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| |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | I.        Introduction            Preliminary flight tests were conducted on the P-51H airplane, AAF No. 44-64161, at the contractor’s plant, Inglewood, California, from 4 April to 14 April 1945. Thirteen flights were made for a total flying time of approximately fifteen hours. These tests were made at the request of the Project Engineer, Lt. P. C. Hollowell, Fighter Branch, Production Section, Procurement Division, in order to check the manufacturer’s guarantee at the fighter configuration, wing bomb racks installed and at the primary load condition. All tests were flown by Major J. D. Onerem with Lt. Frank G. Morris as Flight Test Engineer.  II.       Summary            The P-51H has been designed to incorporate the latest ideas of the AAF and North American Aviation in the design of long range escort fighters. In general appearance the airplane is quite similar to the P-51D, however, a number of changes have been made which are readily distinguishable. A new lower drag air foil section as well as a new wing plan form of the laminar flow series has been employed. The fuselage contours are entirely new, particularly in profile where the increased slope of the engine cowl center line results in improved visibility for the pilot. The increased area of the horizontal and vertical tail surfaces and the improved fairing of the radiator ducts into the fuselage are also new and distinguishable features. In general, the cockpit enclosure and windshield are similar in design and appearance to the P-51D, but slight changes in design have been employed to increase visibility as well as movement of the canopy. The oil radiator and shutter have been eliminated by the use of the heat exchanger. The heat exchanger is essentially an oil radiator which uses the after coolant fluid as a cooling medium instead of air as in the normal radiator system.            High speed and climb performance were good and results obtained compare very closely to the manufacturer’s guarantee. In general, handling characteristics, controllability, and stability are very satisfactory through out the altitude and speed range, however, it was rather difficult to trim the airplane for high powered climbs. Vision for taxiing and for all flight conditions is exceptionally good.            The flight test crew was unable to obtain preliminary performance at the war emergency rating using water injection (90 “Hg and 3000 RPM) due to the engine surge and general malfunctioning of the water injection system and Simmons manifold pressure regulator. However, this information will be obtained and test results will be submitted as an addendum to this report. The principle results of performance obtained to date are as follows:            A.     Maximum speed at critical altitudes | | | | | | | | | | High blower | (67.0" and 3000 RPM) 30750' | | | 450.0 MPH | | | |  | (61.0" and 3000 RPM) 32550' | | | 444.5 MPH | | | |  | | | | | | | | Low blower | (67.0" and 3000 RPM) 16400' | | | 435.0 MPH | | | |  | (61.0" and 3000 RPM) 19300' | | | 432.5 MPH | | | | B.     Maximum speed at sea level | | | | | | | | | |  | (67.0” and 3000 RPM) | | | 358.0 MPH | | | |  | (61.0” and 3000 RPM) | | | 351.0 MPH | | | | C.     Rate of Climb | | | | | | | | | | 1.     Sea Level | (67.0” and 3000 RPM) | | | 3200 ft/min. | | | |  | (61.0” and 3000 RPM) | | | 2875 ft/min. | | | |  |  | | | | | | | 2.    Low blower critical altitudes | | | | | | | |  | (67.0” and 3000 RPM) | | | 3395 ft/min. | | | |  | (61.0” and 3000 RPM) | | | 3080 ft/min. | | | |  |  | | | | | | | 3.    High blower critical altitudes | | | | | | | |  | (67.0” and 3000 RPM) | | | 2640 ft/min. | | | |  | (61.0” and 3000 RPM) | | | 2360 ft/min. | | | |  |  | | | | | | | 4.    Time to climb to service ceiling | | | | | | | |  | (67.0” and 3000 RPM) | | | 23.7 min. | | | |  | (61.0” and 3000 RPM) | | | 24.6 min. | | | | Rate of climb is uncorrected for coolant shutter position as this correction involved a maximum of 2 to 3% change in rate of climb which is within the limits of experimental accuracy.  III.     Condition of Aircraft Relative to Tests            All preliminary flight tests were conducted at the fighter configuration (wing racks installed but without rocket racks) at a take-off weight of 9484 pounds with c. g. at 26.3% MAC, MAC wheels down. This weight includes full fuel and oil, six .50 caliber machine guns and ballast for 1880 rounds of .50 caliber ammunition.            