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HEADQUARTERS
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SUBJECT: Important Information for B-24 Air and Ground Crews.

TO : Commanding Officer, Army Air Base, Westover Field, Massachusetts
Commanding Officer, Army Air Base, Langley Field, Virginia
Commanding Officer, Army Air Base, Charleston Army Air Field, Charleston, South Carolina
Commanding Officer, Army Air Base, Chatham Army Air Field, Savannah, Georgia
Commanding Officer, Radar Calibration Detachment, Fort Dix Army Air Base, Fort Dix, New Jersey.

1. During the recent visit of Air Service Command, Consolidated, and Pratt and Whitney representatives to bases operating B-24's, numerous procedures, corrective maintenance measures, and important miscellaneous information were discussed. This information is presented below and will be immediately brought to the attention of all concerned.

2. The following subjects were presented:

a. Fires in flight.

(1) Maladjustment of chevron clamps.
(2) Gasoline leaks.
(3) Generators breaking loose.

b. Use and adjustment of generators.

c. Gasoline system.

d. Excessive manifold pressures.

e. Turbo superchargers and regulators.

f. Oil dilution.

g. Runaway propellers and failure to feather.

h. Emergency procedures.

(1) Landing with landing gear failure

(2) Landing with engines feathered.

i. Throttle Stops.

j. Idling adjustment.

k. Operation of engines on the ground.

l. Carburetor ice.

m. Spark plugs.

n. Cowl flaps and engine cooling.

o. Unsatisfactory reports.

p. Check lists and cruise control charts.

3. Discussion of items listed in paragraph 2.

a. Fires in flight.

(1) Technical Order No. 02-10-38 covers the proper installation and adjustment of chevron clamps. These clamps should be loose enough to permit clearance for expansion of the exhause stacks and tight enough to prevent spinning. If too tight, the clamp will break permitting the exhaust to escape inside the engine nacelle. A fire will certainly result. If too loose the clamps or exhaust pipes will spin and wear through until failure results. Frequest inspections can prevent this type of failure.

(2) Gasoline leaks from whatever source are a serious fire hazard. Never take off if there is an indication of a gasoline leak around the wing or in the bomb bay. In case of a fire in an engine the gasoline to that engine must be turned off as quickly as possible. By quick action there is a good chance that the fire will die. Allow the engine to run long enough to use up all gasoline in the lines and carburetor, before feathering. Proper maintenance, inspection, and operation can prevent fires.

(3) Generators have been known to break loose from their mounts breaking fuel and/or oil lines, thus starting a fire. Generators and their hold down studs must be checked frequently for security.

b. Use and Adjustment of generators. Various models of B-24's have had no increase in generator capacity though the auxiliary equipment using electrical current has been radically increased. It then becomes

necessary to insure proper use and operation. Aerial engineers must be thoroughly schooled in paralleling generators. They must turn on the generators just before take off and observe the output for the first 20 or 30 seconds of the take off. If any generator attempts to take the full load, turn it off until it has been fully warmed up and paralleled with the other generators. Paralleling of generators must be accomplished in flight to be accurate. Generators must be checked at intervals for proper voltage output by a master voltmeter. Balancing of generators at 28 volts is important. Do not use the APU on take off in place of generators.

c. Gasoline system. Technical Orders numbers 01-5-64, 01-5EC-75, 01-5-65, and 01-5-58 are issued to correct defects on the B-24 fuel system. These Technical Orders must be complied with. Care must be exercised to prevent seromatic fuel from getting on the outside of the fuel cell where it will attack the outer lining and eventually cause leaks. Care must also be taken in installing tanks to prevent damage or scratching the outer lining and also insure that the bellows vent line is given a chance to go into place without crimping. There is no way to check this bellows after the tank has been "pushed home." The gasoline tank caps must be checked before each flight to insure that each is secure and seated. Modified gas caps will soon be available which will correct many gas cap troubles. Pilots should check the wing and bomb bay for signs of gasoline. If there is any indication of gasoline leakage do not take off. Fuel sight gauges are not accurate and are soon to be replaced by a better type. Do not fill fuel tanks to overflowing - leave a small air space between gasoline and gas cap. Maintenance men must be certain that fuel line hose clamps are tight.

d. Excessive manifold pressure.

(1) Manifold pressures allowed by Technical Orders must not be exceeded.

(2) 43 in. MP should be maximum for take off on 91 octane gasoline -- 44 inches for one minute in emergencies. Any MP above 44 on 91 octane gets into incipient detonation which burns holes in cylinders, blows or cracks cylinder heads, and causes engine failures.

