# MESSERSCHMITT BF.109 EMIL


GUIDE BY CHUCK

# PERFORMANCE SHEET

| | (Unit) | SPITFIRE Mk Ia 100 oct | HURRICANE Mk IA Rotol 100oct | BLENHEIM Mk IV | TIGER MOTH DH.82 | BF.109 E-4 | BF.110 C-7 | JU-87B-2 STUKA | JU-88 A-1 | HE-111 H-2 | G.50 SERIE II | BR.20M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TEMPERATURES** | | | | | | | | | | | | |
| Water Rad Min<br>Max | Deg C | 60<br>115 | 60<br>115 | - | - | 40<br>100 | 60<br>90 | 38<br>95 | 40<br>90 | 38<br>95 | - | - |
| Oil Rad (OUTBOUND) Min<br>Max | Deg C | 40<br>95 | 40<br>95 | 40<br>85 | - | 40<br>105 | 40<br>85 | 30<br>95 | 40<br>80 | 35<br>95 | 50<br>90 | 50<br>90 |
| Cylinder Head Temp Min<br>Max | Deg C | - | - | 100<br>235 | - | - | - | - | - | - | 140<br>240 | 140<br>240 |
| **ENGINE SETTINGS** | | | | | | | | | | | | |
| Takeoff RPM | RPM | 3000 | 3000 | 2600 FINE | 2350 | 2400 | 2400 | 2300 | 2400 | 2400 | 2520 | 2200 |
| Takeoff Manifold Pressure | UK: PSI<br>GER: ATA<br>ITA: mm HG | +6 | +6 | +9 BCO ON | See RPM Gauge | 1.3 | 1.3 | 1.35 | 1.35 | 1.35 | 890 | 820 BCO ON |
| Climb RPM | RPM | 2700 | 2700 | 2400 COARSE | 2100 | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2400<br>30 min MAX | 2100<br>30 min MAX |
| Climb Manifold Pressure | UK: PSI<br>GER: ATA<br>ITA: mm HG | +6 | +6 | +5 | See RPM Gauge | 1.23 | 1.2 | 1.15 | 1.15 | 1.15 | 700 | 740 |
| Normal Operation/Cruise RPM | RPM | 2700 | 2600 | 2400 COARSE | 2000 | 2200 | 2200 | 2200 | 2100 | 2200 | 2100 | 2100 |
| Normal Operation/Cruise Manifold Pressure | UK: PSI<br>GER: ATA<br>ITA: mm HG | +3 | +4 | +3.5 | See RPM Gauge | 1.15 | 1.15 | 1.1 | 1.1 | 1.10 | 590 | 670 |
| Combat RPM | RPM | 2800 | 2800 | 2400 COARSE | 2100 | 2400 | 2400 | 2300 | 2300 | 2300 | 2400 | 2100 |
| Combat Manifold Pressure | UK: PSI<br>GER: ATA<br>ITA: mm HG | +6 | +6 | +5 | See RPM Gauge | 1.3<br>5 min MAX | 1.3<br>5 min MAX | 1.15 | 1.15 | 1.15 | 700 | 740 |
| Emergency Power/ Boost RPM @ km | RPM | 2850<br>5 min MAX | 2850<br>5 min MAX | 2600 COARSE<br>5 min MAX | 2350 | 2500<br>1 min MAX | 2400<br>5 min MAX | 2300<br>1 min MAX | 2400<br>1 min MAX | 2400<br>1 min MAX | 2520<br>3 min MAX | 2200<br>5 min MAX |
| Emergency Power / Boost Manifold Pressure @ Sea Level | UK: PSI<br>GER: ATA<br>ITA: mm HG | +12 BCO ON | +12 BCO ON | +9 BCO ON | See RPM Gauge | 1.40<br>1 min MAX | 1.3<br>5 min MAX | 1.35<br>1 min max | 1.35<br>1 min max | 1.35<br>1 min max | 890<br>3 min max | 820 BCO ON<br>5 min MAX |
| Supercharger Stage 1 Operation Altitude | UK: ft<br>GER: M | - | - | - | - | - | - | 0<br>1500 | 0<br>1220 | 0<br>1220 | - | - |
| Supercharger Stage 2 Operation Altitude | UK: ft<br>GER: M<br>ITA: M | - | - | - | - | - | - | 1500+<br>(AUTO/MAN MODES) | 1220+ | 1220+ | - | - |
| Landing Approach RPM | RPM | 3000 | 3000 | 2400 | As required | 2300 | 2300 | 2000 | 2100 | 2300 | 2400 | 2200 |
| Landing Approach Manifold Pressure | UK: PSI<br>GER: ATA<br>ITA: mm HG | As required | As required | As required | See RPM Gauge | As required | As required | As required | As required | As required | As required | As required |
| Notes | | Use "Rich" mixture for normal operation. Use "Lean" mixture for fuel conservation for RPM under 2600 & boost @ +1 or lower. | | Boost Cut-Out Override (BCO) during takeoff often required | **Min Oil Press: 35 psi**<br>**Max Oil Press: 45 psi** | | | No Abrupt Throttling | Eng. very sensitive to ata/rpm | Eng. very sensitive to ata/rpm | | Boost Cut-Out Override (BCO) during takeoff often required |
| **AIRSPEEDS** | | | | | | | | | | | | |
| Takeoff – Rotation | UK: mph<br>GER/ITA: km/h | 120 | 120 | 110 | 55 | 180 | 190 | 170 | 185 | 150 | 170 | 175 |
| Max Dive Speed | | 420 | 390 | 260 | 160 | 750 | 620 | 720 | 675 | 600 | 410 | 600 |
| Optimal Climb Speed | | 165 | 175 | 135 | 66 | 240 | 270 | 215 | 250 | 240 | 240 | 210 |
| Landing – Approach | | 160 | 160 | 140 | 55 | 200 | 220 | 170 | 200 | 200 | 175 | 175 |
| Landing – Touchdown | | 90 | 90 | 85 | 50 | 160 | 180 | 150 | 180 | 140 | 160 | 160 |

# TABLE OF CONTENT – BF.109


- PART 1: AIRCRAFT HISTORY
- PART 2: AIRCRAFT VARIANTS
- PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION
- PART 4: THE CONTROLS
- PART 5: WEAPONS AND ARMAMENT
- PART 6: TAKEOFF
- PART 7: LANDING
- PART 8: ENGINE MANAGEMENT
- PART 9: AIRCRAFT PERFORMANCE
- PART 10: NAVIGATION

# PART 1: AIRCRAFT HISTORY

The **Messerschmitt Bf.109** was a German World War II fighter aircraft designed by Willy Messerschmitt and Robert Lusser during the early to mid-1930s. The "Bf 109" designation was issued by the German ministry of aviation and represents the developing company Bayerische Flugzeugwerke (at which the engineer Messerschmitt led the development of the plane) and a rather arbitrary figure.

# PART 1: AIRCRAFT HISTORY

The first major redesign since the early underpowered variants came with the E series, including the naval variant, the Bf 109T (T standing for *Träger*, or carrier). The Bf 109E, or **"Emil"**, introduced a number of structural changes in order to accommodate the heavier, but significantly more powerful 1,100 PS (1,085 HP) Daimler-Benz DB 601 engine, heavier armament and increased fuel capacity.

Later variants of the Es introduced a fuselage bomb rack or provision for a long-range, standardized 300 litre (79 US gallon) drop-tank, and used the DB 601N engine of higher power output. The 109E first saw service with the "Condor Legion" during the last phase of the Spanish Civil War and was the main variant from the beginning of World War II until mid-1941 when the 109F replaced it in the pure fighter role. From the end of 1941, the Bf.109 was steadily being supplemented by the superior Focke-Wulf Fw 190.

# PART 1: AIRCRAFT HISTORY

It was one of the first truly modern fighters of the era, including such features as all-metal monocoque construction, a closed canopy, a retractable landing gear, and was powered by a liquid-cooled, inverted-V12 aero engine.

# PART 1: AIRCRAFT HISTORY

Originally conceived as an interceptor, later models were developed to fulfill multiple tasks, serving as bomber escort, fighter-bomber, day-, night-, all-weather fighter, ground-attack aircraft, and as reconnaissance aircraft. It was supplied to and operated by several states during World War II, and served with several countries for many years after the war.

The Bf.109 was the most produced fighter aircraft in history, with a total of 33,984 airframes produced from 1936 up to April 1945.

# PART 2: AIRCRAFT VARIANTS

| | (Unit) | Bf.109 E-1 | Bf.109 E-1/B | Bf.109 E-3 | Bf.109 E-3/B | Bf.109 E-4 | Bf.109 E-4/B | Bf.109 E-4/N DERATED | Bf.109 E-4/N |
|---|---|---|---|---|---|---|---|---|---|
| **TEMPERATURES** | | | | | | | | | |
| **Water Rad Min<br>Max** | Deg C | 40<br>100 | 40<br>100 | 40<br>100 | 40<br>100 | 40<br>100 | 40<br>100 | 40<br>100 | 40<br>100 |
| **Oil Rad (OUTBOUND) Min<br>Max** | Deg C | 40<br>105 | 40<br>105 | 40<br>105 | 40<br>105 | 40<br>105 | 40<br>105 | 40<br>105 | 40<br>105 |
| **ENGINE SETTINGS & PROPERTIES** | | | | | | | | | |
| **Engine & Fuel Grade** | | DB601 A-1<br>B-4 – 87 octane | DB601 A-1<br>B-4 – 87 octane | DB601 A-1<br>B-4 – 87 octane | DB601 Aa<br>B-4 – 87 octane | DB601 A-1<br>B-4 – 87 octane | DB601 Aa<br>B-4 – 87 octane | DB601 N-1 DERATED<br>C-3 – 100 octane | DB601 N-1<br>C-3 – 100 octane |
| **Takeoff RPM** | RPM | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2600 | 2600 |
| **Takeoff Manifold Pressure** | UK: PSI<br>GER: ATA<br>ITA: mm HG | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.35 | 1.35 |
| **Climb RPM** | RPM | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2300<br>30 min MAX | 2400<br>30 min MAX | 2400<br>30 min MAX |
| **Climb Manifold Pressure** | UK: PSI<br>GER: ATA<br>ITA: mm HG | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.25 | 1.25 |
| **Normal Operation/Cruise RPM** | RPM | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2300 | 2300 |
| **Normal Operation/Cruise Manifold Pressure** | UK: PSI<br>GER: ATA<br>ITA: mm HG | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 |
| **Combat RPM** | RPM | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2600 | 2600 |
| **Combat Manifold Pressure** | UK: PSI<br>GER: ATA<br>ITA: mm HG | 1.3<br>5 min MAX | 1.3<br>5 min MAX | 1.3<br>5 min MAX | 1.35<br>5 min MAX | 1.3<br>5 min MAX | 1.35<br>5 min MAX | 1.35<br>5 min MAX | 1.35<br>5 min MAX |
| **Emergency Power/ Boost RPM @ km** | RPM | 2500<br>1 min MAX | 2500<br>1 min MAX | 2500<br>1 min MAX | 2500<br>1 min MAX | 2500<br>1 min MAX | 2500<br>1 min MAX | - | 2600<br>1 min MAX |
| **Emergency Power / Boost Manifold Pressure @ Sea Level** | UK: PSI<br>GER: ATA<br>ITA: mm HG | 1.40<br>1 min MAX | 1.40<br>1 min MAX | 1.40<br>1 min MAX | 1.45<br>1 min MAX | 1.40<br>1 min MAX | 1.45<br>1 min MAX | - | 1.42<br>1 min MAX |
| **Landing Approach RPM** | RPM | 2300 | 2300 | 2300 | 2300 | 2300 | 2300 | 2400 | 2400 |
| **Landing Approach Manifold Pressure** | GER: ATA<br>ITA: mm HG | As required | As required | As required | As required | As required | As required | As required | As required |
| **Top Speed @ Sea Level** | UK: MPH<br>GER-ITA: km/h | **490** | **490** | **500** | **510** | **500** | **510** | **510** | **510** |
| **Notes** | | MANUAL PITCH<br>4 x MG17<br>NO CANNON | MANUAL PITCH<br>4 x MG17<br>NO CANNON<br>BOMB LOAD | MANUAL PITCH<br>2 x MG17<br>2 x MG/FF<br>NO MINENGSCH. | MANUAL PITCH<br>2 x MG17<br>2 x MG/FF<br>NO MINENGSCH.<br>BOMB LOAD | AUTO PITCH<br>2 x MG17<br>2 x MG/FFM<br>MINENGSCH. | AUTO PITCH<br>2 x MG17<br>2 x MG/FFM<br>MINENGSCH.<br>BOMB LOAD | AUTO PITCH<br>2 x MG17<br>2 x MG/FFM<br>MINENGSCH.<br>NO WEP | AUTO PITCH<br>2 x MG17<br>2 x MG/FFM<br>MINENGSCH.<br>SAW LITTLE TO NO ACTION |

