# Fw 190 A-8

## Aircraft Handbook

D. (Luft) T. 2190 A-8

**For Official Use Only!**

# Fw 190 A-8

## Aircraft Handbook

Fliegertechnische Schule 4/Dv.-Stelle
L. G. Kdo IV
zugewiesen lt.: I 4 / Dv. Nr. 5238 / 44
Vereinnahmt
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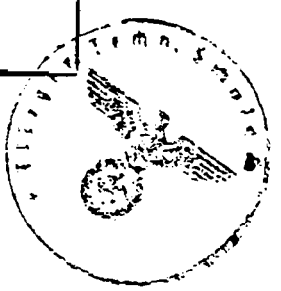

(Effective July 1944)

Issued September 1944

Luftwaffe High Command

Berlin, 5 September 1944

Chief of Technical Services
Nr. 280513/44 (E'Ste. Re. E2V)

I hereby approve D.(Luft) T.2190A-8 -- "Fw 190A-8 Aircraft handbook (Effective July 1944) Issued September 1944."

It is in effect from the date of issue.

By order
Wittmer

To reduce the preparation time of the Fw 190A-8 technical handbooks, the artists have used some drawings originally prepared for earlier marks of this aircraft. Where there are points of difference between them and the Fw 190A-8, they are marked with an asterisk (*). See the general arrangement drawings attached as Annex A to Part 0 to resolve any differences.

D. (Luft) T. 2190 A-8

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# Fw 190 A-8

## Aircraft Handbook

**Part 0**

**General**

(Effective July 1944)

Issued September 1944

# I. General data

## A. Specifications

### 1. Purpose

The Fw 190A-8 is a single-seat fighter aircraft possessing both a high top speed and good maneuverability. It can also be employed as a fighter-bomber carrying bombs, or as an extended range fighter carrying an underfuselage drop tank.

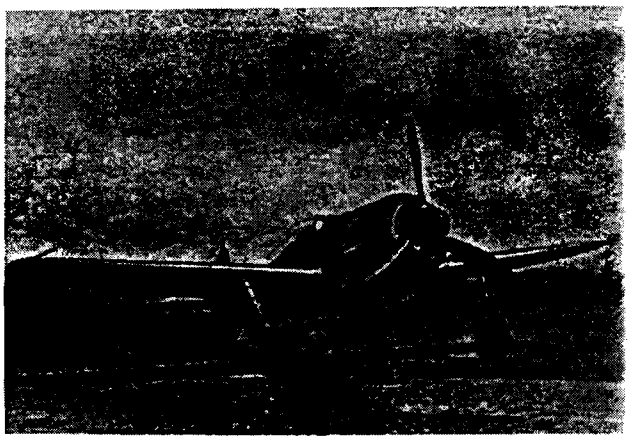

Fig. 1: General view

### 2. Type of construction

The aircraft is a single-engined, cantilever low-wing monoplane, of all-metal construction, with a single vertical tail and retractable undercarriage.

### 3. Airframe

a. Fuselage

The fuselage is composed of a Dural covering over a monocoque frame. At its forward end it is of circular cross-section to match the shape of the powerplant. At the rear end it is of oval cross-section. It comprises two major subsections, the forward fuselage (firewall to bulkhead 8) and the rear fuselage (bulkhead 8 to bulkhead 14).

The engine bearer assembly is attached to the firewall (bulkhead 1). The cockpit and fuel tanks are housed in the forward fuselage. In an emergency, the cockpit canopy can be jettisoned by the actuation of an explosive charge.

Armour plating protects the pilot against enemy fire.

An equipment bay, accessible through a hinged cover, is located in the rear fuselage. A fabric bulkhead, also located in the aft fuselage, prevents the sucking of engine exhaust fumes forward into the cockpit.

b. Undercarriage

The undercarriage consists of a two strut main gear unit and a tailwheel. The tailwheel can be swivelled through 360° and can be locked into position.

Undercarriage actuation is electrical; operation is monitored electrically, by an undercarriage position indicator, and mechanically, by an indicator rod.

The main undercarriage members are attached to the main spar, retracting inwards. When retracted, they are completely stored within apertures in the wing leading edge and are fully covered by fairings and covers.

During undercarriage retraction, the tailwheel is pulled up and held in place by a cable attached to the radius rod hinge point on the right undercarriage leg. The lower half of the tailwheel remains exposed after retraction, serving, in that position, as an emergency tail skid.

c. Control surfaces

The horizontal and vertical tail surfaces are positioned centrally on the tail unit; the ailerons, outboard on the wing trailing edge. The landing flaps are positioned inboard of the ailerons on the wing lower rear surface.

d. Flying controls

Elevators and ailerons are actuated by the pilot's control stick; the rudder by foot pedals. Movement of the controls is accomplished through cables, DUZ flexible push-rods and bellcranks. Through differential gears built into the elevator and rudder controls, the stick forces are kept to a minimum close to the neutral positions of these surfaces. Recently, in place of the rudder control differential bellcrank, a torsion bar fixture (without differential movement) has been installed.

The horizontal stabilizer and flaps are electrically actuated. Synchronized movement of the flap drive motors is accomplished through synchronizing switches.

e. Wing unit

The wing is of one piece construction. The main spar is continuous, the rear spar is divided by the fuselage. Wings and fuselage are connected at both the main and rear spars.

Monocoque type construction. The main spar forms part of the lower shell; the rear spar, part of the upper.

## 4. Powerplant

a. Engine

BMW 801D aircooled, 14-cylinder twin row radial engine with two speed supercharger, reduction gearing and engine cooling fan.

A control unit (Kommandogerät) automatically adjusts and monitors airscrew RPM, boost pressure, fuel mixture, ignition timing adjustment and supercharger switchover.

b. Airscrew

Three bladed adjustable airscrew with constant speed unit. In case of the failure of the automatic adjustment controls, or of the engine, the blades can be electrically positioned by a thumb actuated manual switch.

Airscrew diameter is 3,30 m (10'10").

c. Tanks

Fuel tanks: Two self-sealing fuselage tanks with a total capacity of 524 Liters (115.5 gal). Forward tank 232 Liters (51 gal), rear tank 292 Liters (64.5 gal).

A drop tank of 300 Liter (66.2 gal) capacity can be carried on an ETC 501 rack beneath the fuselage.

Oil tank: A circular tank, protected by an armoured nose ring, with a capacity of 55 Liters (12.1 gal).

An armoured ring also protects the oil cooler.

Hydraulic fluid tank (for control unit): The engine mounting ring serves as container. Capacity 5,6 Liters (4.94 qt).

Primer fuel tank: Built into the rear fuel tank. Capacity 3 Liters (2.64 qt).

Behind bulkhead 8 there is also provision for the installation of a GM-1 tank, 85 Liter (18.7 gal) capacity, or an auxiliary fuel tank, 115 Liter (25.3 gal) capacity.

## 5. Equipment

a. Radio equipment

FuG 25a -- IFF transponder unit
FuG 16ZY -- Air-to-air and air-to-ground VHF communications and homing set

b. Built-in armament

Fuselage: 2 x MG 131
Wing-roots: 2 x MG 151/20E
Wings: 2 x MG 151/20E

c. Armament modifications

Various weapons installations are available; the changes apply to the wing mounted weapons only. The sub-designations are as follows:

| | |
|---|---|
| A-8/R1 | 2 x 2 MG 151/20E |
| A-8/R2 | 2 MK 108 |
| A-8/R3 | 2 MK 103 |

# B. Aircraft data

## 1. General measurements

Dimensions:

| | |
|---|---|
| Span | 10,50 m (34'5½") |
| Overall length | 8,95 m (29'4½") |
| Height | 3,95 m (12'11½") |

Wings:

| | |
|---|---|
| Span | 10,50 m (34'5½") |
| Maximum chord | 2,30 m (7'6") |
| Wing area | 18,30 sq m (196.6 sq ft) |

Control surfaces:

| | |
|---|---|
| Horizontal tail area | 2,73 sq m (29.4 sq ft) |
| Vertical tail area | 1,56 sq m (16.8 sq ft) |
| Aileron area | 1,93 sq m (20.7 sq ft) |
| Flap area | 1,69 sq m (18.2 sq ft) |

Undercarriage:

| | |
|---|---|
| Track | 3,50 m (11'6") |
| Main tire dimensions | 700 x 175 |
| Tail tire dimensions | 350 x 135 or 380 x 150 |
| Mainwheel rims | VDM/8-2090 B-2 or A-3; VDM/8-2061 A-1 |
| Tailwheel rims | KPZ/8-3512 B-2 or A-2 |
| Mainwheel brakes | hydraulic |
| Gear retraction | electro-mechanical |

## 2. Engine performance

a. Rated altitude (without dynamic air pressure) supercharger low setting:

| | Altitude ft | Power hp | Speed RPM | Boost psi |
|---|---|---|---|---|
| Take-off and emergency power (3 min max) | 1970 | 1705 | 2700 | 20.2 |
| Climb and combat power (30 min) | 2300 | 1500 | 2400 | 18.7 |
| Maximum endurance cruise | 3940 | 1350 | 2300 | 17.0 |
| Maximum economy cruise | 5900 | 1045 | 2100 | 15.6 lean |

b. Rated altitude (without dynamic air pressure) supercharger high setting:

| | Altitude ft | Power hp | Speed RPM | Boost psi |
|---|---|---|---|---|
| Take-off and emergency power (3 min max) | 18,700 | 1420 | 2700 | 20.2 |
| Climb and combat power (30 min) | 17,400 | 1300 | 2400 | 18.7 |
| Maximum endurance cruise | 18,000 | 1165 | 2300 | 17.0 |
| Maximum economy cruise | 17,700 | 970 | 2100 | 15.6 lean |

## 3. Flight performance

For detailed data see the Flight performance tables.

## 4. Weight data

Mission type:

I: Fighter operations with 2 MG 131s and 4 MG 151/20Es

IV: Fighter-bomber operations with 2 MG 131s, 4 MG 151/20Es, ETC 501 with 4 ETC 50B-1s or 50L-2s on ER-4 adapter

For mission types I and II, 21-cm rocket launchers and also the additional fuselage fuel tank can be installed.

| Mission type | I | II | III | IV |
|---|---|---|---|---|
| | Weight in lbs. | | | |
| Empty weight | 6750 | 6750 | 6750 | 6750 |
| Additional equipment | 858 | 1050 | 990 | 1160 |
| Empty equipped weight | 7608 | 7800 | 7740 | 7910 |
| Pilot | 222 | 222 | 222 | 222 |
| Fuel, forward (51.1 gal) | 402 | 402 | 402 | 402 |
| Fuel, rear (64.4 gal) | 504 | 504 | 504 | 504 |
| Drop tank (66.2 gal) | --- | 516 | --- | --- |
| Oil (12.1 gal) | 111 | 111 | 111 | 111 |
| Ammunition MG 131 (2 x 450 rounds) | 170 | 170 | 170 | 170 |
| Ammunition MG 151/20E (wing-roots) (2 x 250 rounds) | 243 | 243 | 243 | 243 |
| Ammunition MG 151/20E (outboard) (2 x 140 rounds) | 137 | 137 | 137 | 137 |
| Disposable weight on ETC 501 | --- | --- | 1140 | 650 |
| Winter-emergency equipment | 55 | 55 | 55 | 55 |
| Loaded weight | 9452* | 10160* | 10724*** | 10404** |

* When 21-cm projectiles and launchers are installed, the aircraft weight is increased by 624 lbs.

** When the 4 50L-2 releases are fitted to the ER-4 adapter, aircraft weight is decreased by 71 lbs.

*** At this take-off weight, the tires are overloaded. Use increased tire pressure (see Part 2) and take off only from a paved runway or hard, even field.

With the additional fuselage fuel tank, 115 Ltr (25.3 gal) installed, the aircraft weight is increased by about 265 lbs.

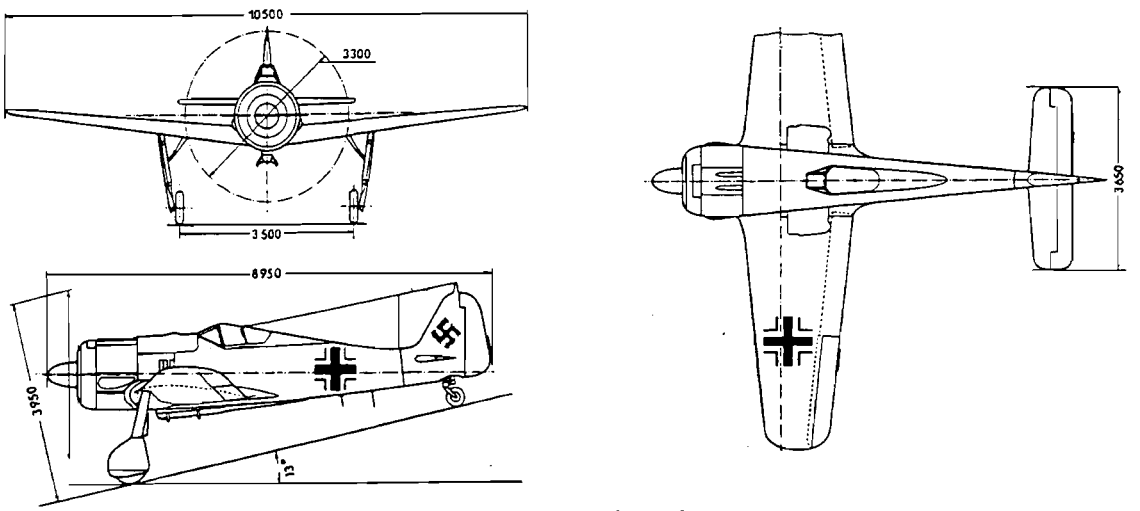


Fig. 2: Major dimensions

## 2. Engine performance

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| | Altitude ft | Power hp | Speed RPM | Boost psi |
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## 3. Flight performance

For detailed data see the Flight performance tables.

## 4. Weight data

Mission type:

I: Fighter operations with 2 MG 131s and 4 MG 151/20Es

II: Fighter operations with 2 MG 131s, 4 MG 151/20Es and increased range

III: Fighter-bomber operations with 2 MG 131s, 4 MG 151/20Es, and ETC 501

IV: Fighter-bomber operations with 2 MG 131s, 4 MG 151/20Es, ETC 501 with 4 ETC 50B-1s or 50L-2s on ER-4 adapter

For mission types I and II, 21-cm rocket launchers and also the additional fuselage fuel tank can be installed.

| Mission type | I | II | III | IV |
|---|---|---|---|---|
| | Weight in lbs. | | | |
| Empty weight | 6750 | 6750 | 6750 | 6750 |
| Additional equipment | 858 | 1050 | 990 | 1160 |
| Empty equipped weight | 7608 | 7800 | 7740 | 7910 |
| Pilot | 222 | 222 | 222 | 222 |
| Fuel, forward (51.1 gal) | 402 | 402 | 402 | 402 |
| Fuel, rear (64.4 gal) | 504 | 504 | 504 | 504 |
| Drop tank (66.2 gal) | --- | 516 | --- | --- |
| Oil (12.1 gal) | 111 | 111 | 111 | 111 |
| Ammunition MG 131 (2 x 450 rounds) | 170 | 170 | 170 | 170 |
| Ammunition MG 151/20E (wing-roots)(2 x 250 rounds) | 243 | 243 | 243 | 243 |
| Ammunition MG 151/20E (outboard)(2 x 140 rounds) | 137 | 137 | 137 | 137 |
| Disposable weight on ETC 501 | --- | --- | 1140 | 650 |
| Winter-emergency equipment | 55 | 55 | 55 | 55 |
| Loaded weight | 9452* | 10160* | 10724*** | 10404** |

* When 21-cm projectiles and launchers are installed, the aircraft weight is increased by 624 lbs.

** When the 4 50L-2 releases are fitted to the ER-4 adapter, aircraft weight is decreased by 71 lbs.

*** At this take-off weight, the tires are overloaded. Use increased tire pressure (see Part 2) and take off only from a paved runway or hard, even field.

With the additional fuselage fuel tank, 115 Ltr (25.3 gal) installed, the aircraft weight is increased by about 265 lbs.

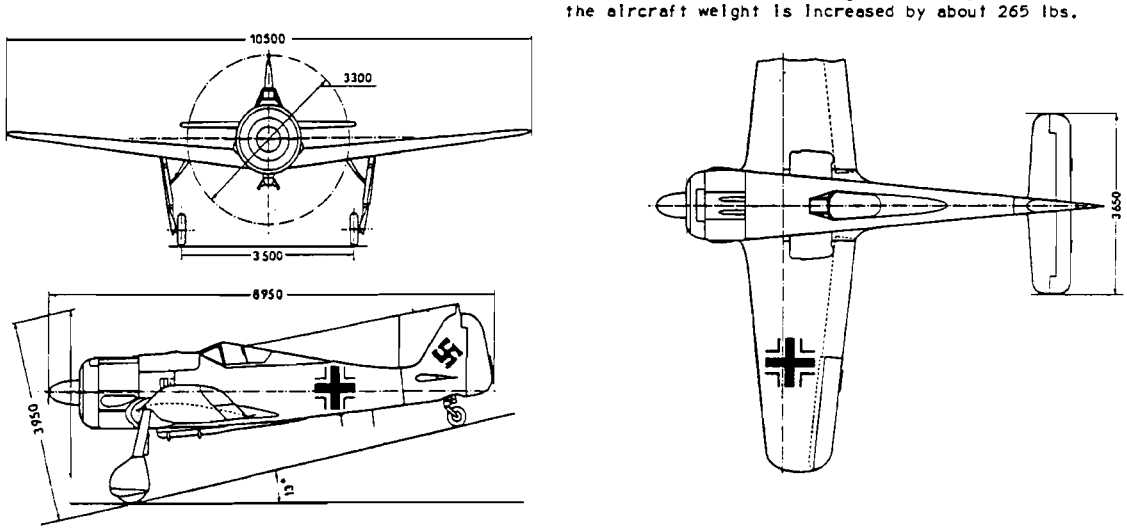



Fig. 2: Major dimensions

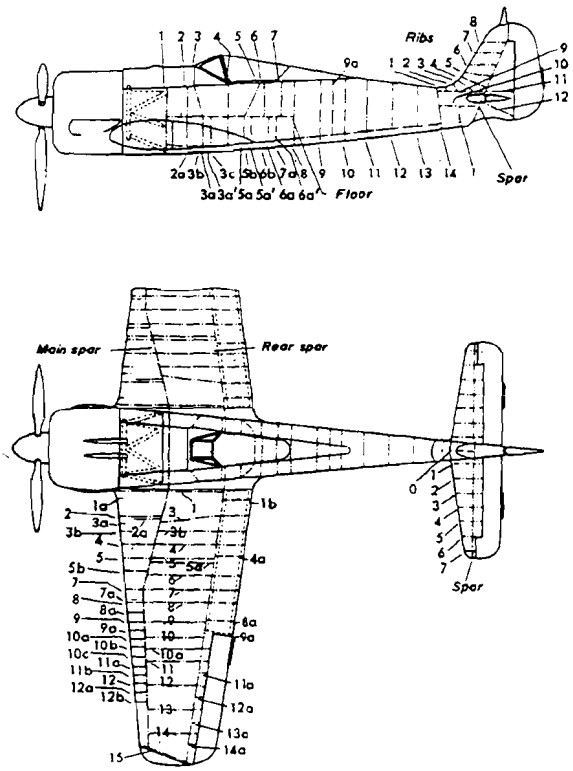



Fig. 3: Bulkhead and rib layout

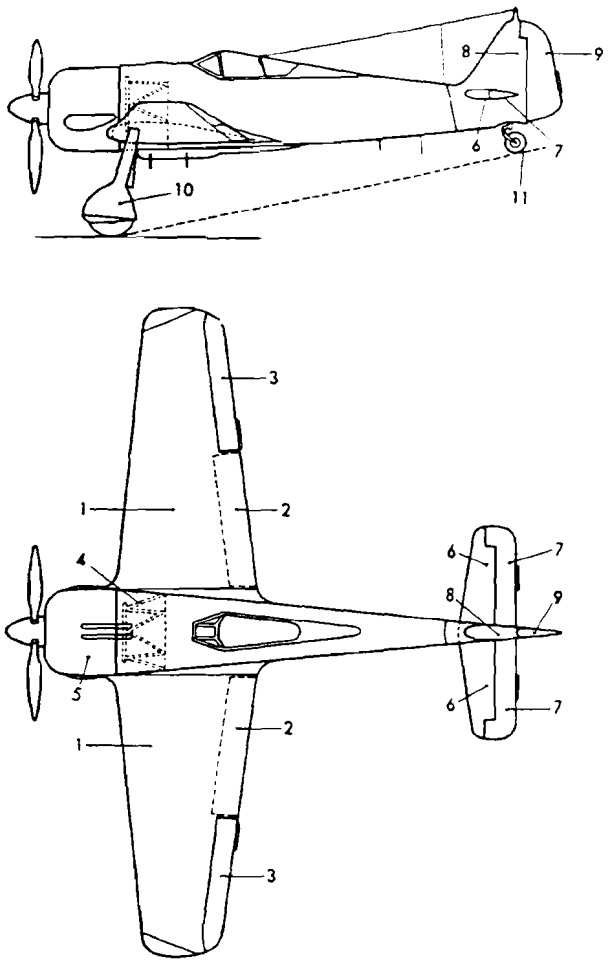


Fig. 4: Major components

## C. Aircraft assembly

### 1. Major components

| No | Designation | Attached to |
|---|---|---|
| 1 | Wings | Fuselage |
| 2 | Flaps | Wings |
| 3 | Allerons | Wings |
| 4 | Engine bearer assembly | Bulkhead 1 |
| 5 | Power unit | Engine bearer assembly |
| 6 | Horizontal stabilizer | Vertical stabilizer spar, spindle drive and anti-stress frame/guide |
| 7 | Elevator | Horizontal stabilizer |
| 8 | Tail unit with vertical stabilizer | Rear fuselage |
| 9 | Rudder | Vertical stabilizer |
| 10 | Undercarriage | Wing and u/c radius struts |
| 11 | Tailwheel unit | Tail unit |

## 2. Covers and panels

| No | Qty | Location | Purpose |
|---|---|---|---|
| 1 | 1 | Engine cowling, top | Engine servicing and inspection |
| 2 | 2 | Engine cowlings, side (rt & left) | Engine servicing and inspection |
| 3 | 2 | Engine cowlings, bottom (rt & left) | Engine servicing and inspection |
| 4 | 1 | Forward fuselage, rt | Forward fuel tank filler pipe cover |
| 5 | 1 | In fuselage armament panel | To open armament panel |
| 6 | 1 | Fuselage armament panel | Fuselage weapons installation and removal |
| 7 | 2 | Bulkhead 1, rt & left | Access to rudder pedals |
| 8 | 2 | Windscreen mounting unit, rt & left | Fuselage weapons installation and removal |
| 9 | 1 | Bulkhead 5, left | Control surfaces locking cord stowage |
| 10 | 1 | Forward fuselage, rt | Rear fuel tank filler pipe cover |
| 11 | 1 | Behind pilot's seat | Stowage bag cover flap |
| 12 | 1 | Rt fuselage between bulkheads 8 & 9 | Oxygen and air tank filler pipe cover |
| 13 | 1 | Forward fuselage, left | Hand hold cover |
| 14 | 1 | Rt fuselage between bulkheads 11 & 12 (omitted) | First aid kit |
| 15 | 2 | Tail unit, rt & left | Installation, servicing and removal of horizontal stabilizer |
| 16 | 2 | Fuselage undersides, rt & left, beneath engine support frame | To cover the u/c lower wheel halves |
| 17 | 2 | Fuselage undersides, rt & left, forward of fuel tank cover | Installation and removal of wing-root weapons ammunition boxes |
| 18 | 2 | Forward fuselage, rt & left | Servicing and inspection of engine accessories |
| 19 | 1 | Forward fuselage, undersides | Fuel tanks installation and removal |
| 20 | 1 | Fuselage undersides, between bulkheads 8 & 9 | Equipment trough cover |
| 21 | 1 | Fuselage undersides, between bulkheads 9 & 10 | Bottom shell access cover |
| 22 | 1 | Forward fuselage, left | Entry step cover plate |
| 23 | 1 | Left fuselage between bulkheads 9 & 10 | Installation and removal of equipment in equipment bay |
| 24 | 1 | Rt fuselage between bulkheads 10 & 11 | External power connection |
| 25 | 2 | Rear fuselage lifting tube | Lifting tube covers |
| 26 | 1 | Vertical stabilizer, left | Servicing tailwheel unit and vertical stabilizer |
| 27 | 2 | Wing lower surfaces, rt & left | Extension of u/c fairings when ETC 501 fitted |
| 28 | 2 | Wing lower surfaces, rt & left | Undercarriage lower fairings |
| 29 | 2 | Wing roots, rt & left | Servicing, installation and removal of wing-root weapons |
| 30 | 2 | Wing lower surfaces, rt & left | Undercarriage upper fairing |
| 31 | 2 | Wing leading edge, rt & left, between nose ribs 7 & 7a | Centre wing leading edge cap |
| 32 | 4 | Wing lower surfaces, 2 per side (left & rt), between mid- | Installation, servicing and removal of flap drive motors |
| 33 | 2 | Wing lower surfaces, between mid-ribs 6 & 7 | Installation and removal of u/c. Removal of wing gun cartridge casings |
| 34 | 2 | Wing lower surfaces, between mid-ribs 7 & 9 | Installation, servicing and removal of wing guns |
| 35 | 2 | Wing lower surfaces, between mid-ribs 9 & 10 | Servicing aileron controls |
| 36 | 1 | Rt fuselage between bulkheads 6 & 8 | Radio bat access panel |
| 37 | 1 | Left fuselage between bulkheads 9 & 9a | Supplementary tank filler pipe cover (GM-1 or extra fuel tank) |

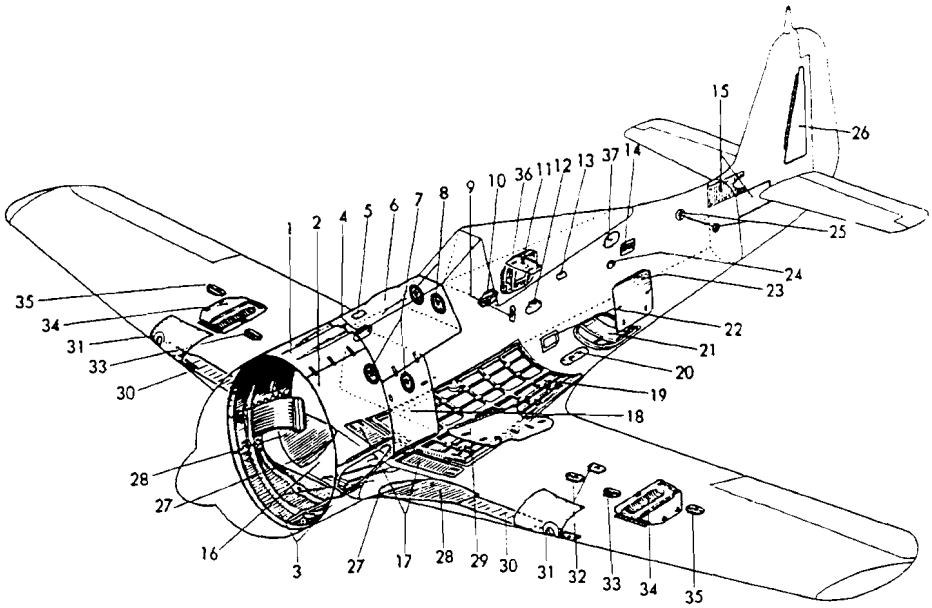



Fig. 5: Covers and panels

# II. General maintenance instructions

## A. General servicing instructions

This section includes all instructions required for general servicing duties.

### 1. Threaded plugs

Before use, carefully clean threads with a clean rag. Due to the danger of explosion, ensure that Oxygen connections are kept free of oil and grease. To prevent seizure of bolt threads, smear them with Graphite paste before use. Cover screws with tape after removal.

### 2. Loose rivets

In deciding whether or not a rivet is loose, consider the following:

1. Truly loose rivets rarely occur; they are almost always due to poor workmanship.
2. Rivets with black rims around their heads are often considered to be loose; from past experience, however, they are normally not. The formation of these rims is caused by a natural 'setting', due to stresses within deeply molded metal panelling (see LgN 11 11 9 Sheet 1).
3. Rivets are loose:
   a) when they can be moved by a probe or similar instrument;
   b) when they are seated at an oblique angle (loose rivets which were pushed through the skin at an angle);
   c) when a 0,1 mm thick probe can be inserted between the rivet head and the aircraft skin up to the rivet shaft (caused by joining a strong component to a weak skin).
4. Rivets are not loose:
   a) when they only have black rims;
   b) when a probe cannot be pushed under the rivet head.
5. Rivets, as described in paras 3a) through c), must be replaced during overhaul.

### 3. Push-rod connections

During installation, the depth of push-rod connector screws can be checked using the connector inspection hole. When inserted, the inspection probe must contact the screw threads. Protect ball-bearing bushed push-rods against dirt (grease and wrap in oil paper).

## 4. Covers and panels

Covers and access panels must fit properly and close fully. The engine cover tension locks must, when locked, remain under tension. They are so designed that the lock cover can be closed with normal hand pressure.

## 5. Pipes and tubes

All open pipe ends are to be sealed with caps, or other similar means, to prevent the entry of dirt and foreign objects. Lines, where abrasion cannot be avoided, must be covered with leather. Before the engine is first run, and before installation of its fittings, the lines must be checked with air pressure. The lines to be checked must be tightly sealed and then tested using a line pressure about 50% greater than maximum system pressure. After the air is shut off, the lines must not lose more than 5% pressure in 5 minutes. Leakage inspection of fluid bearing lines is carried out while the engine is running on a test stand. Upon their reaching system operating pressure, check the lines for leaks.

Pipes and tubes are coded with coloured rings, or glued-on coloured bands, in accordance with DIN 5, to identify the circuits to which they belong.

## 6. Cleaning the painted surfaces

Check the condition of the external painted surfaces. Carefully remove oil and engine exhaust deposits with "Ikarol 237" detergent. Then, thoroughly rinse off these areas with water and dry them. Cleaning the external paint with gas, Benzol, terpentine or alcohol mixtures, even if they are in diluted solution or in paint thinner, is forbidden. These solvents will loosen the paint.

To recognize and then remove corrosion damage, the aircraft must be cleaned from time to time, and especially during overhaul.

After dusting off the outside surfaces with a soft-haired brush, wash off the firmly fixed dirt with clean, luke-warm water. Or, wash them with a weak, non-alkali soap and rinse with water. Afterwards, wipe off the surfaces with sponges and rags. Clean the main and tail wheels frequently with water and brushes to remove any dirt. The "Paint Chart" gives information as to the care of paint applied to steel and aluminum parts.

## 7. Cleaning plexiglass

To remove dust and dirt from Plexiglass surfaces, clean them with water at 40°C to 50°C, applied with a natural or viscous sponge, and then buff dry with a polishing cloth. To cut through the heavier dirt, add liquid soap or soda. "Glasurit-Aircraft cleaner" with water, in a 1:20 solution, can also be used. When buffing a wet glass panel, put some "Plexipol II" on the buffing cloth. The use of abresive or oily polishing -, scouring -, or varnish compounds, or of gas or Benzol, is forbidden (the glass panels will become opaque). Remove varnish, grease, oil or paint with "Sangajol".

During buffing, remove any remaining grease and oil with "Plexipol II". Rub small scratches and opaque glass panels with "Plexipol I" until the problem is eliminated. Then finish off the job with "Plexipol II". Small scratches can also be removed mechanically with a twill fabric buffing wheel and polishing compound.

Before painting the aircraft, cover all glassed areas with oil-paper. Further servicing information is included in Luftwaffe pamphlet No. 1/96 of 3.8.1938--"Flight Safety Inspections and Required Equipment". The same pamphlet includes maintenance instructions for the bullet-resistant glass panel and the windscreen side panels.

## 8. Overhaul

TAGL No. 257/42 provides for an airframe inspection cycle of 200/5. This means that after 200 engine hours a partial overhaul, and after five partial overhauls a complete overhaul takes place. An inspection cycle of 100/2 has been set for the BMW engine. A complete overhaul is to be carried out only at a Maintenance Depot. If, over the space of a year, no partial overhaul is carried out on the engine or airframe, a special inspection is to be carried out to confirm the serviceable condition of that airframe or engine, and so permit it to retain its status. After 200 take-offs carry out an undercarriage actuation test.

# B. General instructions for aircraft assembly and disassembly

## 1. Basic instructions

Avoid the use of unsuitable tools. Use special tools only for their prescribed tasks. Carefully plan each job before beginning it. Ensure that the electrical circuits are disconnected so that inadvertant tripping of switches won't cause an accident. Fire-fighting equipment should be positioned near the work area. DO NOT approach an aircraft with an open flame, or smoke in the work area. Only use electrical equipment that is fitted with a spark suppressor. During drilling, ensure that either no red-hot chips are generated or that adequate cooling of the drill bit is maintained.

## 2. Aircraft walk zones

For working in or on the aircraft, wear only soft soled shoes. For stepping on the outer wing panels, first lay the mats provided.

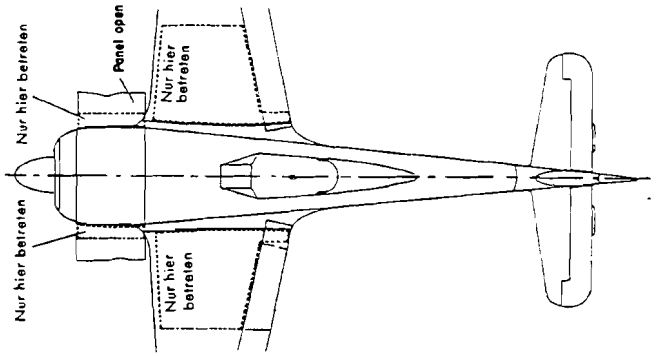



Fig. 6: Aircraft walk zones

## 3. Placement of parts and tools

To avoid damage to removed parts, remove them completely, on padded sheeting or matting, out of the work area. Tools required for servicing and overhaul must be carefully placed on padded sheeting on the aircraft. After job completion, a foreign objects check must be carried out before the first flight.

## 4. Marking of parts

For major disassembly tasks it is advisable to immediately mark each removed part, and so ensure a smooth work flow during reassembly. Special care must be taken to correctly mark the control stick control rod attachment points and the related push-rods.

## 5. Control wire and cable tensions

Cable tension is to be measured with an FW-tension meter. New cables must be prestretched after splicing.

# C. Lifting and trestling

## 1. Lifting

The short lifting cable is placed around the rod in the rear fuselage, the long one around the lifting lugs on the engine mounting ring; both cables are attached to the same lifting hook. After lifting, the aircraft hangs in a well-balanced position; it is steered, during movement, by a cable attached to the tailwheel.

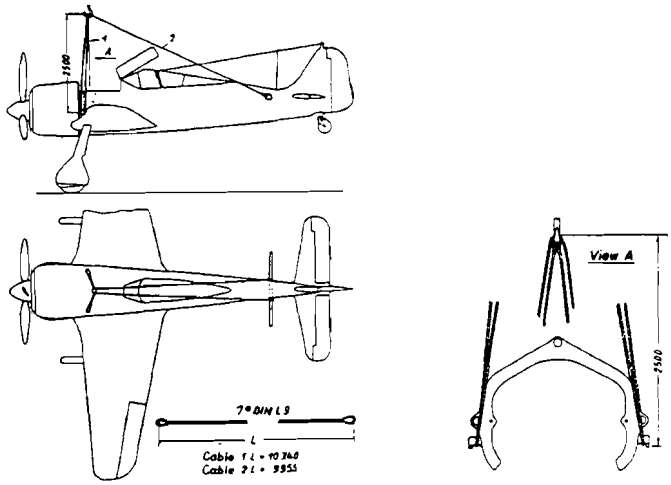



Fig. 7: Lifting the aircraft

## 2. Trestling

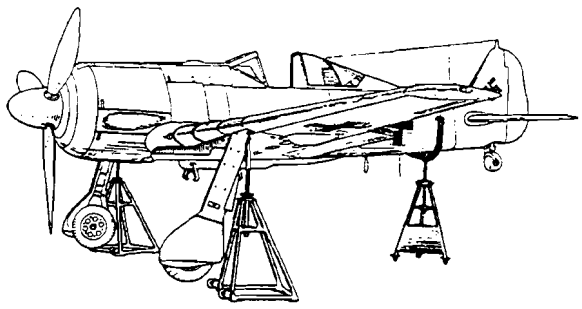


Fig. 8*: Trestling the aircraft

The aircraft is to be trestled only on the trestle points provided on the undersides of the right and left wing panels behind the undercarriage pivot points. The rear fuselage is placed in a sling, lifted, and after placement of the lifting rod onto the rear fuselage trestle (W8-190.00-102), is released..

Important!

The rear fuselage trestle must have a 70 kg (157 lb) weight added to it when the complete aircraft, including engine and tail unit, is trestled; when the tail unit is removed, this weight must be increased to 175 kg (386 lb).

If a rear fuselage trestle (W8-190.00-102) is not

available, a makeshift arrangement is possible. In this, the rear fuselage is supported by a sufficiently long lifting bar, between two suitable trestles and is weighed down as indicated above.

The rear fuselage trestle, W8-190.00-105, is used for trestling only the aircraft tail. The trestle is placed in the designated position beneath the rear fuselage, and wheel chocks are placed both in front of and behind the mainwheels.

## D. Towing

Towing can be carried out with either a towing crew or towing vehicle. When towing with a vehicle, avoid pulling it rearwards (Tail strut fracture).

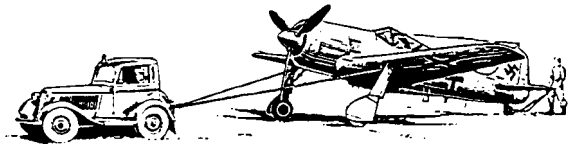


Fig. 9: Towing with a towing vehicle

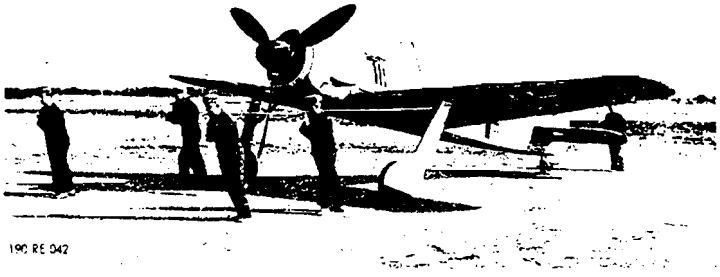



Fig. 10*: Towing forward with a towing crew

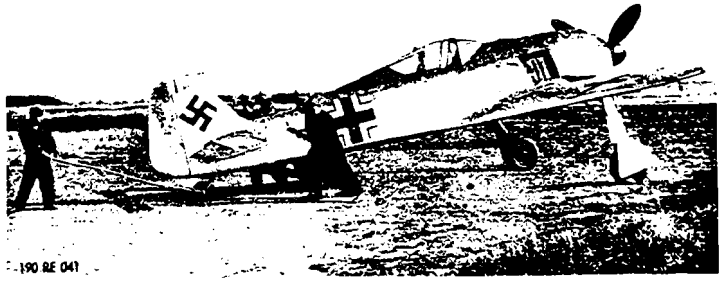



Fig. 11*: Towing rearward with a towing crew

The towing cables are inserted through loops on the upper shock struts. A forked bar attached to the tailwheel is used to steer the aircraft. Avoid backing up the aircraft during towing.

When towing an aircraft with a towing crew, ensure that the aircraft control surfaces are not pushed against.

To tow the aircraft rearwards using a towing crew, slide a pipe (or tube), sufficiently long to allow room for two men pushing per side, through the lifting tube. One man handles the forked tailwheel bar.

Before towing, first ensure that the tailwheel locking unit is disengaged.

## E. Anchoring and covering

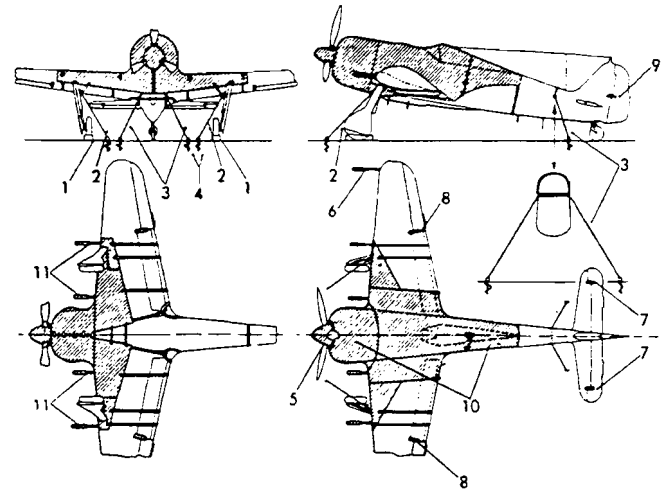



Fig. 12: Aircraft anchored and covered

Aircraft left standing in the open must be anchored, to four ground anchors, and covered. Place wheel chocks in front of and behind each mainwheel. The control surfaces locking cord is hooked onto the left rudder pedal and connected to the control column. The various control surfaces are held in position by gust locks. For temorary parking in calm weather conditions, use of the control surfaces locking cord is sufficient.

At the front, the aircraft is anchored by the towing loops; at the rear; by the rear fuselage lifting tube.

The aircraft rear anchoring line is inserted in one

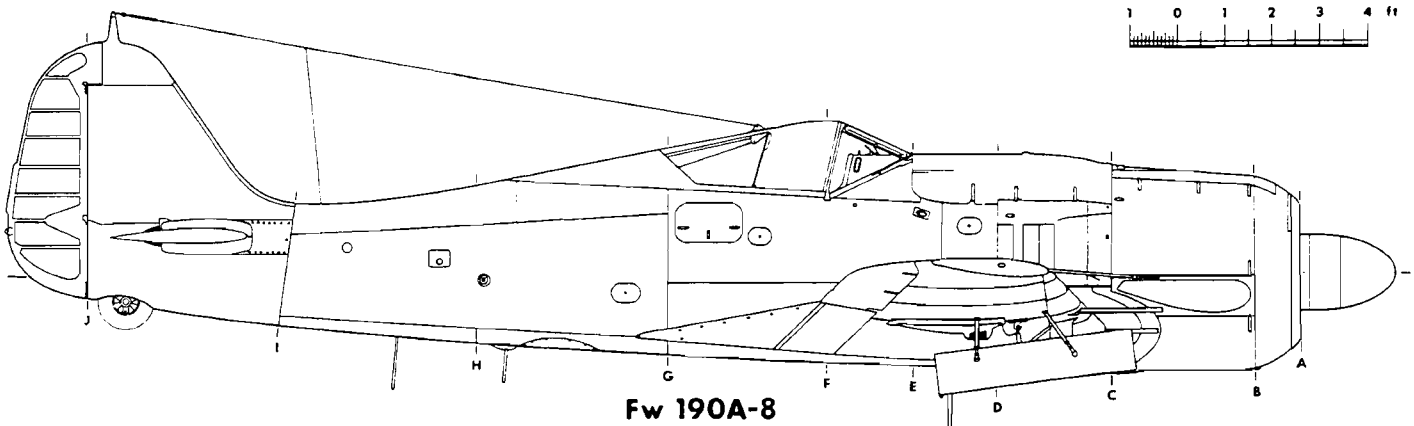
side of the lifting tube, is pulled slightly more than half way through, wrapped over the fuselage, reinserted in the lifting tube, and pulled through to the other side.

The airscrew must be so positioned that one propeller blade points vertically upwards.

The anchoring lines are pulled tight. In case of rain, the lines must be loosened as they will contract when wettened. On the other hand, in stormy weather (high winds), the lines must be tightened.

The powerplant and forward fuselage are covered by a single sheet. Pullover covers are also provided for the airscrew spinner, the pitot tube and the cannon barrels.

▽

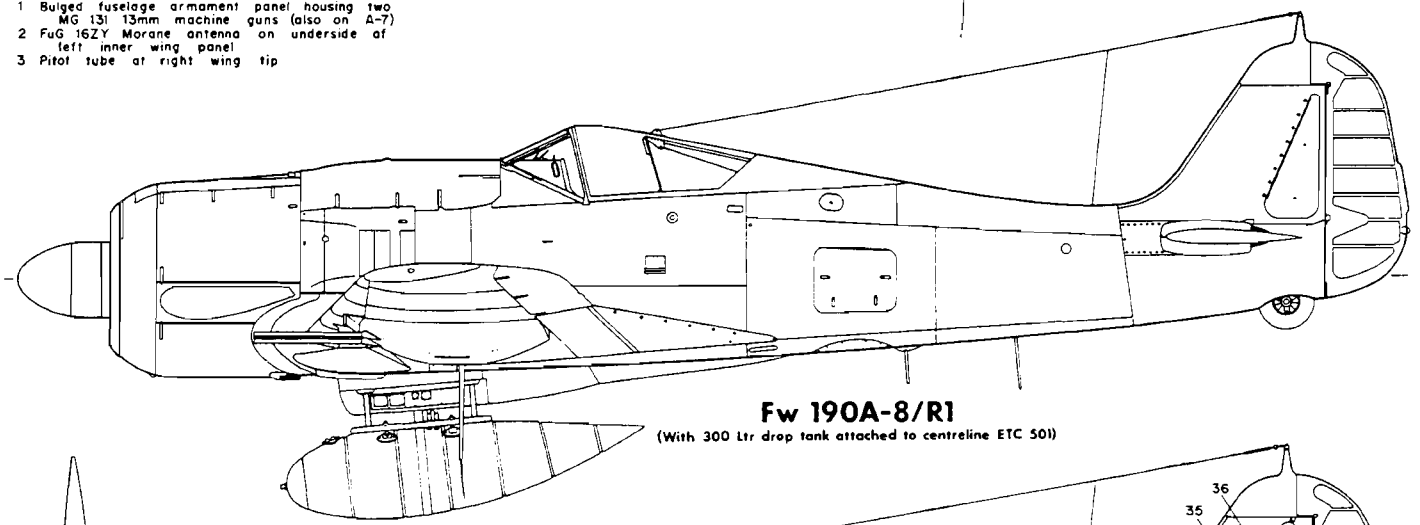



## Fw 190A-8

(With underwing 21-cm BR weapons system)

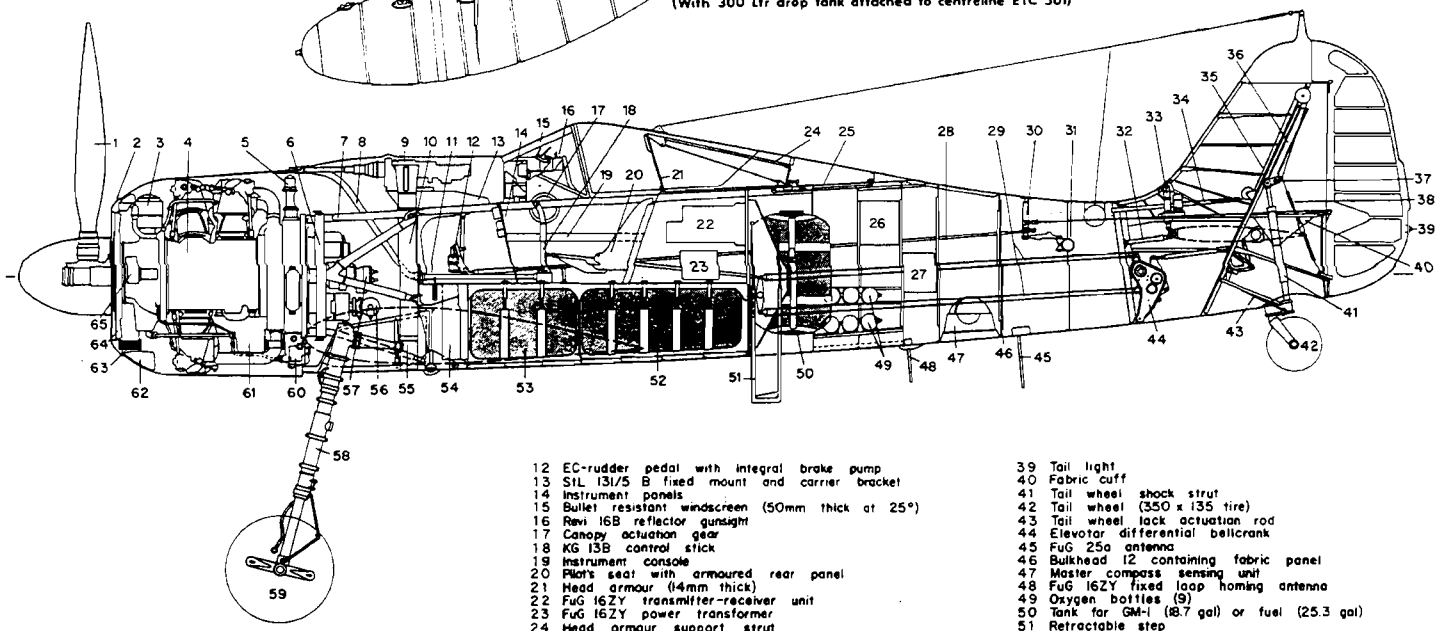
**Recognizing the Fw 190A-8:**

1 Bulged fuselage armament panel housing two MG 131 13mm machine guns (also on A-7)
2 FuG 16ZY Morane antenna on underside of left inner wing panel
3 Pitot tube at right wing tip

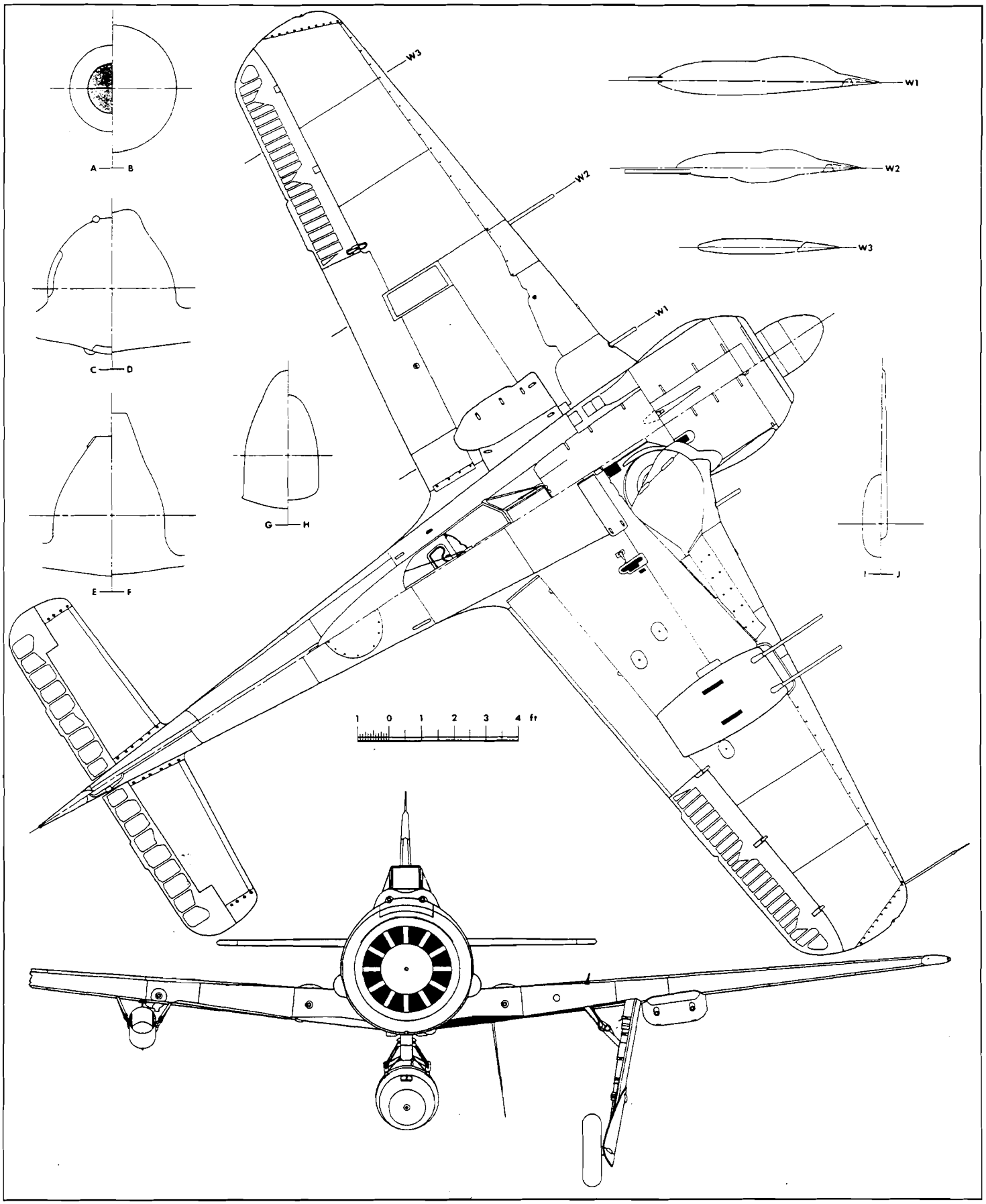


## Fw 190A-8/R1

(With 300 Ltr drop tank attached to centreline ETC 501)




1 VDM 3-bladed, adjustable pitch, constant speed, airscrew (10'10" dia.)
2 Oil cooler nose ring (5mm armour)
3 Bosch twin magneto
4 BMW 801D-2 14-cylinder radial engine (1700 hp)
5 Synchronization gear for wing-root weapons
6 Engine mounting ring with integral control unit oil tank
7 Engine bearer assembly
8 Cockpit fresh air pipe
9 MG 131 13mm machine gun
10 Fuselage weapon ammunition box (400 rounds per gun)
11 Aileron control actuation rod
12 EC-rudder pedal with integral brake pump
13 StL 131/5 B fixed mount and carrier bracket
14 Instrument panels
15 Bullet resistant windscreen (50mm thick at 25°)
16 Revi 16B reflector gunsight
17 Canopy actuation gear
18 KG 13B control stick
19 Instrument console
20 Pilot's seat with armoured rear panel
21 Head armour (14mm thick)
22 FuG 16ZY transmitter-receiver unit
23 FuG 16ZY power transformer
24 Head armour support strut
25 Canopy centre guide tube (contains explosive charge for canopy jettison)
26 FuG 25a transmitter-receiver unit
27 FuG 16ZY homer bearing converter
28 DUZ rudder actuation rods
29 Elevator control cables
30 Rudder deflection reduction gear
31 Rear fuselage lifting tube
32 Triangular stress frame
33 Stabilizer trim drive motor
34 Tail wheel retraction cable guide tube
35 Retraction cable
36 Tail wheel shock strut guide
37 Tail wheel extension lock
38 Tail wheel extension spring
39 Tail light
40 Fabric cuff
41 Tail wheel shock strut
42 Tail wheel (350 x 135 tire)
43 Tail wheel lock actuation rod
44 Elevator differential bellcrank
45 FuG 25a antenna
46 Bulkhead 12 containing fabric panel
47 Master compass sensing unit
48 FuG 16ZY fixed loop homing antenna
49 Oxygen bottles (9)
50 Tank for GM-1 (18.7 gal) or fuel (25.3 gal)
51 Retractable step
52 Fuselage rear fuel tank (64.5 gal)
53 Fuselage forward fuel tank (51 gal)
54 Wing root gun ammunition box (250 rounds)
55 Link belt segment/cartridge casing chute for fuselage weapons
56 Fuel de-aerator
57 Engine starter unit
58 Main undercarriage shock strut
59 Main wheel (700 x 175 tire)
60 Engine oil pump
61 Oil sump
62 Circular oil tank (12.1 gal)
63 Circular oil cooler
64 Engine cooling fan
65 Propeller pitch adjustment mechanism


A — B
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E — F
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W1
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D. (Luft) T. 2190 A-8

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# Fw 190 A-8

## Aircraft Handbook

**Part 1**

**Fuselage**

(Effective July 1944)

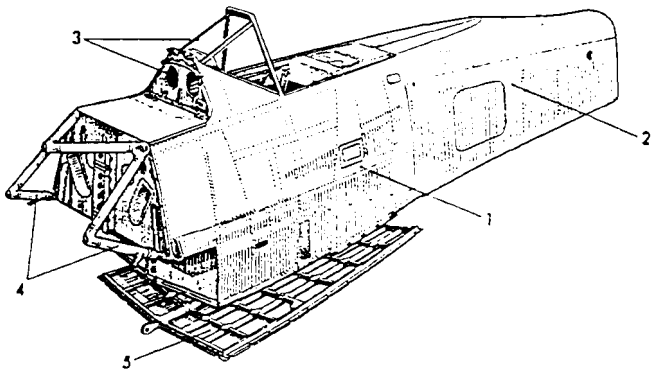
Issued September 1944

# Description

The Dural fuselage, of monocoque construction, is of circular cross-section at the forward end for matching to the radial engine; and of oval cross-section at the rear end for matching to the tail unit.

