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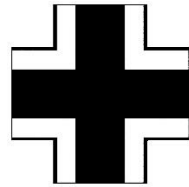
# PILOT'S NOTES

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IL2 Sturmovik

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# Luftwaffe



# Messerschmitt Bf 109 E7

## Engine: DB-601A

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,200	1.15
<b>Combat</b>	30 min	2,300	1.23
<b>Emergency</b>	5 min	2,400	1.30
<b>Boosted</b>	1 min	2,400	1.40

## Temperatures

	Rated	Max
<b>Water</b>	94 C	100 C
<b>Oil</b>	95 C	105 C

## Recommended speeds (km/h)

<u>Take-off</u>	<u>Glideslope</u>	<u>Landing</u>
140-170	180-190	130-140

## Operation features

- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode (R Shift+P) and pitch should be reduced to minimum.
- Water and oil radiator shutters are controlled manually.
- Airplane has a manually controlled horizontal stabilizer. It should be set to +1° before takeoff and to -4°...-5° before landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.
- The design of the cockpit canopy does not allow it to be opened during flight. The canopy should be closed before takeoff to prevent damage. The canopy has an emergency release system for bailouts.

# Messerschmitt Bf 109 F2

## Engine: DB-601N

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.15
<b>Combat</b>	30 min	2,400	1.25
<b>Emergency</b>	3 min	2,600	1.35
<b>Boosted</b>	1 min	2,800	1.42

## Temperatures

	Rated	Max
<b>Water</b>	100 C	110 C
<b>Oil</b>	70 C	85 C

## Recommended speeds (km/h)

<u>Take-off</u>	<u>Glideslope</u>	<u>Landing</u>
145-175	185-195	135-145

## Operation features

- In addition to full-automatic mode there is a special emergency mode for the radiator shutters, which can be used in specific situations. In this mode, the shutters are forced to be fully opened.
- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual (R Shift+P) mode and pitch should be reduced to minimum.
- Airplane has a manually controlled horizontal stabilizer. It should be set to +1° before takeoff and to -4°...-5° before landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.

# Messerschmitt Bf 109 F4

Engine: DB-601E

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.15
<b>Combat</b>	30 min	2,500	1.30
<b>Emergency</b>	1 min	2,700	1.42

Temperatures

	Rated	Max
<b>Water</b>	100-102 C	115 C
<b>Oil</b>	70-80 C	85 C

Recommended speeds (km/h)

<b>Take-off</b>	<b>Glideslope</b>	<b>Landing</b>
150-180	190-200	145-155

Operation features

- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual (R Shift+P) mode and pitch should be reduced to minimum.
- Airplane has a manually controlled horizontal stabilizer. It should be set to +1° before takeoff and to -4°...-5° before landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.
- The control system for the bomb rack only allows for dropping bombs one by one.

# Messerschmitt Bf 109 G2

Engine: DB-605A

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.15
<b>Combat</b>	30 min	2,600	1.30

Temperatures

	Rated	Max
<b>Water</b>	100-102 C	115 C
<b>Oil</b>	70-80 C	85 C

Recommended speeds (km/h)

<b>Take-off</b>	<b>Glideslope</b>	<b>Landing</b>
155-180	195-205	150-155

Operation features

- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode (R Shift+P) and pitch should be reduced to minimum.
- Airplane has a manually controlled horizontal stabilizer. It should be set to +1° before takeoff and to -4°...-5° before landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.

# Messerschmitt Bf 109 (G4 and G6)

Engine: DB-605A

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.15
<b>Combat</b>	30 min	2,600	1.30
<b>Emergency</b>	1 min	2,800	1.42

Temperatures

	Rated	Max
<b>Water</b>	100-102 C	115 C
<b>Oil</b>	70-80 C	85 C

Recommended speeds (km/h)

<b>Take-off</b>	<b>Glideslope</b>	<b>Landing</b>
155-180	195-205	150-155

Operation features

- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode (R Shift+P) and pitch should be reduced to minimum.
- Airplane has a manually controlled horizontal stabilizer. It should be set to +1° before takeoff and to -4°...-5° before landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.



# Messerschmitt Bf 109 G14

## Engine: DB-605AM

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.15
<b>Combat</b>	30 min	2,600	1.30
<b>Emergency</b>	10 min	2,800	1.7

## Temperatures

	Rated	Max
<b>Water</b>	100-102 C	115 C
<b>Oil</b>	70-80 C	85 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing	Stall
155-180	195-205	150-155	164-181

## Operation features

- The aircraft is equipped with MW-50 water-methanol mixture injection system that prevents the engine detonation in the emergency power mode. It engages automatically when the throttle is set to maximum. There is enough mixture for 25-30 minutes. However, the engine can work up to 10 minutes at this mode, wait for another 10 min. at combat mode before engaging the emergency mode again. Attention: Running the engine at the emergency mode without the water-methanol mixture, or altitudes above 6km is forbidden!
- Normal levels of pressure for the injection system is 0.6-0.7 atm, as shown by the gauge on your left, near the canopy latch. If the pressure dips below 0.4 atm stop using the injection system and switch to combat mode.
- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode (R Shift+P) and pitch should be reduced to minimum.
- Airplane has a manually controlled horizontal stabilizer. It should be set to +1° before takeoff and to -4°...-5° before landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.