# PART 2: AIRCRAFT VARIANTS


**BF.109E-1**


**BF.109E-1/B**


**BF.109E-3**


**BF.109E-3/B**


**BF.109E-4**


**BF.109E-4/B**

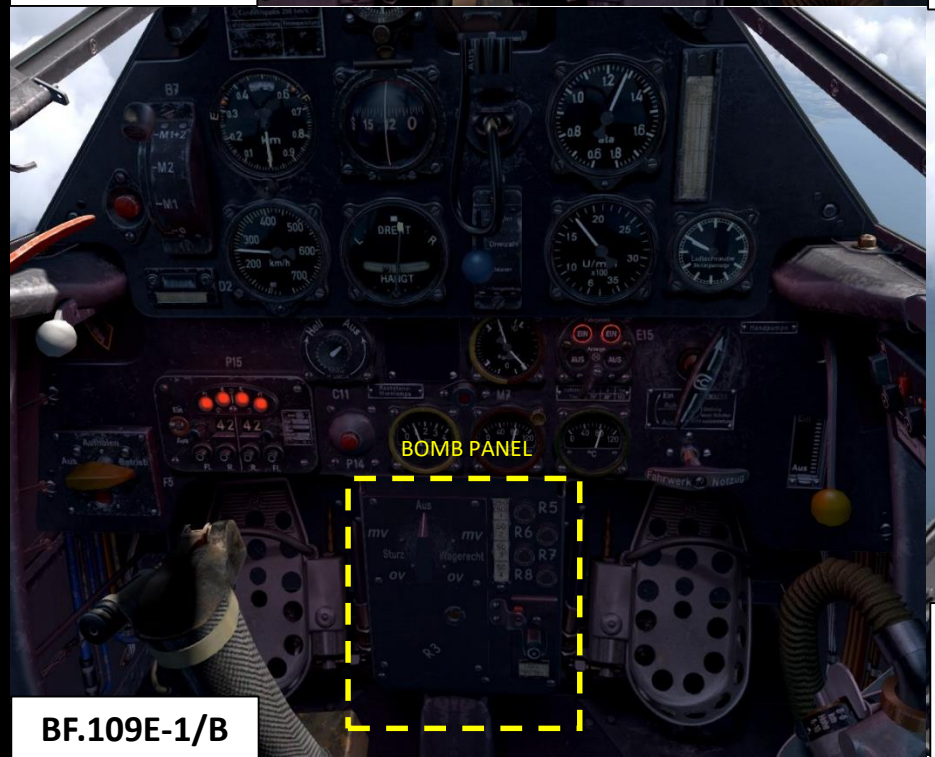

**BF.109E-4/N**


**BF.109E-4/N-DeRated**

# PART 2: AIRCRAFT VARIANTS


BF.109E-1


BF.109E-3



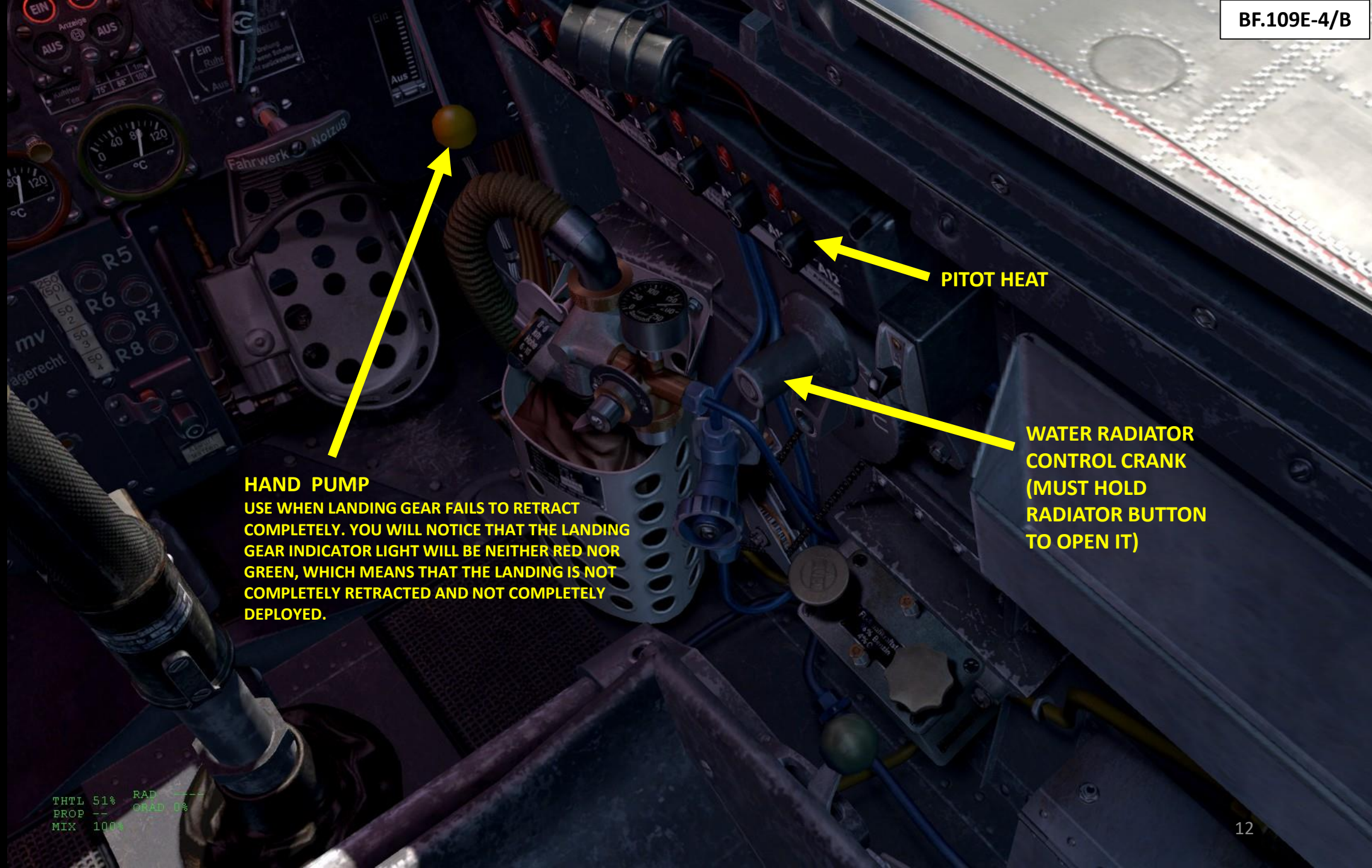

BF.109E-1/B


BF.109E-4
BF.109E-4/N
BF.109E-4/N DERATED

# PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

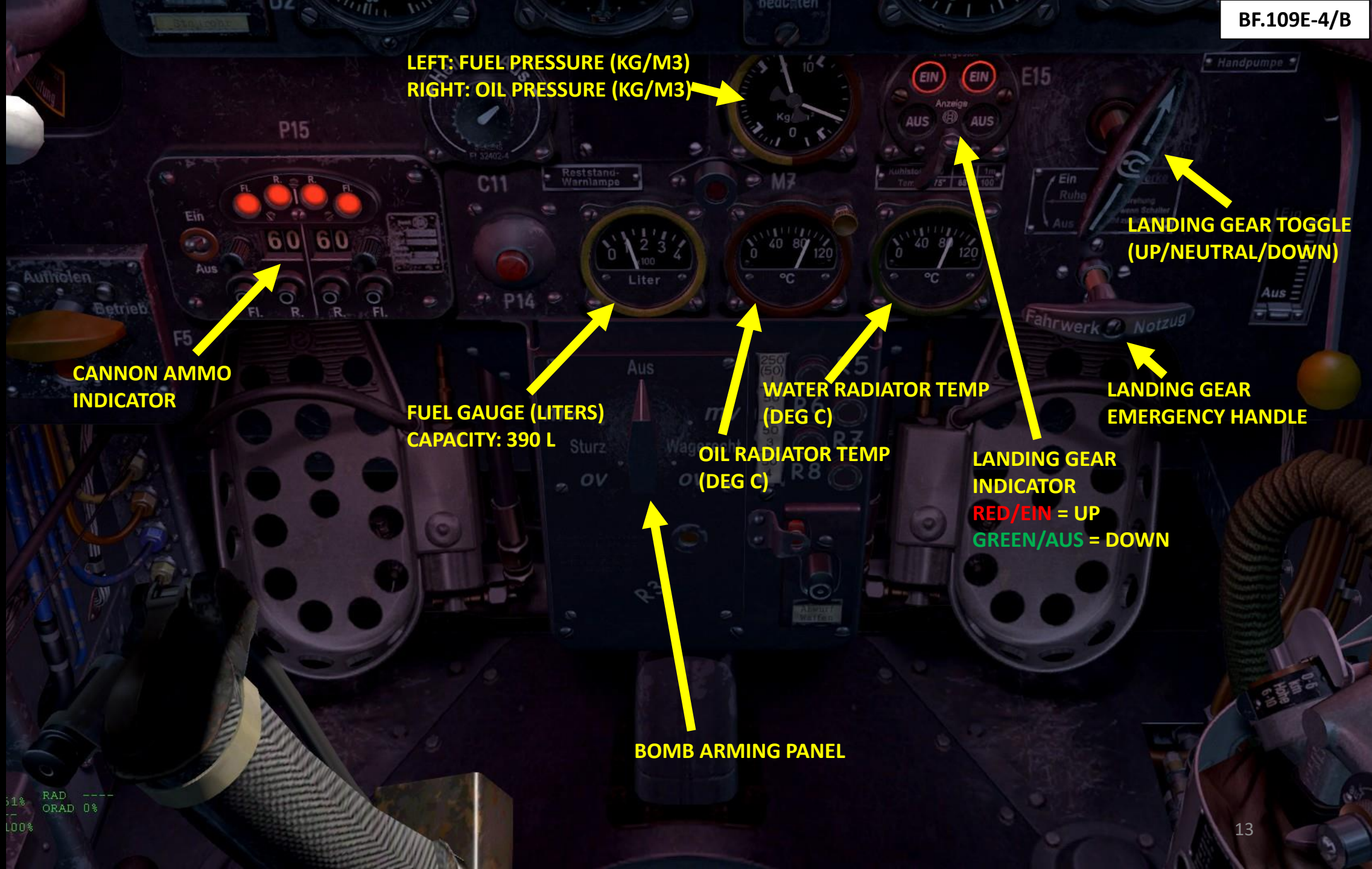
# PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION





# PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

BF.109E-4/B



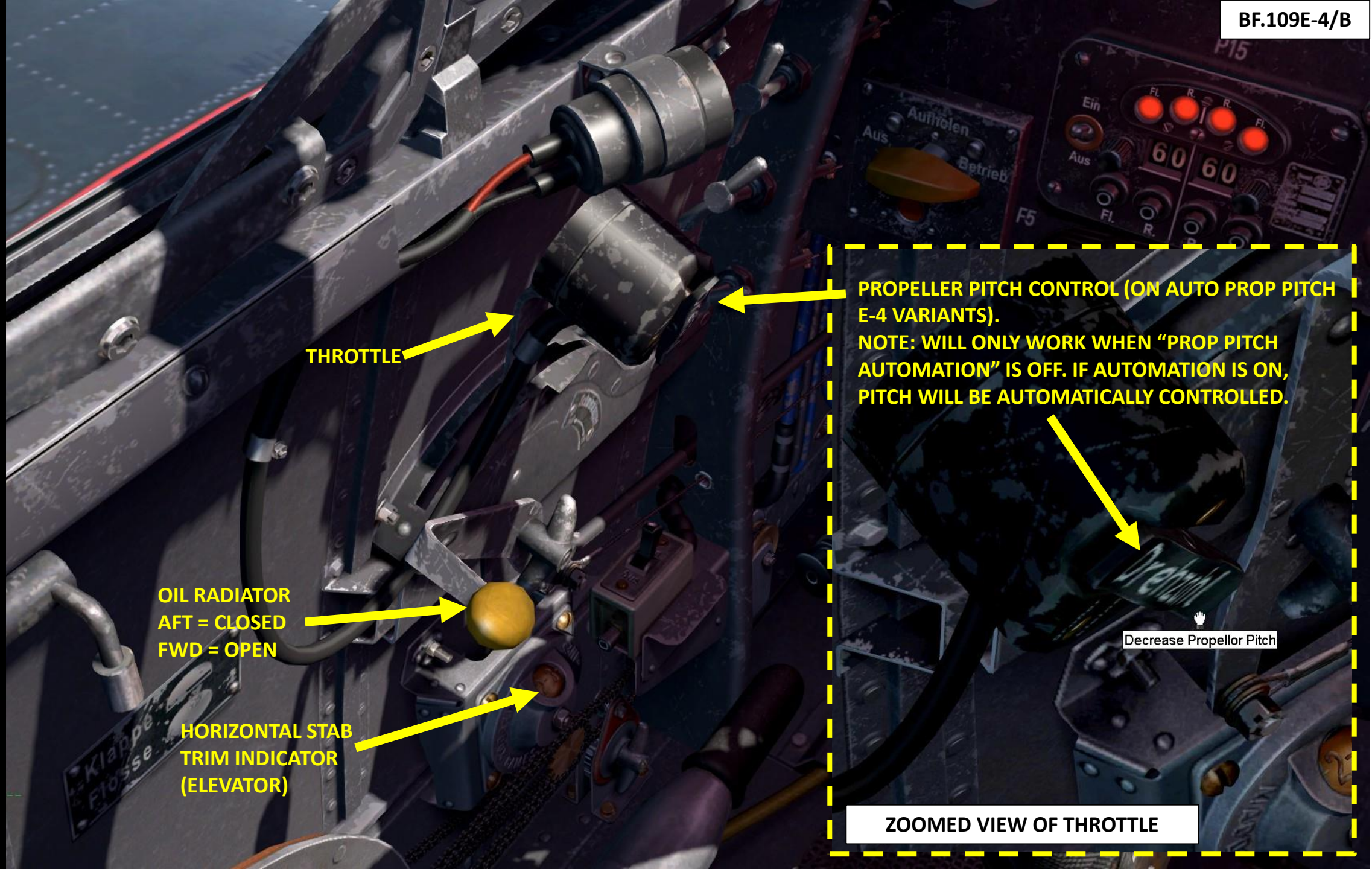
# PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

BF.109E-4/B


GUNSIGHT DIMMER
CLOCK
THTL 51%
PROP --
MIX 100%
RAD ----
ORAD 0%
-M1+2
-M2
-M1

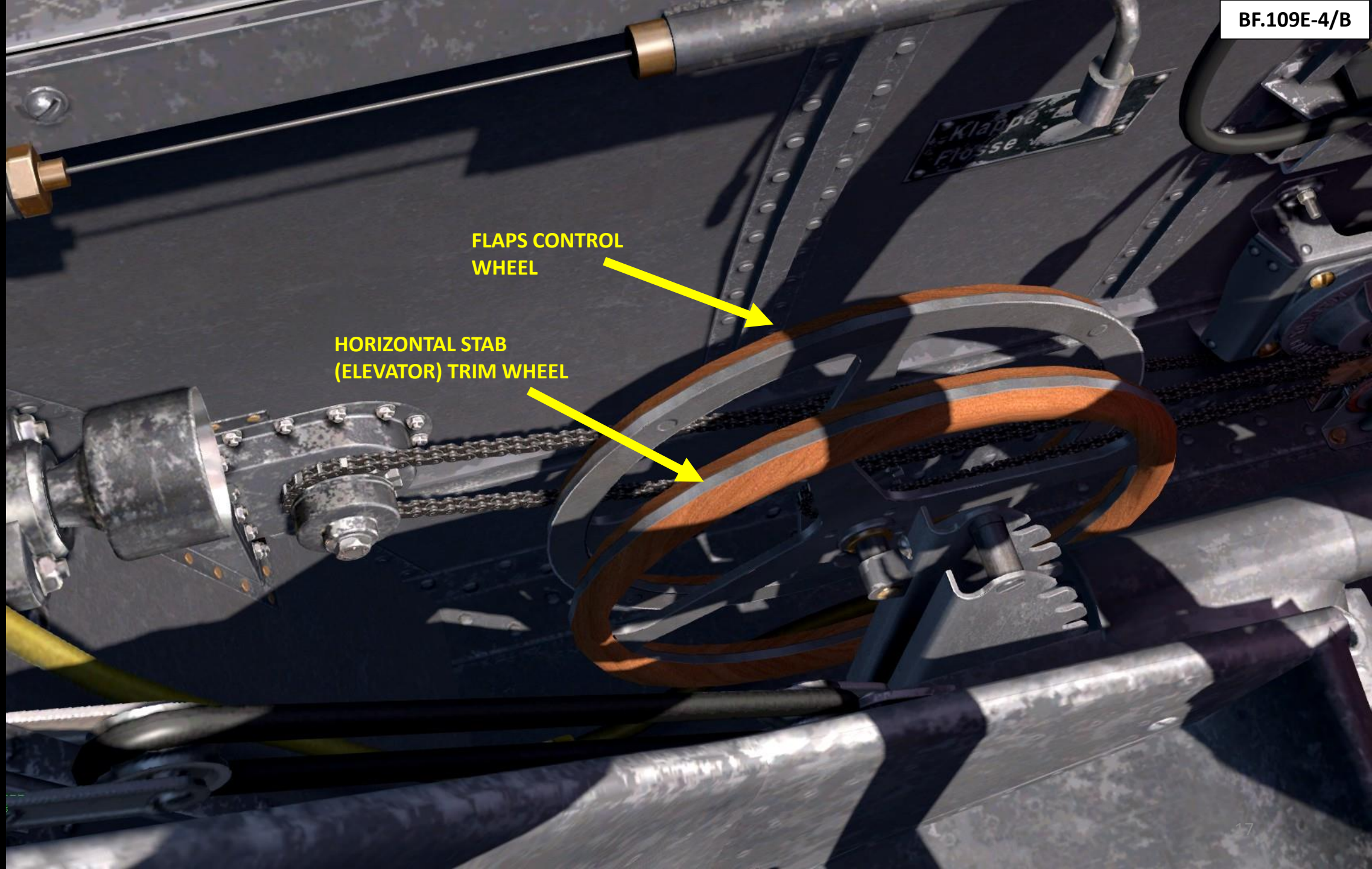
PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