(3) It is evident from excessive cylinder and engine changes that pilots are exceeding authorized manifold pressures.

(4) MPs on ground run up should be set for 42". The ram effect on the take off run will give 43".

e. Turbo superchargers and regulators,

(1) There are several types of superchargers and regulators in service. One type supercharger has a dam welded in the exhaust manifold which gives better distribution on

the turbo wheel but which also, in effect, gives a higher manifold pressure than a turbo without a dam. Pilots and crew chiefs should check the type of turbo installed if, on group run up, the manifold pressure goes above 38" or 39", without use of turbo control. Some installations with dams in the turbos give a MP of as high as 43 to 45 inches on the ground run up by use of throttles only.

(2) Leaks in the ducts leading to the carburetor also give erratic reading on the MP both on the ground and at high altitudes. Inspections should be made for leaks in the supercharger ducts and piping.

(3) The oil type turbo regulator and balance line give considerable trouble particularly in cold weather. These troubles can be minimized or eliminated by:

(a) Keeping the area around the turbo regulator bellows free of sludge and carbon that might have been loosened by oil dilution.

(b) 1/2 inch balance lines should be installed in place of the 1/4 inch now on many airplanes. All balance lines must have a steady drop from the regulator to the exhaust stack. This will prevent water condensation from collecting and, in cold climates or high altitude operation, from freezing in low spots in the balance line. The elbow connection at the exhaust stack should be checked frequently to eliminate any carbon collection that might be present.

(c) If on the run up, while trying to set the turbo erratic manifold pressures result, do not take off. Clean out the balance lines and regulators. If pilots do attempt to take off, a runaway turbo is likely to result which will cause blown cylinder heads or engine failures.

(d) Before take off pilots should run their supercharger handles on oil type regulators from the "off" position to the full "on" position slowly, approximately 5 times to fill the regulator with warm or hot engine oil to insure proper operations on take off.

(4) The electronic supercharger installation is electrically operated. Inverters must not be turned off or switched from one to the other while the elctronic supercharger is in operation. It is possible at altitudes above 5000 feet

to get a condition where the waste gate will fully close and not open. This will occur as follows: (1) reduce throttles - this will close the waste gate above 5000 feet; (2) if at this point the inverters are shut off, or an electronic unit goes out, the waste gate will remain closed or at its last position, and (3) then, if the throttles are opened with closed waste gates, manifold pressures will climb rapidly until the cylinder heads are blown off or the engine fails.

f. Oil dilution. Excessive dilution is detrimental to the engine. When an engine is diluted the gasoline tends to cut loose carbon, sludge, etc., in the engine, which in turn will clog oil screens, orifices, regulators, etc. During winter months when diluting is accomplished the condition of the oil and oil screens should be checked daily. If excessive sludge appears, the oil should be changed. The recommended system for diluting is as follows: Idle the engine until the oil temperature reaches 40° C. Start diluting until an oil pressure drop is observed. A 50% drop in oil pressure should be sufficient for the coldest weather encountered in the continental United States. Lesser degress of oil pressure drop should be used depending on the degree of cold weather to encountered. Before take off, oil temperatures must be at least 50° C to insure that all gasoline in the oil has been distillated. If a take off is attempted with gasoline in the oil, it is possible to build up a vapor pressure inside the engine which escapes through the breather. The breathing gets progressively worse to the point where all oil may be lost through the breather. To stop the loss of oil through the breather reduce power and land as soon as possible.

g. Runaway propellers and failure to feather. This can be caused by two things: first, by clogged oil lines or congealed oil at cold temperatures, second, by lack of sufficient electrical current. Propellers should be run through several times before take off to insure that hot oil gets to the dome and that they are operating properly.

It is believed that the failure to feather many propellers is due to lack of electrical current. The electrical system has been burdened with the tail turret, bottom turret, top turret, nose turret, electronic supercharger, auto pilot, bomb sight, radio, electrically heated suits, etc., to the point where there is little excess amperage left in the "bank". At high altitudes the battery capacity is severely reduced. If, with all electrical equipment operating, it becomes necessary to feather a runaway propeller, there isn't enough current left to do it. The action necessary to feather a propeller under the above conditions is to turn off all possible electrical equipment to get sufficient amperage to feather.

h. Emergency procedure.

(1) Procedure for landing with landing gear failures. Re-

cords show that it is far better to land a B-24 with any part of the landing gear extended. Landings should be made on the hardest surface available, preferably concrete.

