EXPERIMENTAL AIRCRAFT ASSOCIATION

FLIGHT TRAINING MANUAL FOR THE

FLYING FORTRESS

B-17

PUBLISHED BY THE EAA FLIGHT DEPARTMENT

EAA FLIGHT TRAINING MANUAL

Revised March 2012

This flight training manual is intended for use as a reference for EAA personnel operating the B-17G "Aluminum Overcast". It updates and consolidates the information contained within the AAF 50-13 B17G Flying Fortress Pilot Training Manual (revised 1 May 45), the AN 01-20EG-1 USAF Pilot Operating Handbook as well as other applicable manuals. This manual attempts to place all the material necessary for the safe and efficient operation of this aircraft within a single publication. The reference sources and publications from which the information in this manual was derived are listed individually at the end of this description.

The AAF 50-13 manual was written during wartime in a situation heavily orientated towards operating the B-17 as a weapon in combat. As a result of this emphasis it devoted fully as much attention to the aircraft's ordinance and armament as it did to the systems. Since relatively little utilization of the aircraft by the military occurred in the post war period, few or no revisions were made to these manuals. This is in contrast to many other military aircraft, for example the B-25, the A(B)-26 or the C-47, which soldiered on well into the sixties or later. On the original aircraft many of the systems were used solely for the combat mission. Many of these systems have been either retained or reinstalled during the restoration process. Therefore, those systems (although inoperative) will have their functions described for historical reasons and/or to provide answers to questions asked while the aircraft is on tour. In these cases this manual will note that the system is non-functional.

Subjects are arranged in this manual as described within the Table of Contents. Many different people within the EAA's museum operating group have been consulted and have contributed their time, talent and ability to this manual. Limitations as contained within the CAA Operating Specifications for this aircraft, as well as a copy of this document, have been included. Where they have been further restricted by EAA policy, this has been indicated.

Several years ago, the checklist and operating procedures for "Aluminum Overcast" were written and included in our operation. These procedures have now been completely incorporated into this manual.

This manual has been submitted to the Federal Aviation Administration personnel responsible for the operation of this aircraft. The FAA has approved it in this form; therefore the FAA or their representatives must approve any revision.

Corrections, comments and suggested revisions are always solicited; they should be addressed to:

EAA Flight Operations
Weeks Flight Research Center
1145 West 20th Ave.
Oshkosh WI 54902
-or-
e-mail them to:
b17manual@eaa.org

Reference publications:

AAF 50-13 - B17G Pilot Training Manual
AN 01-20EG-1 {Pilot Operating Handbook
T.O. AN 01-EG-1
2nd AF Four-engine pilot transition syllabus

Record of Manual Changes

Change No.	Date Inserted	Inserted by:

Paul H. Poberezny

FOREWARD

This manual for the famous B-17G Flying Fortress began its life in print prior to World War II. Throughout the war it was improved upon by a great many personnel in the service of our country who built, serviced and flew this great aircraft.

The techniques and procedures described in this book have been improved upon by those Experimental Aircraft Association member who, through their combined flight experience, have contributes both their advice and recommendations towards its present form.

As pilots and crew members of the EAA’s “Aluminum Overcast” use this manual to assure that you have learned everything described herein. It is our responsibility to ensure the complete safety of this historic treasure, and more importantly, the safety of the people who are privileged to ride aboard her as crew members and passengers.

Technical orders have long been a part of this aircraft’s operating procedures and will continue to be a source of information. Combine these with this manual and your personal knowledge, as well as the shared experiences of all of us who are honored to fly and operate this priceless artifact of an earlier era.

Fly with pride, in honor of those who flew as crew members on this historic aircraft and those who gave their lives for the freedom our citizens enjoy.

Paul H. Poberezny
Founder and Chairman of the Board
Experimental Aircraft Association

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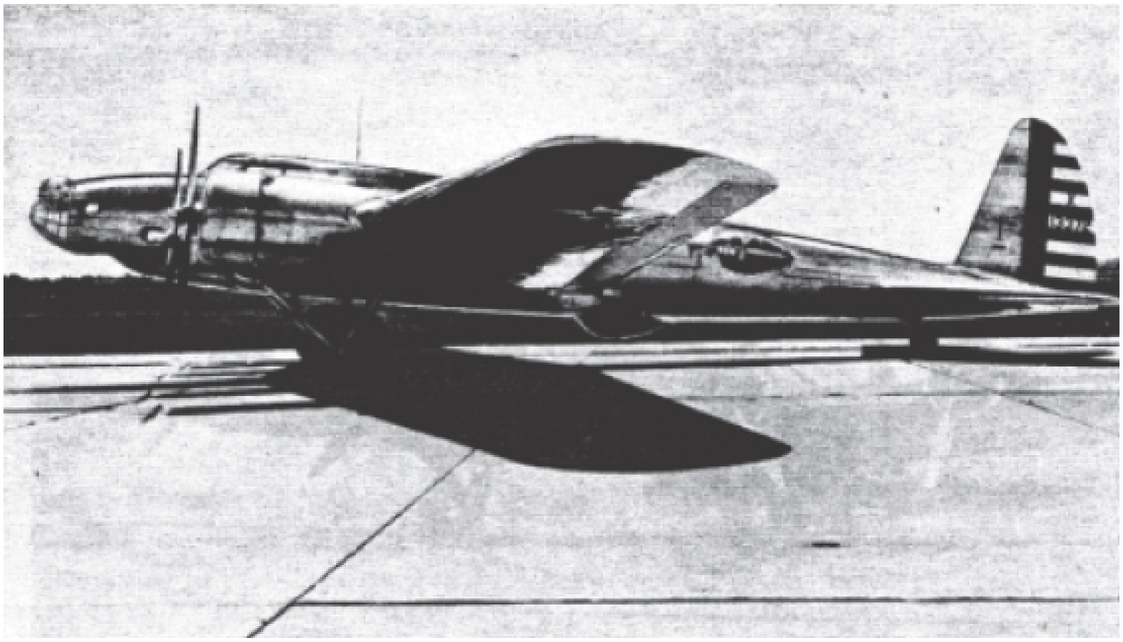
B-17 IN WARTIME



THE FIRST FORTRESS: The Air Corps called for a “battleship of the skies”; Boeing offered the “299” (later the XB-17); observers called it a “regular fortress with wings.” It exceeded expectations, later crashed – victim of pilot error.

THE STORY OF THE B-17 IN WARTIME

In 1934 the U. S. Army Air Corps asked for a battleship of the skies. The specifications called for a “multi-engine” bomber that would have a high speed of 200-250 mph at 10,000 feet, an operating speed of 170-200 mph at the same altitude, a range of 6 to 10 hours, and a service ceiling of 20,000-25,000 feet.

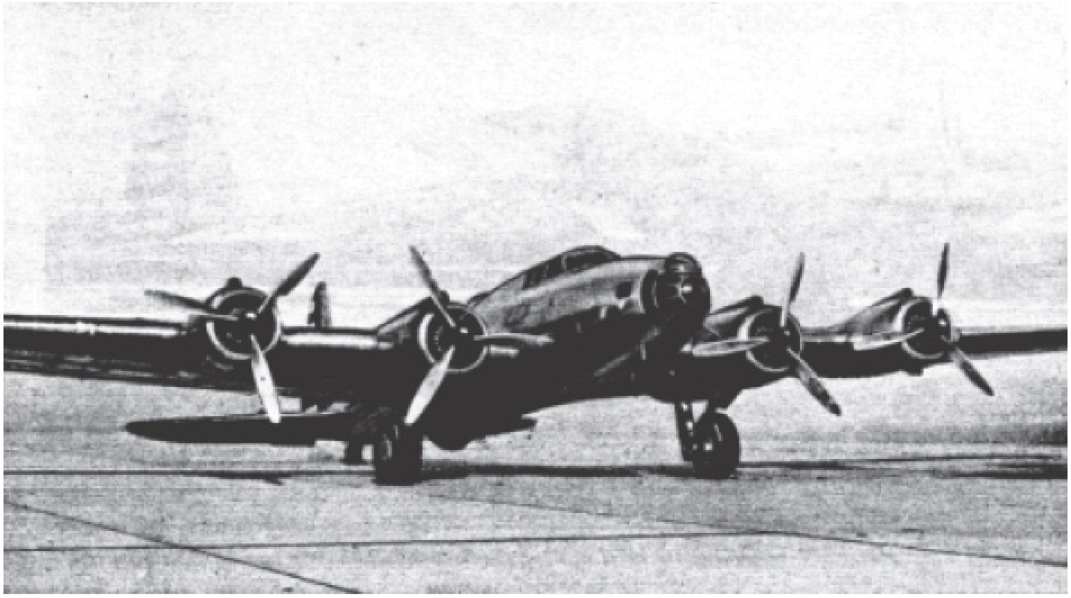
Boeing designers figured that with a conventional 2engine type of airplane they could meet all specifications and probably better them. But such a design probably would not provide much edge over the entries of competitors. They decided to build a revolutionary type of 4engine bomber.

In July 1935 an airplane such as the world had never seen before rolled out on the apron of the Boeing plant at Seattle, Wash. It was huge: 105 feet in wing span, 70 feet from nose to tail and 15 feet in height. It was equipped with 4 Pratt & Whitney Hornet 750 Hp engines and 4 Hamilton Standard 3-bladed constant-speed propellers. To eliminate air resistance, its bomb load was tucked away in internal bomb bays. Pilots and crew had soundproofed, heated, comfortable quarters where they could of climate. And the big bomber bristled with formidable firepower.

“It’s a regular fortress,” someone observed, “a fortress with wings.”

Thus the Boeing 299, later designated the XB-17, was born; the grandfather of the Flying Fortress that was to become champion and pace-setter of all heavy bombardment aircraft in World War II.

The XB-17 surpassed all Army specifications for speed, climb, range and load-carrying requirements. Then, in October, 1935, it crashed at Wright Field when a test pilot neglected to unlock the elevator controls on takeoff.



Next came the Y1B-17: Thirteen were delivered in 1937. One stalled, spun down over Langley Field, recovered, landed safely. Recording instruments showed it had held up under greater stress than it was designed to stand.

The B-17A WENT HIGHER: Equipped with turbos, it topped all previous service callings, gave maximum performance above 30,000 ft. To range, speed, bomb load, firepower, the B-17 added another advantage: altitude operation.

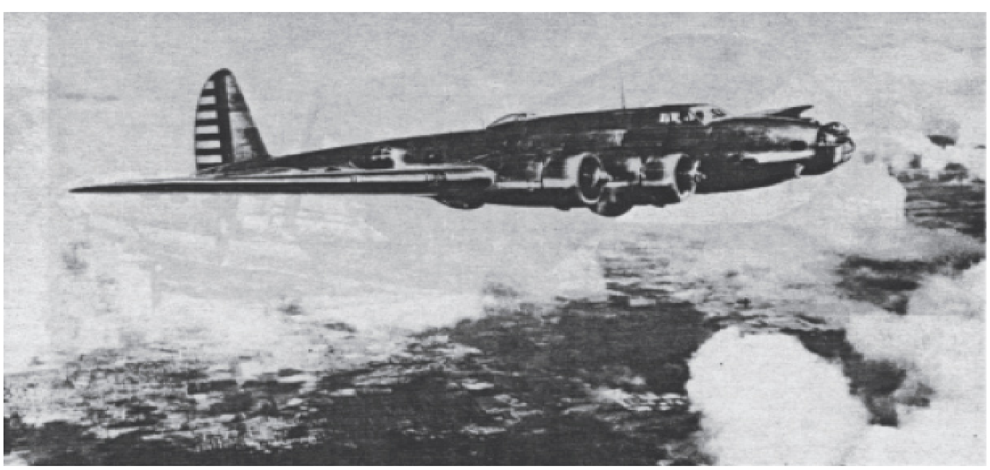
But the Army Air Corps recognized in this first Fortress the heavy bomber of the future. Thirteen airplanes, designated Y1B-17, were ordered. While one airplane was held at Wright Field for experimental purposes, the other 12 went out to set new range and speed records, cruising the Western Hemisphere, and confounding skeptics who said that the Flying Fortress was "too much airplane for any but super-pilots." Not one of the 12 was ever destroyed by accident.

With experience, the Fortress acquired new strength, virtues, possibilities. The Y1B-17A, equipped with Wright G Cyclone engines and General Electric turbo-superchargers, gave astonishing performances at altitudes above 30,000 feet. The B-17B, flight tested in 1939, had 1000 Hp Wright Cyclone engines and hydromatic full-feathering propellers.

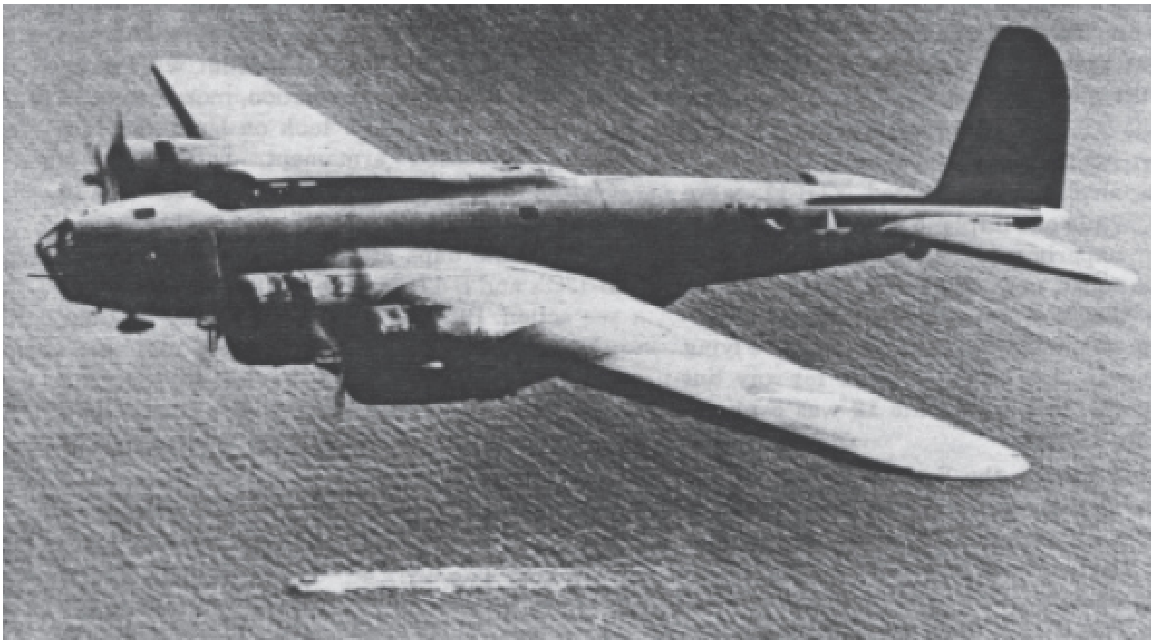
In the spring of 1940, when Hitler had overrun Norway, Denmark, Holland, Belgium, and France, the B-17C made its debut with more armor plate for crew protection, more power in its engines. The B-17D took on leak proof fuel tanks, increased armament, better engine cooling In fast climbs, and a speed increase to more than 300 MPH. When the Japanese attacked Pearl Harbor, the B-17C's and B-17D's were the first Fortresses to see action. But soon the B-17E's were on their way to join them in even greater numbers: faster, heavier, sturdier Fortresses, packing .50-cal. waist and tail guns, with a Sperry ball turret under the fuselage, and another power turret on top.

By the spring of 1942, still another Fortress, the B-17F,with longer range, greater bomb load capacity, more protective armament and striking power, was streaking across both Atlantic and Pacific in enormous numbers to provide what General Arnold called "the guts and backbone of our world-wide aerial offensive."

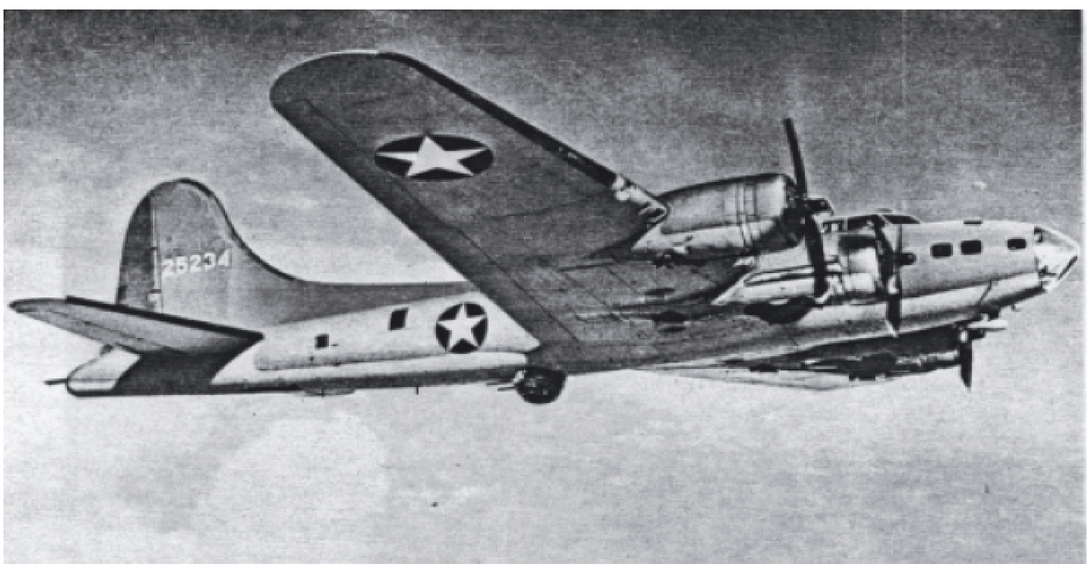
The new B-17G, seventh major revision of the Flying Fortress, is now in operation at many bases in the continental United States. It incorporates a number of new features which have been developed as a result of the B-17's extensive combat experience.



THE FIRST B-17B left Seattle August, 1939, arrived in New York 9 hours, 14 minutes later, setting a new coast-to-coast non-stop record. Later, seven B-17B's cruised the hemisphere for the 50th anniversary of the Republic of Brazil.



THE B-17D SAW ACTION FIRST: When the Japs struck, Fortresses of the C and D series gained experience that later made the B-17 the "guts and backbone of our worldwide aerial offense." B-17E was first wartime model.



THE B-17F FULFILLED THE PROMISE: With over 400 major changes – producing greater speed, range, bomb load, firepower, crew protection – new Forts swept the Pacific and the heart of Europe, raised the curtain on D-Day.

"Rugged Forts Make History"

Pilot points proudly to battle-scarred Fortress—calls it "series of holes held together by ragged metal."

The combat record of the Flying Fortress has been written daily in newspaper headlines since Dec. 7, 1941.

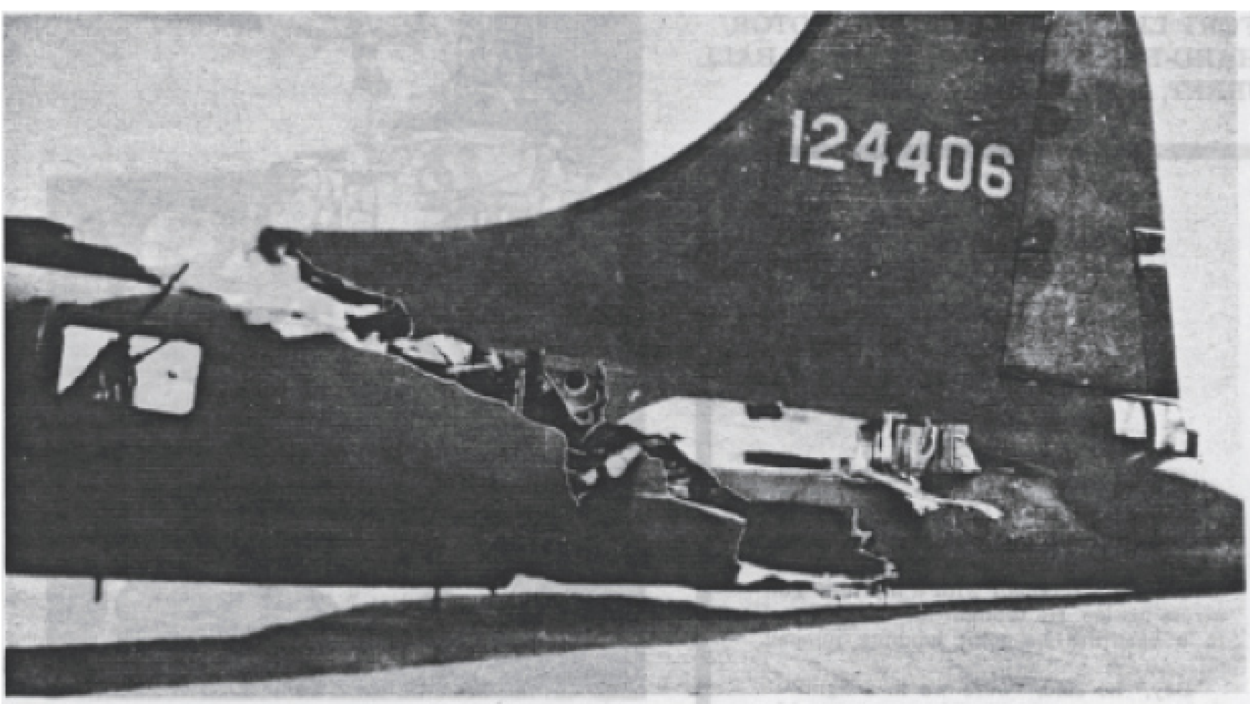
From the hour of Pearl Harbor, through the dark, early months of the war in the Pacific, they were sinking Japanese ships and shooting arrogant Zeros out of the skies.

They carried the war to the enemy in the Coral Sea, over Guadalcanal, New Guinea, Java, Burma, and the Bismarck Sea.

Changing tactics, they hedgehopped volcanic peaks, flew practically at water level through unbroken fog, to bomb the Japs out of the Aleutians.

They flew the blistering deserts to drive the enemy out of North Africa, the Mediterranean, Sicily, and open the way to Rome.

Beginning in August, 1942, they brought



Doomed ME 109 plowed into this Flying Fortress over Tunisia, cutting fuselage nearly in half, entirely removing one elevator. Pilot nursed the airplane home to British base, brought it in for a perfect landing.

daylight bombing to Hitler's Europe, first over strategic targets in Occupied France, then gradually spreading out over the continent until, in the spring of 1944, shuttle bombing from bases in Britain and Russia left no corner of the once haughty Festung Europe safe from concentrated Allied bombing attacks.

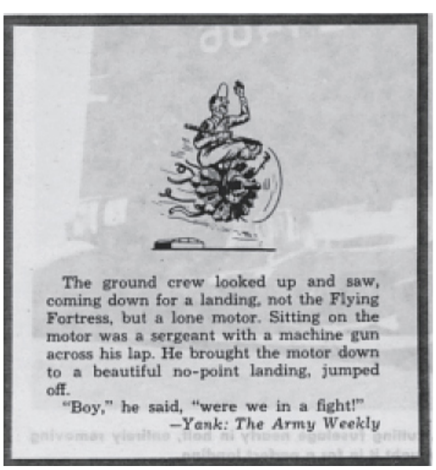
Switching for the moment from strategic to tactical missions, they helped seal off the Normandy peninsula from effective enemy counter-attack and make the miracle of D-Day possible. They blasted a path out of the narrow beachheads for the hard-hitting ground forces to crash their way through into Hitler's inner fortress. Then back again to their relentless job of crushing German war industry.

Detailed Fortress history must remain a voluminous post-war job for military historians. For pilots, however, one important fact stands clear-cut now. The Flying Fortress is a rugged airplane.

In the words of one veteran: "She'll not only get you to the target and do the job, but she'll fight her way out, take terrific punishment, and get you safely home."

Headlines have reiterated that fact with heart-warning redundancy:

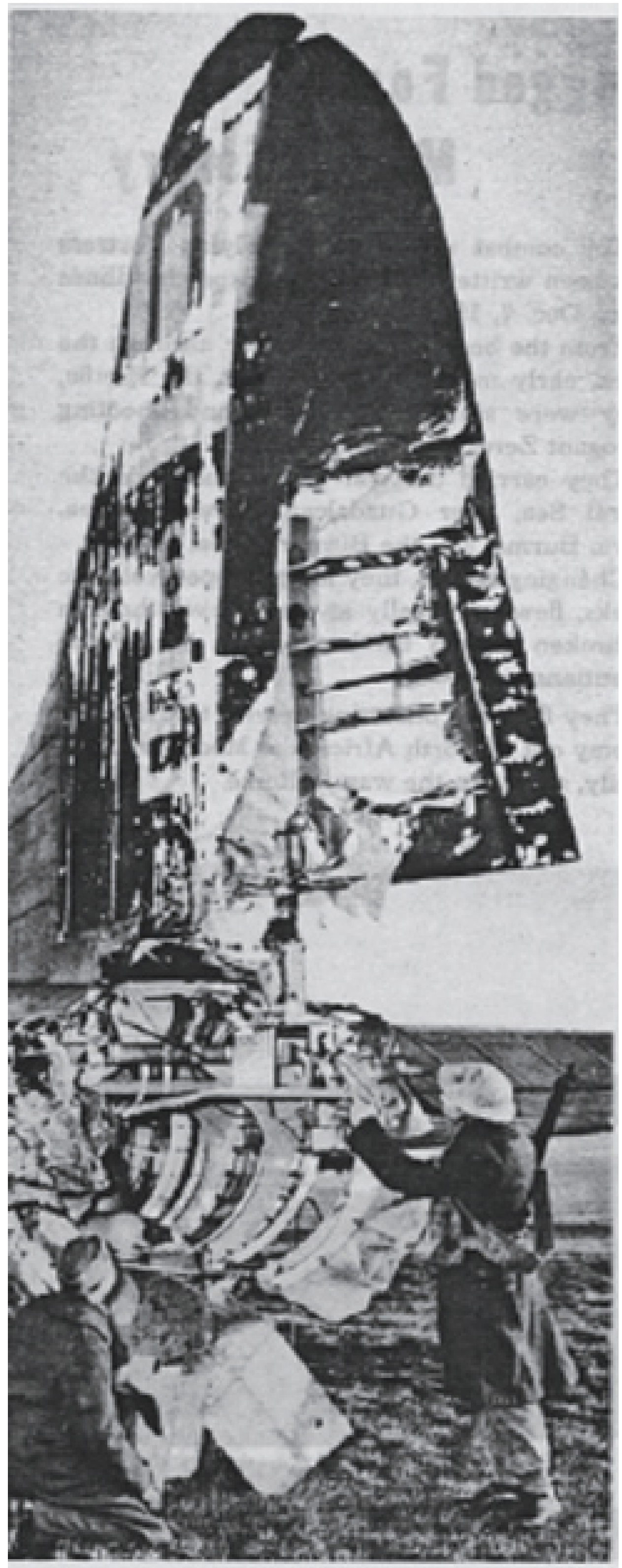
40 NAZIS RIDDLE FORT, BUT FAIL TO DO IT IN.



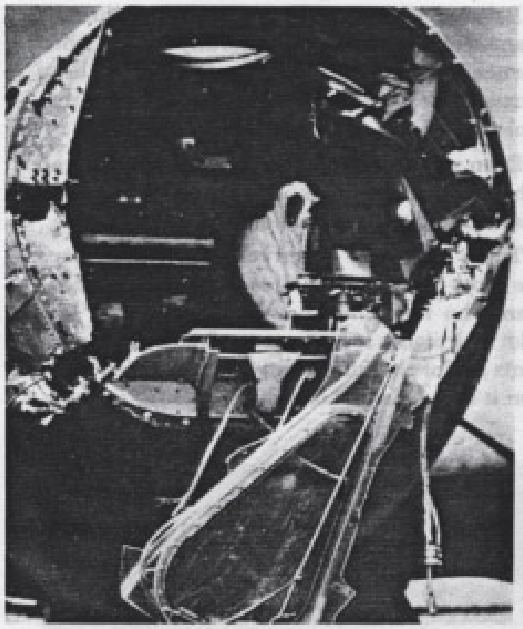
The ground crew looked up and saw, coming down for a landing, not the Flying Fortress, but a lone motor. Sitting on the motor was a sergeant with a machine gun across his lap. He brought the motor down to a beautiful no-point landing, jumped off.

"Boy," he said, "were we in a fight!"

—*Yank: The Army Weekly*

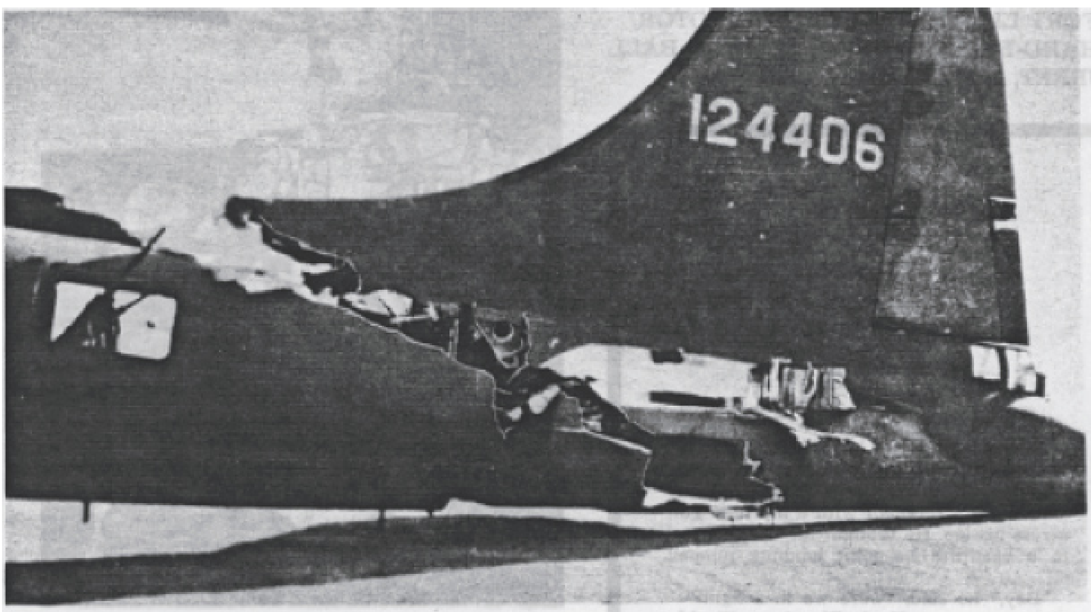


With only ragged pieces of tail left, this Fortress, believed wrecked in enemy territory, limped home.



Swarms of FW 190's shot out plexiglas nose, killed navigator, wounded entire crew. Pilot brought in airplane safely despite loss of flaps, hydraulic system.

Gaping flak and shell holes, received while bombing Nazi aircraft factories, failed to prevent "F for Frenesi" from returning safely with three wounded gunners.



Doomed ME 109 plowed into this Flying Fortress over Tunisia, cutting fuselage nearly in half, entirely removing one elevator. Pilot nursed the airplane home to British base, brought it in for a perfect landing.

LAME FORTRESS BAGS 6 GERMANS, MAKES HOME BASE.

FORT FALLS 10,000', BUT COMPLETES RAID.

HARD-HIT FORT CUTS LOOSE BALL TURRET, GETS HOME.

B-17, SPLIT IN TWO, LANDS SAFELY.

FORT LIMPS HOME ON ONE MOTOR.

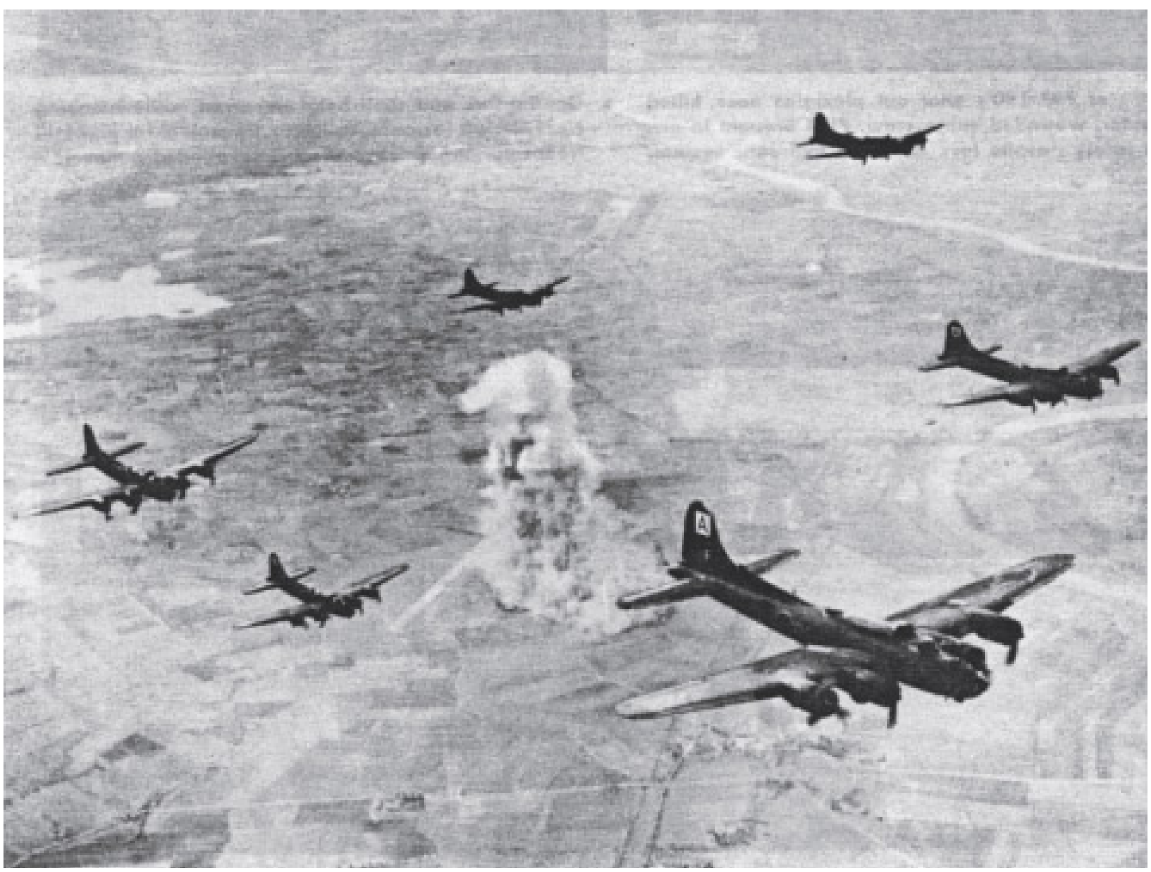
The B-l7's incredible capacity to take it - to come flying home on three, two, even one engine, sieve-like with flak and bullet holes, with large sections of wing or tail surfaces shot away - has been so widely publicized that U. S. fighting men could afford to joke about it. But the fact remains, the rugged Forts can take it and still fly home! Why?

The B-17 is built for battle. Its wings are constructed with heavy truss-type spars which tend to localize damage by enemy fire so that basic wing strength is not affected.

Because of its unusual tail design, the airplane can be flown successfully even when vertical or horizontal tail surfaces have been partially destroyed, or with one or more engines shot away.

Even when battle damage prevents use of all other control methods, the autopilot provides near-normal maneuverability.

There are many other reasons. But perhaps the most important of all is the fact that every man who flies one knows that the B-17 is a pilot's airplane. It inspires confidence and warrants it. For the fulfillment of its intended function it demands just one thing; pilot know-how.



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"Aluminum Overcast"

THE STORY OF THE B-17 IN PEACETIME

A COMPLETE HISTORY OF The EAA'S B-17 G, "ALUMUNUM OVERCAST"

The B-17 is undoubtedly one of the most easily recognized World War II aircraft. The initial B-17 was the Boeing Model 299 prototype, first flown on July 28, 1935. This was in response to a military request for a new multi-engine long range bomber. Although the prototype crashed on a test flight, it would subsequently become the work horse of the Eighth Air Force in the daylight precision bombing of Europe during World War II. Records show a total of 12,731 B-17s being built by the Boeing, Douglas and Vega factories. This aircraft, USAAF #44-85740, was built under license in 1945 by the Vega Aircraft Co. (later Lockheed Aircraft Co. and presently Lockheed Martin Aeronautics Co.) as a B-17G-05-VE. It was delivered in May of 1945 at the close of hostilities in Europe, thus too late to see combat in WW II. By this time the bombing missions against Japan had been taken over by the Boeing B-29s so there was little military use for the B-17s. The airplane was therefore, first sent to the modification center in Louisville, Kentucky and then to the Syracuse, New York storage depot in June of 1945. Along with approximately 250 other Fortresses, the aircraft was stored on Runway 6/24 until October of 1945. It was then declared surplus and transferred to the Altus, Oklahoma storage depot in November of 1945.

Most of the surplus B-17's were "war weary" and were quickly converted into aircraft were cut up and melted in our haste to convert swords to plow shares. Of the 12,731 Fortresses built before and during WW II, only a few survived the wrecker's axe. Fortunately, 44-55140 narrowly escaped this ignominious end to its existence!

In June of 1947 the aircraft was purchased from the War Assets Administration for $750 by Pat Brandenberg of Amarillo, Texas under the name of Metal Products Co. It was assigned a civilian registration of NC-5017N, which was actually incorrect since it carried no ex-military operating limitations. The B-17 needed to be licensed in the limited category and the error was soon corrected.

The aircraft was sold to Universal Aviation Co. of Tulsa, Oklahoma for $1800 in July at 1947. The corrected registration number, NL-5017N was received on August 11, 1947. In the meantime the aircraft had been sold again on August 2, 1947 to Charles Winters of Miami, Florida. He also purchased two other B-17's, allegedly to start an island hopping freightline in the Caribbean.

The other two aircraft were smuggled out of the United States to Israel for use in the Palestine War by the Jewish underground organization, Hagannah.

Two years later Mr. Winters was convicted and sent to prison for eighteen months, allegedly because of his association with this underground group.

NL-5017N was, however purchased on August 16, 1947 by Joe Lopes, a native of Puerto Rico, who owned Vero Beach Export and Import Co. in Florida. The purchase price at this time was $3500. The Fortress was delivered by a ferry crew to Melbourne, Florida from Oklahoma.