BF.109E-4/B



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

BF.109E-4/B

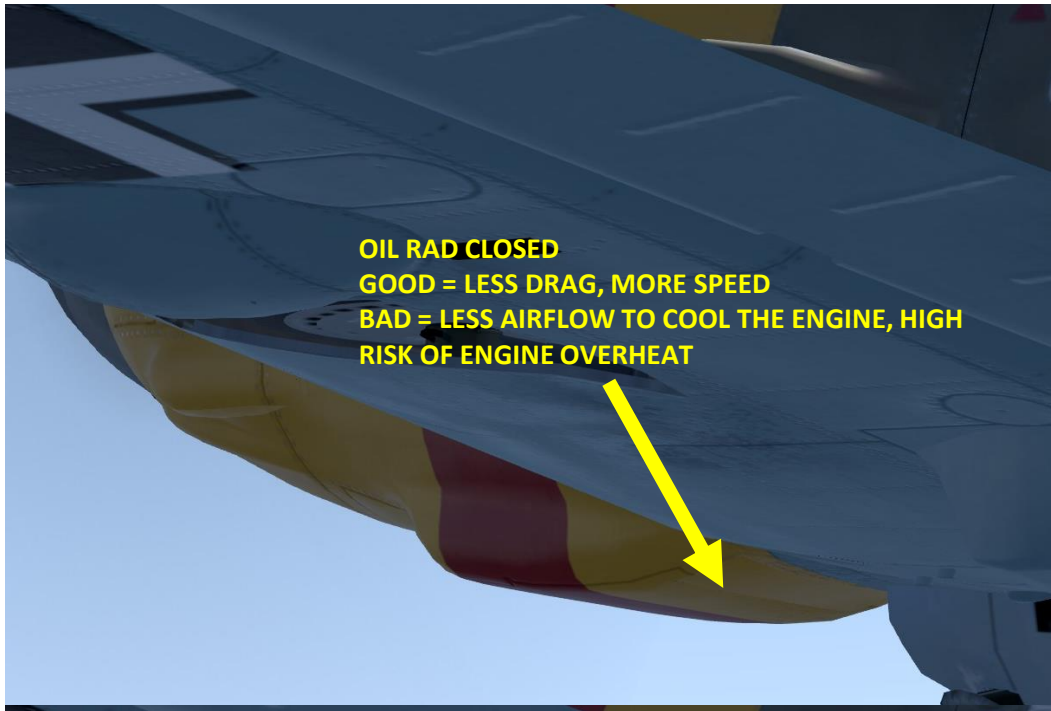


# PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

BF.109E-3
& BF.109E-1

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

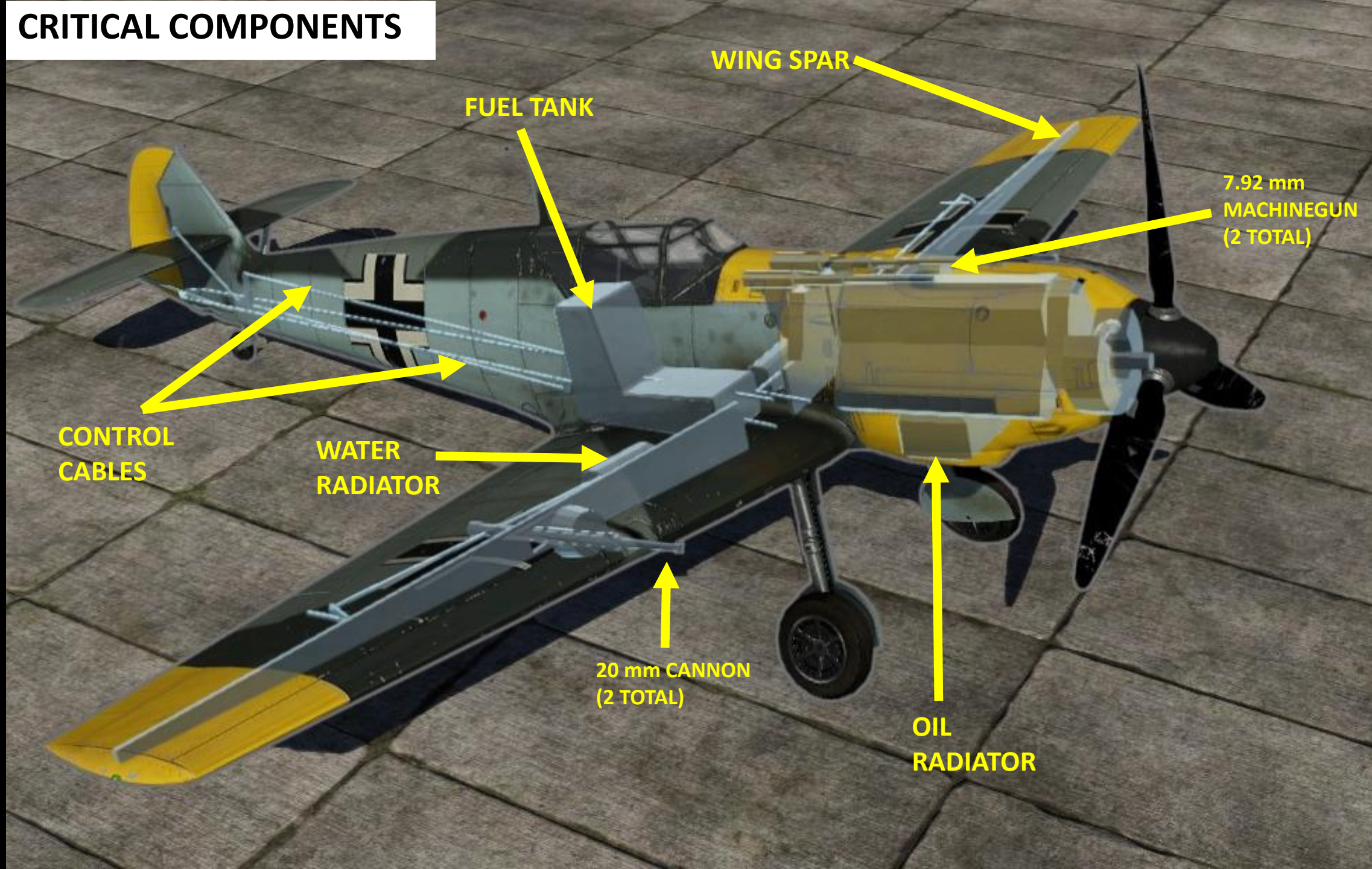
## CHECK THE “ENGINE MANAGEMENT” SECTION FOR RECOMMENDED RADIATOR SETTINGS.



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

# CRITICAL COMPONENTS



# HOW TO RECOGNIZE A TAIL NUMBER

# LUFTWAFFE

The tactical markings system for the Luftwaffe in WWII must have been designed by a mad genius. Comparative simplicity of the systems used by Italy and the British is a further testament to the fact.

The system will seem extremely convoluted to most everyone who reads this guide; imagine programming all that into the sim!

**Serial Number or Werknummer:** usually a four-digit number.

**Some Examples** (symbols in **bold** can be set by the player, symbols in *italics* are automatically set by Cliffs of Dover)

| Plane | Squadron | Tactical # | Serial # |
|---|---|---|---|
| Bf-109E-3 | II./JG26 | <<+- | **1542** |
| Bf-109E-3 | 7./JG26 | **7**+\| | **1195** |
| Bf-110 | 5./ZG1 | *G9*+**I***N* | **4277** |
| Bf-110 | Stab II./ZG76 | *M8*+**K***C* | **3863** |
| He-111 | Stab./KG55 | *G1*+**F***A* | **1582** |
| Ju-87 | III./StG51 | *6G*+**A***D* | **5338** |

**Tail Number.** Two completely different systems were used for bomber and fighter aircraft.

***Fighters:*** Squadron designated by squadron badge. Tactical number either consists of a one- or two-digit number, or a special symbol such as double chevron for a group commander. See below for all symbols supported by Cliffs of Dover.

Colour of the tactical number determines the Staffel within the squadron the aircraft belongs to. Some Gruppen are also marked with another special symbol aft of the fuselage cross, such as a horizontal line for II. Gruppe or a curvy line for the III. Gruppe.

***Bombers:*** a four character string, in which the first two symbols are the squadron code, usually a number and a letter. The next symbol is the individual aircraft letter, and the final is the letter that identifies which Gruppe and Staffel the aircraft belongs to. The final letter also determines the colour of the individual aircraft letter.

## Luftwaffe Fighter Symbols

Note that there are multiple variants for some positions, which give similar but distinct markings. For example both <|- and <I mean Geschwader Adjutant, but display different graphics on the aircraft. These variations were generally created and used by individual squadrons.

| Symbol | Deciphered | Meaning |
|---|---|---|
| <\|- | [less than] [vert line] [dash] | Geschwader Adjutant |
| <\| | [less than] [vert line] | Geschwader Adjutant |
| <I | [less than] [capital I] | Geschwader Adjutant |
| -- | [dash] [dash] | Geschwader Adjutant |
| -o | [dash] [lower case o] | Geschwader Adjutant |
| <-- | [less than] [dash] [dash] | Geschwader Commodore |
| <_1 | [less than] [underscore] [number 1] | Geschwader Commodore |
| <- | [less than] [dash] | Geschwader Commodore |
| <.- | [less than] [period] [dash] | Geschwader Commodore |
| <<- | [less than] [less than] [dash] | Geschwader Commodore |
| <<<4 | [less than] [less than] [less than] | Geschwader Commodore |
| K<< | [less than] [less than] | Geschwader Commodore Kuban |
| <\|\| | [less than] [vert line] [vert line] | Geschwader Major Beim Stab |
| <o- | [less than] [lower case o] [dash] | Geschwader Technical Officer |
| <O- | [less than] [capital O] [dash] | Geschwader Technical Officer |
| <\|o | [less than] [vert line] [lower case o] | Geschwader Technical Officer |
| <Io | [less than] [capital I] [lower case o] | Geschwader Technical Officer |
| <\|O | [less than] [vert line] [capital O] | Geschwader Technical Officer |
| <IO | [less than] [capital I] [capital O] | Geschwader Technical Officer |
| < | [less than] | Gruppen Adjutant |
| _< | [underscore] [less than] | Gruppen Adjutant |
| <1 | [less than] [one] | Gruppen Beim Stab |
| <. | [less than] [period] | Gruppen Kommandeur |
| _<. | [underscore] [less than] [period] | Gruppen Kommandeur |
| << | [less than] [less than] | Gruppen Kommandeur |
| I<< | [capital I] [less than] [less than] | Gruppen Kommandeur |
| <o | [less than] [lower case o] | Gruppen Technical Officer |
| <O | [less than] [capital O] | Gruppen Technical Officer |
| T | [capital T] | Gruppen Technical Officer |
| <* | [less than] [asterisk] | Gruppen Technical Officer |
| <t | [less than] [lower case T] | Kommodore |
| <0 | [less than] [zero] | Kuban |
| -A- | [dash] [capital A] [dash] | Stab. |
| I_ | [capital I] [underscore] | Stab. |

*NOTE: Many of these symbols were historically meant for Stab aircraft only; however you can still assign them to other Staffeln, which may colour these symbols in non-historical Staffel colours.*

PART 4: CONTROLS

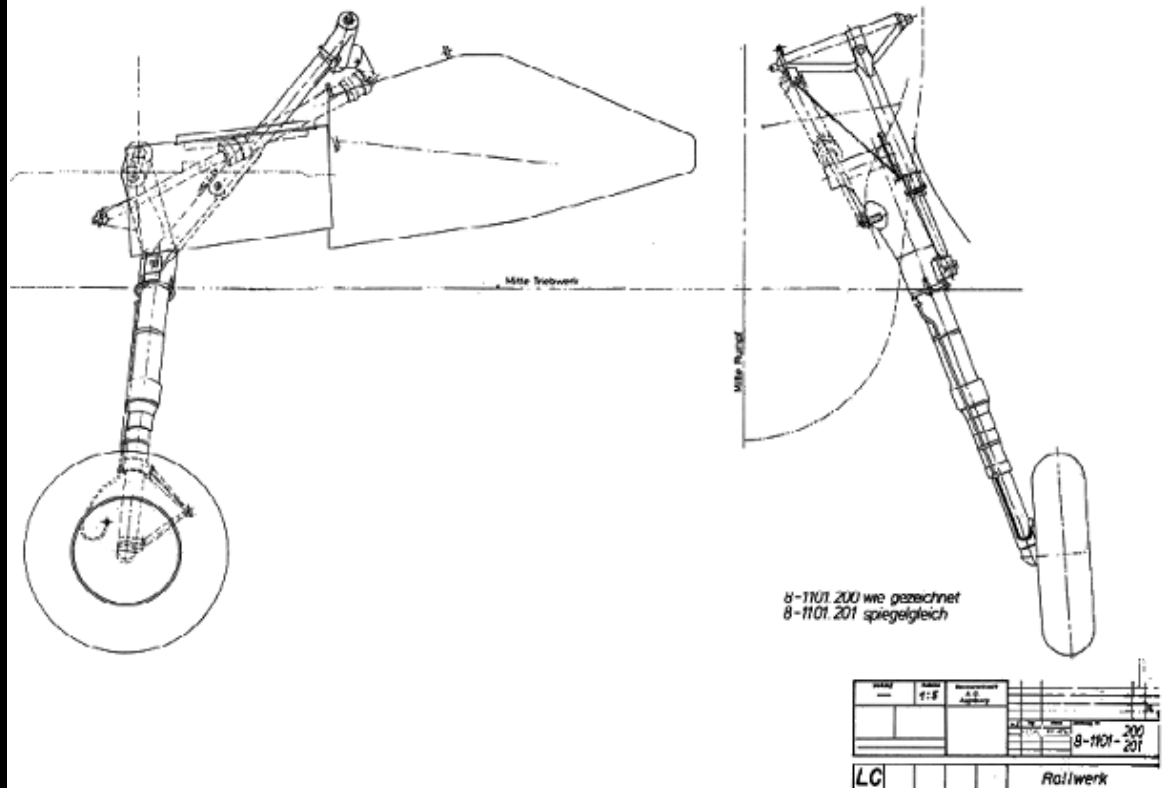
| MESSERSCHMITT BF.109E (ALL VARIANTS) | | |
|---|---|---|
| DESCRIPTION | MAPPED TO | ESSENTIAL / NON-ESSENTIAL |
| Wheel Chocks | | ESSENTIAL |
| toggle primary cockpit illumination | | CLICKABLE IN COCKPIT |
| toggle secondary cockpit illumination | | CLICKABLE IN COCKPIT |
| fire machine guns | Joystick Gun Trigger | ESSENTIAL |
| fire cannons | Joystick Cannon Trigger | ESSENTIAL |
| toggle prop pitch automation (E-4 MODELS ONLY) | | ESSENTIAL |
| toggle gunsight illumination | | ESSENTIAL |
| bomb mode selector – next / previous (salvo/single) | SEE BOMBER NUMPAD | ESSENTIAL |
| bomb salvo quantity – next / previous | SEE BOMBER NUMPAD | ESSENTIAL |
| toggle bombs armed | SEE BOMBER NUMPAD | ESSENTIAL |
| toggle bomb short delay | SEE BOMBER NUMPAD | ESSENTIAL |
| Drop ordnance (bombs) | B | ESSENTIAL |
| toggle selected engine (ignition) | “I” by default | ESSENTIAL |
| directional controls (ailerons, elevators, and rudder) | Joystick & Rudder Pedal axes | ESSENTIAL |
| Trim controls (elevator/Horizontal Stab) | Joystick hat switch | ESSENTIAL |
| Field of View + (allows you to zoom out) | | ESSENTIAL |
| Field of View – (allows you to zoom in) | | ESSENTIAL |

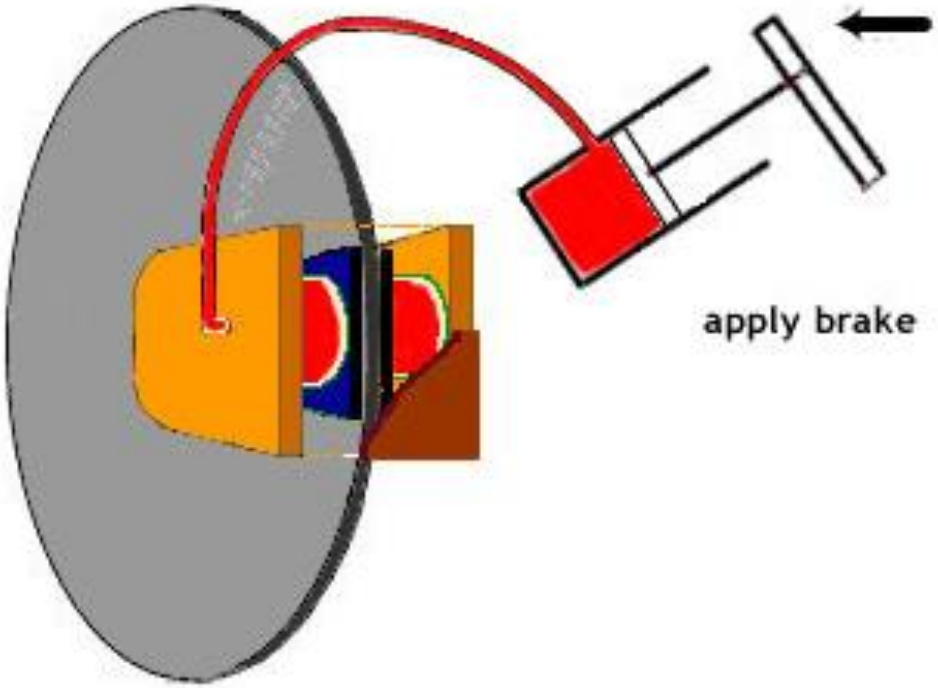
# PART 4: CONTROLS

| MESSERSCHMITT BF.109E (ALL VARIANTS) | | |
|---|---|---|
| DESCRIPTION | MAPPED TO | ESSENTIAL / NON-ESSENTIAL |
| lean to gunsight | | NOT ESSENTIAL |
| throttle | Throttle axis | ESSENTIAL |
| War Emergency Power | | ESSENTIAL |
| toggle canopy/hatch | | ESSENTIAL |
| Jettison canopy | | ESSENTIAL |
| Open oil radiator | Right Arrow keyboard | ESSENTIAL |
| close oil radiator | Left Arrow keyboard | ESSENTIAL |
| open radiator | Up Arrow keyboard | ESSENTIAL |
| close radiator | Down Arrow keyboard | ESSENTIAL |
| increase propeller pitch | **CUSTOM. DO NOT MAP TO AXIS LIKE FOR THE RAF A/C. MAP TO KEYS INSTEAD.** | ESSENTIAL |
| decrease propeller pitch | | ESSENTIAL |
| Toggle undercarriage (landing gear) | | ESSENTIAL |
| Left / Right Wheel brake | Map in AXES if pedals | ESSENTIAL |
| bail out | | ESSENTIAL |
| engage emergency undercarriage system | | CLICKABLE IN COCKPIT |
| Toggle Independent Mode (allows you to use/hide mouse cursor) | F10 | ESSENTIAL |