The fuselage is divided into a forward section (1,1) and a rear section (1,2).

The fuselage forward section comprises the windscreen framework (1,3), the engine bearer assembly (1,4), and the fuel tank cover panel (1,5).




1 Forward section
2 Rear section
3 Windscreen framework
4 Engine bearer assembly
5 Fuel tank cover panel

Fig. 1*: Fuselage

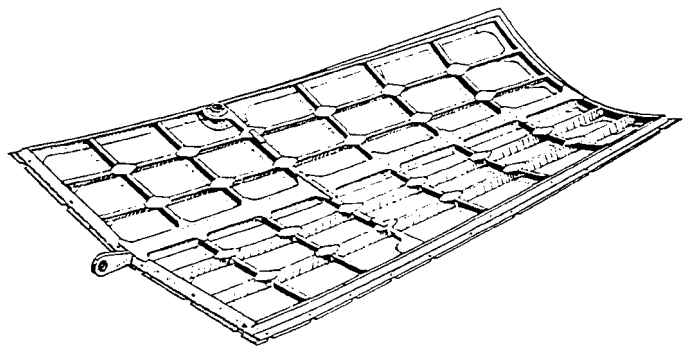


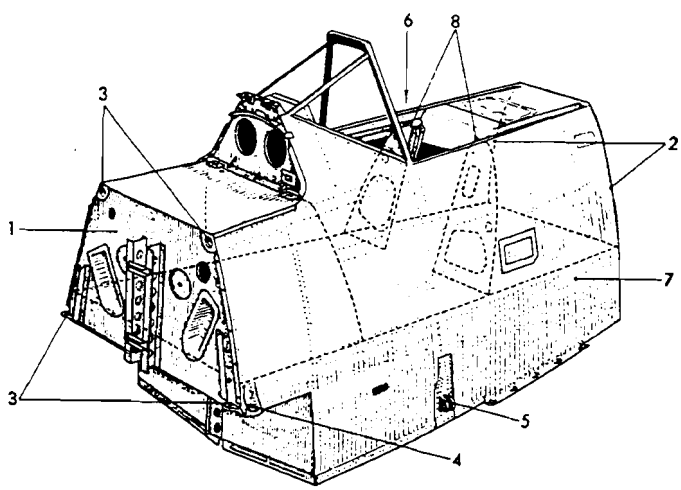
Fig. 3: Fuel tank cover panel

The forward fuselage (Fig. 2) extends from the firewall (2,1) to Bulkhead 8 (2,2). On the firewall are the attachment points for both the engine bearer assembly (2,3) and the wing main spar (2,4). The wing rear spar attachment points are on both sides of Bulkhead 4.

It contains the cockpit (2,6) and the fuel tank compartment (2,7). The latter is enclosed by the fuel tank cover panel (Fig. 3).

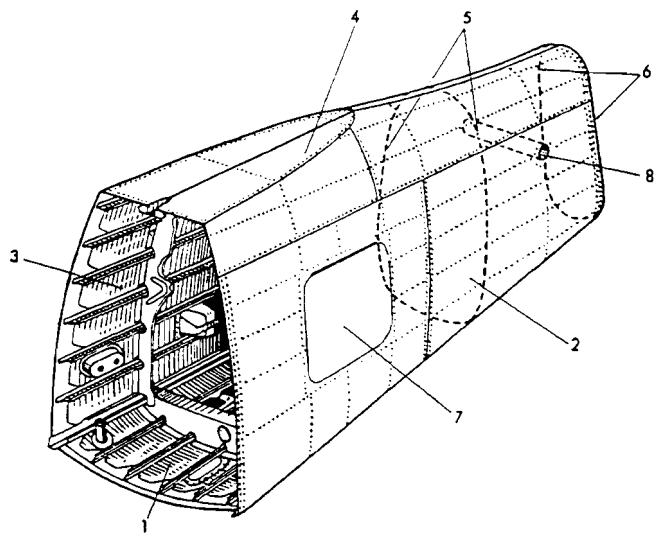
The seat mounting frame (2,8) closes off the rear of the cockpit. It comprises two frame segments, attached to the fuselage sides, and includes integral seat adjustment channels.

## A. Forward fuselage




1 Firewall
2 Bulkhead 8
3 Engine bearer assembly attachment points
4 Wing forward spar attachment point
5 Rear spar attachment point
6 Cockpit
7 Fuel tank compartment
8 Seat mounting frame

Fig. 2: Forward fuselage



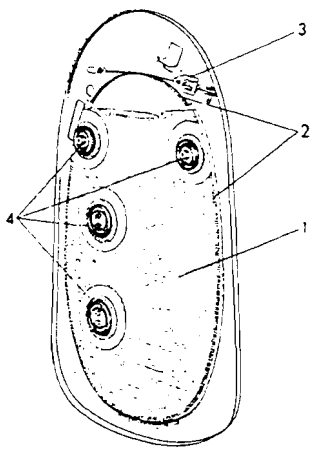

1 Lower shell
2 Left shell
3 Right shell
4 Upper decking
5 Fabric panel
6 Tail unit attachment frame
7 Equipment access panel
8 Rear fuselage lifting tube

Fig. 4*: Rear fuselage

## B. Rear fuselage

The rear fuselage (Fig. 4) consists of a lower shell (4,1), left and right shells (4,2 and 4,3), an upper decking (4,4), as well as a fabric panel (4,5), and a rear frame containing mounting points for the tail unit (4,6).

The shells are composed of frame segments, longerons and outer skin panels. The lower frame shell segments are so constructed as to also serve as platforms for the Oxygen bottles, transformers, etc.; while the side shell frame segments carry the W/T platform supports. The equipment access panel (4,7) is located in the left shell, its hinge being screwed onto the shell. The panel, internally strengthened, is held open by a folded strut, and is held closed by four quick-release fasteners which slide into the side shell. A tube (4,8), designed to accomodate a lifting bar, forms part of Bulkhead 13. The upper decking (4,4) is composed of two skin panels, riveted to a U-shaped channel which acts as a guide for the cockpit canopy centre roller.



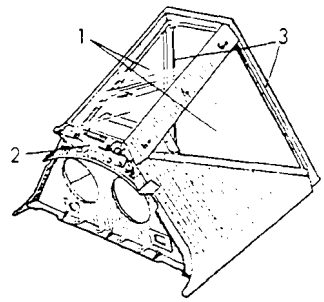

1 Fabric panel
2 Cable
3 Tension lock
4 Rubber collars

Fig. 5: Sealed panel

A sealed panel (Fig. 5) prevents engine exhaust fumes from being sucked forward into the cockpit. The cellulose acetate line sheet (5,1) is held in place by a cable (5,2) which is stretched over the rolled inner edge of the frame (Bulkhead 12), and is secured by a tension lock (5,3). Rubber collars (5,4), enclosing alloy bushings, permit the passage of control cables through the panel.

## C. Windscreen unit

The windscreen unit (Fig. 6) is panelled with three sheets of bullet resistant glass (6,1). The mounting



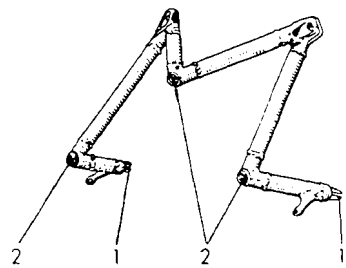

1 Bullet resistant glass panels
2 Windscreen mounting bracket
3 Steel frame (Turnover pylon)

Fig. 6*: Windscreen unit

bracket (6,2) serves also as weapon, gunsight and instrument panel carrier unit, as well as fuselage armament cover hinge point.

A self-supporting welded steel frame (6,3) forms the rear support for the glass panels.

## D. Engine bearer assembly




1 Slotted lugs
2 Threaded sockets

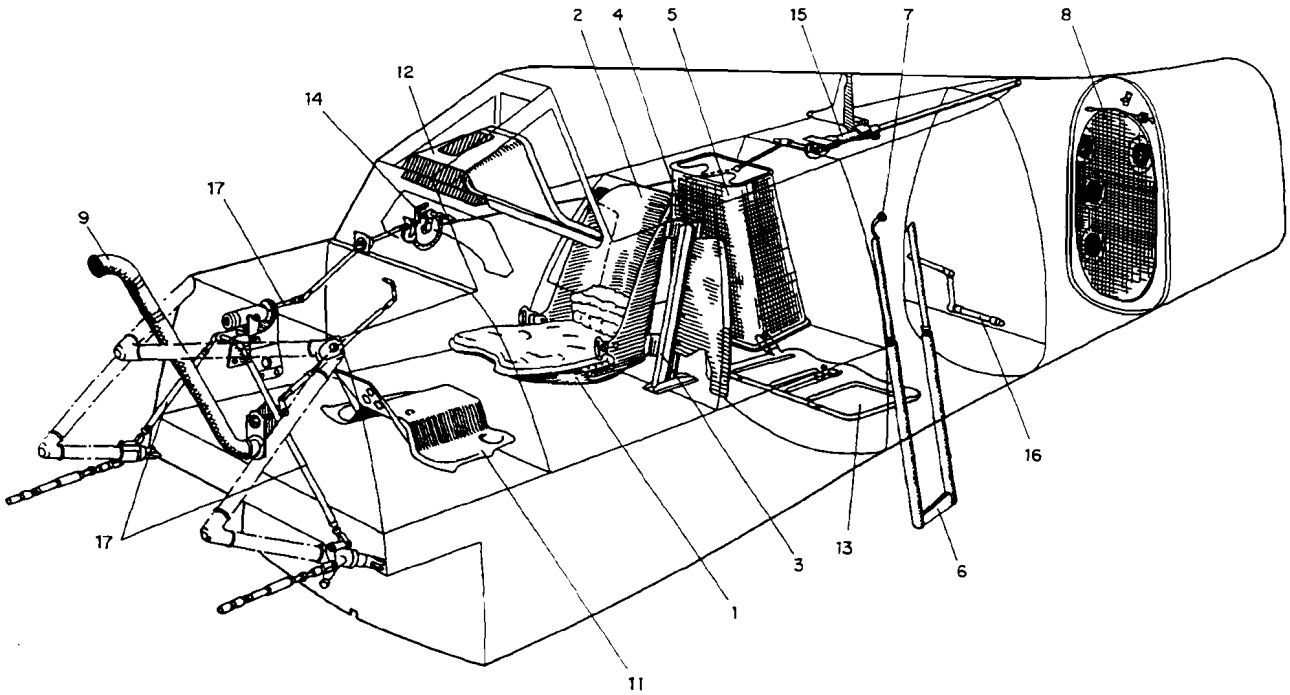
Fig. 7: Engine bearer assembly

The engine bearer assembly, onto which the engine mounting ring is secured, is built up of steel tubing and welded fittings. These fittings include threaded sockets (7,2) for attachment to the engine mounting ring, and slotted lugs (7,1) for attachment to the firewall.

## E. Fuselage fittings

The pilot's seat consists of a Dural pan (8,1) riveted to an armoured back plate (8,2). The seat is attached to the channel sections (8,3) at four points; seat adjustment levers (8,4) are mounted on the upper attachment points. To lock the seat into position, lift the levers; this inserts the lock studs into detents in the slide rails. To release the seat, simply rotate the levers inwards.

A baggage compartment (8,5) is situated behind the




1 Seat pan with cushion
2 Armoured back plate
3 Seat guide channels
4 Seat adjustment lever
5 Baggage compartment
6 Cockpit entrance ladder
7 Ladder extension button
8 Fabric panel
9 Fresh air tube
10 Cockpit ventilation actuation rod
11 Fuel tank cover plate
12 Instrument panel cowling
13 Equipment bearer unit
14 Canopy drive unit
15 Canopy jettison mechanism
16 Starter crank
17 Cooling flap actuation gear

Fig. 8: Fuselage fittings

pilot's seat.

A retractable entrance ladder (8,6) is positioned on the fuselage left side. It is locked in the retracted position by a spring-loaded lever in the ladder guide rods. To lower the ladder, depress the ladder extension button (8,7).

Fresh air enters the cockpit through a ventilation tube (8,9). A valve, positioned on the firewall, permits full adjustment of the air flow. A rod leads from the valve to a lever on Bulkhead 3; the lever is actuated by the right foot.

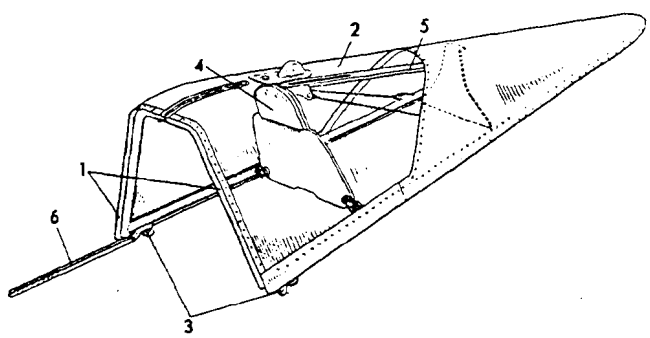
For the functioning of the cooling flap actuation rods, see Part 7.

## F. Fuselage covering

The fuselage covering comprises the units listed in Fig. 9 (see the following page).

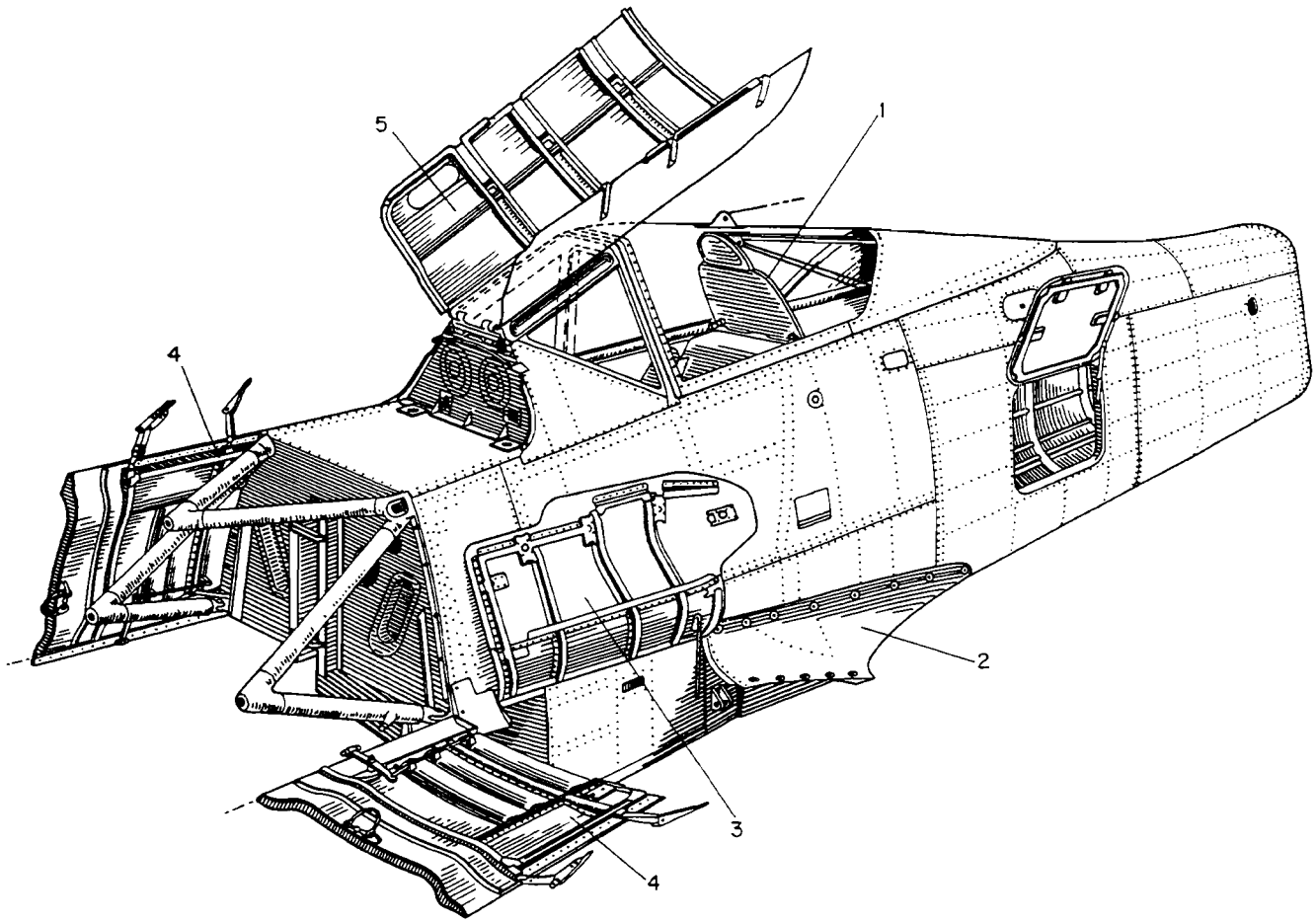
When the aircraft is trestled, secure the fuselage armament cover (9,5) against inadvertent closing by hooking the shoulder straps onto it.

The wing-root armament doors (9,3) are held open by brace struts.




1 Steel framework
2 Plexiglass panelling
3 Rollers
4 Head armour
5 Head armour support strut
6 Canopy drive section

Fig. 10: Canopy




1 Canopy
2 Wing-root fillet
3 Wing-root armament door
4 Fuselage side panels
5 Fuselage armament door

Fig. 9: Fuselage covering

## 1. Canopy

The canopy (Fig. 10) consists of a steel frame (10,1) with Plexiglass panelling (10,2). The unit moves on ball-bearing rollers (10,3) in channels set in the fuselage upper decking. Within the canopy is positioned the head armour (10,4) which is held in place by a steel retaining rod (10,5) and by two cables.

The canopy is opened and closed by a hand crank (11,1), driving a rack-and-pinion gear, located on the cockpit right wall. To prevent the canopy from being moved rearwards beyond the end of the drive section (11,2), its last tooth is located 39 mm (1½ in) from the forward end of the section. At rest, the spring-loaded crank handle is held in place by a stud in the handle (11,3); this stud fits into matching holes arranged around the circumference of the circular base plate (11,4). To turn the crank, keep the handle pulled out. The canopy can be opened from outside by simultaneously turning and depressing a spring-loaded, notched thumb screw, positioned over the crank axle on the fuselage right side.

The canopy is jettisoned by an explosive charge (11,12) which is actuated by firmly depressing the red jettison lever (11,5). As the lever is depressed, it causes a bushed strut (11,20) to raise the hood drive section (11,2) from the pinion wheel (11,6); and simultaneously rotates the safety pawl (11,10) to release the firing pin (11,11).

The outer tube (11,13) of the jettisoning mechanism is attached to the rear of the canopy. It contains the inner, or firing, tube (11,14) which is fitted with three sealing rings to maintain a tight fit. The outer tube which serves as the canopy guide

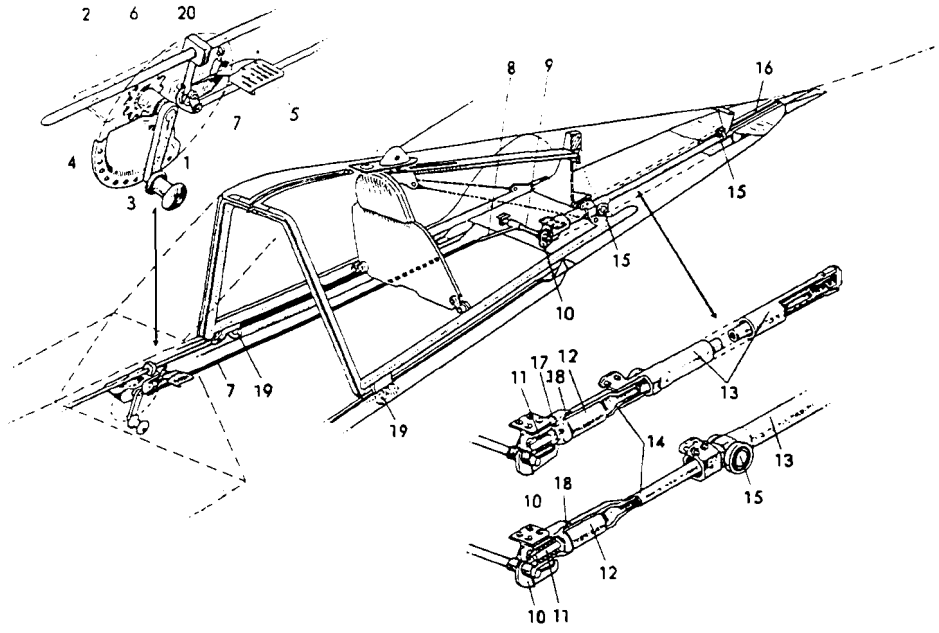



Fig. 11: Canopy jettison mechanism

during normal opening and closing, is fitted with two rollers (11,15) which move inside the upper decking channel section (11,16).

If the aircraft is to remain on the ground for any length of time, safety the jettison mechanism with a wing screw (11,17).

## 2. Fuselage side panels

By hooking the attached cables to the engine bearer assembly, the side panels (9,4) can be positioned horizontally. When so positioned they must not be stepped on.

### Opening and closing the side panels

By opening or closing these panels in an incorrect sequence, one can, in tightening the screw lock (12,4), exert a force sufficient to either distort the panel rivet holes or the panel itself. The following sequence MUST, therefore, be followed in opening or closing the panels:

To open:

a) Open the quick-release fastener (12,1) and the toggle clips (12,2);

b) Loosen the screw lock (12,4). The hook (12,3) will automatically spring out of its guide.

To close:

a) Lightly position the panel; then with the head of the screw, probe for its attachment base;

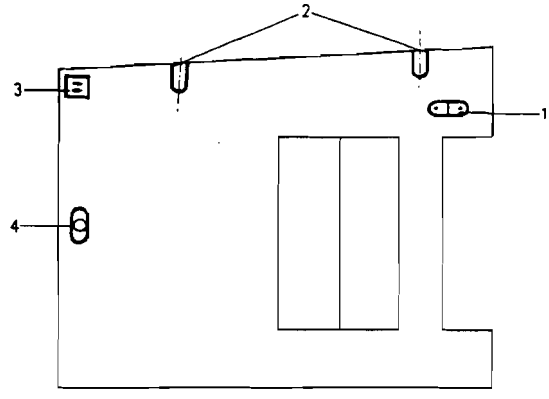



Fig. 12: Fuselage side panel

b) Place the two clips in position, but don't lock them. Leave the quick-release fastener open;

c) Turn the screw lock until further rotation becomes difficult. At this point the panel has the required tension;

d) Give the corner of the panel over the hook a solid blow of the fist to force the hook over a rounded horn on the engine mounting ring;

e) Rotate the screw lock until its tight; then lock the clips and the fastener.

# G. Equipment

## 1. Radio installation

The radio gear is located in the forward fuselage between Bulkheads 6 and 8. A hinged panel on the fuselage right side provides access for equipment adjustment.

This gear is provided with two antenna units; one, a T-shaped wire, stretches between the vertical stabilizer and the sliding canopy, entering the rear upper fuselage via a frequency matching device; the second, a fixed rod, is located beneath the left inner wing panel.

## 2. First aid kit

The first aid kit is contained in a holder on the fuselage right side. Access to it is provided by a hinged cover secured by quick-release fasteners.

## 3. Oxygen bottles

The Oxygen equipment consists of three sets of spherical steel bottles, all mounted on a rack in the equipment bay.

## 4. Flare pistol

The flare pistol is secured by a rubber sleeve mounted on the cockpit right side at Bulkhead 3. Its ammunition is stored beneath the right instrument console.

▽

D. (Luft) T. 2190 A-8

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# Fw 190 A-8

## Aircraft Handbook

**Part 2**

**Undercarriage**

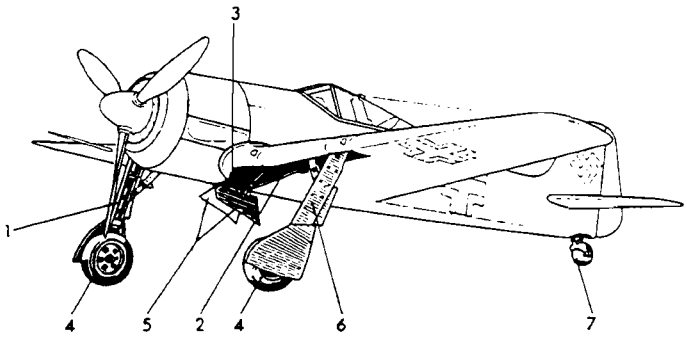
**(Effective July 1944)**

**Issued September 1944**

# I. Description

## A. Main undercarriage unit

### 1. General




1 Single strut main gear
2 Underwing aperture
3 Fuselage aperture
4 Main wheels
5 Wheel covers
6 Undercarriage fairings
7 Tailwheel

Fig. 1: Undercarriage unit

The aircraft has a two strut main undercarriage unit (1,1) which is mounted on the main spar and retracts inwards. When retracted, the unit fits into apertures in the undersides of the wing (1,2) and the fuselage (1,3). The fuselage apertures are either fully covered by hinged doors (1,5), or, when an ETC 501 rack is fitted, partially covered by fixed panels. The underwing apertures are sealed by fairings (1,6) attached to the undercarriage struts.

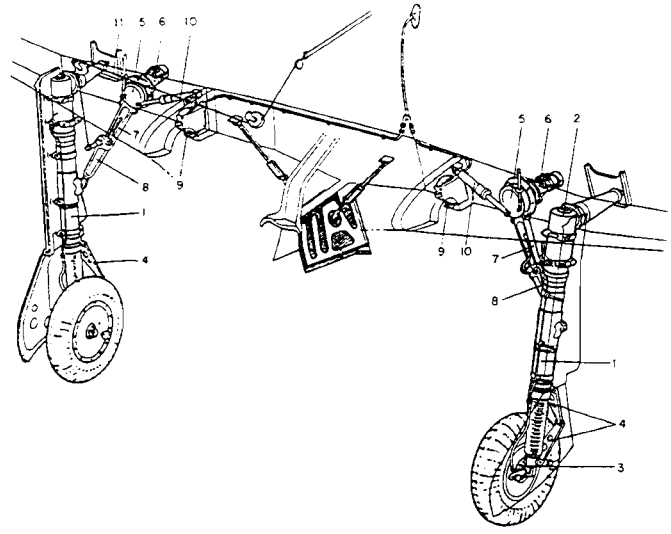
The main gear is both retracted and extended electrically. A cable attached to the right undercarriage member causes the tailwheel (1,7) to retract simultaneously with the main gear.

### 2. Main unit construction

The main gear consists of two EC-oleo shock struts (2,1) which have, at their upper ends, right-angled, tapered mounting assemblies (2,2); and at their lower ends, housings (2,3) for the cantilever axles. A scissors unit (2,4) connecting the upper and lower shock strut members, absorbs torque stresses and ensures proper main gear tracking.

Each main gear strut is retracted and extended individually by a rotating drive unit (2,5) powered by an electric motor (2,6); bolted together, they are mounted on the main spar.

To retract the main gear, the drive unit rotates the upper radius rod (2,7) which pulls up the lower




1 EC-oleo shock strut
2 Main strut mounting assembly
3 Axle housing
4 Scissors unit
5 Rotating drive unit
6 Electric motor
7 Upper radius rod
8 Lower radius rod
9 Retraction locking hooks
10 Sealed air-jack
11 Tailwheel retraction cable

Fig. 2: Main gear unit (with wheel doors fitted)

radius rod (2,8) and with it the shock strut (2,1).

The main gear members are secured in the retracted position by powerful locking hooks (2,9).

A sealed air-jack (2,10) is attached, at one end, to the drive unit and, at the other end, to an attachment point within the wing leading edge. During retraction it is compressed; subsequently, aiding in the undercarriage lowering. In the event of electrical failure it ensures full undercarriage extension.

The tailwheel retraction cable (2,11) is attached to a rod on the right shock strut radius rod hinge point.

### 3. Up-lock mechanism

The main gear up-lock mechanism consists of two locking units (3,1), spurs on each shock strut (3,2), and a DUZ-flexible cable (3,3).

The operation of the up-lock system is described below.

D. (Luft) T. 2190 A-8

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# Fw 190 A-8

## Aircraft Handbook

**Part 3**

**Control unit assembly**

(Effective July 1944)

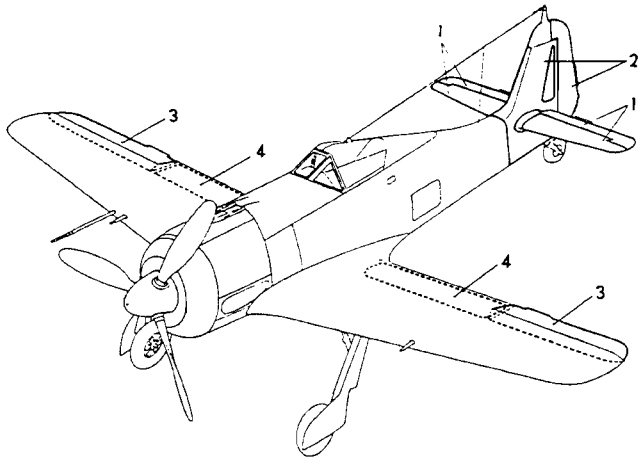
Issued September 1944

# Description

## A. General

The control unit assembly consists of the horizontal stabilizer and elevators (1,1), the vertical stabilizer and rudder (1,2), the ailerons (1,3), and the landing flaps (1,4). The control surfaces have no servo trims, only ground adjustable tabs. The horizontal stabilizer can, however, be electrically adjusted, in flight, for changes of trim.

All control surfaces have mass balancing, and are, except for their leading edges, fabric covered.




1 Elevator unit
2 Rudder unit
3 Allerons
4 Landing flaps

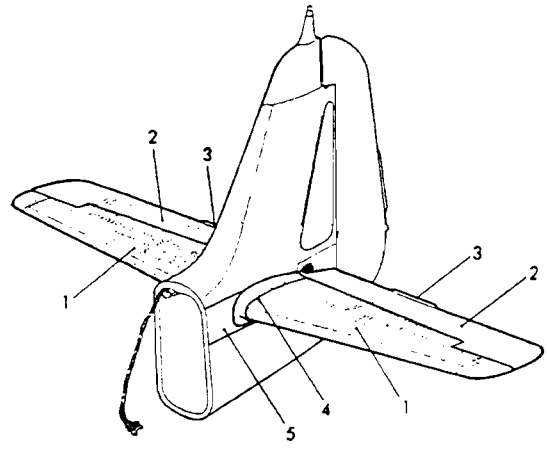
Fig. 1*: Control unit assembly

See Part 4 concerning actuation of the control surfaces and the landing flaps.

## B. Elevator unit

The elevator unit has a symmetrical airfoil, has rounded ends, and is of trapizoidal shape. Its leading edge is on the fuselage longitudinal axis while its rotational axis is positioned 11,5 mm (0.45 in) above it. It consists of a one-piece horizontal stabilizer (2,1) and two elevator halves (2,2).

The horizontal stabilizer (3,1) is of Aluminum construction with a one-piece spar. Basically, it consists of an upper and lower shell, riveted




1 Horizontal stabilizer
2 Elevator half
3 Trim tab
4 Stabilizer fairing panel
5 Cover plate

Fig. 2: Elevator unit

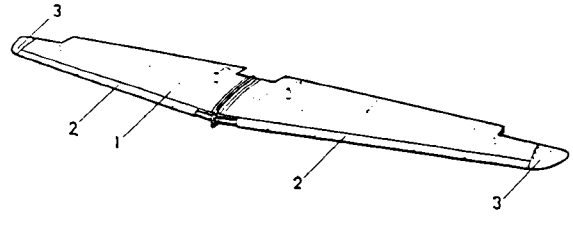
together, to which are screwed the leading edges (3,2) and the tips (3,3).

The stabilizer is attached to both sides of the diagonal spar by a pivotal mounting. Its leading edge upper attachment point connects to an electric motor through a drive spindle; thus permitting stabilizer adjustment. Vertical stresses are passed through the drive spindle to the vertical stabilizer (see Fig. 7).

Sidewards movement of the stabilizer is prevented by a triangular stress frame (7,3) which is connected th the leading edge lower attachment point and to the tail unit forward bulkhead.

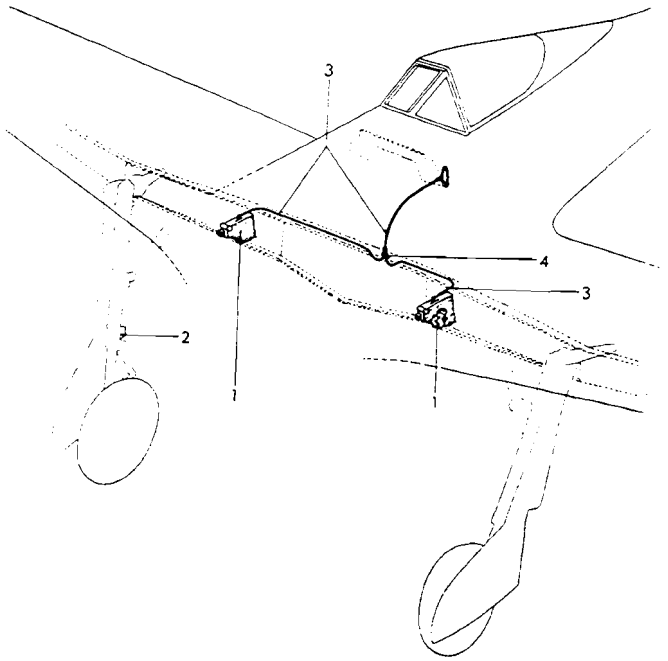
### 1. Horizontal stabilizer

The horizontal stabilizer is actuated by a spring-




1 Horizontal stabilizer
2 Leading edges
3 Tips

Fig. 3: Horizontal stabilizer




1 Locking unit
2 Spur
3 DUZ-flexible cable with handle
4 Shackle

Fig. 3: Locking mechanism

## 4. Operation

Undercarriage operation is controlled by push buttons located on the cockpit left instrument console (4,1). The undercarriage retraction button is secured against accidental activation by a safety cover (4,2).

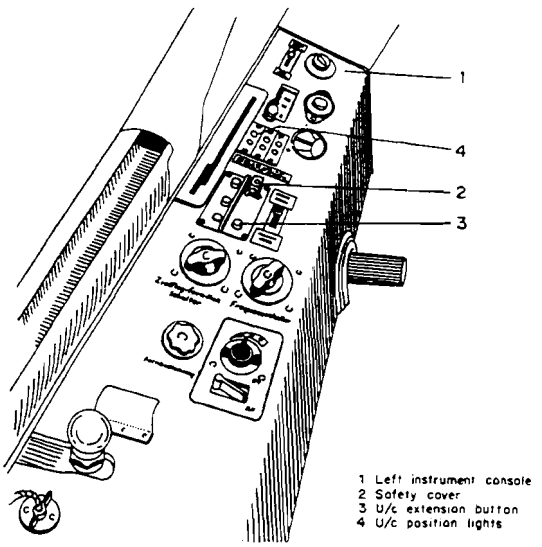
### Undercarriage retraction

After attaining the required minimum altitude, retract the undercarriage by flipping up the red safety cover over the 'Ein' button and depressing that button. This causes the locking hooks to open and the electrical drive motors to start raising the gear. In the last portion of the retraction cycle, the shock strut spurs come in contact with the locking unit hooks which are then forced up and locked in place; securing the undercarriage and simultaneously switching off the electrical motors. This position is indicated by the illumination of the red lights on the undercarriage indicator unit.

In addition to the electrical monitoring of the gear position there is also mechanical monitoring, in the form of an indicator rod (5,1) for each strut. The top of the rod is flush with the wing upper surface when the gear is retracted.

### Undercarriage extension

To lower the undercarriage, depress the 'Aus'



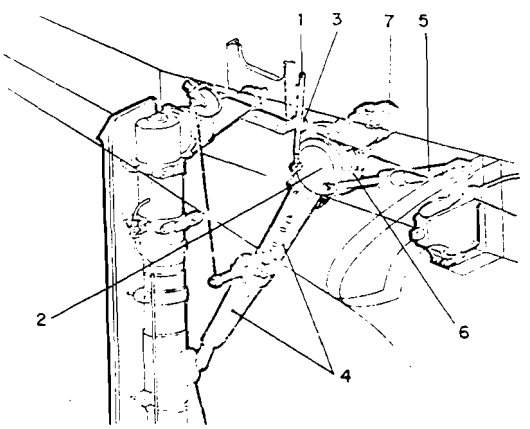

1 Left instrument console
2 Safety cover
3 U/c extension button
4 U/c position lights

Fig. 4: Undercarriage controls

button. This causes the locking unit hook to open, releasing the undercarriage legs, and starts the electric motors. When the gear is fully extended and locked down, a microswitch on each upper radius rod automatically switches off the drive motors. This position is shown by the illumination of the green lights on the undercarriage indicator unit.

The indicator rod (5,1) shows full main gear extension when the white band at its base becomes visible. While only the red portion of the rod shows, the gear is in an unsafe condition.

The indicator rod (5,1) is attached to the rotating




1 Indicator rod
2 Rotating drive outer cover
3 Bushed spherical bearing
4 Radius struts
5 Sealed air-jack
6 Rotating drive unit
7 Electric motor

Fig. 5: Indicator rod mechanism

drive outer cover (5,2), and is led through the wing upper skin by a bushed spherical bearing (5,3).

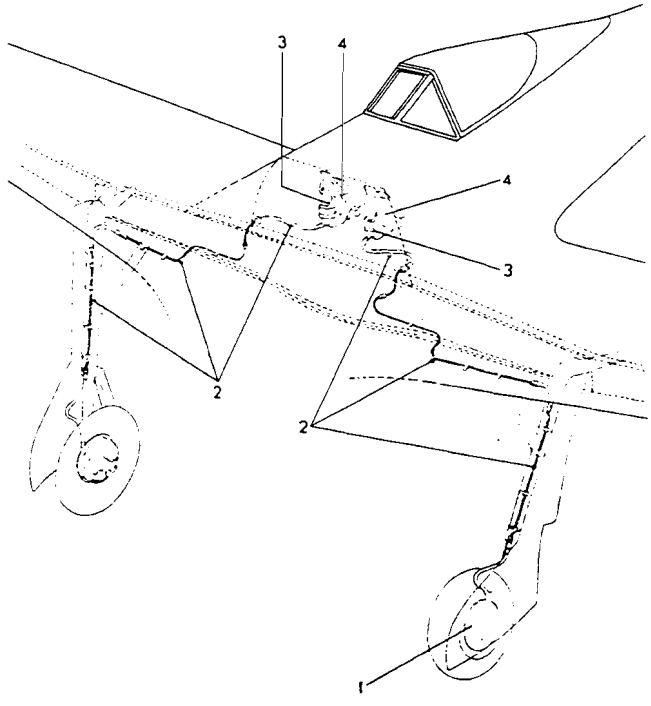
Emergency undercarriage extension

In case of failure of the electric motor, the main gear can be lowered by pulling the emergency gear extension handle. This manually unlocks the shock struts, which, with the help of gravity and the sealed air-jacks, then fully extend. If the electrical monitoring circuitry is also unserviceable, ensure that the white bands on the indicator rods are visible.

## 5. Main tires

The aircraft main tires measure 700 x 175 mm with 300 mm diameter brakes.

## 6. Braking system



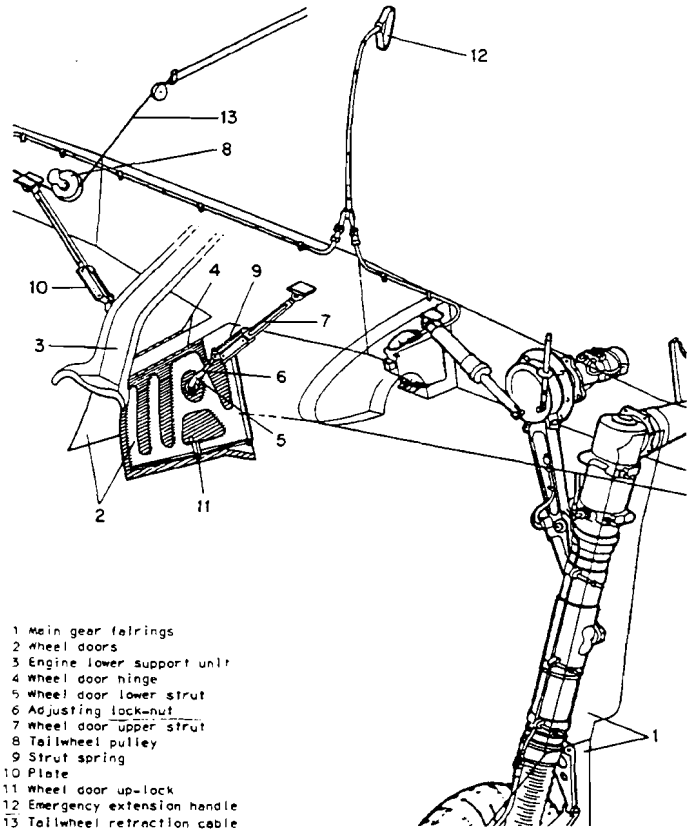

1 Brake shoes
2 Brake lines
3 Brake pumps
4 EC-rudder pedals

Fig. 6: Braking mechanism

The braking system consists of a hydraulically actuated brake shoe (6,1) on each main wheel, brake lines (6,2), and a hydraulic pump (6,3) attached to each EC-rudder pedal (6,4).

The wheels can be braked individually. The brakes are energized by toe pressure on the rudder pedals; causing hydraulic fluid to move down the lines to the brake shoe servos, forcing the shoes against the brake drums. Removing pressure from the brake pumps releases the brakes. The brakes operate on the Duo-Servo-Principle.

## 7. Undercarriage fairings & wheel doors



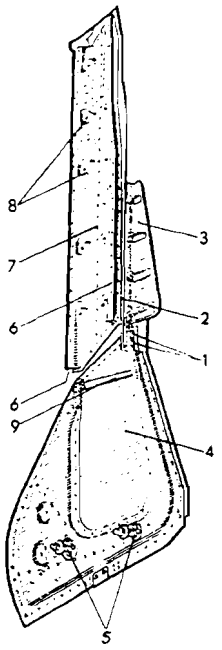

1 Main gear fairings
2 Wheel doors
3 Engine lower support unit
4 Wheel door hinge
5 Wheel door lower strut
6 Adjusting lock-nut
7 Wheel door upper strut
8 Tailwheel pulley
9 Strut spring
10 Plate
11 Wheel door up-lock
12 Emergency extension handle
13 Tailwheel retraction cable

Fig. 7: Wheel door actuation unit

The apertures in the undersides of the wing and fuselage are fully sealed, upon undercarriage retraction, by two-piece fairings (7,1 and Fig. 8) fixed to the shock struts, and by hinged wheel doors (7,2) (fixed fairings are substituted for the doors when an ETC 501 rack is fitted).

The wheel doors (7,2) are attached by hinges (7,4) to the engine lower support unit (7,3), and are opened and closed mechanically by the movement of the main gear.

While the undercarriage is extended, the wheel doors (7,2) are kept open by the tension of the spring (7,9) connecting the wheel door struts (7,5 and 7). During the final phase of undercarriage retraction, the mainwheel presses up against a plate (7,10) on the underside of the upper strut (7,7) forcing the




1 Attachment screws
2 Lower fairing guide channel
3 Triangular fairing plate
4 Lower fairing
5 Attachment bolts
6 Upper fairing guide channel
7 Upper fairing
8 Mounting holes
9 Guide roller

Fig. 8: Right undercarriage fairings (Inner)

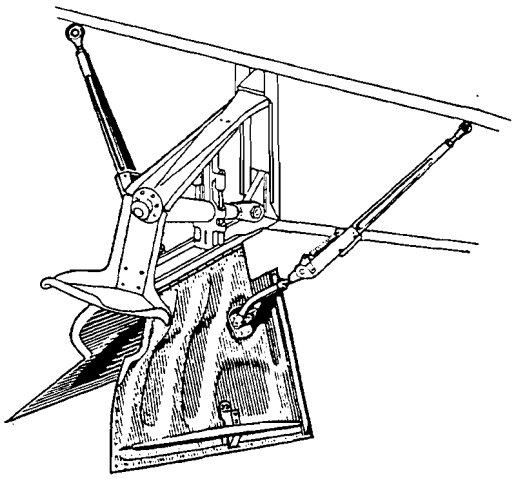


Fig. 8a: Wheel doors

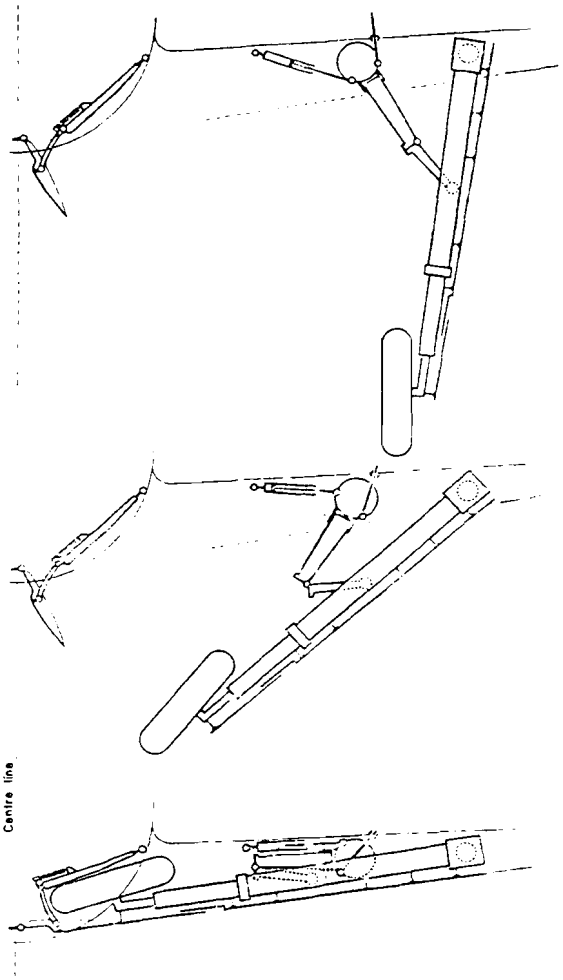



Fig. 9: Wheel door positions during retraction

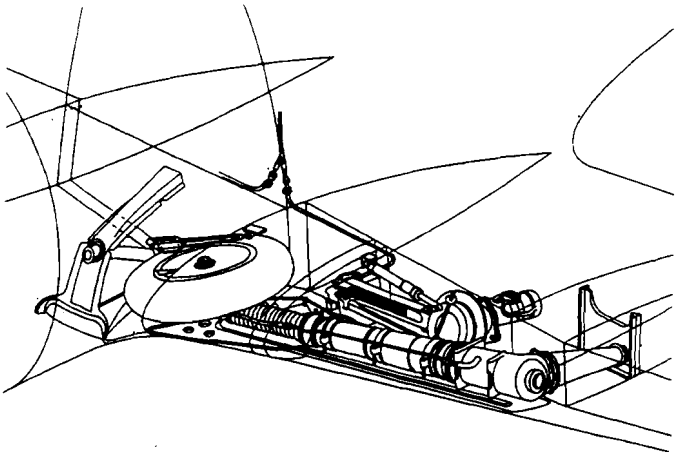


Fig. 10: Undercarriage (left) retracted

the wheel door to close. The door is locked up by a spring-loaded catch (7,11) which engages the main gear lower fairing (8,4) (See also Fig. 9).

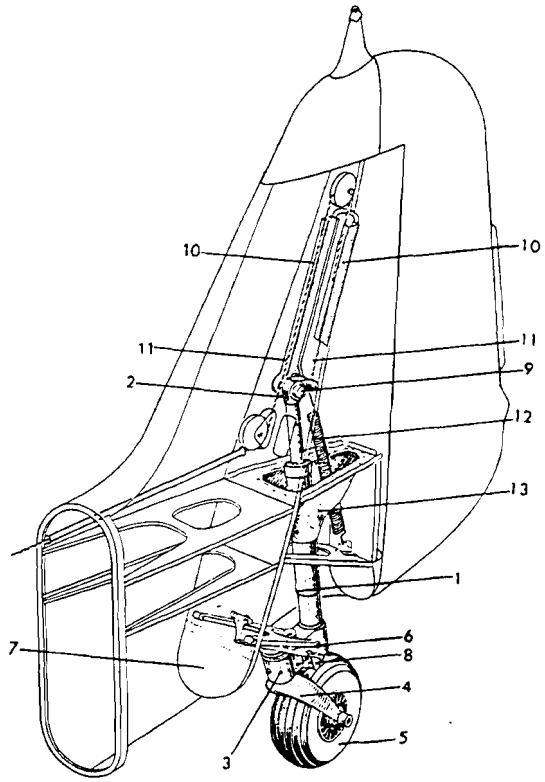
During undercarriage extension, the action of the strut spring (7,9) forces open the wheel doors.

When an ETC 501 undercarriage rack is fitted, the wheel doors are replaced by wheel fairing plates (wheel door struts are also removed). To decrease the uncovered area over the wheels caused by the

removal of the wheel doors, the main gear fairings (7,1) are lengthened by screwing an extension piece onto the bottom of the lower fairing (8,4).

## B. Tailwheel

### 1. General



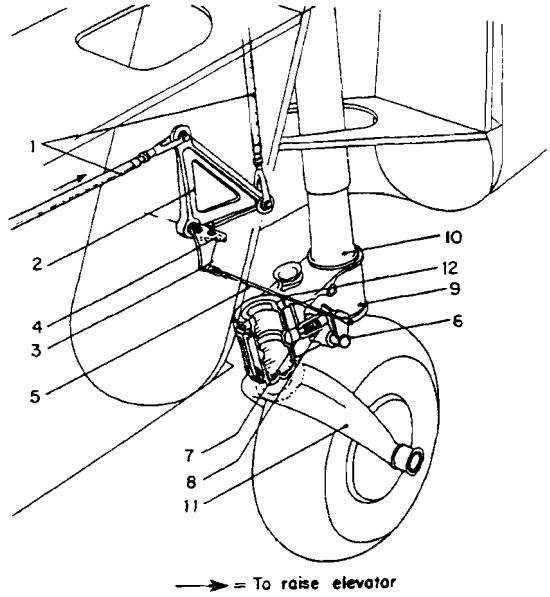

1 Tailwheel shock strut
2 Roller unit and down-lock
3 Tailwheel mounting arm
4 Forked wheel housing
5 Tailwheel
6 Drag yoke
7 Diagonal spar
8 Locking unit
9 Extension locking arm
10 Shock strut guide
11 Retraction cable
12 Extension spring
13 Fabric cuff

Fig. 11: Tailwheel extended

The tailwheel is retracted simultaneously with the main gear by a tailwheel retraction cable attached to the right undercarriage leg which raises it into the vertical stabilizer and holds it there.

The tailwheel can be rotated through 360° and has a centering lock.

A fabric cuff (11,13) prevents dirt from entering the upper portion of the tailwheel unit.




1 Elevator control rods
2 Bell-crank
3 Lever
4 Set screw
5 Locking unit actuation rod
6 Locking arm
7 Locking bolts
8 Spring
9 Tailwheel mounting arm
10 EC-shock strut
11 Forked wheel housing
12 Return spring

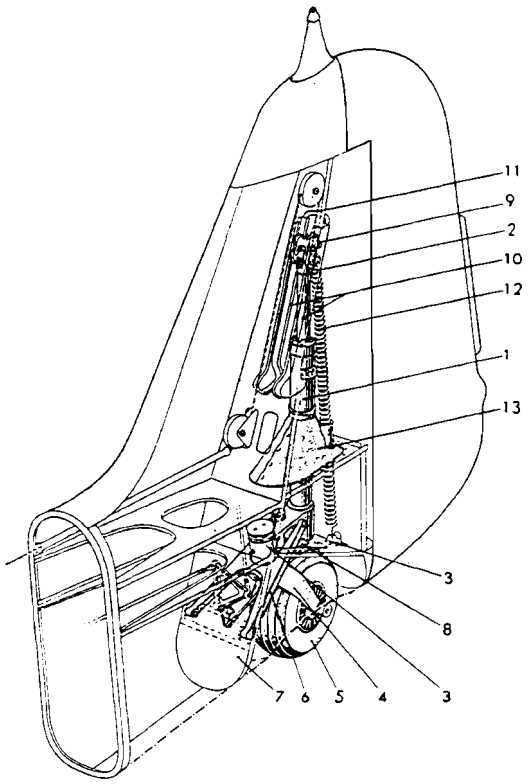
Fig. 12: Tailwheel locking unit

### 2. Tailwheel unit construction

The tailwheel unit is composed of an EC-shock strut (11,1) topped by a combination roller unit and down-lock (11,2), a mounting arm (11,3), a forked housing (11,4), and a tailwheel (11,5). A drag yoke (11,6), attached to both the diagonal spar (11,7) and the mounting arm (11,3) by bushed bearings, guides the movement of the tailwheel unit and absorbs horizontal stresses on it. The locking unit (11,8) is linked to the elevator and is activated when the control stick is pulled fully back (see Fig. 12). During take-off this can be used to prevent tailwheel shimy and possible ground looping. When the tailwheel is extended, the down-lock is wedged into an enlarged cavity at the base of the shock strut guide (13,10). It is held there by the heavy duty spring (13,12) to which it is attached.