Thomas Cobb, Mr. Lopez's pilot, delivered the aircraft to the Eighth Air Depot for cargo conversion on October 1, 1947. The Eighth Air Depot was a modification and service center located at the former Army Air Corps Flying School, Hendricks Field, Sebring, Florida. Many other B-17s had preceded NL-5017N to Hendricks Field as it was a training school for B17 first pilots. The first Fortress arrived at the school on January 29, 1942 and training continued there throughout WWII. Colonel Harold D. (Hal) Weekley, whose name will become germane to this story later, underwent training there prior to his combat crew training at Dalhart, Texas. From there he was sent overseas. Hundreds of other B-17 pilots, who ultimately ended up in the European or North African theater of operations, were trained at Hendricks Field.

The cargo conversion consisted of the addition of a cargo floor extending from the bomb bay bulkhead to the tail. The radio room bulkhead was also removed and tie down straps were added. Cost for the conversion was $11,000. Total time on the air frame was then less than forty hours.

Mr. Lopez operated a cattle ranch in Florida and began hauling beef from Florida to Puerto Rico in December of 1947. The Fortress would haul approximately 15,000 pounds of dressed beef to Puerto Rico and then return the next day with a cargo of cowhides.

Apparently the Fortress performed quite well, requiring only routine maintenance over the next few years. The activities during 1948 and 1949 included the shipment of baby chicks from Miami, Florida to South America.

On June 27, 1949 the aircraft was purchased by Aero Services Corporation of Philadelphia, Pennsylvania for $28,000. It was converted into a high altitude camera and survey aircraft at the Mercer County Airport Maintenance Facility in New Jersey in June of 1949. Following this conversion it was operated as a photographic aircraft, primarily in the Middle East, until May of 1953. In 1949 the CAA (Civil Aeronautics Administration) deleted the inclusion of the aircraft's category in the registration number and so, on June 29, 1949 the new registration became N-5017N.

After four years of high altitude work the aircraft required heavy maintenance. It was, therefore, returned to the Mercer County Airport for an extensive overhaul. In June of 1953 the wings were removed, control surfaces replaced, new fuel tanks installed, rewiring accomplished, new radios, engines, and autopilot were installed. Almost all the instruments, hydraulic systems and oxygen systems were replaced. It was returned to service in September of 1953.

The aircraft then continued with the duties for which it had been converted. Initially this was in Libya and then to Thailand for several months of far east service. It then returned to Libya, then to Italy and later to Egypt.

Her service record was exemplary. During September and October of 1955 the Fortress flew forty four consecutive double shift days photo mapping more than 150,000 square miles. During one month in 1957 64,000 square miles of high attitude photography was accomplished. Overhaul was carried out in Lebanon and the aircraft returned to service. The Fortress was owned by Aero Services Corporation for twelve years. During that time it flew almost one million miles, a distance sufficient to circle the globe more than thirty five times. Most of the flying was above 30,000 feet. In addition to the Middle East coverage, the aircraft provided high altitude photography of Laos, Cambodia and Vietnam, all of which would come in handy a few years later.

In 1962 the aircraft was sold to Chris D. Stoltzfus and Associates of Coatesville, Pennsylvania. The aircraft remained in outside storage there for several years.

Mr. Stoltzfus sold the Fortress on December 16, 1966 to Hugh Wheeless, Sr, of Dothan, Alabama, The aircraft was modified for aerial spraying duties by converting the bomb bay and radio room into a large hopper and placing spray tubes under the full span of the wing. Augers were used to transfer the material from the fuselage out to the wing. The aircraft worked under a contract with the government, primarily in the fire ant control program in the southeast. The material being sprayed was a pesticide called Mirex which was embedded in corn meal. Later, the choice of pesticide and carrier turned out to be a matter of serendipity. Wheeless Aviation had three B-17's in this program. One caught on fire in flight but was partially saved due to the thinking of the crew in quickly accomplishing a belly landing. The other two were retired from service in approximately 1975 when the fire ant control program was discontinued, apparently due to environmental concerns.

The aircraft again languished for several years behind the hangar at a private airport in Dothan, Alabama. By this time the interest in restoring and flying warbird type aircraft had significantly increased. The two B-17s sitting out behind the hangar, however, had been used for spraying and there was a natural assumption they would have been extensively corroded by the pesticide. Fortuitously, a friend of Bill Harrison of Tulsa, Oklahoma stopped in Dothan for fuel and used the opportunity to look at the two B-17's. He reported that, to his untrained eye, there was no significant corrosion. Tony Guirreri, a mechanic who had been actively involved in the warbird movement for several years and was quite knowledgeable, was then asked to go over from his Atlanta home to carefully inspect the B-17's condition. He reported that there was absolutely no corrosion. It appeared that the Mirex was non-corrosive and the corn meal or cotton seed mush actually oiled the interior of the aircraft. In fact, for many years, every time the aircraft would land it would require vacuuming to remove particles of the sprayed material.

The aircraft was purchased by Bill Harrison on November 20, 1978. At that time the air frame had flown 6,051 hours. A group of warbird enthusiasts became involved in the aircraft in May of 1979 and changed the ownership title to the Oklahoma based "B-17 Around the World, Inc." The intent was to restore the aircraft and then fly it around the world as an example of our aviation heritage.

In the spring of 1979 the aircraft was relicensed and prepared for flight. Initially the aircraft was taken from Dothan to Griffin, Georgia. While in Griffin, maintenance was continued by Guirreri, without whose help the project could never have been accomplished. The aircraft was considered a heavy aircraft under FAA regulations, thereby requiring a type rating for the pilots. Since there were no current FAA inspectors for the B-17, the Atlanta FAA region assigned the testing to one Hal Weekley. Weekley, by that time retired from his USAF service and employed by the Federal Aviation Administration as an Air Carrier Inspector in Atlanta, was about to be reunited with his favorite airplane. This began a close man-machine association which has lasted since that time for Weekley. The initial flight training was conducted by Buddy Jordan, who had flown for Wheeless Aviation. After a short period of instruction, the flight tests for type ratings for Hal Weekley and Bill Harrison were accomplished in the spring of 1979.

The first appearance of the partially restored aircraft was at the Miami Air Races in Homestead, Florida during the spring of 1979. Only a minimum of restoration work had been done at that time. The aircraft had been painted with generic markings, deliberately representing all B-17's rather than any particular B-17. While at the air races, the aircraft flew around the race course a couple of times but obviously was not competition for the P-51s which had provided escort service during its operational career.

It was during the trip to Florida that the aircraft received its sobriquet, "Aluminum Overcast". While flying with a gaggle of P-51s, one Mustang pilot commented that flying under the B-17 was like "flying in the shade", much as if he were under an aluminum overcast. This seemed to be an appropriate title and therefore, the aircraft was named "Aluminum Overcast". It still carries this name.

The intention of this group of six pilots who owned the aircraft, Tom Camp, George Enhorning, Bill Harrison, Max Hoffman, Al Shirkey and Scott Smith, had been to conduct an around-the-world flight. However, fate stepped in and prevented this goal from being accomplished. The Middle East became highly volatile in 1979 and 1980 and it soon became readily apparent that the dream was no longer feasible. Fuel costs had exponentially increased and the group's enthusiasm could not overcome a realistic financial evaluation.

Therefore this group of six people donated the aircraft to the Experimental Aircraft Association on March 31, 1981 with the hope that restoration of the aircraft could be completed and that the aircraft be maintained and flown for many years into the future. During the ensuing seven or eight years. the aircraft represented the Experimental Aircraft Association at various air shows throughout the country. Some limited restoration was accomplished - but the aircraft needed a complete restoration. In 1989 through the efforts of Colonel Weekley, the 398th Bomb Group, of which he was a member, adopted "Aluminum Overcast". At the request of the 398th and at their expense, the aircraft was painted in June of 1989 in the exact colors and markings of the aircraft flown by Colonel Weekley in combat over Europe. The colors and markings of this aircraft now represent #42-102516, marked 30H, which was shot down by enemy fire and from which Colonel Weekley and his entire crew safely parachuted. Most of the crew were captured. However, Colonel Weekley was aided by the resistance. After several months of hiding and acting as a deaf mute, he was returned to Allied lines, an incredible story in itself.

After being painted the aircraft returned to Oshkosh and resumed a limited schedule of air show appearances, as well as being available for viewing in the newly constructed Eagle hangar at the Air Adventure Museum. In response to many requests, the aircraft underwent a major restoration in 1993/1994.

A nationwide tour schedule began in 1994 to give our children, grandchildren and great-grandchildren a rare chance to see, hear and smell this legendary aircraft. During these past years on tour the aircraft has provided an unparalleled opportunity for those wishing to experience a B-17 "up close and personal". Members of EAA receive a discount on the cost of a flight experience. In addition, if an EAA member joins or renews their membership on-site, they receive a free ground tour of the B-17.

The aircraft's first trip on tour was in the spring of 1994, flying from Oshkosh to Indianapolis. Little did we know what was in store for us. On that first trip we had the pleasure of the accompaniment of James Smith of Naples, Florida, a B-17 pilot in WW II, along with his two sons. The tears and emotions shared by Jim Smith with the flight crew set the stage for the happenings and emotions encountered on tour since that time.

Approximately 1,000 people per year are joining EAA as a direct result of the EAA B-17 tour program. The stories we have heard on tour are unbelievable.
For many it has been a return to a period of their lives when the United States was fighting for preservation of freedom and democracy. These men, along with their families and the people at home who supported the war effort, were vital links in the chain of success which lead to our victory in WW II. Although waist lines have expanded, the hair has thinned, some even experience great difficulty in entering the aircraft, but the eyes never fail to sparkle when the aircraft is boarded and moisten when they sit in the left seat.

One can only imagine their thoughts and feelings as they return to a time long ago when they were young! It is hard for us today to imagine entering a situation which required at least 25 combat missions to return to the United States and, at the same time, was experiencing a 5 to 10 percent loss rate every mission. It doesn't require a mathematical genius to realize that the odds of survival were slim. The courage to sit there at extremely high altitude, freezing at 50 degrees below zero, having people shoot at you from above, below and on all sides must be absolutely terrifying.

The men who performed this service to our country and for all those of us who have come after must never be forgotten. The current crewmembers of "Aluminum Overcast" stand in awe and admiration of each of these heroes. It is an honor and privilege for us to maintain the B-17's heritage and to share this incredible experience with the men, women, and children who come to see the aircraft. It is our fervent hope that we can maintain this aircraft in operational condition and continue our display of this unique aeronautical machine for many years to come.

This manual, as well as the aircraft itself, is respectfully dedicated to the memories of not only the aircrews and ground crews who served during World War II but to all men and women who have responded to our country's call, thereby allowing us to maintain the freedoms which we cherish so dearly.

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AIRCRAFT SPECIFICATIONS

Type Certificate Data Sheet # LTC-1 *(Limited Type Certificate #1)*

Revision Number: 3
Revision Date: 12/02/1946
Responsible Office ANM-100S Seattle Aircraft Certification Office

SPECIFICATION NUMBER: L-1-3

MODELS: Boeing (Army) B-17F, B-17G (Approved 12/2/46)

(Eligible for Certification in Limited Category Only)

(Holder of Limited Type Certificate: Transcontinental and Western Air, Inc., Washington, D.C.)

Engines	4 Wright Cyclones R1820-97
Fuel	100 minimum octane (CFR) aviation grade gasoline
Engine limits	Maximum, except take-off (low blower plus turbo), 39.5 in. Hg., 2300 rpm (1000 hp) (sea level to 25,000 ft.) Take-off (five minutes), 41 in. Hg., 2500 rpm
Propellers	1. Hamilton Standard 23E50 hub, 6153A-18 blades (for interchangeable blades see Aircraft Propeller Specification No. 603, NOTE 6). and Governor 4K11, or 2. Hamilton Standard 23E50 hub, 6477A-0 blades (for interchangeable blades see Aircraft Propeller Specification No. 603, NOTE 6), and Governor 4G8.
Airspeed limits	Level flight or climb - 225 mph True Ind. Glide or dive - 274 mph True Ind.
Gear operation	180 mph True Ind. (150 mph EAA limit)
Flap operation	140 mph True Ind. (140 mph EAA limit)

Maximum weight	59,000 lbs. (See NOTE 6)
C.G. range	20 percent MAC to 32 percent MAC
Datum	Leading edge wing at root chord (196.16 in. from nose section)
MAC	177.5 in. L.E. MAC (+ 30.3)

Other operating limitations: Army T.O. No. AN01-20EF-1 (Model B-17F); AN01-20EG-1 (Model B-17G) (See NOTE 2)

Certification basis Production basis Export eligibility	Limited Type Certificate No. 1 (CAR 9 effective 11/21/46) None may be produced under this approval Not eligible for a Certificate of Airworthiness for export.
EQUIPMENT:	No equipment other than engines and propellers are specified. However, the equipment required by Civil Air Regulations Part 43.30 for NC aircraft for the proper operation of the aircraft must be installed. In addition, the aircraft may incorporate such military equipment

(except armament) as was originally incorporated in the type for military or naval service. Additional equipment may be installed when it is substantiated that it presents no hazard to safety.

NOTE 1. Weight and Balance Report including list of equipment included in the certificated empty weight must be obtained for each aircraft. Army or Navy weight records, when available and in reasonably current condition, may be submitted in lieu of an actual weight. The equipment list need include no more than the following:
(a) Required equipment as defined under "EQUIPMENT" above.
(b) Additional items as may be reasonably considered removable and are so located or of such weight that their removal or addition could noticeably affect the weight and balance of the aircraft. Items built into the aircraft structure need not be listed. The equipment list must be prepared by the applicant for the approval of the certificating C.A.A. representative and in such form that it can be attached to the C.A.A. Operation Limitations.

NOTE 2. The following statement must appear on the Operation Limitations: "This airplane must be operated at all times within the limitations set forth in T.O. AN01-EF-1 (for Model B-17F) or T.O. AN01-EG-1 (for Model B-17G) except in cases of maximum loadings and airspeed limits in which cases the values given in Aircraft Specification No. AL-1 must be observed. A copy of the T.O. and the aircraft specification must be carried in the aircraft during flight." In all cases it will be the responsibility of the applicant to secure a copy of the correct T.O. The C.A.A. does not have these documents available for distribution.

NOTE 3. All structural repairs should be made in accordance with Army T.O. No. 01-20E-3. If any repairs or modifications (other than those covered in the pertinent Army or Navy repair manual) are made prior to or subsequent to NL certification, it is the responsibility of the owner to furnish sufficient evidence to a Civil Aeronautics Administration representative to show that the modified airplane maintains the same degree of airworthiness as the original. The C.A.A. can give no technical assistance on such matters since complete structural data for NL aircraft are not required by Part 9 and therefore are not available in the C.A.A.

NOTE 4. The following placard should be prominently displayed in the passenger compartment: "This is a military type aircraft and under the Civil Air Regulations shall not be used for the carriage of passengers or cargo for compensation or hire."

NOTE 5. Deleted.

NOTE 6. Eligible for 59,000 pounds with outer wing tanks filled (Tokyo tanks). With outer wing tanks empty maximum weight limited to 54,000 pounds. with outer wing tanks partially filled use a straight line variation of weight between 54,000 and 59,000 pounds.

NOTE 7. For certification for night flying the following must be accomplished:

(a) Replace the wing position lights with certificated units or satisfactorily modify the lights if pertinent. (Type A-9 wing position lights (AN-3033-5 through -8) may be satisfactorily modified by painting the inside of the frosted cover black. Type A-9 (AN-3033-1 through -4) are satisfactory without modification.

(b) Replace the tail light with a certificated unit.

(c) If "Bright and Dim" conditions are provided for the position lights, either the resistors should be disconnected from the circuits and a single-pole-single-throw switch should be used to replace the two single-pole-double-throw switches presently installed for wing-tip and tail lights, or the switches should be placarded to indicate that only the "bright condition" should be used. In either case the tail light and wing-tip lights should operate on one switch.

No original NL airworthiness certificates may be issued after 9/31/48. The list of mandatory changes required prior to original certification may be obtained from CAA Aircraft Service, Washington, D.C. Attn: A-298.

Limitations:

Engine Limits	
Take-off	41 in. Hg., 2500 rpm (limited to 5 minutes)
METO	39.5 in. Hg., 2300 rpm (1000 hp) sea level to 25,000 ft.
Climb Power	35 in. Hg. 2300 rpm
Quiet Climb	31 in Hg. 2100 rpm – Auto lean permissible
Mixture	Auto Rich above 2100 RPM and/or 31 in. Hg.
Engine Instruments	
MAP	Red radial 41 in. Hg. (5 min.), Green arc 28 to 34 in. Hg.
RPM	Red radial 2500 rpm, Green arc 1600 to 2000 rpm
Oil Temperature	Red radial 105°C, Green Arc 60 to 80°C Company policy min 40C before exceeding 1200 RPM
Oil Pressure	Red radials 55 and 85 psi, Green arc 65-75 psi
Cyl Head Temp	Red radial 260°C, Green arc 110 to 205°C
Fuel Press	Green arc 12 to 16 psi
Carb Air Temp	Red radial +70°C Green arc 15 to 35°C
Max Mag drop	100 rpm
Hydraulic System	
Pressure	Red radials 580 and 950 psi Green arc 580 to 830 psi Yellow arc 830 to 950 psi
Emergency Brakes	
Air Pressure	Red radial 1500 psi, Green arc 900 to 1500 psi
Airspeed	
Level flight or climb	225 mph True Ind.
Glide or dive	274 mph True Ind.
Gear operation	180 mph True Ind. (150 mph EAA limit)
Flap operation	147 mph True Ind. (140 mph EAA limit)
Maximum Gross weight	54,000 lbs (Tokyo tanks removed)
CG Range	20 % MAC to 32% MAC

Further operational limitations contained in EAA Aircraft Operations Manual.

Reference Information - EAA's B-17 N 5017N

V speeds (all in MPH)

- Max Normal Operation - 225
- Max Gear Operation – 150 (EAA limit) 180 max for emergency ops
- Max Flap operating and extended - 140
- Recommended Minimum Climb – 120
- Recommended Final Approach – 110-115

EAA crosswind limit – 15 knots (steady state)

Weights

- Max Gross Weight – 54,000 lbs
- AC Empty Weight – 34, 525 lbs (as of 03-2008)
- Typical Tour Flight Weight – 42,750 lbs
- Percent MAC Limits 20% - 32% CG range

Tire & Strut Inflation

- Main Gear Tire – 8.75 inches as measured on the inboard rim
- Tail Wheel - 5.25 inches as measured on the left rim
- Main Strut -1.5" – Tail Strut-2..5"

Tail Wheel Lock

- Do not unlock tail wheel above normal taxi speed
- Do not attempt to lock if shimmy is present

Minimum Oil Pressures

- Inflight – 55 PSI
- Idle – 15 PSI

ADC Filter Indications

- Amber bypass light – monitor and assess
- Red chip detection light – monitor and assess
- Both amber and red lights – shut down if conditions permit

Minimum Oil Grade – 25W-60

Oil Consumption Policy – EAA Headquarters requires notification of any individual engine consuming more than 2 gallons per hour

Turbo Oil Tank Quantity and grade – 1.5 gallons and 30W mineral oil

Fuel Tank Transfer Rates

- Battery Voltage – 9 gallons per minute
- System Voltage – 13 gallons per minute

Auto Lean Mixture Setting Limitations

- 31 inches MP & 2100 RPM (Quiet Climb)
- In the process of troubleshooting (rough running engine on ground or in flight) you may lean farther than auto lean momentarily if at a cruise power setting or lower.

AIRCRAFT STRUCTURE

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AIRCRAFT STRUCTURE:

FUSELAGE COMPARTMENTS:

NOSE SECTION:

• The entrance to this compartment is through the crawlway from the pilot's station. This station was the combat location for the bombardier and naviga-tor.

• On the left side of the crawlway is the front entrance door. Do not use this door while engines are running. It is latched by a beveled latch and handle. It also has a hinged metal guard to prevent a person from falling through this hatch in flight. This guard should be lowered over the door during flight operations. This door has an red emergency jettison handle, pulling it will withdraw the hinge pins and allow the door to fall away.

• The emergency release handle and pins should be checked during the pre-flight inspection to ensure they are properly installed with the small locking tab holding each pin in place.

• The EAA prohibits occupancy of this station during takeoffs and landings, due to the lack of exits.

PILOT'S COMPARTMENT:

• Between the nose section and the bomb bay is the flight deck, which is also referred to as the pilot's compartment. The elevated portion of this compartment contains the pilot's and co-pilot's seats with all the essential flight and engine controls, instruments and navigational equipment.

• It also had the Sperry power turret with twin .50 caliber machine guns installed overhead in the combat airplane.

• Two passenger seats are also located in this compartment. Located on the back of each pilot's seat structure, they face aft and can be folded out of the way when not in use. The seat belt is then used to hold the seats in the folded position.

• Several components of the hydraulic system are also located on the aft wall and the right side of this compartment.

• The main fuse panel (fuse station #4) of the electrical system is on the aft wall of this compartment on the airplane's left side.

• A storage compartment for various pieces of ship's equipment or flight crew personal items is located over the entrance to the bomb bay near the roof of this compartment.

• Emergency equipment – See Page 87.

BOMB BAY:

• The bomb bay is immediately aft of the pilot's compartment. Guards are installed on either side to facilitate movement through this area. The doors are operated by a switch located on the center console.

RADIO COMPARTMENT:

• The radio compartment is immediately aft of the bomb bay. It is reached from the cockpit by use of a catwalk through the center of the bomb bay. Several pieces of authentic radio gear are installed in this compartment, duplicating the installation on a combat aircraft.

• Seats for 3 occupants are installed. Each seat is fitted with an intercom jack.

• There is an emergency exit hatch. Four handles secure this hatch (preflight check).

If the hatch is removed prior to flight, it should be stowed and secured (with bungees)

• There is a large storage area beneath the floor of this compartment. The Flap Emergency Extension mechanism is located in the forward part of this storage area.

BALL TURRET:

• In the floor of the waist section, immediately aft of the bomb bay, is the Sperry ball-type power turret equipped with twin .50 caliber machine guns. This turret can be entered from the interior of the airplane after airborne. The ball turret in this aircraft is fully functional, however, under no circumstances will the Ball Turret be operated in flight.

• Prior to landing the machine guns must be fully raised and centered to the rear. Severe damage to the gun barrels and operating mechanism will occur if this limitation is not observed.

WAIST SECTION:

• The main rear entrance/exit door is located on the right side of the fuselage in this compartment. This exit is latched by a small bevel latch and handle. This door has a red emergency jettison handle, pulling it will withdraw the hinge pins and allow the door to fall away in flight.

• Two flexible .50 caliber machine guns are located at the waist windows in this section. Some early airplanes had windows directly across from each other, later models had their windows slightly staggered (fore to aft) to provide slightly more room for the gunner.

SEAT AND RUDDER PEDAL ADJUSTMENTS:

• The pilots' seats have both height and fore/aft adjustments. A handle is located on the outboard side of each seat.

• Moving this handle forward releases locking pins, permitting an adjustment of approximately 2" fore and aft. Adjust the seat as preferred, then release the handle to allow the locking pin to engage in one of the three available holes. "Wiggle" the seat to make sure that the seat is properly locked.

• Moving the same handle to the rear permits the seat to be adjusted for height. A total range of approximately 5" is available. Taking our weight off the seat allows a bungee cord to assist in this action. Release the handle to the mid position when at the correct height, then "wiggle" the seat slightly to make sure that it is locked in the new position.

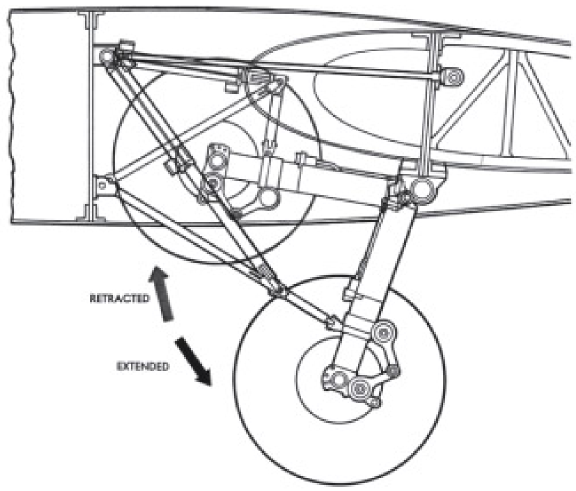
• The rudder pedals are adjustable over a distance of approximately 4" with 5 separate detents. To adjust them, first push the small metal clip at the side of each pedal outwards to release the spring loaded locking pin. Move the pedal to the setting desired and release toe pressure on the pin, allowing it to engage a detent. At the conclusion of this, engage the rudder control lock handle to ensure the rudder is in a neutral position, then check that both rudder pedals are equal.

FLIGHT CONTROL LOCKS:

• A lever immediately to the right of the pilot on the cockpit floor provides a method of locking both the elevator and rudder. To lock these controls, raise the handle to approximately a 45° angle and allow it to snap into the detent. At the same time, center the rudder and elevator controls until they both engage. Gently actuate both controls or "wiggle" them to ensure complete locking of both surfaces.

• To release the controls, slightly raise the lever while at the same time depressing the button on the end. Lower the lever to the floorboard and feel that the button has engaged the down detent as it is clipped flat.

• To lock the aileron controls, remove the control lock from its clip on the rear of the control column. Move the ailerons slightly to one side and insert the plunger into its hole in the post. Depress it against the spring and then place the aileron wheel center in its notch and release pressure.



MAIN GEAR

LANDING GEAR:

GENERAL:

The B-17 has a retractable landing gear of early design. All three gear are retractable. The normal means of retraction/extension is electrical with a hand crank system as a backup. The tail wheel is provided with a cockpit operated lock in the center position. Once unlocked it is full swiveling. The controls and operation are discussed below.

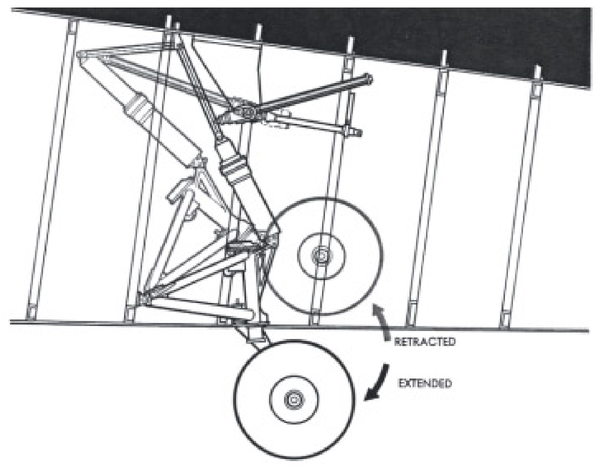
MAIN GEAR:

• The inboard nacelles each have an oleo strut with a main wheel attached. The main wheel is a split half type, the same as used on the B-29. The main tire is a 56" SC. Red slippage marks are painted on each rim and tire to indicate if slippage, with resultant inner tube stem damage, has occurred. Tire inflation is determined by use of a measurement gauge, carried aboard the aircraft.

• The oleo strut is filled with a combination of MIL SPEC 5606 hydraulic fluid and nitrogen to a level prescribed by the military maintenance manual. These struts must not be overfilled or shock absorbing capability is impaired. Conversely, a flat strut with metal to metal contact results in no ability to cushion a shock.

• A retraction system is installed on each inboard nacelle's firewall. This system consists of a DC electrical motor, gearbox and clutch assembly. The reversible motor drives an acme threaded screw during the retraction/extension cycle process. Two different manufacturers provided gear motors. They were each rated for different maximum operating speeds (180 and 160 MPH). "Aluminum Overcast" uses the Bendix Eclipse. For this reason the EAA uses a conservative 150 MPH limiting airspeed for gear extension. In an emergency, the gear extension speed is 180 MPH.

• A snubber (rubber belting with metal strips) is attached to the firewall ahead of each main tire to stop tire rotation after retraction and to prevent any tire rotation from occurring during flight.



Tail Wheel

TAIL WHEEL:

• The tail wheel is attached to an oleo strut. The retracting mechanism has been deactivated.

GEAR CONTROLS AND INDICATORS:

• A ground safety "squat switch" is installed on all three oleo struts. However, the tail wheel squat switch is disabled. Therefore, the two Main gear squat switched only, will control the retraction of the main gear. This will disable the electrical circuit from being powered if the landing gear switch is inadvertently placed in the UP position with the aircraft weight on the gear.

• A control switch is located in front of the co-pilot on top of the glare shield. This switch has a partial guard preventing movement to the UP position unless the red spring loaded guard is moved out of the way. The guard doesn't prevent moving it in the opposite direction. The switch has three positions; UP, OFF and DOWN. The switch is normally left in the OFF position, in this position all electrical power is removed from the system.

In the UP position, all three motors are powered for retraction. The main gear will retract provided both "squat switches" are closed.

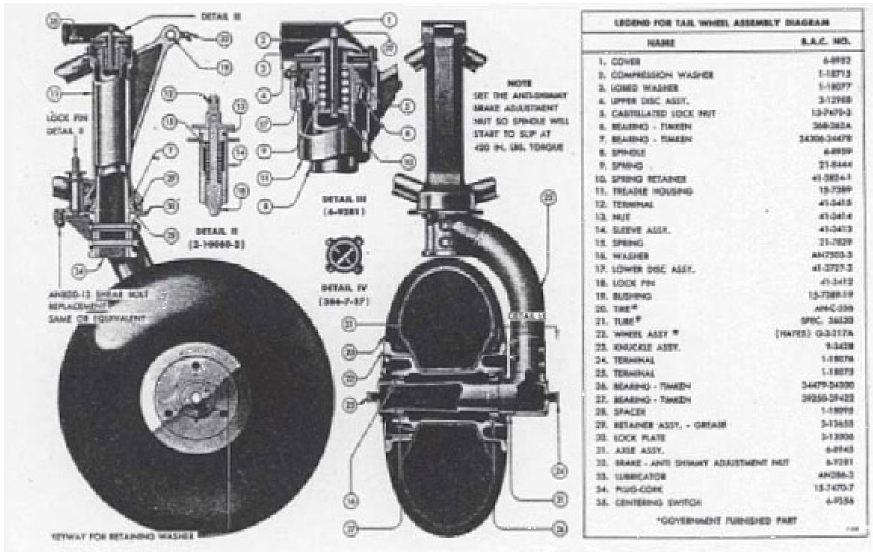
The tail wheel will not retract as it's retraction mechanism has been deactivated.

The gear will continue to operate until power to the individual motor is interrupted by that gear's up limit switch. In the OFF position, all power is removed from the motors. If the gear was in transit it will remain in the position at the time the electrical power was removed.

In the DOWN position, the motors are powered and will begin gear extension, continuing until completed (or stopped by switch) and individual power is interrupted by the applicable down limit switch.

• The gear switch is protected by a 20 amp. fuse, located in fuse station #4.

• When moving the switch do not immediately reverse the switch direction of the operating motor until approximately a ten count. A sudden reversal could sheer the operating mechanism.



TAIL WHEEL LOCKING MECHANISM

• A green GEAR DOWN light is installed on the flight instrument panel. Separate safety switches are located on each landing gear, all three switches must be closed to provide power to illuminate this light. Its brightness may be varied by rotating the lens cap. This light receives its circuit protection through a 15 amp fuse located in fuse station #4.

• Each of the three gear motors is a reversible DC electric motor. The main gear motors have no circuit protective device. The tail wheel motor has a 60 amp circuit breaker at the top of the main junction box.

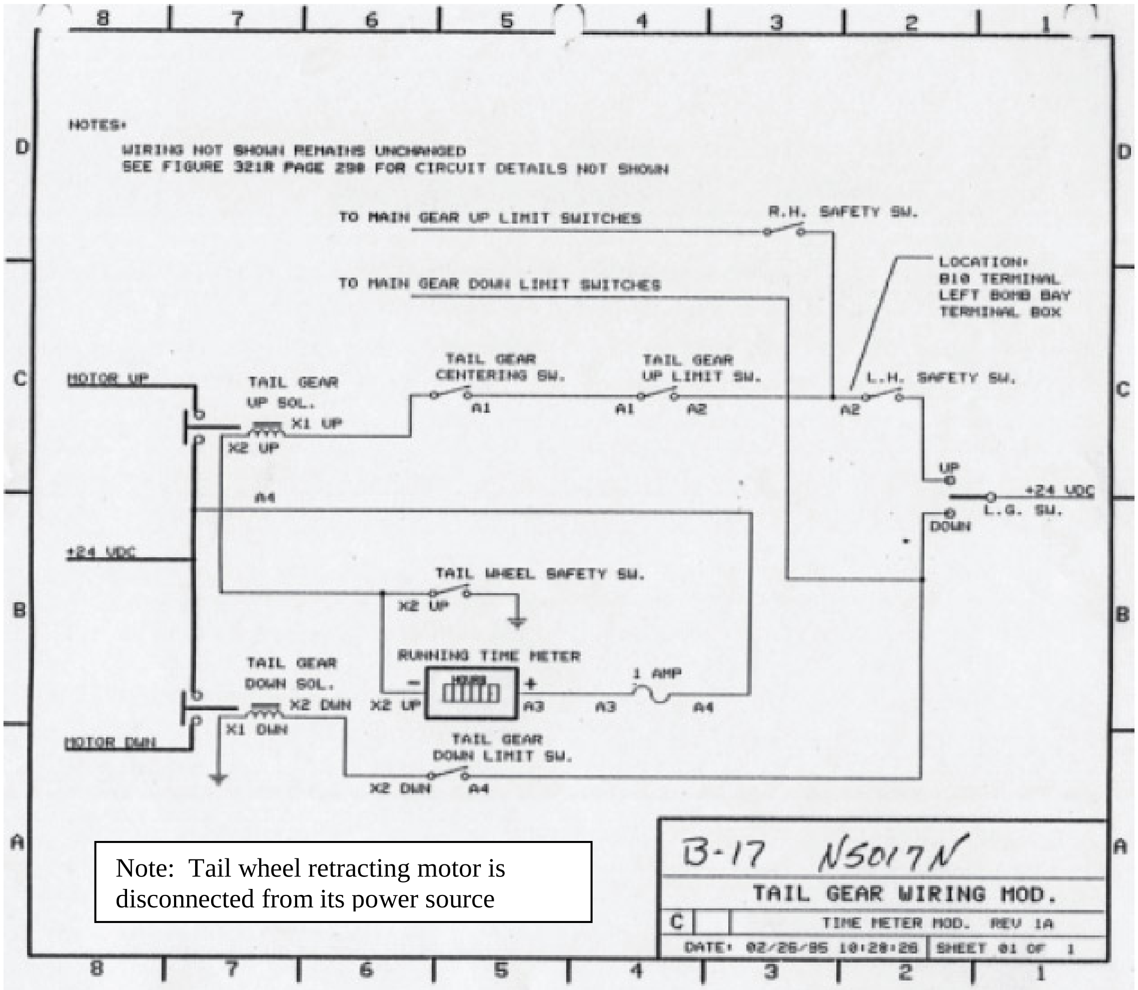
• The tail wheel locking mechanism consists of a lever on the center floor of the cockpit, reachable from either pilot's station. The lowered (LOCKED) position allows a spring loaded pin to insert itself into a recess on the tailwheel strut. If, or when, the tailwheel mechanism is centered the pin locks the tail wheel in the centered position. This action also turns out the warning light on the pilot's center instrument panel. Lifting the lever until reaching the detent (UNLOCKED) will unlock the tail wheel mechanism and cause the warning light to illuminate. If the spring actuated mechanism resists, this can be corrected by briefly "wiggling' the rudder.

• An amber tail wheel locked indicator light is located on the pilot's center instrument panel. This light functions as described in the paragraph above. Its brightness is adjustable by rotating the lens cap.

Intransit Lights – To Be Added

Gear Warning Horn

• A aural gear warning system is NOT installed in this aircraft.



Tail Wheel Warning

This light receives its circuit protection through a 15 amp fuse in fuse station #4.

Emergency extension of the landing gear is accomplished with a hand crank. The crank is kept stowed in the radio room compartment floor. Access to the main gear crank receptacles is on the rear side of the forward bomb bay bulkhead. Certain precautions must be observed in foot placement when standing in the bomb bay to operate this system. Access to the tail wheel crank receptacle is from a location aft of the tail wheel. mechanism. Complete Instructions are contained in the EMERGENCY PROCEDURES section of this manual. Instructions for use are also on a placard at hand crank receptacle.

Wing-Flaps:

General:

The airplane has split flaps under the wing's trailing edges, driven by an electrical motor with a back-up manual crank system. Full extension is 45 degrees.

CONTROLS AND INDICATORS:

The flaps are driven by a DC electric reversible motor, located in the inboard tailing edge of the left wing. This motor is protected by a 60 amp circuit breaker in fuse station #4.

A flap control switch is located on the pilot’s center control pedestal. It is non-guarded and has three positions: UP, OFF and Down.

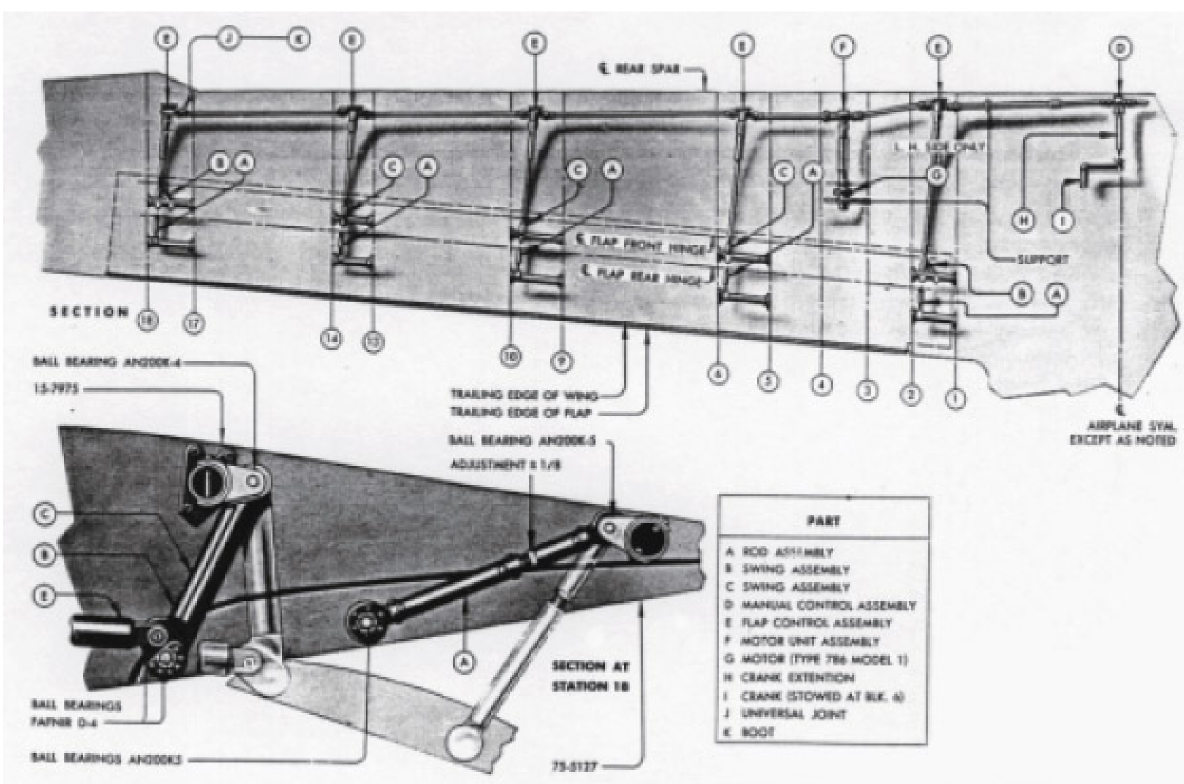
Up position is selected by the pilot. The switch will remain in this position until manually returned to the OFF position. Be alert to the flaps retracting completely it the pilot’s attention is diverted.

