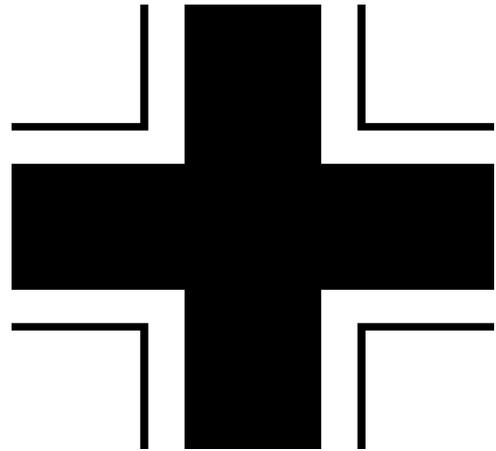


CLIFFS OF DOVER

AIRCRAFT

OPERATIONS CHECKLISTS



2nd Guards Composite Aviation Regiment

OP2GvSAPINST 3710.1B

7 October 2011

COMBINED STATEMENT

of the Air Ministry and the Reichluftfahrtministerium

*with comments by A Flight
Ldr, No 257 Sdqn*

*and Gruppe Technischer
Offizier, III./JG26*

The A.M. and the RLM have published the procedures contained in this document based on proven, tested, and approved aircraft operations. Pilots shall not deviate from these procedures. Non-compliance with the published procedures could result in below-standard performance, increased maintenance requirements, and possible disciplinary action should aircraft damage occur as a result of non-compliance.

because A.M. procedures are great for parades, but are lousy for combat.

It has come to our attention that various squadrons and individuals are creating alternate procedures covering all phases of flight. It must be noted, that while these individuals may be considered "aces" or "experten", these procedures have not been tested nor approved by proper channels nor are the authors trained in the proper protocols for procedure generation.

yeah, Dolfo knows absolutely nothing about fighters...

The use of these procedures by R.A.F. or Luftwaffe personnel should be considered "use at risk." Additionally, though anecdotal evidence may suggest that these "unauthorized" procedures are more effective, they are not approved for use by the A.M. or RLM. Using these unauthorized procedures could result in damage to one's own aircraft and could possibly lead to Trial by Courts Martial.

but using the authorized procedures could result in death, take your pick...

Exactly. All new pilots who wish to live should stick with what Bob teaches...

To all new Pilots - In 71 years, no one will remember the details of ammo loadouts, fuel octane levels, climb and roll rates, or turning radii... they will only remember who lived, and who died.

REVISION HISTORY

The following Changes have been incorporated into this Revision

Revision	Date	Description of Revision
3710.1A	15 July 2011	Initial Release
3710.1B	7 Oct 2011	Add VNO; Edit Temp, Press, etc for ICAO Std Atmos; Clarify DoVA for Hurri/Spit; Combine 87 and 100 Octane Hurri/Spit pages; Reformat Document into Sections by Air Force; Prop Op Page; Weapon Control Box Info; Me 109E4; Tiger Moth; He 111;

TABLE OF CONTENTS

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Sources, References and Acknowledgements

General Data

Conversion Tables, Airspeed Indicators, Airstart and Combat Checklists, Propellers in COD

Royal Air Force

Operating Data and Checklists: Hurricane, Spitfire, Blenheim, Tiger Moth

Luftwaffe

**Operating Data: Me 109, Me 110, Ju 87, Ju 88, He 111
Checklists: Me 109**

Weapons Data

Gunsight Data, Gun and Ammunition Data, Bomb and Fuze Data; Abwurfgeräte Operation

Operating Limits

Engine and Airframe Operating Limits

Procedures

Engine and Flight Procedures

Emergency

Emergency Procedures

Procedures in BROWN Font may not be supported in the Simulation

Additional Aircraft

Operating Data for Hurricane Fixed Pitch, Bf 108, and Anson

Errata

Works in Progress, Known Sim Inaccuracies and Limitations

READ ME

Title Cliffs of Dover: Aircraft Operations Checklists - OPGvSAPINST 3710.1B

About These checklists were originally developed for my (2GvSAP Flea) own personal use and for use by the I12-based 2GvSAP online squadron for I12: Cliffs of Dover. They are available for the entire I12: COD community. This document includes data for all player pilotable aircraft (except Italian), but does not include detailed procedures for some of the larger types. Come visit us at www.2gvsap.org or post on our forums at www.2gvsap.org/phpbb3/

Format This document was created in MS Excel. For the aircraft procedures, I mostly converted the narrative style and format of the source manual into a checklist format. I tried to keep original spellings and word usage where appropriate and to provide some basic translation for German terms. All other sections were just crammed into the available space.

Sources The sources for the data in the checklists were the historical Pilot's Notes, Aircraft Handbuchs, and other historical manuals. Many of those documents are available at the websites listed below. Please visit these sites for an enormous amount of WW2 related information. And please hit the tip jar where appropriate.

References The majority of my references are pulled from the following websites:
<http://www.germanluftwaffe.com>
<http://kurfurst.org>
<http://www.quarry.nildram.co.uk/miltech.htm>
<http://spitfiresite.com>
<http://www.ww2aircraft.net/forum/aviation>
<http://www.wwiiaircraftperformance.org>

Copyrights (where known) Checklists: derived from Bonanza A36 Checklist by Richard Hebert
Luftwaffe Cockpit Drawings Copyright Erwin Weidmer, www.GermanLuftwaffe.com

Special Thanks For comments, recommendations and encouraging words: Fearlessfrog, Freycinet, Senseispcc, Ajay, Ataros, fireship4, White Owl, Blackdog_kt, EinsteinEP's wife (for translation), many unnamed others, and the 2GvSAP squad. I would also like to thank the producers, my agent, and, of course, the Academy for making this all possible. You like me, you really like me!

Extra Special Thanks To Oleg and Ilya for their hard work over the years. Keep at it boys, we ain't home yet.

Game Play Disclaimer These procedures are derived from the actual aircraft Pilot's Notes and Handbuchs and may not represent the optimum procedures for game play. **Some conditions, controls, or activities included in the checklists may not be available as part of the Cliffs of Dover game.** Additionally, ammunition and weapons data were derived from historical references, but I have attempted to incorporate Cliffs of Dover usage into this publication.

Contact Information Compiled by 2GvSAP Flea.
Posting on SimHQ as 2GvSAP Flea
Posting on 1C Company as 2GFlea

DISCLAIMER: This is not intended to be a postgraduate research project. There are errors in this document either through poor or incomplete research, poor, incomplete or misleading references, bad math skills, and pure laziness. I still think everything presented is pretty darn close to accurate. However, I realize that what is presented here may differ from how things are modelled in game.

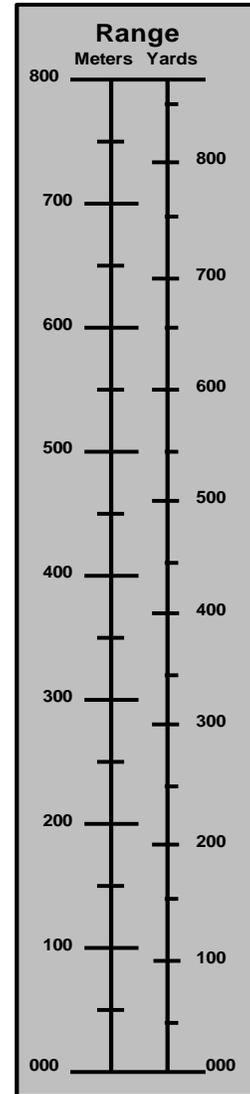
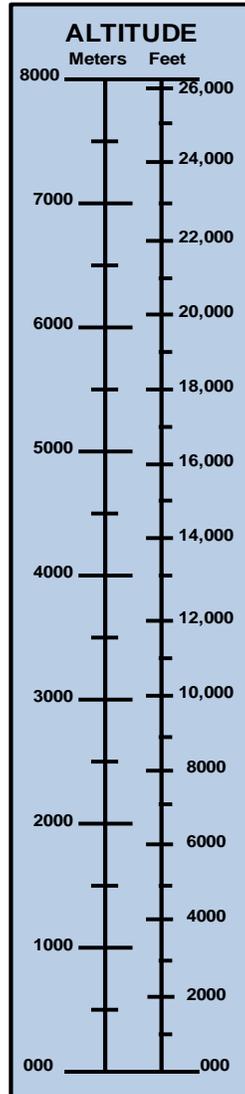
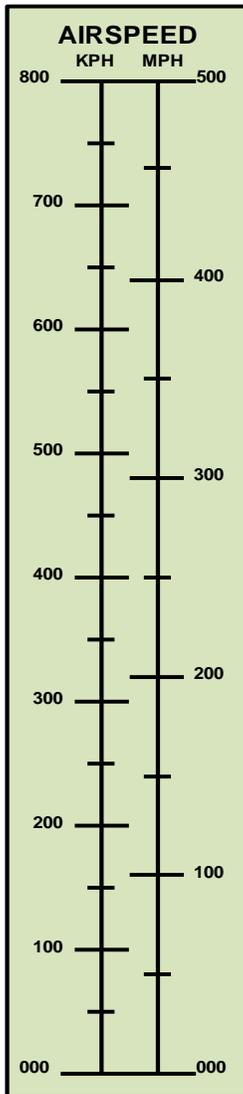
Oh, and this document is not for use in actually flying Real Life (TM) airplanes.

A Note from Flea: Please let us all remember that we are playing a game for entertainment. Seventy-one years ago, young men took to the skies to fight for their homelands and brothers in arms, lifting off not knowing if they would live to see the sun set. Too many did not. They flew because it was their duty; let us fly to honor them. Semper Fidelis.

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

AIRSTART**NOTE:**

Upon Airstart, the pilot must quickly set engine controls for proper flight. **Failure to do so in a timely manner WILL result in engine or cooling system damage.** Recommend "Cruise" for initial settings.

1. Throttle -- **CRUISE** -- Boost
2. Pitch Controls -- **CRUISE** -- RPM
3. Mixture -- **NORMAL or RICH**
4. Radiator Flaps -- **OPEN**
5. Oil Cooler Flaps -- **OPEN**
6. Radiator and Oil Temperature -- **WITHIN OPERATIONAL LIMITS**
7. Oil Pressure -- **WITHIN OPERATIONAL LIMITS**
8. Begin Cockpit Scan
9. Make Other General Preparations For Flight

PRE-COMBAT CHECKS**NOTE:**

Pre-combat checks are conducted prior to entering the expected combat area. These checks should be completed **BEFORE** any anticipated contact with enemy aircraft. Remember **SETG-6**.

1. S - Status: Radiator, Oil, and Fuel -- **WITHIN OPERATIONAL LIMITS**
2. E - Engine Controls -- **AS REQUIRED**
3. T - Trim -- **AS REQUIRED**
4. G - Gunsight -- **ON**
 - 4a. Reticle -- **SET** -- For Gun Convergence Range
 - 4b. Reticle -- **SET** -- For Expected Enemy Aircraft Wingspan
5. Check -- **SIX**

PREPARATION FOR COMBAT**NOTE:**

Combat preparations are conducted upon contact or sighting of unidentified or enemy aircraft. These actions are to prepare the aircraft for combat. Though every situation is unique, these actions will prepare you for most encounters. Remember **CRAFTS**

1. C - Climb: Set Boost and Pitch to -- **CLIMB** -- Settings
2. R - Radiators: Coolant and Oil Radiators -- **AS DESIRED**
3. A - Airspeed and Altitude -- **AS DESIRED**
4. F - FOV: Field of View -- **AS DESIRED**
5. T - Track IR: Set Track IR -- **CENTER** -- As Desired
6. S- Six: Check -- **SIX**

THREE

PROPELLERS IN CLIFFS OF DOVER

THREE

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
Fixed Pitch (FP)	Propeller Pitch Angle is fixed and cannot be changed.	Tigermoth
Variable Pitch (VP)	Propeller Pitch Angle may be changed by the pilot in flight. May be fully variable or limited to a defined set of positions. Susceptible to overspeed/overrev.	Hurricane DH5-20, Spitfire MkIa, Bf 109E-3
Constant Speed (CS)	Variable Pitch Propeller governed by a Constant Speed Unit (CSU). Governor maintains a commanded RPM and prevents propeller overspeed/overrev.	Hurricane RotoI, Spitfire MkII, Blenheim MkIV
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
De Havilland 5-20 (RAF) VP (hydraulic)	The DH 5-20 VP propeller functions as a pilot selectable two pitch prop. Pitch Ranges from 5° (Fully Fine) to 20° (Fully Coarse). Moving the Propeller Pitch Control selects the pitch angle (fine or coarse). Fine Pitch will result in higher RPMs and Coarse Pitch will result in lower RPMs for a given throttle setting.
RotoI (RAF) CS (hydraulic)	The RotoI is a VP prop with a CSU. The CSU governor provides for 35° of pitch change and will automatically adjust the pitch angle to maintain a commanded RPM. This will prevent overspeed until the CSU unit hits the "Full Coarse" stops at which point overspeed becomes possible. The Propeller Pitch Control commands the governor to maintain a constant RPM. "Fully Fine" commands "maximum RPM". Retarding the Pitch Control commands a lower RPM setting. "Fully Coarse" commands "Positive Coarse Lock" at which point the prop will function as a FP prop in the "Fully Coarse" position.
VDM (Luftwaffe) VP (electric)	The VDM propeller functions as a fully adjustable variable pitch prop. The "schalter für verstellerschraube 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.
Luftschaube 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.

THREE

THREE

Mixture Control

Engine	Operation
Gypsy Major	Mixture Lever in rear cockpit has 2 operating positions only: RICH and WEAK. The mixture should be set to RICH at all times under 5000 feet. Above 5000 feet, mixture adjustment should not cause a drop in RPM.
Merlin II - XII	Mixture Lever has 2 operating positions only: RICH (NORMAL) and WEAK. An interlocking arrangement returns the mixture control to RICH when the throttle is closed. Note: Mixture Control moves AFT for RICH and FORWARD for WEAK.
Mercury XV	Single Mixture Lever has 2 operating positions only: NORMAL and WEAK. Mixture returns automatically to NORMAL when throttle is closed or opened beyond the CRUISING gate.
DB 601 A - A1	The DB 601 Series engines are Direct Fuel Injection engines and do not have a pilot selectable mixture control.
Jumo 211 B/D	The Jumo 211 B/D Series engines are Direct Fuel Injection engines and do not have a pilot selectable mixture control.

Throttle Control

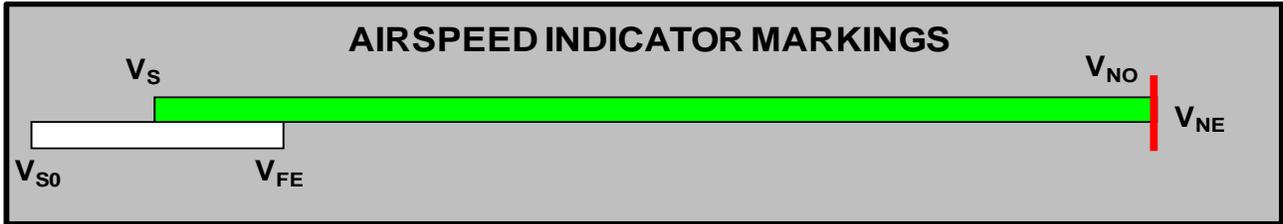
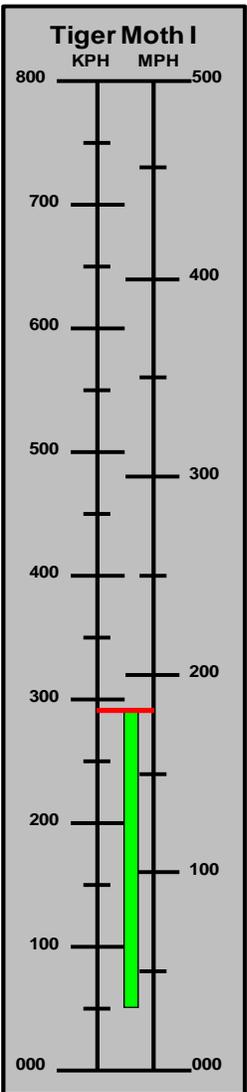
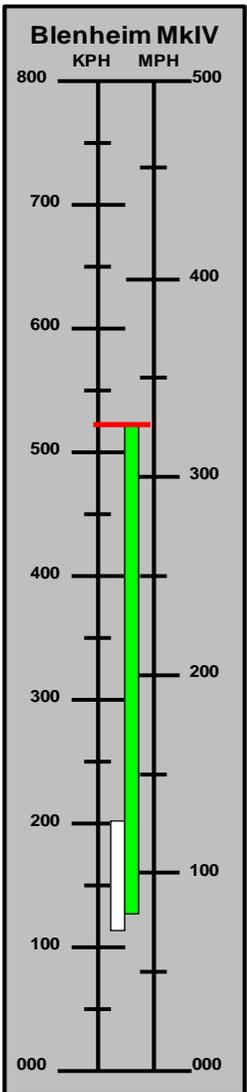
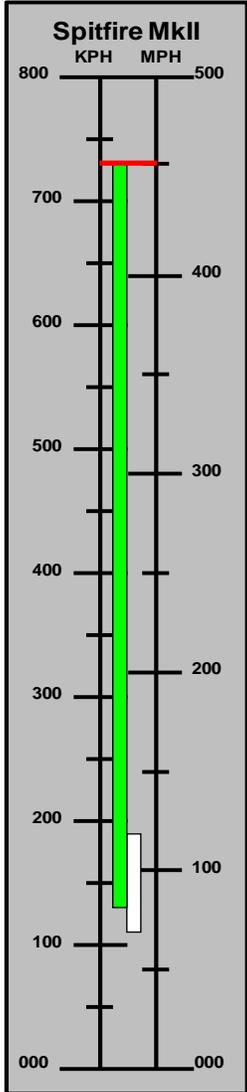
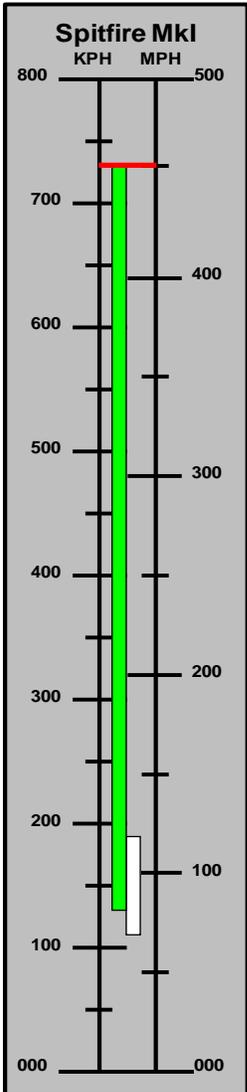
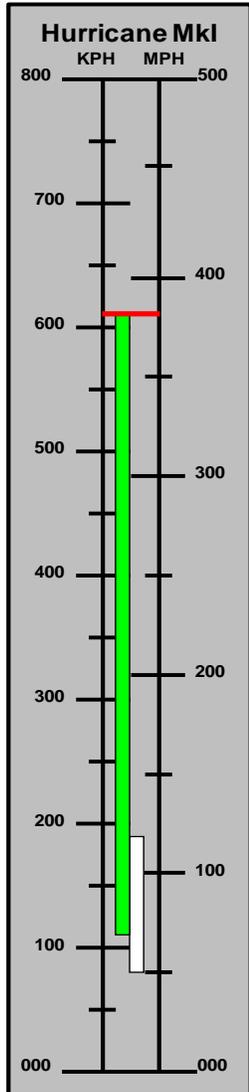
Engine	Operation
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Moving the lever increases the coffee flow so the hamsters run faster increasing the speed of the big fan in front that frightens the air molecules out of the way so that the airplane moves forward. Or something like that.