During undercarriage retraction, the retraction cable (11,11) pulls the rear end of the down-lock out of the guide cavity--against the force of the spring (11,12)--and up the guide (11,10).

When retracted, the tailwheel is not locked into position, but is held in place by the tension on the retraction cable. The mounting arm (13,3) is drawn up through the drag yoke (13,6) to rest against the diagonal spar (13,7).




1 Shock strut
2 Roller unit and down-lock
3 Mounting arm
4 Forked wheel housing
5 Tailwheel
6 Drag yoke
7 Diagonal spar
8 Tailwheel lock
9 Locking arm
10 Shock strut guide
11 Retraction cable
12 Extension spring
13 Fabric cuff

Fig. 13: Tailwheel retracted

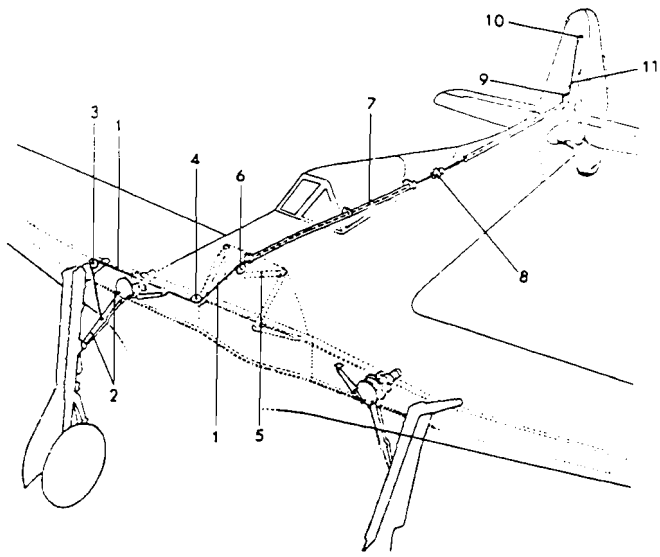
### 3. Emergency tail skid

When it is retracted, approximately one half of the tailwheel remains exposed and so can serve as an emergency tail skid.

## C. Monitoring unit

The electrical monitoring unit shows the pilot the position of the main gear. Tailwheel position is not monitored.

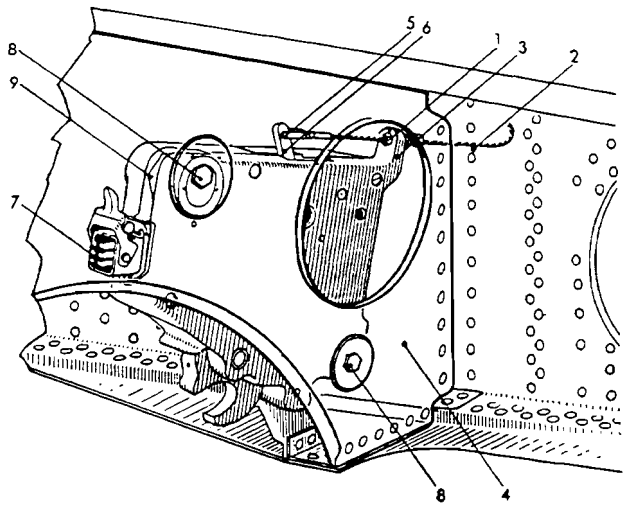
Microswitches on the main gear radius rods and in the locking unit indicate, through red or green lights, the main undercarriage position.




1 Retraction cable
2 Actuation struts
3 Pulley
4 Pulley
5 Engine bearer assembly
6 Pulley
7 Guide tube
8 Bulkhead bushing
9 Pulley
10 Pulley
11 Tailwheel roller unit and down-lock

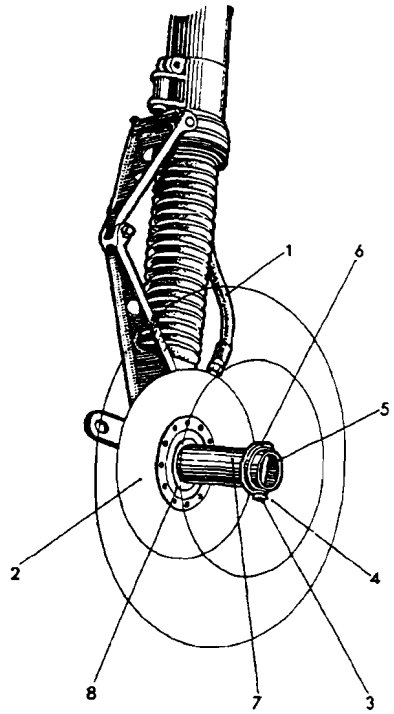
Fig. 14: Tailwheel retraction system

## D. Additional undercarriage details



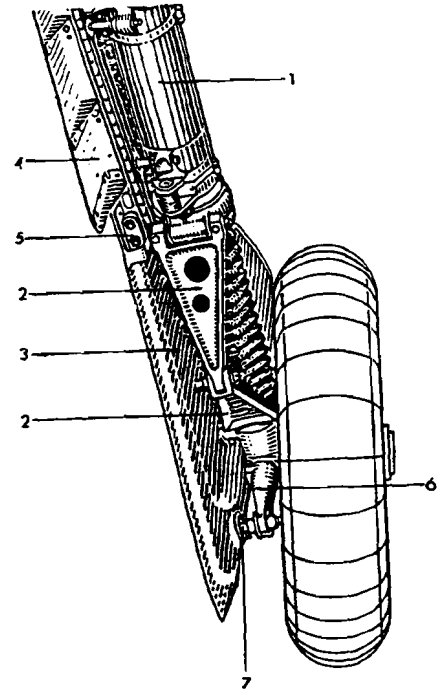

1 Nut
2 Bowden cable
3 Holder
4 Locking unit
5 Split pin bolt
6 Manual release lever
7 Plug connection
8 Bolt
9 Nut on eccentric bushing

Fig. 15: Locking unit




1 Brake line
2 Brake cover plate
3 Cotter pin
4 Crown nut
5 Bolt
6 Retaining ring
7 Axle
8 Axle flange

Fig. 16: Main gear lower strut




1 Shock strut
2 Scissors unit
3 Lower fairing
4 Triangular fairing plate
5 Guide channel attachment point
6 Lower fairing attachment outriggers
7 Attachment bolts

Fig. 17: Lower fairing attachment

# II. Inspection

1) Ensure the main gear and tailwheel tire pressures are as shown in the following table:

| Take-off weight up to kg (lbs) | | Mainwheels atu | psi | Tailwheel atu | psi |
|---|---|---|---|---|---|
| 4300 | 9500 | 5,00 | 73.7 | 4,75 | 70.0 |
| 4600 | 10170 | 5,25 | 77.3 | 5,00 | 73.7 |
| 4900 | 10830 | 5,50 | 81.0 | 5,00 | 73.7 |

During hot weather, ensure that the stated tire pressures are not exceeded by more than 0,3 atu (4.4 psi). Check for tire creep by comparing the red marks on the tire and rim. More than 8 mm displacement is not permitted!

2) Check braking system for correct pressure and the brake pedals for permissible play.

3) Check the main gear shock struts for loss of oil. If so, add Spindle oil-Green in accordance with the appropriate instructions. The pressure within the unloaded shock struts must be:

| | | |
|---|---|---|
| Main gear | 25 atu | (365 psi) |
| Tail strut | 31 atu | (455 psi) |

Check for a secure fit of the shock strut leather sleeves as they protect the sliding surfaces of the struts from sand, dirt and dust.

4) Carry out a daily check of the sealed air-jack pressure. Specified: 95 atu (1400 psi).

▽

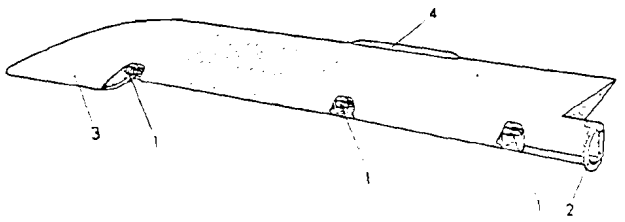
loaded switch located on the cockpit left instrument console, and can be moved between +4° and -1° (see Part 9A under III., 6. 'Horizontal stabilizer--incidence indicator' and Part 4 'Flight Controls').

## 2. Elevator

The elevator comprises two interchangeable half units, each of which is attached to the stabilizer by three pivot bearings (4,1). The elevator halves are joined at their spars and leading edges (4,2). The elevator actuation lever is positioned between the two flanges (see Fig. 7).

Each elevator half unit consists of two frame panels, a spar ( to which the leading edge is riveted), and attached ribs. It is fabric covered.

The elevator is both aerodynamically and mass balanced; in addition, it has ground adjustable trim tabs (4,4).




1 Pivot bearings
2 Connecting flange
3 Balance horn
4 Trim tab

Fig. 4: Elevator half unit

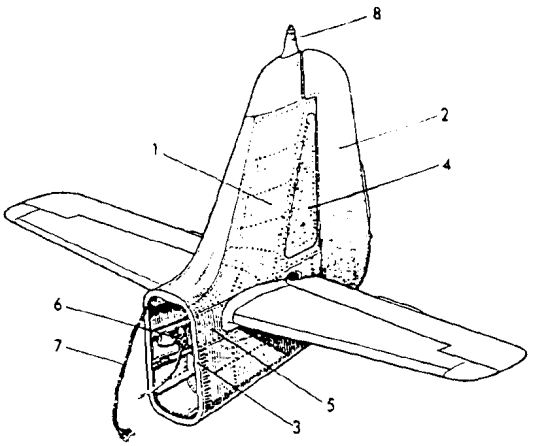
# C. Rudder unit

The centrally mounted rudder unit consists of the vertical stabilizer (5,1) and rudder (5,2).

## 1. Vertical stabilizer

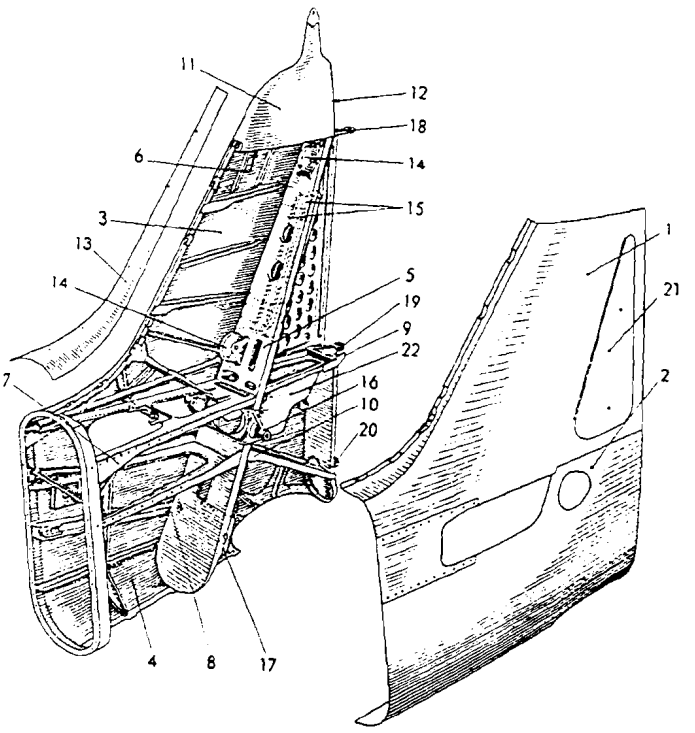
The vertical stabilizer and tail unit comprise a single unit which screws onto the fuselage rear section (attachment bulkhead) (5,3). The vertical stabilizer consists primarily of left (6,1 and 2), and right (6,3 and 4), panels and a diagonal spar (6,5). The panels are stiffened by ribs; and capped by a formed leading edge (6,13), and a rounded tip (6,11).

The diagonal spar (6,5) carries the forged fittings for the tailwheel drag yoke (6,17), the horizontal stabilizer (6,16), and the tailwheel retraction cable pulleys (6,14). In addition, the tailwheel shock strut guide (6,15) is attached to it. Within the vertical stabilizer are also positioned: the




1 Vertical stabilizer
2 Rudder
3 Tail unit attachment frame
4 Inspection door
5 Cover plate
6 Horizontal stabilizer incidence transmission unit
7 Electrical leads for tail light and stabilizer trim motor
8 Antenna attachment horn

Fig. 5: Rudder unit

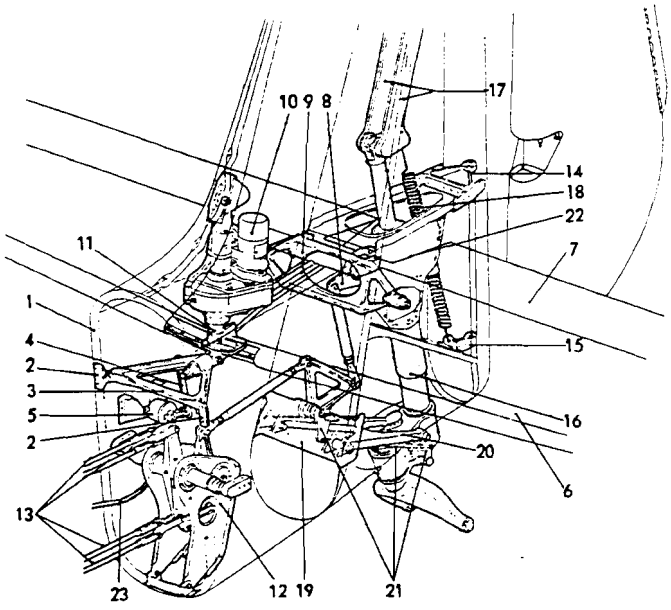



1 Upper panel, left
2 Lower panel, left
3 Upper panel, right
4 Lower panel, right
5 Diagonal spar
6 Rib 8
7 Rib 9
8 Rib 10
9 Rib 11
10 Rib 12
11 Rounded tip
12 Tip spar
13 Leading edge
14 Retraction cable pulley
15 Retraction cable guide tube
16 Horizontal stabilizer rear mounting point
17 Tailwheel drag yoke attachment bracket
18 Rudder top attachment frame
19 Rudder middle attachment frame
20 Rudder bottom attachment frame
21 Inspection door
22 Fabric cuff

Fig. 6: Vertical stabilizer construction (left panels removed)

elevator differential bellcrank (7,12), the horizontal stabilizer trim motor (7,10), the tailwheel unit, and the three rudder attachment fittings (6, 18-20). A large inspection door (6,21) in the left upper panel permits servicing of the tailwheel unit.

The horizontal stabilizer passes through the tail unit. To protect the inside of the tail against dirt, a fabric cuff (6,22) is fastened to Rib 11 (6,9), and secured to the tailwheel shock strut by an elastic band. The tailwheel extension spring passes through the cuff; this spring attaches to the tailwheel down-lock and to a fitting on Rib 12 (6,10). At its forward end, the fabric cuff is secured by snap fasteners.



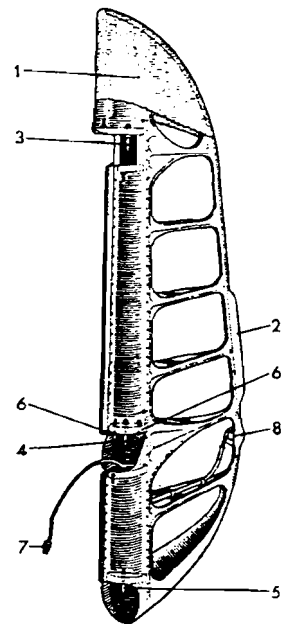

1 Tail unit attachment frame
2 Mounting lug
3 Triangular stress frame
4 Linkage rod
5 Stabilizer incidence relay unit
6 Horizontal stabilizer
7 Elevator
8 Elevator actuation lever
9 Horizontal stabilizer attachment fitting
10 Horizontal stabilizer trim motor
11 Drive spindle
12 Elevator differential bellcrank
13 Control cables
14-15 Rudder attachment fittings
16 Tailwheel shock strut
17 Shock strut guide
18 Extension spring
19 Drag yoke mounting bracket
20 Drag yoke
21 Tailwheel locking linkage
22 Fabric cuff
23 Electrical leads for stabilizer incidence indication

Fig. 7: Tail unit/vertical stabilizer components

## 2. Rudder

The rudder is constructed, in a manner similar to the elevators, of the following components: 2 frame panels, 1 spar, and 7 ribs--it is fabric covered. It has aerodynamic horn balancing (8,1), mass balancing and a ground adjustable trim tab (8,2).

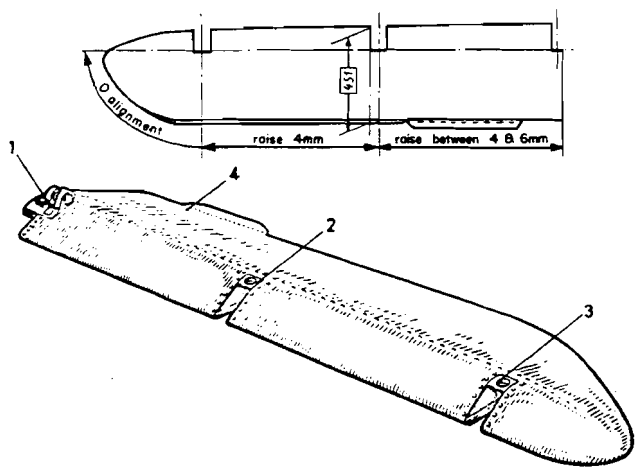
The rudder is attached to the vertical stabilizer by three pivot bearings (8,3-5), and is positioned by an actuation lever bolted to the centre attachment point (see also Fig. 6).




1 Balance horn
2 Trim tab
3 Upper pivot bearing
4 Centre pivot bearing
5 Lower pivot bearing
6 Attachment bolts for rudder actuation lever
7 Electrical lead for tail light
8 Tail light

Fig. 8*: Rudder

## D. Ailerons




1 Inner attachment point with fitting for control rod
2 Centre attachment point
3 Outer attachment point
4 Trim tab

Fig. 9: Aileron

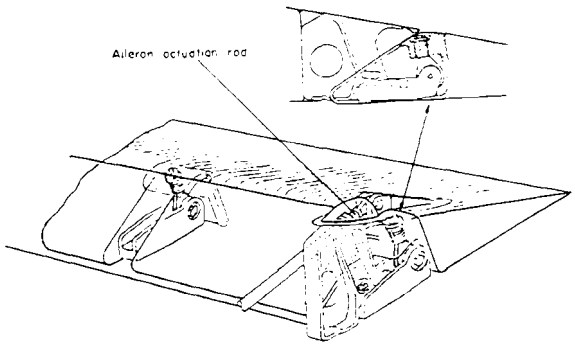



Fig. 9a: Aileron skematic

The ailerons are constructed in the same manner as the other control surfaces; with mass balancing, trim tabs and fabric covering (Fig. 9 and 9a).

## E. Landing flaps

The landing flaps are of split-type design and are interchangeable.

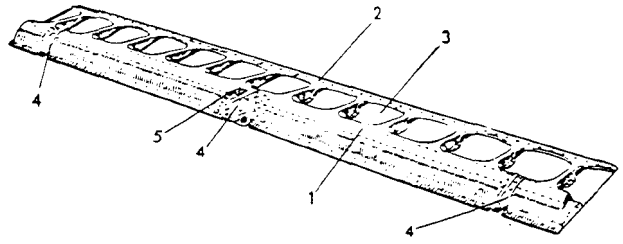



Fig. 10: Landing flap

They consist of a spar (10,1) and two frame panels (10,2 and 3). The lower surface is metal covered, the upper surface is open.

The landing flap is attached to the wing at three points.

They are actuated electrically; the actuating arm is attached to the centre attachment point which has been reenforced.

The flaps can be set to three positions: flight, take-off, and landing. Retraction and extension are controlled by push-buttons on the left instrument console. The flap position indicator lights are contained in the undercarriage/landing flap indicator unit.

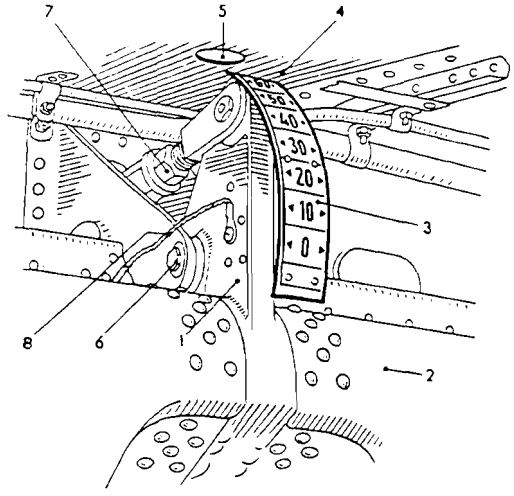



Fig. 11: Landing flap mechanical position indicator

They also have mechanical position indication; this consists of a graduated semi-circular scale (11,3) mounted on the flap actuating arm (11,1). There is a circular hole (11,5) in the upper skin of both wing halves to permit viewing of this scale from the cockpit.

## F. Control locks

There are clamps available with which to lock the control surfaces. These surfaces can also be locked by connecting the control stick (12,1) and the left rudder pedal arm (12,2) by a cord with a snap fastener at one end, and a buckled strap at the other.

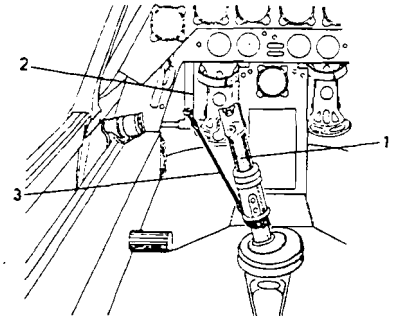



Fig. 12: Control surfaces locking cord attachment

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## Aircraft Handbook

**Part 4**

**Flight controls**

(Effective July 1944)

Issued September 1944

# Description

## A. General

The flight controls consist of the elevator, rudder, and aileron control surfaces; and the flap and stabilizer actuation mechanisms.

The three sets of control surfaces have no inflight trim capability, possessing only ground adjustable trim tabs. The stabilizer and landing flaps are actuated electrically.

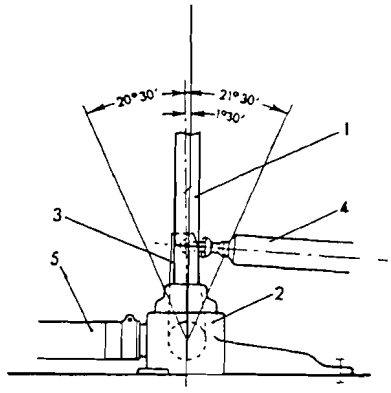
Transmission of steering movements to the control surfaces is via a system of push-rods, DUZ-flexible push-rods, and control cables.

The control train to both the rudder and elevators contains differential bellcranks which keep control stick, or rudder pedal, forces to a minimum near the control surface neutral positions. About these neutral positions, a large movement of the control stick, or rudder pedals, will result in only a small control surface movement. This difference decreases as control surface deflection increases.

Note: In later production series aircraft, the differential bellcrank for the rudder is replaced by non-differential bellcranks.

## B. Elevator controls

The control stick is in the neutral position at a point 1°30' forward of vertical (Fig. 1). Control stick movement is 20°30' forward, and 21°30' rearward.



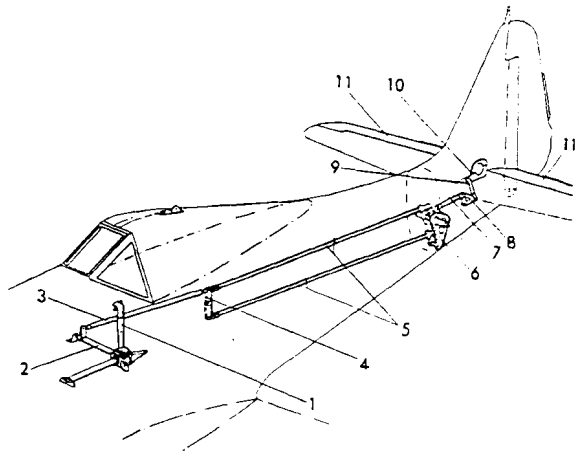

1 Control stick
2 Control stick mounting base
3 Elevator actuation lever
4 Push-rod
5 Aileron control torsion bar

Fig. 1: Control stick movement

Elevator deflection is limited by mechanical stops in the control stick mounting base.

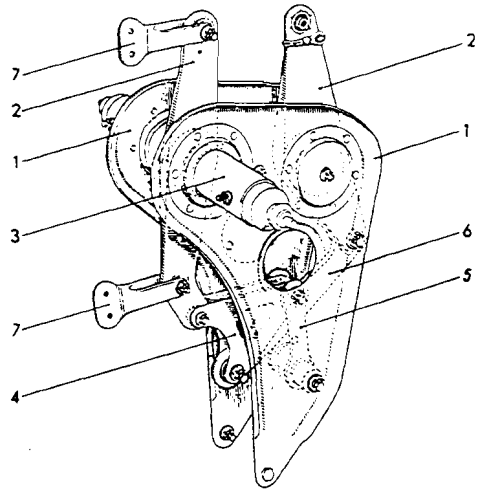
The elevator control train is shown in Fig. 2.

The construction of the differential unit is illustrated in Fig. 3.




1 Control stick
2 Elevator control torsion bar
3 Push-rod
4 Bellcrank (Bulkhead 8)
5 Control cables
6 Elevator differential unit
7 Push-rod
8 Bellcrank
9 Push-rod
10 Elevator actuation lever
11 Elevator

Fig. 2: Elevator controls




1 Side plate
2 Lever
3 Torsion bar
4 Differential crank
5 Radius rods
6 Actuation strut
7 Control cable attachment fittings

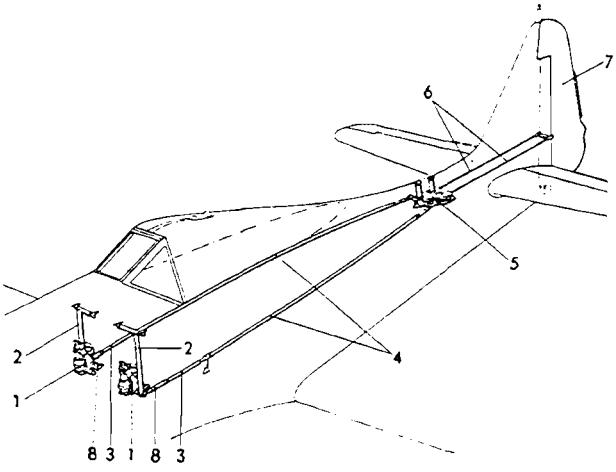
Fig. 3: Elevator differential unit

## C. Rudder controls

The rudder control train is as shown in Fig. 4.

The position of the rudder pedals can be adjusted to suit the individual pilot, by rotation of the adjustment grips (4,8) to vary the length of the adjustable push-rods (4,3). The adjustment forward and aft is 55 mm, for a total of 110 mm (4.3 in). These grips are within the reach of the seated pilot and can be moved simultaneously.

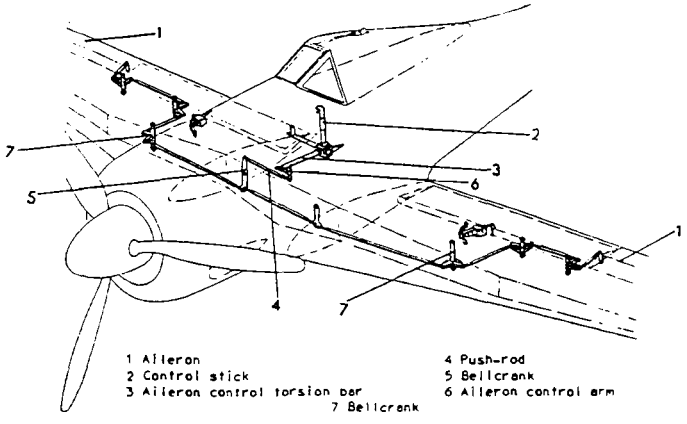
Rudder deflection is limited by stops within the differential unit.




1 EC-pedal unit
2 Rudder pedal arm
3 Adjustable push-rod
4 DUZ-flexible rods
5 Rudder differential unit
6 Control cables
7 Rudder
8 Adjustable grip

Fig. 4: Rudder controls

## D. Aileron controls




1 Aileron
2 Control stick
3 Aileron control torsion bar
4 Push-rod
5 Bellcrank
6 Aileron control arm
7 Bellcrank

Fig. 5: Aileron controls

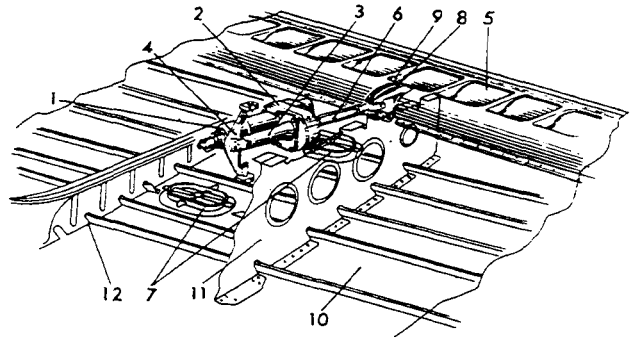
The ailerons (5,1) are moved by the sidewards motion of the control stick (5,2). The transmission of control forces is as shown in Fig. 5.

A hole in the cockpit floor through which the aileron control arm (5,2) passes is protected by a dust cover.

Aileron deflection is limited by mechanical stops in the control stick mounting base.

## E. Flap and stabilizer controls

### 1. Landing flap controls




1 Electric motor
2 Worm gear housing
3 Drive spindle
4 Forged anchor fitting
5 Landing flap
6 Adjustable push-rod
7 Servicing panels
8 Flap position scale
9 Viewing hole in wing upper skin
10 Wing lower skin
11 Centre-rib 6L
12 Centre-rib 4L

Fig. 6: Landing flap system

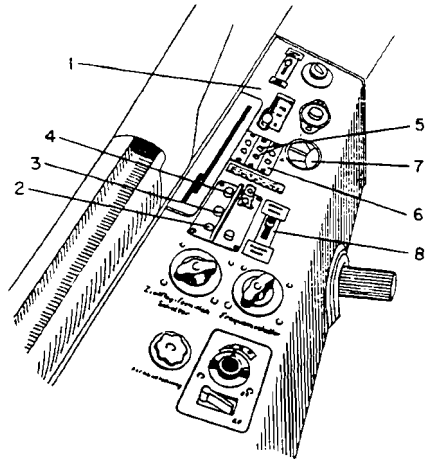
The flaps are positioned electrically, the drive motor push-rod being attached to the flap central attachment fitting. The two motors are synchronized to ensure equal flap movement.

Each flap drive system consists of an electric motor (6,1), a worm gear housing (6,2), and a drive spindle (6,3); all contained within a single unit which is attached to the wing by a pivoting forged anchor fitting (6,4). An adjustable push-rod (6,6) connects the motor to the flap (6,5). The anchor fitting and adjustable push-rod are accessible through servicing panels (6,7) in the wing lower skin (6,10).

The flap actuation buttons are located on the left instrument console (7,1). An individual push-button is provided for each of the three flap positions (Out, Take-off, In). The flap drive motors are actuated when one of these buttons is depressed; they are automatically switched off when the designated flap position is reached. A push-button will remain down until another flap selection is made, at which time it will pop back up.

Flap position is indicated electrically by the middle two bulbs (7,5) in the 6-bulb indicator unit (7,6). The bulb colours are: red-'In' and green-'Out'; there is no electrical monitoring of the 'Take-off' setting.

There is also mechanical flap indication, see Part 3 Fig. 11.



1 Left instrument console
2 Push-button for 'Out'
3 Push-button for 'Take-off'
4 Push-button for 'In'
5 Position indicator lights
6 6-bulb indicator unit
7 Stabilizer incidence indicator
8 Stabilizer trim switch

Fig. 7: Flap and stabilizer controls

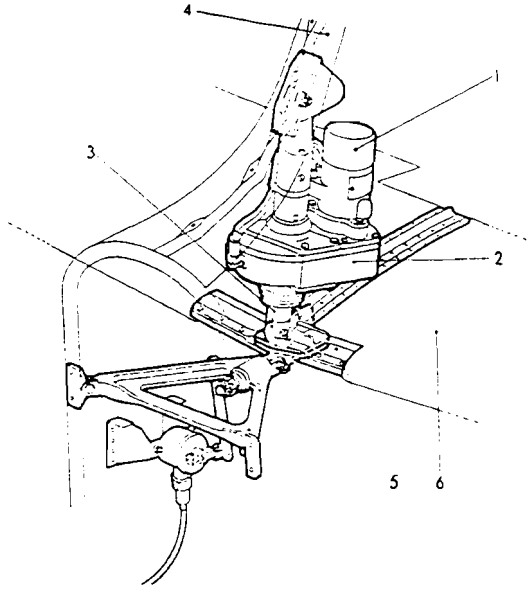
## 2. Horizontal stabilizer adjustment

The stabilizer incidence can be altered to compensate for changes in aircraft trim. Actuation is through an electric motor (8,1) with attached worm-gear housing (8,2) and drive spindle (8,3).

The motor is mounted within the vertical stabilizer (8,4) and is attached to the leading edge upper attachment point (8,5) by the drive spindle (8,3).

The stabilizer can be rotated through 5°, from +4° relative to the fuselage longitudinal axis, to -1°. The normal position, as indicated on the tail unit (Fig. 9) and on the stabilizer trim indicator (7,7), is labelled '0'. The '0' mark is actually +2° relative to the fuselage thrust line. The limit positions are indicated on the tail unit by red stripes and + (plus) and - (minus) notations.

The stabilizer trim switch (7,8) is located on the left instrument console. The electric motor will run for as long as the switch is displaced from its spring-loaded 'Off' position. As the stabilizer reaches its upper or lower limits of movement, the drive motor is switched off by the stabilizer incidence relay unit (8,7). The stabilizer incidence is monitored by an indicator (7,7) on the left instrument console. For further details see Part 9A 'General Equipment'.



1 Electric motor
2 Worm-gear housing
3 Drive spindle
4 Vertical stabilizer
5 Leading edge upper attachment point
6 Horizontal stabilizer
7 Stabilizer incidence relay unit

Fig. 8: Stabilizer trim unit

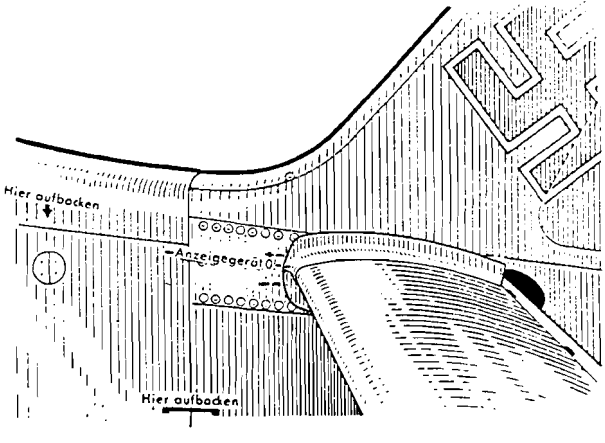



Fig. 9: Stabilizer markings on tail unit

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## Aircraft Handbook

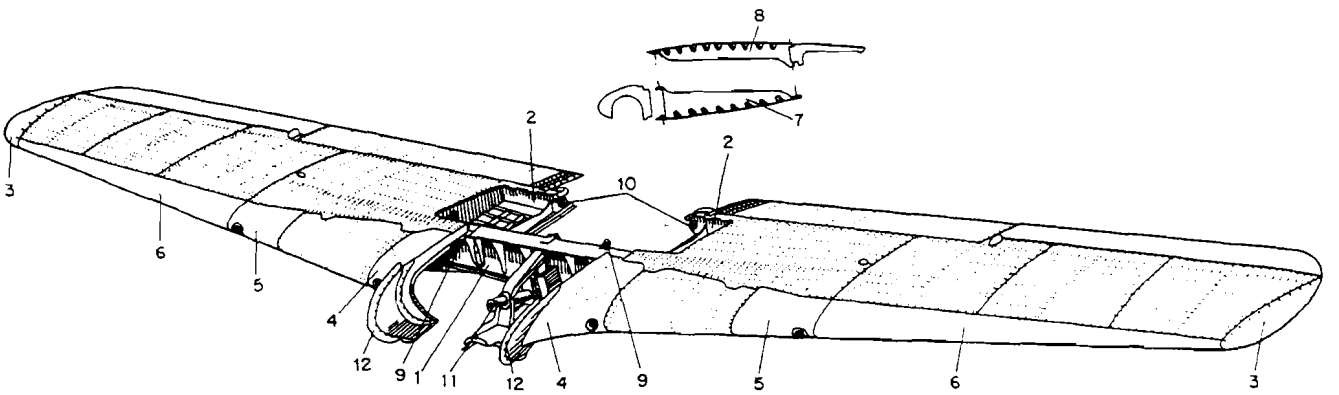
**Part 5**

**Wing assembly**

(Effective July 1944)

Issued September 1944

# Description




1 Main spar
2 Rear spar
3 Wing tip
4 Leading edge inner section
5 Leading edge middle section
6 Leading edge outer section
7 Lower shell
8 Upper shell
9 Wing forward mounting point
10 Wing rear mounting point
11 Engine lower support unit

Fig. 1: Wing unit (wheel cover panels removed)

The wing is of one-piece construction. The main spar (1,1) joins the right and left wing panels; while the rear spar (1,2) is divided by the fuselage.

The wing is of all-metal monocoque construction. It is divided into two shells, the lower one containing the main spar (1,7), and the upper one, the rear spar (1,8). Both are full load bearing members. The skin panels are stiffened by ribs and stringers, and are riveted together.

The leading edge panels and tip units (1,3) are screwed onto the wing panels and are detachable. The leading edge unit comprises inner (1,4), middle (1,5) and outer sections (1,6). The wing tip houses a navigation light.

The main spar and skin panels together bear wing load stresses, while the skin panels alone bear wing torsional stresses.

On the main spar are positioned the mounting units for the main gear and the wing guns.

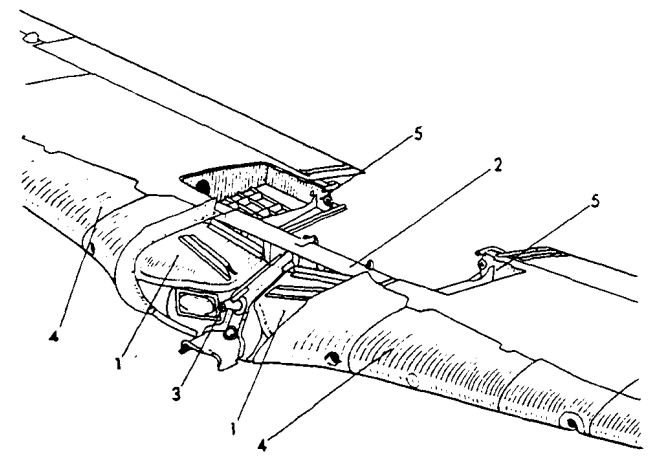
The aileron controls and the flap drive motors are contained within the wings. Weapon, undercarriage, and flap actuation components are accessible through detachable servicing panels on the undersurfaces of the wings.

The wing main spar is attached to Bulkhead 1 by hexagonal bolts (1,9) which attach to both sides of the fuselage. The two portions of the rear spar are each attached by a single bolt (1,10) to either side of Bulkhead 4. Streamlined fairings cover the main spar attachment points.

The engine lower support unit (1,11) is attached to the wing centre section. Positioned on this unit are two hinge mounts, to which the main wheel doors are attached. A mounting lug, onto which the fuel cell cover plate is attached, is fixed to the lower part of the main spar.

Upon retraction, the main wheels lie in the area between the leading edge inner section (2,4) and the engine lower support unit (2,3). The wheels are protected against engine generated heat by wheel cover panels (2,1).

Aileron and flap mounting points are attached to the wing trailing edges and wing lower surfaces respectively.




1 Wheel cover panels
2 Main spar
3 Engine lower support unit
4 Leading edge inner section
5 Rear spar

Fig. 2: Wheel cover panels

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## Aircraft Handbook

**Part 6**

**Powerplant**

(Effective July 1944)

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# Description

## 1. General

The aircraft powerplant is a BMW 801D.

The BMW 801D is an aircooled, 14-cylinder, fuel injection engine with two-stage supercharger, reduction gearing and engine cooling fan.

The engine operates on the four-stroke combustion principle with fuel injected directly into the cylinders, and has, for supercharging, a single impeller unit with two self-setting speed ratios.

In flight, the operation of the engine is governed by a control unit. This unit regulates boost pressure, engine RPM, fuel mixture, ignition-timing adjustment, and the supercharger switchover control; the pilot need only operate the throttle lever. The control unit is attached to the right side of the accessory casing. Special pressure and drain pumps are fitted to circulate the system's hydraulic fluid. This oil is housed in the engine mounting ring.

The powerplant is outfitted with a primer fuel injection system. This system sprays primer fuel into the boost lines of all 14 cylinders. See Part 7 'Engine operation and fuel supply system' for more information about the system.

A number of fighter-bombers equipped with the BMW 801D are outfitted with a C-3 (96-octane) supplementary fuel injection system. This system provides short term increases in the emergency top speed at altitudes below 1000 m (3280 ft). For more details on this system see Part 7 'Engine operation and fuel supply system'.

A newer method of increasing the emergency speed of the fighter has been to insert a pilot operated stop cock in the pressure line of the boost regulator. The result is that, at 2700 rpm, the boost pressure, at low setting can be increased to about 1,58 ata (22.4 psi), and at high setting, to about 1,64 ata (23.3 psi). When this system is incorporated, C-3 supplementary fuel injection is no longer necessary and is, therefore, omitted.

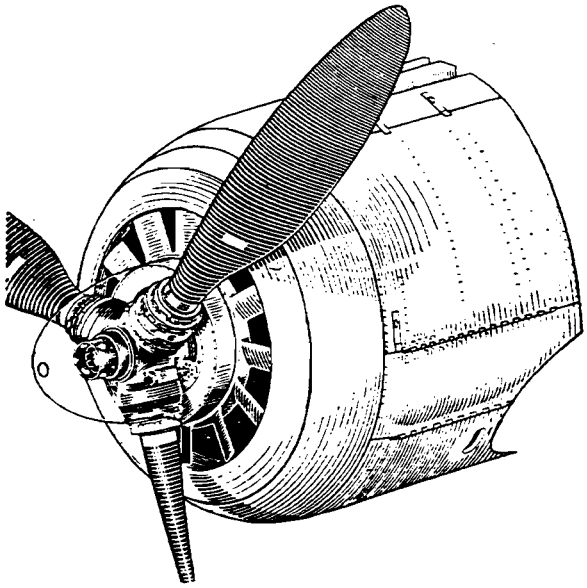
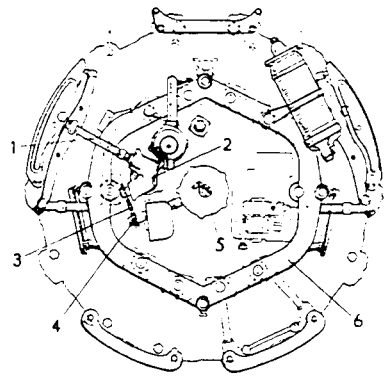


Fig. 1*: Powerplant

## 2. Starter system




1 Torsion tube
2 Gear box
3 Drive chain
4 Torsion bar
5 Inertial starter
6 Engine mounting ring

Fig. 2: Starter installation

An inertial starter is used to start the engine; it can be energized either electrically or manually. It is fastened to the accessory casing by a central nut.

The electrical starter switch is located on the right instrument console. The starter crank is inserted in the powerplant left side; it is stored in the equipment compartmement; to the right of the access panel.

The turning motion of the starter crank on the torsion tube (2,1) is ultimately transmitted to the starter (2,5) in the sequence shown in Fig. 2.

When the starter is energized manually, the starter brushes are disengaged by a handle which is positioned on the lower left side of the auxiliary instrument panel.

## 3. Ignition system

The engine ignition current is supplied by a Bosch twin-magneto which is mounted on the engine nose casing.

The two ignition circuits are electrically isolated from one another; one serves the spark plugs near the inlet valves, the other serves those near the outlet valves. Each plug is fired individually, ignition timing being regulated by the control unit.

## 4. Supercharger air intake

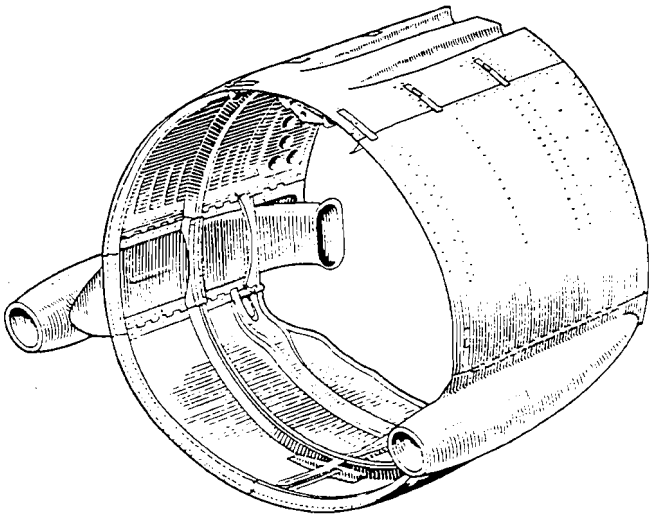


Fig. 3*: Centre cowling with external air intakes

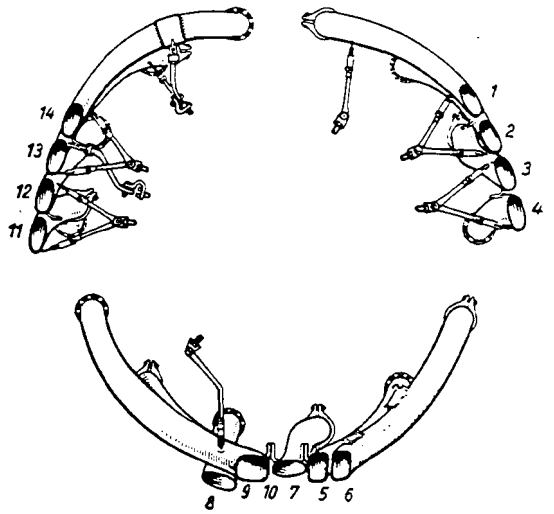



Fig. 4: Exhaust system arrangement
(the numbers indicate the cylinder numbers to which the exhaust pipes belong)

Intake air is delivered, by the cooling fan located at the front of the engine, through two shallow ducts (6,1) (positioned on either side of the cowling) to two air intakes. Dust filters, which prevent the entry of foreign objects, are fitted onto the intake openings.

Tests have been made on the use of air ducts with external intakes (Fig. 3) on various types of aircraft--especially fighters. The installation of this type of duct will result in improved performance above the rated altitude of the engine through increased dynamic air pressure. Beneath that altitude, engine performance is better when using the interior ducts.

## 5. Exhaust system

The exhaust system (Fig. 4) consists of twelve pipes, divided into three groups, which expel exhaust gases past the side and bottom panels of the engine cowling.

Each side unit comprises four pipes; each pipe is individually attached to the engine by support struts.

Five pipes belong to the bottom group. Those of Cylinders 9 and 10 are welded together to form a common unit. The three pipes from Cylinders 5, 7, 9 and 10 are joined together. The Cylinder 6 pipe is welded to that of Cylinder 5; the Cylinder 8 pipe is attached to the combined Cylinder 9 and 10 pipe, which is, in turn, attached to the engine by a support strut.

The side exhaust units are to be so positioned that the distance between the pipe inboard edges and the fuselage side panels is approximately three times as great as the distance between the pipe outboard edges and the cowling skin.

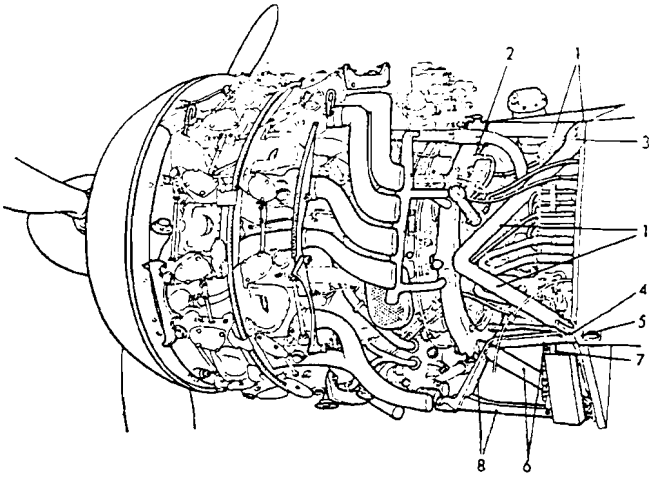
## 6. Powerplant truss

The powerplant truss, which supports the engine mounting ring, consists of the engine bearer assembly and the engine lower support unit.

The engine bearer assembly (5,1) comprises six welded steel tubes which serve as the top and two side pickup points for the engine mounting ring (5,2). This assembly is attached to the firewall (Bulkhead 1) at four points.

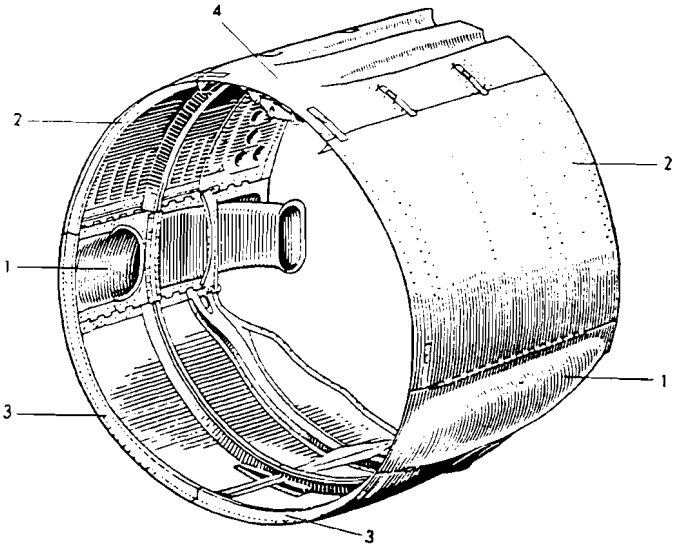
The engine lower support unit consists of the engine lower support strut (5,6), the MG 131 casing chute attachment strut (5,7), and the wheel door attachment and support struts (5,8). The unit is fixed, at its rear end to the lower edge of the main spar, and at its forward end to the engine mounting ring. The support strut (5,6) is adjustable in length.

The engine is attached to the mounting ring by ten bolts which pass through the ring and screw into rubber shock mounts fixed to the rear of the engine.




1 Engine bearer assembly
2 Engine mounting ring
3 Upper attachment point
4 Lower attachment point
5 Main spar mount
6 Engine lower support strut
7 MG 131 casing chute attachment strut
8 Wheel door attachment and support struts

Fig. 5: Powerplant truss




1 Side panels with air intake ducts
2 Side shells
3 Lower shells
4 Upper panel

Fig. 6*: Cowling centre section

## 7. Engine cowling

The engine cowling consists of three interconnected components: the forward section which includes the armoured rings protecting the oil cooler and oil tank (see Part 80 'Special fittings'), the centre section, and the powerplant rear fairings which enclose the engine accessories area and form the transition to the fuselage (see Fig. 9,4 and 5 in Part 1 'Fuselage').

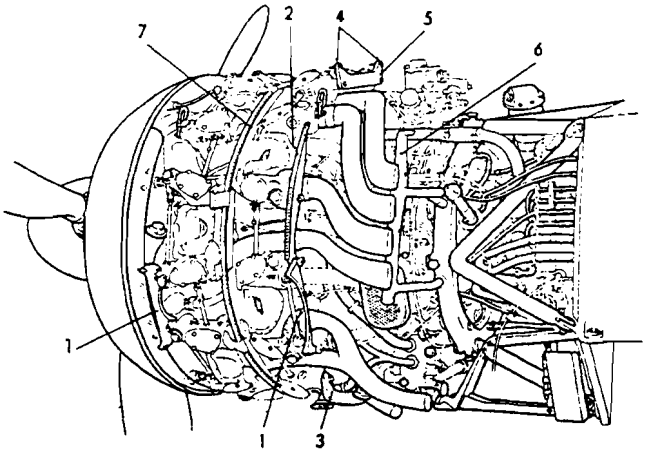
The cowling centre section comprises two side panels (6,1) which serve as air intake ducts, two side shells (6,3), and an upper panel (6,4). The side and lower shells are attached to the side panels by hinges. The upper shell is fixed, at the rear to a mounting bracket (7,5) atop the engine, and at the front to the cowling forward section. The two side shells which, when open, can be used as servicing platforms, are prevented from opening too far by restraining wires which attach to the engine lifting rings (see Fig. 8).

The side and lower shells have toggle clips; the side shells also each have a quick-release fastener.

Onto the inner side of the upper panel are built the following: in the centre, a tube for cockpit ventilation; and, on either side, cooling pipes for the fuselage weapons ammunition boxes.

The hinge pins which connect the side panels to the side and lower shells, also fix them to brackets (7,1) on either side of the engine. At their forward ends, all components of the cowling centre section lie against a rubber seal positioned along the outer rim of the circular oil tank. The side shells are also supported by semi-circular fittings (7,1) against which they lie. The lower shells, secured to one another by toggle clips, lie against two semi-circular fittings (7,3) which are screwed to the bottom of the engine.

The support brackets (7,6) which attach to both sides of the engine mounting ring support both the fuselage armament cover and the fuselage side panels and act as pickup points for the side panel screw locks.




1 Side panel support
2 Side shell support
3 Lower shell support
4 Upper panel attachment bracket
5 Support bracket on the engine mounting ring
6 Airtight wall with rubber sealing ring

Fig. 7: Centre cowling support and attachment points

To avoid cooling losses, the baffles of the forward and rear cylinders are joined to form an airtight wall (7,7) which is sealed to the cowling by a rubber ring around its circumference.

As the forward edges of the cowling are also tightly sealed, the air required for combustion, for engine cooling and for oil cooling cannot escape this area unused.

The powerplant rear fairing comprises three panels. The upper one (fuselage armament cover) is attached to the windscreen mounting bracket and opens upward. The two side panels are hinged to the wing assembly and open downwards; they contain the engine cooling flaps (see Part 7 'Engine operation and fuel system').

## 8. Airscrew

The aircraft is fitted with a three bladed, constant speed airscrew of 3300 mm (10'10") diameter.

Inflight blade pitch adjustment is normally automatic (dependent on RPM), being controlled hydraulically from the control unit. The pitch can also be adjusted manually, eg. when the automatic pitch control fails, and on the ground.

To change from hydraulic (automatic) to electrical (manual) pitch adjustment, move the pitch control switch on the left instrument console to the 'Manual' position. The propeller pitch can then be adjusted by depression of the appropriate side of the thumb switch on the throttle lever; this switch has two settings: 'RPM increase' and 'RPM decrease'. When released, the switch returns to the neutral 'Off' position.

The pitch control unit, with attached switchover motor and RPM governor, is built onto the forward left side of the engine. Propeller pitch is monitored mechanically by an indicator on the auxiliary instrument panel right side.