# PART 4: CONTROLS

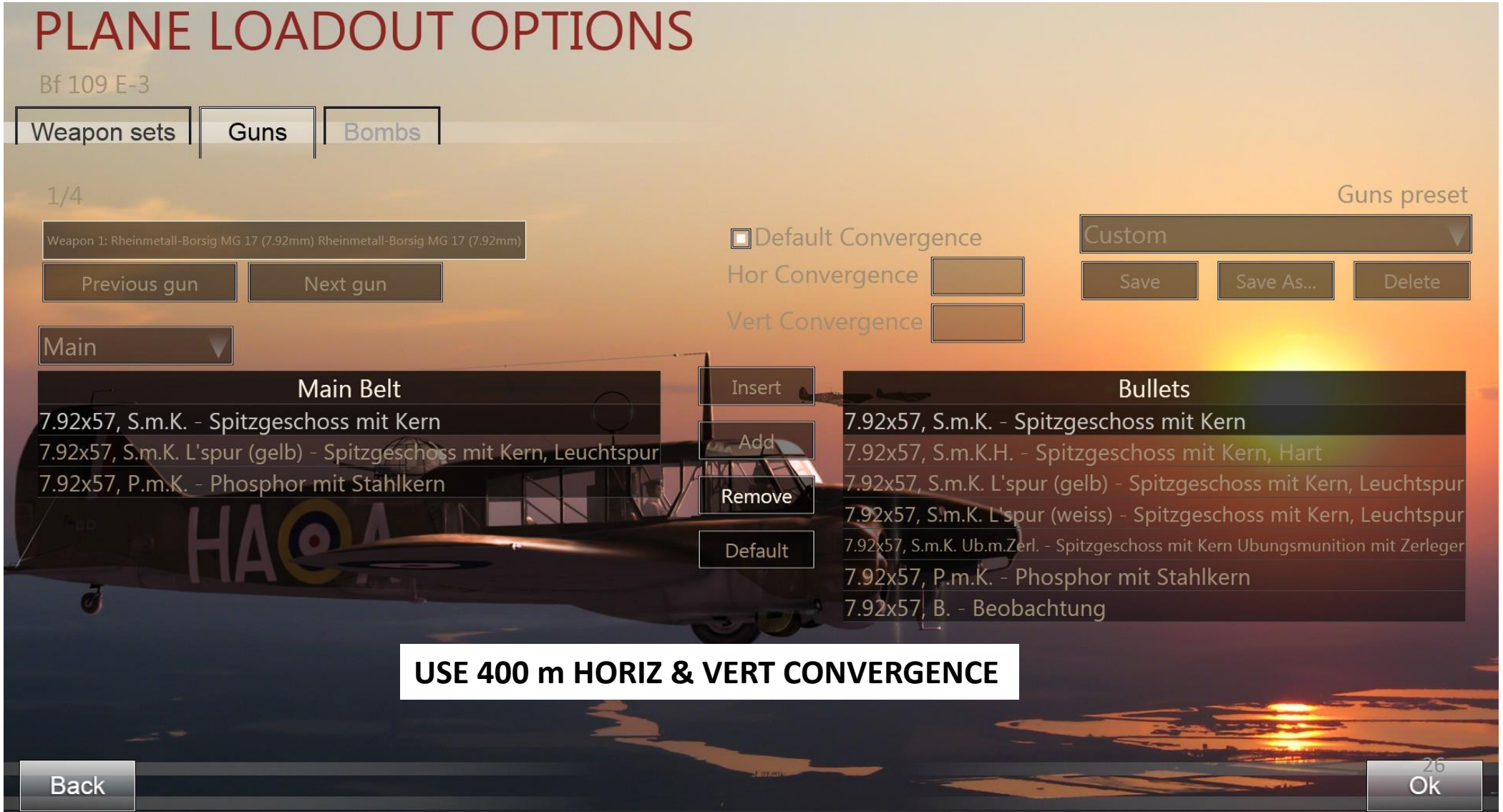
- Most german aircraft, unlike the majority of British and Russian planes, has a “toe brake” or “heel brake” system, which is linked to each individual wheel of your landing gear.
- In order to brake, you need to hold either your left or right wheel toe brake key to steer your aircraft. Applying rudder will also help you turn tighter.
- The main landing wheel brake system employs hydraulically actuated disc-type brakes. Each brake is operated by individual master brake cylinders located directly forward of the instrument panel. The brakes are selectively controlled by means of toe pedals incorporated into the rudder pedal assembly.
- Be careful: your “wheel brake” command used for Differential braking aircraft will lock both your brakes in a german plane. You can map “left/right wheel brake” axes if you have rudder pedals.



# Recommended Machine-Gun Belt Loadout – **Rheinmetall-Borsig MG 17 (7.92 mm)**

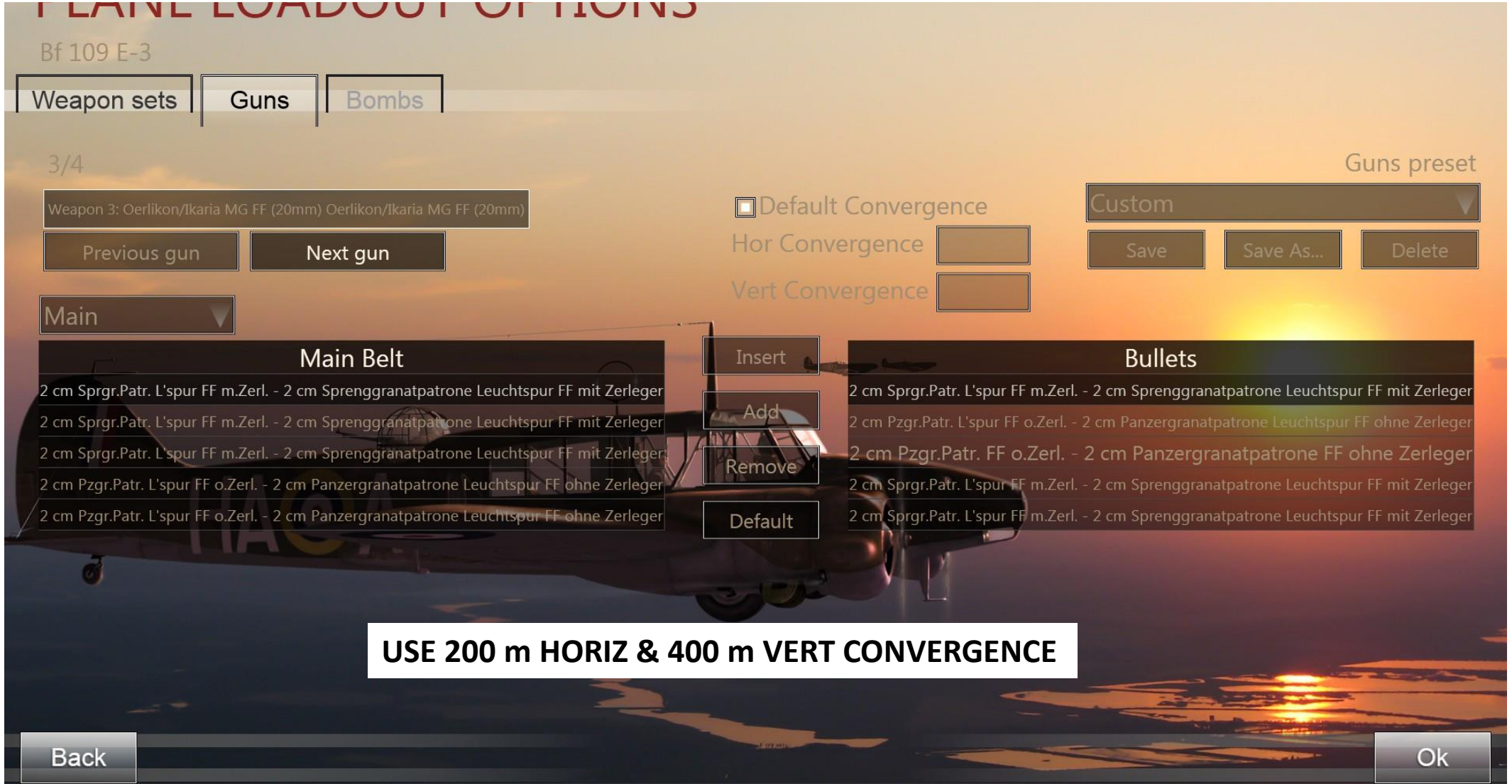
1. 7.92×57, S.m.K.H. - Spitzgeschoss mit Kern, Hart- Improved AP round with tungsten core. Highly recommended if you want a straight AP. However, the S.m.K.H. **in-game is in fact a duplicate of the S.m.K**., because the S.m.K.H. was never used on a fighter aircraft. Tungsten is a precious and expensive metal that was much needed elsewhere for the german war effort.
2. 7.92×57, P.m.K. - Phosphor mit Stahlkern- Standard AP with an incendiary composition. A great round, can still pierce armor and set fires
3. 7.92×57, S.m.K. L'spur (gelb) OR 7.92×57, S.m.K. L'spur (Weiss)- Standard AP with yellow (gelb) or white (Weiss) tracers. Good for aiming.



PART 5: WEAPONS AND ARMAMENT

## Recommended CANNON Belt Loadout – **OERLIKON/IKARIA MG FF OR MG FF/M (20 mm)**

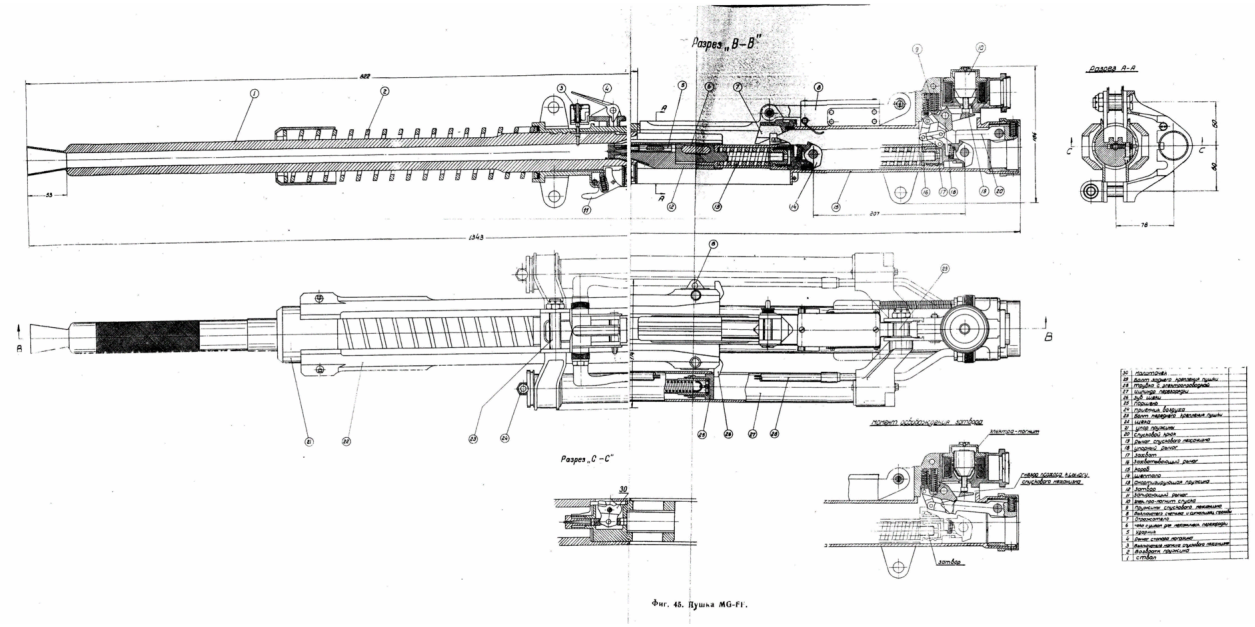
1. ***For Bf.109E-3 Variants (MG FF):*** Sprenggranate L'spur m.Zerl (134g AP round with small HE payload, with tracer and self destruction) A very effective round, has the potential to do major structual damage while still piercing armor.
2. ***For Bf.109E-4 Variants (MG FF/M)****:* M-Geschoss m.Zerl (92g HE with self destruction) Thin walled HE round. Has immense potential for destruction, containing 3 times the amount of HE payload than that of a normal HE round. Arguably the best round for the MG FF/M. However, it does not contain a tracer composition



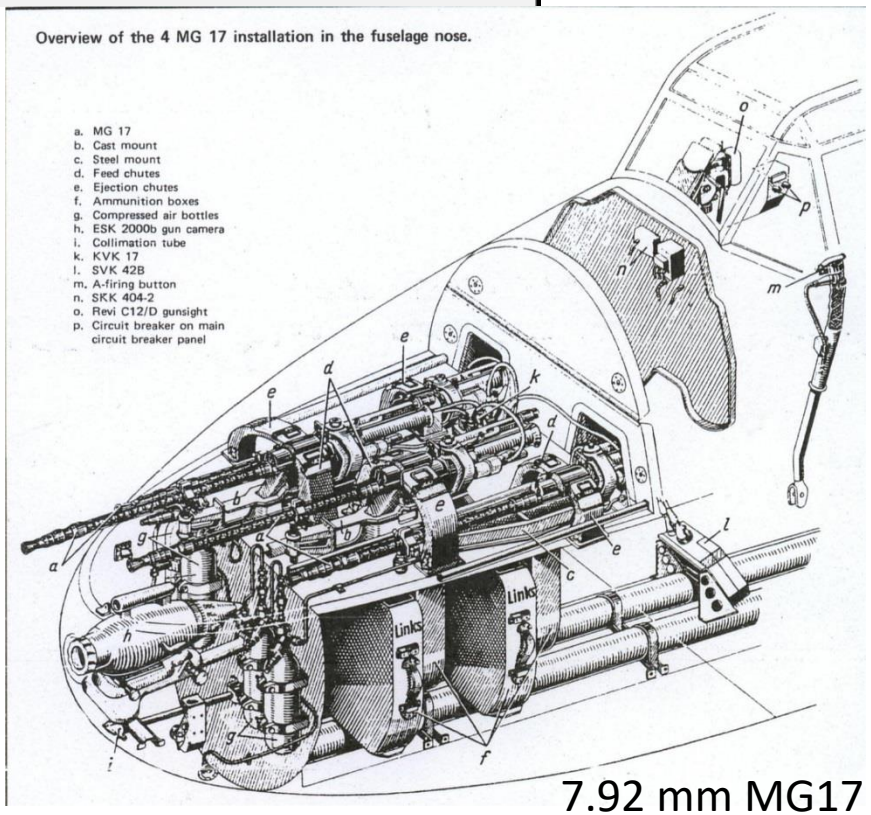

**USE 200 m HORIZ & 400 m VERT CONVERGENCE**

# PART 5: WEAPONS AND ARMAMENT

| ONE | LUFTWAFFE SIGHT DATA | | | | | ONE |
|---|---|---|---|---|---|---|
| Royal Air Force Aircraft | Wingspan | | | REVI C12 SIGHT (100 mils) | | |
| | Meters | Yards | Feet | Range (m) | Range (yds) | Range (ft) |
| Tiger Moth | 8.94 | 9.78 | 29.3 | 89 | 98 | 293 |
| Gladiator Mk.I | 9.80 | 10.72 | 32.2 | 98 | 107 | 322 |
| Spitfire MK.I | 11.23 | 12.28 | 36.8 | 112 | 123 | 368 |
| Defiant MkI | 11.99 | 13.11 | 39.3 | 120 | 131 | 393 |
| Hurricane Mk.I | 12.19 | 13.33 | 40.0 | 122 | 133 | 400 |
| Walrus MkI | 14.00 | 15.31 | 45.9 | 140 | 153 | 459 |
| Blenheim MkI | 17.17 | 18.78 | 56.3 | 172 | 188 | 563 |
| Anson MkI | 17.22 | 18.83 | 56.5 | 172 | 188 | 565 |
| Beaufighter MkIF | 17.65 | 19.30 | 57.9 | 177 | 193 | 579 |
| Wellington MkIc | 26.27 | 28.73 | 86.2 | 263 | 287 | 862 |
| Sunderland MkI | 34.39 | 37.61 | 112.8 | 344 | 376 | 1128 |