In other words, I haven't written this section yet.

ROYAL AIR FORCE





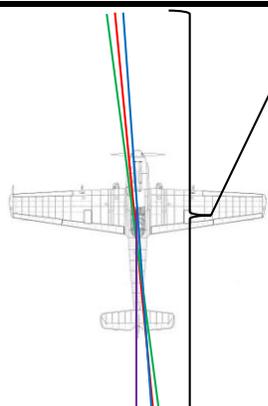
- V_{NE}** Never Exceed Speed
- V_{NO}** Max Structural Cruising Speed
- V_{FE}** Max. Flaps Extend Speed
- V_{LO}** Max Landing Gear Operating Speed
- V_{LE}** Max Landing Gear Extended Speed
- V_R** Rotation Speed
- V_{REF}** Landing Reference Speed
- V_S** Stall Speed
- V_{S0}** Stall Speed
- V_Y** Best Rate-of-Climb
- V_{BE}** Max Speedbrake Extended Speed

- Never Exceed in Any Operation
- Max Speed in Normal Operations (rarely used in WW2 aircraft)
- Do Not Extend Flaps Above this Speed
- Do Not Operate Ldg Gear Above this Speed
- Max Speed with Gear Extended
- Speed at which the Airplane Lifts Off
- Threshold Crossing Speed
- Min Speed at which the A/C is Controllable
- Stall Speed in Landing Configuration
- Delivers Gain in Altitude in Shortest Time
- Do Not Extend Brakes Above this Speed

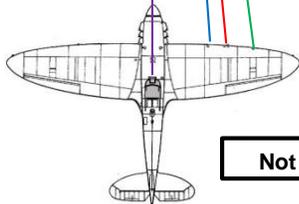
ROYAL AIR FORCE SIGHT DATA

Luftwaffe Aircraft	Wingspan			GM2 MKII SIGHT (118 mils)		
	Meters	Yards	Feet	Range (m)	Range (yds)	Range (ft)
Fiat CR.42	9.70	10.61	31.8	82	90	270
Bf-109E	9.87	10.79	32.4	84	91	274
Bf 108B-2	10.50	11.48	34.4	89	97	292
Fiat G.50	10.96	11.99	36.0	93	102	305
Ju-87B-2	13.80	15.09	45.3	93	102	305
Bf-110C	16.30	17.83	53.5	138	151	453
Do 17Z-1	18.00	19.69	59.1	153	167	500
Ju-88A-1	20.08	21.96	65.9	170	186	558
Fiat BR20M	21.56	23.58	70.7	183	200	599
He 115B-2	22.28	24.37	73.1	189	206	619
He-111H-2	22.50	24.61	73.8	191	209	626
He 59C-2	23.70	25.92	77.8	201	220	659
FW 200C-1	32.85	35.93	107.8	278	304	913

Rg of AC when wingtips touch Sight Ring



<= .4m from Sight Line is Lethal Area (Approx width of fuselage at Cockpit.)



Not to Scale

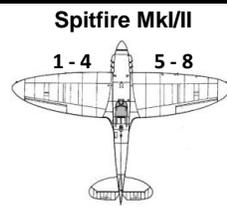
Spitfire Convergence - meters (yds)

Lethal Range Centered on Convergence		
205 (224)	240 (262)	275 (301)
188 (206)	220 (241)	252 (276)
171 (187)	200 (219)	229 (250)
154 (168)	180 (197)	206 (225)
137 (150)	160 (175)	183 (200)
119 (130)	140 (153)	161 (176)
102 (112)	120 (131)	138 (151)
85 (93)	100 (109)	115 (126)

Hurricane Convergence - meters (yds)

Lethal Range Centered on Convergence		
193 (211)	240 (262)	287 (314)
177 (194)	220 (241)	263 (288)
160 (175)	200 (219)	240 (262)
144 (157)	180 (197)	216 (236)
128 (140)	160 (175)	192 (210)
112 (122)	140 (153)	168 (184)
96 (105)	120 (131)	144 (157)
81 (89)	100 (109)	119 (130)

Gun Numbering



TWO

ROYAL AIR FORCE WEAPON DATA

TWO

RAF Machinegun Ammunition

Weapon	Nomen	Type	Fill	Burnout	Tracer Color	Smoke Trail	Notes
Browning .303 cal	Mk I	Ball					
	Mk VI	Ball					
	Mk VII	Ball					
	B Mk Iz	Incend	Ph			Yes	Burns
	B Mk VI	Incend	SR379				Schauzeichen
	G Mk I	Tracer		500 yd	Yellow		
	G Mk II	Tracer		1000 yd	Yellow		
	G Mk III	Tracer		800 yd	Red		
	G Mk IV	Tracer		550 yd	Yellow		
	G Mk V	Tracer		550 yd	Burgandy		Slow Tracer
	G Mk VIz	Tracer		550 yd	Yellow		
	W Mk Iz	AP					Steel Core
	O Mk I	Observer					

Hispano Mkl 20mm		Ball					
	Mk Iz	HE	Pentolite				
		HE-T	Pentolite		Red		

Notes	<p>Fill: Ph (Phosph.)</p> <p>SR379: Incendiary Mixture of Aluminum/Magnesium Alloy and Barium Nitrate - Mg/Al,Ba(NO3)2</p> <p>Pentolite: 50% PETN and 50% TNT</p> <p>Burns = Incendiary Composition (usually Phosphorus) is ignited on firing and burns during flight</p> <p>Flash = Incendiary Ignition or small HE Burst on impact with target</p> <p>Slow Tracer = Delayed tracer ignition for Night use</p>						
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Bombs

Country	Nomen	Type	WT (lbs/kg)	Fuze	Aircraft
RAF	GP 250 MkIV	GP	250 / 113	All	Blenheim MkIV
	GP 500 MkIV	GP	500 / 227	All	Blenheim MkIV

Pistols

Weapon	Nomen	Type	Settings	Bomb Type
RAF Pistols	No 27 MkI	GP	0, .025sD, 1sD, 11sD	GP 250, GP 500
	No 42 MkI	GP	0, .025sD, 1sD, 11sD	GP 250, GP 500
	No 44 MkI	Medium Alt	0, .025sD, 1sD, 11sD	GP 250, GP 500
	No 28 MkIIx	Ever-Ready	0, .025sD, .12sD, 1sD, 11sD	GP 250, GP 500
	No 30 MkIIIx	Unadjustable	NA	GP 250, GP 500
	No 37 MkIV	Delay	6hD, 12hD, 36hD, 72hD, 144hD	GP 250, GP 500

Notes	Settings: 0 = Instantaneous; 8sD = 8 second Delay; 6hD = 6 hour Delay; etc			
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Hurricane Mk I

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Hurricane Mk I	Merlin III / Rotol CSP	87/100 Oct	Pilot's Notes: AP 1564A; Mar 1939

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	380	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	120	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	150	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	80	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	72	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	55	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	157	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	MPH Range	Description
White Arc	55 - 120 MPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	72 - 380 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	380 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Cbt Emer	Take Off	Climb	Max Cruise	Max Cruise	Max Dive	87 Octane
Limit	Limited	5 min	30 min	Cont	Cont	20 sec	
Boost	+6.25 PSI	+6.25 PSI	+6.25 PSI	+4.5 PSI	+2.25 PSI	+6.25 PSI	
RPM	3000	3000	2600	2600	2600	3600	
Mixture	Rich	Rich	Rich	Rich	Weak	Rich	

Condition	Cbt Emer	Take Off	Climb	Max Cruise	Max Cruise	Max Dive	100 Octane
Limit	Limited	5 min	30 min	Cont	Cont	20 sec	
Boost	+12 PSI *	+6.25 PSI	+6.25 PSI	+4.5 PSI	+2.25 PSI	+6.25 PSI	
RPM	3000	3000	2600	2600	2600	3600	
Mixture	Rich	Rich	Rich	Rich	Weak	Rich	

Oil Pressure	Oil Temperature		Coolant Temperature		Operating Pressures
Emer Min = 45 PSI	Min = 15° C	Max = 90° C	Normal = 95° C		Fuel = 1.75 - 2 PSI
Normal = 60 PSI	Emergency Max = 95° C		Min = 70° C	Max = 120° C	Brake >= 120 PSI

*Use of +12lb/sqin Boost: AP1590B/J2-W

Overboost Note

- Requires the use of 100 Octane Fuel.
- Will maintain +12 PSI boost to about 10k feet. Boost will drop above this height. Max (unregulated) boost = +17PSI

The Boost Control Cut-Out enables higher boost pressures. The use, in an emergency, of this high boost pressure is a definite overload condition on the engine and therefore all occasions on which it is essential to make use of this +12lb./sq.in. must be reported by the pilot and recorded in the engine log book so that the engineer officer may be able to assess the reduction in life between overhauls and the need for special inspections.

Pilot's Notes General - A.P. 2095 dated April 1943: Variable Pitch Propellers: DH Variable Pitch Propellers (DH 5-20) are directly controlled by the pilot and have **TWO** settings, **FINE** and **COURSE**. **FINE** should be used for Engine Run Up, Take Off, Low Speed Climb, and Landing with **COURSE** used in all other stages of flight.

Note: Hurricane MkI Checklist Based on Pilot's Notes for Hurricane MkI with Merlin II, and Pilot's Notes for Spitfire MkI with Merlin III (Excerpts) and Spitfire MkII with Merlin XII.

ONE

ONE

TWO

Hurricane Mk I

TWO

PRELIMINARIES

1. Switch on Light Indicator and Check for -- **TWO GREEN** --lights
2. Safety Catch of Hydraulic Selector Covers Chasis -- **UP** -- Position
3. Radiator Flap -- **OPEN** --; In Cold Weather, Keep -- **CLOSED** -- Until Coolant Temperature Rises
4. Movement of the Flying Controls -- **CHECK**
5. Check Throttle Lever Friction Adjustment

STARTING ENGINE

NOTE: For full Particulars of the Merlin III engine see A.P.1590B, Volume I.

NOTE: For starting purposes, the engine should be supplied from the reserve tank as this provides a gravity feed. If main tanks are less than 1/2 full, run up and take off should be on reserve tank. Do not change fuel distributor cock until take off has been accomplished to prevent interruption of fuel flow.

***** IMPORTANT *****

To prevent any danger of air locks in the fuel system, do not exhaust the contents of the reserve or main tanks before switching to the other fuel tank.

1. Check fuel tank levels and determine which to use for run-up and take-off.
2. Fuel Distributer Cock -- **RESERVE**
3. Mixture -- **RICH**
4. Pitch Controls Fully Forward to -- **FINE PITCH**
5. Throttle Lever Forward -- **.5 INCH**
6. Radiator Shutter Fully -- **OPEN**
7. Prime the Cylinders by Injecting -- **FIVE** -- Shots of Fuel
8. Propeller Area -- **CLEAR**
9. Main and Starting Magneto Switches -- **ON**
10. Starting Switch -- **PRESS AND HOLD** -- No More Than -- **30 SECONDS**
11. If Engine Fails to Start Immediately; Then -- **1 OR 2** -- Pumps of Primer
12. Upon Engine START; Starting Magneto to -- **OFF** -- ; Fuel Distributer Cock -- **MAIN TANK**
13. Oil Pressure -- **SATISFACTORY**
14. Warm at Fast Tick-over Until Oil Temperature -- **15° C** --; Radiator Temperature -- **70° C**

CHECKING ENGINE AND INSTALLATIONS

NOTE: The throttle may be opened fully only for the shortest periods necessary for the checks to be made.

***** IMPORTANT *****

The engine should on no account be opened up with the airscrew in coarse pitch (control lever back) as the blade angle is too coarse and severe detonation will result.

1. Fuel Pressure: Main Tank -- **1.75 - 2 PSI** --; Reserve Tank -- **2.25 - 3 PSI**
2. Check Hydraulic Engine Pump: Operate Flaps; Select -- **FLAPS DOWN** -- then Depress Operating Lever
3. Check Hydraulic Hand Pump: Return Flaps; Select -- **FLAPS UP** -- then Operating Hand Lever
4. Hood -- **OPEN and LOCKED**
5. Harness Release -- **FIXED** -- Position
6. Make Other General Preparations For Flight
7. Open Throttle to -- **RATED** -- Gate. Ensure two men hold down the tail
 - 7a-1. Boost -- **+6.25 PSI**
 - 7a-2. RPM -- **2750 - 2850**
 - 7a-3. Oil Pressure -- **60 PSI** -- at NORMAL Temperature
 - 7b. Test Magnetos: Full Throttle, Pitch Full Forward (Fine) - RPM Drop Less Than -- **80 RPM**
 - 7c. Throttle at RATED Gate; Reduce Pitch Slowly until -- **2400 RPM** --. Throttle Down Slightly to Observe RPM maintained at 2400 RPM. Return Pitch to -- **FULLY FINE**
8. Brake Air Pressure -- **100 PSI**

TWO**TWO**

THREE

Hurricane Mk I

THREE

TAXYING OUT

1. Parking Brake -- **RELEASED**
2. Radiator Shutter -- **FULLY OPEN**
3. Brakes Can Be Used With Confidence
4. Check Brake Pressure During Prolonged Taxying

FINAL PREPARATION FOR T-O - DRILL OF VITAL ACTIONS

NOTE: *On reaching the take-off position, stop across wind, facing the aerodrome circuit, and carry out the Drill of Vital Actions. Some of this may already have been done, but must invariably be checked before every take-off. A convenient catch-phrase is applied to this drill "TMPF and Flaps".*

1. T - Trimming Tabs: Elevator Trim for Take-off; Indicator In -- **CENTRAL** -- Position
2. M - Mixture Control -- **RICH**
3. P - Pitch Control -- **FULLY FINE** -- (Lever Fully Forward)
4. F - Fuel Distributor Cock -- **MAIN** -- Tanks
5. Flaps - Depress To -- **28°** -- Indicator -- **TWO** -- Divisions
6. Hydraulic Selector Gate to Uncover -- **UP** -- Position for Undercarriage Lever

TAKE-OFF

NOTE: *Turn into wind, steady the aeroplane, and move forward slowly to straighten up the tail wheel; open to full throttle and take-off by holding the aeroplane to a constant attitude. Firm push on Control Column to raise the tail. Correct tendency to swing by coarse rudder control.*

NOTE: *As a safeguard in the event of engine failure, a steep angle of climb should not be attempted. Aim at clearing aerodrome boundary by a small margin.*

ACTIONS AFTER TAKING-OFF

IMMEDIATE ACTIONS: Upon Ensuring Gaining SPEED and ALTITUDE

1. Raise Undercarriage: Select Wheels -- **UP** --; Press & Hold Operating Lever Until -- **BOTH** -- Red Lights On
 - 1.a. Return Selector Lever to -- **NEUTRAL**
2. Throttle -- **RATED (+6.25 PSI Boost)** --; Pitch -- **2850 RPM**
3. Raise Flaps at -- **> 90 MPH** -- ASI; Select Flaps -- **UP** -- Press Op Lever Until Flap Indicator Shows -- **UP**
4. Accelerate to -- **140 MPH ASI** -- at -- **+6.25 PSI Boost** -- Adjusting Attitude to Maintain Speed

SUBSEQUENT ACTIONS: Perform When Ready

5. Fuel Distributor Cock -- **MAIN** -- Tank
6. Oil Pressure -- **60 PSI**
7. Hood -- **FULLY CLOSE**
8. Radiator Shutter -- **CLOSE**
9. Engine Controls: Adjust Throttle and Pitch as Required
10. Check Radiator and Oil Temperature
11. Begin Cockpit Scan

CLIMBING

The optimum full throttle indicated climbing speed is 170 MPH.

