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SPITFIRE II/V **VS** Bf 109F

Channel Front 1940–42



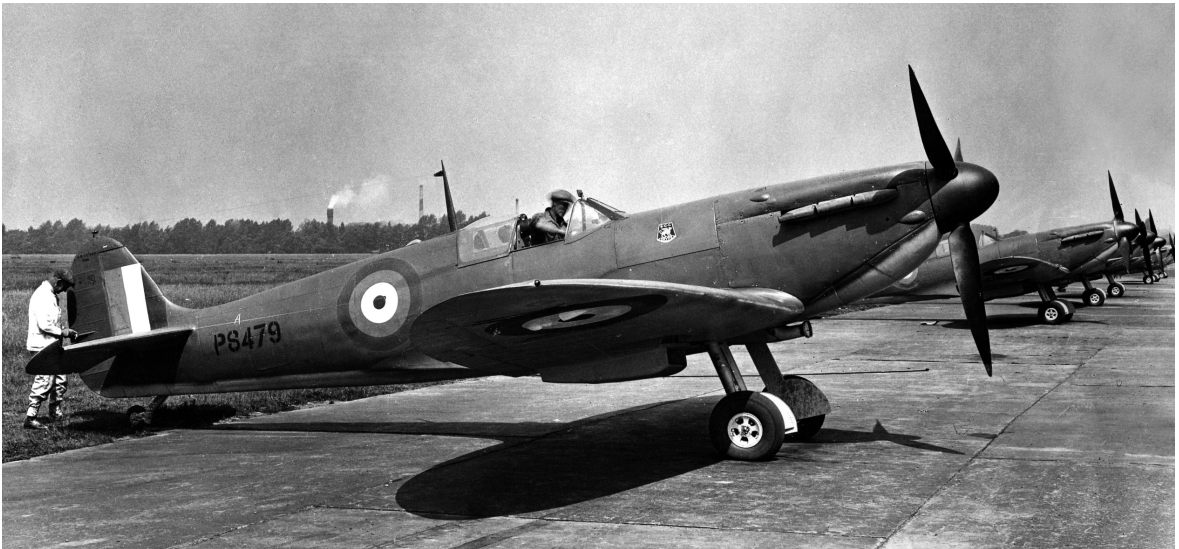
TONY HOLMES

DESIGN AND DEVELOPMENT

SPITFIRE II AND V

Vickers Supermarine commenced Spitfire construction at its Eastleigh plant in April 1938, although only 306 examples had reached the RAF by the time Britain declared war on Germany on 3 September 1939. As early as May of the previous year it was obvious to the RAF that even with the system of sub-contracting organised by Vickers Supermarine, it was not going to receive anywhere near the number of Spitfire Is required to equip a rapidly expanding Fighter Command. A production line similar to that used by the automotive industry was urgently required and the man chosen by the Air Ministry to achieve this was Lord Nuffield, better known as William Morris. Having created the first plant to mass-produce cars for the British market, he was perfectly qualified to establish a new 'Shadow Factory' to build Spitfires.

Although the Air Ministry insisted that the factory be built in Liverpool to help ease unemployment in the area, Lord Nuffield urged that a site at Castle Bromwich be chosen due to the availability of a skilled workforce in Birmingham. Work duly began on the factory in the West Midlands in July 1938 and when finished it had cost more than £4 million to build. Nuffield estimated that the plant would assemble 60 aircraft a week once it was in full production, the Air Ministry having placed an order for 1,000 Spitfire Is in April 1939. After a series of delays, the first example was



delivered on 27 June 1940. The machines emerging from the 'Shadow Factory' were designated Spitfire IIs to differentiate them from the near-identical Vickers Supermarine-built Mk Is when it came to ordering spare parts.

The West Bromwich-built fighters were powered by Merlin XII engines running on 100 octane fuel. They also featured a Coffman cartridge starter system instead of the original electric start of the Mk I's Merlin II, with a small fairing on the left side of the engine cowl housing the new unit.