Limit switches prevent the movement of the propeller blades past their allowable pitch limits.

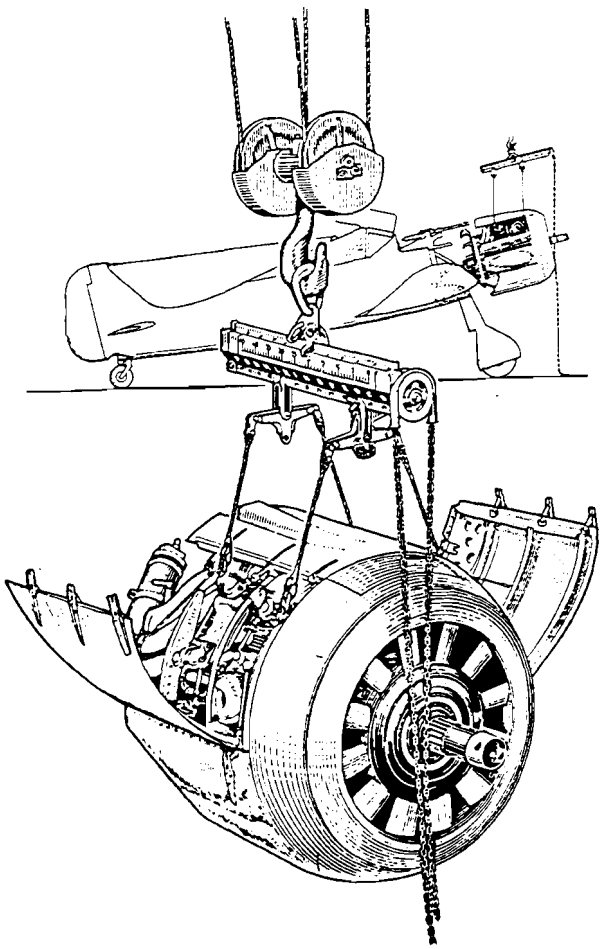


Fig. 8*: Engine in lifting harness

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## Aircraft Handbook

### Part 7

### Engine operating and fuel supply system

(Effective July 1944)

Issued September 1944

# Description

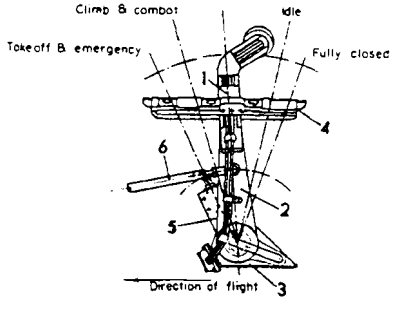
## A. Engine operating system

The following notations refer to Part 9A, Fig. 1.

On the left instrument console is positioned the throttle lever (1,11); and, on the auxiliary instrument panel, the fuel tank selector lever (1,18), the engine starter brushes withdrawal knob (1,14), and the fuel cut-off control lever (1,13).

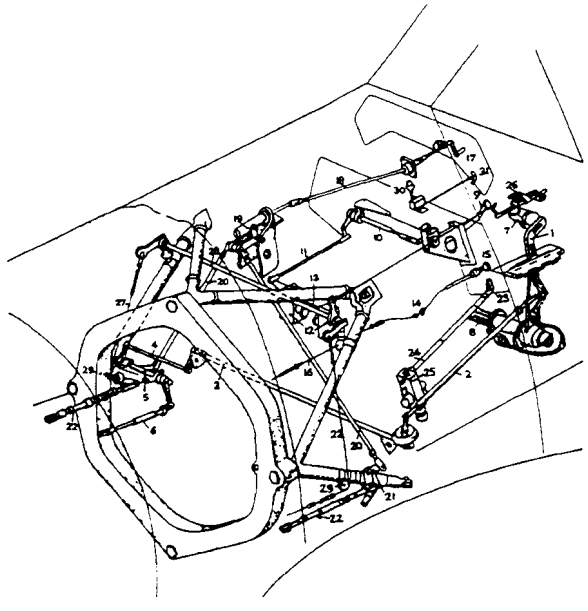
The cooling flap actuation crank (1,31), with its position indicator, is situated at the bottom of the main instrument panel. After use, the crank handle is folded back.

The throttle lever (3,1) can be locked to maintain a predetermined setting by tightening the throttle friction knob (3,8). Throttle lever movement is transmitted to the control unit performance adjustment lever as shown in Fig. 3,1-6.




1 Throttle lever, upper
2 Throttle lever, lower
3 Mounting bracket
4 Detent plate
5 Movement limiting block
6 Throttle push-rod

Fig. 2: Throttle diagram



1 Throttle lever
2 Throttle push-rod
3 Torsion bar behind firewall
4 Push-rod
5 Torsion bar in front of firewall
6 Control unit performance adjustment lever
7 Thumb actuated propeller pitch control
8 Throttle friction knob
9 Fuel tank selector lever
10 Torsion bar with actuation lever
11 Push-rod
12 Fuel valves
13 Fuel valve coupling shaft
14 Grease nipple
15 Engine starter brushes withdrawal button
16 Starter brushes withdrawal cable
17 Cooling flap actuation crank with position indicator
18 Drive rod
19 Torque conversion unit
20 Push-rod
21 Bellcrank
22 Adjustable length push-rod
23 Cut-off valve control lever
24 Torsion bar
25 Fuel cut-off valve
26 Tropical filter flap actuation handle
27 Cable
28 Torsion bar with actuation lever
29 Pulley
30 Valve with mounting bracket
31 Actuation button with push-rod

Fig. 3: Engine operation (overview)

The pilot adjusts the throttle lever in accordance with the supercharger pressure indication rather than by throttle position alone. Moving the throttle and thereby the performance adjustment lever of a stopped engine to the inflight setting should be avoided, because due to lack of hydraulic assist, its subsequent movement to the fully closed position will take greater effort than when the engine is running.

Movement of the fuel tank selection lever (3,9) is transmitted by a torsion bar (3,10) and push-rod (3,11) to the right fuel valve (3,12). The fuel valves, interconnected by a square shaft (3,13), are positioned on a fitting on the rear of the firewall (Bulkhead 1). The lever settings are:

"Auf" (Open)
"Vorderer behalter zu" (Forward tank closed)
"Hinterer behalter zu" (Rear tank closed)
"Zu" (Closed)

The cooling flaps are actuated from the cockpit by a hand crank (3,17); and their position indicated on a scaled plate. The transmission train is illustrated in Fig. 3,17-22. The coupling collars on the actuation rods (3,22) serve as separation points; these rods are adjustable in length. They must be adjusted to place a prescribed tension on the cooling flaps and thereby prevent their inadvertent opening in flight.

Important!

At "0" flap opening, the actuation rods must be set to a tension of 40 kg (88.2 lb); otherwise, there is a possibity of the flaps being

there is a possibility of the flaps being pulled

open by the slipstream during high speed flight.

Before opening the fuselage side panels ensure that the flaps are opened about 10°.

The starter brushes withdrawal button (3,15) is positioned on the auxiliary panel left side; a cable (3,16) attaches it to the brush withdrawal mechanism on the starter unit.

The fuel cut-off control lever (3,23) is spring-loaded to the 'Open' position. During the fuel pump check it must be held in the 'Closed' position. The control lever is connected by a shaft (3,24) to the cut-off valve (3,25) which is positioned on the left filter housing.

## B. Fuel system

See also Fig. 4.

The fuel system comprises two fuselage tanks (4,1 and 4,2); and, if required, an auxiliary fuel tank (Fig. 5) within the fuselage fixed to the rear of Bulkhead 8, and a jettisonable fuel tank (4,26) beneath the fuselage.

Use of the additional tanks is dependent upon the type of mission undertaken. To house the fuel required for increased ranges, either the drop tank (300 Ltr/66.2 gal) or the auxiliary tank (115 Ltr/25.3 gal), or both (415 Ltr/91.5 gal), can be fitted. On a mission with both additional tanks fitted, the drop tank is emptied first, so that, in an emergency, it can be discarded.

### 1. Basic fuel system (main tanks only)

The main fuel tanks are contained in a special compartment beneath the cockpit. This compartment is divided into two by a vertical wall and is sealed by a screw fastened cover panel.

Both fuel tanks are fitted with electrical fuel pumps (4, 8). The pumps start operating as soon as

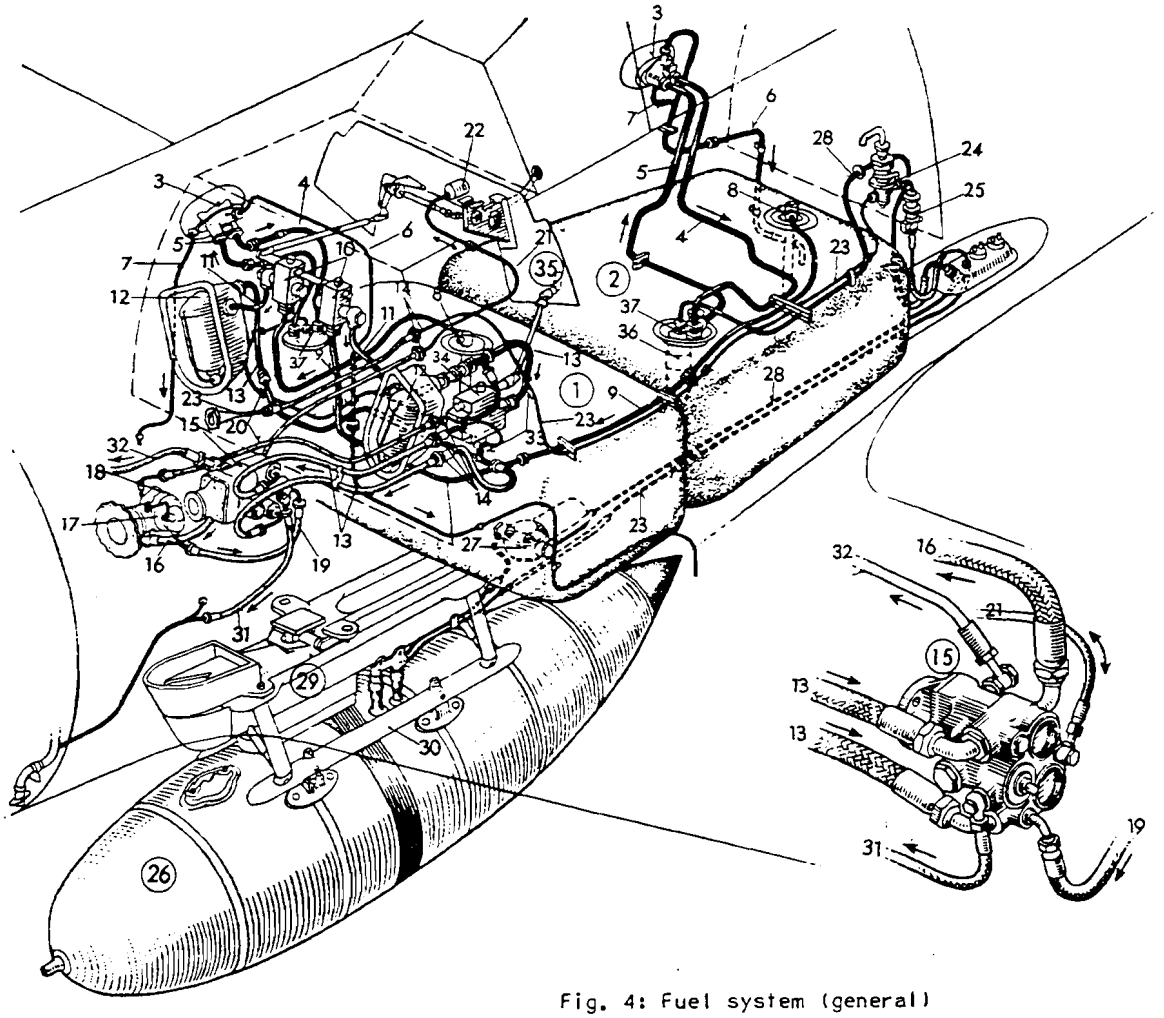



Fig. 4: Fuel system (general)

the appropriate circuit breakers (1,57) on the right instrument console are depressed, and they serve to support the action of the engine mounted (Maihak) pump (4,18).

A fuel gauge (1,36), positioned on the auxiliary instrument panel, measures the contents of each fuel tank individually; switching to the desired tank is via a selector lever (1,43). The fuel gauge reads correctly in level flight.

The forward tank is fitted with a fuel low level device. A red warning lamp (1,41) positioned on the right auxiliary instrument panel illuminates at approximately 90 - 100 Ltr (20-22 gal)(Return-to-base warning). A fuel low level device is also fitted in the rear tank; it causes a white light to illuminate when the contents fall to 10 Ltr (2.2 gal)(Tank switch-over warning).

The fuel pressure is monitored by a gauge (1,20) on the auxiliary instrument panel.

Each tank is provided with a separate filler point (4,3) on the fuselage right side. Fuel is poured through the filler line (4,4) until it begins to back up to the external filler connection via the overflow line (4,5). Fuel tank ventilation is accomplished at the appropriate filler point (ventilation line (4,6)); ventilation of the Bosch float-and-pendulum de-aerator (4,18) takes place through the forward filler point. The spill tube for the rear filler point connects into the rear tank ventilation line; that for the forward tank filler point connects to the fuselage lower surface. The fuel lines (4,9 & 4,11) run from the appropriate tank fuel pump (4,8) to the engine fuel pump (4,18).

Into each fuel line is built a fuel valve (4,10) and filter (4,12). The filters are set into suitable apertures (filter housings) on the forward side of the firewall. This siting of the filters prevents gas fumes from reaching the cockpit. The right filter connects into the forward tank fuel line; the left one, into the rear tank fuel line. The two filter housings are connected by a spill line which connects into the one from the forward filler point; it prevents the accumulation of fuel at the bottom of the housings of leaky filters. The two fuel lines are connected to one another by a line which contains a cut-off valve (4,34) which remains open during all normal powerplant operation. This ensures that both suction chambers of the Maihak fuel pump always contain fuel even when one tank is empty.

## 2. Fuel system with drop tank

The drop tank (4,26) is suspended from the shackles of the Type 500 release gear within the ETC 501 rack by a metal band. The drop tank is connected to the rear fuel tank (4,2) by a fuel line (4,28). An EP-1E fuel pump (4,27) is built into the line at the rear of the rack. An air line (4,23) leads from the supercharger to the drop tank and contains both an excess pressure (4,24), and a reverse pressure (4,25), valve. Rubber sleeves (system separation points) connect the fuel and air lines to the drop tank.

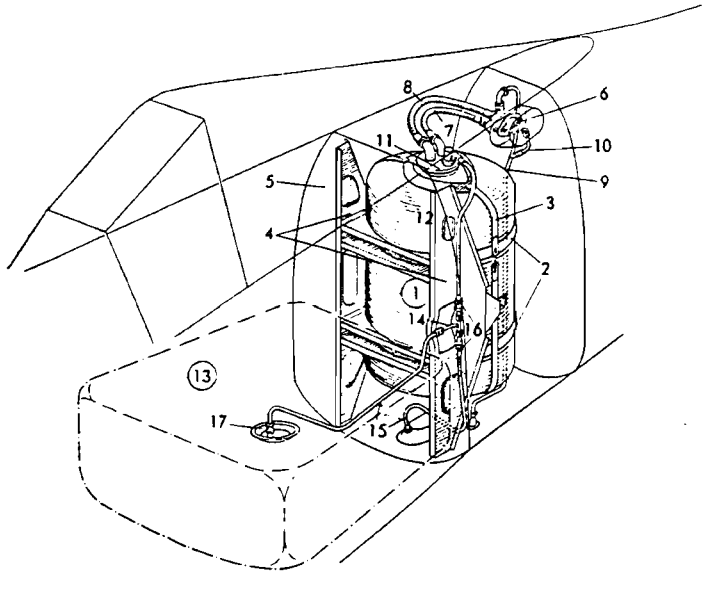
Fuel is forced from the drop tank to the rear fuel tank by air pressure drawn from the supercharger. This action is aided by the EP-1E fuel pump which begins to run as soon as the "Abwurfbehälter" circuit breaker is depressed.

When the supercharger pressure is less than that of the surrounding air, the EP-1E fuel pump alone feeds the fuel to the rear tank. A fuel transfer limit switch (4,36), built into the rear tank fuel pump (4,37), regulates fuel flow from the drop tank. With the drop tank fitted, fuel is drawn from the rear fuel tank until its contents have fallen to 240 Ltr (53 gal). At that point the transfer limit switch opens and permits drop tank fuel to flow into the rear tank until the drop tank is empty.

The drop tank contents are monitored as follows: when, after the limit switch has opened, the rear tank fuel contents sink below 240 Ltr, the drop tank is empty. This does not result in the switching off of the supercharger air pressure.

## 3. Fuel system with auxiliary tank

Old: Self-sealing tank.




1 Auxiliary fuel tank
2 Horizontal straps
3 Vertical strap
4 Tank housing
5 Bulkhead 8
6 Fuel filler point
7 Filler line
8 Overflow line
9 Ventilation line
10 Spill line
11 Tank line/pump unit
12 Fuel line
13 Rear fuel tank
14 T-joint
15 Fuel line (Drop tank to rear tank)
16 Check valves
17 Filler head

Fig. 5: Rear fuselage auxiliary tank

New: Non self-sealing tank with drain cock and supercharger air pressure fuel jettison.

A description of the new system will be added upon completion of the relevant construction documents!

The auxiliary fuel tank is fastened to a housing (5,4) at the rear of Bulkhead 8 (5,5) by two straps (5,2 & 3) and is fueled through a filler point (5,6) on the left fuselage between Bulkheads 9 and 9a. During fueling, the fuel flows through the filler line (5,7) to the tank; when the tank is full, the fuel backs up the overflow line (5,8) to the filler point, and from there, via a ventilation line (5,9) out the bottom of the fuselage. The fuel spill line (5,10) also connects into the ventilation line.

On the top of the tank is positioned a unit (5,11) containing the fueling, overflow and feed lines as well as the fuel pump. The electric fuel pump starts operating as soon as the "Kraftstoffpumpe Zusatzbehälter Rumpf" circuit breaker is depressed.

Fuel flows through a feed line (5,12 & 15) to the rear tank (5,13). Connecting into this line is a T-joint (5,14) with the drop tank fuel line. A check valve (5,16) is installed before the T-joint in each of the two lines. This prevents the flow of fuel from one auxiliary tank to the other; or, when one of these two tanks isn't fitted, prevents loss of fuel through the unconnected feed line.

The fuel transfer limit switch (5,17) regulates the flow of fuel from the auxiliary tank in the same way as for the drop tank.

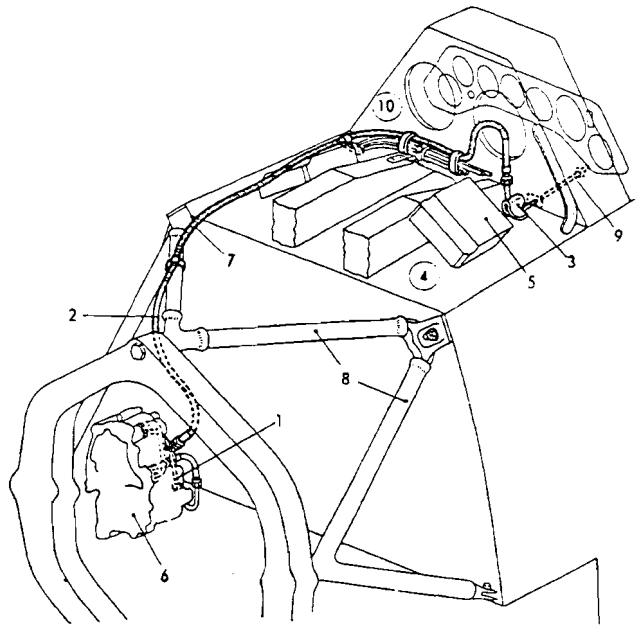
There is no monitoring of auxiliary tank contents; the tank is empty when the rear tank fuel level falls below 240 Ltr.

## C. Emergency power system

See Fig. 6.

An engine emergency power system is provided for this aircraft. This system is to be installed in accordance with Fw 190 Modification Instruction No. 133.

This system provides, for fighters with non-derated BMW 801D or BMW 801TU powerplants, a short-term increase in power up to the rated altitude of the engine. This emergency power can be maintained in level or climbing flight for up to 10 minutes (Watch the oil temperature!). Because of potential oil and cylinder head cooling problems, it is recommended that during a climb, the system, if feasible, be turned off. During system operation in hot summer weather, the oil temperature will reach maximum permissible limits. This system must only be switched on in flight, at full throttle, and with the propeller pitch control on "Automatic".




1 Supercharger air line
2 Boost air bleed line
3 Valve with housing
4 Decking
5 Fuse and distributor box
6 Control unit
7 Helical anti-chaffing tube
8 Engine bearer assembly
9 Operating rod with button
10 Windscreen mounting frame

Fig. 6: Emergency power system

The increased power is gained by bleeding air from the supercharger pressure line (6,1), in which are located two nozzles connected in series. A flexible tube (6,2), through which a portion of the boost air can be drawn off when the valve (6,3) is opened, is connected into the supercharger air line between the fuel mixture chamber and the boost pressure regulator. The two nozzles, the first of which has the smaller inside diameter, are so constructed, that when the actuation valve (6,3) is opened, the air pressure within the boost pressure drops to a very low level; this causes the throttle valve to open wide, thereby increasing the maximum obtainable boost pressure, at 2700 RPM, from 1,42 ata, to 1,58 ata at the low supercharger setting, and to 1,65 ata at the high supercharger setting. The higher boost pressure results in increased fuel consumption, due to the greater quantity of fuel injected into the cylinders.

The actuation valve (6,3) is mounted in a housing on the decking in front of the windscreen mounting frame (6,10) and behind the left fuse and distributor box (6,5). The flexible line (6,2) which connects the valve to the supercharger air line is encased within a helical anti-chaffing tube (6,7).

The valve is operated by a button (6,9) located beneath the left side of the main instrument panel.

The following inscription is placed near this button.

Emergency Power
Pull
2700 RPM
L = 1,58; H = 1,65
Button depressed = Valve 'Closed'
Button pulled = Valve 'Open'

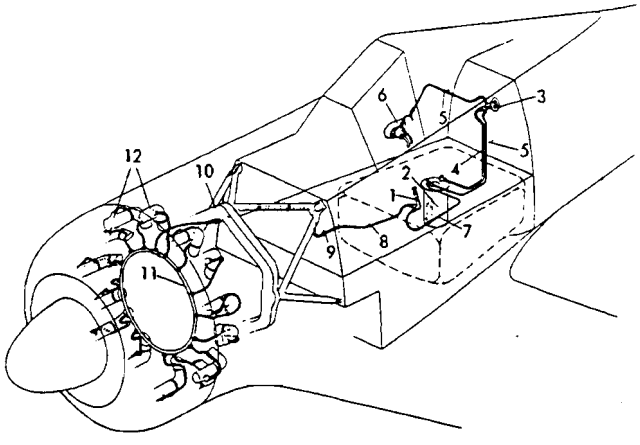
When the emergency power unit is installed, only the following types of spark plugs can be used:

a) Bosch DW 240 ET 7/1A
b) Bosch DW 240 ET 7/1B
c) Bosch DW 250 ET 7

Spark plug c) is to be used only if spark plugs a) and b) are not available.

Aircraft fitted with this unit are to be marked with a yellow ring (50 mm outside diameter and 10 mm wide) which is to be placed on the rear left corner of the fuselage armament cover.

## D. Primer fuel system




1 SUM-Primer pump
2 Primer fuel line
3 Filler point
4 Filler line
5 Ventilation line
6 Rear tank filler point
7 Suction feed line
8 Pressure feed line
9 Firewall transition point
10 Separation point (20) on engine mounting ring
11 Circular feed line harness
12 Supercharger air pressure pipes

Fig. 7: Primer fuel system

This system facilitates engine starting by spraying primer fuel into the supercharger air pressure pipes of all 14 cylinders, and there atomizing it.

The system includes:
1 AP-20 SUM-Primer pump
1 tank with filler point and associated feeder lines.

The primer fuel tank (7,2), which is contained in the rear fuel tank, has a capacity of 3 Ltr (5 Qts). The pump (7,1) is positioned at the rear of the left instrument console.

The tank is fueled through a filler point (7,3) which is situated beneath a sliding cover on the forward fuselage left side. The filler point is connected to the primer fuel tank by the filler line (7,4) and ventilation line (7,5).

Another line, which leads from the primer tank filler point to the rear tank ventilation line (7,6), provides for ventilation in flight.

## E. BMW 801D lubrication system

Documentation for the TU-powerplant will follow.

See Fig. 8.

The circular oil tank is positioned in front of the engine and behind the oil cooler (8,6), and is protected by an armoured ring. The tank has a scaled contents measuring probe within the filler cap (8.24); the filler point is located on the left side of the nose. Oil consumption measurement during flight is not possible.

The ring shaped oil cooler is positioned in front of the oil tank and is also protected by an armoured ring. Between the two armoured rings is a gap of about 10 mm for the exit of the cooling air.

During low temperatures, the system is filled with warm oil forced up through Filler Point I (8,18). The oil cooler is filled first, while air is expelled from the system; then the tank is filled. A line connecting the input side of the main pump and the input side of the auxiliary pump is contained within the oil pumping unit; this line enables the excess oil which is delivered by the oversized auxiliary pump to be returned to it.

The warm oil must be hot enough (over 65°C) to allow the thermostat (8,4) to open the radiator flow circuit.

The engine itself is filled with warm oil through a special filler connection (8,19).

### Oil Flow Circuit

Oil is drawn from the tank by the auxiliary pump and fed past the thermostat (8,4). At an oil temperature below 65°C it flows through the warming chamber (8,5) to the main pump; above 65°C it flows through the radiator block (8,6) to the main pump. A temperature probe (8,8) which directs the flow of oil between the auxiliary pump and the cooler, is positioned between the cooler and the main pump.

The main pump then forces the oil to the engine, following which, three engine return pumps feed the hot oil back to the oil tank. The oil flow circuit then begins anew.

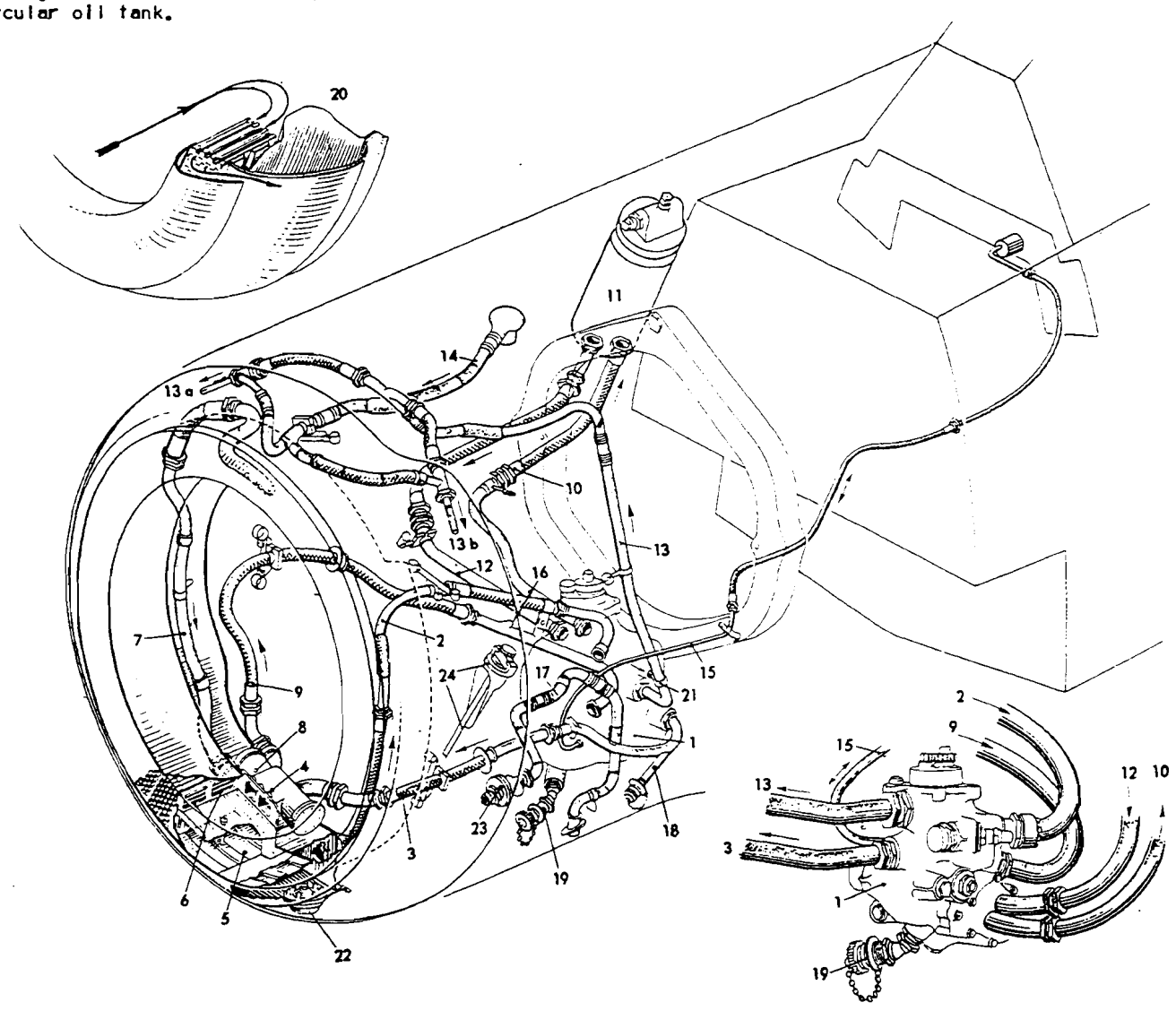
To ensure a continuing supply of oil in case of failure of the thermostat or of the cooler, a line connects the output side of the auxiliary pump directly to the input side of the main pump. To guarantee a constant oil pressure of 8 atü (118 psi) to the engine, the main pump has oversized dimensions and is fitted with a shunt line.

The engine ventilation line (8,14) connects into the circular oil tank.

Between the main pump and the engine, the oil passes through an oil filter (8,11) positioned on the engine mounting ring.

Cold weather starting sequence

Oil is prepared for cold weather starting by a




1 Engine mounted oil pump
2 Input line (tank to pump)
3 Output line (pump to thermostat)
4 Thermostat
5 Oil warming chamber
6 Oil cooler block
7 Line from cooler to temperature probe
8 Temperature probe
9 Input line (probe to pump)
10 Line from pump to oil filter
11 Oil filter
12 Line from oil filter to pump
13 Line from pump to tank
13a Tank inlet line
13b Tank inlet line
14 Engine ventilation line
15 Oil pressure measuring line
16 Oil temperature measuring line
17 Tank ventilation line
18 Warm oil filler point for cooler and tank
19 Warm oil filler point for engine
20 Path of cooling air through the oil cooler
21 Oil mixing nozzle for cold weather starting
22 Oil tank drain valve
23 Pendulum valve
24 Filler cap with contents measuring probe

Fig. 8: BMW 801D Lubrication system

special mixing nozzle (8,21) which is built into the oil return line (8,13).

Fuel is taken from the output side of the Maihak fuel pump and fed through a cut-off valve to the mixing nozzle (a circular tube with fine holes), where it is added to the oil.

To complete the cold weather starting procedures see the Fw 190 Operating Procedures.

Oil temperature (1,15) and pressure (1,14) are monitored by appropriate instruments on the auxiliary instrument panel (1,9).

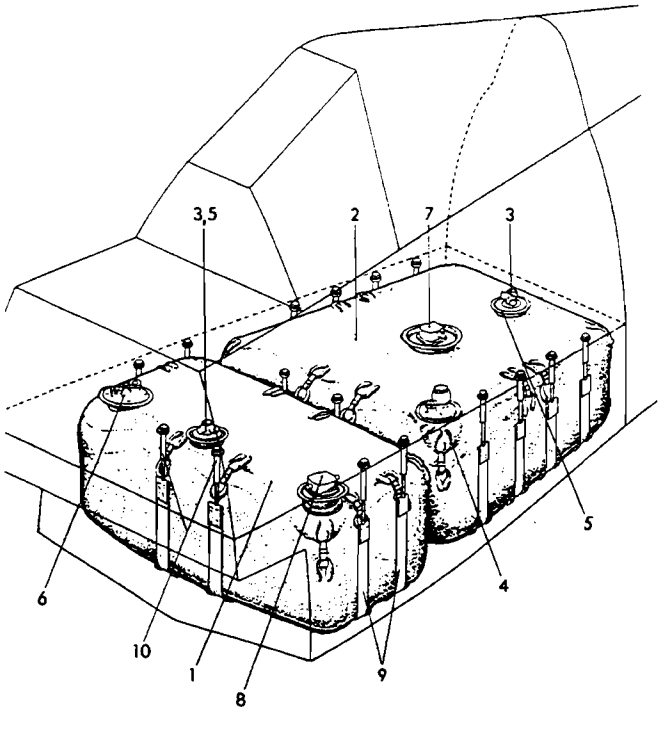
The various oil lines are colour coded in accordance with DIN L5 and are marked with flow direction arrows.

## F. Aircraft tanks

### 1. Fuel tanks

Fuel: C3 (96 Octane)

a. Fuselage tanks




1 Forward fuel tank
2 Rear fuel tank
3 Electrical fuel pump
4 Filler head with fuel transfer limit switch
5 Fuel tank flange fitting
6 Forward tank filler head
7 Contents measuring unit with low level sensor
8 Contents measuring unit with low level sensor
9 Securing straps
10 Adjustable bolts

Fig. 9: Main fuel tanks

Fueling capacity:
Forward tank at least 232 Ltr (51.0 gal)
Rear tank at least 292 Ltr (64.5 gal).

The two self-sealing fuel tanks (9,1 & 2) are positioned within the fuselage beneath the cockpit. They are held by fabric straps (9,9) which are secured to the cockpit floor by adjustable bolts.

Each tank is fitted with an electrical immersion pump (9,3), a filler head (9,4 & 6) (that of the rear tank also contains a fuel transfer limit switch), and a contents measuring unit (9,7 & 8) with attached fuel low level sensor.

Attached to the filler heads of the two tanks are: a filler line (4,4), and an overflow line (4,5); to that of the forward tank, the de-aerator ventilation line (4,20); and, to that of the rear tank, the auxiliary tanks feed line (4,28).

b. Underfuselage drop tank

Fueling capacity: 300 Ltr (66.2 gal).

The drop tank is, when carried, suspended beneath the fuselage from an ETC 501 rack and locked into position by four set screws.

The drop tank is connected to the fuselage feed, and air pressure, lines by rubber sleeves (separation points).

In an emergency, it can be jettisoned by pulling the T-shaped handle labelled "Bomben".

c. Rear fuselage auxiliary tank

Fueling capacity: 115 Ltr (25.3 gal).

See Fig. 5.

The auxiliary tank is, when required, mounted behind Bulkhead 8. It is fastened to a support by fabric straps (two horizontal and one vertical).

The tank has a header unit containing a pump, a filler line, an overflow line, and a feeder line.

It is self-sealing.

### 2. Primer fuel tank

See Fig. 7.

Fuel: Aircraft primer fuel.

Fueling capacity: Approximately 3 Ltr (5 Qts).

The tank (7,2) is contained within the rear fuel tank. It is filled via an external filler point (7,3).

The tank is protected by its location within the rear tank.

## 3. Oil tank

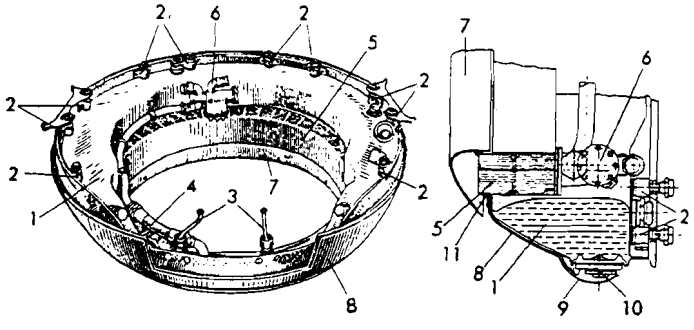
Oil tank capacity: 55 Ltr (12 gal).

Oil tank contents must not be permitted to fall below 20–25 Ltr (4.4–5.5 gal).

Oil type: Only Intava–Redring.

The ring shaped oil tank (10,1) is located within the aircraft nose. It is filled through a fueling nozzle (8,24) on the aircraft nose left side. Oil is drained from the tank by opening the SUM– tank drain valve (10,10), after attaching an oil drain tube to it.

The tank is protected against gunfire by an armoured ring (10,8).



1 Oil tank
2 Rubber shock mounting
3 Connecting lines
4 Oil lines
5 Cooler
6 Thermostat
7 Cooler armour
8 Oil tank armour
9 Cover
10 Tank drain valve
11 Cover segment

Fig. 10: BMW 801D armoured oil cooler and tank

## 4. Control unit oil tank

The engine mounting ring serves as control unit oil tank. It is filled to the level of the filler opening (located on the upper left side of the ring).

Capacity: 5,6 Ltr (4.9 Qts).

Caution!

Add oil only immediately after running up the engine. Reason: when the engine has been sitting for some time, the control unit fills with oil and the oil level within the mounting ring sinks. If the tank is then filled, when the engine is started, the extra oil in the control unit will attempt to move back to the tank. The resulting excess pressure in the system will probably damage both the control unit and the mounting ring.

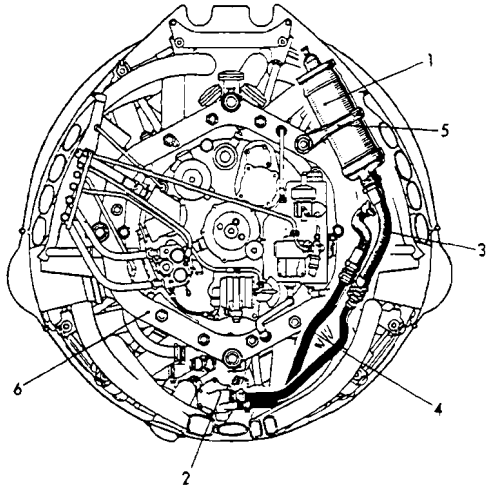
A thin temperature–resisting oil mixture is used, the mixing ratios for summer and winter are:

Summer mixture:

80% Redring + 20% Spindle oil green (Shell AB 11)
or 90% Redring + 10% Hydraulic oil 0435

Winter mixture:

50% Redring + 50% Spindle oil green (Shell AB 11)
or 70% Redring + 30% Hyraulic oil 0435



1 Oil filter
2 Oil pump
3 Line from pump to filter
4 Line from filter to pump
5 Securing clamp
6 Engine mounting ring

Fig. 11: BMW 801D oil filter

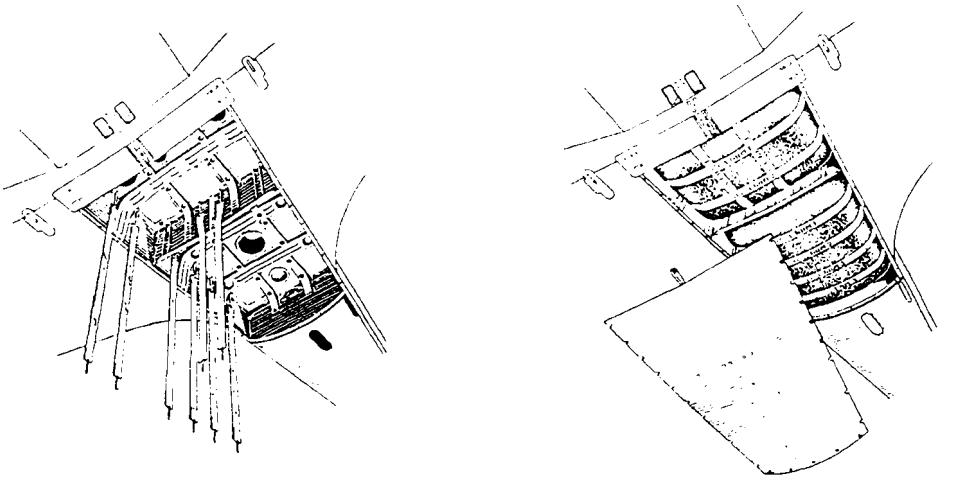


Fig. 12: Fuel tank compartment with fuel tanks removed and installed

1 Forward fuel tank
2 Rear fuel tank
3 Auxiliary tank
4 Drop tank
5 Primer fuel tank
6 Fuel tank filler point
7 Primer fuel filler point
8 Filler line
9 Overflow line
10 Ventilation line
11 Spill line
12 Fuel pump unit
13 Fuel line (tank to fuel valve)
14 Fuel valve
15 Fuel line (fuel valve to filter)
16 Filter
17 Fuel line (filter to fuel pump)
18 Engine fuel pump
19 Fuel line (fuel pump to injection pump)
20 Fuel injection pump
21 Bosch de-aerator
22 Fuel return flow valve
(de-aerator to fuel pump)
23 Ventilation line
(de-aerator to forward fuel tank)
24 Fuel pump spill line
25 Fuel line to cold-start mixing lever
26 Fuel feed lines connecting line
27 Cut-off valve
28 Rear tank fuel pump
29 Fuel transfer limit switch
30 Fuel line separation point
31 Fuel line
(auxiliary tank to rear tank)
32 Air pressure line
(supercharger to drop tank)
33 Excess pressure valve
34 Check valve
35 EP-1S fuel pump
36 ETC 501
37 Spacer bars
38 Auxiliary tank mounting bracket
39 SUM-primer pump
40 Primer fuel line
41 Circular feed line harness
42 Supercharger air pressure pipes
43 Fuel pressure measuring line
44 Fuel pressure gauge
45 Instrument panel bulkhead
46 Windscreen washer operation lever
47 Fuel line
48 Spray tubes
49 Windscreen
50 Bulkhead 1 (firewall)
51 Bulkhead 8

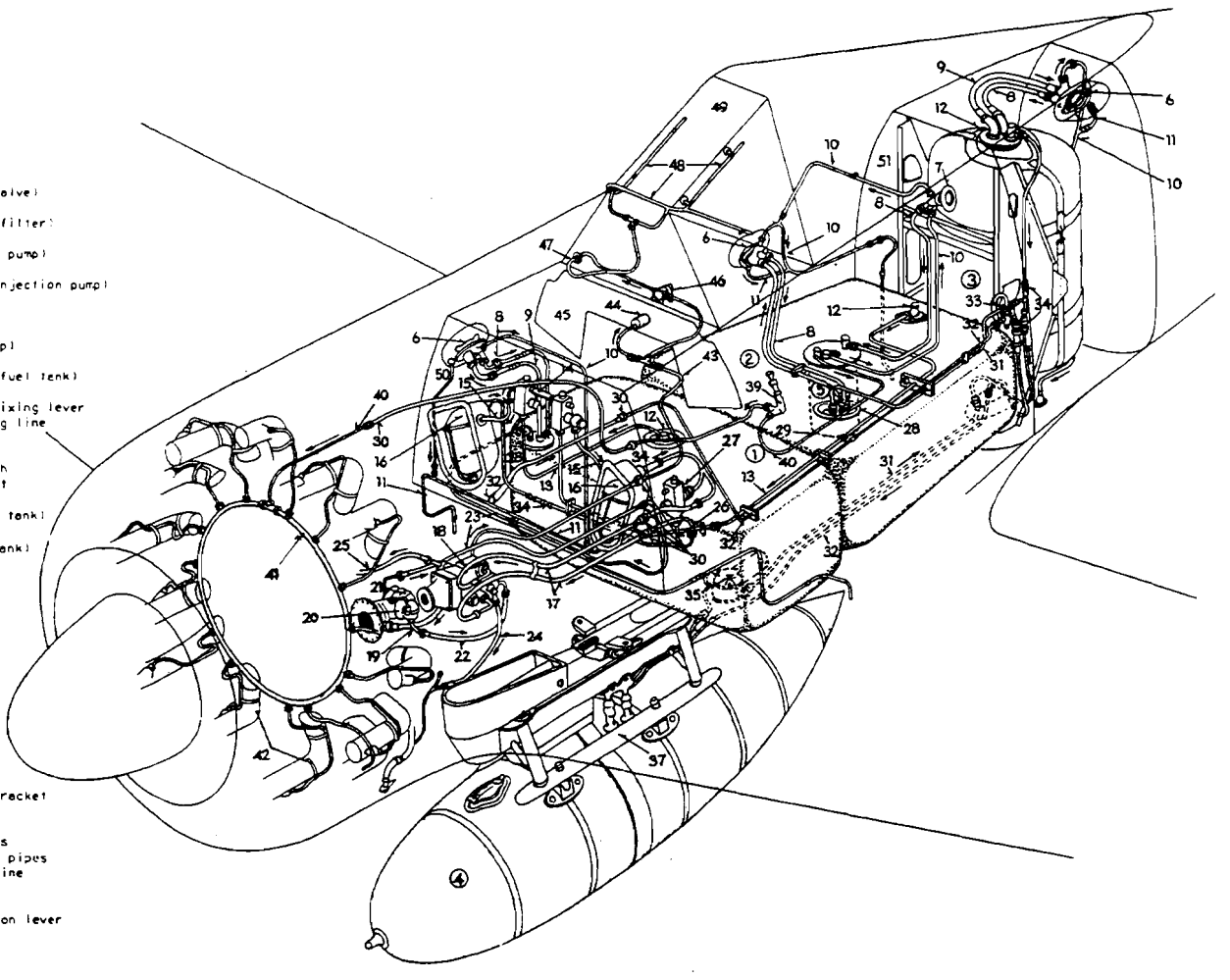


Fig. 13: Fuel system skematic

D. (Luft) T. 2190 A-8

For Official Use Only!

# Fw 190 A-8

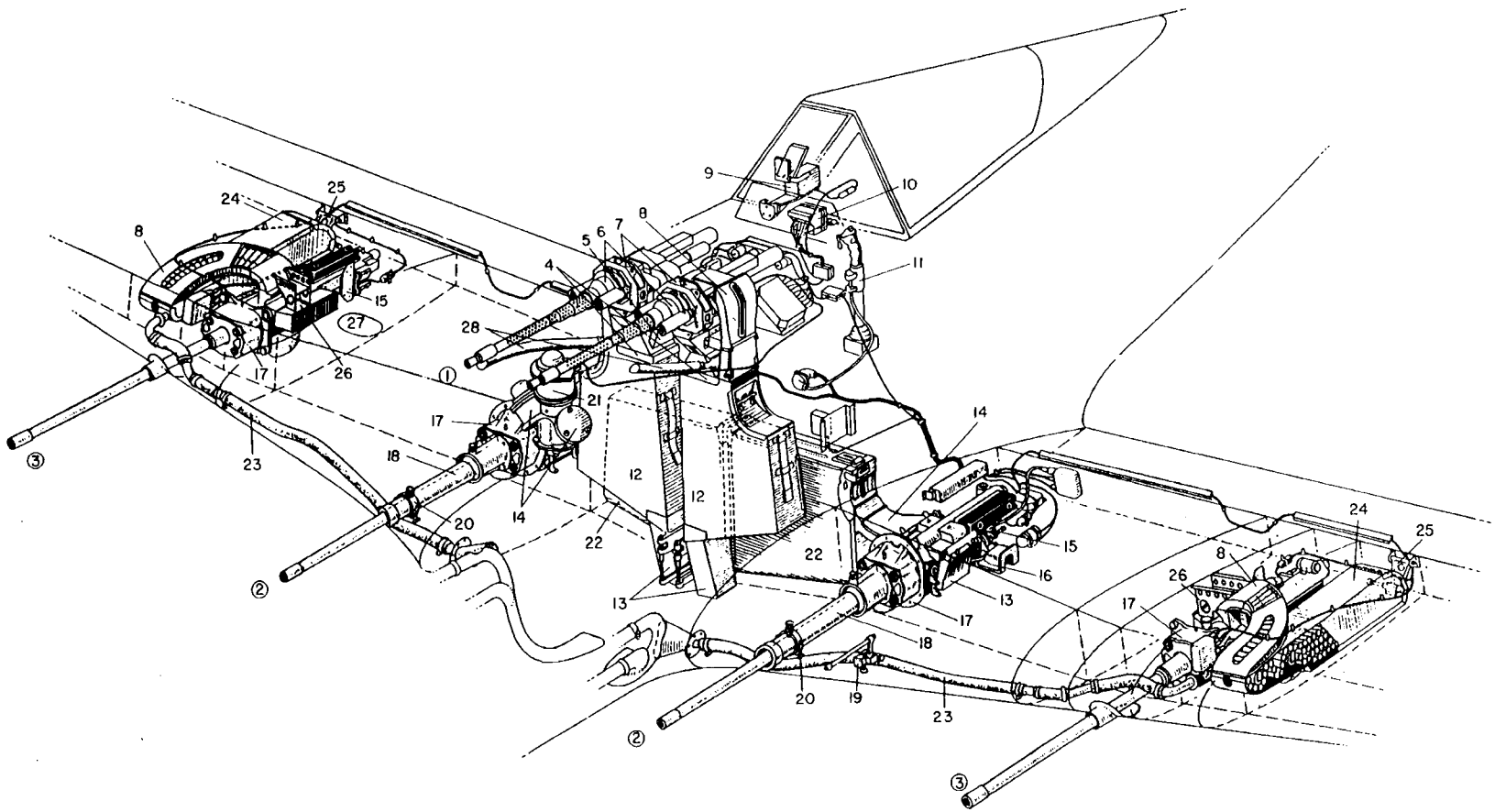
## Aircraft Handbook

### Part 8A

### Armament installation

(Effective July 1944)

Issued September 1944




1 Fuselage MG 131 13mm machine guns
2 Wing-root MG 151/20E 20mm cannons
3 Outboard MG 151/20E 20mm cannons
4 Ammunition box attachment brackets
5 Link belt segment discard chute
6 MG 131 forward mount
7 StL 131/5B weapon mount
8 Ammunition feed chute
9 Revi 16B reflector gunsight
10 SZKK 4 armament switch --, round counter --, and control unit
11 KG 138 control stick
12 Fuselage weapons ammunition boxes (400 rounds each)
13 Link belt segment/cartridge casing discard chute
14 Fuselage weapons synchronizing gear
15 Adjustable rear mount
16 Rear mount support bracket
17 Non-adjustable forward mount
18 Cannon blast tube
19 Armament collimation tube
20 Barrel support clamp
21 Wing-root weapons synchronizing gear
22 Wing-root weapons ammunition boxes (250 rounds each)
23 Hot air pipe for ammunition warming
24 Outboard weapons ammunition boxes (125 rounds each)
25 Ammunition box rear suspension arm
26 Mounting bracket & casing ejection chute
27 Cartridge casing retrieval cover
28 Cold air pipes for ammunition cooling

Fig. 1: System skematic

# I. Description

## A. General

The basic armament of the Fw 190A-8 consists of three groups of weapons. These are:

2 MG 131 machine guns in the fuselage upper cowling with 400 rounds per gun (1,1)

2 MG 151/20E cannons in the wing-roots, one per side, with 250 rounds per gun (1,2)

2 MG 151/20E cannons in the wings outboard of the propeller arc, one per side, with 125 rounds per gun (1,3)

All weapons are fired electrically, and use only E-type ammunition. The MG 131s and the wing-root MG 151/20Es are synchronized to fire through the propeller arc; the outboard MG 151/20Es are unsynchronized.

The positioning of the ammunition belts is indicated by a loading diagram on each ammunition box.

Cartridge casings and link-belt segments are--except for the casings of the outboard weapons--discarded.

The fuselage weapons are harmonized to a range of 400 m (435 yds); the wing mounted weapons, to a range of 550 m (600 yds).

The operating system for each weapons group is fully electrical and includes (inclusive of circuit breakers and electrical lines):

1. SVK 2-151/131E fuse and distributor box, and
2. EDSK-B1 gun cocking control box.

Each operating system is routed through the SZKK 4 switch, round counter, and control unit (1,10).

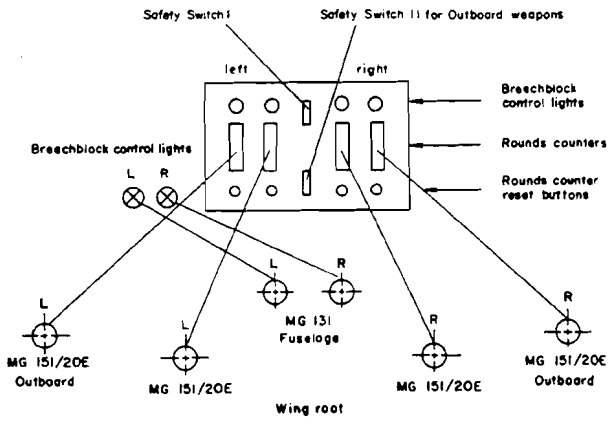



Fig. 2: SZKK-4

The fuselage and wing-root weapons are switched on by Switch I, the outboard weapons by Switch II (Switch I must first have been switched on). The outboard weapons must not be switched on less than 3 seconds after the other weapons. This interval will ensure that cocking of the fuselage and wing-root guns has been completed. As the aircraft battery can support the simultaneous cocking of a maximum of only four weapons, this action avoids the circuit overload that will otherwise result. A special instruction plate is fitted.

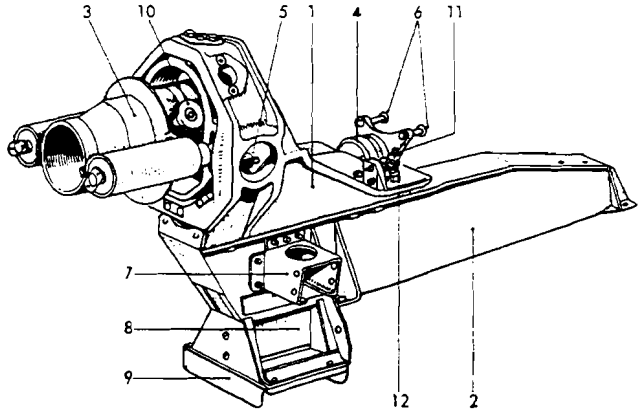
Two firing buttons, A and B1, are fitted on the KG 13B control column grip (1,11). The A-button fires the fuselage and wing-root weapons; the B1-button fires the outboard weapons.

ED-cocking units and EA-firing units are attached to each gun. The ED unit is utilized for automatic weapon cocking, breech-block position indication, and rounds counting; the EA unit, for weapon firing.

## B. Fuselage MG 131s

### 1. Weapon mounting

The first weapons group, two MG 131s, is positioned in the upper cowling, forward of the Windscreen mounting frame, in StL 131/5B fixed mountings (1,7).




1 StL 131/5B weapon mount
2 Carrier bracket
3 Forward support
4 Rear support
5 Electrical contact plate
6 Rear support mounting pins
7 Chute support brackets
8 Casing ejection chute
9 Ammunition box attachment bracket
10 Locking pin
11 Horizontal adjustment screw
12 Vertical adjustment screw

Fig. 3: Fuselage MG mount and carrier unit

The weapon mounts (3,1) are fixed to carrier brackets (3,2) which, in turn, are screwed to Bulkhead 1 and the Windscreen mounting frame.