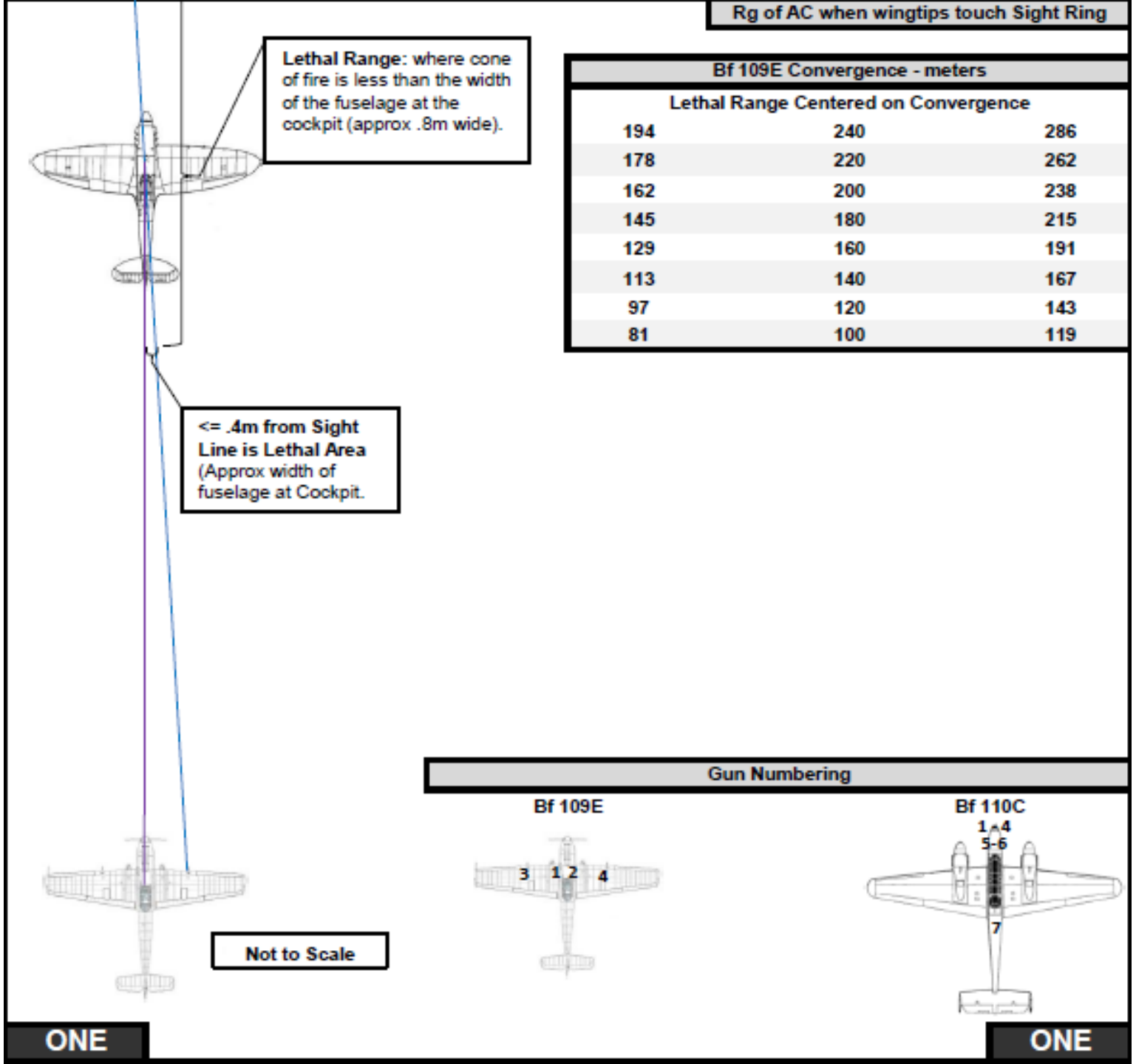


20 mm MG/FF




7.92 mm MG17

# PART 5: WEAPONS AND ARMAMENT



PART 5: WEAPONS AND ARMAMENT

# TWO LUFTWAFFE WEAPON DATA TWO

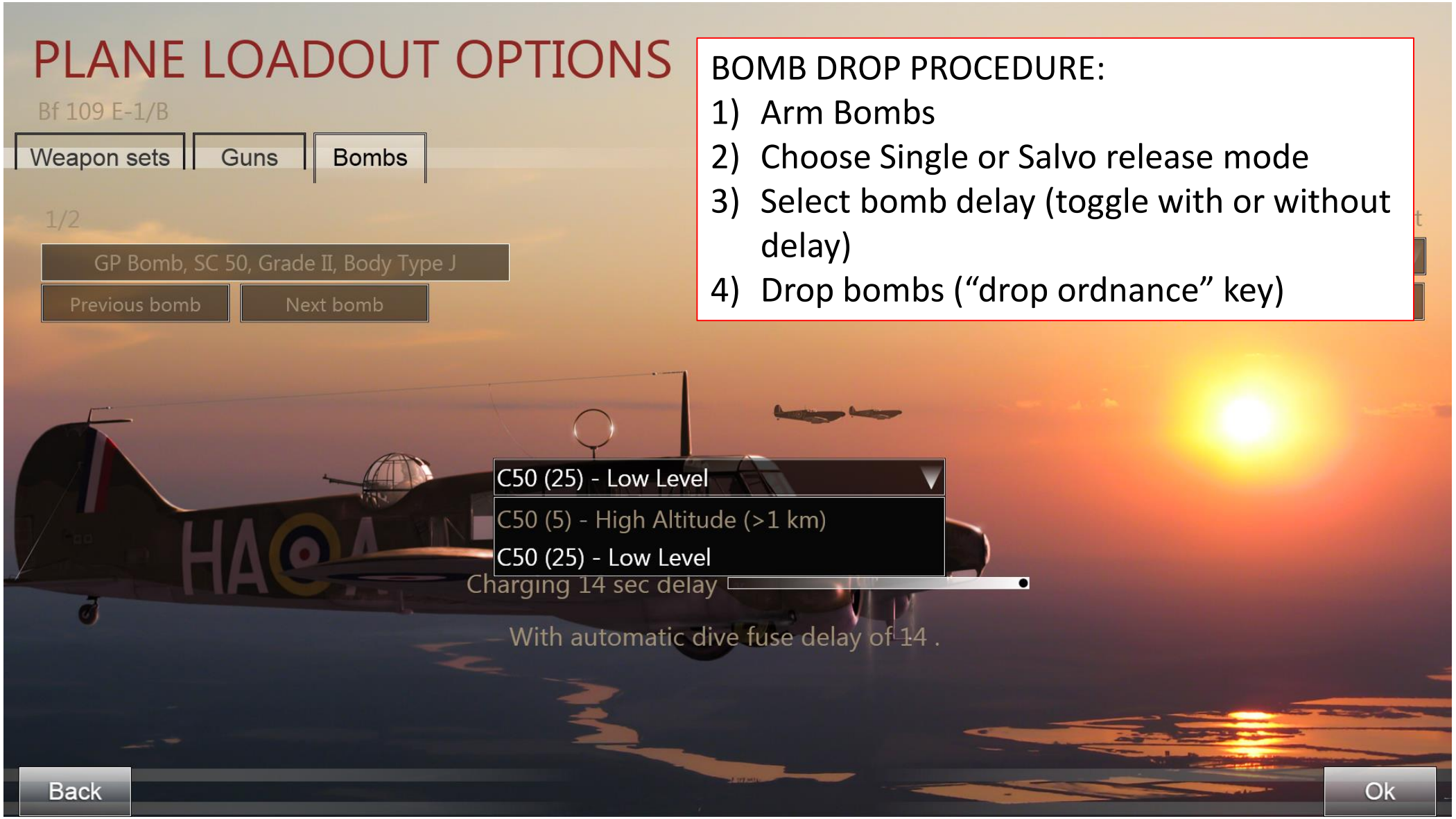
## Luftwaffe Machinegun and Cannon Ammunition

| Weapon | Nomen | Type | Fill | Burnout | Tracer Color | Smoke Trail | Notes |
|---|---|---|---|---|---|---|---|
| MG 17 7.92mm | SmK v | AP | | | | | Steel Core |
| | SmK (H) v | AP (Super) | | | | | WC Core |
| | SmK L'Spur v | AP-T | | 900 m | Yellow | | |
| | SmK L'Spur v | AP-T | | 900 m | White | | |
| | SmK Ub m Zer | SAPHE w SD | | | | | Flash |
| | PmK v | API | Ph | | | Yes | Burns |
| | B Patr v | HEI | Ba | | | | Flash |
| MG FF 20mm | Brsprgr L'Spur | HEI-T / SD | PETN, Mg/Thm | 1100 m | | | 750m SD |
| | Brgr L'Spur | Incend -T / SD | | 1100 m | | Yes | 750m SD, Burns |
| | Pzbrgr | API / SD | | | | | 750m SD |
| | PzBrgr (Elek) | API / SD | Mg | | | | 750m SD |
| | Pzbrgr (Phos) | API / SD | Ph | | | | 750m SD |
| MG FFM | M'gesch. | HE | RDX / Al | | | | 750m SD |
| German Ammunition Types | **SmK - Spitzgeschoss mit Stahlkern** = Pointed bullet with Steel Core | | | | | | |
| | **v - Verbesserte** = Improved - increased propellant for increased muzzle velocity. Aircraft use only | | | | | | |
| | **L'Spur - Leuchtspur** = Tracer | | | | | | |
| | **Ub. - Ubung** = Training Ammo containing a small bursting charge | | | | | | |
| | **m. Zerl - mit Zerleger** = with Burster = SD = Self Destruct Mechanism | | | | | | |
| | **PmK - Phospor mit Stahlkern** = Phosphorus with Steel Core | | | | | | |
| | **B Patr - Beobachtung Patrone** = Observation Cartridge | | | | | | |
| | **Brsprgr - Brandsprenggranate** = Incendiary Explosive Grenade | | | | | | |
| | **Brgr - Brandgranate** = Incendiary Grenade | | | | | | |
| | **Pzbrgr - Panzerbrandgranate** = Armor peircing Incendiary Grenade | | | | | | |
| | **M'gesch. - Minengeschoß** = Mine Projectile - High Capacity HE | | | | | | |
| Notes | **Fill**: Ph (Phosph.), Mg (Magnes.), Al (Alum.), Ba (Barium), WC (Tunsten Carbide), Thm (Thermite) | | | | | | |
| | **Burns** = Incendiary Composition (usually Phosphorus) is ignited on firing and burns during flight | | | | | | |
| | **Flash** = Incendiary Ignition or small HE Burst on impact with target | | | | | | |
| | **Slow Tracer** = Delayed tracer ignition for Night use | | | | | | |

PART 8: ENGINE MANAGEMENT

## Recommended Bomb Loadout

1. **For ship or low-level bombing:** 4 X SC50 GP BOMB, Low Level Fuse, 14 sec delay
2. **For high altitude dive bombing:** 1 X SC250 BOMB, High Altitude Fuse, 0 sec delay




BOMB DROP PROCEDURE:

1) Arm Bombs
2) Choose Single or Salvo release mode
3) Select bomb delay (toggle with or without delay)
4) Drop bombs (“drop ordnance” key)

# PART 5: WEAPONS AND ARMAMENT

| Bombs | | | | | |
|---|---|---|---|---|---|
| **Country** | **Nomen** | **Type** | **WT (lbs/kg)** | **Fuze** | **Aircraft** |
| **Luftwaffe** | SC 50 | GP | 110 / 50 | 5, 25B | Ju87B, Ju88, Me109, He111 |
| | SC 250 | GP | 551 / 250 | 5, 15, 25B | Ju87B, Ju88, Me109, Me110, He111 |
| | SD 250 | Semi-AP Frag | 551 / 250 | 5 | Ju87B, Ju88, Me110, He111 |
| | SC 500 | GP | 1102 / 500 | 25B | Ju87B, Ju88 |
| | SD 500 | Semi-AP Frag | 1102 / 500 | 5 | Ju87B, Ju88 |
| **Notes** | **SC - Sprengcylindrische** = Cylindrical Explosive: GP - General Pupose HE | | | | |
| | **SD - Spreng Dickenwand** = Thick wall Explosive: Semi AP Frag - Thick walled case HE | | | | |

| Pistols | | | | | |
|---|---|---|---|---|---|
| **Weapon** | **Nomen** | **Type** | | **Settings (oV, mV, Vz)** | **Bomb Type** |
| **Luftwaffe Fuzes** | 5 | High Alt | | 0, .8sD | SC50, SC250, SD500 |
| | 15 | Dive | | 0, .05sD, 8sD | SC250 |
| | 25B | Low Alt | | 0, .8sD, 14sD | SC50, SC250, SC500 |
| **Notes** | **Settings:** 0 = Instantaneous; 8sD = 8 second Delay; etc | | | | |
| | **LW High Alt** = High Altitude Release - Greater Than 1km | | | | |
| | **LW Low Alt** = Low Altitude Release - Less Than 1km | | | | |
| | **LW Dive** = Automatic Delay in Dive Release of 14 seconds | | | | |
| **TWO** | | | | | **TWO** |

# PART 5: WEAPONS AND ARMAMENT

THREE **LW WEAPON SYSTEMS OPERATION** THREE

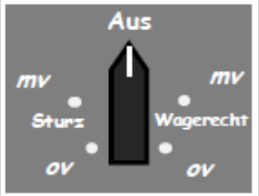
Operating instructions for the ZSK 244 /244 A2 and the ASK-R for the Me 109E-3/B,Me 109E-4/B, and Me 110C-7.

NOTE: The in game operation of the Zünderschaltkasten (ZSK) and Abwurfschaltkasten (ASK) differ from the historical modes of operation for the devices. These operating instructions reflect "In Game" use.

**Schaltkasten (Control Box) Diagrams**

**Zünderschaltkasten (Fuze Control Box)**

Aus (Off)




Sturz (Dive)
Wagerecht (Level)
mv (with Delay)
ov (without Delay)

**Abwurfschaltkasten (Weapons Release Control Box)**

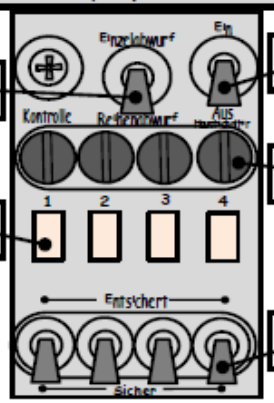
Einzelabwurf (Single Release)

Wahlschalter (Selector Switch)

Reihenabwurf (Salvo Release)

Schauzeichen (Weapon Indicators)

Lit when selected and armed




Ein (On)

Hauptschalter (Main Switch)

Aus (Off)

Bomb Rack Selectors (non-historical)

Entsichert (Armed)

Sicherungsschalter (Arming Switches)

Sicher (Safe)

**In Game Commands to ASK and ZSK Mapping**

| Game Command | Device | Device Function |
|---|---|---|
| Toggle Bombs Arm ON | ASK | Sicherungsschalter Entsichert |
| Toggle Bombs Arm OFF | ASK | Sicherungsschalter Sicher |
| Toggle Distributer Short Delay ON | ZSK | Sturz mV |
| Toggle Distributer Short Delay OFF | ZSK | Waagerecht mV |
| Select Bomb Rack Previous | ASK | Bomb Rack Button (non-historical) |
| Select Bomb Rack Next | ASK | Bomb Rack Button (non-historical) |
| Distributer Mode Previous | ASK | Wahlschalter Einzelabwurf |
| Distributer Mode Next | ASK | Wahlschalter Reihenabwurf |
| Salvo Quantity Decrease | NA | Not Available for the ZSK 244 /244 A2 and the ASK-R |
| Salvo Quantity Increase | NA | Not Available for the ZSK 244 /244 A2 and the ASK-R |
| Distributer Delay Decrease | NA | Not Available for the ZSK 244 /244 A2 and the ASK-R |
| Distributer Delay Increase | NA | Not Available for the ZSK 244 /244 A2 and the ASK-R |

**Abwurfschaltkasten Operation**

| | |
|---|---|
| Einzelaburf (Single Release) | 1. All Safety Switches to -- SICHER (SAFE)<br>2. Hauptschalter to -- EIN (ON); Check for Kontrolle and Weapon Station Indicator Light(s)<br>3. Wahlschalter to -- EINZELABWURF (SINGLE RELEASE)<br>4. Weapon Safety Switches to -- ENTSICHERT (ARM)<br>5. Press Weapon Release Button on Control Stick to release first selected weapon. Each subsequent press will release the next weapon selected. |
| Reihenabwurf (Salvo Release) | 1. All Safety Switches to -- SICHER (SAFE)<br>2. Hauptschalter to -- EIN (ON); Check for Kontrolle Light ON<br>3. Wahlschalter to -- EINZELABWURF (SINGLE RELEASE)<br>4. All Weapon Station Safety Switches to -- ENTSICHERT (ARM)<br>5. Press Weapon Release Button on Control Stick to release ALL weapons simultaneously. Check for Weapon Station Indicators to turn OFF |

Reference: L.Dv.208 Beschreibung, Bedienungs und Wartungsvorschrift des Abwurfschaltkasten ASK-R, 1939

THREE THREE

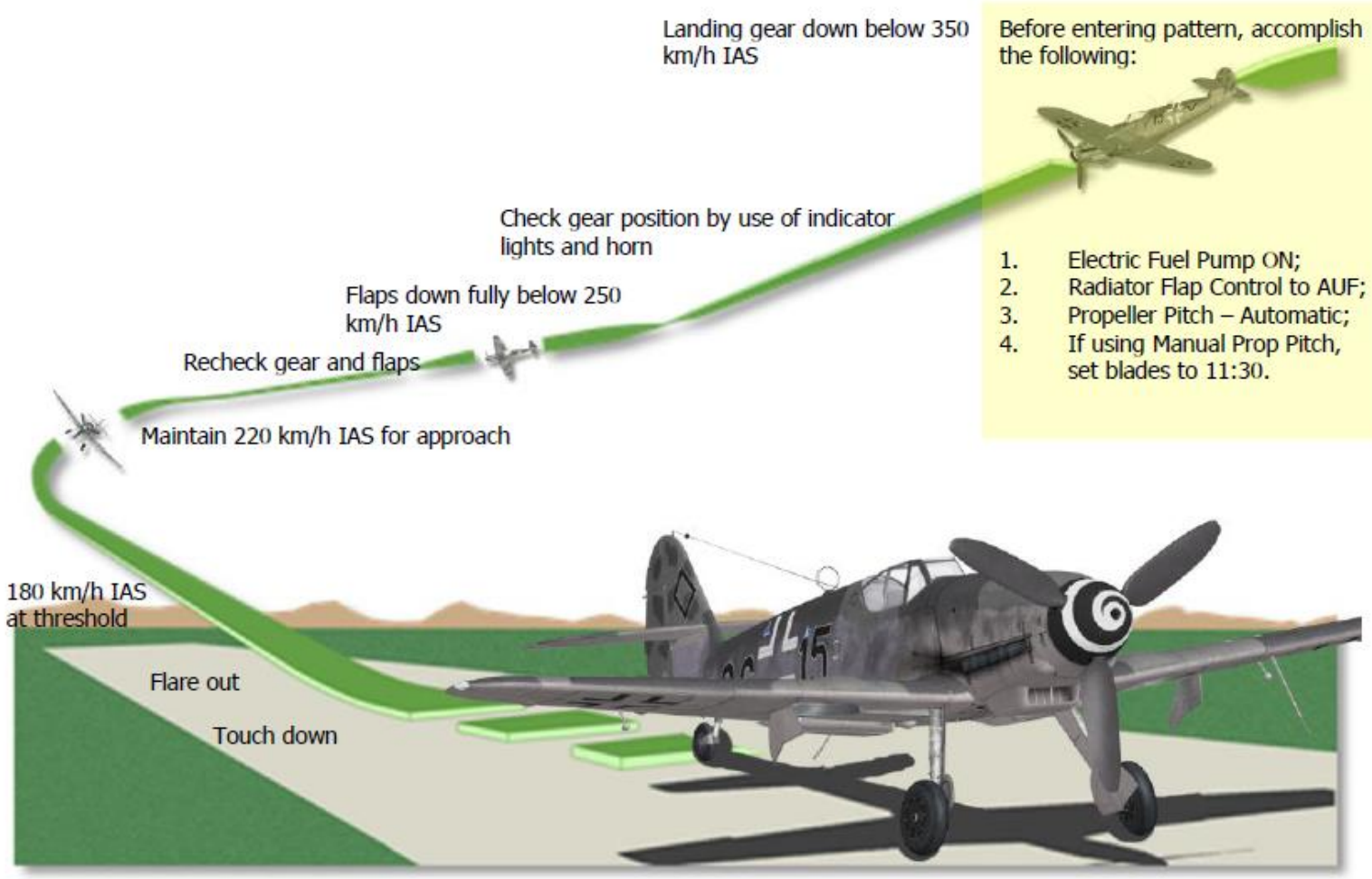
# PART 6: TAKEOFF

**NOTE: This procedure is NOT the real-life start-up procedure, it has been simplified in the sim.**

1. Fuel cock ON
2. Oil rad and water rad fully open (100 %)
3. If flying a Bf.109E-4, disengage Automatic Prop Pitch
4. Prop pitch full fine (12:00 position)
5. Deploy flaps at roughly 20 degrees
6. Crack throttle about an inch
7. Switch Magnetos to M1+M2
8. Make sure your propeller is clear (“Clear prop!”)
9. Engine ignition! (press “I” by default)
10. Wait for oil temperature to reach at least 40 deg C and water rad temperature to reach at least 40 deg C.
11. Taxi to the runway.
12. Make sure you are facing yellow panels on the runway. This means you are facing the right direction for takeoff.
13. Perform last takeoff checks: Canopy Closed, Water & Oil Rads fully open, Full Fine prop pitch (12:00), good oil & water rad temperatures.
14. Gradually throttle up. Compensate for engine torque and wind using rudder pedals and small brake input to keep the aircraft straight. Slightly push the control column forward to lift the tail.
15. Rotation is at 180 km/h.
16. Raise landing gear and flaps and throttle back to approx. 1.2 ATA. Lower prop pitch until engine is operating at 2300 RPM while you are beginning your climb.