With a nose wheel failure the airplane can be landed with little or no damage by the following method. Trim the airplane 3½° tail heavy and put one man in the tail of the plane and 4 men just behind the bomb bay bulkhead. As the airplane is landed and the nose begins to get slightly heavy ring a bell, which by previous arrangement, directs another man to go to the tail of the plane. This is repeated until all 4 men are in the tail of the plane. If the plane has a nose turret a total of at least 6 men should be in the tail. By this method the airplane can be brought to rest without the nose wheel ever touching the runway. Propellers should be put in full high PRM. Engines cut after contact with the runway except one if a ground loop is imminent. Engines can be kept running by returning the mixture control to auto rich just before the engine dies if desired. Men in the tail should be instructed to remain in place after the landing until help arrives. Landing with only one main gear down and the nose wheel down is accomplished as follows. The airplane should be brought in with a slight amount of excess speed with the faulty wheel side high. Put the good main wheel on the runway and get the nose wheel on the runway as soon thereafter as possible to keep the plane straight. Keep the wing off the ground as long as possible and ride the plane to a stop keeping it as straight as possible by use of the brake available. Care should be exercised in picking a runway that has smooth terrain along side as the plane will certainly go off the runway.

(2) Landing with one outboard engine inoperative. The following is recommended:

(a) Keep the dead engine high on all turns near the ground.

(b) Fly the traffic pattern at least 500 feet higher than customary.

(c) Place the base leg close enough so a minimum amount of power is required on the final approach. At the point power reduction is required, instead of partially reducing power on all three active en-

gines together, reduce power on the active outboard to about 12 inches manifold pressure. Then, use the inboard engines for power the same as a twin engine aircraft. Just before landing, close the active outboard throttle with the inboard. If the above procedure is used, the check list for landing can be followed closely in regard to flap settings, landing gear, high RPM, etc. Also, on the final approach, a normal tab setting is possible. Avoid any high rates of sink on the final approach unless you have excessive air speed.

(3) Landing with two engines inoperative on one side:

(a) Approach the traffic pattern high enough to permit the pattern to be flown with a minimum amount of power, in other words, a semi-glide condition all the way in to the actual landing, reducing power on the active outboard engine first. Other than having more altitude in the traffic pattern necessary due to the lack of available power and the off balance power condition existing which makes it undesirable to pull high amount of power from the active outboard engine, proceed the same as landing with one outboard engine inoperative.

(b) Airplanes with one engine out will generally maintain altitude with the landing gear retracted. When only two engines are useful, the airplane cannot be expected to maintain altitude with both landing gear and flaps extended. It then becomes apparent that it is dangerous to "go around" on one engine, and is impossible with two engines out with landing gear and flaps extended. Land on the first approach.

(c) With propellers in Low RPM the tachometer will show a maximum of approximately 1400 RPM and the maximum manifold pressure attainable is 30 inches. All pilots should have this demonstrated to them in the air as the mistake of lowering RPM instead of increasing RPM has caused accidents.

i. Throttle Stops. Excessive smoking of engines at high power output is caused by maldistribution of the fuel air mixture in the induction system of the engine. Such maldistribution causes a 15% decrease in horsepower at full throttle. This decrease in take off horsepower has caused serious accidents. It can be corrected by installing throttle stops. The method is explained in Technical Orders 01-5E-78 and 01-5EC-28. All B-24 airplanes must have throttle stops for both the Stromberg and Ceco carbure-

tors and should not be flown without them.

j. Idling adjustment. Engines must have the proper idling adjustment on the carburetors to prevent fouling of the plugs, insure instant and smooth increase of power in emergency, and prevent backfiring or engine stopping at idling RPM. The method of setting this adjustment is as follows:

(1) Warm up the engine to approximately 175o C head temperature.

(2) Adjust idling RPM to 650 RPM.

(3) Turn mixture adjustment to rich side.

(4) Run engine to 2000 RPM to clear out plugs.

(5) Reduce throttle to 650 RPM.

(6) When the RPM is steady put mixture control to idle cut off and observe RPM rise as the engine dies. If the RPM rises when the mixture control is put in idle cut off the mixture is rich, if RPM falls off rapidly the mixture is too lean.

(7) Instruct the mechanic to turn the idle mixture screw two notches toward lean.

(8) Repeat (4) (5) and (6) above and turn idle mixture screw toward lean two more notches.

(9) Repeat this process by bringing the rise in RPM down in increments until you get a 5 to 10 RPM rise. This is the proper setting. It is not possible due to the sluggish nature of the tachometer to read a 5 or 10 RPM rise but by observing the number of RPM differential in 2 notches of the mixture screw and by bringing the RPM down by increments you can tell when there is a 5 or 10 RPM rise. By using this method and with a healthy engine, plug fouling at idling speeds should be corrected.

