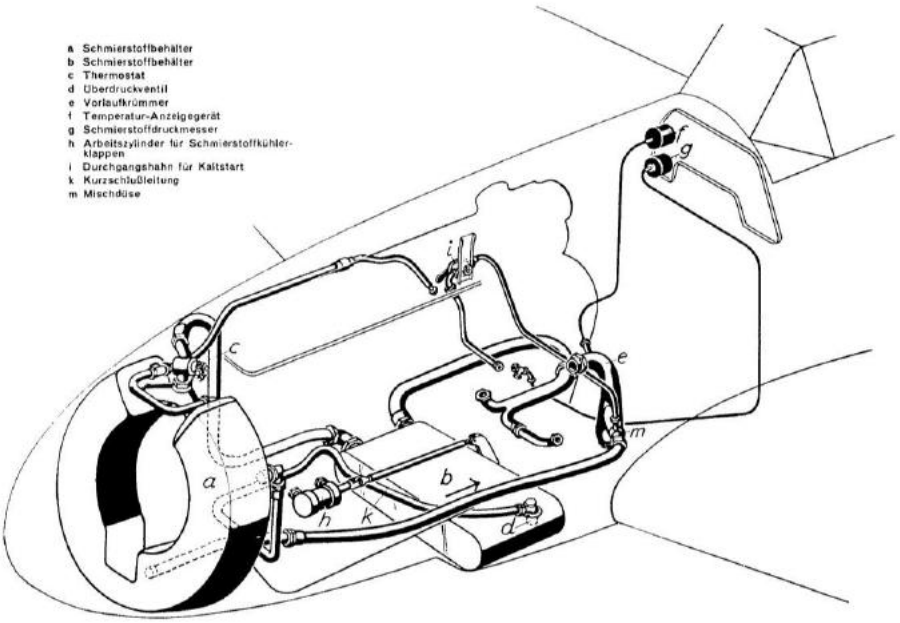


Abb. 34: Übersicht der Schmierstoffanlage

Cooling System

Anlage 5

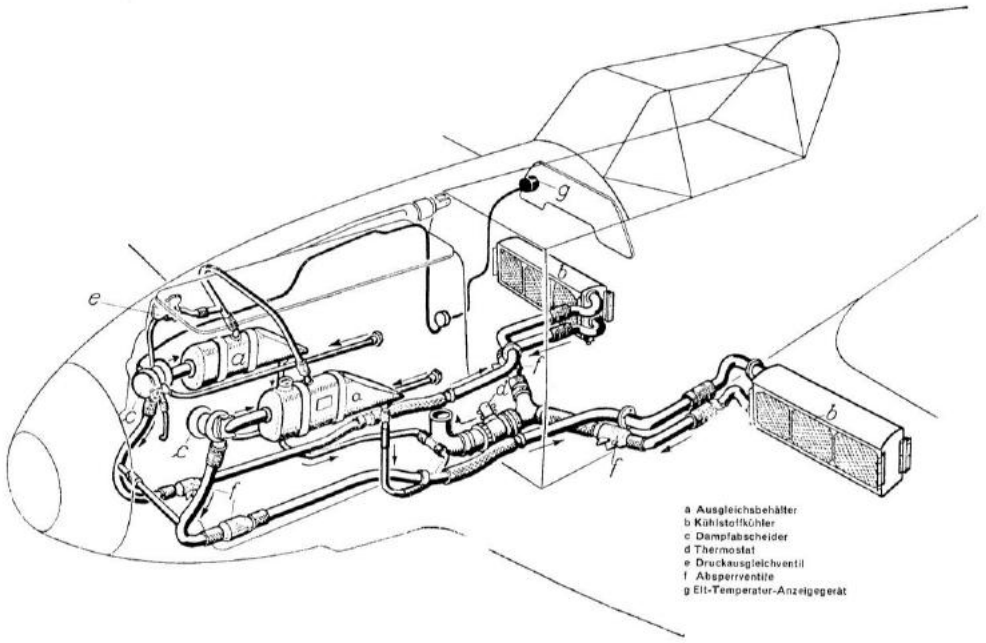


Abb. 36: Übersicht der Kühlstoffanlage

Fuel System

Anlage 1

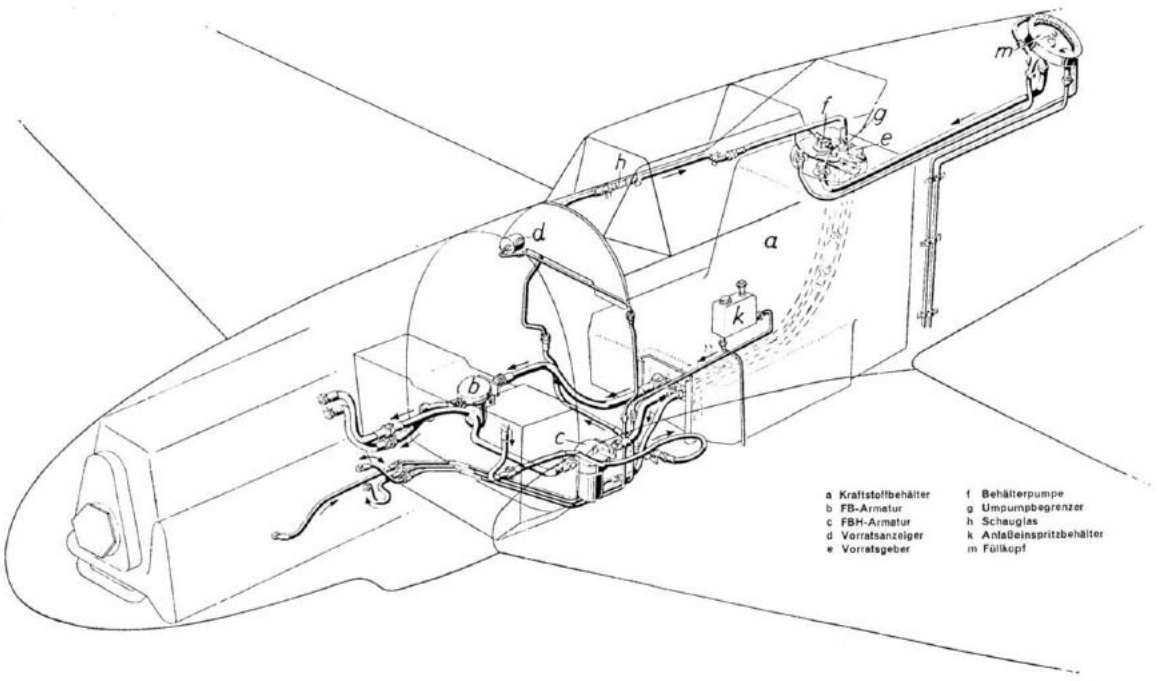


Abb. 32: Übersicht der Kraftstoffanlage

Unit Conversion Tables

Distance

Nautical Miles (nm)	Miles (m)	Kilometres (km)
50	58	93
100	115	185
200	230	370
300	345	556
400	460	741
500	575	926
750	863	1,389
1,000	1,151	1,852

Speed

Knots (kts)	Miles per hour (mph)	Kilometres per hour (kph)
50	58	93
100	115	185
150	173	278
200	230	370
250	288	463
300	345	556
350	403	648
400	460	741

Intake Pressure

Manifold Pressure (MP, inHg)	Boost	Atmospheric Pressure (ATA)
United States	*England*	*Germany*
10	-9.8	0.35
20	-4.9	0.69
(29.92) 30	0.0	1.04
40	+4.8	1.38
45	+7.4	1.55
50	+9.8	1.66
55	+12.3	1.73
60	+14.7	2.07

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Warmest Regards,
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Twotonemurphy
Willy

Special Thanks

David Weiss
Guido Wolf
Helmut "Heli" Schmidt
Klaus Plasa
Michael Rinner
Mike Nixon
Walter Eichhorn

Luftfahrtarchiv Hafner
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