OFF position removes all power from the flap motor. The flaps will “coast” somewhat when the switch is positioned to OFF due to momentum. Therefore, the pilot must anticipate this effect. <u>If the flaps over-shoot the desired setting, DO NOT immediately reverse the switch direction, allow the internal components adequate time to lose their momentum before attempting a new flap setting. A sudden reversal could shear the operating mechanism.</u>

DOWN position will extend the flaps as selected. This is a momentary position of the switch. In the event the flap gauge is inoperative, an average extension time is approx 5 seconds for each 1/3 of flap deployment. Also, a flap limit switch will cut electrical power to the flap motor when the flaps reach the fully extended position.

A flap gauge is located on the pilot’s center instrument panel. The gauge has markings at the normal positions of 1/3, 2/3 or full. This gauge receives its

Flap System



115 volt AC Power from the inverter. The gauge's circuit protection is by a 5 amp fuse located in fuse station # 4. It should be understood that the gauge's indication has no relation to the flap extension, they will operate as selected by the flap switch, even if the gauge is un-powered or not operating.

Emergency extension or retraction of the flaps is accomplished with a hand crank. (NOTE: It is advisable not to use flaps during approach and landing if the electrical system has malfunctioned.) The crank, along with a necessary extension, is stowed under the radio room floor compartment. Raising the floor panel immediately aft of the bomb bay allows access to the crank's receptacle. They are also contained in the EMERGENCY PROCEDURES section of this manual.

Engines

ENGINES:

GENERAL:

This aircraft is powered by four 1200 HP Wright Cyclone R-1820-97, 9-cylinder, radial, air-cooled engines equipped with an internal single speed, gear driven supercharger (7.0:1). These engines use a 16:9 gear ratio from crankshaft to propeller shaft. The forward and supercharger crankcase sections are heat-treated magnesium alloy castings. The main section is machined from steel forgings.

THROTTLES:

The components and controls of the throttle system are described below.

• Four throttles (T-1 through T-4) are mounted on the pilots' control pedestal and have unmarked OPEN and CLOSED positions. When the throttle is full aft (CLOSED) it positions the carburetor controls to an idle position. In this position, and up to approximately 10 degrees (approximately 1000-1200 RPM), the idle mixture valve will provide fuel to the engine. This is considered the idle range. When the throttle is advanced towards the full forward (OPEN) position, the carburetor transitions to the main metering jets which supply metered fuel flow to provide a correct volume of fuel/air mixture to the engine. Intermediate settings of the throttle will supply a proportional volume of fuel/air mixture to the engine. With the throttle fully open at sea level, the engine will deliver about 46 inches of manifold pressure with this installation. Note 41" is EAA Max.

• The throttles have a feature unique to the B-17. Three sets of handles are built into the arrangement. The upper set of handles, if grasped, will provide the pilot with control of the outboard engines only. If grasped by the lower handles they will provide the pilot with control of the inboard engines only. If the center set of handles is grasped, the pilot will have control of all four engines.

• A single throttle friction lock, located to the left of the throttles on the side of the pilots' control pedestal, mechanically provides locking friction to the throttles to prevent throttle creep. The knob on the end of the lever lifts to permit friction adjustment. The handle has three different areas. Moving the lock handle forward from the center OFF position increases the friction on all four throttles. Moving the handle aft from the OFF position increases the friction on the inboard #2 and #3 throttles.

MIXTURE CONTROLS:

The components and controls of the mixture control system are described below.

• Four mixture levers (M-1 through M-4) are mounted on the pilots' control pedestal and mechanically operate the mixture controls.

• The mixture lever's lock handle, on the pilot's control pedestal, mechanically provides locking friction to hold the mixture levers in any desired position. Lift the knob on the end of the lever to permit adjustment. Moving the lock handle forward increases the friction on the levers.

• The mixture control levers have four positions. Forward is Idle Cutoff and rearward is Auto Rich.

IDLE CUT-OFF stops all fuel flow, regardless of fuel pressure.

AUTO-LEAN results in leaner fuel/air ratios than when the mixture is set at AUTO-RICH. It delivers a mixture slightly richer than 15:1 (by weight), close to "best power". During operations when engine settings permit, AUTO-LEAN may be used when fuel economy is of primary importance and when cooling is adequate.

AUTO-RICH delivers a mixture richer than AUTOLEAN at all power settings above the idle range. At "Climb Power" settings and above, a much richer mixture will provide the additional cooling required, thus helping to avoid the possibility of detonation. As power is reduced the ratio decreases. AUTORICH is normally used for all ground operation, takeoff, climb, landing, and certain conditions of cruising. In both of these two automatic settings an aneroid corrects the mixture for changes in air density caused by varying altitudes and temperatures.

EMER-RICH position no longer functions because a post-war Bendix Service Bulletin required the removal of the linkage to the aneroid bypass valve as well as the bypass valve itself. The mixture lever can still be moved into the still existing EMER-RICH position but it has no effect on carburetor operation. This quadrant setting has breakable safety wire in front of it to remind pilots not to use it.

• The position markings on the quadrant may not be exactly placed, but there is a definite "feel" when you move the mixture control lever into the "AUTORICH" or "AUTO- LEAN" position. When you move the lever to one of these two settings "wiggle" it slightly to make sure that it is situated in the detent, not slightly above or below.

<u>• More importantly, during flight, except for troubleshooting, do not attempt to set the mixture manually by moving the lever beyond the "AUTO-LEAN" position.</u>

CARBURETORS & TURBO SUPERCHARGER SYSTEM:

• The carburetors receive their intake air from the inside top of the engine accessory section through an aft facing scoop. Because of this installation, the engines intake air is always heated as if Carb heat were on. There are no provisions for carburetor heat control or air filtration since the filters, intercoolers, and all associated piping were completely removed during restoration.

• The turbocharger system has been deactivated; all components were removed with the exception of the original exhaust ducts, along with the turbo-compressor and its oil supply tank. It has been found that allowing the turbo-compressor to turn freely from the little exhaust flowing through the turbine wheel helps reduce cracking of the exhaust assembly. It also provides an additional means for ventilating the nacelles.

• The turbo-compressor has its own oil supply tank that must be regularly serviced. The tank is located in the nacelle above the turbo-compressor on engines 1 and 4. On engines 2 and 3, the tank is located behind the nacelle and accessed through a panel in the bottom of the wing just outboard of the wheel well.

PRIMING SYSTEM:

GENERAL:

An electric priming system provides the fuel, under controlled conditions, for starting the engines. A primer solenoid on each carburetor discharges raw fuel into two primer nozzles located just below the carburetor and to each side of the carburetor. These nozzles discharge the fuel, in a highly atomized spray, into the supercharger intake.

• Four primer switches (air filter switches on the original airplane), on the copilots' side panel, electrically actuate a primer solenoid on each carburetor. The primer switch has ON (forward), and OFF (aft) positions and is spring-loaded to the OFF position. When a switch is held at ON position, priming fuel is discharged to the engine. When the switch is released to the spring-loaded OFF position, priming is discontinued. The fuel boost pump for the engine being started must be operating to supply priming fuel.

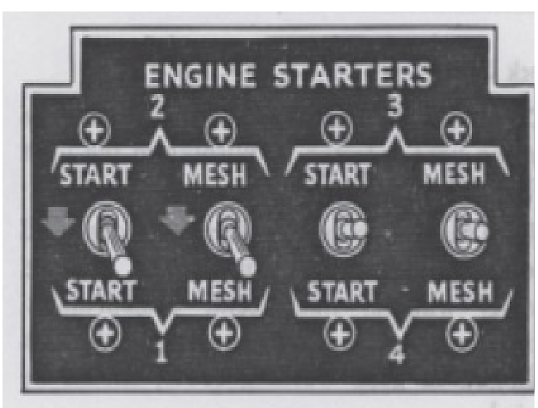
• All four primer switches receive power from the DC bus through one 15-amp fuse on the main fuse panel.

• Avoid excessive priming, since it can create a fire hazard. Also, excessive fuel will dilute the oil on the cylinder walls and possibly score the walls.

STARTER SYSTEM:

GENERAL:

The starter system on each engine consists of a direct-cranking inertia starter, which must be energized before being meshed with the engine. Separate starter switches electrically control both the energizing and meshing operations.



START SWITCHES

• Four starter switches, designated START and MESH, are located on the copilots' side panel and provide for electrical actuation of the starters. Each switch has three positions; up, OFF (unmarked), and down and are spring-loaded to the unmarked OFF position. The left two switches are used to start engines 1 and 2; the right two switches are used to start engines 3 and 4. The START switch must be positioned to the engine being started to energize the starter. Positioning the MESH switch up or down for that engine engages the starter to the engine, and at the same time, energizes the induction vibrator. Both switches are spring-loaded to the OFF position. Energize 7 to 10 seconds before meshing.

• Each starter switch receives power from the DC bus through its own 15-amp fuse on the main fuse panel.

IGNITION SYSTEM:

GENERAL:

A separate ignition system is provided for each engine. Each ignition system includes an induction vibrator, two magnetos, a high-tension harness and a shielded wire harness for each magneto, and an ignition switch. The induction vibrator, located on the aft side of the firewall, provides a hot spark for start whenever the MESH start switch is held on. The right magneto fires the front spark plugs and the left magneto fires the rear spark plugs. The shielded wire harness connects each magneto to the ignition switch. Both magnetos are independently connected to their respective bank of spark plugs through the ignition switch.

• Two ignition switch units, located on the pilots' control pedestal, each contain two conventional ignition switches. Each ignition switch has the positions BOTH, RIGHT, LEFT, and OFF. In the BOTH position, both magnetos of the applicable engine are independently connected to their respective bank of spark plugs for normal operation of the engine. The L and R positions are used to check the left and right magnetos during ground test. The magneto selected in this test is the one operating and being tested. In the OFF position, the magnetos are grounded and thus inoperative. There are no master ignition switches or gang bars on this aircraft.

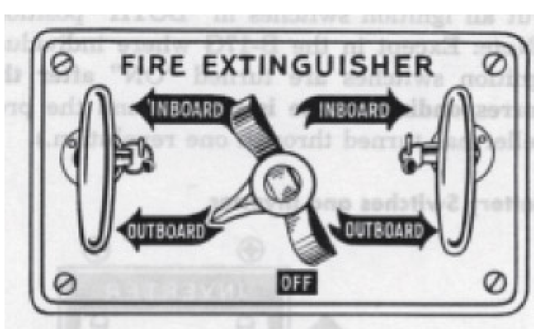
ENGINE FIRE EXTINGUISHER SYSTEM:

GENERAL:

Two separate CO2, 7.5 lb, fire extinguisher bottles are installed in the tunnel just aft of the bombardier's compartment. Each bottle has its own external blowout disc on the right side of the aircraft's nose to indicate system integrity. The controls, valves and piping enables either or both bottles to be used on any engine. The extinguishing agent is discharged aft of the firewall, this system affords no protection to the power section of the engine.

• A fire extinguisher control panel is located on the lower part of the co-pilot's side panel. This red handle rotates 360° and has five placarded positions; OFF, OUTBOARD, INBOARD, INBOARD and OUTBOARD. The other controls are a left and a right "T" handle, attached to a lanyard for discharging an extinguisher bottle.

• The engines are started with the selector in OFF. In the event of a fire, first, rotate the selector to the



FIRE EXTINQUISHER SELECTOR

desired engine, then pull the "T" handle. After an appropriate period of time has passed, the pilots may elect to also discharge the other bottle to the same location by simply pulling the other "T" handle. If the selector is changed to another location, the bottle's contents will discharge to the newly selected position when the handle is pulled. No lights or other warning devices will illuminate to confirm the discharge.

OIL SYSTEM: GENERAL:

Each engine has a completely independent oil supply system which includes a means for regulating oil temperature and supplying oil for propeller feathering. There is no oil shut-off valve installed between the oil tank and the engine driven oil pump on this aircraft.

• Each oil tank has a normal capacity of 37 gallons (includes 2 gallons reserve for propeller feathering only)

• Oil is gravity fed from each self-sealing oil tank, through a check valve in the oil pump body, to the engine driven oil pump. This check valve prevents gravity oil flow from the tank into the engine when the engine is at rest. From the pump the oil passes through a pressure regulator and then through the "Cuno" filter.

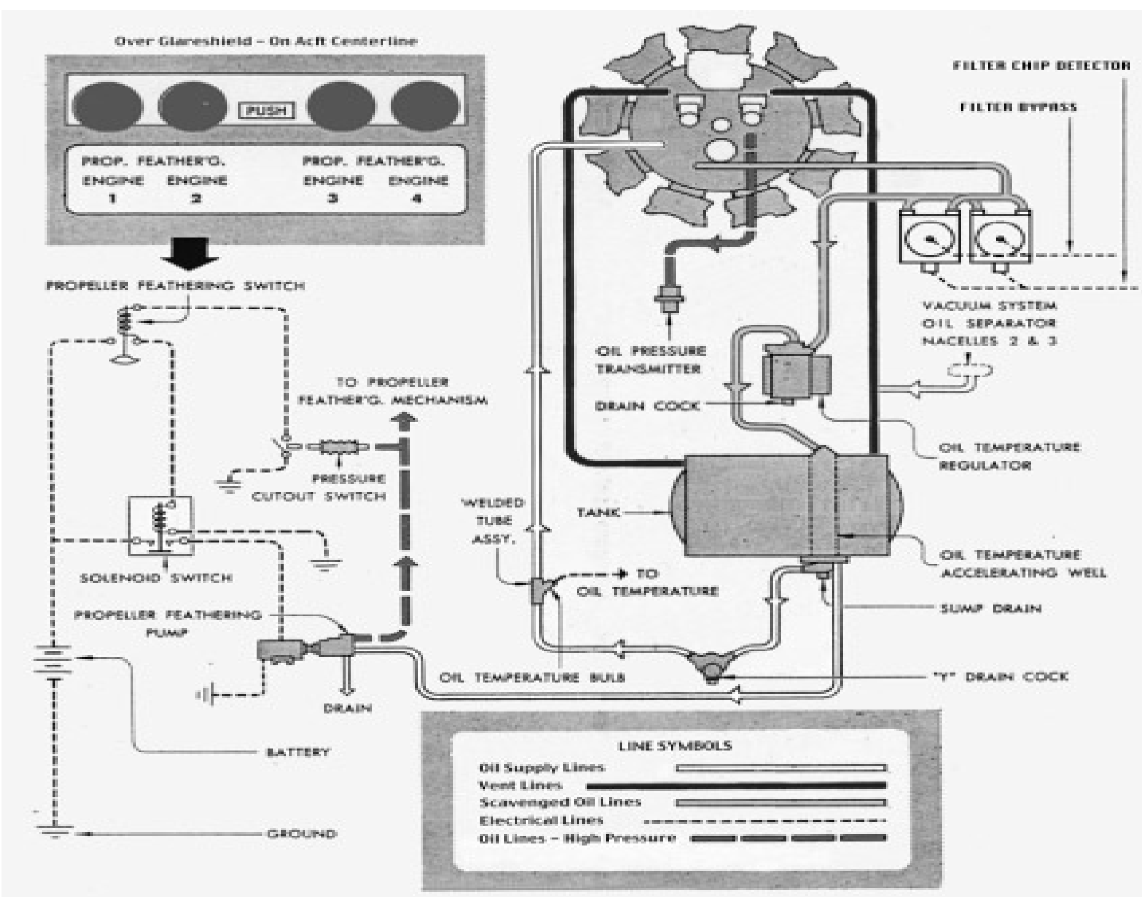
• This oil, under pressure, lubricates and cools all moving parts with the exception of the cylinder walls, piston pins, crankshaft roller, and thrust ball bearings, which are lubricated by a splash arrangement. The oil then drains into a forward dry sump where the scavenge pumps return it to the oil tank.

• On its way, the oil is first filtered through two parallel plumbed "ADC" filter assemblies that filter the oil prior to passing through the coolers. Each filter incorporates bypass and magnetic chip detectors. Two indicator lights for each engine's detectors are located on the copilot's side panel just forward of the primer switches.

• An amber bypass light indicates that one or both of the two filters has become clogged and is actually bypassing. This indicates simply that the system is now in the same situation that existed with no ADC filters installed, this is not an emergency situation. See Page 30.

• A red chip light indicates metallic particles have provided an electrical path across the small gap on the magnetic detector of one or both of the two filters. The chip detectors are located at the bottom of the filter’s intake half. For engines 1 and 4, the filters are mounted in the nacelles, just above the turbocharger, and can be readily accessed through a large panel on the top of the nacelles. For engines 2 and 3, the filters are mounted in the leading edge of the wing and accessible through a large panel on the lower surface between the engine pairs.

• The oil then enters the oil cooler radiators. An integral temperature regulator within the oil cooler regulates oil temperature. The cooler is mounted in the wing leading edge between each engine pair. Air is ducted to the oil coolers through air intakes in the leading edge of the wing and is exhausted into the wing structure. A positive airflow is provided by vents in the low-pressure area of the upper wing skin at a point aft of the maximum camber. The cooling air shutters on the aft end of the oil coolers have been removed. From this point the oil is returned to the supply tank.



ENGINE INSTRUMENTS:

• Two dual indicating tachometers, which indicate engine speed in revolutions per minute (RPM) are located on the main instrument panel. The tachometer is a self-generating instrument completely independent of the main electrical system. The gauge is calibrated in increments of 100 rpm and is marked with a red radial at 2500 rpm and a green arc from 1600 to 2000 rpm

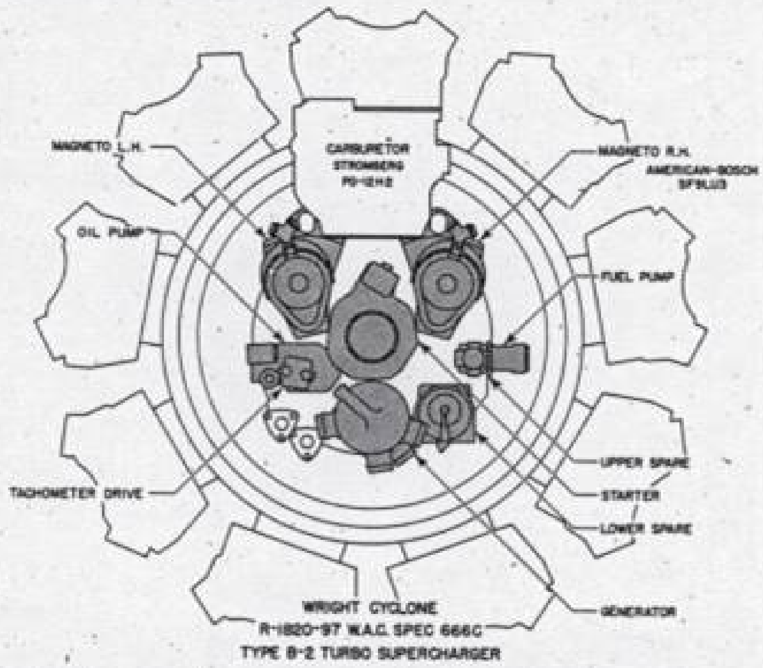
• Two dual indicating manifold pressure (MP) gauges, located on the main instrument panel, indicate the intake manifold pressure of each engine in inches Hg. The manifold pressure gauge is a direct reading instrument connected directly to the impeller section of each engine. The gauge is marked with a red radial at 41 inches and a green arc from 28 to 34 inches.

Two dual indicating cylinder head temperature (CHT) gauges, located on the main instrument panel, are calibrated in degrees centigrade. The temperature is measured by a thermocouple on the rear spark plug of the No. 1 cylinder of each engine. The thermocouple uses dissimilar metals to generate a current transmitted directly to each gauge and is completely independent of the aircraft's main electrical system. The gauges are marked with a red radial at 260 degrees C and a green arc from 110 to 205 degrees C.

• Two dual indicating carburetor air temperature (CAT) gauges, located on the main instrument panel, are calibrated in degrees centigrade. They indicate the temperature of the intake air just prior to its entry into the carburetor. Since the engine draws its air from the accessory section, the carburetor air temperature gauges will indicate slightly warmer than ambient at all times. They should also provide an additional indication of an accessory section fire. The carburetor air temperature gauge receives its power from the DC bus. The gauges are marked with a green arc from 15 to 35 degrees C and a red radial line at 70 degrees C.

• Two dual indicating oil pressure gauges are located on the main instrument panel. The oil pressure gauge indicates oil pressure, through a pressure transmitter, in pounds per square inch. The oil pressure limits are as follows, Red radials 55 and 85 psi, Green arc 65-75 psi, with 15 psi minimum for idle. The pressure transmitter, located on the forward face of each firewall, utilizes a diaphragm seal assembly to separate the oil in the hose to the transmitter from the hydraulic fluid, 5606, utilized in the tube to the gauge.

▪ Two dual indicating fuel pressure gauges located on the main instrument panel. This gauge does not require electrical power to operate. The gauge is marked with a green arc from 12 to 16 psi. The fuel pressure gauge indicates fuel pressure, through a pressure transmitter, in pounds per square inch. The pressure transmitter, located on the forward face of each firewall, utilizes a diaphragm seal assembly to separate the gasoline in the hose to the transmitter from the hydraulic fluid, 5606, utilized in the tube to the gauge.



DRIVE	SPEED RATIO	STYLE DRIVE	FLANGE	ROTATION (DRIVE END)	ACCESSORY AND LOCATION			
					ENGINE 1	ENGINE 2	ENGINE 3	ENGINE 4
STARTER	1 TO 1	3 JAW CLUTCH	6 STUDS	CLOCKWISE	STARTER TYPE G6 OR F2	STARTER	STARTER	STARTER
GENERATOR	1.5 TO 1	16 TOOTH SPLINE (INVOLUTE)	6 STUDS	CLOCKWISE	GENERATOR TYPE P-1 OR O-1	GENERATOR	GENERATOR	GENERATOR
LOWER SPARE	1.5 TO 1	12 TOOTH SPLINE	4 STUDS	COUNTER CLOCKWISE		VACUUM PUMP TYPE B-8	VACUUM PUMP	
UPPER SPARE	1.5 TO 1	12 TOOTH SPLINE (INVOLUTE)	4 STUDS	COUNTER CLOCKWISE		GLYCOL PUMP ROMEC RD-4550		
FUEL PUMP	1 TO 1	11 TOOTH SPLINE (INVOLUTE)	4 STUDS	COUNTER CLOCKWISE	FUEL PUMP TYPE G-9	FUEL PUMP	FUEL PUMP	FUEL PUMP
TACHOMETER	.5 TO 1	STD.	STD.	CLOCKWISE	TACHOMETER GK 38-3	TACHOMETER	TACHOMETER	TACHOMETER
PROPELLER GOVERNOR	1 TO 1	12 TOOTH SPLINE	4 STUDS	CLOCKWISE	PROP. GOV. 4G8-G6C	PROP. GOV.	PROP. GOV.	PROP. GOV.
PROPELLER	9 TO 16	16 TOOTH SPLINE		COUNTER CLOCKWISE	PROPELLER HUB 23E50-473 BLADE 6477A-0	PROPELLER	PROPELLER	PROPELLER

Engine Accessories

PROPELLERS

PROPELLERS:

GENERAL:

Each engine is equipped with a three bladed, constant-speed, full feathering, Hamilton-Standard hydromatic 23E50 hub with 6477A-0 propeller blades.

• A propeller governor on each engine automatically adjusts the propeller pitch to maintain a constant engine speed, as selected, during airspeed changes in flight. This is done by increasing or decreasing oil pressure in the propeller dome. The governor meters engine oil pressure to change the blade angles within the governing range.

• Feathering and unfeathering action of the propeller is accomplished by pressurized oil supplied through the governor from a 28-volt DC feathering pump mounted on the forward side of the firewall. This feathering circuit has no current protection.

• Oil for the feathering operation is obtained from a fitting on the oil tank sump adjacent to the main oil supply to the engine. The design of the sump provides a 2 gallon reserve supply for the feathering pump.

PROPELLER RPM LEVERS:

• Four propeller levers (P-1 through P-4) are located on the aft lower end of the pilots' control pedestal. They are connected by a mechanical system to the propeller governors on the engine nose cases, which control the pitch of the propeller blades and the resulting engine speeds.

• Each lever has LOW RPM (full down) and HIGH RPM (full up) positions. The propeller pitch is decreased and the engine rpm is increased when the lever is placed at the HIGH RPM position. At the LOW RPM position the propeller pitch is increased, resulting in a decrease in engine rpm. The levers can be set at any desired position between HIGH RPM and LOW RPM.

• A locking handle for all four propeller levers is located to the immediate right of the levers. It mechanically provides locking friction to hold the propeller levers in any selected position. Pull out the knob on the handle's end to move the lock handle. When the lock handle is moved up, the propeller lever's friction is increased towards locking. The friction is decreased by moving the handle downwards.

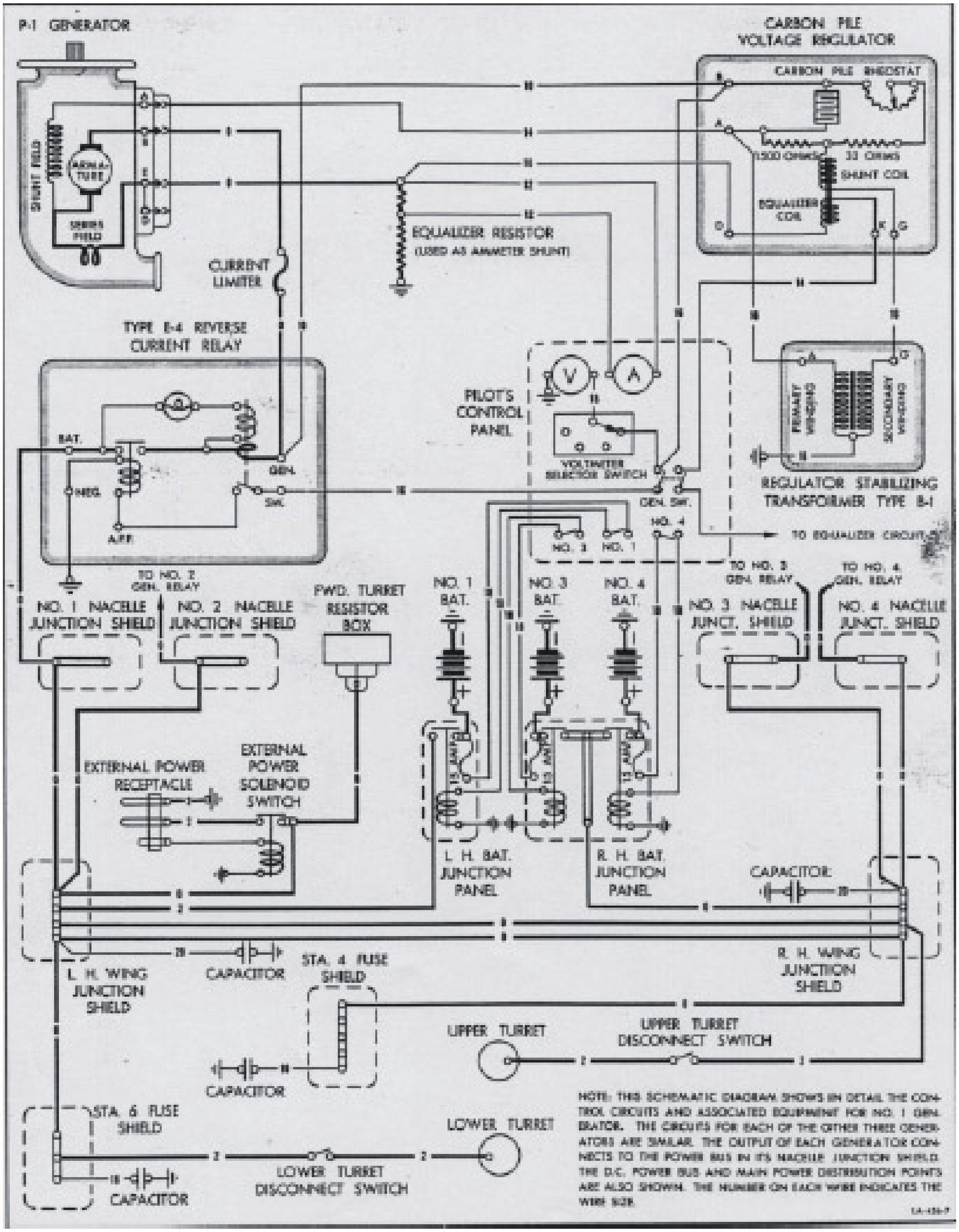
PROPELLER FEATHERING:

• Four propeller feathering buttons, numbered for the feathering pump for each engine, are mounted on a centerline panel above the windshield.

• A feathering pump is started by pushing in its feathering button, thereby electrically powering the feathering pump. The feathering button is held in by an electrical holding coil. This coil is de-energized by the cut-out switch as the propeller reaches full feather position. This is sensed by an electrical oil pressure cutout switch wired in series with the holding coil. The feathering action can be stopped at any time by pulling out on the feathering button. A partially unfeathered propeller, in which the feather pump is not running, will return to its normal pitch setting by the control of the propeller governor if windmilling above 800 hundred rpm.

• When unfeathering, the feathering button must be pushed and held in until engine reaches 800 RPM, then released. This allows the governor to take control. The propeller feathering button receives power from the DC bus, this circuit is not fuse protected.

Electrical System



DC ELECTRICAL SCHEMATIC

ELECTRICAL SYSTEM

GENERAL:

The primary system is 24 volt direct current (DC). A 115 volt alternating current (AC) system is the secondary system. Originally, the aircraft had an exhaust turbo-charging system that required AC power for control and indicating purposes, however this has been removed from this aircraft. It also had a gasoline powered generator unit installed just ahead of the tail wheel in the rear of the airplane as an alternate source of electrical power. This unit has also been removed.

Most of the electrical equipment on the aircraft receives power through and is protected by a fuse system. Some systems require two fuses, one for the indicating system and one or more for the required electrical power. Most of these fuses are located in fuse boxes located at various stations throughout the aircraft. Spare fuses are located in or adjacent to these fuse boxes. Exceptions to this are those for the landing lights, battery solenoids, gear motors, feathering pumps.

DIRECT CURRENT SYSTEM:

• There are three possible sources of electrical power; the engine driven generators, the batteries and the external power source.

• Three 24 volt, 48 amp-hour batteries are provided. #1 is located in the leading edge of the left wing; #3 and #4 are located in the right wing. (There is no #2 battery.)

• Three battery electrical control switches (placarded 1, 3 and 4) are located on the pilot's electrical control panel. Each respective switch individually controls that battery's connection to the DC system through a relay. The switch for that battery must be ON in order for that battery to be charged by the aircraft generators or by the external power source.

• Voltage for the batteries may be read on the DC voltmeter by placing the voltmeter selector to the BAT position and selecting the desired battery switch to the ON position.

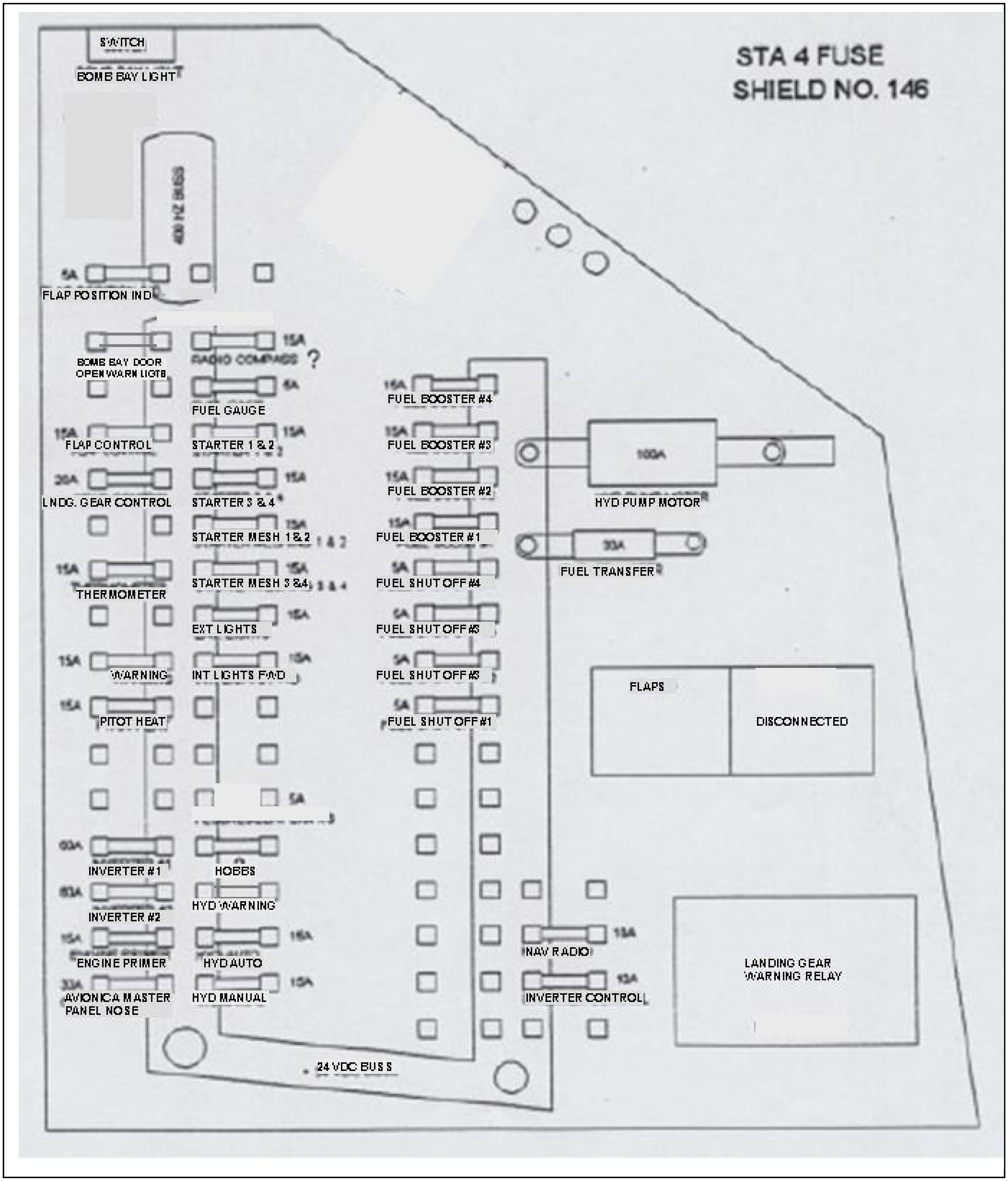
• Each engine's generator is 200 amps, installed on the accessory section. If it becomes necessary a generator may be removed and an accessory pad cover installed on that location.

• A control switch for each generator is located on the pilot's electrical panel. Each switch has a red guard over it. There are two switch positions; ON and OFF.

In ON, the generator is connected by a reverse current relay in the nacelle to the DC electrical system. If the red guard is closed, the switch will be placed in ON.

In OFF, the relay disconnects the generator from the electrical system.

• Each generator is automatically connected to the DC bus by a reverse current relay when the respective generator switch is ON and generator output voltage exceeds bus voltage. This relay automatically disconnects the generator from the DC bus when the bus voltage exceeds the generator's voltage.


STA 4 FUSE
SHIELD NO. 146
SWITCH
BOMB BAY LIGHT
400 HZ BUSS
5A
FLAP POSITION IND
BOMB BAY DOOR
OPEN WARN LIGTS
15A
FUEL GAUGE
FLAP CONTROL
STARTER 1 & 2
LNDG. GEAR CONTROL
STARTER 3 & 4
STARTER MESH 1 & 2
STARTER MESH 3 &4
THERMOMETER
EXT LIGHTS
WARNING
INT LIGHTS FWD
PITOT HEAT
FUEL BOOSTER #4
FUEL BOOSTER #3
FUEL BOOSTER #2
FUEL BOOSTER #1
FUEL SHUT OFF #4
FUEL SHUT OFF #3
FUEL SHUT OFF #2
FUEL SHUT OFF #1
100A
HYD PUMP MOTOR
30A
FUEL TRANSFER
FLAPS
DISCONNECTED
INVERTER #1
HOBBS
INVERTER #2
HYD WARNING
ENGINE PRIMER
HYD AUTO
AVIONICA MASTER
PANEL NOSE
HYD MANUAL
NAV RADIO
INVERTER CONTROL
LANDING GEAR
WARNING RELAY
24 VDC BUSS

The reverse current relay for each engine is mounted in the nacelle.

• Four amp meters to indicate each generator's load are located to each side of the switches: #1 at the top left, #2 at the bottom left, #3 at the bottom right and #4 at the top right.

• Each generator has a 150 amp current limiter installed in the nacelle to protect against an over-voltage.

• Four voltage regulators are located in a junction box under the pilot's seat. Each regulator maintains generator output voltage at 28 volts by changing generator field voltage as necessary.

• The external power access panel and receptacle is located under the fuselage near the centerline, just aft of the forward entrance hatch. When the source of external power is plugged into this receptacle the bus will be powered by it. For this reason it is essential that the flight crew initiate this sequence by signaling the ground crew to plug it in. The batteries should be turned to the OFF position at this time in order to allow the ground unit to power the system. A position of the voltmeter placarded BAT allows the DC bus voltage to be read on the voltmeter.