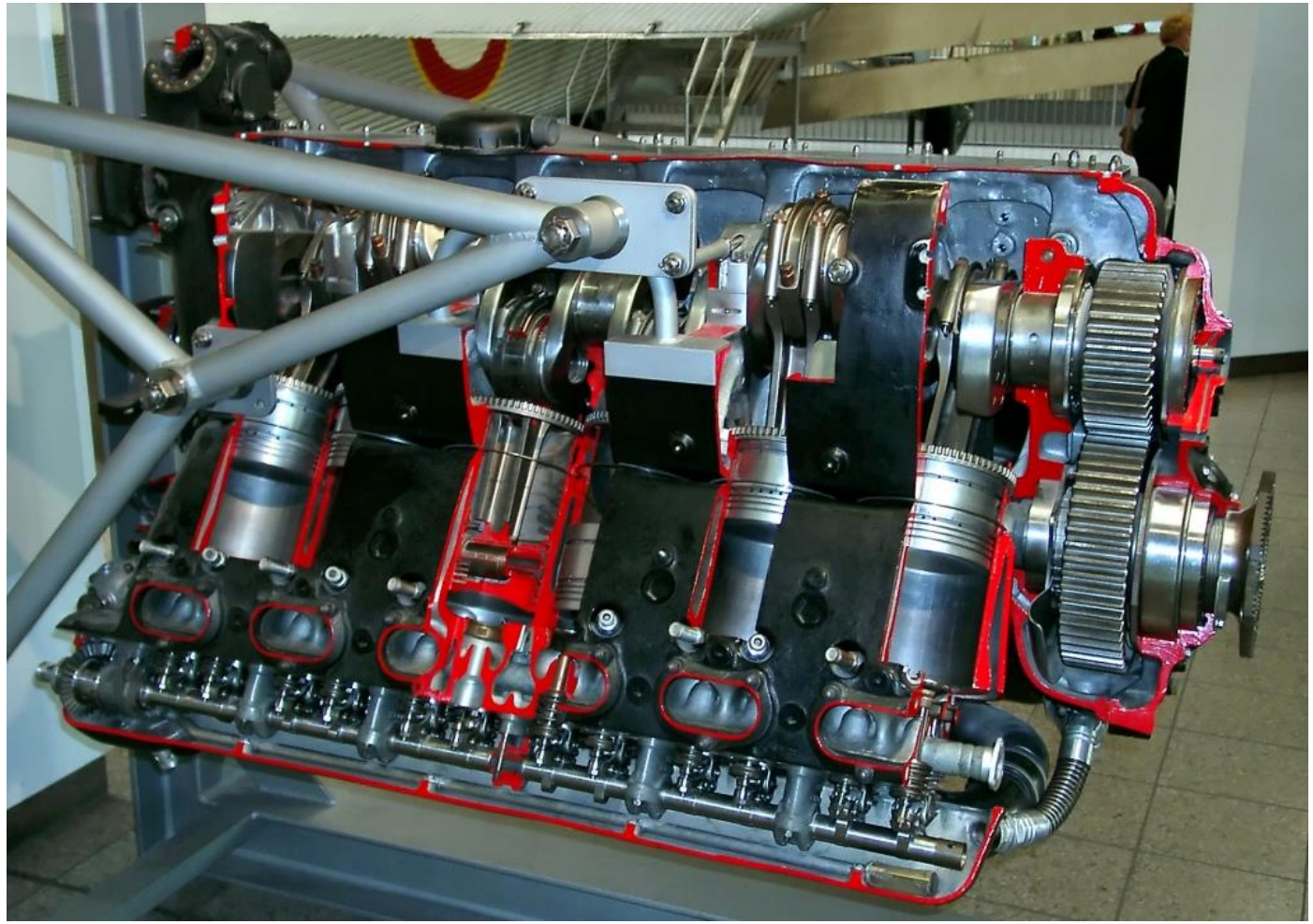

# PART 7: LANDING

1. Start your approach at 200 km/h @ approx. 800 m.
2. Water and oil rads fully open (100 %) and set prop pitch to full fine (12:00).
3. Deploy flaps (down) and landing gear.
4. Cut throttle and try to keep your nose pointed to the end of the runway.
5. Touchdown at 160 km/h in a 3-point landing.
6. Stick fully back.
7. Tap your brakes until you come to a full stop. Be careful not to overheat your brakes or force your aircraft to nose over into a prop strike.




AIRSPEEDS ON PICTURE ARE SLIGHTLY HIGHER BECAUSE IT WAS TAKEN FROM THE DCS BF.109K-4 MANUAL

# PART 8: ENGINE MANAGEMENT



The earlier Mercedes-Benz DB 600 was rated at 1,050 hp at 2,400 rpm for take-off and also developed this power at an altitude of 13,100 ft. It was equipped with a pressure carburetor between the supercharger and the intake manifolds and an automatic timing device which permitted a 10 percent overload for a period of one minute. Using 87-Octane gasoline, four of these engines installed in a Junkers Ju 90 airliner established a World's Record by carrying a payload of 10,000 kg. (22,050 lb.) to an altitude of 7,242 m. (23,750 ft.) on June 8, 1938 in Germany.

**DB 601A**

The **Daimler-Benz DB 601** was a German aircraft engine built during World War II. It was a liquid-cooled inverted V12, and powered the Messerschmitt Bf 109, among others. The DB 601 was basically an improved DB 600 with direct fuel injection. Direct fuel injection gave the Luftwaffe an edge over the RAF during the Battle of Britain since the DB 601 was unaffected by negative g's… unlike the early Merlin models. The engine used dry cylinder liners, had roller bearing connector rods and had a unique system of attaching the cylinders to the crankcase. It was used in several aircraft such as the Heinkel He-111 and Messerschmitt Bf 110 as well. By 1944, Daimler-Benz engines were so important to the Luftwaffe that it ran 8 major factories with 6 more being run by other organizations.

PART 8: ENGINE MANAGEMENT

**DB601-Aa**

The DB601-Aa used a souped-up version of an older supercharger. Bf.109E fighter-bomber variants had the Aa version of the DB 601, while the fighter versions had the DB 601 A. The DB601-Aa generates more horsepower at low altitudes than the A model (but lesser at higher altitudes).

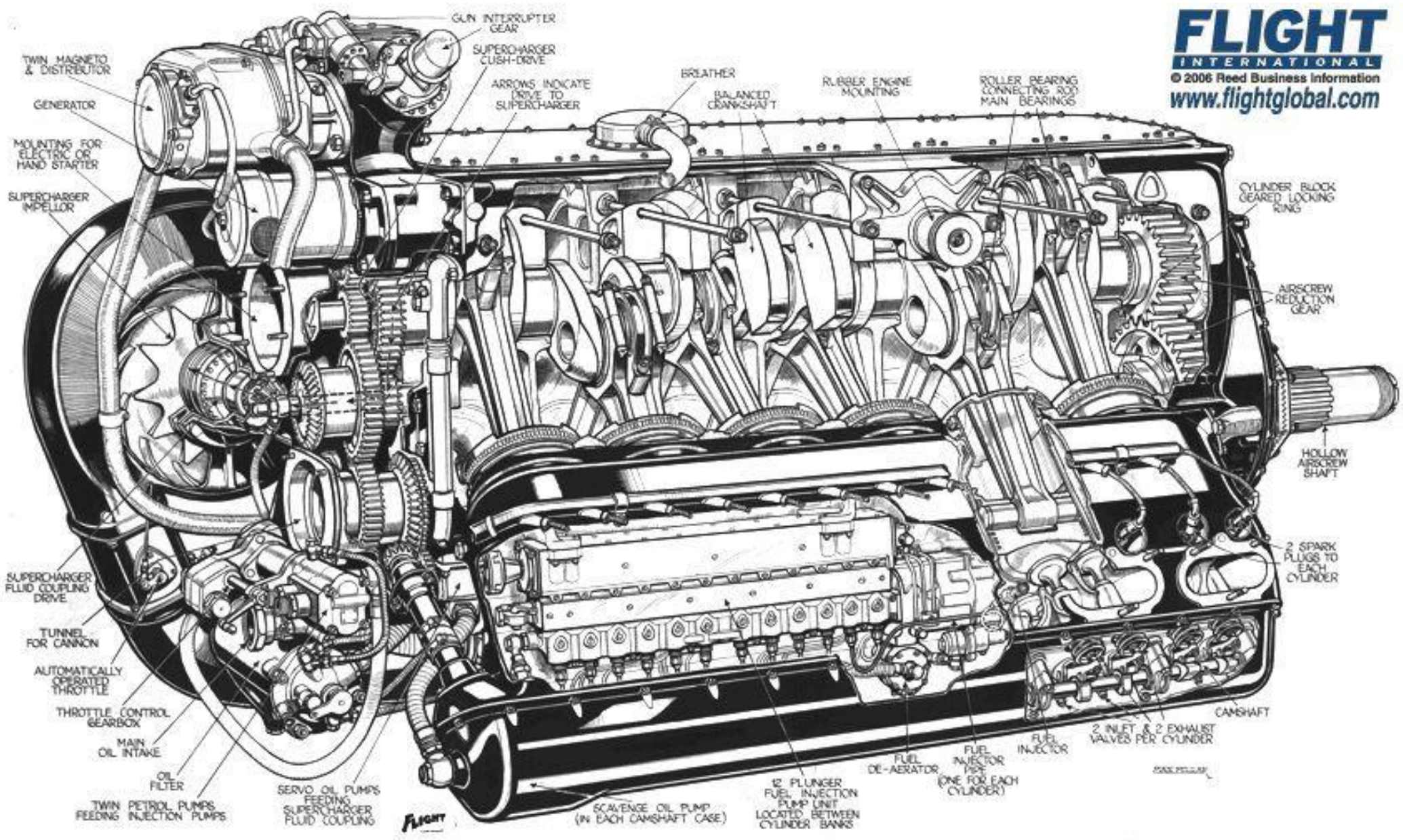
A cardinal fault of the Bf.109E - one which was corrected in the F and G models - was the design of the supercharger air intake. The unit on the Emil was close to the fuselage and ingested the "dirty" boundary layer air which scrubbed along the cowling surface. As a result, the supercharger ram recovery was 37.5% compared with the Spitfire's 50%. The lower ram recovery meant that the critical altitude was reached at a lower altitude. Had the later design been used on the Bf.109E, as much as 1000 ft may have been gained in ceiling and in best combat altitude. This would have nullified much of the Spitfire's performance advantage at height.

Another important difference between the Bf.109E and the Spitfire Mk.IA lay in the supercharger design. The early Merlin engines were equipped with gear-driven single-speed, single-stage units. The supercharger had to be throttles back at low altitude to avoid over-boosting the engine. As altitude increased, more and more of the supercharger capability was used and engine horsepower continued to increase until critical altitude was reached, after which power fell off rapidly.

The DB601Aa engine, on the other hand, was equipped with a single-stage supercharger with a hydraulic or fluid clutch. While heavier and more complex than the gear-driven clutch, this unit had the capability of operating at an infinite number of speed ratios. This meant that the supercharger could be slowed down without choking it and far more power was delivered at lower altitudes. As the Bf.109 flew higher, an aneroid control caused the supercharger to run faster to compensate for the decreased density of the air. The variable speed characteristics of this supercharger are obtained through slippage, so it was necessary for the Bf.109 cooling system to contain more oil for cooling.

At low levels, the variable-speed supercharger of the DB601Aa allowed some 200 additional hp to be delivered to the Bf.109. To a great extent, this was the measure of the low altitude superiority of the Messerschmitt fighter.

# PART 8: ENGINE MANAGEMENT




DB 601 N-1

PART 8: ENGINE MANAGEMENT

A de-rated engine is allowed to operate at maximum power pretty much infinitely. In modern industrial facilities, many gas turbines (which are derived from aero engines) are often requested to be “de-rated” by the customer using them as a power plant. Why? Because industrial engines need to be working 24/7 at high regimes while maintaining a certain security factor (you don’t want to have the engine blow up in your face, eh?).

**'De-rated'** is a term the British used to denote an aircraft engine which had its intended maximum power level reduced (by the manufacturer) to a lower level to reduce the chance of mechanical failure. An engine would be “derated” if it was not deemed to be reliable enough at the higher power settings.

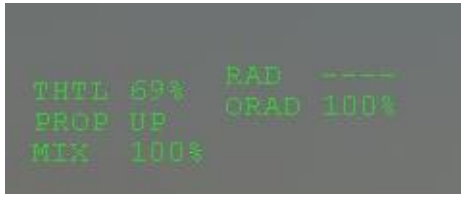
The **DB 601 N-1** engine on the Bf.109E-4/N could reach a max manifold pressure of 1.42 ATA for about 5 minutes before engine failure or damage. With the Bf.109E-4/N de-rated variant, you can reach a max manifold pressure of 1.35 ATA for as long as you like.

It is reasonable to assume (despite the lack of proper documentation on that meticulous matter) that engine reliability issues plagued the Bf.109E-4/N, which was only built in limited numbers and saw little to no action during the Battle of Britain. It is important to note that the DB 601 N-1 also powered the Bf.109 F-2 version at the same time period, which became much more successful once the DB 601E was implemented.

One of the main reasons why the Bf.109E received so few DB 601 N-1 engines was because at the height of the Battle of Britain, the first Bf.109F models started rolling off the assembly line and were given a much higher priority in terms of engine distribution, together with the Bf.110C, D and E series. With the Friedrich coming into service, it did not make sense to retrofit the obsolete E series to the new engine configuration. At the time, the Emil just had two to three months of operations planned until being put in reserve as a second-line fighter.

# PART 8: ENGINE MANAGEMENT

- During a mission, the flight lead usually calls out his engine settings once in a while for the pilots to know what settings they should use.
- You can read your engine settings from the gauges in the cockpit or from an info window.
  - The RPM indicator (1) shows 1600 RPM. The manifold pressure (2) reads 1.0 ATA. The oil (3) and water (4) radiators can be approximated from the crank position or read from the info window in % (only the oil radiator can be read though as the water rad info window will only tell you if you are opening or closing them). Note: 100 % = fully open
  - The resulting RPM is affected by both manifold pressure and prop pitch (5). 12:00 Pitch is fully fine, and generates maximum RPM.






