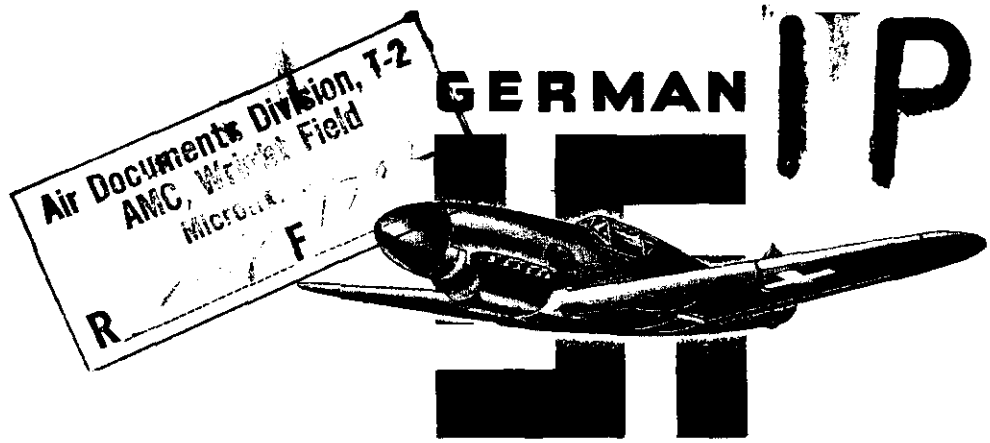
RESTRICTED

AIRCRAFT EVALUATION REPORT

U. S. ARMY AIR FORCES, WASHINGTON, D. C.



MESSERSCHMITT-109F

PREPARED BY MATERIEL COMMAND, ENGINEERING DIVISION
WRIGHT FIELD, DAYTON, OHIO

APPROVED BY THE OFFICE OF THE ASSISTANT CHIEF OF THE AIR STAFF, INTELLIGENCE, WASHINGTON, D. C.

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RESTRICTED

SYNOPTIC ESTIMATE

COUNTRY	-	GERMANY
MANUFACTURER AND MODEL	-	MESSERSCHMITT "ME-109F"
TYPE	-	SINGLE SEAT FIGHTER

GENERAL DESCRIPTION.

The "ME-109F" is comparable to our Bell "P-39D" or Curtiss "P-40E" but is smaller and lighter than either. General characteristics include low wings, single engine in the nose and retractable landing gear. Armed with two small caliber machine guns and one cannon, the "ME-109F" is a formidable weapon.

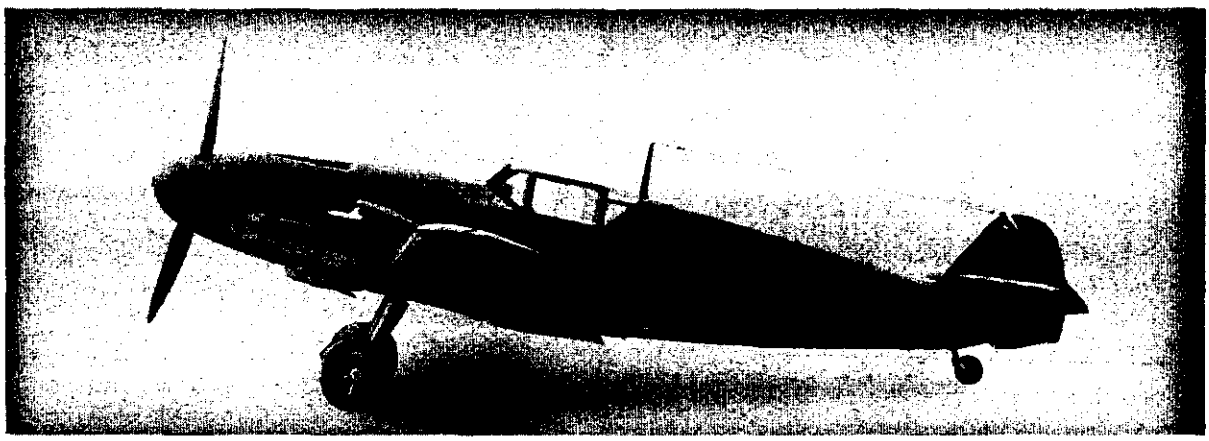
Three sub-types of this airplane are known to be in operation. Sub-types "ME-109F-1" and "ME-109F-2" both have Daimler-Benz "DB-601N" engines but the armament of the "109F-1" consists of 2 x 7.9 mm machine guns and 1 x 20 mm cannon, whereas, the "109F-2" carries 2 x 7.9 mm and 1 x 15 mm guns. Sub-type "ME-109F-4" is powered with the Daimler-Benz "DB-601E" and is armed with 2 x 7.9 mm plus 1 x 20 mm guns.