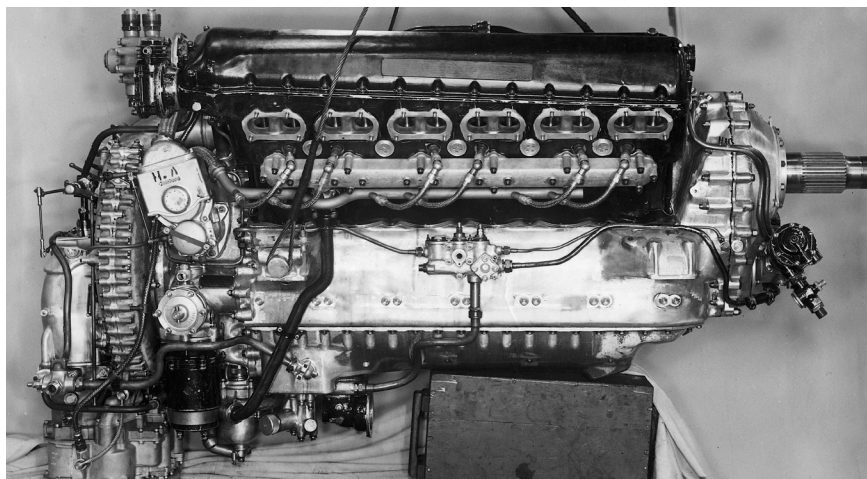
With the Battle of Britain raging, the first Spitfire IIs to be issued to a frontline unit reached No. 611 Sqn at Digby in late August 1940. Nos. 19, 74 and 266 Sqn received the new variant the following month, while further units replaced their Mk Is during the late autumn and early winter. Squadrons assigned to No. 11 Group, defending southeast England, were given priority as the fighting was heaviest there. The Castle Bromwich factory was the sole producer of the Spitfire II and 921 had been built by the time the last example rolled off the line in July 1941.

By then the Mk II had been well and truly supplanted in the frontline by what would prove to be the most numerous Spitfire variant, the Mk V. Vickers Supermarine had originally intended to replace the Mk I/IIs with the Spitfire III which featured a re-engineered and strengthened airframe incorporating several key design improvements. Converting production lines in Southampton and West Bromwich to build the new variant would involve considerable re-tooling, however, and this would take time.

During the winter of 1940–41 the RAF was concerned that it would be forced to fight the Battle of Britain all over again the following summer, possibly against new fighter and bomber types with improved high-altitude performance that were reportedly under development in Germany. The RAF believed that the Luftwaffe's switch to high-altitude operations by small numbers of fighters (including the first examples of the Bf 109F) and bombers in November 1940 was the precursor of a renewed offensive in the spring of 1941. The Hurricane could not intercept the Bf 109F above 20,000ft, let alone fight it, while the Spitfire I/IIs lost much of their advantage over the earlier Bf 109E in terms of manoeuvrability and speed when forced

The finishing touches are applied to Spitfire IIA P8479 as it waits on the ramp at Castle Bromwich for collection by the RAF in early July 1941. Built towards the end of the Mk II production run, this aircraft was paid for by a £5,000 donation from the directors, staff and workers of British Glues and Chemicals Ltd of Welwyn Garden, Hertfordshire. It displays the company emblem just forward of the cockpit. Allotted to No. 74 Sqn in August 1941, the fighter saw little combat. After a lengthy spell with No. 61 OTU, the Spitfire was converted into an ASR(II) air-sea rescue platform and supplied to No. 277 Sqn at Gravesend in January 1943. P8479 returned to No. 61 OTU in late May 1944 and was eventually damaged beyond economical repair in August of that year. (Philip Jarrett)

A great deal of the Rolls-Royce Merlin's success during World War 2 came from the exceptional design of its supercharger, seen at the left-hand end of the engine in this photograph. While the German DB 601 engine had a capacity of 33.93 litres, the Merlin's was a mere 26 litres, and would remain this size for the entire war. The ability of Rolls-Royce to progressively improve the power of the Merlin through supercharger design and higher-octane fuel took the engine's rating from 1,000hp at the start of the war to 2,300hp in 1945. The Merlin 45, seen here, is equipped with a single-stage, single-speed supercharger. The Spitfire V and Seafire IB, IIC and III would be powered by the Merlin 45, 45M, 46, 50, 50A, 50M, 55 and 55M series of engines. (Donald Nijboer)