ALTERNATING CURRENT SYSTEM:

• Two inverters are available to furnish the AC power, according to switch position. The main is a solid state. The spare is a original rotary type. They convert 24 volt DC to 115 volt AC. This AC power is used only for the flap indicator on this airplane. On the original airplane it also furnished power to the turbo-supercharger waste gate controller, chin turret chargers, and ball turret.

• Both inverters are controlled by the inverter control switch located on the pilot's electrical control panel. It has three positions; MAIN, OFF and SPARE.

MAIN position normally selects the solid state main inverter underneath the pilot's seat. It draws less current than the original and for this reason it's operation is preferred.

OFF position removes all power from either inverter. The flaps position indicator will be inoperative.

SPARE position selects the spare (original) inverter located underneath the co-pilot's seat. It has a higher current draw than the solid state replacement, for this reason it is considered the spare.

• "Aluminum Overcast" is equipped with a inverter changeover relay. In the event MAIN is selected and the main inverter fails, the relay will automatically select the spare.

• A MAIN INVERTER OUT warning light on the electrical control panel illuminates if the spare inverter is powered, either through the changeover relay or by selection with the inverter control switch.

• An "INV OUT" warning light on the pilot's instrument panel illuminates if no AC power is sensed at either the main or the spare output relays. Below the INV OUT warning light is the AC volt meter.

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HYDRAULIC SYSTEM

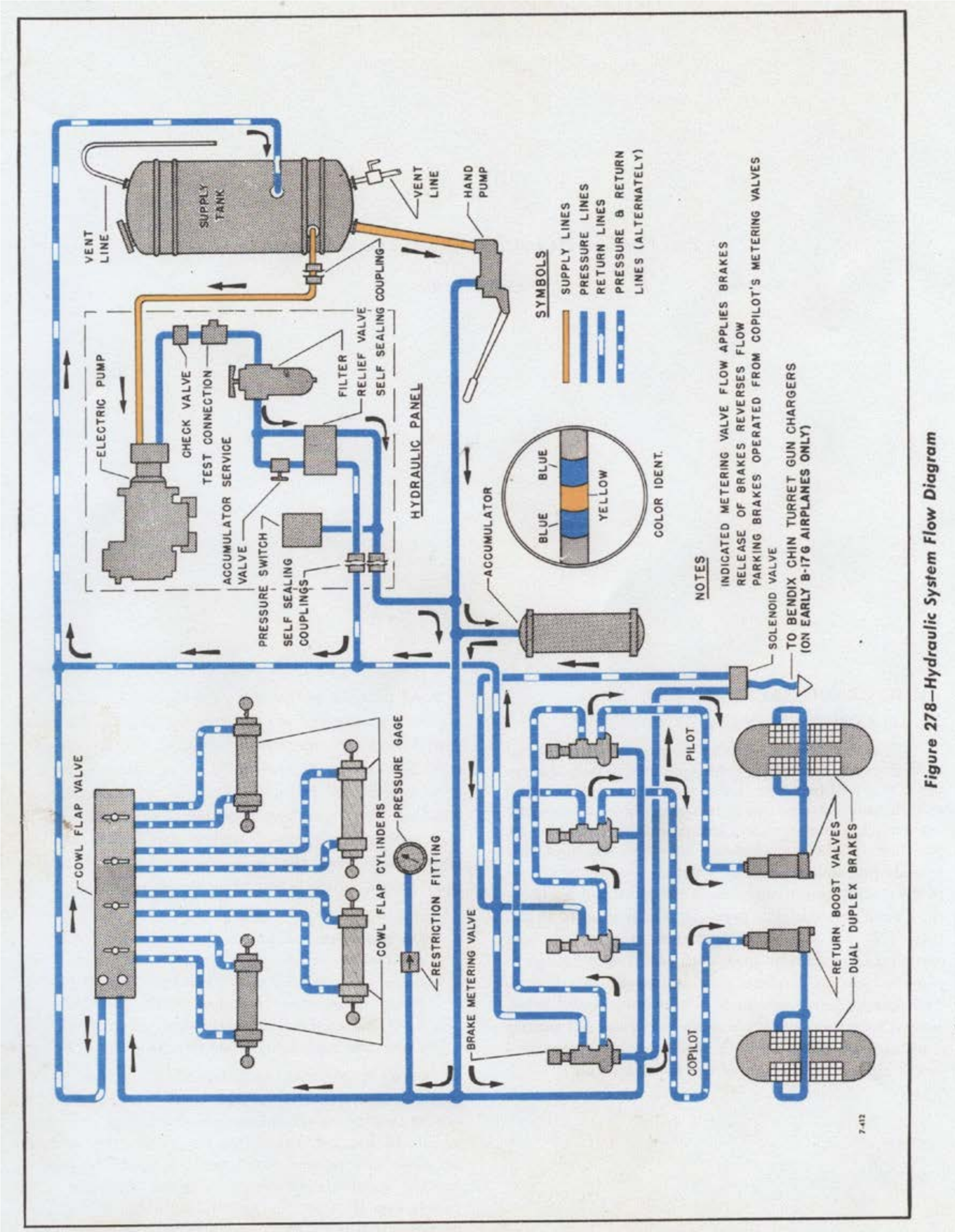


Figure 278—Hydraulic System Flow Diagram

HYDRAULIC SYSTEM:

GENERAL:

Hydraulic pressure is used to operate the normal brakes and the cowl flaps. On the military aircraft the gun chargers for the chin turret were also operated by this system, however, they have been removed from this aircraft.

MAIN HYDRAULIC SYSTEM:

The components and controls of the main hydraulic system are described below.

• An electric hydraulic pump provides the pressure for this system. This gear type pump has a discharge capacity of approximately 1.25 gallons per minute @ 800 psi and 70° F. It receives its supply of hydraulic fluid from the main reservoir. It is installed on the hydraulic panel, located on the right side floor of the pilot's compartment.

• The electric motor on this hydraulic pump is supplied with power by the main DC electrical system. A 100 amp strap fuse, located in the main fuse panel, serves as protection for the motor. A spare fuse is carried on the fuse panel cover.

• Control of this pump motor is provided through a red-guarded, three-position hydraulic control switch on the overhead panel. This switch is protected by a 15 amp fuse, located in Fuse station 4. The positions are MANUAL (up), OFF (center) and AUTOMATIC (down).

In MANUAL, the guard must be lifted to gain access. In addition, the switch is spring-loaded and it must be held in position. If it is released it will return to the OFF position. When held in MANUAL it will cause the hydraulic pump to operate, the hydraulic pressure will continue to increase until the relief valve opens at approximately 850-900 psi. At that point the pressure will continue to hold the valve open as pressure is relieved and fluid is returned to the supply reservoir.

In OFF, the red guard will be in the open position. The switch is spring-loaded to this position. This is the neutral position of the switch and all electrical power is removed from the hydraulic pump motor. In the event of a hydraulic line or component failure that results in fluid being sprayed under pressure, this switch must immediately be placed to the OFF position.

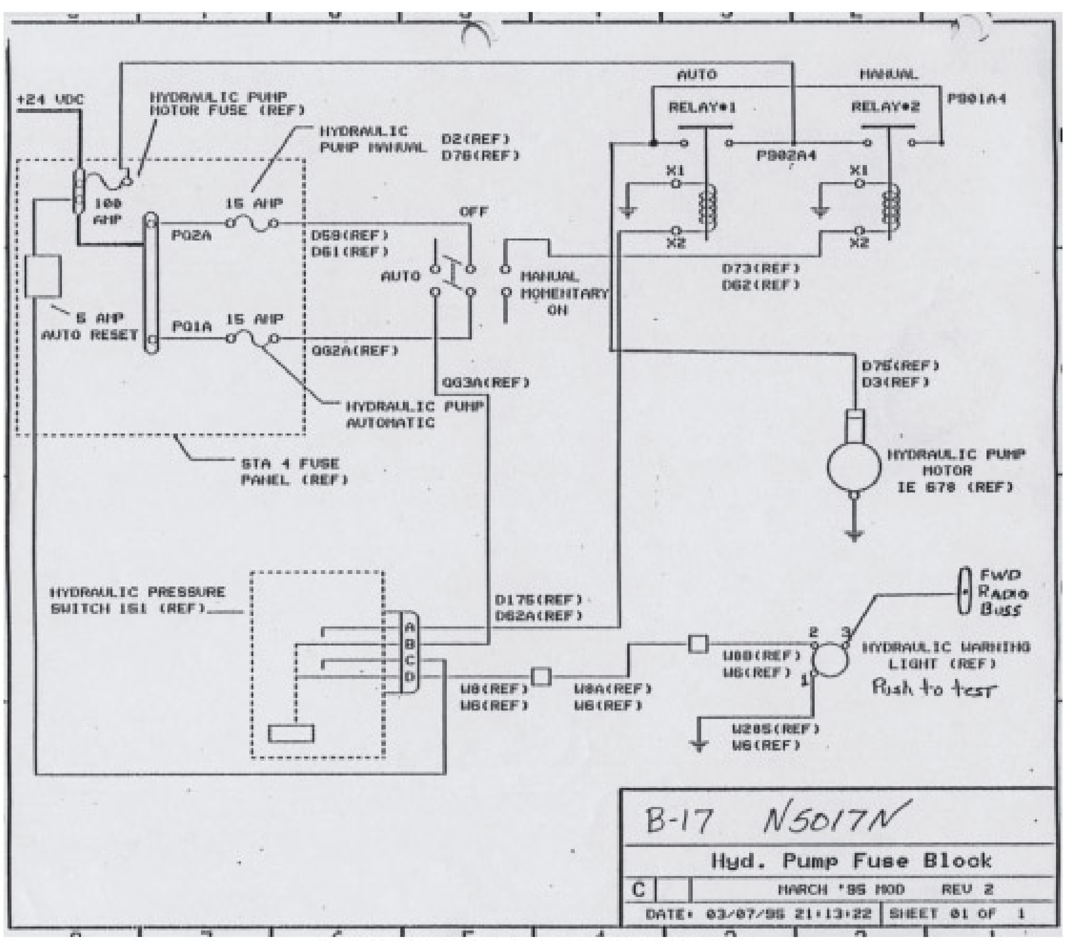
In AUTOMATIC, the red guard may be in either the up or down position, however if the guard is snapped to the down position the switch will be moved to AUTOMATIC. In this position the hydraulic pump will begin to operate if the pressure falls below approximately 600 psi. As the pressure reaches approximately 800 psi the pump will stop. This actuation is controlled by a hydraulic pressure switch on the hydraulic panel.

• A manual hydraulic pump with a red handle is located immediately to the right of the co-pilot's seat on the cockpit floor. When the hand pump is operated its hydraulic pressure goes directly to the accumulator and the using unit, bypassing all components on the hydraulic panel.

• Approximately 26 strokes of the pump handle are required to effectively set the parking brakes at 400 psi. Approximately 210 strokes are required to pressurize the accumulator from a system pressure of zero to 800 psi. The physical effort to operate the handle increases as pressure increases in the accumulator. At 800 psi the force required is approximately 50 pounds.

• A hydraulic reservoir is installed on the pilot's compartment aft bulkhead on the airplane's right side. The reservoir capacity is 4 gallons. The system capacity is 5 gallons of MIL SPEC 5606 red hydraulic fluid. A can of spare fluid is carried aboard beneath the pilot's seat. A dipstick is provided at the top of the reservoir to ascertain the fluid quantity. Normally, this stick is screwed into the reservoir receptacle to secure it. The reservoir is vented to ambient cockpit air. The fluid supply for the normal electric hydraulic pump is obtained at approximately the 1 gallon level. Fluid for electric hydraulic pump is obtained at approximately the one-gallon level. Fluid for the manual hand hydraulic pump is taken from the bottom of the reservoir, ensuring that all the available fluid (including the 1 gallon) will be available to the hand pump for emergency use.

• A system filter is located on the hydraulic panel. It is installed in the pressure line and has a filter bypass capability when the differential pressure exceeds approximately 30 psi. A cleaning handle is located on top of the filter body, allowing scraping of the filter when the handle is rotated. Residue can then be drained from the drain at the bottom of the filter.



Hydraulic System Electrical Schematic

• A system check valve is installed in the output line of the electric hydraulic pump prior to the filter. It prevents the reverse flow of hydraulic pressure.
• A system relief valve is located on the hydraulic panel and is set to open at approximately 850 psi. It will cycle between approximately 850-900 psi as it responds to system demands. Its purpose is to provide backup overpressure protection for the electric hydraulic pump in the event that the pump fails to shut off due to a malfunction of the pressure switch. On the first flight of the day this valve should be checked by holding the switch in MANUAL and noting that the pressure is relieved at this setting by this valve.
.
• The system pressure switch is located on the center overhead panel. If the pilot's control switch is in AUTOMATIC, the electrical system is powered and hydraulic pressure is 600 psi or less, the contacts will close and the electrical pump will start. The pump will run until reaching approximately 800 psi when the contacts are opened, thus stopping the pump. If either this pressure switch or the control switch malfunctions the pump will continue to run and the pressure will be relieved by the system relief valve at 850 to 900 psi. The circuitry for the system low pressure warning light is wired through this switch.
.
• The system accumulator is attached to the rear flight crew compartment bulkhead next to the system reservoir. Its purpose is to store hydraulic pres-sure and to prevent hydraulic pressure surges. The air pre-load is 350 psi. This can be checked by relieving system pressure (cycling the cowl flaps or wheel brakes), noting the last hydraulic pressure indicated on the gauge before it abruptly drops to zero.

• A hydraulic system pressure gauge is located on the upper right of the pilot's instrument panel. This gauge is accurate to 25 psi. It is marked with a red radial at 580 psi, a green arc from 600 – 830 psi, a yellow arc from 830 to 950 psi, and a red radial at 950 psi.
.
• A red hydraulic system low pressure warning light is located adjacent to the system pressure gauge. This light will illuminate at approximately 580 psi.

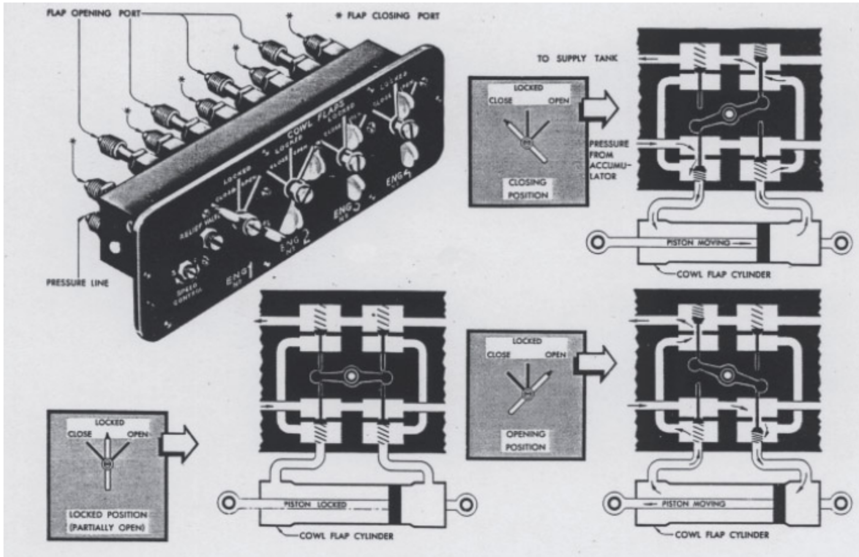
COWL FLAP SYSTEM:

GENERAL:

Each nacelle has 18 cowl flaps, 16 hydraulically actuated and 2 fixed position. Their position assists in controlling the engine cylinder head temperatures. When the cowl flaps are open, a greater flow of cooling air passes across the cylinders and vents directly from the engine section to the outside.

• Four cowl flap hydraulic selector valves (ENG 1 through ENG 4) are mounted on the pilots' control pedestal. Three (OPEN, LOCKED, and CLOSE) positions of the valve actuate a single hydraulic cylinder located just forward of the carburetor. The cowl flaps are then moved by a system of rods and bell cranks. A speed control within this valve is ground adjustable to provide a desired opening-closing time of approximately 2 to 5 seconds. A hydraulic pressure relief valve is also incorporated into each control valve. To obtain a desired cowl flap setting, the valve is moved toward the OPEN or CLOSED position until the flaps are at the desired setting, then returned to the LOCKED position. There is no "trail" position. All three positions of the valve can be felt as a detent in the quadrant. The LOCKED position is used to set the flaps at any desired position. There is no position indicator for the cowl flaps.

• The cowl flap selector valves must be



Cowl Flap System

left in LOCKED when not operating the cowl flaps to prevent loss of fluid in the event of cowl flap hydraulic line failure. If all hydraulic pressure to both sides of the actuating cylinder is lost, or if the valve is actuated with zero hydraulic pressure, the cowl flaps will automatically assume a neutral position, due to airflow.

MAIN BRAKING SYSTEM:

• The parking brake handle is located on the right lower side of the co-pilot's panel, under the start switches. The parking brakes can only be set or released by the co-pilot. If the pilot's metering valves are depressed the parking brakes cannot be set or released by the co-pilot. A hydraulic pressure of 400 psi is required to effectively set the parking brake.

• The main wheel brakes are controlled through a total of four metering valves (one on each rudder pedal). When any metering valve is actuated, fluid is allowed to flow, under system pressure as metered through the pilot's metering valve, to that side of the airplane.

• The fluid next enters the de-booster valve. This valve is located on the appropriate landing gear strut. The hydraulic pressure is reduced at the de-booster valve to approximately 25% of the existing system pressure. This pressure then flows to the expander tube brake assembly. The reduction in pressure also helps to expedite the brake release. All returned brake fluid is routed through the co-pilot's metering valves.

EMERGENCY NITROGEN BRAKE SYSTEM:

GENERAL:

This system was added to prevent loss of the airplane and lives if total hydraulic pressure, and thus normal braking, is lost while taxiing. It allows the pilot an opportunity to stop the aircraft and a limited ability to control the direction through selective application of differential braking. The stock military B-17G airplane did not have this option available. The components and controls are described below.

• The nitrogen bottle is mounted in the tunnel at a location beneath the pilot's seat. It is accessible from the lower forward hatch. A maximum charge of nitrogen is approximately 1500 psi. The operating range is 900 psi to 1500 psi.

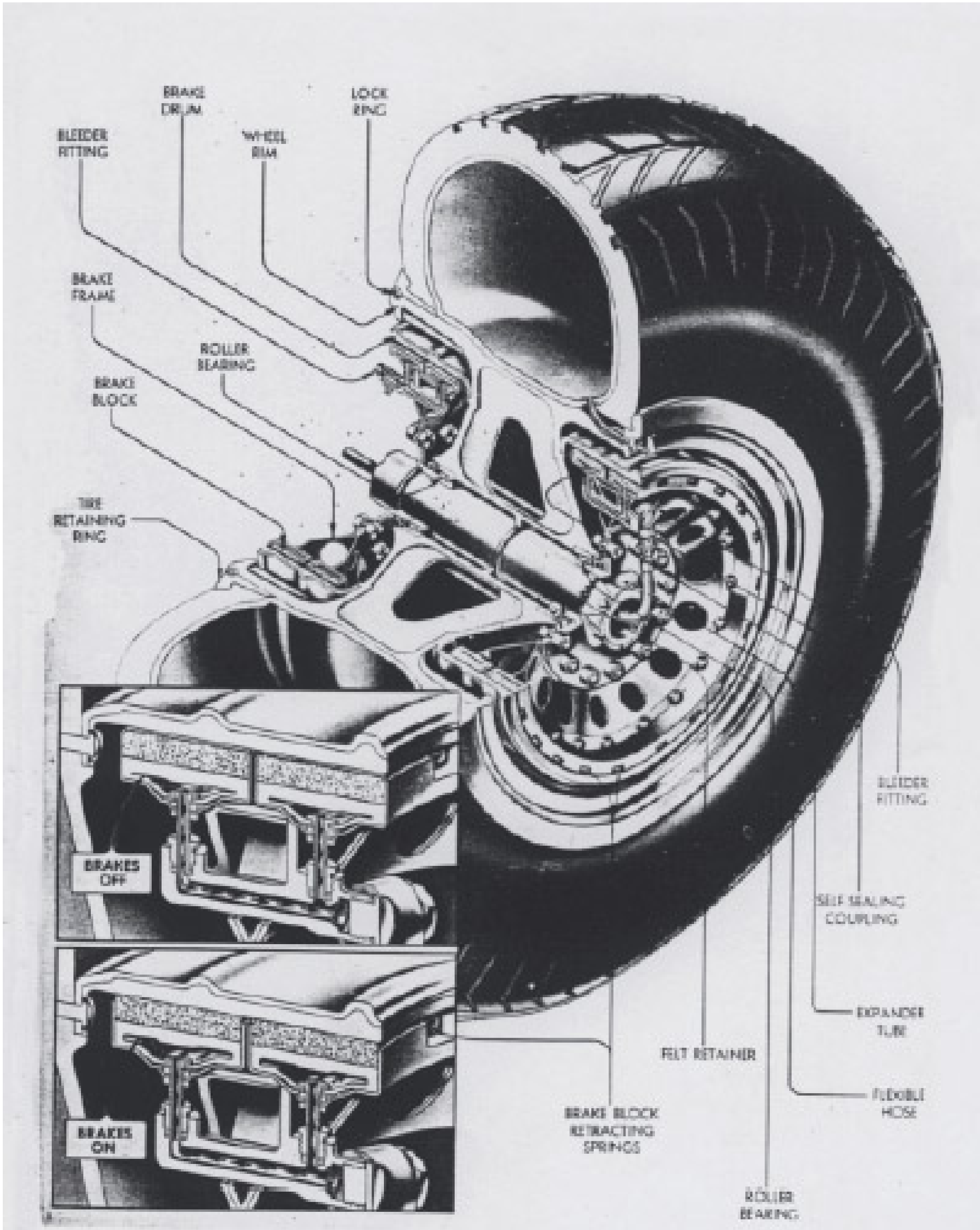
• Nitrogen system pressure gauges for this bottle are located just inside the forward entrance hatch and on the pilot's instrument panel. They are marked with a green arc from 900 to 1500 psi and an upper red radial at 1500 psi. This will be checked by a pilot prior to flight.

• A filler valve for this bottle is accessible through the lower forward hatch at a location approximately 7 inches forward of the nitrogen bottle.

• Two red handles, located just to the left of the pilot's seat, are provided to operate the system. These handles may be grasped with one hand and operated simultaneously by pulling in an upward direction. The higher they are raised, the greater the nitrogen pressure applied to the brake's expander tube. They are safety wired in the OFF position, providing an easy method of determining whether they have been actuated.

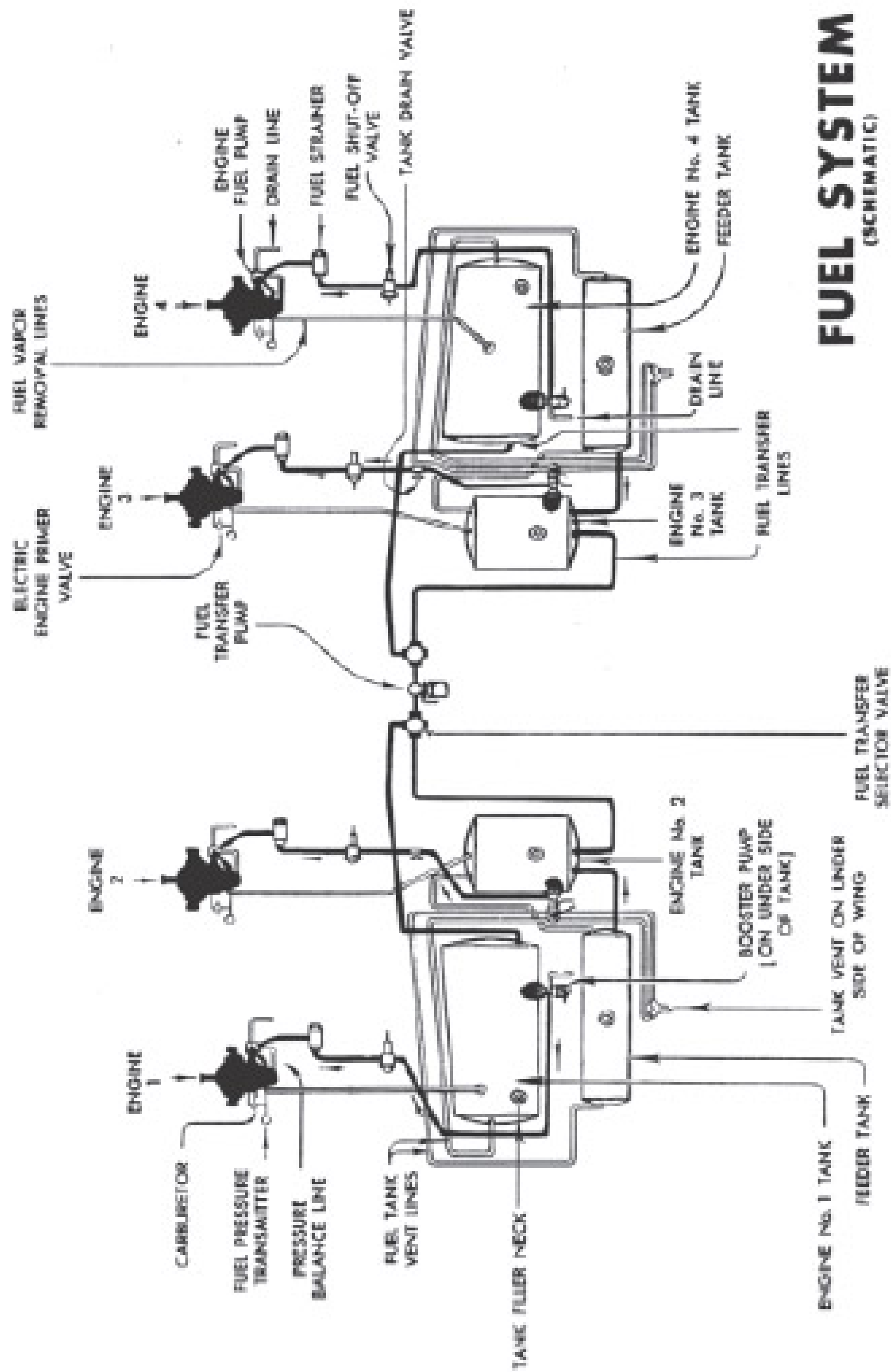
• Each main gear has a shuttle valve installed on the top of its de-booster valve. In a normal operation this valve allows unimpeded passage of hydraulic fluid to the brake. In the event that nitrogen pressure is applied by the emergency system, the nitrogen pressure shoves this valve to the side. This shuts off the flow of hydraulic fluid, allowing nitrogen pressure to flow (as metered by the pilot) to the brake expander tube.

• If this system is utilized, first stop the aircraft, then utilize assistance to move it to a parking spot. The system may be bled by repeatedly actuating the normal brakes until all traces of nitrogen pressure have been expelled from the system. Great care should be taken if the Emergence braking system is used to stop the aircraft. This is necessary to avoid directional control issues or the possibility locking a brake.



WHEEL & BRAKE ASSEMBLY

FUEL SYSTEM


FUEL SYSTEM
(SCHEMATIC)
ENGINE FUEL PUMP
DRAIN LINE
FUEL STRAINER
FUEL SHUT-OFF VALVE
TANK DRAIN VALVE
ENGINE No. 4 TANK
FEEDER TANK
FUEL VAPOR REMOVAL LINES
ENGINE 4
ENGINE 3
DRAIN LINE
FUEL TRANSFER LINES
ELECTRIC ENGINE PRIMER VALVE
ENGINE No. 3 TANK
FUEL TRANSFER PUMP
FUEL TRANSFER SELECTOR VALVE
ENGINE 2
ENGINE No. 2 TANK
BOOSTER PUMP (ON UNDER SIDE OF TANK)
TANK VENT ON UNDER SIDE OF WING
ENGINE 1
CARBURETOR
FUEL PRESSURE TRANSMITTER
PRESSURE BALANCE LINE
FUEL TANK VENT LINES
TANK FILLER NECK
ENGINE No. 1 TANK
FEEDER TANK

FUEL SYSTEM:

GENERAL:

The fuel system of the B-17 consists of six tanks, however, this can actually be thought of as four independent fuel supplies of approximately equal capacities, each supply feeding one engine. The fuel in any tank is available to any engine's supply tank in the airplane through a fuel transfer system consisting of two selector valves and an electrical transfer pump. Electrical fuel booster pumps are provided.

FUEL TANKS AND SHUT-OFF VALVES:

• There are three fuel tanks in each wing of "Aluminum Overcast". Engines 1 and 4 each have a single 425 gallon tank. Engines 2 and 3 each have two tanks, a 213 gallon main tank and a 212 gallon feeder tank, together a total of 425 gallons.

• For combat operations "Tokyo Tanks" (multiple outboards) were also installed, however these were removed during the aircraft's restoration process. In some instances the airplanes had bomb bay fuel tanks installed for combat.

• The normal refueling sequence is to first refuel the inboard main/feeder tanks to the amount required behind that engine. Then refuel the outboard main tank to the amount required behind that engine. Then recheck the inboards and adjust as necessary. Repeat for the opposite side of the airplane.

• Fuel quantity indicators are all read on a fuel gauge on the co-pilot's instrument panel. This gauge has 6 separate indicators, the selector must be rotated clock-wise to position the gauge for reading the desired fuel tank.

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• The fuel shut-off valves provide an emergency means of shutting off the flow of fuel in case the fuel line is severed or burned off. The valves for tanks 1 and 4 are forward of the tanks between the oil coolers. Valves for tanks 2 and 3 are between the tanks and the rear spar. Each valve's design and internal components are such that it is spring loaded to the open position. This means that it is closed by means of an electrical solenoid controlled by an electrical switch in the cockpit. This valve will stay open, if already open, or automatically return to the open position if electrical power to the solenoid is lost.

• The fuel shut-off switches for the above valves are located on the forward part of the pilots' control pedestal. Four switches with two positions (OPEN-CLOSED) provide electrical power to the valves' solenoids. These switches are normally in the OPEN position and a spring guard helps to prevent inad-vertent switch actuation.

FUEL BOOSTER PUMPS:

• A fuel booster pump located on the underside of each of the four main fuel tanks serves to: (1) assure fuel supply to that engine's fuel pump on takeoff and landing; (2) prevent vapor lock from occurring in the fuel lines; (3) provide fuel to the carburetor when starting the engine and; (4) function as a backup for the engine driven fuel pump if it should fail.

• Each pump is electrically controlled and operated by a OFF-ON switch on the pilot's center control panel. These switches are not spring-loaded, re-maining in whichever position placed.

• At higher altitudes, especially with warm fuel, the possibility of fuel vaporization increases. Use of the boost pump will avoid this phenomena from occurring by "fuel conditioning". As the fuel is drawn through the funnel of boost pump the centrifugal action of the impeller throws the bubbles in the fuel out through the sides of the internal screen and back into the fuel tank.

• A C-4 fuel strainer is located on each engine's nacelle firewall. If the strainer's screen becomes clogged, fuel will proceed to the engine through an internal by-pass.

ENGINE DRIVEN FUEL PUMPS:

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• Each engine driven fuel pump is mounted on the engine's accessory section. It provides fuel pressure to the carburetor when the engine is operating.

Output is nominally 12-16 psi. This pump has sufficient capacity to furnish fuel to the engine for any operating condition at any useable altitude. At higher altitudes of approximately 10,000' or above it may be advantageous to operate the fuel booster pumps to avoid fuel vaporization problems and to assist the engine driven pump. The pump's design allows fuel in excess of the carburetor's requirements to be returned to the inlet side of the pump and vents to its respective main tank. It also has a by-pass feature which allows the electrical fuel boost pump to feed the engine if the engine driven fuel pump becomes inoperative.

FUEL TRANSFER SYSTEM:

• Two red fuel selector valves for transferring fuel are located below the bomb bay entrance door at the rear of the flight crew compartment. The actual valve is mounted on the rear of this bulkhead while the handles are located on the front part of the bulkhead.

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• It's important to understand that fuel may only be transferred across the fuselage. This means that if it is desired to transfer fuel from an inboard tank to an outboard tank on one side, you must first transfer to a tank with adequate capacity on the opposite side, then back to the desired fuel tank.

• Each transfer handle has 4 positions. The left handle (facing to the rear) has OFF, TANK ENG 4, TANK ENG 3 and TANK BOMB BAY; the right has OFF, TANK BOMB BAY, TANK ENG 2, and TANK ENG 1. When the handle is turned it mechanically positions the internal mechanism of the valve that will allow fuel to only flow from/to the desired location as placarded on the valve. The BOMB BAY positions are for historical accuracy, no tanks are installed. When finished transferring return the valve handle to the OFF position.

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• Since the operation of this system relies upon internal micro switches it is a good practice to "feel" the vibration or "buzz" of these valves as the pump switch is turned on, in order to ascertain that the selected pump is actually operating. A reversible transfer pump is located behind the bulkhead in the bomb bay. The electrical switch for this pump is located between the two selector valves. The original installation consisted of a two switches, ganged together. This permitted the use of either the Romec or the Pesco pumps. The Pesco is used on this airplane, therefore the unused switch has been removed. Use of the Romec pump is prohibited due to this removal.

• The switch has three positions, LH TANKS TO RH TANKS, OFF, and RH TANKS TO LH TANKS. The switch is always placed in the direction you wish the fuel to be transferred. When finished with transferring fuel, return the switch to OFF in order to terminate the action. The switch should be in OFF anytime fuel is not being transferred.

• Fuel will transfer at the rate of approximately 9-11 gallons per minute with battery voltage or 11-13 gallons per minute with generator system voltage online.

VACUUM SYSTEM

VACUUM SYSTEM

GENERAL:

The vacuum system for this airplane consists of two vacuum pumps, one pump mounted on the accessory section of #2 engine and one on the #3 engine. The system further consists of a selector valve, a relief valve, a direct reading vacuum gauge and a low pressure warning light. The instruments requiring vacuum for their operation are (1) co-pilot's attitude gyro, (2) co-pilot's directional gyro and (3) the captain's turn and slip indicator. The electrically powered instruments are the captains attitude gyro and horizontal situation indicator (HSI). The HSI utilizes a heading bug and course selector. Pilots should operate the HSI system in the slave mode under normal conditions.

• The vacuum (suction pressure) gauge is located on the lower center of the pilot's instrument panel. The vacuum system pressure should read between 3.75 and 4.0 inches Hg, the gauge is marked with a red radial at 4.0 inches Hg

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• The red warning light is just above the vacuum gauge on the pilot's instrument panel. It will illuminate if pressure falls below 3.0 +.5, -.0 inches Hg.

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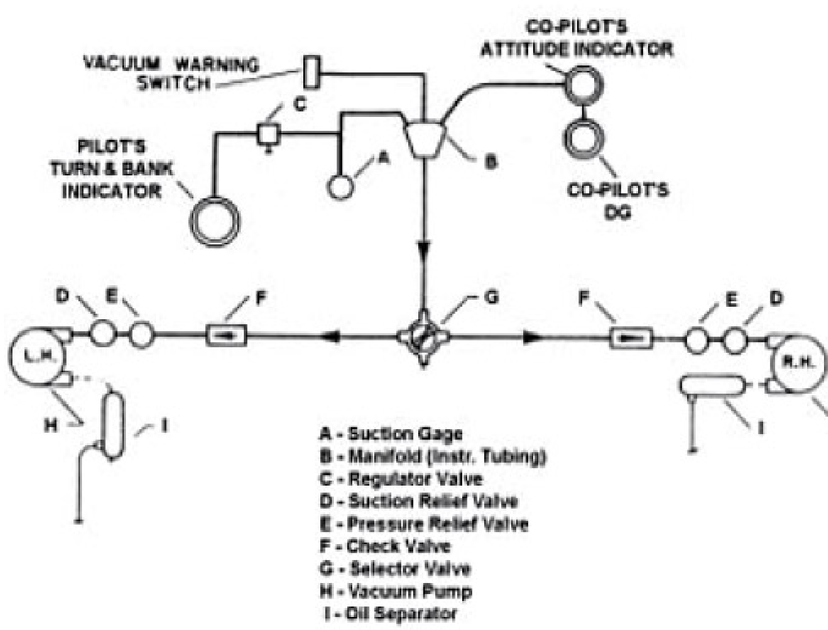
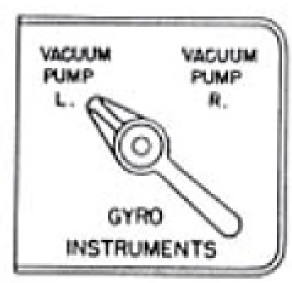
• This rotating selector valve is located on the pilot's side wall of the cockpit just aft of the electrical control panel. It is placarded VACUUM PUMP L and VACUUM PUMP R to indicate which engine's pump is the source of vacuum. In the event of a failure of the selected engine that requires feathering, that pump will be inoperative and the opposite side's vacuum pump must be manually selected to the operative engine to prevent loss of the first officers attitude indicator, first officers directional gyro, and the captains turn and bank indicator.





PITOT-STATIC SYSTEM

Pitot-static system:

The pitot static system on this aircraft consists of an airspeed indicator, an altimeter, a vertical velocity indicator, and two independent altitude encoders. All these instruments are mounted on the pilot's flight instrument panel. Normal static pressure is sensed by two interconnected ports, one on each side of the nose. Alternate static pressure is sensed at an additional port on the left side of the nose.

The static source selector is mounted on the lower right of the pilot's instrument. It provides for the selection of an alternate static source in the event the normal one becomes disrupted or unavailable.

The pitot tube is mounted on the left side of the airplane's nose, well forward of the static sources mentioned above. This tube is electrically heated and this heat is controlled by a switch on the electrical control panel. A 15 Amp fuse located in fuse station # 4 protects this circuit.

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RADIOS and NAVIGATION

RADIOS AND NAVIGATION:

GENERAL:

The aircraft is certified and maintained according to the appropriate Federal Aviation Regulations enabling it to legally file and be operated according to Instrument Flight Rules.

Radios and Navigation Equipment:
All equipment is located on the forward instrument panel unless otherwise noted.

Audio Control System
(1) PS Engineering PMA 7000S located at the top of the radio stack. It provides Radio transmitter selection, audio selection, and intercom. Its operation is covered below.

VHF/Nav/Comm
(2) Garmin GNS430 units. (Comm / VOR / ILS / GS / GPS) The upper unit, #1, provides the VOR / ILS / GS / and GPS signals to the HSI which is located in the center of the pilot's instrument panel. The lower unit, #2, provides the same signals to the copilot's OBS, located on the lower left of the copilot s instrument panel.