- Radiator settings:
  - 65-75 % WATER / 50-60 % OIL during **normal level flight** (1.2 ATA)
  - 75-100 % WATER / 60 % OIL during **shallow climb** (1.2 ATA)
  - 85-100 % WATER / 85 % OIL during **steep climb** (Full power)
  - 50-100 % WATER / 40 % OIL for **WEP level flight** (when extending or pursued)
  - 65-75 % WATER / 50 % OIL for **full throttle no WEP** (extending or pursued)
  - 100 % WATER / 100 % OIL during **takeoff & landing**

| | (Unit) | Bf.109 E-1 | Bf.109 E-1/B | Bf.109 E-3 | Bf.109 E-3/B | Bf.109 E-4 | Bf.109 E-4/B | Bf.109 E-4/N DERATED | Bf.109 E-4/N |
|---|---|---|---|---|---|---|---|---|---|
| **TEMPERATURES** | | | | | | | | | |
| **Water Rad Min** | Deg C | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| **Max** | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **Oil Rad (OUTBOUND) Min** | Deg C | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| **Max** | | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |

# PART 8: ENGINE MANAGEMENT

- I must stress the importance of understanding how “manual prop pitch” works. Many new pilots take the later variants of the Bf.109 (like the E-4) in the hopes that the “automatic propeller pitch control” will reduce their work load. Does it? Yes and no.
- Automatic prop pitch at this stage of development was not as good as the governor systems installed on later 109 versions like the F, the G or the K variants. Auto prop pitch controls your pitch for you, but it does it in a way that preserves the engine to a point where you have a significant decrease in aircraft performance for no gain at all. Imagine your car limiting your engine regime so you don’t go over 80 km/h while on the Autobahn… wouldn’t that be frustrating? In a game where speed is life, you cannot afford to lose speed in critical phases of your mission.
- But why are you telling me this, Chuck? This all seems a little overly dramatic, don’t you think?
- Not in the slightest. **Learn how to use the manual prop pitch from the beginning**. Engine RPM is slower to respond to propeller pitch variation than, say, the RPM control in the Spitfire or the Hurricane.
- The only way you can dominate a Spitfire or a Hurricane is when you fight them in the vertical plane (NEVER in the horizontal plane; don’t e-v-e-r turn with them… unless you like to impersonate swiss cheese). The Bf.109 is a superb climber, but for that you need to use your prop pitch intelligently so you milk every meter of altitude you can get in order to get as high as possible as quickly as possible.
- You do not have to check your prop pitch gauge. You can simply consult your RPM. Maintain it between 2200 and 2400 max. RPM is too low? Get your prop pitch finer and your RPM will go up. RPM is too high? Reduce RPM by getting your prop pitch coarser.
- Experienced pilots can guess their RPM just by listening to the sound of their engine. Yep, they do it by ear. With enough practice, you can do it to.

# PART 8: ENGINE MANAGEMENT

| Propeller Pitch Terminology | | | | |
|---|---|---|---|---|
| |  |  |  | |
| RAF | Fine | Coarse | Feathered | RAF |
| USAAC | Flat / Low | High | Feathered | USAAC |
| Luftwaffe | Startstellung (Start Position) | Reisestellung (Cruise Position) | Segelstellung (Sail Position) | Luftwaffe |

| Propeller Types | | |
|---|---|---|
| **Propeller Types** | **Definition** | **Example** |
| **Luftschauben Verstellautomatik (LV)** | Propeller with an automatic pitch changing device that prevents overrevs. Additionally, every throttle position has a corresponding RPM that is maintained within narrow limits by the automatic device. May be switched off. | **Bf 109E-4, 109E-4/B** |

| Propeller Operations | |
|---|---|
| **Propeller** | **Operation** |
| **VDM (Luftwaffe) VP (electric)** | The VDM propeller functions as a fully adjustable variable pitch prop. The "schalter für verstellschraube drehzahl" (switch for adjusting RPM) adjusts the pitch angle (from Startstellung to Reisestellung) of the airscrew. Adjusting the switch "größer" will increase RPMs by decreasing the pitch angle. Adjusting the lever "kleiner" will decrease RPMs by increasing the pitch angle. Placing the switch in the "segelstllg" position will feather the airscrew. |
| **VDM Automatik (Luftwaffe) LV (electric)** | The LV propeller electrically provides a pitch setting for every throttle position to maintain a given RPM thus coupling throttle and pitch (boost and RPM) to provide optimum performance. |
| **Luftschraube Stellungsanzeige** | The Propeller Position Indicator is a clock mechanism used to indicate the pitch of the propeller. 12:00 = Startstellung; 8:30 = Reisestellung |
| **Note for Cliffs of Dover: For RAF Aircraft, commanding Pitch Increase or Pitch Decrease actually Increases or Decreases RPM. For Luftwaffe Aircraft, commanding Pitch Increase or Pitch Decrease actually increases or decreases pitch. Pitch 10, Pitch 20, etc will only work for RAF Aircraft with a moveable lever. Pitch 10, Pitch 20, etc will not work for Luftwaffe Aircraft with Electrical Pitch Adjustment Switches.** | |

# PART 8: ENGINE MANAGEMENT

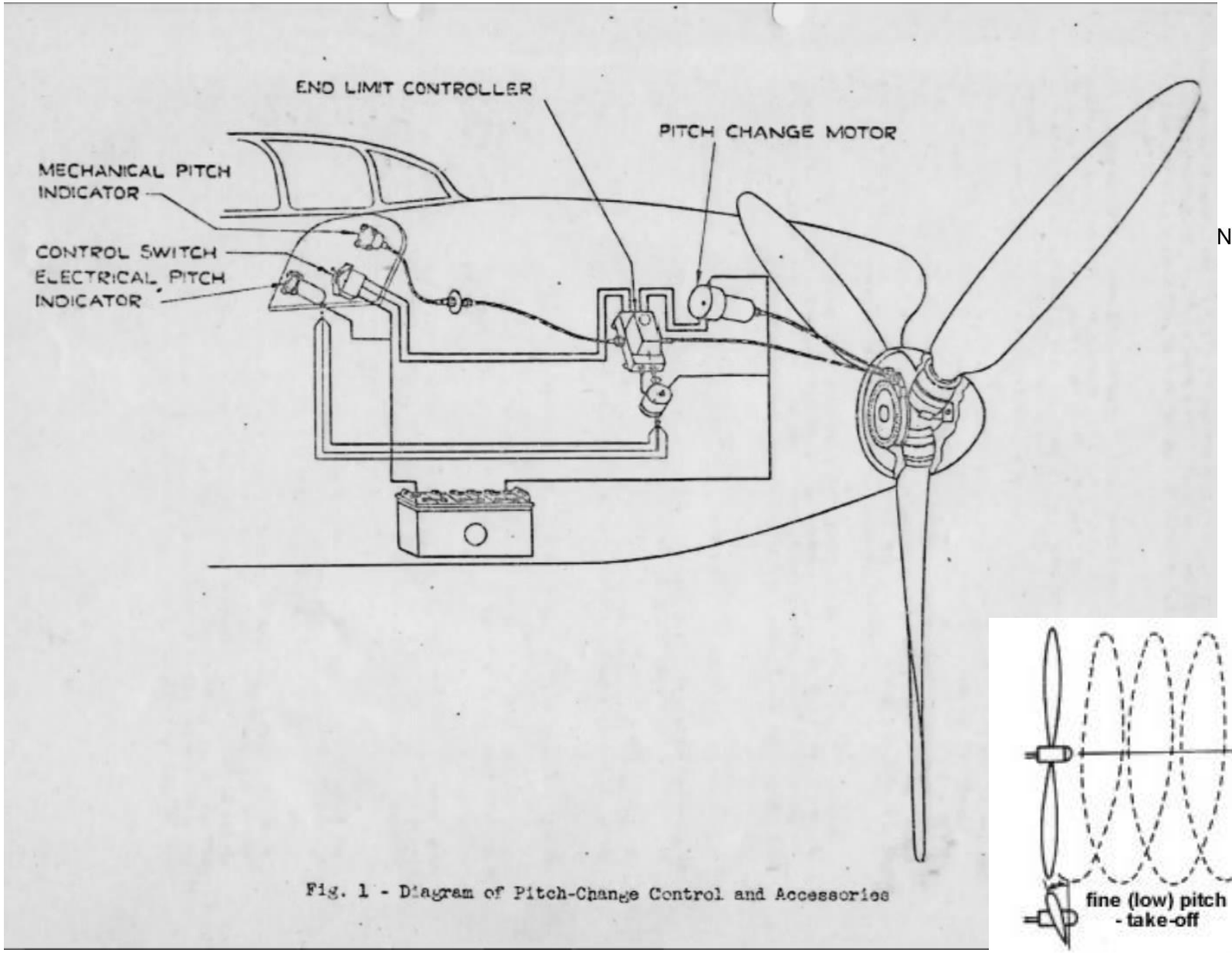
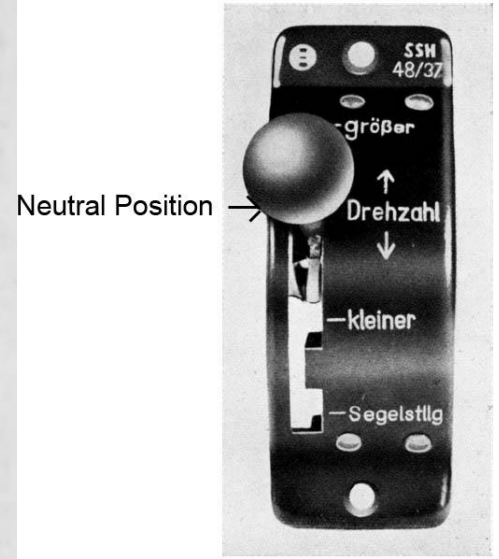
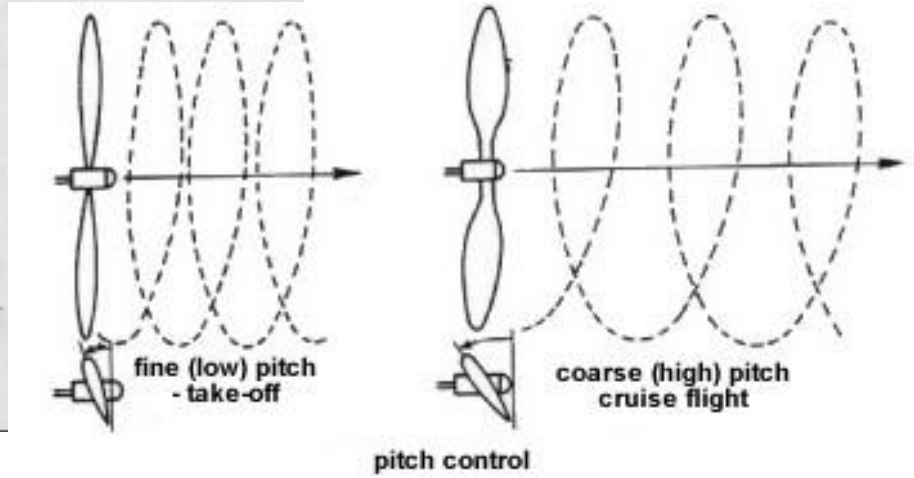


Fig. 1 - Diagram of Pitch-Change Control and Accessories

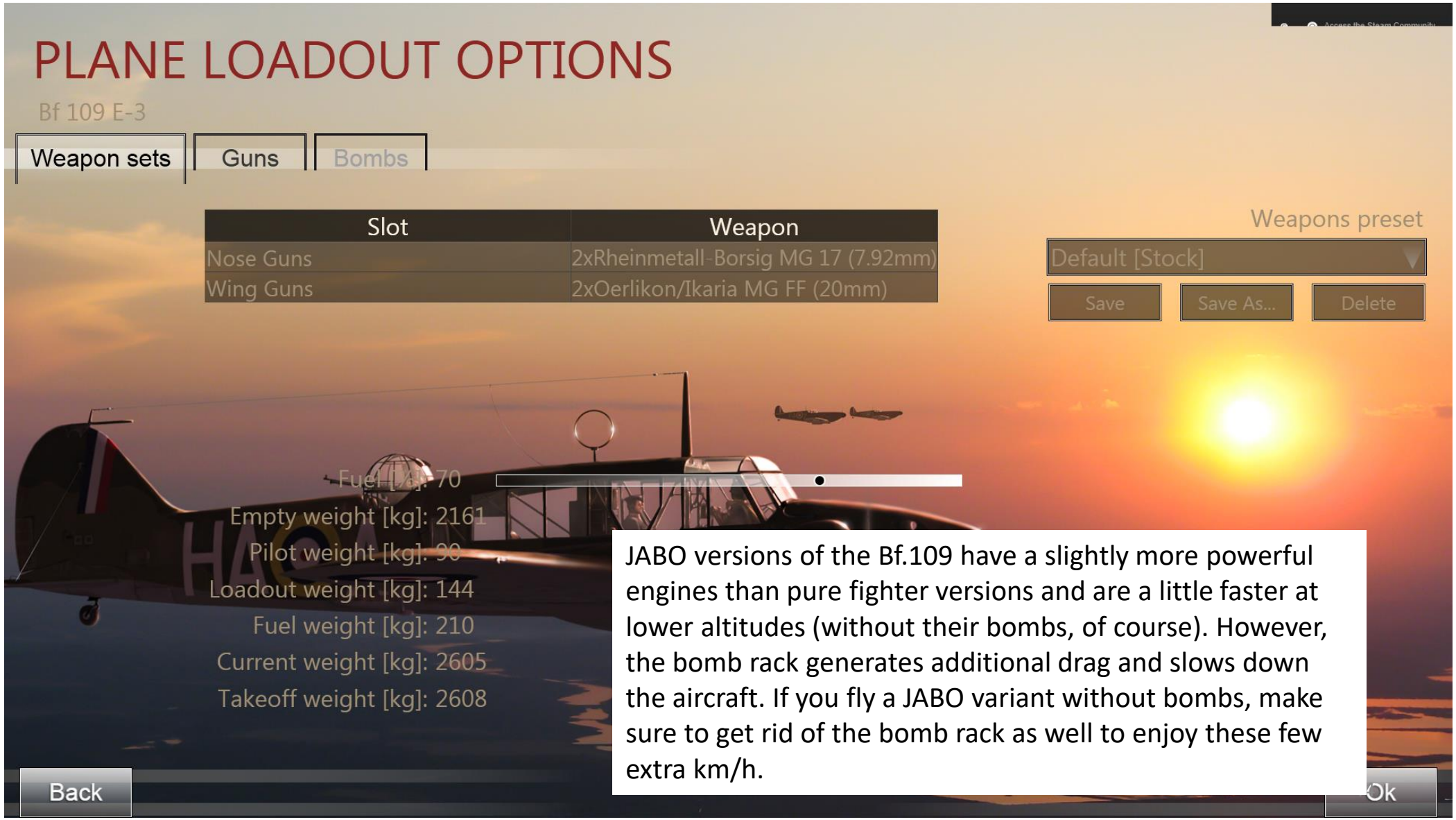



**An excellent video tutorial to understand prop pitch**: https://www.youtube.com/watch?v=qIpZAu61OM8

PART 9: AIRCRAFT PERFORMANCE

In order not to exceed the maximal takeoff weight, I recommend to fly the fighter version of the Bf.109 with 70 % fuel. “JABO” versions (fighter bombers) will obviously need less fuel since the bombs are quite heavy.




JABO versions of the Bf.109 have a slightly more powerful engines than pure fighter versions and are a little faster at lower altitudes (without their bombs, of course). However, the bomb rack generates additional drag and slows down the aircraft. If you fly a JABO variant without bombs, make sure to get rid of the bomb rack as well to enjoy these few extra km/h.

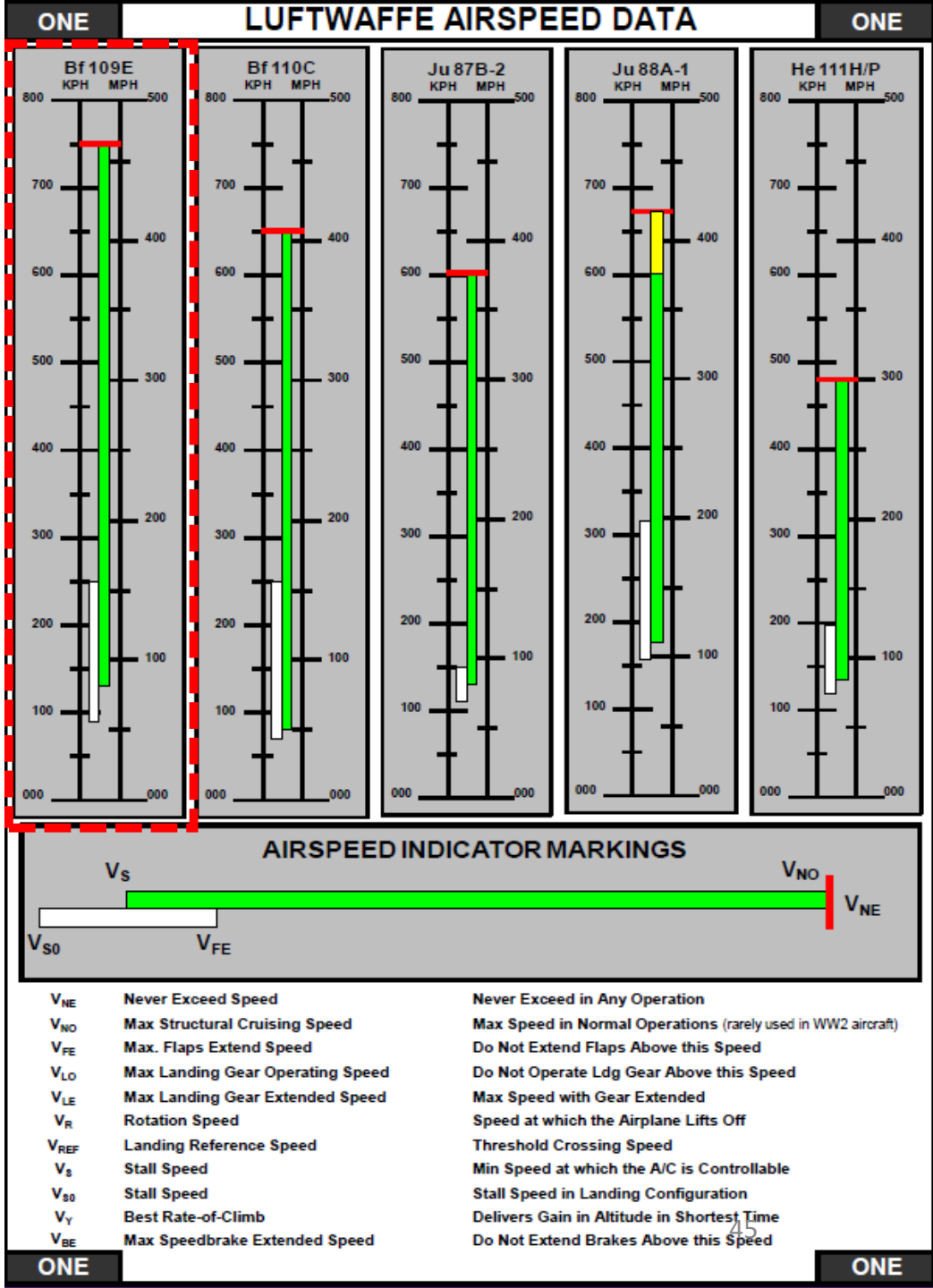
# PART 9: AIRCRAFT PERFORMANCE

## AIRSPEEDS

| | | |
|---|---|---|
| **Takeoff – Rotation** | UK: mph<br><br>GER/ITA: km/h | 180 |
| **Max Dive Speed** | | 750 |
| **Optimal Climb Speed** | | 240 |
| **Landing – Approach** | | 200 |
| **Landing – Touchdown** | | 160 |