# Messerschmitt Bf 110 E2

## Engine: DB-601A

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,200	1.15
<b>Combat</b>	30 min	2,300	1.23
<b>Emergency</b>	5 min	2,400	1.30
<b>Boosted</b>	1 min	2,400	1.40

## Temperatures

	Rated	Max
<b>Water</b>	94 C	100 C
<b>Oil</b>	95 C	105 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
180-220	200-220	140-160

## Operation features

- Water and oil radiator shutters are controlled manually. The oil radiator control has five fixed positions. The water radiator control has nine fixed positions.
- Propellers have a feathering system which should be activated in case of engine damage to reduce drag of the propeller in auto-rotation.
- To reduce swinging during taxiing due to prop-wash it is necessary to use asymmetrical engines thrust. It is recommended to give the left engine 20% more power. Also, the propeller pitch control should be switched to manual mode and pitch should be reduced to minimum.
- Landing flaps have a hydraulic actuator and they can be extended to any angle up to 50°.
- Airplane tail wheel rotates freely and does not have a lock. For this reason, it is necessary to confidently and accurately operate the rudder pedals during the takeoff and landing.
- The design of the cockpit canopy does not allow it to be opened during flight. The canopy should be closed before takeoff to prevent damage. The canopy has an emergency release system for bailouts.
- Airplane is equipped with an automatic bomb salvo controller, it allows you to choose which bomb-racks to be released (central belly, left and right wing) and to switch the bomb salvo (single release or release all bombs).
- Reloading of both MG-FF guns (forward and rearward) must be performed by the rear gunner. The forward firing MGFF must be reloaded at the pilot's command.

# Messerschmitt Bf 110 G2

## Engine: DB-605B

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.15
<b>Combat</b>	30 min	2,600	1.30
<b>Emergency</b>	1 min	2,800	1.42

## Temperatures

	Rated	Max
<b>Water</b>	100-102 C	115 C
<b>Oil</b>	70 - 80 C	85 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
190-230	210-230	150-170

## Operation features

- Water and oil radiator shutters are controlled manually. The oil radiator control has five fixed positions. The water radiator control has nine fixed positions.
- Propellers have a feathering system which should be activated in case of engine damage to reduce drag of the propeller in auto-rotation.
- To reduce swinging during taxiing due to prop-wash it is necessary to use asymmetrical engines thrust. It is recommended to give the left engine 20% more power. Also, the propeller pitch control should be switched to manual mode and pitch should be reduced to minimum.
- Airplane tail wheel rotates freely and does not have a lock. For this reason, it is necessary to confidently and accurately operate the rudder pedals during the takeoff and landing.
- Airplane is equipped with an automatic bomb salvo controller, it allows you to choose which bomb-racks to be released (central belly, left and right wing) and to switch the bomb salvo (single release or release all bombs).
- Reloading of BK37 gun is performed by the rear gunner at the pilot's command.

# Junkers Ju-88 A4

## Engine: Jumo-211J

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,250	1.15
<b>Climb</b>	30 min	2,400	1.25
<b>Take-off</b>	1 min	2,600	1.42

## Temperatures

	Rated	Max
<b>Water</b>	80 C	110 C
<b>Oil</b>	100 C	130 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-210	210-220	150-160

## Operation features

- Each engine has a two-stage mechanical supercharger with an automatic switch system that switches gears depending altitude and engine revolutions. It can also be manually switched to first gear.
- Engine mixture control is automatic.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM.
- Propellers have a feathering system which should be activated in case of engine damage to reduce drag of the propeller in auto-rotation.
- Water and oil radiators shutters are joint with engine cowl outlet shutters and manually operated.
- Airplane has fence-type airbrakes which are located under the wing and used to slow the descent during steep dive bombing.
- Airplane has hydraulic-actuated landing flaps with three fixed positions: retracted, takeoff (25°) and landing (50°). Flap indicator lights are located on left panel.
- Airplane tail wheel rotates freely and does not have a lock. For this reason, it is necessary to confidently and accurately operate the rudder pedals during the takeoff and landing.
- Airplane has dedicated fuel gauges for left and right fuel tank groups and there is a switch between the internal and external fuel tank group indicator. In game the fuel indicator switch changes by itself during horizontal flight every 10 seconds. Also, the airplane has low fuel warning lights (180 liters) for the internal tanks.
- Airplane is equipped with an automatic bomb salvo controller, it allows the pilot to switch between the bomb racks to be released (internal or external) and to switch between different salvo quantities. There is also a controller for a drop delay between each bomb in the salvo.

# Junkers Ju-87 D3

## Engine: Jumo-211J

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,250	1.15
<b>Climb</b>	30 min	2,400	1.25
<b>Take-off</b>	1 min	2,600	1.42

## Temperatures

	Rated	Max
<b>Water</b>	80 C	110 C
<b>Oil</b>	90 C	105 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
140-170	180-195	125-145

## Operation features

- Water and oil radiators shutters control is manual.
- Airplane has fence-type airbrakes which are located under the wing and used to slow the descent during steep dive bombing.
- Airplane has hydraulic-actuated landing flaps with three fixed positions: retracted, takeoff (25°) and landing (40°). Flap indicator lights are located on left panel near the throttle.
- Airplane has a manual tail wheel lock. Wheel should be locked when taxiing straight for a long distance and before takeoff and landing.
- It is impossible to open or close canopy at high speed due to strong airflow. When the canopy is open, it is impossible to use rear gun because it is linked to canopy. The canopy has an emergency release system for bailouts.
- Airplane has a window in the cockpit floor which can be opened by the bomb bay door command.
- Airplane is equipped with a salvo controller, it allows the pilot to choose which bomb racks to use (central, left and right wing) and to switch the bomb salvo (single drop or all bombs on the rack).