PERFORMANCE

	ME-109F-1 & F-2	ME-109F-4
Maximum Speed:-	371 mph/22000 ft	390 mph/20000 ft
Rate of Climb:-	3300 ft/ min	3400 ft/min
Service Ceiling:-	37500 ft	39000 ft

COMPARATIVE CHARACTERISTICS

Type	Maximum Speed	Time of Climb to 15,000 ft	Service Ceiling
ME-109F-1 & F-2	371 mph at 22,000 ft	5.0 min	37,500 ft
ME-109F-4	390 mph at 20,000 ft	4.8 min	39,000 ft
P-39D	368 mph at 13,800 ft	6.0 min	32,100 ft
P-40E	361 mph at 15,000 ft	7.2 min	30,000 ft



IDENTIFICATION

DETAILED DESCRIPTION

CONSTRUCTION.

The fuselage shell is made in two halves aft of the cockpit joined at top and bottom with two longitudinal rows of rivets. Each half shell is composed of cylindrical sections of aluminum skin with integrally formed Z-section rings. These sections are lap-jointed and riveted along planes perpendicular to the thrust line.

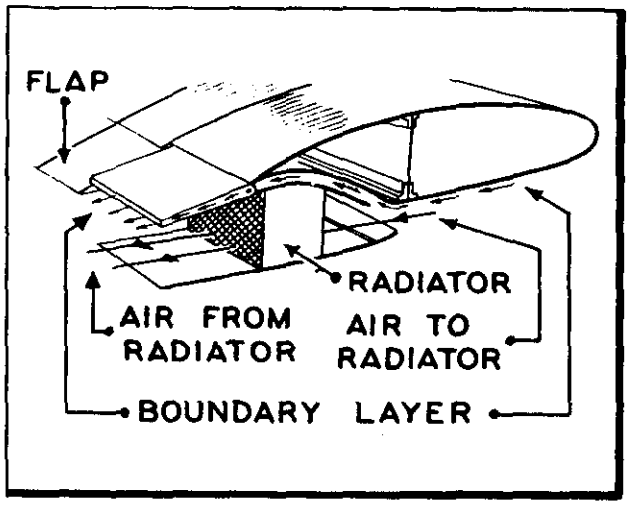
The wing is of single-beam construction using stamped aluminum alloy ribs. An auxiliary trailing edge spar supports the metal flap and fabric covered aileron. The attachment to the fuselage is by three bolts.

Fixed tail surfaces are conventional fully cantilever construction. The elevator and rudder are fabric covered.

FUSELAGE.

The Messerschmitt fuselage is remarkably clean and bulletlike. The engine is compactly mounted in the nose and is inclosed in easily removable cowling. Protuberances that mar the clean lines are cut to a minimum by partially submerging the coolant radiators in the wing.

The pilot's cockpit is placed over the wing approximately three-fourths of the chord back from the wing's leading edge. The cockpit inclosure is composed of flat Pyrolin-type panels and is hinged along the starboard side for entry and exit. Although well arranged, the cockpit is small and would reduce the pilot's efficiency. Improved cockpit features of this version of the "ME-109" are distant reading compass and an electrical turn-and-bank indicator.