OPPOSITE

Spitfire VB W3312/QJ-J *Moonraker* was delivered new to No. 92 Sqn on 20 June 1941 and it was immediately 'acquired' by the unit's boss, Sqn Ldr 'Jamie' Rankin. He duly claimed 11 and one shared victories, one probable and four damaged (all Bf 109Fs, except for a solitary Fw 190 victory) between mid-June and late October 1941 – his first two victories in W3312 came within 24 hours of the aircraft's arrival at Biggin Hill. Rankin continued to fly this Spitfire after he had been made wing leader of the Biggin Hill Wing in September 1941. He was succeeded three months later, after which W3312 was moved on to recently arrived No. 124 Sqn. Lightly damaged on operations in April 1942, the fighter was passed to No. 65 Sqn the following month after being repaired. W3312 was eventually written off on 3 September 1942 when the aircraft suffered engine failure west of Deal during a fighter sweep. Its pilot, Plt Off N. R. Macqueen, bailed out too low over the Goodwin Sands and was killed.

to fight at such altitudes. Although fears of high-altitude combat would ultimately prove to be unfounded, they had a significant impact on the Spitfire's development.

The Mk I and II would be unable to engage enemy aircraft at altitudes exceeding 36,000ft and the RAF demanded a re-engined version capable of enhanced performance. The newly developed Rolls-Royce Merlin XX was intended to provide the Spitfire III with the ability to operate at high altitude. But the engine, which featured a redesigned supercharger with two separate blowers for high- and low-altitude operations, proved to be so complex that Rolls-Royce stated it would be difficult to build in the quantities required by the RAF by the early spring of 1941. Furthermore, Vickers Supermarine made it clear that if these engines were not available it could not guarantee the supply of Spitfire IIIs to the tight production schedule demanded by the RAF.

Fortunately, Rolls-Royce had also been working on a simplified version of the Merlin XX with the low-altitude blower omitted. Known as the Merlin 45, it developed 1,515hp at 11,000ft with +16lb of boost. This represented an increase of 500hp over the Merlin III fitted to the Spitfire II, despite being no larger and only moderately heavier. The engine also lifted the fighter's service ceiling close to 40,000ft, compared with the Mk II's 34,000ft. Lacking the second blower, the engine was also much easier to mass-produce than the Merlin XX, and thanks to its physical similarity to the Merlin III, the Merlin 45 could be fitted to Spitfire I/II airframes with minimal modification. The new fighter, which was then seen by the RAF as a stop-gap pending resolution of the Mk III's problems, was designated the Spitfire V.

On Christmas Eve 1940 a meeting was held at the Aeroplane and Armament Experimental Establishment at Boscombe Down during which Royal Aircraft Establishment staff joined engineers from Vickers Supermarine and Rolls-Royce and senior pilots from Fighter Command to find a solution to the high-altitude performance problems afflicting the Spitfire. Rolls-Royce admitted that large quantities of Merlin XXs would not be available for many months. But it believed it could quickly modify the production Merlin III to Merlin 45 specification and deliver at least 300 by 1 March, with 200 more to follow by 1 April. Just days after the meeting the Air Ministry contracted Rolls-Royce to convert 500 Merlin IIIs into Merlin 45s.

Spitfire VB

29ft 11in



11ft 5in



36ft 10in



No. 92 Sqn flight commander Flt Lt Brian Kingcome and his wingman, Flg Off Geoffrey Wellum, who was known as 'Boy' throughout the unit. Wellum rated Kingcome, who was an ace, as 'the best leader I ever flew with'. Both men flew some of the very first Spitfire VBs to reach the frontline from February 1941, and engaged Bf 109Fs during the spring and summer of that year. (John Dibbs)

Several Spitfire Is were quickly modified by Rolls-Royce to accept the new engine and flight trials commenced at Boscombe Down in early January 1941. Most of the aircraft initially converted were cannon-armed Mk IBs, although a few all-machine gun-armed Spitfire IAs were also re-engined. Flight trials soon revealed that the Mk V offered most of the performance advantages of the Spitfire III but without the production delays predicted for that variant. The Chief of Air Staff, ACM Sir Charles Portal, confirmed the abandonment of the Spitfire III in favour of the Mk V during a planning conference on 6 March. The minutes of the meeting stated:

CAS has decided that the Spitfire V with the Merlin 45 engine with a single-speed blower shall be put into production instead of the Spitfire III. The Spitfire V with improved Merlin 45 [with a slightly larger blower impeller – i.e. the Merlin 46] will give better performance in altitude and ceiling. This will meet the needs of Fighter Command for high-altitude fighters. If the type is a success the Air Staff will want as many as can be produced.