# Junkers Ju 52/3m g4e

## Engine: BMW-132a

	Time limit	RPM
<b>Nominal</b>	-	1,925
<b>Climb</b>	30 min	1,975
<b>Take-off</b>	5 min	2,050

## Temperatures

Temps	Rated	Max
<b>Oil</b>	80 C	100 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
100-120	140-155	95-110

## Operation features

- Engine mixture control is manual; it is necessary to lean the mixture if altitude is more than 1 km for optimal engine operation. Also, leaning the mixture allows a reduction in fuel consumption during flight.
- All three propellers are fixed pitch ones, so thrust can only be controlled by adjusting the engines throttle (from idle at 25% to maximum power at 100%). 0-20% throttle range is used for braking the landing gear wheels. Engine modes can be determined only by watching the engine RPM gauges.
- Airplane has a manually controlled horizontal stabilizer. It should be set to 0° before takeoff, to +2° during flight and to -1.5° for landing. Also, it may be used to trim the flight stick during the flight.
- The mechanical flaps control system can be controlled simultaneously with the horizontal stabilizer, these two systems can be linked or unlinked (by using flaps control buttons). It is important to note that it is possible to render the system inoperable so it would not be able to control either the stabilizer or the flaps by deviating from a standard control procedure described below.
- Before taking off, set the stabilizer to flight position +2°, engage the link and then move the stabilizer to take-off position 0° flaps will be extended to 25°. When airborne, move the stabilizer back to flight position (flaps should also fully retract) and unlink these controls. Before landing, set the stabilizer to flight position +2°, engage the link and then move the stabilizer to landing position -1.5° flaps will be fully extended to 40°.
- Airplane has separate pneumatic wheel brakes. To brake left or right wheels, move their corresponding left or right engine throttle to 20% or less. Setting the central engine throttle to 20% or less will brake both wheels. Maximum braking efficiency can be achieved by moving the throttle all the way down. In the sim, you can also use the brake buttons to move left and right engine throttles to braking position.
- Airplane is equipped with two mechanical fuel float level gauges for left and right fuel tank groups, located on the left and right engine nacelles outside the cabin.
- The left passenger door must be removed before flight for dropping paratroopers or cargo containers. Use the bomb drop button ("B" by default) to drop them.

# Henschel Hs-129 B2

## Engine: Gnome-Rhone 14 M

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,350	1.10
<b>Combat</b>	30 min	2,750	1.25
<b>Take-off</b>	1 min	3,030	1.50

## Temperatures

Temps	Rated	Max
<b>Oil</b>	60-75 C	125 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
145-155	180-200	135-145

## Operation features

- Controlling the propellers RPM is possible only in the manual mode (R Shift+P) by changing the propeller pitch. The automatic mode keeps the RPM at 2750.
- The engine control lever allows setting the pressure up to the combat mode (1.25 ATA).
- To switch the engines to the take-off mode, move the boost lever to 1.5 ATA position and set the propellers to 3030 RPM (manually using R Shift+P).
- Engine mixture control is automatic. Leaning the mixture manually reduces the fuel consumption during flight.
- The oil radiator shutters are controlled automatically and don't have a manual mode.
- The propellers have a feathering system which should be activated in case of engine damage to reduce drag of the propeller in auto-rotation.
- The tail wheel rotates freely and does not have a lock. For this reason, it is necessary to confidently and accurately operate the rudder pedals during the takeoff and landing.
- The aircraft fuel gauges are positioned directly on the engine nacelles and show only the amount of fuel remaining in the wing tanks (the fuel remaining in the central fuel tank is not indicated).
- The aircraft isn't equipped with an oxygen supply system, so flying above 4000 meters is forbidden.
- The aircraft is equipped with an electric bomb release controller that allows dropping the bombs only one by one.

# Heinkel He-111 (H6 and H16)

## Engine: Jumo-211F

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,250	1.15
<b>Climb</b>	30 min	2,400	1.25
<b>Take-off</b>	1 min	2,600	1.42

## Temperatures

	Rated	Max
<b>Water</b>	80 C	110 C
<b>Oil</b>	100 C	130 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-210	180-200	125-150

## Operation features

- Engine mixture control is automatic.
- Propellers have a feathering system which should be activated in case of engine damage to reduce drag of the propeller in auto-rotation.
- Water and oil radiator shutter controls are manual. The oil radiator control has five fixed positions.
- Airplane tail wheel rotates freely and does not have a lock. For this reason, it is necessary to confidently and accurately operate the rudder pedals during the takeoff and landing.
- Airplane has dedicated fuel gauges for left and right fuel tank groups and there is a switch between the internal and external fuel tank group indicator. In game the fuel indicator switch changes by itself during horizontal flight every 10 seconds. Also, there is dedicated fuel gauge for the fuselage fuel tank. Also, the airplane has low fuel warning lights (200 liters) for left and right fuel tank groups.
- Airplane is equipped with an automatic bomb salvo controller, it allows you to switch between the bomb racks to be released (internal or external) and to switch between different salvo quantities. There is also a controller for a drop delay between each bomb in the salvo.



# Focke-Wulf Fw-190 A3

## Engine: BMW-801D

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.20
<b>Combat</b>	30 min	2,400	1.32
<b>Emergency</b>	3 min	2,700	1.42

## Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	180 C	220 C
<b>Oil</b>	105 C	120 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-210	205-215	160-170

## Operation features

- Airplane has a wide automatization of the engine systems, in fact, to control speed it is only necessary to use the throttle lever. There is no need to manually set engine revolutions and mixture or supercharger gear in normal flight. The engine supercharger has an automatic switch system which depends on altitude and engine revolutions.
- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode and pitch should be reduced to minimum.
- When the angle of attack increases to critical levels the wing may stall suddenly and unexpectedly. There is almost no pre-stall buffet before the stalling. To avoid this the pilot must pay additional attention when performing extreme maneuvering.
- Airplane has electrically-actuated landing flaps with three fixed positions: retracted, takeoff (13°) and landing (58°). Flaps control buttons and indicator lights are located on left panel near the throttle. The flap angle may also be checked by indicators on the left and right wing outside the cockpit.
- Airplane has a tail wheel lock system which locks the tail wheel if the flight-stick is pulled backward. The tailwheel should be locked when taxiing straight for a long distance, before takeoff and after touchdown upon landing.
- The control system for the bomb rack only allows for dropping bombs one by one.