The gun mount consists of a fixed forward support (3,3), an adjustable rear support (3,4), and a cast bearer. The forward support, into which the gun is locked, has a recoil fitting and can be rotated about its vertical and horizontal axes.

The rear support mounting pins (3,6) secure the MG 131 rear mounting bracket and lock the weapon into position; adjustable set screws permit vertical and horizontal adjustment of the weapon. The Cardan type suspension of the forward support permits precise alignment of the weapon.

The carrier bracket, of welded sheet steel construction, is attached to Bulkhead 1 and the Windscreen mounting frame. At its forward end it includes a cartridge casing ejection chute (3,8). To either side are screwed support brackets (3,7) for attaching the feed and ejection chutes. The ammunition box attachment bracket (3,9) is fastened beneath the cartridge casing ejection chute.

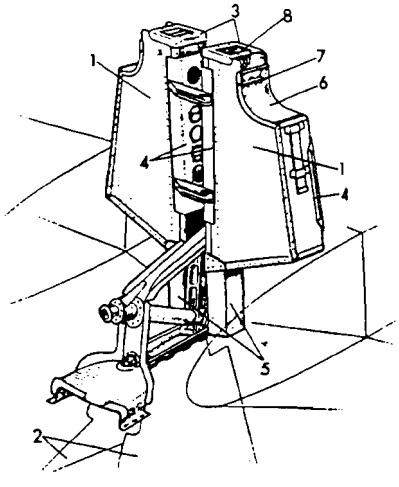
## 2. Ammunition stowage

Ammunition for the MG 131s is contained in two ammunition boxes (1,12), each of which can hold 400 rounds in a Type 131 disintegrating link belt.

The ammunition boxes (4,1) are positioned within the fuselage in front of the main spar and Bulkhead 1 in the area above the mainwheel doors (4,2). At the top, they are secured to attachment brackets (4,3), on the sides by guides (4,4), and at the bottom by hinged chutes (4,5). Each box has a hinged cover (4,6), which is locked by two spring-loaded bolts (4,7), through which the ammunition is loaded. They also each have an enclosed chute (4,8) through which the belt segments and cartridge casings drop into the slipstream. To improve ammunition storage, wooden supports are positioned on the floor of each box.

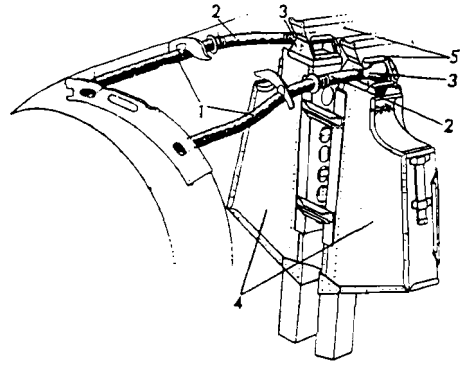
Ammunition in these boxes receives cooling air which is extracted from behind the engine cooling fan.

Two flexible pipes (5,1) on the underside of the centre cowling upper panel and two tubes (quick separation points!) (5,2) with terminal fittings (5,3) carry air to the ammunition boxes (5,4). To secure them, the terminal fittings are pushed rearward into the carrier brackets (5,5). The cooling air then circulates through the ammunition boxes.




1 Ammunition boxes
2 Wheel doors
3 Ammunition box attachment brackets
4 Guide brackets
5 Hinged belt segment and cartridge casing chute
6 Hinged cover
7 Spring-loaded bolts
8 Link-belt segment and cartridge casing chute

Fig. 4: Fuselage MG ammunition boxes




1 Flexible pipe
2 Tube
3 Terminal fitting
4 Ammunition boxes
5 Carrier brackets

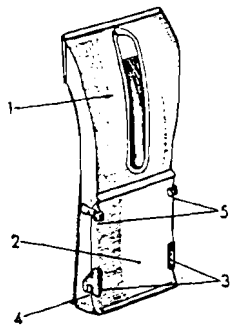
Fig. 5: Fuselage MG ammunition cooling

## 3. Ammunition feed chutes

The MG 131s are adapted for left as well as for right hand ammunition feed. This permits the respective feed chutes (6,1) to be positioned on the outboard sides of both MGs.

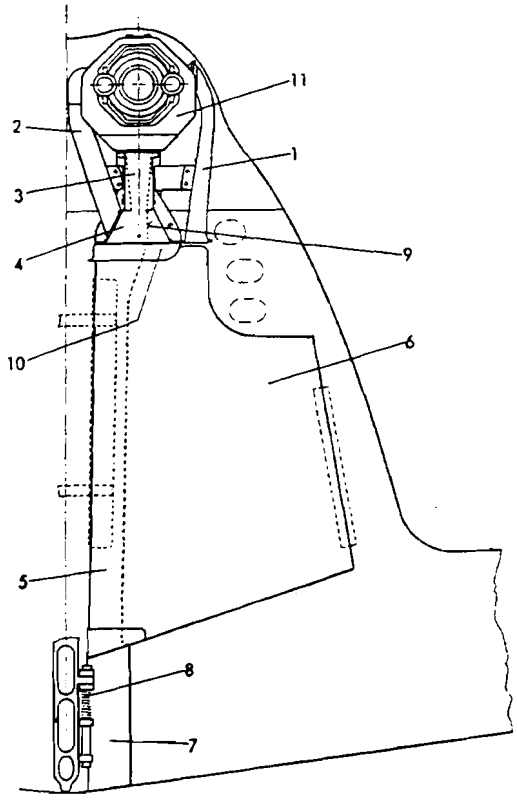
The cover (6,2), which removes to permit insertion of the ammunition belt, is held in place by studs (6,4), latches (6,3), and spring clips (6,5).

The link-belt segment discard chute (7,2) joins onto the cartridge casing ejection chute (7,3) which is mounted directly beneath each MG. The belt segments and casings drop out of the bottom of the fuselage through, in sequence, the above chutes, the ammunition box chute (7,5), and the hinged lower chute (7,7).




1 Ammunition feed chute
2 Cover plate
3 Latch
4 Studs
5 Spring clips

Fig. 6: Fuselage MG ammunition feed chute




1 Ammunition feed chute
2 Link-belt segment discard chute
3 Cartridge casing ejection chute
4 Weapon carrier bracket
5 Enclosed belt segment and cartridge casing chute
6 Ammunition box
7 Hinged discard chute
8 Hinge pin with spiral spring
9 Cartridge casing chute side plate
10 Ammunition box attachment bracket
11 StL 131/58 weapon mount

Fig. 7: Fuselage MG ammunition feed and discard chutes (Seen from the front)

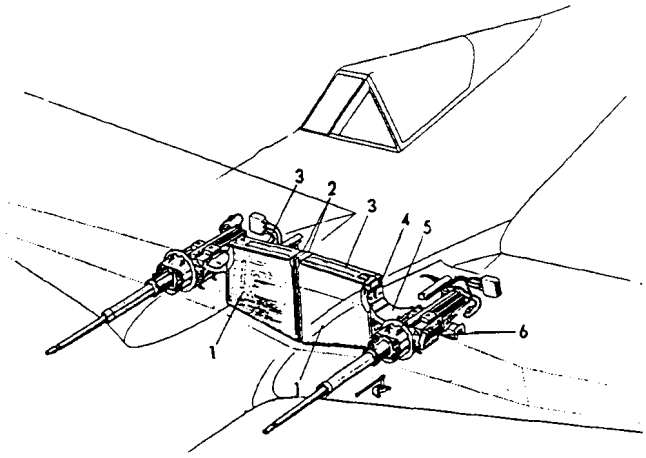
# C. Wing-root MG 151/20Es

## 1. Weapon mounting

Two wing-root MG 151/20E cannons comprise the second group of weapons. Each gun is secured in an StL 151/28 fixed weapon mount; which consists of a forward and a rear support. The forward support (1,17) provides the recoil housing and the forward attachment point for the weapon: the rear support (1,15), the alignment adjustment mechanism and rear attachment point. Both supports are attached to the wing; the front one to the main spar, the rear one to a fitting between Centre ribs 1 and 3.

The cannon barrel is housed within a blast tube (1,18) which is secured to the forward support and to the wing leading edge.

To steady its barrel, the cannon is fitted with a clamp (1,20)--a three piece ring with set screws and lock nuts. In the blast tube are 3 holes through which the set screws pass.




1 Ammunition boxes
2 Nose fitting
3 Hinged door
4 Lock
5 Feed chute
6 Discard chute

Fig. 8: Wing-root cannon layout

## 2. Ammunition stowage

The ammunition boxes for the two MG 151/20Es are positioned within the fuselage behind the main spar. They are accessible through the fuselage bottom via two hinged doors.

Each ammunition box (8,1) is hooked onto the fuselage centre support by its nose fitting (8,2); guide fittings give sidewards support, and the access doors give vertical support.

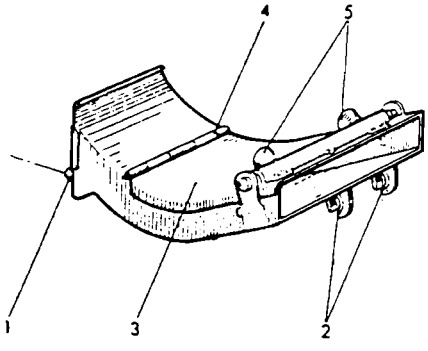
In the throat of each ammunition box is a roller over which the ammunition belt moves as it leaves the box.

A wedge shaped divider piece is built into each ammunition box to improve the efficiency of the ammunition feed.

A hinged door (8,3) on the top of each box opens to give access to the box and permit loading of the ammunition belt.

## 3. Ammunition feed chutes

To permit direct feeding of the ammunition, the MG 151/20Es are both rigged for inboard feed, ie. the left weapon has right side feed, etc. Ammunition is fed to the guns through ammunition feed chutes (Fig. 9).



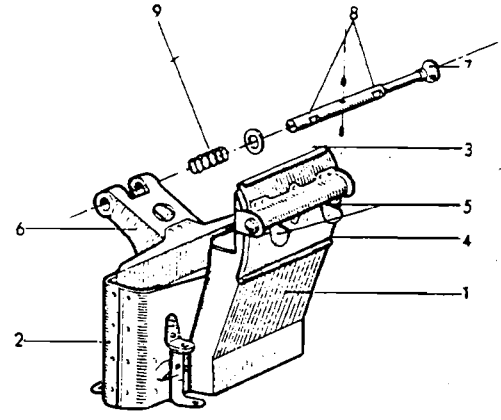

1 Locating stud
2 Retaining slots
3 Hinged cover
4 Hinge
5 Spring-loaded bolts

Fig. 9: Left gun feed chute

The ammunition feed chute is attached to the ammunition box by two studs (9,1) and is secured at its outboard end to the belt link and cartridge disposal chute. The two semi-circular retaining slots (9,2) rest on a shaft to which they are secured. A hinged cover (9,3), locked by two spring-loaded bolts (8,5), gives access to the chute.

The link-belt segments are ejected from the outboard side of each weapon through a combined link-belt disposal chute (10,1) and cartridge casing ejection chute (10,2); the latter positioned directly beneath the gun. Both are screwed to the wing lower skin.

To aid in loading the ammunition belt into the gun, a flap (10,3) on the upper portion of the chute can be opened. A slotted shaft (10,7) fitted into the outrigger bracket (10,6) secures the ammunition feed chute (Fig. 9). With both units in position, the shaft (10,7) is pressed in against the force of the spring (10,9); permitting the feed chute slots (9,2) to drop down over the notches. The shaft is now released and the slots are locked into place.

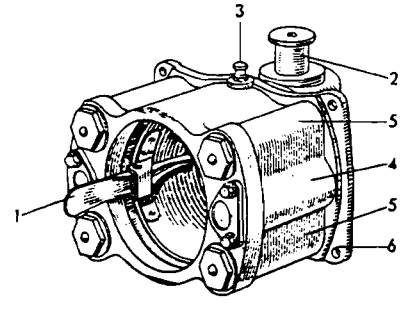



1 Link-belt disposal chute
2 Cartridge casing ejection chute
3 Hinged flap
4 Hinge
5 Spring-loaded bolts
6 Outrigger brackets
7 Feed chute locking shaft
8 Notches
9 Spring

Fig. 10: Left MG link and cartridge disposal chute

# D. Outboard MG 151/20Es

## 1. Weapon mounting




1 Barrel release lever
2 Locking pin
3 Grease nipple
4 Damping cylinder
5 Spring cylinder
6 Attachment flange

Fig. 11: Outboard cannon forward support

The third weapons group consists of two MG 151/20E cannon, located in the left and right wing panels outside the propeller arc. Each weapon is secured in an StL 151/11 fixed mount, which consists of a forward and rear support. The guns are positioned on

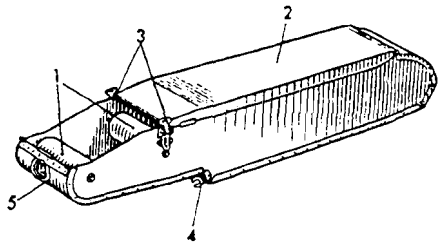
their sides to facilitate ammunition feeding. The forward support houses the weapon trunnions; the rear support secures the weapon rear attachment points.

The forward support is attached to a bracket which is, in turn, secured to the wing lower shell between Centre ribs 7 and 8.

To reduce the weapon firing shock, a recoil unit (11,4 & 5) is fitted within the forward support.

The rear, adjustable, mount is fixed to a mounting bracket which is, in turn, secured to Centre rib 7. The weapon can be adjusted to ±1° vertically and horizontally, and can be removed without affecting its adjustment.

## 2. Ammunition stowage




1 Rollers
2 Hinged cover
3 Feed chute and hinged cover retaining clips
4 Forward attachment claws
5 Warm air inlet hole

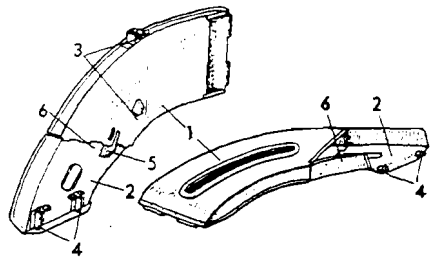
Fig. 12: Outboard gun ammunition box

The ammunition boxes (1,24), each of which can hold up to 125 cartridges in a Type 151 ammunition belt, are mounted parallel to, and outboard of, their respective weapons, between Centre ribs 8 and 9. The MG 151/20E mounted in the left wing has right hand feed; the one in the right wing, left hand feed.

The front end of the ammunition box is secured to the forward rim of the gun bay aperture by a spring-loaded bolt assembly which grips the two suspension claws (12,4). At the back it is secured by a spring-loaded bolt which slides through a fitting at the lower rear edge of the ammunition box. The bolt assembly is retained within a hinged mounting arm which is, in turn, fixed to the rear spar.

A wooden strip is placed in the ammunition box to keep the belt as nearly horizontal as possible. In addition, there are two horizontal rollers to aid ammunition feeding. At the top is a hinged cover (12,2) which opens to permit loading of the ammunition belt. Two catches (12,3), riveted to the sides of the box, lock the cover and secure the ammunition feed chute to the box. Warm air for ammunition warming enters through an opening (12,5) in the front of the box.

## 3. Ammunition feed chutes




1 Feed chute
2 Hinged flap
3 Securing hooks
4 Spring-loaded studs
5 Ammunition belt catch
6 Hinge

Fig. 13: Outboard cannon ammunition feed chute

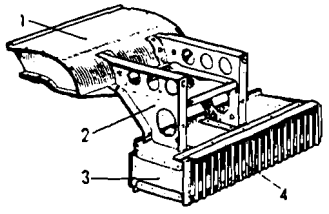
The ammunition belt is fed to the gun through a feed chute (Fig. 13) and an ammunition lead-in section (14,1).

The hinged feed chute, comprising a chute (13,1) and a hinged flap (13,2), is secured to the ammunition box by a hinge assembly and by two hooks (13,3).

The hinged flap, which is open at the top, has two spring-loaded studs (13,4) which are inserted into matching holes in the ammunition lead-in section. A catch (13,5), riveted to the bottom of the flap, prevents ammunition belt movement when the flap is open.

The ammunition lead-in section (14,1) is riveted to a bracket (14,2) which also secures the cartridge casing ejection chute (14,3). The bracket is attached to Centre rib 7.

The casing ejection chute has a spring steel barrier (14,4) which prevents the return of ejected casings to the weapon, thus avoiding the possibility of a firing stoppage. The casings are expelled into the area between Centre ribs 6 and 7; from there they are removed through a hand hole in the wing lower skin. Additional sheet metal is fitted around the area to prevent structural damage by the ejected casings.




1 Ammunition lead-in section
2 Unit mounting bracket
3 Casing ejection chute
4 Spring steel barrier

Fig. 14: Outboard cannon ammunition lead-in section and cartridge casing ejection chute

The link segment disposal chute is riveted to the weapons bay cover door, and guides the ejected link segments from the cannon into the slipstream. When the cover door is locked, the link segment chute must not touch the gun.

### 4. Ammunition warming

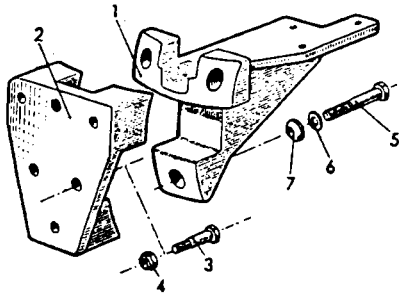
The outboard weapon ammunition boxes are heated by warm air which is drawn from the exhaust pipes for Cylinders 5 and 10. The air flows through a pipe (1,23) within the wing leading edge and then through an opening in the forward end of each ammunition box.

## E. Gunsight

The weapons are aimed by a Revi 16B (1,9) optical sight which is fixed to the Windscreen mounting frame behind a bullet resistant glass panel 50 mm thick and set at an angle of 25°. The shallow slope of the windscreen ensures that the reflection of the sighting image is not visible to the pilot. The field of view downwards is 3°.

The gunsight base plate is fixed to the support bracket (15,1); and, the mounting unit (15,2) is fixed to the Windscreen mounting frame. The bracket and mounting unit are joined by hexagonal screws (15,5) and spherical washers (15,7). The spherical shape of the bearing-surface area between the two units permits precise adjustment of the reflector sight.

The gunsight is connected into the aircraft power supply by depression of the appropriate circuit breaker on the right instrument console.




1 Support bracket
2 Mounting unit
3 Hexagonal screws
4 Nuts
5 Hexagonal screws
6 Washer
7 Spherical washer

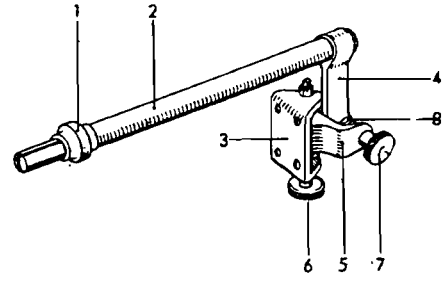
Fig. 15: Gunsight mounting assembly

## F. Collimation tube

The installation location of the collimation tube is shown in Fig. 1-19. Its distance from the fuselage centre-line is 1220 mm.

The tube sighting hole in the wing leading edge is taped over when not in use.

The collimation tube securing nut (16,1) is secured in a spherical support in the wing leading edge; the mounting bracket (16,3) is attached to the rear wall of the leading edge panel. The collimation tube (16,2) is joined to the mounting bracket (16,3) by a connector segment (16,4) and adjustment bracket. The tube can be aligned vertically and horizontally by two set screws (16,6 & 7); the settings being maintained by locknuts (16,8).




1 Tube securing nut
2 Collimation tube
3 Mounting bracket
4 Connector segment
5 Adjustment bracket
6 Vertical adjustment screw
7 Horizontal adjustment screw
8 Locknuts

Fig. 16: Collimation tube

# II. Installation and removal

For removal, the weapons must be uncocked and locked. All installation and removal work can be carried out with the aircraft in the tail down position.

## A. Fuselage MG 131s

Removal:

1) Open the fuselage side panels and the fuselage armament cover.
2) Withdraw the weapon actuation cable from the EDSK-B1 distributor box and the firing cable from its socket.
3) Pull out the forward support locking pin and rotate it leftward to the stop.
4) Pull the weapon rearward until its rear guide bushings are free of the rear mount guide pins.
5) Swing the rear of the weapon upwards and withdraw it from the forward support.

Installation:

For installation, the sequence is reversed.

## B. Wing-root MG 151/20Es

Removal:

1) Open wing-root armament doors.
2) Withdraw the firing cable from the electrical circuit terminal board, and the weapon actuation cable from the EDSK-B1 distributor box.
3) Remove bolt cover.
4) Open and remove the barrel support clamp (Weapon is now no longer adjusted!).
5) Depress the barrel release lever. Rotate barrel 1/6th turn to the left and withdraw it.
6) Release the weapon from the forward support (Pull out locking pin and rotate 90°) and withdraw rearwards. Simultaneously, depress the spring-loaded keys in the guide pins of the rear support.

Installation:

Reverse the sequence of the above procedure.

## C. Outboard MG 151/20Es

Removal:

1) Open weapons bay cover door.
2) Remove ammunition box.
3) Unscrew the weapon actuation cable from the EDSK-B1 distribution box.
4) Remove bolt cover. The gun must not be cocked and the breechblock must be in the saftied position.
5) To withdraw the barrel forward, depress the barrel release lever:
   a) Either from the weapons bay, by reaching forward beyond the forward mount and pressing the lever; whereby a second person removes the barrel; or,
   b) From the wing lower surface through a 10 mm diameter hole with a screw driver, directing it toward the fuselage.
6) Remove the firing cable from its socket.
7) Unlock the gun from its forward support. For that, pull out the locking pin and rotate it left to the stop. Press the spring-loaded keys in the guide pins and withdraw the weapon rearwards.

Installation:

Installation reverses the above procedure.

## D. Fuselage weapons ammunition boxes

When the underfuselage ETC rack is installed, the removal of these boxes is not possible directly. Under these circumstances, the ETC carrier must first be swung down.

Remove the wheel fairing plates.

Rotate the cartridge casing and link segment chutes forward and withdraw the ammunition boxes downward.

Installation reverses the above procedures.

## E. Wing-root weapons ammunition boxes

The removal and installation of the ammunition boxes presents no difficulties. Hinged doors secure the boxes against shifting and falling out.

## F. Outboard weapons ammunition boxes

Removal:

Open the weapons bay cover door.

The ammunition feed chute hinged flap is unlocked and lowered.

First release the ammunition box from the rear suspension point, then from the forward one. Lift the forward end of the ammunition box slightly; this frees the forked fitting from the spring-loaded bolt. Slant the box downward for removal rearwards.

Installation is reversed.

# III. Weapons testing

Before an aircraft undertakes any operational missions, its weapons must be harmonized and a functional test carried out.

1) The aircraft must be trestled and restrained, and be pointing into the butts.

2) Mount the calibrated, rotating disk. Carry out synchronization firing point inspection (Reference point is 1/3 blade width in front of the propeller trailing edge); also complete a firing circuit continuity check.

3) First, carry out a synchronization test on the MG 131s and the wing-root MG 151/20Es. Fire 21 rounds per gun.
Ensure that the belt links separate properly.
Verify the operation of the rounds counters for the MG 151/20Es.
The synchronization test pattern (airscrew without compensating weights fitted) is fired at an engine speed of 1800 rpm. Propeller control: 'Manual' position, takeoff setting (fine pitch).

4) To compute synchronization operating tolerances for the MG 131s, use the following values:
Muzzle velocity = 750 m/sec (2460 fps)
Round advance time = 0,003 sec
Airscrew reduction gearing = 1,84:1
Weapon radius = 685 mm (26.6 in)

For computation of synchronization operating tolerances for the wing-root MG 151/20Es, use the following values:
Muzzle velocity = 705 m/sec (2310 fps)
Round advance time = 0,005 sec
Airscrew reduction gearing = 1,84:1
Weapon radius = 980 mm (38.6 in)

5) The computed tolerance figures can be exceeded by 4%. Permitted firing pattern dispersion: 20% of the computed tolerances.

6) For synchronization test firing, a calibration disk with the predicted impact area cut out, can be used.
The synchronization firing pattern for aircraft with compensating weights fitted is verified without the calibration disk fitted. Propeller control: Takeoff setting (fine pitch) at 2400 rpm.
During functional testing no jams are allowed, otherwise repeat the test.

7) The aircraft is levelled in accordance with its bench marks.

8) The target (Annex 1) is positioned vertically, with its height set in relation to the collimation tube.
The collimation tube is sighted on the aiming cross designated for it. For this, the tube must previously have been levelled.

9) The weapons are so adjusted that the centre of the firing pattern lies in the centre of the aiming cross.

10) The Revi gunsight must be sighted on the appropriate aiming point.

11) The shot pattern for the MG 131s must be fired at one time (21 rounds per gun).
Maximum spread for 100% of the hits:
Height = 100cm Width = 80cm at 100m range

Shot spread for the wing-root MG 151/20Es (21 rounds per gun):
Height = 70cm Width = 60cm at 100m range
Height = 35cm Width = 30cm at 50m range

Shot spread for the outboard MG 151/20Es (21 rounds per gun):
Height = 70cm Width = 80cm at 100m range
Height = 35cm Width = 40cm at 50m range

12) Immediately after test firing, the adjustment screws for all weapons and the gunsight must be locked in place.

13) Test firing can take place immediately before commencement of flying, so long as the aircraft has already been completely prepared and ground checked, and the functioning and adjustment of the weapons system is not affected by subsequent maintenance on the aircraft.

# IV. Adjustment

## A. General

The alignment of the weapons is as shown in Annex A.

The gunsight sighting line is adjusted to focus on the sighting triangle of the target sheet, thus placing it parallel to the aircraft longitudinal axis.

## B. Adjustment procedure

Carry out adjustments in accordance with L.Dv.4/7.

The target (Annex B) is positioned at 100 m (in exceptional circumstances 50 m) distance and is placed vertically.

Insert the collimator in the collimation tube and adjust the target to the appropriate height.

Test firing of the MG 131s is carried out using Type Ub.E. 13 mm high-explosive ammunition; of the MG 151/20Es, using Type Ub.151 20 mm high-explosive ammunition, without the Type E self-destroying fuse (115 g ammunition).

For weapon adjustment, remember the following:

Before commencing adjustment, loosen the set screws on the mount rear supports. Adjustments can now be made to these screws. The vertical and horizontal adjustment screws of each weapon are easily accessible.

In order to adjust the gunsight, the instrument panel cowling must first be removed.

All connections which were loosened during this operation must now be retightened and secured.

After completing all adjustments, remove all tools from the aircraft.

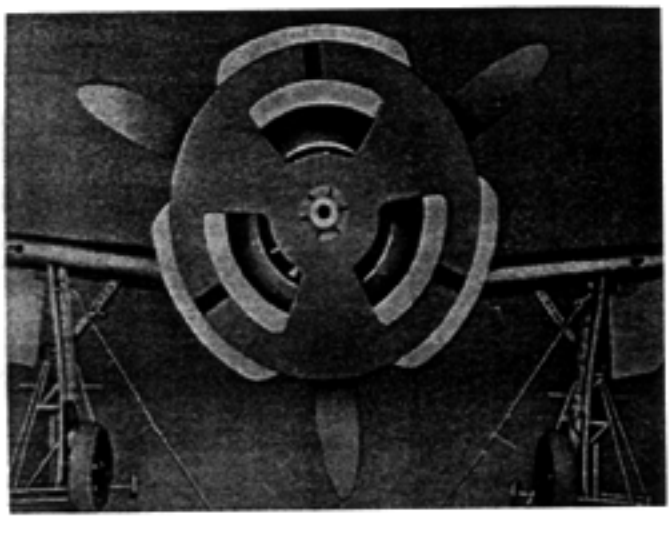
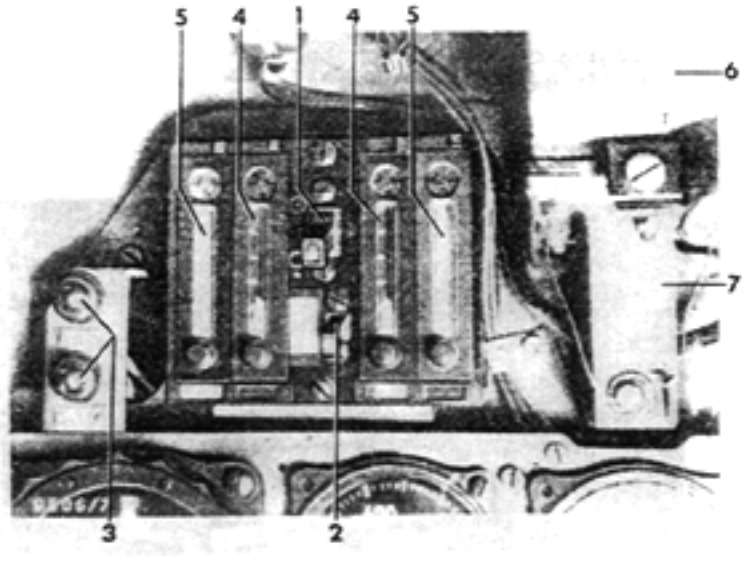


Fig. 17: Aircraft trestled and restrained, synchronized weapons calibration disk fitted



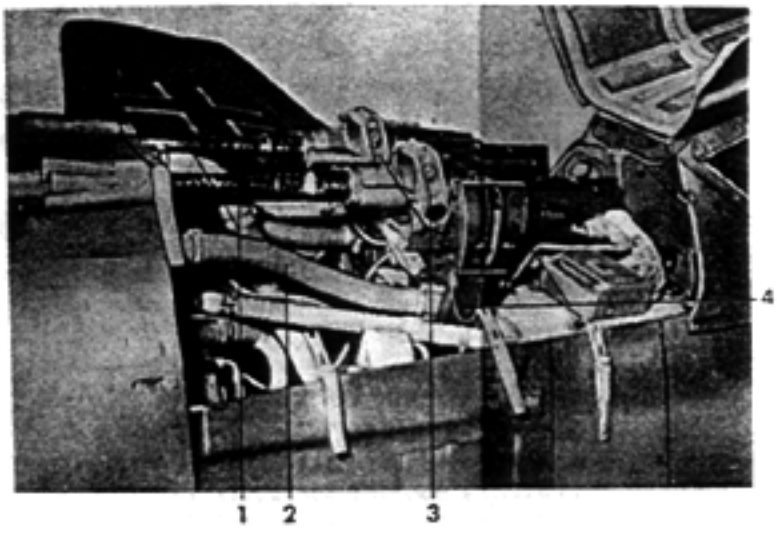

1 Safety switch I
2 Safety switch II
3 Breechblock control lights (MG 131s) (normally mounted horizontally)
4 Rounds counters - wing-root MG 151/20Es
5 Rounds counters - outboard MG 151/20Es
6 Revi 16B gunsight
7 Gunsight mounting unit

Fig. 18: SZKK-4

# Fuselage MG 131s

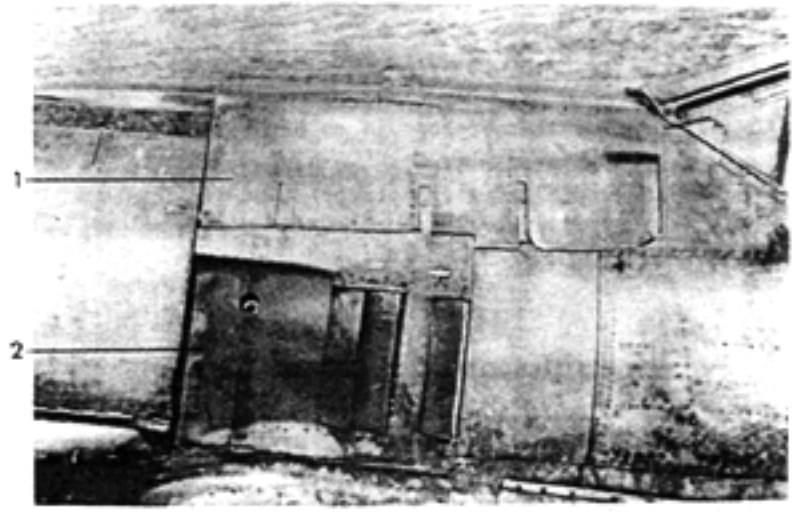

1 MG 131 link belt segment/cartridge casing discard chute
2 MG 131 ammunition boxes

Fig. 19



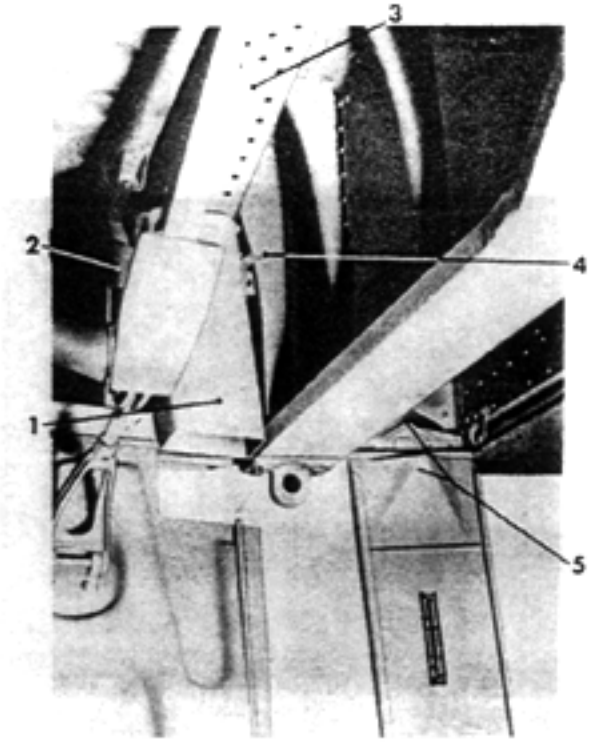

1 MG 131s
2 Ammunition cooling pipe
3 StL 131/5B weapon mounts
4 Ammunition feed chutes

Fig. 20




1 Fuselage armament panel
2 Fuselage side panel

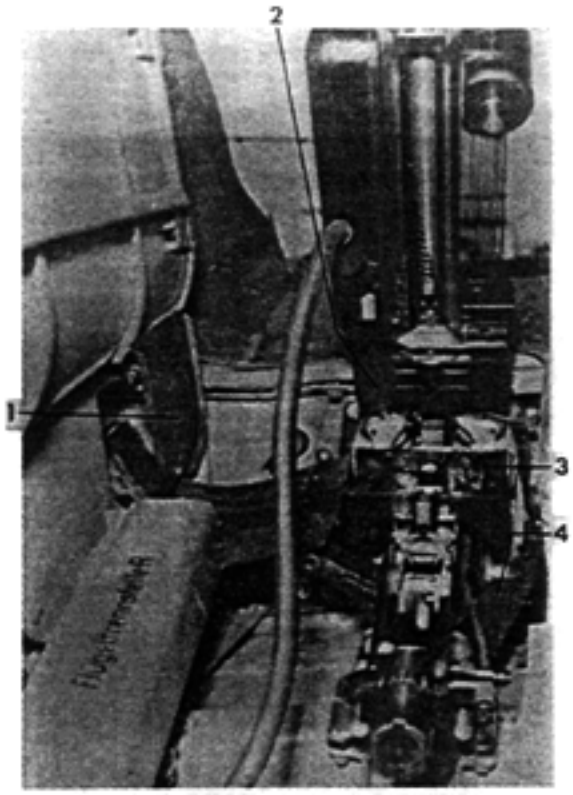
Fig. 21




1 MG 131 link belt segment/cartridge casing discard chute
2 Discard chute hinge
3 MG 131 ammunition box
4 Discard chute lock release lever
5 MG 151/20 ammunition box lock

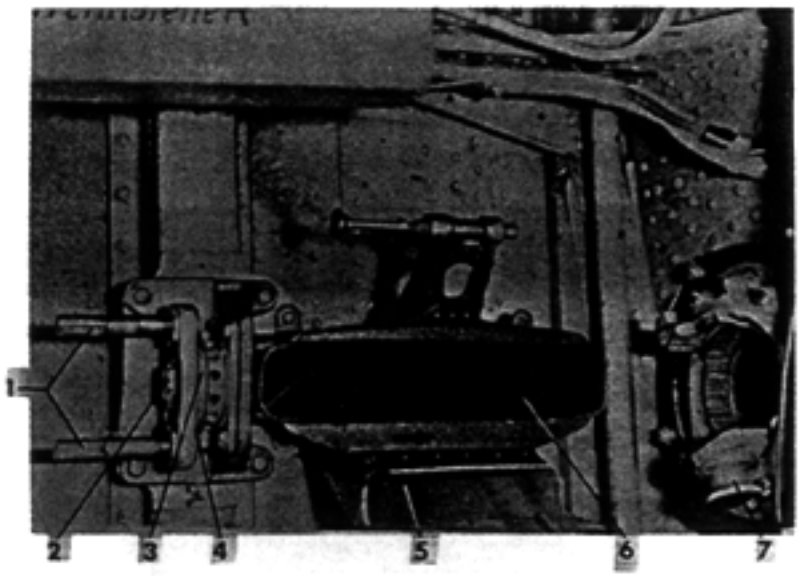
Fig. 22

# Wing-root MG 151/20Es



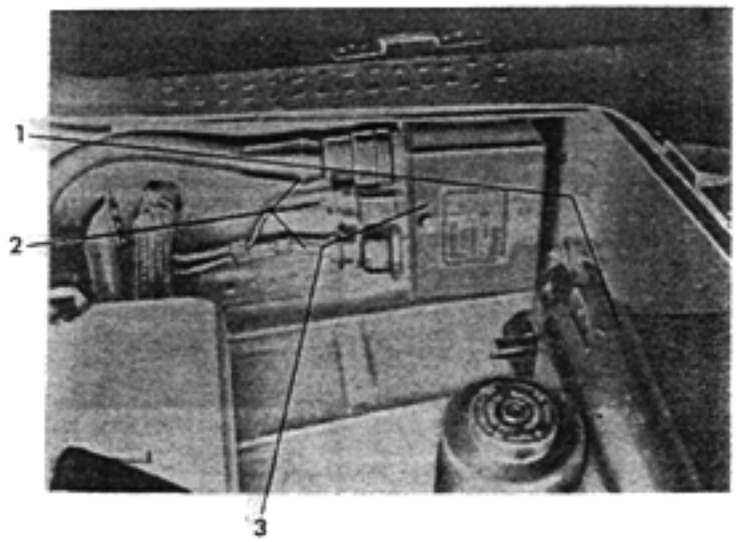

1 Ammunition feed chute (open)
2 MG 151/20E with breech open
3 Ammunition belt guide
4 Link belt discard chute

Fig. 23



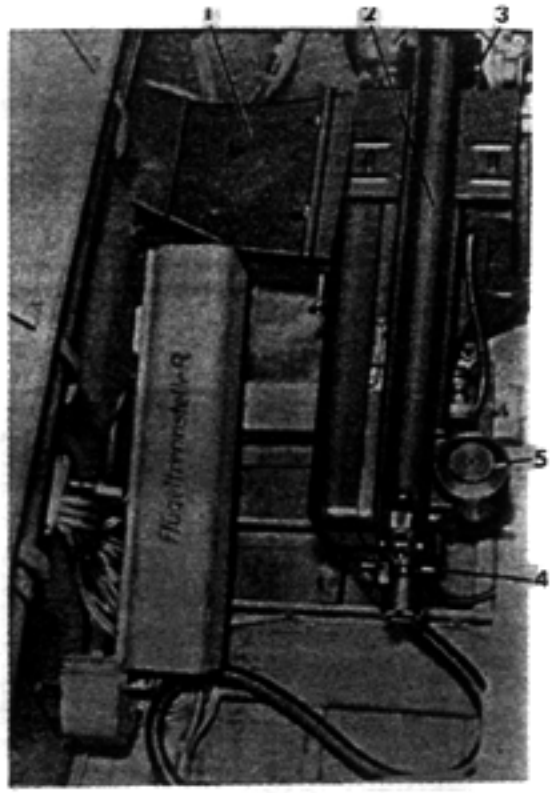

1 Rear mount
2 Safety screw
3 Weapon rotation disk
4 Horizontal adjustment screw
5 Link belt discard chute
6 Cartridge casing discard chute
7 Forward mount locking button

Fig. 24




1 MG 151/20E
2 Weapon cocking and firing leads
3 EDSK-B1 gun cocking control box

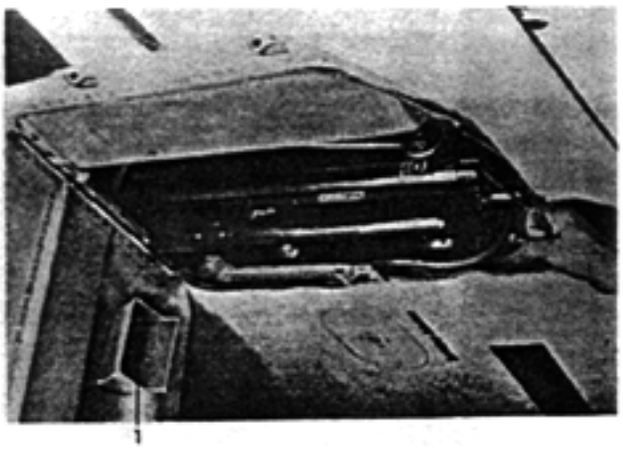
Fig. 25




1 Ammunition feed chute
2 MG 151/20E
3 Forward mount locking button
4 Manual charging handle
5 EA firing unit

Fig. 26

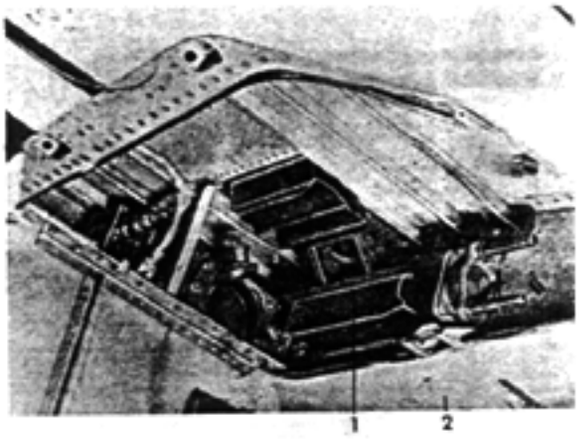
## Outboard MG 151/20Es




1 Link belt ejection chute

Fig. 27: Manual gun charging

Fig. 30: Installing the loaded ammunition box




1 Cartridge casing ejection chute
2 Cartridge casing retrieval cover

Fig. 28


1 Ammunition belt catch

Fig. 31: Ammunition feed attached

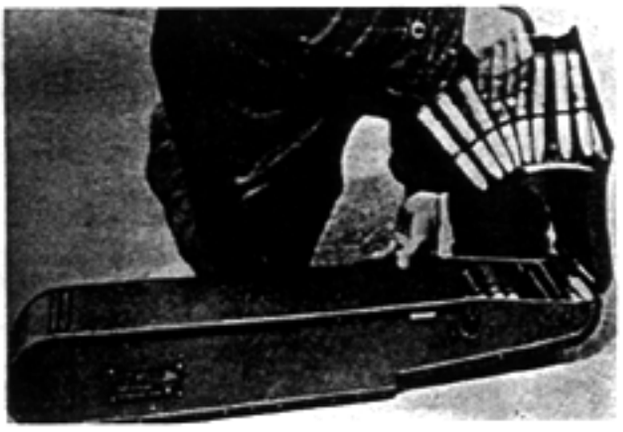
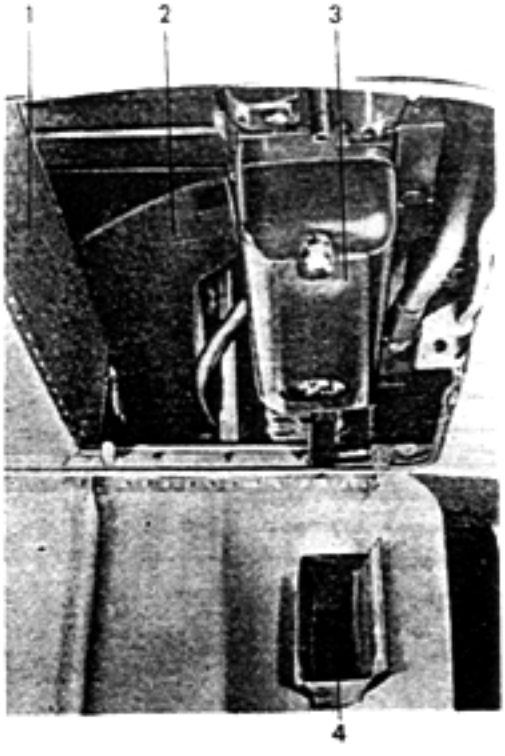


Fig. 29: Closing the loaded ammunition box

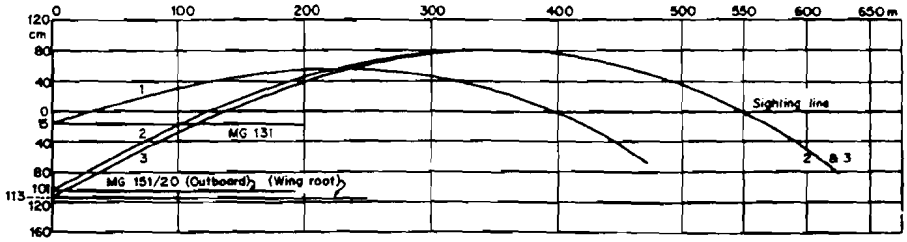
Fig. 32: Barrel removal (Method b)



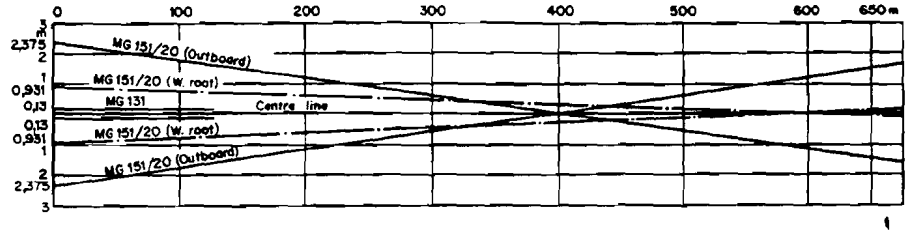

1 Ammunition box
2 Ammunition feed chute
3 MG 151/20E
4 Link belt ejection chute

Fig. 33

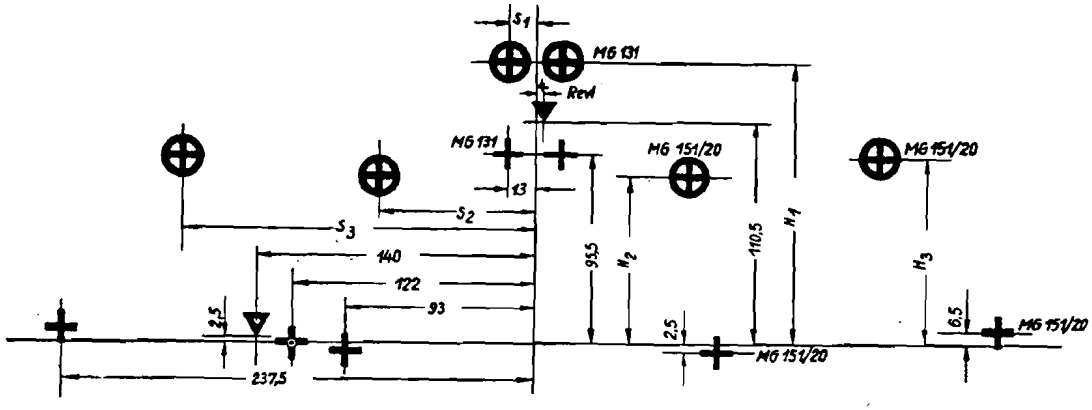
▽




| Projectile trajectories: | Max. height above Sighting line: | Sighting line intersection points: first: | second: |
|---|---|---|---|
| 1 = 2 MG 131 (Fuselage, 13 mm Spr.Gr.Patr.Ob.El. | = 57 cm | 30 m | 400 m |
| 2 = 2 MG 151/20 (Outboard, 2 cm Spr.Gr.Patr.Ub. 151 | = 84 cm | 120 m | 550 m |
| 3 = 2 MG 151/20 (Wing root, 2 cm Spr.Gr.Patr.Ob. 151 | = 82 cm | 135 m | 550 m |




Annex A




| Weapons: | Alignment: | Ammunition: |
|---|---|---|
| Fuselage: 2 MG 131 | Harmonization 400m, Crossover: parallel | 13mm Spr.Gr.Patr.Ub.El. |
| Wing-roots: 2 MG 151/20 | Harmonization 550m, Crossover: 600m | 2cm Spr.Gr.Patr.Ub.151/20 |
| Outboard: 2 MG 151/20 | Harmonization 550m, Crossover: 400m | 2cm Spr.Gr.Patr.Ub.151/20 |

Gunfire strike table at 50m and 100m, in cm

| Range | Fuselage 2 MG 131 | | Wing-root 2 MG 151/20 | | Outboard 2 MG 151/20 | |
|---|---|---|---|---|---|---|
| | $H_1$ | $S_1$ | $H_2$ | $S_2$ | $H_3$ | $S_3$ |
| 0m | 95,5 | 13 | -2,5 | 93 | 6,5 | 237,5 |
| 50m | 121 | 13 | 44 | 85 | 53 | 208 |
| 100m | 142 | 13 | 85 | 78 | 94 | 178 |

Annex B

# Revi 16B

## A. General

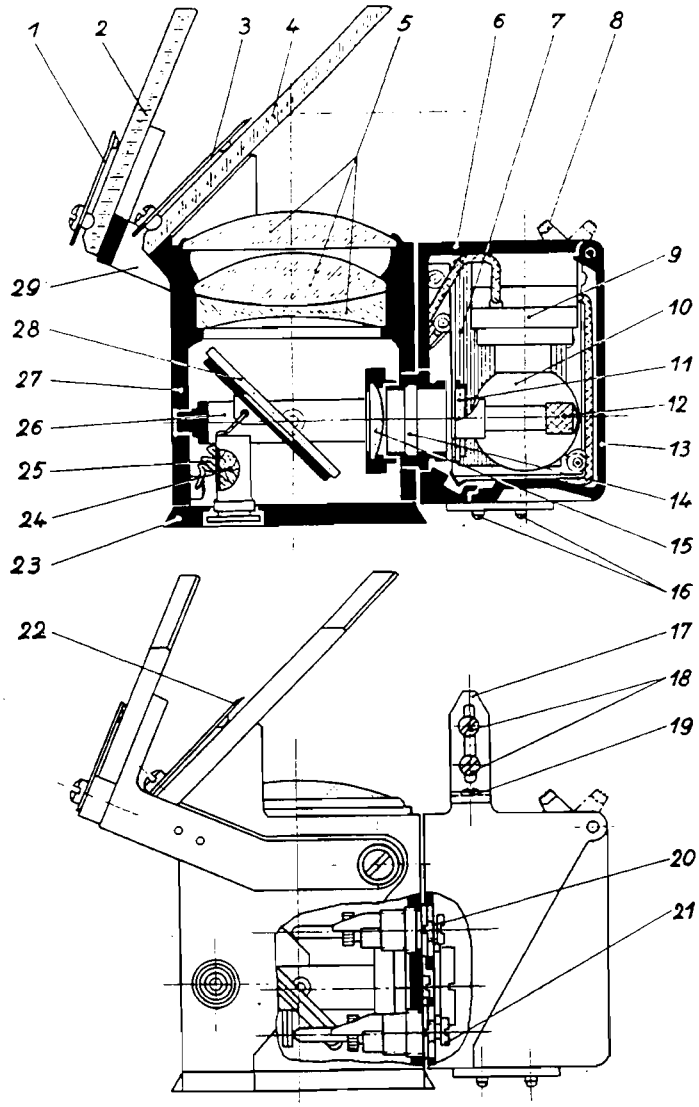
### 1. General

The 'Revi 16B' is an optical gunsight designed for use with aircraft fixed weapons, both synchronized and unsynchronized.

The gunsight can be mounted in any position. It is fitted with a built-in dimmer rheostat, and is attached to the aircraft electrical system by spring-loaded contacts.

### 2. Technical data

| | |
|---|---|
| Weight | approx. 0,8 kg (1,76 lb) |
| Size: | |
| Height | approx. 126 mm (4,96 in) |
| Width | approx. 60 mm (2,36 in) |
| Length | approx. 130 mm (5,12 in) |
| Bulb specification | 21 watt, 24 volt |
| Tinted glass | 90% opacity |
| Night filter | Tone 71 (Dark green) |




1 Tinted glass retaining spring
2 Tinted glass plate
3 Reflector plate retaining spring
4 Reflector plate
5 Objective lenses
6 Light bulb housing
7 Dimmer rheostat
8 Dimmer switch
9 Bulb holder
10 Light bulb
11 Night filter
12 Filter switch
13 Bulb housing cover
14 Non-reflective glass cover
15 Sighting image lens
16 Spring-loaded electrical contacts
17 Blade rear sight
18 Vertical adjustment screws
19 Horizontal adjustment screws
20 Horizontal adjustment screw
21 Vertical adjustment screw
22 Post-type front sight
23 Base plate
24 Silica crystal capsule
25 Adjustment spring
26 Cardan mount
27 Lens chamber
28 Mirror
29 Tinted glass swinging support arm

The vertically mounted engraved sighting image comprises an aiming cross with deflection graduation marks, and a range circle. The angular distance between graduations is 1°. The range circle diameter is equal to 10% of the range (ie. it has a diameter of 10 yds at 100 yds range).

## B. Description

### 1. General

The Revi 16B consists basically of the lens chamber (27). To this is attached the reflector plate (4), the movable tinted glass plate (2), and the light bulb housing (6).

### 2. Optical sight

The optical sight includes the light bulb (10), the night filter (11), the non-reflective cover glass (14), the sighting image lens (15), the mirror (28), the focussing lenses (5), and the reflector plate (4). The reflector, and tinted glass, plates are lightly held in place by retaining springs (3) and (1). The tinted glass plate (2) is positioned by manually rotating its support arms (29). The line of sight can be adjusted ±2,5° horizontally with adjustment screw (20), and ±3° vertically with adjustment screw (21). These screws are reached by raising the bulb housing cover (13). The mirror (28) is positioned in a Cardan mount (26); spring tension (25) ensures a positive response to any adjustments. The base (23) seals the bottom of the len

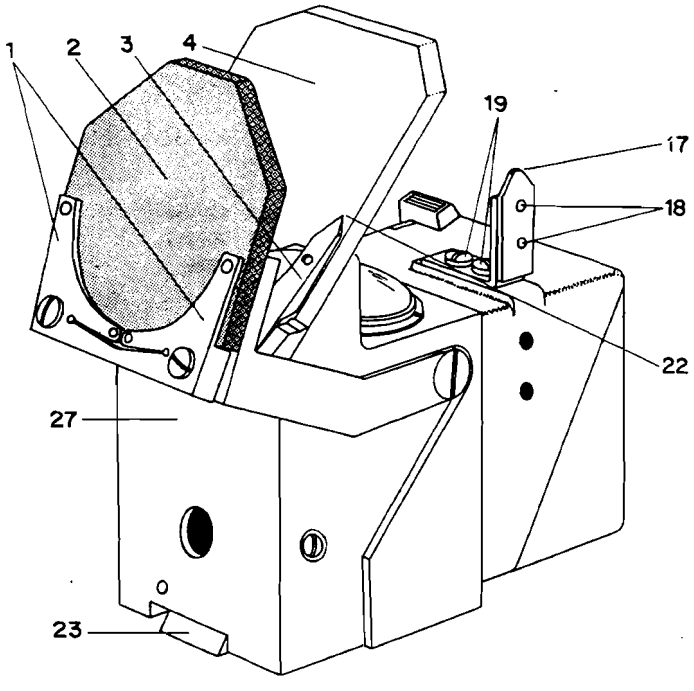
The base plate (23) seals the bottom of the lens chamber (27), and also acts as the gunsight attachment point. In addition, it houses a Silica crystal capsule (24), which is used to absorb any moisture entering the chamber.