Engine Management -- +6.25 PSI Boost, 2850 RPM, 30 Min Limit

1. Radiator Temperatures -- **Max 120° C** -- Adjust Radiator Shutter as Required
2. Oil Inlet Temperature -- **Max 90° C**

THREE**THREE**

FOUR**Hurricane Mk I****FOUR****APPROACH**

1. Reduce Speed to -- **150 MPH** -- ASI
2. Hood -- **OPEN and LOCK**
2. Mixture -- **NORMAL**
3. Maps -- **STOW**
4. Radiator -- **AS REQUIRED**
5. Check Brake Pressure: Before Landing -- **>120 PSI**
6. Flaps Up Approach: Increase Approach Speed by -- **10 MPH** -- ASI

DRILL OF VITAL ACTIONS FOR LANDING

NOTE: *This should be carried out quickly and decisively when the right moment arrives, when approaching the lee side of the aerodrome. A convenient catch-phrase is applied to this drill, "U.P. and Flaps".*

1. Undercarriage: Engine Pump: Select Gear -- **DOWN** ; Press Operating Lever Until -- **GREEN** -- Lamps Light
 - 1.a. Undercarriage: Hand Pump: Select Gear -- **DOWN** ; Operate Hand Pump Until -- **GREEN** -- Lamps Light
2. P - Pitch Control -- **FULLY FINE** -- (Lever Fully Forward)
3. Flaps: Select Flaps -- **DOWN** --; Press Oil Valve Operating Lever or Operate Hand Pump

LANDING

Non Engine Assisted Approach: 90 MPH ASI

Engine Assisted Approach: 80 MPH ASI

Brakes -- Use With Confidence

MISLANDING

1. Power -- **FULL THROTTLE**
2. Flaps and Gear -- **DOWN**

SHUTTING DOWN

1. Radiator Shutter -- **OPEN**
2. Taxi to Park; Fuel Cocks -- **OFF** --; Slow Running Cut Out -- **PULL and HOLD** -- ; Ignition -- **OFF**
3. Switch Undercarriage Indicator -- **OFF**
4. Select Flaps -- **UP**
5. Safety Catch of Hydraulic Selector Covers Chassis -- **UP** -- Position
6. Indicator Lights and Other Electrical Equipment -- **OFF**

UNDERCARRIAGE EMERGENCY OPERATION

If difficulty is experienced in selecting wheels "DOWN", or the wheels fail to drop (indicated by the failure of the RED lights to extinguish), select wheels "UP" again and press the operating lever for 15 seconds or operate the hand pump; after which select wheels "DOWN" immediately.

1. Reduce Speed to -- **90 MPH** -- ASI
2. Press Undercarriage Emergency Release Knobs with -- **BOTH FEET** -- and Select Wheels -- **DOWN**

ENGINE FAILURE DURING TAKE-OFF

In case of engine failure during takeoff, the first and foremost essential is maintain ample flying speed.

1. Attitude -- **NOSE DOWN**
2. Undercarriage -- **UP**
3. Flaps -- **DOWN**
4. Land Straight Ahead; DO NOT ATTEMPT TO TURN
5. Fuel Cocks and Switches -- **OFF**

FORCED LANDING OWING TO ENGINE FAILURE

Maintain ample gliding speed, select a landing ground, glide toward it and try to rectify the trouble.

If landing without engine is inevitable, act as the following:

1. Ignition and Fuel Cocks -- **OFF**
2. Undercarriage -- **AS DETERMINED** -- If in Doubt, Land with Undercarriage -- **UP**
3. Approach and Land as Normal; Flaps -- **AS REQUIRED** -- Use Hand Pump

FOUR**FOUR**

ONE

Spitfire Mk I

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Spitfire Mk Ia	Merlin III / Rotol CSP	87/100 Oct	Pilot's Notes: AP 1565A; Date

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	450	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	140	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	160	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	NA	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	79	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	71	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	160	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	MPH Range	Description
White Arc	71 - 140 MPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	79 - 450 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	450 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Cbt Emer	Take Off	Climb	Max Cruise	Max Cruise	Max Dive	87 Octane
Limit	Limited	5 min	30 min	Cont	Cont	20 sec	
Boost	+6.25 PSI	+6.25 PSI	+6.25 PSI	+4.5 PSI	+2.25 PSI	+6.25 PSI	
RPM	3000	3000	2600	2600	2600	3600	
Mixture	Rich	Rich	Rich	Rich	Weak	Rich	

Condition	Cbt Emer	Take Off	Climb	Max Cruise	Max Cruise	Max Dive	100 Octane
Limit	Limited	5 min	30 min	Cont	Cont	20 sec	
Boost	+12 PSI *	+6.25 PSI	+6.25 PSI	+4.5 PSI	+2.25 PSI	+6.25 PSI	
RPM	3000	3000	2600	2600	2600	3600	
Mixture	Rich	Rich	Rich	Rich	Weak	Rich	

Oil Pressure	Oil Temperature		Coolant Temperature		Operating Pressures
Emer Min = 45 PSI	Min = 15° C	Max = 90° C	Normal = 100° C		Fuel = 2.5 - 3 PSI
Normal = 60 PSI	Emergency Max = 95° C		Min = 70° C	Max = 120° C	Brake >= 120 PSI

*Use of +12lb/sqin Boost: AP1590B/J2-W

Overboost Note

1. Requires the use of 100 Octane Fuel.
2. Will maintain +12 PSI boost to about 10k feet. Boost will drop above this height. Max (unregulated) boost = +17PSI

The Boost Control Cut-Out enables higher boost pressures. The use, in an emergency, of this high boost pressure is a definite overload condition on the engine and therefore all occasions on which it is essential to make use of this +12lb./sq.in. must be reported by the pilot and recorded in the engine log book so that the engineer officer may be able to assess the reduction in life between overhauls and the need for special inspections.

Pilot's Notes General - A.P. 2095 dated April 1943: Variable Pitch Propellers: DH Variable Pitch Propellers (DH 5-20) (Spitfire MkI) are directly controlled by the pilot and have **TWO** settings, **FINE** and **COURSE**. **FINE** should be used for Engine Run Up, Take Off, Low Speed Climb, and Landing with **COURSE** used in all other stages of flight.

Note: Spitfire MkI Checklist Based on Pilot's Notes for Spitfire MkI with Merlin III (Excerpts) and Pilot's Notes for Spitfire MkII with Merlin XII for Engine Management and Operation.

ONE

ONE

TWO

Spitfire Mk I

TWO

PRELIMINARIES

1. Ignition switches -- **OFF**
2. Undercarriage Selector Lever Position -- **DOWN** -- gate; Indicator Shows -- **IDLE**
3. Switch on Light Indicator and Check for -- **GREEN** --lights
4. Flaps -- **UP**
5. Landing Lamps -- **UP**
6. Wheel Brakes -- **ON**
7. Fuel Contents -- **CHECK**
8. Movement of the Flying Controls -- **CHECK**

STARTING ENGINE

NOTE: For full Details of the Merlin XII engine see A.P.1590B, Volume I.

NOTE: Whenever possible the pilot should start the engine himself; this will ensure that he will have ample time to carry out all of the checks, and that unnecessary running of the engine is avoided.

1. Mixture -- **NORMAL**
2. Pitch Controls Fully Forward to -- **FINE PITCH**
3. Radiator Shutter Fully -- **OPEN**
4. Raise Both Fuel Cock Levers to -- **ON**
5. Prime the Cylinders by Injecting -- **FIVE** -- Shots of Fuel
6. Propeller Area -- **CLEAR**
7. Switch Ignition --**ON** --; Throttle -- **OPEN SLIGHTLY**
8. Starting Switch -- **PRESS AND HOLD** -- No More Than -- **30 SECONDS**

NOTE: Do not oscillate the throttle lever, but open it slowly to get the engine running smoothly at a fast tick-over; if the engine begins to fade, or "spit-back", close the throttle quickly and open it up again very slowly.

9. Oil Pressure -- **SATISFACTORY**
10. Warm at Fast Tick-over Until Oil Temperature -- **15° C** --; Radiator Temperature -- **70° C**

TESTING ENGINE AND INSTALLATIONS

NOTE: The engine should not be run at full power for more than a few seconds - just long enough to test magnetos and observe oil pressure, boost and r.p.m.

***** IMPORTANT *****

The engine should on no account be opened up with the airscrew in coarse pitch (control lever back) as the blade angle is too coarse and severe detonation will result.

1. Fuel Pressure -- **2.5 - 3 PSI**
2. Brake Pressure - Reservoir Pressure at least -- **120 PSI**
3. Pneumatic Systems - Cycle Flaps -- **DOWN** -- and -- **UP**
4. Set Altimeter and Directional Gyro
5. Hood -- **LOCKED OPEN** --; Emergency Exit Door at -- **HALF COCK** -- Position
6. Harness Release -- **FIXED** -- Position
7. Make Other General Preparations For Flight

NOTE: Warming up should not be unduly prolonged, as the temperature rises quickly, and some margin must be kept in hand for taxiing. If it is 130° before the aeroplane taxis out, it will become excessive if there is any distance to taxi downwind. The engine should not idle for any length of time in a light wind, and the aircraft should always face into the wind.

8. Open Throttle to -- **RATED** -- Gate. Ensure two men hold down the tail
 - 8a-1. Boost -- **+6.25 PSI**
 - 8a-2. RPM -- **2750 - 2850**
 - 8a-3. Oil Pressure -- **60 PSI** -- at NORMAL Temperature
 - 8b. Test Magnetos: Full Throttle, Pitch Full Forward (Fine) - RPM Drop Less Than -- **80 RPM**
 - 8c. Throttle at RATED Gate; Reduce Pitch Slowly until -- **2400 RPM** --. Throttle Down Slightly to Observe RPM maintained at 2400 RPM. Return Pitch to -- **FULLY FINE**
 - 8d. Wave Away Chocks

TWO**TWO**

THREE

Spitfire Mk I

THREE

TAXYING OUT

1. Parking Brake -- **RELEASED**
2. Radiator Shutter -- **FULLY OPEN**
3. Brake Pressure -- **CHECK** --. If failure during taxi, apply FULL Brake immediately.
- 4a. Use the brakes as little as possible in taxiing, in order to save wear
- 4b. Do not relax throttle tension in order to prevent throttle coming back during take off
- 4c. Clear Engine before take off by increasing to moderate rpm against fully held brakes

FINAL PREPARATION FOR T-O - DRILL OF VITAL ACTIONS

NOTE: *On reaching the take-off position, stop across wind, facing the aerodrome circuit, and carry out the Drill of Vital Actions. Some of this may already have been done, but must invariably be checked before every take-off. A convenient catch-phrase is applied to this drill "TMP and Flaps".*

1. T - Trimming Tabs -- **Elevator One Division Nose Down; Rudder Central**
2. M - Mixture Control -- **NORMAL**
3. P - Pitch Control -- **FULLY FINE** -- (Lever Fully Forward)
4. Flaps -- **UP**

NOTE: *The aeroplane would, however, take-off with flaps down, and if, by a serious omission of drill, the pilot leaves them down, he must on no account raise them until speed is at least 120 mph ASI at a safe height.*

TAKING-OFF

NOTE: *Turn into wind, steady the aeroplane, and move forward slowly to straighten up the tail wheel; open to full throttle and take-off by holding the aeroplane to a constant attitude. The tail need not be raised much. Correct tendency to swing by coarse rudder control. Hold down to almost level flight.*

ACTIONS AFTER TAKING-OFF

IMMEDIATE ACTIONS: Upon Ensuring Gaining SPEED and ALTITUDE

1. Undercarriage -- **RAISE** -- Check Red Indicator Light -- **UP** -- is On
2. Throttle -- **RATED (+6.25 PSI Boost)** --; Pitch -- **2850 RPM**
3. Accelerate to -- **185 MPH ASI** -- at -- **+6.25 PSI Boost** -- Adjusting Attitude to Maintain Speed

SUBSEQUENT ACTIONS: Perform When Ready

4. Oil Pressure -- **60 PSI**
5. Emergency Exit Door -- **FULLY CLOSE** --; Hood -- **FULLY CLOSE**
6. Radiator Shutter -- **CLOSE**
7. Engine Controls: Adjust Throttle and Pitch as Required
8. Check Radiator and Oil Temperature
9. Begin Cockpit Scan

CLIMBING

Engine Management -- **+6.25 PSI Boost, 2850 RPM, 30 Min Limit**

1. Radiator Temperatures -- **Max 120° C** -- Adjust Radiator Shutter as Required
2. Oil Inlet Temperature -- **Max 90° C**

THREE

THREE

FOUR

Spitfire Mk I

FOUR

PRELIMINARY APPROACH

1. Hood -- **OPEN** and **LOCK**
2. Mixture -- **NORMAL**
3. Maps -- **STOW**
4. Radiator -- **AS REQUIRED**

DRILL OF VITAL ACTIONS FOR LANDING

NOTE: *This should be carried out quickly and decisively when the right moment arrives, when approaching the lee side of the aerodrome. A convenient catch-phrase is applied to this drill, "U.P. and Flaps".*

1. U- Undercarriage -- **DOWN** -- Check Green Indicator Light -- **DOWN** -- is On
2. P - Pitch Control -- **FULLY FINE** -- (Lever Fully Forward)
3. Flaps -- **DOWN** -- On Final Approach

NOTE: *If the undercarriage green indicator light does not come ON, hold the lever hard back in the LOWER position. When the light comes on, release lever to IDLE position. If GREEN indicators do not show fully DOWN and LOCKED, cycle the undercarriage UP then repeat lowering the undercarriage. If indicators still do not show fully DOWN and LOCKED, the EMERGENCY LOWERING SYSTEM should be used.*

LANDING

Non Engine Assisted Approach: 90 MPH ASI

Engine Assisted Approach: 80 - 85 MPH ASI

Brakes -- Use With Care

MISLANDING

1. Power -- **FULL THROTTLE**
3. Flaps -- **UP** -- After Attaining -- **120 MPH ASI**

PROCEDURE AFTER LANDING

1. Flaps -- **UP**
2. Radiator Shutter -- **OPEN**
3. Taxi to Park; Fuel Cocks -- **OFF** --; Slow Running Cut Out -- **PULL and HOLD** --; Ignition -- **OFF**
4. Indicator Lights and Other Electrical Equipment -- **OFF**

UNDERCARRIAGE EMERGENCY OPERATION

1. Undercarriage -- **DOWN**
2. Undercarriage Emergency Lever -- **FORWARD** and **DOWN**

NOTE: *After use, replace the CO2 cylinder and seal the lever. Inspect and refill the hydraulic system*

ENGINE FAILURE DURING TAKE-OFF

NOTE: *In case of engine failure during takeoff, the first and foremost essential is maintain ample flying speed.*

1. Attitude -- **NOSE DOWN**
2. Undercarriage -- **UP**
3. Flaps -- **DOWN**
4. Land Straight Ahead; DO NOT ATTEMPT TO TURN
5. Fuel Cocks and Switches -- **OFF**

FORCED LANDING OWING TO ENGINE FAILURE

NOTE: *Maintain ample gliding speed, select a landing ground, glide toward it and try to rectify the trouble. If landing without engine is inevitable, act as the following:*

1. Ignition and Fuel Cocks -- **OFF**
2. Undercarriage -- **AS DETERMINED** -- If in Doubt, Land with Undercarriage -- **UP**
3. Approach and Land as Normal; Flaps -- **AS REQUIRED**

FOUR**FOUR**

ONE

Spitfire Mk II

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Spitfire Mk II	Merlin XII / Rotol CSP	87/100 Oct	Pilot's Notes: AP 1565B; July 1940

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	450	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	140	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	160	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	NA	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	79	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	71	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	160	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	MPH Range	Description
White Arc	71 - 140 MPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	79 - 450 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	450 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Take-Off	All Out Level	Climb	Max Cruise	Max Cruise	Max Dive	87 Octane
Limit	1000' or 3 min	5 min	30 min	Cont	Cont	20 sec	
Boost	+9 PSI	+7 PSI	+7 PSI	+5 PSI	+2.5 PSI	+9 PSI	
RPM	3000	3000	2850	2650	2650	3600	
Mixture	Normal	Normal	Normal	Normal	Weak	Normal	

Condition	Take-Off	All Out Level	Climb	Max Cruise	Max Cruise	Max Dive	100 Octane
Limit	1000' or 3 min	5 min	30 min	Cont	Cont	20 sec	
Boost	+12 PSI	+9 PSI	+9 PSI	+7 PSI	+3.75 PSI	+9 PSI	
RPM	3000	3000	2850	2650	2650	3600	
Mixture	Normal	Normal	Normal	Normal	Weak	Normal	

Oil Pressure	Oil Temperature		Coolant Temperature		Operating Pressures
Emer Min = 45 PSI	Min = 15° C	Max = 90° C	Normal = 100° C		Fuel = 2.5 - 3 PSI
Normal = 60 PSI	Emergency Max = 95° C		Min = 60° C	Max = 120° C	Brake >= 120 PSI

*Use of +12lb/sqin Boost: AP1590B/J2-W

Overboost Note

1. Requires the use of 100 Octane Fuel.
2. Will maintain +12 PSI boost to about 10k feet. Boost will drop above this height. Max (unregulated) boost = +17PSI

The Boost Control Cut-Out enables higher boost pressures. The use, in an emergency, of this high boost pressure is a definite overload condition on the engine and therefore all occasions on which it is essential to make use of this +12lb./sq.in. must be reported by the pilot and recorded in the engine log book so that the engineer officer may be able to assess the reduction in life between overhauls and the need for special inspections.

Pilot's Notes General - A.P. 2095 dated April 1943: Variable Pitch Propellers: DH Variable Pitch Propellers (DH 5-20) (Spitfire MkI) are directly controlled by the pilot and have **TWO** settings, **FINE** and **COURSE**. **FINE** should be used for Engine Run Up, Take Off, Low Speed Climb, and Landing with **COURSE** used in all other stages of flight.

Note: Spitfire MkII Checklist Based on Pilot's Notes for Spitfire MkII with Merlin XII.