# Focke-Wulf Fw-190 A5

## Engine: BMW-801D

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.20
<b>Combat</b>	30 min	2,400	1.32
<b>Emergency</b>	3 min	2,700	1.42
<b>C3 injection</b>	10 min	2,700	1.65

## Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	180 C	220 C
<b>Oil</b>	105 C	120 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-210	205-215	160-170

## Operation features

- Airplane has a wide automatization of the engine systems, in fact, to control speed it is only necessary to use the throttle lever. There is no need to manually set engine revolutions and mixture or supercharger gear in normal flight. The engine supercharger has an automatic switch system which depends on altitude and engine revolutions.
- U17 strike modification includes C3 additional fuel injection system. When engaged, it increases pressure to 1.65 ATA (10 minutes time limit). This system can be turned on by engine boost command only at 100% throttle, with automatic propeller pitch control enabled and at altitudes lower than 1 km.
- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode and pitch should be reduced to minimum.
- When the angle of attack increases to critical levels the wing may stall suddenly and unexpectedly. There is almost no pre-stall buffet before the stalling. To avoid this the pilot must pay additional attention when performing extreme maneuvering.
- Airplane has electrically-actuated landing flaps with three fixed positions: retracted, takeoff (13°) and landing (58°). Flaps control buttons and indicator lights are located on left panel near the throttle. The flap angle may also be checked by indicators on the left and right wing outside the cockpit.
- Airplane has a tail wheel lock system which locks the tail wheel if the flight-stick is pulled backward. The tailwheel should be locked when taxiing straight for a long distance, before takeoff and after touchdown upon landing.
- The control system for the bomb rack only allows for dropping bombs one by one.

# Focke-Wulf Fw-190 A8

## Engine: BMW-801D

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,300	1.20
<b>Combat</b>	30 min	2,400	1.32
<b>Emergency</b>	3 min	2,700	1.42

## Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	180 C	220 C
<b>Oil</b>	105 C	120 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing	Stall
180-220	215-225	160-180	177-208

## Operation features

- Airplane has a wide automatization of the engine systems, in fact, to control speed it is only necessary to use the throttle lever. There is no need to manually set engine revolutions and mixture or supercharger gear in normal flight. The engine supercharger has an automatic switch system which depends on altitude and engine revolutions.
- There is an additional emergency engine mode system installed. When engaged, it increases pressure to 1.58 ATA and the second gear pressure to 1.65 ATA (10 minutes time limit). This system can be turned on by engine boost command only at 100% throttle, with automatic propeller pitch control enabled and at altitudes lower than 1 km.
- Outlet cowl shutters are operated manually.
- To reduce swinging during taxiing due to prop-wash the propeller pitch control should be switched to manual mode and pitch should be reduced to minimum.
- When the angle of attack increases to critical levels the wing may stall suddenly and unexpectedly. There is almost no pre-stall buffet before the stalling. To avoid this the pilot must pay additional attention when performing extreme maneuvering.
- Airplane has electrically-actuated landing flaps with three fixed positions: retracted, takeoff (13°) and landing (58°). Flaps control buttons and indicator lights are located on left panel near the throttle. The flap angle may also be checked by indicators on the left and right wing outside the cockpit.
- Airplane has a tail wheel lock system which locks the tail wheel if the flight-stick is pulled backward. The tailwheel should be locked when taxiing straight for a long distance, before takeoff and after touchdown upon landing.
- The control system for the bomb rack only allows for dropping bombs one by one.

# Macchi Aeronautica MC.202 series VIII

Engine: RA.1000 (export DB 601)

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,200	1.23
<b>Combat</b>	5 min	2,400	1.35
<b>Boosted</b>	1 min	2,500	1.45

## Temperatures

Temps	Rated	Max
<b>Water</b>	94 C	100 C
<b>Oil</b>	90-100 C	110 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
160-190	190-200	140-150

## Operation features

- Throttle lever is inverted: backward = full throttle, forward = idle throttle.
- Engine RPM has an automatic governor with two fixed modes: 2200 RPM normal mode, 2400 RPM boosted mode. Also, it is possible to turn off the governor and control the propeller pitch manually by mechanical actuator.
- Water and oil radiator shutter control is manual.
- Airplane has a manually controlled horizontal stabilizer. It should be set to neutral before takeoff and landing. Also, it may be used to trim the flight stick during the flight. In a deep dive the stabilizer should be set so that the pilot must push the flight stick forward to maintain the dive angle.
- Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- The control system of wing-mounted bomb racks only allows the dropping of bombs one by one.

VVS



# Polikarpov I-16 Type 24

## Engine: Shvetsov M-63

	Time limit	RPM	ATA
<b>Nominal</b>	-	2,200	915 mm
<b>Boosted</b>	5 min	2,300	1065 mm

## Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	120-200 C	205 C
<b>Oil</b>	55-90 C	125 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
145-175	185-195	135-145

## Operation features

- Cockpit has side-doors which should be closed before takeoff to prevent damage.
- Engine has a boost mode. To set boost mode it is necessary to push the boost lever fully forward and increase the engine to 2300 RPM.
- Engine has a two-stage mechanical supercharger which should be manually shifted at 3000m altitude.
- Engine mixture control is automatic when the mixture lever is set to maximum. It is possible to manually lean the mixture by moving the mixture control to less than maximum. This also reduces fuel consumption during flight.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM.
- Oil radiator shutter and air cooling intake shutters control is manual.
- Airplane has a tail wheel control mechanism which is linked to rudder pedals. Because of this, it is necessary to avoid of large rudder pedal inputs when moving at high speed on the ground.
- Airplane has independent left and right mechanical wheel brakes. To brake it is necessary to push upper part of the rudder pedal.
- Airplane has a hydrostatic fuel gauge which shows total fuel remaining only when manual sucker lever is pushed in. In game this happens by itself during horizontal flight by every 10 seconds.
- When bombs are installed there is a salvo controller, it has two release modes: single drop or drop two in a salvo.
- When rockets are installed there is a salvo controller, it has three launch modes: single fire, fire two in a salvo or fire by four in a salvo.
- The gunsight has a sliding sun-filter. There is also a back-up folding mechanical sight which can be used if main sight is damaged.