Spitfire IB-equipped No. 92 Sqn at Manston was chosen as the unit to give the Mk V its combat debut. The first converted aircraft arrived at the Kent airfield in mid-February 1941. Over subsequent weeks the squadron sent its remaining Mk IBs to the Rolls-Royce plant at Hucknall for conversion to Mk VB standard. It took up to ten days to replace a Merlin III with a Merlin 45, which meant that for several weeks No. 92 Sqn flew both marks operationally. The first Mk Vs were almost identical to late-production Mk I/IIIs, although this soon changed when No. 92 Sqn discovered that the Merlin 45 ran at excessively high oil temperatures and low pressures when at high altitude. Clearly, the fighter's unmodified oil cooling system was not powerful enough to cope with the increased demands placed upon it by the blown Merlin 45. A larger matrix had to be fitted to the cooler, and this in turn meant a larger intake to allow increased airflow through it. The oil cooler intake under the left wing was enlarged and made circular, rather than semi-circular as on the Spitfire I/II – this was an obvious identification feature for the new variant.

Among the No. 92 Sqn pilots giving the Spitfire VB its operational debut was Flg Off Geoffrey Wellum, who recalled one of his early flights with the aircraft in his outstanding autobiography *First Light*:

Increase in all-round performance is truly tremendous and perhaps most important of all it gives us a much higher ceiling. Only the other day I was a member of the squadron patrolling North Foreland to Dungeness and our entire formation was flying at just a fraction under 40,000 ft. The view was breath-taking. A clear, cold day and I gazed in wonderment at the coastline as it swept right round the bulge of East Anglia to where it curves away westward into the Wash. To the west, the Isle of Wight stood out so plainly that I felt I could put my hand out and almost touch it. Way beyond was Portland Bill. It was a great experience and the sheer beauty had a great and lasting effect on me.

But Wellum's flight was curtailed when he noticed that his oil temperature had climbed alarmingly. This was to be the curse of the early Mk VBs. Five of his squadronmates suffered similar problems during these early sorties, which otherwise proved the Merlin 45's enhanced performance. Wellum recalled, 'The height and results we achieve astound even the boffins, something about the cold winter air giving greater volumetric efficiency.' Yet despite the dramatic results of these flights, No. 92 Sqn received a shock when two German aircraft were spotted *above* them during a patrol:

We were all shattered when a pair of 109s described a couple of wide circles round our formation about 1,000ft above us. We were at the absolute limit of our ceiling and could do sweet damn all about it. I bet they in turn were surprised to see a whole squadron of Spits patrolling in good order at only just below their height. They made no attempt to attack and the thought was that they might have been unarmed photo recce aircraft.

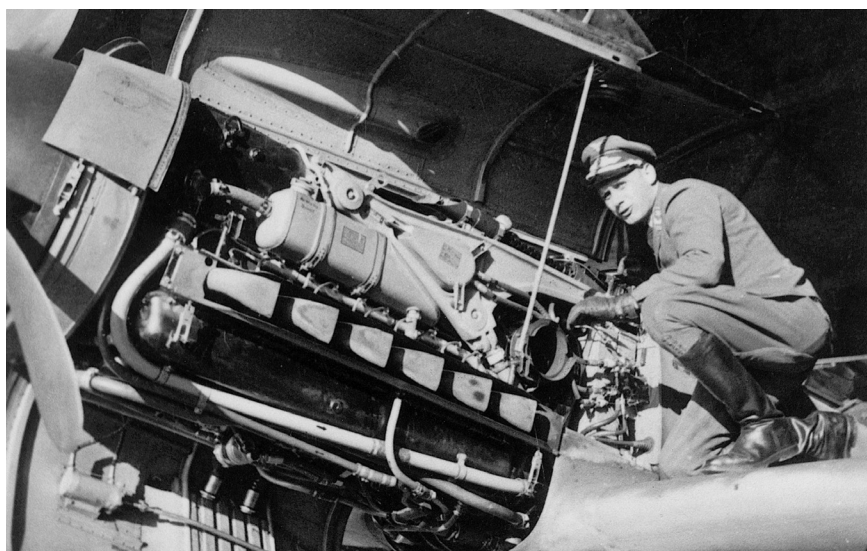
No. 92 Sqn also encountered problems with the Spitfire VB's de Havilland Hydromatic propellers, or, more specifically, failure of the constant speed unit (CSU) that controlled them. This came to a head on 19 March 1941 when three pilots, including the CO, Sqn Ldr James Rankin, were forced to crash-land due to CSU failure during a fruitless high-altitude search for Bf 109s detected at 36,000ft over Kent. Normally, the CSU limited the maximum speed of the Merlin engine to about 3,000 rpm, but at the very low temperatures encountered by the No. 92 Sqn fighters the oil in the CSUs congealed and the propeller blades went to full pitch. The engines duly raced to 4,000 rpm and threatened to shake themselves apart, forcing the pilots to shut down immediately. All three escaped the ensuing forced landings without injury, although their precious Mk VBs were sufficiently damaged to keep them out of action for several months. Following this incident pilots flying the Spitfire V at extreme altitude were instructed to make frequent throttle changes to exercise the propeller pitch mechanism. At the same time, as many Mk Vs as possible were fitted with Rotol CSUs until a modification was devised to solve the problem with the de Havilland propeller.