- In comparison to the Bf.109, the Spitfire has a better turn rate. However, the Bf.109 has a superior climb rate and dive speed. The preferred way of fighting the Spitfire is when you have an altitude advantage.
- The Spitfire has better performance at higher altitudes (over 20,000 ft) than the 109, but the 109 is generally faster and climbs better under 20,000 ft. Use this to your advantage.
- Never try to turn with a Spitfire. The 109 should be used as a pure energy fighter (boom and zoom).
- The Bf.109 will always have a superior dive speed. Use that to your advantage if you want to bounce someone or use a power dive to escape from a Spitfire.
- For more information on either aircraft or engine performance, consult the **2nd Guards Composite Aviation Regiment** Operations Checklist. It is a fantastic resource (link below).

https://drive.google.com/open?id=0B-uSpZROuEd3NGN4c0JRNHJpYkk&authuser=0



# PART 9: AIRCRAFT PERFORMANCE

| ONE | Me 109E-1/3 | | | ONE |
|---|---|---|---|---|
| Aircraft Type | Engine & Prop | Fuel | Reference | |
| Me 109E-1 / E-3 | DB 601A / VDM VP | 87 Oct | Betriebs- und Rustanleitung Me109 | |

**AIRSPEED LIMITATIONS**

| | Design Speeds | KPH | |
|---|---|---|---|
| $V_{NE}$ | Never Exceed Speed | 750 | Never Exceed in Any Operation |
| $V_{FE}$ | Max. Flaps Extend Speed | 250 | Do Not Extend Flaps Above this Speed |
| $V_{LO}$ | Max Landing Gear Operating Speed | 220 | Do Not Operate Ldg Gear Above this Speed |
| $V_{LE}$ | Max Landing Gear Extended Speed | 350 | Max Speed with Gear Extended |
| $V_R$ | Rotation Speed | 110 | Speed at which the Airplane Lifts Off |
| $V_{REF}$ | Landing Reference Speed | NA | Threshold Crossing Speed |
| $V_S$ | Stall Speed | 125 | Min Speed at which the A/C is Controllable |
| $V_{S0}$ | Stall Speed | 88 | Stall Speed in Landing Configuration |
| $V_Y$ | Best Rate-of-Climb | 250 | Delivers Gain in Altitude in Shortest Time |
| $V_{BE}$ | Max Speedbrake Extended Speed | NA | Do Not Extend Brakes Above this Speed |

**AIRSPEED INDICATOR OPERATING RANGES**

| ASI MARKING | KPH Range | Description |
|---|---|---|
| White Arc | 88 - 250 KPH | Full Flap Operating Range. Lower Limit is Max. Weight $V_{S0}$. Upper Limit Max Speed w/Flaps Extended. |
| Green Arc | 125 - 750 KPH | Normal Operating Range. Lower Limit is Max. Weight $V_S$. Upper limit Is Max Structural Cruising Speed. |
| Red Line | 750 KPH | Maximum Speed for ALL operations. |

**OPERATING DATA**

| Condition | Take-Off | Climb | Cruise | Max Dive | Condition | |
|---|---|---|---|---|---|---|
| Limit | 5 min | 30 min | Cont | | Limit | Luftschraubestellungs... |
| Man Press | 1.45 ATA | 1.35 ATA | 1.3 ATA | IDLE | Boost | Full Course 8:30 |
| RPM | 2500 | 2400 | 2300 | 3000 | RPM | Full Fine 12:00 |
| Pitch | Manual | Manual | Manual | 9:30 | Pitch | |

| ONE | Me 109E-4 | | | ONE |
|---|---|---|---|---|
| Aircraft Type | Engine & Prop | Fuel | Reference | |
| Me 109E-4 | DB 601A / VDM Auto | 87 Oct | Betriebs- und Rustanleitung Me109 | |

**AIRSPEED LIMITATIONS**

| | Design Speeds | KPH | |
|---|---|---|---|
| $V_{NE}$ | Never Exceed Speed | 750 | Never Exceed in Any Operation |
| $V_{FE}$ | Max. Flaps Extend Speed | 250 | Do Not Extend Flaps Above this Speed |
| $V_{LO}$ | Max Landing Gear Operating Speed | 220 | Do Not Operate Ldg Gear Above this Speed |
| $V_{LE}$ | Max Landing Gear Extended Speed | 350 | Max Speed with Gear Extended |
| $V_R$ | Rotation Speed | 110 | Speed at which the Airplane Lifts Off |
| $V_{REF}$ | Landing Reference Speed | NA | Threshold Crossing Speed |
| $V_S$ | Stall Speed | 125 | Min Speed at which the A/C is Controllable |
| $V_{S0}$ | Stall Speed | 88 | Stall Speed in Landing Configuration |
| $V_Y$ | Best Rate-of-Climb | 250 | Delivers Gain in Altitude in Shortest Time |
| $V_{BE}$ | Max Speedbrake Extended Speed | NA | Do Not Extend Brakes Above this Speed |

**AIRSPEED INDICATOR OPERATING RANGES**

| ASI MARKING | KPH Range | Description |
|---|---|---|
| White Arc | 88 - 250 KPH | Full Flap Operating Range. Lower Limit is Max. Weight $V_{S0}$. Upper Limit Max Speed w/Flaps Extended. |
| Green Arc | 125 - 750 KPH | Normal Operating Range. Lower Limit is Max. Weight $V_S$. Upper limit Is Max Structural Cruising Speed. |
| Red Line | 750 KPH | Maximum Speed for ALL operations. |

**OPERATING DATA**

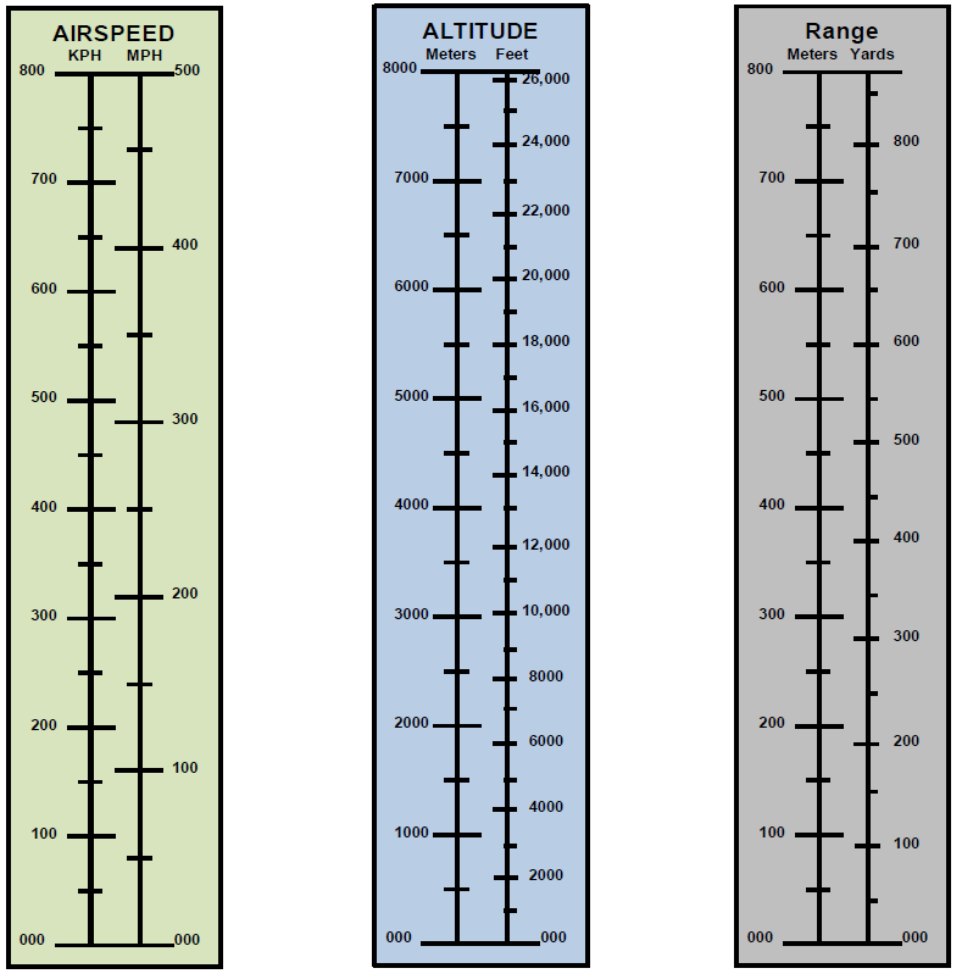
| Condition | Take-Off | Climb | Cruise | Max Dive | Condition | |
|---|---|---|---|---|---|---|
| Limit | 5 min | 30 min | Cont | | Limit | Luftschraubestellungs... |
| Man Press | 1.45 ATA | 1.35 ATA | 1.3 ATA | IDLE | Boost | Full Course 8:30 |
| RPM | 2500* | 2400 | 2300 | 3000 | RPM | Full Fine 12:00 |
| Pitch | Automatik | Automatik | Automatik | Automatik | Pitch | |

* RPM may be increased to 2600 above 5.5km alt for 5 mins

| Best Airspeed for Climb | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sea Level | 1000 m | 2000 m | 3000 m | 4000 m | 5000 m | 6000 m | 7000 m |
| 250 kph | 243 kph | 236 kph | 229 kph | 222 kph | 215 kph | 208 kph | 200 kph |

# PART 9: AIRCRAFT PERFORMANCE

ONE **CONVERSION DATA** ONE




| International Civil Aviation Organization International Standard Atmosphere | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature | | Altitude Above Sea Level | | Atmospheric Pressure | | | Mach 1 |
| °F | °C | feet | meters | inches Hg | mm Hg | psia | mph |
| 59 | 15 | SL | 0 | 29.92 | 760 | 14.70 | 761 |
| 55 | 13 | 1000 | 305 | 28.86 | 733 | 14.17 | 758 |
| 52 | 11 | 2000 | 610 | 27.82 | 706 | 13.67 | 755 |
| 48 | 9 | 3000 | 914 | 26.82 | 681 | 13.17 | 752 |
| 45 | 7 | 4000 | 1219 | 25.84 | 656 | 12.69 | 750 |
| 41 | 5 | 5000 | 1524 | 24.90 | 632 | 12.23 | 748 |
| 38 | 3 | 6000 | 1829 | 23.98 | 609 | 11.78 | 745 |
| 34 | 1 | 7000 | 2134 | 23.09 | 586 | 11.34 | 742 |
| 31 | -1 | 8000 | 2438 | 22.22 | 564 | 10.92 | 740 |
| 27 | -3 | 9000 | 2743 | 21.39 | 543 | 10.51 | 736 |
| 23 | -5 | 10000 | 3048 | 20.58 | 523 | 10.10 | 734 |
| 5 | -15 | 15000 | 4572 | 16.89 | 429 | 8.29 | 720 |
| -13 | -25 | 20000 | 6096 | 13.75 | 349 | 6.75 | 706 |
| -31 | -35 | 25000 | 7620 | 11.10 | 282 | 5.45 | 693 |
| ONE | | | | | | | ONE |

PART 9: AIRCRAFT PERFORMANCE

FOR ADDITIONAL INFORMATION ON THE BF.109, CHECK OUT THESE YOUTUBE CHANNELS. THESE GUYS COMPLETELY UNDERSTAND HOW TO FLY THE BF.109 AND EXPLAIN IT CLEARLY AND EFFORTLESSLY.

## APEOFTHEYEAR

Channel:
https://www.youtube.com/user/Apeoftheyear/featured
Tutorials:
https://www.youtube.com/playlist?list=PLUyEbp1iw_PrgHx7nji2ohQyhHqBPluh1

## JG4_KARAYA

Channel:
https://www.youtube.com/user/JG52Karaya
Bf.109 Tutorial:
https://www.youtube.com/watch?v=FjrVLQgqqso&index=7&list=PLQIkL6RW88E9cV_s8hxbuTam1fgApAahF

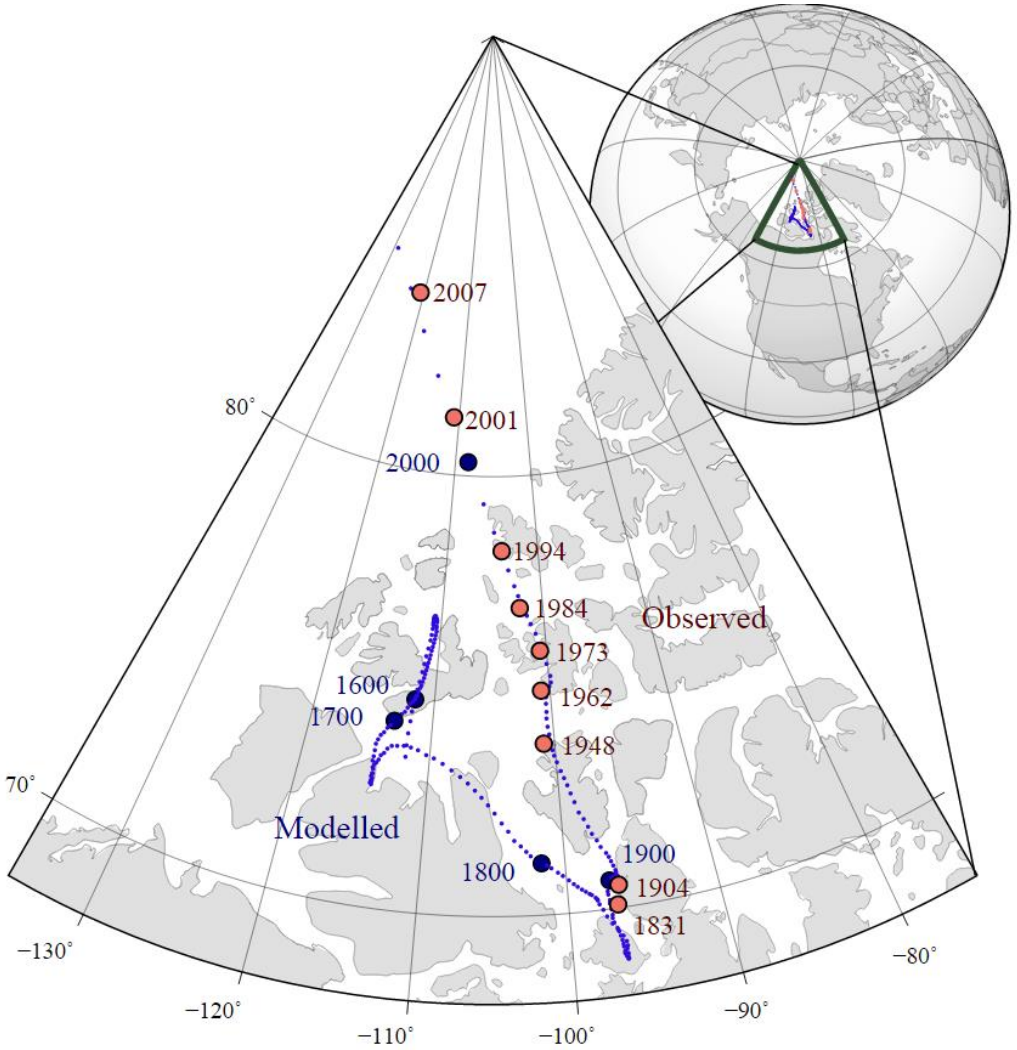
PART 10: NAVIGATION

# About Magnetic Declination

The direction in which a compass needle points is known as magnetic north. In general, this is not exactly the direction of the North Magnetic Pole (or of any other consistent location). Instead, the compass aligns itself to the local geomagnetic field, which varies in a complex manner over the Earth's surface, as well as over time. The local angular difference between magnetic north and true north is called the magnetic declination. Most map coordinate systems are based on true north, and magnetic declination is often shown on map legends so that the direction of true north can be determined from north as indicated by a compass.

This is the reason why in Cliffs of Dover, the magnetic compass needs to be “adjusted” to take into account this magnetic declination of the magnetic North pole (which is actually modelled in the sim, which is pretty neat).

In 1940, the magnetic declination required an adjustment of 10 degrees and 8 minutes. We round that to 10 deg.




The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007