WING.

One of the best means of identification of the original "ME-109" planes, the square wing tips, has been changed in the later "ME-109F" series. The tips are now well rounded, the wing leading edge is slightly swept back and the trailing edge rather sharply swept forward. Automatic slots, operating independently, are fitted on the leading edge of each wing panel. The ailerons are externally mass balanced and are fitted with metal tabs, adjustable on the ground.

Each flap is divided into two sections: the outer section is a modified split arrangement serving the additional purpose of controlling the airflow through the internally mounted wing radiators. At the front edge of the radiator is a hinged plate linked with the trailing edge flaps to open with them. This plate picks up the boundary layer on the underside of the wing, bypasses it around the radiator, and discharges it at the trailing edge. This form of boundary layer control causes smoother flow through the radiator, thereby reducing the area required for proper cooling.

TAIL SURFACES.

Neither the fin nor horizontal stabilizer is externally braced. The vertical surfaces appear very small; the leading edge is straight, the trailing edge almost circular. The horizontal surfaces have straight, equally tapered edges and slightly rounded tips. Metal tabs, adjustable on the ground, are fixed to both elevators.

LANDING GEAR.

The main landing gear struts of the "ME-109F" are simple cantilever members pivoted at the fuselage in such a manner that they may swing out and slightly back into the wings when retracted. This system permits the changing of wing panels without removal of the landing gear. The narrow tread landing gear would tend to make recovery from a ground loop more difficult than would be anticipated with a wider tread gear. When extended, the wheels are sufficiently far ahead of the center-of-gravity to permit severe braking without nosing over. The tail wheel is almost completely retractable, only a portion of the wheel being visible below the fuselage.

FUEL TANKS.

One L-shaped self-sealing fuel tank is installed immediately behind and under the pilot's seat. The weight of tank and fuel is taken by a specially strengthened panel of the fuselage and the walls are kept from bulging by plywood panels. Provisions are made for an externally mounted jettisonable tank.

PROPELLER.

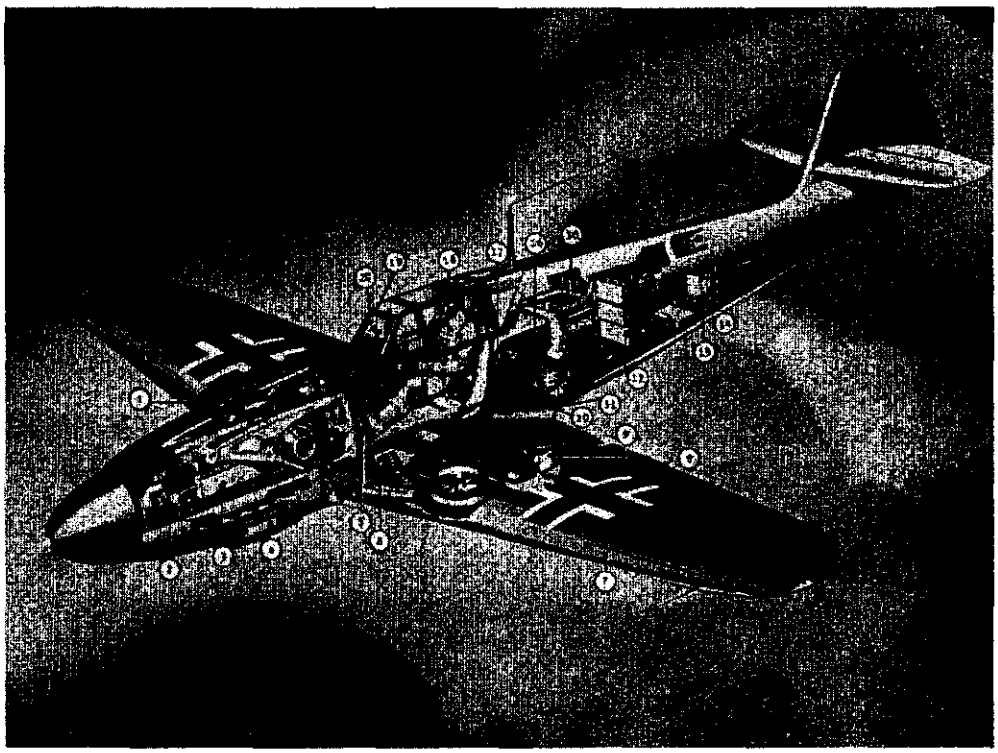
The three-bladed propeller is infinitely variable in pitch and has a governor that limits the rpm in proportion to the throttle setting. The automatic governing mechanism can be disconnected and manual operation used for feathering, etc.