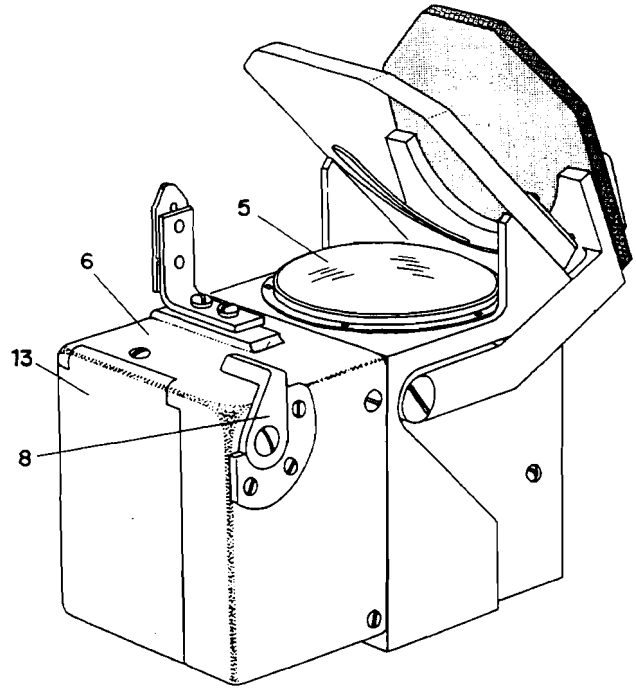
### 3. Mechanical sight

The mechanical sight consists of a blade rear sight (17) and a post-type front sight (22). The front sight comprises the upper portion of the reflector plate left retaining spring (3). The sight, after loosening screws (18) and (19), can be adjusted ±3° vertically and/or horizontally.

### 4. Lighting system

The lighting system includes the dimmer rheostat (7), the bulb holder (9), and the light bulb (10). The bulb draws power from the aircraft electrical system (24 volt), via two spring-loaded contacts (16). Its brightness is controlled by a dimmer switch (8). To reduce sighting image glare during night operations, the night filter (11) can be rotated in front of the light bulb (10) by the filter switch (12); this switch is reached by raising the bulb housing cover (13).



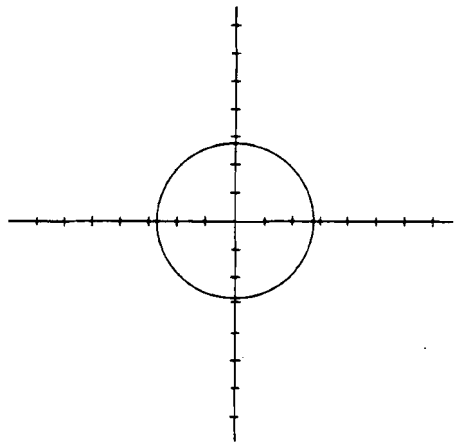
## C. Operation

When the light bulb is switched on, it illuminates the sighting image. This image is then reflected off the mirror, and is so adjusted by its passage through the objective lenses that when it is projected rearwards from the reflector plate, it appears, to the sighting eye, to originate at infinity, and, therefore, to superimpose itself upon the target along the line of sight.

The optical sight permits the sighting eye:

1. To shift a distance of up to approximately 50 mm (1.97 in) without altering the line of sight; and,
2. To vary its distance from the reflector plate from about 200 mm (7.87 in) to about 450 mm (17.72 in) without affecting the size of the target.

Using the mechanical sight, on the other hand, the eye must be accurately lined up with the front sight—rear sight axis.



Revi 16B sighting image

▽

D. (Luft) T. 2190 A-8

For Official Use Only!

# Fw 190 A-8

## Aircraft Handbook

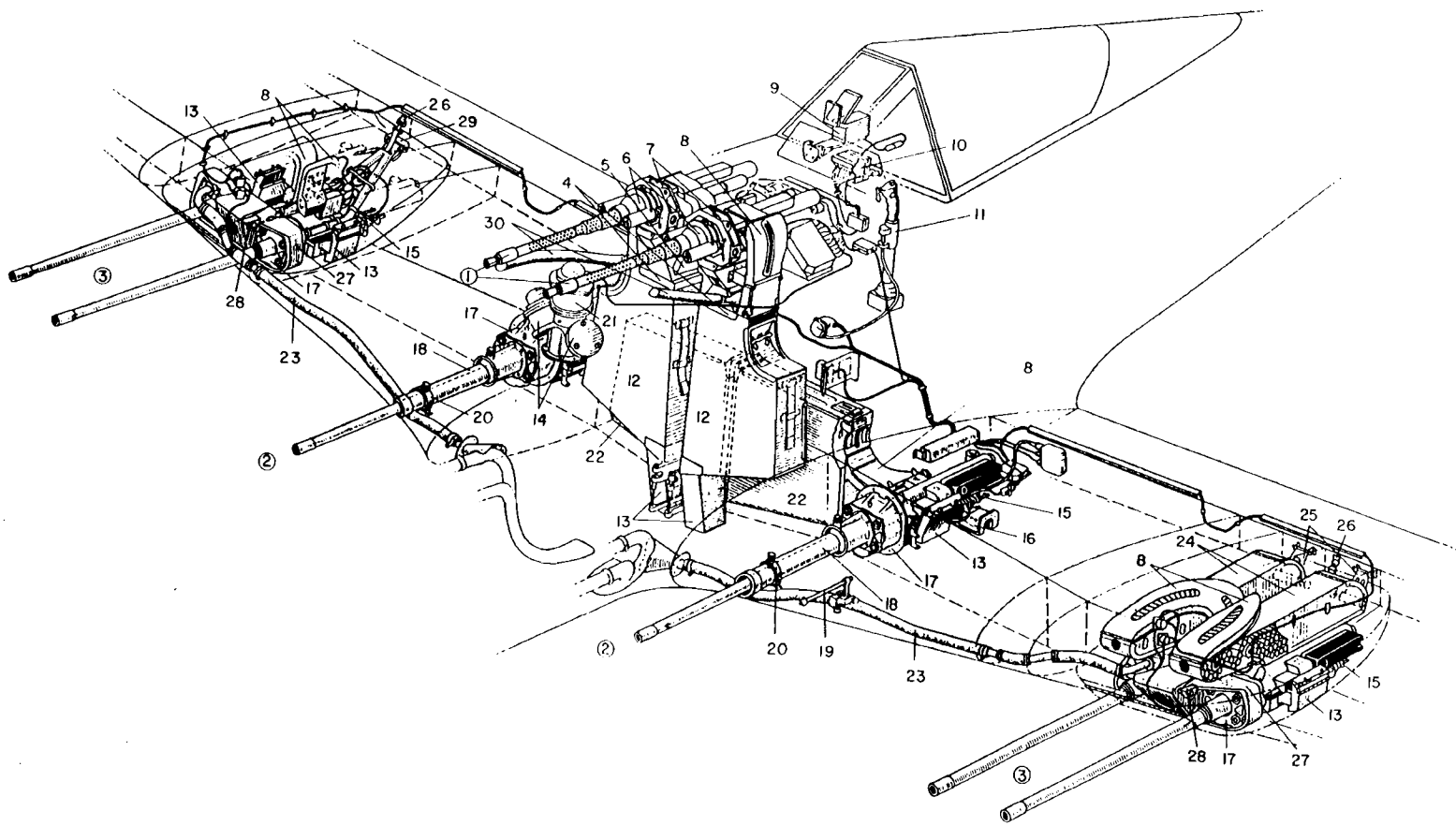
### Part 8A

### Armament installation

**Supplement 1: A-8/R1**

(Effective July 1944)

Issued September 1944



1 Fuselage MG 131 13mm machine guns
2 Wing-root MG 151/20E 20mm cannons
3 Outboard MG 151/20E 20mm cannons
4 Ammunition box attachment brackets
5 Link belt segment discard chute
6 MG 131 forward mount
7 StL 131/5B weapon mount
8 Ammunition feed chute
9 Revi 16B reflector gunsight
10 SZKK 4 armament switch --, round counter --, and control unit
11 KG 13B control stick
12 Fuselage weapons ammunition boxes (400 rounds each)
13 Link belt segment/cartridge casing discard chute
14 Fuselage weapons synchronizing gear
15 Adjustable rear mount
16 Rear mount support bracket
17 Non-adjustable forward mount
18 Cannon blast tube
19 Armament collimation tube
20 Barrel support clamp
21 Wing-root weapons synchronizing gear
22 Wing-root weapons ammunition boxes (250 rounds each)
23 Hot air pipe for ammunition warming
24 Outboard weapons ammunition boxes (125 rounds each)
25 Ammunition box rear suspension arms
26 Restraining cord for weapons carrier frame
27 Outboard weapons carrier frame
28 Carrier frame forward mounting point
29 Carrier frame rear mounting point
30 Cold air pipes for ammunition cooling

Fig 1: System skematic

# I. Description

The weapons system of the Fw 190A-8/R1 consists of:

A. 2 synchronized MG 131s in the fuselage, with 400 rounds per gun.

B. 2 synchronized MG 151/20Es in the wing-roots, with 250 rounds per gun.

C. 4 unsynchronized MG 151/20Es, two beneath each outer wing panel, with 125 rounds per gun.

Use E-type ammunition for all MG 151/20Es.

# II. Gun mounts

## A. Fuselage MG 131s

The MG 131s are positioned within St.L 131/5B mounts which are fixed to a light metal carrier unit. These are, in turn, attached to Bulkhead 1 and to the Windscreen mounting frame.

## B. Wing-root MG 151/20Es

Each weapon is positioned in an St.L 151/2 mounting unit. The forward mount is attached to the main spar; and the rear mount, to a carrier unit between Centre ribs 1 and 3.

## C. Gondola MG 151/20Es

(Equipment package R1 includes the two gondolas)

Each MG 151/20E is positioned in an ST.L 151/7 gun mount; two fixed to each weapons carrier frame. This carrier frame can be swung down for weapons loading and servicing. It is covered by a streamlined fairing (gondola).

# III. Ammunition placement and loading

## A. Fuselage MG 131s

The ammunition is positioned within the fuselage forward of Bulkhead 1. The 400 round boxes are removed from the aircraft for loading; then are slid up into the fuselage through the wheel cavities, and are held there by the hinged belt segment and cartridge casing chutes.

## B. Wing-root MG 151/20Es

The ammunition is positioned within the fuselage behind the main spar. The 250 round boxes are loaded outside the aircraft and slid up into the fuselage. Hinged doors secure the boxes against sideward movement, and against falling out.

## C. Gondola MG 151/20Es

The ammunition is carried in 125 round boxes that lie within the wings, parallel to, and above, the weapons.

The boxes are loaded outside the aircraft and then, after swinging down the carrier frame, positioned within the wing. The boxes are secured at their forward and rear ends by spring-loaded bolts (See Fig. D).

# IV. Ammunition warming

## A. Fuselage MG 131s

The ammunition, positioned forward of Bulkhead 1 and directly behind the engine, is cooled by dynamic air drawn from behind the cooling fan.

## B. Wing-root MG 151/20Es

Warm air radiated from the engine prevents the ammunition temperature from falling below -35°C.

## C. Gondola MG 151/20Es

Warm air, drawn from the engine exhausts, is led, via pipes in the wing leading edge, to the front of the weapons bay.

# V. Weapons sighting and alignment

(See Annexes A and B)

## A. Sighting

The Revi 16B gunsight is positioned behind an armoured windscreen, 50 mm thick and set at an angle of 25°. The shallow slope of the windscreen ensures that the reflection of the sighting image on the windscreen surface is not visible to the pilot. The field of view downwards is 3°.

## B. Alignment

The weapons are to be adjusted to the alignment specified in Annex B.

## C. Adjustment

For weapons adjustment, a tube is provided in the left wing-root for positioning of a 7,9 mm collimator. Various bench marks are provided on the aircraft to ensure accurate levelling.

# VI. Weapons electrical system

The electrical circuitry for each weapon is routed through the SZKK-4 switch, round counter, and control unit.

The fuselage and wing-root weapons are switched on by Safety Switch I; the outboard weapons, by Safety Switch II (Switch I must already be 'On'). The outboard weapons must be turned on no less than 3 seconds after the other weapons. This interval will ensure that the cocking of the inboard weapons has been completed. As the aircraft can support the simultaneous charging of a maximum of only 4 guns, this action avoids the current overload that would otherwise result. A special instruction plate is fitted.

Two firing buttons, A and B1, are fitted on the KG 138 control column grip. The A-button fires the inboard weapons; the B1-button, the outboard weapons.

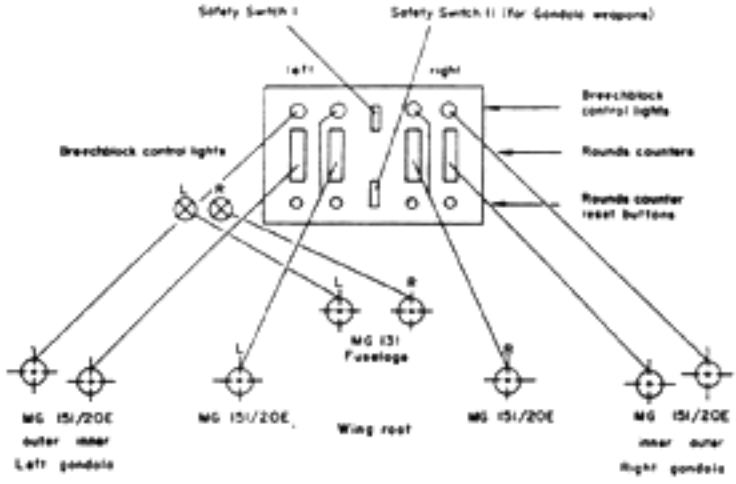
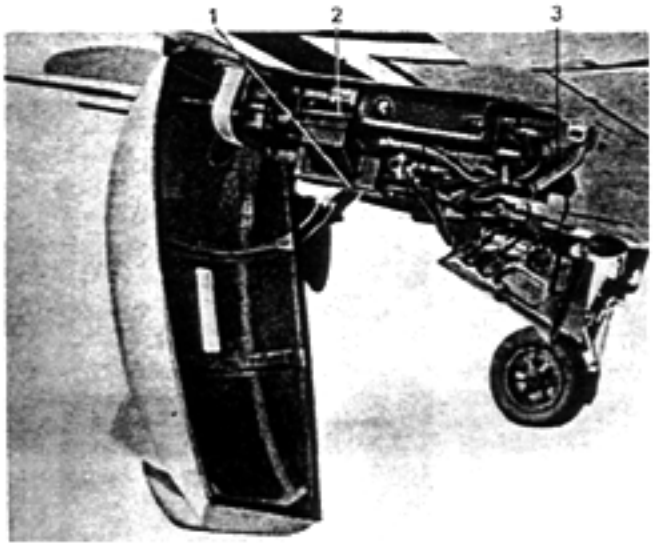



Fig. 2: SZKK-4

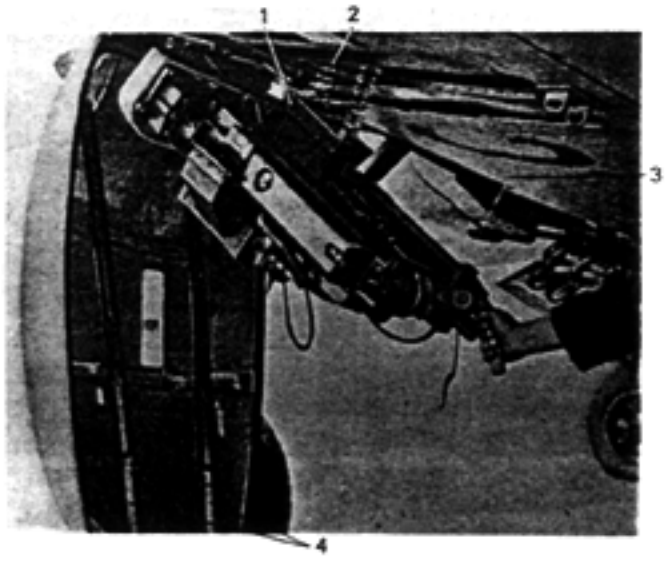
# VII. Camera installation

Provision has been made for the installation of a BSK 16 16mm movie camera in the wing leading edge, within the propeller arc (See Part 8E). The camera can be triggered by the firing of the guns, or separately by a button on the throttle lever.



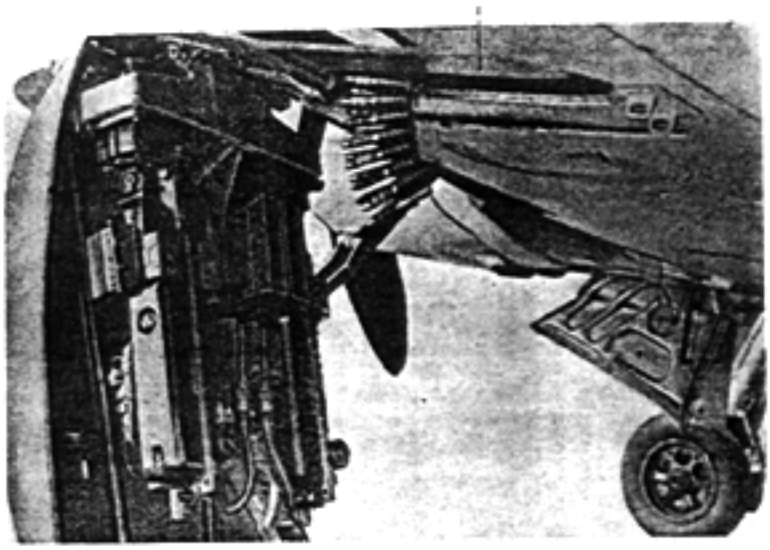

1 Link belt segment/cartridge casing chute
2 Link belt segment chute
3 Weapons carrier locking handle

Fig. 3: Twin gun pack in position; gondola down



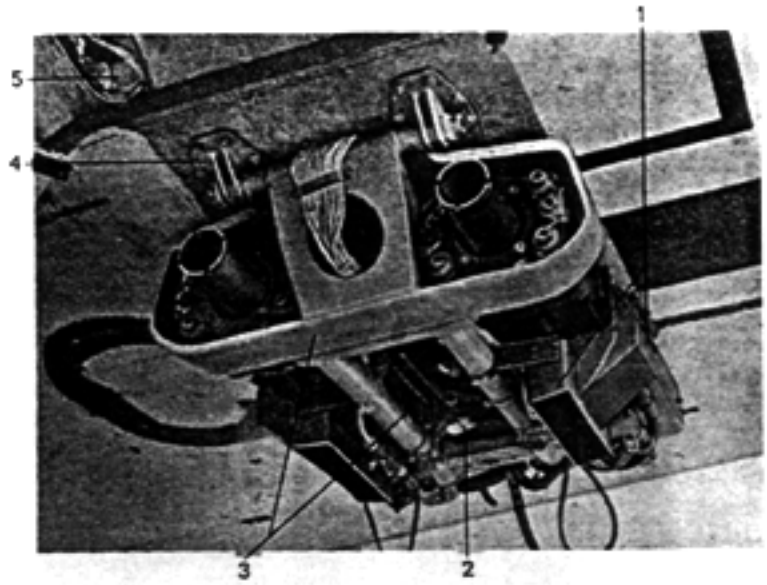

1 Ammunition feed chute
2 Ammunition belt
3 Carrier restraining cord
4 Cannon barrels

Fig. 4: Cannon pack being lowered; gun barrels secured in gondola



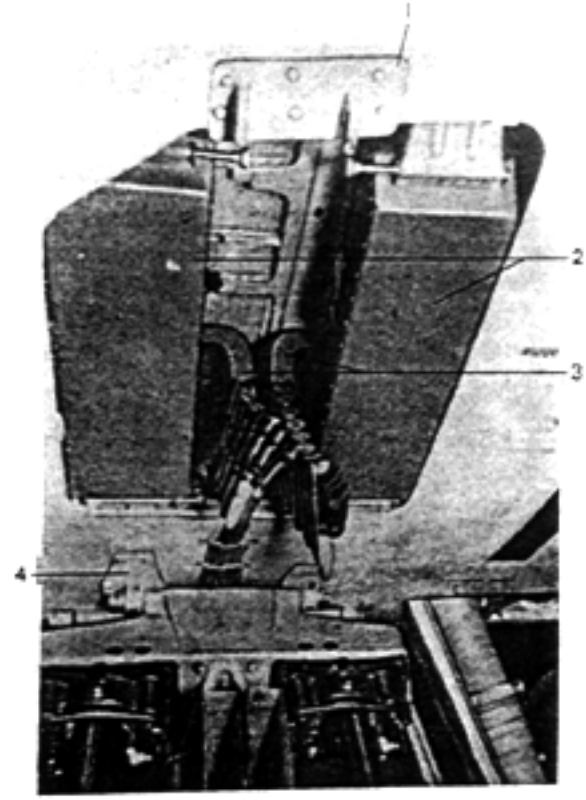
1 Ammunition box

Fig. 5: Cannon pack fully down



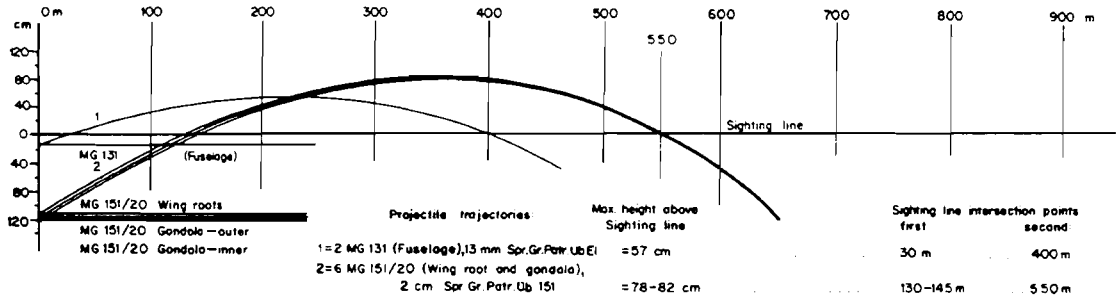

1. Link belt segment / cartridge casing chute
2. Ammunition belt
3. Carrier frame
4. Carrier forward mounting point
5. Cannon barrel protective cuff (in gondola)

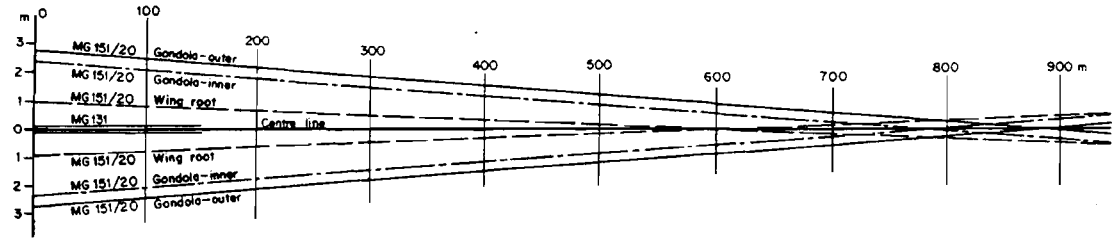
Fig. 6: Gun pack in position; barrels removed



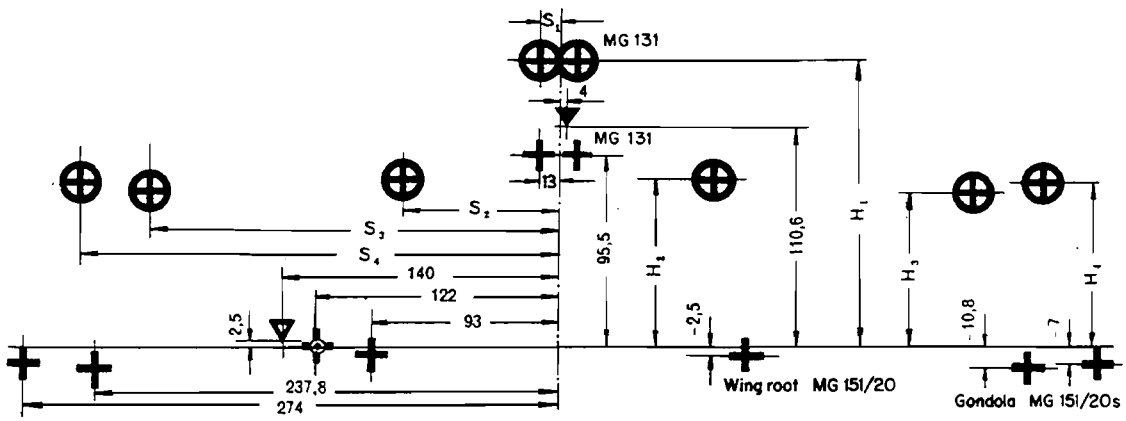

1. Carrier rear mounting point
2. Ammunition boxes
3. Ammunition feed chutes with belted ammunition
4. Carrier forward mounting point

Fig. 7: Ammunition stowage area




Annex A




**Weapons:**

Fuselage: 2 MG 131
Wing-roots: 2 MG 151/20
Gondola,inner: 2 MG 151/20
Gondola,outer: 2 MG 151/20

**Alignment:**

Harmonization 400m, Crossover: parallel
Harmonization 550m, Crossover: 600m
Harmonization 550m, Crossover: 800m
Harmonization 550m, Crossover: 900m

**Ammunition:**

13mm Spr.Gr.Ub.El.
2cm Spr.Gr.Patr.Ub.151
2cm Spr.Gr.Patr.Ub.151
2cm Spr.Gr.Patr.Ub.151

Gunfire strike table at 50m and 100m, in cm

| Range | Fuselage 2 MG 131 | | Wing-root 2 MG 151/20 | | Gond.,inner 2 MG 151/20 | | Gond.,outer 2 MG 151/20 | |
|---|---|---|---|---|---|---|---|---|
| | $H_1$ | $S_1$ | $H_2$ | $S_2$ | $H_3$ | $S_3$ | $H_4$ | $S_4$ |
| 0m | 95,5 | 13 | -2,5 | 93 | -10,8 | 237,8 | -7 | 274 |
| 50m | 121 | 13 | 44 | 85 | 37 | 223 | 41 | 258 |
| 100m | 142 | 13 | 85 | 78 | 78 | 208 | 83 | 244 |

Annex B

D. (Luft) T. 2190 A-8

For Official Use Only!

# Fw 190 A-8

## Aircraft Handbook

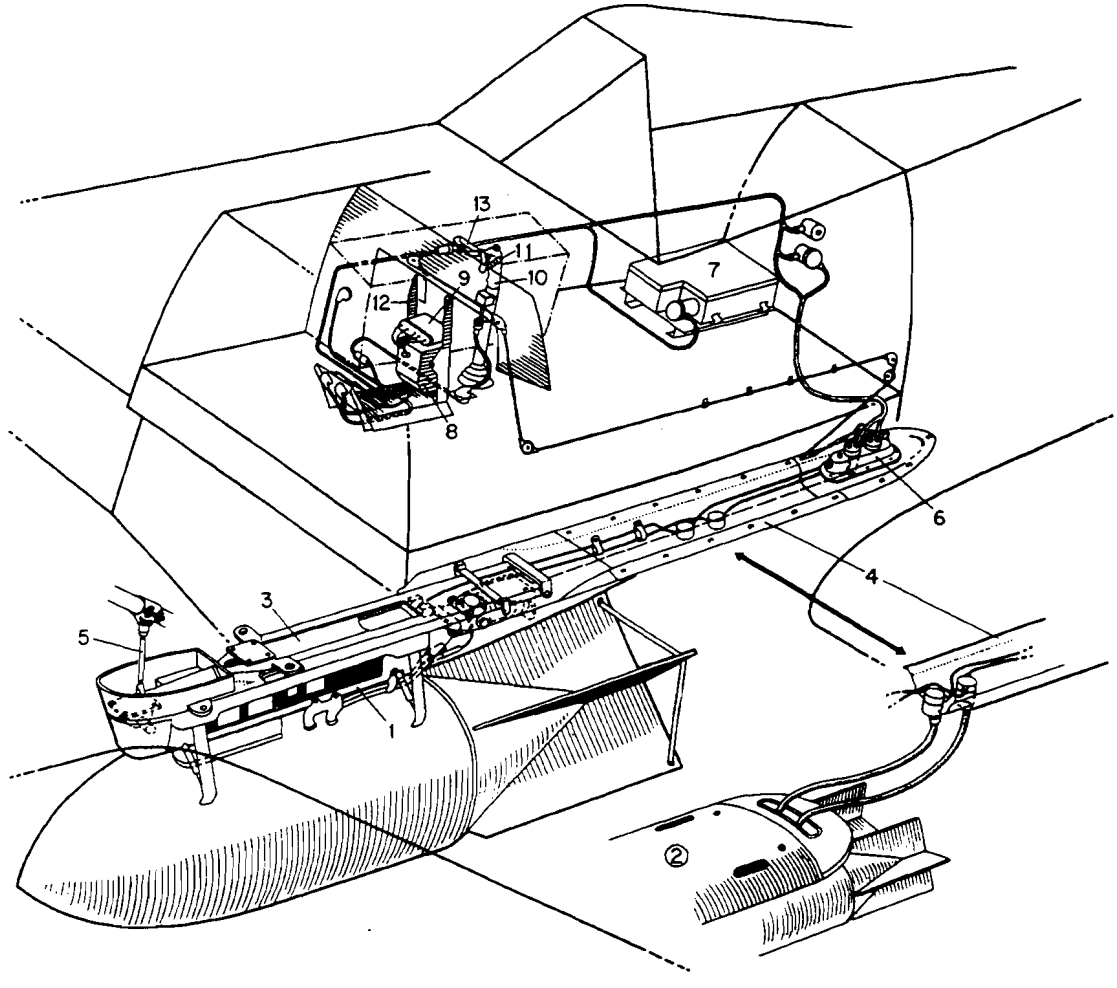
### Part 8B

### Bomb release system

(Effective July 1944)

Issued September 1944

# Description




1 ETC 501
2 ER-4 adapter unit with Type 50 release
3 ETC 501 carrier unit
4 Fairing
5 Support
6 Instrument trough
7 ZBK 241/1 fusing battery box
8 ZSK 244/A fusing selector box
9 Release indicator unit
10 KG 13B control stick
11 Bomb release button
12 Armament panel
13 Emergency release handle

Fig. 1: Bomb release system skematic

## General

The Fw 190A-8 differs from earlier A-series aircraft in that its ETC 501 carrier has been moved forward 200 mm (7,9 in). This repositioning has been made necessary by the building of an auxiliary fuel tank into the aircraft rear fuselage.

Simplifications have been made to the bomb release system within the A-8 production run. These are concerned primarily with the electrical release and monitoring circuits.

## A. Bomb release mechanism

To this belong:

ETC 501 (1,1)
ETC 501 carrier (1,3)
Fairing (1,4)
Armament panel (1,12)

The ETC 501, the ETC 501 carrier, and the fairing are fitted to the underside of the aircraft.

The armament panel is located between the auxiliary instrument panel and the cockpit floor.

## 1. ETC 501

The ETC 501 can be loaded with bombs or disposable carriers to a total weight of 500 kg (1102 lb); or with an ER-4 adapter unit for four bombs or disposable carriers, each of a maximum weight of 50 kg (110 lb).

A Type 500/XII release unit is fitted into the ETC 501.

The selector switch on the ER-4 adapter is to be set to the normal setting (single release).

A 300 Ltr (66.2 gal) drop tank can be fitted in place of bombs. For this, spacer bars must be attached to the ETC 501. These bars are not required when the E2 metal tank is fitted.

Two cotter-pin saftied bolts, one each through the forward and rear fittings, secure the ETC 501 to its carrier. During servicing, the carrier and ETC 501 are considered to comprise one unit.

Note:

Before loading the bombs, ensure that full ammunition boxes for the MG 131s and the wing-root MG 151/20Es have been inserted, as this can only be done with the forward portion of the ETC 501 carrier swung down. To insert the MG 131 ammunition boxes, remove the wheel cover fairings and swing the link-belt segment and cartridge casing chute on the engine lower support frame forward.

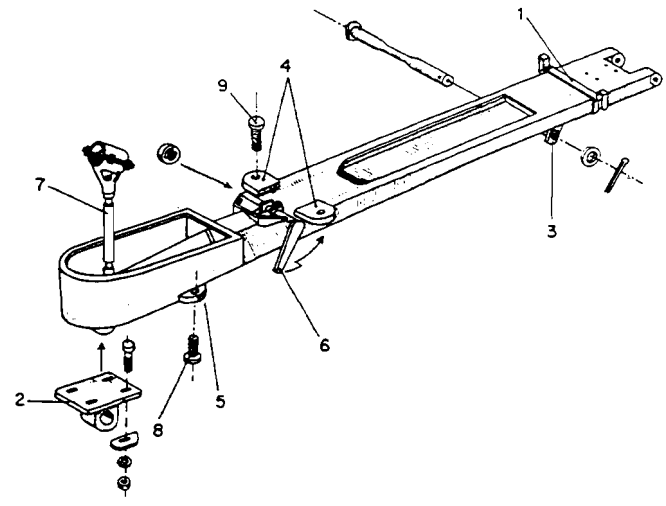
## 2. ETC 501 carrier unit

The carrier (Fig. 2) is of a special design to hold the ETC 501.

The ETC 501 is secured to its carrier by: a forward fitting (2,2), and by a rear fitting (2,3). Tightening the set screws (2,8) within the upper mounting plates (2,4) secures the ETC 501 carrier; tightening the set screws (2,9) within the lower mounting plates (2,5) secures the ETC 501. The attachment of the carrier unit to the fuselage mounting points (the forward mounting point is on the main spar, the rear mounting point on Bulkhead 4, and a stabilizing strut mounting point on the engine lower support strut) is accomplished by two bolts and a strut. The forward, spring-loaded, bolt is fitted with an engaging lever (2,6) and is locked by rotation of that lever; the rear bolt is secured by a cotter pin; and, the stabilizing strut is attached by a screw-on collar.

The rear end of the carrier unit is forked and secured to a fitting on Bulkhead 4 (carrier rear suspension point).

To the underside of the carrier rear segment is fixed, in an accessible position, an E55 electric motor which drives the EP-1E drop tank fuel pump.

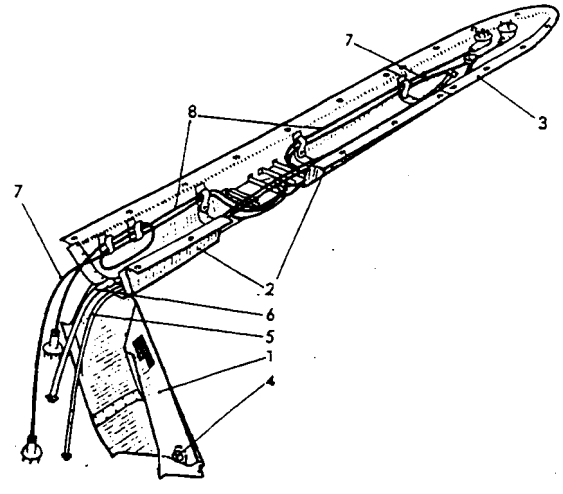



1 Clip
2 Forward fitting
3 Rear fitting
4 Upper mounting plates
5 Lower mounting plates
6 Spring-loaded carrier release lever
7 Stabilizing strut
8 Set screws
9 Set screws

Fig. 2: ETC 501 carrier unit

## 3. Fairing

The fairing consists of the following three parts:
Forward portion (3,1)
Centre portion (3,2)
Rear portion (3,3)




1 Forward portion
2 Centre portion
3 Rear portion
4 Screw lock
5 Supercharger air line
6 Fuel pressure line
7 Fusing line
8 Bomb release lead

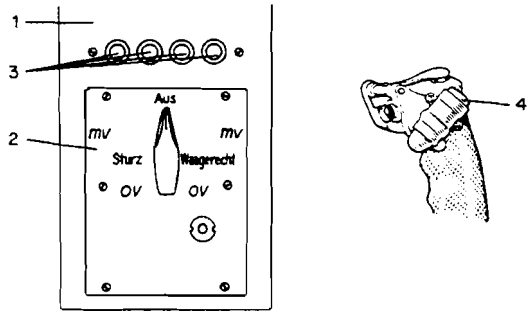
Fig. 3: Fairing

It is attached to the fuselage bottom with countersunk screws. The forward and centre portions (3,1 & 2) are joined by a hinge; the forward portion being secured to the ETC 501 by a screw lock (3,4).

The lines (3,5-8) which lie within the fairing centre portion connect the aircraft systems to the ETC 501 carrier and thus to the equipment on the ETC 501.

### 4. Armament panel

The armament panel (4,1) contains the ZSK 244A bomb fusing selection box (4,2) and the SAM 77 Fw 74 release indicator lights (4,3). It is situated between the auxiliary instrument panel and the cockpit floor, and is connected to these by screws.




1 Armament panel
2 Bomb fusing selection box
3 Release indicator lights
4 Bomb release button

Fig. 4: Armament panel

## B. Release and monitoring circuits

This circuit is used for the release and monitoring of the bomb release system. It consists of the following units:

1 ZSK 244A fusing selector box
1 SAM 77 Fw 74 indicator unit
1 bomb release button

The ZSK acts as the main switch for the electrical release unit.

The indicator unit is secured to the armament panel by two screws. When a 250 kg or 500 kg bomb is carried, only the right hand indicator light is connected into the fusing selector box circuit. When the ER-4 adapter release units (4 ETC 50/XIII) are loaded the three other indicator lights are also connected into the fusing circuit. After a bomb is released, the appropriate indicator light illuminates.

The bomb release B2-button (4,4) is located on the KG 138 control grip.

The system is connected into the aircraft circuit by depressing circuit breaker V50 on the right instrument console.

## C. Sighting device

The Revi 16B is used as the sighting device for the bombing system; it is more fully discussed in Part 8A.

## D. Emergency bomb release

Pulling the emergency bomb release handle (1,13)--release force ≈ 30 kg (with movement of at least 24 mm)—labelled "Bomben" causes the jettison of any load being carried on the ETC 501. When the ER-4 adapter (1,2) is mounted, an emergency release of the individual loads is not possible, in fact, during emergency release the adapter itself is dropped; in this event, the fusing and release lead plugs are torn out.

Note! Bombs loaded on the ER-4 adapter, when released manually, fall safetied even if the ZSK has been switched on. Bombs loaded directly onto the ETC 501, will fall armed if the ZSK has been switched on.

## E. System removal

If the aircraft is to be flown without the bomb release system, the ETC 501 carrier, with integral ETC 501, fairing and Bulkhead 4 suspension fittings must be removed. In the same way, the electrical leads, the fuel line leads, the air pressure lines, and the emergency release cable to the underfuselage trough (1,6) are no longer necessary. A streamlined cap to fair in the forward mounting points on the main spar, and a plate to cover the opening for the underfuselage trough are provided in the aircraft equipment bag.

Since, when the ETC 501 carrier unit is attached, the undercarriage wheel covers cannot open or close properly, the wheel covers are exchanged for fixed fairings when the ETC 501 rack is installed. These fixed fairings cover a small portion of the underfuselage apertures in the same manner as do the wheel doors. In that case, the undercarriage fairings are lengthened.

For operations without the bomb release mechanism, the fixed fairing plates are traded for the wheel door units, and the lengthening segments are unscrewed from the undercarriage lower fairings.

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D. (Luft) T. 2190 A-8

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# Fw 190 A-8

## Aircraft Handbook

**Part 8C**

**Special weapons system**

(Effective July 1944)

Issued September 1944

# Description

## A. General

The Fw 190A-8 is outfitted to carry the 21-cm BR weapons system.

The 21-cm BR unit serves to fire a spin stabilized projectile, the 21-cm Type 42 mortar shell (Information concerning the weapon is contained in the following two publications, H.Dv. 481/62 and H.Dv. 119/984). As aimed fire with this weapon is not possible, it can only be feasibly used against large targets (enemy bomber formations). The projectile is

Fig. 1*: Fw 190 with 21-cm BR system

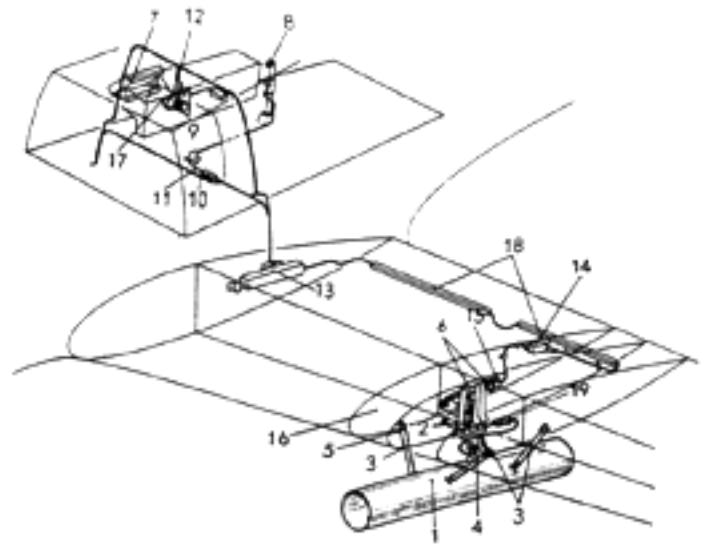
fired from a launching tube (2,1), one of which is located beneath each wing panel. Each launching tube is suspended by a carrier strut (2,4), from a hook (2,2) fixed to the wing lower surface; and is locked into position by four bracing struts (2,3). In an emergency, the launching tube can be jettisoned by severing the carrier strut. The two projectiles are fired simultaneously by depressing the B2-button on the KG 13B control grip.

## B. Equipment

### 1. Launching tube

The launcher consists of a tube (3,1) 1,3 m (51,2 in) long and of 210 mm (8.32 in) calibre. To the inner surface of the tube are attached--at 120° intervals--three guide rails (3,2). Three retaining springs, located near the rear end of the tube, hold the shell in place; a screw bolt (3,3), at its lower rear end, prevents the weapon from sliding out; and, a spring-loaded contact (6,3), at its upper rear end, fires the weapon.

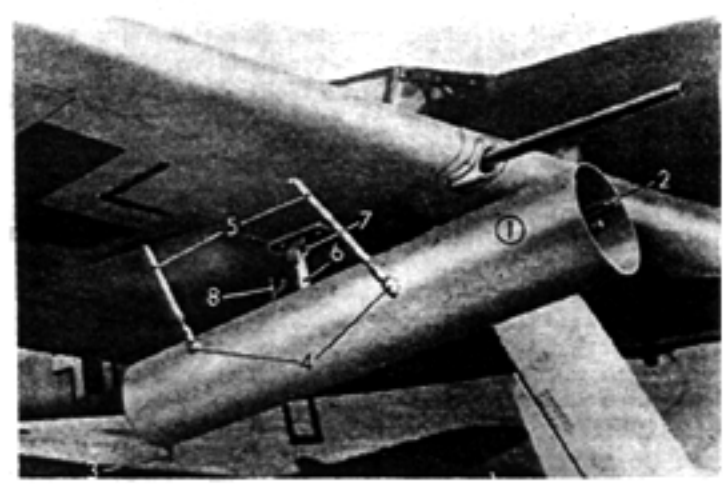
The bracing strut lower studs (3,5) fit into bracing



1 Launching tube
2 Hook with suspension bracket
3 Bracing struts
4 Firing tube carrier strut
5 Centre rib 8
6 Support brackets
7 SVK 3x151/1516 fuse and junction box
8 KG 13B control stick
9 Armament switch PB02
10 Connector jack PB05
11 Electrical plug PB
12 Armament panel
13 Wing separator point
14 Circuit relay
15 Plug connector PB12/PB11
16 Centre rib 7
17 Armament switch PB01
18 Conduit
19 Plug connector PB14/PB15

Fig. 2: System skematic

lugs (3,4) welded to the upper portion of the launching tube. The tube hangs beneath the outboard weapons bay, suspended from a hook (3,7) which is secured to Centre rib 8 (2,5) by two screws and



1 Launching tube
2 Guide rail
3 Screw bolt
4 Bracing lugs
5 Bracing struts
6 Carrier strut
7 Hook with suspension bracket
8 Firing lead

Fig. 3: Launching tube beneath right wing panel

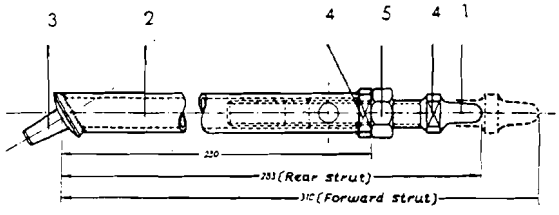
crown nuts (safetied by cotter pins). Two support brackets (2,6), attached to Centre rib 8 at this point, serve to strengthen the mounting area. The launching tube is elevated 7° relative to the fuselage longitudinal axis.

## 2. Bracing struts

To lock the launching tube into position, the upper studs (4,3) of the four bracing struts are fitted into the wing lower skin through suitable holes or rimmed bushings. The length of each strut can be changed by rotation of the lower stud (4,1), and it can be locked in length by tightening the lock nut (4,5) against the strut collar (4,4).

The rounded ends of the lower studs (4,1) are inserted into the tube bracing lugs.

The strut tube (4,2) is 230 mm (9 in) long. The overall lengths of the forward and rear struts are as shown in Fig. 4.

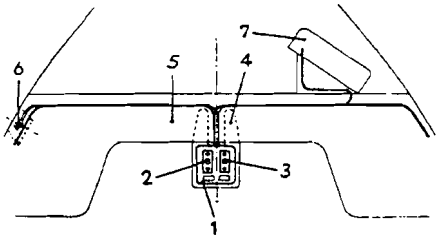



1 Lower stud
2 Strut tube
3 Upper stud
4 Strut collar
5 Lock nut

Fig. 4: Bracing strut

## 3. Release strut

The carrier strut (release strut) contains an electrically primed explosive charge which, in an emergency, severs it and so releases the launching tube.




1 Armament panel
2 Armament switch P802
3 Armament switch P801
4 Attachment brackets
5 Auxiliary instrument panel
6 Jettison circuit grounding point
7 SVK 2-151/131E fuse and junction box

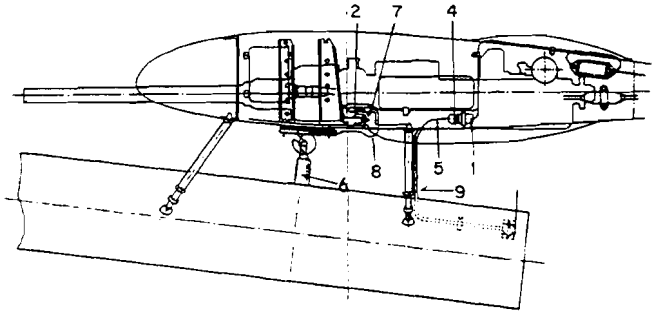
Fig. 5: Armament switch layout

## 4. BR-armament panel

The BR-armament panel (5,1) contains two armament switches (5,2 & 3). This panel is attached to the auxiliary instrument panel (5,5) by two brackets (5,4).

# C. Sighting device

The Revi 16B reflector sight (see D.(Luft) T.6403), serves as the sighting device for this system. After notification by a TAGTT, it will, at the appropriate time, be replaced by the Revi 16F.




1 Socket P812
2 Socket P814
3 Projectile firing terminal
4 Plug P813
5 Firing lead
6 Carrier/release unit
7 Plug P815
8 Release lead
9 Firing lead protective tube

Fig. 6: 21-cm BR system side view

The field of vision through the Revi view finder must be at least 7,5° in all directions from the sighting line.

# D. Control system

The control system consists of the electrical firing and release circuits. The firing circuit is used to fire the projectiles while the release circuit jettisons the launching tubes.

## Operation

a. Firing

Complete the firing circuit by activating circuit breaker P1 (right instrument console), Safety switch I (SZKK4 control unit), and toggle switch P802 (marked "Sicherungsschalter Gerät 21" and located on the left side of the BR armament panel). To fire the shells, depress the bomb release button, B2, located

on the upper left side of the control grip.

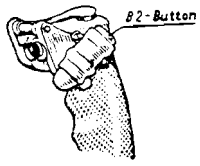



Fig. 7: KG 13B with B2 firing button

## b. Release

In an emergency, the launching tubes can be released by severing the carrier struts with explosive charges. Circuit breaker P1 and Safety switch I complete the release circuit. To fire the charges, actuate toggle switch P801 (marked "Absprengung Gerät 21" and located on the right side of the BR armament panel). To prevent accidental actuation of the toggle switch, it is held in the safe position by a spring-loaded plate.

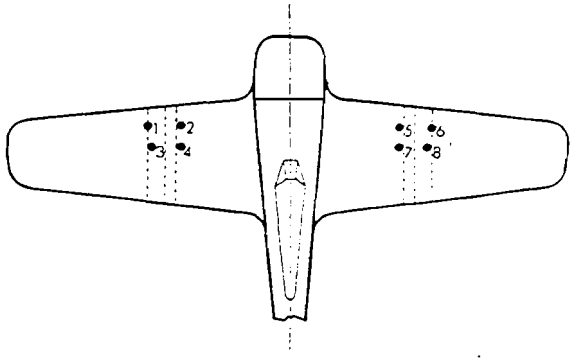



Fig. 8: Positioning of the bracing struts

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D. (Luft) T. 2190 A-8

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# Fw 190 A-8

## Aircraft Handbook

**Part 8D**

**Special fittings**

(Effective July 1944)

Issued September 1944

## General

'Special fittings' specifies the aircraft armour.

The armour protects the pilot, the oil cooler and the circular oil tank. Its positioning within the aircraft is as shown in Fig. 1.

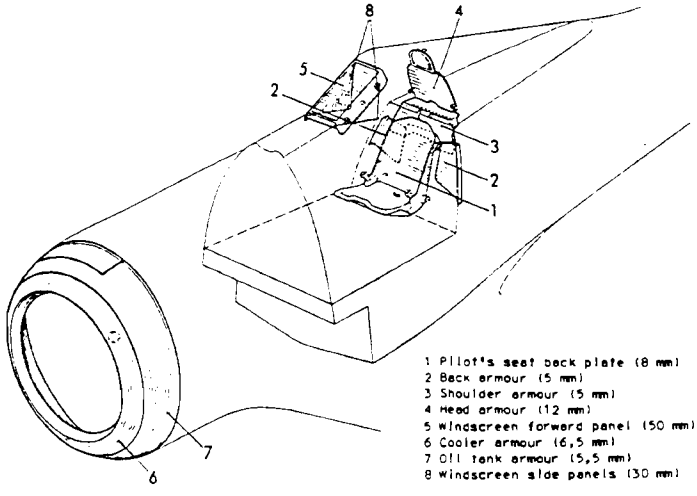



Fig. 1: Aircraft armour layout

## A. Cockpit armour

The cockpit armour consists of the back plate (1,1) on the pilot's seat, two back plates (1,2), a shoulder plate (1,3), and a head plate (1,4).

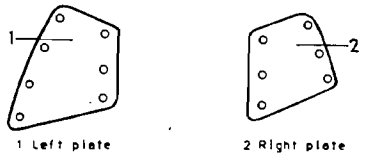



Fig. 2: Back armour, seen in direction of flight

Protection against gunfire is also provided:

a) from the front: by the bullet resistant windscreen (1,5);

b) from the sides: by bullet resistant glass panels (1,8) on either side of the forward windscreen panel; and,

c) from below: by the two fuselage self-sealing fuel tanks.

The seat rear plate and seat pan are riveted together.

The back armour consists of two separate plates whose inner edges are screwed to the seat guide rails, and whose outer edges are screwed to angle pieces in the fuselage walls. Nuts are riveted to the guide rails and the angle pieces; the plates are fastened from the rear by screws.

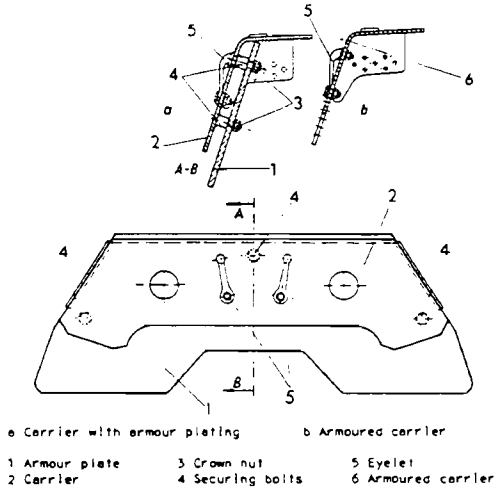



Fig. 3: Shoulder armour

The shoulder armour can be attached in either of two ways (see Fig. 3,a & b):

a) The shoulder armour consists of both an armour panel (3,1) and a carrier unit (3,2).

The armour plate is positioned behind the carrier and is attached to it by three nuts. This method of attachment allows fast replacement of the armour plating. The carrier is riveted to the fuselage.

b) In the second design, the armoured carrier itself serves as the shoulder armour (see Fig. 3b).

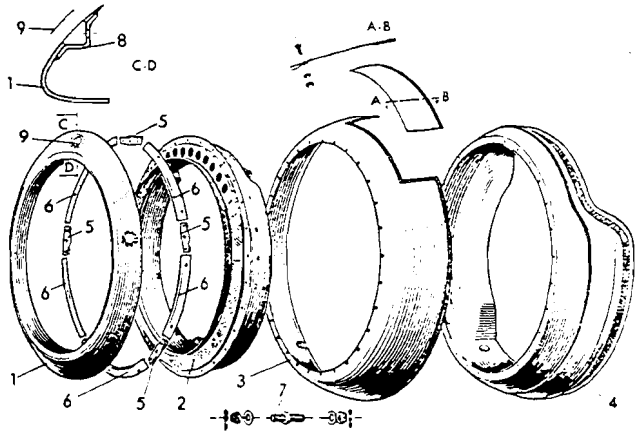
The head armour is built into the canopy and is secured to it at its base, by two guide bars secured by hexagonal bolts, and, at its top, by a screwed on support strut. The strut is secured by two cables (see Part 1). In newer production aircraft, the head armour is secured by a sheet fairing and two cables; the support is then omitted.

a) The bullet resistant windscreen is housed in a steel frame, and is secured to it by a screwed on molded framing.

b) The side plates slide into the nose-over frame and are secured by a base rabbet.