ONE

ONE

TWO

Spitfire Mk II

TWO

PRELIMINARIES

1. Ignition switches -- **OFF**
2. Undercarriage Selector Lever Position -- **DOWN** -- gate; Indicator Shows -- **IDLE**
3. Switch on Light Indicator and Check for -- **GREEN** --lights
4. Flaps -- **UP**
5. Landing Lamps -- **UP**
6. Wheel Brakes -- **ON**
7. Fuel Contents -- **CHECK**
8. Movement of the Flying Controls -- **CHECK**

STARTING ENGINE

NOTE: For full Details of the Merlin XII engine see A.P.1590P, Volume I.

NOTE: Whenever possible the pilot should start the engine himself; this will ensure that he will have ample time to carry out all of the checks, and that unnecessary running of the engine is avoided.

1. Mixture -- **NORMAL**
2. Pitch Controls Fully Forward to -- **FINE PITCH**
3. Radiator Shutter Fully -- **OPEN**
4. Raise Both Fuel Cock Levers to -- **ON**
5. Prime the Cylinders by Injecting -- **FIVE** -- Shots of Fuel
6. Propeller Area -- **CLEAR**
7. Cartridge Starting: Switch Ignition --**ON** --; Throttle -- **OPEN SLIGHTLY**
8. **PRESS** -- Starter Button Until Engine is Firing Evenly

NOTE: Do not oscillate the throttle lever, but open it slowly to get the engine running smoothly at a fast tick-over; if the engine begins to fade, or "spit-back", close the throttle quickly and open it up again very slowly.

9. Oil Pressure -- **SATISFACTORY**
10. Warm at Fast Tick-over Until Oil Temperature -- **15° C** --; Radiator Temperature -- **70° C**

TESTING ENGINE AND INSTALLATIONS

NOTE: The engine should not be run at full power for more than a few seconds - just long enough to test magnetos and observe oil pressure, boost and r.p.m.

***** IMPORTANT *****

The engine should on no account be opened up with the airscrew in coarse pitch (control lever back) as the blade angle is too coarse and severe detonation will result.

1. Fuel Pressure -- **2.5 - 3 PSI**
2. Brake Pressure - Reservoir Pressure at least -- **120 PSI**
3. Pneumatic Systems - Cycle Flaps -- **DOWN** -- and -- **UP**
4. Set Altimeter and Directional Gyro
5. Hood -- **LOCKED OPEN** --; Emergency Exit Door at -- **HALF COCK** -- Position
6. Harness Release -- **FIXED** -- Position
7. Make Other General Preparations For Flight

NOTE: Warming up should not be unduly prolonged, as the temperature rises quickly, and some margin must be kept in hand for taxiing. If it is 130° before the aeroplane taxies out, it will become excessive if there is any distance to taxi downwind. The engine should not idle for any length of time in a light wind, and the aircraft should always face into the wind.

8. Open Throttle to -- **RATED** -- Gate. Ensure two men hold down the tail
 - 8a-1. Boost -- **+9 PSI**
 - 8a-2. RPM -- **2750 - 2850**
 - 8a-3. Oil Pressure -- **60 PSI** -- at NORMAL Temperature
 - 8b. Test Magnetos: Full Throttle, Pitch Full Forward (Fine) - RPM Drop Less Than -- **80 RPM**
 - 8c. Throttle at RATED Gate; Reduce Pitch Slowly until -- **2400 RPM** --. Throttle Down Slightly to Observe RPM maintained at 2400 RPM. Return Pitch to -- **FULLY FINE**
 - 8d. Wave Away Chocks

TWO**TWO**

THREE

Spitfire Mk II

THREE

TAXYING OUT

1. Parking Brake -- **RELEASED**
2. Radiator Shutter -- **FULLY OPEN**
3. Brake Pressure -- **CHECK** --. If failure during taxi, apply FULL Brake immediately.
- 4a. Use the brakes as little as possible in taxiing, in order to save wear
- 4b. Do not relax throttle tension in order to prevent throttle coming back during take off
- 4c. Clear Engine before take off by increasing to moderate rpm against fully held brakes

FINAL PREPARATION FOR T-O - DRILL OF VITAL ACTIONS

NOTE: *On reaching the take-off position, stop across wind, facing the aerodrome circuit, and carry out the Drill of Vital Actions. Some of this may already have been done, but must invariably be checked before every take-off. A convenient catch-phrase is applied to this drill "TMP and Flaps".*

1. T - Trimming Tabs -- **Elevator One Division Nose Down; Rudder Central**
2. M - Mixture Control -- **NORMAL**
3. P - Pitch Control -- **FULLY FINE** -- (Lever Fully Forward)
4. Flaps -- **UP**

NOTE: *The aeroplane would, however, take-off with flaps down, and if, by a serious omission of drill, the pilot leaves them down, he must on no account raise them until speed is at least 120 mph ASI at a safe height.*

TAKING-OFF

NOTE: *Turn into wind, steady the aeroplane, and move forward slowly to straighten up the tail wheel; open to full throttle and take-off by holding the aeroplane to a constant attitude. The tail need not be raised much. Correct tendency to swing by coarse rudder control. Hold down to almost level flight.*

ACTIONS AFTER TAKING-OFF

IMMEDIATE ACTIONS: Upon Ensuring Gaining SPEED and ALTITUDE

1. Undercarriage -- **RAISE** -- Check Red Indicator Light -- **UP** -- is On
2. Throttle -- **RATED (+9 PSI Boost)** --; Pitch -- **2850 RPM**
3. Accelerate to -- **185 MPH ASI** -- at -- **+9 PSI Boost** -- Adjusting Attitude to Maintain Speed

SUBSEQUENT ACTIONS: Perform When Ready

4. Oil Pressure -- **60 PSI**
5. Emergency Exit Door -- **FULLY CLOSE** --; Hood -- **FULLY CLOSE**
6. Radiator Shutter -- **CLOSE**
7. Engine Controls: Adjust Throttle and Pitch as Required
8. Check Radiator and Oil Temperature
9. Begin Cockpit Scan

CLIMBING

Engine Management -- +9 PSI Boost, 2700 RPM, 30 Min Limit

1. Radiator Temperatures -- **Max 120° C** -- Adjust Radiator Shutter as Required
2. Oil Inlet Temperature -- **Max 90° C**

THREE**THREE**

PRELIMINARY APPROACH

1. Hood -- **OPEN** and **LOCK**
2. Mixture -- **NORMAL**
3. Maps -- **STOW**
4. Radiator -- **AS REQUIRED**

DRILL OF VITAL ACTIONS FOR LANDING

NOTE: *This should be carried out quickly and decisively when the right moment arrives, when approaching the lee side of the aerodrome. A convenient catch-phrase is applied to this drill, "U.P. and Flaps".*

1. U- Undercarriage -- **DOWN** -- Check Green Indicator Light -- **DOWN** -- is On
2. P - Pitch Control -- **FULLY FINE** -- (Lever Fully Forward)
3. Flaps -- **DOWN** -- On Final Approach

NOTE: *If the undercarriage green indicator light does not come ON, hold the lever hard back in the LOWER position. When the light comes on, release lever to IDLE position. If GREEN indicators do not show fully DOWN and LOCKED, cycle the undercarriage UP then repeat lowering the undercarriage. If indicators still do not show fully DOWN and LOCKED, the EMERGENCY LOWERING SYSTEM should be used.*

LANDING

Non Engine Assisted Approach: 90 MPH ASI

Engine Assisted Approach: 80 - 85 MPH ASI

Brakes -- Use With Care

MISLANDING

1. Power -- **FULL THROTTLE**
3. Flaps -- **UP** -- After Attaining -- **120 MPH ASI**

PROCEDURE AFTER LANDING

1. Flaps -- **UP**
2. Radiator Shutter -- **OPEN**
3. Taxi to Park; Fuel Cocks -- **OFF** --; Slow Running Cut Out -- **PULL and HOLD** --; Ignition -- **OFF**
4. Indicator Lights and Other Electrical Equipment -- **OFF**

UNDERCARRIAGE EMERGENCY OPERATION

1. Undercarriage -- **DOWN**
2. Undercarriage Emergency Lever -- **FORWARD** and **DOWN**

NOTE: *After use, replace the CO2 cylinder and seal the lever. Inspect and refill the hydraulic system*

ENGINE FAILURE DURING TAKE-OFF

NOTE: *In case of engine failure during takeoff, the first and foremost essential is maintain ample flying speed.*

1. Attitude -- **NOSE DOWN**
2. Undercarriage -- **UP**
3. Flaps -- **DOWN**
4. Land Straight Ahead; DO NOT ATTEMPT TO TURN
5. Fuel Cocks and Switches -- **OFF**

FORCED LANDING OWING TO ENGINE FAILURE

NOTE: *Maintain ample gliding speed, select a landing ground, glide toward it and try to rectify the trouble. If landing without engine is inevitable, act as the following:*

1. Ignition and Fuel Cocks -- **OFF**
2. Undercarriage -- **AS DETERMINED** -- If in Doubt, Land with Undercarriage -- **UP**
3. Approach and Land as Normal; Flaps -- **AS REQUIRED**

ONE

Blenheim Mk IV

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Blenheim MkIV	Mercury XV / DH CSP	100 Oct	Pilot's Notes: AP 1530C; Jan 1943

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	325	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	125	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	140	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	90	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	80	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	70	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	130	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	MPH Range	Description
White Arc	70 - 125 MPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	80 - 325 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	325 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Take-Off	All Out Level	Climb	Max Cruise	Max Cruise	Max Dive	100 Octane
Limit	1000' or 3 min	30 min	30 min	Cont	Cont	20s @ 2750	
Boost	+9 PSI	+9 PSI	+5 PSI	+3.5 PSI	+1.5 PSI	+5 PSI	
RPM	2750	2750	2650	2400	2400	3120	
Mixture	Normal	Normal	Normal	Normal	Weak	Normal	

Oil Pressure	Oil Temperature (Inlet)		Cylinder Temperature		Operating Pressures
Emer Min = 70 PSI	Min = 5° C	Max = 90° C	Normal = 190° C		Fuel = 2.5 - 3.5 PSI
Normal = 80 PSI	Emergency Max = 95° C		Min	Max = 235° C	Brake >= 100 PSI

Correction of ASI Reading for Position Error

ASI (MPH)	+ / -	Adjustment	CAS (MPH)
120	+	4	124
140	+	2	142
160	0	0	160
180	-	2	178
200	-	4	196
220	-	4	216
240	-	6	234
260	-	6	254

87 Octane Fuel Restrictions

Condition	Take-Off	All Out Level
Limit	1000' or 3 min	5 min
Boost	+5 PSI	+5 PSI
RPM	2650	2750

Engine Provided Systems

Hydraulic	Pump	Port Engine
Pneumatic	Compressor	Starb'd Eng
Electrical	Generator	Port Engine

Note: Blenheim MkIV Checklist Based on Pilot's Notes for Blenheim MkV.

ONE

ONE

TWO**Blenheim Mk IV****TWO****PRELIMINARIES**

1. Hydraulic Selector -- **DOWN** --; Undercarriage Operating Lever -- **DOWN**
2. Undercarriage Indicator -- **ON** --; Undercarriage Locked -- **DOWN**
3. Auxilliary Fuel Feed -- **CHECK** -- If Required

STARTING ENGINES AND WARMING UP

1. Set Controls as Follows:
 - 1a. Fuel Cocks -- **INNER** -- Tanks; Balance Cock -- **OFF**
 - 1b. Throttle Open -- **.5 Inch**
 - 1c. High Boost Control to -- **5 LBS**
 - 1d. Mixture -- **NORMAL**
 - 1e. Pitch Control -- **FULLY BACK**
 - 1f. Carburetor Heat Control -- **COLD**
 - 1g. Cowl Flaps -- **OPEN**
2. High Volatile Fuel Should be Used When Air Temperature is Below Freezing
3. Prime the Cylinders by Injecting -- **ONE to FIVE** -- Strokes of Fuel, depending on Air Temperature
4. Ignition and Booster Coil Switches to -- **ON**
5. Starting Switch -- **PRESS AND HOLD** -- No More Than -- **20 SECONDS**
 - 5a. Wait -- **30 SECONDS** -- Between Starting Each Engine
6. Booster Coil Switch to -- **OFF**
7. After -- **ONE** -- Minute, Open Up to Fast Tick-over
8. Pitch Control -- **FULLY FORWARD**

TESTING ENGINES AND INSTALLATIONS

1. Hydraulic Systems - Cycle Flaps -- **DOWN** -- and -- **UP**
2. Open Throttle to -- **MAX WEAK CONTINUOUS** -- Boost. Check Operation of Propellers
3. Open Throttle -- **FULLY** --; Check Boost to -- **+5 PSI**
4. With 100 Octane Fuel: High Boost Control to -- **9 LBS** --; RPM -- **2750 - 2850**
 - 4a. Return Boost Control to -- **5 LBS** -- Before Throttling Back
5. Test Magnetos: Max Rich Continuous Boost - RPM Drop Less Than -- **100 RPM**

TAXYING OUT

1. Undercarriage Locking Pins -- **REMOVED** -- And -- **STOWED**
3. Brake Pressure -- **100 PSI**

DRILL OF VITAL ACTIONS FOR TAKE-OFF**DRILL OF VITAL ACTIONS**

1. H - Hydraulic Selector -- **DOWN**
1. T - Trimming Tabs -- Rudder -- **CENTRAL** --; Elevator -- **ONE INCH BELOW NEUTRAL** -- Nose Heavy
2. M - Mixture Control -- **NORMAL**
3. P - Pitch Control -- **FULLY FORWARD**
4. Fuel - Check Contents and Cock Settings
5. Flaps -- **20° DOWN**
6. Cowl Flaps -- **CLOSED**
7. Boost Control -- **9 LBS**

TAKE-OFF

1. There is a Slight Tendency to Swing to the Right
2. Apply Steady Backpressure to Lift Off at -- **90 MPH** -- at 16,000 Lbs
3. Safety Speed -- **140 MPH**
4. After Reaching Safety Speed, Move High Boost Control to -- **5 LBS** -- and Set Climbing Boost and RPM
5. Raise Undercarriage and Flaps
 - 5a. Set Hydraulic selector to -- **CENTRAL** --; or -- **UP** -- For Turret Operation

TWO**TWO**

THREE

Blenheim Mk IV

THREE

CLIMBING

Engine Management -- +5 PSI Boost, 2650 RPM, 30 Min Limit

1. Cowl Flaps -- **FULLY OPEN**
2. Maximum Rate of Climb -- **130 MPH** -- Up to 10k Feet; Reduce By -- **1 MPH PER 1K FEET** -- Above 10k

USE OF WARM AND COLD INTAKE

Warm Intake should be used:

1. Boost -- **<= +3.5 PSI** -- Air Temperature -- **<= 15° C**
2. Flight in -- **HIGH** -- Humidity; or In -- **CLOUDS, RAIN, SNOW, SLEET**

Cold Intake should be used:

1. Starting
2. Take-Off
3. Landing; Except in -- **HIGH** -- Humidity; or In -- **CLOUDS, RAIN, SNOW, SLEET**
4. Boost -- **>= +3.5 PSI** -- Air Temperature -- **>= 15o C**

ECONOMICAL CRUISING

1. Mixture -- **WEAK** --; RPM -- **1900** --; Boost Up to -- **+1.5 PSI** --; ASI -- **140 MPH**
2. If Unable to Maintain -- **140 MPH ASI** -- Increase RPM

DRILL OF VITAL ACTIONS FOR LANDING

1. H - Hydraulic Selector -- **DOWN**
2. U- Undercarriage -- **DOWN**
3. M - Mixture -- **NORMAL**
2. P - Pitch Control -- **FULLY FORWARD**
3. Flaps -- **DOWN**

APPROACH

Non Engine Assisted Approach: 100 MPH ASI

Engine Assisted Approach: 95 MPH ASI

MISLANDING

1. Power -- **FULL THROTTLE**
2. Undercarriage -- **RAISE**
3. Flaps -- **UP** -- After Attaining -- **120 MPH ASI**

PROCEDURE AFTER LANDING

1. Cowl Flaps -- **OPEN**
2. Flaps -- **UP** --; Hydraulic Selector -- **DOWN**
3. Pitch Control -- **FULLY BACK** -- Open Engine Sufficiently to Change Pitch to Course
4. Slow Running Cut Out -- **PULL and HOLD** -- ; Ignition -- **OFF**
5. Replace Undercarriage Safety Pins

FUEL CONSUMPTION

	gals/hour @ 10k Feet		RPM				
	Mixture	Boost	2400	2200	2000	1900	
WEAK		+1 PSI	75	70	65		
		0 PSI	69	65	61	58	
		-1 PSI	66	62	58	54	
		-2 PSI	61	57	53	49	
		-3 PSI	56	52	48	45	
Mixture	Boost	RPM	gals/hr	Fuel Tanks	Capacity	Quantity	Tot Capacity
NORMAL	+5 PSI	2650	146	Inner	140 gals	2	280 gals
	+3.5 PSI	2400	112	Outer	94 gals	2	188 gals
	+ 1.5 PSI	2400	90				

THREE**THREE**

FOUR

Blenheim Mk IV

FOUR

ENGINE FAILURE

- NOTE:** *Aircraft will NOT maintain height on one engine, except when lightly loaded.*
1. Failed Engine Pitch Control -- **FULLY BACK** -- To Positive Coarse Pitch
 2. Best Speed -- **100 MPH ASI**

UNDERCARRIAGE EMERGENCY OPERATION CARTRIDGE SYSTEM

1. Hydraulic Selector -- **DOWN**
2. Lower Flaps with Hand Pump
 - 2a. Undercarriage Selector -- **UP**
 - 2b. Flap Selector -- **DOWN**
 - 2c. Operate Hand Pump
 - 2d. Flap Selector -- **NEUTRAL**
3. Lower Undercarriage with Hand Pump
 - 3a. Undercarriage Selector -- **DOWN**
 - 3b. Operate Hand Pump

If Hand Pump Fails:

4. Operate Cartridge System: Tear White Fabric Strip and Pull Handle

UNDERCARRIAGE EMERGENCY OPERATION HAND PUMP

1. Hydraulic Selector -- **DOWN**
2. Lower Undercarriage with Hand Pump
 - 2a. Undercarriage Selector -- **DOWN**
 - 2b. Operate Hand Pump
3. Lower Flaps with Hand Pump
 - 2a. Flap Selector -- **DOWN**
 - 2b. Operate Hand Pump

FOUR

FOUR

ONE

Tiger Moth

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Tiger Moth II	Gypsy Major / FP	73 Oct	Pilot's Notes: Feb 1944

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	180	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	NA	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	NA	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	NA	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	55	Threshold Crossing Speed
V _S	Stall Speed - Engine On	30	Min Speed at which the A/C is Controllable
V _S	Stall Speed - Engine Off	40	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	66	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	MPH Range	Description
White Arc	NA	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	30 - 180 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	180 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Full Throttle	Max Climb	Norm Climb	Max Cruise	Norm Cruise	Max Dive	73 Octane
Limit	5 min	30 min	Cont	30 min	Cont	20 secs	
RPM	2350	2100	2050	2100	1950	2200	
Mixture	Rich Setting to be used below 5000 feet.						