The airplane was equipped with a Packard built Rolls Royce model V-1650-9 engine, supplied with water injection for use at war emergency power, Bendix Stromberg PD18C-3A carburetor, and four bladed Aero-Products propeller H20-162-29M5, design No. 86892. All power figures are based on power curve from Eng. Spec. No. AC-10356 and MX100, dated 29 November 1944. At the present time the V-1650-9 engine has not been calibrated and all power curves are computed from calculated power curves.            All flights were made with wheels retracted, wing flaps neutral, coolant scoop automatic, canopy closed and mixture auto-rich.  IV.     Flight Characteristics            A.    Taxiing and Ground Handling                    The ground handling characteristics of this airplane are very good, and directional control is easily maintained.                    The tailwheel, when in the locked position, is steerable through a twelve degree angle which is desirable. It is conveniently unlocked by pushing the stick full forward.                    The brakes operate satisfactorily and are effective when applied from all rudder positions.                    Visibility straight forward is obstructed completely by the nose when in the three point position, but, in general, the visibility, as well as taxiing characteristics, is the most desirable of any airplane with conventional type landing gear.            B.    Take-off                    Take-off characteristics are normal for this type airplane. The airplane tends to swing slightly to the left on take-off when the throttle is opened rapidly, however, sufficient trim is available to compensate for this. Sufficient trim is not available for maintaining the desired climbing speeds in high powered climbs.                    Ground roll for take-off is relatively short, and the initial angle of climb is steep.            C.    Stability                    Throughout the entire speed range the airplane is statically and dynamically stable longitudinally. Lateral stability is neutral and the airplane is both statically and dynamically stable directionally. The airplane has a slight tendency to hunt longitudinally and this condition is aggravated by rough air. These qualitative tests were made with c. g. location at 26.3% MAC.            D.    Trim and Balance                    The airplane has trim tabs on all control surfaces and may be trimmed satisfactorily for all flight conditions except high power climbs. Any variation in airspeed and power requires a change in trim. Any nose heaviness, from extended landed gear, open coolant shutter, or external wing flaps, may be easily corrected for by use of the elevator trim control.            E.    Controllability                    The airplane has good control characteristics and coordination is easy throughout the speed range. At both high and slow speeds the controls are very effective with moderate forces. Controllability throughout a stall is also very good.            F.    Maneuverability                    The airplane is very maneuverable with excellent control during acrobatics. In both gentle and light runs, the controls are light and very effective. When pulled in moderately in a turn, it gives warning of the approaching stall by a slight buffeting and vibration of the controls.                    The rate of roll of the airplane is especially good with moderate control forces..            G.    Stalling Characteristics                    The airplane has very good stalling characteristics in the clean configuration, power off. The stall is straight forward and is proceeded slightly by mild buffeting and stick vibration. The nature of the stall is relatively mild, with effective control throughout. No accelerated stalls were attempted.            H.    Spinning Characteristics                    None performed            I.    Diving Characteristics                    At relatively high speeds the controls are very effective with moderate forces. At extremely high speeds a distinct rumble is heard which probably develops around the coolant shutter. Considerable rudder trim is necessary for changes in speeds during the dive.            J.    Single Engine Operation                    Not applicable to this airplane            K.    High Altitude Trials                    The stability does not appear to change at high altitude, and the surface controls operated satisfactorily. Elevator trim freezes above 30000 feet and the aileron and rudder trim tabs freeze above 25,000 feet.                    The cabin heater was disconnected during the tests because of fumes given off when it was in use. The cabin temperature was satisfactory up to 30000 feet without the heater, but above this altitude the cockpit becomes increasingly colder and a heater is needed for comfort.                    The entire canopy frosts over when descending from altitude but as neither the defroster nor cockpit heater were operative, they could not be evaluated.            L.    