## B. Nose armour

The oil cooler (4,2) and ring-shaped oil tank (4,4), both of matching circular construction, are enclosed by armoured rings which form the forward portion of the engine cowling. The cooler armour is secured by hexagonal screws; the oil tank armour by crown nuts. The five openings in the armoured nose ring, required for its installation, are covered by formed disks (4,9).




1 Cooler armour
2 Oil cooler
3 Oil tank armour
4 Circular oil tank
5 Support bracket
6 Semi-circular fairing
7 Tie bolts
8 Cooler armour attachment brackets
9 Formed disks

Fig. 4: Oil cooler and oil tank armour

A ten piece ring, consisting of five support brackets (4,5) joined to five semi-circular fairings (4,6), is positioned between the cooler armour and the cooler. The ring is secured to the oil cooler by crown nuts and tie bolts.

The air exit gap between the oil cooler and the oil tank armour is 10 mm.

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# Fw 190 A-8

## Aircraft Handbook

**Part 8E**

**Camera system**

(Effective July 1944)

Issued September 1944

# Description

## General

The 'Type 16 Gun camera' (BSK 16) is installed in the Fw 190A-8 fighter. Its installation in the field, in previously delivered aircraft, is made for A-8 series aircraft using Fw 190 Modification Instruction Nr. 85.

The 'Robot' miniature camera is installed in all ground-attack aircraft (Series F) and extended range fighter-bombers (Series G).

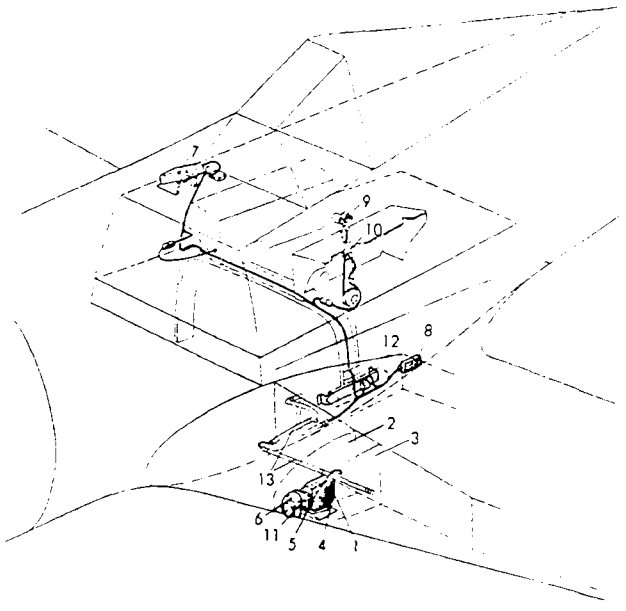
It is also possible, in fighter aircraft, to replace the BSK 16 with the 'Robot' using an adapter unit. In the 'Robot' installation, the lead from the camera to the weapons system is not attached.

## A. BSK 16 gun camera

The BSK 16 camera (1,1) is mounted on an adjustable platform (1,4) in the leading edge of the left wing panel between Ribs 3b (1,2) and 4 (1,3), and is attached to the aircraft electrical system by a plug connector (1,5). The camera lens opening in the wing leading edge is covered by a fairing and glass window (1,6); the clear glass panel can be exchanged for a coloured light filter.

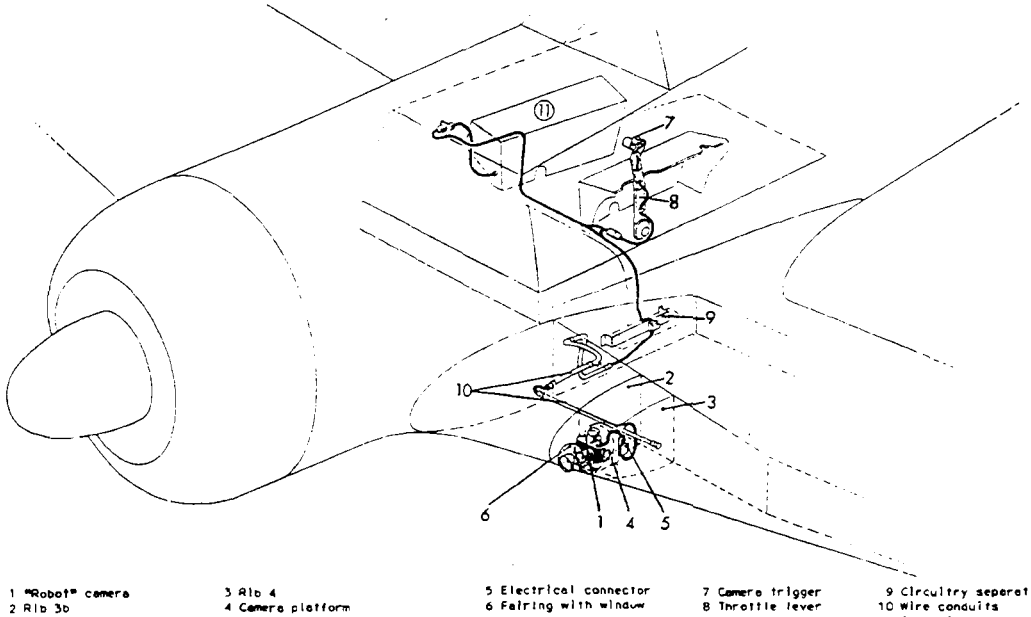
The BSK 16 is a 16 mm movie camera. The film roll is 15 m (49.2 ft) in length, and is driven by an electric motor in the camera. The motor controls a switch which limits film movement to 3,75 m (12.3 ft) per run, and permits four film runs of from 43 to 57 seconds duration each. Depressing the firing button for the fuselage and wing-root weapons starts the camera.

The camera can also be triggered by depressing a button (1,9) on the throttle lever (1,10), thus




1 BSK 16 camera
2 Rib 3b
3 Rib 4
4 Camera platform
5 Electrical connector
6 Fairing with window
7 Electrical junction box
8 Magnetic switch
9 Camera trigger
10 Throttle lever
11 Sighting image projector
12 Circuitry separation point
13 Wire conduits

Fig. 1: BSK 16 (Ballistic gun camera) system




1 "Robot" camera
2 Rib 3b
3 Rib 4
4 Camera platform
5 Electrical connector
6 Fairing with window
7 Camera trigger
8 Throttle lever
9 Circuitry separation point
10 Wire conduits
11 Right instrument console

Fig. 2: 'Robot' camera installation

enabling gun camera photos to be taken without pressing the firing button.

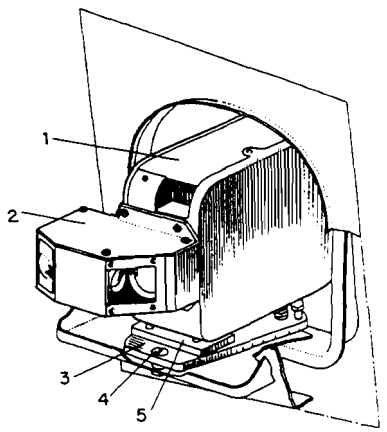
## B. "Robot" miniature camera

With the 'Robot', Model II, miniature camera, single photos can be taken from high altitudes down to approximately 2000 m (6562 ft). The camera is aimed through the gunsight. Frame size is 2,4 x 2,4 cm, and the film roll is 1,6 m (5.25 ft) long.

The 'Robot' camera (2,1) is, as is the BSK 16, mounted on an adjustable platform (2,4) in the wing leading edge between Ribs 3b (2,2) and 4 (2,3), and is attached to the electrical circuit by a plug connection.

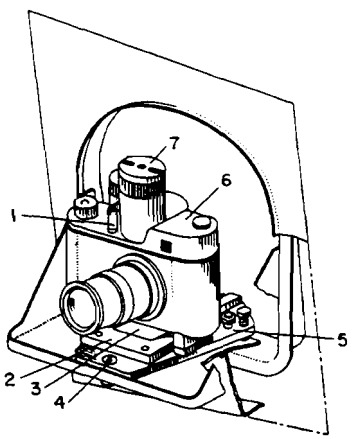
The film is advanced by a spring device on the camera; this spring must be wound before each flight. Near the spring is situated an actuation button. When this button is pressed, the shutter is released and the film advanced one frame.

The circuitry for releasing the shutter is connected to a button (2,7) on the throttle lever (2,8). This button activates a magnet situated on the camera mount. The magnet triggers the charging lever which depresses the camera shutter release.




1 BSK 16 camera
2 Sighting image projector
3 Adjustable platform
4 Platform forward attachment point
5 Camera forward fixing point

Fig. 3: BSK 16 camera




1 Shutter release
2 Camera forward fixing point
3 Camera base plate
4 Platform forward attachment point
5 Adjustable platform
6 "Robot" camera
7 Film advance spring

Fig. 4: 'Robot' camera

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# Fw 190 A-8

## Aircraft Handbook

**Part 9A**

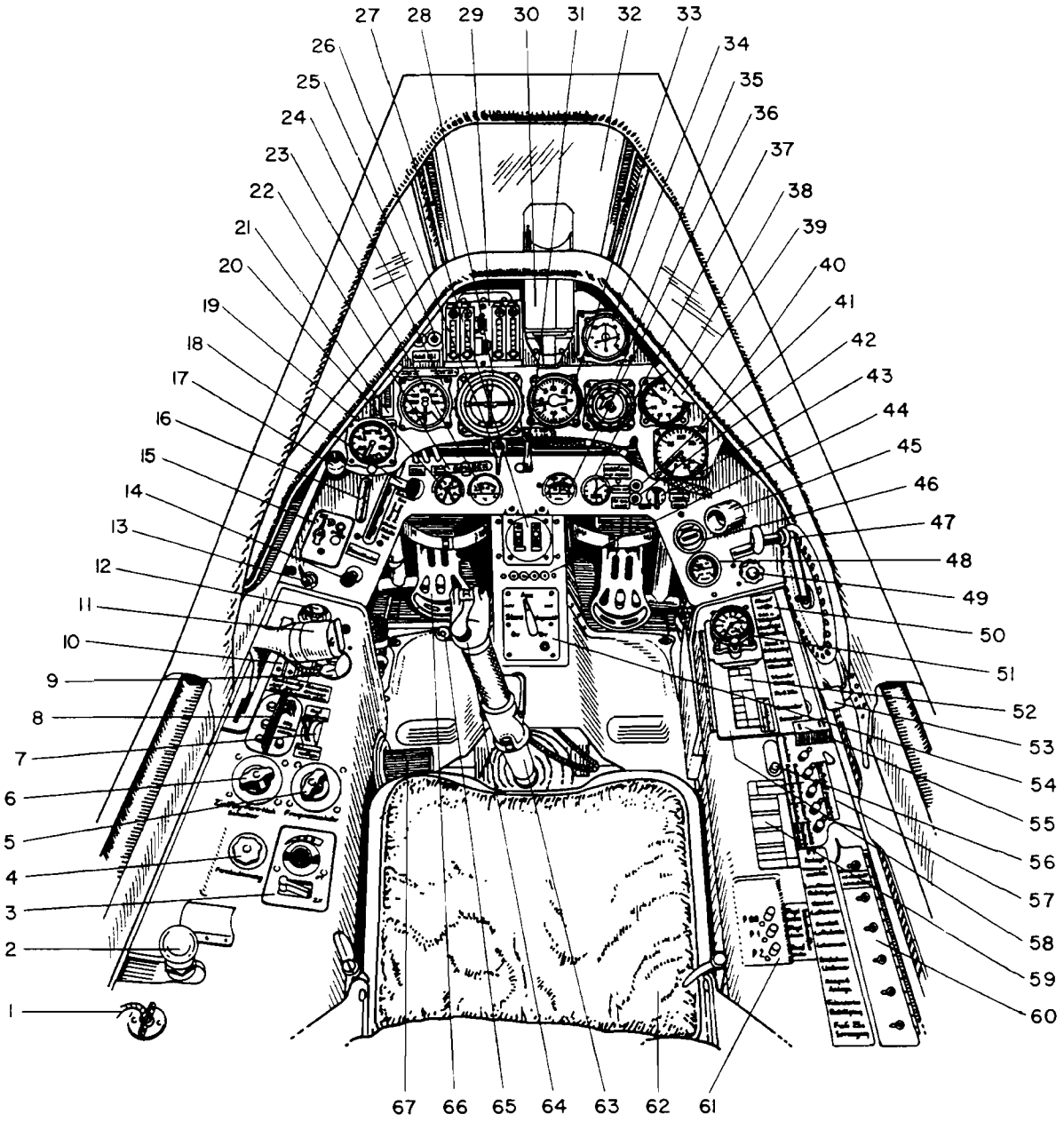
**General equipment**

**(Effective July 1944)**

**Issued September 1944**

# I. Instrument panels and consoles

## 1. Instrument panels

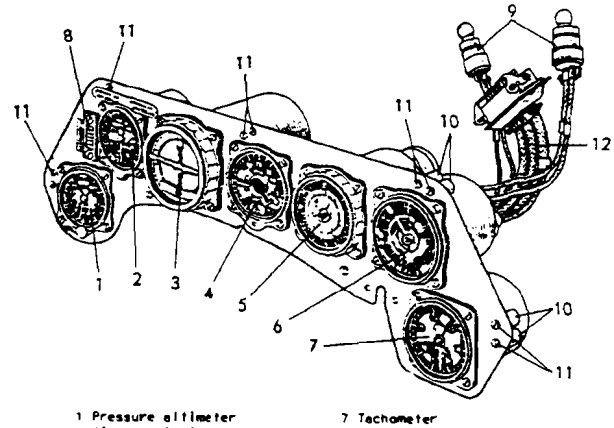



1 Headset cord attachment point
2 Primer fuel pump handle
3 Volume control and FT (communications) - ZF (homing) switch (FuG 16ZY)
4 Receiver fine tuning (FuG 16ZY)
5 Frequency selector (FuG 16ZY)
6 Homing range switch (FuG 16ZY)
7 Horizontal stabilizer trim switch
8 Undercarriage and landing flap actuation buttons
9 Horizontal stabilizer trim indicator
10 Undercarriage position indicators (l & r), flap position (centre)
11 Throttle lever with thumb actuated propeller pitch control
12 Instrument panel lightning dimmer control
13 Stop cock control lever
14 Engine starter brushes withdrawal button
15 IFF control unit (FuG 25a)
16 Undercarriage manual extension handle
17 Cockpit ventilation knob
18 Fuel tank selector lever
19 Altimeter
20 Fuel and oil pressure gauge
21 Pitot tube heater light
22 Manual jettison handle for under fuselage stores
23 Oil temperature gauge
24 Air speed indicator
25 MG 131 armed lights
26 Windscreen washer actuation lever
27 21 cm rocket control unit
28 Artificial horizon
29 Armament switch —, round counter — and control unit (SZKK 4)
30 Revi 16B reflector gunsight
31 Engine ventilation flap positioning lever
32 Bullet resistant windscreen (50 mm at 25°)
33 Rate of climb/descent indicator
34 AFN 2 homing indicator (FuG 16ZY)
35 Repeater compass
36 Fuel contents gauge
37 Propeller pitch indicator
38 Supercharger pressure gauge
39 Ultra-violet cockpit light
40 Tachometer
41 Fuel low level warning light (red)
42 Rear tank switchover light (white)
43 Fuel gauge selector switch
44 Disposable load indicator lights
45 Flare pistol holder
46 Oxygen flow indicator
47 Canopy actuator drive
48 Oxygen pressure gauge
49 Oxygen flow valve
50 Circuit breaker panel cover
51 Clock
52 Operations data card
53 Canopy jettison lever
54 Bomb fusing selector unit
55 Starter switch
56 Flare box cover plate release button
57 Fuel pump circuit breakers
58 Flare box cover
59 Compass deviation card
60 Circuit breaker panel cover
61 Armament circuit breakers
62 Pilot's seat cushion
63 Control stick
64 Wing cannon firing button
65 Bomb release button
66 Rudder pedal with integral braking unit
67 Throttle friction knob

Fig. 1: Cockpit Interior

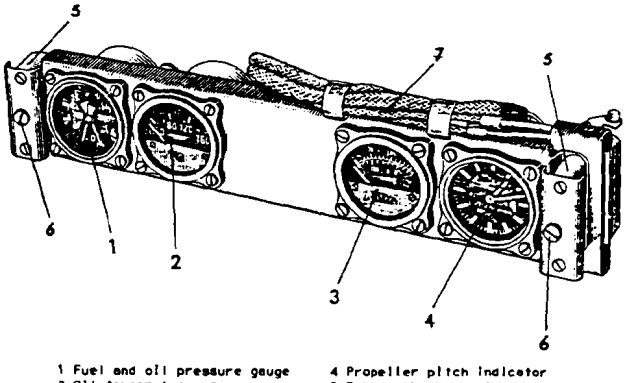
ine instrument panels comprise a main panel (Fig. 2) and an auxiliary panel (Fig. 3). In the area above these panels are positioned additional instruments and the instrument glare cover. A third instrument panel, situated between the auxiliary panel and the floor, serves as the armament panel.

The auxiliary instrument panel base plate is a load bearing component of the fuselage and is secured to it (instrument bulkhead).




1 Pressure altimeter
2 Airspeed indicator
3 Artificial horizon
4 Vertical speed indicator
5 Repeater compass
6 Supercharger pressure gauge
7 Tachometer
8 Pitot tube heater light
9 Light sockets
10 Rubber shock mounts
11 Mounting points
12 Electrical leads

Fig. 2: Main instrument panel




1 Fuel and oil pressure gauge
2 Oil temperature gauge
3 Fuel contents gauge
4 Propeller pitch indicator
5 Rubber shock mounts
6 Base plate attachment points
7 Electrical leads

Fig. 3: Auxiliary instrument panel

## 2. Instrument consoles

The left and right instrument consoles contain operating controls and circuit breakers. The left console contains the engine primer pump and the battery master switch, as well as the controls and monitoring instruments for the undercarriage, the landing flaps and the stabilizer incidence; the right console, all aircraft electrical system circuit breakers, the engine starter switch, the flare gun ammunition and the aircraft clock. The electrical system circuit breakers are protected by spring-loaded covers and designated by name plates near the covers.

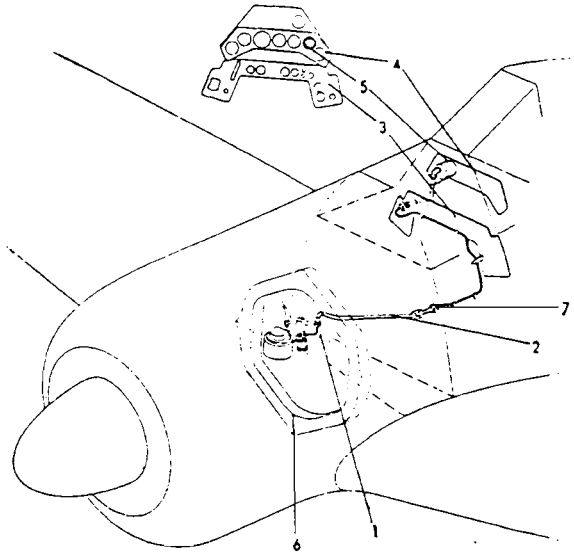
In more recently produced aircraft the two groups of circuit breakers are consolidated into one.

# II. Powerplant monitoring instruments

## 1. Supercharger pressure gauge

The supercharger pressure gauge (1,38) is mounted on the right side of the main instrument panel. Instrument range: 0,6-1,8 ata (8.5-25.5 psi).

For the routing of the instrument measuring line see Fig. 4.




1 Attachment point of the supercharger pressure line to the command unit
2 Supercharger pressure measuring line
3 Auxiliary instrument panel
4 Main instrument panel
5 Supercharger pressure gauge
6 Engine mounting ring
7 Separation point 2 on Bulkhead 1 (Firewall)

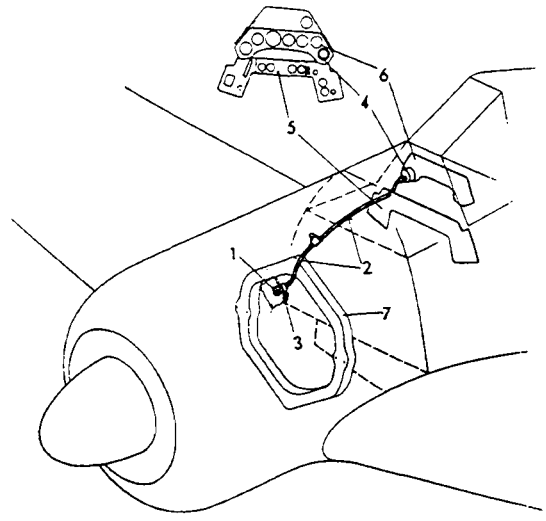
Fig. 4: Supercharger indicator system

## 2. RPM gauge

The RPM gauge (1,40) is positioned on the right side of the main instrument panel. The engine and the gauge are connected by a flexible cable.

Measurement range: 600-3600 rpm.

An oil extractor (5,3) is built into the flexible cable near its point of attachment to the engine. Any oil that has penetrated the cable is extracted at this point and allowed to drop into the engine compartment.




1 Attachment point of the measurement cable to the engine
2 Flexible cable
3 Oil extractor
4 RPM gauge
5 Auxiliary instrument panel
6 Main instrument panel
7 Engine mounting ring

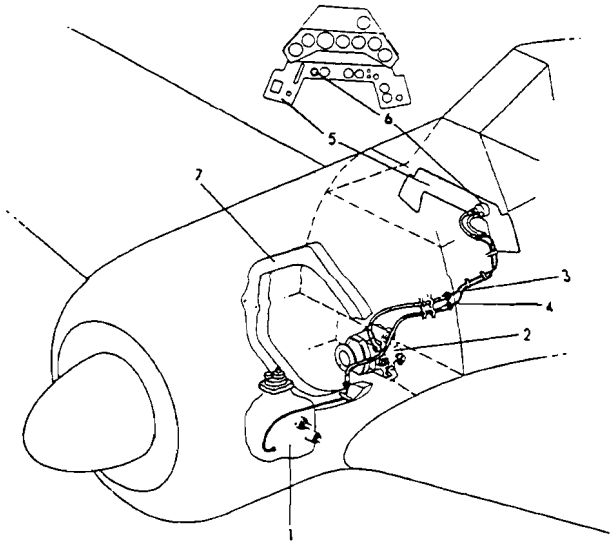
Fig. 5: Engine RPM measurement system

## 3. Fuel and oil pressure gauge

The dual pressure gauge (1,20) is mounted on the near left side of the auxiliary instrument panel. The feed pressure of the pumps is indicated in Kg/sq cm.

Fuel pressure range 0- 3,0 Kg/sq cm (0- 42.6 psi)
Oil pressure range 0-15,0 Kg/sq cm (0-213.0 psi)

The operating limits are marked by indicator lines.

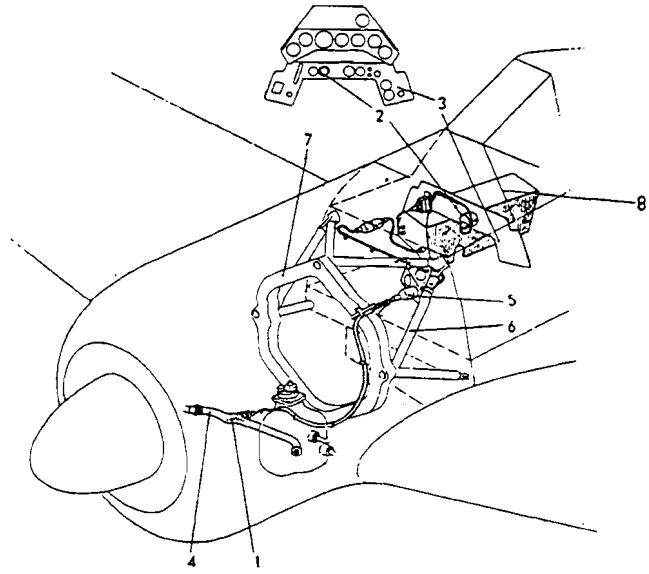



1 Oil pump
2 Fuel pump
3 Fuel pressure line separation point
4 Oil pressure line separation point
5 Auxiliary instrument panel
6 Fuel and oil pressure gauge
7 Engine mounting ring

Fig. 6: Fuel and oil pressure measurement system

## 4. Oil temperature gauge

This instrument (1,23) is positioned in the near left side of the auxiliary instrument panel, and provides an indication of oil temperature. The unit consists of an electrical probe (7,1) and an indicator (7,2), and uses the 24 volt aircraft electrical system. Indication range: 0-130°C (32-266°F).




1 Electrical temperature probe
2 Oil temperature gauge
3 Auxiliary instrument panel
4 Oil line from cooler to main pump
5 Separation point 10
6 Engine bearer assembly
7 Engine mounting ring
8 Right instrument console

Fig. 7: Oil temperature measuring circuit

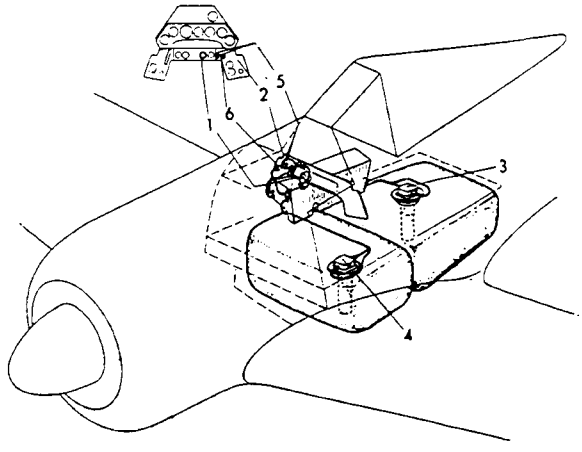
## 5. Fuel contents gauge

The electrical fuel contents gauge, (1,36) and (8,1), is positioned on the near right side of the auxiliary instrument panel (8,2); it is possible to individually measure, in liters, the contents of each main fuel tank.

The unit consists of a fuel contents probe with low level warning attachments in both the rear (8,3) and forward (8,4) tanks, and an indicator unit (8,1). Indicator lights (8,5) are positioned in the Instrument bulkhead. The lower, white light, acting as tank switchover warning, illuminates when rear tank contents have dropped to 10 Ltr (2.2 gal); the upper, red light, provides return to base warning, illuminating when 80 Ltr (17.6 gal) remain in the forward fuel tank. Plate inscription: 20 minutes remaining at economical cruise.

A gauge selector switch (8,6) enables the indicator unit to be switched to measure the contents of the forward or rear tank.

Operating power: 24 volts.




1 Fuel contents gauge
2 Auxiliary instrument panel
3 Rear tank contents probe with low level warning
4 Forward tank contents probe with low level warning
5 Indicator lights (low level warning)
6 Fuel gauge selector switch

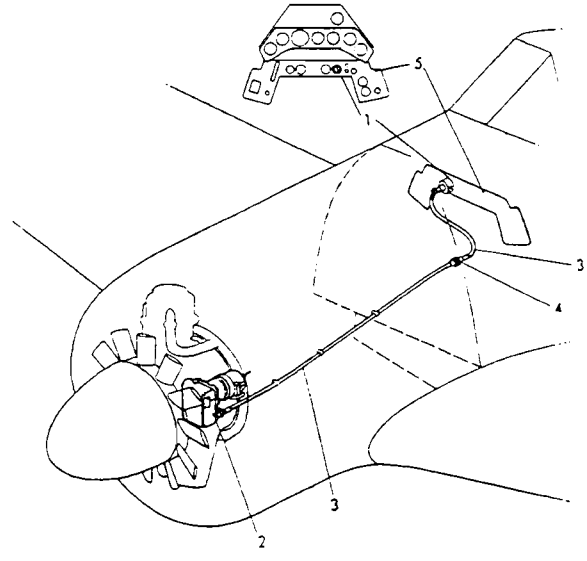
Fig. 8: Fuel tank contents circuit

## 6. Mechanical airscrew pitch indicator

The unit, (1,37) and (9,1), serves to indicate the pitch of the adjustable airscrew. Indication impulses are fed from the pitch control unit (9,2) via a flexible cable (9,3). The propeller blade pitch indication is given in hours and minutes.

For operation and maintenance of the unit consult the appropriate publications.

From time to time examine the cable attachment points for good seating, to prevent line damage due to chafing.




1 Pitch indicator
2 Hydraulic-electric pitch control unit
3 Flexible cable
4 Separation point 1 on Bulkhead 1
5 Auxiliary instrument panel

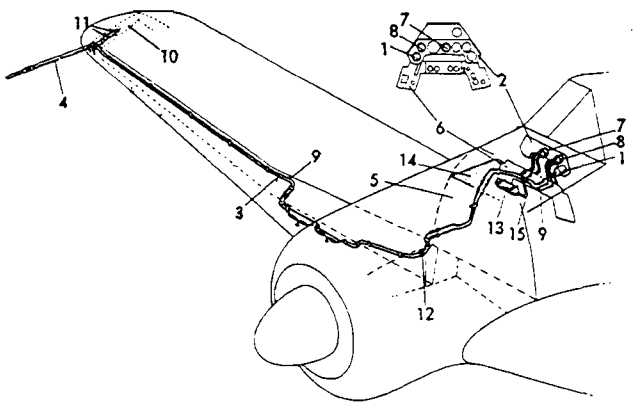
Fig. 9: Airscrew pitch indicator

# III. Flight monitor and navigation instruments

## 1. Pressure altimeter

The unit, (1,19) and (10,1), is positioned on the left side of the main instrument panel (10,2).

Measuring range: 0–10 km (0–32810 ft).



1 Pressure altimeter
2 Main instrument panel
3 Static pressure line
4 Pitot tube
5 Bulkhead 1
6 Auxiliary instrument panel
7 Vertical speed indicator
8 Airspeed indicator
9 Dynamic air pressure line
10 Rib 15R
11 Pitot tube heater line
12 Wing-root separation point
13 Differential pressure chamber
14 Decking in front of windscreen
15 Air line

Fig. 10: Flight monitor instrument circuits

## 2. Airspeed indicator

The airspeed indicator, (1,24) and (10,8), is positioned on the left side of the main instrument panel (10,2).

It is connected to both the static air pressure line (10,3) and to the dynamic air pressure line (10,9); the two lines are routed parallel to one another.

When the pitot tube heater is switched on, a latticed indicator located on the left side of the main instrument panel is illuminated.

## 3. Vertical speed indicator

The indicator, (1,33) and (10,7), is positioned in the centre of the main instrument panel (10,2) and is connected to the static air pressure line (10,3). The differential pressure tank (10,13) is secured by two clamps beneath the decking in front of the windscreen (10,14), and is connected to the vertical speed indicator by an air line.

Measurement limits: 'descent' and 'climb'

3000–0–3000 m/s (9840–0– 9840 fps)
2000–0–5000 m/s (6560–0–16400 fps)

The bottom figure is the maximum value of the older indicators.

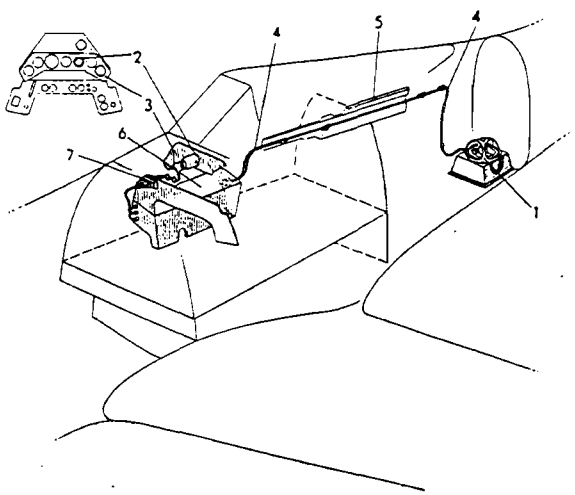
## 4. Artificial horizon

Location of the unit (1,28): centre main instrument panel. It indicates the position of the aircraft relative to the natural horizon, and the turn speed and speed of rotation of the aircraft about its vertical axis.

For detailed instructions concerning the inspection, installation, operation, servicing, and maintenance of the unit see D.(Luft)T.5405.

## 5. Remote compass system

The system comprises the master compass and the pilot's repeater compass. The master compass (11,1) is located in the rear fuselage; the repeater compass (11,2), in the near right side of the main instrument panel.



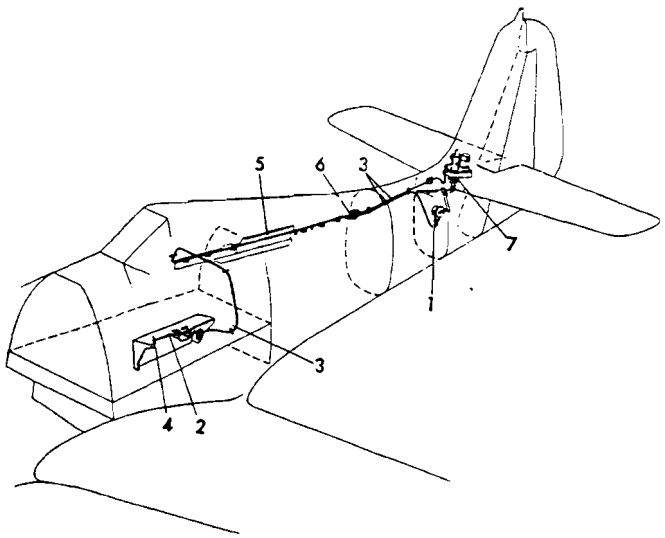
1 Master compass
2 Pilot's repeater compass
3 Main instrument panel
4 Signal transmission unit
5 Cable shield between Bulkheads 6 and 8
6 Right instrument console
7 Plug connector

Fig. 11: Remote compass system

## 6. Stabilizer incidence indicator

This system consists of the stabilizer incidence relay unit (12,1) and indicator (12,2). The indicator (13,7) and the actuation switch (13,8) are located in the left instrument console.

The incidence relay unit (13,1) is positioned in the right side of the vertical stabilizer and is connected to the triangular stress frame (13,5) by a push rod (13,4). The stabilizer incidence is indicated as + or - (Fig. 14).




1 Incidence relay unit
2 Indicator
3 Electrical leads
4 Left instrument console
5 Cable shield between Bulkheads 6 and 8
6 Connector plug
7 Stabilizer trim motor

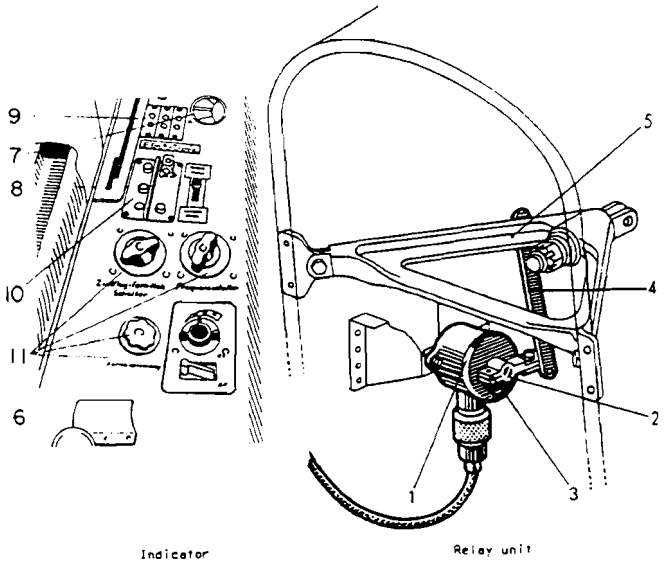
Fig. 12: Stabilizer trim system

### Trim system indication

The stabilizer null setting and limit settings are marked on the stabilizer fairing and left cover plate (Fig. 14), and on the indicator (Fig. 15).

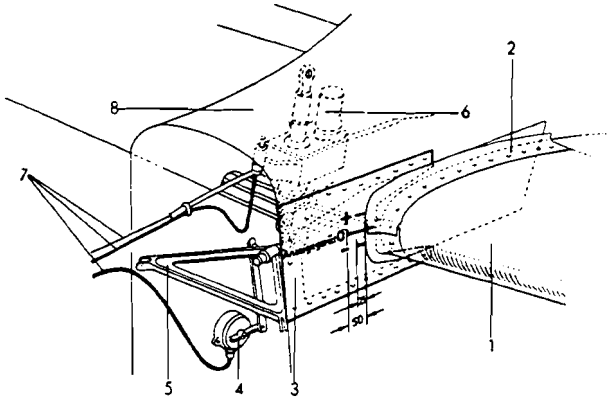
The stabilizer null setting is marked on the stabilizer fairing (14,2), in the centre of the overlap, by a red stripe which is extended for 50 mm onto the cover plate. It is annotated "Anzeigegerät 0" in red letters 10 mm high.

At the stabilizer maximum negative setting, a stripe, 25 mm long, is marked on the cover plate, and denoted by a - (minus). A similar stripe is marked at the stabilizer maximum positive setting. It is indicated by a + (plus).




1 Incidence relay unit
2 Relay unit axle
3 Lever
4 Push-rod
5 Triangular stress frame
6 Left instrument console
7 Indicator
8 Actuation switch
9 Undercarriage and flap indicator unit
10 Undercarriage and flap push buttons
11 Radio switches

Fig. 13: Stabilizer trim system

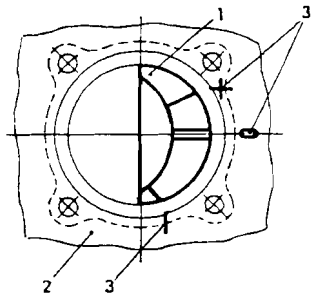



1 Horizontal stabilizer
2 Stabilizer fairing panels
3 Cover plate
4 Stabilizer incidence relay unit
5 Triangular stress frame
6 Stabilizer trim motor
7 Electrical leads
8 Tail unit

Fig. 14: Tail unit trim components

These registration marks are placed on the fuselage left side only.

During inspection of the stabilizer trim system ensure that the registration marks on the indicator and on the cover plate are in agreement.




1 Stabilizer incidence indicator
2 Left instrument console
3 Stabilizer incidence notations

Fig. 15: Indicator

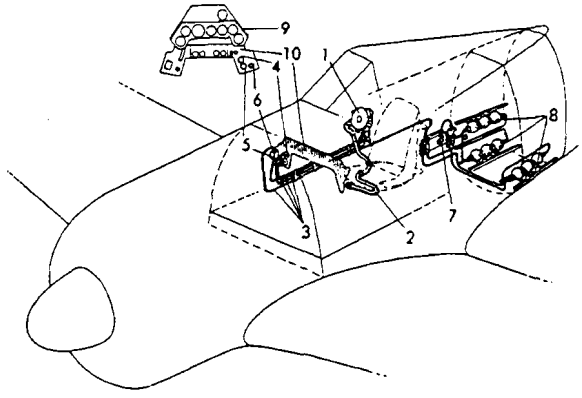
### 7. Aircraft clock

Position: on the right instrument console (1,51).

# IV. Oxygen system

## A. Description

The system consists of three two liter light steel spherical bottles (16,8), a regulator unit (16,1) with oxygen hose (16,2), high pressure lines (16,3) with pressure gauge (16,5), an oxygen flow monitor (16,4), and a flow valve (16,6).




1 Regulator unit
2 Hose
3 High pressure lines
4 Flow monitor
5 Pressure gauge
6 Flow valve
7 External filler point
8 Oxygen bottles
9 Main instrument panel
10 Auxiliary instrument panel

Fig. 16: Aircraft oxygen system

The oxygen bottles are mounted at the base of the radio compartment (equipment bay) behind Bulkhead 9; two are on the fuselage right side--facing the equipment bay access door--and the third is on the left side beneath the equipment bay door. As a safety measure, the three bottles are divided into two separate systems by the installation of four non-return valves. A non-return valve is built into the filler line, between the external connection and the first oxygen bottle. The regulator unit is positioned behind the pilot's seat on the right side frame; the pressure gauge, oxygen flow monitor and flow valve are on the auxiliary instrument panel right side.

After the flow valve is opened, the oxygen first flows to the regulator unit. The emergency pressure button on the regulator can be actuated by the right elbow of the pilot.

## B. Inspection

Inspect the oxygen system for proper operation, satisfactory condition and secure mounting. See D.(Luft) 1205.

Short test

Open the valve, read the pressure, close the valve. In 20 minutes, the system pressure (150 atü) must not fall by more than 10 atü.

# V. Rescue and safety equipment

## 1. First aid kit

The first aid kit is positioned within the right side of the rear fuselage between Bulkheads 9 and 10, and is accessible from the outside.

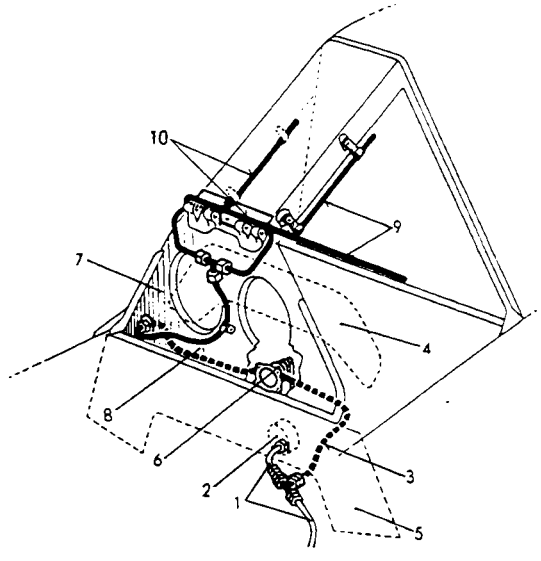
## 2. Flare gun

The flare gun is located in the right side of the Instrument bulkhead (1,45). There it is inserted in a tube and can, from that position, be fired. The required ammunition is carried within the right instrument console (1,58).

## 3. Seat straps and parachute

The pilot's seat is outfitted with lap and shoulder straps, with integral quick-release mechanism. The pilot is provided with a back parachute and a one-man dinghy pack.

# VI. Windscreen cleaning




1 Fuel pressure gauge feed line
2 Fuel and oil pressure gauge
3 Fuel line
4 Main instrument panel
5 Auxiliary instrument panel
6 Windscreen washer operation lever
7 Windscreen mounting frame
8 Fuel line
9 Spray tubes
10 Spray tubes

Fig. 17: Windscreen cleaning system

During flight, oil on the front and side window panels can drastically reduce vision through them. These panels can be cleared by spraying fuel over them. The required fuel is drawn from the fuel pressure gauge feed line (17,1). Just before the line enters the gauge (17,2), a tube branches off and runs between the main instrument panel (17,4) and the auxiliary instrument panel (17,5), to a stop cock (17,6) on the windscreen mounting frame (17,7).

The spray tubes (17,9 & 10) are so positioned that when the stop cock is opened, fuel expelled through the small holes in the tubes, will be blown rearward by the slipstream to clean the three glass panels.

D. (Luft) T. 2190 A-8

For Official Use Only!

# Fw 190 A-8

## Aircraft Handbook

### Part 9A

### General equipment

**Supplement 1: PKS 12 Patin directional control**

(Effective July 1944)

Issued September 1944

## A. General

The Patin directional control is used to maintain a required flight course by supplying automatic steering inputs to the rudder. This facilitates both flying in bad weather conditions and penetration of continuous cloud cover.

The sole control device provided for the pilot is the turn switch (V60) mounted on the control column. The switch comprises both a bipolar tumbler switch to engage and disengage the automatic pilot system, and a five position rate-of-turn switch which comprises a centre 'null' position and two turn rate positions each to right and left. These turn rate positions permit the initiation of a turn at either of two predetermined turning rates, 1°/sec or 2°/sec.

The elevator and ailerons are operated in the normal manner.

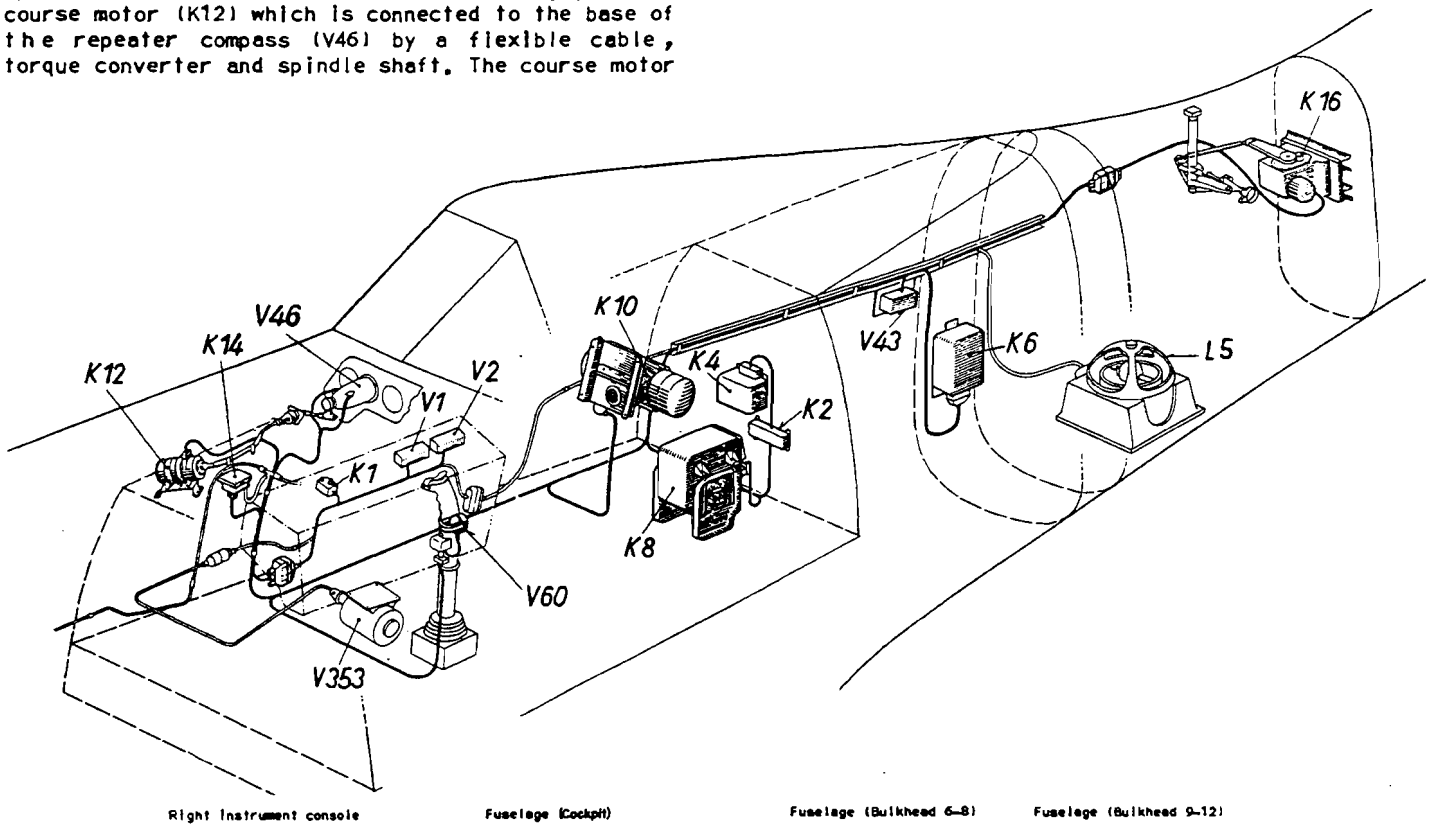
## B. Method of operation

Operation of the turn switch (V60) engages the course motor (K12) which is connected to the base of the repeater compass (V46) by a flexible cable, torque converter and spindle shaft. The course motor is activated when the turn switch is operated, to turn the aircraft compass course onto a desired direction which is indicated by a reference stripe. After the pilot moves the turn switch to contact 1 or 2, the course motor will change the compass course at a turning rate of either 1°/sec or 2°/sec.

When the steering mechanism is disengaged, the rotation speed of the compass course indicator (through a weakening of the magnetic field within the course motor) is increased to 6°/sec. By manually turning the aircraft onto the desired heading before engaging the automatic pilot, the aircraft can be brought to the desired course in a shorter time.

Installed in the steering relay is a moving coil unit, with five electrically separated coils, which passes through the field of a permanent magnet. The various direction sensors create electrical currents of specific strengths and directions which act on given coils; the strength and direction of these currents are transmitted to the steering unit (K8).

In the steering unit (K8) are contained the steering




Right instrument console
K 1 System circuit breaker
V 1 Junction box
V 2 Negative distributor

Fuselage (Cockpit)
K 12 Course motor
K 14 Damping regulator
K 46 Repeater compass (Main instrument panel)
V 60 Turn switch (Control stick)
V 353 Transformer

Fuselage (Bulkhead 6–8)
K 2 Junction box
K 4 Impedance unit
K 8 Steering unit
K 10 Leonard transformer

Fuselage (Bulkhead 9–12)
K 6 Position integration unit
L 5 Master compass
V 43 Negative distributor

Tail
K 16 Rudder drive

and mixing units for the system:

1) The damping circuit;
2) The steering relay; and,
3) The oscillating transformer.

The damping circuit is fitted with a matching circuit in which the voltage generated by a divergence from horizontal flight is matched by an equal and opposite voltage generated by the circuit.

The oscillating transformer has an AC frequency of 50Hz--input to one of the coils in both the position integration unit and the steering unit, so that slight vibrations will not, through slippage or jamming, cause seizure.

The damping regulator (K14) includes an air intake pipe in which the movement of the shaft operates an electrical transmission line which relates the deflection of the rudder to the aircraft speed. Thus at greater speeds the required rudder deflection is less than at lower speeds.

As only an average course is maintained by the steering unit, small deviations from the required course cause only very weak currents which will not result in operation of the steering unit.

The Leonard transformer (K10) is an DC-DC transformer, and is excited by the steering control current produced by the steering relay. The current is then passed to the armature of the DC motor in the rudder drive (K16).

The rudder drive also contains an electrical coupling, operated from the automatic pilot engaging switch (V60), which connects the gear drive to the rudder actuating lever. When the rudder drive is disengaged, however, the rudder is released.

Within the impedance casing (K4) is located an adjustable resistor to control the adjustment rate of the actuating spindle on the course motor (K12). Additionally, two relays are provided, which when the automatic pilot is uncoupled (disengaged), cause a weakening in the field of the course motor (K12), thus permitting a higher adjustment rate of the actuating spindle and thereby the compass course indicator.

▽

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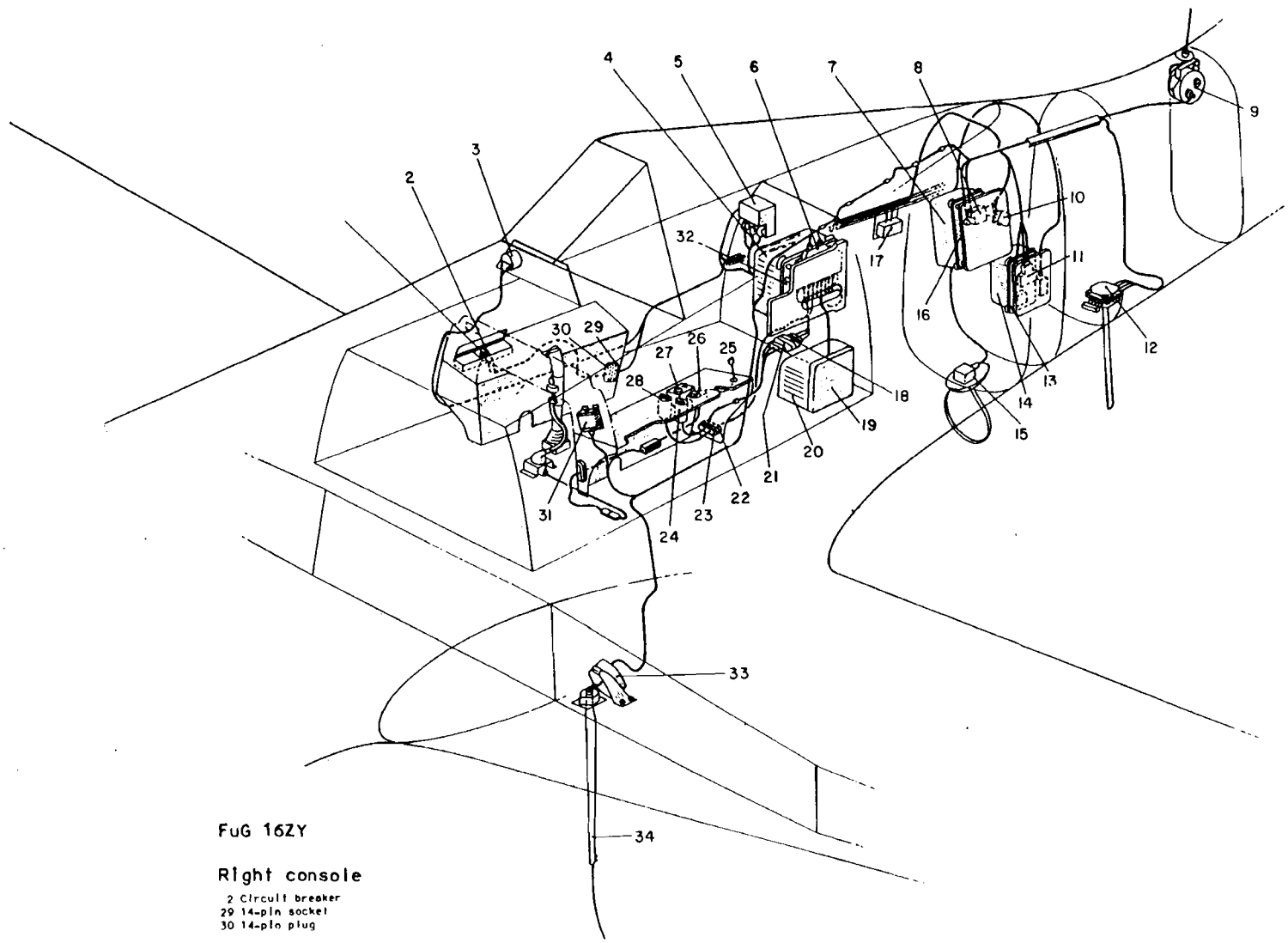
## Aircraft Handbook

**Part 9B**

**Radio installation**

(Effective July 1944)

Issued September 1944




## FuG 16ZY

### Right console

2 Circuit breaker
29 14-pin socket
30 14-pin plug

### Left console

22 20-pin socket
23 20-pin plug
24 Homing range switch
26 Receiver fine tuning
27 Volume control and FT-ZF switch
28 Frequency selector

### Fuselage

3 AFN 2 homing indicator
4 Transmitter-receiver unit
5 Switcher unit
6 Distributor unit
9 Antenna matching unit
11 Distributor box
13 Suspension frame
14 Homer bearing converter
15 Fixed loop homing antenna
17 Junction box
18 20-pin socket
19 Transformer base plate
20 Power transformer
21 20-pin plug
25 Headset cord attachment point
32 Suspension frame

### Left wing

33 Antenna matching unit
34 Morane antenna

## FuG 25a

### Right console

1 Circuit breaker

### Fuselage

7 Transponder unit
8 Distributor box
10 Impedance unit
12 Antenna matching unit
16 Suspension frame
31 Control unit

# Top Secret

*Observe appropriate security regulations*

Technical description No. 284

Fw 190 A-8 Fighter

Prepared by:

## Data sheet

| | |
|---|---|
| **Mission type:** | Single-seat fighter (Fighter-bomber) |
| **Construction:** | Single engine, low wing, cantilever construction with electrically retractable undercarriage. |
| **Structural strength:** | For Fw 190A-8/R2 on fighter operations, at G = 4450 kg (9812.2 lb), safe 'G' factor $n_A$ = 6,0<br>On fighter-bomber operations, at G = 4775 kg (10,528.9 lb), $n_A$ = 5,5 |
| **Powerplant:** | BMW 801 D (F 600), from about July 1944 BMW 801 TU |

**Dimensions:**

| | | |
|---|---|---|
| Wing area | F = 18,3 sq m | (197 sq ft) |
| Span | b = 10,5 m | (34' 5.4") |
| Aspect ratio | $b^2/F$ = 6,0 | |
| Length | L = 8,95 m | (29' 4.4") |
| Max. height | H = 3,15 m | (10' 4.0") |
| Main wheels | 700 Ø x 175 mm | |
| Tail wheel | 350 Ø x 135 mm or<br>380 Ø x 150 mm | |

**Normal flying weight:**

| | |
|---|---|
| Fighter operations | G = 4400 - 4450 kg (9702 - 9812.2 lb) |
| Fighter-bomber operations | G = 4775 kg (10,528.9 lb) |

**Airframe weight:** 1225 kg (2701.1 lb), composed of 55,8% Dural; 36,6% Steel; 4,3% Rubber and plastic; 3,3% Wood

**Armament:**

| | |
|---|---|
| Fw 190 A-8: | 2 MG 131 in fuselage with 475 rpg<br>2 MG 151 in wing-roots with 250 rpg<br>2 MG 151 in outer wings with 140 rpg |
| Fw 190 A-8/R2: | 2 MK 108 with 55 rpg replace the outboard MG 151s |
| Fw 190 A-8/R3: | 2 MK 103 with 35 rpg (beneath the wings) replace the outboard MG 151s |

**Armour:**

Engine armour BMW 801 D (F 600)
Thickness 6,5/5,5 mm; Weight 78,0 kg (171.9 lb)

Engine armour BMW 801 TU
Thickness 10,0/6,0 mm; Weight 106,0 kg (233.7 lb)

Cockpit armour 60,0 kg (132.3 lb)

Total armour weight 136 or 166 kg (299.8 or 366.0 lb)

Equipment: Fu G 16 ZY; Fu G 25a; Revi 16b

Fuel load: Normal: 525 l (115.5 gal)
Additional fuselage tank: 115 l (25.3 gal)
Drop tank: 300 l (66.2 gal)

## Design modifications

The Fw 190 A-8 is the latest production version of the Fw 190 series and includes a number of changes in armament, navigation equipment, range capabilities, etc. designed to meet the demands of modern air warfare. These modifications include:

Fuselage auxiliary tank: Based on the requirement to increase aircraft range without degrading its aerodynamic efficiency, provision has been made for the mounting of a protected fuel tank within the rear fuselage. After August - September 1944 all A-8 aircraft will be delivered with the auxiliary tank fitted. If required, instead of the 115 Ltr (25.3 gal) fuel tank, an unprotected Methanol-water (MW 50) tank of either 115 Ltr (25.3 gal) or 140 Ltr (30.8 gal) capacity, or a GM 1 tank of 85 Ltr (18.7 gal) capacity, can be installed. At the present time, however, it is planned that the standard A-8 will be produced only with the auxiliary fuel tank.