Oil Pressure	Emer Min = 30 PSI	Oil Temperature	Min = 30° C	Max = 80° C
	Normal = 40 - 45 PSI		Emergency Max = 90° C	

ONE**ONE**

TWO

Tiger Moth

TWO

PRELIMINARIES

1. Intercommunication System -- ON
2. Elevator Trim -- **FULLY TAIL HEAVY**
3. Switches -- **OFF**
4. Fuel Control -- **ON**
5. Throttle -- **CLOSED**

STARTING ENGINE

Engine is started by Fitter spinning the airscrew; procedures OMMITTED

WARMING UP

NOTE: When the engine is running smoothly and the oil pressure has settled, run the engine at 900-1000 rpm for at least 4 minutes, then check as follows.

1. Trim Moves Freely; Set Trim --**TAIL HEAVY**
2. Throttle Friction Nut -- **LOOSEN**
3. Mixture -- **RICH** -- Fully Aft
4. Set Altimeter -- **ZERO**
5. Check ASI for mph or knots
6. Check Instruments for Servicability and -- LOCK-- Compass Grid Ring
7. Check Oil Pressure -- **35 PSI** -- at -- **1000** -- RPM
8. Slots -- **LOCKED**
9. Fire Extinguisher -- **SECURE**
10. All Switches -- **UP**
11. Fuel -- **CHECK**
12. Flying Controls -- **CHECK**

RUNNING UP

1. Hold Stick -- **FULL BACK**
2. Test Magnetos: RPM -- **1600** -- RPM Drop Less Than -- **80 RPM**
3. Throttle: Fully Open: RPM - Minimum -- **1825**, Normal -- **2100**; Oil Pressure -- **40-45 PSI**
4. Throttle: Close: RPM -- **550-600**

TAXYING OUT

1. Throttle Friction Nut -- **LOOSEN**
2. Trim -- **FULLY TAIL HEAVY**
3. Avoid taxying or idling for prolonged periods at low rpm

TAKE-OFF

1. Trim -- **NEUTRAL**
2. Throttle Friction Nut -- **TIGHTEN**
3. Mixture -- **RICH** -- Fully Aft
4. Fuel Distributor Cock -- **FULLEST** -- Tank
5. Slots -- **UNLOCKED**
6. Engine Clear: RPM -- **900**; Test Magnetos; Oil Pressure -- **35 PSI**
7. Flying Controls -- **FREE** -- Taxy into the Wind, Rudder -- **NEUTRAL** -- to Straighten Tail Skid
8. Take Off: Throttle -- **FULL OPEN**; Initial Climb -- **70 MPH**
 - 8.a. At 300 Feet, Throttle to -- **2050 RPM**; Maintain Climbing Sppeed of -- **66 MPH**

CLIMBING

- Engine Management -- 2050 RPM
1. Set Best Climbing Speed -- **66 MPH**

CRUISING

- Engine Management -- 1950 RPM
1. Speed -- **75-80 MPH**
 2. Endurance -- **2.5 Hours**

TWO**TWO**

THREE

Tiger Moth

THREE

STALLING AND SPINNING

1. Normal Stall from Straight Glide: Engine Off -- **40 MPH**; Engine On -- **35 MPH**
2. Slots -- **LOCKED** -- for Spinning

STEEP TURNS

1. Throttle -- **2100 RPM**
2. Speed: Maintain at Least -- **70 MPH**
3. The Same Speed Applies for Steep Gliding Turns

AEROBATICS

1. Mixture -- **RICH** -- Fully Aft
2. Fuel -- **CHECK**
3. Slots -- **LOCKED**
4. Safety Harness -- **SECURE**
5. The Correct Speeds Are as Follows:

Loop	115 MPH	Barrel Roll	115 MPH
Stall Turn	90 MPH	Half Roll off Top of Loop	135 MPH
Inverted Gliding	85 MPH	Half Roll	95 MPH
Slow Roll	110 MPH		

DESCENDING

1. Engine Assisted Descent -- **1100 - 1200 RPM** -- ASI -- **66 MPH**
2. Maintain Power During Turns: Lower Nose to Maintain Airspeed
3. Engine Off Descent - ASI -- **66 MPH**
4. Gliding Turns: Lower Nose to Increase Speed, Up to -- **70 MPH** -- ASI

LOW FLYING

1. Use Normal Cruise Power: **1950 RPM** and **75-80 MPH**
2. Increase Power During Turns

DRILL OF VITAL ACTIONS FOR LANDING

NOTE: *This should be carried out on the downwind leg.*

1. Fuel: Sufficient for Additional Circuit
2. Mixture: Fully -- **RICH**
3. Slots -- **UNLOCKED**
4. Approach Speed: **66 MPH** ASI

APPROACH AND LANDING

1. Final Approach Speed: **55 MPH** ASI at -- **250 FT AGL**

MISLANDING

1. Power -- **FULL THROTTLE**
2. Initial Climbing Speed -- **70 MPH ASI**
3. Above 200-300 Ft AGL, Climb as Normal

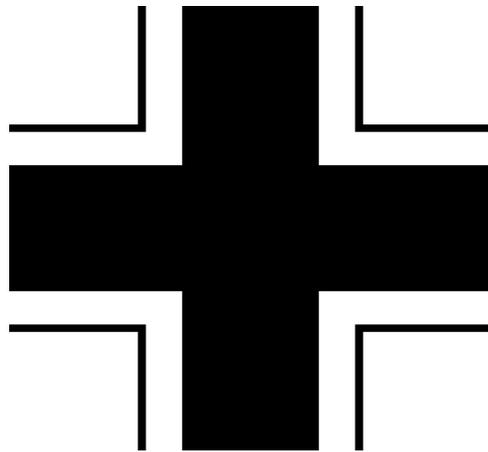
SHUTTING DOWN

1. Set Trim -- **TAIL HEAVY**
2. Throttle -- **900 - 1000 RPM**
3. Stick -- **Fully Aft**
4. Switches -- **OFF** -- Throttle -- **FULLY OPEN** -- Until Engine Stops
5. Throttle -- **CLOSED**
6. Fuel Cock -- **OFF**
7. Front Switches -- **OFF**

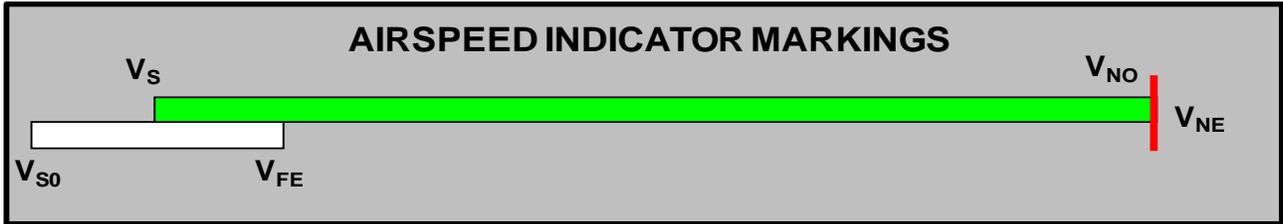
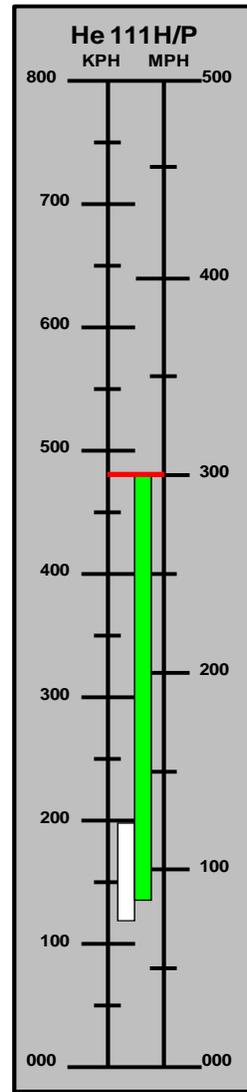
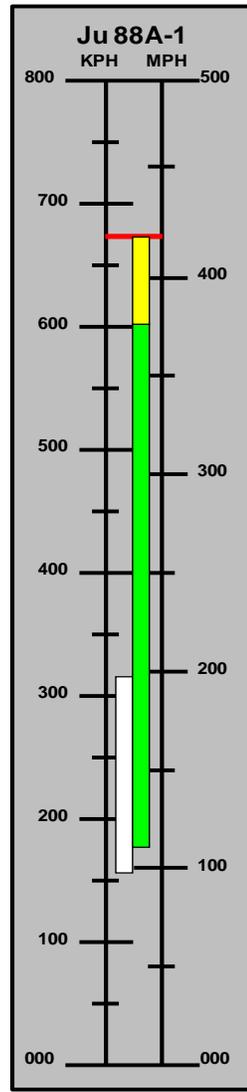
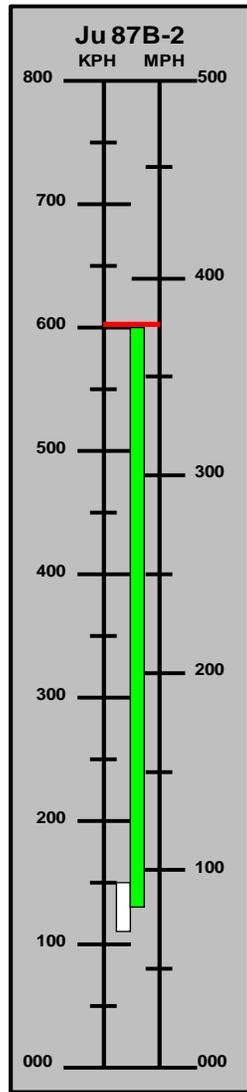
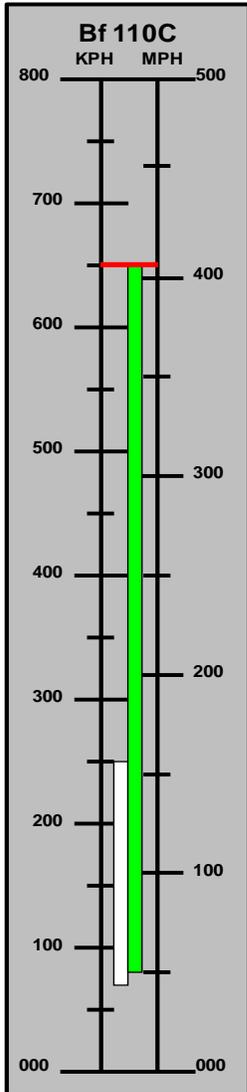
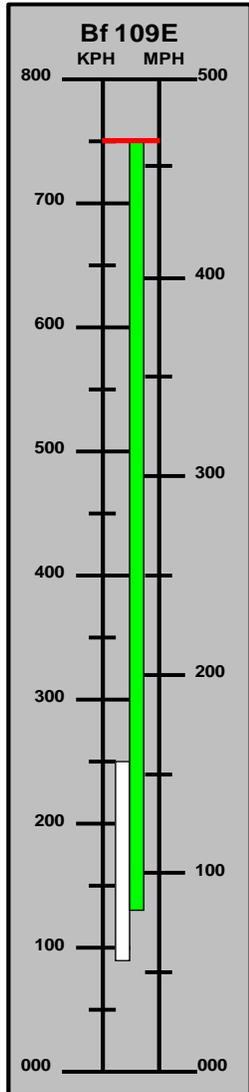
THREE

THREE

LUFTWAFFE



LUFTWAFFE AIRSPEED DATA



- V_{NE} Never Exceed Speed
- V_{NO} Max Structural Cruising Speed
- V_{FE} Max. Flaps Extend Speed
- V_{LO} Max Landing Gear Operating Speed
- V_{LE} Max Landing Gear Extended Speed
- V_R Rotation Speed
- V_{REF} Landing Reference Speed
- V_S Stall Speed
- V_{S0} Stall Speed
- V_Y Best Rate-of-Climb
- V_{BE} Max Speedbrake Extended Speed

- Never Exceed in Any Operation
- Max Speed in Normal Operations (rarely used in WW2 aircraft)
- Do Not Extend Flaps Above this Speed
- Do Not Operate Ldg Gear Above this Speed
- Max Speed with Gear Extended
- Speed at which the Airplane Lifts Off
- Threshold Crossing Speed
- Min Speed at which the A/C is Controllable
- Stall Speed in Landing Configuration
- Delivers Gain in Altitude in Shortest Time
- Do Not Extend Brakes Above this Speed

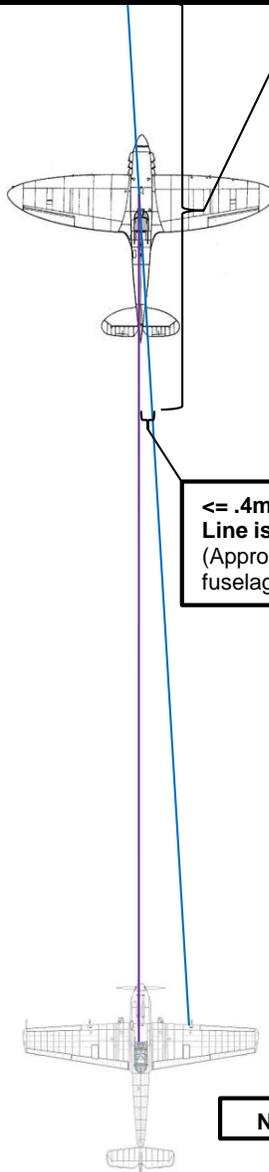
ONE

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

Rg of AC when wingtips touch Sight Ring



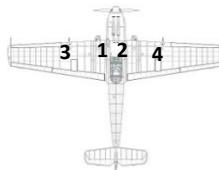
Lethal Range: where cone of fire is less than the width of the fuselage at the cockpit (approx .8m wide).

<= .4m from Sight Line is Lethal Area
(Approx width of fuselage at Cockpit.)

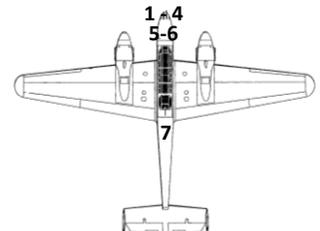
Bf 109E Convergence - meters		
Lethal Range Centered on Convergence		
194	240	286
178	220	262
162	200	238
145	180	215
129	160	191
113	140	167
97	120	143
81	100	119

Gun Numbering

Bf 109E



Bf 110C



Not to Scale

ONE

ONE

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
	Bgrgr 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 - Phosphor mit Stahlkern = Phosphorus with Steel Core						
	B Patr - Beobachtung Patrone = Observation Cartridge						
	Brsprgr - Brandsprenggranate = Incendiary Explosive Grenade						
	Bgrgr - 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						

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

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



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

Einzelabwurf (Single Release)	<ol style="list-style-type: none"> All Safety Switches to -- SICHER (SAFE) Hauptschalter to -- EIN (ON); Check for Kontrolle and Weapon Station Indicator Light(s) Wahlschalter to -- EINZELABWURF (SINGLE RELEASE) Weapon Safety Switches to -- ENTSICHERT (ARM) Press Weapon Release Button on Control Stick to release first selected weapon. Each subsequent press will release the next weapon selected.
Reihenabwurf (Salvo Release)	<ol style="list-style-type: none"> All Safety Switches to -- SICHER (SAFE) Hauptschalter to -- EIN (ON); Check for Kontrolle Light ON Wahlschalter to -- EINZELABWURF (SINGLE RELEASE) All Weapon Station Safety Switches to -- ENTSICHERT (ARM) 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

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 Rusterleitung 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	

Oil Pressure	Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure
Min = 2.5 kg/cm ²	Min = 30° C	Max = 75° C	Min = 40° C	Max = 95° C	Min = 1.1 kg/cm ²
Max = 6 kg/cm ²	Emergency Max = 80° C		Emergency Max = 105° C		Max = 1.5 kg/cm ²

Maximum Coolant Temperature						Oxygen
Sea Level	2000 m	4000 m	6000 m	8000 m	10000 m	Begin Use @ 4000 m
Max = 100° C	Max = 95° C	Max = 91° C	Max = 87° C	Max = 82° C	Max = 78° C	Min Pressure= 10 kg/cm ²

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

ONE

ONE

TWO**Me 109E-1/3****TWO****STARTING ENGINE**

1. Cabin -- **CLOSE** -- Cabin Lever to Closed (Zu); Right Cabin Window -- **OPEN**
2. Landing Gear -- **NEUTRAL (Ruhe)**
3. Master Bus -- **ON**
4. Spark Plug Master Switch -- **OPEN (Auf)**
5. Throttle -- **IDLE** ; Gas Pressure Switch to -- **UNPRESSURIZED (Behaelter Entueftet)**
6. Operate Center Fuel Pump to -- **0.5 kg/cm2**
7. Wind Up Starter; Crank Handle in Baggage Area, Starter Well on Top Right of Engine
8. Prime the Cylinders by Injecting -- **TWO or THREE** -- Shots of Fuel (Cold = 3-4, Hot = 1-2)
9. Insert Key Into Ignition Switch and Select -- **M 1+2**
10. Pull Sparkplug Handle and -- **HOLD** -- Handle Cannot be Locked
11. Pull Starter Handle
12. Release Starter Handle After Engine Start
13. Oil Pressure (COLD Engine) -- **6-8 kg/cm2** -- Within 3-5 Seconds
14. Secure Starter Crank Handle to Luggage Area

NOTE: *If Engine does not start, wait a few minutes, then repeat.*

***** IMPORTANT *****

Do not attempt to turn propellers by hand.