PRODUCTION.

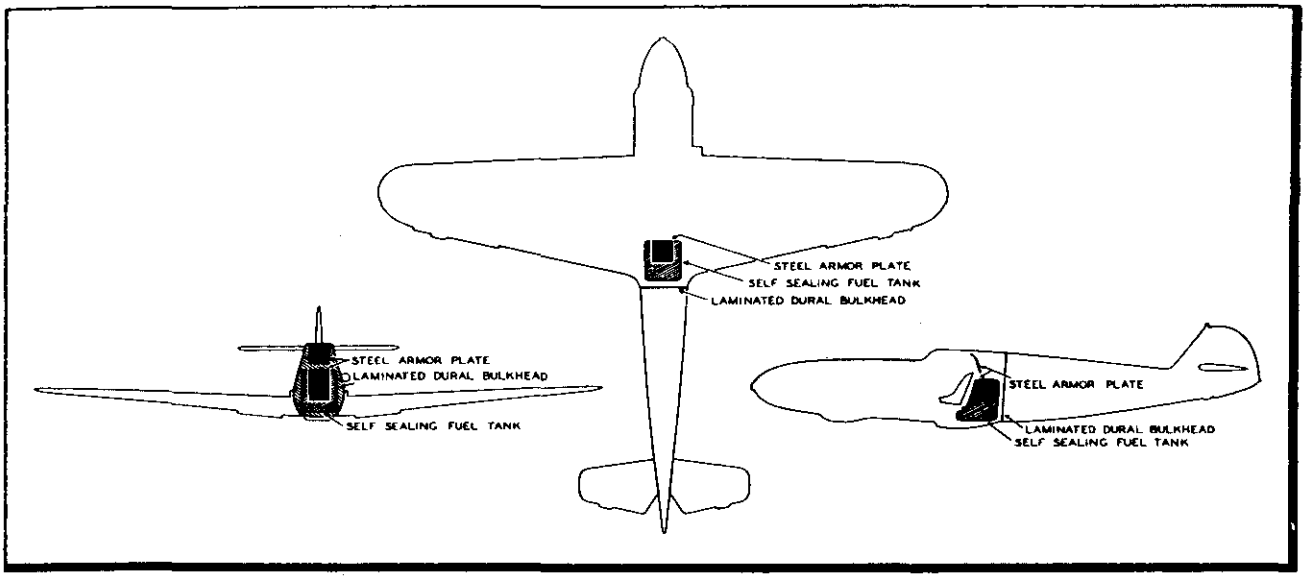
This airplane is in mass production in Germany. It is replacing all the older versions of the "ME-109" and is seeing service on all fronts.

WEIGHTS AND DIMENSIONS.

Empty Weight:-	F-1 & F-2	4702 lb
	F-4	4812 lb
Normal Weight:-	F-1 & F-2	6090 lb
	F-4	6200 lb
Normal Fuel:-		102 U.S. gal
Maximum Fuel:-		182 U.S. gal
Oil Capacity:-		10 gal
Span: -		32 ft 9 in.
Length: -		29 ft 10 in.
Height: -		8 ft 5 in.
Wing Area: -		173 sq ft (gross)
Wing Loading: -		F-1 35.2 lb/sq ft
		F-2 35.2 lb/sq ft
		F-4 35.8 lb/sq ft