Issues with the Mk VB's 20mm cannon armament and the ballooning of fabric-covered ailerons at speeds in excess of 400mph also afflicted the aircraft in its early service career. Both these problems were inherited from the earlier Spitfire I/II but were eventually solved as the Spitfire V rapidly matured – this variant was the subject of more than 1,100 modifications during its service life. Far from being a stop-gap, the Mk V proved to be the workhorse of Fighter Command during the Channel Front campaign. A total of 6,479 examples were built between January 1941 and November 1943.

Bf 109F

Augsburg-based Bayerische Flugzeugwerke began work on what would become the Bf 109F in the autumn of 1938 just as the first Daimler-Benz-engined version of the Messerschmitt fighter, the Bf 109E, was about to enter frontline service with the

The DB 601N of this early-build Bf 109F-1 is exposed for routine maintenance. The upper cowling of the F-model was not only aerodynamically cleaner than the 'Emil's', but it was designed in a much more practical way. Whereas the E-model's was in one piece, the 'Friedrich's' upper cowling was split in two halves fastened by two clips on each side. This meant that both cowling sides could be rotated upwards around a common axis, separately or together. As can be seen here, this gave the mechanics improved access to the engine. [EN-Archive]



Luftwaffe. Company founder Professor Willy Messerschmitt and Chief of Project Planning Robert Lusser wanted an aircraft that could exceed the performance of previous Bf 109 variants through a combination of airframe aerodynamic refinements and the installation of a more powerful version of Daimler-Benz's DB 601A engine. The latter, designated the DB 601E, utilised direct fuel injection to its inverted V12 cylinders – as had the DB 601A – to give the powerplant a predicted 1,350hp at 17,750ft. This represented an increase of 23 per cent over the DB 601A. The new engine was 17.2 inches longer, which dictated a major redesign of the Bf 109's engine bearers and cowling. The F-model would also feature the streamlined propeller spinner created for the next generation of Messerschmitt single- and twin-engined fighters and inspired by the record-breaking Me 209 racing aircraft.

In a bid to achieve the most streamlined forward fuselage possible, Messerschmitt redesigned the chin-mounted oil cooler intake which was such a recognition feature of the E-model. It also revised the wing-mounted coolant radiators by making them twice as wide and half as deep as those fitted to the Bf 109E. This new design drastically reduced drag. Two-piece airflow flaps were located at the rear of the radiator housings, replacing the single-piece flap of the 'Emil'. The bottom flap both adjusted the airflow and acted as the landing flap. The wings also featured extended semi-elliptical tips rather than the distinctive clipped tips of the Bf 109E. There were also re-shaped ailerons, leading edge slats and flaps. To save weight, no wing armament was installed, the F-model featuring a single engine-mounted 15mm or 20mm cannon firing through the propeller hub, supplemented by two MG 17 7.92mm machine guns mounted in the upper cowling.