Radio compartment: Fitting of the auxiliary fuel tank has required the relocation of the Fu G 16 radio installation from Bulkhead 8 to the area behind the pilot's seat. An access door built into the fuselage right side provides easy access to the compartment.

Fu G 16 ZY: Fu G 16 ZY radio equipment will be installed in place of the earlier Fu G 16 Z. This set is like the Fu G 16 Z, but has, in addition, the E-type range measuring circuitry. In the interim, Fu G 16 ZE is being fitted; it is equivalent to the Fu G 16 ZY except for its lack of homing capability.

Forward placement of ETC 501: Fitting of the additional fuselage tank has necessitated shifting the ETC 501 (Part no. 8-190.861) forward about 200 mm (7.9 in). Starting with the Fw 190 A-8 series, only the forward mounted ETC 501 (Part no. 8-190.8861) is to be installed. This will be replaced, at a later date, by the aerodynamically and functionally superior ETC 504.

Vertical speed indicator: To improve flight monitoring, a Vertical Speed Indicator will be built into the centre of the main instrument panel.

Camera installation: Starting in June 1944, provision will be made for the installation of a BSK 16 gun camera (Part no. 8-190.8061). The gun camera provides confirmation of gunnery results.

Powerplant: Commencing in July 1944, the BMW 801 D2 (F 600) will be replaced by the BMW 801 TU. This engine is an intermediate step between the BMW 801 D2 (F 600) and the later, more powerful, BMW 801 TS or TH. Due to delays encountered in readying the BMW 801 F for service, the

BMW 801 D will, as a temporary measure, be fitted with certain drive components of the BMW 801 TS/TH; in addition, it will also receive the heavier 10 mm/6 mm armoured nose rings. The BMW 801 TU will be delivered as a complete replacement unit; it is fully interchangeable with the BMW 801 D2 (F 600). With the TS/TH engine installed, the Fw 190 A-8 is re-designated Fw 190 A-9.

Increased emergency power: Commencing in July 1944, all Fw 190 A-8 aircraft will be fitted with the 'emergency power unit'. By overriding the supercharger boost regulator, this system increases the boost pressure, on take-off and emergency power, at the low supercharger setting, from 1,42 ata to 1,58 ata; and at the high supercharger setting, from 1,42 ata to 1,65 ata. The resulting increase in maximum horizontal speed is about 22 km/h (13.6 mph) at the low setting, and about 25 km/h (15.5 mph) at the high setting. Due to the danger of engine overheating, this system must not be used for more than 10 minutes at a time.

GM1 installation: The fitting of a GM1 unit in place of the additional fuselage fuel tank is basically feasible; but, in the Fw 190 A-8 series is not normally done. It can be used at altitudes above 8 km (26,250 ft) and gives a speed increase of about 58 km/h (36.0 mph) at climb and combat power.

Armament: The normal armament of the Fw 190 A-8 consists of:

2 MG 131 in the upper cowling with 475 rpg
2 MG 151 in the wing-roots with 250 rpg
2 MG 151 in the outer wings with 140 rpg

This armament has been standard commencing with the Fw 190 A-7. Attachment points for a WGR 21 weapons unit beneath each outer wing panel are provided on the A-8.

An armament modification currently in production is the:

Fw 190 A-8/R2 with MK 108s in the outer wing panels

with 55 rpg (replacing the outboard MG 151s)

Another armament modification currently in preparation is the:

Fw 190 A-8/R3 with 2 MK 103s beneath the outer wing panels

with 35 rpg (replacing the outboard MG 151s)

Fw 190 A-8/R11 Bad weather fighter: A portion of the A-8 production series will, commencing in September 1944, be outfitted as bad weather fighters and will be allocated the designation Fw 190 A-8/R11. Additional equipment will comprise:

1.) PKS Course steering unit, with rudder drive installed in the rear fuselage.

2.) Window heating: The front and left windscreen panels will be electrically heated.

3.) Fu G 125 radio range approach system.

Due to the rearward shift of the Centre of gravity caused by the weight of the steering unit, all Fw 190 A-8/R11 aircraft will be equipped with the heavier BMW 801 TU engine.

The following modifications are, at this time, in the planning stage:

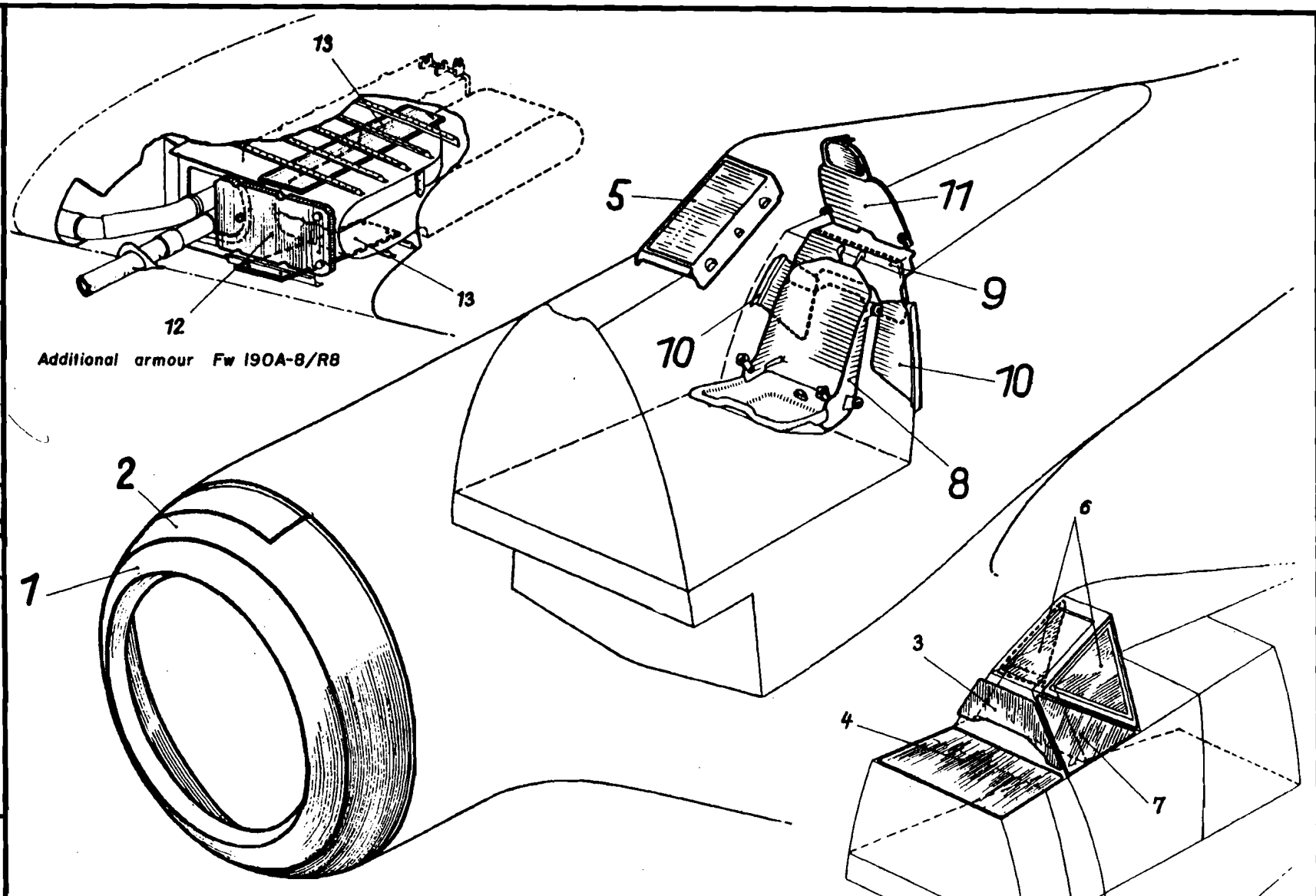
Fw 190 A-8/R7 with increased cockpit armour for use by the Sturmstaffeln (Attack squadrons), with the following armament: 2 MG 131 and 4 MG 151 as per the standard Fw 190 A-8.

Fw 190 A-8/R8 also with increased armour, but with 2 MK 108s in the outer wings as per the Fw 190 A-8/R2.

The Fw 190 A-8 possesses the following armour variations:

| | Sub-type | Fw 190 A-8 with BMW 801 D2 | | Fw 190 A-8 with BMW 801 TU | | Fw 190 A-8/R8 (Attack fighter) | |
|---|---|---|---|---|---|---|---|
| | | d (mm) | G (kg) | d (mm) | G (kg) | d (mm) | G (kg) |
| 1. | Oil cooler armour | 6,5 | 34,7 | 10,0 | 53,3 | 10,0 | 53,3 |
| 2. | Oil tank armour | 5,5 | 43,5 | 6,0 | 52,4 | 6,0 | 52,4 |
| 3. | Windscreen mounting unit | - | - | - | - | 15,0 | 16,0 |
| 4. | Horizontal panel | - | - | - | - | 4,0 | 9,0 |
| 5. | Windscreen | 50,0 | 14,6 | 50,0 | 14,6 | 50,0 | 14,6 |
| 6. | Windscreen side panels | - | - | - | - | 30,0 | 8,0 |
| 7. | Triangular panels | - | - | - | - | 4,0 | 13,5 |
| 8. | Seat armour | 8,0 | 18,2 | 8,0 | 18,2 | 8,0 | 18,2 |
| 9. | Back armour | 5,0 | 5,9 | 5,0 | 5,9 | 5,0 | 5,9 |
| 10. | Panels on Bulkhead 5 | 5,0 | 7,9 | 5,0 | 7,9 | 5,0 | 7,9 |
| 11. | Head armour | 12,0 | 13,0 | 12,0 | 13,0 | 20,0 | 20,0 |
| 12. | MK 108 ammunition protection front | - | - | - | - | 20,0 | 21,0 |
| 13. | MK 108 ammunition protection top & bottom | - | - | - | - | 4,0 | 9,0 |
| | Total weight of armour | | 137,8<br>313.8 lb | | 165,3<br>364.5 lb | | 248,8<br>548.6 lb |

For Attack fighter sub-types of the Fw 190 A-9, the weight of armour is further increased.




# Standard armour Fw 190A-8

Focke-Wulf Aviation Corporation Bremen

# Fw 190A-8 armour

File Nr.

Issued by

Page: 7

## Weight distribution

| | | |
|---|---|---|
| Fuselage | 345,2 kg | 761.2 lb |
| Undercarriage | 258,3 " | 569.5 " |
| Control surfaces | 120,8 " | 266.4 " |
| Flight controls | 32,3 " | 71.2 " |
| Wing assembly | 475,0 " | 1047.4 " |
| Powerplant | 1661,3 " | 3663.2 " |
| Standard equipment | 248,1 " | 547.1 " |
| Permanent accessories | 27,4 " | 60.4 " |
| Additional accessories | 319,3 " | 704.1 " |
| Paint | 2,0 " | 4.4 " |
| Fw 190 A-8 empty weight | 3489,7 ~ 3490 kg | 7694.8 ~ 7695.4 lb |
| Pilot, parachute, flying gear | 100,0 kg | 220.5 lb |
| Normal fuel 525 l | 410,0 " | 904.0 " |
| Auxiliary fuel tank 115 l | 90,0 " | 198.4 " |
| Lubricants | 50,0 " | 110,2 " |
| Ammunition for MG 131 (2x475 rpg) | 77,0 " | 169.8 " |
| Ammunition for MG 151 (2x250 rpg) | 110,0 " | 242.6 " |
| Ammunition for MG 151 (2x140 rpg) | 64,0 " | 141.1 " |
| Useful load | 901,0 kg | 1986.6 lb |
| Empty weight | 3490,0 kg | 7695.4 lb |
| 1. Fw 190 A-8 flying weight | 4391,0 ~ 4400 kg | 9682.2 ~ 9702.0 lb |
| Removal of 2 MG 151s and ammunition | -176,5 kg | -389.2 lb |
| 2 MK 108 with 55 rpg | 240,0 " | 529.2 " |
| 2. Fw 190 A-8/R2 flying weight | 4454,5 ~ 4450 kg | 9822.2 ~ 9812.2 lb |
| Removal of 2 MK 108s | -240,0 kg | -529.2 lb |
| 2 MK 103 with 35 rpg | 460,0 " | 1014.3 " |
| 3. Fw 190 A-8/R3 flying weight | 4674,5 ~ 4675 kg | 10307.3 ~ 10308.4 lb |
| Removal of 2 MK 103s | -460,0 kg | -1014.3 lb |
| ETC 501 carrier (8861) | 60,7 " | 133.8 " |
| SC 500 bomb | 500,0 " | 1102.5 " |
| 4. Fighter-bomber flying weight | 4775,2 ~ 4775 kg | 10529.3 ~ 10528.9 lb |

Installation of the BMW 801 TU engine increases the aircraft weight by about 35 kg (77.2 lb).

Focke-Wulf Aviation Corporation Bremen

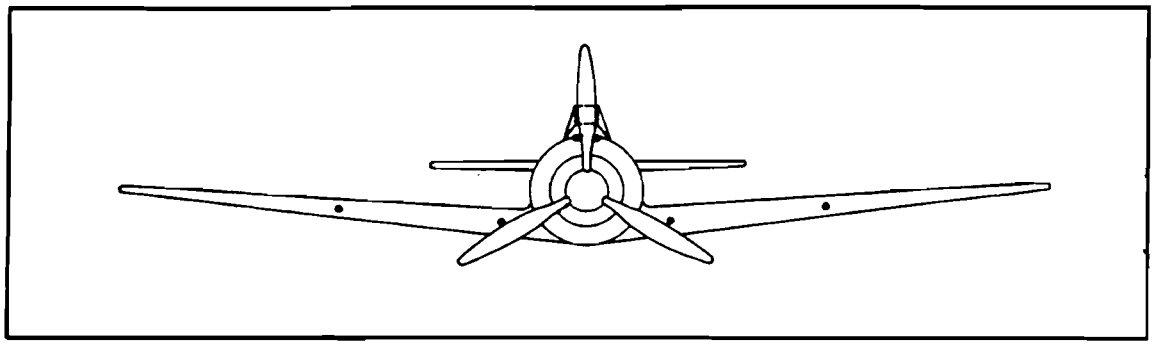
# Range & Endurance Calculations

**Fw 190A-8 Fighter**



TOP SECRET

*Takeoff weight:* 4365 kg (9625 lb)
*Disposable load:* ——
*Fuel load:* 640 Ltr (141 Gal)



***Status:***

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| *Armament* | 2x MG 131 each 475 rds. | 2x MG 151 each 250 rds. | 2x MG 151 each 140 rds. |
| *Carrier* | | | |
| *Disposable load* | | | |
| *Fuel load* | 500 kg (1102 lb) | | |

| Altitude km | Altitude (ft) | Engine speed rpm | Supercharger pressure ata | Supercharger pressure (psi) | Fuel consumption kg/h | Fuel consumption (lb/h)[1] | Average speed km/h | Average speed (mph)[2] | Flight endurance h[3] | Flight distance km | Flight distance (miles)[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0,3 | 984 | 2300 | 1,20 | 17,0 | 360 | 795 | 515 | 320 | 1,20 | 615 | 382 |
| | | 2100 | 1,10 | 15,6 | 225 | 496 | 465 | 289 | 1,91 | 885 | 550 |
| | | 2000 | 1,05 | 14,9 | 205 | 452 | 440 | 273 | 2,10 | 920 | 572 |
| 2,0 | 6562 | 2300 | 1,20 | 17,0 | 370 | 816 | 550 | 342 | 1,28 | 635 | 394 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 505 | 314 | 1,82 | 890 | 554 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 480 | 298 | 2,01 | 945 | 587 |
| 3,0 | 9843 | 2300 | 1,20 | 17,0 | 350 | 772 | 540 | 335 | 1,30 | 665 | 413 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 505 | 314 | I,82 | 885 | 550 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 490 | 304 | 2,01 | 955 | 594 |
| 5,0 | 16405 | 2300 | 1,20 | 17,0 | 360 | 795 | 575 | 357 | 1,32 | 695 | 431 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 535 | 332 | 1,84 | 925 | 575 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 510 | 317 | 2,02 | 985 | 612 |
| 7,0 | 22967 | 2300 | 1,20 | 17,0 | 325 | 716 | 580 | 360 | 1,48 | 775 | 481 |
| | | 2100 | 1,10 | 15,6 | 220 | 485 | 530 | 329 | 1,98 | 990 | 616 |
| | | 2000 | 1,05 | 14,9 | 195 | 430 | 495 | 308 | 2,18 | 1035 | 644 |

***Notes:***

*1) Consumption from BMW specifications + 12.5% reserve*

*2) Average speed = arithmetic average of outbound and inbound legs*

*3) Endurance includes climb and descent times*

*4) Range calculated without deductions for tactical requirements! Includes climb and descent distances*

*Deductions have been made for warmup, taxi, takeoff, climb, descent, overshoot and reserves*

| | | Date 23.12.43 | Compiled by Janacu Voigtländer | |
|---|---|---|---|---|

Focke-Wulf Aviation Corporation Bremen

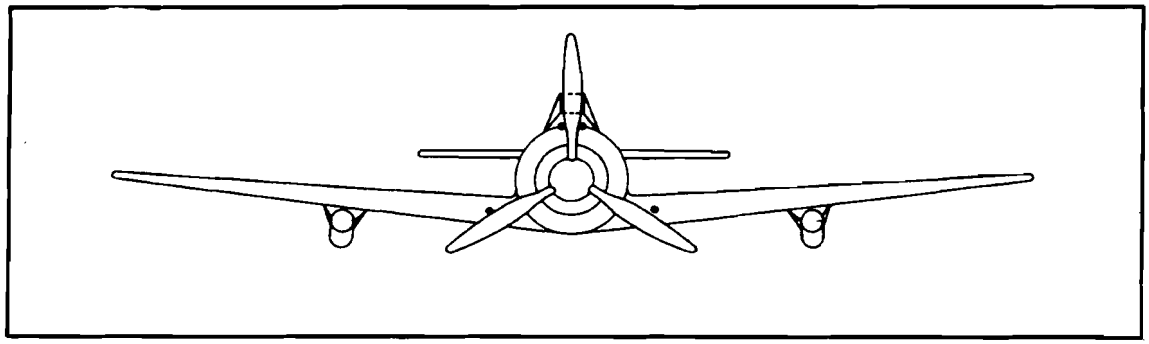
# Range & Endurance Calculations

**Fw 190A-8 Fighter**



TOP SECRET

*Takeoff weight:* 4480 kg (9866 lb)
*Disposable load:* WR 21
*Fuel load:* 640 Ltr (141 Gal)



***Status:***

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| ***Armament*** | 2x MG 131 each 475 rds. | 2x MG 151 each 250 rds. | 2x WR 21 |
| ***Carrier*** | | | |
| ***Disposable load*** | WR 21 | | |
| ***Fuel load*** | 500 kg (1102 lb) | | |

| Altitude km | Altitude (ft) | Engine speed rpm | Supercharger pressure ata | Supercharger pressure (psi) | Fuel consumption kg/h | Fuel consumption (lb/h)[1] | Average speed km/h | Average speed (mph)[2] | Flight endurance h[3] | Flight distance km | Flight distance (miles)[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0,3 | 984 | 2300 | 1,20 | 17,0 | 360 | 795 | 470 | 292 | 1,20 | 565 | 351 |
| | | 2100 | 1,10 | 15,6 | 225 | 496 | 425 | 264 | 1,91 | 810 | 503 |
| | | 2000 | 1,05 | 14,9 | 205 | 452 | 400 | 249 | 2,10 | 845 | 525 |
| 2,0 | 6562 | 2300 | 1,20 | 17,0 | 370 | 816 | 500 | 311 | 1,22 | 585 | 363 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 460 | 286 | 1,81 | 815 | 506 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 440 | 273 | 2,01 | 865 | 538 |
| 3,0 | 9843 | 2300 | 1,20 | 17,0 | 350 | 772 | 495 | 308 | 1,30 | 610 | 379 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 460 | 286 | 1,82 | 805 | 500 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 445 | 276 | 2,01 | 865 | 538 |
| 5,0 | 16405 | 2300 | 1,20 | 17,0 | 360 | 795 | 527 | 328 | 1,31 | 630 | 391 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 490 | 304 | 1,81 | 840 | 522 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 465 | 289 | 1,99 | 885 | 550 |
| 7,0 | 22967 | 2300 | 1,20 | 17,0 | 325 | 716 | 525 | 327 | 1,44 | 685 | 425 |
| | | 2100 | 1,10 | 15,6 | 220 | 485 | 475 | 295 | 1,92 | 860 | 535 |
| | | 2000 | 1,05 | 14,9 | 195 | 430 | 435 | 270 | 2,11 | 885 | 550 |

***Notes:***

*1) Consumption from BMW specifications + 12.5% reserve*

*2) Average speed = arithmetic average of outbound and inbound legs*

*3) Endurance includes climb and descent times*

*4) Range calculated without deductions for tactical requirements! Includes climb and descent distances Deductions have been made for warmup, taxi, takeoff, climb, descent, overshoot and reserves*

| | | Date | Compiled by |
|---|---|---|---|
| | | 23.12.43 | Jansen Voigtländer |

Focke-Wulf Aviation Corporation Bremen

# Range & Endurance Calculations

**Fw 190A-8 Fighter**

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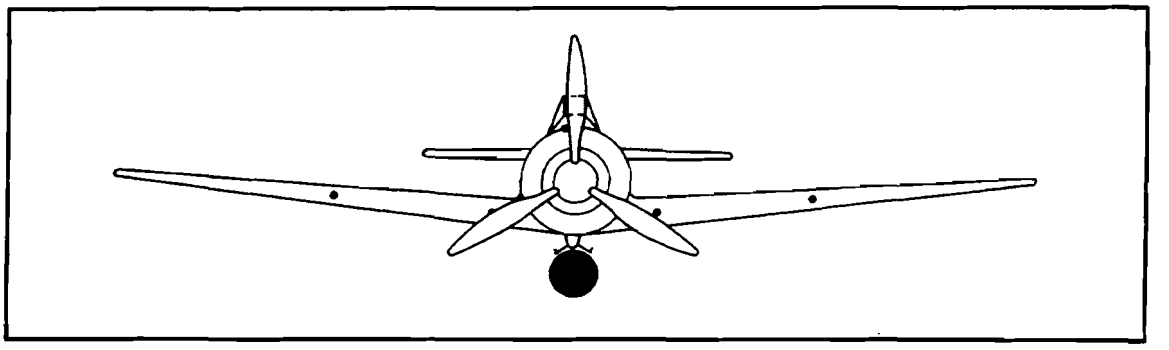
TOP SECRET

Takeoff weight: 4683 kg (10326 lb)
Disposable load: 300 Ltr (66.2 Gal) drop tank
Fuel load: 940 Ltr (207 Gal)



**Status:**

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| Armament | 2x MG 131 each 475 rds. | 2x MG 151 each 250 rds. | 2x MG 151 each 140 rds. |
| Carrier | ETC 501 | | |
| Disposable load | 300 l (66,2 gal) drop tank | | |
| Fuel load | 734 kg (1618 lb) | | |

| Altitude km | Altitude (ft) | Engine speed rpm | Supercharger pressure ata | Supercharger pressure (psi) | Fuel consumption kg/h | Fuel consumption (lb/h)[1] | Average speed km/h | Average speed (mph)[2] | Flight endurance h[3] | Flight distance km | Flight distance (miles)[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0,3 | 984 | 2300 | 1,20 | 17,0 | 360 | 795 | 490 | 304 | 1,85 | 915 | 569 |
| | | 2100 | 1,10 | 15,6 | 225 | 496 | 440 | 273 | 2,95 | 1310 | 816 |
| | | 2000 | 1,05 | 14,9 | 205 | 452 | 415 | 258 | 3,24 | 1370 | 852 |
| 2,0 | 6562 | 2300 | 1,20 | 17,0 | 370 | 816 | 520 | 323 | 1,86 | 950 | 590 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 475 | 295 | 2,79 | 1325 | 825 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 455 | 282 | 3,10 | 1415 | 880 |
| 3,0 | 9843 | 2300 | 1,20 | 17,0 | 350 | 772 | 515 | 320 | 1,98 | 990 | 616 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 480 | 298 | 2,80 | 1325 | 825 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 460 | 286 | 3,10 | 1420 | 884 |
| 5,0 | 16405 | 2300 | 1,20 | 17,0 | 360 | 795 | 545 | 338 | 1,97 | 1025 | 637 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 505 | 314 | 2,79 | 1375 | 856 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 485 | 301 | 3,10 | 1470 | 915 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**Notes:**

1) Consumption from BMW specifications + 12.5% reserve
2) Average speed = arithmetic average of outbound and inbound legs
3) Endurance includes climb and descent times
4) Range calculated without deductions for tactical requirements! Includes climb and descent distances

Deductions have been made for warmup, taxi, takeoff, climb, descent, overshoot and reserves

Date 23.12.43

Compiled by Jansen / Voigtländer

Focke-Wulf Aviation Corporation Bremen

# Range & Endurance Calculations

Fw 190A-8 F-B

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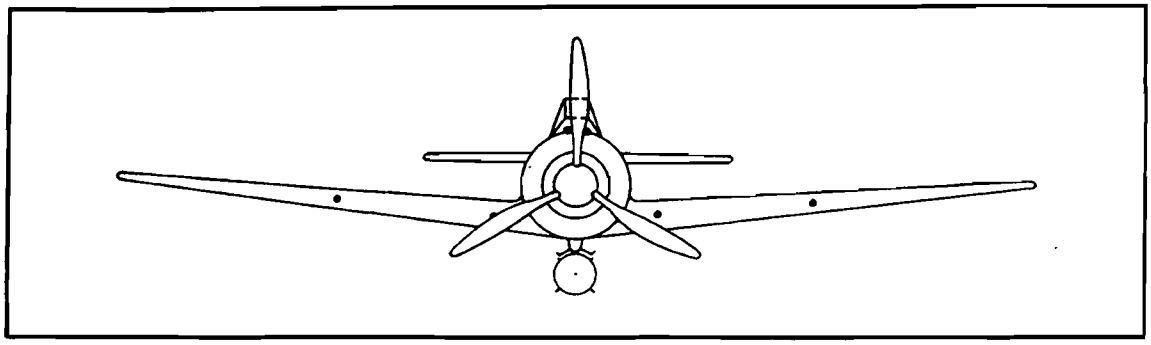
Takeoff weight: 4923 kg (10855 lb)
Disposable load: SC 500
Fuel load: 640 Ltr (141 Gal)

TOP SECRET



**Status:**

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| Armament | 2x MG 131 each 475 rds. | 2x MG 151 each 250 rds. | 2x MG 151 each 140 rds. |
| Carrier | ETC 501 | | |
| Disposable load | SC 500 | | |
| Fuel load | 500 kg (1102 lb) | | |

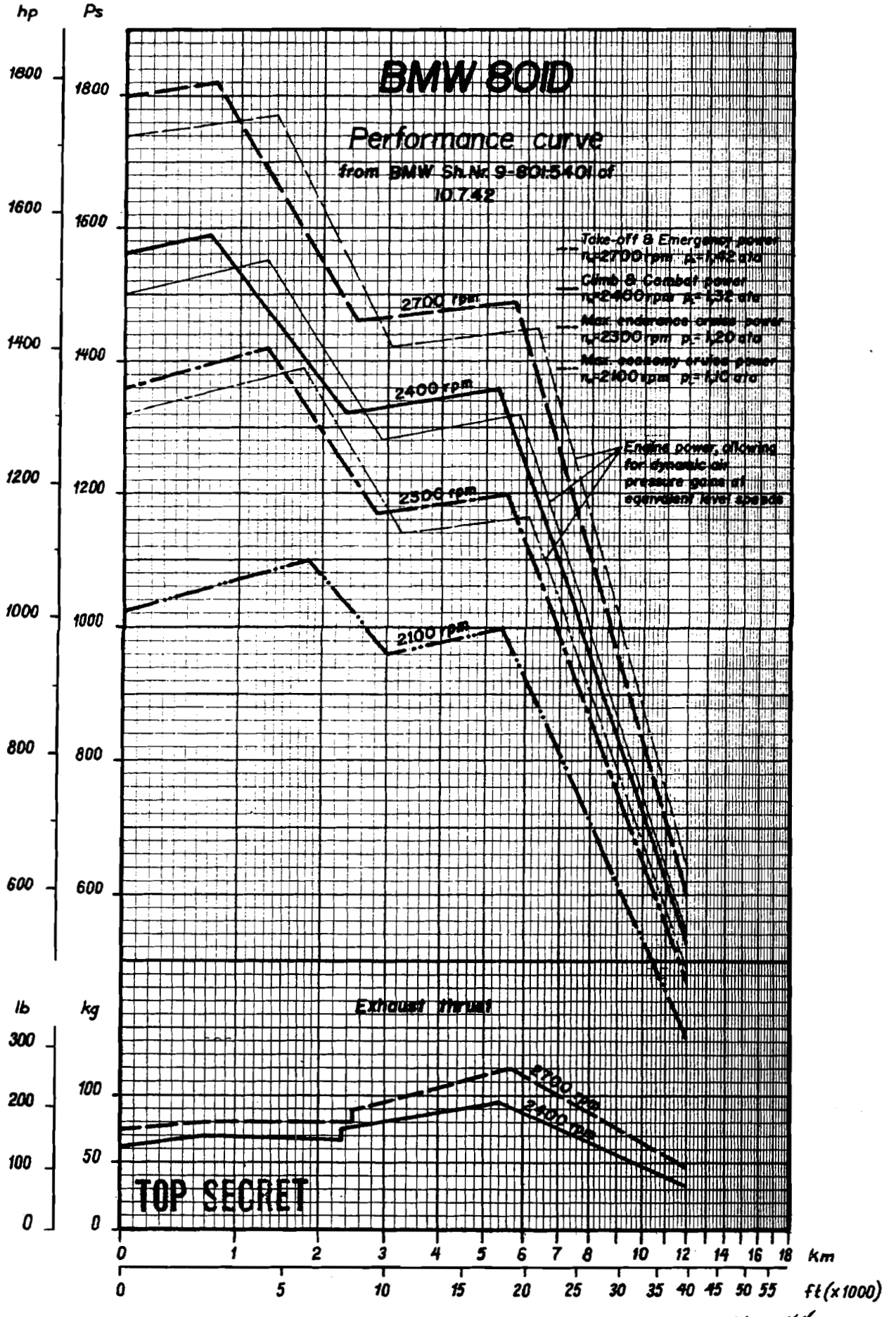
| Altitude km | (ft) | Engine speed rpm | Supercharger pressure ata | (psi) | Fuel consumption kg/h | (lb/h)[1] | Average speed km/h | (mph)[2] | Flight endurance h[3] | Flight distance km | (miles)[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0,3 | 984 | 2300 | 1,20 | 17,0 | 360 | 795 | 485 | 301 | 1,20 | 575 | 357 |
| | | 2100 | 1,10 | 15,6 | 225 | 496 | 430 | 267 | 1,91 | 825 | 513 |
| | | 2000 | 1,05 | 14,9 | 205 | 452 | 410 | 255 | 2,10 | 860 | 535 |
| 2,0 | 6562 | 2300 | 1,20 | 17,0 | 370 | 816 | 515 | 320 | 1,21 | 590 | 366 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 470 | 292 | 1,79 | 815 | 506 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 450 | 280 | 2,00 | 870 | 546 |
| 3,0 | 9843 | 2300 | 1,20 | 17,0 | 350 | 772 | 510 | 317 | 1,28 | 610 | 379 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 470 | 292 | 1,78 | 805 | 500 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 455 | 282 | 1,96 | 860 | 535 |
| 5,0 | 16405 | 2300 | 1,20 | 17,0 | 360 | 795 | 540 | 335 | 1,29 | 630 | 391 |
| | | 2100 | 1,10 | 15,6 | 240 | 529 | 500 | 311 | 1,77 | 830 | 516 |
| | | 2000 | 1,05 | 14,9 | 215 | 474 | 475 | 295 | 1,94 | 875 | 544 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**Notes:**

1) Consumption from BMW specifications + 12.5% reserve
2) Average speed = arithmetic average of outbound and inbound legs
3) Endurance includes climb and descent times
4) Range calculated without deductions for tactical requirements! Includes climb and descent distances

Deductions have been made for warmup, taxi, takeoff, climb, descent, overshoot and reserves

| | | Date 23.12.43 | Compiled by Jaacer Voigtländer | |
|---|---|---|---|---|

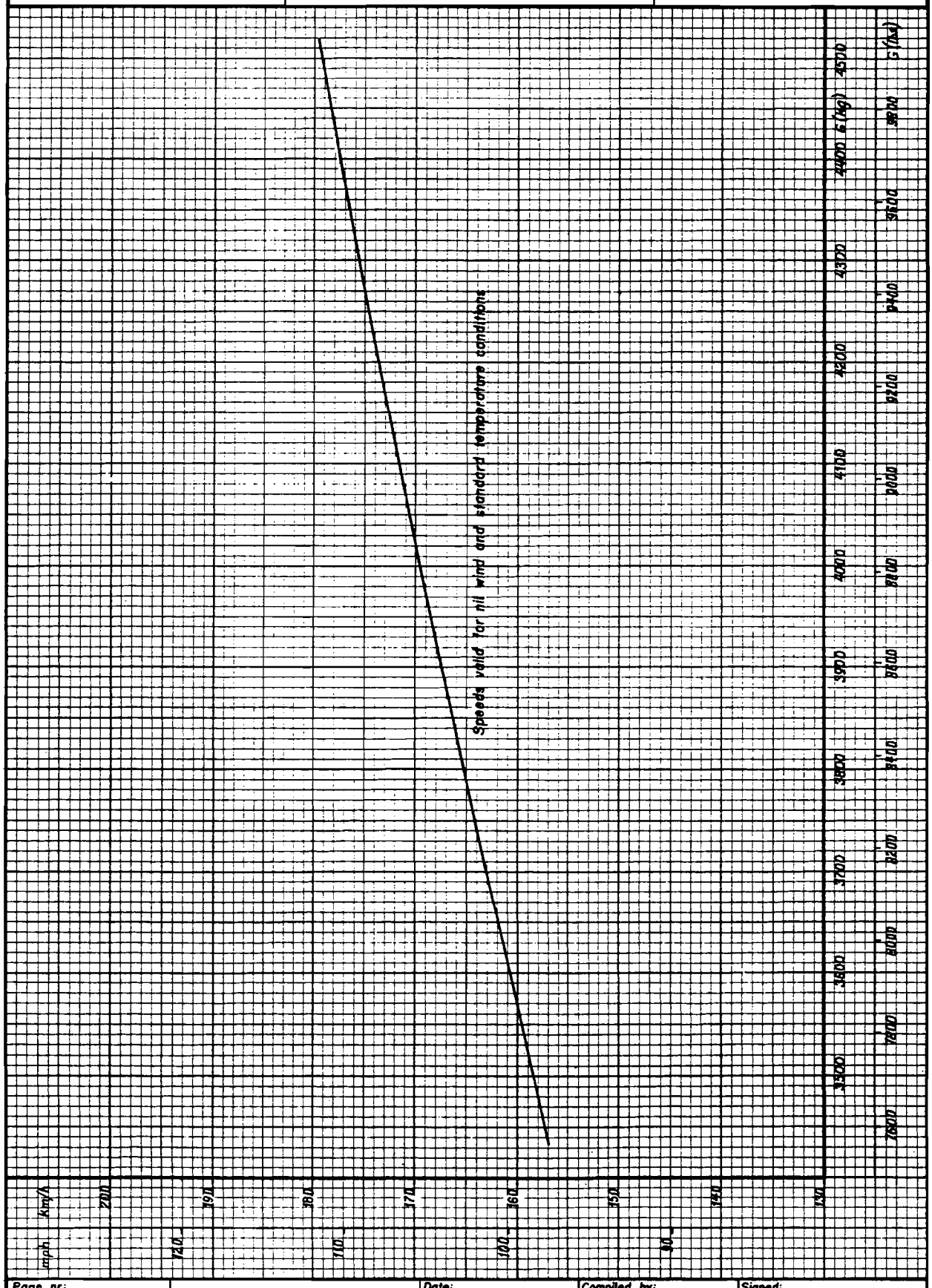

BMW 801D
Performance curve
from BMW Sh.Nr. 9-801.540 I of 10.7.42
Take-off & Emergency power
Climb & Combat power
Max. endurance cruise power
Max. economy cruise power
Engine power, allowing for dynamic air pressure gains at equivalent lever speeds
2700 rpm
2400 rpm
2300 rpm
2100 rpm
Exhaust thrust
2700 rpm
2400 rpm
TOP SECRET
hp
Ps
lb
kg
km
ft (x1000)

11.09.44
Hii.

Focke-Wulf Aviation Corporation
Dept: Aviation Engineering

# Landing speed

## Fw 190A-8 Fighter

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| 15 | | 26.11.43 | Krause Voigtländer | |

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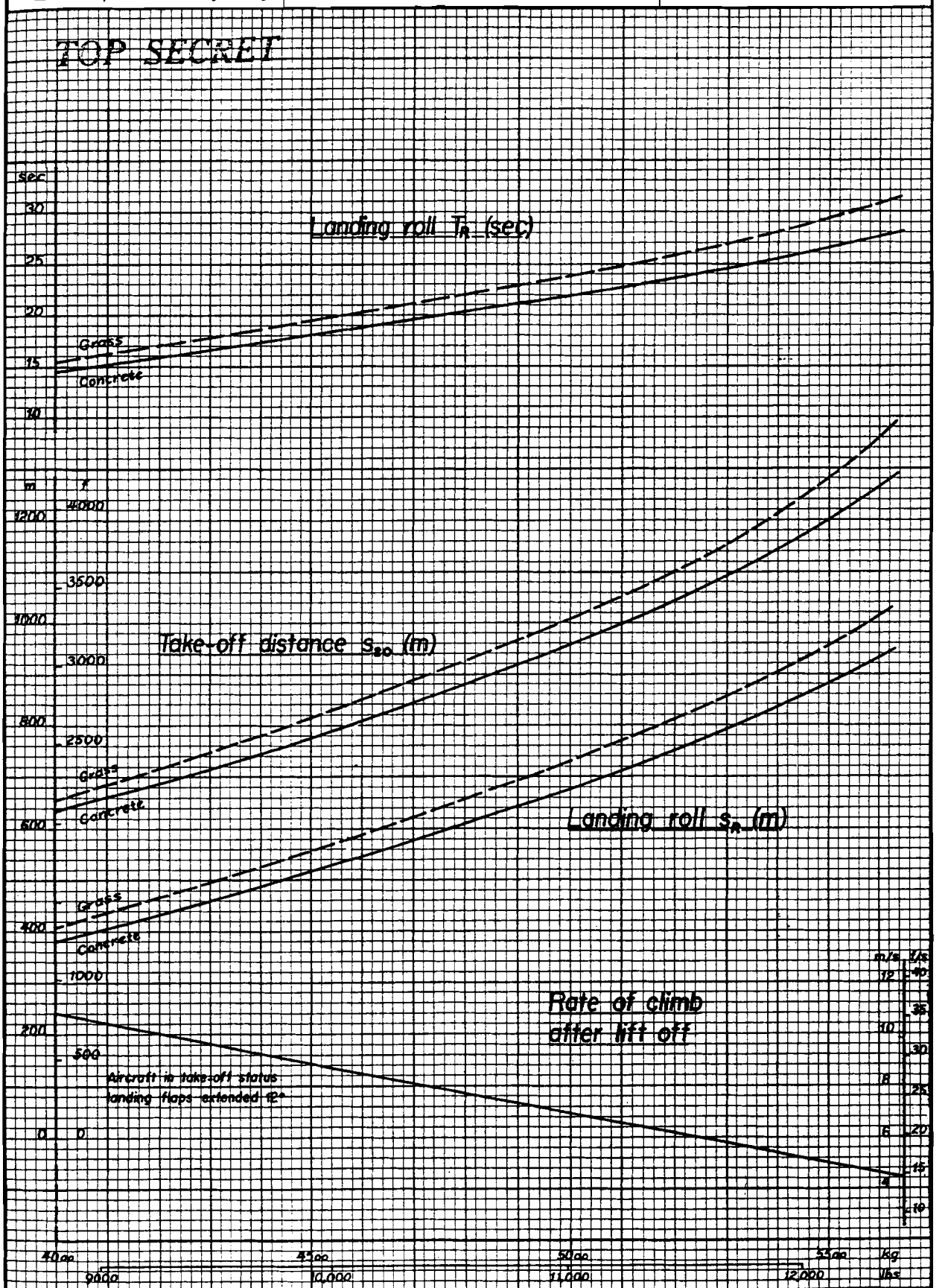
# Take-off performance

With standard temperatures & no wind

## Fw 190A-8 Fighter

TOP SECRET

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| 14 | 190.801-127 | 9.8.44 | Voigt, Lusy | |

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# Flight performance

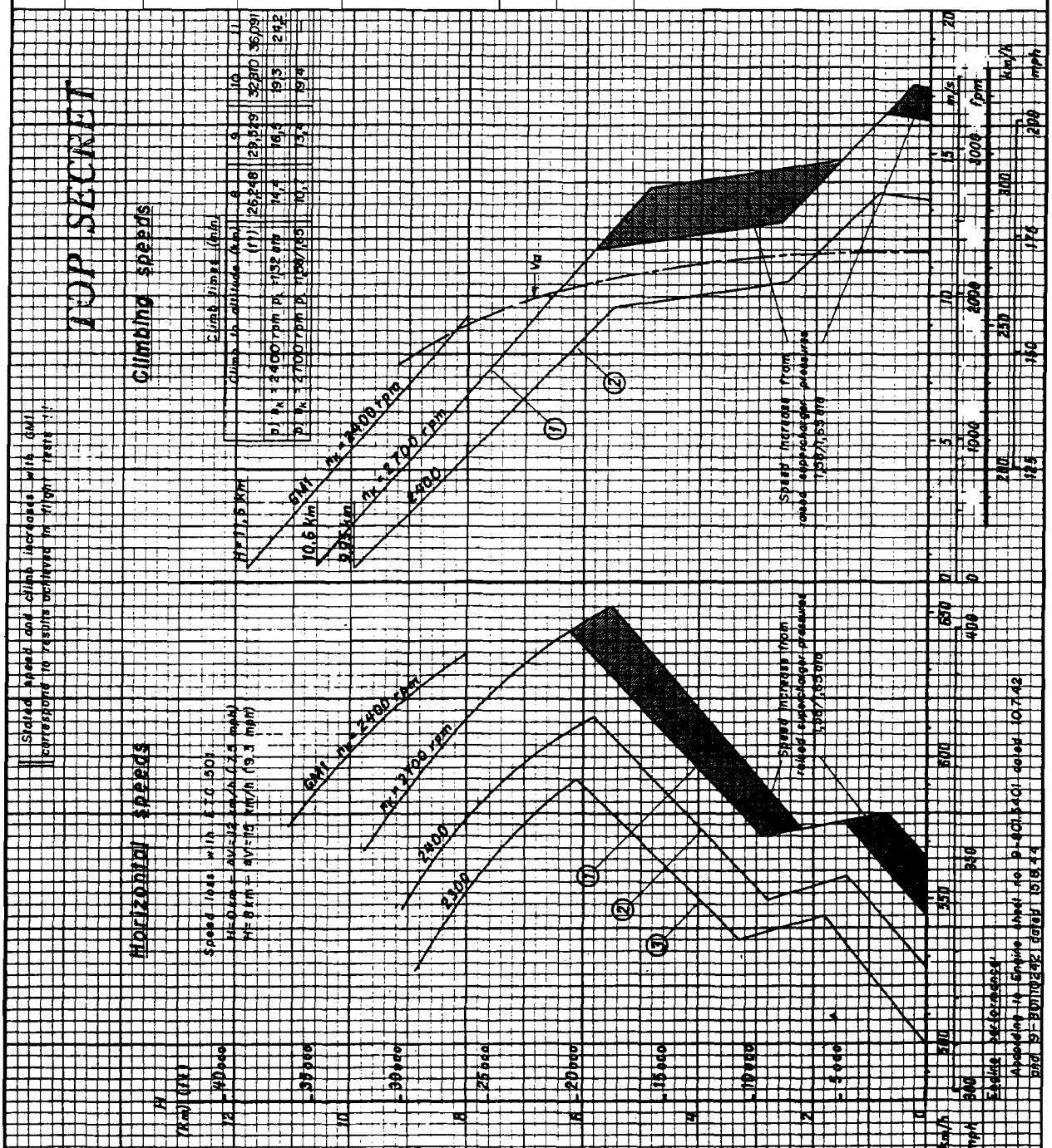
## Fw 190A-8 Fighter

| Curve Nr. | Aircraft type | Flying weight | Engine | Power setting | n (rpm) | P |
|---|---|---|---|---|---|---|
| 1 | Fw 190 | 4300 kg 9481 lb | BMW 801D | Take-off and emergency power | 2700 | 1,42 ata 20.2 psi |
| 2 | | | | Climb and combat power | 2400 | 1,32 ata 18.7 psi |
| 3 | | | | Maximum endurance cruise | 2300 | 1,20 ata 17.0 psi |

**Status**

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| Armament | 2 x MG 131 | 2 x MG 151 | 2 x MG 151 |
| Ammunition | 2 x 475 rds | 2 x 250 rds | 2 x 140 rds |

Fuel: 525 Ltr (115.5 Gal) + GM1 system
Without ETC 501
Undercarriage: Wheel doors fitted
RT: FuG 16ZY
External surfaces: Filled + polished

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| 17 | n.J. 190.801-133 | 25.10.44 | Erich Voigtländer | |

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# Flight performance

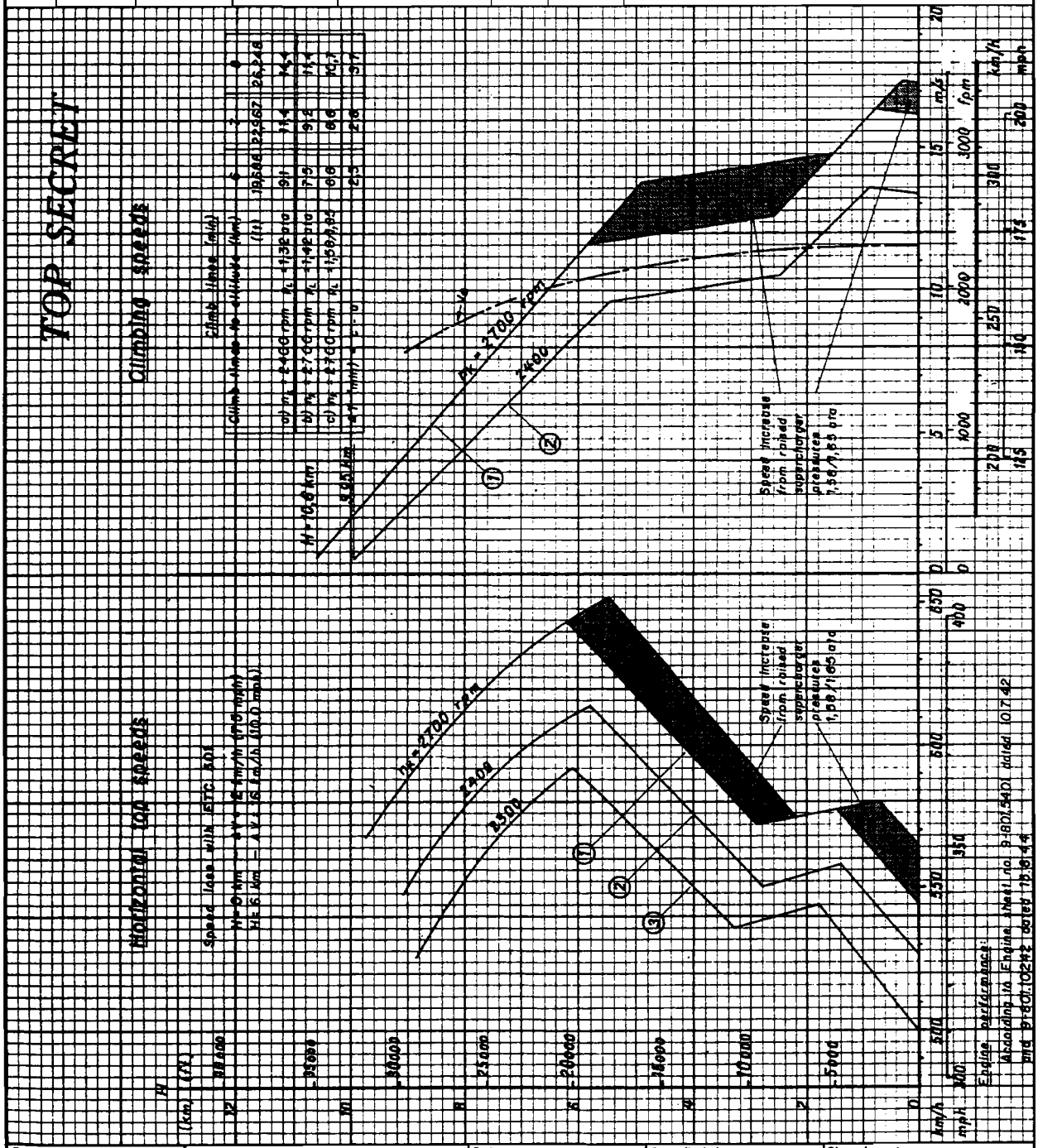
## Fw 190A-8 Fighter

| Curve Nr. | Aircraft type | Flying weight | Engine | Power setting | n (rpm) | $P_L$ |
|---|---|---|---|---|---|---|
| 1 | Fw 190 | 4300 kg 9481 lb | BMW 801D | Take-off and emergency power | 2700 | 1,42 ata 20.2 psi |
| 2 | | | | Climb and combat power | 2400 | 1,32 ata 18.7 psi |
| 3 | | | | Maximum endurance cruise | 2300 | 1,20 ata 17.0 psi |

**Status**

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| Armament | 2 x MG 131 | 2 x MG 151 | 2 x MG 151 |
| Ammunition | 2 x 475 rds | 2 x 250 rds | 2 x 140 rds |

Fuel: 525 Ltr (115.5 Gal) + 115 Ltr (25.3 Gal) in rear fuselage
Without ETC 501
Undercarriage: Wheel doors fitted
RT: FuG 16ZY
External surfaces: Filled + polished

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| 16 | n.d. 190.801-132 | 25. 10. 44 | Eick. | |

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# Flight performance

## Fw 190A-8/R2

| Curve Nr. | Aircraft type | Flying weight | Engine | Power setting | n (rpm) | $P_L$ |
|---|---|---|---|---|---|---|
| 1 | Fw 190 | 4300 kg 9481 lb | BMW 801D | Take-off and emergency power | 2700 | 1,42 ata 20.2 psi |
| 2 | | | | Climb and combat power | 2400 | 1,32 ata 18.7 psi |
| 3 | | | | Maximum endurance cruise | 2300 | 1,20 ata 17.0 psi |

**Status**

| | Fuselage | Wing-roots | Outer wings |
|---|---|---|---|
| Armament | 2 x MG 131 | 2 x MG 151 | 2 x MK 108 |
| Ammunition | 2 x 475 rds | 2 x 250 rds | 2 x 55 rds |

*Fuel: 525 Ltr (115.5 Gal) + 115 Ltr (25.3 Gal) in rear fuselage*
*Without ETC 501*
*Undercarriage: Wheel doors fitted*
*RT: FuG 16ZY*
*External surfaces: Filled + polished*

TOP SECRET

Climbing speeds

Horizontal speeds

Speed loss with ETC 501

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n. J. 190.801-136

Date: 28.10.44

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