1. 2 SYNCHRONIZED M.G.17 GUNS 7-9 MM FIRING THROUGH PROPELLER 500 ROUNDS PER GUN
2. OIL TANK
3. COOLANT TANK
4. OIL COOLER
5. M.G. 151 .20 MM FIRING BETWEEN CYLINDER BANKS AND THROUGH PROPELLER HUB
6. BELT FEED FOR M.G.151 200 ROUNDS
7. AUTOMATIC SLOT
8. WING FLAP
9. COOLANT RADIATOR
10. MASTER COMPASS
11. LAMINATED DURAL PLATE
12. RADIO EQUIPMENT
13. COMPRESSED AIR BOTTLES
14. BATTERY
15. OXYGEN BOTTLES
16. FUEL TANK EXTENDS UNDER PILOTS SEAT
17. 8 MM ARMOR PLATE BEHIND PILOTS SEAT
18. PILOTS HEAD ARMOR 10 MM
19. REFLECTOR SIGHT
20. BULLET RESISTING GLASS



OFFENSIVE AND DEFENSIVE EQUIPMENT

ARMOR AND FUEL TANKS.

The armor and flexible fuel tank are installed as shown in the sketches above. Protection for the pilot's body is provided by plates immediately behind the seat: the upper 1-1/2 feet are 8 mm thick and the remainder is 4 mm. The pilot's head and shoulders are protected by a curved piece of armor 10 mm thick attached to the cockpit inclosure. A section of bullet-resistant glass 2-1/4 inches thick is mounted on the windshield directly in front of the pilot.

Additional armor has been found on "109-F" airplanes recently inspected. This is in the form of a laminated dural bulkhead placed approximately 6 inches behind the fuel tank. Total thickness of the thirty laminations used is about 7/8 inches.

The British have carried out tests on one of these bulkheads with the following results: from 100 yards range dead astern, .303 inch and .5 inch incendiary ammunition will not penetrate the dural bulkhead. At this range 20 mm HE/I (high explosive/incendiary) is still effective for penetrating the bulkhead and igniting the tank. At 200 yards range, the effect of the interposition of the dural bulkhead is that at 5 degrees off dead astern .303 A.P. (armor piercing) is completely ineffective against the pilot, but .5 A.P. in about 30 percent of cases will pass through the bulkhead and will penetrate the 8 mm pilot's armor, even if it has to pass through the tank below fuel level. Twenty mm A.P. will still be effective in penetrating the pilot's armor.

Subsequent tests reveal that U.S. .50 caliber M1 incendiary ammunition is capable of penetrating the dural plate effectively.

ARMAMENT.

The "ME-109F" is armed with a light yet effective complement of guns composed of two machine guns mounted in the nose of the fuselage to fire through the propeller (synchronized) and one cannon firing from the hollow propeller shaft. The machine guns are provided with 500 rounds of ammunition per gun and the cannon with about 200 rounds.

The rate of fire of the Mauser gun is different for the two versions: the 15 mm fires approximately 740 rounds per minute with armor-piercing ammunition and 680 rounds per minute with high explosive ammunition; and the 20 mm fires approximately 800 rounds per minute. The synchronized guns are 7.9 mm (approximately .30 caliber). German prisoners claim that centralization of guns in the nose permits better aim in turns and at long range.

COMBAT TACTICS

FUNCTIONS OF THE "ME-109F"

The "109F" is being used by the German Air Force in all theaters of operation as a standard pursuit ship; however, they have been concentrated particularly in North Africa while the FW-190 has to some extent replaced the Messerschmitt in the European Theater. A bomber version (external rack) is sometimes employed and is usually escorted by fighters to insure the accomplishment of the mission without having to jettison the bombs to fight.

COMBAT TACTICS

Reports of observers at the battlefronts indicate that the Messerschmitt should be highly regarded in respect to rate of climb and altitude performance. Maneuverability of the "F" series, although greatly improved over the older series, is still not quite as good as the Spitfire at higher altitudes or the "P-40" at lower altitudes.