# Mikoyan-Gurevich MiG-3 series 24

## Engine: Mikulin AM-35a

	Time limit	RPM	mm Hg
<b>Nominal</b>	-	2,050	1040
<b>Boosted</b>	10 min	2,050	1240

## Temperatures

Temps	Rated	Max
<b>Water</b>	80-110 C	120 C
<b>Oil</b>	115 C	120 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
180-200	195-205	135-145

## Operation features

- Engine has a boost mode which is engaged by setting the mixture control lever to maximum.
- Engine has a single-stage mechanical supercharger which does not require manual control.
- Engine mixture control is automatic when the mixture lever is set to the intermediate (50%) position. It is possible to manually lean the mixture by setting the control to less than 50%. This will reduce fuel consumption during flight.
- Landing flaps have a limiter for the maximum angle. The flaps have an extended range from 0° to 50°. The landing flaps have pneumatic actuator. Flaps can only be instantly extended to the angle which is set by limiter, gradual extending is impossible. Due to weak force of the actuator the extended landing flaps may retract upward by the airflow when the airspeed is more than 220 km/h. For this reason, it is necessary to remember that flaps will not extend fully in case of high speed. In case of a high-speed landing approach the flaps may extend a few steps right before landing.
- Airplane has a tailwheel control system which is unlocked and made controllable by the rudder if the rudder pedal is pressed more than for 40% of its range. The tailwheel remains locked if pedals are deflected less than 40%. Because of this, it is necessary to avoid large rudder pedal inputs when moving at high speed, or be ready to control the airplane with an unlocked tailwheel should large rudder inputs be made.
- It is impossible to open or close the canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- When bombs are installed a salvo controller can be used, it has two release modes: single drop or drop two in a salvo.
- When rockets are installed a salvo controller can be used, it has three launch modes: single fire, fire two in a salvo or fire four in a salvo.





# Lavochkin-Gorbunov-Gudkov LaGG-3 series 29

Engine: Klimov M-105PF

	Time limit	RPM	mm Hg
Nominal	-	2,700	1050

## Temperatures

Temps	Rated	Max
Water	70-85 C	100 C
Oil	90-100 C	115 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
165-200	200-210	140-160

## Operation features

- Engine has a two-stage mechanical supercharger which must be manually switched at 2500m altitude.
- Engine mixture control is manual, it is necessary to lean the mixture if altitude is more than 3-4 km for optimal engine operation. Also, leaning the mixture allows a reduction in fuel consumption during flight.
- Airplane tail wheel rotates freely and does not have a lock. Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- Cockpit canopy has a weak lock when in the opened position, for this reason the canopy may spontaneously close in a deep dive. Also, it is impossible to open or close canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- The control system of wing-mounted bomb racks only allows the dropping of bombs one by one.
- When rockets are installed a salvo controller is used, it has three launch modes: single fire, fire two in a salvo or fire four in a salvo.

# Yakolev Yak-1 (series 69 and 127)

Engine: Klimov M-105PF

	Time limit	RPM	mm Hg
Nominal	-	2550-2700	1050

## Temperatures

Temps	Rated	Max
Water	70-85 C	100 C
Oil	90-100 C	115 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
160-190	195-205	135-145

## Operation features

- Engine has a two-stage mechanical supercharger which must be manually switched at 2300m altitude.
- Engine mixture control is manual; it is necessary to lean the mixture if altitude is more than 3-4 km for optimal engine operation. Also, leaning the mixture allows a reduction in fuel consumption during flight.
- Landing flaps have a pneumatic actuator. Flaps can only be fully extended; gradual extending is impossible. Due to the weak force of the actuator the extended landing flaps may be pressed upwards by the airflow if the airspeed is more than 220 km/h. Remember that the flaps will not extend fully in case of high speed. In case of a high-speed landing approach the flaps may extend a few steps further right before landing.
- Airplane has a manual control for the tailwheel lock. The unlocked tailwheel has a 90° turn limit. The tailwheel should be locked when taxiing straight for a long distance and before takeoff and landing.
- Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- Fuel gauges are installed on left and right wing fuel tanks, outside of the cockpit. They show remaining fuel level only when there is less than 80 liters of fuel left in the tank.
- It is impossible to open or close the canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- The control system for the wing-mounted bomb racks only allows releasing of both bombs together.
- When rockets are installed a salvo controller can be used, it has three launch modes: single fire, fire two in a salvo or fire four in a salvo.

# Yakolev Yak-7B (series 36)

Engine: Klimov M-105PF

	Time limit	RPM	mm Hg
Nominal	-	2600-2700	1050

## Temperatures

Temps	Rated	Max
Water	70-85 C	100 C
Oil	90-100 C	115 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-175	200	145-165

## Operation features

- Engine has a two-stage mechanical supercharger which must be manually switched at 2000 m altitude.
- Engine mixture control is manual; it is necessary to lean the mixture if altitude is more than 3-4 km for optimal engine operation. Also, leaning the mixture allows a reduction in fuel consumption during flight.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM.
- Water and oil radiator shutters are controlled manually.
- Airplane has only the pitch flight-control trimmer.
- Landing flaps have a pneumatic actuator. Flaps can only be fully extended; gradual extending is impossible. Due to the weak force of the actuator the extended landing flaps may be pressed upwards by the airflow if the airspeed is more than 250 km/h. Remember that the flaps will not extend fully in case of high speed. In case of a high-speed landing approach the flaps may extend a few steps further right before landing.
- Airplane has a manual control for the tailwheel lock. The unlocked tailwheel has a 90° turn limit. The tailwheel should be locked when taxiing straight for a long distance and before takeoff and landing.
- Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- Fuel gauges are installed on left and right wing fuel tanks, outside of the cockpit. They show remaining fuel level only when there is less than 130 liters of fuel left in the tank.
- It is impossible to open or close the canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- The control system for the wing-mounted bomb racks only allows releasing of both bombs together.