WARM UP

1. Radiator Flaps Open -- **AS REQUIRED**
2. Oil Cooler Flap -- **CLOSE** -- If Cold
3. Oil Pressure -- **5-6 kg/cm2** -- Increase RPM to -- **1000** -- To Maintain Oil Pressure

ENGINE CHECK DURING WARM UP

1. Check Magnetos - Cycle Magnetos at Different Engine RPM to Ensure Engine Runs Smoothly
2. Fuel Pump Operation - Engine RPM -- **1400**
 - 2a. Cycle Sparkplug Master Switch (P1 and P2) for 30 seconds each
 - 2b. Fuel Pressure -- **NO FLUCTUATION**
3. Electronics Operation - Engine RPM -- **1900**
 - 3a. Master Bus -- **OFF** -- Equipment Switchbox -- **ON**; Check Equipment
 - 3b. Equipment Switchbox -- **OFF** -- Master Bus -- **ON**

ENGINE RUN UP

NOTE: *Perform Run UP only if there has been 2 hours since last flight.*

***** IMPORTANT *****

Point into the wind and weigh down the tail.

1. Cabin -- **CLOSE** -- Cabin Lever to Closed (Zu)
2. Propellor Pitch -- **12:00**
3. Radiator Flaps -- **OPEN** -- Oil Cooler Flaps -- **CLOSE**

NOTE: *Perform Run Up only with minimum Oil Temperature of 30° C and maximum Coolant Temperature of 80° C.*

5. Controls -- **BACK AND HOLD**
6. Open Throttle to -- **FULL**
 - 6a. RPM -- **2200 - 2250**
 - 6b. Boost -- **1.35 ATA**
 - 6c. Oil Pressure -- **2.5 - 6 kg/cm2**
 - 6d. Coolant Temperature -- **94°C** -- Max
 - 6e. Oil Temperature (In) -- **30°C** -- Min
 - 6f. Fuel Pressure -- **1.1 - 1.5 kg/cm2**
7. Check Magnetos - Cycle Magnetos -- **50 RPM** -- Drop Max
8. Check the Engine is Running Smoothly and Evenly
9. Reduce Throttle Slowly

NOTE: *If Coolant Temperature exceeds 94° C, reduce to 1100 RPM until temperature decreases*

TWO**TWO**

THREE

Me 109E-1/3

THREE

PILOT ENGINE START

NOTE: See above procedures

1. Cabin -- **CLOSE** -- Cabin Lever to Closed (Zu)
2. Spark Plug Master Switch -- **OPEN (Auf)**
3. Radiator and Oil Cooler Flaps -- **OPEN**
4. Electronics -- **ON**
5. Temperature and Pressure Gauges -- **CHECK**
6. Propellor Pitch -- **12:00**
7. Landing Gear Indicator Lights -- **GREEN** -- Mechanical Indicators -- **CHECK**
8. Elevator Trim -- **0 to 1 DEGREE UP**
9. Pitot Heat -- **ON** -- If High Humidity and Temperature below 0°C

TAXI

1. Landing Flaps -- **UP**
2. Coolant Temperature -- **94°C** -- MAX
3. For Tight Turns, Add Throttle for Straight-aways, Reduce Throttle and Brake Into Turn

TAKE OFF

1. Landing Flaps -- **20°**
2. Take Off
3. Set Climbing Speed -- **250 KPH**
4. Landing Gear - Retract - Landing Gear Switch to -- **IN (EIN)**
 - 4a. Switch Automatically Returns to -- **NEUTRAL (Ruhe)**
 - 4b. If Landing Gear Does Not Lock in Retracted Position, Landing Gear Switch to -- **IN (EIN)**
 - 4c. Landing Gear Indicator: Retracted and Locked -- **RED**; Extended and Locked -- **GREEN**

NOTE: Indicator Lights can be turned off, but will automatically turn on when gear are extended. Audible tone if landing gear is not locked down and flaps are extended.

5. Landing Flaps -- **RETRACT**; Trim for Flight

FLIGHT

1. Observe Operating Limits
2. Use Best Climbing Speeds

***** ATTENTION *****

At High Altitude, if Fuel Pressure drops below 1 kg/cm2, turn on Fuel Pressure Pump

3. Adjust Propellor Pitch to Maintain Desired Boost and RPM Settings
4. Fuel Gauge - Accurate ONLY in Level Flight; Fuel Warning Light -- **10 MINS** -- Cruise Flight Remaining
5. Radiator Flaps - Operate to Maintain Coolant Temperature Within Limits.

LANDING

1. Decrease Speed to -- **220 KPH**
2. Propellor Pitch to -- **12:00**
3. Landing Gear - Extend - Landing Gear Switch to -- **OUT (AUS)**
 - 3a. Switch Automatically Returns to -- **NEUTRAL (Ruhe)**
 - 3b. If Landing Gear Does Not Lock in Retracted Position, Landing Gear Switch to -- **OUT (AUS)**
 - 3c. Landing Gear Indicator: Retracted and Locked -- **RED**; Extended and Locked -- **GREEN**

NOTE: Indicator Lights can be turned off, but will automatically turn on when gear are extended. Audible tone if landing gear is not locked down and flaps are extended.

4. Landing Flaps -- **FULL**; Trim for Flight

***** ATTENTION *****

250 KPH Speed Limit With Full Flaps

5. Glide at -- **150 KPH**

NOTE: The plane will be sharply nose down with a steep decent angle. The plane will lose speed rapidly with a shallower angle with reduced throttle.

6. Left Front Window -- **OPEN** -- If Icing is Present

THREE

THREE

FOUR**Me 109E-1/3****FOUR****DIVING**

1. Trim to Maintain Dive; Best Trim -- 0.5° TAIL HEAVY -- From Cruise Trim Position
2. Throttle -- IDLE
3. Oil and Coolant Temperature -- 40° C MIN
4. Radiator -- HALF OR FULLY CLOSED
5. Propellor Pitch -- 9:30 -- Max RPM -- 3000

NIGHT FLIGHT

1. Night Lights -- ON
2. If Warning, Control, and Weapons Lamps Are Too Bright, Cover With Isolation Tape
3. Elevator Trim - Set Before Take Off

HIGH ALTITUDE FLIGHT

1. Dip Cotton Ball in Olive Oil and Plug Nose
2. Ensure Mask Fits Comfortably and Tight
3. Cold Protection Leather To Be Worn Under Cap
4. Start Oxygen at -- 4000m
5. Do Not Interrupt Oxygen Breathing Once Begun
6. Adjust Flow Lever Based on Altitude
7. Observe Oxygen Pressure Gauge
8. Oxygen Pressure Below -- 10 kg/cm2 -- Descend Below -- 4000m
9. After Use, Close All Levers
10. If Flight Above 4000m is Planned, Plug Nose With Cotton Balls and Don Mask Before Take Off

ENGINE SHUT DOWN

1. Throttle -- IDLE
2. Run Engine at -- IDLE -- For -- 3 minutes
3. Cycle Ignition Through M2, Then M1, Then 0. Coolant Temperature Not To Exceed -- 80°C
4. Close Spark Plug Master Switch Upon Engine Stop
5. Electronic Circuits -- OFF

LANDING GEAR OPERATION WITHOUT HYDRAULICS

1. Landing Gear Lever to -- OUT (AUS)
2. Pull Landing Gear Emergency Lever with Sudden Motion
3. If Landing Gear Does Not Lock, Lock Through Push Something on Left or right Side

EMERGENCY LANDING DUE TO ENGINE FAILURE

1. At Low Altitude, Climb Until -- 200 KPH
2. Deploy Landing Flaps; Trim Towards Tail
3. Extend Landing Gear Through Emergency Mechanism

NOTE: *If terrain is not appropriate, it may be safer to land with landing gear retracted.
At high altitude, it is appropriate to go a long distance, deploying landing gear and flaps below 1000m.*

4. Propellor Pitch to -- GLIDE
5. Electronic Circuits -- OFF
6. Ignition -- OFF
7. Sparkplug Master Switch -- CLOSED (Zu)

PARACHUTING

1. At Low Altitude, Climb Until -- 200 KPH
2. Lower Speed if Possible
3. If Possible; Electrics, Ignition -- OFF; Sparkplug Master Switch -- CLOSED (Zu)
4. Red Cabin Eject Lever -- PULL -- Located Over Left Shoulder Strap
5. Unbuckle and Exit Aircraft

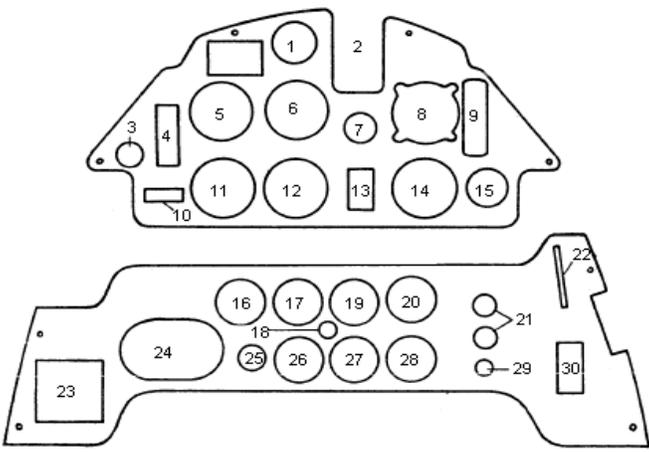
FOUR**FOUR**

FIVE

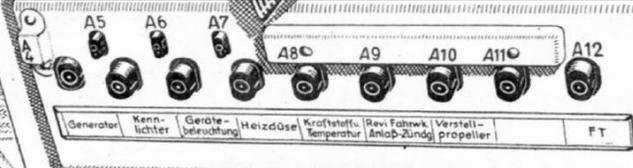
Me 109E-1/3

FIVE

Aircraft Type	Engine Type	Fuel	Reference
Me 109E-1 / E-3	DB 601A	87 Oct	Betriebs- und Rusteranleitung Me109

Upper Panel	Main Instrument Panel	Lower panel
Clock 1		16 Panel Dimmer Switch
Revi C12 2		17 Blank Panel
Electrical Master Switch 3		18 Fuel Level Warn Lamp
Magneto Switch 4		19 Fuel / Oil Pressure
Altimeter 5		20 Landing Gear Indicator
Magnetic Compass 6		21 Landing Gear Handles
Revi Power Socket 7		22 Hand Fuel Pump Lever
Manifold Pressure 8		23 R/T Switch Box
Compass Deviation 9		24 Weapons Arming Panel
Pitot Tube Heating Ind 10		25 MG Synch Button
Airspeed Indicator 11		26 Fuel Gauge
Turn & Bank Indicator 12		27 Oil Temperature
Prop Pitch Control 13		28 Coolant Temperature
Tachometer 14		29 Landing Gear Lock
Prop Pitch Indicator 15		30 Mech Landing Gear Ind

Main Fuze Panel

Generator A4		A8 Fuel Temperature
Navigation Lights A5		A9 Revi/Gear/Starter/Ingn
Cockpit Lights A6		A10 Adjustable Prop
Pitot Heat A7		A11
		A12 Radio

FIVE

FIVE

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

Oil Pressure		Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure	
Min = 2.5 kg/cm ²		Min = 30° C	Max = 75° C	Min = 40° C	Max = 95° C	Min = 1.1 kg/cm ²	
Max = 6 kg/cm ²		Emergency Max = 80° C		Emergency Max = 105° C		Max = 1.5 kg/cm ²	
Maximum Coolant Temperature						Oxygen	
Sea Level	2000 m	4000 m	6000 m	8000 m	10000 m	Begin Use @ 4000 m	
Max = 100° C	Max = 95° C	Max = 91° C	Max = 87° C	Max = 82° C	Max = 78° C	Min Pressure= 10 kg/cm ²	
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

Luftschrauben Verstellautomatik Operation

To assist the pilot an automatic airscrew pitch changing device has been introduced. This ensures, without intervention by the pilot, that the maximum revs are not exceeded and the engine is not subjected to excessive strain. In addition, every position of the throttle lever has a corresponding rev. speed, which is kept within narrow limits by the automatic device in all flying conditions, including diving.

Disabling the Luftschrauben Verstellautomatik

The automatik device may be disabled by the toggle switch on the left fuselage wall. With the automatik device disabled, the propeller is fully controllable by the thumb switch on the throttle.

Economical Flight

In the case of economical flight, where lower revs are desirable for each throttle setting in order to increase the range, the automatic device can be switched off and the necessary changes in the airscrew pitch carried out by the thumb switch.

ONE

ONE

TWO**Me 109E-4****TWO****STARTING ENGINE**

1. Cabin -- **CLOSE** -- Cabin Lever to Closed (Zu); Right Cabin Window -- **OPEN**
2. Landing Gear -- **NEUTRAL (Ruhe)**
3. Master Bus -- **ON**
4. Spark Plug Master Switch -- **OPEN (Auf)**
5. Throttle -- **IDLE** ; Gas Pressure Switch to -- **UNPRESSURIZED (Behaelter Entueftet)**
6. Operate Center Fuel Pump to -- **0.5 kg/cm2**
7. Wind Up Starter; Crank Handle in Baggage Area, Starter Well on Top Right of Engine
8. Prime the Cylinders by Injecting -- **TWO or THREE** -- Shots of Fuel (Cold = 3-4, Hot = 1-2)
9. Insert Key Into Ignition Switch and Select -- **M 1+2**
10. Pull Sparkplug Handle and -- **HOLD** -- Handle Cannot be Locked
11. Pull Starter Handle
12. Release Starter Handle After Engine Start
13. Oil Pressure (COLD Engine) -- **6-8 kg/cm2** -- Within 3-5 Seconds
14. Secure Starter Crank Handle to Luggage Area

NOTE: *If Engine does not start, wait a few minutes, then repeat.*

***** IMPORTANT *****

Do not attempt to turn propellers by hand.

WARM UP

1. Radiator Flaps Open -- **AS REQUIRED**
2. Oil Cooler Flap -- **CLOSE** -- If Cold
3. Oil Pressure -- **5-6 kg/cm2** -- Increase RPM to -- **1000** -- To Maintain Oil Pressure

ENGINE CHECK DURING WARM UP

1. Check Magnetos - Cycle Magnetos at Different Engine RPM to Ensure Engine Runs Smoothly
2. Fuel Pump Operation - Engine RPM -- **1400**
 - 2a. Cycle Sparkplug Master Switch (P1 and P2) for 30 seconds each
 - 2b. Fuel Pressure -- **NO FLUCTUATION**
3. Electronics Operation - Engine RPM -- **1900**
 - 3a. Master Bus -- **OFF** -- Equipment Switchbox -- **ON**; Check Equipment
 - 3b. Equipment Switchbox -- **OFF** -- Master Bus -- **ON**

ENGINE RUN UP

NOTE: *Perform Run UP only if there has been 2 hours since last flight.*

***** IMPORTANT *****

Point into the wind and weigh down the tail.

1. Cabin -- **CLOSE** -- Cabin Lever to Closed (Zu)
2. Verstellautomatik Switch -- **OFF**; Propellor Pich -- **12:00**
3. Radiator Flaps -- **OPEN** -- Oil Cooler Flaps -- **CLOSE**

NOTE: *Perform Run Up only with minimum Oil Temperature of 30°C and maximum Coolant Temperature of 80°C.*

5. Controls -- **BACK AND HOLD**
6. Open Throttle to -- **FULL**
 - 6a. RPM -- **2200 - 2250**
 - 6b. Boost -- **1.35 ATA**
 - 6c. Oil Pressure -- **2.5 - 6 kg/cm2**
 - 6d. Coolant Temperature -- **94°C** -- Max
 - 6e. Oil Temperature (In) -- **30°C** -- Min
 - 6f. Fuel Pressure -- **1.1 - 1.5 kg/cm2**
7. Check Magnetos - Cycle Magnetos -- **50 RPM** -- Drop Max
8. Check the Engine is Running Smoothly and Evenly
9. Reduce Throttle Slowly

NOTE: *If Coolant Temperature exceeds 94°C, reduce to 1100 RPM until temperature decreases*

TWO**TWO**

THREE**Me 109E-4****THREE****PILOT ENGINE START****NOTE:** See above procedures

1. Cabin -- **CLOSE** -- Cabin Lever to Closed (Zu)
2. Spark Plug Master Switch -- **OPEN (Auf)**
3. Radiator and Oil Cooler Flaps -- **OPEN**
4. Electronics -- **ON**
5. Temperature and Pressure Gauges -- **CHECK**
6. Verstellautomatik Switch -- **OFF**; Propellor Pich -- **12:00**
7. Landing Gear Indicator Lights -- **GREEN** -- Mechanical Indicators -- **CHECK**
8. Elevator Trim -- **0 to 1 DEGREE UP**
9. Pitot Heat -- **ON** -- If High Humidity and Temperature below 0°C

TAXI

1. Landing Flaps -- **UP**
2. Coolant Temperature -- **94°C** -- MAX
3. For Tight Turns, Add Throttle for Straight-aways, Reduce Throttle and Brake Into Turn

TAKE OFF

1. Landing Flaps -- **20°**
2. Verstellautomatik Switch -- **ON**; Take Off
3. Set Climbing Speed -- **250 KPH**
4. Landing Gear - Retract - Landing Gear Switch to -- **IN (EIN)**
 - 4a. Switch Automatically Returns to -- **NEUTRAL (Ruhe)**
 - 4b. If Landing Gear Does Not Lock in Retracted Position, Landing Gear Switch to -- **IN (EIN)**
 - 4c. Landing Gear Indicator: Retracted and Locked -- **RED**; Extended and Locked -- **GREEN**

NOTE: Indicator Lights can be turned off, but will automatically turn on when gear are extended. Audible tone if landing gear is not locked down and flaps are extended.