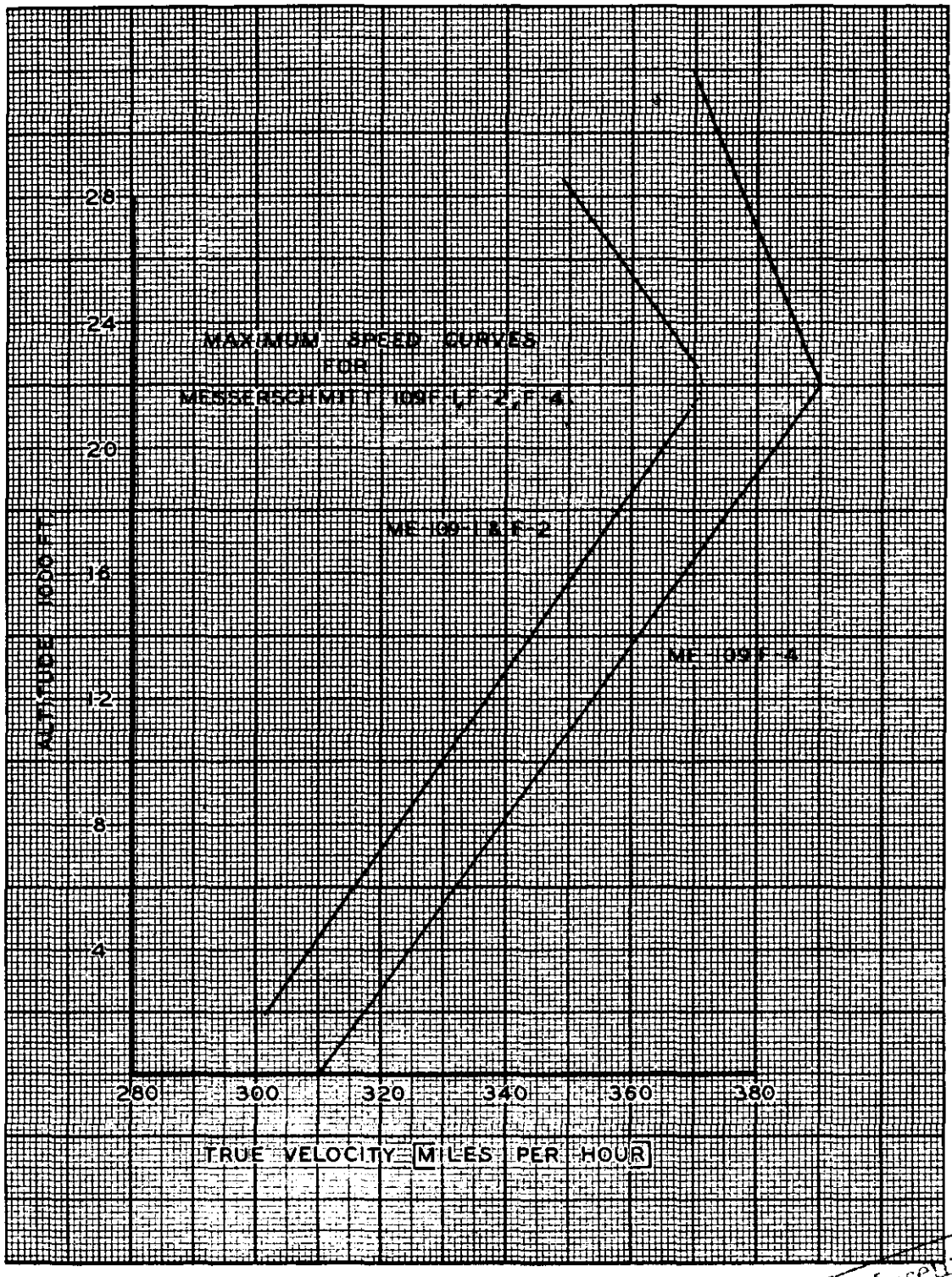
The following excerpt may give some idea of what may be expected in action. It is taken from combat reports of British pilots flying Kittyhawks (P-40E) in Africa. "The Messerschmitts attack from high altitude making use of all available sun and cloud cover and then zoom away. They have proven most vulnerable at the top of their zoom when they are almost stalled."