K. Operation of engines on the ground.

(1) Lean mixture at idling speeds often cause backfiring. If a backfire occurs the vanes in the turbo ducts leading to the carburetor may be damaged or even torn loose. If damaged the restriction will cause the turbo wheel to turn at a higher speed to overcome the restriction. At high altitudes this overspeeding unknown to the pilot can cause turbo wheel failures. If the

vanes are torn loose parts can get into the turbo impeller and cause damage or parts can get on the carburetor causing restrictions to the fuel and air passage. It then becomes necessary for all backfires to be reported to maintenance personnel so that a check can be made of those vanes.

(2) The auto rich and auto lean device on the carburetor does not operate at idling speeds up to 1000 to 1200 RPM. By setting the proper idling adjustment and speed there is no need to keep the RPM of an engine at 1000 to prevent spark plug fouling. By keeping the mixture control in auto rich during all ground operation there is no chance of taking off in auto lean. Taking off in auto lean with 91 octane gas is extremely dangerous.

(3) Detents on the mixture quadrant on the carburetor must line up with the marks on the mixture control quadrant in the cockpit. By moving the mixture control back and forth those detents can often be felt from the cockpit. The mixture control must be in the proper detents.

(4) Excessive full throttle operation on the ground is hard on an engine. Keep it to a minimum.

(5) During the run up check for take off pilots should use the following sequence on electronic superchargers; open throttle to the stops; you should get approximately 38"; turn turbo dial to increase MP to 42"; return turbo dial to off position then reduce throttle. By using this sequence pilots should observe if the MP reduces when the dial is turned down. If it does not the waste gate has not opened which indicates a non-operative electronic regulator. Do not under any circumstances take off with this condition.

(6) Fuel pressure for Ceco carburetor should be 17 pounds. Instructions to be issued to have all fuel pressures at 17 pounds to prevent lean mixtures at high altitudes will probably come out in Technical Orders soon.

(7) Use the auxiliary hydraulic pump on take off.

(8) A check list must be used. Past experience proves that pilots often fail to use a check list. Many think it is childish or a trait of weakness to use a check list. An old pilot depends on that check list to insure that no item is forgotten -- nothing is left to memory or chance.

l. Carburetor ice. Information is being sought on this subject. Pilots who had encountered ice in the carburetor were asked to relate their experiences. An attempt is being made to determine under what conditions the present carburetors ice up. Few actual cases can give sufficient information. Anyone encountering carburetor ice should take notes on the atmospheric conditions, temperature of the air, humidity, power settings, and instrument readings and conditions of flight.

m. Spark Plugs. The LS86 type is the best available. It should be used to prevent freezing in the insert. Before installing spark plugs use a tap especially provided to clean out the threads. Put a small amount of grease on the tap to catch chips to prevent them from falling down into cylinder heads. Before inserting the spark plug put a small amount of anti-seizure compound on the threads. Avoid getting any on the electrodes. Screw the plugs in with a reasonable amount of torque pounds but avoid excessive pressure.

n. Cowl flaps and cooling of engines.

(1) Cowl flaps must be set at 2½o open setting when fully closed. Do not open cowl flaps in flight more than 12° in an effort to cool the engine. An opening greater than 12° will only slow the airplane down and decrease the cooling effect.

(2) Because of the increase in weight and decrease in speed due to the front turret installation, cooling of the engine has become a problem. This is particularly true of the B-24H and J. At present the only solution is the increase speed.

(3) In cold climates if the engine oil runs too cold (45 to 50°), a 1½ inch circular ring over the oil cooler will raise the temperature to a reasonable operating temperature.

o. Unsatisfactory Reports should be submitted on troubles and material failures so that Air Service Command will have a record of troubles encountered by the operating units. Corrective action is based on the percentage of reports received from the using services. UR's are encouraged.

p. Check lists and cruise control charts.

(1) The use of check lists are mandatory. The standard check list published by Army Air Forces must be used.

(2) Pilots must be thoroughly familiar with the use of cruise control charts for the type airplane being flown. The charts give the best cruising settings available. Use them.

2. Miscellaneous.

(1) To provide adequate engine oil reserve for feathering the propellers, following loss of engine oil, T.O. 01-5-57 has modified the oil tank by the installation of a sump.

(2) Many pilots unnecessarily feather propellers when minor engine or instrument trouble has been encountered. Retain engine power where possible for emergency landings or operation. When feathering a propeller make certain that the correct button is used.

By Command of Major General HUNTER:

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