5. Landing Flaps -- **RETRACT**; Trim for Flight

FLIGHT

1. Observe Operating Limits
2. Use Best Climbing Speeds

***** ATTENTION *******At High Altitude, if Fuel Pressure drops below 1 kg/cm2, turn on Fuel Pressure Pump**

3. Adjust Throttle to Maintain Desired Boost and RPM Settings
4. Fuel Gauge - Accurate ONLY in Level Flight; Fuel Warning Light -- **10 MINS** -- Cruise Flight Remaining
5. Radiator Flaps - Operate to Maintain Coolant Temperature Within Limits.

LANDING

1. Decrease Speed to -- **220 KPH**
2. Verstellautomatik Switch -- **ON**
3. Landing Gear - Extend - Landing Gear Switch to -- **OUT (AUS)**
 - 3a. Switch Automatically Returns to -- **NEUTRAL (Ruhe)**
 - 3b. If Landing Gear Does Not Lock in Retracted Position, Landing Gear Switch to -- **OUT (AUS)**
 - 3c. Landing Gear Indicator: Retracted and Locked -- **RED**; Extended and Locked -- **GREEN**

NOTE: Indicator Lights can be turned off, but will automatically turn on when gear are extended. Audible tone if landing gear is not locked down and flaps are extended.

4. Landing Flaps -- **FULL**; Trim for Flight

***** ATTENTION *******250 KPH Speed Limit With Full Flaps**

5. Glide at -- **150 KPH**

NOTE: The plane will be sharply nose down with a steep decent angle. The plane will lose speed rapidly with a shallower angle with reduced throttle.

6. Left Front Window -- **OPEN** -- If Icing is Present

THREE**THREE**

FOUR**Me 109E-4****FOUR****DIVING**

1. Trim to Maintain Dive; Best Trim -- **0.5° TAIL HEAVY** -- From Cruise Trim Position
2. Throttle -- **IDLE**
3. Oil and Coolant Temperature -- **40° C MIN**
4. Radiator -- **HALF OR FULLY CLOSED**
5. Verstellautomatik Switch -- **ON**

NIGHT FLIGHT

1. Night Lights -- **ON**
2. If Warning, Control, and Weapons Lamps Are Too Bright, Cover With Isolation Tape
3. Elevator Trim - Set Before Take Off

HIGH ALTITUDE FLIGHT

1. Dip Cotton Ball in Olive Oil and Plug Nose
2. Ensure Mask Fits Comfortably and Tight
3. Cold Protection Leather To Be Worn Under Cap
4. Start Oxygen at -- **4000m**
5. Do Not Interrupt Oxygen Breathing Once Begun
6. Adjust Flow Lever Based on Altitude
7. Observe Oxygen Pressure Gauge
8. Oxygen Pressure Below -- **10 kg/cm2** -- Descend Below -- **4000m**
9. After Use, Close All Levers
10. If Flight Above 4000m is Planned, Plug Nose With Cotton Balls and Don Mask Before Take Off

ENGINE SHUT DOWN

1. Throttle -- **IDLE**
2. Run Engine at -- **IDLE** -- For -- **3 minutes**
3. Cycle Ignition Through M2, Then M1, Then 0. Coolant Temperature Not To Exceed -- 80°C
4. Close Spark Plug Master Switch Upon Engine Stop
5. Electronic Circuits -- **OFF**

LANDING GEAR OPERATION WITHOUT HYDRAULICS

1. Landing Gear Lever to -- **OUT (AUS)**
2. Pull Landing Gear Emergency Lever with Sudden Motion
3. If Landing Gear Does Not Lock, Lock Through Push Something on Left or right Side

FAILURE OF THE LUFTSCHRAUBEN VERSTELLAUTOMATIK

1. Verstellautomatik Switch to -- **OFF**
2. Control Propeller Pitch by Means of the Thumb Switch on Throttle

EMERGENCY LANDING DUE TO ENGINE FAILURE

1. At Low Altitude, Climb Until -- **200 KPH**
2. Deploy Landing Flaps; Trim Towards Tail
3. Extend Landing Gear Through Emergency Mechanism

NOTE: *If terrain is not appropriate, it may be safer to land with landing gear retracted.
At high altitude, it is appropriate to go a long distance, deploying landing gear and flaps below 1000m.*

4. Verstellautomatik Switch to -- **OFF**; Propeller Pitch to -- **GLIDE**
5. Electronic Circuits -- **OFF**
6. Ignition -- **OFF**
7. Sparkplug Master Switch -- **CLOSED (Zu)**

PARACHUTING

1. At Low Altitude, Climb Until -- **200 KPH**
2. Lower Speed if Possible
3. If Possible; Electrics, Ignition -- **OFF**; Sparkplug Master Switch -- **CLOSED (Zu)**
4. Red Cabin Eject Lever -- **PULL** -- Located Over Left Shoulder Strap
5. Unbuckle and Exit Aircraft

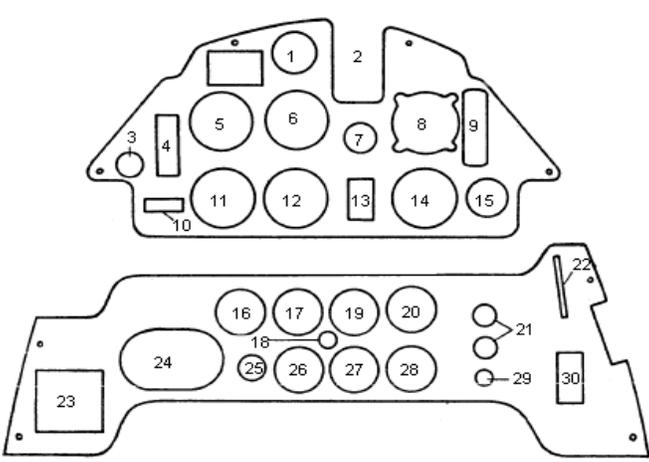
FOUR**FOUR**

FIVE

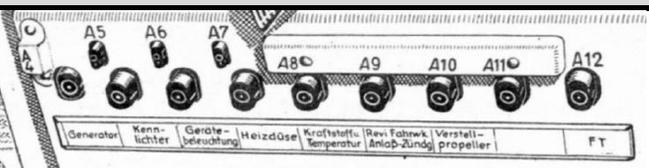
Me 109E-4

FIVE

Aircraft Type	Engine Type	Fuel	Reference
Me 109E-4	DB 601A / VDM Auto	87 Oct	Betriebs- und Rusteranleitung Me109

Upper Panel	Main Instrument Panel	Lower panel
Clock 1		16 Panel Dimmer Switch
Revi C12 2		17 Blank Panel
Electrical Master Switch 3		18 Fuel Level Warn Lamp
Magneto Switch 4		19 Fuel / Oil Pressure
Altimeter 5		20 Landing Gear Indicator
Magnetic Compass 6		21 Landing Gear Handles
Revi Power Socket 7		22 Hand Fuel Pump Lever
Manifold Pressure 8		23 R/T Switch Box
Compass Deviation 9		24 Weapons Arming Panel
Pitot Tube Heating Ind 10		25 MG Synch Button
Airspeed Indicator 11		26 Fuel Gauge
Turn & Bank Indicator 12		27 Oil Temperature
Blank Plate 13		28 Coolant Temperature
Tachometer 14		29 Landing Gear Lock
Prop Pitch Indicator 15		30 Mech Landing Gear Ind

Main Fuze Panel

Generator A4		A8 Fuel Temperature
Navigation Lights A5		A9 Revi/Gear/Starter/Ingn
Cockpit Lights A6		A10 Adjustable Prop
Pitot Heat A7		A11
		A12 Radio

FIVE

FIVE

ONE

Me 110C

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
ME 110C-4 / C-7	DB 601A / VDM VP	87 Oct	

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V _{NE}	Never Exceed Speed	650	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	250	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	NA	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	79	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	71	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	NA	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	71 - 250 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	79 - 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	1.3 ATA	1.2ATA	1.18 ATA	IDLE	Boost	Full Course 8:30
RPM	2300	2300	2200/2400	2500	RPM	Full Fine 12:00
Pitch	12:00	Manual	Manual	Manual	Pitch	

Oil Pressure	Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure
Min = 2.2 kg/cm ²	Min = 30° C	Max = 75° C	Min = 40° C	Max = 95° C	Min = 1.0 kg/cm ²
Max = 5 kg/cm ²	Emergency Max = 105° C		Emergency Max = 105° C		Max = 1.5 kg/cm ²

Maximum Coolant Temperature						Oxygen
Sea Level	2000 m	4000 m	6000 m	8000 m	Min Temp	Begin Use @ 4000 m
Max = 100° C	Max = 95° C	Max = 91° C	Max = 87° C	Max = 82° C	Min = 60° C	Min Pressure= kg/cm ²

Best Airspeed for Climb

Sea Level	1000 m	2000 m	3000 m	4000 m	5000 m	6000 m	7000 m

Note: Bf 110C Checklist Based on Air Ministry Pamphlet 114C Instructions For Flying the Messerschmitt 110 and Betriebs und Rustanleitung BF 110B mit 2 Motoren Jumo 210G.

ONE

ONE

ONE

Ju 87B

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Ju 87B-2	Jumo 211 D / Ju VS5 VP	87 Oct	Ju 87B-2 Betriebsanleitung Jun 1940

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V _{NE}	Never Exceed Speed	600	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	150	Do Not Extend Flaps Above this Speed
V _{FO}	Max Flaps Operating Speed	125	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	115	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	150	Threshold Crossing Speed
V _S	Stall Speed	130	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	110	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	215	Delivers Gain in Altitude in Shortest Time
V _{BE}	Max Speedbrake Extended Speed	430	Do Not Extend Brakes Above this Speed

AIRSPEED INDICATOR OPERATING RANGES

ASI MARKING	KPH Range	Description
White Arc	110 - 150 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	130 - 600 KPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	600 KPH	Maximum Speed for ALL operations.

OPERATING DATA

Condition	Take-Off	Climb	Cruise	Max Dive	Condition	
Limit	1 min	30 min	Cont		Limit	Luftschraubestellungs...
Man Press	1.35 ATA	1.15ATA	1.1 ATA	IDLE	Boost	Full Course
RPM	2300	2300	2100	2400	RPM	Full Fine
Pitch	Start/Climb	Start/Climb	Cruise/Dive	Cruise/Dive	Pitch	

Oil Pressure	Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure
Min = 4 kg/cm ²	Min = 30° C	Max = 90° C	Min = 40° C	Max = 95° C	Min = 1.0 kg/cm ²
Max = 6 kg/cm ²	Emergency Max = ° C		Emergency Max = ° C		Max = 1.5 kg/cm ²

Maximum Coolant Temperature						Oxygen
Sea Level	2000 m	4000 m	6000 m	8000 m	Min Temp	Begin Use @ 4000 m
Max = 95° C	Max = 95° C	Max = 90° C	Max = 85° C	Max = 80° C	Min = 60° C	Min Pressure= kg/cm ²

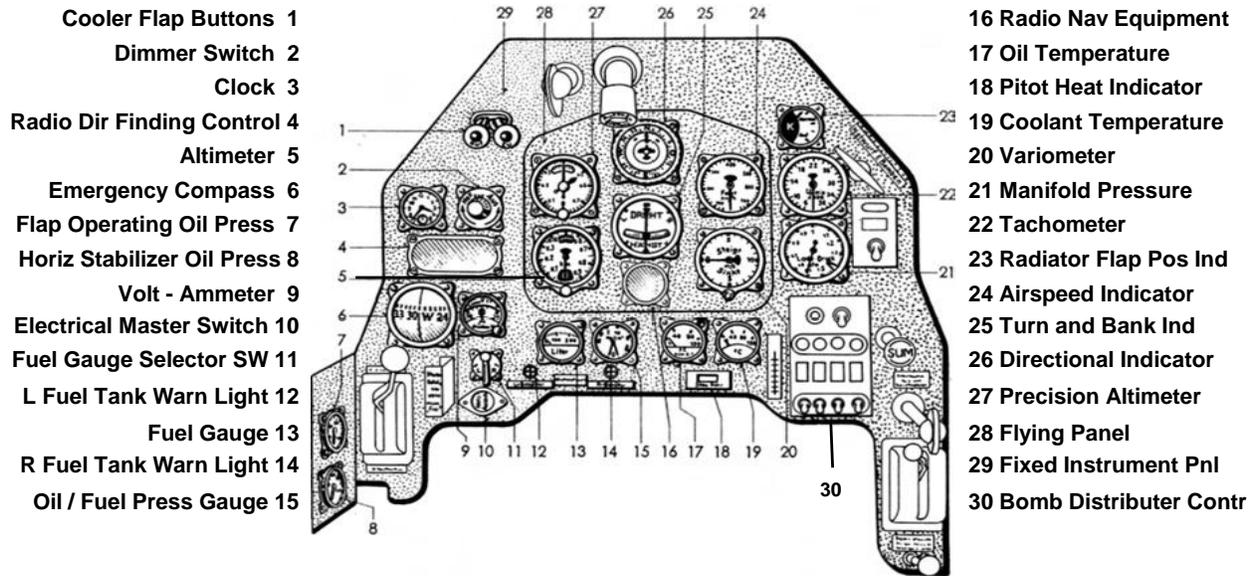
Best Airspeed for Climb

Sea Level	1000 m	2000 m	3000 m	4000 m	5000 m	6000 m	7000 m
215 kph	205 kph	195kph	185 kph	175 kph	165 kph	155 kph	145kph

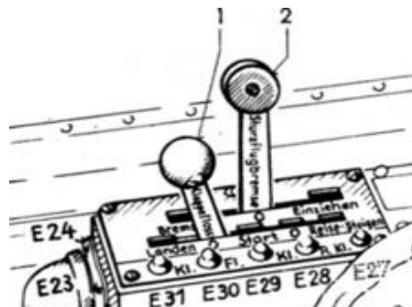
ONE

ONE

Aircraft Type	Engine Type	Fuel	Reference
Ju 87B-2	Jumo 211 D / Ju VS5 VP	87 Oct	Ju 87B-2 Betriebsanleitung Jun 1940
Upper Panel	Main Instrument Panel		Lower panel



Flap Controls



- 1 Landing Flap Lever
- 2 Dive Brake Lever

ONE

Ju 88A

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Ju 88A-1	Jumo 211B-1	87 Oct	

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V _{NE}	Never Exceed Speed (wo/w dive break)	675/575	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed (25°/50°)	320/275	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	NA	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	265	Max Speed with Gear Extended
V _R	Rotation Speed (13k/13.7k kg)	175/180	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	210	Threshold Crossing Speed
V _S	Stall Speed	180	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	160	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	160 - 320 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	180 - 600 KPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Yellow Arc	600 - 675 KPH	Operation must be above 2000m Altitude
Red Line	675 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	1.25 ATA	1.25ATA	1.15 ATA		Boost	Full Course 9:30
RPM	2600	2400	2250/2400		RPM	Full Fine 12:00
Pitch					Pitch	

Oil Pressure	Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure
Min = 4 kg/cm ²	Min = 30° C	Norm = 80° C	Min = ° C	Max = ° C	Min = 1.0 kg/cm ²
Max = 9 kg/cm ²	Emergency Max = 105° C		Emergency Max = ° C		Normal = 2 - 2.5 kg/cm ²

Maximum Coolant Temperature						Oxygen	
Sea Level	1000 m	< 4000 m	< 8000 m	Emer <10min	Min Temp	Begin Use @ 4000 m	
Max = 110° C	Max = 110° C	Max = 100° C	Max = 80° C	Max = 120° C	Min = 40° C	Min Pressure= ## kg/cm ²	

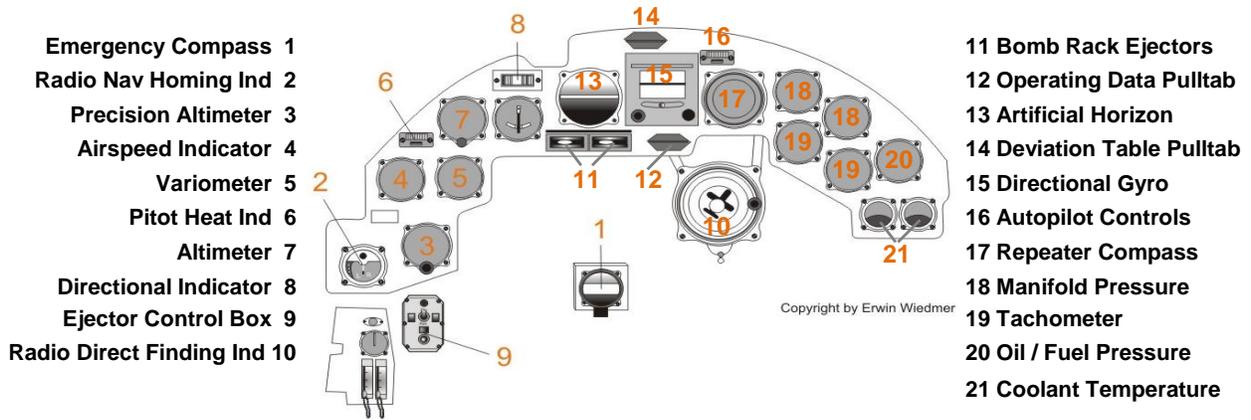
Best Airspeed for Climb

Sea Level	1000 m	2000 m	3000 m	4000 m	5000 m	6000 m	7000 m
250 kph						240 kph	

ONE

ONE

Aircraft Type	Engine Type	Fuel	Reference
Ju 88A-1	Jumo 211B-1	87 Oct	
Upper Panel		Main Instrument Panel	
		Lower panel	



- Emergency Compass 1
- Radio Nav Homing Ind 2
- Precision Altimeter 3
- Airspeed Indicator 4
- Variometer 5
- Pitot Heat Ind 6
- Altimeter 7
- Directional Indicator 8
- Ejector Control Box 9
- Radio Direct Finding Ind 10

- 11 Bomb Rack Ejectors
- 12 Operating Data Pulltab
- 13 Artificial Horizon
- 14 Deviation Table Pulltab
- 15 Directional Gyro
- 16 Autopilot Controls
- 17 Repeater Compass
- 18 Manifold Pressure
- 19 Tachometer
- 20 Oil / Fuel Pressure
- 21 Coolant Temperature

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ONE

He 111H

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
He 111H-2	Jumo 211A-1	87 Oct	D. (Luft) T 2220/1; June 1940

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V _{NE}	Never Exceed Speed	480	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	200	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	200	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	250	Max Speed with Gear Extended
V _R	Rotation Speed	150	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	180	Threshold Crossing Speed
V _S	Stall Speed	135	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	115	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	200	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	115 - 200 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	135 - 480 KPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	480 KPH	Maximum Speed for ALL operations.