# Lavochkin La-5 series 8

## Engine: Shvetsov M-82

	Time limit	RPM	mm Hg
<b>Nominal</b>	-	2,400	950
<b>Boosted</b>	5 min	2,400	1140

## Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	140-210 C	215 C
<b>Oil</b>	55-90 C	125 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-200	200-210	150-160

## Operation features

- Engine has a boost mode. To set boost mode it is necessary to push the boost knob and increase manifold pressure to 1140 mm Hg.
- Engine has a two-stage mechanical supercharger which must be manually switched at 3500m altitude.
- Engine mixture control is automatic when the mixture lever is set to maximum. It is possible to manually lean the mixture by moving the mixture control to less than maximum. This also reduces fuel consumption during flight.
- Air cooling intake shutters should always be open. They should only be closed when there is a possibility of engine overcooling, for example in a dive with idle throttle.
- Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- Cockpit canopy has a weak lock when in the opened position, for this reason the canopy may spontaneously close in a deep dive. Also, it is impossible to open or close canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- The control system of wing-mounted bomb racks only allows the dropping of bombs one by one.

## Lavochkin La-5FN series 2

### Engine: Shvetsov M-82FN

	Time limit	RPM	mm Hg
<b>Nominal</b>	-	2,400	1000
<b>Boosted</b>	10 min	2,500	1180

### Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	180-215 C	250 C
<b>Oil</b>	65-75 C	85 C

### Recommended speeds (km/h)

Take-off	Glideslope	Landing
175-195	200-210	150-160

### Operation features

- The engine has a boost mode. To engage it, increase the manifold pressure to 1180 mm Hg. Boost only works on 1st supercharger gear.
- Engine has a two-stage mechanical supercharger which must be manually switched at 3500m altitude.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM.
- Oil radiator, air cooling intake and outlet shutters are manually controlled.
- Air cooling intake shutters should always be open. They should only be closed when there is a possibility of engine overcooling, for example in a dive with idle throttle.
- Aircraft is equipped with elevator and rudder trimmers.
- Airplane has automatic wing slats. They deploy when the high angle of attack increases which makes pre-stall softer.
- Landing flaps have a hydraulic actuator and they can be extended to any angle up to 60°.
- Airplane tail wheel rotates freely and does not have a lock. For this reason, it is necessary to confidently and accurately operate the rudder pedals during the takeoff and landing.
- Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- Airplane has a fuel gauge which shows total remaining fuel.
- Also, it is impossible to open or close canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- The control system for the bomb rack only allows to drop bombs one by one.





# Curtiss P-40 E1 Kittyhawk

Engine: Allison V-1710-39

	Time limit	RPM	inch Hg
Nominal	-	2,600	37.2
Combat	5 min	3,000	42.0
Take-off	2 min	3,000	45.5
Max (prohibited by manual)	-	3,000	56.0

## Temperatures

Temps	Rated	Max
Water	105-115 C	125 C
Oil	70-85 C	90 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
160-190	210-220	140-145

## Operation features

- Engine has no manifold pressure automatic governor. For this reason, manifold pressure not only depends on throttle position, but also from RPM and altitude. This requires additional checking of manifold pressure to not cause engine damage.
- Engine is equipped with an automatic fuel mixture control which maintains optimal mixture if mixture lever is set to Auto Rich (66%) position. To use automatic mixture leaning to reduce fuel consumption during flight it is necessary to set mixture lever to Auto Lean (33%) position. In the case of malfunction of the automatic mixture control the mixture lever should be set to Full Rich (100%) position. To stop the engine mixture lever should be set to the Cut Off (0%) position.
- Water and oil radiators shutters are joint with engine cowl outlet shutters and manually operated.
- Airplane has a very small stability margin in yaw. When angle of side slip is more than 12° plane becomes unstable in yaw and starts to increase the side slip angle by itself. Because of this, it is necessary to accurately operate the rudder pedals and pay attention to the side slip indicator.
- Airplane has a tailwheel control system which is unlocked by the rudder if the rudder pedal is pressed more than half of its range. The tailwheel remains locked if pedals are deflected less than half way. Because of this, it is necessary to avoid large rudder pedal inputs when moving at high speed.
- Airplane is equipped with a parking brake system.
- Airplane is equipped with mechanical releasing system for a single bomb.
- When rockets are installed a salvo controller can be used, it has three launch modes: single fire, fire two in a salvo or fire four in a salvo.

# Ilyushin Il-2 (model of 1941 and 1942)

## Engine: Mikulin AM-38

	Time limit	RPM	mm Hg
<b>Nominal</b>	-	2,050	1180
<b>Boosted</b>	10 min	2,150	1280

## Temperatures

Temps	Rated	Max
<b>Water</b>	80-110 C	120 C
<b>Oil</b>	85 C	120 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
150-190	185-195	130-140

## Operation features

- Engine has a boost mode which is engaging by setting mixture control lever to maximum position.
- Engine mixture control is automatic when the mixture lever is set to the intermediate (50%) position. It is possible to manually lean the mixture by moving the control lever to less than 50%. This will lower fuel consumption during flight.
- Water and oil radiator shutter control is manual. Airplane has armored oil radiator shutters which should to be closed on start of ground attack to reduce possibility of combat damage. After finishing the attack, it is necessary to re-open the shutters to the required position.
- Landing flaps have a pneumatic actuator. Flaps can only be fully extended; gradual extending is impossible. Due to the weak force of the actuator the extended landing flaps may be pressed upwards by the airflow if the airspeed is more than 220 km/h. Remember that the flaps will not extend fully in case of high speed. In case of a high-speed landing approach the flaps may extend a few steps further right before landing.
- Airplane has a fuel gauge which shows the amount of remaining fuel in the front or bottom fuel tank depending on the switch position. In game the fuel indication switch changes by itself during horizontal flight by every 10 seconds. Rear fuel tank level is not indicated.
- Cockpit canopy weight is 50 kg and it has no lock in the open position, for this reason the canopy may to spontaneously close in a deep dive. Also, it is impossible to open or close canopy at high speed due to strong airflow. The canopy has no emergency release, so bail out requires the speed drop before it.
- Airplane is equipped with a joint salvo controller both for bombs and rockets, it has three release/fire modes: single launch, launch two in a salvo or launch four in a salvo.
- The gunsight is installed on a sliding bar which allows the pilot to extend the gunsight towards the pilot allowing for an increase in the field of view through the gunsight.