The tail area of the Bf 109F was also cleaned up to improve the aerodynamics. The most significant of these changes was the removal of the tailplane bracing struts. Although this greatly reduced drag, it also weakened the airframe to the point where several early aircraft were lost in combat when their tail units broke off due to high-speed flutter. The weak point was the tail unit attachment ahead of the tailplanes leading edges and the tailwheel recess. This problem was cured in early examples by

OPPOSITE

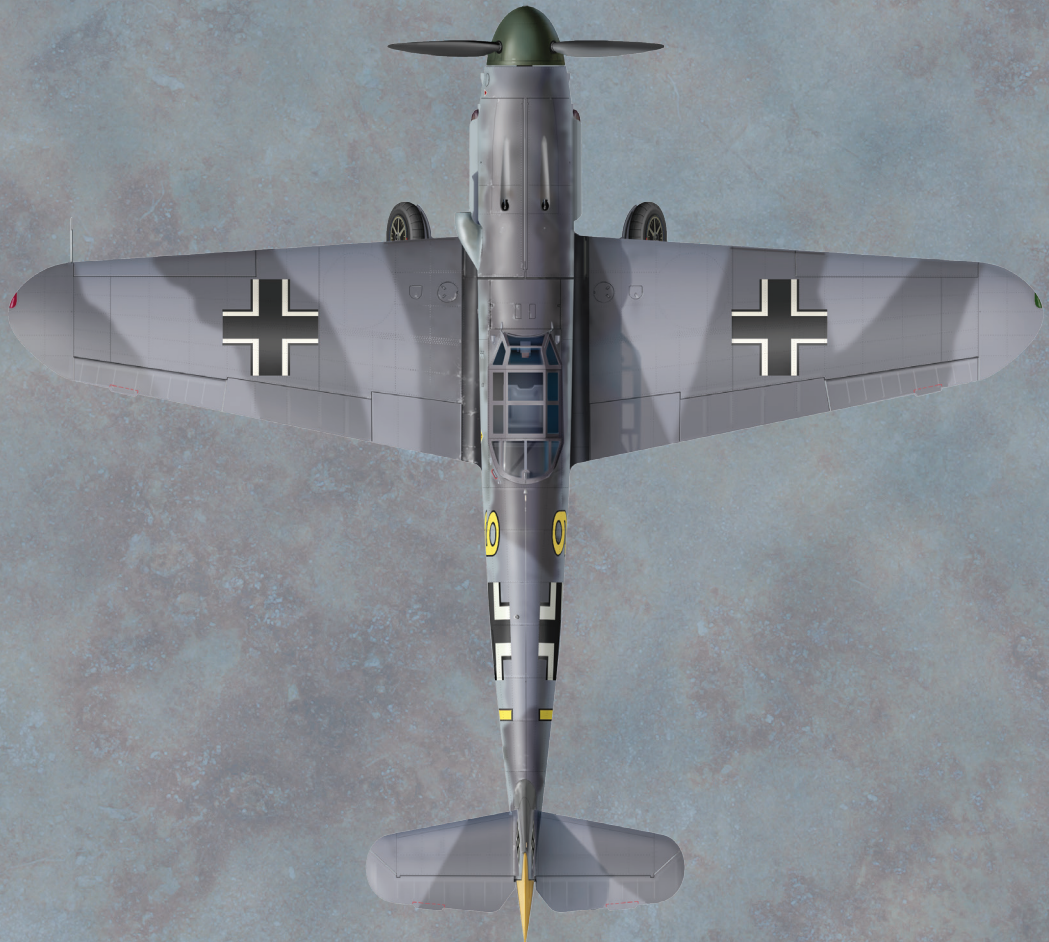
Bf 109F-2 Wk-Nr 9552 was assigned to 9./JG 2's *Staffelkapitän*, Oberleutnant Siegfried Schnell, the leading ace on the Channel Front in terms of Spitfire II/Vs destroyed. Maintained in immaculate condition at the *Gruppe*'s Theville base in the spring of 1942, the aircraft was finished in standard camouflage for the period, with the addition of protective paint on the wing roots and lower fuselage to prevent staining by exhaust deposits. A total of 57 victories were displayed on the rudder.

Bf 109F-2

29ft 3.2in



8ft 5.3in



32ft 5.4in



A pilot is helped on with his straps as he settles into the cockpit of a brand new Bf 109F-2 in early 1941. This is a machine from I./JG 51, and it was among the first 'Friedrichs' to reach the Channel Front in February 1941. Note the fighter's streamlined forward fuselage, Messerschmitt having redesigned the previously protruding chin oil cooler intake that was such a recognition feature of the Bf 109E. Final details of the I./JG 51 'Gemsbock' unit badge had still to be added to the partially applied marking below the cockpit when this photograph was taken. [EN-Archive]

two thin metal strips riveted to the weak point. Definitive modifications were included as part of the production process at Messerschmitt.