Transponder
(2) One Garmin GTX 320 and one Bendix-King KT-76A, both located one above the other at the bottom of the radio stack on the center instrument panel. Both units incorporate altitude reporting utilizing separate altitude encoders.

Marker Beacon
The control / test switch and lights are located above the pilot's attitude indicator. There is a volume control located on the lower right of the pilot's instrument panel.

Automatic Direction Finding (ADF)
The ADF has been removed from the aircraft with the installation of the Garmin GNS 430's.

Distance Measuring Equipment (DME)
The DME has been removed from the aircraft with the installation of the Garmin GNS 430's.

The avionics systems are protected by several circuit breakers located on a panel in the Navigator's Compartment. The panel is accessible through an opening in the canvas cover that shields the front side of the pilot's instruments. This panel also includes a Radio Master Relay Bypass switch. It is used to power the radios by bypassing the avionics power relay should it fail. This switch is normally safety wired OFF.

PS PMA 7000S Audio Panel Operation

This section provides detailed operating instructions for the PS Engineering PMA7000 Audio Selector Panel/Intercom Systems

Power Switch (Fail Safe Operation)
Unit power is turned on and off by pushing the volume knob. In the OFF or "FAIL-SAFE" position, the pilot is connected directly to Com 1. This allows communication capability regardless of unit condition. Any time power is removed or turned OFF, the audio selector will be placed in the fail-safe mode. The power switch also controls the audio selector panel functions and. Unless the mic selector is in Com 3 mode, at least one of the selected audio LEDs will be on (Com 1 or Com 2).

Audio/Selector

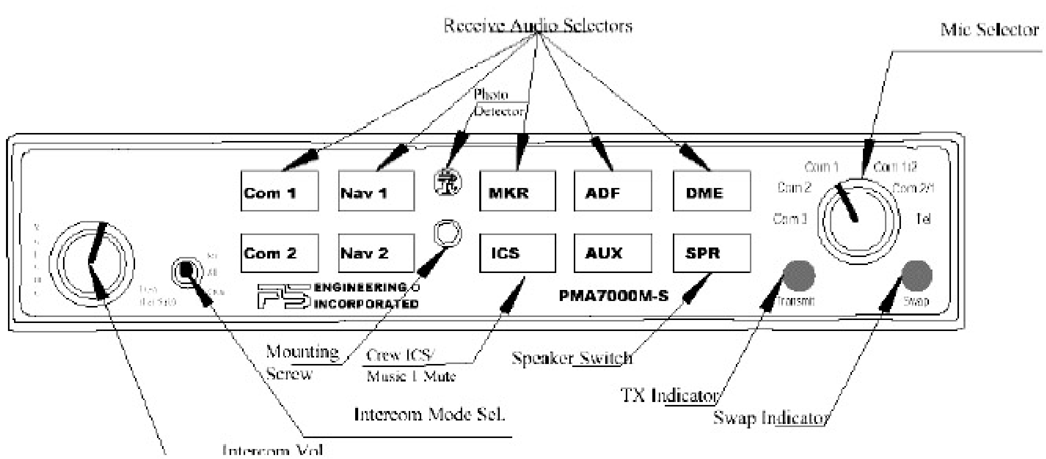
Receiver audio is selected through two momentary and six latched, push-button, backlit switches. Com 1 and Com 2 are the momentary switches. Because the rotary microphone selector switch controls what transceiver is being heard, the Com l and Com 2 push-buttons are of the momentary type and do not remain in when selected. This is also part of the "auto function. You will always hear the audio from the transceiver that is selected for transmit by the rotary mic selector switch. The users can identify which receivers are selected by noting which of the green switch LEDs are illuminated. Push buttons labeled Nav 1, Nav 2, DME, MKR (Marker), ADF, AUX (auxiliary), and SPR (Speaker) are "latched" type switches. When one of these buttons is pressed, it will stay in the "in" position. Press the switch again and it be in the "out" position and remove that receiver from the audio.

Speaker Amplifier

The "SPR" in the push-button section stands for speaker. This switch will place all selected audio on the cockpit speaker when this switch is selected. NOTE: The speaker amplifier is not active in the "Split Mode."

Microphone Selector

When the mic selector switch is in the Com 1 position, both pilot and copilot will be connected to the Com l transceiver. Only the person who presses their Push To Talk (PTT), will be heard over the aircraft radio. Turning the rotary switch to the COM 2 position will place pilot and copilot on Com 2



The PMA7000 gives priority to the pilot's PTT. If the copilot is transmitting, and the pilot presses his PTT, the pilot's microphone will be heard over the selected com transmitter.

Note: Split Mode does not turn off other (Nav, ADF, ect.) selected audio to pilot. However, the copilot will only hear the selected communications receiver.

Turning the mic selector fully counterclockwise places the pilot and copilot on Com 3. Com 3 receive audio is automatically placed in the headset (and speaker if selected). Com 1 and/or Com 2 receiver audio can be selected to monitor those transceivers.

The PMA7000-Series has an automatic selector mode. Audio from the selected transceiver is automatically heard in the headsets and speaker. You can check this function by switching from COM 1 to COM 2 and watch the selected audio light on the selector change from COM 1 to COM 2. This ensures the pilot will always hear the audio from the transceiver he is transmitting on.

When switching the mic selector rotary switch from COM 1 to COM 2, while COM 2 audio had been selected, Com 1 audio will continue to be heard. This eliminates the pilot having to switch Com 1 audio back on, if desired. When switching from COM 1 to COM 2 while Com 2 has NOT been selected, Com 1 audio will be switched off. In essence, switching the mic selector will not effect the selection of Com audio.

The TEL position is not active. Placing the mic selector switch in the TEL position will disable pilot and copilot intercom, as the intercom circuit would be transferred to the telephone use.

Swap Mode (Switch from Com 1 to Com 2 remotely) With a yoke mounted, momentary switch, the pilot can change from the current Com transceiver to the other by depressing this switch. When "Swap Mode" is active, an annunciator in the lower right corner of the unit will illuminate, indicating that the Mic Selector switch position is no longer current. To cancel "Swap Mode," the pilot may either press the yoke mounted switch again, or turn the Mic Selector Switch to the Com that is active.

Split Mode

Turning the rotary switch to COM 1/COM 2 places the PMA7000 into "Split Mode." This places the pilot on Com 1 and the copilot on Com 2. An example of this useful feature is when the pilot may want to talk to Air Traffic Control, while the copilot may be speaking to Flight Watch. Although this mode has limitations (see below) we believe you will find this to be a useful feature. Switching to Com 2/Com l will reverse the Split Mode radio selection. The pilot will be on Com 2 and the copilot will be on Com 1.

Split Mode ICS
In split mode, the pilot and copilot are usually isolated from each other on the intercom, simultaneously using their respective radios. Depressing the ICS button in Split Mode will activate VOX intercom between the pilot and copilot positions. This permits intercommunication when desired between the crew. Pressing the ICS button again disables this crew intercom function.

> Note: Due to the nature of VHF communications signals, and the size constraints in general aviation aircraft, it is probable that there will be some bleed-over in the Split mode, particularly on adjacent frequencies. PS Engineering makes no warranty about the suitability of Split Mode in all aircraft conditions.

Intercom

IntelliVox" VOX-Squelch

No adjustment of the IntelliVox squelch control is necessary. Through three individual signal processors, the ambient noise appearing in all six microphones is constantly being sampled. Non voice signals are blocked. When someone speaks, only their microphone circuit opens, allowing them to communicate on the intercom.

The system is designed to block continuous tones, therefore people humming or whistling in monotone may be blocked after a few moments.

For best performance, the headset microphone must be placed within 1/4 inch of your lips, preferably against them. It is also a good idea to keep the microphone out of a direct wind path. Moving your head through a vent air stream may cause the IntelliVox to open momentarily. This is normal.

Volume Control

The volume control knob adjusts the loudness of the intercom for the pilot and copilot only. It has no effect on selected radio levels, music input levels or passengers' volume level.

Adjust the radios and intercom volume for a comfortable listening level for the pilot. Most general aviation headsets today have built-in volume controls; therefore, passenger volume can be adjusted at the headset. If desired, passenger volume level can be adjusted by a screwdriver adjustment at the top of the tray

Intercom Modes

The lower switch on the left side is a 3-position mode switch that allows the pilot to tailor the intercom function to best meet the current cockpit situation. The description of the intercom mode function is valid only when the unit is not in the "Split" mode. Then, the pilot and copilot intercom is controlled with the ICS button.

ISO: (Up Position): The pilot is isolated from the intercom and is connected only to the aircraft radio system. He will hear the aircraft radio reception (and side tone during radio transmissions). Copilot will hear passengers intercom, while passengers˚ will hear copilot intercom. Neither will hear aircraft radio receptions or pilot transmissions.

ALL: (Middle Position): All parties will hear the aircraft radio and intercom.

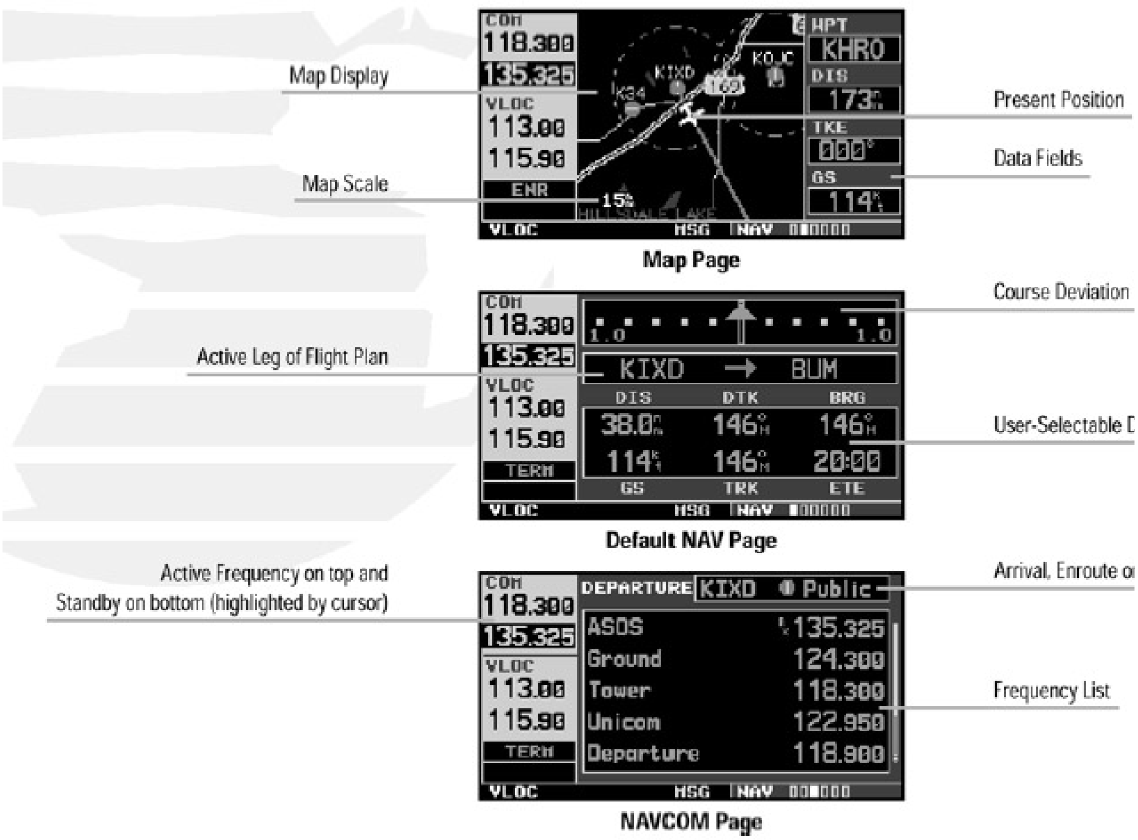
CREW (Down Position): Pilot and copilot are connected on one intercom channel and have exclusive access to the aircraft radios. Passengers can continue to communicate with themselves without interrupting the Crew.

Anytime the PMA7000 is in either the COM 1/COM 2, COM 2/COM 1, ("Split Mode"), the pilot and copilot intercom is controlled with the ICS button. The passengers will maintain intercommunications, but never hear aircraft radios.

Mode	Pilot Hears	Copilot Hears	Passenger Hears	Telephone	Comments
Isolate	A/C Radios Pilot Sidetone (during radio transmis-sion) Entertainment 1 is Muted	Copilot and passenger intercom Entertainment #1	Passenger and Copilot intercom Entertainment #2	"Phone Booth" mode Pilot has exclusive use of the telephone. In TEL, Pilot connected to Com 1 for PTT TX and re-ceive.	This mode allows the pilot to communicate without the others bothered by the conversations. Copilot and passengers can continue to communicate and listen to music
All	Pilot Copilot A/C Radio Passengers Entertainment #1	Copilot Pilot A/C Radio Passengers Entertainment #1	Passengers Pilot Copilot A/C Radio Entertainment #2	All have access to phone through Hook Switch. Pilot access through TEL switch. All hear telephone audio.	This mode allows all on board to hear radio recep-tion as well as communi-cate on the intercom. Music and intercom is muted during intercom and radio communications
Crew	Pilot Copilot A/C Radio Entertainment #1	Copilot Pilot A/C Radio Entertainment #1	Passengers Entertainment #2	Pilot and copilot don't have phone access, unless mic sel in TEL. Passengers have phone through Hook Switch. Passengers hear phone audio.	This mode allows the pilot and copilot to concentrate on flying, while the pas-sengers can communicate amongst themselves.

Intercom Modes


GARMIN GNS 430
GARMIN
GNS 430
COM
136.975
118.000
VLOC
117.95
108.00
TERM
GPS
KHPN
WPT
KHPN
DIS
TKE
GS
NAV
RNG
MENU
CLR
ENT
DEFAULT NAV
GPS
COM/VLOC
PUSH C/V
PUSH CRSR
CDI
OBS
MSG
FPL
PROC



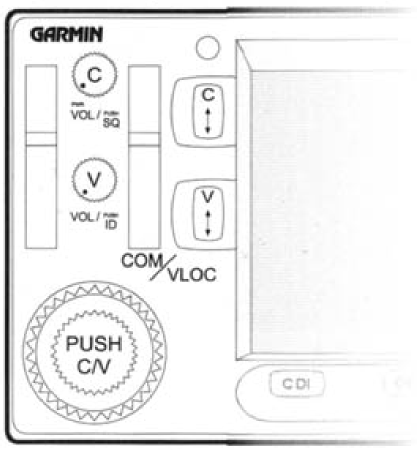
Map Page

Default NAV Page

NAVCOM Page

Key and Knob Functions

The GNS 430 is designed to make operation as simple as possible. The key and knob descriptions below provide a general overview of the primary function(s) for each key and knob.



Left-hand Keys and Knobs

Left-hand Keys and Knobs

The COM power/volume knob controls unit power and communications radio volume. Press momentarily to disable automatic squelch control.

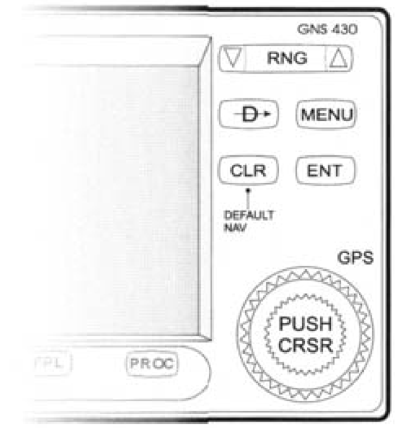
The VLOC volume knob controls audio volume for the selected VOR/Localizer frequency. Press momentarily to enable / disable the ident tone.

The large left knob (COM/VLOC) is used to tune the megahertz (MHz) value of the standby frequency for the communications transceiver (COM) or the VLOC receiver, whichever is currently selected by the tuning cursor.

The small left knob (COM/VLOC) is used to tune the kilohertz (KHz) value of the standby frequency for the communications transceiver (COM) or the VLOC receiver, whichever is currently selected by the tuning cursor. Press this knob momentarily to toggle the tuning cursor between the COMM and VLOC frequency fields.

The COM flip-flop key is used to swap the active and standby COM frequencies. Press and hold to select emergency channel (121.500 MHz)

The VLOC flip-flop key is used to swap the active and standby VLOC frequencies (i.e. make the selected standby frequency active.)



Right-hand Keys and Knobs

Right-hand Keys and Knobs

The range key allows you to select the desired map scale. Use the up arrow side of the key to zoom to a larger area, or the down arrow side to zoom in to a smaller area.

The direct-to key provides access to the direct-to function, which allows you to enter a destination waypoint and establishes a direct course to the selected destination.

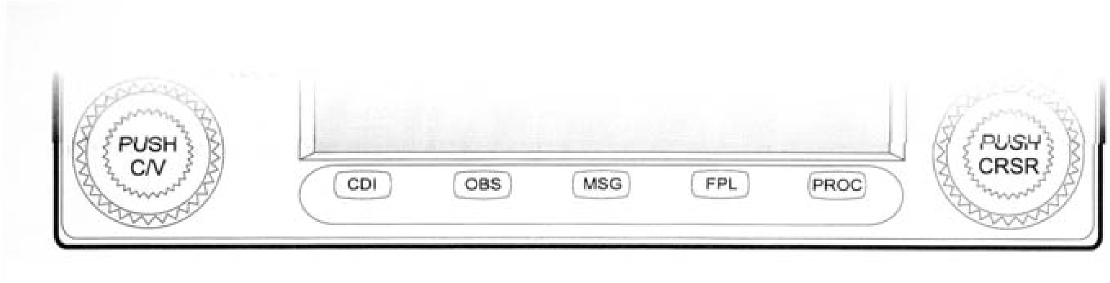
The menu key displays a context-sensitive list of options. This options list allows you to access additional features or make settings changes which relate to the currently displayed page.

The clear key is used to erase information or cancel an entry. Press and hold this key to immediately display the default Navigation Page regardless of which page is currently displayed.

The enter key is used to approve an operation or complete data entry. It is also used you confirm information, such as during power on.

The large right knob (CRSR) is used to select between the various page groups: NAV, WPT,AUX or NRST. With the on-screen cursor enabled, the large right knob allows you to move the cursor about the page.

The small right knob (CRSR) is used to select between the various pages within one of the groups listed above. Press this knob momentarily to display the on-screen cursor. The cursor allows you to enter data and/or make a selection from a list of options.



Bottom Row Keys

The CDI key is used to toggle which navigation source (GPS or VLOC) provides output to the external HIS or CDI.

The OBS key is used to select manual or automatic sequencing of waypoints. Pressing the OBS key selects OBS mode, which will retain the current active to waypoint as your navigation reference even after passing the waypoint (i.e., prevents sequencing to the next waypoint). Pressing the OBS key again will return to normal operation, with automatic sequencing of waypoints. Whenever OBS mode is selected, you may set the desired course to/from a waypoint using the OBS page, or an external OBS selector on your HIS or CDI.

The message key is used to view system messages and to alert you to important warnings and requirements.

The flight plan key allows you to create, edit, activate and invert flight plans, as well as access approaches, departures and arrivals. A closest point to flight plan feature is also available from the flight plan key.

The procedures key allows you to select and remove approaches, departures and arrivals from your flight plan. When using a flight plan, available procedures for your departure and/or arrival airport are offered automatically. Otherwise, you may select the desired airport, then the desired procedure.

EMERGENCY EQUIPMENT

FIRE EXTINGUISHERS:

There are two (2) portable Halon fire extinguishers carried aboard the aircraft. One is mounted on the cockpit wall just behind the copilot's seat. The other is located just opposite the aft entrance door, on the fuselage's left sidewall.

CRASH AXE:

The crash axe is located in the bottom of the ammo box of the waist gun position. A small axe is underneath the radio room floor hatch.

FIRST AID KIT

The First Aid kit is located on the cockpit wall behind the pilot's seat.

HAND CRANKS

The hand cranks and extensions for gear and flap emergency operation are located under the radio room floor hatch.

FLASH LIGHT

Two Flashlights are strapped to the cockpit wall next to the co- pilot's seat.

SPARE HYDRAULIC FLUID

A five gallon can is located under the Captains seat on the flight deck.

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WEIGHT AND BALANCE

Weight & Balance

With wartime equipment and turbo charger ducting removed, "Aluminum Overcast's empty weight is about 3,200 lbs lighter than when she was built. The Center of Gravity limits were reduced from the war time condition of 19 - 35% to 20-32% by the CAA Type certificate. This appears to be partly due to elevator down spring and bulbous trim tab removal in civilian usage.

Following are examples of: (1) The minimum dispatch fuel and crew, (2) A typical tour flight load of passengers, (3) A Long Range reposition (ferry mission) with max dispatch loading.

Minimum Dispatch Fuel and Crew:

EAA B-17 Weight & Balance Computations for N5017N

Per FAA Type Certificate

Maximum Gross weight for T/0 and La	54,000lbs
Center of Gravity range	20% to 32% MAC
CG Range as measured in "Arm"	270.8 to 292.1

Item	No.	# per	Weight	Arm	Moment
Aircraft Empty Wt			34,524	282.8	9762240.70
Pilot & Co-Pilot	2	200	400	167.6	67040.00
TAMO	1	200	200	193.6	38720.00
Fwd Passenger (1)		200	0	193.6	0.00
Radio Room Passengers (3)		200	0	374.0	0.00
Rear Passengers (6)		200	0	559.0	0.00
Aircraft tools/Equipment			50	665.0	33050.00
Tanks 1 & 4 (425 ea)	250	6	1500	281.9	422850.00
Tanks 2 & 3 (213 ea)	125	6	750	292.2	219150.00
Feeder Tanks 2 & 3 (212 ea)	125	6	750	324.1	243075.00
Total			38,174	282.55	10786125.70
			CG in %	26.7	

This Example is based on Weight & Balance data dated 2/14/08

Typical Tour Flight Load.

EAA B-17 Weight & Balance Computations for N5017N

Per FAA Type Certificate

Maximum Gross weight for T/0 and La	54,000lbs
Center of Gravity range	20% to 32% MAC
CG Range as measured in "Arm"	270.8 to 292.1

Item	No.	# per	Weight	Arm	Moment
Aircraft Empty Wt			34,524	282.8	9762240.70
Pilot & Co-Pilot	2	230	460	167.6	77096.00
TAMO	1	250	250	193.6	48400.00
Fwd Passenger (1)	1	200	200	193.6	38720.00
Radio Room Passengers (3)	3	250	750	374.0	280500.00
Rear Passengers RS (3)	3	160	480	559.0	268320.00
Rear Passengers LS (1)	1	170	170	621.0	105570.00
Rear Passengers TW (2)	2	200	400	665.0	266000.00
Aircraft tools/Equipment			50	665.0	33250.00
Tanks 1 & 4 (425 ea)	400	6	2400	281.9	676560.00
Tanks 2 & 3 (213 ea)	240	6	1440	292.2	420768.00
Feeder Tanks 2 & 3 (212 ea)	160	6	960	324.1	311136.00
Total			42,084	292.0	12288560.70
			CG in %	31.9	

This Example is based on Weight & Balance data dated 2/14/08

Maximum Dispatch, fuel, crew, passengers, and baggage:

EAA B-17 Weight & Balance Computations for N5017N

Per FAA Type Certificate

Maximum Gross weight for T/0 and La	54,000lbs
Center of Gravity range	20% to 32% MAC
CG Range as measured in "Arm"	270.8 to 292.1

Item	No.	# per	Weight	Arm	Moment
Aircraft Empty Wt			34,524	282.8	9762240.70
Pilot & Co-Pilot	2	200	400	167.6	67040.00
TAMO	1	200	200	193.6	38720.00
Fwd Passenger (1)	1	200	200	193.6	38720.00
Radio Room Passengers (3)	3	200	600	374.0	224400.00
Rear Passengers RS (3)	3	170	510	559.0	285090.00
Rear Passengers LS (1)	0	170	000	621.0	000000.00
Rear Passengers TW (2)	0	200	000	665.0	000000.00
Aircraft tools/Equipment			50	665.0	33250.00
Main Tanks 1 & 4 (425 ea) 850	6		5100	281.9	1437690.00
Main Tanks 2 & 3 (213 ea) 426	6		2556	292.2	746863.20
Feeder Tanks 2 & 3 (212 ea)424	6		2544	324.1	824510.40
Total			46,684	288.3	13458523.30
		CG in %		29.9	

This Example is based on Weight & Balance data dated 2/14/08

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PERFORMANCE

Performance:

This section provides a collection of performance graphs and charts obtained from several B-17 manuals. They represent the best material currently available.

Base your performance calculations with the following weights in mind:

Aircraft Empty Weight (2/14/08)	~ 34,000
Pilots plus TAMO	600
Passengers	1,400
Fuel (1700 Gallons Max)	10,200
Misc. Equipment	200
Total Max Take-off weight	46,400
No Pax and Min fuel (500 gal)	37,800

Charts included:

Specific Engine Flight Chart
Engine Flight Calibration
Takeoff Distance
Takeoff (1/3 flap), Climb, Landing Distances
Stall Speeds
Fuel Consumption
Three Engine Cruise
Two engine Absolute ceiling
One Engine Descent

SPECIFIC ENGINE FLIGHT CHART

AIRPLANE MODELS: B-17G

ENGINE MODELS: R-1820-97

CONDITION	FUEL PRESSURE (LB./SQ. IN.)	OIL PRESSURE (LB./SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F
DESIRED	17	70	74			
MAXIMUM	18	75	88			
MINIMUM	16	65				
IDLING	12	25				

MAX. PERMISSIBLE DIVING RPM 2760

CONDITION	ALLOWABLE OIL CONSUMPTION	
MAX. CONTINUOUS	23 IMP.PT/HR	14 U.S.QT/HR
MAXIMUM CRUISE	13 IMP.PT/HR	8 U.S.QT/HR
MIN. SPECIFIC	8 IMP.PT/HR	5 U.S.QT/HR

OIL GRADE: (S) 1120 (W) 1100-A

SUPERCHARGER TYPE: G. E. TYPE B-22 TURBOSUPERCHARGER

FUEL OCTANE. 100 GRADE 130

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL./HR./ENG.) U.S.	FUEL FLOW (GAL./HR./ENG.) IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (Minutes)	REMARKS
TAKE-OFF & MILITARY	2500	46"	* 1220	32,700			AUTO. RICH	* 138	115	260	500	5	
WAR EMERGENCY	2500	51"	1350	28,500			AUTO. RICH	—	—	—	—	5	
MAXIMUM CONTINUOUS	2300	38"	980	35,200			AUTO. RICH	100	84	232 (CLIMB) 218	450 424	CONTINUOUS	
MAXIMUM CRUISE (Economical Maximum)	2100	31"	760	OVER 35,000			AUTO. LEAN	63	53	218	424	CONTINUOUS	
MINIMUM SPECIFIC CONSUMPTION	2000 TO 1600	28"	650 TO 520	SEE ENGINE CALIBRATION CHART			AUTO. LEAN	47 TO 37	39 TO 31	218	424	CONTINUOUS	
MINIMUM CRUISING	1400	24"	370	15,000			AUTO. LEAN	26	21	218	424	CONTINUOUS	

CONDITIONS TO AVOID

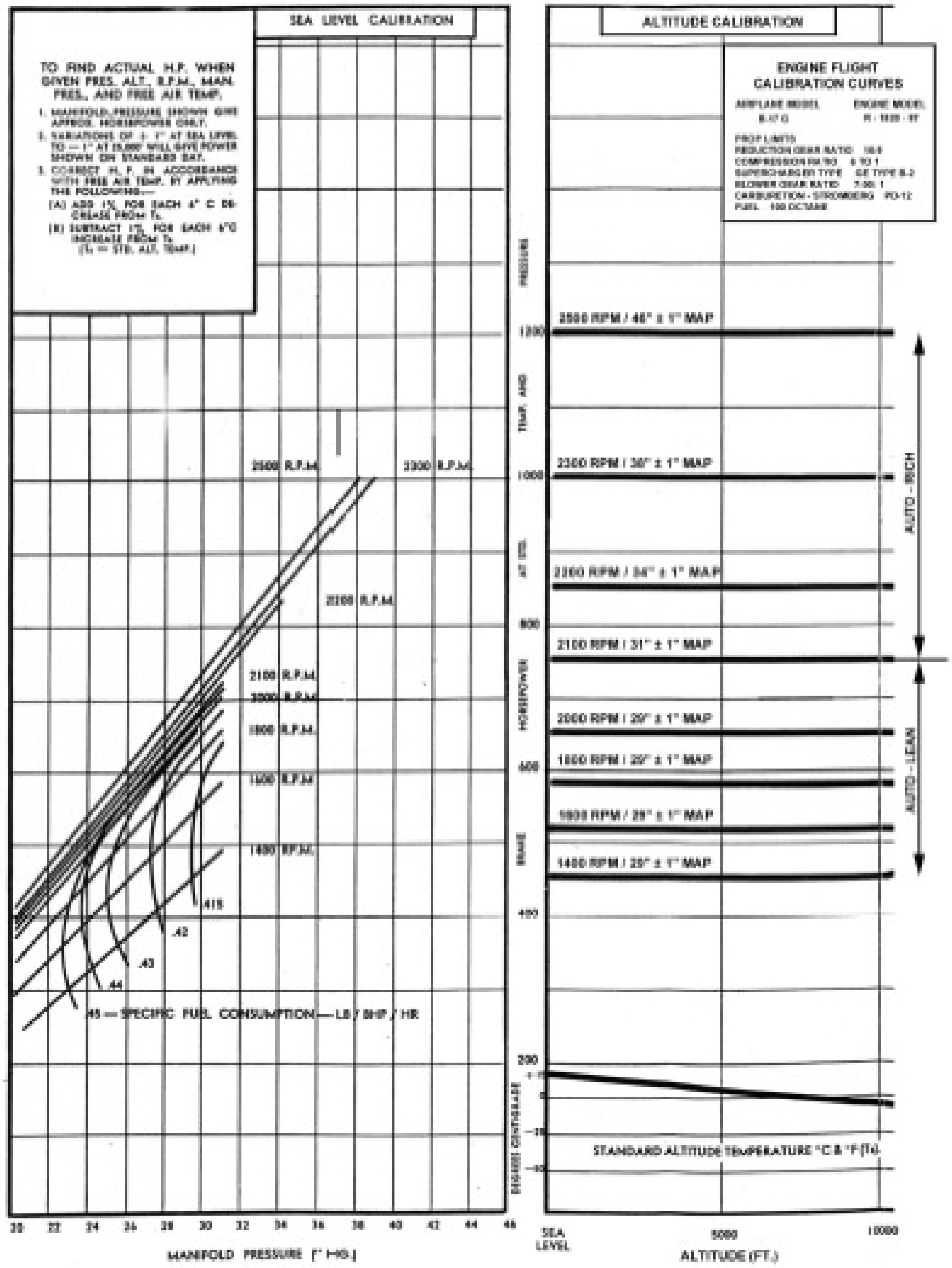
1. AIR INTAKE FILTERS MUST BE "OFF" ABOVE 15,000 FT. IN ORDER TO OBTAIN MAXIMUM POWER AT ALTITUDE.
2. DO NOT MANUALLY LEAN. AUTO-LEAN GIVES MAXIMUM RANGE.
3. DO NOT USE EXCESSIVE PART THROTTLE ABOVE 25,000 FEET BECAUSE OF POWER SURGE.