ENGINE CHARACTERISTICS

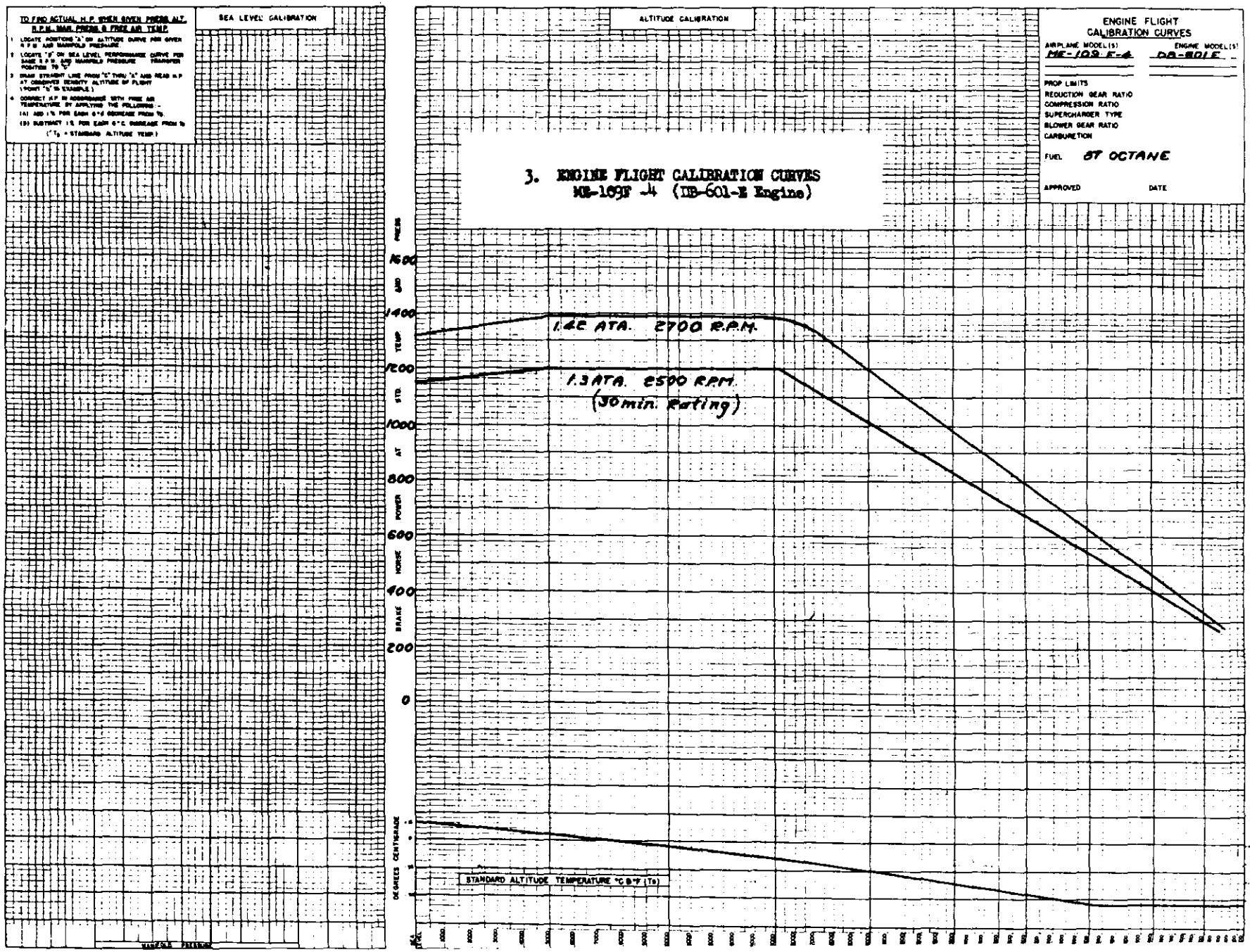
DAIMLER-BENZ DB-601N & DB-601E

	DB-601N	DB-601E
1. Production Began	1941	1942
2. Status	Standard	Standard
3. Cooling Medium	Water-Glycol	Water-Glycol
4. Propeller Gear Ratio		
5. Supercharger	Two Speed, Gear Driven (Fluid Coupling)	Two Speed, Gear Driven (Fluid Coupling)
6. (a) Bore	5.9 in.	5.9 in.
(b) Stroke	6.3 in.	6.3 in.
(c) Piston Displacement	2065 cu in.	2065 cu in.
(d) Compression Ratio	8.2	6.9
7. (a) Length*	67.7 in.	67.7 in.
(b) Width*	28 in.	28 in.
(c) Height*	39.3 in.	39.3 in.
8. Cylinders	12, Inverted V	12, Inverted V
9. Starter	Hand Inertia	Hand Inertia
10. Military Rating (3 Min)	1270 hp at 16,250 ft at 2600 rpm	1400 hp at 16,000 ft at 2700 rpm
11. Normal Continuous Cruising	2300 rpm	2300 rpm
12. Normal Sea Level Power	1085 hp	
13. Take-off Rating (1 Min)	1200 hp at 2600 rpm	1325 hp at 2700 rpm
14. Engine Weight	1540 lb (with acces.) 1400 lb (dry)	
15. Injector	1 injector/cylinder	1 injector/cylinder
16. Airplanes in Which Used	Macchi-202, Regianne -1001, ME-110, ME-109,F-1 & F-2. HE-113(?), FW 187	ME-109F-4 Early models of the ME 109G, and future ME 210's.