Approach and Landings                    Landing characteristics of this airplane are very good. There is very little floating tendency and on normal landings the rudder and elevator are effective throughout. The landing flaps operate very quickly and should be handled carefully on the approach. There is noticeable nose heaviness when gear and flaps are lowered, accentuated by opening of the radiator scoop, but this is readily trimmed out with the elevator trim tab.            M.    Night Flights                    None performed            N.    Noise and Vibration                    The noise level is slightly lower because of the tight fitting canopy. Vibrations develop when running at high powers and this condition may be due to the water injection system operating improperly. The propeller also starts a noise cycle which sounds much like two propellers being out of synchronization. Though noticeable, the noise is not loud enough to be objectionable.            O.    Vision and Cockpit Layout                    Visibility, in general, is very good, excepting slight distortion noted in the side panels and in the rear of the canopy.                    Objections to the cockpit are few. The idle cut off should be placed where it can be more easily reached. Its present location requires considerable reaching and is quite awkward to operate. The oxygen regulator should be relocated where the pilot can watch its operation, and be able to select the desired amount of oxygen with more ease. Its present location requires considerable twisting in order to read its settings which wearing an oxygen mask.                    Cockpit ventilation on warm days is inadequate.  V.      Shipboard Tests            A.    No ship board tests performed.  VI.     Performance Data            A.    Airspeed, Altimeter, and Free Air Temperature Calibration                    1.    The airspeed, altimeter, and free air temperature position corrections are shown in Figure 1, Figure 2, and Figure 3 respectively. The location of the flush static holes and pitot head will be shown in the addendum to this report.            B.    High Speed                    1.    Curves of speed vs altitude are given in [Figure 4](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Speed-vs-Altitude.jpg) and [Figure 5](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Level_Flight_Data.jpg) at a take-off gross weight of 9484 pounds.                    2.    High speeds in level flight at 3000 RPM (“dry”, war emergency power) mixture auto-rich, coolant scoop in automatic, at a gross weight at take-off of 9484 pounds are presented in the following table: | | | | | | | | | |  | | | | | | | | | | ALTITUDE FT. | | TRUE SPEED MPH. | INTAKE Man. PRESS. ”Hg | | BHP FROM CHART | BLOWER | | THROTTLE | |  | | | | | | | | | | 0 | | 358.0 | 67.0 | | 1480 | low | | part | | 10000 | | 403.4 | 67.0 | | 1552 | low | | part | | \*16400 | | 435.0 | 67.0 | | 1600 | low | | W. O. | | 20000 | | 431.7 | 59.7 | | 1460 | low | | W. O. | | 25000 | | 435.0 | 67.0 | | 1311 | high | | part | | \*\*30700 | | 450.2 | 67.0 | | 1330 | high | | W. O. | | 33000 | | 442.6 | 59.7 | | 1185 | high | | W. O. | | 37000 | | 415.5 | 46.9 | | 950 | high | | W. O. | | \*  Critical altitude for 3000 RPM and 67 “Hg manifold pressure in low blower.            \*\*Critical altitude for 3000 RPM and 67 “Hg manifold pressure in high blower.                    3.    High speeds in level fight at 3000 RPM (military power) mixture auto-rich, coolant scoop automatic, at a gross weight at take-off of 9484 pounds are presented in the following table: | | | | | | | | | |  | | | | | | | | | | ALTITUDE FT. | | TRUE SPEED MPH. | INTAKE Man. PRESS. ”Hg | | BHP FROM CHART | BLOWER | | THROTTLE | |  | | | | | | | | | | 0 | | 351.0 | 61.0 | | 1388 | low | | part | | 10000 | | 393.4 | 61.0 | | 1439 | low | | part | | \*19300 | | 432.5 | 61.0 | | 1485 | low | | W. O. | | 23000 | | 427.2 | 54.5 | | 1358 | low | | W. O. | | 25000 | | 425.2 | 61.0 | | 1187 | high | | part | | \*\*32550 | | 444.5 | 61.0 | | 1212 | high | | W. O. | | 35000 | | 432.0 | 53.1 | | 1065 | high | | W. O. | | 37000 | | 415.5 | 46.9 | | 950 | high | | W. O. | | \*  Critical altitude for 3000 RPM and 61 “Hg manifold pressure in low blower.            \*\*Critical altitude for 3000 RPM and 61 “Hg manifold pressure in high blower.            C.    Climb Data                    1.    