* HORSEPOWER AND FUEL FLOW FOR 15,000 FEET ALTITUDE

NOTE: CRITICAL ALTITUDE IS THAT AT WHICH MAXIMUM POWER IS OBTAINED WITH FULL THROTTLE UNDER CONDITIONS SHOWN

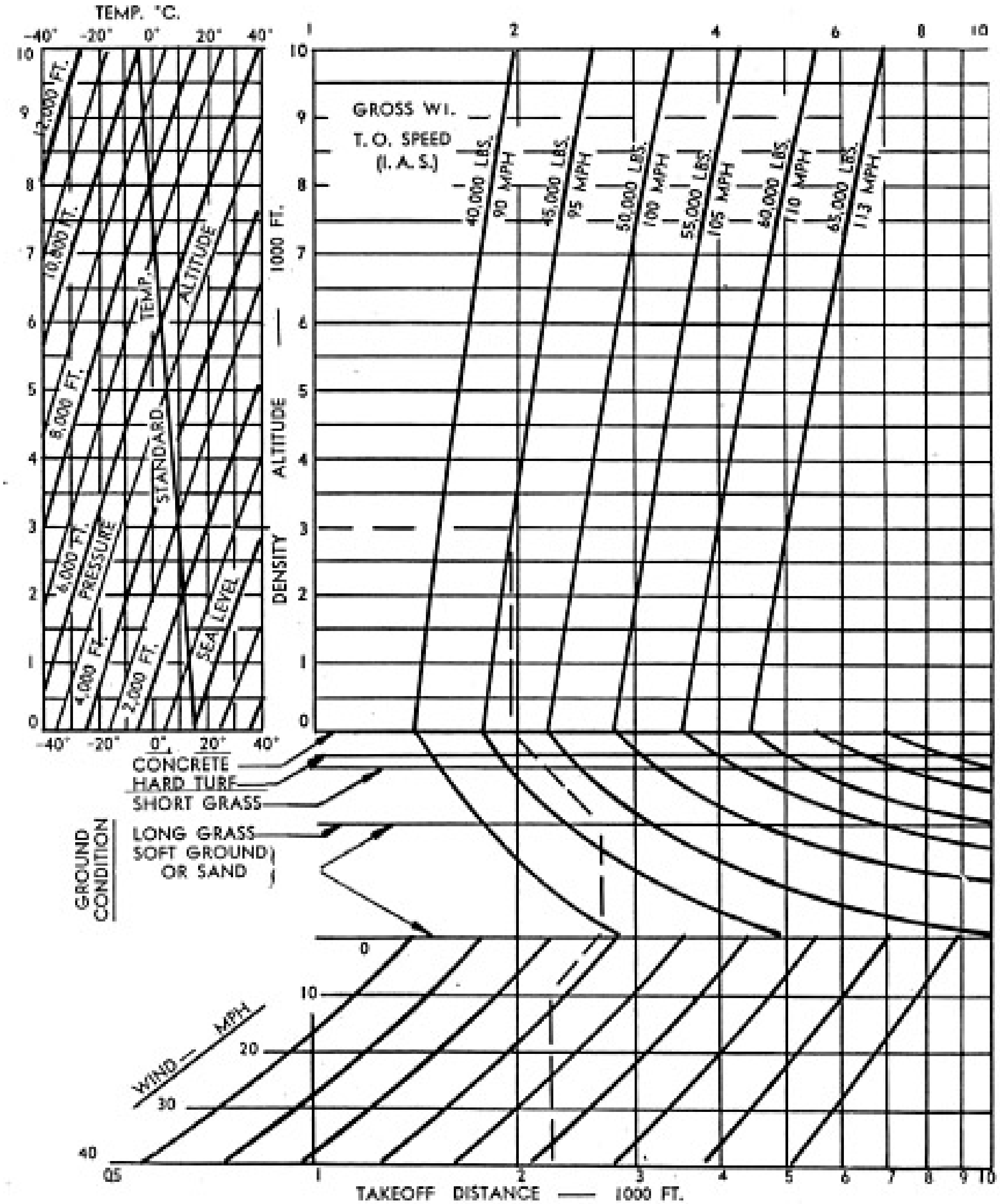
Figure 87—Specific Engine Flight Chart

Specific Engine Flight Chart



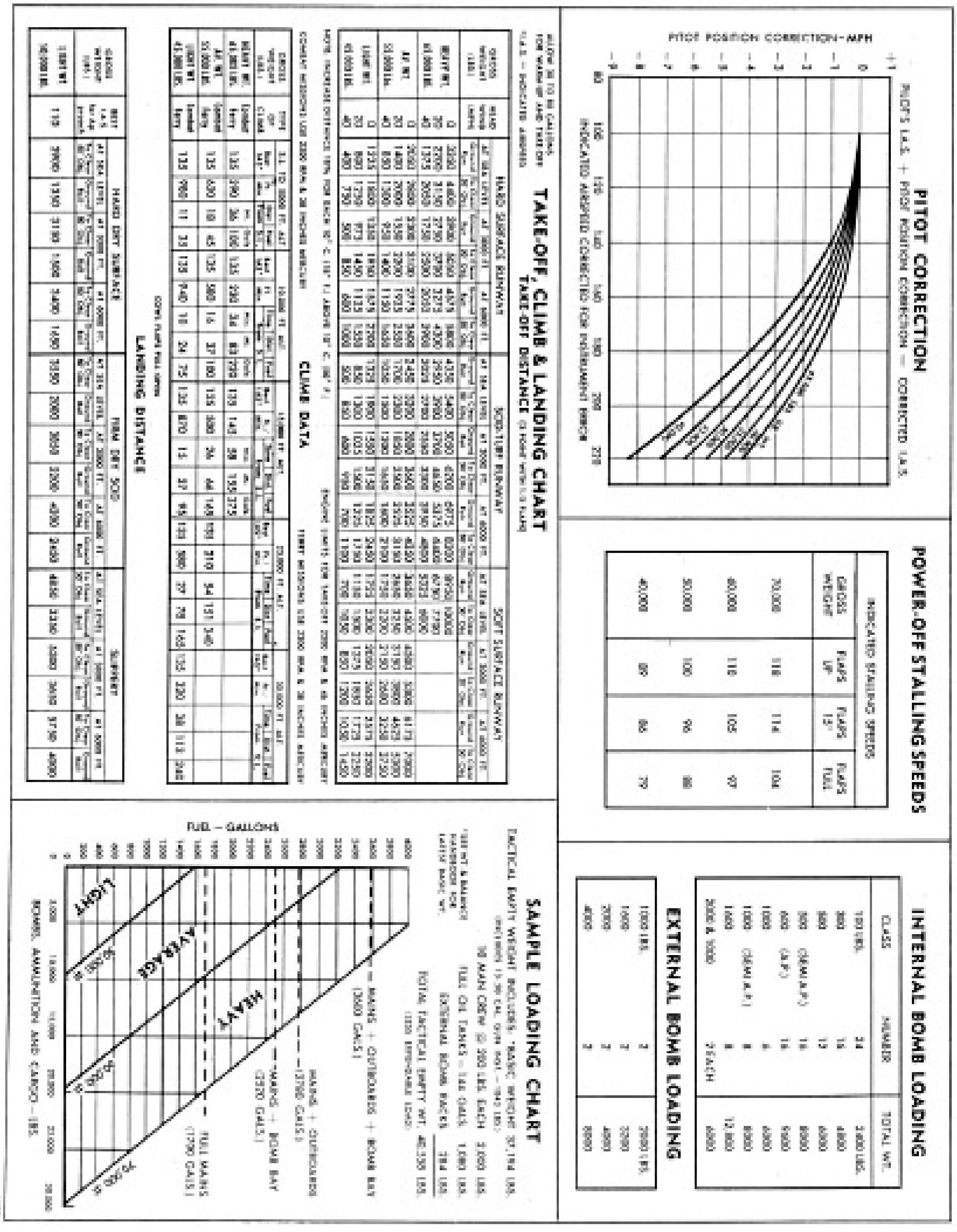
Engine Flight Calibration Curve

Engine Flight Calibration

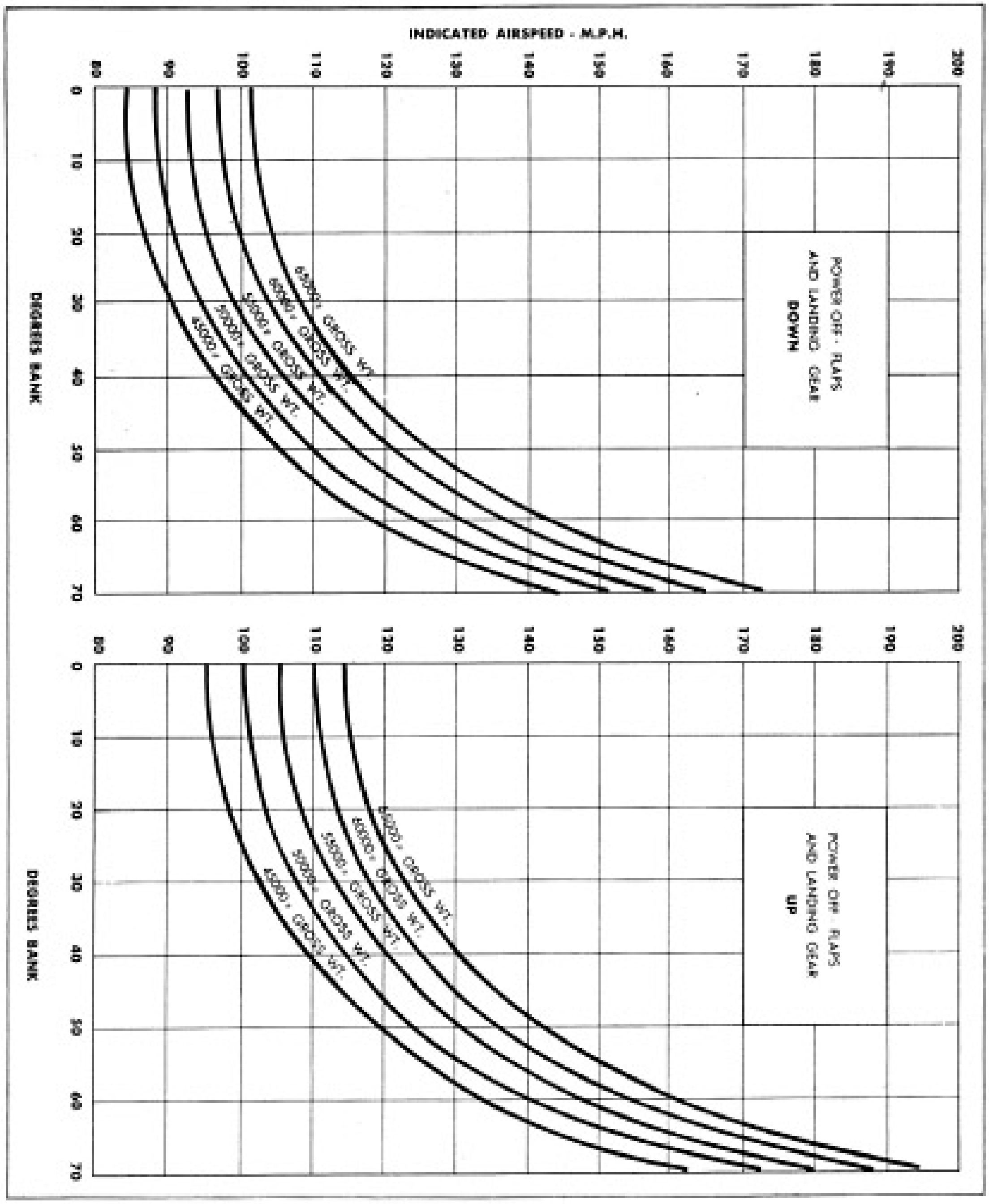


Take-Off Control Chart

Takeoff Distance



Takeoff (1/3 flap), Climb, Landing Distance



Stall Speeds

Appendix III

RESTRICTED

AN 01-20EG-1

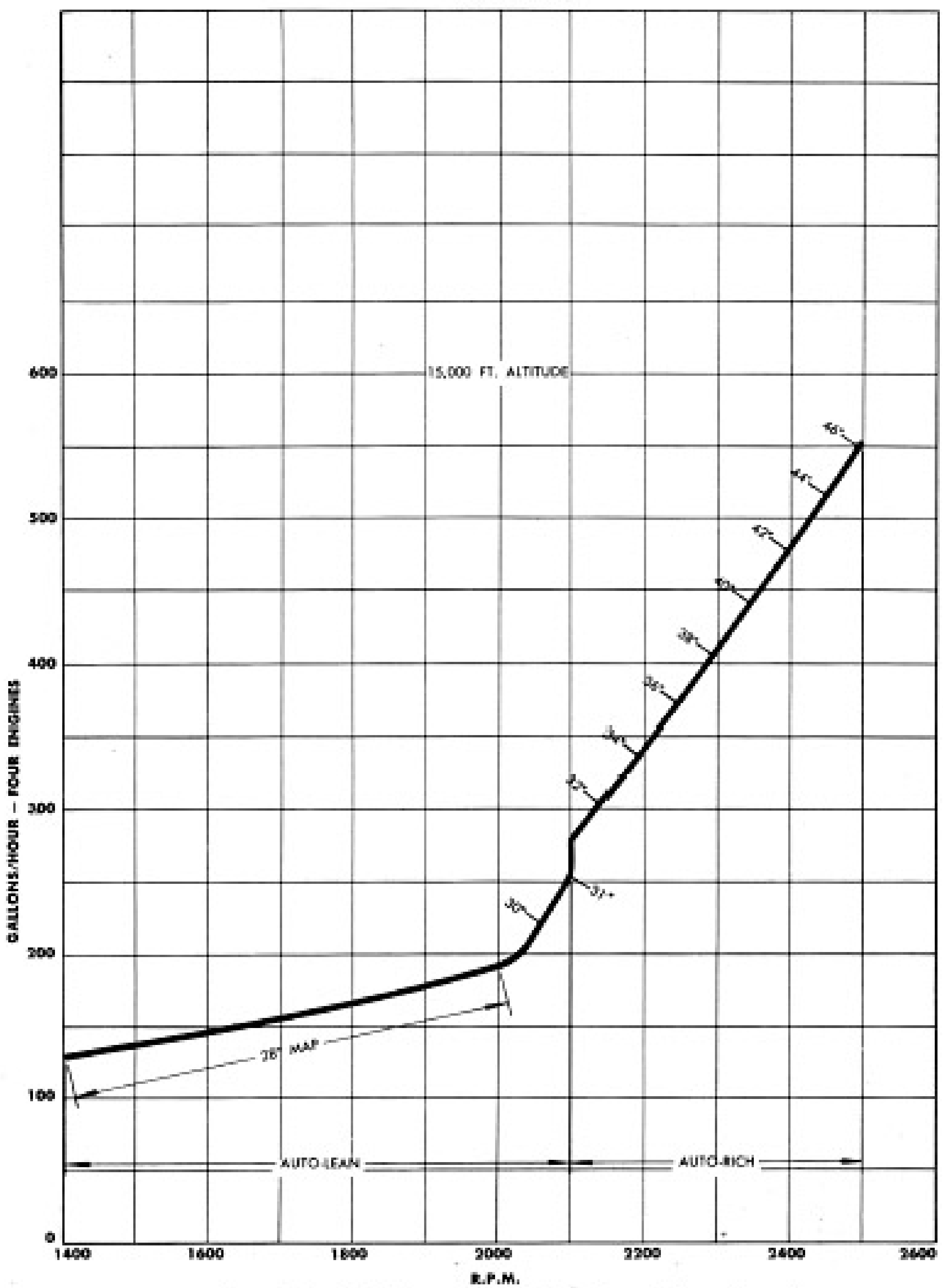


Figure 88 —Fuel Consumption Chart—Four Engines Operating

Fuel Consumption

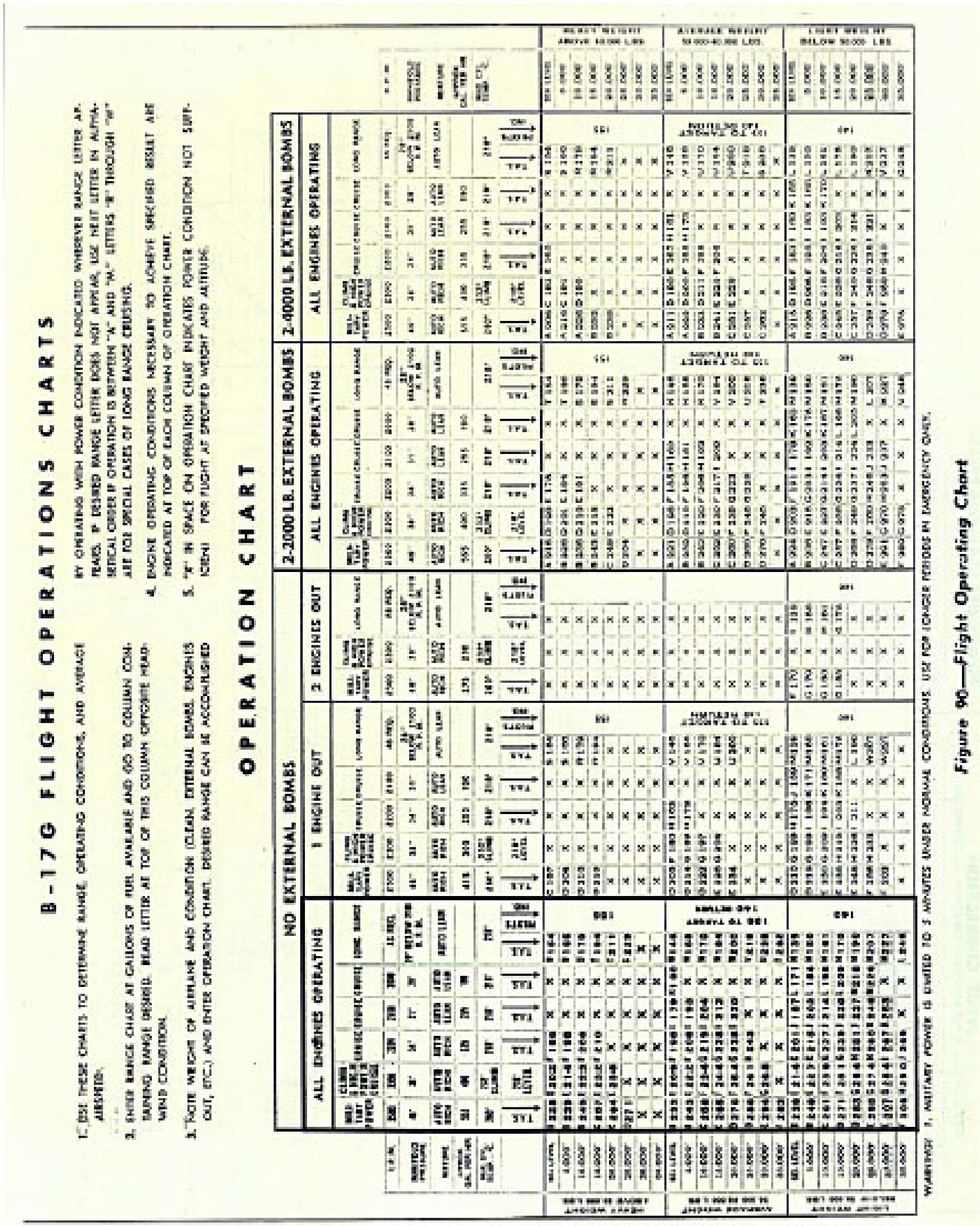


Figure 90—Flight Operating Chart

Restricted

Two engine Absolute ceiling

TBD

One Engine Descent

TBD

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PREFLIGHT

Preflight Inspection

Inspection Date __________

Inspection Item

Wings **Mech./Pilot**

1. Inspect flaps, ailerons, and trim tabs for condition and defects.
2. Inspect inspection doors and fairings for security and condition.
3. Inspect skin for condition and defects.
4. Drain fuel tank sumps.
5. Inspect oil coolers for security and leakage.
6. Inspect wings for overall condition.

Fuselage

7. Inspect skin for condition and defects.
8. Inspect all seats and seat belts for condition and security.
9. Inspect interior for condition and security of all items.
10. Inspect doors, windows and hatches for security and condition.
11. Inspect pitot tube and static port for condition.
12. Inspect inspection and access doors for security and condition.
13. Inspect antennas for condition and security.

Empennage

14. Inspect vertical and horizontal stabilizers for condition and defects.
15. Inspect rudder, elevator, and trim tabs for condition and damage.

Engine/Nacelle

16. Inspect cowling for security.

17. Inspect engines for fluid leaks.

18. Inspect propellers for cracks, nicks, oil leaks, and damage.

19. Accomplish continuity check on chip detectors.

20. Inspect turbochargers for condition and free operation.

Landing Gear

21. Inspect tail and main gear for damage and defects.

22. Inspect tail and main struts for condition and inflation. (tail - $2\,^5/_8$" & main - $1\,^1/_2$")

23. Inspect tail and main wheel assemblies for condition and damage.

24. Inspect landing gear retract actuators for condition and security.

25. Inspect tail and main tires for condition and inflation.

26. Inspect emergency brake system for condition and proper inflation.

Cockpit **Mech./Pilot**

27. Inspect windshield and windows for security, cracks and cleanliness.

28. Inspect engine controls for freedom of movement and full travel.

29. Inspect flight controls for freedom of movement and range.

30. Inspect flaps for proper operation and indication.

31. Inspect instruments for security, loose or broken glass proper pointer position and proper markings.

32. Inspect fuel transfer valve for binding.

33. Inspect hydraulic quantity and service if required (type MIL-H-5606).

34. Inspect hydraulic accumulator pressure and service if required (350 psi).

35. Inspect fire bottles for security, visual indicator and blow out discs.

Electrical

36. Inspect cockpit and instrument lighting for proper operation.

37. Inspect operation of landing lights, position lights and rotating beacon.

38. Inspect battery and inverter voltage. (battery 22 volts min. inverter 100 volts min.)

39. Inspect radios for security and damage.

40. Inspect headsets for condition.

General

41. Inspect fuel quantity and service if required. Ensure that fuel caps are secure.

42. Inspect engine oil quantity and service if required.

43. Remove control locks.

44. Inspect turbo oil quantity and service if required. ($1\,{}^{1}/_{2}$ gals. of 30 wt. mineral oil)

Discrepancies

1.

2.

3.

4.

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7.

8.

9.

10.

Signature:_________________________________

Certificate Number:_________________________

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NORMAL
&
EMERGENCY
CHECKLIST

BEFORE START *ALL C & R*

PREFLIGHT/PAX BRIEFING-------------------------------------- COMPLETED
AIRCRAFT FORMS--- CHECKED
BATTERY SWITCHES--- 3 CHECKED & ON
AVIONICS MASTER--- ON
FUEL & OIL---STICK & GAGES X-CKD
GEAR & SYSTEM FUSES--- IN & CHECKED
LANDING GEAR--- GREEN-INTRNST LTS OFF – SW OFF
TRANSFER VALVE & SWITCH---------------------------------- OFF
CRANKS & EXTENSIONS--- 2 & EXTENSION ABOARD
EMERG. BRAKE & PRESS--SFTD & "____" LBS
HYD. PUMP--MNL CKD, AUTO & "____"
GENERATORS--- ON
INVERTERS-- SPARE CKD & MAIN ON
FLIGHT CONTROLS-- UNLOCKED
PARKING BRAKE--- SET & CHOCKS OUT
FIRE EXTINGUISHER--- OFF
FILTER & CHIP LIGHTS---CHECKED
MANIFOLD PRESSURE--- "____" INCHES
WING FLAPS--UP & OFF
LANDING LIGHTS-- OFF
BEACON & STROBES--ON
FUEL SHUT OFFS--- OPEN
MAG SWITCHES---OFF
BOOST PUMPS--- OFF
COWL FLAPS-- OPEN & LOCKED
MIXTURES-- IDLE CUT OFF
PROPELLERS-- HIGH RPM
TRIM-- 1-2-3 SET

BEFORE START Quick Turn *ALL C & R*

PARKING BRAKE--- SET
FUEL TRANSFER VALVES & SW---------------------------------VALVES & SW OFF
BATTERY SWITCHES--- 3 ON
INVERTERS-- ON MAIN
AVIONICS MASTER---ON
HYDRAULIC PUMP--- AUTO & "____" LBS
MAGNETOS--- AS REQUIRED
LANDING GEAR-- GREEN LIGHT – SW OFF
WING FLAPS--UP – SW OFF
BOOST PUMPS--- OFF
PROPELLERS -- HIGH RPM & LOCKED
FLIGHT CONTROLS-- UNLOCKED

AFTER START *ALL C & R*

BOOST PUMPS---OFF
VACUUM (FIRST FLIGHT)--------------------------------CHECKED
BATTERIES-- ON
MANIFOLD PRESSURE---------------------------------- CHECKED
BOMB BAY DOORS (FIRST FLIGHT)------------------ CLOSED & LIGHT OUT
COWL FLAPS---AS REQUIRED
DOORS & HATCHES-------------------------------------- CONFIRM CLOSED
PASSENGERS-- CONFIRM BRIEFED, SECURE & SOB

TAXI *ALL C & R*

BRAKES---CHECKED
FLIGHT INSTRUMENTS---------------------------------- CHECKED

BEFORE TAKE OFF *ALL C & R*

NAVIGATION EQUIPMENT----------------------------- SET FOR DEPARTURE
FLIGHT INSTRUMENTS & ALTIMETER-------------- CHECKED
COMPASSES--- ALIGNED
TRANSPONDER--- ALT
HYDRAULIC PUMP-------------------------------------- AUTO & "____" LBS
WING FLAPS-- AS REQUIRED
COWL FLAPS---TRAIL
MIXTURES--AUTO RICH
PROPELLERS-- HIGH RPM & LOCKED
TRIM 1-2-3 SET
FLIGHT CONTROLS FREE & CORRECT
CREW BRIEFING COMPLETED

....

WINDOWS--CLOSED & LOCKED
BOOST PUMPS---ON
LANDING LIGHTS---AS DESIRED
TAIL WHEEL---LOCKED & LIGHT OUT

AFTER TAKE OFF *MAY BE SILENT*

LANDING GEAR--- UP – INTRNST LTS OFF –SW OFF
EACH WHEEL CHECKED UP
WING FLAPS-- UP & SW OFF
BOOST PUMPS---OFF
ENGINES & ENGINE INSTRUMENTS------------------CHECKED
COWL FLAPS---AS REQUIRED
LANDING LIGHTS---AS REQUIRED
MIXTURES--AS REQUIRED

CRUISE *MAY BE SILENT*

CRUISE POWER--- SET
ENGINE-ENGINE INSTRUMENTS--------------------- CHECKED
COWL FLAPS--- AS REQUIRED
LANDING LIGHTS---OFF
MIXTURES---AUTO LEAN

IN RANGE *ALL C & R*

CREW BRIEFING-- COMPLETE
NAVIGATION EQUIPMENT----------------------------- SET
FLIGHT INSTRMNTS & ALTIMETER------------------SET & "____" INCHES
TRANSFER VALVES & SWITCH------------------------ VALVES & SW OFF
HYDRAULIC PUMP--------------------------------------- AUTO "____" LBS
FUEL QUANTITY--CHECKED
LANDING LIGHTS---AS REQUIRED

BEFORE LANDING *ALL C & R*

BOOST PUMPS---ON
MIXTURES---AUTO RICH
LANDING GEAR--- DOWN-GREEN LGT-INTRST LT & SW OFF
WING FLAPS--- SET- SW OFF

FINAL LANDING CHECK *ALL C & R*
NLT 500 AGL

FINAL LANDING CHECK

PNF : "I HAVE A WHEEL OVER CENTER,GREEN LIGHT, INTRANSIT LIGHTS OUT, FLAPS SET, STANDING BY THE PROPS"

PF: "I HAVE A WHEEL OVER CENTER, GREEN LIGHT, INTRANSIT LIGHTS OUT PROPELLERS (CROSSING THE FENCE)-------------- HIGH RPM

AFTER LANDING *MAY BE SILENT*

HYDRAULIC PRESSURE---------------------------------- "____" LBS
LANDING LIGHTS-- OFF
COWL FLAPS-- OPEN & LOCKED
WING FLAPS-- UP – SW OFF
BOOST PUMPS-- OFF

ENGINE SHUT DOWN *ALL C & R*

TAIL WHEEL-- LOCKED & LIGHT OUT
PARKING BRAKE--- SET
MAGNETO & IDLE MIXTURE CHECK----------------- AS REQUIRED
OIL SCAVENGE--- COMPLETED
MIXTURES-- IDLE CUT OFF

SECURING *ALL C & R*

MAGNETOS-- OFF
BEACON--- ON
TRANSPONDER--- STANDBY / OFF
INVERTER---OFF
HYDRAULIC PUMP--------------------------------------- OFF
AVIONICS SWITCH--------------------------------------- OFF
BATTERIES--- OFF
FLIGHT CONTROLS---------------------------------------LOCKED
CHOCKS--- IN
PARKING BRAKE-- OFF
FLIGHT & MAINT FORMS------------------------------- COMPLETE

EMERGENCY CHECKLIST

ENGINE FIRE CHECKLIST *ACTIONS DIRECTED BY PIC*

ALL MIXTURES-- AUTO RICH
POWER-- AS REQUIRED
WING FLAPS & LANDING GEAR--------------------- AS REQUIRED
FAILED ENGINE THROTTLE------------------------- CLOSED
FAILED ENGINE PROPELLER------------------------ LOW RPM
FAILED ENGINE MIXTURE--------------------------- IDLE CUT OFF
FAILED ENGINE FEATHER BUTTON--------------- FEATHER
FAILED ENGINE FIRE EXTINGUISHER------------ SELECT & DISCHARGE
VACUUM SELECTOR---------------------------------- AS REQUIRED
FAILED ENGINE BOOST PUMP---------------------- OFF

…………………………………………………………………………………………………

CLEAN UP ITEMS

FAILED ENGINE COWL FLAP -------------------------CLOSED & LOCKED
FAILED ENGINE FUEL SHUT OFF-------------------- CLOSED
FAILED ENGINE GENERATOR------------------------ OFF
FAILED ENGINE MAG SWITCH----------------------- OFF

ENGINE FAILURE IN FLIGHT *ACTION DIRECTED BY PIC*

ALL MIXTURES---AUTO RICH
POWER--- AS REQUIRED
WING FLAPS & LANDING GEAR---------------------- AS REQUIRED
FAILED ENGINE THROTTLE-------------------------- CLOSED
FAILED ENGINE PROPELLER------------------------- LOW RPM
FAILED ENGINE MIXTURE---------------------------- IDLE CUT OFF
FAILED ENGINE FEATHER BUTTON---------------- FEATHER
VACUUM SELECTOR----------------------------------- AS REQUIRED
FAILED ENGINE BOOST PUMP------------------------OFF

…………………………………………………………………………………………………

CLEAN UP ITEMS

FAILED ENGINE COWL FLAP--------------------------CLOSED & LOCKED
FAILED ENGINE FUEL SHUT OFF-------------------- CLOSED
FAILED ENGINE GENERATOR------------------------ OFF

FAILED ENGINE MAG SWITCH----------------------- OFF

EMERGENCY GEAR EXTENSION ***DIRECTED BY PIC***

LANDING GEAR SWITCH---------------------------------OFF
LANDING GEAR FUSE------------------------------------ REMOVED
BOMB BAY DOOR FUSE---------------------------------- REMOVED
CRANK GEAR DOWN--------------------------------------GREEN LIGHT & OVER CENTER
LANDING GEAR FUSE-------------------------------------IN
LANDING GEAR--- VISUALLY CHECKED

ENGINE UNFEATHERING ***ACTIONS DIRECTED BY PIC***

FEATHERED ENGINE FUEL SHUT OFF---------------OPEN
FEATHERED ENGINE BOOST PUMP------------------ON
FEATHERED ENGINE MAG SWITCH------------------BOTH
FEATHERED ENGINE THROTTLE---------------------CLOSED
FEATHERED ENGINE PROPELLER--------------------LOW RPM
FEATHERED ENGINE MIXTURE----------------------- IDLE CUT OFF
FEATHERED ENGINE STARTER (IF REQRD)------- 6 BLADES
FEATHERED ENGINE FEATHER BUTTON-----------PUSH TO 800 RPM, RELEASE
FEATHERED ENGINE PROP GOVERNING----------- CHECKED 1100-1200 RPM
FEATHERED ENGINE OIL PRESSURE---------------- CHECKED
FEATHERED ENGINE MIXTURE-----------------------AUTO RICH
FEATHERED ENGINE GENERATOR-------------------ON

EMERGENCY AIR BRAKES

EMERGENCY BRAKE LEVERS--------------------------AS REQUIRED & HOLD

Emergency Evacuation Procedure

Preamble

The following is guidance to EAA B-17 crews in the event of an emergency evacuation in the B-17. It is based on Industry best practice and original Boeing data from WWII. When using these procedures EAA B-17 crewmembers should keep in mind that all situations are going to be different - use your best judgment in ascertaining the course of action to be taken and use all available resources. You must act with a "command presence" in order to ensure the passengers listen to your direction. In addition, crewmembers must be prepared to act on behalf of other crewmembers that may be incapacitated.

Crew Duties

PIC

Instruct TAMO to wedge or jettison door (as required) and remove exit safety belt prior to touchdown.

Evaluate and discuss the anticipated best exit.

Call for and complete evacuation checklist.

Take flashlight and first aid kit and proceed to cabin and direct evacuation while sweeping cabin clear.

When cabin is clear or all possible assistance is given, leave the aircraft via the cabin door or another exit if cabin door is not available.

Attempt to keep passengers together and away from aircraft – direct passengers to SIC's assigned gathering point.

Try to account for all passengers and crew and provide for their safety.

SIC

Notify tower, ground control, or make necessary distress calls.

Read evacuation checklist.

Take flashlight and axe, exit aircraft immediately from the most expeditious exit (forward most usable exit possible).

Direct evacuation of aircraft from outside.

Assign passengers to a gathering place that is a safe distance away from the aircraft.

Assist in accounting for all passengers and crew and provide for their safety.

TAMO

During passenger briefing select most suitable passenger to designate for assistance of passenger egress from the main cabin door.

At the direction of the PIC, relocate to aft cabin area and either wedge or jettison the cabin door and remove the exit safety belt. Brief passengers for existing situation and anticipated plan of action for emergency landing.

After the aircraft has stopped moving, command the passengers to to “unfasten seatbelts” and “get put” (use simple language such as “come this way”). Immediately grab the emergency crash axe and fire extinguisher for possible use.

If main cabin exit is unavailable, evaluate using the radio room exit or break out the appropriate side window (waist gun position). Consider use of seat cushion or a jacket to lie across broken Plexiglas exit window frame.

Assist passengers in expeditiously exiting the aircraft. Maintain orderly conduct while keeping a rapid pace of movement towards exits. Assure anyone needing assistance is accommodated and yet does not become a bottleneck. Rendezvous with passengers and crew at gathering area outside and clear of the aircraft.

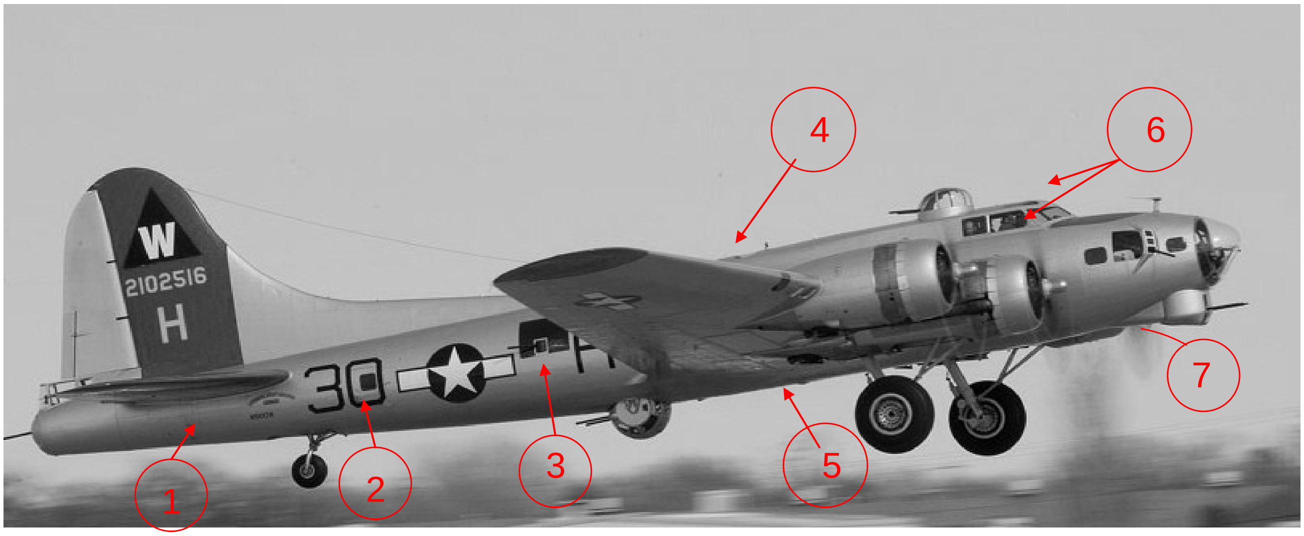
Passenger Evacuation Checklist

1. Set Parking Brake
2. Notify tower or ground control if applicable
3. Notify TAMO "EVACUATE THE AIRCRAFT"
4. Batteries off, Magnetos off, and Mixtures to idle cut off
5. Pull engine fire bottles into nacelle (s) with fire
6. Perform assigned crew evacuation

Note: All crew members must be prepared to act on behalf of other crew members who may be incapacitated.

TAMO Cabin Preparation

When preparing for an emergency landing, the TAMO's duties are to coordinate with the pilots, prepare the cabin, and prepare the passengers. Consideration should be given to selecting the best exit, ensuring rapid and safe egress, and will be responsible for securing the crash axe located under the flooring adjacent to the ball turret and be prepared to use it if needed to add a side window exit.



LIST OF EMERGENCY EXITS

1. **Tail Gunner (not useable on N5017N**
2. **Main Cabin Door**
3. **Waist Gun Windows (if broken with axe)**
   ***One on each side of aircraft**
4. **Radio Room Hatch**
5. **Bomb Bay Doors**
6. **Pilots Windows**
7. **Nose Entry Door (under pilots seat)**

Rev. 3/27/12

EXPANDED NORMAL CHECKLIST

Normal Checklist
For B-17 "Aluminum Overcast"

The following is a description or "design intent" of how the checklist was tailored to fit this specific aircraft and operation. Some items are self explanatory and need no explanation, others require a note to provide an insight into the reason a procedure is written in that manner. The appropriate verbal response is in **bold** print. Note that some responses are printed **AS REQ'D**, in this case the correct response will be the actual position or setting as required by conditions existing at the time. **THESE EXPANDED ITEMS ARE FOR TRAINING PURPOSES AND THE ORDER DOES NOT NECESSARILY REFLECT THE ORDER OF THE CURRENT ACTUAL CHECKLIST.**

P - Pilot
CP - Co Pilot
PF - Pilot Flying
PNF - Pilot Not Flying
CC - Crew Chief

BEFORE START

CP P
PRE FLIGHT / PAX BRIEFING ………...…................. **COMPLETED**
AIRCRAFT FORMS ....…...........**CKD**
BATTERY SWITCHES ....….. **THREE CKD & ON**
Sequentially move each battery switch to the ON position, check for a normal electrical indication for each battery by turning the previous battery switch back OFF. After checking all three batteries, leave the last one ON and return the first two to ON. This leaves the system powered for the rest of the checklist.
AVIONICS MASTER SWITCH .... **ON**
This is turned ON at this time to provide interphone communications for the crew. During the start it also ensures that radio communications are instantly available for alerting any fire apparatus, should this become necessary.
FUEL & OIL (Quantities) .... **STICK & GAGES X-CKD**
This item requires a cross check of the fuel boarded against the dip stick, then a comparison with the individual gages, as well as the total. All crew members involved must fully concur.
GEAR & SYSTEM FUSES ....…...**IN & CKD**
LANDING GEAR .... **GREEN & SWITCH OFF**
INTRANSIT LIGHTS OFF
TRANSFER VALVES & SWITCHES...................... **OFF**
These may be partially blocked from view from the pilot's seats and should be checked upon entry.
CRANKS & EXTENSIONS...................................... **TWO & EXTENSION ABOARD**
EMER BRAKES & PRES .... **SFTD & "___" LBS**
The P will check both handles DOWN and safetied. Note that the gauge pressure reads between 900 minimum and 1500 maximum pounds.
HYD PUMP .... **MNL CKD, AUTO & "___" LBS**
Hold the hydraulic pump switch in MANUAL while noting pump operation. On the first flight of the day note that pressure continues to build until the relief valve opens, indicated by pressure stabilizing near upper red line and sound of fluid bypassing. Move switch to the AUTO position and

close guard.
GENERATORS .... **ON**
INVERTERS... **SPARE CKD & MAIN ON**
Check the spare inverter, then turn the main ON and check it.
FLIGHT CONTROLS .... **UNLOCKED**
The elevator and rudder lock should be moved until the detent engages in the fully unlocked position, then remove and stow the aileron control.
PARKING BRAKES .... **SET & CHOCKS OUT**
To set the parking brakes the CP will actuate the pedals, pull and hold the parking brake control OUT, release the pedals and then release the control. Both pilots check their main wheel to verify that the chocks have been removed.
FIRE EXTINGUISHER ....**OFF**
The CP will respond to this item. The fire extinguisher is left in this position for start and all normal operations. If a fire is observed during starting or at any other time the control must first be selected to the engine involved prior to discharge.
FILTER & CHIP LIGHTS……………………………..**CHECKED**
The CP will note that none of these lights is illuminated, then press to test all of them.
MANIFOLD PRESSURE ……………………………**"____" INCHES**
Note the gage manifold pressures for subsequent use during the runup power check.
WING FLAPS…………………………………………**UP & OFF**
Check that the flaps are retracted, then turn the switch OFF.
LANDING LIGHTS……………………………………**OFF**
BEACON & STROBES ……………………………...**ON**
FUEL SHUTOFFS ……………………………………**OPEN**
MAG SWITCHES……………………………………..**OFF**
BOOST PUMPS ……………………………………...**OFF**
COWL FLAPS………………………………………..**OPEN & LOCKED** PF and PNF check engines on their respective sides.
MIXTURES …………………………………………**IDLE CUT OFF**
PROPS………………………………………………**HIGH RPM**
TRIM…………………………………………………**1-2-3 SET**

BEFORE START QUICK TURN

ALL C&R

This checklist can be used when there is no crew change and multiple flights. If there is any doubt, accomplish the complete Before Start Check List.

PARKING BRAKE………………………………**SET**
FUEL TRANSFER VALVES & SW……………**VALVES & SW OFF**
BATTERY SWITCHES…………………………**3 ON**
INVERTERS……………………………………..**ON MAIN**
AVIONICS MASTER……………………………**ON**
HYDRAULIC PUMP……………………………**AUTO & "__" LBS**
MAGNETOS……………………………………..**AS REQUIRED**
LANDING GEAR………………………………..**GREEN LIGHT SW OFF**

WING FLAPS…………………………………….**UP –SWITCH OFF**
BOOST PUMPS……………………………….…**OFF**
PROPELLERS…………………………………..**HIGH RPM & LOCKED**
FLIGHT CONTROLS……………………………**UNLOCKED**

,

The following engine starting procedures are not included as checklist items, however they are included here as a description of a normal starting procedure.

This description assumes that completion of all pre-start procedures and checklists. The normal sequence for engine start will be 2-1-3-4. This allows access by the fire guard to the engine being started without having to pass through the area of an already running engine.
(Inoperative generators or other considerations may alter this sequence.)
*The pilot (P) holds up two fingers indicating to the fire guard that the #2 engine is to be started. After receiving a corresponding number of fingers from the fire guard (who should ensure all propellers are clear in case the wrong switch is activated) he directs the co-pilot (CP) to start #2.
*The P places the boost pump switch ON and checks full pressure.

***The CP's right hand is used for the started engage and mesh switches and his left hand for the primer switch. The P's right hand is used exclusively for the throttle, his left hand is used for the ignition and mixture. Actuate the energize switch for approximately 10 seconds, then actuate mesh switch and note propeller turning. After counting nine blades turn the ignition switch to BOTH. After the ignition is turned ON actuate the primer switch and hold until the engine is firing normally. As soon as the engine fires and begins to accelerate move the mixture to AUTO RICH. The best results occur if attention is transferred to the tachometer as soon as the engine fires rather than looking at the propeller. As soon as the mixture takes over (indicated by a sagging RPM), the CP releases the primer but keeps a finger on it in the likely event the engine begins to die and a momentary shot of prime is required.
*Check for rising oil pressure, turn the boost pump OFF and then check the fuel pressure.

*Set 800 RPM for warmup.
*Repeat the items covered in the above paragraph for all the remaining engines in sequence except the CP will be responsible for giving the signal to the fire guard on #3 and #4.
*After all engines are started the P will give the "disconnect ground power" (if utilized) signal to the ground crew and, after noting electrical loss, move all three battery switches to ON.
*He will then call for the AFTER START checklist. When ready retard the throttles to get the ground crew's attention and to minimize prop blast, then give the "remove chocks" signal to the ground crew.