OPERATING DATA

Condition	Take-Off	Climb	Cruise	Max Dive	Condition	
Limit	1 min	5 min	Cont		Limit	Luftschraubestellungs...
Man Press	1.2 ATA	1.11 ATA	1.05 ATA		Boost	Full Course 9:30
RPM	2200	2200	2100		RPM	Full Fine 12:00
Pitch					Pitch	
Maximum RPM = 2200						

Oil Pressure	Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure
Min = 4 kg/cm ²	Min = 35° C	Norm = 60° C	Norm = 70° C	Max = 85° C	Min = 1.0 kg/cm ²
Normal = 6 kg/cm ²	Emergency Max = 75° C		Emergency Max = 95° C		Max = 1.5 kg/cm ²

Maximum Coolant Temperature						Oxygen	
Sea Level	< 3000 m	4000 m	6000 m	Emer <10min	Min Temp	Begin Use @ 4000 m	
Max = 95° C	Max = 95° C	Max = 91° C	Max = 86° C	Max = ° C	Min = ° C	Min Pressure= kg/cm ²	

Best Airspeed for Climb

Sea Level	1000 m	2000 m	3000 m	4000 m	5000 m	6000 m	7000 m
200 kph		200 kph		200 kph		200 kph	

ONE

ONE

ONE

He 111P

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
He 111P-2	DB 601A-1	87 Oct	D. (Luft) T 2220/1; June 1940

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V _{NE}	Never Exceed Speed	480	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	200	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	200	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	250	Max Speed with Gear Extended
V _R	Rotation Speed	150	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	180	Threshold Crossing Speed
V _S	Stall Speed	135	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	115	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	200	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	115 - 200 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	135 - 480 KPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	480 KPH	Maximum Speed for ALL operations.

OPERATING DATA

Condition	Take-Off	Take-Off	Climb	Cruise	Condition	
Limit	1 min	5 min	30 min	Cont	Limit	Luftschraubestellungs...
Man Press	1.4 ATA	1.3 ATA	1.23 ATA	1.15 ATA	Boost	Full Course 9:30
RPM	2400	2400	2300	2200	RPM	Full Fine 12:00
Pitch					Pitch	
Maximum RPM = 3000						

Oil Pressure	Oil Temperature (Inlet)		Oil Temperature (Outlet)		Fuel Pressure
Min = 2.6 kg/cm ²	Min = 35° C	Norm = 80° C	Min = ° C	Max = 105° C	Min = 1.0 kg/cm ²
Normal = 3.5 - 8 kg/cm ²	Emergency Max = ° C		Emergency Max = ° C		Max = 1.5 kg/cm ²

Maximum Coolant Temperature						Oxygen
Sea Level	2000 m	4000 m	6000 m	Emer <10min	Min Temp	Begin Use @ 4000 m
Max = 100° C	Max = 96° C	Max = 91° C	Max = 86° C	Max = ° C	Min = ° C	Min Pressure= ## kg/cm ²

Best Airspeed for Climb

Sea Level	1000 m	2000 m	3000 m	4000 m	5000 m	6000 m	7000 m
220 kph		215 kph		200 kph		190 kph	180 kph

ONE

ONE

ADDITIONAL AIRCRAFT

NON-STANDARD AND NON-PILOTABLE AIRCRAFT

ONE

Hurricane Mk I Early

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Hurricane Mk I	Merlin II / FP	87 Oct	Pilot's Notes: AP 1564A; Mar 1939

AIRPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	380	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	120	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	150	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V _R	Rotation Speed	80	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	72	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	55	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	157	Delivers Gain in Altitude in Shortest Time
V _{BE}	Max Speedbrake Extended Speed	NA	Do Not Extend Brakes Above this Speed

AIRPEED INDICATOR OPERATING RANGES

ASI MARKING	MPH Range	Description
White Arc	55 - 120 MPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	72 - 380 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	380 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Take-Off	All Out Level	Climb	Max Cruise	Max Cruise	Max Dive	87 Octane
Limit	1000' or 3 min	5 min	30 min	Cont	Cont	20 sec	
Boost	+6.25 PSI	+6.25 PSI	+6.25 PSI	+4.5 PSI	+2.25 PSI	+6.25 PSI	
RPM	2850	3000	2600	2600	2600	3600	
Mixture	Rich	Rich	Rich	Rich	Weak	Rich	

Oil Pressure	Oil Temperature		Coolant Temperature		Operating Pressures
Emer Min = 45 PSI	Min = 15° C	Max = 90° C	Normal = 95° C		Fuel = 1.75 - 2 PSI
Normal = 60 PSI	Emergency Max = 95° C		Min = 70° C	Max = 120° C	Brake >= 120 PSI

Correction of ASI Reading for Postion Error

ASI (MPH)	+ / -	Adjustment	CAS (MPH)
80	+	6	86
100	+	3.2	103.2
120	+	0.5	120.5
140	-	1.7	138.3
160	-	4.0	154
180	-	6.0	174
200	-	7.5	192.5
220	-	8.7	211.3
240	-	9.5	230.5
260	-	9.7	250.3

Note: Hurricane MkI Early Checklist Based on Pilot's Notes for Hurricane MkI with Merlin II and 2 Bladed Fixed Pitch Airscrew.

ONE**ONE**

TWO

Hurricane Mk I Early

TWO

PRELIMINARIES

1. Switch on Light Indicator and Check for -- **TWO GREEN** --lights
2. Safety Catch of Hydraulic Selector Covers Chasis -- **UP** -- Position
3. Radiator Flap -- **OPEN** --; In Cold Weather, Keep -- **CLOSED** -- Until Coolant Temperature Rises
4. Movement of the Flying Controls -- **CHECK**
5. Check Throttle Lever Friction Adjustment

STARTING ENGINE

NOTE: For full Particulars of the Merlin II engine see A.P. 1590B, Volume I.

NOTE: For starting purposes, the engine should be supplied from the reserve tank as this provides a gravity feed. If main tanks are less than 1/2 full, run up and take off should be on reserve tank. Do not change fuel distributor cock until take off has been accomplished to prevent interruption of fuel flow.

***** IMPORTANT *****

To prevent any danger of air locks in the fuel system, do not exhaust the contents of the reserve or main tanks before switching to the other fuel tank.

1. Check fuel tank levels and determine which to use for run-up and take-off.
2. Fuel Distributer Cock -- **RESERVE**
3. Throttle Lever Forward -- **.5 INCH**
4. Prime the Cylinders by Injecting -- **FIVE** -- Shots of Fuel
5. Propeller Area -- **CLEAR**
6. Main and Starting Magneto Switches -- **ON**
7. Starting Switch -- **PRESS AND HOLD** -- No More Than -- **30 SECONDS**
8. If Engine Fails to Start Immediately; Then -- **1 OR 2** -- Pumps of Primer
9. Upon Engine START; Starting Magneto to -- **OFF** -- ; Fuel Distributer Cock -- **MAIN TANK**
10. Warm at Fast Tick-over Until Oil Temperature -- **15° C** --; Radiator Temperature -- **70° C**

CHECKING ENGINE AND INSTALLATIONS

NOTE: The throttle may be opened fully only for the shortest periods necessary for the checks to be made.

1. Fuel Pressure: Main Tank -- **1.75 - 2 PSI** --; Reserve Tank -- **2.25 - 3 PSI**
2. Check Hydraulic Engine Pump: Operate Flaps; Select -- **FLAPS DOWN** -- then Depress Operating Lever
3. Check Hydraulic Hand Pump: Return Flaps; Select -- **FLAPS UP** -- then Operating Hand Lever
4. RPM -- **2100 - 2200**
5. Boost -- **+6 PSI**
6. Oil Pressure: -- **70 - 95 PSI** -- Initially; -- **60 PSI** -- at NORMAL Temperature
7. Test Magnetos: RPM Drop Less Than -- **80 RPM**
8. Brake Air Pressure -- **100 PSI**

PREPARATION BEFORE TAKE-OFF

1. Set Elevator Trim for Take-off; Indicator In -- **CENTRAL** -- Position
2. Depress Flaps -- **28°** -- Indicator -- **TWO** -- Divisions
3. Hydraulic Selector Gate to Uncover -- **UP** -- Position for Undercarriage Lever
4. Cockpit Hood -- **OPEN and LOCKED**

TWO**TWO**

THREE

Hurricane Mk I Early

THREE

TAXYING OUT

1. Parking Brake -- **RELEASED**
2. Brakes Can Be Used With Confidence
3. Check Brake Pressure During Prolonged Taxying

TAKE-OFF

NOTE: *The aeroplane should be taken off at full throttle with the mixture control at "Rich".*

1. Firm Push on Control Column to Raise the Tail
2. Rotate at --> **80 MPH** -- ASI
3. Raise Undercarriage: Select Wheels -- **UP** --; Press and Hold Operating Lever Until -- **BOTH** -- Red Lights On
4. Raise Flaps at -- > **90 MPH** -- ASI; Select Flaps -- **UP** -- Press Op Lever Until Flap Indicator Shows -- **UP**
5. Fuel Distributor Cock -- **MAIN** -- Tank

PRECAUTION AFTER TAKE-OFF

*As a safeguard in the event of engine failure, a steep angle of climb should not be attempted.
Aim at clearing aerodrome boundary by a small margin.*

CLIMBING

The optimum full throttle indicated climbing speed is 157 MPH. The radiator flap should be set to fully open.

APPROACH

1. Reduce Speed to -- **150 MPH** -- ASI
 - 1.a. Hood -- **OPEN and LOCK**
 - 1.b. Wheels: Engine Pump: Select Wheels -- **DOWN** ; Press Operating Lever Until -- **GREEN** -- Lamps Light
ALT: Wheels: Hand Pump: Select Wheels -- **DOWN** ; Operate Hand Pump Until -- **GREEN** -- Lamps Light
2. Flaps: Select Flaps -- **DOWN** --; Press Oil Valve Operating Lever or Operate Hand Pump
3. For Unsuccessful Landing: Take-off again with Flaps and Gear -- **DOWN**
4. Check Brake Pressure: Before Landing -- >**120 PSI**
5. Flaps Up Approach: Increase Approach Speed by -- **10 MPH** -- ASI

LANDING

Non Engine Assisted Approach: 90 MPH ASI

Engine Assisted Approach: 80 MPH ASI

Brakes -- Use with Confidence

SHUTTING DOWN

1. Allow Engine to -- **IDLE** -- For a Short Period
2. Fuel Distributor Cocks -- **OFF**
3. Switches -- **OFF** -- When Irregular Firing Becomes Noticable
4. Switch Undercarriage Indicator -- **OFF**
5. Select Flaps -- **UP**
6. Safety Catch of Hydraulic Selector Covers Chasis -- **UP** -- Position

UNDERCARRIAGE EMERGENCY OPERATION

If difficulty is experienced in selecting wheels "DOWN", or the wheels fail to drop (indicated by the failure of the RED lights to extinguish), select wheels "UP" again and press the operating lever for 15 seconds or operate the hand pump; after which select wheels "DOWN" immediately.

1. Reduce Speed to -- **90 MPH** -- ASI
2. Press Undercarriage Emergency Release Knobs with -- **BOTH FEET** -- and Select Wheels -- **DOWN**

FORCED LANDING OWING TO ENGINE FAILURE

1. Undercarriage -- **AS DETERMINED** -- If in Doubt, Land with Undercarriage -- **UP**
2. Flaps -- **AS REQUIRED** -- Using Hand Pump

THREE

THREE

ONE

Bf 108B

ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Bf 108B	As 10C	87 Oct	Kurzbetriebs ; June 1938

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V_{NE}	Never Exceed Speed	350	Never Exceed in Any Operation
V_{FE}	Max. Flaps Extend Speed	190	Do Not Extend Flaps Above this Speed
V_{LO}	Max Landing Gear Operating Speed	NA	Do Not Operate Ldg Gear Above this Speed
V_{LE}	Max Landing Gear Extended Speed	180	Max Speed with Gear Extended
V_R	Rotation Speed	96	Speed at which the Airplane Lifts Off
V_{REF}	Landing Reference Speed	130	Threshold Crossing Speed
V_S	Stall Speed		Min Speed at which the A/C is Controllable
V_{S0}	Stall Speed		Stall Speed in Landing Configuration
V_Y	Best Rate-of-Climb	170	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		Full Flap Operating Range. Lower Limit is Max. Weight V_{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc		Normal Operating Range. Lower Limit is Max. Weight V_S . Upper limit Is Max Structural Cruising Speed.
Red Line		Maximum Speed for ALL operations.

OPERATING DATA

Condition	Maximum	Max Cont	Cont	Oil Temperature (Inlet)	Fuel Pressure
RPM	2000	1880	1800	Normal = 30 - 85° C	Min = 0.12 kg/cm ²
Oil Pressure		Normal = 3 - 6 kg/cm ²		Emergency Max = ° C	Max = 0.22 kg/cm ²

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Anson Mk I

ONE

Aircraft Type

Engine & Prop

Fuel

Reference

Anson MkI

Cheetah IX / FP

87 Oct

Pilot's Notes: AP 1525A; Apr 1943

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V _{NE}	Never Exceed Speed	213	Never Exceed in Any Operation
V _{FE}	Max. Flaps Extend Speed	98	Do Not Extend Flaps Above this Speed
V _{LO}	Max Landing Gear Operating Speed	NA	Do Not Operate Ldg Gear Above this Speed
V _{LE}	Max Landing Gear Extended Speed	213	Max Speed with Gear Extended
V _R	Rotation Speed	NA	Speed at which the Airplane Lifts Off
V _{REF}	Landing Reference Speed	NA	Threshold Crossing Speed
V _S	Stall Speed	57	Min Speed at which the A/C is Controllable
V _{S0}	Stall Speed	48	Stall Speed in Landing Configuration
V _Y	Best Rate-of-Climb	100	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	MPH Range	Description
White Arc	48 - 98 MPH	Full Flap Operating Range. Lower Limit is Max. Weight V _{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	57 - 213 MPH	Normal Operating Range. Lower Limit is Max. Weight V _S . Upper limit Is Max Structural Cruising Speed.
Red Line	213 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Take-Off	All Out Level	Climb	Max Cruise	Max Cruise	Max Dive	87 Octane
Limit	1000'	5 min	1 hour	Cont	Cont	20s @ 2425	
Boost	FT	+1.5 PSI	+1.5 PSI	-0.5 PSI	-1 PSI	+1.5 PSI	
RPM	2100	2425	2300	2100	2100	2910	
Mixture	Take-Off	Take-Off	Normal	Normal	Weak	Normal	

Oil Pressure

Oil Temperature (Inlet)

Cylinder Temperature

Operating Pressures

Emer Min = 35 PSI

Min = 25° C Max = 80° C

Normal = 180° C

Fuel = 2 - 3 PSI

Normal = 70 PSI

Emergency Max = 90° C

Min Max = 250° C

Brake

Correction of ASI Reading for Position Error

ASI (MPH)	+ / -	Adjustment	CAS (MPH)
70	+	7	77
88	+	7	95
108	+	5	113
135	+	3	138
170	+	1	171

Aircraft Systems

	Hydraulic	Hand Pump	Cockpit	
	Pneumatic	Air bottle	Gnd Filled	
	Electrical	Generator	Each Engine	
	Fuel Tanks	Capacity	Quantity	Tot Capacity
	Port	35 gals	2	70 gals
	Starboard	35 gals	2	70 gals

gals/hour @ 10k Feet

RPM

Mixture	Boost	2400	2200	2000	1900
WEAK	+1 PSI	75	70	65	
	0 PSI	69	65	61	58
	-1 PSI	66	62	58	54
	-2 PSI	61	57	53	49
	-3 PSI	56	52	48	45
RICH	+5 PSI	2650 RPM		146 gals/hr	
	+3.5 PSI	2400 RPM		112 gals/hr	
	+ 1.5 PSI	2400 RPM		90 gals/hr	

Note: Anson MkI Checklist Based on Pilot's Notes for Anson MkI.

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Errata

and

Works in Progress

~~Yeah, this section hasn't been done yet making this entire document a worthless pile of steaming dog doo. I blame bosses, Real Life™, beer (especially that good German stuff like Molson), and hot, humid weather.~~

Since many of you have pointed out that Molson is Canadian (or Canadienne) and not German, please consider donating to the "Get Flea Drunk at Oktoberfest Fund" so that I may experience true German Bier.

Oh, and I still haven't done this section yet.