*Dimensions assumed to be the same as DB-601A.



Estimated Performance


TO FIND ACTUAL H.P. WHEN GIVEN PRESS. ALT. R.P.M. MAN. PRESS. & FREE AIR TEMP.
1. LOCATE POSITION "A" ON ALTITUDE CURVE FOR GIVEN R.P.M. AND MANIFOLD PRESSURE
2. LOCATE "B" ON SEA LEVEL PERFORMANCE CURVE FOR SAME R.P.M. AND MANIFOLD PRESSURE TRANSFER POSITION TO "C"
3. DRAW STRAIGHT LINE FROM "C" THRU "A" AND READ H.P. AT OBSERVED DENSITY ALTITUDE OF FLIGHT (POINT "E" IN EXAMPLE)
4. CORRECT H.P. IN ACCORDANCE WITH FREE AIR TEMPERATURE BY APPLYING THE FOLLOWING:-
(A) ADD 1% FOR EACH 6°C DECREASE FROM To
(B) SUBTRACT 1% FOR EACH 6°C INCREASE FROM To
(°To = STANDARD ALTITUDE TEMP.)
SEA LEVEL CALIBRATION
ALTITUDE CALIBRATION
ENGINE FLIGHT CALIBRATION CURVES
AIRPLANE MODEL(S) ME-109 F-4
ENGINE MODEL(S) DB-601E
PROP LIMITS
REDUCTION GEAR RATIO
COMPRESSION RATIO
SUPERCHARGER TYPE
BLOWER GEAR RATIO
CARBURETION
FUEL 87 OCTANE
APPROVED
DATE
3. ENGINE FLIGHT CALIBRATION CURVES
ME-109F -4 (DB-601-E Engine)
1.42 ATA. 2700 R.P.M.
1.3 ATA. 2500 R.P.M.
(30 min. Rating)
STANDARD ALTITUDE TEMPERATURE °C.B°F (To)
DEGREES CENTIGRADE
BRAKE HORSE POWER AT STD. ALT. TEMP
MANIFOLD PRESSURE