Climb performance at 3000 RPM mixture auto-rich, coolant scoop in automatic, and at a take-off weight gross weight of 9484 pounds is presented in the following table. Climb performance curves are shown in [Figure 6](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Climb_Data.jpg) and [Figure 7](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Climb_Data-Fig7.jpg). | | | | | | | | |   "DRY" WAR EMERGENCY POWER   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | | | | | | | ALTITUDE | MAN. PRESS. "Hg | BHP FROM CHART | RATE OF CLIMB FT/MIN | TIME TO CLIMB MIN | BLOWER | |  | | | | | | | 0 | 67.0 | 1503 | 3200 |  | low | | 5000 | 67.0 | 1548 | 3285 | 1.55 | low | | 10000 | 67.0 | 1590 | 3350 | 3.00 | low | | \*13800 | 67.0 | 1622 | 3395 | 4.20 | low | | 20000 | 67.0 | 1320 | 3060 | 6.10 | high | | 25000 | 67.0 | 1340 | 2750 | 7.85 | high | | \*\*26700 | 67.0 | 1347 | 2640 | 8.50 | high | | 30000 | 59.4 | 1209 | 2275 | 9.85 | high | | 35000 | 49.4 | 1012 | 1510 | 12.50 | high | | 40000 | 40.6 | 830 | 440 | 18.00 | high |   MILITARY POWER   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | | | | | | | ALTITUDE | MAN. PRESS. "Hg | BHP FROM CHART | RATE OF CLIMB FT/MIN | TIME TO CLIMB MIN | BLOWER | |  | | | | | | | 0 | 61.0 | 1370 | 2870 |  | low | | 5000 | 61.0 | 1420 | 2975 | 1.75 | low | | 10000 | 61.0 | 1467 | 3050 | 3.35 | low | | \*16300 | 61.0 | 1498 | 3080 | 5.40 | low | | 20000 | 61.0 | 1190 | 2580 | 6.75 | high | | 25000 | 61.0 | 1215 | 2480 | 8.60 | high | | \*\*29300 | 61.0 | 1237 | 2360 | 10.45 | high | | 30000 | 59.4 | 1209 | 2275 | 10.80 | high | | 35000 | 49.4 | 1012 | 1510 | 13.40 | high | | 40000 | 40.6 | 830 | 440 | 18.00 | high | | S/C - service ceiling = 41,400', 100 ft/min rate of climb                    A/C - absolute ceiling - 41,800'                    \* Critical altitude in low blower                    \*\* Critical altitude in high blower                    Note: Automatic blower shift occurs between 20,000 and 21,000 feet.                    2.    Time to climb to service ceiling at war emergency and military powers was 23.7 minutes and 24.6 minutes respectively.            D.    Cooling Shutter Tests                    1.    When in the automatic position, the coolant scoop position was regulated by a thermostat which maintained the coolant scoop near flush and the coolant temperature within the desired temperature range. The average of the scoop positions for all flight conditions was approximately 8 inches, or open to the flush position, therefore, all performance was corrected to the flush position.                    2.    The effect of coolant scoop position on indicated airspeed and coolnat temperature in level flight is shown in Figure 8 and Figure 9.  VII.    Curves            All data in the following curves has been reduced to NACA Standard Atmospheric Conditions. These curves are located in Appendix A.  [Speed vs. Altitude](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Speed-vs-Altitude.jpg)            [Level Flight Data](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Level_Flight_Data.jpg)            [Climb Data](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Climb_Data.jpg)            [Climb Data](http://www.wwiiaircraftperformance.org/mustang/P-51H_64161_Climb_Data-Fig7.jpg)  VIII.   Conclusions            A.    Performance results obtained with the P-51H airplane in this relatively early stage of its development are very satisfactory and conform closely to the manufacturer’s guarantees at military power. Company guarantees due not include performance guarantees at dry, war emergency power, so no direct comparison can be made at this time.            B.    It was necessary to terminate all performance tests using water injection due to general malfunctioning of the manifold pressure regulator and the engine power.  IX.     Recommendations            A.    It is urgently recommended that measures be taken to eli minate the difficulty encountered with the Simmons manifold pressure regulator when using water injection and high powers. Upon leaving the factory it had not been determined whether this regulator would reduce the manifold pressure when the water was exhausted. At this time it would allow 90 inches manifold pressure to be drawn without water injection. In view of these facts it is further recommended that the water supply be increased to allow for more than one water injection run per flight.            B.    It is recommended that the investigation to determine causes of engine surge be continued.            C.    It is recommended that the idle cut-off and the oxygen regulator be relocated so as to be more accessible for operating.            D.    It is recommended that freezing of the trim tab controls at altitude be prevented, that the cockpit heating and defrosting systems be checked for proper operation, and that a fresh air vent of some other method of cockpit ventilation be supplied for low altitude flying in warm weather.  X.     General Dimensions and Photographs            A.    General Dimensions                    1.    Span        37’-0-5/6”                    2.    Length     33’ – 4 “                    3.    Tread       11’ – 1” | | | | | | |