AFTER START

CP P
BOOST PUMPS .... **OFF**
VACUUM (FIRST FLIGHT) .... **CKD**
P will note flight instrument suction on vacuum gage, then rotate the selector to the other inboard engine and note that pump's reading.
BATTERIES .... **ON**

Check Batteries "ON" if external power used

MANIFOLD PRESSURE……………………….**CKD**
Check that all Manifold Pressures are 14-16" MAP. A higher reading could mean a dead cylinder.
BOMB BAY DOORS(FIRST FLIGHT)……...**CLOSED AND LIGHT OUT**
COWL FLAPS………………………………….**AS REQUIRED**
On cold days cowl flaps may be positioned to Close for engine oil temperature increase. Full CLOSED position may be necessary.
DOORS AND HATCHES……………………..**CONFIRM CLOSED**
PASSENGERS……………………………..…**CONFRIM BRIEFED, SECURE & SOB**

TAXI

CP P
BRAKES.. **CKD**
As soon as the aircraft moves, check the braking action and a hydraulic system recovery.
FLIGHT INSTRUMENTS .... **CKD**
Note correct operation of the various flight instruments.

RUNUP

Face aircraft into wind if possible, checking area behind for possibility of prop blast problems. Let aircraft roll ahead slightly to center and lock the tail wheel, then call for the CP to set parking brake. The following checklist is not a do list, it is checked after runup.

CP P
PARKING BRAKES ………………………………………... **SET**
ENGINE INSTRUMENTS …………………………… **IN LIMITS**

Oil temperature of must be 40 ^{o} C before exceeding 1200 RPM.
MIXTURES…………………………………………… **AUTO RICH**
RPM ……………………………………………………. **1500**
PROPS …………………………………………………. **CKD**

Advance all four throttles to 1500 RPM and slightly tighten the friction lock if necessary. Cycle all four prop levers to low RPM and note that the RPM drops a few hundred, then return to high RPM. Repeat this operation as necessary to assure supply of warm oil to prop domes. On the final cycle allow the props to fully reach their minimum obtainable governing, then check for a RPM of 1100 - 1200. (This check is important in that if a feather pump fails during flight the prop will have to be placed in this position to obtain minimum drag.) FEATHERING & GENERATORS .... **CKD**

With all four props at approximately 1500 RPM the P will turn the #1 feather button a couple of turns clockwise to assure that it is screwed on tightly, then depress button to FEATHER while calling "NUMBER 1". P observes increased generator loading from the feather motor operation. CP observes feathering action of #1 prop and after a couple hundred RPM drop, P pulls the feather button back out. P notes a decrease in generator load at this time. Prop should return to approximately 1500 RPM. (If the button should stick in the FEATHER position or come loose in your hand, the holding coil can be released by **immediately** turning all four generators and three batteries OFF, removing all electrical current.) Repeat for all other engines. After all engines are checked, place all prop controls in low RPM, observe beginning of RPM drop and then return to high RPM. This is to check for proper reseating of the prop governor pilot valve. Make sure prop friction control is set as described below concerning throttle friction.

POWER & MAGS (AT FIELD BARO) ....**CKD**

A part of this portion of the runup is to set the throttle friction for the ensuing takeoff. The desired friction setting is that which allows throttle movement as desired without changing the friction lock but also tight enough to prevent "creep" if left unguarded. Establish proper throttle friction if necessary. The P will advance the #1 and #4 engines to the field barometric MP noted before starting, the CP assists by backing up the throttles to maintain this setting. Check the RPM at 2100 (± 50) for the power check. The P will check the magnetos on #1 and #4 in turn while calling out "LEFT, BOTH, RIGHT, BOTH", calling out RPM drop on the tachometer. Max RPM drop 100. During this check both the CP and the CC will observe the cowlings/spinners for any signs of excess roughness or other problems. For trouble shooting purposes, a fast drop is indicative of a fouled plug(s), a slow drop is associated with retarded timing and zero drop indicates the mag switch or "P" lead is bad with no grounding taking place. Note engine temperatures and pressures for correct indications. When complete, the CP will retard #1 and #4 throttles to 800-1000 RPM while the P advances #2 and #3 to field barometric. The CP again backs up the throttles and the above check is repeated for these two engines. Return throttles to 800-1000 RPM. The engine instruments are an integral and continuous part of the above checks, re-observe as necessary at this time.

BEFORE TAKEOFF

CP P

TRANSPONDER...**ON**

HYDRAULIC PUMP ....**AUTO & "___" LBS**

WING FLAPS..**AS REQ'D**

Set the flaps to the desired takeoff setting at this time.

COWL FLAPS ....**TRAIL**

MIXTURES……………………………………**AUTO RICH**

PROPELLERS...**HIGH RPM & LOCKED**

TRIM..**1 - 2 - 3 SET**

FLIGHT CONTROLS....................................**FREE & CORRECT**

P will actuate all flight controls through a complete cycle checking for full travel, freedom of movement and correct displacement.

CREW BRIEFING ....**COMPLETED**

P will brief crew actions to be taken in the event of an aborted take off , in-flight emergency or other situation requiring other than normal crew duties. Abnormal situations such as thunderstorms, low ceiling, low visibility and high winds should be briefed at this time. After first flight briefing can just be "Standard Brief".

The dashed line below is intended to indicate to the flight crew to "hold" or interrupt the final items of the checklist at this point until takeoff clearance is obtained to proceed beyond the yellow taxiway line onto the active runway.

WINDOWS... **CLOSED & LOCKED**

P &CP check windows closed and locked.

BOOST PUMPS..**ON**

LANDING LIGHTS.. **AS DESIRED**

TAIL WHEEL .... **LOCKED & LIGHT OUT**

The tail wheel control lock should be lowered to the LOCKED position only once the aircraft is aligned with the runway centerline and the tailwheel is straight. The goal is to see the light extinguish the moment the lever is dropped.

AFTER TAKEOFF

After climb is well established call for the following items to be checked.

PNF PF

LANDING GEAR .... **UP** (PF Verbal Response)
INTRANSIT LIGHTS OFF
SWITCH OFF
EACH WHEEL CHECKED UP

The PNF checks intransit lights *ON* during gear retraction and lights *OUT* when gear is fully retracted. As a backup, generator loads can be monitored for landing gear motor cutout. Serious damage can result if a limit switch malfunctions and the gear motor continues to run. When performing this checklist each pilot visually checks the gear up on both sides. PNF then returns the gear switch to OFF.

WING FLAPS... **UP & SWITCH OFF**

Check the flap gage at UP – Switch in OFF.

BOOST PUMPS .... **OFF**

Turn OFF the booster pumps one at a time, a technique of always using a sequence of 1,3,2,4 or 1,4,2,3 in the air when operating any switch or control that could possibly affect power should minimize a possible simultaneous shutdown of two engines on one side. ENGINES & ENGINE INSTRUMENTS.................. **VISUALLY CKD** COWL FLAPS .... **AS REQ'D**

LANDING LIGHTS... **AS REQ'D**

These may be used as necessary, this item is included at this point as a reminder.

Mixtures…………………………………………….**AS REQ'D**

When "Quiet Climb" is used, 31" MAP & 2100 RPM, engines may be auto leaned. CHT should be below 205°C.

CRUISE

CRUISE POWER……………………………………**SET**

Set as desired from cruise power charts.

ENGINES / ENGINE INSTRUMENTS……….…..**CHECKED**

COWL FLAPS……………………………………….**AS REQUIRED**

LANDING LIGHTS…………………………………**OFF**

MIXTURES………………………………………….**AUTO LEAN**

Auto lean under 600 HP. 205°C – CHT.

IN RANGE

PNF PF

CREW BRIEGING …………................................... **COMPLETE**

Brief as necessary for type of approach and existing conditions.

NAVIGATION EQUIPMENT………………………….**SET**

Set navigation equipment as required for type of approach.

FLT INSTS & ALTIMETERS .... **SET & "___"**

TRANSFER VALVES & SWITCHES .... **VALVE & SWITCH OFF**

HYDRAULIC PUMP….. **AUTO & "___" LBS**

FUEL QUANTITY ....…....... **CKD**

LANDING LIGHTS...................................…....... **AS REQ'D**

The IN RANGE checklist should be completed down to this point before entering the traffic pattern so the crew's attention may then be directed outside the cockpit.

BEFORE LANDING

PNF PF

BOOST PUMPS .... **ON**

MIXTURES.. **AUTO RICH**

LANDING GEAR (MAX 150)..................................**DOWN**, **GREEN**
INTRANSIT LIGHTS & SW OFF

Normal gear speed is 180 MPH, however some gear motors are rated at a 160 MPH maximum and an additional 10 MPH conservative factor has been added as EAA policy. Check intransit lights *ON* during gear extension and *OUT* as gear is over center and locked.

WING FLAPS (MAX 140)..**SET - SWITCH OFF**

Normal flap speed is 147 MPH, again EAA policy of 140 MPH is conservative.

FINAL LANDING CHECK
NLT 500' AGL

PNF ANNOUNCES – Final Landing Check

I Have A Wheel Over Center, Green Light, Intransit Lights Out, Flaps Set, Standing By The Props

PF ANNOUNCES – I Have A Wheel Over Center, Green Light, Intransit Lights Out

PROPELLERS (crossing the fence) ....**HIGH RPM**

This item is only a reminder that the RPM must be increased if the MP will exceed the limiting figure.

AFTER LANDING

Do not perform any part of the following checklist (other than the PNF retracting the flaps in a cross-wind (as briefed) or checking the available hydraulic pressure) until the aircraft has been taxied clear of the active runway. Loss of hydraulic pressure could result if cowl flaps are actuated with a leak in the system.

HYDRAULIC PRESS ....**"___" LBS**
LANDING LIGHTS ....**OFF**
COWL FLAPS...**OPEN & LOCKED**
WING FLAPS ....**UP –SWITCH OFF**
BOOST PUMPS..**OFF**

ENGINE SHUT DOWN

TAIL WHEEEL…………………………………………….**LOCKED & LIGHT OUT**
PARKING BRAKE……………………………………..**SET**
MAGNETO & IDLE MIXTURE CHECK………..….…**COMPLETED**
If desired, magneto and idle mixture check should be accomplished at 600 RPM.
OIL SCAVENGE………………………………………..**COMPLETED**
Scavenge 1 minute at 1000 RPM.
MIXTURES…………………………………………….**IDLE CUT OFF**

SECURING

MAGNETOS…... ....**OFF**
BEACON ....**ON**
The Beacon is left on to alert personnel outside the aircraft that a battery has been turned on. The aircraft batteries are not disconnected while on the ground. This procedure will prevent the aircraft batteries from being inadvertently discharged.
TRANSPONDER...**STANDBY/OFF**
INVERTER..**OFF**
HYDRAULIC PUMP………………………………...**OFF**
AVIONICS SWITCH ....**OFF**
BATTERIES ....**OFF**
FLIGHT CONTROLS...**LOCKED**
Move the lock control to the up position, then place the yoke to the full nose down position. Attempt to pull the yoke rearward to check the lock, then wiggle the rudders to ensure locking. Remove the aileron lock from behind the yoke and install.
CHOCKS ....**IN**
PARKING BRAKE...**OFF**
Release the parking brakes as soon as chocks have been installed to prevent heat buildup damage to the brake assemblies.
FLIGHT& MAINT FORMS.. **COMPLETE** Completed by PIC for flight

EXPANDED EMERGENCY CHECKLIST

EMERGENCY CHECKLISTS FOR B-17 "ALUMINUM OVERCAST"

The emergency section of the checklist, as well as this section of the manual, is written in an attempt to provide insight into how a variety of foreseeable emergencies might be handled. The crew should follow these procedures as long as they fit the emergency; otherwise the pilot's best judgment must prevail. It is realized that a hurried reaction to an emergency could result in a worse situation, therefore a deliberate approach to the situation is desired. The most important thing to be done is to fly the airplane. Designate who is to deal with the emergency and who is to fly the airplane. Deal with the emergency first, then communicate, instead of expending 50% of your crew resources on radio calls to ground personnel who will very likely be unable to provide any immediate assistance. Whenever a checklist step is to be taken that could significantly affect performance, both pilots must concur before the control/switch is actuated.

ENGINE FIRE IN FLIGHT

MIXTURES……………………………………………**AUTO RICH**
Ensure all mixtures are in auto rich, if a higher power setting is required
POWER………………………………………………..**AS REQUIRED**
WING FLAPS AND LANDING GEAR………………..**AS REQUIRED**
Retract landing gear and flaps IF drag needs to be reduced.
FAILED ENGINE THROTTLE ……………………….**CLOSED**
Verify correct throttle is being closed. FAILED
ENGINE PROPELLER……………………..**LOW RPM**
Verify that correct prop lever is being set to full decrease. FAILED
ENGINE MIXTURE…………………….……**IDLE CUT OFF**
Verify that correct mixture is being placed to idle cot off.
FAILED ENGINE FEATHER BUTTON……………...**FEATHER**
Verify that correct feather button is being pushed to feather propeller.
FAILED ENGINE FIRE EXTINGUISHER………….**SELECT AND DISCHARGE**
Verify that correct engine fire extinguisher is selected. Select engine and discharge agent. Utilize second bottle as necessary to extinguish the fire.
VACUUM SELECTOR………………………………..**AS REQUIRED**
Verify that vacuum selector is positioned to an operative engine. FAILED
ENGINE BOOST PUMP……………………**OFF** Failed engine boost pump off.

……………………………………………………………………………...

CLEAN UP ITEMS

(ACCOMPLISH IF TIME PERMITS)

FAILED ENGINE COWL FLAP……………….**CLOSED & LOCKED**
FAILED ENGINE FUEL SHUT OFF…………**CLOSED**
FAILED ENGINE GENERATOR……………..**OFF**
FAILED ENGINE MAG SWITCH……………..**OFF**

ENGINE FAILURE IN FLIGHT

ALL MIXTURES.. **AUTO RICH**
POWER.. **AS REQ'D**
WING FLAPS AND LANDING GEAR………………**AS REQUIRED**
Retract landing gear and flaps IF drag needs to be reduced. FAILED
ENGINE THROTTLE .... **CLOSED**
FAILED ENGINE PROP ....……......**LOW RPM**
FAILED ENGINE MIXTURE ....…..........**IDLE CUT OFF**
FAILED ENGINE FEATHER BUTTON...................…..**FEATHER**
VACUUM SELECTOR ....**AS REQ'D**
FAILED ENGINE BOOST PUMP……………………..**OFF**

…………………………………………………………………………….

CLEAN UP ITEMS

FAILED ENGINE COWL FLAP ....**CLOSED & LOCKED**
FAILED ENGINE FUEL SHUT OFF ....**CLOSED** FAILED
ENGINE GENERATOR ....**OFF** FAILED ENGINE
MAGNETOS………………………**OFF**

EMERGENCY GEAR EXTENSION

LANDING GEAR SWITCH ....**OFF**
This removes power from the gear motor system but leaves the indicating system electrically powered so that the gear may be checked with the green light after it is cranked down. It is extremely important that this switch be turned OFF in order to prevent any injury to the person actuating the emergency landing gear extension crank.
LANDING GEAR FUSE ....**REMOVED**
This is an additional safety item.
BOMB BAY DOOR FUSE……………………………**REMOVED**
A safety item to insure bomb bay doors cannot opened.
CRANK GEAR DOWN ....**GREEN LIGHT & OVER CENTER**
Insert the crank on the appropriate gear shaft and rotate as per the placard. It will take approximately 269 turns until the stop is reached. The green light should illuminate at this time.
LANDING GEAR FUSE..**IN**
Replace the fuse to enable normal gear retraction if it becomes necessary.
LANDING GEAR ....**VISUALLY CHECK**

ENGINE UNFEATHERING

FEATHERED ENGINE FUEL SHUTOFF................**OPEN**
FEATHERED ENGINE BOOST PUMP ....**ON**
FEATHERED ENGINE MAG SWITCH ....**BOTH**
FEATHERED ENGINE THROTTLE ....**CLOSED**
FEATHERED ENGINE PROP ....**LOW RPM**
FEATHERED WNGINE MIXTURE………………….. **IDLE CUT OFF**
FEATHERED ENGINE STARTER(IF REQUIRED).**6 BLADES**

If the engine has only been shut down for practice or for a few minutes, this step will not be necessary. However, if the engine has been feathered for more than a few minutes and any possibility of a "liquid lock" exists, turn the engine through with the starter to check for any sudden stoppage. The reason for this is that the starter turns the engine through a clutch, while no such device exists to prevent damage when the propeller blades turn the engine.

FEATHERED ENGINE FEATHER BUTTON ....**PUSH TO 800 RPM**, **RELEASE**
FEATHERED ENGINE PROP GOVERNING ....**CKD 1100 - 1200 RPM**
FEATHERED ENGINE OIL PRESSURE ....**CKD** FEATHERED
ENGINE MIXTURE ....**AUTO RICH**
FEATHERED ENGINE GENERATOR ....**ON**

EMERGENCY AIR BRAKES

EMER BRAKE LEVERS...**AS REQ'D & HOLD**

(DO NOT USE THE NORMAL BRAKES AND DO NOT "PUMP" THE EMERGENCY BRAKES. THE NITROGEN SUPPLY IS LIMITED)

These emergency air (nitrogen) brakes can only be applied by the pilot occupying the left seat. Gently raise both emergency brake levers simultaneously until desired braking action is obtained, then maintain that pressure with the levers. Keep your right hand on the throttles, if possible, provide any required "burst" of throttle to assist the rudder in controlling the aircraft's direction should it become necessary. DO NOT pump the handles, this results in the supply of nitrogen being rapidly expended. Instead, utilize a steady pull on the handles to achieve the desired result. After stopping the aircraft, hold the emergency brake levers on until the engines have been cut and chocks have been inserted. In the event of a failure of the normal braking system downstream of the shuttle valve, the emergency system will also have no effect. In that case, braking would need to be applied on the opposite side using only that respective brake handle. The tailwheel must be locked, rudder and throttle may be effective in preventing a ground loop in this circumstance. Attempt to minimize braking as much as possible in this situation to prevent the tailwheel shear bolt from failing.

NORMAL FLIGHT PROCEDURES

NORMAL FLIGHT PROCEDURES
FOR B-17 "ALUMINUM OVERCAST"

The following is a summary of the flight procedures for the B-17G, "ALUMINUM OVERCAST". A thorough understanding of these EAA (Experimental Aircraft Association) procedures, in conjunction with those in the B-17 Pilot's Manual, will ensure the safe and efficient operation of this aircraft. Your use of these standard procedures will serve to both create a favorable impression of the EAA and to safely accommodate the repeated interchanges of crewmembers during the tours. Suggested changes or safety of flight items are encouraged and should be communicated directly to the EAA.

GROUND OPERATIONS

Taxiing and Brake Usage:

As soon as the aircraft begins to roll check the brakes for normal operation. Note the operation of the turn sensitive flight instruments for proper operation as soon as practicable. When taxiing the B-17 remember to minimize power (600 RPM) and utilize the rudder/ outboard engines as much as possible in order to keep the use of brakes to an minimum. Placing the hand on the upper set of throttles will allow you to control the outboard engines separately. Don't lock up any of the throttles tightly, use only enough friction to keep them from creeping. Another item to keep in mind is that the outboard props have only a nominal 42" ground clearance, be extremely alert for any lights or signs on either side of the taxiway that could possibly come close to the prop arc. Lock the tail wheel for all straight ahead taxiing, unlocking it in advance of turns. Remember to check for elevator control surface clearance from obstacles when making turns, the tail covers a much greater arc than the tailwheel on this aircraft. Avoid "pivot" turns, always let the inside wheel describe a slight arc. Be constantly aware while taxing of the hydraulic pressure gauge and the sound of the hydraulic pump running frequently since your brakes are solely dependent on it.

The batteries must furnish this electrical current since the generators will be below "cut-in" RPM. Upon reaching run-up position turn the aircraft into the wind if possible, lock the tailwheel and allow the aircraft to roll a few feet straight ahead and check the light to ensure that the tailwheel has locked. Be absolutely certain that the runup area you select cannot blast or cause any damage to any arcraft or othe property. <u>The EAA's and the pilot's reputations can easily be damaged by this type of operations, if any possibility of this exists find another runup area.</u>

DEPARTURE

Normal Takeoff and Climb:

First, complete the applicable takeoff briefing, considering the crew's experience and currency. The normal takeoff is with zero flaps, however, 1/3 flaps may be used on a short runway or if desired by the pilot in command. Drop your heels to the floorboards so as to prevent inadvertent brake contact or, worse yet, developing a reliance on brake usage during initial part of roll. Directional control is maintained with up to full rudder if necessary and differential power in the earliest part of the takeoff roll, then rudder alone afterwards. Brakes would only be used in the event that control is beginning to be lost.

*Place the yoke in the neutral elevator position and neutral aileron position. If a crosswind is present apply an appropriate amount of aileron in that direction.

*Turn your hand upside down (palm up) and grasp the middle set of handles on the throttles. This position seems to allow the easiest control of individual throttles for small adjustments. Begin to advance throttles, utilizing differential power and rudder to control direction. After directional control is well established finish walking the throttles up to takeoff MP. The pilot not flying (PNF) will equalize all MPs and then keep his hand on the throttles to prevent creep. He also checks RPMs, adjusting if necessary. Maintain directional control with rudder, using sufficient aileron to maintain a wings level attitude if a cross-wind is present.

*After effective control is gained and as elevator becomes effective, raise the tail slightly to a medium tail-low attitude for the remainder of the takeoff roll.

*When approaching a comfortable flying speed of approximately 100 MPH, raise the nose slightly to allow the aircraft to break ground cleanly. Assume a normal pitch attitude at this point which is approximately the same as that of the aircraft sitting on the ramp. *After you are sure you are definitely airborne and no chance exists of settling back to the runway the pilot flying (PF) will give the PNF both a visual and aural "gear up" signal. The PNF will not place his hand anywhere near the gear switch in anticipation of this signal.

*The PNF will repeat "gear up", then place the gear switch to UP.
*At a safe altitude, call for PNF to retract flaps to UP if they were used for takeoff. *Upon reaching 115/120 MPH call for the PNF to set CLIMB/QUIETCLIMB power. Don't hesitate reducing the RPM while attempting to obtain an exact MP, first reduce the MP's, then the RPM's, then fine tune.

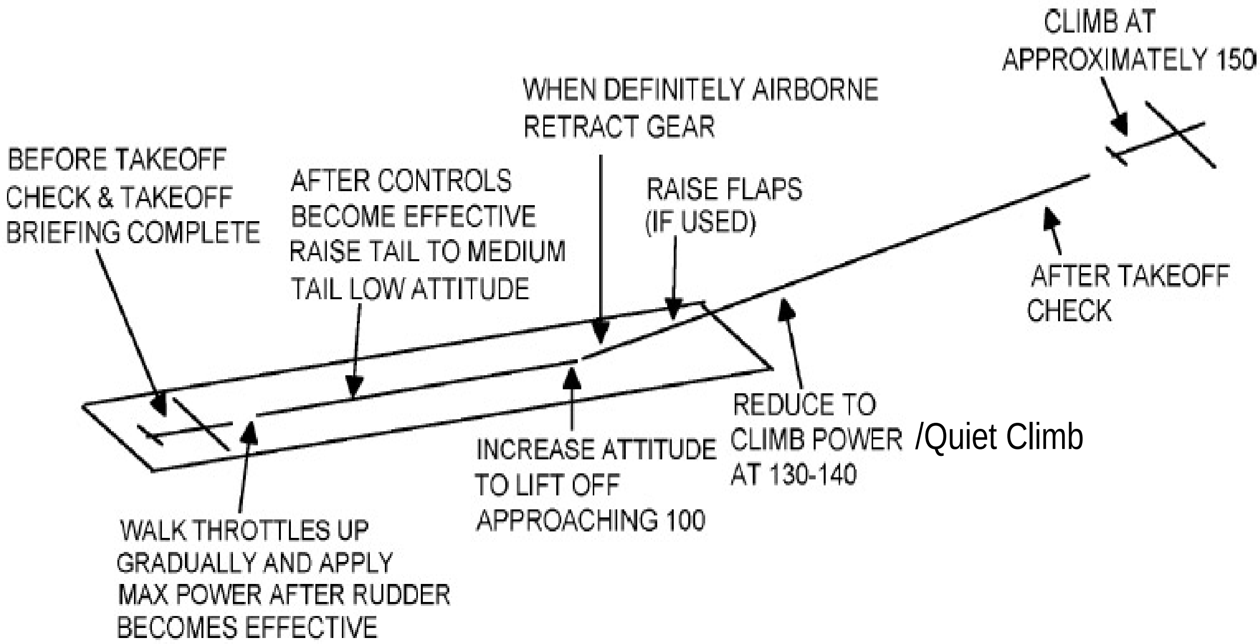


FIG. 1 NORMAL TAKEOFF

□

*After completing above and reaching a reasonable altitude, PF calls for the AFTER TAKEOFF checklist. It is important to realize that even if this call is delayed the PNF must monitor gear intransit lights "ON" as retraction is started and "OFF" as main gear finishes retraction. Serious gear retraction system problems can result if a limit switch malfunctions and the gear motor continues to run. Both pilots will visually check gear fully retracted on their side, PNF then returns the gear and flap switches to OFF. Turn OFF the boost pumps. (A good habit on any four engine aircraft is to move any valve/switch that could possibly affect engines or power in a sequence of 1-3-2-4 or 1-4-2-3 so that no two engines on one side would ever lose power simultaneously.) Both pilots should visually check engines on their side as well as engine instruments. After checking cylinder head temperatures, adjust the cowl flaps to the approximate 1/2 position or as required. Landing lights will be turned OFF unless traffic requires.

*Climb at an airspeed of approximately 150 MPH.

*The PNF advances throttles as needed to maintain desired MP and adjusts cowl flaps as required to regulate CHT during climb.

Short Field Takeoff:

This takeoff involves several factors of risk. Of necessity, it involves a liftoff below normal liftoff airspeed. First, lower 1/3 flaps. Align the aircraft with the center of the runway and assure the tailwheel is locked with light out. Hold the tail on the ground with elevator and advance the throttles to approximately 30" -35" MP before releasing the brakes. If the aircraft swerves somewhat after brake release (another one of the risk factors) try to avoid use of the brakes to realign the aircraft, doing so will lengthen the takeoff roll. If excessive brakes are required it may be best to abort the takeoff and taxi back to begin another takeoff. Apply maximum power as soon as possible while maintaining the tailwheel on the runway. Maintain precise directional control and, as the airspeed reaches approximately 70 -75, gently increase back pressure to achieve a three point liftoff. Avoid "muscling" the aircraft into the air in a tailwheel last liftoff. Allow the aircraft to gain a few feet of altitude (or obstruction clearance if required) and then gradually level the climb so as to accelerate. When definitely airborne call for GEAR UP. Be alert to any power loss which might require the opposite engine's throttle to be retarded to maintain directional control. This must be briefed and understood. As the aircraft attains a normal airspeed retract the flaps and continue as after a normal takeoff. Accelerate to 115/120 as soon as possible.

ENROUTE

Cruise Transition:

*Accelerate to cruise airspeed at CLIMB power.

*When changing power, remember that when RPM is reduced at lower altitudes the MP will increase, at higher altitudes it will decrease.

*Reduce throttles to desired MP. After this, reduce the RPM to desired cruise setting. At higher weights, 2000 RPM may be necessary. At lighter weights 1800 - 1900 RPM or less (if smooth) may be satisfactory. Reset MP as necessary.

*Adjust cowl flaps towards CLOSED position, then return to LOCKED.

*Place mixtures to AUTO LEAN after CHTs are established at or below 205°C.

Climb Transition:

*When transitioning from cruise to a climb, first place the mixtures in AUTO RICH, set 2300 RPM and then advance MP to desired setting if climb power is necessary. Adjust cowl flaps to keep desired CHTs.

Descent:

*Power setting remains at cruise if desired, remember that MP will increase approximately 1" for every 1000' of descent. Normal descents require a minimum of one inch of manifold per 100 RPM to avoid reciprocating loads.

INSTRUMENT APPROACHES

Normal or Three Engine Instrument Approach:

Prior to crossing the initial fix outbound perform IN RANGE checklist and LANDING checklist items up to the gear.

*Slow the aircraft to cross the fix outbound or initial vectors at approximately 130 MPH. This places you well under the 147 MPH (EAA 140 MPH) flap limit airspeed.

*Prior to intercepting final approach course inbound, lower 1/3 flaps.

*Slow to 120-130 MPH for a straight-in approach, 120 MPH for a circling maneuver.

*When approaching G/S interception or final fix inbound, maintain cruise RPM or set 2100 RPM as necessary on all engines. With three engines set the RPM to either 2100 or 2300 as necessary. Lower the gear and perform remainder of LANDING checklist. Divide attention between navigation and checklist and perform these checks in a deliberate manner. Don't become intent on one to the exclusion of the other. Aviate, navigate, communicate.

*Maintain 120 MPH airspeed on final.

*At minimums and visual on a straight-in, extend landing flaps and reduce airspeed as necessary to complete normal landing.

*For circling, maintain 120 MPH awhile maneuvering, extend landing flaps on base or final for landing.

Two Engine Instrument Approach:

Consider the ceiling and visibility existing at the landing airport. You must ensure that weather conditions exist that would allow you to safely perform a two engine go around or that you have adequate conditions to allow enough time to lower gear and flaps after visually acquiring the airport beneath the ceiling. Prior to crossing the initial fix outbound perform all appropriate emergency checklists, INRANGE checklist and BEFORE LANDING checklist items up to the gear.

*Slow the aircraft to cross the fix outbound or initial vectors at approximately 130 MPH.

*When approaching G/S interception or final approach fix inbound extend the gear and maintain 120 MPH.

*If weather will permit a safe two engine go around considering published minimums, the flaps may be extended to 1/3 when beginning descent.

*Maintain 120 MPH on approach and perform remainder of configuration changes and checklists as described under two engine procedures.

LANDING AND GO AROUND

Normal and Three Engine Approach and Landing:

Landing lights may be turned ON during arrival as necessary due to traffic concerns. The checklist item is included near the beginning as a reminder. Complete remainder of IN RANGE checklist prior to entering the traffic pattern if possible.

*Plan to fly the downwind at 1000' AGL and approximately 130 MPH. This places you well under the 140 MPH flap limit airspeed.

*Normally leave the props at cruise setting to keep the noise down and minimize reciprocating load. If necessary, RPM may be increased (not to exceed 2300 RPM).

*When desired, the PF calls for GEAR DOWN -BEFORE LANDING checklist. (As an aside, if voice communications are difficult it may be desirable to use a visual thumb down for the gear and 1,2 or 3 fingers for flap positions.) PNF places gear switch DOWN. As the gear approaches the down position both pilots should note the over centering action of the drag linkage that occurs as the gear limit is reached. Note intransit lights "ON" during gear extension and "OUT" when gear is over center. PNF notes green light and then places gear switch OFF.

*PF calls for 1/3 flaps and utilizes elevator pressure as required to resist pitch up tendency. *Maintain 110-120 MPH on base and call for flap extension as required to control airspeed while avoiding severe MP reduction.

*On final call for landing flaps, normally 2/3 or full depending upon preference.

*Use a normal 2 -1/2^{o} to 3^{o} glidepath (same as ILS) angle.

Make absolutely certain that the arches of your feet are on the rudder bar pivot point so that no inadvertent brake actuation will occur.

*Gradually slow aircraft so as to cross the threshold at approximately 100-105 MPH.

*Just prior to flare smoothly wiggle throttles closed and then keep hand on throttles.

*As the PF closes throttles he will call for high RPM. The PNF will raise the prop levers to full high RPM. Since the blades are already resting on the stops there shouldn't be any "surge."

*Gradually increase attitude to allow a tail low touchdown.

*If a slight skip or bounce occurs attempt to maintain the same back pressure and attitude. It the bounce results in an uncomfortable gain in altitude add enough power to stabilize the airspeed. Allow the aircraft to touch down again and then retard throttles fully (if you added power). Avoid trying to "pin" the aircraft in the event of a bounce, this usually results in a porpoising series of touchdowns and could result in a loss of control. *Hold throttles back to make sure they remain fully closed during landing rollout. *Allow tail to touch runway and then maintain contact with gentle rear elevator pressure.

*Raise feet to brake pedals and start easing into brakes. The brake actuation pressures are nicely proportioned and provide good feel. Avoid heavy braking or locking tires up.

*Do not actuate any systems during landing rollout other than the raising of flaps in a cross-wind if briefed.

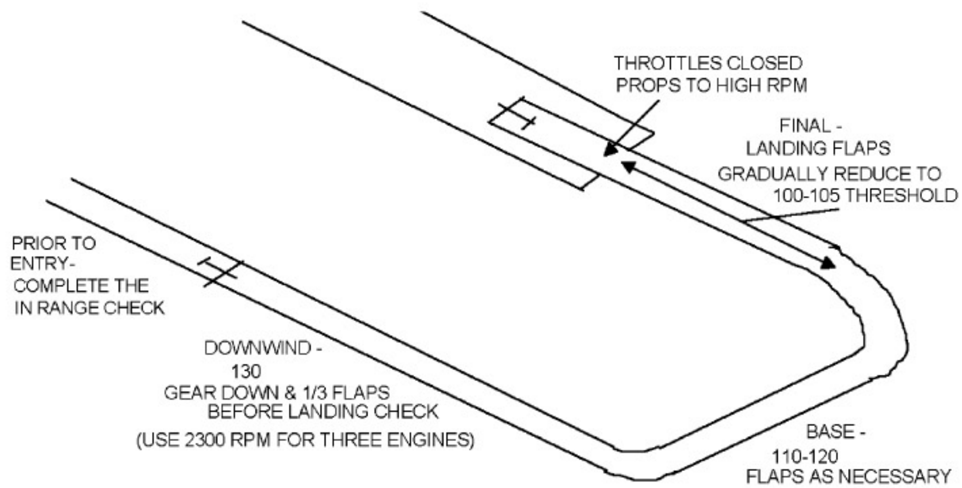


FIG. 2 NORMAL & THREE ENGINE APPROACH

****If tailwheel shimmy occurs, DO NOT RELOCK TAILWHEEL, this will almost certainly result in shearing off tail wheel shear pin.***

*If tailwheel shimmy occurs two actions are possible depending upon your speed. First, try applying forward pressure on the elevator to raise tailwheel off the runway and change the angle of the tailwheel strut. If unable to raise tailwheel and stop shimmy or, as speed is lost in first scenario, apply full up elevator and maximum loading on the tailwheel. Use somewhat greater than normal braking in an effort to shorten the time period spent decelerating through the speed range in which shimmy occurs.

*At a walking speed just prior to turnoff, call for the PNF to unlock the tailwheel. If he encounters difficulty trying to unlock against spring pressure, wiggle the rudder to alleviate the side load on the pin.

*Turn off the active runway, then call for the AFTER LANDING checklist.

Cross Wind Landing:

*Use a normal approach angle of 2-1/2^{o} to 3^{o} (just like an ILS approach).

*Fly a normal speed, any excess will almost certainly result in "floating" with problems in controlling the aircraft's attitude while waiting for the excess airspeed to dissipate. *With a strong crosswind it may be advisable to limit flaps to 1/2. *Crab the aircraft so as to maintain a precise alignment with the extended centerline of the runway. *Consider positioning your hand on the throttles so that your thumb is on the side that may need a throttle "burst" in the event of a gust or swerve after touchdown. *Your order of control priority is flight controls, power, then, as a last resort, your brakes.

*Do not apply aileron trim in anticipation of aileron forces during flare. *At a comfortable point nearing the runway progressively begin aligning the longitudinal axis of the aircraft with the runway centerline and using your bank angle to control drift. Once you are on the ground, your ailerons create helpful adverse yaw if you use them. So always use them!

*Close the throttles normally but keep your hand on the throttles.

*Use flight controls to whatever extent necessary to maintain a no drift, aligned condition. The entire intent is to maintain a no-drift condition and to touchdown in this condition.

*After touchdown continue to fly the aircraft to maintain the above condition. A brief "burst" of power from the outboard throttle on one side may become necessary in the event of a gust or swerve.

*If a slight skip occurs maintain the same pressure as in a normal landing. Avoid trying to "pin" the aircraft with the usual attendant "porpoising". Use ailerons to keep the aircraft from beginning a drift towards the side of the runway. If a drift occurs, make a determination (especially if on a narrow runway) whether you will have adequate runway width for the ensuing second touchdown. If not, go around.

*After touchdown call for FLAPS UP if desired to assist in tail wheel touchdown.

*Use flight controls, up to the limits if necessary, to maintain control of the aircraft and flight/ground path.

*Only after full weight is on gear apply brakes as needed.

Short Field Landing:

*Use a normal approach glidepath of 2-1/2° to 3° (just like an ILS approach) with full flaps.

*Ease power off early and let aircraft decelerate to approximately 95 MPH while maintaining a normal glidepath. This should be timed so that the 95 MPH is reached on very short final.

*Catch the airspeed at 95 MPH with throttles. Avoid large pitch changes. Close throttles in the roundout and attempt to perform a three-point landing.

*After touchdown (if runway length requires) raise the tail off the runway and ease into the brakes as control is established, then use braking as necessitated by the runway length.

Touch and Go Landings / Stop and Go Landings:

These will only be done with an instructor and only from a normal or no flap approach.

*After landing lower the tailwheel to the runway normally.

*Pilot makes sure throttles remain fully retarded.

*Instructor makes sure he has hand on flap switch and then raises them to 1/3 or UP as desired, props in HIGH RPM, trim and engine instruments.

*After completing the above items the instructor will verbally authorize takeoff power application after flaps reach desired takeoff setting and he has returned switch to OFF.

Normal Go Around:

If required with propellers still at cruise RPM and before retarding throttles.

*Call for PNF to set RPM to 2300.

*Advance throttles and call for PNF to set 35"MP.

*Call for flaps to 1/3 while accelerating.

*Call for gear UP when you are sure you won't touch down.

*At approximately 110 MPH call for flaps UP.
*Climb out as after normal takeoff.
If requires after power reduction on short final (balked/rejected landing):
*Call for PNF to set MAX (2500) RPM while PF immediately advance throttles.
*Call for PNF to se 41" MP.
*Call for FLAPS 1/3.
*Depending in airspeed and altitude, aircraft might touch down momentarily. Delicate pitch control may be necessary at this time while the flaps are retracting.
*When you are certain you won't touchdown call for GEAR UP.
*Climb out as after a normal takeoff.