The F-model also featured numerous internal improvements. These included a redesigned cooling system with coolant tanks positioned on either side of the engine; a semi-rigid self-sealing fuel tank (on later models only); improved armour to protect the fuel tank and pilot; a new hydraulic system with a reservoir located on the left-hand side of the engine; improved cockpit instrumentation; and electro-mechanical variable pitch control for the VDM 9-11207A or 9-12010A three-bladed metal propeller, the latter modification having been introduced in late-production E-models.

Assembly of two experimental prototypes began in the early winter of 1938 once initial research had been completed. The first of these, designated Bf 109 V22, made its maiden flight on 26 January 1939. It was already clear that series production of the DB 601E was behind schedule and the V22 had to be fitted with a DB 601A instead. A second prototype (the V23) flew soon afterwards, fitted with the still experimental DB 601E motor. Both of these aircraft were, in fact, re-engined Bf 109Ds, and during

the spring and summer of 1939 they were used for testing the engine, forward fuselage profile, new cooling system and modified wings.

Although the RLM had placed an order for 15 pre-production Bf 109F-0s for delivery between November 1939 and April 1940, progress with the F-model was slow. This was due to ongoing issues with the DB 601E, while Messerschmitt was forced to focus on production of the Bf 109E because of the outbreak of war. It was decided that early aircraft would have to be fitted with the less powerful DB 601N, although it would only be available in modest numbers from mid-1940 due to the Luftwaffe's high demand for the proven DB 601A. Nevertheless, three Bf 109F-0s were assembled during January 1940, these aircraft being regarded as prototypes for the production model. Work was then abruptly halted by order of the Führer himself, as he believed that he could conquer western Europe with the weapons already at his disposal. By then at least two factories had already made preparations for series production of the Bf 109F.

At the end of May 1940 it was decided to restart the 'Friedrich' programme, with a fourth F-0 assembled in late June. By February 1941 14 had been completed, with the final five being built by June of that year. No two F-0s were alike, as Messerschmitt used them to test new systems and equipment in an effort to improve the fighter's performance. Early examples lacked the modified wings with elliptical tips, while others featured differing supercharger air intake shapes – no fewer than ten shapes were tested. All aircraft were initially powered by DB 601A/Ns, although several F-0s and early F-1s were fitted with the definitive DB 601E for flight testing from March 1941. One F-0 served as the series production prototype for the F-1, being fitted with a DB 601N, while another was used as a test bed for the wing slats and radiator flaps unique to the F-model. Finally, another F-0, fitted with standard E-model wings, tested the 'Friedrich's' engine cooling system.

Despite flight trials with the ever-increasing fleet of Bf 109F-0s still far from completion at Rechlin and elsewhere, the RLM ordered Messerschmitt to start series production of the F-1 at its Regensburg factory from August 1940. The following month the first examples of the Mauser MG 151/15 cannon were delivered to Regensburg for installation in the F-2 variant. Production of this model started shortly thereafter. Assembly of this model commenced at AGO in November, while at the same time F-1 production started at the WNF plant. By spring 1941 the Messerschmitt factories at Regensburg and Augsburg had assembled 157 aircraft – 19 F-0s and 138 F-1s – and the WNF plant 49 F-1s. These numbers fell well short of the 610 planned by the RLM, which meant that the F-model played only a minor role in operations on the Channel Front in the first six months of 1941, with just a single *Jagdgeschwader* (JG 51) fully re-equipping with the fighter.

In January and February 1941 construction of the F-2 commenced at two more plants (including WNF), and the variant would remain in production until September of that year. By then the definitive Bf 109F-4, which at last featured the DB 601E engine and incorporated many of the improvements demanded by the Luftwaffe after early combat with the F-1/2, had been rolling off the assembly lines for four months. F-4s would continue to be built until the summer of 1942, by which time 2,550 'Friedrichs' of all sub-variants had been completed and the fighter's combat career, on the Channel Front at least, was rapidly coming to an end.