# Ilyushin Il-2 model of 1943

## Engine: Mikulin AM-38F

	Time limit	RPM	mm Hg
<b>Nominal</b>	-	2,050	1200
<b>Boosted</b>	5 min	2,350	1360

## Temperatures

Temps	Rated	Max
<b>Water</b>	80-110 C	120 C
<b>Oil</b>	85 C	120 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
160-200	195-205	145-155

## Operation features

- Engine has a boost mode which is engaged by setting mixture control lever to maximum position.
- Engine mixture control is automatic when the mixture lever is set to the intermediate (50%) position. It is possible to manually lean the mixture by moving the control lever to less than 50%. This will lower fuel consumption during flight.
- Water and oil radiator shutter control is manual. Airplane has armored oil radiator shutters which should be closed at the beginning of ground attack to reduce a possibility of combat damage. After finishing the attack, it is necessary to re-open the shutters to the required position.
- Airplane has differential pneumatic wheel brakes with shared control lever. This means that if the brake lever is held and the rudder pedal the opposite wheel brake is gradually released causing the plane to swing to one side or the other.
- Airplane is equipped with a joint salvo controller both for bombs and rockets, it has three release/fire modes: single launch, launch two in a salvo or launch four in a salvo.
- The mechanical gun sight "Visier Vladimirova" allows aiming rockets and guns at ground and air targets and horizontal bombing at certain speeds and altitudes.

## Petlyakov Pe-2 (series 35 and 87)

Engine: Klimov M-105RA and M-105RF

	Time limit	RPM	mm Hg
Nominal (series 35)	-	2,700	910
Nominal (series 87)	-	2,700	1050

### Temperatures

Temps	Rated	Max
Water	70-85 C	100 C
Oil	90-100 C	110 -115 C (s87)

### Recommended speeds (km/h)

Take-off	Glideslope	Landing
160-200	220-240	155-165

### Operation features

- Engine has a two-stage mechanical supercharger which must be manually switched at 2700m altitude.
- Engine mixture control is manual; it is necessary to lean the mixture if altitude is more than 3-4 km for optimal engine operation. Also, leaning the mixture allows a reduction in fuel consumption during flight.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM. The governor for the series 35 is electrically actuated and takes a long time to reach the required revolutions, up to 45 seconds when going from minimum to maximum.
- Airplane has fence-type airbrakes which are located under the wing and used to slow the descent during steep dive bombing.
- Landing flaps have electro-hydraulic actuator and they can be extended to any angle up to 50°. When landing and the flaps are fully extended the angle of attack for a stall is less than landing pitch angle. For this reason, it is prohibited to extend flaps to more than to 35° (70%) on landing.
- Airplane has automatically controlled horizontal stabilizer. The automatic control system adjusts the stabilizer angle depending on landing flaps extended angle.
- Airplane has three fuel gauges which shows the level in the fuselage fuel tank, left wing tanks and right wing tanks.
- Airplane is equipped with a bomb salvo controller, it has four release modes: drop single, drop two in a salvo, drop four in a salvo or drop all bombs in salvo. There is also a controller for a drop delay between each bomb in the salvo.
- When rockets are installed a salvo controller can be used, it has three launch modes: single fire, fire two in a salvo or fire four in a salvo. Aircraft has a fire control system that is designed for eight rockets. However, for added punch, ten rockets were typically loaded. In that case, the ninth rocket will fire with the seventh and the tenth will fire with the eighth.

# Supermarine Spitfire Mk.VB

## Engine: Rolls Royce Merlin 45 and 46

	Time limit	RPM	Boost
Max cruising	-	2,650	+7
International power	30 min	2,850	+9
Emergency Max All Out	5 min	3,000	+16

## Temperatures

Temps	Rated	Max
Water	105-115 C	125 C
Oil	70-85 C	105 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
160-170	145-160	130-135

## Operation features

- Engine is equipped with the automatic governor of the manifold pressure that works when the throttle is set to 1/3 position or above. It is necessary to turn the automatic governor off to set the boost value to +16.
- Engine is equipped with an automatic fuel mixture control which maintains optimal mixture if mixture lever is set to the forward position. To use automatic mixture leaning to reduce fuel consumption during flight move the mixture lever to backward position.
- The water radiator is operated manually, while the oil radiator is not adjustable.
- Aircraft has a neutral static stability. The elevator effectiveness is high, so the aircraft should be controlled carefully, not giving too much flight stick input.
- Aircraft becomes unstable with extended landing flaps.
- Landing flaps have a pneumatic actuator, so they can be extended to maximum position only. Speed with extended landing flaps is limited to 150 mph.
- Airplane is equipped with a siren that warns a pilot if the throttle is set to low position with landing gear retracted.
- Airplane is equipped with upper and bottom formation lights which can be turned on simultaneously or independently.
- The gunsight is adjustable: both the target distance and target base can be set.
- The gunsight has a sliding sun-filter.