AIRWORK PROCEDURES

Steep Turns (Visual or On Instruments):
*Set MP to 25". When airspeed is stabilized, roll into 45^o bank angle. Increase pitch as necessary to maintain altitude. Add approximately 1" - 2" MP as necessary when passing through 30^o bank angle to maintain airspeed. When rolling out of turn, lead by approximately 15^o. Remember that the B-17 takes a good amount of rudder to counteract yaw when rolling into and out of turns.
Unusual Attitudes (Visual or On Instruments):
Instructor will maneuver the aircraft while pilot is asked to look at trim knobs on floor. Recovery procedures depend on whether the aircraft is nose up or down when the pilot is told to regain control. Three elements (Power -Pitch -Bank) in different order constitute the recoveries. The pilot must be able to immediately interpret the instrument indications and initiate the proper recovery. The power adjustment can be made almost immediately while considering the sequence of the following two elements.
*Nose Low: While reducing MP (Power) to prevent further increase in airspeed, roll the wings level (Bank) to prevent a rolling pullout, then begin pullout (Pitch) being careful not to overstress the aircraft. Return the aircraft to desired altitude. (**Power** and **Bank**, then **Pitch**)
*Nose High: While adding MP (Power) to stop deceleration and regain flying speed, force the nose below the horizon (Pitch) to stop climb. When the pitch has stabilized nose low and airspeed is well above stall, roll the wings level (Bank). (**Power** and **Pitch**, then **Bank**)
*<u>Note that at the instant that the altimeter stops in either a climb or descent, **the aircraft is in level flight for that airspeed.**</u>

Approach to Stalls and Recoveries:
These maneuvers are performed to familiarize you with the stall speeds in various configurations and attitudes and also to provide you with knowledge of the aircraft's handling characteristics. Prior to practicing any stall make clearing turns. While turning, accomplish the IN RANGE checklist. Use 2000 RPM and 20" MP until reaching 100 IAS to minimize reciprocating load on all demonstrations of stalls.
The **#1 stall** is clean (gear and flaps UP) at zero thrust, wings level. *When rolling out of the clearing turn gradually retard the throttles as airspeed is lost and at
approximately 110 MPH retard the throttles to zero thrust the same as during a no flap landing.
*Maintain altitude with back pressure until stall buffet occurs.
*Note stall speed and characteristics, then lower nose and add throttle to full power.***
The **#2 stall** is in the takeoff configuration (gear DOWN and 1/3 flaps), 20" MP and 20^o bank.
*After recovering from the previous stall, call for GEAR DOWN and 1/3 flaps.

*Call for 20" MP and start 20° bank climbing turn.
*Note stall speed and characteristics, then lower nose and add full power.***

The **#3 stall** is in the landing configuration (gear and flaps DOWN), zero thrust and wings level.
*After recovering from the previous stall call for GEAR DOWN and FULL FLAPS. *Maintain altitude with back pressure as aircraft slows.
*Gradually reduce MP and at approximately 100 MPH retard throttles to zero thrust as during a normal landing.
*Note stall speed and characteristics, then lower nose and add full power and call for flaps to 1/3 and gear UP. ***
*Minimize altitude loss and at approximately 110 MPH call for flaps UP.
*** THE INSTRUCTOR PILOT WILL STOP THROTTLE TRAVEL TO 30" MP.

ABNORMAL & EMERGENCY FLIGHT PROCEDURES

ABNORMAL & EMERGENCY PROCEDURES

The following is a discussion of various emergencies that may be foreseen or have a reasonable possibility of occurring on this airplane or any similar one. To that end, this discussion will attempt to provide some advance insights and thoughts of many concerned parties, discussing some of those possible events.

Engine Fire on Ground: If a engine fire develops while starting, first attempt to crank the engine to start it and suck the fire through the intake system. If this proves impossible, proceed as follows:

*Turn the fuel shut off valve on the appropriate engine to CLOSED. This will close the fuel valve at the fuel tank, thereby curtailing fuel pressure.

*Turn the appropriate fuel boost pump to OFF.

*Apply full throttle

*Mixture to IDLE CUT OFF

Make sure the cowl flaps on the appropriate engine are fully open to allow the fire guard complete access to the engine's power section.

*Select the engine fire extinguisher, discharge both bottles in sequence if on fire.

*Turn all magneto switches to OFF.

*Alert ground radio facility to dispatch the fire equipment.

*Turn batteries OFF.

*Exit the aircraft if deemed necessary.

Rejected Takeoff:

On any of the runway lengths normally used by the EAA, a takeoff may be aborted any time prior to liftoff airspeed. It is essential that this subject be covered and clearly understood by both pilots during the briefing immediately prior to takeoff. If a rejected (aborted) takeoff becomes necessary the decision should be made by the Pilot-In-Command. The PIC will immediately assume control of the aircraft while retarding the throttles and perform the following:

*Immediately close all throttles to the idle stops. Advise the PNF to assist in holding them against the stops so no unnecessary thrust is created**. If runway remaining becomes an overriding concern, the mixtures may also be placed in the Idle-Cutoff position.**

*If the tail is still on the runway, apply braking to immediately stop the aircraft while using the elevator to maintain positive tailwheel contact.

*If the tail is in the air, apply braking as required in order to stop short of the confines of the available runway. Use the elevator to maintain the existing attitude in an attempt to maintain maximum weight on the wheels while braking.

*As airspeed is lost, allow the tailwheel to settle to the runway while maintaining constant braking to stop the aircraft.

ENGINE FAILURE PROCEDURES

Engine Failure after Takeoff:

If an engine failure is experienced prior to reaching the reject airspeed that was briefed prior to takeoff, the throttles should be immediately closed and the takeoff rejected, utilizing brakes and all available options to remain on the runway.

EAA utilizes a tail-low attitude for liftoff, not the three point liftoff commonly depicted or described in the wartime military pilot training manuals. That provided some combat advantages off of short fields, but also added a definite risk factor to the airplane and crew at liftoff. Delaying the liftoff until approximately 100 MPH provides us the ability to control flight if the most critical engine fails at liftoff.

Even so, aggressive use of the flight controls will very likely be necessary to control the airplane at this point, along with intelligent action and prompt management of power plant controls. If the failure occurs immediately after liftoff, use any power the engine may be developing to attain the three engine climb airspeed of approximately 115 MPH at the weights this aircraft is operated.

*Raise the wing very slightly (approximately 3°…) on the failed engine's side. At the same time, maintain a very shallow angle of climb.

*Call for the copilot to raise the gear as soon as the aircraft is definitely airborne.

*Call for the copilot to raise the flaps as adequate airspeed is obtained. Ascertain that the pitch is increased as the flaps retract to maintain a shallow climb angle.

*Utilize the memory procedures listed above under Engine Failure to determine and feather the failed engine.

Double Engine Failure (on either wing) after Takeoff:

In the event that this unlikely situation occurs, it will require a high degree of cooperation, intelligent troubleshooting and a very precise flying technique. However, it is possible to successfully accomplish the maneuver.

If enough runway remains and the gear is not retracting, close the throttles and stop. Use any maneuvers necessary to remain on the runway. I.e., a "ground loop" may be preferable to an overrun accident.

There is a critical airspeed of approximately 115-120 MPH, below which the airplane will not climb. It also will not accelerate on two engines at or below that critical airspeed, regardless of how much additional power is utilized. For this reason, the only possibility of making this maneuver succeed -if the failures occur at less than critical airspeed - is to descend in order to attain the critical airspeed. It is obviously difficult and counterintuitive for a pilot to lower the nose if he's only a few hundred feet in the air, however this is the only possible way to make the outcome successful. The procedure and recovery must follow this order:

*Apply rudder and aileron to raise the wing with the dead engines approximately 3° above the horizon. Simultaneously lower the nose if below critical airspeed.

*The pilot flying must apply full throttles on all engines while calling for the pilot not flying to immediately ensure that the propellers are set to maximum RPM.

*Raise the landing gear.

*Do not feather any engine that is producing any amount of usable power. Feather the engines only after you have absolutely determined that you know that you have selected the correct ones.

*Use rudder pressure to control the airplane, ask for assistance from the other pilot if necessary. Do not bother with trim until the recovery has been completed and adequate time is available for that task.

*Do not try to climb before the recovery is fully accomplished. Even though you've recovered successfully, you stand a good chance of losing the airplane if you try to climb prior to reaching your critical airspeed. A remote possibility exists that the aircraft may be operating in "ground effect" for some period of time during this transition.

*Use a minimum of aileron while attempting to attain the critical airspeed. Remember that a downward aileron acts as a "flap", inevitably adding to the drag of that airfoil. Use of full rudder, in preference to aileron, provides the highest likelihood of sufficient directional control to permit the critical airspeed to be obtained.

Keep in mind that a stall encountered while in a yaw invariably means a spin. If it is obvious that the critical airspeed cannot be obtained, be extremely careful of causing yourself to roll uncontrollably. Retard the throttles while still under control, belly the aircraft in while still under control, rather than to roll yourself - and the airplane - into a ball.

Engine Failure at Altitude:

An engine failure encountered while cruising, or at altitude, obviously allows some time to troubleshoot the problem before making a decision whether or not to feather the engine. Compared with a two-engine aircraft, the presence of four engines will add some additional complications to the troubleshooting process. In this case the "dead foot -dead engine" procedure tells only half the story (i.e., which side of the aircraft the failure is on). The pilot must then furnish the observation and/or deductive process to correctly determine the failed engine.

If an engine fails abruptly, resulting in a power loss on one side, immediately apply a sufficient amount of rudder to maintain your heading. Don't fall victim to the tendency to use the aileron to maintain a heading, be sure to use the rudder for this purpose. After that, the aileron may be used to maintain a very slightly raised wing (approximately 3°) on the failed engine's side.

Check the fuel quantity and supply. A total loss of fuel pressure may be restored with the boost pump, however a partial loss of fuel pressure may indicate a far more serious problem caused by a fuel leak. A fuel supply problem in the B-17 takes longer to deal with in that fuel transfer between tanks on the same side is not possible (no cross feed manifold as such is installed). This is ample reason to always keep close track of your fuel supply on this aircraft.

If the failure is obvious, you can prepare to feather that specific engine if the situation requires. However, if the malfunctioning engine isn't immediately apparent and you're able to isolate the loss to only one side, then you'll have to carefully determine the failed engine by further checking and analysis. Several failure modes or possibilities can be contemplated and are discussed here. An engine fire, as opposed to a failure, will be handled in a much different manner and is described separately. While the following will serve as a rather complete discussion, it may not always be complete or exactly fit the situation. Again, in the event that the emergency is not adequately covered or other items make it impractical, the pilot's best judgment must take precedence.

Engine failure - unidentified engine:

*Maintain aircraft control and call for all engines to be advanced to at least the next higher power setting. I.e., if at CRUISE, set at least CLIMB power, if at CLIMB, set at least METO power. You should never be afraid to add too much power initially!

*Call for flap and gear retraction if applicable.

*Check for signs of engine roughness or other visible signs of engine distress such as copious amounts of smoke. If a noise or popping sound is obvious you might try retarding a throttle in an attempt to isolate the offending engine. However, be alert to the fact that sometimes the noise is "masked" and reducing either throttle of engines on the same side may result in a lessening or cessation of the noise.

*In the event that no signs are obvious, first make sure you are holding a heading and then try reducing the throttle on each engine on the "bad" side, one at a time. Check for obvious signs of additional loss of power if you pulled the wrong engine's throttle. Conversely, if you have selected the correct engine you will notice no change as the throttle is reduced. Be very careful that you and the other flight crewmembers agree, do not force yourself into an unwise decision when proceeding to steps of ever increasing irrevocability.

*Compare the engine gauges against one another. For example, if the oil pressure decreases alone you might suspect gauge error if the oil temperature remains constant and no other signs are evident. Tachometers fail or malfunction frequently. Remember that in the event of a simple engine power failure no gauge will immediately point out to you the offending engine. The RPM will govern anytime it has engine oil pressure from a rotating engine (until the blades rest on the pitch stop after airspeed loss), the MP gauge will respond normally to throttle movement and the fuel pressure is maintained by a rotating fuel pump. Only after a time interval will the CHT decrease enough to reflect the loss of combustion or power.

Another method of identifying an engine that's delivering power to the propeller is to briskly move the throttle forward, abruptly increasing the manifold pressure. If the engine is delivering power to the propeller, it will cause a momentary increase in RPM, then a return to the selected RPM as the governor exerts control. The throttle can then be briskly retarded to repeat the process. Again, if the engine has been delivering power to the propeller, it will cause a momentary underspeed until the governor again exerts control over the RPM. On the other hand, an engine that is not delivering power to the propeller, i.e., a "dead engine", would not cause any change in RPM to take place as the throttle movements are made.

*Proceed with the memory items on the ENGINE FAILURE CHECKLIST below.

Engine failure - identified engine:

In the event a specific engine is malfunctioning and no question exists regarding its identity or location, the following actions are suggested.

Be extremely alert to the possibility of improper identification, thereby radically increasing the gravity of the situation if the wrong engine is feathered. First (and always), seek concurrence among the other cockpit crewmembers as to its identity and the need for feathering. Some of the situations that might come under this heading include an obvious failure of an engine such as shaking or other obvious indications. Another would be a decrease of oil pressure accompanied by and confirmed by a rise in the oil temperature. Another might be a chip light confirmed by oil temperature/pressure problems and a filter light.

No good reason exists for increasing the power setting on an engine that can be identified by these obvious means. Accordingly, first place all the mixture controls in RICH. Then call for the propellers on the other three engines to be placed to at least the next higher power setting, then do the same for the throttles. Call for flap and gear retraction if applicable. Proceed with the memory items on the ENGINE FAILURE CHECKLIST below.

Engine Failure and Shutdown:

Once you've decided to feather the engine and both pilots agree that you have identified the correct engine, proceed as follows.

*Maintain aircraft control and heading. Simply spoken, this means to "fly the airplane first". Use rudder to control the heading and, if necessary, the aileron may be used to raise the wing very slightly (approximately 3°) on the failed engine's side.

*Identify and call out the engine to be feathered.

*Put all mixtures to rich in the event a higher power setting is required, depending on conditions.

*Power as required for conditions.

*Wing Flaps and Landing Gear AS REQUIRED for conditions.

*Retard the throttle to IDLE on the failed engine. Be alert for any change in control pressures and listen for a change in engine sound to ensure you haven't pulled the incorrect one.

*Reduce the RPM on the failed engine to the FULL DECREASE position. Again, listen and feel for any change. If you've retarded the correct engine's propeller control, there will be very little discernible change.

*Move the mixture control to the IDLE CUT OFF position. This is the final analysis item so stop and think! "Are the good engines still running and I haven't shut off the wrong one?" Place your finger on the applicable feather button for concurrence and state, "I'm feathering "X" engine", then push the feather button. Maintain tactile contact with the switch with your finger to assure that it has stayed down. When the propeller reaches feather, the button should pop up. The propeller may still be coming to a stop when this occurs. If the button pops early, push it down again and hold it until the prop feathers, then release it. If the button doesn't promptly pop, the propeller will pass directly through the feathered position and begin unfeathering. If this happens, pull the button up and then immediately push down again. Keep your finger upon it and then manually pull the button up the instant the propeller stops.

This completes the engine failure memory items.

*Call for the ENGINE FAILURE IN FLIGHT checklist, start from the top and make sure all items have been completed. Don't delay, since a vacuum pump is installed on the inboard engines only. In order to regain the vacuum flight instruments you'll need to select the other pump if you've feathered that engine.

*Vacuum selector is AS REQUIRED, depending upon which engine was feathered. (With advance knowledge, this can be accomplished earlier to avoid a momentary loss of flight instruments.)

* Boost pump should be OFF on the feathered engine.

CLEAN UP ITEMS

*Cowl flaps are CLOSED AND LOCKED on the feathered engine. They should be utilized as necessary on the remaining engines for temperature control.

*Fuel shut off should be placed to CLOSED on the feathered engine.

*Generator should be placed to OFF on the feathered engine.

*Mag switch placed to OFF on feathered engine.

Engine Unfeathering in Flight:

With a feathered engine, unfeather and restart it as described in the following ENGINE UNFEATHERING CHECKLIST:

*Fuel shutoff valve should be placed to OPEN.

*Boost pump should be turned ON.

*Mag switch should be confirmed in the BOTH position.

*Throttle CLOSED.

*Propeller FULL DECREASE RPM position.

*Mixture in the IDLE CUT OFF position.

*If the engine has been feathered for more than 10 minutes, first turn the engine approximately 6 blades with the starter to check for hydraulic lock.

*Push feather button and hold down until reaching 800 RPM and then release. If the tachometer briefly fails to operate, release the button when your judgment tells you that the propeller is rotating freely and will continue to do so. A good way to approximate this is when you can no longer count the individual blades. Confirm that the button pops up when released.

*It is important to check that tachometer has stabilized at approximately 1100-1200 RPM, indicating propeller governing, prior to the next step.

*After governing and oil pressure is checked, place mixture in AUTO RICH.

*Set 15" MP/1500 RPM to warm up engine.
*Turn the generator ON.
*After CHT reaches 100° and oil temperature is within limits, re-establish the desired power. To avoid reciprocating load initially set the throttle to approximately 20" MP, then increase the RPM to cruise, then set the cruise MP.

Propeller Overspeeding:
When a propeller "overspeeds" or "runs away" it simply means that the hydraulic propeller governor (operated by engine oil) has failed to maintain the RPM selected by the cockpit control. This could be due to any number of causes; loss of engine oil quantity, blockage or a valve sticking within the governor, breakage of the internal springs in the governor, cable breakage between the cockpit and the governor, etc.
In the event of cable breakage the RPM should automatically assume approximately 2200 RPM.
One important fact to keep in mind is that the propeller should not be feathered on takeoff where the power is needed until you have made a very deliberate attempt to regain control. First try to reduce the throttle and then reduce the propeller control in an effort to regain control. If this is successful, throttle may be added as RPM control permits.
This is most important after liftoff when all available power is necessary to continue flight. The pilot should reduce the throttle somewhat while the copilot pushes in the appropriate feather button in an attempt to regain control of, or decrease, the RPM. Attempt to set the throttle to approximately CLIMB power and, as the RPM decreases to approximately 2400-2500, pull the feather button back out. Allow the RPM to increase slightly towards 2600 and then again push it back in to lower it as before. As soon as a critical need for the power ceases to exist, feather the propeller and perform the engine failure checklist.
If the overspeed occurs during cruise flight at a higher airspeed, immediately reduce the airspeed by raising the nose and reducing power. A propeller whose blades are resting on the "pitch stops" will have much more reasonable RPM at an airspeed closer to the stall than at a high cruise airspeed.

Engine Fire in Flight:
An engine fire on this aircraft is dealt with in an expeditious manner that emphasizes standardization and similarity to other emergency procedures and checklists. In the event a fire is noted, determine the affected engine and concur on that location. The sequence contained in the ENGINE FIRE IN FLIGHT checklist for this emergency **should be immediately followed from memory:**
*__Mixtures to AUTO RICH to ensure a higher power setting is available__
***Power is set AS REQUIRED - remember, fly the airplane!**
***Flaps and landing gear are positioned AS REQUIRED to reduce drag if necessary**
***Throttle is CLOSED on the affected engine - verify no change in performance**
***Propeller is set to LOW RPM in preparation for the feather**
*__Mixture for affected engine to IDLE CUT OFF__
***Feather button is depressed to FEATHER the affected engine - verify the correct button is selected PRIOR to pushing it in**
***Engine fire extinguisher is SELECTED and DISCHARGED - if necessary, employ the second bottle to discharge on the affected engine**
***Vacuum selector will be verified or positioned to an operative engine AS REQUIRED**
*__Boost pump is turned OFF__

CLEAN UP ITEMS

*Cowl flaps to CLOSED AND OFF with a visual inspection of the affected nacelle
*Fuel Shut Off valve is selected to the CLOSED position
*Generator is selected to the OFF position for the affected engine
*Mag Switch to OFF position for the affected engine

Landing gear extension may be a consideration for an inboard engine fire. The tire may be burned if the fire is within the wheel well. For this reason, it may be advantageous to extend the landing gear to prevent further damage.

If the fire persists and is considered uncontrollable, the flight crew should consider an immediate landing in any appropriate area while controlled flight is still available.

Single Engine Flight:

This oft-recited tale of the B-17's flying capability should never be taken for granted. It may or may not be true that the airplane is capable of level flight on one engine. The power required to maintain level flight in a 40,000# aircraft at 5,000' is slightly in excess of 1,000 brake horsepower. This is probably more than one engine can reasonably be expected to maintain over an extended period of time.

Accordingly, the practical value may lie more in the opportunity to extend the glide to an airport that might have been impossible to reach otherwise. Its equation must take into consideration that the balance will be affected by the location of the one remaining engine on the wing, i.e., is it an inboard or an outboard operating engine?

*If you find yourself in this situation, jettison any excess loose equipment.
*Close all windows and hatches to minimize drag.
*Attempt to achieve a centered C.G. if possible.
*Maintain the minimum airspeed that will allow you to sustain flight while minimizing or avoiding any altitude loss. This could be in the vicinity of approximately 110 MPH but the amount of available and usable power will, of course, depend upon whether the operating engine is an inboard or outboard.

*All engines not operating should be feathered with cowl flaps closed. Remember that with three engines feathered, the landing flare characteristics will be noticeably different than with the engines at idle.

ABNORMAL LANDINGS

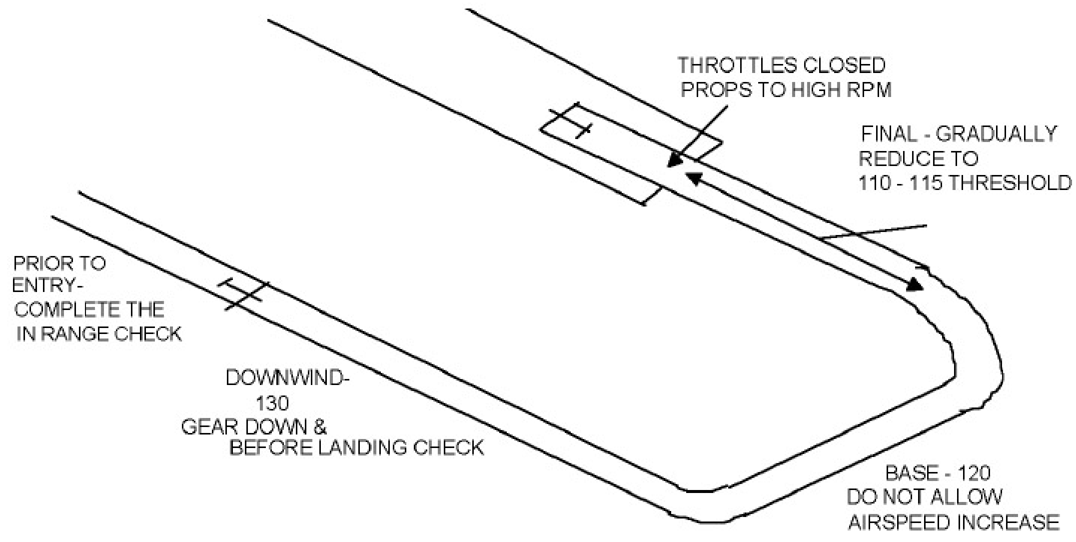


FIG. 3 NO FLAP APPROACH & LANDING

No Flap Landing:

*Fly a normal downwind but plan on flying a somewhat farther out base leg than normal. This is to avoid the need for a severe reduction in MP on base and final when no drag from the flaps is available. **Try to establish a base that would establish approximately 120 MPH on glide path.**
After turning final, gradually reduce to 110 --115 MPH as a threshold speed while maintaining a 2 1/2° to 3° approach (same as an ILS) angle. Don't make the common mistake of dragging it in with a deliberately flatter than normal approach, this will greatly increase the touchdown distance.

*Close the throttles while calling for HIGH RPM and land without excessive "float".

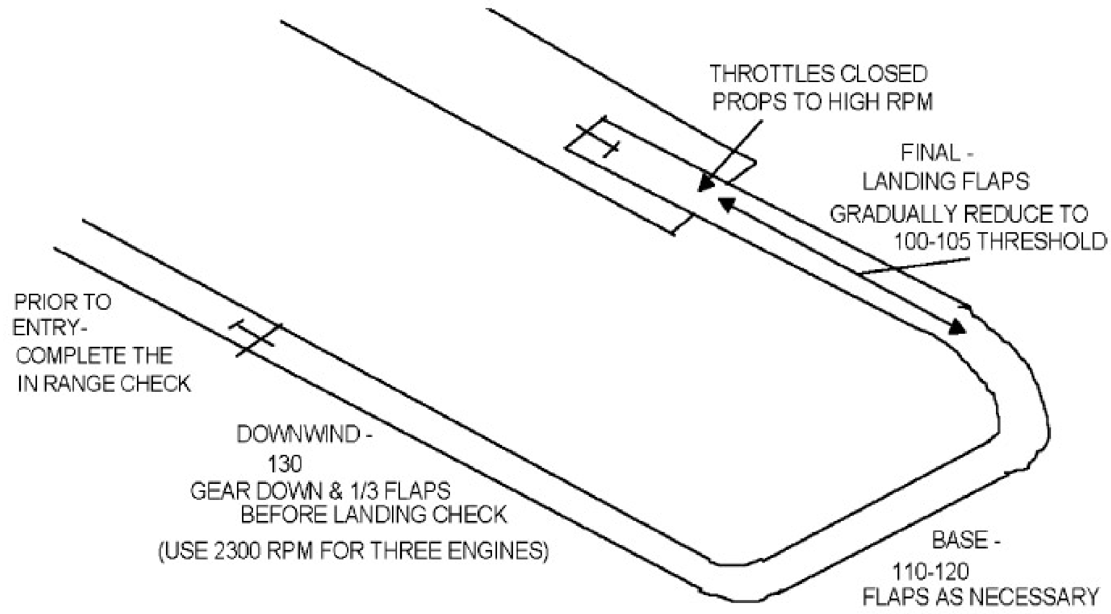


FIG. 2 NORMAL & THREE ENGINE APPROACH

Three Engine Landing:

During instruction the instructor will simulate a feathered engine by setting power to 15" MP/1500 RPM.

*Perform normal IN RANGE checklist.

*On a normal downwind set the three remaining engines to 2100 or as desired RPM.

*At the normal point abeam PF calls for GEAR DOWN - BEFORE LANDING checklist.

*Fly a comparable approach to that of a normal four engine landing. Do not allow the aircraft's speed to "get away" or speed up on base due to change from a normal power, maintain precise control.

Three Engine Go Around:

If aircraft altitude permits.

*Call for PNF to set MAX (2500) RPM while PF immediately advances throttles.

*Call or PNF to set 41" MP.

*Call for FLAPS 1/3.

*Continue descent if necessary to obtain/maintain approximately 110 MPH. Raise wing slightly on the dead engine side to improve performance but **do not use more than 5° of bank at the most**.

*When you are sure you won't touchdown call for GEAR UP.

*At approximately 110 MPH call for FLAPS UP. A definite requirement for elevator pressure to compensate for angle of attack change will be noticed as the last portion or the flaps retract.

*When climbing at a safe altitude and approximately 120 MPH call for 38" MP (METO) and 2300 RPM. If aircraft performance is satisfactory during climb 35" MP (CLIMB) may be utilized.

Two Engine Landing: This situation calls for the use of completely different procedures and techniques. It also requires that very close attention be devoted to airspeed. Make sure that the runway is clear and yours alone by radio notification of your emergency intentions. If this situation is to be given in flight training the instructor will simulate two engines feathered on one side.

*Perform normal IN RANGE checklist, make sure passengers and crew are informed of situation and are secured for landing.

*Use 2300 RPM (or greater if required) on downwind to maintain approximately 130 MPH.

*Trim aircraft as desired to alleviate the control forces necessary to control aircraft at this speed. A slight amount of raised wing on the failed engine side will improve the performance slightly but **do not use more than 5° of bank at the most**.

*When intercepting the appropriate extended 2 1/2° to 3° glidepath (same as an ILS) PF calls for GEAR DOWN - BEFORE LANDING checklist. At the same time also call for 1/3 flaps to more precisely control the airspeed.

Remember that the extended glide path may occur while on base or even on the downwind, it must be visualized as extending all the way around these legs. Do not allow the airspeed to increase, attempt to maintain approximately 120-125 MPH until rolling out on final.

*Lead turn to final so as to require only a shallow bank.

*When established on a normal approach angle call for 1/3 flaps but be absolutely sure to avoid settling below glide path resulting in a "dragging it in" approach. Slow to approximately 120 MPH.

*Landing may be made with 1/3 flaps if runway length is substantially in excess of normal.

*If runway length is shorter, **after landing is assured** call for 2/3 or full flaps and slow further to threshold speed of 100-105 MPH while maintaining precise control of glide path. At this point **you are committed** to landing. Use whatever throttle is necessary to precisely control airspeed from this point.

*Remember that the aircraft will "float" much more noticeably with two propellers feathered than with propellers windmilling.

*Be alert for any swerve at or after touchdown due to asymmetric power and feathered props.

Two Engine Go Around:

Do this only in an emergency and if you have not passed the commit altitude (300' agl) and have not lowered flaps more than 1/3. Maintain positive control of aircraft attitude and heading during the transition by aggressive use of flight controls as necessary:

*Call for PNF to set MAX (2500) RPM while PF immediately advances throttles.

*Call for PNF to set max power.

*Call for FLAPS UP, GEAR UP. A definite requirement for elevator pressure to compensate for angle of attack change will be noticed as the last portion of the flaps retract.

*Continue descent if necessary to obtain/maintain approximately 120 MPH. Raise wing slightly on the side of the dead engines to improve performance but **use no more than 5° of bank at the most**.

*When climbing at a safe altitude and approximately 125 MPH call for 38" MP (METO) and 2300 RPM.

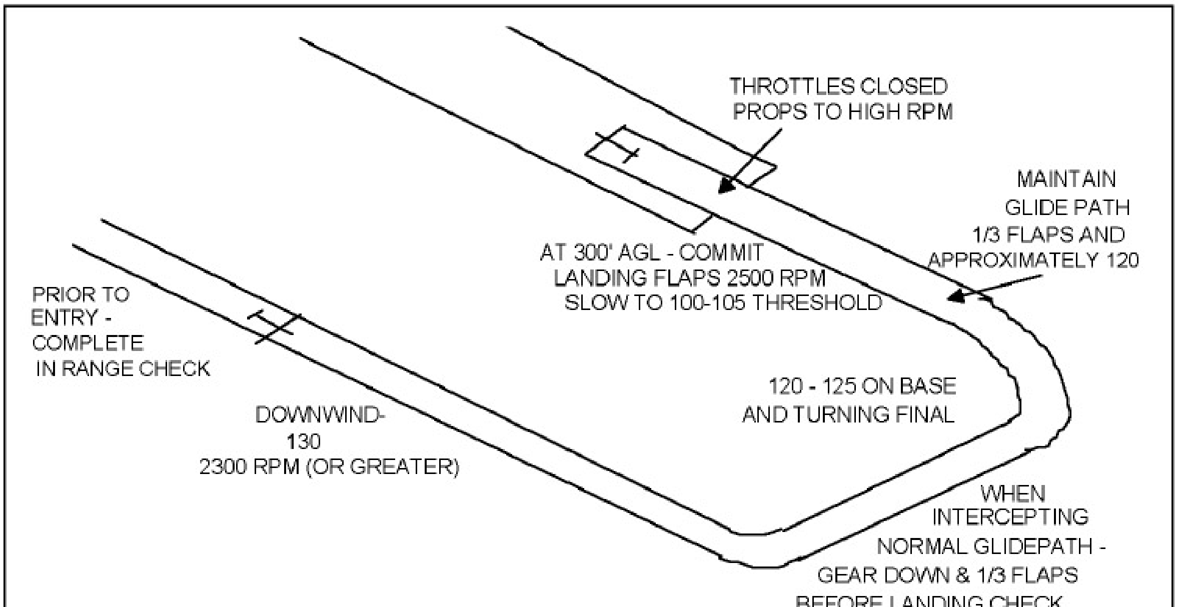


FIG. 4 TWO ENGINE APPROACH

Crash Landing:

No written procedure in this manual can adequately describe all the possible scenarios for this situation, the pilot in command must utilize his/her and the crew's knowledge to modify or alter these procedures as necessary.

Should you find yourself faced with this eventuality:

*Notify all on board personnel and passengers of the potential crash/belly landing and

their stations during the landing.

*Immediately alert any ground and other airborne sources who might be of help, inform them of your location and intentions.

*Secure all loose items and survey the entire interior of the aircraft for any loose objects that might become projectiles during a crash/belly landing.

*Consider the possibility that a belly landing with the propellers feathered may result in those engine(s) being torn from their mounts, rather than simply bending the propeller blades to the rear.

Emergency Evacuation – B-17

Preamble

The following is guidance to EAA B-17 crews in the event of an emergency evacuation in the B-17. It is based on Industry best practice and original Boeing data from WWII. When using these procedures EAA B-17 crewmembers should keep in mind that all situations are going to be different - use your best judgment in ascertaining the course of action to be taken and use all available resources. You must act with a "command presence" in order to ensure the passengers listen to your direction. In addition, crewmembers must be prepared to act on behalf of other crewmembers that may be incapacitated.

Crew Duties

PIC

Instruct TAMO to wedge or jettison door (as required) and remove exit safety belt prior to touchdown.

Evaluate and discuss the anticipated best exit.

Call for and complete evacuation checklist.

Take flashlight and first aid kit and proceed to cabin and direct evacuation while sweeping cabin clear.

When cabin is clear or all possible assistance is given, leave the aircraft via the cabin door or another exit if cabin door is not available.

Attempt to keep passengers together and away from aircraft – direct passengers to SIC's assigned gathering point.

Try to account for all passengers and crew and provide for their safety.

SIC

Notify tower, ground control, or make necessary distress calls.

Read evacuation checklist.

Take flashlight and axe, exit aircraft immediately from the most expeditious exit (forward most usable exit possible).

Direct evacuation of aircraft from outside.

Assign passengers to a gathering place that is a safe distance away from the aircraft.

Assist in accounting for all passengers and crew and provide for their safety.

TAMO

During passenger briefing select most suitable passenger to designate for assistance of passenger egress from the main cabin door.

At the direction of the PIC, relocate to aft cabin area and either wedge or jettison the cabin door and remove the exit safety belt. Brief passengers for existing situation and anticipated plan of action for emergency landing.

After the aircraft has stopped moving, command the passengers to to "unfasten seatbelts" and "get put" (use simple language such as "come this way"). Immediately grab the emergency crash axe and fire extinguisher for possible use.

If main cabin exit is unavailable, evaluate using the radio room exit or break out the appropriate side window (waist gun position). Consider use of seat cushion or a jacket to lie across broken Plexiglas exit window frame.

Assist passengers in expeditiously exiting the aircraft. Maintain orderly conduct while keeping a rapid pace of movement towards exits. Assure anyone needing assistance is accommodated and yet does not become a bottleneck. Rendezvous with passengers and crew at gathering area outside and clear of the aircraft.

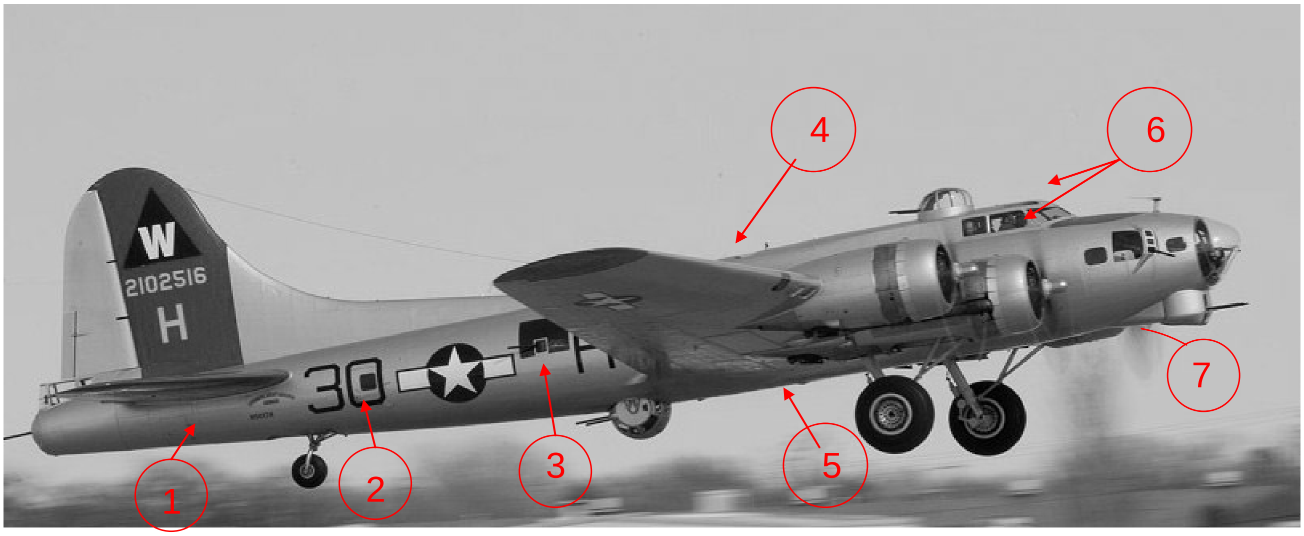
Passenger Evacuation Checklist

7. Set Parking Brake
8. Notify tower or ground control if applicable
9. Notify TAMO "EVACUATE THE AIRCRAFT"
10. Batteries off, Magnetos off, and Mixtures to idle cut off
11. Pull engine fire bottles into nacelle (s) with fire
12. Perform assigned crew evacuation

Note: All crew members must be prepared to act on behalf of other crew members who may be incapacitated.

TAMO Cabin Preparation

When preparing for an emergency landing, the TAMO's duties are to coordinate with the pilots, prepare the cabin, and prepare the passengers. Consideration should be given to selecting the best exit, ensuring rapid and safe egress, and will be responsible for securing the crash axe located under the flooring adjacent to the ball turret and be prepared to use it if needed to add a side window exit.



LIST OF EMERGENCY EXITS

1. **Tail Gunner (not useable on N5017N**
2. **Main Cabin Door**
3. **Waist Gun Windows (if broken with axe)**
   ***One on each side of aircraft**
4. **Radio Room Hatch**
5. **Bomb Bay Doors**
6. **Pilots Windows**
7. **Nose Entry Door (under pilots seat)**