# Supermarine Spitfire Mk.IXe

## Engine: Rolls Royce Merlin 66 and 70

	Time limit	RPM	Boost
Max cruising	-	2,650	+7
International power	1 hour	2,850	+12
Emergency Max All Out	5 min	3,000	+18

## Temperatures

Temps	Rated	Max
Water	105-115 C	135 C
Oil	90 C	105 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing	Stall
160-170	145-160	130-135	143-163

## Operation features

- Engine is equipped with the automatic governor of the manifold pressure that works when the throttle is set to 1/3 position or above.
- Engine is equipped with an automatic fuel mixture control which maintains optimal mixture if mixture lever is set to the forward position. To use automatic mixture leaning to reduce fuel consumption during flight move the mixture lever to backward position.
- The water radiator and oil radiator shutters are operated automatically, but there is a special manual mode that forces radiator shutters to open completely.
- Aircraft has a neutral static stability. The elevator effectiveness is high, so the aircraft should be controlled carefully, not giving too much flight stick input.
- Aircraft becomes unstable with extended landing flaps. Landing flaps have a pneumatic actuator, so they can be extended to maximum position only. Speed with extended landing flaps is limited to 140 mph.
- Airplane tail wheel rotates freely and does not have a lock.
- Airplane has differential pneumatic wheel brakes with shared control lever, meaning that if the brake lever needs to be used in conjunction with the rudder pedals in order to turn when taxiing.
- Airplane is equipped with a siren that warns a pilot if the throttle is set to low position with landing gear retracted.
- Airplane is equipped with a bottom formation light.
- The gunsight is adjustable: both the target distance and target base can be set. The gunsight has a sliding sun-filter.

# Bell P-39 L1 Airacobra

## Engine: Allison V-1710-63

	Time limit	RPM	inch Hg
<b>Nominal</b>	-	2,600	37.2
<b>Military</b>	15 min	3,000	42.0
<b>Take-off</b>	5 min	3,000	51.0
<b>Max</b>	2 min	3,000	60.0

## Temperatures

	Temps	Rated	Max
<b>Water</b>		105-115 C	125 C
<b>Oil</b>		70-85 C	90 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
150-180	180-210	155-160

## Operation features

- There is War Emergency power mode. To engage it, move the throttle to max forward position and set the mixture control to Full Rich (move it 90% forward to engage the Take-Off mode).
- Engine has a single stage mechanical supercharger which does not require manual control.
- Engine is equipped with an automatic fuel mixture control which maintains optimal mixture if mixture lever is set to Auto Rich (66%) position. To use automatic mixture leaning to reduce fuel consumption during flight it is necessary to set mixture lever to Auto Lean (33%) position. To stop the engine mixture lever should be set to the Cut Off (0%) position. Full Rich position is used during take-off, in case of emergency or automatic mixture system malfunction.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM. Also, it is possible to turn off the governor and control propeller pitch manually.
- Water and oil temperatures are controlled manually by adjusting the outlet engine radiator shutters.
- The nose gear orients by itself, doesn't have brakes and can't be controlled. Its maximum turn angle is 60° left or right.
- Airplane has two fuel gauges which shows the level in each group of fuel tank.
- Although there are two cockpit doors equipped with window lifters, usually only the right one is used. They can't be opened during flight but can be jettisoned to bail out.
- Airplane is equipped with mechanical releasing system for a single bomb.
- The gunsight has a sliding sun-filter. There is also a back-up mechanical sight which can be used if main sight is damaged.

# Douglas A-20B

## Engine: Wright R-2600-11

	Time limit	RPM	Boost 1 <sup>st</sup> gear	Boost 2 <sup>nd</sup> gear	Mixture
<b>Cruise</b>	-	1,705	27.5	30.0	Auto lean
<b>Nominal</b>	-	2,300	36.0	40.0	Auto rich
<b>Combat</b>	5 min	2,400	43.0	41.0	Auto rich

## Temperatures

Temps	Rated	Max
<b>Cylinder head</b>	140-240 C	260 C
<b>Oil</b>	80-95 C	105 C

## Recommended speeds (km/h)

Take-off	Glideslope	Landing
170-195	185-225	150-170

## Operation features

- Engine has no manifold pressure automatic governor. For this reason, manifold pressure not only depends on throttle position, but also from RPM and altitude. This requires additional checking of manifold pressure to not cause engine damage.
- Engine is equipped with an automatic fuel mixture control which maintains optimal mixture if mixture lever is set to Auto Rich (66%) position. To use automatic mixture leaning to reduce fuel consumption during flight it is necessary to set mixture lever to Auto Lean (33%) position. In the case of malfunction of the automatic mixture control the mixture lever should be set to Full Rich (100%) position. To stop the engine mixture lever should be set to the Cut Off (0%) position.
- Engine RPM has an automatic governor and it is maintained at the required RPM corresponding to the governor control lever position. The governor automatically controls the propeller pitch to maintain the required RPM.
- Oil radiators shutters are joint with engine cowl outlet shutters and manually operated.
- Airplane is equipped with a siren that warns a pilot if the throttle is set to low position with landing gear retracted.
- Airplane is equipped with upper formation lights.
- Engine has a two-stage mechanical supercharger which must be manually switched at 2900m (9500 ft) altitude.
- Airplane have a fuel gauge which shows remaining fuel in left and right fuel tanks depending on switch position. In game the fuel indicator switch changes by itself during horizontal flight by every 15 seconds.
- The aircraft is equipped with an electromechanical safety system that blocks the hydraulic landing gear actuator while the aircraft is on the ground.
- The nose gear orients by itself, doesn't have brakes and can't be controlled.



- It is forbidden to open the upper cowl flaps during flight, so they should be closed before taking off.
- The upper cowl flaps are controlled simultaneously using a shared hydraulic actuator.
- There are white and red signal lamps in the tail: the white one is lit while bomb doors are open and the red one lights up for 5 seconds when bombs are released.
- The upper cockpit door can't be opened during flight, but there is an emergency jettison handle.
- Airplane is equipped with a bomb salvo controller that has four release modes: drop single, drop two in a salvo, drop four in a salvo or drop all bombs in salvo. There is also a controller for a drop delay between each bomb in the salvo.